REEDER AND FELSON’S

GAMUTS IN RADIOLOGY

COMPREHENSIVE LISTS OF ROENTGEN DIFFERENTIAL DIAGNOSIS

Fourth Edition

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with MRI Gamuts by WILLIAM G. BRADLEY, JR., MD, PhD, FACR
and Ultrasound Gamuts by CHRISTOPHER R. MERRITT, MD, FACR

and input from a distinguished 20-member subspecialty Editorial Board

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Dedication

This book is dedicated to Colonel William LeRoy Thompson, Medical Corps, U.S. Army (1891-1975)

Colonel Thompson, legendary teacher of morphology in radiology and originator of the Gamut concept, received his M.D. degree from the University of Pennsylvania in 1917, and began his long and illustrious career in the U.S. Army Medical Corps that same year. He had various assignments in general medicine and administration and later became one of the early Army radiologists.

However, it was during his last year before retirement from the Army (1951) that he began his most important work, his major contribution to medicine: the organization of the Registry of Radiologic Pathology at the Armed Forces Institute of Pathology. After retirement, he offered his services, without remuneration, to continue as full-time Registrar and Chief of Radiologic Pathology.

In the ensuing 16 years, Colonel Thompson worked laboriously in accessioning new material and collating the material already in the files of the Institute. He was sustained in this labor by hours of daily contact with his “students.” It was here, in seminars at the viewbox, that Colonel Thompson drew upon a lifetime of accumulated knowledge and experience to educate residents, fellows, and practicing physicians from all over the world who came to study under his guidance. In this role, Colonel Thompson was the catalyst, igniting in his students a love of learning and an understanding of the vital role that pathology plays in the discipline of radiology. He was primarily a morphologist, and accepted as such by his colleagues and peers at the AFIP.

Colonel Thompson’s down-to-earth nature, his éclat in interpersonal relationships, his obvious deep regard for his students as well as medicine, and his abundant and abiding warmth as a human being made him truly beloved by all who came to know him.
A Tribute to Ben Felson

He was certainly the greatest radiologist of his time, and perhaps of all time. He was one of the great men of this century. He was also my very close and dear friend and colleague. He was like a second father to me and his loss to me is monumental, as is his loss to all whose lives he touched in such a profound and positive manner. He lived the fullest life of anyone I ever knew. He was the quintessential student and teacher, the consummate traveler, and the most compassionate, loving, and lovable human most of us have ever known.

He was that rare combination of Will Rogers and William Osler, and wherever he went, from Cincinnati to Colombia to China, he made a lasting impact and lifelong friends. More than anyone else, he enhanced the reputation and knowledge of the fledgling specialty of Radiology through his inquisitiveness and his gift for communication with both the written and spoken word. He nurtured the careers of countless students, residents, and doctors around the world. He will live forever in the hearts and minds of all who knew and loved him.

Godspeed Ben, and continue to smile down on us from above as you did so often during your all-too-brief stay with us on earth.

Maurice M. Reeder, MD
Foreword to the Third Edition

By the late Elias G. Theros, MD
I. Meschan Distinguished Professor of Radiology
Wake Forest University Medical Center
Winston-Salem, North Carolina, USA

Amongst the present generation of radiologists, beguiled by the glamour and excitement of the new high tech imaging and interventional modalities, too few have developed a strong sense of differential diagnosis based on radiologic pattern recognition and its correlation with clinical and laboratory findings. There is no question about the incredible contribution by the new modalities to our diagnostic armamentarium, but, in the evolution of modern-day radiologic practice, the cognitive element has been neglected and our abilities as diagnosticians have suffered.

The advent of this third edition of Reeder and Felson’s Gamuts in Radiology is timely and welcome. As always, use of the gamut lists will help evoke differential thinking, and this has been enhanced by the addition of more than 250 new gamuts as well as by the updating of more than three-fourths of the existing gamuts. Interestingly, about 130 of the new gamuts are MRI Gamuts developed by Dr. William Bradley, whose enormous experience in clinical MRI has prepared him to think differentially about look-alike patterns and/or locations of lesions displayed by this modality. This is an important step forward in the use of this remarkable new diagnostic tool. It is our fervent hope that some of our very experienced colleagues in CT scanning, sonography, and PET scanning will also organize their findings in terms of gamuts and thus pass their experience to others who can thereby sharpen their diagnostic skills for the benefit of their patients.

Drs. Reeder and Felson, in preparing these gamuts, have made a major contribution to diagnosis in radiology. This they were able to do because of the depth of their own experience and their powers of observation. Those of us who have worked closely with them know that they are radiologists of consummate skills, both in the teaching and practice settings. They are master teachers to whom we all owe much. It is radiology’s great fortune that Dr. Reeder has persisted, after Dr. Felson’s untimely death, in laboring long hours in gamuts researching and updating. He is providing his professional colleagues with an ever improving powerful diagnostic tool. We are all in his debt.
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The word *gamut* is defined as the whole range of anything. As used in this book, it indicates a complete list of causes of a particular roentgen finding or pattern.

Most radiologists use the “Gamut approach” without calling it that. You see an epiphyseal lesion of bone and immediately search your memory bank for causes. You recall perhaps six causes, then eliminate two because of rarity or incompatible roentgen pattern. Then with the clinical information at your elbow in the form of an x-ray requisition or a clinician, you weed out two more that don’t fit the clinical setting, leaving you with perhaps one or two likely diagnoses.

This process is the basis of the triangulation approach to radiologic diagnosis espoused by the originator of the gamut concept, Colonel William LeRoy Thompson. He taught that roentgen diagnosis begins with accurately interpreting all the nuances and data inherent in the radiograph, then using that information to derive a particular pattern. The second side of the triangle involves reference to a well constructed list of differential diagnoses, which includes not only the common causes, responsible for over 80 percent of the entities, but also the uncommon causes, which are frequently overlooked. The triangle is then completed by reference to the pertinent clinical and laboratory data, age, sex, and other important information concerning the patient.

The purpose of this book is to provide you with complete and accurate lists of differential diagnoses. It is an unobtrusive consultant, quickly available whenever you interpret films or prepare a presentation. In each patient, the possibilities can be narrowed down to those that fit the roentgen signs and the clinical and laboratory findings. Of course, all the pertinent data on the film must be analyzed to find the appropriate roentgen sign or pattern. Study well—to identify a pattern incorrectly will land you in the wrong gamut, which could lead to an improper diagnosis.

The publication of the fourth edition of *Gamuts in Radiology*, the second prepared without the direct input of

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**The Triangulation Approach to Radiographic Diagnosis**

- Accurate analysis of clues on the radiograph
- Reference to a well-constructed list of differential diagnoses (Gamut)
- Correlation of radiographic findings and Gamut with patients’ clinical and lab findings to arrive at the most likely diagnosis
my widely loved and esteemed colleague, the late Ben Felson, marks many important changes in the book. Most conspicuously, we have added gamuts for over 250 additional patterns, especially in the areas of Ultrasound, Magnetic Resonance Body Imaging, and Head and Neck Imaging, and have updated more than 80 percent of the previously existing gamuts. The end result is a text with approximately 33 percent new material from the third edition, which in turn doubled the information available in the first two editions. Indeed, scarcely a single gamut remains unchanged from the first edition, while the book has tripled in size, reflecting the dramatic advances that have occurred in Radiology over the past three decades, especially in the areas of Ultrasound, CT, and MRI. The three prior editions of the book found wide acceptance—over 50 thousand copies are in circulation throughout North America and Europe, with tens of thousands more present in China, Japan, and most other countries of the world in at least three different languages. However, the information and data banks previously available have been greatly expanded by virtue of this publication.

While the individual gamuts are extensively referenced up to the year 2002, you will note that the majority of current references refer to textbooks rather than journal articles. This is because today’s general and subspecialty textbooks are much more likely to refer to the multiple causes for a given pattern than are individual articles, which usually relate to specific entities or procedures. Furthermore, exhaustive lists of references would increase the book’s size enormously and undermine its primary goal, which is to provide a quick, efficient reference.

Since the publication of this book’s first edition in 1975, it has been flattering to see many of our individual gamuts reproduced in a variety of publications. Many excellent texts have been published that emphasize the gamut or differential diagnosis approach. However, some other authors have in our view lessened the value of the gamuts by culling from our original lists several common causes for a particular pattern and adding a few lines of description (available in most radiology texts) under the guise of providing a brief resume for residents studying for national Board examinations. There are several major disadvantages to this watered-down approach. First, the most common causes for a given pattern should be already known to radiology residents preparing to sit for a Board examination, or else their training program should be suspect. Second, many residents and practitioners who use these abbreviated lists are deprived of the true worth of gamuts, which is to provide a comprehensive listing of the multiple causes, both common and uncommon, for a particular pattern, especially when confronted with difficult or problem cases. The point is to jog your memory to recall all the various possibilities when analyzing an imaging study at the viewbox or monitor. A resident who wants to memorize a few common causes of a particular pattern (for the purpose of passing an examination) need only consult the COMMON heading of the appropriate gamut. Otherwise, this book makes available, in an instant, virtually all possible diagnoses for any given finding.

Dr. Felson and I were always the first to admit that the amount of information and knowledge required to analyze with unerring accuracy and completeness all of the patterns that can present to the radiologist is beyond the comprehension of any two (or perhaps 20) individuals. Nevertheless, our combined experience of over 85 years’ practice in major medical centers in the United States, as well as numerous visiting professorships throughout virtually the entire world, gave us sufficient perspective to at least attempt such a prodigious endeavor. Along the way we were greatly aided by our close association with such outstanding radiologists as Colonel William LeRoy Thompson, Elias (Lee) Theros, Harold Jacobson, Richard Marshak, Jerome Wiot, Philip Palmer, and others who broadened our horizons and added invaluable insights in their own specialty areas.

And to each of our 20 Section Editors and Consultants, who have contributed their wisdom and experience in verifying the correctness of the existing gamuts and adding new disease entities to most of them, I extend my profound thanks for a job well done. Along the way they have added several hundred new gamuts to the text. I selected each Section Editor and Consultant because of his or her preeminence in his or her subspecialty area, and they did not disappoint. A personal by-product of their involvement for the first time in the Gamuts projects has been their finding that there were fortunately only a handful of inaccuracies in the original 1500 gamuts compiled by Dr.
Felson and myself, which provides the gratifying bonus of an expert peer review of our prior editions.

Continuing in that collaborative tradition, I am enormously pleased that our Associate Editor, Dr. William Bradley, Jr., has once again lent his incomparable experience in MRI and neuroradiology to the fourth edition of the book. Although there are many experts in MRI today, I can think of no individual better qualified to develop accurate lists of differential diagnosis for the many patterns that have evolved in this exciting and burgeoning modality than Bill Bradley, who has been an innovator and pioneer in the field since its inception. Similarly, I am grateful that Dr. Christopher Merritt has called on his extensive experience in Ultrasound to greatly expand the Sonography gamuts found throughout the various body sections and to create a new Obstetrical Ultrasound section. My longtime friend and former Army Radiology colleague, Dr. Jack Campbell, has provided an enormous contribution by reviewing and updating the hundreds of pediatric and congenital gamuts scattered throughout the various sections of the text.

My first mentor in radiology, the legendary (though not well publicized) Colonel Thompson, is well remembered by his former students and disciples for his insistence on the triangulation approach to radiographic interpretation, a rigorous analytic approach that emphasizes careful study of the film and clinical reasoning. In today’s clinical setting, where the proliferation of new technologies is colliding with ever increasing pressures to contain costs and optimize the use of diagnostic tests (as Dr. Theros so eloquently stated in his previous foreword), it is more important than ever that young radiologists learn and apply these principles, which are summarized in these remarks by the Colonel:

The radiograph is to the radiologist what the gross specimen is to the pathologist. It is a window on the disease, monitoring the many changes occurring within the patient during the course of an illness.

The clues to the pattern (and often the diagnosis itself) are almost always on the film if you are observant enough to pay attention to all the data inherent in the radiograph.

Remember that the radiograph is only one-tenth of a second in the history of a disease process. You must always think back to what the findings looked like a day or a week or a year ago (preferably with the help of old films if available, but using intuition or deductive reasoning in their absence) and what the findings are likely to be tomorrow or next week.

A good radiologist must be a good anatomist and morphologist and have a clear understanding of the correlation between what is seen on the radiograph and the underlying gross and microscopic pathology.

Finally, I would like to add a few of my own thoughts that I have passed on to residents over the years:

The radiograph is only one piece of the diagnostic puzzle. It must be evaluated in light of what you know about this patient. The radiologist cannot function as an isolated island unto him- or herself. He or she needs a knowledge of differential diagnosis together with clinical information and interaction with the patient’s physician to arrive at the proper solution.

The radiograph is like a single page in a mystery novel. To find out “whodunit” you usually need more detailed information than is available in a single glance or a single moment in time.

Remember that what comes out of the automatic processor so often is not a diagnosis but rather a diagnostic challenge, a pattern for which there may be four or forty possible causes. It is up to us, as the physician’s consultant, to interpret this pattern correctly using the triangulation approach.

The ideal radiologist should combine exceptional visual acuity with the intuitiveness of a good detective and the knowledge of odds or probabilities of a smart card player. It is these qualities and attention to detail that set him or her apart from other physicians who “look at” films.

And perhaps the most important advice to young residents: “Work hard and play hard. Enjoy your work and your free time. Life is short.”

Indeed, as I sit surrounded by dozens of books and journals spread out over my desk and tables, with my lovely wife, Barbara, and my loyal and lovable West Highland terriers “Kea” and “Pua” nearby, the work is hard but interesting and life is indeed good here in the rolling Potomac countryside outside our nation’s capital. Only one thing is missing—my dear friend Ben at my side with his wisdom and counsel and endless tales of the history of radiology and, above all, his great good humor.

Maurice M. Reeder, MD
In creating a project of this magnitude, the author inevitably borrows freely from many sources. Specific citations follow most gamuts and a list of more general references appears. For those instances where debts are not acknowledged, the user should understand that lost notes and jaded memories, not ingratitude, are to blame.

The following outstanding radiologists made valuable additions to many of the gamuts found in this and previous editions of the Gamuts book: Drs. Francis A. Burgener, George B. Greenfield, Kenneth R. Kattan, Herbert E. Parks, Andrew K. Poznanski, Leonard E. Swischuk, Hooshang Taybi, and the late John P. Dorst, Harold G. Jacobson, and Elias G. Theros. We are also grateful for the help provided in reviewing specific areas of the text by Dr. Robert McLelland for his review of the Mammography Section I and addition of numerous current references, and by Dr. Hoon Ji for his assistance to Dr. Pablo Ros with the Liver, Spleen, and Pancreas portion of Gastrointestinal Section G.

The production and distribution of this fourth edition of the Gamut book has been greatly aided by Mr. Rob Albano, Ms. Terry Kornak, and others on the Editorial and Production staffs of Springer-Verlag New York, who kept the project on track through its various deadlines to ensure the timely production of a highly refined end product. I am also very grateful to Dr. David Lamel and Mr. Peter Vasilev of Medical Interactive who have used their combined 50 years of experience in producing computerized teaching aids for Radiology and Medicine to aid in the development of a remarkably versatile and user-friendly CD-ROM based on this edition of the Gamuts book, but offering many additional features not possible with the text alone. Finally, my wife, Barbara, and youngest son, Robby, have been towers of strength and support as they guided me through the many landmines of computer quirks and frustrations as I have struggled this past decade to learn the nuances of this brave world of microchips and gigabytes that rightfully belongs to the generations that follow this graying author.

Maurice M. Reeder, MD
An Appreciation

To Barbara Reeder, whose patience, love, and perseverance made possible the timely publication of this present work; and to all the Reeder sons, Dave, Dan, Bill, and Robby, and stepsons, Steve and Eric, in whom previous editions of the book invariably raised a gamut of emotions; and to those colleagues, mentors, and friends, past and present, who have so indelibly defined my own career:

William LeRoy Thompson
Benjamin Felson
Elias G. Theros
Harold G. Jacobson
Philip E.S. Palmer
How to Use This Book

1. SECTIONS
This book is organized into twelve sections, the first eight of which conform to the body systems utilized in the American College of Radiology Index for Roentgen Diagnosis. Each section is denoted by an alphabetical letter. Thus, under D you will find all the gamuts that deal with the skeletal system.

2. TABLE OF CONTENTS
This book has an extensive index. In addition, each section has its own table of contents, the pages of which have been black-edged for quick recognition. You can identify the appropriate table of contents by referring to page xv or by counting down the black index marks along the free edge of the closed book.

It will pay you to take a few minutes to look over the subheadings in the table of contents of each section. Gamuts are grouped in what we consider a logical manner. However, our logic may not be your logic; if you don’t find a gamut where you think it belongs, scan the entire table of contents of that section or refer to the index before assuming that it is absent.

3. SUBGAMUTS (eg, A-1-2)
Many times a major gamut will be divided into separate logical components, which are identified by -1, -2, -3, etc. following the number of the parent gamut. These subgamuts amplify or extend the list of diagnoses pertinent to the main gamut to which they belong. For example, a long list of pertinent Congenital Syndromes may be listed as A-1-2 rather than being incorporated into the major heading of Craniosynostosis (A-1-1). Be sure to refer to these associated subgamuts after you have finished with the parent gamut.

4. SUPPLEMENTARY GAMUTS
Most of the gamuts refer to a roentgen sign, pattern, or complex. However, interspersed throughout the book are classifications, tables, drawings, anatomic and physiologic gamuts, and other information useful to the radiologist, which are designated by the letter S following the gamut number. Typical examples are Gamuts D-50-S (Age Range of Highest Incidence of Various Bone Neoplasms) and D-52-S (Sites of Predilection and Eponyms for Avascular Necrosis).

5. INCIDENCE
In most of the gamuts, the entities are subdivided into two groups, COMMON and UNCOMMON. These refer to the relative, rather than absolute, incidence of the disease. Although a bone blister (Gamut D-70) is an uncommon roentgen finding, if you do see one, the diagnosis will generally prove to be giant cell tumor or nonossifying fibroma (two of the conditions listed under COMMON). Conversely, an acute disseminated consolidation (alveolar) pattern (Gamut F-8) is frequently encountered in a busy hospital as a result of the prevalence of pulmonary edema and of pneumonia. Pulmonary hemorrhage is not a rare condition but simply a less common cause of that pattern and consequently is listed under UNCOMMON.

The prevalence of many disorders varies both geographically and from one type of institution to another.
Amebiasis is one of the most common entities in the world, but it is only occasionally seen in most of the United States. A Ewing sarcoma is much more commonly seen at Walter Reed Army Hospital than it is in a county hospital. To avoid such discrepancies, we have based our incidence estimates on our experience at Theoretical General Hospital, Midland, USA.

To attempt to list each cause of a particular pattern in order of its absolute frequency (as some have suggested) would not only be impossible but quite erroneous, since the incidence of various entities varies so remarkably in different countries and continents and even in different communities separated by only a few hundred miles. Thus, in the gamut for Segmental Narrowing of the Colon, carcinoma and Crohn’s disease, diverticulitis and ulcerative colitis would be common causes in the United States, but quite uncommon or rare in tropical or developing countries where amebiasis, tuberculosis, schistosomiasis and lymphogranuloma venereum would be far more common causes of that pattern.

Admittedly, some of the gamuts deal with seldom seen roentgen signs, but it is in just this type of situation that a gamut is most welcome. It substitutes someone else’s experience for your own lack of it.

6. ALPHABETICAL LISTING

The entries in each gamut have been alphabetized for your convenience. Since the entry may not be listed in the form that first comes to your mind, be sure to scan the entire gamut before assuming that a condition is not included.

7. TERMINOLOGY

We have usually selected the most widely used terms for each disease, often furnishing a synonym or eponym as well.

The term generalized indicates more or less diffuse involvement (eg, thalassemia of the skeleton); widespread means extensive but spotty involvement (eg, Paget’s disease of the skeleton); multiple means more than one lesion but less than widespread (eg, large metastatic nodules in the lung).

In order to shorten the gamut lists, similar or related conditions are combined, often separated by a comma or semicolon (eg, scleroderma; dermatomyositis). Inclusive group designations, such as primary anemia, lymphoma, and paralytic disorders are often utilized. In these instances you will find the subscript \( g \) which tells you to look in the Glossary (page 949) if you want to know all the entities in that group. Example: Anemia, primary\( _g \). If one member of a group is a more likely cause of a particular roentgen finding, it is specifically listed. To illustrate: Anemia, primary\( _g \) (e.g., thalassemia). Abbreviations (such as incl., eg, S, ASD, PDA, etc) are listed on p. 947.

8. BRACKETS

Brackets \([\ )\] are used to indicate a condition that does not actually cause the gamuted roentgen finding, but can produce roentgen changes that simulate it. Thus, in Gamut E-45 (Prominence of the Main Pulmonary Artery Segment), mediastinal or left hilar mass, which is not a cause, but a mimic, is bracketed.

9. APOSTROPHES

I fully recognize there are many inconsistencies throughout the text with regards to the use of apostrophes when listing diseases or syndromes bearing an individual’s name. Recently there has been a growing trend to drop all apostrophes, but the various Medical and Radiology journals and publishers have as yet not adopted a uniform view on the subject. Consequently I have taken the editorial liberty of listing entities according to what appears to be the most commonly accepted terminology and what sounds best to the human ear. I for one cannot readily adapt to the sight or sound of Paget disease or Crohn disease; in ordinary conversation most physicians still refer to Paget’s or Crohn’s disease, using the apostrophe. On the other hand, many congenital syndromes seem to adapt well to dropping the apostrophe, as in Turner syndrome. My resolve to be nonconformist was heightened by a telephone conversation with my longtime friend and current editor of \( AJR \), Dr. Lee Rogers, who agreed with me and said he would expect nothing less from a fellow gray-hair than to buck the current trend by younger authors to drop all apostrophes no matter how badly the resulting terminology offends the human eye or ear.
10. SYNDROMES

S. stands for Syndrome. We must apologize for the great number of congenital syndromes we have included. Since the information is available, we could hardly ignore it. Lump them together? The pediatric roentgenologists have assiduously split them apart. We had a huge tiger by the tail, an animal with variegated stripes and swollen gamuts. Shawl scrotum, Cockayne syndrome, and Prader-Willi syndromes, indeed! They should have their own Gamut book. We can only advise those of you who seldom see dwarfs and other little people to ignore these entries.

11. REFERENCES

References are used to cite only articles, books, and other contributions that have provided a number of the disease entities listed in a gamut. To document each entity would be an impossible task and lengthen the book beyond reason. A listing of general references, updated through 2002, appears in each gamut as appropriate. Some older references for a particular gamut have been retained since they are classical articles or texts with respect to that pattern or several of its causes. Rest assured that, in virtually every case, a listed cause for a particular pattern has been seen or verified by the author or the editorial consultants or documented in the literature.

11. OMISSIONS

We are fully aware that there are omissions on the Gamut lists. Very rare entities or syndromes or single case reports have been deliberately omitted. There are also some inconsistencies in terminology, coverage, and unity. There may even be occasional factual inaccuracies. We hope these flaws are neither too frequent nor too annoying.

Please correct errors if you encounter them; delete entities that you feel do not belong on a gamut; insert additional disorders and add new gamuts as you discover them in the literature or in your practice; create some gamuts yourself. Send us your changes, with documentation, so that they can be incorporated in future editions.
Skull and Brain

SKULL

ABNORMAL SIZE OR SHAPE

A-1-1  Premature Craniosynostosis (Craniostenosis)
A-1-S  Classification of Primary (Idiopathic) Premature Craniosynostosis
A-1-2  Congenital Syndromes and Bone Dysplasias with Premature Craniosynostosis
A-2    Microcephaly (Microcrania)
A-3-1  Macrocephaly (Macrocrania)
A-3-2  Congenital Syndromes and Bone Dysplasias with Macrocephaly (Megalencephaly; Macrocrania)
A-4    Abnormal Contour of the Calvarium (See A1-13)
A-5    Unilateral Small Cranium
A-6    Flat Occiput in an Infant
A-7    Prominent Occiput in an Infant
A-8    Frontal Bossing (Prominent Central Forehead)
A-9    Biparietal Bossing
A-10   Localized Bulge of the Calvarium or Scalp
A-11   Hypoplasia of the Base of the Skull
A-12   Basilar Invagination
A-13   Tam-O’-Shanter Skull (Thickening of the Skull Vault with Basilar Invagination)

ABNORMAL DENSITY OR THICKNESS

A-14   Localized Increased Density, Sclerosis, or Thickening of the Calvarium
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PREMATURE CRANIOSYNOSTOSIS (CRANIOSTENOSIS)

COMMON
1. Congenital syndromes and bone dysplasias (See A-1-2)
2. Decreased intracranial pressure (cerebral atrophy; shunted hydrocephalus “contracting skull”) *
3. Primary (idiopathic) craniosynostosis (See A-1-S)

UNCOMMON
1. Anemia (eg, sickle cell disease; thalassemia; iron deficiency)
2. Cretinism; hypothyroidism (treated)
3. Hyperthyroidism
4. Hypervitaminosis D
5. Microcephaly (failure of brain growth)
6. Polycythemia vera
7. Rickets (hypophosphatemic, treated; vitamin D resistant)

* Secondary craniosynostosis.

CLASSIFICATION OF PRIMARY (IDIOPATHIC) PREMATURE CRANIOSYNOSTOSIS

1. Brachycephaly (short, wide, slightly high head with “harlequin” orbits)—bilateral coronal sutures
2. Microcephaly (small round head)—all sutures (universal craniosynostosis)
3. Oxycephaly (tall, wide, short head) or turriccephaly (tower-shaped, pointed head with overgrowth of bregma and flat, underdeveloped lower posterior fossa)—bilateral lambdoid and coronal sutures
4. plagiocephaly (oblique asymmetrical head)—unilateral coronal suture (with flattening of ipsilateral frontoparietal region, elevation of ipsilateral sphenoid wing, and unilateral “harlequin” orbit) and/or lambdoid suture
5. Scaphocephaly (long, narrow, boat head) or dolichocephaly (long, slightly high head)—sagittal suture
6. Trigonocephaly (triangular head; narrow in front, broad behind with hypotelorism)—metopic suture
7. Triphyllocephaly (cloverleaf skull {kleeblattschädel anomaly})—trilobular skull with frontal and temporal bulges—intrauterine premature closure of sagittal, coronal, and lambdoid sutures with hydrocephalus

References
CONGENITAL SYNDROMES AND BONE DYSPLASIAS WITH PREMATURE CRANIOSYNOSTOSIS

COMMON
1. Achondroplasia (base of skull)
2. Acrocephalopolysyndactyly (Carpenter and other types)
3. Acrocephalosyndactyly (Apert, Pfeiffer, and Saethre-Chotzen types)
4. Asphyxiating thoracic dysplasia (Jeune S.)
5. Chondrodysplasia punctata
6. Cloverleaf skull (kleeblattschädel anomaly)
7. Crouzon S. (craniofacial dysostosis)
8. Fetal rubella S.
9. Hypophosphatasia (late)
10. Mucopolysaccharidoses (eg, Hurler S.; Maroteaux-Lamy S.); mucolipidosis III (pseudo-Hurler polydystrophy); fucosidosis
11. Thanatophoric dysplasia
12. Trisomy 21 S. (Down S.)

UNCOMMON
1. Acro-cranio-facial dysostosis
2. Adrenogenital S.
3. Aminopterin fetopathy
4. Antley-Bixler S.
5. Baller-Gerold S. (craniostenosis-radial aplasia S.)
6. Bardet-Biedl S.
7. Christian S. (adducted thumbs S.)
8. Chromosomal syndromes (5p-, 7p-, 7q+)
9. Cranio-fronto-nasal dysplasia
10. Cranietelencephalic dysplasia
11. Fetal hydantoin S. (Dilantin embryopathy)
12. Fetal trimethadione S.
13. FG syndrome
14. Hallermann-Streiff S. (oculo-mandibulo-facial S.)
15. Holoprosencephaly (arrhinencephaly)—(results in microcephaly, trigonocephaly, cebocephaly)
16. Meckel S.

17. Metaphyseal chondrodysplasia (Jansen type)
18. Opitz trigonocephaly S. (C syndrome)
19. Pyknodysostosis
20. Seckel S. (bird-headed dwarfism)
21. Trisomy 13 S.
22. Trisomy 18 S.
23. Williams S. (idiopathic hypercalcemia)

References

MICROCEPHALY (MICROCRANIA)

COMMON
1. Anencephaly
2. Cerebral atrophy; perinatal brain damage from hypoxia
3. Congenital transplacental infection (eg, toxoplasmosis; rubella; cytomegalovirus; herpes; syphilis)
4. Craniosynostosis, total
5. Encephalocoele
6. Micrencephaly (idiopathic small brain)

UNCOMMON
1. Aminopterin fetopathy
2. Aspartylglucosaminuria
3. Beckwith-Wiedemann S.
4. Børjeson-Forssmann-Lehman S.
5. Brachmann-de Lange S. (de Lange S.)
6. Cephaloskeletal dysplasia (Taybi-Linder S.)
7. Cerebro-oculo-facio-skeletal S. (Pena–Shokein S. type II)
8. Chondrodysplasia punctata (rhizomelic type)
9. Christian S. (adducted thumbs S.)
11. Cockayne S.
12. Coffin-Siris S.
13. Cohen S.
14. Cutis verticis gyrata
15. Deprivation (psychosocial) dwarfism
16. Dubowitz S.
17. Dyggve-Melchior-Clausen dysplasia (Smith–McCort S.)
18. Familial
19. Fanconi anemia (pancytopenia-dysmelia S.)
20. Fetal alcohol S.
21. Fetal hydantoin S. (Dilantin embryopathy)
22. Fetal trimethadione S.
23. Fraser S. (cryptophthalmia S.)
24. Freeman-Sheldon S. (whistling face S.)
25. Galloway-Mowat S.
26. Goltz S. (focal dermal hypoplasia)
27. “Happy puppet” S. (Angelman S.)
28. Holoprosencephaly; arrhinencephaly
29. Homocystinuria
30. Incontinentia pigmenti
31. Johanson-Blizzard S.
32. Juberg-Hayward S.
33. Kearns-Sayre S.
34. Krabbe disease (globoid cell leukodystrophy)
35. Lenz microphthalmia S.
36. Lesch-Nyhan S.
37. Lissencephaly syndromes (congenital agyria)
38. Lowry-Wood S.
39. Marden-Walker S.
40. Marinesco-Sjögren S.
41. Maternal phenylketonuria
42. Meckel S.
43. Menkes S. (kinky-hair S.)
44. Microcephalic osteodysplastic dysplasia
45. Microcephaly-lymphedema S.
46. Noonan S.
47. [Normal variant]
48. Oculo-auriculo-vertebral spectrum (Goldenhar-Gorlin S.)
49. Opitz trigonocephaly S. (C syndrome)
50. Prader-Willi S.
51. Prenatal radiation
52. Riley-Day S. (familial dysautonomia)
53. Rubinstein-Taybi S.
54. Seckel S. (bird-headed dwarfism)
55. Smith-Lemli-Opitz S.
56. Trichorhinophalangeal dysplasia, type II (Langer-Giedion) and III (Ruvalcaba S.)
57. Trisomy 9 S.
58. Trisomy 13 S.
59. Trisomy 18 S.
60. Trisomy 21 S. (Down S.)
61. Trisomy 22 S.
62. XXXXX S.

References

Gamut A-3-1

MACROCEPHALY (MACROCRANIA)

COMMON
1. Benign subdural fluid collections of infancy
2. [Calvarial thickening (eg, congenital anemias)]
3. *Congenital syndromes (See A-3-2)
4. *Craniosynostosis
5. Hydrocephalus (See A-114-1)

(continued)
6. Paget’s disease
*7. Subdural hematoma

UNCOMMON
1. Aqueduct stenosis
2. Arnold-Chiari malformation
3. Choroid plexus papilloma
*4. Expansion of middle fossa (See A-69)
5. Hydranencephaly
6. Infantile multisystem inflammatory disease (NOMID)
7. Infection causing hydrocephalus (eg, meningitis; toxoplasmosis)
8. Megalencephaly
9. Porencephalic cyst (porencephaly)
10. Posterior fossa cyst (eg, dermoid; teratoma; Dandy-Walker S. (Dandy-Walker malformation))
*11. Tumor or subarachnoid cyst adjacent to calvarium
12. Vein of Galen aneurysm

* May be asymmetrical.

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut A-3-2

CONGENITAL SYNDROMES AND BONE DYSPLASIAS WITH MACROCEPHALY (MEGALENCEPHALY; MACROCRANIA)*

COMMON
1. Achondroplasia; hypochondroplasia
2. Hydrocephalus (See A-114-1)
3. Hyperostosis diseases (eg, osteopetrosis; diaphyseal dysplasia {Camurati-Engelmann disease}; pyknodysostosis; hyperphosphatasia)
4. Mucopolysaccharidoses (incl. Hurler, Hunter, Morquio, Maroteaux-Lamy); mucolipidoses (See J-4-S); GM1 and GM2 gangliosidosis
5. Neurofibromatosis
6. Thanatophoric dysplasia

UNCOMMON
1. Achondrogenesis (type II); hypochondrogenesis
2. Acrocollosal S.
3. Aminoacidurias
4. Bannayan-Riley-Ruvalcaba S.
5. Beckwith-Wiedemann S.
6. Camptomelic dysplasia
7. Cleidocranial dysplasia
8. Cowden S.
9. Craniodiaphyseal dysplasia
10. Cranioectodermal dysplasia
11. Craniometaphyseal dysplasia
12. Dandy-Walker S. (Dandy-Walker malformation)
13. Endosteal hyperostosis (van Buchem type)
14. FG syndrome
15. Familial megalencephaly; megalencephaly syndromes
16. Fragile X S.
17. Gorlin S. (nevus basal cell carcinoma S.)
18. Greig cephalopolysyndactyl S.
19. Hydrocephalus
20. Hypomelanosis of Ito
21. Infantile multisystem inflammatory disease (NOMID)
22. Klippel-Trenaunay-Weber S.
23. Kniest dysplasia
24. Lenz-Majewski dysplasia (hyperostotic dwarfism)
25. Lhermitte-Duclos S.
26. Leukodystrophies
27. Marfan S.
28. Marshall-Smith S.
29. Noonan S.
30. Osteogenesis imperfecta
31. Osteopetrosis (osteopathia striata with cranial sclerosis
32. Pituitary gigantism
33. Proteus S.
34. Riley-Day S. (familial dysautonomia)
35. Robinow S.
36. Schwarz-Lélek S.
37. Sclerosteosis
38. Silver-Russell S.
39. Sotos S. (cerebral gigantism)
40. Tay-Sachs disease
41. Trisomy 8 S.
42. Tuberous sclerosis
43. Weaver S. (Weaver–Smith S.)
44. Zellweger S. (cerebrohepatorenal S.)

* Many dwarfs have relative macrocephaly.

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ABNORMAL CONTOUR OF THE
CALVARIUM (SEE A-1-13)

COMMON
1. Achondroplasia, other congenital syndromes and
bone dysplasias (See A-1 to 13)
2. Bone tumor (eg, osteoma; osteosarcoma)
3. Cerebral hemiatrophy (eg, Sturge-Weber S.; Dyke-
Davidoff-Masson S.); localized cerebral atrophy
4. Fibrous dysplasia; leontiasis ossea
5. Hydrocephalus
6. Paget’s disease (eg, tam-o’-shanter skull) (See A-13)
7. Postoperative deformity
8. Postural flattening, usually occipital (eg, cerebral
palsy); postural asymmetry from scoliosis
9. Premature craniosynostosis (See A-1)
10. Trauma (incl. obstetrical); depressed fracture;
cephalohematoma

UNCOMMON
1. Acromesomelic dysplasia
2. Arachnoid cyst
3. Craniolacunia
4. Craniopagus twins
5. Crouzon S. (craniofacial dysostosis)
6. Dandy-Walker S. (Dandy-Walker malformation)
7. Encephalocele
8. Hemimegancephaly
9. Hyperphosphatasia
10. Hypertelorism (See B-3); cranium bifidum
11. Hypomelanosis of Ito
12. Microcephaly
13. Neurofibromatosis
14. Osteogenesis imperfecta
15. Porencephalic cyst (porencephaly); cerebral cyst
16. Proteus S.
17. Rickets, healed with bossing
18. Silver-Russell S.
19. Subdural hematoma, chronic; hygroma
Gamut A-5

UNILATERAL SMALL CRANIUM

COMMON
1. Cerebral hemiatrophy (eg, Dyke-Davidoff-Masson S.; Sturge-Weber S.)
2. Head positioning in infancy (postural flattening)
3. Normal (slight)
4. Trauma (depressed skull fracture)
5. Unilateral lambdoid or coronal craniosynostosis (plagiocephaly)

UNCOMMON
1. Radiation therapy
2. Silver-Russell S. (congenital hemiatrophy)

Gamut A-6

FLAT OCCIPUT IN AN INFANT

COMMON
1.achondroplasia
2. Postural flattening (eg, normal, mental retardation, or immobilized infant)
3. Trisomy 21 S. (Down S.)

UNCOMMON
1. Acrocephalopolysyndactyly (Carpenter type)
2. Acrocephalosyndactyly (Apert, Pfeiffer, Saethre-Chotzen types)
3. Acrodysostosis
4. Brachmann de Lange S. (de Lange S.)
5. Crouzon S. (craniofacial dysostosis)
6. Mucopolysaccharidosis III (Sanfilippo S.)
7. Weaver S. (Weaver–Smith S.)
8. Weill-Marchesani S.
9. XXXXY S.

Reference

Gamut A-7

PROMINENT OCCIPUT IN AN INFANT

COMMON
1. Bathrocephaly (idiopathic)
2. Dandy-Walker S. (Dandy-Walker malformation); posterior fossa arachnoid cyst

UNCOMMON
1. Beckwith-Wiedemann S.
2. Campomelic dysplasia
3. Cephalohematoma, occipital
4. Diaphyseal dysplasia (Camurati-Engelmann disease)
5. Hajdu-Cheney S. (idiopathic acro-osteolysis)
6. Meningocele, occipital
7. Mulibrey nanism
8. Otopalatodigital S.
9. Pyknodyostosis
10. Trisomy 9 S.
11. Trisomy 18 S.

Reference

Gamut A-8

FRONTAL BOSSING
(PROMINENT CENTRAL FOREHEAD)

COMMON
1. Achondroplasia
2. Anemia, (esp. sickle cell disease; thalassemia)
3. Rickets, healed
UNCOMMON
1. Achondrogenesis
2. Acrocallosal S.
3. Cerebral gigantism (Sotos S.)
4. Cleidocranial dysplasia
5. Coffin-Lowry S.
6. Craniodiaphyseal dysplasia
7. Cranio-fronto-nasal dysplasia
8. Cranio-metaphyseal dysplasia
9. Cranio-telencephalic dysplasia
10. Diaphyseal dysplasia (Camurati-Engelmann disease)
11. Diastrophic dysplasia
12. Frontometaphyseal dysplasia
13. GAPO S.
14. Gorlin S. (nevoid basal cell carcinoma S.)
15. Greig cephalopolysyndactyly S.
16. Hallermann-Streiff S. (oculo-mandibulo-facial S.)
17. Hydrocephalus
18. Hypochondroplasia
19. Infantile multisystem inflammatory disease (NOMID)
20. Larsen S.
21. Lissencephaly syndromes (congenital agyria)
22. Lowe S. (oculocerebrorenal S.)
23. Marshall-Smith S.
24. Megalencephaly
25. Metatropic dysplasia
26. Mucopolysaccharidoses (Hurler S.; Maroteaux-Lamy S.) (See J-4); mucolipidosis II (I-cell disease); GM1 gangliosidosis; fucosidosis
27. Oculo-auriculo-vertebral spectrum (Goldenhar-Gorlin S.)
29. Osteoglophonic dysplasia
30. Osteopetrosis, severe
31. Otopalatodigital S.
32. Progeria
33. Pyknodysostosis
34. Pyle dysplasia (familial metaphyseal dysplasia)
35. Robinow S.
36. Schinzel-Giedion S.
37. Schwarz-Lélek S.
38. Sclerosteosis
39. Silver-Russell S.
40. Sotos S. (cerebral gigantism)
41. Subdural hematoma, chronic
42. Thanatophoric dysplasia
43. Trisomy 8 S.

References

BIPARIETAL BOSSING*

1. Bilateral coronal synostosis, isolated or with Crouzon S. (craniofacial dysostosis)
2. Bilateral subdural hematoma, chronic
3. Cleidocranial dysplasia
4. Cloverleaf skull (kleeblattschädel anomaly)
5. Gorlin S. (nevoid basal cell carcinoma S.)
6. Pyknodysostosis
7. Rickets, healed

* Patients with achondroplasia, hypochondroplasia, and thanatophoric dysplasia have, in addition to frontal bossing, biparietal bossing which can be quite prominent clinically.

Reference
**Gamut A-10**

**LOCALIZED BULGE OF THE CALVARIUM OR SCALP**

**COMMON**
1. Anemia, chronic (eg, sickle cell disease; iron deficiency anemia)
2. Cephalohematoma
3. Metastatic carcinoma or neuroblastoma
4. Myeloma
5. Osteoma

**UNCOMMON**
1. Arachnoid cyst with erosion
2. Dermoid cyst, intradiploic
3. Fibrous dysplasia
4. Intracranial neoplasm (large) with erosion of calvarium
5. Langerhans cell histiocytosis
6. Leptomeningeal cyst
7. Meningioma
8. Meningocele; encephalocele
9. Neoplasm of skull, other (eg, osteosarcoma; lymphoma, hemangioma)
10. Paget's disease with secondary malignant neoplasm
11. Porencephalic cyst (porencephaly)
12. Scalp neoplasm or cyst
13. Subdural hematoma

**Reference**

**Gamut A-11**

**HYPOPLASIA OF THE BASE OF THE SKULL**

**COMMON**
1. Achondroplasia
2. Cretinism
3. Trisomy 21 S. (Down S.)

**UNCOMMON**
1. Achondrogenesis; hypochondrogenesis
2. Acrocephalopolysyndactyly (Carpenter type)
3. Acrocephalosyndactyly (Apert and Pfeiffer types)
4. Cranial dysplasia; cleidocranial dysplasia
5. Crouzon S. (craniofacial dysostosis)
6. Diastrophic dysplasia
7. Hallermann-Streiff S. (oculo-mandibulo-facial S.)
8. Hypochondroplasia
9. Metaphyseal chondrodysplasia (Jansen type)
10. Metatropic dysplasia
11. Orbital hypotelorism with arrhinencephaly; trisomy 13 S.
12. Short rib-polydactyly syndromes
13. Spondyloepiphyseal dysplasia congenita
14. Thanatophoric dysplasia

**References**

**Gamut A-12**

**BASILAR INVAGINATION**

**COMMON**
1. Arnold-Chiari malformation
2. Congenital craniovertebral anomaly (See C-9-1)
   a. Atlantoaxial dislocation with or without congenital separation of odontoid
b. Atlanto-occipital fusion (assimilation)
c. Klippel-Feil S.
d. Stenosis of foramen magnum
e. Unfused posterior arch of atlas

3. Osteogenesis imperfecta
4. Osteomalacia; rickets (See D-44)
5. Paget’s disease

UNCOMMON
1. Achondroplasia
2. Ankylosing spondylitis; rheumatoid arthritis; psoriatic arthritis
3. Aqueduct stenosis
4. Cleidocranial dysplasia
5. Crouzon S. (craniofacial dysostosis)
6. Familial
7. Fibrous dysplasia
8. Hajdu-Cheney S. (idiopathic acro-osteolysis)
9. Hydrocephalus, chronic
10. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
11. Hypophosphatasia
12. Langerhans cell histiocytosis
13. Lowe S. (oculocerebrorenal S.)
14. Metaphyseal chondrodysplasia (Jansen type)
15. Mucopolysaccharidoses (eg, Hurler, Morquio) (See J-4)
16. Occipital craniotomy in a child
17. Osteomyelitis (incl. syphilis; tuberculosis)
18. Osteopenia
19. Osteoporosis
20. Pyknodysostosis
21. Sjögren-Larsson S.
22. Trauma, severe
23. Trisomy 21 S. (Down S.)

References

Gamut A-13

TAM-O’-SHANTER SKULL (THICKENING OF THE SKULL VAULT WITH BASILAR INVAGINATION)

COMMON
1. Paget’s disease

UNCOMMON
1. Fibrous dysplasia
2. Hypophosphatasia
3. Neurofibromatosis
4. Osteogenesis imperfecta
5. Osteomalacia
6. Rickets

Gamut A-14

LOCALIZED INCREASED DENSITY, SCLEROSIS, OR THICKENING OF THE CALVARIUM

COMMON
1. Anatomic variation (eg, sutural sclerosis; external occipital protuberance)
2. Anemia (esp. sickle cell disease)
3. [Artifact; hair braid; overlying soft tissue tumor or calcified sebaceous cyst; neurofibroma; neurofibromatosis]
4. Cephalohematoma, calcified; ossified subdural hematoma

References (continued)
5. Chronic osteomyelitis or adjacent cellulitis; tuberculosis; syphilis; actinomycosis; mycetoma
6. [Depressed skull fracture]
7. Fibrous dysplasia
9. Meningioma
10. Metastasis, osteoblastic (eg, prostate; breast)
11. Osteoma
12. Paget’s disease

UNCOMMON
1. Arteriovenous malformation of dura
2. Cerebral hemiatrophy (Dyke-Davidoff-Masson S.)
3. [Dural calcification]
4. Epidermal nevus S.
5. Frontometaphyseal dysplasia
6. Head-banging, chronic
7. Hemangioma
8. Hypoparathyroidism
9. Ischemic necrosis (eg, bone flap)
10. Langerhans cell histiocytosis $g$, healing
11. Lipodystrophy, total (lipoaatrophic diabetes)
12. Lymphoma $g$
13. Mastocytosis
14. Osteoblastoma
15. Osteochondroma
16. Osteosarcoma*; infantile fibrosarcoma
17. Radiation osteonecrosis; treated tumor (eg, brown tumor of hyperparathyroidism; lytic metastasis from breast)
18. Tuberous sclerosis

* Sunburst spiculations may be present.

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

DIFFUSE OR WIDESPREAD INCREASED DENSITY, SCLEROSIS, OR THICKENING OF THE CALVARIUM

COMMON
1. Acromegaly
2. Anemia $g$ (sickle cell disease; thalassemia; iron deficiency anemia; hereditary spherocytosis)
3. Cerebral atrophy in childhood (contracting skull)
4. Congenital syndromes; sclerosing bone dysplasias (eg, osteopetrosis) (See A-15-2)
5. Fibrous dysplasia; leontiasis ossea
6. Hydrocephalus (postshunting)
7. Hyperostosis interna generalisata; Morgagni-Stewart-Morel S.
8. Normal; idiopathic
9. Metastases, osteoblastic (eg, prostate; breast)
10. Myelosclerosis
11. Paget’s disease (“cotton wool” appearance)
12. Renal osteodystrophy (secondary hyperparathyroidism) (treated, esp. in patients on dialysis)

UNCOMMON
1. Arteriovenous malformation, large
2. Craniosynostosis (See A-1)
3. Cretinism, hypothyroidism (treated)
4. Cyanotic congenital heart disease, longstanding
5. Dilantin (hydantoin) therapy
6. Fluorosis
7. Hemihypertrophy of cranium due to cerebral hemiatrophy (Dyke-Davidoff-Masson S.)
8. Homocystinuria
9. Hyperphosphatasia
10. Hypervitaminosis D
11. Hypoparathyroidism
12. Leukemia; lymphoma
13. Meningioma
14. Metastatic neuroblastoma
15. Microcephaly
16. Myotonic dystrophy
17. Osteomyelitis, chronic; mycetoma; syphilis
18. Polycythemia (childhood)
19. Rickets, treated (“bossing”); vitamin D-resistant rickets

* May show vertical striations (“hair on end”).
+ May develop leontiasis ossea (lion-like facies) due to overgrowth of facial bones.

References

Gamut A-15

CONGENITAL CONDITIONS WITH INCREASED DENSITY OR THICKENING OF THE SKULL

COMMON
1. Anemia (sickle cell disease; thalassemia; pyruvate kinase deficiency; hereditary spherocytosis)
2. Craniometaphyseal dysplasia; Pyle dysplasia; frontometaphyseal dysplasia
3. Craniostenosis (See A-1)
4. Cretinism; hypothyroidism
5. Cyanotic congenital heart disease, long standing
6. Diaphyseal dysplasia (Camurati-Engelmann disease)
7. Endosteal hyperostosis (van Buchem and Worth types)
8. Fanconi anemia (pancytopenia-dysmelia S.)
9. Fibrous dysplasia; leontiasis ossea (incl. polystotic fibrous dysplasia {McCune-Albright S.})
10. Hemihypertrophy of cranium due to cerebral hemiatrophy (Dyke-Davidoff-Masson S.)
11. Homocystinuria
12. Hyperphosphatasia
13. Marfan S.
14. Microcephaly
15. Mucopolysaccharidoses (eg, Hurler S.; Hunter S.; Sanfilippo S.; Maroteaux-Lamy S.) (See J-4); GM1 gangliosidosis; mannosidosis; fucosidosis
16. Osteopetrosis
17. Pachydermoperiostosis
18. Pseudohypoparathyroidism; pseudopseudohypoparathyroidism
19. Pyknody sostosis
20. Tuberous sclerosis

UNCOMMON
1. Aase-Smith S.
2. Acrodysostosis (peripheral dysostosis)
3. Cockayne S.
4. Coffin-Lowry S.
5. Craniodiaphyseal dysplasia
6. Distal osteosclerosis
7. Dysostoeosclerosis
8. Lenz-Majewski hyperostotic dwarfism
9. Lipodystrophy, total (lipatrophic diabetes)
10. Marshall S.
11. Melorheostosis
12. Neu-Laxova S.
13. Oculo-dento-osseus dysplasia
14. Osteodysplasty (Melnick-Needles S.)
15. Osteogenesis imperfecta
16. Osteopathia striata with cranial sclerosis
17. Otopalatodigital S., type I
18. Patterson S.
19. POEMS S.
20. Proteus S.
21. Salla disease
22. Schinzel-Giedion S.
23. Schwarz-Lélek S.

(continued)
24. Sclerosteosis  
25. Sialidosis (mucolipidosis I); mucolipidosis II (I-cell disease)  
26. Trichodentoosseous dysplasia  
27. Troell-Junet S.  
28. Tubular stenosis (Kenny-Caffey S.)  
29. Weill-Marchesani S.  
30. Williams S. (idiopathic hypercalcemia)  
31. XXXXY S.  

* May develop leontiasis ossea (lion-like facies) due to overgrowth of facial bones.

References  

Gamut A-16

LOCALIZED INCREASED DENSITY, SCLEROSIS, OR THICKENING OF THE BASE OF THE SKULL (SEE A-17)

COMMON
1. Fibrous dysplasia  
2. Mastoiditis, chronic sclerotic  
3. Meningioma

UNCOMMON
1. Chordoma (with calcification)  
2. Lymphoepithelioma of nasopharynx or paranasal sinus  
3. Lymphoma  
4. Nasopharyngeal infection, chronic (eg, tuberculosis)  
5. Osteoblastic metastasis  
6. Osteoma; chordroma  
7. Petrositis or osteomyelitis, chronic  
8. Radiation therapy for invasive carcinoma of ear, sphenoid sinus, or nasopharynx  
9. Sarcoma (eg, osteosarcoma; chondrosarcoma; rhabdomyosarcoma)  
10. Sphenoid sinusitis; mucocele

References  

Gamut A-17

GENERALIZED INCREASED DENSITY, SCLEROSIS, OR THICKENING OF THE BASE OF THE SKULL (SEE A-16)

COMMON
1. Fibrous dysplasia  
2. Paget’s disease

UNCOMMON
1. Anemia, primary (eg, thalassemia; sickle cell disease; pyruvate kinase deficiency; hereditary spherocytosis)  
2. Cleidocranial dysplasia  
3. Craniodiaphyseal dysplasia  
4. Craniometaphyseal dysplasia; frontometaphyseal dysplasia  
5. Cretinism; hypothyroidism  
6. Diaphyseal dysplasia (Camurati-Engelmann disease)  
7. Dysosteosclerosis  
8. Endosteal hyperostosis (van Buchem and Worth types)  
9. Fluorosis  
10. Hyperparathyroidism, primary or secondary (renal osteodystrophy) (treated)
11. Hyperphosphatasia
12. Hypervitaminosis D
13. Infantile multisystem inflammatory disease (NOMID)
14. Melorheostosis
15. Meningioma (extensive)
16. Metaphyseal chondrodysplasia (Jansen type)
17. Mucopolysaccharidosis (esp. Hurler S.)
18. Neurofibromatosis
19. Osteodysplasty (Melnick-Needles S.)
20. Osteopathia striata with cranial sclerosis
21. Osteopetrosis
22. Otopalatodigital S.
23. Pachydermoperiostosis
24. Pyknodysostosis
25. Pyle dysplasia
26. Ribbing disease (hereditary multiple diaphyseal sclerosis)
27. Sclerosteosis
28. Tricho-dento-osseous S.
29. Vitamin D-resistant rickets (healing)
30. Williams S. (idiopathic hypercalcemia)

References

Gamut A-18
LOCALIZED THINNING OF THE SKULL

COMMON
1. Parietal thinning
2. Subdural hematoma, chronic

UNCOMMON
1. Congenital arachnoid cyst
2. Intracranial tumor, slow growing
3. Leptomeningeal cyst
4. Localized cerebral agenesis or atrophy
5. Localized temporal horn hydrocephalus
6. Necrosis of skull (eg, radiation therapy)
7. Neurofibromatosis
8. Osteoporosis circumscripta (Paget's disease)
9. Porencephalic cyst (porencephaly)

References
References

Gamut A-20
DIFFUSE OR WIDESPREAD DEMINERALIZATION OR DESTRUCTION OF THE SKULL (INCLUDING “SALT AND PEPPER” SKULL) (SEE A-19)

COMMON
*1. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
*2. Leukemia; lymphoma
*3. Metastatic carcinoma or neuroblastoma
*4. Multiple myeloma (myelomatosis)
*5. Osteomyelitis, diffuse
6. Osteoporosis (eg, senile; postmenopausal)
   (See D-43-1)

UNCOMMON
1. Anemia (eg, sickle cell disease; thalassemia)
2. Electric burn; thermal burn
3. Idiopathic
4. Meningioma or other meningeal neoplasm
5. Osteomalacia; rickets (See D-44)
6. Osteonecrosis
*7. Paget’s disease (osteoporosis circumscripta)
8. Primary malignant neoplasm of skull (eg, Ewing sarcoma)
9. Radiation osteonecrosis; radium poisoning
10. Steroid therapy; Cushing S.
11. Syphilis

* May show mottled or “salt and pepper” destruction of calvarium.

Gamut A-21
EROSION OF THE INNER TABLE OF THE SKULL

COMMON
1. Metastasis
2. Osteomyelitis
3. Pacchionian granulation
4. Subdural hematoma, chronic

UNCOMMON
1. Arteriovenous malformation of brain surface
2. Cisterna magna anomaly
3. Epidermoid
4. Glioma or cyst of superficial brain cortex (eg, oligodendroglioma; leptomeningeal cyst)
5. Hemangioma
6. Langerhans cell histiocytosis (esp. eosinophilic granuloma)
7. Meningioma
8. Multiple myeloma
9. Neoplasm of dura, other (eg, sarcoma; melanoma)
10. Porencephalic cyst (porencephaly)
11. Sinus pericranii

Gamut A-22
BUTTON SEQUESTRUM OF THE SKULL*

COMMON
1. Eosinophilic granuloma
2. Metastatic carcinoma (esp. breast)
3. Osteomyelitis (esp. staphylococcal)

UNCOMMON
1. [Burr hole or bone flap]
2. [Calvarial “doughnut,” idiopathic]
3. Dermoid cyst
4. Epidermoid (primary cholesteatoma)
5. Fibrosing osteitis
6. [Hemangioma]
7. Meningioma
8. Multiple myeloma
9. Osteonecrosis (eg, radiation therapy; radium poisoning; electric burn; electric shock therapy)
10. Paget’s disease
11. Sarcoidosis
12. Syphilis
13. Tuberculosis

* Round radiolucent skull defect with central bony density or sequestrum.

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References

A. Skull and Brain 23

Gamut A-23

SOLITARY OSTEOLYTIC SKULL LESION (SEE A-23-2)

COMMON
*1. Cholesteatoma (inflammatory)
*2. Epidermoid (primary cholesteatoma)
*3. Fibrous dysplasia
4. Fracture (esp. depressed)
*5. Hemangioma
*6. Langerhans cell histiocytosis {esp. eosinophilic granuloma)

*7. Meningocele; encephalocele; cranium bifidum
8. Metastasis (esp. from carcinoma of breast, lung, thyroid, or kidney; neuroblastoma)
9. Myeloma; plasmacytoma
10. Normal variant (eg, venous lake; enlarged emissary channel; inioindineal canal; fontanelle; pacchionian granulation; parietal foramen; parietal thinning) (See A-35-S1)
*11. Osteomyelitis
12. Paget’s disease (osteoporosis circumscripta)
*13. Surgical defect (eg, burr hole; craniotomy flap)

UNCOMMON
1. Aplasia cutis congenita
2. Arachnoid cyst
3. Arteriovenous malformation
4. Bone sarcoma (eg, osteolytic osteosarcoma; Ewing sarcoma; chondrosarcoma)
5. Brown tumor of hyperparathyroidism
*6. Button sequestrum (See A-22)
*7. Calvarial “doughnut”; idiopathic
8. Chordoma of clivus
9. Dermal sinus
10. Dermoid
11. Direct extension from carcinoma of paranasal sinuses or nasopharynx
12. Ectopic intradiploic glial tissue (occipital)
*13. Fungus disease
14. Gaucher’s disease; Niemann-Pick disease
15. Glomus jugulare tumor (base)
16. Hydatid disease
17. Leptomeningeal cyst
*18. Lymphoma
*19. Mucocele or neoplasm of paranasal sinus
*20. Neoplasm of brain or dura with bone erosion (esp. meningioma)
21. Neoplasm or cyst of scalp (eg, carcinoma; rodent ulcer; neurofibroma; sebaceous cyst)
22. Neoplasm of skull, other (eg, chondroid lesion; aneurysmal bone cyst; lymphangioma; giant cell tumor, esp. complicating Paget’s disease; malignant fibrous histiocytoma; melanotic progonoma)
23. Neurofibromatosis (eg, asterion or lambdoid suture defect; absent sphenoid wing)

(continued)
24. Osteonecrosis of skull (eg, radiation therapy; electrical or thermal burn)
25. Sarcoidosis
26. Subdural hematoma (intraosseous or chronic)
27. Syphilis
28. Tuberculosis

* May have surrounding sclerosis.

References

Gamut A-23

RADIOLUCENT LESION OR BONE DEFECT IN THE SKULL, SOLITARY OR MULTIPLE

CONGENITAL OR DEVELOPMENTAL DEFECT
1. Aplasia cutis congenita
2. Congenital arachnoid cyst
3. Congenital fibromatosis
4. [Craniolacunia (lacunar skull)]
5. Dermal sinus
6. Dermoid
7. Ectopic intradiploic glial tissue
8. Encephalocele; meningoencephalocele; dermal sinus; median cleft face S.; cranium bifidum
9. Epidermoid (primary cholesteatoma)
10. Fibrous dysplasia (incl. cortical)
11. Fontanelle
12. Frontal fenestra
13. Hemangioma or arteriovenous malformation of bone or scalp
14. Iniondineal canal (emissary vein canal)

15. Neurofibromatosis (eg, asterion or lambdoid suture defect; absent sphenoid wing)
16. Pacchionian granulation
17. Parietal foramina
18. Parietal thinning
19. Venous lake or diploic channel
20. Wide sutures (See A-40, 41)

TRAUMATIC
1. Burr hole; surgical defect; craniotomy
2. Fracture, simple or depressed
3. Hematoma (cephalohematoma; intradiploic; subdural); cephalohydrocele
4. Leptomeningeal cyst

INFLAMMATORY OR INFECTIOUS
1. Cholesteatoma
2. Hydatid disease
3. Mucocele of paranasal sinus
4. Osteomyelitis, bacterial or fungal; abscess
5. Sarcoidosis
6. Syphilis; yaws
7. Tuberculosis

NEOPLASTIC
1. Aneurysmal bone cyst
2. Bone sarcoma (eg, Ewing sarcoma; osteosarcoma, chondrosarcoma, fibrosarcoma)
3. Chondroid lesion
4. Chordoma of clivus
5. Giant cell tumor (esp. complicating Paget’s)
6. Glomus jugulare tumor
7. Hemangioma; angiomatosis; lymphangioma
8. Intracranial tumor with erosion
9. Lymphoma; leukemia (chloroma)
10. Malignant fibrous histiocytoma
11. Melanotic progonoma
12. Meningioma
13. Metastasis (esp. from neuroblastoma or carcinoma of breast, lung, thyroid, or kidney)
14. Myeloma; plasmacytoma
15. Neoplasm of paranasal sinus or nasopharynx with direct extension
16. Neurofibroma of bone or scalp
17. Skin or scalp tumor with invasion (eg, carcinoma; rodent ulcer)

**MISCELLANEOUS**
1. Brown tumor of hyperparathyroidism
2. Button sequestrum (See A-22)
3. Calvarial “doughnut”; idiopathic
4. Gaucher disease; Niemann-Pick disease; Weber-Christian disease
5. Hemophilic pseudotumor
6. Langerhans cell histiocytosis (eosinophilic granuloma; Hand-Schüller-Christian disease; Letterer-Siwe disease)
7. Infantile cortical hyperostosis (Caffey’s disease)
8. Intraciphoideal neural heterotopia
9. Osteonecrosis (eg, radiation therapy; electrical or thermal burn; postoperative bone flap necrosis)
10. Paget’s disease (osteoporosis circumscripta)
11. Parietal thinning, senile

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**
3. Jacobson HG: Personal communication
5. Taveras JM, Wood EH: Diagnostic Neuroradiology. (ed 2) Baltimore: Williams & Wilkins, vol 1, 1976

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**Gamut A-24**

**SMALL SELLA TURCICA**

**COMMON**
1. Decreased intracranial pressure (eg, cerebral atrophy; successful shunt for hydrocephalus)
2. Hypopituitarism; growth hormone deficiency
3. Normal variant

**UNCOMMON**
1. Cockayne S.
2. “Contracting skull” (postinflammatory or posttraumatic cerebral degeneration)
3. Deprivation (psychosocial) dwarfism
4. Fibrous dysplasia
5. Genetic (primordial) dwarfism
6. Microcephaly (See A-2)
7. Myotonic dystrophy
8. Prader-Willi S.
9. Radiation therapy during childhood
10. Sheehan S. (postpartum pituitary necrosis)
11. Trisomy 21 S. (Down S.)
12. Vestigial or dysplastic sella

**References**

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**Gamut A-25-1**

**ABNORMAL SELLA—J-SHAPED SELLA TURCICA**

**COMMON**
1. Hydrocephalus (mild arrested)
2. Normal variant (5% of normal children)
3. Optic chiasm glioma

**UNCOMMON**
1. Achondroplasia
2. Cretinism
3. Mucopolysaccharidoses (eg, Hurler S. [gargoylism]; Hunter S.; Maroteaux-Lamy S.); mucolipidoses (See J-4)

(continued)
4. Neurofibromatosis (sphenoid dysplasia)
5. Pituitary tumor extending anteriorly
6. Subarachnoid cyst (intrasellar)
7. Suprasellar tumor

Reference

Gamut A-25-2

ELONGATED OR STRETCHED SELLA

1. Craniopharyngioma or other juxtasellar or suprasellar neoplasm (eg, meningioma)
2. Enlarging head (eg, storage diseases; chondrodystrophies; hydrocephalus; megalencephaly)
3. Normal variant

Reference

Gamut A-25-3

OMEGA OR SCOOPED SELLA

COMMON
1. Normal (unilateral)
2. Optic chiasm tumor (glioma; neurofibroma)
3. Pituitary fossa tumor (esp. chromophobe or eosinophilic adenoma)

UNCOMMON
1. Maroteaux-Lamy S.

Reference

Gamut A-25

DYSPLASTIC SELLA

1. Neurofibromatosis

Reference

Gamut A-26

ENLARGED, ERODED, OR DESTROYED SELLA TURCICA (INCLUDING INTRASELLAR OR PARASELLAR MASS ON CT OR MRI)

COMMON
1. Aneurysm or ectatic internal carotid artery (cavernous or suprasellar segment); carotid-cavernous fistula
2. Craniopharyngioma
3. Cretinism; hypothyroidism
4. Empty sella syndrome; hypopituitarism
5. Increased intracranial pressure, chronic (eg, obstructive hydrocephalus; dilated third ventricle {aqueductal stenosis}; neoplasm; universal craniosynostosis)
6. Juxtasellar or suprasellar neoplasm, other (eg, meningioma; schwannoma of cranial nerves III to VI; optic chiasm glioma; epidermoid; dermoid; teratoma; hamartoma of tuber cinereum; hypothalamic glioma; germinoma; ectopic pinealoma)
7. [Osteoporosis; osteomalacia; hyperparathyroidism]
8. Pituitary adenoma (eg, chromophobe adenoma; eosinophilic adenoma, often with acromegaly or gigantism)

UNCOMMON
1. Abscess (pituitary)
2. Arachnoid cyst, suprasellar or intrasellar, congenital or acquired (eg, after intracranial bleeding, infection, or with storage disease)
3. Basilar (transspHENoid) encephalocele
4. Benign neoplasm of skull base (eg, ossifying fibroma; osteochondroma; osteoma; chondroma)
5. Chordoma
6. Frontal lobe neoplasm
7. Hypogonadism (incl. Turner S.)
8. Infundibular lesion (eg, metastasis; sarcoidosis)
9. Langerhans cell histiocytosis (often leading to diabetes insipidus)
10. Lymphocytic hypophysitis (pituitary enlargement, usually with normal sella, in postpartum woman with thyrotoxicosis)
11. Metastasis (esp. from carcinoma of lung, breast, or kidney; melanoma)
12. MuCOcele of sphenoid sinus
13. Mucopolysaccharidoses (esp. Hurler S.); mucolipidosis (See J-4)
14. Neoplasm of sphenoid sinus or nasopharynx with local invasion (eg, carcinoma; juvenile angiofibroma; giant cell tumor; osteosarcoma)
15. Neurofibromatosis
16. Optic nerve neoplasm (eg, glioma; neurofibroma; meningioma)
17. Osteomyelitis, granuloma (eg, syphilis; tuberculosis; sarcoidosis; fungus disease)
18. Oxycephaly
19. Pituitary gland hypertrophy after adrenal ablation (Nelson S.) or with hypothyroidism or primary precocious puberty
20. Pituitary neoplasm, other (eg, adenocarcinoma; carcinosarcoma; lymphoma; oncocytoMA; prolactinoma; choristoma)
21. Postoperative change
22. Rathke cleft cyst

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References

Gamut A-27

EROSION OF THE SPHENOID WING

COMMON
1. [Congenital defect, isolated or with neurofibromatosis]
*2. Meningioma

UNCOMMON
1. Benign bone neoplasm (eg, chondroma; giant cell tumor)
2. Chordoma
*3. Craniopharyngioma
4. Expansion of middle fossa (See A-69)
*5. Glioma (eg, optic)
6. Increased intracranial pressure, chronic
7. Langerhans cell histiocytosis
8. Metastasis

(continued)
Gamut A-28

9. Parasellar aneurysm of internal carotid artery
10. Pituitary tumor (esp. chromophobe adenoma)
11. Plexiform neurofibroma

* Lesser wing erosion; other lesions listed involve the greater wing.

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut A-28

EROSION OF THE PETROUS RIDGE, PYRAMID, OR APEX

COMMON
1. Acoustic schwannoma
2. Bone neoplasm, benign or malignant (eg, chondroma; hemangioma; osteoblastoma; chordoma)
*3. Cholesteatoma, acquired* or congenital (epidermoid)
4. Cholesterol granuloma
*5. Metastasis (esp. breast, lung, kidney)

UNCOMMON
*1. Aneurysm of intracavernous or intrapetrous carotid artery
*2. Carcinoma of external auditory meatus
3. Glioma
*4. Glomus jugulare tumor
5. Langerhans cell histiocytosis
6. Leptomeningeal cyst
7. Lymphoma
8. Malignant neoplasm of nasopharynx (invasive)
9. Meningioma of Meckel’s cave
10. Osteomyelitis; apical petrositis (Gradenigo S.)
*11. Rhabdomyosarcoma (child)
12. Schwannoma of V, IX, or X nerve
*13. Tuberculosis

* Middle ear lesion.

References

Gamut A-29

EROSION OR WIDENING OF THE INTERNAL AUDITORY MEATUS

COMMON
1. Acoustic schwannoma
2. [Normal patulous canal]

UNCOMMON
1. Cholesteatoma, inflammatory or congenital (epidermoid)
2. Cyst
3. Glioma of brain stem
4. Increased intracranial pressure; chronic hydrocephalus
5. Meningioma of cerebellopontine angle or petrous apex
6. Metastasis
7. Neurofibromatosis
8. Schwannoma of V or VII nerve
9. Vascular lesion (eg, aneurysm of internal auditory canal artery; arteriovenous malformation; hemangioma)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut A-30

DENSE TEMPORAL BONE LESION

COMMON
1. Fibrous dysplasia
2. Mastoiditis, chronic sclerotic

UNCOMMON
1. Congenital bone dysplasia (eg, osteopetrosis; pyknodysostosis; craniometaphyseal dysplasia)
2. Ossifying fibroma
3. Osteoblastic metastasis
4. Osteosarcoma
5. Otodystrophies (See B-25, B-34)
6. Paget’s disease (treated)

Reference

Gamut A-31

NEOPLASM INVOLVING THE TEMPORAL BONE

BENIGN
COMMON
1. Acoustic schwannoma (VIII nerve)
2. Cholesterol granuloma
3. Epidermoid (congenital cholesteatoma)
4. Langerhans cell histiocytsisg (esp. eosinophilic granuloma)

UNCOMMON
1. Adenoma (soft tissue); ceruminous gland tumor of external auditory canal
2. Exostosis of external auditory canal
3. Giant cell tumor
4. Glomus jugulare tumor; glomus tympanicum tumor
5. Hemangioma
6. Meningioma
7. Osteoma (cancellous or compact)
8. Schwannoma of V, VII, IX, X, XI, or XII nerve

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

MALIGNANT
COMMON
1. Metastasis (esp. from carcinoma of breast, lung, prostate, or kidney; or melanoma) or local extension from parotid carcinoma

UNCOMMON
1. Carcinoma of external auditory canal or rarely the middle ear
2. Lymphoma; leukemia
3. Myeloma
4. Sarcoma (eg, rhabdomyosarcoma; fibrosarcoma; lymphosarcoma; osteosarcoma; chondrosarcoma; undifferentiated sarcoma)

(continued)
References

SMALL OR IRREGULAR FORAMEN MAGNUM

1. Bilateral or unilateral occipitalization (fusion) of C1 to base of skull
2. Chondrodystrophies
   a. Achondroplasia
   b. Achondrogenesis, types I and II
   c. Diastrophic dysplasia
   d. Hypochondroplasia
   e. Metatropic dysplasia
   f. Thanatophoric dysplasia

References

ENLARGED FORAMEN MAGNUM

UNCOMMON
1. Frontometaphyseal dysplasia
2. Hydrocephalus S.
3. Hypophosphatasia
4. Neoplasm of posterior fossa or upper cervical spine
5. Rubinstein-Taybi S.
6. Syringobulbia

References

SKULL AND FACIAL BONES OF MEMBRANOUS ORIGIN

1. Facial bones, including mandible
2. Frontal bone
3. Occipital bone (upper squamosa)
4. Parietal bone
5. Pterygoid (medial plate)
6. Temporal bone (squamosal and tympanic parts)
7. Vomer

Reference
NORMAL SKULL VARIANTS

COMMON
1. Arterial groove (eg, middle meningeal)
2. [Artifact (eg, hair braid; rubber band; skin fold; EEG paste; surgical tape or dressing; skin laceration with air trapping)]
3. Convolutional impressions
4. Crista galli
5. Dural sinus (eg, transverse or sigmoid sinus)
6. Emissary vein; venous lake; diploic channel; sinus groove; other prominent vascular markings
7. Fontanelle
8. Frontal crest
9. Infantile J-shaped sella turcica
10. Metopic suture; mendosal suture
11. Pacchionian granulation
12. Sutural (wormian) bones; interparietal sutures; atypical suture line
13. Torcular Herophili

UNCOMMON
1. Cruciate ridge
2. Inioindineal canal
3. Interparietal bone
4. Kerckring bone (process)
5. Occipital fissure (superior, inferior longitudinal fissure); posterior parietal fissure
6. Parietal foramina
7. Parietal thinning
8. Unfused planum sphenoidale

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

NORMAL SKULL VARIANTS THAT MAY SIMULATE A FRACTURE

1. Arterial groove (eg, meningeal vessels; middle temporal branch of superficial temporal artery; deep temporal branches of internal maxillary artery; supraorbital artery)
2. Artifact or soft tissue alteration (eg, skin laceration; skin fold; air trapped beneath skin; matted hair; hair braid; rubber band; tape; dressing; linen)
3. Emissary vein; venous lake; diploic channel; sinus groove
4. Fissure; synchondrosis; suture
   a. Cerebellar synchondrosis
   b. Coronal suture
   c. Innominate synchondrosis
   d. Interparietal suture
   e. Intersphenoid synchondrosis
   f. Lambdoid suture
   g. Lateral fissures of the foramen magnum
   h. Lateral interparietal fissure
   i. Lateral sphenoidal suture
   j. Median occipital fissure
   k. Mendosal suture
   l. Metopic suture
   m. Occipitomastoid suture
   n. Parietal fissure
   o. Parietomastoid suture
   p. Spheno-occipital synchondrosis
   q. Squamosal suture
   r. Transverse occipital suture
   s. Unfused planum sphenoidale
5. Wormian (sutural) bone

References

MULTIPLE WORMIAN (SUTURAL) BONES

COMMON
1. Cleidocranial dysplasia
2. Cretinism; hypothyroidism
3. Hypophosphatasia
4. Normal up to 6 months of age; idiopathic
5. Osteogenesis imperfecta
6. Progeria
7. Pyknody sostosis

UNCOMMON
1. Acrogeria
2. Aminopterin fetopathy
3. Aplasia cutis congenita (Adams-Oliver S.)
4. Chondrodysplasia punctata (Conradi-Hönermann type)
5. Familial idiopathic osteoarthropathy (Currarino S.)
6. Geroderma osteodysplastica
7. Hajdu-Cheney S. (idiopathic acro-osteolysis)
8. Hallermann-Streiff S. (oculo-mandibulo-facial S.)
9. Hydrocephalus (infantile)
10. Infantile multisystem inflammatory disease (NOMID)
11. Mandibuloacral dysplasia
12. Menkes S. (kinky-hair S.); copper deficiency
13. Metaphyseal chondrodysplasia (Jansen type)
14. Osteopetrosis, infantile type; sclerosteosis
15. Otopalatodigital S.
16. Pachydermoperiostosis
17. Prader-Willi S.
18. Schinzel-Giedion S.
19. Trisomy 21 S. (Down S.)
20. Zellweger S. (cerebrohepato renal S.)

References

DELAYED OR DEFECTIVE CRANIAL OSSIFICATION

TRANSIENT
(Spontaneous correction before 3 years of age)
1. Aminopterin fetopathy
2. Aplasia cutis congenita (congenital scalp defect—may not correct)
3. Craniolacunia (lacunar skull)
4. Cutis laxa; Ehlers-Danlos S.
5. Hypophosphatasia
6. Menkes S. (kinky-hair S.)
7. Metaphyseal chondrodysplasia (Jansen type)
8. Mucopolysaccharidoses (eg, Hunter S.; Hurler S.; Maroteaux-Lamy S.) (See J-4)
9. Osteogenesis imperfecta (does not often correct before age 3)
10. Rubinstein-Taybi S.
11. Silver-Russell S.
12. Trisomy 13 S.
13. Trisomy 18 S.
14. Trisomy 21 S. (Down S.)
15. Zellweger S. (cerebrohepato renal S.)
INTERMEDIATE
(Spontaneous correction between 3 and 10 years)
1. Cretinism; hypothyroidism
2. Osteogenesis imperfecta
3. Otopalatodigital S.
4. Pachydermoperiostosis
5. Progeria
6. Rickets

PROTRACTED
(Persistence beyond 10 years of age)
1. Cleidocranial dysplasia
2. Cranium bifidum occultum
3. Cretinism; hypothyroidism
4. Dermal sinus
5. Encephalocele
6. Frontonasal dysplasia (median cleft face S.)
7. Hallermann-Streiff S. (oculo-mandibulo-facial S.)
8. Hypertelorism with Sprengel’s deformity
9. Parietal foramina; occipital foramina
10. Parietal thinning
11. Pyknodyostosis
12. Stanescu dysostosis
13. Tubular stenosis (Kenny-Caffey S.)

LETHAL ENTITIES WITH DEFECTIVE CRANIAL OSSIFICATION
1. Achondrogenesis, type I
2. Fibrochondrogenesis
3. Hypochondrogenesis
4. Hypophosphatasia (prenatal form; severe congenital form)
5. Short rib-polydactyly S., type I (Saldino-Noonan S.)

References
1. Campbell JB: Personal communication.
2. Dorst JP: Personal communication.

SMALL ANTERIOR FONTANELLE
1. Craniosynostosis, primary
2. Craniosynostosis, secondary (eg, chronic anemia; rickets; hypophosphatasia)
3. Premature closure of sutures (eg, cerebral atrophy; decreased intracranial pressure due to shunted hydrocephalus)
4. Normal variant

Reference

CONGENITAL SYNDROMES AND BONE DYSPLASIAS WITH LARGE ANTERIOR FONTANELLE OR DELAYED CLOSURE OF FONTANELLES

COMMON
1. Cleidocranial dysplasia
2. Cranium bifidum with lacunar skull
3. Cretinism; hypothyroidism
4. Intrauterine growth retardation (IUGR) or prenatal infection (eg, fetal rubella S.)
5. Normal (esp. in premature)
6. Osteogenesis imperfecta
7. Rickets, severe
8. Trisomy 21 S. (Down S.)

UNCOMMON
1. Aase S.
2. Aminopterin fetopathy
3. Aplasia cutis congenita (congenital scalp defects)
4. Chondrodysplasia punctata

(continued)
5. Coffin-Lowry S.
6. Cutis laxa, type II; occipital horn S.
7. Familial idiopathic osteoarthropathy (Currarino S.)
8. Fetal hydantoin S. (Dilantin embryopathy)
9. Fetal primidone S.
10. Frontonasal dysplasia (median cleft face S.)
11. G syndrome
12. GAPO S.
13. Greig cephalopolysyndactyly S.
14. Hallermann-Streiff S. (oculo-mandibulo-facial S.)
15. Hypochondroplasia
16. Hypophosphatasia
17. Infantile multisystem inflammatory disease (NOMID)
18. Lenz-Majewski dysplasia (hyperostotic dwarfism)
19. Microcephalic osteodysplastic dysplasia
20. Oculo-auriculo-vertebral spectrum (Goldenhar S.)
21. Opitz BBBG syndrome (hypertelorism-hypospadias S.)
22. Opsismodyplasia
23. Osteodysplasty (Melnick-Needles S.)
24. Otopalatodigital S., types I and II
25. Progeria
26. Pyknodysostosis
27. Rubinstein-Taybi S.
28. Schinzel-Giedion S.
29. Silver-Russell S.
30. Trisomy 13 S.
31. Trisomy 18 S.
32. Tubular stenosis dysplasia (Kenny-Caffey S.)
33. Winchester S.
34. Yunis-Varon S.
35. Zellweger S. (cerebrohepatorenal S.)

References
11. Hyperparathyroidism, primary infantile or secondary (renal osteodystrophy)
12. Hypoparathyroidism
13. Hypophosphatasia
14. Laron S. (pituitary dwarfism II); growth hormone deficiency
15. Mandibuloacral dysplasia
16. Neurofibromatosis (bone defect along lambdoid suture)
17. Pachydermoperiostosis
18. Progeria
19. Prolonged parenteral hyperalimentation
20. Pseudotumor cerebri
21. Pyknody sostosis
22. Rubinstein-Taybi S.
23. Schinzel-Giedion S.
24. Silver-Russell S.
25. Trisomy 13 S.
26. Trisomy 18 S.
27. Vitamin A deficiency or intoxication
28. Winchester S.
29. Zellweger S. (cerebrohepatorenal S.)

References

SEPARATION OR INFILTRATION OF SKULL SUTURES IN AN INFANT OR CHILD (See A-40)

COMMON
1. Brain abscess; cerebritis
2. Brain tumor (eg, pinealoma; medulloblastoma)
3. Cerebral edema, hemorrhage, or contusion
4. Hydrocephalus (See A-114); hydranencephaly
5. Incomplete ossification adjacent to sutures (See A-40)
6. Increased intracranial pressure, other causes (See A-113)
7. Lead poisoning; other encephalopathy
8. Leukemia; lymphoma
9. Meningitis; meningoencephalitis
10. Neuroblastoma, metastatic
11. Normal (esp. prematurity)
12. Subdural hematoma or hygroma
13. Trauma; intracranial injury

UNCOMMON
1. Hydranencephaly
2. Hypervitaminosis A encephalopathy
3. Intracranial cyst, large
4. Megalencephaly
5. Pseudotumor cerebri
6. Rebound growth of brain and body after treatment for hypothyroidism or deprivation (psychosocial) dwarfism

References
Gamut A-42

DECREASED OR ABSENT
CONVOLUTIONAL MARKINGS

COMMON
1. Cerebral atrophy
2. Normal to age 3 years
3. Shunted hydrocephalus

UNCOMMON
1. Cretinism; hypothyroidism
2. Deprivation (psychosocial) dwarfism
3. Failure to thrive, severe

Reference

Gamut A-43

INCREASED CONVOLUTIONAL
(DIGITAL) MARKINGS

COMMON
1. Craniosynostosis, primary (localized or universal, incl. cloverleaf skull {kleblattschädel anomaly})
2. Increased intracranial pressure, chronic (eg, brain tumor; cyst; hydrocephalus) (See A-113,114)
3. [Lacunar skull (craniolacunia; luckenschädel)]
4. Normal

UNCOMMON
1. Craniometaphyseal dysplasia
2. Craniosynostosis, secondary (eg, healing rickets, hypophosphatemia; hypercalcemia; hyperthyroidism; chronic anemia — esp. thalassemia)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Gamut A-44

INCREASED SIZE OF THE VASCULAR
GROOVES OF THE SKULL

COMMON
1. Arteriovenous malformation
2. Hemangioma of skull
3. Meningioma
4. Normal variant

UNCOMMON
1. Collateral circulation (eg, thrombosis of a venous sinus; occlusion of internal carotid artery)
2. Fibrous dysplasia
3. Metastasis (eg, from carcinoma of thyroid or kidney)
4. Pacchionian granulations
5. Paget’s disease
6. Sarcoma or other malignant neoplasm of skull

Reference

Gamut A-45-1

GENERALIZED “HAIR ON END” PATTERN IN THE SKULL

COMMON
1. Congenital hemolytic anemias, (thalassemia; sickle cell disease; spherocytosis; elliptocytosis)
UNCOMMON
1. Cyanotic congenital heart disease with secondary polycythemia
2. Hypernephroma with increased erythropoiesis
3. Iron deficiency anemia, severe
4. Leukemia; lymphoma
5. Multiple myeloma
6. Polycythemia vera
7. Red cell enzyme deficiencies with secondary reticulo-locytosis (e.g., pyruvate kinase, hexokinase, glucose-6–phosphate dehydrogenase)

References

LOCALIZED “SUNBURST” PATTERN IN THE SKULL

COMMON
1. Hemangioma
2. Meningioma
3. Metastasis (esp. neuroblastoma; carcinoma of prostate or breast)

UNCOMMON
1. Ewing sarcoma
2. Osteosarcoma

References
10. Granuloma (congenital cerebral)
11. Hamartoma
12. Hemangioma
13. Hematoma, chronic (eg, intracerebral; subdural; epidural)
14. Hypophysis
15. [Iatrogenic (eg, contrast medium injection into an abscess or cyst)]
16. Infarct, cerebral
17. Lipoma of corpus callosum
18. Meningioma
19. Metastatic neoplasm (eg, from osteosarcoma; mucinous adenocarcinoma of colon)
20. Parasitic cyst (eg, hydatid; Cysticercus; Paragonimus)
21. Pinealoma (eg, germinoma; teratoma)
22. Pituitary adenoma (esp. chromophobe)
23. Pituitary “stone”
24. Porencephalic cyst (porencephaly)
25. Radiation necrosis
26. Scarring; gliosis
27. Schwannoma; neurofibroma
28. Syphilitic gumma
29. Tuberous sclerosis

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

MULTIPLE INTRACRANIAL CALCIFICATIONS (SEE A-46, 49)

COMMON
1. Atherosclerosis (esp. carotid artery siphon)
2. Idiopathic
3. Physiologic (eg, dura {falx, tentorium, superior sagittal sinus}; petroclinoid and interclinoid ligament {diaphragma sellae}; choroid plexi; pineal gland; habenula)

UNCOMMON
1. AIDS with opportunistic infections (eg, toxoplasmosis)
2. Arteriovenous malformation; aneurysms; hemangiomas; Sturge-Weber S.; von Hippel-Lindau disease
3. Basal ganglia (eg, hypoparathyroidism; pseudohypoparathyroidism; Fahr disease) (See A-49)
4. Brain abscesses (healed)
5. Calcification, metastatic
6. Carbon monoxide intoxication
7. Cockayne S.
8. Encephalitis, viral (eg, congenital transplacental infection*—fetal rubella S.; cytomegalovirus infection; fetal herpes simplex infection); measles; chickenpox; poliomyelitis
9. Folic acid deficiency
10. Fungus disease with basal arachnoiditis (eg, cryptococcosis {torulosis}; coccidioidomycosis; zygomycosis {mucormycosis})
11. Gorlin S. (nevus basal cell carcinoma S.) (falx; tentorium)
12. Hematomas, old (eg, intracerebral; subdural; epidural)
13. Homocystinuria
14. Hyperparathyroidism, primary or secondary (renal osteodystrophy); renal failure (vascular calcifications)
15. Hypervitaminosis D (dura; pineal gland)
16. [Iatrogenic (eg, Pantopaque or other contrast medium residual)]
17. Lead poisoning
18. Leukemia (treated)
19. Lipoid proteinosis (hyalinosis cutis)
20. Lissencephaly syndromes (congenital agyria) (Miller-Dieker S.)
21. Listeriosis
22. Methotrexate therapy for childhood leukemia
23. Needle-tracks following ventriculography
24. Neoplasms, multiple (eg, meningiomas; gliomas; metastases)
25. Neurofibromatosis (choroid plexi)
26. Parasitic disease (eg, cysticercosis; paragonimiasis; hydatid disease)
27. Pseudoxanthoma elasticum
28. [Scalp (eg, sebaceous cysts; cysticercosis; foreign bodies; EEG paste)]
29. Scarring; gliosis (eg, postradiation therapy; old birth trauma or other injuries)
30. Toxoplasmosis*
31. Tuberculomas; tuberculous meningitis (treated)
32. Tuberous sclerosis
33. Williams S. (idiopathic hypercalcemia) (falx, tentorium)
34. Wilson’s disease

* Newborn infantile brain calcifications which can be seen on ultrasound.

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut A-48
SELLAR OR PARASELLAR CALCIFICATION

COMMON
1. Aneurysm of a cerebral artery (eg, giant internal carotid aneurysm; circle of Willis; basilar artery)
2. Atherosclerosis of internal carotid artery siphon in cavernous sinus
3. Craniofaryngioma
4. Normal (petroclinoid or interclinoid ligament-diaphragma sellae)

UNCOMMON
1. Arteriovenous malformation
2. Dermoid
3. Ectopic pinealoma; teratoma
4. Hyperparathyroidism (vascular calcification)
5. Meningioma
6. Optic chiasm glioma (rare)
7. Skull neoplasm (eg, chordoma; osteochondroma; chondroma; osteoma)
8. Pituitary adenoma (esp. chromophobe)
9. Pituitary “stone” in otherwise normal pituitary gland
10. Tuberculous meningitis, healed; granuloma

(continued)
References

Gamut A-49

BASAL GANGLIA CALCIFICATION

COMMON
1. Hypoparathyroidism; pseudohypoparathyroidism
2. Idiopathic; normal variant; physiologic with aging

UNCOMMON
1. AIDS encephalopathy
2. Atherosclerosis
3. Birth anoxia, hypoxia
4. Carbonic anhydrase II deficiency
5. Carbon monoxide intoxication
6. Cockayne S.
7. Fahr disease (ferrocalcinosis)
8. Familial idiopathic symmetrical basal ganglia calcification and microcephaly
9. Hallervorden-Spatz disease
10. Hemorrhage
11. Hyperparathyroidism
12. Hypothyroidism; cretinism
13. Idiopathic lenticulodentate calcification (Hastings-James S.)
14. Kearns-Sayre S.
15. Lead encephalopathy
16. Lipoid proteinosis (hyalinosis cutis)
17. MELAS syndrome
18. Methotrexate therapy for childhood leukemia
19. Oculo-dento-osseous dysplasia
20. Parasitic disease (eg, toxoplasmosis; cysticercosis)
21. Parkinsonism
22. Phenylketonuria variants
23. Pseudopseudohypoparathyroidism
24. Radiation therapy
25. Trisomy 21 S. (Down S.)
26. Tuberous sclerosis
27. Viral encephalitis, esp. in fetus or newborn (eg, rubella; measles; chickenpox; cytomegalovirus infection); coxsackie B

References

Gamut A-50

CURVILINEAR OR RING-LIKE INTRACRANIAL CALCIFICATION

VASCULAR
1. Aneurysm (incl. vein of Galen “aneurysm”)
2. Arteriosclerosis (esp. internal carotid artery)
3. Hemangioma; arteriovenous malformation; Sturge-Weber S.
4. Hematoma, chronic (esp. subdural); hygroma

NEOPLASTIC
1. Cystic astrocytoma
2. Cystic craniopharyngioma
3. Lipoma of corpus callosum
4. Pinealoma; teratoma
PARASITIC
1. Cysticercus cyst (occasional ring-like calcification)
2. Hydatid cyst
3. Paragonimus cyst (often “soap-bubble” calcification)
4. Toxoplasmosis

OTHER
1. Abscess, old
2. Cytomegalovirus infection

Reference

Gamut A-51-S1
WHO CLASSIFICATION OF TUMORS OF THE NERVOUS SYSTEM

TUMORS OF NEUROEPITHELIAL TISSUE

Astrocytic Tumors

Diffuse astrocytoma 3
Fibrillary astrocytoma 3
Protoplasmic astrocytoma 3
Gemistocytic astrocytoma 3
Anaplastic astrocytoma 3
Glioblastoma 3
Giant cell glioblastoma 3
Gliosarcoma 3
Pilocytic astrocytoma 1
Pleomorphic xanthoastrocytoma 3
Subependymal giant cell astrocytoma 1

Oligodendroglial Tumors

Oligodendroglioma 3
Anaplastic oligodendroglioma 3

Mixed Gliomas
Oligoastrocytoma 3
Anaplastic oligoastrocytoma 3

Ependymal Tumors
Ependymoma 3
Cellular 3
Papillary 3
Clear cell 3
Tanycytic 3
Anaplastic ependymoma 3
Myxopapillary ependymoma 1
Subependymoma 1

Choroid Plexus Tumors
Choroid plexus papilloma 0
Choroid plexus carcinoma 3

Glial Tumors of Uncertain Origin
Astroblastoma 3
Gliomatosis cerebri 3
Choroid glioma of the 3rd ventricle 1

Neuronal and Mixed
Neuronal-Glial Tumors
Gangliocytoma 0
Dysplastic gangliocytoma of cerebellum (Lhermitte-Duclos) 0
Desmoplastic infantile astrocytoma/ganglioglioma 1
Dysembryoplastic neuroepithelial tumor 0
Ganglioglioma 1
Anaplastic ganglioglioma 3
Central neurocytoma 1
Cerebellar liponeurocytoma 1
Paragangioma of filum terminale 1

Neuroblastic Tumors
Olfactory neuroblastoma (Aesthesioneuroblastoma) 3
Olfactory neuroepithelioma 3
Neuroblastomas of the adrenal gland and sympathetic nervous system 3

(continued)
### Pineal Parenchymal Tumors

<table>
<thead>
<tr>
<th>Behavior*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pineocytoma</td>
</tr>
<tr>
<td>Pineoblastoma</td>
</tr>
<tr>
<td>Pineal parenchymal tumor of intermediate differentiation</td>
</tr>
</tbody>
</table>

### Embryonal Tumors

<table>
<thead>
<tr>
<th>Behavior*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medulloepithelioma</td>
</tr>
<tr>
<td>Ependymoblastoma</td>
</tr>
<tr>
<td>Medulloblastoma</td>
</tr>
<tr>
<td>Desmoplastic medulloblastoma</td>
</tr>
<tr>
<td>Large cell medulloblastoma</td>
</tr>
<tr>
<td>Medulomyoblastoma</td>
</tr>
<tr>
<td>Melanotic medulloblastoma</td>
</tr>
<tr>
<td>Supratentorial primitive neuroectodermal tumor (PNET)</td>
</tr>
<tr>
<td>Neuroblastoma</td>
</tr>
<tr>
<td>Ganglioneuroblastoma</td>
</tr>
<tr>
<td>Atypical teratoid/rhabdoid tumor</td>
</tr>
</tbody>
</table>

### TUMORS OF THE MENINGES

#### Tumors of Meningothelial Cells

<table>
<thead>
<tr>
<th>Behavior*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meningioma</td>
</tr>
<tr>
<td>Meningothelial</td>
</tr>
<tr>
<td>Fibrous (fibroblastic)</td>
</tr>
<tr>
<td>Transitional (mixed)</td>
</tr>
<tr>
<td>Psammomatous</td>
</tr>
<tr>
<td>Angiomatous</td>
</tr>
<tr>
<td>Microcystic</td>
</tr>
<tr>
<td>Secretory</td>
</tr>
<tr>
<td>Lymphoplasmacyte-rich</td>
</tr>
<tr>
<td>Metaplastic</td>
</tr>
<tr>
<td>Clear cell</td>
</tr>
<tr>
<td>Choroid</td>
</tr>
<tr>
<td>Atypical</td>
</tr>
<tr>
<td>Papillary</td>
</tr>
<tr>
<td>Rhabdoid</td>
</tr>
<tr>
<td>Anaplastic meningioma</td>
</tr>
</tbody>
</table>

#### Primary Melanocytic Lesions

<table>
<thead>
<tr>
<th>Behavior*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diffuse melanocytosis</td>
</tr>
<tr>
<td>Melanocytoma</td>
</tr>
<tr>
<td>Malignant melanoma</td>
</tr>
<tr>
<td>Meningeal melanomatosis</td>
</tr>
</tbody>
</table>

#### Tumors of Uncertain Histogenesis

<table>
<thead>
<tr>
<th>Behavior*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemangioblastoma</td>
</tr>
</tbody>
</table>

### TUMORS OF PERIPHERAL NERVES

#### Schwannoma

<table>
<thead>
<tr>
<th>Behavior*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neurilemmoma, Neurinoma</td>
</tr>
<tr>
<td>Cellular</td>
</tr>
<tr>
<td>Plexiform</td>
</tr>
<tr>
<td>Melanotic</td>
</tr>
</tbody>
</table>

#### Neurofibroma

<table>
<thead>
<tr>
<th>Behavior*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plexiform</td>
</tr>
</tbody>
</table>

#### Perineurinoma

<table>
<thead>
<tr>
<th>Behavior*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intraneural perineurinoma</td>
</tr>
<tr>
<td>Soft tissue perineurinoma</td>
</tr>
</tbody>
</table>

#### Malignant Peripheral Nerve Sheath Tumor (MPNST)

<table>
<thead>
<tr>
<th>Behavior*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epithelioid</td>
</tr>
<tr>
<td>MPNST with divergent mesenchymal and/or epithelial differentiation</td>
</tr>
<tr>
<td>Melanotic</td>
</tr>
<tr>
<td>Melanotic psammomatous</td>
</tr>
</tbody>
</table>

#### Mesenchymal, Non-meningothelial Tumors

<table>
<thead>
<tr>
<th>Behavior*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipoma</td>
</tr>
<tr>
<td>Angiolipoma</td>
</tr>
<tr>
<td>Hibernoma</td>
</tr>
<tr>
<td>Liposarcoma (intracranial)</td>
</tr>
<tr>
<td>Solitary fibrous tumor</td>
</tr>
<tr>
<td>Fibrosarcoma</td>
</tr>
<tr>
<td>Malignant fibrous histiocytoma</td>
</tr>
<tr>
<td>Leiomyoma</td>
</tr>
<tr>
<td>Leiomyosarcoma</td>
</tr>
<tr>
<td>Rhabdomyoma</td>
</tr>
<tr>
<td>Rhabdomyosarcoma</td>
</tr>
<tr>
<td>Chondroma</td>
</tr>
<tr>
<td>Chondrosarcoma</td>
</tr>
</tbody>
</table>
LYMPHOMAS AND HEMOPOIETIC NEOPLASMS

- Malignant lymphomas: 3
- Plasmacytoma: 3
- Granulocytic sarcoma: 3

GERM CELL TUMORS

- Germinoma: 3
- Embryonal carcinoma: 3
- Yolk sac tumor: 3
- Choriocarcinoma: 3
- Teratoma: 1
  - Mature: 0
  - Immature: 3
  - Teratoma with malignant transformation: 3
- Mixed germ cell tumors: 3

TUMORS OF THE SELLA REGION

- Craniopharyngioma: 1
- Adamantinomatous: 1
- Papillary: 1
- Granular cell tumor: 0

METASTATIC TUMORS

*Tumor behavior is coded 0 for benign tumors, 1 for low or uncertain malignant potential or borderline malignancy, and 3 for malignant tumors.

ALTERNATE CLASSIFICATION OF PRIMARY BRAIN TUMORS

GLIOMAS (Glial Neoplasms)

1. Astrocytoma
   (I and II) Low-grade (“benign”) astrocytoma
   (III) Anaplastic (“malignant”) astrocytoma
   (IV) Glioblastoma multiforme
2. Oligodendroglioma
3. Paraglioma
   a. Ependymoma*
   b. Choroid plexus papilloma* or carcinoma

NON-GLIAL NEOPLASMS

Tumors of Primitive Bipotential Precursors and Nerve Cells

1. Ganglioglioma; gangliocytoma
2. Medulloblastoma; other PNET g
3. Neuroblastoma (primary cerebral)

Nerve Sheath Tumors

1. Neurofibroma
2. Neurofibrosarcoma
3. Schwannoma (neurinoma)

Tumors of Mesenchymal Tissue

1. Hemangioblastoma
2. Meningioma
3. Sarcoma (eg, fibrosarcoma and meningeal sarcomatosis; gliosarcoma; hemangiopericytoma)

(continued)
Tumors of the Lymphoreticular System
1. Langerhans cell histiocytosis
2. Leukemia
3. Lymphoma (non-Hodgkin’s)
4. Myeloma

Tumors of Maldevelopmental Origin
(eg, Arising from Embryonal Remnants)
1. Colloid cyst
2. Craniopharyngioma
3. Dermoid
4. Epidermoid
5. Germ cell tumors
   a. Germinoma
   b. Teratoid tumor
      i. Choriocarcinoma
      ii. Embryonal carcinoma
      iii. Endodermal sinus (yolk sac) tumor
      iv. Teratoma
      v. Mixed tumor (eg, teratocarcinoma)
6. Hamartoma
7. Lipoma (eg, of corpus callosum)
8. Rathke cleft cyst

Pineal Tumor
1. Germinoma
2. Pineoblastoma
3. Pineocytoma
4. Teratoma
5. Teratocarcinoma

Phakomatoses (neurocutaneous syndromes)
*1. Neurofibromatosis (eg, cranial nerve schwannomas—esp. acoustic; meningiomas; gliomas of optic chiasm; cerebral hamartomas)
2. Sturge-Weber S.
*3. Tuberous sclerosis
4. von Hippel-Lindau disease

References

INCIDENCE OF BRAIN TUMORS

Percent Incidence in All Age Groups

<table>
<thead>
<tr>
<th>Classification</th>
<th>Walker</th>
<th>Lane</th>
<th>Dähnert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glioma</td>
<td></td>
<td></td>
<td>34</td>
</tr>
<tr>
<td>Glioblastoma multiforme</td>
<td>23.0</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Astrocytoma, low grade</td>
<td>13.0</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Ependymoma</td>
<td>1.8</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Oligodendroglioma</td>
<td>1.6</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Mixed &amp; other gliomas</td>
<td>1.9</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Medulloblastoma (PNET)</td>
<td>1.5</td>
<td>3</td>
<td>15+</td>
</tr>
<tr>
<td>Meningioma</td>
<td>16.0</td>
<td>14</td>
<td>17</td>
</tr>
<tr>
<td>Pituitary adenoma</td>
<td>8.2</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Schwannoma (esp. acoustic)</td>
<td>5.7</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Craniopharyngioma</td>
<td>2.8</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Hemangioblastoma</td>
<td>2.7</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Sarcoma</td>
<td>2.5</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Pineal tumor</td>
<td>1.1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Metastases*</td>
<td>13.0</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>Other rare tumors (eg, dermoid, epidermoid, colloid cyst; choroid plexus papilloma)</td>
<td>7.0</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Percent Incidence in Pediatric Age Group

<table>
<thead>
<tr>
<th>Classification</th>
<th>Walker</th>
<th>Lane</th>
<th>Dähnert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astrocytoma</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medulloblastoma</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ependymoma</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Craniopharyngioma</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Choroid plexus papilloma</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>17</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Percent Incidence in Adult Age Group

<table>
<thead>
<tr>
<th>Classification</th>
<th>Walker</th>
<th>Lane</th>
<th>Dähnert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metastases</td>
<td>33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glioma</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meningioma</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pituitary adenoma</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schwannoma (esp. acoustic)</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Actual incidence of metastatic tumors is higher since more are being identified with CT and MRI, and many others are not worked up radiologically.
+ In pediatric age group.

References

Gamut A-53-1

SUPRATENTORIAL INTRACRANIAL TUMORS IN INFANCY AND CHILDHOOD

CEREBRAL HEMISPHERE TUMORS
1. Astrocytoma
2. Desmoplastic infantile ganglioglioma
3. Ependymoma
4. Giant cell tumor (in tuberous sclerosis)
5. [Inflammatory pseudotumor (plasma cell granuloma)]
6. Meningioangiomatosis
7. Mixed neuronal-glial tumors (eg, gangliogioma; gangliocytoma)
8. Oligodendroglioma
9. Primitive neuroectodermal tumor \( (PNET)_g \); medullopithelioma
10. Rhabdoid tumor

SELLAR AND SUPRASELLAR TUMORS
1. Arachnoid cyst
2. Craniopharyngioma
3. Germ cell tumors (see below)
4. [Granuloma (tuberculosis; sarcoidosis)]
5. Hypothalamic glioma
6. Hypothalamic hamartoma
7. Langerhans cell histiocytosis
8. Optic nerve or chiasm glioma
9. Pituitary adenoma (prolactinoma; chromophobe; eosinophilic)
10. Rathke cleft cyst

PINEAL REGION TUMORS
1. Epidermoid; dermoid
2. Germ cell tumors (germinoma; teratoma; endodermal sinus (yolk sac) tumor; embryonal cell tumor; choriocarcinoma)
3. Pineal and pineal region glioma
4. Pineal cyst; cystic pineal tumor
5. Pineal parenchymal tumors (pineocytoma; pineoblastoma)

EXTRAPARENCHYMAL TUMORS
1. Calvarial tumors
2. Choroid plexus papilloma of lateral ventricle
3. Choroid plexus carcinoma
4. Epidermoid; dermoid
5. Langerhans cell histiocytosis
6. Leukemia; lymphoma
7. Meningioma; dural sarcoma

* Common.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
INFRATENTORIAL INTRACRANIAL TUMORS IN INFANCY AND CHILDHOOD

INTRAPARENCHYMAL TUMORS
*1. Brain stem glioma
*2. Cerebellar astrocytoma
*3. Ependymoma of fourth ventricle
  4. Hemangioblastoma
*5. Medulloblastoma; other primitive neuroectodermal tumor (PNET)g
  6. Rhabdoid tumor
  7. Teratoma

EXTRAPARENCHYMAL TUMORS
  1. Choroid plexus papilloma of fourth ventricle
  2. Enteric cyst
  3. Epidermoid; dermoid
  4. Schwannoma (neurinoma)
  5. Meningioma
  6. Skull base tumors
  7. Teratoma

* Common.

References

BRAIN TUMORS IN CHILDREN UNDER ONE YEAR OF AGE ON CT OR MRI
1. Choroid plexus papilloma or carcinoma
2. Ependymoma
3. Hypothalamic astrocytoma
4. Primitive neuroectodermal tumor (PNET)g (esp. medulloblastoma)
5. Rhabdoid tumor (eg, rhabdomyosarcoma)
6. Teratoma

Reference

PRIMARY SITES OF ORIGIN FOR METASTASES TO THE BRAIN, MENINGES, AND SKULL

CEREBRAL PARENCHYMAL METASTASES (seen in approximately 18% of cancer patients) (esp. from carcinoma of lung, breast, GI or GU tract, or paranasal sinus, or melanoma)

HEMORRHAGIC CEREBRAL PARENCHYMAL METASTASES
(esp. from melanoma; choriocarcinoma; thyroid, renal cell, lung or breast carcinoma)

MENINGEAL CARCINOMATOSIS (8% to 10% of all intracranial metastases)
1. Seeding from primary CNS tumors (eg, medulloblastoma, ependymoma, pineoblastoma)
2. Metastatic spread from melanoma, or carcinoma of breast or lung

SKULL METASTASES
1. Adult—from carcinoma of breast or lung; multiple myeloma
2. Child—from neuroblastoma; leukemia

Reference
SOLITARY INTRACRANIAL MASS—NEOPLASTIC

PRIMARY (CEREBRAL, CEREBELLAR)

1. Congenital
   a. Chordoma
   b. Craniopharyngioma; Rathke cleft cyst
   c. Dermoid; teratoma
   d. Epidermoid
   e. Hemangioma
   f. Hemangioblastoma
   g. Pineal tumor

2. Cranial nerve origin
   a. Acoustic schwannoma (neurinoma)
   b. Glioma of optic nerve
   c. Trigeminal and other cranial schwannomas (neurinomas)

3. Glioma
   a. Low-grade glioma (grade I and II)
   b. Anaplastic astrocytoma (grade III)
   c. Glioblastoma multiforme (grade IV)
   d. Ependymoma; subependymoma
   e. Mixed glioma
   f. Oligodendroglioma

4. Primitive neuroectodermal tumor (PNET)
   a. Supratentorial PNET (cerebral neuroblastoma; pineoblastoma)
   b. Medulloblastoma
   c. Medulloepithelioma
   d. Pigmented medulloblastoma (melanotic vermian PNET)
   e. Ependymoblastoma

5. Pineal tumor
   a. Germinoma
   b. Pineoblastoma
   c. Pineocytoma
   d. Teratoma
   e. Teratocarcinoma

6. Intraventricular
   a. Choroid plexus papilloma or carcinoma

b. Colloid cyst
   c. Meningioma
7. Lymphoma, esp. in AIDS
8. Meningioma
9. Pituitary tumor (esp. eosinophilic or chromophobe adenoma)
10. Sarcoma

METASTATIC CARCINOMA

1. Esp. from carcinoma of lung, breast, kidney or melanoma

VASCULAR LESION

1. Aneurysm of internal carotid or vertebral artery or their branches
2. Arteriovenous malformation
3. Cavernous angioma
4. Vein of Galen “aneurysm”

HEMATOMA

1. Epidural
2. Intracerebral (traumatic or spontaneous)
3. Subdural

INFECTION

1. Abscess
   a. Extracerebral
      1. Epidural
      2. Subarachnoid
      3. Subdural
   b. Intracerebral
2. Granulomatous disease
   a. Fungus disease (e.g., cryptococcosis {torulosis})
   b. Sarcoidosis

(continued)
c. Syphilis
d. Tuberculosis

3. AIDS and its associated conditions
   a. HIV encephalitis
   b. Progressive multifocal leukoencephalopathy (PML)
   c. Toxoplasmosis
d. [Lymphoma g]
e. [Kaposi sarcoma]
f. Cryptococcosis (torulosis)

INFLAMMATORY CONDITION
1. Tumefactive multiple sclerosis
2. Acute disseminated encephalomyelitis (ADEM)

CYST
1. Dandy-Walker syndrome (Dandy-Walker malformation)
2. Leptomeningeal
3. Parasitic (eg, hydatid; *Paragonimus*; *Cysticercus*; *Strongyloides*)
4. Porencephalic cyst (porencephaly)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

MULTIFOCAL INTRACRANIAL LESIONS

COMMON
1. Abscesses (bacterial, fungal; parasitic—toxoplasmosis), intracerebral or extracerebral (subarachnoid; subdural; epidural)
2. AIDS and its associated conditions
   a. HIV encephalitis
   b. Progressive multifocal leukoencephalopathy (PML)
   c. Toxoplasmosis
d. Cryptococcosis (torulosis)
e. Lymphoma
f. Kaposi sarcoma
3. Aneurysms of internal carotid or vertebral artery or their branches
4. Degenerative and metabolic diseases of brain (esp. Alzheimer’s disease)
5. Hematomas (eg, intracerebral (traumatic or spontaneous); subdural; epidural)
6. Infarcts
7. Metastases (esp. from carcinoma of lung, breast, kidney, or melanoma)

UNCOMMON
1. Acute disseminated encephalomyelitis (ADEM)
2. Arteriovenous malformations
3. Dysmyelinating or demyelinating diseases (See A-95-1, A-95-2)
4. Granulomatous disease
   a. Fungus disease (eg, cryptococcosis {torulosis})
   b. Sarcoidosis
c. Syphilis
d. Tuberculosis
5. Lymphoma (primary multicentric, esp. in AIDS)
6. Meningiomas (multicentric)
7. Metastases from primary CNS tumor (eg, medulloblastoma, other PNET; ependymoma; glioblastoma)
8. Parasitic cysts (neurocysticercosis; paragonimiasis; hydatid disease)
9. Phakomatoses (neurocutaneous syndromes) (See A-56-S)
   a. Neurofibromatosis (meningiomatosis; bilateral acoustic schwannomas; bilateral optic nerve gliomas; cerebral gliomas; choroid plexus papillomas; multiple spine tumors, arteriovenous malformations)
b. Sturge-Weber S. (intracerebral and cutaneous hemangiomas or arteriovenous malformations)
c. Tubrous sclerosis (subependymal tubers; intraventricular gliomas (giant cell astrocytoma); ependymomas)
d. von Hippel-Lindau disease (retinal angiomatosis; hemangioblastomas)
10. Tumefactive multiple sclerosis
MULTIPLE CNS AND CRANIAL NERVE TUMORS

1. Multiple meningiomas
2. Neurofibromatosis types I and II
3. Neurofibromatosis types I and II mosaicism (segmental NFI or NFII)
4. Schwannomatosis
5. Tuberous sclerosis
6. von Hippel-Lindau S.

PHAKOMATOSES (NEUROCUTANEOUS SYNDROMES)

COMMON
1. Neurofibromatosis type 1 (von Recklinghausen’s disease) (meningiomatosis; bilateral acoustic schwannomas; bilateral optic nerve gliomas; cerebral gliomas; choroid plexus papillomas; multiple spine tumors, arteriovenous malformations)
2. Sturge-Weber S. (intracerebral and cutaneous hemangiomas or arteriovenous malformations)
3. Tuberous sclerosis (subependymal tubers; intraventricular gliomas {giant cell astrocytoma}; ependymomas)
4. von Hippel-Lindau disease (retinal angiomatosis; hemangioblastomas)

UNCOMMON
1. Ataxia-telangiectasia
2. Epidermal nevus S.
3. Gorlin S. (nevus basal cell carcinoma S.)
4. Linear nevus sebaceous S.
5. Louis-Bar S.
6. Neurocutaneous melanosis
7. Neurofibromatosis type 2 (bilateral acoustic schwannomas)
8. Proteus S.
9. Wyburn-Mason S.

REFERENCES

CT ATTENUATION (DENSITY) OF VARIOUS INTRACRANIAL LESIONS (RELATIVE TO NORMAL BRAIN)—HYPERDENSE

COMMON
1. Acoustic schwannoma (neurinoma)
2. Aneurysm, giant
3. Arteriovenous malformation
4. Craniopharyngioma (solid or calcified)
5. Cysticercosis
6. Hematoma (2 weeks old or less) (eg, acute intracerebral hemorrhage; acute subdural or epidural hematoma)
7. Medulloblastoma; other PNET
8. Meningioma
9. Metastasis, hemorrhagic (esp. melanoma; choriocarcinoma; carcinoma of thyroid, lung, or kidney); calcified metastasis (eg, osteosarcoma; mucinous adenocarcinoma of colon); high density metastasis (eg, carcinoma of colon)
10. Pituitary adenoma (esp. chromophobe)

(continued)
UNCOMMON
1. Choroid plexus papilloma or carcinoma
2. Colloid cyst
3. Ependymoma
4. Glioblastoma multiforme
5. Hamartoma (eg, in tuberous sclerosis)
6. Langerhans cell histiocytosis
7. Lymphoma, primary or secondary
8. Paragonimiasis (calcified cysts)
9. Pineoblastoma; pineocytoma; germinoma

References

Gamut A-57-2

CT ATTENUATION (DENSITY)
OF VARIOUS INTRACRANIAL LESIONS—ISODENSE

COMMON
1. Acoustic schwannoma (neurinoma)
2. Astrocytoma, low-grade or high-grade (glioblastoma)
3. Craniopharyngioma (solid or cystic)
4. Hematoma (subacute subdural—2 to 4 weeks old)
5. Metastasis
6. Pituitary adenoma

UNCOMMON
1. Chordoma
2. Colloid cyst
3. Ependymoma
4. Ganglioglioma; ganglioneuroma; neuroblastoma
5. Glioma of brain stem
6. Granuloma (esp. tuberculoma)
7. Hemangioblastoma (cystic)
8. Langerhans cell histiocytosis
9. Lymphoma, primary
10. Pineocytoma; germinoma

References

Gamut A-57-3

CT ATTENUATION (DENSITY)
OF VARIOUS SUPRATENTORIAL LESIONS—HYPODENSE

COMMON
1. Abscess (intracerebral or epidural)
2. Astrocytoma (low-grade; cystic; juvenile pilocytic; or high-grade {glioblastoma})
3. Cerebral edema
4. Cerebral infarction
5. Cerebritis (bacterial, tuberculous, fungal, malarial)
6. Cyst
   a. Arachnoid
   b. Leptomeningeal
   c. Parasitic (eg, hydatid, Paragonimus, Cysticercus, Strongyloides)
   d. Porencephalic cyst (porencephaly)
7. Cystic neoplasm, other
8. Glioma of brain stem
9. Granuloma (esp. tuberculoma)
10. Hematoma, resolving intracerebral or subdural (3 to 6 weeks old)
11. Metastasis (esp. from squamous cell primary)
12. Multiple sclerosis (periventricular)
UNCOMMON
1. Craniopharyngioma (cystic)
2. Dermoid; teratoma
3. Epidermoid
4. Ganglioglioma; gangliocytoma; ganglioneuroma; neuroblastoma
5. Hemangioblastoma
6. Herpes simplex encephalitis
7. Lipoma
8. Necrosis of globus pallidus (basal ganglia)
9. Oligodendroglioma
10. Progressive multifocal leukoencephalopathy (PML) (periventricular)
11. Prolactinoma
12. Radiation necrosis
13. Subdural empyema

References

Gamut A-58-1
CONTRAST ENHANCEMENT PATTERNS OF INTRACRANIAL MASSES ON CT—MARKED ENHANCEMENT (HOMOGENEOUS)

COMMON
1. Aneurysm, large
2. Meningioma
3. Metastasis
4. Pituitary adenoma

UNCOMMON
1. Acoustic schwannoma (neurinoma)
2. Choroid plexus papilloma or carcinoma

3. Ependymoma
4. Germinoma, teratocarcinoma (pineal)
5. Hemangioblastoma
6. Langerhans cell histiocytosis
7. Lymphoma, primary (non-Hodgkins)

References

Gamut A-58-2
CONTRAST ENHANCEMENT PATTERNS OF INTRACRANIAL MASSES ON CT—MARKED ENHANCEMENT (PATCHY, MIXED, OR RING-LIKE)

COMMON
1. Astrocytoma, anaplastic or high-grade (glioblastoma)
2. Arteriovenous malformation; large aneurysm
3. Metastasis

UNCOMMON
1. Lymphoma; primary (if necrotic, as in AIDS)
2. Pineoblastoma

References
CONTRAST ENHANCEMENT PATTERNS OF INTRACRANIAL LESIONS ON CT—MODERATE ENHANCEMENT (VARIABLE IN APPEARANCE—HOMOGENEOUS, MIXED, OR RING-LIKE)

COMMON
1. Abscess or cerebritis (ring-like)
2. Astrocytoma (incl. hypothalamic glioma)
3. Cerebral infarction (1–8 weeks—gyral enhancement)
4. Craniopharyngioma (homogeneous, mixed, or ring-like)
5. Cysticercus cyst (ring-like)
6. Ependymoma (homogeneous or patchy)
7. Granuloma (esp. tuberculoma) (ring-like)
8. Hemorrhage (intracerebral or subdural—resolving 3–6 weeks) (ring-like or marginal)
9. Medulloblastoma (homogeneous)

UNCOMMON
1. Chordoma
2. Glomus tumor
3. Hemangioblastoma (homogeneous)
4. Neuroblastoma (mixed)
5. Oligodendroglioma (mixed)
6. Pineocytoma (homogeneous)
7. PNET, other (variable)
8. Radiation necrosis (ring-like)

References

CONTRAST ENHANCEMENT PATTERNS OF INTRACRANIAL MASSES ON CT—MINIMAL OR NO ENHANCEMENT

COMMON
1. Astrocytoma, low-grade (mixed) or cystic (homogeneous)
2. Cerebral infarction (12–48 hours)
3. Cyst
   a. Arachnoid
   b. Colloid
   c. Leptomeningeal
   d. Parasitic (eg, hydatid; Cysticercus; Paragonimus; Strongyloides)
   e. Pineal
   f. Porencephalic cyst (porencephaly)
4. Hematoma (may show faint ring-like enhancement during resorption—2 to 6 weeks old)

UNCOMMON
1. Craniopharyngioma, cystic
2. Dermoid, teratoma (minimal or no enhancement)
3. Epidermoid (no enhancement)
4. Ganglioglioma; ganglioneuroma (mixed)
5. Lipoma (no enhancement)
6. Oligodendroglioma (minimal or no enhancement)
7. Prolactinoma (no enhancement)

References
# FEATURES USEFUL IN CT IDENTIFICATION OF VARIOUS TYPES OF INTRACRANIAL TUMORS*

<table>
<thead>
<tr>
<th>Tumor</th>
<th>Initial density</th>
<th>Frequency calcification</th>
<th>Edema</th>
<th>Enhancement pattern</th>
<th>Age/sex group</th>
<th>Location</th>
<th>Other findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meningioma</td>
<td>↑</td>
<td>20%</td>
<td>+1</td>
<td>+3 H</td>
<td>A/F</td>
<td>Dural attachment</td>
<td>Occasional hemorrhage</td>
</tr>
<tr>
<td>Pineoblastoma</td>
<td>↑</td>
<td>Rare</td>
<td>0</td>
<td>+3 M</td>
<td>P/M</td>
<td>Pineal region</td>
<td>Irregular margin and hypodense center</td>
</tr>
<tr>
<td>Choroid plexus papilloma or carcinoma</td>
<td>↑</td>
<td>Rare</td>
<td>0</td>
<td>+3 H</td>
<td>P</td>
<td>Ventricular system</td>
<td>Occasional hemorrhage, irregular margin</td>
</tr>
<tr>
<td>Colloid cyst</td>
<td>↑</td>
<td>0</td>
<td>0</td>
<td>0/+1 H</td>
<td>A</td>
<td>Anterior 3d ventricle</td>
<td></td>
</tr>
<tr>
<td>Germinoma</td>
<td>↑/↔</td>
<td>Rare</td>
<td>0</td>
<td>+3 H</td>
<td>A/M</td>
<td>Pineal region</td>
<td>Meningeal and ependymal seeding</td>
</tr>
<tr>
<td>Pituitary adenoma</td>
<td>↔/↑</td>
<td>&lt;5%</td>
<td>0</td>
<td>+3 H</td>
<td>A</td>
<td>Sella</td>
<td>Rare hemorrhage or infarction</td>
</tr>
<tr>
<td>Neuroma</td>
<td>↔/↑</td>
<td>0</td>
<td>+1</td>
<td>+3 H</td>
<td>A</td>
<td>Cerebellopontine angle</td>
<td>Occasionally cystic</td>
</tr>
<tr>
<td>Pineocytoma</td>
<td>↔/↑</td>
<td>Rare</td>
<td>0</td>
<td>+3 H</td>
<td>P</td>
<td>Pineal region</td>
<td></td>
</tr>
<tr>
<td>Craniohypophygioma</td>
<td>↔/-</td>
<td>30/80%</td>
<td>0</td>
<td>+2 M/R</td>
<td>A/P</td>
<td>Suprasellar</td>
<td>Some cystic</td>
</tr>
<tr>
<td>Teratoma</td>
<td>↓</td>
<td>Frequent</td>
<td>+1/0</td>
<td>0</td>
<td>P/A/M</td>
<td>Midline supratentorial</td>
<td>Some cystic, rupture, and seeding</td>
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<tr>
<td>Dermoid; epidermoid</td>
<td>↓</td>
<td>Frequent</td>
<td>+1/0</td>
<td>0</td>
<td>P/A/F</td>
<td>Post-fossa base of skull</td>
<td>Some cystic</td>
</tr>
<tr>
<td>Lipoma</td>
<td>↓</td>
<td>Rare</td>
<td>+1/0</td>
<td>0</td>
<td>P/A</td>
<td>Supratentorial midline</td>
<td></td>
</tr>
<tr>
<td>Primary lymphoma</td>
<td>↑/↔</td>
<td>0</td>
<td>+2</td>
<td>+2/+3 H</td>
<td>A</td>
<td>Peripheral and deep</td>
<td>Irregular margin, multiplicity</td>
</tr>
<tr>
<td>Medulloblastoma</td>
<td>↑</td>
<td>10%</td>
<td>+2</td>
<td>+2 H</td>
<td>P</td>
<td>Vermis</td>
<td>Irregular margin</td>
</tr>
<tr>
<td>Oligodendroglioma</td>
<td>↑</td>
<td>&gt;90%</td>
<td>+1</td>
<td>+2 M</td>
<td>A</td>
<td>Supratentorial</td>
<td>Irregular margin</td>
</tr>
<tr>
<td>Ependymoma</td>
<td>↔/↑</td>
<td>30-40%</td>
<td>+2</td>
<td>+2 H</td>
<td>P</td>
<td>4th ventricle</td>
<td>Irregular margin</td>
</tr>
<tr>
<td>Embryonal cell carcinoma</td>
<td>↑/↓</td>
<td>Rare</td>
<td>+1</td>
<td>+3 H</td>
<td>P</td>
<td>Pineal</td>
<td></td>
</tr>
<tr>
<td>Hemangioblastoma</td>
<td>↔</td>
<td>0</td>
<td>+1</td>
<td>+3 H</td>
<td>A</td>
<td>Posterior</td>
<td>Cystic, mural nodule</td>
</tr>
<tr>
<td>Ganglioglioma</td>
<td>↓/↔</td>
<td>&gt;30%</td>
<td>0</td>
<td>+1 M</td>
<td>P/A</td>
<td>Temporal lobe</td>
<td>Irregular margin, cystic</td>
</tr>
<tr>
<td>Neuroblastoma</td>
<td>↔/↓</td>
<td>Common</td>
<td>+2</td>
<td>+2 M</td>
<td>P</td>
<td>Supratentorial</td>
<td>Hermorrhage</td>
</tr>
<tr>
<td>Low-grade astrocytoma</td>
<td>↔/↓</td>
<td>&lt;30%</td>
<td>+1</td>
<td>0/+1 M</td>
<td>A</td>
<td>Supratentorial</td>
<td>Indistinct margin</td>
</tr>
<tr>
<td>High-grade astrocytoma (glioblastoma)</td>
<td>↔/↓</td>
<td>Rare</td>
<td>+2</td>
<td>2-3 M/R</td>
<td>A</td>
<td>Supratentorial</td>
<td>Can be cystic, irregular margin</td>
</tr>
<tr>
<td>Brain stem glioma</td>
<td>↓/↔</td>
<td>0</td>
<td>0</td>
<td>+1/M</td>
<td>P</td>
<td>Brain stem</td>
<td>Indistinct margin</td>
</tr>
<tr>
<td>Cystic astrocytoma</td>
<td>↓</td>
<td>Rare</td>
<td>+1</td>
<td>+1 H</td>
<td>P</td>
<td>Posterior</td>
<td>Mural tumor nodule</td>
</tr>
</tbody>
</table>

Key:  
- ↑ = Hyperdensity  
- ↓ = Hypodensity  
- ↔ = Isodensity  
- +1 = Minimal enhancement  
- +2 = Moderate enhancement  
- +3 = Intense enhancement  
- H = Homogeneous  
- M = Mixed  
- A = Adult; P = Pediatric  
- R = Ring pattern  
- F = Female predominance


Reference
MULTIPLE ENHANCING LESIONS IN THE CEREBRUM AND CEREBELLUM ON CT OR MRI

COMMON
1. Abscesses (eg, from septicemia; intravenous drug abuse; immunosuppression; cyanotic congenital heart disease; pulmonary AVM)
2. Metastasis (esp. from carcinoma of lung, breast, colon, rectum, or kidney, or melanoma)
3. Multifocal infectious disease (eg, tuberculosis; histoplasmosis)
4. Multiple sclerosis (periventricular demyelinating plaques)
5. Parasitic disease (eg, cysticercosis; toxoplasmosis; paragonimiasis; neurotrichinosis)

UNCOMMON
1. Arteriovenous malformations; aneurysms
2. Cerebral gliomatosis (no enhancement on CT, but some uptake may occur on MRI)
3. Contusions (> 2 weeks old)
4. Infarction, subacute multifocal
   a. Arterial (eg, underperfusion; multiple emboli; cerebral vasculitis due to lupus erythematosus; meningitis)
   b. Venous (superior sagittal sinus thrombosis with parasagittal hemorrhages)
5. Langerhans cell histiocytosis
6. Lymphoma, primary (esp. in immunosuppressed or organ transplant patients)
7. Sarcoidosis (usually in meninges)

RING-ENHANCING LESION ON CT OR MRI

COMMON
1. Abscess (bacterial; fungal; parasitic— toxoplasmosis)
2. Cysticercus cyst
*3. Glioblastoma multiforme
4. Hematoma, resolving intracerebral (3–6 weeks old)
*5. Lymphoma (eg, if necrotic in transplant recipients or in AIDS)
6. Metastasis
7. Subdural hematoma, resolving (1 to 4 weeks old)

UNCOMMON
1. Aneurysm, large (esp. if thrombosed)
2. Astrocytoma, grade II
3. Craniopharyngioma
4. Demyelinating disease (esp. tumefactive multiple sclerosis; ADEM)
5. Emyema, epidural or subdural
6. Infarction (resolving)
7. Meningioma (atypical)
8. Radiation necrosis
* May cross corpus callosum.

References
Gamut A-62-1

SIGNAL INTENSITY OF VARIOUS INTRACRANIAL LESIONS ON MRI—HYPERINTENSE T1, HYPERINTENSE T2 SIGNAL

COMMON
1. Aneurysm (with chronic clot or flow phenomenon)
2. Calcification (post-hemorrhagic)
3. Cholesterol cyst or granuloma
4. Chronic or late subacute hematoma
5. Craniopharyngioma
6. Flow (first echo slice entry phenomenon; second echo rephasing)
7. Mucocele of paranasal sinus
8. Normal variant (posterior pituitary bright spot)
9. Rathke cleft cyst

UNCOMMON
1. Dermoid
2. Lipoma (hemorrhagic)
3. Teratoma
4. Xanthogranuloma

Reference

Gamut A-62-2

HYPERINTENSE T1, HYPOINTENSE T2 SIGNAL ON MRI

COMMON
1. Flow (first echo slice entry phenomenon)
2. Hemorrhagic metastasis (eg, choriocarcinoma; thyroid or renal cell carcinoma; neuroblastoma; embryonal cell carcinoma; malignant melanoma)
3. Lipoma
4. Pantopaque
5. Subacute hematoma

UNCOMMON
1. Colloid cyst
2. Xanthogranuloma (calcified)

Reference

Gamut A-62-3

HYPO- TO ISOINTENSE T1, HYPOINTENSE T2 SIGNAL ON MRI (1.5 TESLA)

COMMON
1. Acute hematoma
2. Aneurysm with flow phenomenon
3. Calcification (nontraumatic; nonhemorrhagic)
4. Flow (first echo void; second echo rephasing)
5. Iron in brain
6. Meningioma
7. Metastasis (eg, from carcinoma of colon, breast, prostate; osteosarcoma)
8. Neoplasm with acute hemorrhage

UNCOMMON
1. Chloroma
2. Colloid cyst
3. Malignant melanoma

Reference
Gamut A-62-4

ISOINTENSE T1 AND T2 SIGNAL ON MRI

COMMON
1. Aneurysm with flow phenomenon
2. Flow (combinations of flow void and flow-related hyperintensity)
3. Hamartoma
4. Hematoma, acute (mid field 0.5 Tesla) or subacute (high field)
5. Iron in brain
6. Isointense metastases (from carcinoma of colon, breast, or prostate; osteosarcoma)
7. Meningioma

UNCOMMON
1. Colloid cyst
2. Lymphomatous
3. Medulloblastoma; adult cerebellar sarcoma
4. Tuberculoma

Reference

Gamut A-62-5

HOMOGENEOUS WATER SIGNAL, VERY HYPOINTENSE T1, VERY HYPERINTENSE T2 ON MRI

COMMON
1. Arachnoid cyst
2. Cystic encephalomalacia
3. Mega cisterna magna (Blake’s pouch)
4. Nonependymal-lined cyst
5. Porencephalic cyst

UNCOMMON
1. Dandy-Walker malformation
2. Meningocele
3. Pseudomeningocele (dural leak)
4. Seroma (postsurgical)
5. Trapped fourth ventricle

Reference

Gamut A-62-6

ISOINTENSE OR HYPOINTENSE T1, HYPERINTENSE T2 SIGNAL ON MRI

COMMON
1. Cerebritis; encephalitis
2. Glial tumors (eg, astrocytoma; glioma; glioblastoma)
3. Infarction (nonhemorrhagic)
4. Lymphoma, primary or secondary
5. Meningioma
6. Metastasis
7. Pituitary adenoma
8. Schwannoma (neurinoma)

UNCOMMON
1. Chordoma
2. Choroid plexus papilloma
3. Craniopharyngioma
4. Ependymoma
5. Gliosis; scar
6. Granuloma (active)
7. Hamartoma
8. Medulloblastoma
9. Pinealoma; pineoblastoma
10. Radiation necrosis
11. Subependymoma
12. Tuberculoma

Reference
Gamut A-62-7

INHOMOGENEOUS WATER SIGNAL, 
HYPOINTENSE T1, HYPERINTENSE T2 
ON MRI

COMMON
1. Abscess
2. Acute hemorrhage (low field)
3. Arachnoid cyst (complex)
4. Cystic astrocytoma
5. Cystic metastases (from oat cell or squamous cell 
carcinoma of lung; carcinoma of colon, ovary, or 
kidney)
6. Hemangioblastoma
7. Hyperacute hemorrhage (high and low field)
8. Mucocele
9. Nonependymal-lined cyst (complex)
10. Porencephalic cyst (complex)

UNCOMMON
1. Amyloidoma
2. Cysticercosis
3. Epidermoid

Reference
1. Pomeranz SJ: Gamuts and Pearls in MRI. Cincinnati: MRI 
   Education Foundation, Inc., 1990

Gamut A-62-8

GYRIFORM CORTICAL/SUBCORTICAL 
HYPOINTENSE T2 SIGNAL ON HIGH 
FIELD MRI

COMMON
1. Acute hemorrhagic cortical infarction
2. Luxury flow effect in bland cortical infarct
3. Subacute hemorrhagic cortical infarction (early)

UNCOMMON
1. Acute subarachnoid hemorrhage (high field)
2. Meningitis (flow phenomenon in subcortical U 
fibers)
3. Superficial siderosis (old subarachnoid hemorrhage)

Reference
1. Pomeranz SJ: Gamuts and Pearls in MRI. Cincinnati: MRI 
   Education Foundation, Inc., 1990

Gamut A-62-9

GYRIFORM CORTICAL/SUBCORTICAL 
HYPERINTENSE T1 SIGNAL ON MRI

COMMON
1. Chronic or late subacute hemorrhagic cortical in-
farction
2. Contrast-enhanced subacute cortical infarction
3. Subacute or chronic subarachnoid hemorrhage

UNCOMMON
1. Contrast-enhanced dural/leptomeningeal neoplasm 
or inflammation
2. Cortical or dural arteriovenous malformation (slice 
entry or even-echo rephasing)

Reference
1. Pomeranz SJ: Gamuts and Pearls in MRI. Cincinnati: MRI 
   Education Foundation, Inc., 1990
GYRIFORM CORTICAL HYPERINTENSE T2 SIGNAL WITH PARENCHYMAL LESIONS ON MRI

COMMON
1. Deep white matter and peripheral cortical infarction

UNCOMMON
1. Cryptococcoma with cryptococcal meningitis
2. Granulomatous disease (eg, tuberculosis; sarcoidosis; syphilis)
3. Lymphoma
4. Parenchymal metastases with cerebral carcinomatosis
5. Primary brain tumor with subarachnoid or leptomeningeal seeding (eg, ependymoma; ependymoblastoma; medulloblastoma; oligodendroglioma; glioblastoma)
6. Viral meningoencephalitis

Reference

BLACK SIGNAL ON MRI

1. Air or gas
2. Bone
3. Calcium
4. Flow
5. Hemosiderin (T2 dependent)
6. Iron, copper, or other metal intracranially
7. Ligaments or tendons
8. Superparamagnetic contrast agents

Reference

HYPOINTENSE RINGS ON MRI

1. Abscess (fibrous rim)
2. Chronic hematoma (hemosiderin ring)
3. Glial tumor (eg, astrocytoma; glioma) (susceptibility rim artifact)
4. Meningioma (pseudocapsule)
5. Parasitic disease (eg, cysticercosis; paragonimiasis; hydatid disease)

Reference

SELLAR AND PARASELLAR MASSES ON CT OR MRI (SEE A-26, 64, 65)

COMMON
1. Aneurysm of internal carotid artery at siphon
2. Craniopharyngioma
3. Glioma of optic chiasm or hypothalamus (often with neurofibromatosis)
4. Pituitary adenoma (macroadenoma or microadenoma) (eg, chromophobe; eosinophilic; basophilic)

UNCOMMON
1. Arachnoid cyst
2. Chordoma
3. Dermoid
4. Ectopic posterior pituitary lobe
5. Epidermoid
6. Germ cell tumor (eg, germinoma; teratoma)
7. Hamartoma of tuber cinereum
8. Infundibular lesion (eg, Langerhans cell histiocytosis; sarcoidosis; lipoma)
9. Mandibular nerve (V₃) schwannoma
10. Meningioma (suprasellar)
11. Metastasis (esp. from carcinoma of lung, breast, kidney, or GI tract, or direct spread from carcinoma of nasopharynx or sphenoid sinus)
12. Pituitary hyperplasia (may be normal during puberty or pregnancy)
13. Pituitary neoplasm, other (eg, prolactinoma; choristoma; adenocarcinoma; carcinosarcoma; lymphoma, oncocytoma)
14. Rathke cleft cyst
15. Sphenoid sinus mass (eg, mucocele; carcinoma)

References

Gamut A-64

ENHANCING SELlar AND SUPRASELLAR LESIONS ON CT OR MRI

COMMON
1. Aneurysm; arteriovenous malformation
2. Craniopharyngioma
3. Meningioma
4. Pituitary adenoma (eosinophilic; chromophobe)

UNCOMMON
1. Chordoma
2. Choristoma (granular cell tumor of neurohypophysis)
3. Glioma of optic chiasm or hypothalamus
4. Infundibular lesion (eg, Langerhans cell histiocytosis; sarcoidosis); adenohypophysitis
5. Lymphoma (juxtasellar)
6. Meningitis (basal cisterns)
7. Metastasis
8. Pineal tumor (eg, germinoma; pineoblastoma; pineocytoma; teratoma; teratocarcinoma)

References
SELLAR OR SUPRASELLAR MASS
WITH EQUAL (ISODENSE) OR MIXED
ATTENUATION ON CT

COMMON
1. Aneurysm of internal carotid artery (thrombosed)
2. Craniopharyngioma
3. Glioma of optic chiasm or hypothalamus (often with
   neurofibromatosis)
4. Pituitary adenoma (eosinophilic; chromophobe)

UNCOMMON
1. Hamartoma of tuber cinereum
2. Infundibular lesion (metastasis; tuberculosis; sar-
   coidosis; Langerhans cell histiocytosis; choritis-
   toma); adenohypophysitis
3. Lymphoma (juxtasellar)
4. Mucocele or neoplasm of sphenoid sinus (infrasellar)
5. Pineal tumor (eg, germinoma; pineocytoma)
6. [Pituitary hyperplasia]

[ ] This condition does not actually cause the gamuted imaging finding,
but can produce imaging changes that simulate it.

References
1. Burgener FA, Kormano M: Differential Diagnosis in Com-
   puted Tomography. New York: Thieme Medical Publishers,
   Inc., 1996, pp 34–39
   Williams & Wilkins, 1999, p 199
3. Hatam A, Bergstrøm M, Greitz T: Diagnosis of sellar and
   parasellar lesions by computed tomography. Neuroradiol-
   ogy 1979;18:249–258
4. Lee SH, Rao K: Cranial Computed Tomography and MRI.

SELLAR OR SUPRASELLAR MASS
WITH HIGH ATTENUATION ON CT

1. Aneurysm or ectasia of internal carotid artery
2. Chordoma
3. Craniopharyngioma
4. Germ cell tumor (eg, germinoma; teratoma)
5. Meningioma
6. Metastasis
7. Pineal tumor (eg, pineoblastoma; pineocytoma)
8. Pituitary adenoma (esp. chromophobe)

References
1. Burgener FA, Kormano M: Differential Diagnosis in Com-
   puted Tomography. New York: Thieme Medical Publishers,
   Inc., 1996, pp 34–39
2. Hatam A, Bergstrøm M, Greitz T: Diagnosis of sellar and
   parasellar lesions by computed tomography. Neuroradiol-
   ogy 1979;18:249–258
3. Lee SH, Rao K: Cranial Computed Tomography and MRI.
**VISUAL ESTIMATION OF CT ATTENUATION* AND ENHANCEMENT IN VARIOUS SELLAR AND PARASELLAR LESIONS**

<table>
<thead>
<tr>
<th>Type of Lesion</th>
<th>No. of Cases</th>
<th>Attenuation relative to that of brain</th>
<th>Enhancement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Higher</td>
<td>Lower</td>
</tr>
<tr>
<td>Craniopharyngioma</td>
<td>11</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Chromophobe adenoma</td>
<td>9</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Eosinophilic adenoma</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Dermoid cyst</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Arachnoid cyst</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Meningioma</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Optic glioma</td>
<td>2</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Metastasis</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Aneurysm</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Unverified tumor</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>39</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Attenuation relative to that of brain.

**Reference**

HYPOTHALAMIC LESIONS ON MRI

1. Ectopic posterior pituitary gland
2. Germinoma
3. Glioma
4. Hamartoma of tuber cinereum
5. Langerhans cell histiocytosis
6. Lymphoma, primary
7. Sarcoidosis; tuberculoisis
8. Wernicke’s encephalopathy

Reference

MASS INVOLVING THE JUGULAR FORAMEN ON MRI* WITH ENLARGEMENT OF THE JUGULAR CANAL

LESION WITHIN THE CANAL
1. Aneurysm of internal carotid artery
2. Arteriovenous malformation
3. Glomus jugulare tumor
4. [Normal]
5. Schwannoma of cranial nerve IX, X, or XI

LESION ARISING OUTSIDE THE CANAL
1. Carcinoma of nasopharynx
2. Chondroma; chondrosarcoma
3. Chordoma
4. Epidermoid
5. Lymphoma, (non-Hodgkin’s)
6. Meningioma
7. Metastasis
8. Rhabdomyosarcoma

* Usually isointense with brain stem on T1WI, with high signal intensity on T2WI, and intense contrast enhancement.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

MASS OR ABNORMAL ENHANCEMENT OF THE TRIGEMINAL NERVE ON CT OR MRI

1. Hemangioma
2. Infection (herpes zoster; Lyme disease; AIDS)
3. Lipoma
4. Meckel’s cave lesion (eg, meningioma; metastasis; dermoid; epidermoid)
5. Meningioma (petroclival or cavernous sinus)
6. Metastasis
7. Perineural spread of tumor
8. Sarcoidosis
9. Schwannoma of VII and VIII nerves
10. Trigeminal nerve schwannoma, benign or rarely malignant with neurofibromatosis (plexiform neurofibroma)

References

**Gamut A-69**

**MASS IN THE MIDDLE FOSSA ON CT OR MRI WITH EXPANSION OR EROSION OF THE MIDDLE FOSSA FLOOR**

**COMMON**

*1. Aneurysm of internal carotid artery (large); carotid-cavernous fistula; cavernous sinus thrombosis
*2. Arachnoid cyst; temporal lobe agenesis or atrophy with overlying cerebospinal fluid collection
3. Glomus jugulare or vagale tumor
4. Intra-axial temporal lobe neoplasm (glioma), hematoma, or abscess
*5. Meningioma of sphenoid ridge or middle fossa
6. Nasopharyngeal or paranasal sinus carcinoma or other neoplasm with middle fossa extension
*7. Subdural hematoma, chronic; hygroma

**UNCOMMON**

1. Benign bone tumor (eg, chondroma; giant cell tumor)
2. [Congenital or postoperative defect]
3. Epidermoid; cholesteatoma

*4. [Increased intracranial pressure, chronic]
5. Langerhans cell histiocytosis
6. Metastasis
7. Midline neoplasm extending laterally (eg, chondroma; craniopharyngioma; pituitary adenoma)
*8. Neurofibromatosis
*9. [Oxycephaly with partial stenosis of sagittal and metopic sutures]
*10. Porencephalic cyst (porencephaly)
11. Schwannoma (eg, trigeminal; gasserian ganglion)
*12. Temporal horn hydrocephalus, localized
*13. Tolosa-Hunt syndrome (granulomatous invasion of cavernous sinus)

* May cause expansion of middle fossa floor. Other entities usually cause erosion of floor.

[ ] This condition does not actually cause a mass, but can produce expansion or simulate erosion of the middle fossa floor.

**References**


**Gamut A-70**

**MASS OR DESTRUCTIVE LESION INVOLVING THE CLIVUS, PREPONTINE CISTERN AREA, OR POSTERIOR SKULL BASE ON CT OR MRI**

**ARISING FROM THE SKULL BASE**

1. Bone sarcoma (osteosarcoma; chondrosarcoma)
2. Brown tumor of hyperparathyroidism
3. Chondroid tumor (chondroma; osteochondroma; chondromyxoid fibroma)
*4. Chordoma
5. Epidermoid
6. Fibrous dysplasia
7. Giant cell tumor
8. Glomus jugulare tumor
9. Hemangioma
10. Langerhans cell histiocytosisg (esp. eosinophilic granuloma)
11. Lymphoma; leukemia; chloroma
12. Metastasis (hematogenous or direct extension with proximal spread from head and neck tumors)
13. Osteomyelitis
14. Plasmacytoma; multiple myeloma
15. Radiation osteonecrosis

ARISING ABOVE THE SKULL BASE OR INTRASELLAR
*1. Aneurysm or ectasia of basilar or vertebral artery
*2. Meningioma (of clivus; petroclival ligament; planum sphenoidale; tuberculum sella)
*3. Parasellar neoplasm with extension (eg, cranio-pharyngioma; optic glioma)
*4. Pituitary macroadenoma (eg, chromophobe; eosinophilic)

ARISING BELOW THE SKULL BASE
*1. Carcinoma of nasopharynx
2. Carcinoma (squamous cell) of sphenoid sinus
3. Mucocele of sphenoid sinus
4. Rhabdomyosarcoma of nasopharynx
5. Schwannoma of trigeminal or lower cranial nerves (See A-68)

* Common.

References

Gamut A-71

EXTRA-AXIAL MASSES AND FLUID COLLECTIONS

CONGENITAL AND DEVELOPMENTAL
1. Arachnoid cyst
2. Cerebral atrophy
3. Hydrocephalus (external)
4. Normal variant (eg, mega-cisterna magna)

VASCULAR
1. Aneurysm (esp. giant aneurysm)
2. Arteriovenous malformation; varix
3. Subarachnoid hemorrhage (eg, trauma; ruptured aneurysm or AVM)

TRAUMATIC
1. Epidural hematoma, acute or chronic
2. Subdural hematoma, acute or chronic
3. Subdural shunts or drains

ATROPHIC CONDITIONS WITH DIFFUSE PROMINENCE OF SUBARACHNOID SPACES AND CISTERN
1. Dehydration
2. Ischemia; hypoxia
3. Infection (eg, meningitis)
4. Malnutrition; deprivational states
5. Neurodegenerative diseases
6. Posttraumatic
7. Steroid therapy
8. Radiation therapy; chemotherapy

INFECTION/INFLAMMATION
1. Idiopathic hypertrophic pachymeningitis
2. Meningitis
3. Sarcoidosis
4. Subdural empyema or effusion
5. Syphilis with hypertrophic pachymeningitis

NEOPLASM
1. Lymphoma; leukemia
2. Metastasis (eg, from carcinoma of lung, breast, prostate, or kidney, or neuroblastoma)
3. Plasmacytoma
4. Primary intracranial extra-axial tumor or cyst
   a. Chordoma
   b. Choroid plexus papilloma or carcinoma
   c. Colloid cyst of third ventricle
   d. Dermoid
   e. Craniopharyngioma
   f. Epidermoid
   g. Lipoma
   h. Meningioma
   i. Pineal tumor (eg, pineoblastoma; pineocytoma; germinoma; teratoma)
   j. Pituitary adenoma (eosinophilic, basophilic, chromophobe)
   k. Schwannoma (neurinoma)—esp. acoustic

References

MIDLINE SUPRATENTORIAL TUMORS OR CYSTS

TUMORS
COMMON
1. Astrocytoma (giant cell) associated with tuberous sclerosis
2. Craniopharyngioma
3. Optic glioma; hypothalamic glioma
4. Pineal tumor (eg, germinoma; pinealoma; pineoblastoma; teratoma)
5. Pituitary adenoma (esp. chromophobe; eosinophilic)

UNCOMMON
1. Choroid plexus papilloma or carcinoma
2. Lipoma of corpus callosum
3. Meningioma (esp. of tentorium)

CYSTIC STRUCTURES OR LESIONS
1. Arachnoid cyst
2. Cavum septi pellucidi (“fifth ventricle”)
3. Cavum veli interpositi
4. Cavum vergae (“sixth ventricle”)
5. Colloid cyst of third ventricle
6. Cystic neoplasm (esp. craniopharyngioma)
7. Parasitic cyst (eg, cysticercosis (Cysticercus cyst), hydatid disease (echinococcal cyst), paragonimiasis (Paragonimus cyst))
8. Pineal cyst

(continued)
VASCULAR LESIONS

1. Aneurysm or ectasia of basilar artery
2. Vein of Galen “aneurysm”

References

CYSTIC BRAIN TUMOR WITH A MURAL NODULE

1. Ganglioglioma
2. Glioblastoma multiforme
3. Hemangioblastoma
4. Metastasis (necrotic or hemorrhagic)
5. [Parasitic cyst (Cysticercus; Paragonimus)]
6. Pilocytic astrocytoma
7. Pleomorphic xanthoastrocytoma

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

Reference

INTRAVENTRICULAR TUMOR OR CYST

COMMON
1. Astrocytoma
   a. Frontal horn most common
   b. Cystic cerebellar astrocytoma in children (4th ventricle mass)
   c. Giant cell astrocytoma in 10% of tuberous sclerosis at foramen of Monro
   d. Pilocytic astrocytoma at foramen of Monro
2. Choroid plexus cyst or papilloma
3. Colloid cyst of third ventricle
4. Cysticercosis
5. Ependymoma
6. Hemangioma in Sturge-Weber S.
7. Meningioma

UNCOMMON
1. Arachnoid cyst
2. Arteriovenous malformation
3. Choroid plexus carcinoma
4. Craniopharyngioma (third ventricle)
5. Dermoid; teratoma
6. Ependymal cyst
7. Epidermoid
8. Germ cell tumor or hypothalamic glioma invading third ventricle
9. Hemangioblastoma
10. Hematoma (congenital hemorrhage in premature; trauma; hypertension)
11. Heterotopic gray matter (subependymal nodules)
12. Lymphoma
13. Metastasis (esp. from carcinoma of lung or breast; melanoma; medulloblastoma)
14. Neurocytoma (medulloepithelioma); neuroblastoma
15. Oligodendroglioma
16. Primitive neuroectodermal tumor (PNET) (medulloblastoma; ependymoblastoma)
17. Sturge-Weber S. (ipsilateral enlargement of choroid plexus in 70% of cases)
18. Subependymoma
19. Trapped ventricle (usually the fourth and usually associated with ventriculitis)
20. Tuberous sclerosis
   a. Paraventricular foci of astrocytes form subependymal nodules
   b. Giant cell astrocytoma adjacent to foramen of Monro in 10% of cases

References

**Gamut A-75**

VENTRICULAR WALL NODULE(S)

**COMMON**
*1. Choroid plexus
2. Heterotopic gray matter
3. Neurocysticercosis
4. Nodular caudate nucleus
5. Tuberous sclerosis

**UNCOMMON**
1. Coarctation of lateral ventricles with ependymal adhesions
2. Ependymal seeding from malignant brain tumor (eg, ependymoma; medulloblastoma; glioblastoma)
3. Ependymitis (esp. cryptococcosis {torulosis})
4. Intraventricular neoplasm (eg, ependymoma; subependymoma; epidermoid; menigioma; choroid plexus papilloma or carcinoma)

* May show calcification.

**Reference**

**Gamut A-76**

WIDENING OF THE SEPTUM PELLUCIDUM (> 3 MM)

**COMMON**
1. Cyst or neoplasm of septum pellucidum
2. Noncommunicating cavum septi pellucidi

**UNCOMMON**
1. Corpus callosum neoplasm infiltrating septum pellucidum
2. Intraventricular astrocytoma extending into septum pellucidum
3. Lipoma of corpus callosum
4. Neoplasm of third ventricle

**Gamut A-77-1**

MASS INVOLVING THE TRIGONE AND ATRIUM OF THE LATERAL VENTRICLE

**CHILD**
1. Choroid plexus cyst
2. Choroid plexus papilloma
3. Cysticercosis (Cysticercus cyst)
4. Ependymoma
5. Neuroepithelial (noncolloidal) cyst

**ADULT**
1. Choroid plexus cyst
2. Cysticercosis (Cysticercus cyst)
3. Meningioma
4. Neuroepithelial (noncolloidal) cyst

**References**
CHILD
1. Choroid plexus papilloma
2. Cysticercosis (Cysticercus cyst)
3. Ependymoma
4. Pilocytic astrocytoma
5. Primitive neuroectodermal tumor (PNET)
6. Teratoma

ADULT
1. Cysticercosis (Cysticercus cyst)
2. Glioblastoma multiforme
3. Lymphoma
4. Metastasis
5. Neuroepithelial (noncolloidal) cyst
6. Subependymoma

References

MASS INVOLVING THE FORAMEN OF MONRO AND/OR THE ANTERIOR RECESS AND INFERIOR THIRD VENTRICLE

COMMON
1. Choroid plexus papilloma
2. Cysticercus cyst
3. Glioma or other neoplasm arising from quadrigeminal body
4. Pinealoma; teratoma
5. Vertebral or basilar artery aneurysm or ectasia

UNCOMMON
1. Cystic pineal gland
2. Ependymal cyst
3. Ependymoma

References
4. Meningioma (eg, intraventricular or incisural)
5. Quadrigeminal cyst
6. Vascular malformation (incl. vein of Galen “aneurysm”)

References

Gamut A-79

PINEAL AREA MASS

COMMON
1. Pineal cyst (cystic pineal gland)
*2. Pineal tumor (eg, germinoma; pineoblastoma; pineocytoma; teratoma; teratocarcinoma; choriocarcinoma)

UNCOMMON
*1. Glioma of nonpineal origin (eg, tumor arising in thalamus, posterior hypothalamus, brain stem, tectal plate of mesencephalon, or splenium with extension into quadrigeminal cistern)
*2. Meningioma (subsplenial)
3. Metastasis (midline tumor arising from edge of tentorium)
*4. Vein of Galen “aneurysm”
*5. Intensely enhancing lesion on CT or MRI

References

Gamut A-80-1

INFRATENTORIAL (POSTERIOR FOSSA) LESIONS ON CT OR MRI—FOURTH VENTRICLE (INTRAVENTRICULAR) LESIONS BY LOCATION AND AGE

COMMON
1. Ependymoma

UNCOMMON
1. Arteriovenous malformation; hemangioma
2. Astrocytoma (from brain stem or cerebellum)
3. Choroid plexus papilloma or carcinoma
4. Cysticercosis (Cysticercus cyst)
5. Dermoid; teratoma
6. Epidermoid
7. Hemorrhage
8. Medulloblastoma
9. Meningioma
10. Metastasis
11. Subependymoma

BODY OF FOURTH VENTRICLE

CHILD
1. Astrocytoma (from brain stem or cerebellum)
2. Cysticercosis (Cysticercus cyst)
3. Ependymoma
4. Medulloblastoma

ADULT
1. Cysticercosis (Cysticercus cyst)
2. Dermoid
3. Epidermoid
4. Metastasis

(continued)
LATERAL RECESSES OF FOURTH VENTRICLE

CHILD
1. Ependymoma

ADULT
1. Choroid plexus papilloma

INFERIOR FOURTH VENTRICLE AND OBEX

CHILD
1. Glioma

ADULT
1. Metastasis
2. Subependymoma

References

INFRATENTORIAL LESIONS ON CT OR MRI—CEREBELLAR (PARENCHYMAL) LESIONS

COMMON
1. Astrocytoma
2. Hemangioblastoma (esp. in von Hippel-Lindau syndrome)
3. Hemorrhage
4. Infarction
5. Hypoplasia or aplasia of cerebellum
6. Medulloblastoma, other PNET (eg, ependymoblastoma; medulloepithelioma; pigmented medulloblastoma; cerebellar medulloblastoma) (See A-82)
7. Metastasis
8. Neurocysticercosis

UNCOMMON
1. Abscess (pyogenic; tuberculous; fungal)
2. Arteriovenous malformation
3. Dysplastic gangliocytoma of cerebellum—pürkingeoma (Lhermitte-Duclos disease)
4. Gliosis (esp. with neurofibromatosis type 1)
5. Lymphoma
6. Multiple sclerosis
7. Sarcoidosis
8. Sarcoma (lateral medulloblastoma)

References
INFRATENTORIAL LESIONS ON CT OR MRI—OTHER POSTERIOR FOSSA LESIONS

COMMON
1. Aneurysm of basilar or vertebral artery
2. Aqueductal stenosis (eg, from midbrain glioma)
3. Arachnoid cyst
4. Cerebellopontine angle neoplasm (eg, acoustic schwannoma; meningioma; epidermoid; glomus jugulare tumor) (See A-81)
5. Chordoma of clivus
6. Glioma (astrocytoma) of brain stem (pons)

UNCOMMON
1. Arteriovenous malformation
2. Other schwannoma (VII, X, XI or XII nerve)
3. Rhabdomyosarcoma

References

CEREBELLOPONTINE ANGLE MASS ON CT OR MRI

COMMON
1. Acoustic schwannoma (neurinoma)
2. Aneurysm or ectasia of basilar or vertebral artery
3. Epidermoid (congenital cholesteatoma)
4. Lateral extension of adjacent tumor (eg, pontine glioma; ependymoma or other fourth ventricular tumor; choroid plexus tumor; cerebellar neoplasm {astrocytoma; hemangioblastoma}; chordoma)
5. Meningioma

References
POSTERIOR FOSSA TUMORS
IN CHILDREN (OVER 1 YEAR OF AGE)
ON CT OR MRI

COMMON
1. Brain stem glioma (astrocytoma)
2. Cerebellar astrocytoma (juvenile pilocytic; anaplastic)
3. Ependymoma
4. Primitive neuroectodermal tumor (PNET) a
   a. Cerebellar medulloblastoma
   b. Ependymoblastoma
   c. Medulloepithelioma
   d. Pigmented medulloblastoma (melanotic vermian PNET)

UNCOMMON
1. Acoustic schwannoma (esp. with neurofibromatosis)
2. Dysplastic gangliocytoma of cerebellum–pуркингейма (Lhermitte-Duclos disease)
3. Hemangioblastoma (rare below age 15)
4. Metastasis
5. Other extraparenchymal tumor (eg, dermoid; epidermoid; meningioma; choroid plexus papilloma; skull base tumor)
6. Rhabdoid tumor (eg, rhabdomyosarcoma)
7. Teratoma

CONGENITAL CRANIOCEREBRAL MASS
OR MALFORMATION
1. Arachnoid cyst (extra-axial)
2. Dandy-Walker malformation; Dandy-Walker variant
3. Ependymal cyst
4. Giant cisterna magna
5. [Vein of Galen “aneurysm” (may appear cystic on ultrasound unless Doppler is used)]

INFECTIOUS LESION
1. Abscess (esp. streptococcal; anaerobic)
2. Granulomatous infection (tuberculosis or fungus disease)
3. Parasitic disease (eg, cysticercosis; hydatid disease; paragonimiasis)

BENIGN OR MALIGNANT NEOPLASM
1. Acoustic schwannoma with associated arachnoid cyst (about 5%)
2. Brain stem glioma
3. Cystic astrocytoma (eg, juvenile pilocystic astrocytoma of cerebellum)
4. Dermoid
5. Ependymoma
6. Epidermoid
7. Hemangioblastoma
8. Medulloblastoma (rarely tiny cystic areas, esp. in lateral medulloblastoma (“cerebellar sarcoma”))
9. Metastasis
10. [Tumefactive multiple sclerosis]

References
TRAPPED FOURTH VENTRICLE (POSTSHUNTING)

Reference


[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Gamut A-84

OBSTRUCTION AT THE FOURTH VENTRICLE OUTLET*

COMMON

1. Atresia of fourth ventricle foramina (eg, Dandy-Walker S. {Dandy-Walker malformation})
2. Basilar arachnoiditis (eg, tuberculous meningitis)
3. Basilar invagination (eg, Paget’s disease)
4. Chiari I and Chiari II (Arnold-Chiari) malformations
5. Neoplasm (esp. medulloblastoma; astrocytoma; ependymoma; metastasis)
6. Tonsillar herniation

UNCOMMON

1. Arachnoid cyst
2. *Cysticercus* cyst
3. Fusion deformity at craniovertebral junction
4. Meningocele

* Enlargement of the entire ventricular system with disproportionate dilatation of the fourth ventricle.

Gamut A-85

ENLARGED BRAIN STEM

COMMON

1. Glioma
2. Hemorrhage
3. Metastatic neoplasm

UNCOMMON

1. Abscess
2. Encephalitis
3. Ependymoma
4. Granulomatous disease (eg, tuberculosis; sarcoidosis)
5. Hemangioblastoma
6. Infarction (acute)
7. Medulloblastoma
8. Multiple sclerosis (with mass effect)
9. Other tumors (eg, lipoma; hamartoma; teratoma; epidermoid; lymphoma)
10. Syringobulbia
11. Vascular anomaly

References

LOW ATTENUATION (HYPODENSE) LESION IN THE BRAIN STEM ON CT (ALSO HYPOINTENSE ON MRI T1-WEIGHTED IMAGES)

COMMON
1. Glioma
2. Infarction
3. Metastasis
4. Multiple sclerosis
5. Normal (decussation of superior cerebellar peduncles at level of inferior colliculi)
6. Syringobulbia (eg, with syringomyelia; Arnold-Chiari malformation; trauma)

UNCOMMON
1. Central pontine myelinolysis
2. Epidermoid
3. Granuloma (eg, tuberculosis or other infection; sarcoidosis)
4. Hamartoma
5. Lipoma
6. Lymphoma
7. Teratoma

Reference

SUBDURAL EMPYEMA ON CT OR MRI

COMMON
1. Sinusitis (frontal or ethmoid) with spread to subdural space
2. Trauma with penetrating injury to skull

UNCOMMON
1. Mastoiditis; middle ear infection
2. Osteomyelitis of skull
3. Purulent meningitis
4. Surgery (craniectomy)

Reference

RIM OR LINEAR ENHANCEMENT OF THE BRAIN SURFACE OR MENINGES ON CT OR MRI (Indicates abnormal fluid collection over brain surface)

1. Empyema, subdural or epidural
2. Hematoma, subdural or epidural, resolving or chronic (eg, trauma; blood dyscrasia; anticoagulant therapy)

DIFFUSE GYRIFORM MENINGEAL ENHANCEMENT ON CT OR MRI (Indicates disseminated leptomeningeal disease)

1. Benign leptomeningeal fibrosis (eg, scarring from craniotomy, shunt placement, or intrathecal chemotherapy)
2. Langerhans cell histiocytosis
3. Lymphoma; leukemia
4. Meningeal carcinomatosis (eg, from carcinoma of breast or lung, or melanoma)
5. Meningitis (eg, bacterial; syphilitic; tuberculous; fungal; viral—esp. herpes simplex; parasitic—neurocysticercosis; chemical)

Reference
6. Neoplastic spread or seeding from primary CNS tumor (malignant astrocytoma; ependymoma; medulloblastoma; pineoblastoma; germinoma; choroid plexus tumor)
7. Orbital tumor with leptomeningeal spread (eg, retinoblastoma; ocular melanoma)
8. Primary meningeal tumor (eg, meningioma; glioma—primary leptomeningeal glioblastomatosis/gliosarcomatosis; lymphoma; sarcoma)
9. Rheumatoid pachymeningitis
10. Sarcoidosis
11. Subarachnoid hemorrhage, posttraumatic or spontaneous, late with fibroblastic proliferation (in acute or subacute phase, cisternal enhancement can occur)
12. Thrombosis of dural venous sinus (eg, oral contraceptives; infection; dehydration; craniotomy)

References

Gamut A-88-3

LOCALIZED GYRIFORM MENINGEAL ENHANCEMENT ON CT OR MRI

1. Arteriovenous malformation
2. Encephalitis
3. Infarction (esp. subacute)
4. Glioma
5. Meningioma
6. Meningitis, localized (eg, bacterial, tuberculous, fungal, cysticercosis)

* Parenchymal lesions which infiltrate the cortex and obliterate the sulci.

Gamut A-89

EPENDYMAL AND SUBEPENDYMAL ENHANCEMENT OF VENTRICULAR MARGINS, CISTERNS, AND SUBARACHNOID SPACES ON CT OR MRI

COMMON
1. Meningeal carcinomatosis (esp. metastasis from carcinoma of lung or breast; melanoma of skin or eye; retinoblastoma)
2. Normal (esp, periventricular vascular structures)
3. Subependymal spread or ependymal seeding of primary brain neoplasm (esp. astrocytoma; glioblastoma; ependymoma; medulloblastoma; pineal tumor {germinoma; pineoblastoma}; choroid plexus tumor)
4. Inflammatory (eg, ventriculitis; meningitis)
   a. Abscess or inflammatory cyst rupture
   b. Bacterial, viral, fungal, or parasitic meningitis
   c. Chemical ventriculitis (eg, from shunt placement or intrathecal chemotherapy)
   d. Chronic granulomatous disease (eg, tuberculosis; sarcoidosis; Lyme disease)
   e. Cysticercosis

UNCOMMON
1. Leukemia
2. Lymphoma, primary or systemic
3. Vascular
   a. Arteriovenous malformation
   b. Collateral venous drainage (dural sinus or cortical vein occlusion; Sturge-Weber S.)
   c. Venous angioma

(continued)
INCREASED DENSITY WITHIN THE BASILAR CISTERNS ON NONENHANCED CT

COMMON
1. Iodinated intrathecal contrast media
2. Subarachnoid hemorrhage

UNCOMMON
1. Basilar cistern infection, active (eg, tuberculosis; cryptococcosis {torulosis}; coccidioidomycosis)
2. Bromism
3. En plaque neoplasm (eg, lymphoma, melanoma; meningioma)
4. Epidermoid
5. Meningeal calcification (eg, prior tuberculous meningitis)
6. Polycythemia
7. Postischemic hypervascularity of the meninges
8. Sarcoidosis

References
1. Enzmann DR: Imaging of Infections and Inflammations of the CNS: CT, Ultrasound and NMR. New York: Raven Press, 1984

INTENSE ENHANCEMENT OF THE BASILAR CISTERNS ON CT

COMMON
1. Leptomeningeal neoplasm (eg, carcinomatosis; gliomatosis; lymphoma; leukemia; melanoma; seeding from medulloblastoma or other CNS neoplasm)
2. Meningitis (incl. tuberculous)
3. Subarachnoid hemorrhage, recent

UNCOMMON
1. Cryptococcosis (torulosis)
2. Polycythemia vera
3. Sarcoidosis
4. Siderosis
5. Syphilis

References
1. Enzmann DR: Imaging of Infections and Inflammations of the CNS: CT, Ultrasound and NMR. New York: Raven Press, 1984
2. Holmes S: Personal communication.
3. Kudel TA, Bingham WT, Tubman DE: CT findings of primary malignant leptomeningeal melanoma in neurocutaneous melanosis. AJR 1979;133:950–951

References
5. Holmes S: Personal communication.
Gamut A-91-1

INTRACRANIAL FAT LUCENCY
ON CT OR MRI

COMMON
1. Lipoma of corpus callosum

UNCOMMON
1. Dermoid cyst; mature teratoma
2. Epidermoid

Gamut A-91-2

INTRACRANIAL AIR LUCENCY
(PNEUMOCEPHALUS) ON PLAIN
FILMS, CT, OR MRI

COMMON
1. Trauma (eg, penetrating injury or fracture of a paranasal sinus or mastoid sinus)

UNCOMMON
1. Air embolism in cerebral vessels
2. Iatrogenic (eg, surgery {hypophysectomy; paranasal sinus surgery}; ventriculography)
3. Infection with gas-forming organism (brain abscess; mastoiditis; sinusitis)
4. Neoplasm eroding base of skull arising in a paranasal sinus or nasopharynx (esp. osteoma; carcinoma) or sella (pituitary adenoma); mucocele of paranasal sinus

Gamut A-92

COMMON CONGENITAL
MALFORMATIONS OF THE BRAIN
SEEN ON CT OR MRI

DISORDERS OF NEURAL TUBE CLOSURE
1. Encephalocele
2. Meningocele

DISORDERS OF NEURONAL MIGRATION
1. Heterotopia
2. Lissencephaly
3. Pachygyria
4. Polymicrogyria
5. Schizencephaly

OTHER DISORDERS OF ORGANOGENESIS
1. Agenesis of corpus callosum
2. Cerebellar aplasia or hypoplasia
3. Chiari malformations (Chiari I, II, and III)
4. Dandy-Walker malformation
5. Holoprosencephaly
6. Lipoma of corpus callosum
7. Septo-optic dysplasia

PHAKOMATOSES (NEUROCUTANEOUS SYNDROMES) (SEE A-56-S)
1. Neurofibromatosis (eg, cranial nerve schwannoma-esp. acoustic; meningioma; glioma of optic chiasm; cerebral hamartomas)
2. Sturge-Weber S.
3. Tuberous sclerosis
4. von Hippel-Lindau S.

References

Reference
INFECTIONS AND INFLAMMATION
OF THE BRAIN AND MENINGES
IDENTIFIABLE ON CT OR MRI

FOCAL PARENCHYMAL LESIONS
1. Abscess secondary to emboli
2. Cerebritis
3. Direct extension from sinusitis
4. Trauma with penetrating injury

CYSTIC PARASITIC LESIONS
1. Cysticercosis (parenchymal, intraventricular, subarachnoid)
2. Hydatid disease
3. Paragonimiasis
4. Strongyloidiasis

DIFFUSE PARENCHYMAL INFECTIONS
1. ADEM (slow viruses)
2. AIDS encephalopathy
3. Epstein-Barr encephalitis
4. Herpes simplex encephalitis
5. Malaria
6. Progressive multifocal leukoencephalopathy (PML)

MENINGITIS, Ependymitis
1. Bacterial
2. Tuberculous
3. Viral

EXTRACEREBRAL INFECTIONS—
SUBDURAL OR EPIDURAL EMPYEMA
1. Postmeningitis
2. Posttraumatic
3. Secondary to hematogenous or adjacent spread (eg, from sinusitis)

VASCULITIS SECONDARY TO INFECTION
1. Bacterial
2. Granulomatous (eg, tuberculous; fungal)
3. Viral (eg, herpes zoster ophthalmicus)

SARCOIDOSIS (DURAL, LEPTOMENINGEAL, INTRAPARENCHYMAL)

Reference
1. Sze G: Lecture at Hawaii Radiological Society Meeting, 1992

DEGENERATIVE AND METABOLIC DISORDERS OF THE BRAIN ON MRI

DEGENERATIVE DISORDERS

COMMON
1. Alzheimer’s disease
2. Parkinson’s disease; Parkinsonism-plus syndromes

UNCOMMON
1. Huntington’s chorea
2. Jakob-Creutzfeldt disease (spongiform encephalopathy)
3. Olivopontocerebellar atrophy
4. Pick’s disease
5. Progressive supranuclear palsy
6. Shy-Drager S.
7. Striatonigral degeneration
8. Wernicke’s encephalopathy

METABOLIC DISORDERS
1. Adrenoleukodystrophy
2. Central pontine myelinolysis
3. Hallervorden-Spatz disease
4. Leigh’s disease
5. Mucopolysaccharidoses (See J-4)
6. Nonketotic hyperglycemia
7. Phenylketonuria
8. Wilson’s disease

Reference

UNKNOWN METABOLIC DEFECT
1. Alexander’s disease
2. Pelizaeus-Merzbacher disease

References

AMINO ACID AND ORGANIC ACID METABOLIC DISORDERS
1. Canavan’s disease (spongiform leukodystrophy)
2. Maple syrup urine disease

COMMON
1. AIDS encephalitis
2. Multiple sclerosis
3. Progressive multifocal leukoencephalopathy (PML)

UNCOMMON
1. Acute disseminated encephalomyelitis (ADEM)
   a. Allergic (postvaccination)
   b. Fulminating (fatal)
   c. Postinfection (measles; vaccinia; varicella)
   d. Spontaneous or during a respiratory infection

(continued)
2. Acute encephalitis (eg, rubella; measles; chickenpox; mumps; herpes simplex; epidemic encephalopathies)
3. Acute hemorrhagic encephalomyelitis
4. Carbon monoxide encephalopathy
5. Central pontine myelinolysis
6. Congenital transplacental infection (eg, rubella; cytomegalovirus; herpes simplex)
7. Disseminated necrotizing leukoencephalopathy (after methotrexate therapy)
8. Hypoxic-ischemic encephalopathy (eg, periventricular leukomalacia in premature infants)
9. Jakob-Creutzfeldt disease
10. Malnutrition; vitamin B12 deficiency
11. Marchiafava-Bignami disease (corpus callosum)
12. Radiation therapy (necrosis); chemotherapy
13. Schilder’s disease (myelinoclastic diffuse sclerosis)
14. Subacute sclerosing panencephalitis
15. Subcortical arteriosclerotic encephalopathy (SAE; Binswanger’s disease)
16. Trauma (white matter shearing injury)
17. Vascular (eg, small vessel disease, lacunar infarcts, migraine, and aging may cause small multifocal white matter lesions)

SECONDARY DEMYELINATING CONDITIONS
1. Anoxia
2. Brain abscess
3. Cerebral infarction
4. Cerebral neoplasm, primary or metastatic
5. Deficiency syndromes
6. Intoxication

* 60% of healthy elderly patients with normal cognitive function may show multiple foci of increased white matter signal on T2WI.

References

Gamut A-96

PERIVENTRICULAR HYPERINTENSE (BRIGHT) LESION ON T2-WEIGHTED MRI

CHILDREN AND YOUNG ADULTS
1. Acute disseminated encephalomyelitis (ADEM) (postviral leukoencephalopathy)
2. Ependymitis granularis (anterior and lateral to frontal horns in normal individuals)
3. Leukodystrophies
   a. Adrenoleukodystrophy
   b. Alexander’s disease
   c. Canavan’s disease
   d. Krabbe disease (globoid cell leukodystrophy)
   e. Metachromatic leukodystrophy
   f. Pelizaeus-Merzbacher disease
4. Migraine
5. Mucopolysaccharidoses (See J-4)
6. Multiple sclerosis
7. Vasculitis (lupus erythematosus; sickle cell disease; Behçet S.)
8. Virchow-Robin spaces in putamen

ELDERLY
1. Ischemia of deep white matter (eg, ischemic cardiovascular disease; hypertension; smoking)
2. Lacunar infarction
PATIENTS WITH AIDS
1. Lymphoma
2. Progressive multifocal leukoencephalopathy (PML)
3. Subacute white matter encephalitis (esp. due to HIV or cytomegalovirus infection)
4. Toxoplasmosis

PATIENTS WITH TRAUMA
1. Diffuse axonal/shearing injury
2. Diffuse necrotizing leukoencephalopathy (DNL) (intrathecal methotrexate +/- whole brain radiation)
3. Radiation injury to whole brain with demyelination of periventricular white matter

PATIENTS WITH HYDROCEPHALUS
1. Transependymal CSF flow

References

PERIVENTRICULAR HYPODENSE LESION ON CT
1. Cystic neoplasm
2. Encephalomalacia
3. Hematoma (resolving)
4. Parasitic cyst (Cysticercus; Paragonimus: hydatid)
5. Porencephalic cyst (porencephaly)

Reference

CEREBRAL INFARCTION (STROKE)
ON CT, MRI, OR ANGIOGRAPHY

VASCULAR CAUSES (95% of all strokes)

I. ISCHEMIC STROKE (80%)

A. Arterial Occlusive Disease
1. Arteriosclerosis (intracerebral arteriolar occlusive disease, esp. with chronic hypertension—lacunar infarct)
2. Atherosclerotic occlusion of a major extracranial or intracranial artery (eg, stenosis; thrombosis; plaque ulceration and embolism)

B. Cardiogenic Emboli
1. Ischemic heart disease with mural thrombus (eg, myocardial infarction; arrhythmia)
2. Left atrial myxoma
3. Nonvalvular atrial fibrillation
4. Valvular heart disease
   a. Infective endocarditis
   b. Nonbacterial thrombotic endocarditis
   c. Prosthetic valve(s)
   d. Rheumatic valvulitis (esp. mitral stenosis)

C. Hypercoaguable State

D. Nonatheromatous Disease
1. Aneurysm (rare)
2. Arteritis; vasculitis
   a. Behçet disease
   b. Collagen vascular disease
   c. Lymphoid granulomatosis
   d. Syphilis
   e. Takayasu arteritis
   f. Temporal arteritis
3. Dissection (spontaneous; traumatic)
4. Elongation, coiling or kinking of artery
5. Fibromuscular dysplasia
6. Moyamoya disease

(continued)
7. Postendartectomy thrombosis, embolism, or restenosis

II. HEMORRHAGIC STROKE (20%)

A. Intracerebral Hemorrhage
   1. Amyloid angiopathy
   2. Arteriovenous malformation
   3. Bleeding diathesis (eg, hemophilia)
   4. Drugs (esp. anticoagulants)
   5. Hypertensive hemorrhage

B. Vasospasm Due to Nontraumatic Subarachnoid Hemorrhage
   1. Arteriovenous malformation
   2. Ruptured aneurysm

C. Veno-occlusive Disease, Septic or Aseptic
   (Involving major venous sinuses, superficial cortical veins, and/or deep venous system)
   1. Venous obstruction (eg, thrombosis)

NONVASCULAR CAUSES
(5% of all strokes)

A. Anoxic Ischemic Encephalopathy Due to Acute Respiratory Insufficiency
   1. Allergic reaction
   2. Carbon monoxide intoxication
   3. Drug overdose (eg, central respiratory depressant drugs, esp. alcohol, narcotics, and barbiturates)
   4. Heart failure or hypotension (acute)
   5. Near-drowning
   6. Primary central respiratory failure

B. Brain Tumor

RISK FACTORS FOR STROKE

1. Alcoholism
2. Atrial fibrillation
3. Diabetes
4. Heart failure
5. Heredity
6. Hypercholesterolemia (familial)
7. Hypertension
8. Myocardial infarction
9. Obesity
10. Oral contraceptives
11. Smoking
12. Stress; high anxiety

References

Gamut A-99

INTRACEREBRAL HEMORRHAGE OR HEMATOMA ON CT, MRI, OR ANGIOGRAPHY

COMMON
1. Aneurysm (rupture or leakage of berry or infectious aneurysm)
2. Arteriovenous malformation; venous angioma; cavernous angioma
3. Hemorrhagic venous infarction (eg, superior sagittal sinus or other dural sinus thrombosis; cortical vein occlusion)
4. Hypertensive vascular disease (arteriolosclerosis)
5. Neoplasm
   a. Primary—usually in white matter
   b. Metastatic—usually in gray matter (esp. from lung, kidney, melanoma, choriocarcinoma)
6. Stroke (hemorrhagic arterial infarction)
7. Trauma to head

UNCOMMON
1. Amphetamine abuse
2. Amyloid angiopathy
3. Arteritis (See A-102)
4. Bleeding or clotting disorder (eg, hemophilia; anticoagulant therapy)
5. Neonatal germinal matrix hemorrhage (esp. in pre-matures less than 1500 gm)
6. Surgery; postoperative

References

<table>
<thead>
<tr>
<th>Stage</th>
<th>Image Type</th>
<th>Appearances</th>
<th>Nature of Hematoma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute</td>
<td>T1W</td>
<td>Dark</td>
<td>Intracellular oxyhemoglobin</td>
</tr>
<tr>
<td></td>
<td>T2W</td>
<td>Dark</td>
<td></td>
</tr>
<tr>
<td>1–2 days</td>
<td>T1W</td>
<td>Intermediate</td>
<td>Intracellular deoxyhemoglobin</td>
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<tr>
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<td>T2W</td>
<td>Dark; bright margin</td>
<td>Perifocal edema</td>
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<tr>
<td>3–4 days</td>
<td>T1W</td>
<td>Bright rim appears</td>
<td>Beginning formation of methemoglobin in hematoma</td>
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<tr>
<td></td>
<td>T2W</td>
<td>Dark with increased signal</td>
<td></td>
</tr>
<tr>
<td>5–7 days</td>
<td>T1W</td>
<td>Bright with dark marginal</td>
<td>Methemoglobin with rim of fluid and edema</td>
</tr>
<tr>
<td></td>
<td>T2W</td>
<td>zone of edema</td>
<td></td>
</tr>
<tr>
<td>2nd week</td>
<td>T1W</td>
<td>As above</td>
<td>As above</td>
</tr>
<tr>
<td></td>
<td>T2W</td>
<td>Bright with dark rim</td>
<td>Methemoglobin in center with hemosiderin rim</td>
</tr>
<tr>
<td>2 months</td>
<td>T1W</td>
<td>Bright with very dark rim</td>
<td>Gliotic or cystic center. Ring of hemosiderin in macrophages</td>
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</table>

Reference
SUBARACHNOID HEMORRHAGE

COMMON
1. Ruptured aneurysm

UNCOMMON
1. Bleeding diathesis (eg, anticoagulant therapy)
2. Arteriovenous malformation (brain or spinal canal)
3. Hypertensive intracerebral hemorrhage
4. Idiopathic; no known cause
5. Neoplasm (intracranial or spinal)
6. Trauma (skull or spine fracture or contusion)
7. Vasculopathy

PATTERN ANALYSIS OF CEREBRAL VESSELS ON ANGIOGRAPHY
(VASCULAR FILLING, SIZE, CONTOUR, AND TRANSIT TIME) (SEE A-102-104)

LACK OF VASCULAR FILLING
1. Compression
2. Dissection
3. Embolization (incl. iatrogenic)
4. Shunt
5. Thrombosis (eg, atherosclerosis; vasculitis)

HYPERVASCULARITY (TOO MANY VESSELS)
1. Arteriovenous malformation; vein of Galen “aneurysm”
2. Collateral circulation
3. Congenital variant
4. Neoplasm (eg, brain tumor; meningioma)

INCREASED SIZE OF VESSELS
1. Aneurysm (incl. vein of Galen “aneurysm”)
2. Arteriovenous malformation
3. Carotid-cavernous fistula
4. Ectasia
5. High flow system
6. Neoplasm (eg, brain tumor; meningioma)

DECREASED SIZE OF VESSELS
1. Atherosclerosis
2. Dissection
3. Low flow system
4. Spasm (eg, subarachnoid hemorrhage; migraine)
5. Vasculitis; arteritis

CONTOUR IRREGULARITY OF VESSEL WALLS
1. Atherosclerosis
2. Dissection
3. Fibromuscular hyperplasia
4. Spasm
5. Tumor vascularity or encasement
6. Vasculitis; arteritis

PROLONGED TRANSIT TIME
1. Focal edema
2. Hyperventilation; decreased pCO₂
3. Infarction or occlusion
4. Venous thrombosis

DECREASED TRANSIT TIME AND EARLY VENOUS FILLING
1. Arteriovenous malformation
2. Increased pCO₂
3. Infarction
4. Neoplasm (eg, brain tumor; meningioma)

References
2. Osborn A: Diagnostic Cerebral Angiography. (ed 2) Philadelphia: Lippincott Williams & Wilkins, 1999
COMMON
1. Bacterial arteritis; infectious aneurysm (eg, from abscess; meningitis; osteomyelitis; embolism)
2. Connective tissue disease (collagen vascular disease) (esp. polyarteritis nodosa; lupus erythematosus)
3. Drug or chemical arteritis (eg, ergot; amphetamine; heroin; arsenic; carbon monoxide)
4. Necrotizing angiitis (eg, rheumatic fever; hypersensitivity angiitis; giant cell (temporal) arteritis; Wegener’s granulomatosis; granulomatous angiitis)
5. Takayasu arteritis

UNCOMMON
1. Amyloid angiopathy
2. Behçet syndrome
3. Carotid arteritis (infant or child)
4. Fungal arteritis (esp. cryptococcosis {torulosis}; aspergillosis; phycomycosis; actinomycosis; nocardiosis
5. High-flow angiopathy (associated with arteriovenous malformations or fistulas)
6. Radiation arteritis
7. Rickettsial arteritis
8. Sarcoid arteritis
9. Syphilitic arteritis
10. Tuberculous arteritis
11. Viral arteritis (eg, herpes zoster)

References

CEREBRAL ARTERIAL DISEASE OTHER THAN ARTERITIS ON ANGIOGRAPHY (NARROWING, IRREGULARITY, OCCLUSION, OR ANEURYSM)

1. Arterial spasm (eg, subarachnoid or cerebral hemorrhage; migraine)
2. Arteriosclerosis
3. Arteriovenous malformation
4. Berry aneurysm
5. Cerebral thrombosis (eg, sickle cell disease; oral contraceptives)
6. Embolism (eg, subacute bacterial endocarditis; atrial myxoma)
7. Fibromuscular dysplasia (usually extracranial)
8. Idiopathic
9. [Increased intracranial pressure]
10. Inflammatory disease of brain (eg, abscess; purulent or tuberculous meningitis)
11. Multiple progressive intracranial artery occlusions with telangiectasia (moyamoya)
12. Neoplasm (eg, glioblastoma; lymphoma; metastasis)
13. Phakomatoses (neurocutaneous syndromes—eg, neurofibromatosis; Sturge-Weber S.; tuberous sclerosis)
14. Trauma

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
Gamut A-104

INTRACRANIAL ARTERIOVENOUS SHUNTING AND EARLY VENOUS FILLING ON CEREBRAL ANGIOGRAPHY

COMMON
1. Arteriovenous malformation, congenital or acquired (incl. carotid-cavernous fistula; vein of Galen “aneurysm”)  
2. Cerebral infarction  
3. Occlusive vascular disease  
4. Malignant neoplasm of brain, primary or metastatic  
5. Meningioma

UNCOMMON
1. Cerebral arteritis  
2. Contusion of brain  
3. Epilepsy, focal idiopathic  
4. Inflammatory lesion (eg, brain abscess)  
5. Intracerebral hematoma

References

Gamut A-105

AVASCULAR INTRACRANIAL MASS

COMMON
1. Abscess  
2. Contusion  
3. Edema  
4. Epidural hematoma, hygroma, or empyema  
5. Hematoma (intracerebral)

UNCOMMON
1. Arachnoid cyst  
2. Bone lesion infiltrating dura (eg, metastasis; sarcoma; epidermoid; Langerhans cell histiocytosis)  
3. Normal large subarachnoid space (infant)
4. Parasitic cyst (eg, *Cysticercus; Paragonimus; hydatid*)
5. Porencephalic cyst (porencephaly)
6. Subdural invasion by glioma
7. Syphilitic pachymeningitis
8. Tuberculoma

**Reference**

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**Gamut A-108**

**SUBCLAVIAN STEAL SYNDROME**

**COMMON**
1. Atherosclerosis

**UNCOMMON**
1. Coarctation of aorta with obliteration of subclavian orifice
2. Extravascular obstruction (eg, fibrous band)
3. Hypoplasia, atresia, or isolation of subclavian artery with anomalous aortic arch
4. Ligation for correction of tetralogy of Fallot or coarctation of aorta
5. Obstruction of subclavian artery secondary to cannulation
6. Vascular ring

**References**

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**Gamut A-109**

**LESIONS IDENTIFIABLE ON ULTRASOUND EXAMINATION OF THE INFANT BRAIN**

**COMMON**
1. Hemorrhage involving
   a. Cerebellum
   b. Choroid plexus
   c. Germinal matrix in prematures
   d. Periventricular or intraventricular in full-term infant

(continued)
e. Subdural
f. White matter, in full-term or preterm infant (latter associated with periventricular leukomalacia)

2. Hydrocephalus

**UNCOMMON**

1. Absent septum pellucidum
2. Agenesis of corpus callosum
3. Arnold-Chiari malformation (Chiari II malformation)
4. Bacterial ventriculitis (occasionally meningitis or encephalitis)
5. Dandy-Walker S.; Dandy-Walker variant
6. Hemimegancephaly
7. Holoprosencephaly
8. Hydranencephaly, anencephaly
9. Hypoxic ischemic injury (diffuse; multifocal; focal; watershed infarcts)
10. Intracranial calcification
11. Lipoma of corpus callosum
12. Lissencephaly
13. Mineralizing vasculopathy
14. Neoplasm (congenital intracranial)
15. Porencephalic cyst (porencephaly) (esp. following periventricular hemorrhage)
16. Schizencephaly
17. Vein of Galen “aneurysm”

**References**


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**Gamut A-110**

**ECHOGENIC BRAIN LESIONS ON ULTRASOUND**

**COMMON**

1. Calcification
2. Hemorrhage (eg, subependymal)
3. Infarction
4. Normal (choroid plexus; caudothalamic groove)

**UNCOMMON**

1. Air
2. Arteriovenous malformation
3. Edema
4. Encephalitis
5. Hamartoma
6. Periventricular leukomalacia
7. Tumor

**Reference**


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**Gamut A-111**

**CYSTIC BRAIN LESIONS ON ULTRASOUND**

**COMMON**

1. [Aneurysm; arteriovenous malformation]
2. Arachnoid cyst
3. Leptomeningeal cyst
4. Periventricular leukomalacia
5. Porencephalic cyst (porencephaly)
UNCOMMON
1. Agenesis of corpus callosum with midline cyst
2. Choroid plexus cyst
3. Colloid cyst of third ventricle
4. Dandy-Walker cyst
5. Holoprosencephaly (alobar)
6. Parasitic cyst (eg, hydatid; *Cysticercus; Paragonimus*)
7. Schizencephaly
8. Ventricular cyst

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

Gamut A-112-1

LOW DIASTOLIC FLOW IN INTERNAL CAROTID ARTERY

COMMON
1. Aortic valve insufficiency
2. Distal internal carotid artery stenosis
3. Distal small vessel disease
4. Low cardiac output

UNCOMMON
1. Increased intracranial pressure

Gamut A-112-2

LOW VELOCITY FLOW IN INTERNAL CAROTID ARTERY

COMMON
1. Aortic valve stenosis
2. Distal small vessel disease
3. Low cardiac output
4. Proximal internal carotid artery stenosis
5. Tandem lesions

UNCOMMON
1. Increased intracranial pressure

Gamut A-113

INCREASED INTRACRANIAL PRESSURE

COMMON
1. Brain abscess
2. Cerebral edema, contusion, hemorrhage, or infarction
3. Hematoma (intracerebral, extradural, subdural); hygroma
4. Hydrocephalus, obstructive (See A-114-1)
5. Lead encephalopathy
6. Malignant hypertension
7. Meningitis, meningoencephalitis (eg, tuberculosis; cryptococcosis (tourolusis); toxoplasmosis)
8. Metastatic neoplasm (eg, bronchogenic carcinoma; neuroblastoma)
9. Primary brain tumor
10. Increased venous pressure
11. Leukemia; lymphoma
12. Meningocele

(continued)
13. Parasitic disease (eg, cysticercosis; hydatid disease; paragonimiasis)
14. Pseudotumor cerebri

**Gamut A-113-S**

**RADIOLOGIC FEATURES OF INCREASED INTRACRANIAL PRESSURE**

1. Increased craniofacial ratio
2. Increased digital markings of calvarium (“hammered silver” appearance)
3. Sellar changes
   a. Decalcification of floor and dorsum of sella
   b. Pointed anterior clinoids
   c. Sellar enlargement
   d. Thinning or loss of posterior clinoids
4. Sutural diastases; unusually deep sutural interdigitations
5. Thinning of calvarium

**Gamut A-114-1**

**HYDROCEPHALUS**

**ATROPHIC HYDROCEPHALUS (CEREBRAL ATROPHY)**

1. Arteriovenous malformation; vascular lesion
2. Cerebral maldevelopment (eg, lissencephaly syndromes [congenital agyria]; cerebral hemiatrophy (Dyke-Davidoff-Masson S.))
3. Congenital inflammatory disease (eg, toxoplasmosis; cryptococcosis {torulosis}; fetal cytomegalovirus infection)
4. Demyelinating disease (eg, multiple sclerosis; encephalomyelitis)
5. Drugs (eg, Dilantin; steroids; chemotherapy; marijuana; hard drugs); alcohol
6. Hypertensive cerebral degenerative disease
7. Idiopathic
8. Multi-infarct dementia
9. Normal aging
10. Primary neuronal degeneration (eg, Alzheimer’s disease; Pick’s disease; Jakob-Creutzfeldt disease; Huntington’s chorea)
11. Radiation therapy
12. Trauma

**COMMUNICATING (NONABSORPTIVE) HYDROCEPHALUS (SECONDARY TO OBSTRUCTION OF SUBARACHNOID SPACES AT CEREBRAL CONVEXITY, BASAL CISTERNs, OR FORAMEN MAGNUM)**

1. Achondroplasia
2. Arnold-Chiari malformation
3. Basilar invagination (See A-12)
4. Dural sinus/cortical venous thrombosis (“Otitic hydrocephalus”) (esp. superior sagittal sinus thrombosis)
5. Encephalocele
6. Idiopathic in elderly (“normal pressure hydrocephalus”)
7. Leptomeningeal carcinomatosis (metastatic breast carcinoma in adults; medulloblastoma in children; leukemia; lymphoma; ependymoma; pineal germi-noma)
8. Meningeal infiltration in storage diseases
9. Meningitis, acute or chronic (esp. tuberculous)
10. Meningomyelocele
11. Neoplasm (eg, brain tumor; meningioma)
12. Subarachnoid or subdural hemorrhage (eg, trauma; bleeding or clotting disorder; prematurity)
OBSTRUCTIVE (NONCOMMUNICATING) HYDROCEPHALUS (SECONDARY TO INTRAVENTRICULAR, AQUEDUCTAL, FORAMINA OF MONRO, OR FORAMINA OF MAGENDIE AND LUSCHKA OBSTRUCTION)

Intraventricular Mass (See A-74)
1. Choroid plexus papilloma or carcinoma
2. Ependymoma
3. Hematoma; intraventricular hemorrhage or blood clot (eg, trauma; arteriovenous malformation)
4. Intraventricular glioma or meningioma
5. Tuberous sclerosis (subependymal nodules)

Foramen of Monro Obstruction (See A-78-1)
1. Aneurysm or ectasia of basilar artery
2. Colloid cyst of third ventricle
3. Craniopharyngioma
4. Glioma of optic chiasm
5. Hypothalamic glioma
6. Pituitary adenoma (chromophobe or eosinophilic)
7. Tuberous sclerosis (giant cell astrocytoma)

Aqueductal Obstruction
1. Congenital aqueductal stenosis or occlusion (usually with Arnold-Chiari malformation)
2. Developmental stenosis
3. Meningioma of tentorium
4. Midbrain neoplasm or hemorrhage
5. Pineal area tumor (eg, pinealoma; teratoma)
6. Vein of Galen “aneurysm”

Fourth Ventricle Obstruction (See A-84)
1. Arachnoid cyst (eg, of suprasellar or quadrigeminal cistern)
2. Brain-stem edema
3. Cerebellopontine angle tumor (eg, large acoustic schwannoma; metastasis)
4. Neoplasm involving fourth ventricle (eg, medulloblastoma {PNET}; ependymoma; astrocytoma)
5. Outlet obstruction, congenital (eg, Dandy-Walker S. {Dandy-Walker malformation}) or acquired (old hemorrhage or infection)

Other Etiologies Which May Involve One or More of the Above Areas
1. Abscess
2. Basal arachnoiditis (incl. tuberculosis; sarcoidosis; fungus disease)
3. Encephalitis/ventriculitis
4. Parasitic cyst (Cysticercus; Paragonimus; hydatid)
5. Tumefactive multiple sclerosis

OVERPRODUCTION OF CEREBROSPINAL FLUID
1. Choroid plexus papilloma

References

Gamut A-114-2

CONGENITAL SYNDROMES ASSOCIATED WITH HYDROCEPHALUS

COMMON
1. Achondroplasia
2. Acrocephalosyndactyly (Apert and Pfeiffer types)
3. Arnold-Chiari malformation
4. Crouzon S. (craniofacial dysostosis)
5. Dandy-Walker S. (Dandy-Walker malformation)
6. Fetal alcohol S.
7. Fetal toxoplasmosis infection
8. Huntington’s chorea

(continued)
9. Mucopolysaccharidosis I-H (Hurler S.), II (Hunter S.), and VI (Maroteaux-Lamy S.)
10. Osteopetrosis, severe
11. Thanatophoric dysplasia

UNCOMMON
1. Aase-Smith S.
2. Acrocallosal S.
3. Acrodyssostosis (peripheral dysostosis)
4. Acromesomelic dysplasia
5. Aicardi S.
6. Aminopterin fetopathy
7. Amniotic band sequence
8. Aplasia cutis congenita (Adams-Oliver S.)
9. Biemond S. II
10. Bobble-head doll S.
11. Caudal dysplasia sequence
12. Cloverleaf skull (kleeblattschädel anomaly)
13. Cockayne S.
14. Craniodiaphyseal dysplasia
15. Cranioetaphyseal dysplasia
16. Cystinosis
17. Diencephalic S.
18. Epidermal nevus S.
19. Farber disease (disseminated lipogranulomatosis)
20. Fetal isotretinoin S. (retinoic acid embryopathy)
21. Fetal varicella infection
22. Gorlin S. (nevus basal cell carcinoma S.)
23. Greig cephalopolysyndactyly S.
24. Hajdu-Chenev S.
25. Hydrocephalus S.
26. Incontinentia pigmenti (Bloch-Sulzberger S.)
27. Infant of the diabetic mother
28. Kasabach-Merritt S.
29. Klüver-Bucy S. (temporal hydrocephalus)
30. Lissencephaly syndromes (congenital agyria); Miller-Dieker S.
31. Mannosidosis
32. Meckel S.
33. MELAS S.
34. Metachromatic leukodystrophies
35. Metatropic dysplasia
36. Mulibrey nanism
37. Neu-Laxova S.
38. Neurocutaneous melanosis
39. Oculo-auriculo-vertebral spectrum (Goldenhar S.)
40. Oro-facio-digital S. I (Papillon-Leage and Psaume S.)
41. Osteogenesis imperfecta
42. Oto-palato-digital S. (type II)
43. Rieger S.
44. Riley-Day S. (familial dysautonomia)
45. Roberts S.
46. Sjögren-Larsson S.
47. Smith-Lemli-Opitz S.
48. Sotos S. (cerebral gigantism)
49. Triploidy (fetal triploidy S.)
50. Trisomy 13 S.; pseudotrismy 13 S. (holoprosencephaly-polydactyly S.)
51. Tuberous sclerosis
52. VATER association
53. Walker-Warburg S.
54. Warfarin embryopathy (fetal warfarin S.)
55. X-linked hydrocephalus
56. Zellweger S. (cerebrohepatorenal S.)

References

LARGE HEADS IN INFANTS

WITH LARGE VENTRICLES
1. Hydrocephalus, obstructive communicating or non-communicating (eg, aqueductal stenosis; Arnold-Chiari malformation; Dandy-Walker malformation)
2. Intracranial cyst
3. Neoplasm (posterior fossa or intracranial)
4. Overproduction of CSF (nonobstructive hydrocephalus)

WITH NORMAL VENTRICLES
1. Calvarial thickening
2. Cerebral edema
3. Macrocephaly; megalencephaly (See A-3)

Reference

Gamut A-117

SMALL VENTRICLES ON CT
1. Increased intracranial pressure
2. Normal variant
3. Postshunting (slitlike ventricles)
4. Pseudotumor cerebri (idiopathic intracranial hypertension—ventricles usually normal on CT)

Reference

Gamut A-115-2

LARGE VENTRICLES IN INFANTS

WITH LARGE HEAD (MACROCEPHALY)
1. Hydrocephalus (See A-114)
2. Intracranial tumor

WITH NORMAL-SIZED OR SMALL HEAD (MICROCEPHALY)
1. Primary failure of brain growth
   a. Dysgenesis (eg, holoprosencephaly; trisomies)
   b. Environmental factors (eg, alcohol or drug abuse; toxins)
   c. Congenital transplacental infection (TORCH—toroplasmosis; rubella; cytomegalovirus; herpes simplex)
2. Loss of brain substance
   a. Hemorrhage (porencephaly; leukomalacia)
   b. Vascular occlusion (hydranencephaly; porencephaly; schizencephaly)
   c. Congenital transplacental infection (TORCH)
3. Natal or postnatal anoxia

References
CEREBROSPINAL FLUID RHINORRHEA

COMMON
1. Fracture of frontal or sphenoid sinus, or mastoid sinus
2. Neoplasm of base of skull (esp. osteoma; carcinoma)
3. Postoperative

UNCOMMON
1. Congenital skull defect
2. Hydrocephalus (elevated pressure)
3. Neoplasm of brain or meninges (meningioma) with erosion
4. Osteomyelitis

Reference

CENTRAL NERVOUS SYSTEM COMPLICATIONS OF HIV INFECTION AND AIDS

INFECTIONS
1. Bacterial (meningitis or brain abscess)
   a. Tuberculosis
   b. Atypical mycobacterial infection
   c. Syphilis
   d. Other (E. coli; Listeria; Nocardia)
2. Fungal (meningitis or brain abscess)
   a. Aspergillosis
   b. Candidiasis
   c. Coccidioidomycosis
   d. Cryptococcosis (torulosis)
   e. Histoplasmosis
3. Protozoal
   a. Toxoplasmosis (meningoencephalitis)
4. Viral (encephalopathy; encephalitis; diffuse atrophy or white matter disease)
   a. Human immunodeficiency virus (HIV; AIDS)
   b. Cytomegalovirus
   c. Herpes simplex
   d. Papovavirus JC (progressive multifocal leukoencephalopathy—PML)

NEOPLASMS
1. Kaposi sarcoma
2. Lymphoma, primary non-Hodgkin’s

CEREBROVASCULAR DISORDERS
1. Cerebral infarction
2. Intracerebral or subarachnoid hemorrhage

CNS SYNDROMES OF UNCERTAIN ETIOLOGY
1. AIDS-related dementia
2. Aseptic meningitis
3. Vacuolar myelopathy

PERIPHERAL NERVOUS SYSTEM DISORDERS
1. Acute polyradiculoneuropathy (eg, Guillain-Barré S.)
2. Chronic inflammatory demyelinating polyneuropathy
3. Distal symmetrical axonal polyneuropathy
4. Mononeuritis multiplex

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### Globe Calcification (on CT) Neoplasm within the Globe

### Extraglobal Calcification (on CT)

### Periorbital Soft Tissue Swelling

### Lacrimal Gland Enlargement

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### Bone Disorder Associated with Otosclerosis (on Tomography or CT)

### Lesions of the Facial Canal in the Temporal Bone (on Tomography or CT)

### Lesions Involving the Facial Nerve Outside the Temporal Bone

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### Osteolysis of the Temporal Bone

### Destructive Lesions in the Petrous Apex

### Vascular Middle Ear Mass (Intratympanic or Retrotympanic)

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### Complications Associated with Cholesteatoma

### Erosion or Destruction of Tympanic Portion of Petrous Bone, Middle Ear, or Mastoid

### Syndromes with Mastoid Abnormalities—Mastoiditis

### Underdevelopment of Mastoids

### Increased Pneumatization of Mastoids

### Absence or Stenosis (Bony Narrowing) of the External Auditory Canal

### External Auditory Canal Tumor

### Calcification in Ear Cartilage (Pinna)

### Deformity, Asymmetry, or Opacification of the Nasal Cavity

### Unilateral Nasal Cavity Mass

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### PHARYNX AND LARYNX

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MALFORMATION OF THE ORBIT

COMMON
1. Craniosynostosis
2. Enucleation in childhood, traumatic or surgical
3. Fibrous dysplasia; leontiasis ossea
4. Hypertelorism (eg, acrocephalosyndactyly {Apert type}; S.; craniofacial dysostosis (Crouzon S.); Treacher Collins S.) (See B-3)
5. Posttraumatic; postoperative

UNCOMMON
1. Anophthalmos; microphthalmos (eg, Meckel S.)
2. Cerebral atrophy and mental retardation (round orbits)
3. Cyclops
4. Encroachment from adjacent mass (eg, frontal sinus mucocele; frontal encephalocele; antral neoplasm or cyst)
5. Forebrain hypoplasia; holoprosencephaly; arhinencephaly; cebocephaly (small, round orbits)
6. Hypotelorism (See B-2)
7. Neoplasm (eg, neurofibroma; Burkitt lymphoma)
8. Neurofibromatosis
9. Osteoblastic bone lesion or hyperostosis with encroachment on orbit (eg, meningioma; osteosarcoma; Paget’s disease; osteopetrosis; craniometaphyseal dysplasia; hypercalcemia; thalassemia)
10. Radiation therapy

References

HYPOTELORISM (DECREASED INTERORBITAL DISTANCE)

1. Acrofrontonasal dysostosis
2. CHARGE association
3. Chromosome 20p dup S.
4. Craniotelencephalic dysplasia
5. Forebrain hypoplasia (eg, holoprosencephaly; arhinencephaly; cebocephaly)
6. Intrauterine growth retardation syndromes (eg, fetal hydantoin S.)
7. Meckel S.
8. Myotonic dystrophy
9. Oculodentos osseous dysplasia
10. Postaxial acrofacial dysostosis (Miller type)
11. Trigonocephaly (craniostenosis with premature closure of metopic suture)
12. Trichorhinophalangeal dysplasia
13. Trisomy 13 S.
14. Trisomy 21 S. (Down S.)
15. Williams S. (idiopathic hypercalcemia)

References

HYPERTHELORISM

1. Anterior meningocele or encephalocele; cranium bifidum
2. Congenital syndromes (See B-3-2)
3. Craniosynostosis of coronal sutures
4. Dermoid (midline)
5. Fibrous dysplasia; leontiasis ossea

(continued)
6. Hydrocephalus in growth period, severe (overgrowth of lesser wing of sphenoid)
7. Idiopathic
8. Mucocele
9. Nasal tumor
10. Thalassemia

Gamut B-3-2

CONGENITAL SYNDROMES WITH HYPERTELORISM

COMMON
1. Acrocephalosyndactyly (Apert, Pfeiffer, Saethre-Chotzen types)
2. Cleidocranial dysplasia
3. Crouzon S. (craniofacial dysostosis)
4. Craniosynostosis of coronal sutures
5. Ehlers-Danlos S.
6. Familial hypertelorism; normal variant
7. Fibrous dysplasia; leontiasis ossea
8. Frontonasal dysplasia (median cleft face S.—median cleft nose and palate)
9. Greig cephalopolysyndactyly S.
10. Noonan S.
11. Osteopetrosis
12. Sotos S.
13. Thalassemia
14. Treacher Collins S. (mandibulofacial dysostosis)

UNCOMMON
1. Aarskog S.
2. Acrocallosal S.
3. Acrodysostosis (peripheral dysostosis)
4. Aminopterin fetopathy
5. Beckwith-Wiedemann S.
6. Brachmann-de Lange S. (de Lange S.)
7. Campomelic dysplasia
8. Cardio-facio-cutaneous S.
9. Cat-eye S.
10. Chondrodysplasia punctata
11. Chromosome syndromes (4: del (4p) {Wolf-Hirschhorn S.}; 4: dup (4p); 5: del (5p) {cat cry S. or cri du chat S.}; 18p-)
12. Cloverleaf skull (kleeblattschädel anomaly)
13. Coffin-Lowry S.
14. Craniofrontonasal dysplasia
15. Craniometaphyseal dysplasia
16. Diamond-Blackfan S.
17. DiGeorge S.
18. Dubowitz S.
19. Dyssegmental dysplasia
20. Fetal akinesia sequence (Pena-Shokeir S., type I)
21. FG syndrome
22. Fraser S. (cryptophthalmia S.)
23. Freeman-Sheldon S. (whistling face S.)
24. Frontometaphyseal dysplasia
25. Gorlin S. (nevoid basal cell carcinoma S.)
26. Intrauterine growth retardation syndromes (eg, fetal hydantoin syndrome {Dilantin embryopathy}; fetal isotretinoin S. {retinoic acid embryopathy})
27. Larsen S.
28. Lenz-Majewski dysplasia (hyperostotic dwarfism)
29. LEOPARD S. (multiple lentigenes S.)
30. Marden-Walker S.
31. Metaphyseal chondrodysplasia (Jansen type)
32. Neu-Laxova S.
33. Opitz BBBG syndrome (hypertelorism-hypospadias S.; G S.)
34. Oro-facio-digital S. I and II
35. Oromandibular-limb hypogenesis syndromes
36. Osteoglophonic dysplasia
37. Otopalatodigital S. (types I and II)
38. Pallister-Killian S.
39. Potter sequence
40. Pterygium syndromes
41. Roberts S.
42. Robinow S.
43. Rubinstein-Taybi S.
44. Schinzel-Giedion S.
45. Sclerosteosis
46. Seckel S. (bird-headed dwarfism)
47. Sjögren-Larsson S.
48. Spondyloepiphyseal dysplasia congenita
49. Waardenburg S.
50. Warfarin embryopathy (fetal warfarin S.)
51. Weaver S. (Weaver–Smith S.)
52. XXXXX S.
53. XXXXY S.

References

Gamut B-4

SMALL ORBIT AND/OR OPTIC CANAL

COMMON
1. Enucleation in childhood
2. Optic nerve atrophy
3. Osteoblastic bone lesion or hyperostosis with encroachment on orbit (eg, meningioma; osteosarcoma; fibrous dysplasia; Paget’s disease; osteopetrosis; cranioetaphyseal dysplasia; hypercalcemia; thalassemia)
4. Radiation therapy

UNCOMMON
1. Anophthalmos, microphthalmos (eg, Hallermann-Streiff S. [oculo-mandibulo-facial S.]; oculovertebral S.–unilateral; trisomy 13 S.; oculo-dento-osseous dysplasia; osteoporosis-pseudoglioma S.)
2. Congenital underdevelopment of globe and face (unilateral)
3. Craniosynostosis of coronal suture
4. Encroachment from adjacent mass (eg, frontal sinus mucocele or neoplasm; antral neoplasm or cyst)

5. Forebrain hypoplasia syndromes with hypotelorism (See B-2)
6. Neurofibromatosis (orbital dysplasia)
7. Osteitis (eg, from sphenoid sinusitis)

References

Gamut B-5

LARGE ORBIT

COMMON
1. Coronal craniosynostosis with elevation of orbit
2. Exophthalmos (eg, thyrotoxicosis) (See B-17)
3. Pseudotumor of orbit
4. Tumor, intraconal (eg, hemangioma; optic nerve glioma; neurofibroma; retinoblastoma; metastasis) or extraconal

UNCOMMON
1. Congenital glaucoma (buphthalmos; hydrophthalmos)
2. Congenital serous cyst (often associated with anophthalmos or microphthalmos)
3. Hypoplastic maxilla
4. Langerhans cell histiocytosis
5. Lymphoma, Burkitt’s lymphoma
6. Neurofibromatosis (orbital dysplasia)
7. [Small contralateral orbit]
8. Varix of orbital vein

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

(continued)
References

Gamut B-6-1

ORBITAL LESIONS ARISING WITHIN THE ORBIT—INTRAOCULAR OR INTRACONAL MASS

COMMON
1. Cavernous hemangioma
2. Infiltration of retrobulbar fat and intraorbital soft tissues (eg, amyloidosis; Erdheim-Chester disease)
3. Intraocular foreign body
4. Melanoma
5. Meningioma of optic nerve
6. Optic glioma
7. Pseudotumor of orbit

UNCOMMON
1. Benign infantile myxofibromatosis
2. Choroidal osteoma
3. Hamartoma (tuberosus sclerosis)
4. Metastasis (esp. from carcinoma of lung or breast)
5. Neurinoma or schwannoma of optic nerve; neurofibroma of cranial nerve III, IV, or V
6. Ophthalmic artery aneurysm
7. Optic neuritis
8. Retinoblastoma
9. Sarcoma (esp. liposarcoma)
10. Vascular lesion, other (eg, capillary hemangioma; hemangiopericytoma; lymphangioma; venous angioma; orbital varices; hematic cyst)

References
NONNEOPLASTIC
1. Chronic retinal detachment
2. Coat’s disease
3. Persistent hyperplastic primary vitreous (PHPV)
4. Retinopathy of prematurity or retinal dysplasia (ROP)
5. Toxocariasis or larval granulomatosis
6. Uveitis

References

ORBITAL LESIONS ARISING WITHIN THE ORBIT—CHOROIDAL MASS

COMMON
1. Hemangioma
2. Hemorrhage
3. Melanoma
4. Metastasis to choroid
5. Retinal/choroidal detachment

UNCOMMON
1. Leiomyoma
2. Neurofibroma; schwannoma
3. Nevi
4. Retinal cyst
5. Retinal gliosis
6. Retinoblastoma
7. Sarcoidosis

References

ORBITAL LESIONS ARISING WITHIN THE ORBIT—EXTRACONAL OR MUSCLE MASS

COMMON
1. Graves’ disease, thyrotoxicosis (thyroid ophthalmopathy)
2. Lacrimal gland tumor
3. Lymphoma; Burkitt’s lymphoma
4. Meningioma
5. Metastasis
6. Pseudotumor
7. Trauma
8. Vascular lesion (eg, hemangioma; arteriovenous fistula; lymphangioma; hemangioblastoma; hemangiopericytoma; orbital varices)

UNCOMMON
1. Dacryocystitis
2. Dermoid cyst; epidermoid

(continued)
3. Hematoma
4. Orbital myositis
5. Rhabdomyosarcoma

References
1. See B-6-1 above

---

**Gamut B-6-5**

**ORBITAL LESIONS ARISING EXTRAORBITALLY OR EXTRACRANially**

*(eg, From Nasopharynx, Nasal Cavity, Paranasal Sinus, Orbital Bone, or Infratemporal Fossa)*

**COMMON**
1. Bone neoplasm, benign (eg, osteoma)
2. Bone neoplasm, malignant (eg, sarcoma; myeloma; metastasis)
3. Carcinoma of paranasal sinus, nasal cavity, or skin
4. Lymphoma, Burkitt’s lymphoma
5. Orbital abscess or cellulitis (eg, from sinusitis or eyelid infection)
6. Osteomyelitis
7. Paget’s disease
8. Trauma (incl. foreign body)

**UNCOMMON**
1. Bone neoplasm, other benign (eg, osteochondroma; chondroma; aneurysmal bone cyst; ossifying fibroma)
2. Craniofacial malformations
3. Esthesioneuroblastoma (olfactory neuroblastoma)
4. Fibrous dysplasia (leontiasis ossea); other bone dysplasia
5. Granulomatous disease (eg, tuberculosis; sarcoidosis; Wegener’s granulomatosis; lethal midline granuloma)
6. Hydatid disease
7. Juvenile angiofibroma (esp. in pterygopatine fossa)
8. Langerhans cell histiocytosis
9. Mucocele
10. Neurofibromatosis
11. Osteopetrosis
12. Sinus neoplasm (eg, carcinoma; inverting papilloma)

References
1. See B-6-1 above

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**Gamut B-6-6**

**ORBITAL LESIONS ARISING INTRACRANially WITH SECONDARY INVOLVEMENT OF ORBIT**

**COMMON**
1. Meningioma (anterior or middle fossa)

**UNCOMMON**
1. Aneurysm of internal carotid artery
2. Carotid-cavernous fistula
3. Chiasmatic arachnoiditis
4. Chordoma
5. Craniopharyngioma
6. Encephalomeningocele
7. Hypothalamic tumor
8. Optic glioma
9. Pituitary adenoma

Reference
1. See B-6-1 above
### CT CHARACTERISTICS OF ORBITAL MASSES IN CHILDREN

<table>
<thead>
<tr>
<th>Location</th>
<th>Extension</th>
<th>Attenuation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preseptal</td>
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<td>Intracanal</td>
</tr>
<tr>
<td>Optic nerve glioma</td>
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<td>+</td>
</tr>
<tr>
<td>Rhabdomyosarcoma</td>
<td>+/-</td>
<td>+</td>
</tr>
<tr>
<td>2° Neuroblastoma</td>
<td>+/-</td>
<td>+</td>
</tr>
<tr>
<td>Lymphangioma</td>
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<td>+</td>
</tr>
<tr>
<td>Hemangioma</td>
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<td>+</td>
</tr>
<tr>
<td>Histiocytosis X</td>
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<tr>
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<td>+</td>
</tr>
<tr>
<td>Dermoid</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Pseudotumor</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

**References**

SCLEROSIS AND THICKENING OF THE ORBITAL ROOF OR WALLS

COMMON
1. Fibrous dysplasia; leontiasis ossea
2. Meningioma
3. Osteitis secondary to chronic sinusitis or mucocele
4. Paget’s disease

UNCOMMON
1. Benign infantile myxofibromatosis
2. Cranioangiofibroma
3. Multiple myeloma
4. Neurofibromatosis (orbital dysplasia)—“empty orbit”
5. Primary bone tumor (eg, sarcoma; myeloma; lymphoma; aneurysmal bone cyst)

References

NARROWED SUPERIOR ORBITAL (SPHENOIDAL) FISSURE

COMMON
1. Fibrous dysplasia
2. Normal variant; congenital asymmetry or narrowing
3. Paget’s disease

UNCOMMON
1. Bone neoplasm (eg, osteoma; osteoblastic metastasis)
2. Meningioma with hyperostosis
3. Osteitis secondary to chronic sinusitis
4. Osteopetrosis
5. Thalassemia

References
Gamut B-11

**ENLARGED SUPERIOR ORBITAL (SPHENOIDAL) FISSURE (EROSION AND WIDENING)**

**COMMON**
1. Aneurysm of intracavernous portion of internal carotid artery
2. Normal asymmetry
3. Pituitary tumor (esp. chromophobe adenoma)

**UNCOMMON**
1. Carotid-cavernous fistula
2. Chordoma (parasellar)
3. Craniopharyngioma
4. Extension from orbital or infraorbital mass (eg, hemangioma; arteriovenous malformation; optic glioma; juvenile xanthogranuloma; lymphoma; Burkitt’s lymphoma; neuroblastoma) or from paranasal sinus malignancy
5. Increased intracranial pressure, chronic
6. Langerhans cell histiocytosis
7. Meningioma, orbital or intracranial
8. Metastatic carcinoma to sphenoid wing
9. Middle fossa mass (eg, infratemporal chronic subdural hematoma or hygroma; arachnoid cyst with temporal lobe agenesis; temporal lobe astrocytoma)
10. Mucocele of sphenoid sinus
11. Neurofibroma
12. Neurofibromatosis (orbital dysplasia)
13. Orbital varix
14. Posterior orbital encephalocele
15. Pseudotumor of orbit
16. Superior orbital fissure syndrome (impairment of cranial nerves III, IV, and VI associated with sphenoid sinusitis)

**References**

Gamut B-12

**LOCALIZED BONY DEFECT OR EROSION ABOUT THE OPTIC CANAL (See B-8,13)**

**COMMON**
1. Aneurysm of internal carotid artery (cavernous portion)
2. Malignant neoplasm arising in orbit, sphenoid sinus, or nasal cavity
3. Pituitary adenoma

**UNCOMMON**
1. Craniopharyngioma
2. Granuloma (eg, tuberculosis; sarcoidosis)
3. Langerhans cell histiocytosis
4. Metastasis
5. Mucocele of sphenoid sinus
6. Neoplasm of anterior fossa (eg, meningioma; astrocytoma; glioma)
7. Neurofibroma; neurofibromatosis (orbital dysplasia)
8. Surgical defect

**Reference**

Gamut B-13

**OPTIC CANAL ENLARGEMENT (OVER 6.5 MM IN DIAMETER) (See B-12,14)**

**COMMON**
1. Glioma of optic nerve
2. Meningioma of optic nerve sheath
3. Metastasis
4. Neurofibromatosis with or without optic neurofibroma or glioma

**References**
UNCOMMON
1. Aneurysm of ophthalmic artery or cavernous portion of internal carotid artery
2. Arteriovenous malformation with ophthalmic artery involvement
3. Carcinoma of ethmoid or sphenoid sinus
4. Granuloma (eg, tuberculosis; sarcoidosis)
5. Increased intracranial pressure
6. Mucocele of sphenoid sinus
7. Mucopolysaccharidoses (esp. Hurler S.) (See J-4)
8. Pituitary adenoma or craniopharyngioma extending anteriorly
9. Pseudotumor of orbit
10. Retinoblastoma with intracranial extension

References

OPTIC NERVE ENLARGEMENT
(ON CT OR MRI)

NEOPLASTIC

COMMON
1. Meningioma of optic nerve sheath, or of intracranial origin
2. Optic nerve glioma

UNCOMMON
1. Hemangioblastoma; hemangiopericytoma
2. Lymphoma; leukemia (chloroma)
3. Metastasis or local extension of ocular tumor (eg, retinoblastoma; melanoma); leptomeningeal carcinomatosis
4. Neurofibroma

NONNEOPLASTIC

COMMON
1. Optic neuritis

UNCOMMON
1. Central retinal vein occlusion
2. Connective tissue disease
3. Cyst of optic nerve sheath
4. Dural ectasia
5. Graves’ disease, thyrotoxicosis (thyroid ophthalmopathy) (late)
6. Hematoma, traumatic or other
7. Increased intracranial pressure (with papilledema)
8. Infection (eg, toxoplasmosis; tuberculosis; fungus disease; syphilis; HIV-related optic neuropathies)
9. Multiple sclerosis
10. Pseudotumor of orbit
11. Radiation induced optic neuropathy
12. Sarcoïdosis
13. Trauma to optic nerve
14. Vascular lesion (eg, arteriovenous malformation—Wyburn-Mason S.; aneurysm of ophthalmic artery; hemangioma; varix; venous occlusion; ischemia of optic nerve associated with severe hypertension, temporal arteritis, or systemic vasculopathies)

References
OPTIC NERVE “TRAM-TRACK” SIGN
(DISTINCT OPTIC NERVE WITH PERINEURAL ENHANCEMENT ON CT)

<table>
<thead>
<tr>
<th>COMMON</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Optic nerve sheath meningioma</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNCOMMON</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Carcinomatous infiltration (eg, from lacrimal gland)</td>
</tr>
<tr>
<td>2. Erdheim-Chester disease</td>
</tr>
</tbody>
</table>

References
5. Peyster RG, Hoover E, Hershey BL: High resolution CT of lesions of the optic nerve. AJNR 1983;4:169–174
### UNILATERAL EXOPHTHALMOS (PROPTOSIS)

#### SYSTEMIC DISEASE

**COMMON**

1. Hyperthyroidism, thyrotoxicosis

#### BONE DISEASE

**COMMON**

1. Fracture with retro-orbital hematoma or orbital emphysema
2. Metastasis

**UNCOMMON**

1. Bone neoplasm, benign or malignant (eg, osteosarcoma)
2. Craniostenosis, severe (See A-1-1)
3. Fibrous dysplasia; ossifying fibroma
4. Infantile cortical hyperostosis (Caffey’s disease)
5. Langerhans cell histiocytosis
6. Multiple myeloma
7. Neurofibromatosis
8. Osteoma of a paranasal sinus
9. Osteomyelitis
10. Osteopetrosis
11. Paget’s disease
12. Thalassemia

#### PARANASAL SINUS OR NASOPHARYNGEAL DISEASE WITH INTRAORBITAL EXTENSION

**COMMON**

1. Carcinoma, lymphoepithelioma, or other neoplasm
2. Mucocele

**UNCOMMON**

1. Sinusitis

---

### References

PRIMARY ORBITAL SOFT TISSUE DISEASE
(Including Extension From an Intracranial Lesion)

COMMON
1. Abscess, cellulitis, or myositis (retrobulbar or peri-orbital)
2. Granuloma
3. Hemangioma; lymphangioma
4. Lacrimal gland tumor
5. Lymphoma; leukemia; Burkitt’s lymphoma
6. Meningioma (orbital or sphenoid ridge)
7. Metastatic or invasive neoplasm
8. Optic nerve glioma
9. Pseudotumor of orbit
10. Retinoblastoma
11. Spindle cell tumor, benign or malignant (eg, rhabdomyosarcoma)

UNCOMMON
1. Carotid artery aneurysm; carotid-cavernous fistula; cavernous sinus thrombosis; arteriovenous malformation (congenital or traumatic)
2. Dermoid; teratoma
3. Epidermoid
4. Foreign body
5. Hydatid cyst
6. Liposarcoma
7. Neurofibroma; neurilemmoma
8. Optic neuritis
9. Orbital meningocele or encephalocele (congenital or traumatic)
10. Orbital varices
11. [Pseudoproptosis (eg, large eye; normal asymmetry)]
12. Retrobulbar infarcts in sickle cell disease
13. Sympathicoblastoma; neuroblastoma

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

DEFORMITY AND DIMENSIONAL CHANGES IN THE EYEBALL
(ON CT OR MRI)

COMMON
*1. Axial myopia
*2. Coloboma of globe
*3. Microphthalmos
*4. Neoplasm (retinal, choroidal, scleral)
*5. Phthisis bulbi
*6. Surgical scleral banding
*7. Trauma

UNCOMMON
1. Aphakia
*2. Congenital glaucoma (buphthalmos)
*3. Macrophthalmos
*4. Posterior staphyloma
*5. Pseudotumor of orbit
*6. Subchoroidal hemorrhage
*7. Wegener’s granulomatosis

* May show enlarged eye with increased size of globe.

(continued)
References

Gamut B-19

INTRAORBITAL CALCIFICATION

(See B-20, 21)

COMMON
1. Cataract (lens)
2. [Foreign body; fracture fragment]
3. Phlebolith (eg, orbital varices, venous malformation, cavernous hemangioma, arteriovenous malformation or shunt)
4. Phthisis bulbi (trauma or infection with shrunken globe)
5. Retinoblastoma

UNCOMMON
1. Aneurysm or atherosclerosis of internal carotid or ophthalmic artery; vascular calcification (eg, diabetes)
2. Congenital syndromes
   a. Cryptophthalmia S.
   b. Fetal cytomegalovirus infection
   c. Neurofibromatosis
   d. Oculo-dento-osseous dysplasia
   e. von Hippel-Lindau S.
3. Connective tissue disease (collagen disease), (eg, band keratopathy of cornea in rheumatoid arthritis)
4. Drusen
5. Glaucoma
6. Hematoma; myositis ossificans of extraocular muscles
7. Hypercalcemia (conjunctiva or cornea) (eg, in hypervitaminosis D; hyperparathyroidism, primary or secondary {renal osteodystrophy}; metastatic disease; multiple myeloma; milk-alkali S.; Williams S. {idiopathic hypercalcemia})
8. Idiopathic
9. Infection, intraocular (eg, abscess; bacterial ophtalmitis; tuberculosis; syphilis)
10. Intraorbital neoplasm (eg, meningioma; hemangioma; dermoid; teratoma; optic glioma; plexiform neurofibroma; choroidal osteoma; hamartoma; lacrimal gland carcinoma; hemangioendothelioma; metastasis)
11. Mucocele invading orbit
12. [Osteoma; fibrous dysplasia]
13. Parasitic disease (eg, hydatid disease; cysticercosis; toxoplasmosis)
14. Phakoma
15. Radiation therapy
16. Retinal disease (eg, detachment; retinitis; fibrosis; retrolental fibroplasia)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut B-20

GLOBE CALCIFICATION (ON CT)
NEOPLASM WITHIN THE GLOBE

COMMON
1. Retinoblastoma

UNCOMMON
1. Choroidal osteoma
NEOPLASM INFILTRATING POSTERIOR GLOBE FROM OPTIC NERVE

COMMON
1. Meningioma of optic nerve sheath

UNCOMMON
1. Hamartoma (tuberous sclerosis)
2. Optic nerve glioma or neurofibroma
3. Sarcoidosis of optic nerve sheath

TRAUMA

COMMON
1. Foreign body in globe
2. Phthisis bulbi (result of chronic post-traumatic degeneration or infection)

UNCOMMON
1. Chronic retinal detachment
2. Postoperative

MISCELLANEOUS

COMMON
1. Drusen
2. Lens (senile cataract)

UNCOMMON
1. Hypercalcemic states
2. Radiation therapy
3. Retrolental fibroplasia
4. Toxoplasmosis
5. Vascular lesion (eg, Sturge-Weber S.; von Hippel-Lindau S.)

REFERENCES

EXTRAGLOBAL CALCIFICATION (ON CT)

COMMON
1. Meningioma of optic nerve sheath
2. Trauma, old
3. Vascular (eg, hemangioma, varices with phleboliths; arteriovenous malformation; atherosclerosis)

UNCOMMON
1. Dermoid
2. Hypercalcemic states
3. Lacrimal gland neoplasm
4. Neuroblastoma
5. Neurofibroma
6. Optic glioma
7. [Orbital wall abnormality (eg, fibrous dysplasia; osteosarcoma; metastasis from prostate or breast carcinoma)]
8. Retinoblastoma (infiltrating)

[This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.]

REFERENCES

(continued)

**Gamut B-22**

**PERIORBITAL SOFT TISSUE SWELLING**

1. Orbital infection, cellulitis, or abscess (bacterial, viral, fungal)
2. Orbital inflammation
   a. Connective tissue disorders
   b. Extension from acute sinusitis or orofacial abscess
   c. Granulomatous diseases (sarcoidosis; Wegener’s granulomatosis)
   d. Orbital pseudotumor
   e. Vasculitides

**References**


**Gamut B-23**

**LACRIMAL GLAND ENLARGEMENT**

**COMMON**

1. Benign mixed tumor (pleomorphic adenoma)
2. Carcinoma (esp. adenoid cystic carcinoma; also mucoepidermoid carcinoma; adenocarcinoma)
3. Inflammation (incl. orbital pseudotumor)
   a. Acute dacryoadenitis (usually following a viral infection such as mumps or infectious mononucleosis; also after bacterial or fungus infections)
   b. Chronic dacryoadenitis (eg, sarcoidosis; Sjögren S.; Mikulicz S. [may be associated with tuberculosis, syphilis, or leprosy]; Wegener’s granulomatosis)
4. Lymphoma
5. Metastasis

**UNCOMMON**

1. Amyloidosis
2. Benign lymphoid hyperplasia
3. Dermoid; epidermoid
4. Metastasis
5. Thyroid ophthalmopathy

**References**


Gamut B-24

CONGENITAL ABNORMALITIES OF THE TEMPORAL BONE

ANOMALIES OF THE SOUND CONDUCTING SYSTEM
1. Stenosis, agenesis, or soft tissue or bony atresia plate of external auditory canal
2. Microtia (deformity of auricle), often with dysplasia of external auditory canal as in:
   a. Mandibular facial dysostosis (eg, Treacher Collins S.; Franceschetti S.)
   b. Hypoplastic mandibular condyle and flat temporomandibular fossa
3. Atresia or hypoplasia of mastoid air cells
4. Hypoplasia or agenesis of middle ear
5. Anomalies of incus and malleus
6. Abnormalities of labyrinthine window and stapes (eg, congenital fixation of stapes footplate; stapedial otosclerosis)

ANOMALIES OF THE FACIAL NERVE
1. Abnormal course, shortening, or ectopia of facial nerve

ANOMALIES OF THE INNER EAR
1. Anomaly or defect in otic capsule
   a. Michel deformity (hypoplasia or aplasia of petrous pyramid and inner ear structures)
   b. Mondini deformity (abnormal cochlea)

VESTIBULAR AQUEDUCT AND SEMICIRCULAR CANAL ANOMALIES
1. Dilated shortened aqueduct
2. Hypoplasia or aplasia of vestibule and semicircular canals (eg, Waardenburg S.)

ANOMALIES OF THE INTERNAL AUDITORY CANAL
1. Hypoplasia of canal
2. Dilated shortened canal (sometimes with chronic hydrocephalus)

DILATED COCHLEAR AQUEDUCT

CONGENITAL OBLITERATIVE LABYRINTHITIS

CONGENITAL CEREBROSPINAL FLUID OTORRHEA (due to defect in internal auditory canal and stapes footplate)

CONGENITAL VASCULAR ANOMALIES
1. High large jugular fossa and bulb
2. Defect in dome of jugular fossa with herniation of bulb into middle ear simulating glomus tumor
3. Ectopic intratemporal course of internal carotid artery (lateral position of artery which may lie in middle ear and be associated with persistent stapedial artery and aberrant middle meningeal artery)

References

(continued)
BONE DISORDER ASSOCIATED WITH OTOSCLEROSIS (ON TOMOGRAPHY OR CT)

COMMON
1. Fibrous dysplasia
2. Paget's disease

UNCOMMON
1. Bone tumor, osteogenic (eg, osteoma; osteosarcoma) or chondrogenic (eg, chondrosarcoma)
2. Cleidocranial dysplasia
3. Craniometaphyseal dysplasia
4. Hurler syndrome
5. Osteoblastic metastasis
6. Osteogenesis imperfecta
7. Osteopetrosis

References

LESIONS INVOLVING THE FACIAL NERVE OUTSIDE THE TEMPORAL BONE

1. Cholesteatoma
2. Chordoma
3. Hemangioma
4. Idiopathic facial nerve palsy
5. Inflammation/infection (herpes zoster; varicella; sarcoidosis; syphilis)
6. Lymphoma; leukemic deposits
7. Malignant otitis externa
8. Metastasis
9. Neurinoma; schwannoma

References
1. Lanzieri CF: Head and neck case of the day. AJR 1997;169:275–282

### FACIAL NERVE PALSY

1. Bell’s palsy
2. Benign tumor
   a. Acoustic schwannoma
   b. Choristoma
   c. Epidermoid cyst (congenital cholesteatoma)
   d. Facial nerve tumor (schwannoma; hemangioma; lipoma)
   e. Glomus tympanicum tumor
   f. Meningioma of cerebellopontine angle
3. Herpes zoster oticus
4. Langerhans cell histiocytosis
5. Malignant tumor
   a. Direct invasion (eg, glomus jugulare tumor; embryonal rhabdomyosarcoma; cystadenocarcinoma of the endolymphatic sac)
   b. Lymphoma
   c. Metastasis
   d. Perineural spread (parotid or EAC malignancy)
   e. Sarcoma of facial nerve
6. Trauma; temporal bone fracture

### References
DESTRUCTIVE LESIONS IN THE PETROUS APEX

INFECTION/INFLAMMATORY LESIONS
1. Abscess of petrous apex
2. Malignant otitis externa (osteomyelitis of skull base)
3. Petrous apicitis; petrous apex syndrome (Gradenigo S.)

BENIGN TUMORS
1. Cholesteatoma
2. Cholesterol granuloma
3. Meningioma
4. Paraganglioma

MALIGNANT TUMORS
1. Carcinoma of nasopharynx
2. Chondrosarcoma of skull base
3. Chordoma
4. Lymphoma
5. Metastasis
6. Plasmacytoma; multiple myeloma

References

VASCULAR MIDDLE EAR MASS (INTRA- or RETROTYMPANIC)

1. Aberrant or exposed internal carotid artery
2. Aneurysm of carotid artery
3. Chronic inflammation (eg, cholesterol granuloma; inflammatory debris with hemorrhage)
4. Exposed, high riding jugular bulb
5. Glomus jugulare or glomus tympanicum tumor
6. Hemangioma
7. Persistent stapedial artery

References

Gamut B-31

SOFT TISSUE IN THE MIDDLE EAR

1. Cholesteatoma, acquired (pars flaccida or pars tensa) (See B-31-S)
2. Cholesterol granuloma
3. Chronic otitis media
4. Glomus tympanicum tumor
5. Granulation tissue
6. Malignant otitis externa
7. Neoplasm (squamous cell carcinoma in adults; rhabdomyosarcoma in children)

Reference

Gamut B-31-S

COMPLICATIONS ASSOCIATED WITH CHOLESTEATOMA

1. Abscess
2. Encephalitis
3. Facial nerve paralysis
4. Labyrinthine fistula
5. Meningitis
6. Petrous apex syndrome (Gradenigo S.)
7. Sinus thrombosis

Reference

Gamut B-32

EROSION OR DESTRUCTION OF TYPANIC PORTION OF PETROUS BONE, MIDDLE EAR, OR MASTOID

COMMON
1. Cholesteatoma, acquired or congenital (epidermoid—rare in mastoid)
2. Cholesterol granuloma
3. Chronic otitis media (incus and rarely malleus)
4. Fracture of the temporal bone
5. Mastoiditis, acute or chronic
6. [Postoperative defect; simple or radical mastoidectomy]

UNCOMMON
1. Bone neoplasm, benign or malignant (eg, hemangioma; embryonal rhabdomyosarcoma)
2. Carcinoma of mastoid, external auditory meatus, or middle ear
3. Ceruminous gland tumor
4. Dermoid cyst
5. Epidermal cyst or pneumatocele
6. Glomus jugulare tumor; glomus tympanicum tumor (nonchromaffin paraganglioma)
7. Granuloma (esp. tuberculosis)
8. Keratosis obturans
9. Langerhans cell histiocytosis
10. [Large mastoid air cell]
11. Lymphoma
12. Malignant necrotizing external otitis (acute osteomyelitis of temporal bone in aged diabetic due to Pseudomonas aeruginosa)
13. Meningioma
14. Metastasis
15. Nasopharyngeal neoplasm (invasive)
16. Neurinoma
17. Postmastoidectomy meningocoele or meningo-encephalocele

Reference

(continued)
18. Sarcoidosis
19. Syphilis
20. Venous malformation

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut B-33-1

SYNDROMES WITH MASTOID ABNORMALITIES—MASTOIDITIS

1. Achondroplasia
2. Chronic granulomatous disease of childhood (petrositis)
3. Gradenigo S. (apical petrositis)
4. Hyperimmunoglobulinemia E S. (Buckley S. or Job S.)
5. Immotile cilia S.

6. Langerhans cell histiocytosis
7. Wiskott-Aldrich S.

References

Gamut B-33-2

SYNDROMES WITH MASTOID ABNORMALITIES—UNDERDEVELOPMENT OF MASTOIDS

1. Cleidocranial dysplasia
2. Cockayne S.
3. Craniodiaphyseal dysplasia
4. Craniometaphyseal dysplasia
5. Diaphyseal dysplasia (Camurati-Engelmann disease)
6. Endosteal hyperostosis (van Buchem type)
7. Frontometaphyseal dysplasia
8. Hypothyroidism, infantile (cretinism)
9. Mucopolysaccharidoses (See J-4)
10. Osteopathia striata (Voorhoeve disease)
11. Osteopetrosis
12. Otopalatodontial S. (type I)
13. Polyostotic fibrous dysplasia (McCune-Albright S.)
14. Pyknody sostosis
15. Treacher Collins S.

Reference
SYNDROMES WITH MASTOID ABNORMALITIES—INCREASED PNEUMATIZATION OF MASTOIDS

1. Acromegaly
2. Adrenogenital S.
3. Cerebral hemiatrophy (Dyke-Davidoff-Masson S.)
4. Lipodystrophy (lipoatrophic diabetes)

References

ABSENCE OR STENOSIS (BONY NARROWING) OF THE EXTERNAL AUDITORY CANAL

CONGENITAL
1. Bony or membranous atresia or stenosis of the EAC
2. Cleidocranial dysplasia
3. Congenital rubeola
4. Crouzon S. (craniofacial dysostosis)
5. Goldenhar S.
6. Klippel-Feil S.
7. Osteopetrosis
8. Thalidomide embryopathy
9. Treacher Collins S.

ACQUIRED
1. Exostosis of the EAC (swimmer’s ear)
2. Fibrous dysplasia
3. Neoplasm (eg, osteoma; chondroid tumors); other benign and malignant bone tumors (rare)
4. Paget’s disease
5. Postsurgical changes
6. Recurrent external otitis

References

EXTERNAL AUDITORY CANAL TUMOR

COMMON
1. Carcinoma (esp. squamous cell; also basal cell carcinoma; melanoma; metastasis)
2. Exostosis

(continued)
UNCOMMON
1. Adenomatous tumor (adenoma; pleomorphic adenoma; adenoid cystic carcinoma; adenocarcinoma)
2. Ceruminoma (benign ceruminous adenoma)
3. Cholesteatoma
4. Keratosis obturans; invasive keratitis
5. Osteoma (ivory or cancellous)
6. Retroauricular proliferating hemangioma
7. Skin lesion, benign (eg, lipoma; fibroma; sebaceous cyst)

References

CALCIFICATION IN EAR CARTILAGE (PINNA)

COMMON
1. Boxing or other trauma
2. Frostbite
3. Gout

UNCOMMON
1. Acromegaly
2. Addison’s disease
3. Connective tissue disease (collagen disease)
4. CPPD crystal deposition disease
5. Diabetes mellitus
6. Diastrophic dysplasia
7. Familial cold hypersensitivity
8. Hypercalcemia
9. Hypercorticism (Cushing S.)
10. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
11. Hyperthyroidism
12. Hypoparathyroidism
13. Hypopituitarism (anterior lobe)
14. Idiopathic
15. Inflammation; infection
16. Keutel S.
17. Ochronosis (alkaptonuria)
18. Relapsing polychondritis
19. Sarcoidosis
20. Senility; aging
21. Syphilitic perichondritis
22. von Meyenberg disease (systemic chondromalacia)

References

DEFORMITY, ASYMMETRY, OR OPACIFICATION OF THE NASAL CAVITY

COMMON
1. Congenital deformity of nasal septum
2. Fracture of nasal plates or septum
3. Mucosal swelling (inflammatory, allergic, traumatic)
4. Pseudopolyp or polyp (incl. allergic polyposis; polypoid rhinosinusitis; cystic fibrosis [mucoviscidosis])
5. Rhinolith; foreign body
6. Turbinate abnormality (eg, enlargement; congenital absence)
UNCOMMON
1. Antrochoanal polyp
2. Benign neoplasm (eg, fibroma; neurofibroma; ossifying fibroma; osteoma)
3. Carcinoma of nose or antrum
4. Choanal atresia or stenosis
5. Dermoid cyst; mature nasopharyngeal teratoma
6. Encephalomeningocele, transsphenoid
7. Esthesioneuroblastoma (olfactory neuroblastoma)
8. Fibrosarcoma
9. Hypoplasia of nasal bones in various congenital syndromes
10. Inverting papilloma
11. Lymphoma
12. Mucocele
13. Rhinoscleroma with granulomatous mass
14. Wegener’s granulomatosis

References

UNILATERAL NASAL CAVITY MASS
1. Carcinoma (squamous cell) of maxillary sinus
2. Granulomatous disease (eg, fungus disease; tuberculosis; syphilis; rhinoscleroma; Wegener’s granulomatosis; lethal midline granuloma)
3. Inverted papilloma
4. Mucocele
5. Nasopharyngeal angiofibroma
6. Polyp (angiomatic polyp; nasoantral polyp)

References

Gamut B-40

NASAL RIDGE MASS IN A CHILD

Congenital/Developmental Lesions
1. Dermal sinus
2. Fibrous dysplasia involving the nasal bones and forehead (cherubism)
3. Nasal dermoid/epidermoid
4. Nasal encephalocele
5. Nasal glioma

Inflammatory/Infectious Lesions
1. Cellulitis/phlegmon or abscess
2. Congenital syphilis
3. Inflammatory polyp
4. Pott’s puffy tumor (tuberculosis)

Benign and Malignant Neoplasms
1. Angioma
2. Langerhans cell histiocytosis \( g \) (esp. eosinophilic granuloma)
3. Lymphoma \( g \), Burkitt lymphoma
4. Metastasis
5. Neurofibroma
6. Olfactory neuroblastoma
7. Rhabdomyosarcoma
8. Teratoma

Gamut B-41-1

BENIGN AND MALIGNANT LESIONS OF THE NASOPHARYNX, NASAL CAVITY, AND PARANASAL SINUSES

Benign
COMMON
1. Inflammatory polyp; polypoid rhinosinusitis
2. Juvenile angiofibroma
3. [Lymphoid tissue; adenoids]
4. Mucocele
5. Mucous retention cyst
6. Osteoma

References
**UNCOMMON**

1. Adenoma
2. Ameloblastoma
3. Amyloidosis
4. Antrochoanal polyp
5. Arteriovenous malformation or fistula
6. Branchial cleft cyst
7. Chondroma
8. Dentigerous (follicular) cyst
9. Dermoid; teratoma
10. Encephalocele; meningocele
11. Epithelial papilloma (inverting and squamous)
12. Fibroma; desmoid tumor
13. Giant cell reparative granuloma
14. Giant cell tumor
15. Granuloma (eg, tuberculosis; sarcoidosis)
16. Hamartoma
17. Hemangioma
18. Histiocytosis
19. Inclusion cyst
20. Lipoma
21. Lymphangioma
22. Mucormycosis
23. Nasalveolar cyst
24. Neurogenic tumor (eg, neurinoma of IX, X, or XI nerve)
25. [Rhinolith, foreign body]
26. Rhinoscleroma
27. Salivary gland tumor (eg, Warthin tumor)
28. Tornwaldt cyst (notochord remnant)

**MALIGNANT**

**COMMON**

1. Carcinoma (esp. squamous cell; also adenocarcinoma; adenoid cystic carcinoma);
2. Lymphoepithelioma (incl. Schmincke tumor)
3. Lymphoma; Burkitt lymphoma
4. Metastasis (incl. retropharyngeal lymphadenopathy)

**UNCOMMON**

1. Chordoma
2. Esthesioneuroblastoma (olfactory neuroblastoma)
3. Hemangiopericytoma
4. Malignant histiocytoma
5. Melanoma
6. Plasmacytoma (extramedullary); myeloma
7. Salivary gland neoplasm (eg, carcinoma; mixed tumor)
8. Sarcoma (eg, neurosarcoma; rhabdomyosarcoma; spindle cell sarcoma; fibrosarcoma)
9. Wegener’s granulomatosis; lethal midline granuloma

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

**References**

Gamut B-41-2

**CYSTIC NASOPHARYNGEAL MASS**

1. Atypical lymph node
2. Encephalomeningocele
3. Pharyngeal cyst
4. Tornwaldt cyst

References

Gamut B-42

**AGGRESSIVE NASOPHARYNGEAL MASS IN A CHILD**

1. Carcinoma of nasopharynx
2. Chloroma
3. Esthesioneuroblastoma
4. Hemangiopericytoma
5. Infection, aggressive (fungal, tuberculous, bacterial cocci)
6. Langerhans cell histiocytosis
7. Lymphoma, incl. Burkitt’s lymphoma
8. Metastatic neuroblastoma
9. Minor salivary gland malignancy
10. Rhabdomyosarcoma; other soft tissue sarcomas
   (incl. fibrosarcoma; angiosarcoma; mesenchymal chondrosarcoma; malignant mesenchymoma)

References

Gamut B-43

**EXTENSION OF NEOPLASM FROM INTRACRANIAL CAVITY TO NASOPHARYNX**

**COMMON**
1. Chromophobe adenoma

**UNCOMMON**
1. Craniopharyngioma
2. Malignant otitis externa extending medially
3. Meningioma
4. Neurinoma; neurofibroma
5. Paraganglioma (glomus jugulare, glomus vagale, or carotid body tumor)

References

\[ \text{Gamut B-44} \]

NASOPHARYNGEAL (AND/OR INFRATEMPORAL FOSSA) LESION

COMMON
1. Abscess (retropharyngeal) or cellulitis
2. Cervical spine lesion, including fracture
3. Enlarged adenoids, tonsils
4. Hematoma
5. Juvenile angiofibroma
6. Malignant nasopharyngeal neoplasm (esp. carcinoma; lymphoepithelioma; lymphoma; rhabdomyosarcoma; plasmacytoma) (See B-41-1)

UNCOMMON
1. Amyloidosis
2. Aneurysm of internal carotid artery
3. Antrochoanal polyp
4. Arteriovenous malformation
5. Benign nasopharyngeal neoplasm, other (See B-41-1)
6. Bone sarcoma (eg, chondrosarcoma; osteosarcoma)
7. Chordoma of clivus
8. Encephalocele, transsphenoid
9. Foreign body
10. Inflammatory polyp; polypoid rhinosinusitis
11. Lymphadenopathy, other (eg, infectious mono-nucleosis; sinus histiocytosis)
12. Meningioma of skull base
13. Metastasis
14. Mucocele
15. Nasal polyp; enlarged turbinate
16. Neoplasm extending from sphenoid, ethmoid, or maxillary sinus, nasal fossa, or parotid gland
17. Papillomas (Schneiderian)
18. Rhinoscleroma
19. Sarcoïdosis
20. Tornwaldt cyst (notochord remnant)
21. Tuberculosis of nasopharynx or cervical spine

References

\[ \text{Gamut B-45} \]

LESIONS OF THE PTERYGOPALATINE (SPHENOMAXILLARY) FOSSA

COMMON
1. Juvenile angiofibroma
2. Malignant neoplasm, invasive (eg, carcinoma; melanoma; rhabdomyosarcoma; esthesioneuroblastoma {olfactory neuroblastoma})
3. Meningioma of sphenoid wing or nasal fossa
4. Metastasis
5. Trauma with fracture of pterygoid plates (eg, zygomatico-maxillary and Le Fort fractures)

(continued)
UNCOMMON
1. Aneurysm (carotid-cavernous sinus; paraclinoid)
2. Hyperostotic bone disease (eg, fibrous dysplasia; Paget’s disease; meningioma; chronic osteomyelitis)
3. Inflammatory disease (eg, necrotizing granuloma; fungus infection; chronic hypertrophic polypoid rhinosinusitis)
4. Inverting papilloma
5. Mucocele (sphenoethmoid)
6. Pituitary adenoma or trigeminal neurinoma extending into base of pterygoid plates
7. Soft tissue tumor extension from parotid gland, nasopharynx, or cervical nodes

References
2. Woodruff WW, Vrabec DP: Inverted papilloma of the nasal vault and paranasal sinuses: spectrum of CT findings. AJR 1994;162:419–423

POST-STYLOID PARAPHARYNGEAL (CAROTID) SPACE MASS
1. Enlarged lateral retropharyngeal lymph node
2. Glomus jugulare or vagale tumor (paraganglioma)
3. Meningioma
4. Metastasis
5. Pleomorphic adenoma (benign mixed tumor from accessory salivary tissue)
6. Schwannoma

References

LESIONS OF THE PARAPHARYNGEAL SPACE
1. Abscess
2. Branchial cleft cyst
3. Carcinoma (adenocarcinoma; adenoid cystic carcinoma; mucoepidermoid carcinoma)
4. Epidermoid inclusion cyst
5. Fibromatosis
6. Jugular vein thrombosis (chronic)
7. Lipoma; other fatty lesions (See B-47-2)
8. Lymphadenopathy
9. Meningioma
10. Minor salivary gland tumor
11. Neurinoma; schwannoma

References
12. Paraganglioma
13. Pleomorphic adenoma
14. Sarcoma
15. Thrombosed aneurysm of the internal carotid artery
16. Vascular malformation (rarely pure venous)

References
3. Helmburger RC, Stringer SP, Mancuso AA: Rhabdomyosarcoma of the pharyngeal musculature extending into the prestyloid parapharyngeal space. AJNR 1996;17:1115–1118

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Gamut B-48

FATTY LESIONS IN THE PRESTYLOID PARAPHARYNGEAL SPACE (PPS)

1. Angiolipoma
2. Benign symmetric lipomatosis (Madelung disease)
3. Dermoid cyst; teratoma
4. Hibernoma
5. Lipoblastoma; lipoblastomatosis (pediatric patient)
6. Lipoma
7. Liposarcoma

References

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Gamut B-48

LESIONS OF THE MASTICATOR SPACE

1. Abscess (odontogenic)
2. Accessory parotid gland
3. Benign masseteric hypertrophy
4. Carcinoma (squamous cell)
5. Hemangioma
6. Hemangiopericytoma
7. Leiomyoma
8. Lymphangioma
9. Lymphoma (non-Hodgkins)
10. Metastasis
11. Minor salivary gland tumor
12. Neurofibroma; schwannoma
13. Osteoblastoma
14. Osteomyelitis of mandible
15. Sarcoma (chondrosarcoma; osteosarcoma; rhabdomyosarcoma; leiomyosarcoma)
16. Trigeminal (V3) denervation atrophy

(continued)
References

Gamut B-49-1

ABNORMALITIES OF THE PHARYNX—CONGENITAL

1. Choanal atresia
2. Cleft palate
3. Cyst (Tornwaldt cyst {notochord remnant}; parapharyngeal cyst)
4. Encephalocele; meningocele

Reference

Gamut B-49-2

ABNORMALITIES OF THE PHARYNX—FUNCTIONAL DISORDER

1. Functional nasopharyngeal obstruction by enlarged adenoids or uvula (eg, pickwickian S. {marked obesity}; hypersomnolence states)
2. Swallowing disorder (eg, myasthenia gravis, scleroderma, dysautonomia) (See G-1, G-2)

Reference

Gamut B-49-3

ABNORMALITIES OF THE PHARYNX—TRAUMA

1. Fracture (eg, pterygoid plates; angle of mandible)
2. Puncture wound of nasopharynx or pharynx (air in soft tissues; abscess; airway distortion)
3. Thorotrast injury to pharyngeal soft tissues and carotid arteries

Gamut B-49-4

ABNORMALITIES OF THE PHARYNX—INFECTION

1. Abscess
2. Adenoid hypertrophy; tonsillitis
3. Fungus disease (eg, mucormycosis; actinomycosis; candidiasis)
4. Granulomatous disease (eg, tuberculosis; sarcoidosis; rhinoscleroma)

Reference

Gamut B-49-5

NEOPLASMS OF THE PHARYNX

1. Neoplasms of nasopharynx (See B-41-1)
2. Neoplasms of oropharynx (See B-106)
3. Neoplasms of hypopharynx (See B-111)
Gamut B-50

HYPOPLASTIC OR ABSENT PARANASAL SINUSES (USUALLY FRONTAL)

COMMON
1. Anemia, primary (esp. thalassemia; also sickle cell disease)
2. Congenital absence or hypoplasia
3. Cretinism; hypothyroidism
4. Fibrous dysplasia; leontiasis ossea
5. Kartagener S.
6. Paget’s disease
7. Trisomy 21 S. (Down S.)

UNCOMMON
1. Binder S. (maxillonasal dysplasia)
2. Cleidocranial dysplasia
3. Cockayne S.
4. Craniometaphyseal dysplasia
5. Diaphyseal dysplasia (Camurati-Engelmann disease); craniodiaphyseal dysplasia
6. Frontometaphyseal dysplasia
7. Frontonasal dysplasia (median cleft face S.)
8. Hyperphosphatasia
9. Hypopituitarism
10. Metaphyseal chondrodysplasia (Jansen type)
11. Osteodysplasty (Melnick-Needles S.)
12. Osteopathia striata with cranial sclerosis
13. Osteopetrosis
14. Otopalatodigital S.
15. Prader-Willi S.
16. Pyknodysostosis
17. Schwarz-Lélek S.
18. Treacher Collins S.

References

Gamut B-51

OPACIFICATION OF ONE OR MORE PARANASAL SINUSES

COMMON
*a. Hemorrhage or edema from trauma or surgery; epistaxis; barotrauma
b. [Hypoplasia or aplasia of a sinus]
c. Inflammatory mass (eg, nonsecretory cyst; mucous retention cyst; polyp; mucocele; pyocele)
d. Sinusitis
*e. [Spurious opacification (eg, swelling of soft tissues of cheek; technical factors—poor positioning; increased thickness of adjacent bone—eg, fibrous dysplasia; Paget’s disease; thalassemia; cranio-metaphyseal dysplasia)]

UNCOMMON
1. Cystic fibrosis (mucoviscidosis)
*a. Granulomatous or other infectious disease
  a. Fungus disease (eg, mucormycosis; aspergillosis; actinomycosis; blastomycosis; rhinosporidiosis)
  b. Leprosy
  c. Rhinoscleroma
  d. Sarcoidosis
  e. Syphilis
  f. Tuberculosis
2. Kartagener S.; immotile cilia S. (sinusitis)
*a. Neoplasm, benign or malignant (eg, carcinoma; lymphoma, incl. Burkitt lymphoma)
*b. Polypoid rhinosinusitis
*c. Wegener’s granulomatosis; lethal midline granuloma
* Often with bone destruction.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

(continued)
FLUID LEVEL IN A PARANASAL SINUS

COMMON
1. Fracture of sinus wall with hemorrhage
2. Sinusitis, acute

UNCOMMON
1. Iatrogenic (eg, maxillary antral lavage; nasal packing for epistaxis; indwelling nasogastric tube)
2. Neoplasm (eg, osteoma or carcinoma of sinus)
3. Normal (infant)

Reference

MASS IN A PARANASAL SINUS

COMMON
*1. Carcinoma (esp. squamous cell; also adenocarcinoma; adenoid cystic; cylindroma)
2. Encapsulated exudate, pus, or blood
*3. Extrinsic neoplasm invading sinus (eg, pituitary, orbital, oral, or nasopharyngeal; chordoma; juvenile angiofibroma; lymphoepithelioma; Burkitt lymphoma)
*4. Fracture with hematoma (eg, blow-out fracture of orbit)
5. Impacted tooth (maxillary sinus)
6. Mucocele (esp. frontal or ethmoid)
7. Mucosal edema or inflammation (eg, from sinusitis due to allergy or infection)
8. Mucous retention cyst; serous or nonsecretory cyst
*9. Osteoma (esp. frontal or ethmoid)
10. Polyp or pseudopapill (incl. cystic fibrosis [mucoviscidosis])
*11. [Spurious opacification (eg, swelling of soft tissues of cheek; technical factors—poor positioning; increased thickness of adjacent bone—fibrous dysplasia, Paget’s disease, thalassemia, cranio-metaphyseal dysplasia)]

UNCOMMON
1. Antrochoanal polyp (maxillary sinus)
2. Barotrauma
*3. Benign neoplasm, other (eg, osteochondroma; hemangioma; hemangiopericytoma; dermoid; lipoma; ossifying fibroma; osteoid osteoma; osteoblastoma; giant cell tumor; aneurysmal bone cyst)
*4. Bone sarcoma (eg, osteosarcoma; chondrosarcoma).
*5. Encephalocele
6. Epithelial papilloma (squamous and inverting)
7. Foreign body
*8. Granulomatous disease (eg, tuberculosis; syphilis; leprosy; glands; fungus disease; sarcoidosis; rhinoscleroma; giant cell granuloma)
*9. Langerhans cell histiocytosis
*10. Metastasis (esp. from carcinoma of kidney, lung, or breast)
*11. Myeloma, plasmacytoma (extramedullary)
*12. Neurogenic tumor (eg, schwannoma; neurofibroma; neurocele; meningioma)
*13. Odontogenic cyst or tumor (eg, dentigerous cyst; globulomaxillary cyst; odontoma) at base of maxillary antrum
*14. Polypoid rhinosinusitis
15. Sinolith (calcified secretions)
*16. Surgical ciliated cyst (post Caldwell-Luc operation)
*17. Wegener’s granulomatosis; lethal midline granuloma

* Usually with bone involvement.

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut B-54

LIQUID SINUS MASS (ON CT OR MRI)

1. Acute sinusitis
2. Cyst (odontogenic; keratocyst)
3. Iatrogenic (previous tooth extraction; sinus surgery)
4. Meningoencephalocele
5. Mucocele
6. Necrotic malignant tumor
7. Trauma

References

Gamut B-55

SINUS DISEASE WITH BONE DESTRUCTION

AGGRESSIVE INFECTION
1. Actinomycosis
2. Aspergillosis
3. Bacterial osteomyelitis
4. Candidiasis
5. Cryptococcosis
6. Histoplasmosis
7. Nocardiosis
8. Mucormycosis
9. Rhinoscleroma
10. Syphilis
11. Tuberculosis

NONINFECTIOUS GRANULOMATOUS PROCESSES
1. Idiopathic midline granuloma
2. Sarcoidosis
3. Wegener’s granulomatosis
NEOPLASM
1. Bone sarcoma (osteosarcoma; chondrosarcoma; Ewing sarcoma; fibrosarcoma)
2. Carcinoma (adenocarcinoma; squamous cell carcinoma)
3. Esthesioneuroblastoma
4. Lymphoma; Burkitt lymphoma
5. Malignant fibrous histiocytoma
6. Melanoma
7. Metastasis
8. Minor salivary gland neoplasm
9. Plasmacytoma; multiple myeloma
10. Rhabdomyosarcoma

MISCELLANEOUS
1. Langerhans cell histiocytosis (esp. eosinophilic granuloma)
2. Nasal abuse from cocaine or chromate salts
3. Radiation injury
4. Trauma with fracture

Note: In an HIV-positive patient, aggressive infections either bacterial (nocardiosis) or fungal (aspergillosis, mucormycosis, candidiasis, cryptococcosis) are likely, as is an aggressive lymphoma.

References

Gamut B-56
TEMPOROMANDIBULAR JOINT DISEASE

COMMON
1. Condylar morphological abnormality (congenital or acquired); abnormal condylar excursion
2. Degenerative arthritis
3. Rheumatoid arthritis
4. Temporomandibular joint syndrome (limited excursion of mandibular condyle with displacement of the meniscus, usually anteriorly, occasionally posteriorly, best seen on MRI)
   a. Anterior dislocation with or without reduction
   b. Combined dislocations (both in frontal and sagittal planes)
   c. Disc perforation
5. Postsurgical changes
6. Posttraumatic changes

UNCOMMON
1. Adjacent bony disease (eg, Paget’s disease; fibrous dysplasia)
2. Ankylosing spondylitis
3. Erosive (inflammatory) arthritis
4. Gout (rare)
5. Iatrogenic (eg, multiple steroid injections)
6. Infectious arthritis
7. Juvenile rheumatoid arthritis
8. Loose body
9. Neoplasm (eg, osteochondroma)
10. Osteochondritis dissecans (avascular necrosis)
11. Pigmented villonodular synovitis
12. Psoriatic arthritis

References

Gamut B-57-1
PROGNATHISM

COMMON
1. Acromegaly
2. Normal variant; idiopathic

UNCOMMON
1. Cherubism (fibrous dysplasia)
2. Congenital syndromes (See B-57-2)
3. Edentulous mandible
4. Epidermolysis bullosa dystrophica
5. Hypothyroidism (juvenile)
6. Lymphangioma of tongue; other congenital tongue enlargements
7. Paget’s disease

Gamut B-57-2
CONGENITAL SYNDROMES AND BONE DYSPLASIAS WITH PROGNATHISM

COMMON
1. Cherubism (fibrous dysplasia)
2. Cleidocranial dysplasia
3. Crouzon S. (craniofacial dysostosis)

UNCOMMON
1. Acrocephalosyndactyly (Apert type)
2. Acrodysostosis (peripheral dysostosis)
3. Beckwith-Wiedemann S.
4. Binder S. (maxillonasal dysplasia)

(continued)
5. Cloverleaf skull (kleeblattschädel anomaly)
6. Cockayne S.
7. Craniodiaphyseal dysplasia
8. Craniometaphyseal dysplasia
9. Endosteal hyperostosis (van Buchem and Worth types)
10. Facial hemihypertrophy (unilateral prognathism)
11. Gorlin S. (nevaid basal cell carcinoma S.)
12. Hajdu-Cheney S. (idiopathic acro-osteolysis)
13. “Happy puppet” S.
14. Hypothyroidism (juvenile)
15. LEOPARD S.
16. Mucolipidosis III (pseudo-Hurler polydystrophy)
17. Myotonic dystrophy
18. Normal variant
19. Oculo-dento-osseous dysplasia
20. Opitz BBBG S. (G syndrome)
21. Osteoglophonic dwarfism
22. Pyle dysplasia (familial metaphyseal dysplasia)
23. Rieger S.
24. Sclerosteosis
25. Sotos S. (cerebral gigantism)
26. Williams S. (idiopathic hypercalcemia)
27. XXXXY S.

Reference

BILATERAL ENLARGEMENT OF THE MANDIBLE IN A CHILD

1. Fibrous dysplasia; cherubism
2. Multiple dentigerous cysts, esp. Gorlin S. (nevaid basal cell carcinoma S.)

References

MICROGNATHIA

COMMON
1. Pierre Robin S. (Robin sequence)
2. Primary or secondary absence (severe hypoplasia) of the tongue
3. Treacher Collins S. (mandibulofacial dysostosis)

UNCOMMON
1. Acrofacial dysostosis (Nager, Miller, or Weyers types)
2. Acrogeria
3. Aminopterin fetopathy
4. Arthrogryposis
5. Atelosteogenesis
6. Brachmann-de Lange S. (de Lange S.)
7. Campomelic dysplasia
8. Cat cry S. (cri du chat S.)
9. Catel-Manzke S.
10. Cerebro-costo-mandibular S.
11. Cerebro-oculo-facio-skeletal S. (Pena-Shakein S. type II)
12. Chondrodysplasia punctata
13. Chromosome 4p- S. (Wolf S.)
14. Chromosome 18: del (18p) S.
15. Cockayne S.

References
16. Cohen S.  
17. Contractural arachnodactyly  
18. Cowden S. (multiple hamartoma S.)  
19. DiGeorge sequence  
20. Diastrophic dysplasia  
21. Dubowitz S.  
22. Dyssegmental dysplasia  
23. Ehlers-Danlos S.  
24. Femoral hypoplasia-unusual facies S.  
25. Fetal akinesia sequence (Pena-Shokeir S., type I)  
26. Fetal alcohol S.  
27. Fetal valproate S.  
28. FG S.  
29. Freeman-Sheldon S. (whistling face S.)  
30. Frontometaphyseal dysplasia  
31. Fryns S.  
32. GAPO S.  
33. Hajdu-Cheney S.  
34. Hallermann-Streiff S. (oculo-mandibulo-facial S.)  
35. Hypoglossia-hypodactyly S. (aglossia-adactylyia S.)  
36. Infantile cortical hyperostosis (Caffey’s disease) (late sequela)  
37. Johanson-Blizzard S.  
38. Klippel-Feil S.  
39. Larsen S.  
40. Lissencephaly syndromes (congenital agyria) (Miller-Dieker S.)  
41. Mandibuloacral dysplasia  
42. Marden-Walker S.  
43. Marshall-Smith S.  
44. Meckel S.  
45. Mesomelic dysplasia (Langer type)  
46. Metaphyseal chondrodysplasia (Jansen type)  
47. Möbius S.  
48. Neu-Laxova S.  
49. Noonan S.  
50. Oculo-auculo-vertebral spectrum (Goldenhar S.)  
51. Opitz BBBG S. (G syndrome)  
52. Opitz trigonocephaly S. (C syndrome)  
53. Oro-facio-digital S. I (Papillon-Leage and Psaume S.) and II (Mohr S.)  
54. Oromandibular-limb hypogenesis S. (incl. Hanhart S.)  
55. Osteodysplasty (Melnick-Needles S.)  
56. Osteolysis with nephropathy  
57. Otopalatodigital S., type II  
58. Oto-spondylo-megaepiphyseal dysplasia (OSMED)  
59. Pallister-Hall S.  
60. Pallister-Killian S. (only in infancy)  
61. Potter sequence  
62. Progeria  
63. Pterygium syndromes  
64. Pyknodyostosis  
65. Roberts S.  
66. Robinow S.  
67. Ruinstein-Taybi S.  
68. Schwartz-Jampel S. (ostochondromuscular dystrophy)  
69. Seckel S. (bird-headed dwarfism)  
70. Short rib-polydactyly syndromes (Saldino-Noonan and Majewski types)  
71. Silver-Russell S.  
72. Smith-Lemli-Opitz S.  
73. Stickler S. (arthro-ophthalmopathy)  
74. TAR S. (thrombocytopenia-absent radius S.)  
75. Tricho-rhino-phalangeal dysplasia, types I and II  
76. Trisomy syndromes (13, 18, 22)  
77. Turner S.  
78. Weissenbacher-Zweymüller phenotype  
79. Williams S. (idiopathic hypercalcemia)  
80. Yunis-Varón S.  
81. Zellweger S. (cerebrohepatorenal syndrome)  

References  
CONGENITAL SYNDROMES
AND BONE DYSPLASIAS
WITH MIDFACE (MAXILLARY AND/OR MALAR-ZYGOMATIC) HYPOPLASIA

COMMON
1. Achondroplasia
2. Chondrodysplasia punctata
3. Cleidocranial dysplasia
4. Crouzon S. (craniofacial dysostosis)
5. Treacher Collins S. (mandibulofacial dysostosis)
6. Trisomy 21 S. (Down S.)

UNCOMMON
1. Aarskog S.
2. Acrocephalosyndactyly (Apert type)
3. Acrodysostosis (peripheral dysostosis)
4. Acrofacial dysostosis (Nager and Miller types)
5. Acromesomelic dysplasia
6. Antley-Bixler S.
7. Atelosteogenesis
8. Binder S. (maxillonasal dysplasia)
9. Bloom S.
10. Campomelic dysplasia
11. Chromosome 18q- S.
12. Cowden S. (multiple hamartoma-neoplasia S.)
13. Craniofrontonasal dysplasia
14. Dysostosclerosis
15. Dyssegmental dysplasia
16. Fetal alcohol S.
17. Fetal valproate S.
18. Freeman-Sheldon S. (whistling face S.)
19. Frontonasal dysplasia (median cleft face S.)
20. GAPO S.
21. Geroderma osteodysplastica
22. Hajdu-Cheney S.
23. Hallermann-Streiff S. (oculo-mandibulo-facial S.)
24. Hypochondroplasia
25. Keutel S.
26. Kyphomelic dysplasia
27. Larsen S.
28. Mandibuloacral dysplasia
29. Oculo-auriculo-vertebral spectrum (Goldenhar S.)
30. Osteoglophonic dysplasia
31. Otopalatodigital dysplasia, type II
32. Progeria
33. Pyknody sostosis
34. Rieger S.
35. Schinzel-Giedion S.
36. Schneckenbecken dysplasia
37. Seckel S. (bird-headed dwarfism)
38. Silver-Russell S.
39. Sponastrime dysplasia
40. Stanescu dysostosis
41. Stickler S. (arthro-ophthalmopathy)
42. Thanatophoric dysplasia
43. 3-M S.
44. Trichorhinophalangeal dysplasia
45. Trisomy 18 S.
46. Weill-Marchesani S.
47. Weisschenbacher-Zweymüller phenotype
48. Wildervanck S.
49. Yunis-Varón S.

Reference
Gamut B-61-1

DELAYED ERUPTION OR NON-ERUPTION OF TEETH

CONGENITAL SYNDROMES (See B-61-2)

ENDOCRINOPATHIES
1. Hypoparathyroidism
2. Hypopituitarism (anterior lobe)
3. Hypothyroidism; cretinism

FAMILIAL TENDENCY

IDIOPATHIC

LOCAL FACTORS
1. Developmental
   a. Cleft lip and/or cleft palate
   b. Disorientation of tooth germ
   c. Ectopic eruption
   d. Lack of space
   e. Prolonged retention of deciduous teeth
   f. Submersion and ankylosis
   g. Supernumerary teeth
2. Hereditary (eg, amelogenesis imperfecta)
3. Iatrogenic
   a. Improperly contoured restoration (eg, stainless steel crowns)
   b. Lack of space (eg, premature extraction of deciduous teeth and loss of space for permanent successor)
   c. Over-retained roots of deciduous teeth
4. Inflammatory (eg, Garré’s sclerosing osteomyelitis)
5. Mechanical (eg, fibrosis of alveolar mucosa; dilaceration of tooth; impacted tooth)
6. Nonodontogenic jaw lesion
   a. Fibrous dysplasia; cherubism
   b. Giant cell reparative granuloma
   c. Ossifying fibroma
7. Obstruction by dentigerous or radicular cyst
8. Odontogenic tumor
   a. Adenoameloblastoma
   b. Ameloblastic fibroma and myxoma
   c. Ameloblastic fibro-odontoma
   d. Neuroectodermal tumor of infancy (melanotic progonoma)
   e. Odontogenic myxoma and fibroma
   f. Odontoma (compound or complex)
9. Traumatic (eg, injury to deciduous teeth early in life; jaw fracture)

References

Gamut B-61-2

CONGENITAL SYNDROMES AND BONE DYSPLASIAS WITH DELAYED ERUPTION OR NONERUPTION OF TEETH (See B-62)

COMMON
1. Chondroectodermal dysplasia (Ellis-van Creveld S.)
2. Cleidocranial dysplasia
3. Fetal rubella S.
4. Gardner S.
5. Hypoparathyroidism; pseudohypoparathyroidism
6. [Hypophosphatemic rickets]
7. Hypopituitarism (anterior lobe)
8. Hypothyroidism; cretinism
9. Mucopolysaccharidoses (See J-4-S)
10. Osteogenesis imperfecta
11. Osteopetrosis
12. Progeria
13. Pyknodysostosis
14. Trisomy 21 S. (Down S.)
15. Williams S. (idiopathic hypercalcemia)

UNCOMMON
1. Aarskog S.
2. Acродysostosis (peripheral dysostosis)

(continued)
3. Acrocephalosyndactyly (Apert type)
4. Brachmann-de Lange S. (de Lange S.)
5. Dubowitz S.
6. Ectodermal dysplasia (hypohidrotic)
7. GAPO S.
8. Goltz S. (focal dermal hypoplasia)
9. Hallermann-Streiff S. (oculo-mandibulo-facial S.)
10. Hanhart S.
11. Incontinentia pigmenti
12. Kocher-Debré-Sémélaigne S.
13. Lacrimo-auriculo-dento-digital S. (LADD S.)
14. Osteoglophonic dysplasia
15. Robinow S.
16. Romberg S.
17. Tricho-dento-osseous S.
18. Trichorhinopharyngeal dysplasia (type I)
19. Winchester S.

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References

Gamut B-62

CONGENITAL SYNDROMES AND BONE DYSPLASIAS WITH DEFECTIVE AND/OR DELAYED DENTITION (See B-61-2)

COMMON
1. Cherubism; polyostotic fibrous dysplasia (McCune-Albright S.) (delayed eruption or agenesis; displaced teeth)
2. Chondroectodermal dysplasia (Ellis-van Creveld S.) (neonatal teeth; conical peg-shaped teeth; partial anodontia; delayed eruption)
3. Cleidocranial dysplasia (delayed eruption; supernumerary teeth; partial anodontia; malformed roots; enamel hypoplasia; early loss)
4. Cretinism; hypothyroidism (delayed eruption)
5. Ehlers-Danlos S. (small, irregular teeth; partial anodontia)
6. [Fluorosis]
7. Gorlin S. (nevoid basal cell carcinoma S.) (odontogenic cyst; irregular placement; caries)
8. Homocystinuria (irregular, crowded teeth)
9. Hypoparathyroidism; pseudohypoparathyroidism (hypodontia; delayed eruption; enamel hypoplasia; caries)
10. Hypophosphatasia (early loss; poor dentin; caries)
11. [Hypophosphatemic rickets (delayed eruption; enamel hypoplasia; gingival and periapical infection)]
12. Hypopituitarism (anterior lobe) (delayed eruption)
13. Mucopolysaccharidoses (eg, Hurler S.; Hunter S.; Morquio S.) (small malaligned teeth; thin enamel) (See J-4)
14. Osteogenesis imperfecta I, III, and IV (hypodontia; delayed eruption; poor dentin; short roots; opalescent teeth)
15. Osteopetrosis (delayed eruption)
16. Progeria (delayed eruption; crowded teeth)
17. Pyknodysostosis (delayed eruption; partial anodontia; irregular placement; persistent deciduous teeth)
18. Pyle dysplasia (poor teeth)
19. [Syphilis, congenital (Hutchinson’s teeth)]
20. Trisomy 21 S. (Down S.) (hypodontia; microdontia; delayed eruption)

UNCOMMON
1. Aarskog S. (delayed eruption; hypodontia; malocclusion; enamel hypoplasia)
2. Acrocephalosyndactyly (Apert type) (delayed eruption)
3. Aglossia-adactylia S. (missing incisors)
4. Aminopterin fetopathy
5. Bardet-Biedl S.
6. Brachmann-de Lange S. (de Lange S.) (delayed eruption)
7. Cerebro-costo-mandibular S.
8. Cockayne S. (caries)
9. Coffin-Lowry S.
10. Cohen S.
11. Congenital insensitivity to pain (early loss)
12. Craniocutaneous dysplasia (microdontia; hypodontia, fusion; enamel dysplasia)
13. Craniofacial dysplasia
14. Crouzon S. (craniofacial dysostosis) (partial anodontia; wide spacing)
15. DOOR S.
16. Dyskeratosis congenita S. (caries; malalignment)
17. Dysostosis cleidocranialis
18. Ectodermal dysplasias (eg, hereditary, anhidrotic, hypohidrotic, or Robinson type) (partial anodontia; conical teeth)
19. Endosteal hyperostosis (Worth type)
20. Epidermal nevus S. (odontodysplasia)
21. Frontometaphyseal dysplasia (hypodontia)
22. Gardner S. (delayed eruption)
23. Goltz S. (focal dermal hypoplasia) (hypodontia; enamel hypoplasia; delayed eruption; malformed teeth; irregular placement)
24. Hajdu-Cheney S. (idiopathic acro-osteolysis) (early loss)
25. Hallermann-Streiff S. (oculo-mandibulo-facial S.) (hypodontia; supernumerary teeth; neonatal teeth; delayed eruption)
26. Hanhart S. (hypodontia; delayed eruption)
27. Hyperphosphatasia (early loss)
28. Hypoglossia-hypodontia S. (neonatal teeth)
29. Hypomelanosis of Ito (irregular spacing; peglike incisors)
30. Incontinentia pigmenti (hypodontia; delayed eruption; conical teeth)
31. Johanson-Blizzard S. (oligodontia; small teeth)
32. KBG S. (macrodontia; oligodontia; malposition; enamel hypoplasia)
33. Kocher-Debré-Sémélaigne S. (delayed eruption)
34. Lacrimo-auriculo-dento-digital S. (LADD S.) (delayed eruption; anodontia; enamel dysplasia)
35. Lenz microphthalmia S.
36. Lenz-Majewski dysplasia
37. Lowe S. (oculo-cerebro-renal S.) (cysts)
38. Marinesco-Sjögren S. (irregular teeth)
40. Mesomelic dysplasias
41. Oculo-auriculo-vertebral spectrum (Goldenhar S.) (delayed eruption; missing teeth)
42. Oculo-dento-osseous dysplasia (hypodontia; microodontia; enamel hypoplasia)
43. Oro-facio-digital S. I (Papillon-Leage and Psaume S.) (missing lower central and lateral incisors; supernumerary cuspids and bicusps; enamel hypoplasia; malocclusion)
44. Oro-facio-digital S. II (Mohr S.) (missing central incisors)
45. Osteodysplasty (Melnick-Needles S.) (malaligned teeth)
46. Osteoglophonic dysplasia (delayed eruption)
47. Osteolysis (familial expansile) (progressive tooth mobility and fracture; pulpitis)
48. Otopalatodigital S. (types I and II) (hypodontia)
49. Pachyonychia congenita (caries; early loss)
50. Papillon-Lefèvre S. (early loss)
51. Prader-Willi S. (dental caries; enamel hypoplasia)
52. Rieger S. (hypodontia; microdontia)
53. Robinow S. (delayed eruption)
54. Romberg S. (delayed eruption)
55. Rothmund-Thomson S. (microdontia; hypodontia; delayed eruption; supernumerary teeth)
56. Rubinstein-Taybi S.
57. Sclerostosis
58. Seckel S. (bird-headed dwarfism) (missing teeth)
59. Short rib-polydactyly S. (type I)
60. Singleton-Merten S.
61. Sjögren-Larsson S. (dental caries; enamel hypoplasia)
62. Stanescu dysostosis (small, crowded teeth; enamel hypoplasia)
63. Stickler S. (arthro-ophthalmopathy) (malocclusion; dental maleruption)
64. Thalidomide embryopathy
65. Treacher Collins S. (mandibulofacial dysostosis)
66. Tricho-dento-osseous S. (delayed eruption; early loss)
67. Weill-Marchesani S. (malformed teeth)
68. Werner S.
69. Weyers acrodiastomatic dysostosis

(continued)
70. Wildervanck S. (defective teeth)
71. Williams S. (idiopathic hypercalcemia) (delayed eruption; microdontia)
72. Winchester S. (delayed eruption)
73. XXXXY S. (hypodontia)
74. Yunis-Varón S. (hypodontia; impacted teeth)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut B-63

EARLY LOSS OF TEETH

COMMON
1. Dental caries, advanced
2. Juvenile periodontitis
3. Trauma

UNCOMMON
1. Acroosteolysis
2. Chédiak-Higashi S.
3. Cleidocranial dysplasia
4. Congenital insensitivity to pain
5. Cyclic neutropenia
6. Hajdu-Cheney S.
7. Heavy metal poisoning
8. Hyperparathyroidism
9. Hyperphosphatasia
10. Langerhans cell histiocytosis
11. Leukemia
12. Mandibuloacral dysplasia
13. Metastatic disease (esp. neuroblastoma; rhabdomyosarcoma)
14. Papillon-Lefèvre S.
15. Pyknodysostosis
16. Rickets, severe
17. Sheehan S. (Simmonds disease) (postpartum pituitary necrosis)
18. Trichodento-osseous S.
19. Werner S.

References

Gamut B-64

CONGENITAL SYNDROMES WITH MULTIPLE MISSING TEETH (ANODONTIA OR HYPODONTIA)
(See B-61-2)

COMMON
1. Cherubism (fibrous dysplasia)
2. Chondroectodermal dysplasia (Ellis-van Creveld S.)
3. Cleidocranial dysplasia
4. Crouzon S. (craniofacial dysostosis)
5. Ehlers-Danlos S.
6. Idiopathic
7. Osteogenesis imperfecta
8. Pseudohypoparathyroidism
9. Trisomy 21 S. (Down S.)

UNCOMMON
1. Aarskog S.
2. Acrofacial dysostosis (peripheral dysostosis)
3. Böök S.
4. Coffin-Lowry S.
5. Ectodermal dysplasia (hypohidrotic)
6. EEC S.
7. Frontometaphyseal dysplasia
8. Goltz S. (focal dermal hypoplasia)
9. Hallermann-Streiff S. (oculo-mandibulo-facial S.)
10. Hanhart S.
11. [Hereditary]
12. Hypoglossia-hypodactylia S.; aglossia-adactyla S.
13. Hypophosphatasia
14. [Idiopathic; nonfamilial]
15. Incontinentia pigmenti
16. Johanson-Blizzard S.
17. Lacrimo-auriculo-dento-digital S. (LADD S.)
18. Oculo-dento-osseous dysplasia
20. Oro-facio-digital S. II (Mohr S.)
21. Otopalatodigital S.
22. Progeria
23. Pyknodysostosis
24. Rieger S.
25. Rothmund-Thomson S.
26. Seckel S. (bird-headed dwarfism)
27. XXXXY S.

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut B-66

B. Head and Neck

1. Cleft palate
2. Cleidocranial dysplasia
3. Compound odontoma
4. Idiopathic

UNCOMMON
1. Achondroplasia
2. Ehlers-Danlos S.
3. Gardner S.
4. Hallermann-Streiff S. (oculo-mandibulo-facial S.)
5. Orofaciodigital S.

Reference

Gamut B-66

LOSS OF LAMINA DURA OF THE TEETH

COMMON
1. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
2. Local inflammatory disease; periodontitis (eg, gingivitis; pyorrhea; dental caries; periodontal abscess; periapical granuloma or abscess; radicular cyst; sclerosing osteomyelitis)
3. Osteoporosis (esp. postmenopausal)
4. Periodontosis (noninflammatory, degenerative)

UNCOMMON
1. Anemia (eg, thalassemia; sickle cell)
2. Burkitt’s lymphoma

(continued)
3. Cushing S.; steroid therapy
4. Fibrous dysplasia
5. Hyperphosphatasia
6. Hypertvitaminosis D
7. Hypoparathyroidism
8. Hypothyroidism
9. Langerhans cell histiocytosis \(_g\) (esp. eosinophilic granuloma)
10. Leukemia
11. Metastasis (esp. from carcinoma of breast)
12. Multiple myeloma
13. Neoplasm, primary (eg, malignant tumor; fibrous histiocytoma)
14. Osteomalacia; rickets (severe)
15. Paget’s disease
16. Periapical cemental dysplasia
17. Removal of opposing tooth
18. Renal acidosis; oxalosis
19. Scleroderma (widened periodontal membrane)
20. Scurvy
21. Traumatic (hemorrhagic) bone cyst

References

UNCOMMON
1. Agranulocytosis and cyclic neutropenia
2. Ameloblastoma
3. Calcifying odontogenic cyst (Gorlin cyst)
4. Carcinoma of mouth
5. Desmoplastic fibroma
6. Fibrous dysplasia
7. Giant cell reparative granuloma
8. Hemangioma or lymphangioma of mandible
9. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
10. Hypophosphatasia
11. Lymphoma \(_g\); leukemia, Burkitt’s lymphoma
12. Melanotic progonoma
13. Mercury poisoning
14. Metastatic neoplasm (esp. neuroblastoma)
15. Myeloma; plasmacytoma
16. Odontogenic myxoma; odontogenic fibroma
17. Papillon-Lefèvre syndrome (juvenile periodontosis)
18. Sarcoma (esp. osteosarcoma; Ewing sarcoma)
19. Traumatic (hemorrhagic) bone cyst

References

Gamut B-67

FLOATING TEETH

COMMON
1. Langerhans cell histiocytosis \(_g\) (esp. eosinophilic granuloma)
2. Periodontitis, severe; periapical abscess
4. Osteomyelitis (pyogenic; Garré’s sclerosing osteomyelitis)
5. Reactive periostitis to adjacent soft tissue infection

UNCOMMON
1. Actinomycosis
2. Hypervitaminosis A
3. Idiopathic (eg, with dysproteinemia)
4. Infantile cortical hyperostosis (Caffey’s disease)
5. Leukemia; lymphoma
6. Necrosis (thermal, chemical, radiation)
7. Scurvy
8. Syphilis
9. Tuberculosis

SPICULATED PERIOSTEAL NEW BONE PERPENDICULAR TO CORTEX

COMMON
1. Bone sarcoma (osteosarcoma; Ewing sarcoma)
2. Metastatic disease (eg, osteoblastic metastases; neuroblastoma)

UNCOMMON
1. Anemia, primary (eg, thalassemia; sickle cell disease)
2. Burkitt lymphoma
3. Hemangioma
4. Syphilis

References

Gamut B-69

GENERALIZED OSTEOPENIA OR OSTEOLYSIS OF THE JAW

COMMON
1. Anemia (esp. thalassemia; sickle cell disease; spherocytosis)
2. Cachectic diseases (eg, malignancy); malnutrition; protein-deficient states
3. Connective tissue diseases (esp. rheumatoid arthritis)
4. Diabetes
5. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
6. Immobilization, prolonged
7. Langerhans cell histiocytosis
8. Leukemia; lymphoma; Burkitt’s lymphoma; lymphosarcoma
9. Metastases (carcinomatosis)
10. Multiple myeloma
11. [Normal anatomic variations in radiodensity of bone]
12. Osteomalacia; rickets (eg, calcium or Vitamin D deficiency; long term anticonvulsant therapy) (See D-44)
13. Osteoporosis (eg, senile; postmenopausal; drug or steroid-induced; Cushing S.; thyrotoxicosis) (See D-43-1)
14. Paget’s disease (lytic phase)

UNCOMMON
1. Acromegaly (pseudo-osteoporosis)
2. Cyclic neutropenia; agranulocytosis
3. Gaucher’s disease
4. Hemangioma (central cavernous)
5. Hypogonadism, incl. Turner S. (XO S.); Klinefelter S. (XXY S.)
6. Hypoparathyroidism
7. Hypophysiatasia
8. Hypoprophosphatasia
9. Massive osteolysis (Gorham’s disease)

(continued)
10. Myelofibrosis
11. Osteogenesis imperfecta
12. Oxalosis
13. Progeria
14. Radiation therapy
15. Sarcoidosis
16. Squamous cell carcinoma of mandible; other diffuse
   local malignancy

[ ] This condition does not actually cause the gamuted imaging finding,
but can produce imaging changes that simulate it.

References
1. Farman AG, Nortjé CJ, Wood RE: Oral and Maxillofacial Di-

NORMAL ANATOMIC
RADIOLUCENCIES IN THE JAW
(MAXILLA AND MANDIBLE)

MAXILLA
1. Greater palatine foramen
2. Incisive foramen, incisive canal; superior foramina
   of incisive canal
3. Intermaxillary suture
4. Maxillary sinus
5. Nasolacrimal duct or canal

MANDIBLE AND MAXILLA
1. Marrow space
2. Nutrient canal
3. Periodontal ligament space
4. Pulp chamber and root canal
5. Tooth crypt (developing)

Reference
1. Wood NK, Goaz PW: Differential Diagnosis of Oral

NONODONTOGENIC RADIOLUCENT
LESIONS OF THE JAWS

COMMON
1. Fibrous dysplasia (cherubism)
2. Giant cell granuloma
3. Multiple myeloma
4. Metastatic or invasive neoplasm (esp. from carcinoma of mouth, lung, breast, or kidney)
5. Osteomyelitis

UNCOMMON
1. Aneurysmal bone cyst
2. Bone cyst (solitary; traumatic; hemorrhagic)
3. Brown tumor of hyperparathyroidism
4. Desmoplastic fibroma
5. Giant cell tumor (rare)
6. Incisive canal cyst (nasopalatine canal cyst); mid-
   palatal cyst
7. Langerhans cell histiocytosis, (esp. eosinophilic
   granuloma)
8. Lingual mandibular bone defect (Stafne cyst)
9. Malignant mandibular bone defect (Stafne cyst)
10. Malignant neoplasm, primary
    a. Chondrosarcoma
    b. Ewing sarcoma
    c. Fibrosarcoma

Reference
1. Farman AG, Nortjé CJ, Wood RE: Oral and Maxillofacial Di-
d. Lymphoma
  e. Osteolytic osteosarcoma

10. Neurogenic tumor
11. Ossifying fibroma, early
12. Radiation necrosis
13. Surgical defect
14. Vascular lesion (eg, arteriovenous malformation; angioma)

References

WELL-DEFINED LYTIC (CYST-LIKE) LESIONS OF THE JAW
(See B-73 to B-81)

COMMON
*1. Ameloblastoma
*2. Dentigerous (follicular) cyst
*3. Giant cell reparative granuloma
  4. Normal anatomic variation (eg, marrow space; fol-licle nutrient canal; foramen)
  5. Periapical granuloma or abscess
  6. Periodontal cyst (radicular, dental, periapical, or residual cyst)
  7. Postsurgical or postextraction defect

UNCOMMON
  1. Adenomatoid odontogenic tumor (ade-noameloblastoma), early
  2. Ameloblastic fibroma and myxoma
*3. Ameloblastic fibrosarcoma
*4. Aneurysmal bone cyst
*5. Bone cyst (solitary; traumatic; hemorrhagic)
*6. Bone sarcoma (eg, chondrosarcoma; fibrosarcoma)
*7. Brown tumor of hyperparathyroidism
*8. Calcifying epithelial odontogenic tumor (Pindborg tumor)
*9. Calcifying odontogenic cyst (Gorlin cyst)
10. Cementifying fibroma, early
11. Cementoma, early; periapical cemental dysplasia
*12. Desmoplastic fibroma
13. Developmental lingual mandibular salivary gland defect (Stafne cyst)
*14. Fibrous dysplasia (cherubism)
15. Fissural developmental cyst (eg, globulomaxillary; median palatal; median mandibular; median alveolar; incisive canal; nasopalatine)
*16. Giant cell tumor (rare)
*17. Hemangioma (central); arteriovenous malforma-
  tion
*18. Hydatid cyst
  19. Langerhans cell histiocy-
gist (esp. eosinophilic granuloma)
20. Lingual mandibular bone defect (Stafne cyst)
21. Melanotic neuroectodermal tumor of infancy
*22. Metastasis
*23. Multiple myeloma; plasmacytoma
24. Neurogenic tumor (esp. neurofibroma arising from mandibular nerve); neurofibromatosis
25. Odontogenic fibroma
26. Odontogenic keratocyst (primordial cyst)
*27. Odontogenic myxoma
28. Odontoma, compound
29. Ossifying fibroma, immature
30. Tuberculosis (cystic)

* May be expansile.

References
2. Burgener FA, Kormano M: Differential Diagnosis in Con-

(continued)
UNILOCAL CYSTIC LESIONS OF THE MANDIBLE

ODONTOGENIC CYSTS
1. Ameloblastoma
2. Dentigerous (follicular) cyst
3. Odontogenic keratocyst
4. Primordial cyst
5. Radicular cyst
6. Residual cyst

NONODONTOGENIC CYSTS
1. Developmental cortical bone defect (Stafne cyst)
2. Traumatic cyst

References

MULTILOCULAR LESIONS OF THE JAW

COMMON
1. Ameloblastoma
2. Giant cell granuloma
3. Multilocular radicular or residual cyst
4. Odontogenic keratocyst (incl. Gorlin-Goltz S.)
5. Odontogenic myxoma

UNCOMMON
1. Ameloblastic fibroma
2. Aneurysmal bone cyst
3. Arteriovenous malformation; hemangioma
4. Brown tumor of hyperparathyroidism
5. Calcifying odontogenic cyst (Gorlin cyst)
6. Fibrous dysplasia; cherubism
7. Giant cell tumor
8. Langerhans cell histiocytosis (esp. eosinophilic granuloma)
9. Metastasis
10. Mucoepidermoid tumor
11. Multiple myeloma
12. Odontoma (developing)
13. Traumatic bone cyst

References
References
4. Krolls SO: Personal communication

Gamut B-76

PERIAPICAL RADIOLUCENCY IN THE JAWS

COMMON
*1. [Anatomic (false) periapical lucency (eg, dental papilla; greater palatine foramen; incisive foramen and canal; mandibular canal; marrow spaces; maxillary sinus; mental foramen; naris; nasolacrimal duct; submandibular and sublingual fossae)]
*2. Dentigerous (follicular) cyst
3. Malignant neoplasm (eg, metastasis; multiple myeloma; leukemia; lymphoma; Burkitt lymphoma; squamous cell carcinoma; malignant salivary gland tumor; osteolytic osteosarcoma; chondrosarcoma; Ewing sarcoma; fibrosarcoma)
4. [Other nonodontogenic radiolucent lesions of the jaws] (See B-71)
*5. Periapical cementoosseous dysplasia, early
*6. Periodontal cyst, other (eg, residual, paradental, incisive canal, median mandibular, midpalatal, or primordial)
*7. Pulpoperiapical disease
   a. Periapical granuloma

(continued)
b. Radicular cyst
c. Scar; fibrous healing defect
d. Chronic and acute dentoalveolar abscess
e. Osteomyelitis
f. Hyperplasia of maxillary sinus lining
8. Surgical defect
9. Traumatic bone cyst

**UNCOMMON**

*1. Ameloblastic variants
*2. Ameloblastoma
  3. Aneurysmal bone cyst
  4. Brown tumor of hyperparathyroidism
*5. Buccal cyst
*6. Cementoossifying fibroma (early)
*7. Cementoblastoma (early)
*8. Central odontogenic fibroma—WHO type
*9. Dentin dysplasia
10. Fibrous dysplasia; cherubism
11. Gaucher’s disease
*12. Giant cell granuloma
13. Juvenile ossifying fibroma
14. Langerhans cell histiocytosis, (esp. eosinophilic granuloma)
*15. Odontoma (early)
16. Pseudotumor of hemophilia

* Odontogenic periapical radiolucency.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**


**PERICORONAL RADIOLUCENCY IN THE JAWS (AROUND AN IMPACTED OR UNERUPTED TOOTH)**

**COMMON**

*1. Adenomatoid odontogenic tumor (adenoameloblastoma)
*2. Ameloblastic fibroma
*3. Ameloblastoma (multiocular or unicystic mural)
*4. Calcifying odontogenic cyst (Gorlin cyst), early
*5. [Dental follicle (pericoronal space); follicular hyperplasia]
*6. Dentigerous (follicular) cyst
7. Malignant neoplasm (eg, metastasis; multiple myeloma; leukemia; lymphoma, ; Burkitt lymphoma; squamous cell or odontogenic carcinoma; malignant salivary gland tumor; osteolytic osteosarcoma; chondrosarcoma; Ewing sarcoma; teratoma)
8. [Other nonodontogenic radiolucent lesions of the jaws] (See B-71)

**UNCOMMON**

*1. Ameloblastic fibrosarcoma
*2. Calcifying epithelial odontogenic tumor (Pindborg tumor)
3. Gardner S.
*4. Gorlin-Goltz S. (odontogenic keratocyst-basal cell nevus S.)
5. Juvenile ossifying fibroma
6. Langerhans cell histiocytosis, (esp. eosinophilic granuloma)
*7. Odontogenic fibroma, myxoma, or fibromyxoma
*8. Odontogenic keratocyst; other primordial cysts
*9. Odontoma or ameloblastic fibroodontoma (premineralized stage)
*10. Paradental cyst
11. [Postextraction socket]
12. Pseudotumor of hemophilia
13. Squamous odontogenic tumor

* Odontogenic pericoronal lesion.

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut B-78

INTERRADICULAR RADIOLUCENCY IN THE JAW (BETWEEN THE ROOTS OF TEETH OR AT THE SIDE OF A TOOTH ROOT)

COMMON
1. Anatomic radiolucency (eg, primary tooth crypt; mental foramen and canal; maxillary sinus; incisive foramen; lateral fossa between lateral incisor and canine teeth; bone marrow pattern; nutrient canal)
2. Benign nonodontogenic tumor or tumor-like condition (See B-71)
3. Extension of disease from adjacent tooth
4. Furcation involvement (eg, advanced periodontal disease)
5. Globulomaxillary radiolucencies (esp. cyst)
6. Incisive canal cyst (nasopalatine canal cyst)
7. Lateral periodontal cyst (inflammatory or developmental)
8. Lateral canal periapical (radicular) cyst
9. Malignant neoplasm (eg, metastasis; multiple myeloma; leukemia; lymphoma \textsubscript{g}; squamous cell or odontogenic carcinoma; bone sarcoma)
10. Median mandibular cyst
11. Odontogenic cyst, other (eg, dentigerous cyst; paradental cyst; odontogenic keratocyst {primordial cyst}; buccal cyst)
12. Odontogenic tumors (See B-76, 77)
13. Perforation of root during endodontic therapy
14. Periodontal abscess
15. Periodontal bony pocket
16. Traumatic bone cyst

UNCOMMON
1. Adenomatoid odontogenic tumor (adenoameloblastoma)
2. Giant cell granuloma
3. Langerhans cell histiocytosis \textsubscript{g} (eosinophilic granuloma)

(continued)
4. Melanotic neuroectodermal tumor of infancy (usually in anterior maxilla)
5. Radiation osteonecrosis

References

WELL-DEFINED (CYST-LIKE) LESIONS OF THE JAW (NOT NECESSARILY CONTACTING TEETH)

COMMON
1. Ameloblastoma (multilocular or unicystic)
2. [Anatomic patterns (eg, marrow spaces; maxillary sinus; early stage of tooth crypts; median sigmoid depression)]
3. Brown tumor of hyperparathyroidism
4. Cementoosseous dysplasia (focal)
5. Cementoossifying fibroma (early)
6. Dentigerous (follicular) cyst
7. Giant cell granuloma
8. Focal osteoporotic bone marrow (hematopoietic) defect of the jaw
9. Incisive canal cyst (nasopalatine canal cyst); mid-palatine cyst
10. Lingual mandibular bone defect (Stafne cyst)
11. Metastasis
12. Odontogenic keratocyst; other primordial cysts
13. [Periapical granuloma or abscess; radicular cyst]
14. Residual cyst
15. Surgical defect; postextraction socket
16. Traumatic (hemorrhagic, simple) bone cyst

UNCOMMON
1. Adenomatoid odontogenic tumor (adenoameloblastoma), early
2. Ameloblastic fibroma and myxoma
3. Ameloblastic fibrosarcoma
4. Aneurysmal bone cyst
5. [Artifact]
6. Benign nonodontogenic tumor (eg, lipoma; myxoma; fibroma; giant cell tumor; osteoblastoma–early)
7. Bone sarcoma (eg, chondrosarcoma; fibrosarcoma)
8. Calcifying epithelial odontogenic tumor (Pindborg tumor)
9. Calcifying odontogenic cyst (Gorlin cyst)
10. Central squamous cell carcinoma in cyst lining
11. Dentinoma (immature)
12. Desmoplasic fibroma
13. Fibrous dysplasia; cherubism
14. Hemangioma (central); arteriovenous malformation; aneurysm in bone
15. Hydatid cyst
16. Langerhans cell histiocytosis (esp. eosinophilic granuloma)
17. Minor salivary gland tumor in bone
18. Myeloma; plasmacytoma
19. Neurofibroma arising from mandibular nerve; schwannoma; neurofibromatosis; amputation neuroma
20. Odontogenic fibroma or myxoma
21. Odontoma, early
22. Ossifying fibroma, immature
23. Postoperative maxillary cyst
24. Pseudotumor of hemophilia
25. Squamous odontogenic tumor
26. Tuberculosis, cystic

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
MULTIPLE SEPARATE WELL-DEFINED LUCENT LESIONS OF THE JAW

COMMON
1. Anatomic variations (eg, focal osteoporotic marrow defects; postextraction sockets)
2. Cysts (eg, dentigerous, radicular, primordial)
3. Gorlin S. (nevoid basal cell carcinoma S.)
4. Langerhans cell histiocytosis g
5. Metastases
6. Multiple myeloma
7. Periapical granulomas

UNCOMMON
1. Ameloblastomas
2. Brown tumors of hyperparathyroidism
3. Cementoosseous dysplasia (early)
4. Cherubism (fibrous dysplasia)
5. Giant cell granulomas
6. Hemangiomas
7. Leukemia; lymphoma; Burkitt lymphoma
9. Multiple dental cysts with arachnodactyly (Marfan S.)
10. Neurofibromatosis
11. Nodular cemental masses; periapical cemental dysplasia (early)
12. Noonan S. (odontogenic keratocysts)

References

Gamut B-81
EXPANSILE RADIOLUCENT LESIONS OF THE JAWS (INCLUDING MULTilocULAR LESIONS) WITH DISCRETE MARGINS

COMMON
1. Ameloblastoma
2. Aneurysmal bone cyst
3. Cherubism (fibrous dysplasia)
4. Dentigerous (follicular) cyst
5. Giant cell granuloma
6. Metastasis (esp. from carcinoma of lung, breast, GI tract, or kidney)
7. [Normal anatomic pattern (eg, maxillary sinus compartments; marrow spaces)]
8. Odontogenic keratocyst (other primordial cysts)
9. Odontogenic myxoma

UNCOMMON
1. Ameloblastic fibrosarcoma
2. Ameloblastic odontoma
3. Arteriovenous malformation; central hemangioma
4. Bone cyst
5. Brown tumor of hyperparathyroidism

(continued)
*6. Calcifying epithelial odontogenic tumor (Pindborg tumor)
*7. Calcifying odontogenic cyst (Gorlin cyst)
  8. Carcinoma (central mucoepidermoid or adenoid cystic)
*9. Cementoossifying fibroma
10. Central mucoepidermoid carcinoma of mandible
11. Chondroma
12. Desmoplastic fibroma
13. Giant cell tumor (rare)
14. Hemangiopericytoma
*15. Hydatid cyst
16. Langerhans cell histiocytosis (esp. eosinophilic granuloma)
17. Lymphoma; Burkitt lymphoma
18. Myeloma; plasmacytoma
19. Neuroectodermal tumor of infancy
20. Neurofibromatosis; neurofibroma of mandibular nerve
*21. Odontogenic fibroma
22. Odontoma (immature)
23. Osteosarcoma (eg, telangiectatic)
*24. Pseudotumor of hemophilia
25. Residual cyst
26. Squamous odontogenic tumor
* May be multilocular.

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
2. Carcinoma of oral cavity (esp. squamous cell)
3. Chronic osteitis (chronic alveolar abscess)
4. Langerhans cell histiocytosis, (esp. eosinophilic granuloma)
5. Metastasis (esp. from carcinoma of breast, lung, GI tract, or kidney; melanoma; neuroblastoma)
6. Multiple myeloma; plasmacytoma
7. Osteomyelitis; actinomycosis

UNCOMMON
1. Ameloblastoma (esp. malignant)
2. Aneurysmal bone cyst (rapid growth)
3. Desmoplastic fibroma
4. Fibrous dysplasia (early)
5. Arteriovenous malformation; hemangioma
6. Hemanotopic bone marrow defect
7. Lymphoma, (incl. leukemia; Burkitt lymphoma; lymphosarcoma)
8. Malignant fibrous histiocytoma
9. Malignant minor salivary gland tumor
10. Massive osteolysis (Gorham’s disease)
11. Neuroectodermal tumor of infancy
12. Odontogenic myxoma or fibroma
13. Odontogenic sarcoma
14. Osteoblastoma
15. Paget’s disease (early)
16. Primary intraosseous carcinoma; spindle cell carcinoma
17. Radiation necrosis
18. Sarcoidosis
19. Surgical defect
20. Tuberculosis

References

Gamut B-84
LYTIC LESIONS OF THE JAW WITH INTERNAL RESIDUAL BONE

COMMON
1. Ameloblastoma
2. Hemangioma
3. Invasive squamous cell carcinoma
4. Odontogenic myxoma

UNCOMMON
1. Bone sarcoma (esp. Ewing sarcoma; osteosarcoma)
2. Fibrous dysplasia
3. Lymphoma
4. Ossifying fibroma

Reference

Gamut B-85-1
MIXED RADIOLUCENT AND RADIOPAQUE PERIAPICAL LESIONS OF THE JAWS

COMMON
1. Calcifying crown of developing tooth
2. Cementoossifying fibroma
3. Periapical cementoosseous dysplasia (intermediate stage of cementoma)
4. Rarefying and condensing osteitis
5. Tooth root with rarefying osteitis

UNCOMMON
1. Calcifying odontogenic cyst
2. Cementoblastoma (intermediate stage)
3. Complex and compound odontoma (intermediate stage)
4. Foreign body (eg, root canal cement)
5. Nodular cemental masses
6. Osteomyelitis (chronic)
7. Paget’s disease

References

MIXED RADIOLUCENT AND RADIOPAQUE PERICORONAL LESIONS OF THE JAWS

COMMON
1. Adenomatoid odontogenic tumor (adenoameloblastoma)
2. Ameloblastic fibroodontoma
3. Calcifying epithelial odontogenic tumor (Pindborg tumor)
4. Calcifying odontogenic cyst
5. Complex or compound odontoma (intermediate stage)

UNCOMMON
1. Ameloblastic fibrodentinoma
2. Calcifying hyperplastic dental follicle
3. Cystic odontoma

4. Odontogenic fibroma
5. Postsurgical healing

References

MIXED RADIOLUCENT AND RADIOPAQUE LESIONS OF THE JAWS NOT NECESSARILY CONTACTING TEETH (INCLUDING TARGET LESION)

COMMON
1. Bone island
*2. Cementosseous dysplasia (focal or florid)
*3. Cementoossifying fibroma
4. Desmoplastic ameloblastoma
5. Fibrous dysplasia; cherubism
6. Ossifying postsurgical bone defect
7. Ossifying subperiosteal hematoma
8. Osteoblastic metastasis (esp. from breast or prostate)
9. Osteomyelitis, chronic (pyogenic with sequestrum*; Brodie abscess; Garré’s sclerosing osteomyelitis; complicating a malignant tumor)
10. Paget’s disease
*11. Periapical cemental dysplasia; sclerosing cemental masses
*12. Retained deciduous tooth root; infected residual permanent root tip

UNCOMMON
*1. Adenomatoid odontogenic tumor (adenoameloblastoma)
2. Ameloblastic fibro-odontoma or fibrodentinoma
*3. Bone sarcoma (eg, osteosarcoma; chondrosarcoma; Ewing sarcoma)

*4. Calcifying epithelial odontogenic tumor (Pindborg tumor)

5. Calcifying odontogenic cyst (Gorlin cyst)

*6. Cementoblastoma

*7. Chondroma

*8. Complex and compound odontoma (intermediate stage)

*9. Hemangioma

10. Langerhans cell histiocytosis, healing

11. Lymphoma

12. Odontodysplasia

*13. Ossifying fibroma

*14. Osteoblastoma (intermediate)

15. Osteoid osteoma

16. Osteonecrosis (eg, radiation)

17. [Superimposed soft tissue calcification (eg, sialolith)]

* Radiopaque lesion of the jaw, which may have a peripheral lucent shadow (target lesion).

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References


Gamut B-85-4

SOLITARY OPACITY IN THE JAW NOT NECESSARILY CONTACTING TEETH

COMMON

1. Bone island; osteoma

*2. Cemento-osseous dysplasia (focal)

3. Complex odontoma

4. Condensing or sclerosing osteitis

5. Idiopathic osteosclerosis

6. Ossifying subperiosteal hematoma

7. Osteomyelitis, chronic (pyogenic with sequestrum; Garre’s sclerosing osteomyelitis)

8. [Periapical cemental dysplasia; sclerosing cemental masses]

9. Retained tooth root

10. Tori; exostosis

11. Unerupted, impacted, or supernumerary tooth

UNCOMMON

*1. Bone sarcoma (eg, osteosarcoma; chondrosarcoma)

*2. Cementoossifying fibroma

3. Chondroma

4. Fibrous dysplasia

5. Foreign body

*6. Hemangioma

7. Langerhans cell histiocytosis, healing

8. Lymphoma

*9. Ossifying fibroma

10. Ossifying postsurgical bone defect

11. Osteoblastic metastasis (esp. from breast or prostate)

*12. Osteoblastoma; osteoid osteoma

13. Osteonecrosis (eg, radiation)

14. Paget’s disease

15. [Superimposed soft tissue calcification (eg, sialolith; antrolith; calcified lymph nodes)]

* Radiolucent lesion of the jaw, which may have a central opacity (target lesion).

(continued)
This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References

PERIAPICAL RADIOOPACITIES

COMMON
1. Bone island; periapical idiopathic osteosclerosis; osteoma (incl. Gardner S.)
2. Condensing or sclerosing osteitis
3. Foreign body
4. Hypercementosis
5. [Odontoma, compound or complex]
6. Periapical or focal cementoosseous dysplasia
7. [Unerupted succedaneous tooth; impacted tooth; retained root]

UNCOMMON
1. Calcifying odontogenic cyst
2. Cementoossifying fibroma
3. Cementoblastoma
4. Chondroma; chondrosarcoma
5. Focal or diffuse sclerosing osteomyelitis
6. Hamartoma
7. Osteoblastic metastasis
8. Osteoblastoma
9. Osteosarcoma
10. Paget’s disease
11. [Superimposed sialolith, antrolith, phlebolith, calcified lymph node]
12. Torus mandibularis or palatinus; exostosis

MULTIPLE OR GENERALIZED OPAQUE LESIONS OF THE JAW

COMMON
1. Cementoosseous dysplasia (florid)
2. Fibrous dysplasia (eg. McCune-Albright S.)
3. Multiple hypercementoses
4. Multiple periapical condensing osteitis
5. Multiple periapical or focal cementoosseous dysplasia
6. Multiple socket sclerosis
7. Paget’s disease
8. Sclerosing osteomyelitis (eg, Garré’s sclerosing osteomyelitis; chronic diffuse sclerosing osteomyelitis; actinomycosis)
9. Unerupted or impacted teeth; retained roots

UNCOMMON
1. Cleidocranial dysplasia
2. Cretinism (unerupted teeth)
3. Enchondromatosis (Ollier’s disease)
4. Familial gigantiform cementomas
5. Generalized hyperostosis diseases (eg, fluorosis; endosteal hyperostosis {van Buchem type}; osteopetrosis; hyperphosphatasia; dysosteosclerosis; craniometaphyseal dysplasia; diaphyseal dysplasia; craniodiaphyseal dysplasia; pyknody sostosis)
6. Hypercementosis
7. Infantile cortical hyperostosis (Caffey’s disease)
8. Multiple odontomas
9. Multiple osteomas (eg, Gardner S.)
10. Multiple tori, exostoses, or osteochondromas
11. Osteoblastic metastases
12. [Superimposed sialoliths, phleboliths, calcified lymph nodes]

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

SYNDROMES WITH SALIVARY GLAND ABNORMALITY
1. Cystic fibrosis (mucoviscidosis)
2. Hyperparathyroidism, primary
3. Hypoglossia-hypodactyly S. (aplasia-adactyly S.)
4. Lacrimeo-auriculo-dento-digital S. (LADD S. or Levy-Hollister S.)
5. Mikulicz S.
6. Oculo-auriculo-vertebral spectrum (Goldenhar S.)
7. Sjögren S.
8. Treacher Collins S.

* Salivary duct ectasia.

References

SALIVARY DUCT STRicture ON SIALOGRAPHY
1. Carcinoma
2. Congenital
3. Infection; inflammation; scarring

(continued)
4. Radiation therapy
5. Stone
6. Trauma, including surgical

References

Gamut B-90

PAROTID OR OTHER SALIVARY GLAND ENLARGEMENT

COMMON
1. Mumps
2. Neoplasm, benign (esp. pleomorphic adenoma [mixed tumor]; monomorphic adenoma-Warthin tumor; oncocytoma; hemangioma; lymphangioma; lipoma) (See B-91)
3. Neoplasm, malignant (esp. adenoid cystic {cylindroma} and mucoepidermoid carcinoma; also acinic cell tumor and adenocarcinoma)
4. Stone in duct (esp. in submandibular gland)
5. Suppurative sialadenitis, acute; abscess
6. Trauma with hemorrhage, edema, fistula, or sialocele

UNCOMMON
1. Alcoholism; cirrhosis
2. Allergic or drug reaction (eg, sulfas; iodides)
3. Chronic punctate sialadenitis (benign lymphoepithelial disease, sicca S.)
4. Cyst (eg, lymphoepithelial {esp. in AIDS patients}; dermoid; branchial cleft; mucous retention; ranula)
5. Cystic fibrosis (mucoviscidosis)
6. Granulomatous disease involving parotid gland and lymph nodes (eg, sarcoidosis; tuberculosis; atypical mycobacterial infection; actinomycosis; Wegener’s granulomatosis; cat-scratch fever)
7. Hormonal disturbance (eg, diabetes; hypothyroidism; pregnancy)
8. Idiopathic; lipomatous pseudohypertrophy of parotid
9. Infection, other (eg, acute parotitis; recurrent pyogenic parotitis; sialodochitis)
10. Lymph node (esp. intraparotid)
11. Malnutrition; kwashiorkor
12. [Masseter muscle hypertrophy]
13. Metastasis (eg, melanoma; squamous cell carcinoma)
14. Mikulicz S. (bilateral salivary enlargement due to lymphoma, sarcoidosis, or other disease)
15. Mucocele
16. Radiation therapy
17. Sialodochitis fibrinosa
18. Sjögren S. (primary or associated with rheumatoid arthritis, lupus, scleroderma, or lymphoproliferative disorders)
19. Stricture of duct (See B-89)[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
SALIVARY GLAND NEOPLASM

BENIGN

COMMON
1. Hemangioma; lymphangioma
2. Monomorphic adenoma, esp. Warthin’s tumor (papillary adenocystoma lymphomatous; cystadenolymphoma)
3. Pleomorphic adenoma (mixed tumor)

UNCOMMON
1. Lipoma
2. Neurinoma; neurofibroma
3. Oncocytoma (oxyphilic adenoma)

MALIGNANT

COMMON
1. Carcinoma
   a. Adenoid cystic (cylindroma)
   b. Carcinoma in pleomorphic adenoma (malignant mixed tumor)
   c. Mucoepidermoid

UNCOMMON
1. Acinic cell tumor
2. Carcinoma, other types
   a. Adenocarcinoma
   b. Epidermoid (squamous cell)
   c. Undifferentiated
3. Lymphoma
4. Metastasis (esp. melanoma; carcinoma of skin)
5. Sarcoma

References
12. Sialocele
*13. Sjögren S.
*14. Warthin tumor
* May be bilateral.

References

Gamut B-93
MULTIPLE DISCRETE INTRAPAROTID LESIONS

1. Lymphadenopathy, inflammatory (eg, local or regional infection; sarcoidosis; Kimura’s disease) or metastatic (lymphoma; melanoma; squamous cell carcinoma of the external auditory canal, midface, or scalp)
2. Multicentric oncocytomas
3. Multicentric Warthin tumors
4. Multiple benign lymphoepithelial cysts (esp. in AIDS)
5. Multiple branchial cleft cysts
6. Multiple intraparotid cysts
7. Multiple pleomorphic adenomas
8. Sjögren S.

Reference

Gamut B-94
BILATERAL PAROTID ENLARGEMENT WITH PARENCHYMAL HETEROGENEITY (US, CT, MRI)

SIALOADENOSIS
1. Chronic alcoholism
2. Diabetes
3. Drug reaction
4. Hyperlipidemia
5. Malnutrition (nutritional mumps)
6. Postradiation therapy

SIALADENITIS
1. Infectious (viral parotitis; lymphoepithelial cysts {esp. in AIDS})
2. Inflammatory (eg, sarcoidosis; graft vs. host disease; Mikulicz S.)

BILATERAL PAROTID NEOPLASMS
1. Oncocytoma
2. Pleomorphic adenoma
3. Warthin’s tumor

MULTIPLE INTRAPAROTID LYMPHADENOPATHY
1. Lymphoma
2. Metastatic disease
3. Reactive

OTHERS
1. Amyloidosis
2. Clear cell oncocytoysis
3. Polycystic (dysgenetic) disease

References

SMALL PAROTID GLAND
1. Chronic postobstructive atrophy
2. Normal variant
3. Postoperative superficial or total parotidectomy
4. Postradiation therapy

References

BILATERAL CHEEK MASSES

PSEUDOMASSES
1. Benign masseteric hypertrophy
2. Bilateral accessory parotid gland tissue
3. Bilateral facial processes of the parotid glands

INFECTION/INFLAMMATION
1. Bilateral lymphoepithelial cysts (HIV-associated)
2. Mikulicz S.

(continued)
3. Sarcoidosis
4. Sjögren S. (early inflammatory stage)
5. Viral parotitis

**NEOPLASM**
1. Bilateral intraparotid lymphadenopathy (eg, lymphoma)
2. Bilateral parotid gland tumors (eg, pleomorphic adenoma, Warthin’s tumor, oncocytoma)

**OTHER**
1. Bilateral parotid gland hypertrophy secondary to alcoholism

**References**

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**Gamut B-98**

**LESIONS OF THE SUBLINGUAL SPACE**

1. Abscess
2. Benign mixed tumor of salivary glands
3. Carcinoma (squamous cell; adenoid cystic; mucoepidermoid)
4. Cystic hygroma (lymphangioma)
5. Dilated excretory duct of submandibular gland
6. Epidermoid; dermoid
7. Hemangioma
8. Hypoglossal nerve atrophy
9. Lingual thyroid tissue
10. Ludwig angina; cellulitis
11. Ranula

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**Gamut B-97**

**LESIONS OF THE SUBMANDIBULAR SPACE**

1. Benign tumor of submandibular gland
2. Branchial cleft cyst
3. Calculus in a salivary gland
4. Carcinoma (adenoid cystic; mucoepidermoid; acinar cell)
References

Gamut B-99
SOFT TISSUE MASS IN THE NECK

CYSTIC MASS
1. Abscess (eg, from tonsillitis, pharyngitis, parotid infection, dental procedure, or trauma)
2. Aneurysm of the carotid artery or jugular vein
3. Branchial cleft cyst (first or second)
4. Cervical thymic cyst
5. Dermoid cyst; teratoma; epidermoid
6. Diverticulum, air-filled (eg, lateral pharyngeal, tracheal, Zenker’s)
7. Laryngocele (external)
8. Lymphangioma (cystic hygroma)
9. Necrotic lymph node (esp. from tonsillar or nasopharyngeal malignancy)
10. Neurogenic tumor (eg, cystic schwannoma or neurofibroma)
11. Parathyroid cyst
12. [Subcutaneous emphysema]
13. Thyroglossal duct cyst
14. Thyroid cyst

SOLID MASS
1. Abscess
2. Actinomycosis
3. Carotid body tumor (paraganglioma; chemodectoma)
4. Cervical thymus gland
5. Epidermoid
6. Lipoma; liposarcoma
7. Lymphadenopathy, esp. metastatic from squamous cell carcinoma, melanoma, or thyroid carcinoma
8. Lymphoma; Burkitt lymphoma
9. Mesenchymal tumor
10. Neurogenic tumor (schwannoma; neurofibroma; plexiform neurofibroma; neuroblastoma)
11. Parathyroid adenoma
12. Sebaceous cyst
13. Salivary gland enlargement (eg, mumps; stone in duct; neoplasm—pleomorphic adenoma) (See B-90); ectopic salivary gland tissue
14. Thyroid tumor (eg, adenoma; goiter; carcinoma); thyroiditis; ectopic thyroid

VASCULAR MASS
1. Aneurysm of the carotid artery or jugular vein
2. Arteriovenous fistula
3. Carotid body tumor (paraganglioma; chemodectoma)
4. Cervical aortic arch
5. Dilated jugular lymph sac
6. Hemangioma
7. Hemangiopericytoma
8. Hematoma
9. Jugular vein ectasia or asymmetry
10. Jugular vein thrombosis (bland, septic or metastatic clot) (See B-100)
   a. Septic—Lemierre S. (necrobacillosis), a suppurative thrombophlebitis of the IJV secondary to an oropharyngeal infection
   b. Placement of central venous lines and indwelling catheters
   c. Puncture of IJV by intravenous drug abusers
11. Lymphangioma (cystic hygroma)
12. Posttraumatic pseudoaneurysm

PSEUDOMASS
1. Hypertrophy of the sternocleidomastoid muscle
2. Status post-unilateral radical neck dissection

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
References


Gamut B-100-S

PATHOGENESIS OF INTERNAL JUGULAR VEIN THROMBOSIS

1. Hypercoaguable states (eg, malignancies; paraproteinemias; connective tissue disorders, eg lupus erythematosus); pregnancy; coagulation defects (eg, deficiency of protein C and S, antithrombin III)
2. Placement of central venous lines and indwelling catheters
3. Puncture of IJV by intravenous drug abusers
4. Radiation therapy
5. Sepsis, infection—Lemierre S. (necrobaciliosis), a suppurative thrombophlebitis of the IJV secondary to tonsillitis or other oropharyngeal infection, otitis, mastoiditis, or dental infection
6. Stasis of blood (eg, hypotension; dehydration; immobilization)
7. Surgical trauma during head and neck procedures
8. Thrombus extension from an intracrania venous sinus (esp. sigmoid and transverse sinuses)
9. Trauma to neck (open or blunt)

References

METASTATIC CERVICAL LYMPHADENOPATHY ON CT OR MRI
(LOCATION OF LYMPH NODES AND SUSPECTED PRIMARY SITE OF MALIGNANCY)

UPPER CERVICAL NODES
1. Base of tongue
2. Maxillary or ethmoid sinus
3. Nasopharynx
4. Tonsil

MIDDLE AND LOWER JUGULAR NODES
1. Esophagus
2. Larynx
3. Pharynx
4. Thyroid

MIDLINE OR PARATRACHEAL NODES
1. Larynx
2. Lung
3. Thyroid

SUBMAXILLARY NODES
1. Floor of mouth
2. Tongue

SUPRACLAVICULAR NODES
1. Breast
2. Esophagus
3. Lung
4. Stomach

References
NEOPLASTIC
1. Carcinoma of thyroid (eg, anaplastic; squamous cell)
2. Lymphoma of thyroid
3. Metastasis (esp. carcinoma of breast, lung, or kidney; melanoma)
4. Sarcoma (rare)

IATROGENIC
1. Postradiation therapy (radiation-induced thyroiditis)
2. Postsurgical changes

References
FATTY TUMORS OF THE NECK

SOLITARY

WITH NO CONTRAST ENHANCEMENT
1. Dermoid cyst
2. Lipoma

WITH CONTRAST ENHANCEMENT
1. Angiolipoma
2. Hibernoma
3. Lipoblastoma; lipoblastomatosis
4. Liposarcoma

MULTIPLE
1. Benign symmetric lipomatosis (Madelung disease)
2. Cushing syndrome

WITH NO INFLAMMATORY SIGNS
1. Benign or multiple symmetric lipomatosis
2. Cushing syndrome
3. Lipoblastomatosis (children)
4. Liposarcoma
5. Morbid obesity
6. Multiple familial lipomatosis

WITH INFLAMMATORY SIGNS
1. Dercum’s disease (acute panniculitis)
2. Progressive nodular lipomatosis
3. Weber-Christian disease (painful adiposis)

References

DIFFUSE LIPOMATOSIS OF THE NECK

WITHOUT INFLAMMATORY SIGNS
1. Benign or multiple symmetric lipomatosis
2. Cushing syndrome
3. Lipoblastomatosis (children)
4. Liposarcoma
5. Morbid obesity
6. Multiple familial lipomatosis

WITH INFLAMMATORY SIGNS
1. Dercum’s disease (acute panniculitis)
2. Progressive nodular lipomatosis
3. Weber-Christian disease (painful adiposis)

References
INCREASED RETROPHARYNGEAL (PREVERTEBRAL) SPACE IN AN INFANT OR CHILD

COMMON
1. Enlarged adenoids and lymphoid tissue
2. Hematoma or edema from cervical spine injury or fracture
3. Retropharyngeal abscess or cellulitis (eg, from pyogenic adenitis; perforation of pharynx by foreign body or intubation)
4. Retropharyngeal inflammatory lymphadenopathy (bacterial, viral, tuberculous, histoplasmic)
5. [Technical factors (eg, buckling of airway; crying; inspiratory film; improper positioning with flexion or obliquity of neck; superimposed ear lobe)]

UNCOMMON
1. Branchial cleft cyst (third)
2. Dilated jugular veins and carotid arteries from vein of Galen aneurysm or other large intracranial arteriovenous malformation
3. Enteric or duplication cyst
4. Lymph fluid
5. Lymphadenopathy, noninflammatory (eg, metastatic disease; Langerhans cell histiocytosis; leukemia; lymphoma; sinus histiocytosis)
6. Myxedema (hypothyroidism)
7. Neoplasm (eg, hemangioma; lymphangioma; cystic hygroma; angiofibroma; plexiform neurofibroma; ganglioneuroma; neuroblastoma; lipoma; teratoma; rhabdomyosarcoma)
8. Retropharyngeal goiter
9. Spinal disease (eg, osteomyelitis; tuberculosis; metastasis; primary neoplasm; fracture)
10. Superior vena cava obstruction with edema
11. Traumatic pseudodiverticulum of pharynx (from finger in infant’s mouth during delivery)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
INCREASED RETROPHARYNGEAL (PREVERTEBRAL) SPACE IN AN ADULT

COMMON
1. Abscess or cellulitis
2. Direct invasion from nasopharyngeal or oropharyngeal squamous cell carcinoma
3. Lymphadenopathy (eg, metastatic disease; lymphoma; tuberculosis)
4. Postcricoid carcinoma
5. Spinal disease (eg, osteophytes; primary or metastatic neoplasm; inflammation or osteomyelitis)
6. Tortuous carotid artery
7. Trauma (prevertebral edema or hematoma; spine fracture)

UNCOMMON
1. Chordoma
2. Lymphangioma; hemangioma; lipoma
3. Myxedema (hypothyroidism)
4. Retropharyngeal goiter
5. Zenker’s diverticulum

References

LESSIONS OF THE OROPHARYNX

COMMON
1. Carcinoma of tonsil, soft palate, or base of tongue (esp. squamous cell; rarely lymphoepithelioma or transitional cell)
2. Extension of nasopharyngeal or hypopharyngeal tumor to oropharynx
3. Macroglossia (eg, neoplasm of tongue—esp. carcinoma or granular cell myoblastoma; ranula; sialocyst; amyloidosis; congenital—Down S.; cretinism) (See B-108)
4. [Normal variant (eg, lingual tonsil hypertrophy; prolapse of mucosa through thyrohyoid membrane mimicking oropharyngeal diverticulum)]
5. Thyroglossal duct cyst
6. Tonsillitis; peritonsillar abscess

(continued)
UNCOMMON
1. Abscess/bacterial cellulitis (Vincent’s angina)
2. Branchial cleft cyst
3. Dermoid
4. Lipoma
5. Lymphangioma (cystic hygroma)
6. Metastasis
7. Minor salivary gland malignancy (adenoid cystic carcinoma; mucoepidermoid carcinoma; adenocarcinoma)
8. Schwannoma; neurofibroma
9. Venous malformation

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

Gamut B-107

LESIONS OF THE HARD AND SOFT PALATE

1. Carcinoma (squamous cell)
2. Fistula
3. Lymphoma; Burkitt lymphoma
4. Minor salivary gland tumor
5. Sarcoma (eg, osteosarcoma)

References

Gamut B-108

LARGE TONGUE (MACROGLOSSIA)

COMMON
1. Amyloidosis
2. Cretinism; hypothyroidism
3. Trisomy 21 S. (Down S.)

UNCOMMON
1. Acromegaly
2. Beckwith-Wiedemann S.
3. Chromosome 4:dup (4p) S.
4. Cyst (eg, duplication; lingual; thyroglossal duct; dermoid)
5. Glycogen storage disease, type II (Pompe’s disease)
6. Infant of diabetic mother
7. Jaw or dental deformity with increased mouth size
8. Kocher-Debré-Sémélaigne S.
9. Lingual thyroid
10. Mucopolysaccharidoses (esp. Hurler S.) (See J-4-S); GM1 gangliosidosis
11. Multiple endocrine neoplasia, type IIB (MEN IIB; mucosal neuroma S.)
12. Muscular dystrophy; myotonia congenita
13. Neoplasm of tongue (eg, hemangioma; lymphangioma; granular cell myoblastoma; rhabdomyoma; rhabdomyosarcoma; carcinoma)
14. Ranula; sialocyst
15. Robinow S.
16. Trauma

References

Gamut B-109

MASS IN THE MIDLINE OR AT BASE OF TONGUE

1. Carcinoma (squamous cell) of tongue
2. Dermoid
3. Hemangioma
4. Lingual thyroid
5. Lingual tonsil (esp. with lymphoid hyperplasia)
6. Lymphoma
7. Metastasis
8. Ranula, atypical
9. Schwannoma
10. Thyroglossal duct cyst

References

Gamut B-110

CYSTIC FLOOR OF THE MOUTH MASS

1. Abscess/bacterial cellulitis (Vincent’s angina)
2. Branchial cleft cyst, atypical
3. Dermoid cyst; epidermoid
4. Lymphangioma (cystic hygroma)
5. Necrotic neoplasm
6. Ranula (simple or plunging)
7. Salivary gland neoplasm, cystic
8. Thyroglossal duct cyst

References

Gamut B-111

LESIONS OF THE HYPOPHARYNX, LARYNX, AND UPPER TRACHEA

COMMON
1. Carcinoma of hypopharynx (esp. in pyriform sinus, posterolateral wall, or postcricoid)
2. Carcinoma of larynx (See B-119)
3. Congenital (eg, tracheoesophageal fistula; atresia; hypoplasia; web; stenosis; laryngomalacia)
4. Epiglottic enlargement (esp. epiglottitis) (See B-114)
5. Foreign body
6. Hemangioma, esp. subglottic in children
7. Infection (eg, Clostridium tetani; tuberculosis; fungus disease—esp. candidiasis)
8. Juvenile papillomatosis
9. Laryngoele (esp. in glassblowers or musicians, or with chronic coughing)
10. Papilloma, squamous cell (solitary)
11. Polyp
12. Retropharyngeal abscess
13. Tracheal tumor

(continued)
### Gamut B-112

14. Trauma (incl. intubation)
15. Vocal cord paralysis (eg, involvement of recurrent laryngeal nerve by malignancy; trauma; congenital)
16. Zenker’s diverticulum

### UNCOMMON
1. Adenoma
2. Amyloidosis
3. Benign neoplasm of larynx (eg, chondroma; angiofibroma; fibroma; myoma; lipoma; paraganglioma; neurofibroma) (See B-119)
4. Cyst
5. Kaposi sarcoma
6. Lymphoma
7. Metastasis
8. Midline granuloma
9. Plasmacytoma
10. Rhinoscleroma
11. Sarcoidosis
12. Sarcoma
13. Wegener’s granulomatosis

### References

### SOLID
1. Carcinoma (squamous cell)
2. Ectopic thyroid
3. Hemangioma

### References

#### Gamut B-113

### PYRIFORM SINUS MASS

1. Carcinoma of pyriform sinus
2. Lymphoma
3. Mesenchymal tumor
4. Metastasis
5. Postoperative scarring
6. Postradiation edema

### References
Gamut B-114

EPIGLOTTIC ENLARGEMENT

COMMON
1. Epiglottitis (esp. Haemophilus influenzae, type B)

UNCOMMON
1. Allergy (esp. angioneurotic edema; drug reaction)
2. Amyloidosis
3. Bleeding disorder (esp. hemophilia)
4. Carcinoma (squamous cell)
5. Congenital aryepiglottic enlargement
6. Congenital “omega” epiglottis
7. Edematous reaction to foreign body, hot air, or smoke
8. Hypothyroidism
9. Infection, other (eg, tuberculosis; sarcoidosis; candidiasis {moniliasis}; leishmaniasis; syphilis)
10. Laryngocele, atypical
11. Lye ingestion
12. Neoplasm, other (eg, hemangioma; lymphangioma; lymphoma)
13. [Pseudothickening of aryepiglottic folds due to buckling caused by poor inspiration or laryngomalacia]
14. Radiation therapy (edema)
15. Retention cyst
16. Trauma (incl. intubation)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References


Gamut B-115

SUPRAGLOTTIC MASS

1. Amyloidosis
2. Carcinoma of larynx (supraglottic)
   a. Anterior carcinoma arising on epiglottis and anterior false cords
   b. Posterolateral carcinoma arising from medial surface of the aryepiglottic folds and the paralaryngeal spaces (marginal tumors)
3. Chondroma
4. Hemangioma
5. Laryngocele
6. Lymphoma
7. Metastasis
8. Papilloma
9. Posttraumatic deformity (pseudomass)

References

(continued)
Gamut B-116

PARALARYNGEAL CYSTIC MASS

1. Branchial cleft cyst
2. Congenital laryngeal cyst
3. Cyst of the epiglottis
4. Dermoid; teratoma
5. Laryngocele
6. Lymphangioma (cystic hygroma)
7. Neoplasm with necrosis simulating cyst
8. Thyroglossal duct cyst
9. Valcular cyst

References

Gamut B-117

LARYNGEAL ASYMMETRY

1. Arytenoid dislocation
2. Carcinoma of larynx
3. Laryngocele
4. Recurrent laryngeal nerve paralysis
5. Superior laryngeal nerve paralysis
6. Traumatic deformity

References

Gamut B-118

ABNORMAL SHAPE OF THE LARYNGEAL CARTILAGE (INCLUDING EXPANSILE OR DESTRUCTIVE LESIONS)

1. Carcinoma of larynx (esp. squamous cell)
*2. Chondroma
*3. Chondrosarcoma
4. Congenital deformity
*5. Metastasis to cartilage (esp. from melanoma; carcinoma of kidney, breast, lung or prostate)
6. Postsurgical changes
*7. Posttraumatic deformity (chronic)
8. Trauma to larynx, acute

* May cause an expansile lesion of laryngeal cartilage.

References
1. Carcinoma of supraglottic, glottic, or subglottic (esp. squamous cell; occasionally adenocarcinoma or carcinosarcoma)
2. Juvenile papillomatosis

UNCOMMON
1. [Amyloidosis]
2. Benign neoplasm (eg, chondroma; granular cell myoblastoma; plasma cell granuloma; chemodectoma; neurofibroma; angiofibroma; fibroma; myoma; lipoma)
3. Cyst (congenital retention)
4. [Laryngocele]
5. Lymphoma
6. Metastasis
7. Papilloma, squamous cell (solitary)
8. Polyp
9. Sarcoma (eg, rhabdomyosarcoma; fibrosarcoma)
10. [Subglottic hemangioma or other tumor] (See B-122)

References

VOCAL CORD ASYMMETRY

1. Carcinoma of glottis (90% squamous cell)
2. Papilloma of vocal cord
3. Recurrent laryngeal nerve paralysis
4. Teflon injection of vocal cord

References

(continued)

### PARALYZED OR PARETIC VOCAL CORD

#### COMMON
1. Aortic aneurysm
2. Carcinoma, metastatic or invasive (esp. thyroid, esophagus, lung, breast)
3. Laryngeal disease (carcinoma; infection)
4. Mediastinal neoplasm (esp. thyroid tumor; lymphoma)
5. Postoperative (eg, thyroidecctomy, radical neck dissection, mediastinal surgery)
6. Recurrent laryngeal nerve pathology (insult to brain stem, skull base, neck, or mediastinum)
7. Superior sulcus tumor
8. Trauma (eg, gunshot wound)

#### UNCOMMON
1. Arytenoid dislocation
2. Cerebral lesion; Chiari malformation; intracranial tumor; birth injury
3. Diabetic neuropathy
4. Idiopathic
5. Inflammatory lesion within thorax (eg, tuberculosis)
6. Jugular foramen neoplasm
7. Laryngocele
8. Vascular ring

#### References

### SUBGLOTTIC TRACHEAL NARROWING

#### COMMON
1. Acquired subglottic stenosis (eg, external trauma; hematoma; post-intubation; posttracheostomy fibrosis; postoperative repair of esophageal atresia)
2. Carcinoma
3. Croup (laryngotracheobronchitis)
4. Extrinsic mass, other (eg, paratracheal cyst; goiter; lymphadenopathy; lymphoma; lymphangioma; localized retropharyngeal abscess)
5. Normal (eg, expiratory collapse (“floppy trachea”); anterior tracheal indentation in infants)
6. Subglottic hemangioma (esp. infants)
7. Tracheomalacia
8. Vascular compression (eg, right aortic arch; double aortic arch; aberrant left subclavian artery; innominate artery compression S.)

#### UNCOMMON
1. Amyloidosis
2. Congenital subglottic stenosis (primary tracheal stenosis)
3. Ectopic intratracheal thyroid or thymus tissue; ectopic goiter
4. Epidermolysis bullosa
5. Foreign body aspiration into trachea or esophagus, impacted food
6. Injury to larynx or upper trachea, other (eg, intense heat; smoke; lye; acid)
7. Juvenile papillomatosis
8. Laryngeal web
9. Lipoid proteinosis
10. Radiation therapy
11. Scleroma (rhinoscleroma)
12. Subglottic mass, other (eg, mucocele, inflammatory histiocytoma; lipoma; fibroma; adenoma; polyp; papilloma; polypoid hemangioendothelioma; cyst)
13. Tuberculosis
References

Gamut B-123

UPPER AIRWAY OBSTRUCTION
IN A CHILD—ACUTE OR CHRONIC
(See B-105-1, 106, 111, 114, 122)

ACUTE

COMMON
1. Abscess (peritonsillar, retropharyngeal, mediastinal)
2. Choanal atresia
3. Croup (laryngotracheobronchitis)
4. Epiglottitis, other epiglottic enlargement
(See B-114)
5. Foreign body
6. Laryngeal edema (eg, allergic, anaphylactic, or hereditary angioneurotic edema; inhalation of noxious gases; posttraumatic)
7. Retropharyngeal hemorrhage (eg, bleeding or clotting disorder; hematoma from trauma or neck surgery)

UNCOMMON
1. Diphtheria
2. Laryngeal spasm (eg, tetany)
3. Ludwig’s angina

CHRONIC

COMMON
1. Esophageal atresia; tracheoesophageal fistula
2. Extrinsic mass (eg, neoplasm; thyroid mass; cervical lymphadenopathy; cystic hygroma; thyroglossal duct cyst)
3. Tonsil and adenoid hypertrophy
4. Tracheal mass, intrinsic (eg, subglottic hemangioma; cyst; polyp; hamartochondroma; lipoma; chloroma; scleroma; ectopic thyroid tissue; web)
(See F-81-1, F-81-2)
5. Tracheal stricture or stenosis (traumatic; prolonged intubation; postoperative; inflammatory; burn; congenital)
6. Vascular ring (esp. double aortic arch) (See E-21-S); innominate artery compression

References
## Spine and Its Contents

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- **C-2-S** Nonspinal Conditions Associated with Vertebral Anomalies
- **C-3-1** Kyphosis
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- **C-4** Scoliosis
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### CERVICAL SPINE

- **C-6-S1** Cervical Spine Injuries: Mechanism of Injury
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- **C-6-S3** Radiologic Signs of Spine Instability
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C-30 Exaggerated Concavity (Scalloping) of the Posterior Surface of One or More Vertebral Bodies

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SPINAL CANAL AND CORD (ESP. ON MYELOGRAPHY, CT, OR MRI)  C-57  Congenital Syndromes and Bone Dysplasias with a Narrow Spinal Canal (Narrow Interpedicular Distance): Spinal Stenosis
C-58  Wide Spinal Canal (Increased Interpedicular Distance) (See C-59, 61)
C-59  Intramedullary Lesion (Widening of Spinal Cord on Myelography, CT, or MR)
C-60  Spinal Cord Atrophy
C-61  Intradural, Extramedullary Lesion (on Myelography, CT, or MR)
C-62  Arachnoiditis
C-63  Extradural Lesion (on Myelography, CT, or MR)
C-64  Spinal Block (on Myelography, CT, or MR)
C-65  Tortuous Filling Defect on Lumbar Myelography
CONGENITAL SYNDROMES AND BONE DYSPLASIAS WITH VERTEBRAL ABNORMALITY

(See also C-11–17 and C-21–25)

COMMON

1. Achondroplasia (narrow lumbar spinal canal; lower thoracic kyphosis; lumbar lordosis)
2. Acrocephalosyndactyly (Apert, Pfeiffer, and Saethre-Chotzen types) (cervical and lumbar vertebral fusion)
3. Cleidocranial dysplasia (spina bifida; kyphoscoliosis)
4. Cretinism; hypothyroidism (kyphosis; beaked, flat vertebrae)
5. Diastrophic dysplasia (kyphoscoliosis; platyspondyly; narrow lumbar spinal canal)
6. Fanconi anemia (scoliosis; kyphosis; Klippel-Feil S.; spina bifida; sacral agenesis)
7. Fetal alcohol S. (scoliosis; hemivertebrae; Klippel-Feil S.)
8. Holt-Oram S. (scoliosis; fusion; hemivertebrae)
9. Homocystinuria (kyphoscoliosis; osteoporosis; “codfish vertebrae”)
10. Hypophosphatasia (osteoporosis with collapsed vertebrae)
11. Klippel-Feil S. (cervical block vertebrae; hemivertebrae; atlantooccipital fusion; atlantoaxial instability; spinal stenosis)
12. Marfan S. (scoliosis; spondylolisthesis)
13. Mucopolysaccharidoses, esp. Morquio S. (See J-4) (atlantoaxial subluxation; narrow spinal canal; kyphoscoliosis)
14. Multiple epiphyseal dysplasia (Fairbank) (hemivertebrae; platyspondyly)
15. Neurofibromatosis (kyphoscoliosis)
16. Noonan S. (scoliosis; kyphosis; Klippel-Feil S.)
17. Osteogenesis imperfecta (scoliosis; fractured vertebrae)
18. Osteopetrosis (dense vertebrae; fractures)
19. Pseudoachondroplasia (kyphoscoliosis)
20. Spondyloepiphyseal dysplasia, all forms (kyphoscoliosis; platyspondyly)
21. Spondylometaphyseal dysplasia (kyphoscoliosis)
22. Thanatophoric dysplasia (platyspondyly; narrow spinal canal)
23. Trisomy 21 S. (Down S.) (atlantoaxial subluxation)

UNCOMMON

1. Achondrogenesis, types I and II (lumbar vertebrae et al. appear absent)
2. Acrodysostosis (peripheral dysostosis) (narrow spinal canal)
3. Aicardi S. (block vertebrae; hemivertebrae; spina bifida; Arnold-Chiari malformation)
4. Alagille S. (arteriohepatic S.) (butterfly vertebrae; narrow spinal canal)
5. Atelosteogenesis (coronal and sagittal clefts; thoracic vertebral hypoplasia; platyspondyly; scoliosis)
6. Binder S. (cervical spine anomalies with kyphosis or scoliosis; spina bifida; block vertebrae)
7. Brachyolmia (scoliosis; platyspondyly with square or round edges; narrow disk spaces)
8. Campomelic dysplasia (hypoplastic cervical spine; kyphosis)
9. Caudal dysplasia sequence (variable vertebral agenesis in lumbosacral spine; tethered cord; diastematomyelia; lipoma; syringomyelia)
10. CHILD S. (scoliosis; hemivertebrae; fused vertebrae)
11. Chondrodysplasia punctata (kyphoscoliosis; atlantoaxial subluxation)
12. Cockayne S. (ovoid, biconcave or scalloped vertebrae; kyphosis; intervertebral calcification)
13. Crouzon S. (craniofacial dysostosis) (craniovertebral junction abnormalities)
14. Currarino triad (sacral hypoplasia with anterior meningocele or teratoma; tethered cord)
15. de la Chapelle dysplasia (small vertebrae; platyspondyly)
16. Dysostosclerosis (platyspondyly)
17. Dyssegmental dysplasia (short spine; ovoid or misshapen vertebrae)
18. Dyspondylochondromaosis (kyphoscoliosis; hemivertebrae; anisospondyly)
19. Ehlers-Danlos S. (scoliosis; spondylolisthesis)
20. Enchondromatosis (Ollier’s disease) (kyphoscoliosis)
21. Femoral hypoplasia—unusual facies S. (missing or hemivertebrae; scoliosis; sacral dysplasia)
22. Freeman-Sheldon S. (whistling face S.)
23. Geroderma osteodysplastica (platyspondyly)
24. GM1 gangliosidosis; fucosidosis (platyspondyly)
25. Goltz S. (focal dermal hypoplasia) (scoliosis; vertebral malsegmentation)
26. Gorlin S. (nevoid basal cell carcinoma S.) (kyphoscoliosis; multiple anomalies)
27. Hajdu-Cheney S. (idiopathic acro-osteolysis) (kyphoscoliosis; osteoporosis)
28. Hallermann-Streiff S. (oculo-mandibulo-facial S.) (spina bifida)
29. Hyperphosphatasia (scoliosis, biconcave vertebrae)
30. Hypochondroplasia (narrow spinal canal; lordosis; platyspondyly)
31. Incontinentia pigmenti (scoliosis; vertebral anomalies)
32. Kniest dysplasia (platyspondyly; lordosis; kyphoscoliosis; narrow spinal canal)
33. Larsen S. (cervical kyphosis)
34. LEOPARD S. (kyphoscoliosis with cervical and posterior spinal fusion)
35. Marshall S. (platyspondyly)
36. Metaphyseal chondrodysplasia (Jansen and McKusick types) (atlantoaxial instability)
37. Metatropic dysplasia (kyphoscoliosis; platyspondyly; atlantoaxial subluxation)
38. Multiple pterygium S. (scoliosis; multiple vertebral anomalies)
39. Nail-patella S. (osteo-onychodysplasia) (spina bifida)
40. Narrow lumbar spinal canal S.
41. Oculo-auculo-vertebral spectrum (Goldenhar S.) (hemivertebrae; block vertebrae; Klippel-Feil S.; spina bifida)
42. Oculovertbral S. (hemivertebrae; block vertebrae)
43. Osteodysplasty (Melnick-Needles S.) (tall vertebrae with anterior concavity)
44. Osteoglophonic dwarfism (platyspondyly; narrow spinal canal)
45. Otopalatodigital S. (posterior spinal defects)
46. Parastremmatic dysplasia (kyphoscoliosis; platyspondyly)
47. Patterson S. (cervical platyspondyly; ovoid thoracic and lumbar vertebrae)
48. Poland sequence (scoliosis; vertebral anomalies)
49. Popliteal pterygium S. (spina bifida)
50. Prader-Willi S. (scoliosis; kyphosis; osteoporosis)
51. Progeria (osteoporosis; infantile, ovoid vertebrae)
52. Pyle dysplasia (familial metaphyseal dysplasia) (platyspondyly)
53. Robin sequence (Pierre Robin S.) (occipito-atlantoaxial hypermobility with arch defects of atlas)
54. Robinow S. (hemivertebrae; vertebral fusions)
55. Rothmund-Thomson S. (flat, elongated vertebrae)
56. Rubinstein-Taybi S. (odontoid hypoplasia; C1-C2 instability; vertebral anomalies)
57. Schwartz-Jampel S. (osteochondromuscular dystrophy) (kyphoscoliosis; platyspondyly)
58. Seckel S. (bird-headed dwarfism) (kyphoscoliosis)
59. Shawl scrotum S. (hypoplastic C1; subluxation C1-C2)
60. Short rib-polydactyly syndromes (misshapen, poorly ossified vertebrae; coronal clefts)
61. Smith-McCort S. (platyspondyly)
62. Split notochord S. (spina bifida anterior and posterior; split cord; spinal cord and nerve defects; neuroenteric cyst)
63. Sponastrine dysplasia
64. Spondylocarpotarsal fusion S. (scoliosis; vertebral fusion; narrow disks)
65. Spondylocostal dysostosis (Jarcho-Levine S.) (fused, absent, butterfly, or hemivertebrae; kyphoscoliosis)
66. Spondyloepimeta physeal dysplasia (kyphoscoliosis)
67. Spondyloepiphyseal dysplasia (platyspondyly)
68. Stickler S. (arthro-ophthalmopathy) (kyphoscoliosis; irregular end plates with anterior wedging of vertebrae; cervical spine stenosis and myelopathy)
69. Tethered cord S. (numerous anomalies in lower spine)
70. Trisomy 13 S. (spina bifida)
71. Trisomy 18 S. (kyphoscoliosis; meningomyelocele)
72. VATER association (cervical kyphosis; Klippel-Feil S.)
73. Wildervanck S. (cervico-oculo-acoustic S.) (cervical segmentation malformation)
74. Williams S. (idiopathic hypercalcemia) (dense vertebrae; kyphoscoliosis)

References

Gamut C-2-S

NONSPINAL CONDITIONS ASSOCIATED WITH VERTEBRAL ANOMALIES

COMMON
1. Cloacal abnormality
2. Congenital heart disease
3. Genitourinary abnormality
4. Imperforate anus (sacral)
5. Maternal diabetes
6. Neurofibromatosis
7. Sprengel’s deformity

UNCOMMON
1. Aplasia or hypoplasia of lung
2. Neurenteric cyst; duplication cyst
3. Venolobar S. (eg, scimitar S.; lobar agenesis)

Gamut C-3-1

KYPHOSIS

COMMON
1. Congenital spinal anomaly (eg, fused vertebrae; hemivertebra; spina bifida with meningocele; bony bar)
2. Congenital syndromes (esp. achondroplasia; other osteochondrodysplasias; storage diseases; neurofibromatosis) (See C-1)
3. Fracture, traumatic or pathologic; dislocation
4. Idiopathic
5. Infection (eg, spinal osteomyelitis or tuberculosis (Pott’s disease))
6. Neoplasm of spine, primary or metastatic; multiple myeloma
7. Neuromuscular disorder with hypotonia (eg, cerebral palsy; muscular dystrophy; myasthenia gravis)
8. [Normal in infants (thoracolumbar; C2-3 angulation)]
9. Osteoporosis (esp. juvenile, senile or postmenopausal) (See D-43-1)
10. Paget’s disease
11. Paralysis (eg, poliomyelitis; paraplegia)
12. Posture, faulty or occupational (upper thoracic; changes with position)
13. Rheumatoid or ankylosing spondylitis
14. Scheuermann disease (juvenile kyphosis)

UNCOMMON
1. Acromegaly; excessive endocrine growth
2. Charcot spine; neuropathic osteoarthropathy
3. Cretinism; hypothyroidism
4. Generalized weakness
5. Hyperparathyroidism (primary)
6. Osteomalacia; rickets
7. Radiation therapy atrophy
8. Syringomyelia
9. Tuberous sclerosis

[] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

(continued)
Gamut C-3

References

Gamut C-3-2
CERVICAL KYPHOSIS

1. Binder S.
2. Burton S.
3. Campomelic dysplasia
4. Compression fracture
5. Desbuquois dysplasia
6. Diastrophic dysplasia
7. Larsen S.
8. Metnick-Needles S. (lethal variety)
9. Neurofibromatosis type 1
10. Pseudodiastrophic dysplasia
11. Retropharyngeal abscess

References

Gamut C-3-3
THORACOLUMBAR GIBBUS

REFERENCES

ACQUIRED
1. Compression fracture
2. Infantile multisystem inflammatory disease (NOMID)
3. Langerhans cell histiocytosis, \( g \) (esp. eosinophilic granuloma)
4. Neoplasm of spine, primary or metastatic
5. Pyogenic osteomyelitis
6. Scheuermann disease, severe
7. Tuberculous spondylitis (Pott’s disease)

CONGENITAL
1. Achondroplasia
2. Coffin-Lowry S.
3. GM\(_1\) gangliosidosis; fucosidosis
4. Hypothyroidism (cretinism)
5. Mucolipidosis II (Leroy’s I-cell disease)
6. Mucopolysaccharidoses (Hurler S.; Hunter S.; Maroteaux-Lamy S.)

References

Gamut C-4
SCOLIOSIS

COMMON
1. Chest wall abnormality (eg, asymmetric chest; congenital rib anomalies; Sprengel deformity)
2. Congenital spinal anomaly (eg, fusion of posterior elements; unilateral bar; meningomyelocele; segmentation anomaly; wedge vertebra; hemivertebra; Klippel-Feil S.)
3. Congenital syndromes (esp. Ehlers-Danlos S.; fetal alcohol S.; Marfan S.; homocystinuria; osteogenesis imperfecta; campomelic dysplasia; storage diseases; neurofibromatosis; Proteus S.) (See C-1)
4. Degenerative spondylosis
5. Degenerative disc disease
6. Idiopathic
7. Infection (eg, spinal tuberculosis, osteomyelitis)
8. Leg shortening or amputation; pelvic tilt; foot deformity

References
9. Neoplasm, intraspinal or extraspinal, primary or metastatic; multiple myeloma
10. Neuromuscular disorder with hypotonia (eg, cerebral palsy; muscular dystrophy; Friedreich’s ataxia; myotonic dystrophy)
11. Osteoporosis (See D-43-1)
12. Paralysis (eg, poliomyelitis; paraplegia; hemiparesis; hemiplegia)
13. Postoperative (eg, thoracoplasty; pneumonectomy)
14. Postural; changes with position
15. Pulmonary or pleural disease, unilateral (eg, fibrosis; fibrothorax; empyema; hypoplastic lung)
16. Spasm (eg, retroperitoneal, psoas, or abdominal abscess, inflammation, or hemorrhage; ureteral or renal calculus)
17. Trauma (fracture; subluxation)

UNCOMMON
1. Congenital heart disease (eg, ASD; tetralogy)
2. Hyperparathyroidism (primary)
3. Neurenteric cyst; duplication cyst
4. Osteoid osteoma
5. Radiation therapy atrophy
6. Rickets
7. Syringomyelia

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References

Gamut C-5
PARASPINAL SOFT TISSUE MASS
(See F-90, F-99)

COMMON
1. Abscess
2. Aortic aneurysm; tortuous aorta
3. Esophageal dilatation; achalasia
4. Hematoma, traumatic or spontaneous
5. Hiatal hernia
6. Idiopathic; anatomic variant
7. Lymphadenopathy, any cause
8. Lymphoma; leukemia
9. Metastatic neoplasm
10. Multiple myeloma
11. Neurogenic tumor (neurofibroma; neurilemmoma; ganglioneuroma; neuroblastoma; malignant peripheral nerve sheath tumor; neurofibromatosis with neurofibroma or dural estasia); intraspinal tumor of hourglass type
12. Osteoarthritis (spondylitis deformans); other arthritis with spur formation; DISH; extruded disk
13. Osteomyelitis of spine with abscess (eg, tuberculous, sarcoïd, fungal, brucellar, Salmonella, other bacterial); nonspecific spondylitis
14. Pleural effusion; empyema
15. Pneumonia; atelectasis

UNCOMMON
1. Amyloidosis
2. Bochdalek hernia
3. Bronchogenic cyst
4. Chemodectoma
5. Dilatedazygos system (eg, superior or inferior vena cava obstruction); mediastinal varices
6. Langerhans cell histiocytosis (esp. eosinophilic granuloma of vertebra)
7. Extramedullary hematopoiesis (esp. in thalassemia)
8. Fibromatosis
9. Hydatid disease
10. Hydroureter; retrocaval ureter
11. Meningocele (all types)

(continued)
12. Mesothelioma
13. Mustard operation for transposition of great vessels
14. Neoplasm of spine, primary (eg, giant cell tumor; chordoma; sarcoma)
15. Neurenteric cyst; duplication cyst
16. Other posterior mediastinal or retroperitoneal neoplasm (See F-90)
17. Paget’s disease
18. Pancreatic pseudocyst or neoplasm
19. Pheochromocytoma; other adrenal neoplasm
20. Retroperitoneal fibrosis
21. Rhabdomyosarcoma; other soft tissue sarcoma
22. Sequestration, extrapulmonary
23. Splenosis
24. Thoracic kidney

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut C-6-S1

CERVICAL SPINE INJURIES: MECHANISM OF INJURY

FLEXION
1. Anterior subluxation (hyperflexion sprain)
2. Bilateral interfacetal dislocation
3. Clay-shoveler’s fracture
4. Flexion teardrop fracture
5. Simple wedge fracture

FLEXION—ROTATION
1. Rotatory dislocation with interlocking
2. Unilateral interfacetal dislocation or fracture-dislocation

EXTENSION—ROTATION
1. Pillar fracture
2. Pedicolaminar fracture separation

VERTICAL COMPRESSION
1. Burst fracture
   a. Burst fracture of lower cervical vertebrae
   b. Fracture of occipital condyle
   c. Jefferson fracture of atlas

EXTENSION
1. Avulsion fracture anterior arch of atlas
2. Extension teardrop fracture
3. Hyperextension dislocation or fracture-dislocation
4. Laminar fracture
5. Posterior dislocation of atlas with fractured odontoid
6. Posterior neural arch fracture of atlas
7. Spinous process fracture
8. Traumatic spondylolisthesis; hangman’s fracture (deceleration; hyperextension)

LATERAL FLEXION
1. Jefferson fracture, asymmetric (Jefferson variant)
2. Lateral compression fracture
3. Occipital condyle fracture
4. Transverse process fracture
5. Uncinate process fracture

COMPLEX OR POORLY UNDERSTOOD MECHANISM
1. Acute traumatic transverse atlantal ligament rupture
2. Occipitoatlantal dissociation
3. Odontoid fracture
4. Rotary subluxation/fixation C1-2 (torticollis)
5. Acute traumatic rotary atlantoaxial dissociation
CERVICAL SPINE INJURIES: STABILITY

STABLE
1. Anterior subluxation
2. Avulsion of anterior arch of C1
3. Burst fracture (lower cervical vertebrae)
4. Clay-shoveler’s fracture
5. Laminar fracture
6. Pillar fracture
7. Posterior neural arch fracture of atlas
8. Simple wedge fracture
9. Spinal process fracture
10. Torticollis
11. Unilateral interfacetal dislocation

UNSTABLE
1. Bilateral interfacet dislocation
2. Extension teardrop fracture (stable in flexion, unstable in extension)
3. Flexion teardrop fracture
4. Hyperextension dislocation and fracture-dislocation
5. Jefferson fracture of atlas
6. Occipitoatlantal dissociation
7. Odontoid fracture (all types)
8. Pedicolar fracture separation
9. Traumatic spondylolisthesis (hangman’s fracture)

RADIOLOGIC SIGNS OF SPINE INSTABILITY

1. Loss of vertebral height (<25% cervical spine; >50% dorsolumbar spine)
2. Vertebral displacement > 2mm
3. Widened interlaminar space (>2mm than levels above or below)
4. Widened interspinous space (>2mm than levels above or below)
5. Widened facet joints (>2mm than levels above or below)
6. Widened interpedicular distance (>2mm than levels above or below)
7. Disruption of posterior vertebral body line
8. Focal narrowing or widening of intervertebral disc space
9. Focal angulation >11N (cervical spine)

Reference
ATLANTOAXIAL SUBLUXATION OR INSTABILITY

COMMON
1. Incompetence of transverse atlantoaxial ligament (congenital, traumatic, or hyperemic condition)
2. [Normal widening of C1-dens distance in children (up to 4–5 mm)]
3. Rheumatoid arthritis; juvenile chronic arthritis
4. Occipitalization of atlas
5. Trauma (with fracture of odontoid or torn transverse ligaments)

UNCOMMON
1. Absent anterior arch of atlas
2. Absent, hypoplastic, or separate odontoid process (os odontoideum)
3. Arthritis, other—with laxity of transverse ligament or erosion of odontoid (eg, ankylosing spondylitis; psoriatic arthritis; Reiter S.; gout)
4. Atlantooccipital fusion
5. Behçet S.
6. Block vertebra C2-C3
7. Calcium pyrophosphate dihydrate deposition disease (CPPD)
8. Collagen vascular disease, (lupus erythematosus; scleroderma; CREST S.)
9. Congenital syndromes (esp. trisomy 21 S. {Down S.}; Morquio S.; other storage diseases; Marfan S.) (See C-7-2)
10. Infection, esp. in children (eg, retropharyngeal or nasopharyngeal infection or abscess; mastoiditis; parotitis; cervical adenitis; tooth abscess)
11. Tuberculosis

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
9. Metatropic dysplasia
10. Mucolipidosis III (pseudo-Hurler polydystrophy)
11. Neurofibromatosis I
12. Opsismodysplasia
13. Patterson S.
14. Pseudoachondroplasia
15. Spondyloepimetaphyseal dysplasia (Strudwick and short limb-hand types)
16. Spondyloepiphyseal dysplasia congenita and tarda
17. Spondylometaphyseal dysplasia
18. Winchester S.

* Congenital laxity of ligaments and associated hypoplasia of dens and C1.
[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References

Gamut C-8

**ODONTOID (DENS) ABSENCE, HYPOPLASIA, FRAGMENTATION OR EROSION**

**COMMON**
1. Arthritis (eg, rheumatoid; gout; psoriasis; ankylosing spondylitis; lupus erythematosus)
2. Craniovertebral junction anomaly (eg, occipitalization of atlas; atlantoaxial fusion; os odontoideum)
3. Klippel-Feil S.
4. Morquio S.
5. Trauma (eg, resorption after cervical spine trauma in infancy)
6. Trisomy 21 S. (Down S.)

**UNCOMMON**
1. Aarskog S.
2. Campomelic dysplasia
3. Chondrodysplasia punctata (Conradi-Hönermann type and others)
4. CREST S.
5. Diastrophic dysplasia
6. Dyggve-Melchior-Clausen dysplasia
7. Gorlin S. (nevoid basal cell carcinoma S.)
8. Kniest dysplasia
9. Marshall-Smith S.
10. Metaphyseal chondrodysplasia (McKusick type)
11. Metastasis
12. Metatropic dysplasia
13. Microcephalic osteodysplastic dysplasia
14. Mucopolysaccharidoses, other (esp. Hurler S.; Maroteaux-Lamy S.); mucolipidosis II (I-cell disease) and III (pseudo-Hurler polydystrophy); fucosidosis (See J-4)
15. Multiple epiphyseal dysplasia (Fairbank)
16. Patterson S.
17. Rubenstein-Taybi S.
18. Smith-McCort S.
19. Spondyloepimayseal dysplasias
20. Spondyloepiphyseal dysplasia congenita and tarda
21. Tuberculous spondylitis

References

(continued)
CRANIOVERTEBRAL JUNCTION ABNORMALITY—CONGENITAL

BONE ABNORMALITY, ASYMPTOMATIC
1. Asymmetric atlantoaxial joint
2. Asymmetric atlanto-occipital joint
3. Posterior arch of atlas defect
4. Rachischisis of C-1
5. Third occipital (tertiary) condyle

BONE ABNORMALITY, SYMPTOM-PRODUCING
1. Atlantoaxial fusion or malsegmentation
2. Atlantooccipital fusion (occipitalization of atlas); hypoplasia of occipital condyle
3. Basilar invagination (See A-12)
4. Crouzon S. (craniofacial dysostosis)
5. Odontoid dysplasia with atlantoaxial dislocation; os odontoideum (separate odontoid); hypoplasia or aplasia of dens
6. Stenosis of foramen magnum
7. Stenosis of cervical spinal canal

CERVICOMEDULLARY ANOMALY
1. Arteriovenous malformation
2. Chiari malformations
3. Hydromyelia

References

CRANIOVERTEBRAL JUNCTION ABNORMALITY—ACQUIRED

BONE LESION
1. Fibrous dysplasia
2. Inflammatory disease
3. Neoplasm of skull base (primary or metastatic)
4. Paget’s disease
5. Posttraumatic or degenerative lesion

EXTRAMEDULLARY LESION
1. Aneurysm
2. Cystic lesion (eg, arachnoid cyst; epidermoid cyst)
3. Neoplasm (eg, meningioma; neurofibroma; lipoma)

INTRAMEDULLARY LESION
1. Glioma
2. Hemangioblastoma
3. Syringomyelia

References
COMMON
1. Ankylosing spondylitis
2. Block vertebrae, congenital or acquired (eg, post-traumatic; surgical fusion; tuberculosis or other infection)
3. Diffuse idiopathic skeletal hyperostosis (DISH)
4. Juvenile chronic arthritis (Still’s disease)
5. Rheumatoid arthritis (incl. juvenile)

UNCOMMON
1. Acrocephalosyndactyly (Apert, Pfeiffer, and Saethre-Chotzen types)
2. Fibrodysplasia (myositis) ossificans progressiva
3. Fluorosis
4. Hypervitaminosis A
5. Hypoparathyroidism
6. Klippel-Feil S.
7. Psoriatic arthritis
8. Reiter S.
9. SAPHO S.
10. Vertebral malsegmentation (See C-11)

References

Gamut C-11
CONGENITAL VERTEBRAL MALSEGMENTATION
(SUPERNUMERARY, PARTIALLY FORMED OR HEMIVERTEBRAE, FUSED OR BLOCK VERTEBRAE)

COMMON
1. Chondrodysplasia punctata
2. Diastematomyelia
3. Isolated anomaly
4. Klippel-Feil S.
5. Meningomyelocele

UNCOMMON
1. Acrocephalosyndactyly (Apert, Pfeiffer, and Saethre-Chotzen types)
2. Aicardi S.
3. Alagille S. (arteriohepatic S.)
4. Binder S.
5. Cat cry S. (cri du chat S.)
6. Caudal dysplasia sequence
7. CHILD S.
8. Dysspondylochondromatosis
9. Dyssegmental dysplasia
10. Fanconi anemia
11. Femoral hypoplasia-unusual facies S.
12. Fetal alcohol S.
13. Goltz S. (focal dermal hypoplasia)
14. Gorlin S. (nevoid basal cell carcinoma S.)
15. Holt-Oram S.
16. Hypophosphatasia (perinatal lethal)
17. Incontinentia pigmenti
18. Larsen S.
19. LEOPARD S. (multiple lentigenes S.)
20. Multiple pterygium S.
21. MURCS association
22. Noonan S.
23. Oculo-auriculo-vertebral spectrum (Goldenhar S.)
24. Poland S. (pectoral muscle aplasia-syndactyly)


Gamut C-12

ABSENT OR MINIMALLY OSSIFIED VERTEBRAE

1. Achondrogenesis
2. Atelosteogenesis
3. Boomerang dysplasia
4. Caudal dysplasia (caudal regression S.)
5. Dyssegmental dysplasia
6. Hypochondrogenesis
7. Opsismodysplasia
8. Schneckenbecken dysplasia
9. Spondyloomegaepiphyseal-metaphyseal dysplasia

Reference

Gamut C-13

CORONAL CLEFT VERTEBRAE

COMMON
1. Chondrodysplasia punctata (all types)
2. Kniest dysplasia
3. Mesomelic dysplasias
4. Metatropic dysplasia
5. Normal variant (esp. in lower thoracic-upper lumbar spine of premature male infant)

UNCOMMON
1. Atelosteogenesis
2. Desbuquois dysplasia
3. Dyssegmental dysplasia
4. Fibrochondrogenesis
5. Humerospinal dysostosis
6. Malsegmentation of spine
7. Otochondrometaepiphysal dysplasia (OSMED)
8. Short rib-polydactyly S., type I (Saldino-Noonan S.)
9. Spondyloepimetaepiphyseal dysplasia (Iraqi type)
10. Trisomy 13 S.
11. Weissenbacher-Zweymüller S. (incl. micrognathic dwarfism)

References
Gamut C-14

PROMINENT ANTERIOR CANAL (CENTRAL VEIN GROOVE) OF A VERTEBRAL BODY

COMMON
1. Hypothyroidism; infantile (cretinism)
2. Normal (up to age 7)
3. Sickle cell disease

UNCOMMON
1. Cockayne S.
2. Gaucher’s disease
3. Leukemia, lymphoma
4. Metastatic neuroblastoma
5. Osteopetrosis
6. Progeria
7. Thalassemia major

References

Gamut C-15

CONGENITAL PLATYSPONDYLY

COMMON
1. Anemia (eg, sickle cell disease; thalassemia)
2. Hypothyroidism, juvenile; cretinism
3. Metatropic dysplasia
4. Morquio S.
5. [Osteogenesis imperfecta congenita with numerous compression fractures]
6. Spondyloepiphyseal dysplasia, all forms
7. Thanatophoric dysplasia and variants

UNCOMMON
1. Achondrogenesis
2. Achondroplasia (homozygous)
3. Atelosteogenesis (type I)
4. Brachyolmia
5. Cephaloskeletal dysplasia (Taybi-Linder S.)
6. de la Chapelle S.
7. Diastrophic dysplasia
8. Dyggve-Melchior-Clausen dysplasia
9. Dysosteosclerosis
10. Ehlers-Danlos S.
11. Fibrochondrogenesis
12. Freeman-Sheldon S. (whistling face S.)
13. Gaucher disease
14. Geroderma osteodysplastica
15. GM1 gangliosidosis; fucosidosis
16. Hallermann-Streiff S. (oculo-mandibulo-facial S.)
17. Homocystinuria
18. Hyperphosphatasia
19. Hypochondrogenesis
20. Hypophosphatasia, severe
21. Hypopituitarism (anterior lobe)
22. [Idiopathic juvenile osteoporosis]
23. Kniest dysplasia
24. Larsen S.
25. Lethal osteosclerotic skeletal dysplasias
26. Marshall S.
27. Opsismodysplasia
28. Osteoglophonic dwarfism
29. Otopspondylomegaepiphyseal dysplasia
30. Parastreptomastic dwarfism
31. Patterson S. (cervical spine)
32. Pseudoachondroplasia
33. Pseudodiastrophic dysplasia
34. Rothmund-Thomson S.
35. Schwartz-Jampel S. (osteochondromuscular dystrophy)
36. Short rib-polydactyly S., type I (Saldino-Noonan S.)
37. Smith-McCort S.
38. Spondyloenchondromatosis

(continued)
39. Spondyloepimetaphyseal dysplasia
40. Spondylometaphyseal dysplasia (Kozlowski and other types)
41. Spondyloperipheral dysplasia
42. Wolcott-Rallison dysplasia

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut C-16

ANISOSPONDYLY*
1. Campomelic dysplasia
2. Dyssegmental dysplasia
3. Homocystinuria
4. Kniest dysplasia
5. Osteogenesis imperfecta
6. Spondyloepimetaphyseal dysplasia
7. Spondyloepiphyseal dysplasia
8. Spondylometaphyseal dysplasia
9. Stickler S. (arthro-ophthalmopathy)

* Congenital irregular flattening of two or more vertebral bodies in the presence of other normal vertebrae.

Reference

Gamut C-17

SOLITARY COLLAPSED VERTEBRA (INCLUDING VERTEBRA PLANA) (See C-18)

COMMON
1. Brown tumor of hyperparathyroidism
*2. Eosinophilic granuloma (Langerhans cell histiocytosis)
*3. Fracture, traumatic or pathologic
*4. Hemangioma
*5. Lymphoma; leukemia
*6. Metastasis (incl. neuroblastoma)
7. Myeloma; plasmacytoma
8. [Normal developmental variant (eg, C5 or C6 or a thoracic vertebra reduced in height)]
9. Osteomyelitis (eg, tuberculous, fungal, pyogenic, brucellar, typhoid, syphilitic)
10. Osteoporosis (eg, senile, postmenopausal) (See D-43-1)
*11. Paget’s disease
12. Steroid therapy; Cushing S.

UNCOMMON
1. Amyloidosis
2. Benign bone tumor, other (eg, giant cell tumor; aneurysmal bone cyst)
3. Chordoma
4. Hydatid disease
5. Neuropathy (eg, diabetes; syphilis; congenital insensitivity to pain)
6. Osteomalacia
7. Sarcoidosis
8. Sarcoma (eg, Ewing sarcoma; osteosarcoma; chondrosarcoma)
9. Scheuermann’s disease
*10. Traumatic ischemic necrosis (eg, Kömmell’s disease)

* May produce vertebra plana.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
**Gamut C-18**

**MULTIPLE COLLAPSED VERTEBRAE**  
(See C-17)

**COMMON**
1. Fractures, traumatic or pathologic
2. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
3. Metastases
4. Multiple myeloma
5. Neuropathy (eg, diabetes; syphilis; congenital insensitivity to pain)
6. Osteomalacia (See D-44)
7. Osteomyelitis (eg, tuberculous, fungal, pyogenic, brucellar, syphilitic)
8. Osteoporosis (eg, senile, postmenopausal, or idiopathic juvenile osteoporosis; hypogonadism; prolonged immobilization) (See D-43-1)
9. Scheuermann’s disease
10. Sickle cell disease; other anemias
11. Steroid therapy; Cushing S.

**UNCOMMON**
1. Amyloidosis
2. Congenital fibromatosis
3. Convulsions (eg, tetanus; tetany; hypoglycemia; electroshock therapy)
4. Gaucher’s disease
5. Hajdu-Cheney S. (idiopathic acro-osteolysis)
6. Hemangiomatosis (Gorham’s vanishing bone disease)
7. Hydatid disease
8. Hyperphosphatasia
9. Hypophosphatasia
10. Langerhans cell histiocytosis
11. Lymphoma; leukemia
12. Osteogenesis imperfecta
13. Paget’s disease
14. [Platyspondyly, esp. dwarf syndromes (eg, Morquio S.; spondyloepiphyseal dysplasia; pseudoachondroplasia; thanatophoric dysplasia)] (See C-15)
15. Radiation therapy
16. Rheumatoid arthritis

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**Gamut C-19**

**BICONCAVE (“FISH”) VERTEBRAE**  
(INCLUDING STEP-LIKE VERTEBRAE*)

**COMMON**
1. Hyperparathyroidism, primary or secondary (renal osteodystrophy)*
2. Metastatic disease
3. Osteomalacia; rickets (See D-44)
4. Osteoporosis (eg, senile or postmenopausal; malnutrition; steroid therapy) (See D-43-1)
5. Paget’s disease
6. Schmorl’s nodes
7. Sickle cell disease

**UNCOMMON**
*1. Anemias, other (eg, thalassemia; hereditary spherocytosis; iron deficiency)
*2. Gaucher’s disease
*3. Homocystinuria
4. Lymphoma
5. Osteogenesis imperfecta
6. Sponastrine dysplasia

* Step-like vertebra with H-shaped or Lincoln log configuration may occur.

**References**

(continued)
Gamut C-20

WEDGED VERTEBRA*

1. Chronic hyperflexion of spine; muscular hypotonia
2. Congenital syndromes and bone dysplasias with thoracolumbar wedging (eg, achondroplasia; hypothyroidism; mucopolysaccharidoses—See J-4)
3. Hemivertebra (gibbus or lateral wedging)
4. Kyphosis (See C-3)
5. Normal variant (minimal wedging in thoracic spine or at C3 or C4 in infant or young child)
6. Pathologic fracture in weakened vertebra (eg, osteoporosis; infection; metastasis; multiple myeloma; primary neoplasm)
7. Rotoscoliosis (lateral wedging)
8. Scheuermann’s disease
9. Trauma (compression fracture)
10. Tuberculosis (gibbus); other chronic infection of spine (spondylitis)

* Primarily anterior wedging unless otherwise indicated.

References

Gamut C-21

ANTERIOR BEAKED VERTEBRAE IN A CHILD

COMMON
1. Achondroplasia (central anterior wedging)
2. Cretinism; hypothyroidism (inferior beak)
4. Neuromuscular disease with generalized hypotonia (eg, Werdnig-Hoffmann disease; Niemann-Pick disease; phenylketonuria; mental retardation)
5. Normal variant in infants (thoracolumbar junction; C2-3 angulation)
6. Scheuermann’s disease
7. Trauma, acute or chronic; battered child S. (hyperflexion-decompression spinal injury)

UNCOMMON
1. Adenosine deaminase deficiency with severe combined immunodeficiency and chondro-osseous dysplasia
2. Aspartylglucosaminuria
3. Diastrophic dysplasia
4. Dyggve-Melchior-Clausen dysplasia (Smith-McCort S.)
5. Marshall S.
6. Mucolipidoses; GM1 gangliosidosis; fucosidosis; mannosidosis; sialidosis (See J-4)
7. Neurofibromatosis (dysplastic vertebrae)
8. Pseudoachondroplasia
9. Spondyloepimetaphyseal dysplasia (short limb-hand type)
10. Spondyloepiphyseal dysplasia congenita
11. Trisomy 21 S. (Down S.)

References

Gamut C-22

CUBOID VERTEBRAE

COMMON
1. Achondroplasia
2. Normal variant (cervical spine and thoracolumbar junction)

UNCOMMON
1. Diastrophic dysplasia
2. Gorlin S. (nevoid basal cell carcinoma S.)
3. Hypochondroplasia
4. Mucopolysaccharidoses (See J-4)
5. Pseudodiastrophic dysplasia
6. Short rib-polydactyly syndromes (eg, Saldino-Noonan S.; Majewski S.)
7. Thanatophoric dysplasia

References

Gamut C-23

ROUND VERTEBRAE

COMMON
1. Cretinism; hypothyroidism (untreated)
2. Normal in neonate (esp. thoracolumbar junction) or child with delayed appearance of ring epiphyses

3. Vertebral body underdevelopment (eg, meningomyelocele)

UNCOMMON
1. Bone dysplasias with “pear shaped” vertebrae (eg, Morquio S.;
   a. Acromesomelic dysplasia
   b. Chondroectodermal dysplasia
   c. Cranioectodermal dysplasia
   d. Dyggve-Melchior-Clausen dysplasia (Smith-McCort S.)
   e. Hypochondrogenesis
   f. Schneckenbecken dysplasia
   g. Spondyloepiphyseal dysplasia congenita
   h. Spondyloepimetaaphyseal dysplasia
   i. Spondyloepimetaaphyseal dysplasia
2. Patterson S. (ovoid thoracic and lumbar bodies)
3. Pseudoachondroplasia
4. Short rib-polydactyly syndromes (eg, Saldino-Noonan S.; Majewski S.)
5. Smith-Lemli-Opitz S. (type II) (high ovoid lumbar bodies)
6. Weill-Marchesani S.

References

Gamut C-24

TALL VERTEBRAE

COMMON
1. Block or fused vertebra (See C-25)
2. Hypotonia (eg, neuromuscular disorders; mental retardation); nonweight bearing
3. Trisomy 21 S. (Down S.)

(continued)
UNCOMMON
1. Antley-Bixler S.
2. Chromosome 4:del (4p) S. (Wolf-Hirschhorn S.)
3. Dolicohypopondal dysplasia
4. Dyssegmental dysplasia
5. Freeman-Sheldon S. (whistling face S.)
6. Hadju-Cheney S.
7. Infantile multisystem inflammatory disease
8. Marfan S.; arachnodactyly
9. Osteodysplasty (Melnick-Needles S.)
10. Proteus S.
11. Spondylocostal dysplasia

References
1. Gooding CA, Neuhauser EBD: Growth and development of the vertebral bodies in the presence and absence of normal stress. AJR 1965;93:388–393

Gamut C-25
FUSED OR BLOCK VERTEBRAE (Congenital and Acquired)

CONGENITAL
1. Acrocephalosyndactyly (Apert and Pfeiffer types)
2. Crouzon S. (craniofacial dysostosis)
3. Fetal alcohol S.
4. Fibrodysplasia (myosis) ossificans progressiva
5. Goltz S. (focal dermal hypoplasia) (anterior fusion)
6. Holt-Oram S.
7. Isolated anomaly (esp. C2-3)
8. Klippel-Feil S.
9. With spinal dysraphism
10. Aicardi S.
11. Binder S.
12. CHILD S.
13. Diamond-Blackfan S. (cervical spine)
14. Hypomelanosis of Ito
15. LEOPARD S.
16. Multiple synostosis S.
17. Mayer-Rokitansky-Kuster S.
18. Noonan S.
19. Oculo-auriculo-vertebral spectrum (Goldenhar S.)
20. Proteus S.
21. Robinow S.
22. Spondylocostal dysostoses (esp. Jarcho-Levin S.)
23. Wildervanck S.

ACQUIRED
1. Ankylosing spondylitis
2. Infection (esp. tuberculosis); juvenile discitis (healed)
3. Rheumatoid arthritis (esp. juvenile)
4. Scheuermann’s disease
5. Surgical fusion
6. Trauma (severe)

References

Gamut C-26
ENLARGEMENT OF ONE OR MORE VERTEBRAE

COMMON
1. Acromegaly; gigantism
2. Congenital (eg, block vertebra—See C-25)
3. Paget’s disease
**UNCOMMON**

1. Benign bone tumor (eg, giant cell tumor; hemangiomia; aneurysmal bone cyst; osteoblastoma)
2. Compensatory enlargement from nonweight bearing (eg, paralysis)
3. Fibrous dysplasia
4. Hydatid disease
5. Hyperphosphatasia

**References**


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**Gamut C-27**

**“SQUARING” OF ONE OR MORE VERTEBRAL BODIES**

**COMMON**

1. Ankylosing spondylitis
2. Normal variant
3. Paget’s disease

**UNCOMMON**

1. Hypervitaminosis A
2. Psoriatic arthritis
3. Reiter S.
4. Rheumatoid arthritis
5. SAPHO S.
6. Wilson disease

* Acquired diseases causing squared vertebrae. For congenital cuboid or occasionally squared vertebrae, see Gamut C-22.

**References**

1. Jacobson HG: Personal communication.

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**Gamut C-28**

**SPOOL-SHAPED VERTEBRAE (ANTERIOR AND POSTERIOR SCALLOPING)**

**COMMON**

1. Hypotonia
2. Neurofibromatosis
3. Normal (occasionally mild in lumbar spine)

**UNCOMMON**

1. Cockayne S.
2. Mucopolysaccharidoses (See J-4)
3. Osteodysplasty (Melnick-Needles S.)
4. Trisomy 21 S. (Down S.); other trisomies

**Reference**


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**Gamut C-29**

**ANTERIOR GOUGE DEFECT (SCALLOPING) OF ONE OR MORE VERTEBRAL BODIES**

**COMMON**

1. Aneurysm of aorta
2. Lymphoma; chronic leukemia
3. Lymphadenopathy from metastases or inflammation
4. Neurofibromatosis (dysplastic vertebra)
5. Normal variant (lower thoracic, upper lumbar)
6. Tuberculosis (spondylitis)

**UNCOMMON**

1. Adjacent intraabdominal neoplasm or cyst
2. Chondrodystrophies and storage diseases

* (continued)
3. Cockayne S.
*4. Glycogen storage disease
5. Multiple myeloma (paravertebral soft tissue mass)
*6. Osteodysplasty (Melnick-Needles S.)
*7. Trisomy 21 S. (Down S.)

* Often have spindle- or spool-shaped vertebrae with both anterior and posterior scalloping.

References

Gamut C-30

EXAGGERATED CONCAVITY
(SCALLOPING) OF THE POSTERIOR
SURFACE OF ONE OR MORE
VERTEBRAL BODIES

COMMON
1. Achondroplasia; other chondrodystrophies with a narrow spinal canal (See Uncommon #4)
2. Increased intraspinal pressure (eg, severe communicating hydrocephalus; neoplasm)
3. Neoplasm of spinal canal (eg, ependymoma; dermoid; lipoma; neurofibroma; meningioma)
4. Neurofibromatosis with or without neurofibroma (“duiral ectasia”); congenital expansion of the subarachnoid space (“intraspinal meningocele”)
5. Normal variant (physiologic scalloping—esp. L4, L5)

UNCOMMON
1. Acromegaly
2. Cyst of spinal canal
3. Hydatid disease
4. Other congenital syndromes and bone dysplasias
   a. Cockayne S.
   b. Diastrophic dysplasia
   c. Dyggve-Melchior-Clausen dysplasia
   d. Ehlers-Danlos S. (duiral ectasia)
   e. Marfan S. (duiral ectasia)
   f. Metatropic dysplasia
   g. Mucopolysaccharidoses (eg, Hurler S; Hunter S.; Morquio S.; Sanfilippo S.); mucolipidosis II (I-cell disease) (See J-4)
   h. Osteogenesis imperfecta
   i. Smith-McCort S.
   i. Thanatophoric dysplasia
5. Spinal dysraphism; meningocele
6. Syringomyelia; hydromyelia

References
### Gamut C-31

**INCREASED BAND(S) OF DENSITY IN THE SUBCHONDRAL ZONES OF VERTEBRAE (INCLUDING RUGGER JERSEY SPINE)**

**COMMON**
1. Compression fracture
2. Hypercorticism; Cushing S.; steroid therapy
3. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
4. Osteopetrosis
5. Paget’s disease
6. Sclerosing spondylosis in the elderly

**UNCOMMON**
1. Growth arrest lines
2. Heavy metals (eg, Thorotrast; lead)
3. Hypoparathyroidism; pseudohypoparathyroidism
4. Lead poisoning, chronic
5. Leukemia, treated
6. Lipid granulomatosis (Erdheim-Chester disease)
7. Myeloid metaplasia (myelosclerosis)
8. Osteomesopyknosis
9. Radiation therapy
10. Williams S. (idiopathic hypercalcemia)

* May have the appearance of a “ruger jersey.”

**References**

### Gamut C-32

**BONE-IN-BONE OR SANDWICH VERTEBRA**

**COMMON**
1. Osteopetrosis
2. Paget’s disease
3. Physiologic in newborn (often premature) infant
4. Renal osteodystrophy (secondary hyperparathyroidism), healing

**UNCOMMON**
1. Chronic illness (growth arrest lines)
2. Hypercalcemia; hypervitaminosis D
3. Lead poisoning, chronic
4. Radiation therapy
5. Thorotrast

* May have a “ruger jersey spine” or “sandwich vertebra” appearance.

**Reference**

### Gamut C-33

**INCREASED VERTICAL (PIN-STRIPE OR CORDUROY) TRABECULATION OF ONE OR MORE VERTEBRAL BODIES**

**COMMON**
1. Anemia, primary
2. Hemangioma
3. Osteoporosis
4. Paget’s disease

**UNCOMMON**
1. Axial osteomalacia
2. Fibrogenesis imperfecta ossium

(continued)
3. Lymphoma; leukemia
4. Metastatic disease (incl. carcinomatosis)
5. Multiple myeloma (incl. myelomatosis)

* Due to loss of the minor bone trabeculae, with the remaining major trabeculae aligned vertically for support.

Reference

Gamut C-34

FOCAL AREA OF SCLEROSIS IN A VERTEBRA

COMMON
1. Enostosis (bone island)
2. Fracture (compression or healing or healed)
3. Idiopathic
4. Osteoblastic metastasis
5. Sclerosis of apophyseal joints due to arthritis or malalignment
6. Spondylosis (discogenic sclerosis)

UNCOMMON
1. Bone sarcoma (esp. osteosarcoma; chondrosarcoma; Ewing sarcoma)
2. Chordoma
3. Hemangioma
4. Langerhans cell histiocytosis (healed)
5. Lymphoma
6. Mastocytosis
7. Melorheostosis
8. Myeloma (eg, POEMS S.)
9. Osteoblastoma
10. Osteoid osteoma
11. Osteoma
12. Osteomyelitis (esp. chronic from tuberculosis, brucellosis, fungus disease, or typhoid fever)

13. Sarcoidosis
14. Sclerotic pedicle (See C-42)
15. Tuberculous sclerosis

References

Gamut C-35

DENSE SCLEROTIC VERTEBRA, SOLITARY OR MULTIPLE (INCLUDING IVORY VERTEBRA)

COMMON
1. Fracture (compression or healing)
2. Hemangioma
*3. Lymphoma
*4. Myelosclerosis (myeloid metaplasia)
*5. Osteoblastic metastasis
*6. Osteomyelitis, chronic sclerosing (eg, tuberculosis; syphilis; brucellosis; typhoid)
*7. Paget’s disease
8. Renal osteodystrophy (secondary hyperparathyroidism)

UNCOMMON
1. Bone sarcoma (eg, osteosarcoma*; chondrosarcoma; Ewing sarcoma)
*2. Chordoma
*3. Fluorosis
4. Hypervitaminosis D
5. Idiopathic (eg, nondiscogenic sclerosis)
6. Lenz-Majewski dysplasia (hyperostotic dwarfism)
7. Mastocytosis
8. Multiple myeloma (rarely—<3%); POEMS S.
9. Osteoblastoma
10. Osteoma; enostosis (bone island)
11. Osteopetrosis
12. Radiation therapy; radium poisoning
13. Rickets (healing)
14. Sarcoïdosis
15. Sickle cell disease
16. Spondylosis (discogenic sclerosis)
17. Tuberous sclerosis
18. Williams S. (idiopathic hypercalcemia)

* Can cause “ivory” vertebra(e).

References
12. Meningocele; diastematomyelia
13. Nonossifying fibroma
14. Osteoblastoma
15. Osteoid osteoma
16. Traumatic ischemic necrosis (Kömmell’s disease)

Gamut C-38-S

VERTEBRAL NEOPLASMS AND LOOK-ALIKES

BENIGN

COMMON
1. Aneurysmal bone cyst
2. Hemangioma
3. Osteoblastoma

UNCOMMON
1. Enostosis (bone island); osteoma
2. Giant cell tumor
3. Osteochondroma
4. Osteoid osteoma

MALIGNANT

COMMON
1. Chordoma
2. Ewing sarcoma
3. Lymphoma; leukemia
4. Metastasis
5. Multiple myeloma; plasmacytoma

UNCOMMON
1. Angiosarcoma
2. Chondrosarcoma
3. Fibrosarcoma
4. Malignant giant cell tumor
5. Malignant fibrous histiocytoma
6. Malignant hemangioendothelioma and hemangiopericytoma
7. Osteosarcoma
8. PNET
9. Rhabdomyosarcoma

LOOK-ALIKES
1. Arthritic spondylitis (eg, rheumatoid; gout; psoriatic)
2. Eosinophilic granuloma (Langerhans cell histiocytosis)
3. Fibrous dysplasia
4. Hydatid disease
5. Paget’s disease
6. Spondylodiskitis (osteomyelitis/diskitis) (eg, tuberculous, sarcoïd, fungal, brucellar, other bacterial)

Reference

Gamut C-39

LESIONS OF THE VERTEBRAL BODY AND/OR APPENDAGES WITH PROMINENT EXPANSILE REMODELING

COMMON
1. Aneurysmal bone cyst
2. Hemangioma
3. Osteoblastoma

UNCOMMON
1. Chondroid lesion
2. Fibrous dysplasia
3. Giant cell tumor
4. Gout
5. Hydatid cyst
6. Metastasis
7. Multiple myeloma; plasmacytoma
**Gamut C-40-1**

**ABNORMAL SIZE OR SHAPE OF A VERTEBRAL PEDICLE—ABSENT OR HYPOPLASTIC PEDICLE**

1. Congenital absence or hypoplasia
2. Destroyed pedicle (See C-41)
3. Mucopolysaccharidoses (esp. Hunter S.)
4. Neurofibromatosis
5. [Poorly visualized pedicles C2-C5]
6. Radiation therapy

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**


**Gamut C-40-2**

**ENLARGED PEDICLE**

1. Compensatory hypertrophy with contralateral deficiency of neural arch
2. Neoplasm (eg, osteoid osteoma; osteoblastoma; hemangioma)

**Reference**


**Gamut C-40-3**

**DYSPLASTIC PEDICLE**

**COMMON**

1. Neurofibromatosis
2. Part of other congenital anomaly

**UNCOMMON**

1. Diastematomyelia
2. Klippel-Feil S.
3. Meningomyelocele

**Reference**


**Gamut C-40-4**

**FLATTENED PEDICLE**

1. Intraspinal expanding neoplasm or cyst; arteriovenous malformation
2. Normal (eg, upper lumbar spine)
3. Syringomyelia; hydromyelia

**Reference**

Gamut C-41

VERTEBRAL PEDICLE EROSION OR DESTRUCTION

COMMON
1. Intraspinal neoplasm or cyst (esp. neurofibroma; meningioma)
2. Metastasis
3. Tuberculosis, fungus or other infectious disease

UNCOMMON
1. Benign bone tumor (eg, aneurysmal bone cyst; giant cell tumor; hemangiopericytoma)
2. [Congenital absence of pedicle]
3. Eosinophilic granuloma (Langerhans cell histiocytosis)
4. Hydatid disease
5. Lymphoma
6. Multiple myeloma
7. Syringomyelia; hydromyelia
8. Vertebral artery aneurysm or tortuosity (cervical spine); arteriovenous malformation

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Gamut C-42

VERTEBRAL PEDICLE SCLEROSIS

COMMON
1. Metastasis (osteoblastic)
2. Osteoblastoma
3. Osteoid osteoma
4. Stress-induced
   a. Congenital absence or hypoplasia of contralateral posterior elements
   b. Malalignment of apophyseal joints
   c. Spondylolisthesis

UNCOMMON
1. Idiopathic
2. Lymphoma
3. Osteosarcoma; Ewing sarcoma
4. Paget’s disease
5. Posttraumatic (healed fracture)

References

Gamut C-43

SMALL OR NARROW INTERVERTEBRAL FORAMEN

COMMON
1. Degenerative or posttraumatic arthritis with hypertrophic bony ridging and spurring

UNCOMMON
1. Diastematomyelia
2. Fused vertebra
3. Klippel-Feil S.
4. Meningomyelocele
5. Posterior subluxation of cervical spine
6. Unilateral bar resulting in scoliosis

Reference
**Gamut C-44**

**ENLARGED INTERVERTEBRAL FORAMEN**

**COMMON**
1. Congenital with other anomalies
2. Neurofibroma

**UNCOMMON**
1. Congenital absence or hypoplasia of pedicle or neural arch
2. Dermoid; teratoma
3. Dejerine-Sottas S. (hypertrophic interstitial polyneuritis)
4. Dural ectasia (eg, idiopathic; neurofibromatosis; Marfan S.; Ehlers-Danlos S.)
5. Fibroma of spinal ligaments
6. Hydatid disease
7. Lateral thoracic meningocele
8. Lymphoma
g
9. Metastasis to spine or nerve
10. Neuroblastoma, ganglioneuroma (dumbbell tumors)
11. Neurofibromatosis (bony dysplasia; dural ectasia)
12. Postsurgical
13. Posttraumatic (eg, fracture; avulsed nerve root “diverticulum”)
14. Primary neoplasm of spine or spinal cord (eg, chor-doma; meningioma; lipoma)
15. Spondylolysis
16. Vertebral artery aneurysm or tortuosity (eg, coarctation of aorta)

**References**

**Gamut C-45-1**

**DEFECTIVE OR DESTROYED POSTERIOR NEURAL ARCHES—CONGENITAL DEFECTS**

1. Defect in posterior arch of C1 (rarely C2 or other vertebrae)
2. Diastematomyelia
3. Meningocele; meningomyelocele; sacral dimple
4. [Normal synchondroses between body and arches seen on oblique views]
5. Spina bifida occulta (usually L5 or S1)
6. Spondylolysis

* Note: Must differentiate the normal synchondrosis occurring between the dens and arch of C2 from a hangman’s fracture.
+ Believed to be due to stress fractures but may have a tendency to occur with some frequency in hypoplastic neural arches

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**

**Gamut C-45-2**

**DEFECTIVE OR DESTROYED POSTERIOR NEURAL ARCHES—ACQUIRED DEFECTS OR DESTRUCTION**

1. Fracture with hyperextension injury (eg, hangman’s fracture of C2)
2. Hydatid disease

(continued)
3. Langerhans cell histiocytosis
4. Metastasis
5. Multiple myeloma
6. Osteomyelitis
7. Primary neoplasm of spine (eg, hemangioma; aneurysmal bone cyst; osteoblastoma; osteoid osteoma; giant cell tumor; Ewing sarcoma; other bone sarcoma)
8. Spondylolysis, spondylolisthesis (pars interarticularis defects or stress fractures)

References

Gamut C-46-1

SPINA BIFIDA OCCULTA*

COMMON
1. Isolated anomaly

UNCOMMON
1. Aarskog S.
2. Aicardi S.
3. Bardet-Biedl S.
4. Dermoid (intraspinal)
5. Diastematomyelia
6. Dorsal dermal sinus
7. Epidermoid cyst
8. Fanconi anemia
9. Filum terminale lipoma
10. Freeman-Sheldon S. (whistling face S.)
11. Gorlin S. (nevus basal cell carcinoma S.)
12. Hallermann-Streiff S. (oculo-mandibulo-facial S.)
13. Klinefelter S. (XXY S.)
14. Klippel-Feil S.
15. LEOPARD S.
16. Lipomeningocele
17. Meningocele
18. Otopalatodigital S. (type I)
19. Split notochord S.
20. Tethered cord S.
21. Wildervanck S.

* Skin-covered defect in posterior neural arch, commonly seen in the lower lumbar spine or upper sacrum and rarely associated with neurologic defect by itself.

References

Gamut C-46-2

SPINA BIFIDA APERTA*

1. Meningocele
2. Meningomyelocele
3. Myelocele
4. Myeloschisis

* Incomplete fusion of posterior elements of vertebrae and overlying soft tissues; posterior protrusion of all or parts of the contents of the spinal canal through a bony spina bifida; almost always associated with neurologic defect.

Reference

Gamut C-47

SACRAL AGENESIS OR HYPOPLASIA

1. Caudal regression S. or mermaid S. (sirenomelia) (usually in infants of diabetic mothers)
2. Fanconi anemia
3. Femoral-facies S.
4. Oculo-auriculo-vertebral spectrum (Goldenhar S.)
5. Roberts S.
6. Silver-Russell S.
7. Teratoma (presacral)

References

Gamut C-48-1

SACRAL DEFORMITY
(Curved or Sickle-Shaped Sacrum)

1. Currarino triad
2. Imperforate anus
3. Meningocele (anterior, lateral, or intrasacral)
4. Teratoma (presacral)
5. Tethered cord S. (often with spinal lipoma)

References

Gamut C-49-1

SACROILIAC JOINT DISEASE
(EROSION, WIDENING, SCLEROSIS AND/OR FUSION)

COMMON
*1. Ankylosing spondylitis
*2. Infectious arthritis or osteomyelitis (eg, pyogenic; tuberculous)
+3. Osteitis condensans ili
4. Osteoarthritis, degenerative or posttraumatic
*5. Psoriatic arthritis
*6. Reiter S. (reactive arthritis)
7. Rheumatoid arthritis (incl. juvenile)

UNCOMMON
1. Agenesis (caudal dysplasia)
2. Behçet S.
3. Bone neoplasm of sacrum, primary (eg, giant cell tumor; chordoma; sarcoma) or metastatic

(continued)
4. Calcium pyrophosphate crystal deposition disease
5. Enteropathic arthritis due to inflammatory bowel disease (eg, ulcerative colitis; Crohn’s disease; Whipple’s disease)
6. Familial Mediterranean fever (familial recurrent polyserositis)
*7. Gaucher’s disease
8. Gout
+9. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
+10. Leukemia; lymphoma
+11. Multicentric reticulohistiocytosis (lipoid dermatitis)
*12. Occupational acro-osteolysis (eg, polyvinylchloride osteolysis)
*13. Paraplegia, paralysis
14. Pseudohypoparathyroidism
*15. Relapsing polychondritis
16. SAPHO S.
17. Sacroilitis circumscripta

* Fusion of sacroiliac joint(s) may occur.
+ Usually unilateral symmetrical.

References

Gamut C-49-2

SACROILIAC JOINT ABNORMALITIES—SYMMETRICAL VS. ASYMMETRICAL AND UNILATERAL VS. BILATERAL

SYMOMETRICAL INVOLVEMENT
COMMON
1. Ankylosing spondylitis
2. Inflammatory bowel disease (Crohn disease; ulcerative colitis; Whipple S.)
3. Osteitis condensans ilii
4. Osteoarthritis
5. Reiter/reactive disease
6. Rheumatoid arthritis (adult)

UNCOMMON
1. Behçet S.
2. Familial Mediterranean fever
3. Gout
4. Hyperparathyroidism
5. Juvenile rheumatoid arthritis
6. Mixed connective tissue disease (overlap S.)
7. Psoriatic arthritis
8. Relapsing polychondritis
9. SAPHO S.

ASYMMETRICAL INVOLVEMENT
COMMON
1. Osteoarthritis
2. Psoriatic arthritis
3. Reiter/reactive disease

UNCOMMON
1. Behçet S.
2. Familial Mediterranean fever
3. Gout
4. Infection
5. Juvenile rheumatoid arthritis
6. Mixed connective tissue disease (overlap S.)
7. Relapsing polychondritis
8. Rheumatoid arthritis (adult)
9. SAPHO S.

**UNILATERAL INVOLVEMENT**

**COMMON**
1. Infection
2. Osteoarthritis
3. Psoriatic arthritis
4. Reiter/reactive disease

**UNCOMMON**
1. Behçet S.
2. Familial Mediterranean fever
3. Gout
4. Juvenile rheumatoid arthritis
5. Mixed connective tissue disease (overlap S.)
6. Relapsing polychondritis
7. Rheumatoid arthritis (adult)
8. SAPHO S.

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**SACROCOCCYGEAL OR PRESACRAL MASS (See C-51)**

**COMMON**
1. Abscess (eg, rectal perforation from trauma or surgery; sinus tract from Crohn’s disease, ulcerative colitis, amebiasis, schistosomiasis, tuberculosis, or lymphogranuloma venereum)
2. Bone cyst or neoplasm, benign (eg, aneurysmal bone cyst; giant cell tumor)
3. Carcinoma of prostate
4. Hematoma; fracture
5. Malignant neoplasm of sacrum (eg, chordoma; sarcoma; metastasis; myeloma)
6. Normal variant or after pelvic surgery
7. Teratoma; dermoid cyst

**UNCOMMON**
1. Arachnoid, extradural, or perineural cyst
2. Ectopic kidney
3. Hamartoma
4. Hydatid cyst
5. Hydroureter; urinoma
6. Intraspinal neoplasm, other (eg, ependymoma; lipoma)
7. Lymphocele
8. Lymphoma
9. Meningocele (anterior sacral)
10. Neurenteric cyst
11. Neurofibromatosis I
12. Neurogenic tumor
13. Osteomyelitis of sacrum
14. Ovarian cyst or neoplasm; tubo-ovarian abscess
15. Rectal duplication

**References**
**Gamut C-51**

**SACRAL NEOPLASM (See C-50)**

**BENIGN**

**COMMON**
1. Aneurysmal bone cyst
2. Benign neurogenic tumor (neurofibroma; neurilemmoma); notochordal rest
3. Giant cell tumor
4. Teratoma (sacroccocygeal)

**UNCOMMON**
1. Osteoblastoma
2. Osteochondroma
3. Osteoma

**MALIGNANT**

**COMMON**
1. Chondrosarcoma
2. Chordoma
3. Ewing sarcoma
4. Lymphoma
5. Metastasis (esp. from carcinoma of breast, prostate, kidney, colon, or cervix)
6. Multiple myeloma; plasmacytoma

**UNCOMMON**
1. Fibrosarcoma; malignant fibrous histiocytoma
2. Malignant giant cell tumor
3. Malignant peripheral nerve sheath tumor (MPNST); neuroblastoma
4. Osteosarcoma
5. Paget’s sarcoma
6. Radiation-induced sarcoma

References

**Gamut C-52**

**NARROW DISK SPACES**

**COMMON**
1. Ankylosing spondylitis
2. Block vertebra, congenital or acquired (See C-25)
3. Degenerative disk disease (usually associated with osteoarthritis)
4. Discitis; spondylarthritis (juvenile)
5. Herniated disk
6. Kyphosis; scoliosis (severe)
7. Neuropathic arthropathy (eg, diabetes; syringomyelia; tabes dorsalis)
8. Osteomyelitis (eg, pyogenic; tuberculous; sarcoid; brucellar; typhoid)
9. Rheumatoid arthritis; other inflammatory arthritis
10. Scheuermann’s disease
11. Trauma (flexion-rotation injury)

**UNCOMMON**
1. Calcium pyrophosphate crystal deposition disease
2. Cockayne S.
3. Kniest dysplasia
4. Morquio S.
5. Neoplasm (rarely)
6. Ochronosis (alkaptonuria)
7. Ruvalcaba S.
8. Spondyloepiphyseal dysplasia tarda

* Often with adjacent sclerosis of the vertebral margins.

References

**Gamut C-53**

**WIDE DISK SPACES**

1. Acromegaly
2. Biconcave vertebrae (See C-19)
3. Calcific discitis
4. Endplate infarction (eg, sickle cell disease; Gaucher’s disease)
5. Osteomalacia (See D-44)
6. Osteoporosis (See D-43-1)
7. Platyspondyly (esp. Morquio S.; osteogenesis imperfecta; cretinism; metatropic dysplasia) (See C-15)
8. Trauma (hyperextension injury to spine)

**Reference**

**Gamut C-54**

**TUMORS THAT CAN CROSS THE INTERVERTEBRAL DISK**

**COMMON**
1. Chondroma
2. Chondrosarcoma
3. Lymphoma

**UNCOMMON**
1. Ewing sarcoma
2. Giant cell tumor

3. Metastasis
4. Myeloma

**Reference**

**Gamut C-55**

**CALCIFICATION OF ONE OR MORE INTERVERTEBRAL DISKS**

**COMMON**
*1. Degenerative spondylosis
2. Idiopathic (eg, transient calcification in children, esp. in cervical spine; persistent type in adults)
*3. Ochronosis (alkaptonuria)
*4. Posttraumatic
5. Spinal fusion (eg, congenital block vertebra; Klippel-Feil S.; fibrodysplasia {myositis} ossificans progressiva; surgical fusion)

**UNCOMMON**
1. Aarskog S.
2. Acromegaly
3. Amyloidosis
*4. Ankylosing spondylitis
5. Calcium pyrophosphate dihydrate deposition disease
6. Chondrocalcinosis; other causes (See D-242)
7. Cockayne S.
8. Diffuse idiopathic skeletal hyperostosis (DISH)
9. Gout
10. Hemochromatosis
11. Homocystinuria
12. Hypercalcemia
13. Hyperparathyroidism
14. Hypervitaminosis D
15. Hypophosphatasia
*16. Infection (eg, brucellosis)

(continued)
17. Mucolipidosis II (I-cell disease)
18. Paraplegia; poliomyelitis
19. Rheumatoid spondylitis (incl. juvenile chronic arthritis)
20. Spondyloepiphyseal dysplasia tarda
21. Wilson disease

* Can cause disk ossification.

References

Gamut C-56

GAS IN AN INTERVERTEBRAL DISK (VACUUM DISK)*

COMMON
1. Degeneration of nucleus pulposus
2. Schmorl’s nodes (intraosseous herniation of disk) (on CT)
3. Spondylosis deformans

UNCOMMON
1. Fractured vertebra
2. Metastatic disease to adjacent vertebra with vertebral collapse
3. Osteomyelitis of vertebra (rare)
4. Osteonecrosis with vertebral collapse (Kömmell’s disease)

* Nitrogen gas from surrounding tissues enters into clefts of a disk with an abnormal nucleus pulposus or annulus attachment.

References

Gamut C-57

CONGENITAL SYNDROMES AND BONE DYSPLASIAS WITH A NARROW SPINAL CANAL (NARROW INTERPEDICULAR DISTANCE): SPINAL STENOSIS

COMMON
1. Achondroplasia; hypochondroplasia
2. Acromegaly
3. Diastrophic dysplasia
4. Klippel-Feil S.

UNCOMMON
1. Acrodyostosis (peripheral dysostosis)
2. Acromesomelic dysplasia
3. Alagille S. (arteriohepatic S.)
4. Brachyolmia
5. Calcium pyrophosphate crystal deposition disease
6. Cauda equina S. (narrow lumbar spinal canal S.)
7. Cerebrocostomandibular S.
8. Chondroectodermal dysplasia (Ellis-van Creveld S.)
9. Dyggve-Melchior-Clausen dysplasia (Smith-McCort S.)

Gamut C-56

GAS IN AN INTERVERTEBRAL DISK (VACUUM DISK)*

COMMON
1. Degeneration of nucleus pulposus
2. Schmorl’s nodes (intraosseous herniation of disk) (on CT)
3. Spondylosis deformans

UNCOMMON
1. Fractured vertebra
2. Metastatic disease to adjacent vertebra with vertebral collapse
3. Osteomyelitis of vertebra (rare)
4. Osteonecrosis with vertebral collapse (Kömmell’s disease)

* Nitrogen gas from surrounding tissues enters into clefts of a disk with an abnormal nucleus pulposus or annulus attachment.

References
10. Dyschondrosteosis
11. Gordon S.
12. Kniest dysplasia
13. Metatropic dysplasia
14. Mucolipidosis II (early infancy)
15. Osteoglophonic dysplasia
16. Pseudohypoparathyroidism; pseudopseudohypo-
aparathyroidism
17. Robinow S.
18. Schneckenbecken dysplasia
19. Spondylometaphyseal dysplasia
20. Stickler S.
21. Thanatophoric dysplasia
22. Trisomy 8 S.
23. Turner S.
24. Weill-Marchesani S.

References
1. Kozlowski K, Beighton P: Gamut Index of Skeletal Dys-
2. Taybi H, Lachman RS: Radiology of Syndromes, Metabolic
Disorders, and Skeletal Dysplasias. (ed 4) St. Louis: Mosby-
Year Book Inc., 1996, p 1047

Gamut C-58
WIDE SPINAL CANAL (INCREASED
INTERPEDICULAR DISTANCE)
(See C-59, 61)

COMMON
1. Intraspinal neoplasm (eg, ependymoma; astrocy-
toma; neurofibroma; lipoma) or cyst
2. Meningocele; meningomyelocele
3. [Rotation of vertebra due to scoliosis or poor radio-
graphic positioning]

UNCOMMON
1. Arteriovenous malformation
2. Diastematomyelia
3. Frontometaphyseal dysplasia

4. Idiopathic
5. Marfan S.
Morquio S.)
7. Neurofibromatosis I; dural ectasia
8. Otopalatom digital S. (type I)
9. Syringomyelia; hydromyelia
10. Tethered cord S.

[] This condition does not actually cause the gamuted imaging finding,
but can produce imaging changes that simulate it.

Reference
1. Taybi H, Lachman RS: Radiology of Syndromes, Metabolic
Disorders, and Skeletal Dysplasias. (ed 4) St. Louis: Mosby-
Year Book Inc., 1996, p 1047

Gamut C-59
INTRAMEDULLARY LESION
(WIDENING OF SPINAL CORD ON
MYELOGRAPHY, CT, OR MR)

COMMON
1. [Extrinsic compression (eg, by cervical ridge; herni-
ated disk; large extramedullary or extradural tumor)]
2. Infection (eg, abscess; myelitis—viral or bacterial;
HIV; Lyme disease; cytomegalovirus; progressive
multifocal leukoencephalopathy {PML})
3. Inflammation (eg, multiple sclerosis; acute trans-
verse myelitis; acute disseminated en-
cephalomyelitis {ADEM}; Devic S.)
4. Intramedullary tumor (esp. ependymoma and astro-
cytoma; also rarely oligodendroglioma; gangli-
glioma; hemangioblastoma; primary melanoma; lipoma; lymphoma)
5. Syringomyelia; hydromyelia

UNCOMMON
1. Arteriovenous malformation; angioma
2. Dermoid; teratoma; epidermoid

(continued)
3. Diastematomyelia
4. Granuloma (eg, sarcoidosis; tuberculosis)
5. Hematoma, contusion, or edema of cord (post-traumatic or anticoagulant therapy)
6. Infarct of spinal cord (eg, anterior spinal artery infarct; venous infarct/ischemia)
7. Meningomyelocele
8. Metastasis (eg, breast, lung, melanoma); drop metastasis through the central canal (eg, medulloblastoma)
9. Postradiation myelopathy
10. [Spinal cord atrophy] (See C-60)
11. Transection of cord

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut C-60

SPINAL CORD ATROPHY

COMMON
1. Amyotrophic lateral sclerosis
2. Multiple sclerosis
3. Posttraumatic
4. Spondylosis; disk hernation (esp. cervical)
5. Syringomyelia, hydromyelia (after collapse)

UNCOMMON
1. Arteriovenous malformation of cord
2. Friedreich’s ataxia
3. Ischemia with cord infarction
4. Other motor neuron disease or motor and sensory neuropathies
5. Postradiation myelopathy
6. Subacute combined degeneration
7. Tabes dorsalis

Reference

Gamut C-61

INTRADURAL, EXTRAMEDULLARY LESION (ON MYELOGRAPHY, CT, OR MR)

COMMON
1. Arachnoiditis (See C-62)
2. Meningioma
3. Metastasis, esp. leptomeningeal “drop” seeding from CNS tumor (eg, medulloblastoma; glioblastoma; pinealoma; ependymoma; PNET) or hematogenous (eg, from carcinoma of lung or breast; melanoma; lymphoma)
4. Neurofibroma

UNCOMMON
1. Arachnoid cyst
2. Cysticercosis (cysts)
3. Dermoid; teratoma; epidermoid
4. Ependymoma of filum terminale
5. Granuloma (eg, tuberculoma; fungal—aspergilloma; sarcoid)
6. Hemangioblastoma; hemangiopericytoma
7. Lipoma (lipomyeloschisis)
8. Meningocele
9. Neurenteric cyst
10. Tortuosity of nerve roots
11. Vascular malformation; angioma; varices

Reference

Gamut C-62
ARACHNOIDITIS

1. Cysticercosis
2. Pantopaque myelography
3. Postoperative
4. Posttraumatic
5. Spinal meningitis
   a. Bacterial
   b. Fungal
   c. HIV 1
   d. Sarcoid
   e. Tuberculotic

Gamut C-63
EXTRADURAL LESION (ON MYELOGRAPHY, CT, OR MR)

COMMON
1. Dermoid; teratoma; epidermoid
2. Disk disease (bulging disk; herniated or sequestered nucleus pulposus)
3. Epidural metastasis (eg, lymphoma)
4. Epidural scar (eg, after disk surgery)
5. Fracture fragment or dislocation from vertebral trauma
6. Hematoma (traumatic, spontaneous, or bleeding hemangioma)
7. [Iatrogenic (needle point defect; extradural injection of Pantopaque)]
8. Ligamentum flavum thickening; intraspinal ligament ossification (eg, DISH; primary—esp. in Japanese)
9. Lipomatosis (obesity; steroid therapy; Cushing S.)
10. Meningioma (with intradural component)
11. Metastasis (esp. from carcinoma of lung, breast, prostate, or colon)
12. Neurogenic tumor (esp. neurofibroma with intradural component; also ganglioneuroma; ganglioneuroblastoma; neuroblastoma)
13. Osteomyelitis; epidural abscess (esp. tuberculous; pyogenic)
14. Spinal stenosis; spondylosis; osteophyte
15. Vertebral neoplasm with intraspinal extension (eg, sarcoma; myeloma; chordoma; hemangioma; giant cell tumor; aneurysmal bone cyst; osteoblastoma; osteochondroma)

UNCOMMON
1. Amyloidosis
2. Arachnoid cyst
3. Arachnoiditis (See C-62)
4. Epidural granuloma (eg, tuberculous; fungal; sarcoïd)
5. Extramedullary hematopoiesis
6. Lipoma; fibroma
7. Paget’s disease
8. Parasitic infection (eg, cysticercosis; hydatid disease; schistosomiasis)
9. Retroperitoneal neoplasm extending through intervertebral foramen (eg, neuroblastoma; lymphoma)

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

(continued)
SPINAL BLOCK
(ON MYEOGRAPHY, CT, OR MR)

COMMON
1. Fracture, traumatic or pathologic
2. Hemorrhage (traumatic; spontaneous; anticoagulant therapy)
3. Herniated disk
4. Intervertebral joint disorder
5. Metastasis or contiguous spread of malignancy
6. Neoplasm of spine, primary (eg, sarcoma; myeloma; chordoma; giant cell tumor)
7. Neurogenic tumor (esp. neurofibroma)
8. Spinal stenosis

UNCOMMON
1. Abscess, epidural
2. Achondroplasia
3. Arachnoiditis (See C-62)
4. Cyst of spinal canal (eg, congenital; arachnoid; dermoid; Cysticercus; hydatid)
5. Fibrous dysplasia
6. Granuloma (eg, tuberculosis; schistosomiasis)
7. Hemangioma of vertebra
8. Intramedullary lesion, large (eg, syringomyelia; ependymoma; lipoma)
9. Klippel-Feil S.
10. Lipoma of canal
11. Lymphoma

12. Meningioma
13. Osteomyelitis of spine
14. Paget’s disease

References

TORTUOUS FILLING DEFECT ON LUMBAR MYEOGRAPHY

COMMON
1. Nerve root elongation, redundancy, or displacement
   (eg, spinal stenosis or arthrosis; disk herniation; achondroplasia)

UNCOMMON
1. Arachnoiditis (See C-62)
2. Extradural or intradural neoplasm
3. Multiple lesions at same or adjacent levels
4. Vascular abnormality (eg, arteriovenous malformation; venous angioma; varices)

Reference
### I. BONE—GENERALIZED

#### GROWTH OR MODELING DISORDERS

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**D-206**  Short Lesion of a Rib (Under 6 cm) (See D-207)

**D-207**  Long Lesion of a Rib (Over 6 cm—Usually Expansile) (See D-206)

**D-208**  Multiple Expanding Rib Lesions

**D-209-1**  Congenital Sternal Abnormality—Hypersegmentation or Undersegmentation (often with Hypoplasia and Premature Fusion)

**D-209-2**  Pectus Carinatum (Pigeon Breast) (Same as F-129)

**D-209-3**  Pectus Excavatum (Same as F-130)

**D-210**  Erosion, Sclerosis, and/or Fusion of the Sternoanubrial Synchondrosis or Sternoclavicular Joints

**III. JOINTS**

**D-211**  Congenital Syndromes with Limited Joint Mobility or Contractures

**D-212**  Congenital Syndromes with Joint Laxity or Hypermobility

**D-213**  Congenital Syndromes with Joint Dislocation or Subluxation (See D-212)

**D-214**  Monoarticular Joint Disease

**D-215**  Polyarticular Joint Disease

**D-216**  Arthritis Occurring Predominantly in Men

**D-217**  Transient Arthritis or Arthralgias

**D-218**  Rheumatoid-like Arthritis

**D-219-S**  Classification of Juvenile Chronic Arthritis

**D-220**  Degenerative Joint Disease in a Young Adult (Premature Osteoarthritis)

**D-221**  Secondary Osteoarthritis of the Hip
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-222-S1</td>
<td>Local Complications of Total Hip, Knee, or Other Joint Arthroplasty</td>
</tr>
<tr>
<td>D-222-S2</td>
<td>Imaging Findings Suggesting Loosening and/or Infection of Joint Arthroplasty</td>
</tr>
<tr>
<td>D-223</td>
<td>Neuropathic Arthropathy (including Charcot Joint)</td>
</tr>
<tr>
<td>D-224-1</td>
<td>Bilateral Symmetrical Sacroiliac Joint Disease</td>
</tr>
<tr>
<td>D-224-2</td>
<td>Bilateral Asymmetrical Sacroiliac Joint Disease</td>
</tr>
<tr>
<td>D-224-3</td>
<td>Unilateral Sacroiliac Joint Disease</td>
</tr>
<tr>
<td>D-225</td>
<td>Narrowed Joint Space (NOTE: Most arthritides cause joint space narrowing in their advanced stages)</td>
</tr>
<tr>
<td>D-226</td>
<td>Widened Joint Space (NOTE: Many arthritides cause joint space widening in their early stages)</td>
</tr>
<tr>
<td>D-227</td>
<td>Joint Effusion</td>
</tr>
<tr>
<td>D-228</td>
<td>Arthritis with Osteoporosis</td>
</tr>
<tr>
<td>D-229</td>
<td>Arthritis with Little or No Osteoporosis (Usually Ulnar Deviation in the Hands)</td>
</tr>
<tr>
<td>D-230</td>
<td>Arthritis with Multiple Joint Subluxations (Usually Ulnar Deviation in the Hands)</td>
</tr>
<tr>
<td>D-231</td>
<td>Arthritis with “Swan-Neck” Deformity</td>
</tr>
<tr>
<td>D-232</td>
<td>Arthritis Associated with Periostitis or Other New Bone Production</td>
</tr>
<tr>
<td>D-233</td>
<td>Calcaneal Spur (Plantar Surface)</td>
</tr>
<tr>
<td>D-234</td>
<td>Calcaneal Bone Resorption (Plantar or Posterior Surface)</td>
</tr>
<tr>
<td>D-235</td>
<td>Arthritis with Soft Tissue Nodules</td>
</tr>
<tr>
<td>D-236</td>
<td>Soft Tissue Mass About a Joint</td>
</tr>
<tr>
<td>D-237</td>
<td>Popliteal (Baker) Cyst</td>
</tr>
<tr>
<td>D-238</td>
<td>Benign Synovial Lesion Involving a Major Joint</td>
</tr>
<tr>
<td>D-239</td>
<td>Bone Lesions Involving Both Sides of a Joint</td>
</tr>
<tr>
<td>D-240</td>
<td>Multiple Filling Defects in the Knee or Other Joints on Arthrography</td>
</tr>
<tr>
<td>D-241</td>
<td>Calcified Intraarticular (Often Loose) Body in a Joint</td>
</tr>
<tr>
<td>D-242</td>
<td>Chondrocalcinosis (Calcification in Articular Cartilage)</td>
</tr>
<tr>
<td>D-243</td>
<td>Periarticular or Intraarticular Calcification (See D-241, 242)</td>
</tr>
</tbody>
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### IV. SOFT TISSUES

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<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>D-244</td>
<td>Soft Tissue Ossification</td>
</tr>
<tr>
<td>D-245-1</td>
<td>Calcification in the Muscles and Subcutaneous Tissues—Systemic or Widespread (See D-247–249)</td>
</tr>
<tr>
<td>D-245-2</td>
<td>Calcification in the Muscles and Subcutaneous Tissues—Localized (See D-246–251)</td>
</tr>
<tr>
<td>D-246-1</td>
<td>Calcification in a Bursa</td>
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<tr>
<td>D-246-2</td>
<td>Calcification in a Tendon or Ligament</td>
</tr>
<tr>
<td>D-246-3</td>
<td>Calcification in a Nerve</td>
</tr>
<tr>
<td>D-247</td>
<td>Vascular Calcification</td>
</tr>
<tr>
<td>D-248</td>
<td>Calcification About the Fingertips</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>D-249</td>
<td>Calcification in Lymph Nodes</td>
</tr>
<tr>
<td>D-250</td>
<td>Solitary Large Calcified Soft Tissue Mass Adjacent to Bone (See D-243–246; D-261)</td>
</tr>
<tr>
<td>D-251</td>
<td>Soft Tissue Mass with Underlying Bone Erosion or Destruction</td>
</tr>
<tr>
<td>D-252</td>
<td>Musculoskeletal Lesions with Prominent Surrounding Edema (CT, MRI)</td>
</tr>
<tr>
<td>D-253</td>
<td>Musculoskeletal Lesions with Predominant Lower Signal on T2-Weighted MRI</td>
</tr>
<tr>
<td>D-254-S</td>
<td>Classification of Soft Tissue Tumors</td>
</tr>
<tr>
<td>D-255</td>
<td>Benign Soft Tissue Tumors: Incidence</td>
</tr>
<tr>
<td>D-256</td>
<td>Malignant Soft Tissue Tumors: Incidence</td>
</tr>
<tr>
<td>D-257-S</td>
<td>Round Cell Lesions of Soft Tissue</td>
</tr>
<tr>
<td>D-258-1</td>
<td>Common Soft Tissue Tumors in Children (&lt;16 years of age)</td>
</tr>
<tr>
<td>D-258-2</td>
<td>Common Soft Tissue Tumors in Young Adults (16–45 years of age)</td>
</tr>
<tr>
<td>D-258-3</td>
<td>Common Soft Tissue Tumors in Older Adults (Over 45 years of age)</td>
</tr>
<tr>
<td>D-259-1</td>
<td>Soft Tissue Tumors by Location: Subcutaneous</td>
</tr>
<tr>
<td>D-259-2</td>
<td>Soft Tissue Tumors by Location: Intermuscular</td>
</tr>
<tr>
<td>D-259-3</td>
<td>Soft Tissue Tumors by Location: Intramuscular</td>
</tr>
<tr>
<td>D-259-4</td>
<td>Soft Tissue Tumors by Location: Intraarticular or Juxtaarticular</td>
</tr>
<tr>
<td>D-260</td>
<td>Soft Tissue Tumors That Can Be Multifocal</td>
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<tr>
<td>D-261</td>
<td>Soft Tissue Tumors with Associated Calcification or Ossification</td>
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<tr>
<td>D-262</td>
<td>“Cystic” Soft Tissue Tumors (CT, MRI)</td>
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<tr>
<td>D-263</td>
<td>Soft Tissue Tumors with Prominent Fluid-fluid Levels (CT, MRI)</td>
</tr>
<tr>
<td>D-264</td>
<td>Soft Tissue Tumors with Prominent Visible Vascularity (CT, MRI)</td>
</tr>
<tr>
<td>D-265-S1</td>
<td>Staging of Musculoskeletal Tumors: Enneking Staging of Sarcomas of Soft Tissue and Bone</td>
</tr>
<tr>
<td>D-265-S2</td>
<td>American Joint Commission Staging Protocol for Sarcomas of Soft Tissue</td>
</tr>
<tr>
<td>D-265-S3</td>
<td>Hadju Classification of Soft Tissue Sarcomas</td>
</tr>
<tr>
<td>D-266-S</td>
<td>Rates of Recurrence from Common Soft Tissue Sarcomas</td>
</tr>
<tr>
<td>D-267-1</td>
<td>Diseases Affecting Muscle to Fat Ratio—Decreased muscle mass, often increased fat</td>
</tr>
<tr>
<td>D-267-2</td>
<td>Diseases Affecting Muscle to Fat Ratio—Diminution in subcutaneous fat</td>
</tr>
<tr>
<td>D-267-3</td>
<td>Diseases Affecting Muscle to Fat Ratio—Increase in muscle mass; normal fat</td>
</tr>
</tbody>
</table>
D-267-4  Diseases Affecting Muscle to Fat Ratio—Increase in fat; normal muscle
D-268  Thickening of Heel Pad (Greater than 23 mm)
D-269  Soft Tissue Emphysema or Gas
D-270  Swelling of the Soft Tissue Interstitial Markings (“Reticulation” of Soft Tissues)
D-271  Lymphangiectasia (Lymphatic Vessel Dysplasia)
D-272  Lymphatic Obstruction on Lymphangiogram (Lymphedema)
D-273-S  Roentgen Signs of Lymphatic Channel Obstruction
D-274  Filling Defect in Lymph Node on Lymphangiogram
1. Achondroplasia group

Osteochondrodysplasia                       Mode of Inheritance*
Thanatophoric dysplasia,                  AD
     Type I (includes San Diego Type)       AD
Thanatophoric dysplasia, Type II           AD
Achondroplasia                             AD
Hypochondroplasia                          AD
Hypochondroplasia                          AD
SADDAN (severe achondroplasia,              AD
    developmental delay, acanthosis nigricans)
2. Severe Spondylodyplastic dysplasias      SP
Lethal platyspondylic skeletal dysplasias   SP
    (Torrance Type, Luton Type)
Achondrogenesis Type 1A                    AR
Opsismodysplasia                           AR
SMD Sedaghatian Type                       AR
3. Metatropic dysplasia group               AR
Fibrochondrogenesis                        AR
Schneckenbecken dysplasia                  AR
Metatropic dysplasia (various forms)       AD
4. Short-rib dysplasia (SRP)                AR
    (with or without polydactyly) group     AR
SRP type I/III (Saldino-Noonan/            AR
    Verma-Naumoff)
SRP type II (Majewski)                     AR
SRP type IV (Beemer)                       AR
Asphyxiating thoracic dysplasia (Jeune)    AR
Chondroectodermal Dysplasia                AR
    (Ellis-van Creveld dysplasia)
Thoracolaryngopelvic dysplasia (Barnes)    AD
5. Atelosteogenesis-Omody’splasia group     AD
Osteochondrodysplasia                      Mode of Inheritance*
Atelosteogenesis type I (includes         SP
    “Bommerang dysplasia”)                  AD
Omody’splasia I (Maroteaux)                AD
Omody’splasia II (Borochowitz)             AR
Atelosteogenesis Type III                  AD
de la Chapelle dysplasia                   AD
6. Diastrophic dysplasia group             AR
Achondrogenesis 1B                         AR
Diastrophic dysplasia                      AR
MED Autosomal Recessive Type               AR
7. Dyssegmental dysplasia group             AR
Dyssegmental dysplasia, Silverman-         AR
    Handmaker Type
Dyssegmental dysplasia, Rolland-           AR
    Desbuquois Type
8. Type II collagenopathies                AR
Achondrogenesis II (Langer-Saldino)        AR
Hypochondrogenesis                         AR
Spondyloepiphyseal dysplasia (SED)         AR
    congenita
Spondyloepimetaepiphyseal dysplasia        AR
    (SEMD) Strudwick Type
Kniest dysplasia                           AR
SEDNamaqualand Type                        AR
Spondyloepimeral dysplasia                 AR
Mild SED with premature onset arthrosis    AD
Stickler dysplasia Type I                  AD
9. Type XI collagenopathies                AR
Stickler dysplasia Type II                 AD
Stickler dysplasia Type III                AD
Marshall syndrome                          AD
Otospondyloepimepiphysial dysplasia        AR
    (OSMED)
Otospondyloepimepiphysial dysplasia        AD
    (OSMED)
(continued)
## 10. Other spondyloepi-(meta)-physeal [SE(M)D] dysplasias

### Mode of Osteochondrodysplasia Inheritance*

<table>
<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Inheritance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-linked SED tarda</td>
<td>XLD</td>
</tr>
<tr>
<td>SEMD Handigodu Type</td>
<td>AD?</td>
</tr>
<tr>
<td>Progressive pseudorheumatoid dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Dyggve-Melchior-Clausen dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Wolcott-Rallison dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Immuno-osseous dysplasia (Schimke)</td>
<td>AR</td>
</tr>
<tr>
<td>Schwartz-Jampel syndrome</td>
<td>AR</td>
</tr>
<tr>
<td>SEMD with joint laxity (SEMDJL)</td>
<td>AR</td>
</tr>
<tr>
<td>SEMD with multiple dislocations (Hall) (leptodactylic Type)</td>
<td>AR</td>
</tr>
<tr>
<td>SPONASTRIME dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>SEMD short limb - abnormal calcification type</td>
<td>AR</td>
</tr>
<tr>
<td>SEMD Pakistani Type</td>
<td>AR</td>
</tr>
<tr>
<td>Anauxetic dysplasia</td>
<td>AR</td>
</tr>
</tbody>
</table>

## 11. Multiple epiphyseal dysplasia & pseudoachondroplasia

<table>
<thead>
<tr>
<th>Pseudoachondroplasia</th>
<th>AD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple epiphyseal dysplasia (MED)</td>
<td>AD</td>
</tr>
<tr>
<td>(Fairbanks and Ribbing Types)</td>
<td>AD</td>
</tr>
<tr>
<td>Familial hip dysplasia (Beukes)</td>
<td>AD</td>
</tr>
</tbody>
</table>

## 12. Chondrodysplasia punctata (CDP) (stippled epiphyses group)

<table>
<thead>
<tr>
<th>Rhizomelic CDP Type 1</th>
<th>AR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhizomelic CDP Type 2</td>
<td>AR</td>
</tr>
<tr>
<td>Rhizomelic CDP Type 3</td>
<td>AR</td>
</tr>
<tr>
<td>CDP Conrad-Hünernmann Type</td>
<td>XLD</td>
</tr>
<tr>
<td>CDP X-linked recessive Type (brachytelephalangic)</td>
<td>XLR</td>
</tr>
<tr>
<td>CDP Tibia-metacarpal Type</td>
<td>AD</td>
</tr>
<tr>
<td>CHILD (limb-reduction-ichthyosis)</td>
<td>XLD</td>
</tr>
<tr>
<td>CHILD (limb-reduction-ichthyosis)</td>
<td>XLD</td>
</tr>
<tr>
<td>Hydrops-ectopic calcification-moth-eaten appearance HEM (Greenberg dysplasia)</td>
<td>AR</td>
</tr>
<tr>
<td>Dappled diaphyseal dysplasia</td>
<td>AR</td>
</tr>
</tbody>
</table>

## 13. Metaphyseal dysplasias

### Mode of Inheritance*

<table>
<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Inheritance*</th>
</tr>
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<tbody>
<tr>
<td>Jansen Type</td>
<td>AD</td>
</tr>
<tr>
<td>Schmid Type</td>
<td>AD</td>
</tr>
<tr>
<td>Cartilage-Hair-Hypoplasia (McKusick)</td>
<td>AR</td>
</tr>
<tr>
<td>Metaphyseal anadysplasia (various types)</td>
<td>AD/XLD</td>
</tr>
<tr>
<td>Metaphyseal dysplasia with pancreatic insufficiency and cyclic neutropenia (Shwachmann Diamond)</td>
<td>AR</td>
</tr>
<tr>
<td>Adenosine deaminase (ADA) deficiency</td>
<td>AR</td>
</tr>
<tr>
<td>Metaphyseal chondrodysplasia Spahr Type</td>
<td>AR</td>
</tr>
<tr>
<td>Acroscyphodysplasia (various types)</td>
<td>AR</td>
</tr>
</tbody>
</table>

## 14. Spondylometaphyseal dysplasias (SMD)

### Mode of Inheritance*

<table>
<thead>
<tr>
<th>Spondylometaphyseal dysplasia</th>
<th>Inheritance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spondylometaphyseal dysplasia Kozlowski Type</td>
<td>AD</td>
</tr>
<tr>
<td>Spondylometaphyseal dysplasia (Sutcliffe/corner fracture Type)</td>
<td>AD</td>
</tr>
<tr>
<td>SMD with severe genu valgum (includes Schmidt and Algerian Types)</td>
<td>AD</td>
</tr>
</tbody>
</table>

## 15. Brachyolmia spondylodysplasias

| Hobaek (includes Toledo Type) | AR |
| Maroteaux Type | AR |
| Autosomal dominant Type | AD |

## 16. Mesomelic dysplasias

| Dyschondrosteosis (Leri-Weill) | AD |
| Langer type (homozygous dyschondrosteosis) | AR |
| Nievergelt Type | AD |
| Kozlowski-Reardon Type | AR |
| Reinhardt-Pfeiffer Type | AD |
| Werner Type | AD |
| Robinow Type, dominant | AD |
| Robinow Type, recessive | AR |
| Mesomelic dysplasia with synostoses | AD |
| Mesomelic dysplasia Kantaputra Type | AD |
| Mesomelic dysplasia Verloes Type | AD |
| Mesomelic dysplasia Savarirayan Type | AD |
### 17. Acromelic dysplasias

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<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Mode of Inheritance*</th>
</tr>
</thead>
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<tr>
<td>Acromicric dysplasia</td>
<td>AD</td>
</tr>
<tr>
<td>Geleophysic dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Myhre dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Weill-Marchesani dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Trichorhinophalangeal dysplasia Types I/III</td>
<td>AD</td>
</tr>
<tr>
<td>Trichorhinophalangeal dysplasia Type II (Langer-Giedion)</td>
<td>AD</td>
</tr>
<tr>
<td>Brachydactyly Type A1</td>
<td>AD</td>
</tr>
<tr>
<td>Brachydactyly Type A2</td>
<td>AD</td>
</tr>
<tr>
<td>Brachydactyly Type A3</td>
<td>AD</td>
</tr>
<tr>
<td>Brachydactyly Type B</td>
<td>AD</td>
</tr>
<tr>
<td>Brachydactyly Type C</td>
<td>AD</td>
</tr>
<tr>
<td>Brachydactyly Type D</td>
<td>AD</td>
</tr>
<tr>
<td>Brachydactyly Type E</td>
<td>AD</td>
</tr>
<tr>
<td>Pseudohypoparathyroidism (Albright Hereditary Osteodystrophy)</td>
<td>AD</td>
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<tr>
<td>Acrodysostosis</td>
<td>SP(AD)</td>
</tr>
<tr>
<td>Saldino-Mainzer dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Brachydactyly-hypertension dysplasia (Bilginturan)</td>
<td>AD</td>
</tr>
<tr>
<td>Craniofacial conodysplasia</td>
<td>AD</td>
</tr>
<tr>
<td>Angel-shaped phalango-epiphyseal dysplasia (ASPED)</td>
<td>AD</td>
</tr>
<tr>
<td>Camptodactyly arthropathy coxa vara pericarditis (CACP)</td>
<td>AR</td>
</tr>
<tr>
<td>Christian Brachydactyly</td>
<td>AD</td>
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### 18. Acromesomelic dysplasias

<table>
<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Mode of Inheritance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acromesomelic dysplasia Type Maroteaux</td>
<td>AR</td>
</tr>
<tr>
<td>Acromesomelic dysplasia Type Campailla-Martinelli</td>
<td>AR</td>
</tr>
<tr>
<td>Acromesomelic dysplasia Type Ferraz/Ohba Remondini</td>
<td>AD</td>
</tr>
<tr>
<td>Grebe dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Cranioectodermal dysplasia</td>
<td>AR</td>
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</tbody>
</table>

### 19. Dysplasias with predominant membranous bone involvement

<table>
<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Mode of Inheritance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleidocranial dysplasia</td>
<td>AD</td>
</tr>
<tr>
<td>Yunis-Varon dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Parietal foramina (isolated)</td>
<td>AD</td>
</tr>
<tr>
<td>Parietal foramina (isolated)</td>
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### 20. Bent-bone dysplasia group

<table>
<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Mode of Inheritance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campomelic dysplasia</td>
<td>AD</td>
</tr>
<tr>
<td>Cumming syndrome</td>
<td>AR</td>
</tr>
<tr>
<td>Stüve-Wiedemann dysplasia (neonatal Schwartz-Jampel)</td>
<td>AR</td>
</tr>
</tbody>
</table>

### 21. Multiple dislocations with dysplasias

<table>
<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Mode of Inheritance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Larsen syndrome</td>
<td>AD</td>
</tr>
<tr>
<td>Larsen-like syndromes (including La Reunion Island)</td>
<td>AR</td>
</tr>
<tr>
<td>Desbuquois dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Pseudodiastrophic dysplasia</td>
<td>AR</td>
</tr>
</tbody>
</table>

### 22. Dysostosis multiplex group

<table>
<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Mode of Inheritance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mucopolysaccharidosis III</td>
<td>AR</td>
</tr>
<tr>
<td>Mucopolysaccharidosis IS</td>
<td>AR</td>
</tr>
<tr>
<td>Mucopolysaccharidosis II</td>
<td>XLR</td>
</tr>
<tr>
<td>Mucopolysaccharidosis IIIA</td>
<td>AR</td>
</tr>
<tr>
<td>Mucopolysaccharidosis IIIB</td>
<td>AR</td>
</tr>
<tr>
<td>Mucopolysaccharidosis IIIC</td>
<td>AR</td>
</tr>
<tr>
<td>Mucopolysaccharidosis IIID</td>
<td>AR</td>
</tr>
<tr>
<td>Mucopolysaccharidosis IVA</td>
<td>AR</td>
</tr>
<tr>
<td>Mucopolysaccharidosis IVB</td>
<td>AR</td>
</tr>
<tr>
<td>Mucopolysaccharidosis VI</td>
<td>AR</td>
</tr>
<tr>
<td>Mucopolysaccharidosis VII</td>
<td>AR</td>
</tr>
<tr>
<td>Fucosidosis</td>
<td>AR</td>
</tr>
<tr>
<td>a-Mannosidosis</td>
<td>AR</td>
</tr>
<tr>
<td>b-Mannosidosis</td>
<td>AR</td>
</tr>
<tr>
<td>Aspartylglucosaminuria</td>
<td>AR</td>
</tr>
<tr>
<td>GM1 Gangliosidosis, several forms</td>
<td>AR</td>
</tr>
<tr>
<td>Sialidosis, several forms</td>
<td>AR</td>
</tr>
<tr>
<td>Sialic acid storage disease</td>
<td>AR</td>
</tr>
<tr>
<td>Galactosialidosis, several forms</td>
<td>AR</td>
</tr>
<tr>
<td>Multiple sulfatase deficiency</td>
<td>AR</td>
</tr>
<tr>
<td>Mucolipidosis II</td>
<td>AR</td>
</tr>
<tr>
<td>Mucolipidosis III</td>
<td>AR</td>
</tr>
</tbody>
</table>

(continued)
### 23. Low birthweight slender bone group

<table>
<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Mode of Inheritance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I microcephalic osteodysplastic dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Type II microcephalic osteodysplastic dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Microcephalic osteodysplastic dysplasia (Saul Wilson)</td>
<td>AR</td>
</tr>
<tr>
<td>3M syndrome</td>
<td>AR</td>
</tr>
</tbody>
</table>

### 24. Dysplasias with decreased bone density

| Osteogenesis imperfecta I (normal teeth) | AD |
| Osteogenesis imperfecta I (normal teeth) | AD |
| Osteogenesis imperfecta I (opalescent teeth) | AD |
| Osteogenesis imperfecta II | AD |
| Osteogenesis imperfecta III | AD |
| Osteogenesis imperfecta IV (normal teeth) | AD |
| Osteogenesis imperfecta IV (opalescent teeth) | AD |
| Osteogenesis imperfecta V | AD |
| Osteogenesis imperfecta VI | AD |
| Cole-Carpenter dysplasia | SP |
| Bruck dysplasia I | AR |
| Bruck dysplasia II | AR |
| Singleton-Merton dysplasia | AR |
| Osteopenia with radiolucent lesions of the mandible | AD |
| Osteoporosis-pseudoglioma dysplasia | AR |
| Geroderma osteodysplasticum | AR |
| Idiopathic juvenile osteoporosis | SP |

### 25. Dysplasias with defective mineralization

| Hypophosphatasia- perinatal lethal and infantile forms | AR |
| Hypophosphatasia dult form | AD |
| Hypophosphatemic rickets | XLD |
| Neonatal hyperparathyroidism | AR |
| Transient neonatal hyperparathyroidism with hypocalciuric hypercalcemia | AD |

### 26. Increased bone density without modification of bone shape

<table>
<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Mode of Inheritance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteopetrosis</td>
<td></td>
</tr>
<tr>
<td>Infantile form (OPB)</td>
<td>AR</td>
</tr>
<tr>
<td>With infantile neuroaxonal dysplasia</td>
<td>AR?</td>
</tr>
<tr>
<td>Delayed form Type I (OPA1)</td>
<td>AD</td>
</tr>
<tr>
<td>Delayed form Type II (OPA2)</td>
<td>AD</td>
</tr>
<tr>
<td>Intermediate form (possibly heterogeneous)</td>
<td>AR</td>
</tr>
<tr>
<td>With ectodermal dysplasia and immune defect (OLEDAID)</td>
<td>XL</td>
</tr>
<tr>
<td>Dysosteosclerosis</td>
<td>AR</td>
</tr>
<tr>
<td>Osteomesopyknosis</td>
<td>AD</td>
</tr>
<tr>
<td>Cranial osteosclerosis with bamboo hair (Netherton)</td>
<td>AR</td>
</tr>
<tr>
<td>Pyknody sostosis</td>
<td>AR</td>
</tr>
<tr>
<td>Osteosclerosis Stanescu Type</td>
<td>AD</td>
</tr>
<tr>
<td>Osteopathia striata (isolated)</td>
<td>SP</td>
</tr>
<tr>
<td>Osteopathia striata with cranial sclerosis</td>
<td>AD/XLD?</td>
</tr>
<tr>
<td>Melorheostosis</td>
<td>SP</td>
</tr>
<tr>
<td>Osteopoikilosis</td>
<td>SP</td>
</tr>
<tr>
<td>Mixed sclerosing bone dysplasia</td>
<td>SP</td>
</tr>
</tbody>
</table>

### 27. Increased bone density with diaphyseal involvement

<table>
<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Mode of Inheritance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diaphyseal dysplasia</td>
<td>AD</td>
</tr>
<tr>
<td>Camurati Engelmann</td>
<td></td>
</tr>
<tr>
<td>Diaphyseal dysplasia with anemia (Ghosal)</td>
<td>AR</td>
</tr>
<tr>
<td>Craniodiaphyseal dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Lenz Majewski dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Endosteal hyperostosis</td>
<td></td>
</tr>
<tr>
<td>van Buchem Type</td>
<td>AR</td>
</tr>
<tr>
<td>Sclerosteosis</td>
<td>AR</td>
</tr>
<tr>
<td>Worth Type</td>
<td>AD</td>
</tr>
<tr>
<td>Sclero-osteocerebellar dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Kenny Caffey dysplasia Type I</td>
<td>AR</td>
</tr>
<tr>
<td>Kenny Caffey dysplasia Type II</td>
<td>AD</td>
</tr>
<tr>
<td>Osteoectasia with hyperphosphatasia (Juvenile Paget disease)</td>
<td>AR</td>
</tr>
</tbody>
</table>
**Osteochondrodysplasia** | **Mode of Inheritance*** | **Osteochondrodysplasia** | **Mode of Inheritance***
--- | --- | --- | ---
Diaphyseal medullary stenosis with bone malignancy | AD | Jaffe Campanacci Type | SP
Oculodentoosseous dysplasia | AR | Fibrodysplasia ossificans progressiva | AD
Trichodentoosseous dysplasia | AD | Cherubism | AD

28. Increased bone density with metaphyseal involvement

<table>
<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Mode of Inheritance***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyle dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Craniometaphyseal dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Severe Type</td>
<td>AD</td>
</tr>
<tr>
<td>Mild Type</td>
<td>AD</td>
</tr>
</tbody>
</table>

29. Craniofacial dysplasias

<table>
<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Mode of Inheritance***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontometaophyseal dysplasia</td>
<td>XLR</td>
</tr>
<tr>
<td>Osteodysplasty, Melnick-Needles</td>
<td>XLD</td>
</tr>
<tr>
<td>Precocious osteodysplasty (terHaar dysplasia)</td>
<td>AR</td>
</tr>
<tr>
<td>Otopalatodigital syndrome Type I</td>
<td>XLD</td>
</tr>
<tr>
<td>Otopalatodigital syndrome Type II</td>
<td>XLR</td>
</tr>
</tbody>
</table>

30. Neonatal severe osteosclerotic dysplasias

<table>
<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Mode of Inheritance***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blomstrand dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Raine dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Caffey disease with prenatal onset</td>
<td>AD</td>
</tr>
<tr>
<td>Astley-Kendall dysplasia</td>
<td>AR</td>
</tr>
</tbody>
</table>

31. Disorganized development of cartilaginous and fibrous components of the skeleton

<table>
<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Mode of Inheritance***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dysplasia epiphysealis hemimelica</td>
<td>SP</td>
</tr>
<tr>
<td>Multiple cartilaginous with hemangiomata (Maffucci)</td>
<td>SP</td>
</tr>
<tr>
<td>Spondyloepiphysial dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>Spondyloepiphysial dysplasia with basal ganglia calcification</td>
<td>AR</td>
</tr>
<tr>
<td>Dysplasia epiphysial dysplasia</td>
<td>SP</td>
</tr>
<tr>
<td>Metaphyseal dysplasia</td>
<td>AD</td>
</tr>
<tr>
<td>Osteoglophonic dysplasia</td>
<td>AD</td>
</tr>
<tr>
<td>Genochondromatosis</td>
<td>AD</td>
</tr>
<tr>
<td>Carpotarsal osteochondromatosis</td>
<td>AD</td>
</tr>
<tr>
<td>Fibrous dysplasia (McCune-Albright and others) mosaic</td>
<td>SP</td>
</tr>
</tbody>
</table>

32. Osteolyses

<table>
<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Mode of Inheritance***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multicentric -hands and feet</td>
<td>AD</td>
</tr>
<tr>
<td>Multicentric carpal-tarsal osteolysis with and without nephropathy</td>
<td>AD</td>
</tr>
<tr>
<td>Winchester syndrome</td>
<td>AR</td>
</tr>
<tr>
<td>Torg syndrome</td>
<td>AR</td>
</tr>
<tr>
<td>Distal phalanges</td>
<td>AD</td>
</tr>
<tr>
<td>Hadju-Cheney syndrome</td>
<td>AD</td>
</tr>
<tr>
<td>Mandibulacral syndrome</td>
<td>AR</td>
</tr>
<tr>
<td>Diaphyses and metaphyses</td>
<td>AD</td>
</tr>
<tr>
<td>Familial expansile osteolysis</td>
<td>AD</td>
</tr>
<tr>
<td>Juvenile hyaline fibromatosis (includes systemic juvenile hyalinosis)</td>
<td>AR</td>
</tr>
</tbody>
</table>

33. Patella dysplasias

<table>
<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Mode of Inheritance***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nail patella dysplasia</td>
<td>AD</td>
</tr>
<tr>
<td>Patella hypoplasia/aplasia</td>
<td>AD</td>
</tr>
<tr>
<td>Ischiopubic patellar dysplasia</td>
<td>AD</td>
</tr>
<tr>
<td>Genitopatellar syndrome</td>
<td>AR</td>
</tr>
<tr>
<td>Ear patella short stature syndrome</td>
<td>AR</td>
</tr>
<tr>
<td>(Meier Gorlin)</td>
<td>AR</td>
</tr>
</tbody>
</table>

**LOCALIZED SKELETAL MALFORMATIONS (DYSOSTOSES)**

A. Localized disorders with predominant cranial and facial involvement

<table>
<thead>
<tr>
<th>Osteochondrodysplasia</th>
<th>Mode of Inheritance***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apert syndrome</td>
<td>AD</td>
</tr>
<tr>
<td>Pfeiffer syndrome</td>
<td>AD</td>
</tr>
<tr>
<td>Crouzon syndrome</td>
<td>AD</td>
</tr>
<tr>
<td>Craniostenosis (Crouzon-like) with Acanthosis Nigricans</td>
<td>AD</td>
</tr>
<tr>
<td>Jackson-Weiss syndrome</td>
<td>AD</td>
</tr>
<tr>
<td>Jackson-Weiss syndrome</td>
<td>AD</td>
</tr>
</tbody>
</table>
### Osteochondrodysplasias

<table>
<thead>
<tr>
<th>Mode of Inheritance*</th>
<th>Osteochondrodysplasia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saethre-Chotzen syndrome</td>
<td>AD</td>
</tr>
<tr>
<td>Craniosynostosis Muenke Type</td>
<td>AD</td>
</tr>
<tr>
<td>Craniosynostosis Boston Type</td>
<td>AD</td>
</tr>
<tr>
<td>Craniosynostosis Adelaide Type</td>
<td>AD</td>
</tr>
<tr>
<td>Craniosynostosis with polydactyly (Carpenter)</td>
<td>AR</td>
</tr>
<tr>
<td>Antley-Bixler syndrome</td>
<td>AD</td>
</tr>
<tr>
<td>Craniosynostosis with cutis gyrata (Beare-Stevenson)</td>
<td>AD</td>
</tr>
<tr>
<td>Oral-facial-digital syndrome Type I</td>
<td>XLR</td>
</tr>
<tr>
<td>Cephalo-polysyndactyly (Greig)</td>
<td>AD</td>
</tr>
<tr>
<td>Craniofrontonasal dysplasia</td>
<td>XLD</td>
</tr>
<tr>
<td>Mandibulo-facial dysostosis (Treacher-Collins)</td>
<td>AD</td>
</tr>
<tr>
<td>Spondylocostal dysplasia</td>
<td>AD</td>
</tr>
<tr>
<td>Spondylocostal dysplasia</td>
<td>AR</td>
</tr>
<tr>
<td>COVESDEM (COsto VErtebral Segmentation DEfect with Mesomelial and peculiar face)</td>
<td>AR</td>
</tr>
<tr>
<td>Oculo-vertebral syndrome (Weyer)</td>
<td>AD</td>
</tr>
<tr>
<td>Isolated SHFM3</td>
<td>AD</td>
</tr>
<tr>
<td>Isolated SHFM4</td>
<td>AD</td>
</tr>
<tr>
<td>Syndromic SHFM1 with deafness and MR</td>
<td>AD</td>
</tr>
<tr>
<td>Isolated SHFM2</td>
<td>XL</td>
</tr>
<tr>
<td>Ectrodactyly-ectodermal dysplasia</td>
<td>AD</td>
</tr>
<tr>
<td>clfelt-palate syndrome</td>
<td>AD</td>
</tr>
<tr>
<td>Symphalangism - proximal</td>
<td>AD</td>
</tr>
<tr>
<td>Rubinstein-Taybi syndrome</td>
<td>?AD</td>
</tr>
<tr>
<td>Coffin-Siris syndrome</td>
<td>AR</td>
</tr>
<tr>
<td>Coffin-Siris syndrome</td>
<td>AR</td>
</tr>
<tr>
<td>Fanconi syndrome Group A</td>
<td>AR</td>
</tr>
<tr>
<td>Fanconi syndrome Group C</td>
<td>AR</td>
</tr>
<tr>
<td>Fanconi syndrome Group D</td>
<td>AR</td>
</tr>
<tr>
<td>Fanconi syndrome Group E</td>
<td>AR</td>
</tr>
<tr>
<td>Fanconi syndrome Group F</td>
<td>AR</td>
</tr>
</tbody>
</table>

### Mode of Inheritance*

*AD autosomal dominant. AR autosomal recessive. SP sporadic. XLD X-liked dominant. XLR X-linked recessive

---

### SCLEROSING BONE DYSPLASIAS

#### COMMON

1. Cranioledysplasia
2. Diaphyseal dysplasia (Camurati-Engelmann disease)
3. Endosteal hyperostosis (van Buchem and Worth types); sclerosteosis
4. Hyperphosphatasia
5. Melorheostosis
6. Oculodentosseous dysplasia
7. Osteopathia striata (Voorhoeve disease); osteopathia striata with cranial sclerosis
8. Osteopetrosis
9. Osteopoikilosis
10. Pachydermoperiostosis
11. Pyknodysostosis
12. Pyle dysplasia

#### UNCOMMON

1. Craniodiaphyseal dysplasia
2. Dysosteosclerosis
3. Frontometaphyseal dysplasia
4. Lenz-Majewski dysplasia (hyperostotic dwarfism)
5. Ribbing disease (hereditary multiple diaphyseal sclerosis)

### References

CLASSIFICATION OF SCLEROSING BONE DYSPLASIAS

DYSPLASIAS OF ENDOCHONDRAL BONE FORMATION

Affecting primary spongiosa (immature bone)
1. Osteopetrosis (Albers-Schönberg disease)
   a. Autosomal-recessive type (lethal)
   b. Autosomal-dominant type
   c. Intermediate-recessive type
   d. Autosomal-recessive type with tubular acidosis
      (Sly disease)
2. Pyknody sostosis

Affecting spongiosa (mature bone)
1. Bone island (enostosis)
2. Osteopathia striata (Voorhoeve disease)
3. Osteopoikilosis

DYSPLASIAS OF INTRAMEMBRANOUS BONE FORMATION

1. Diaphyseal dysplasia (Camurati-Engelmann disease)
2. Endosteal hyperostosis (hyperostosis corticalis generalisata)
   a. Autosomal-recessive form
      i. Van Buchem type
      ii. Sclerosteosis
   b. Autosomal-dominant form
      i. Worth type
      ii. Nakamura disease

3. Ribbing disease (hereditary multiple diaphyseal sclerosis)

MIXED SCLEROSING DYSPLASIAS (affecting both endochondral and intramembranous ossification)

Affecting predominantly endochondral ossification
1. Cranio metaphyseal dysplasia
2. Dysostosclerosis
3. Pyle dysplasia

Affecting predominantly intramembranous ossification
1. Craniodiaphyseal dysplasia
2. Melorheostosis
3. Progressive diaphyseal dysplasia with skull base involvement (Neuhauser variant)

COEXISTENCE OF TWO OR MORE SCLEROSING BONE DYSPLASIAS
1. Melorheostosis with osteopoikilosis and osteopathia striata
2. Osteopathia striata with cranial sclerosis (Horan-Beighton S.)
3. Osteopathia striata with osteopoikilosis and cranial sclerosis
4. Osteopathia striata with osteopoikilosis
5. Osteopathia striata with generalized cortical hyperostosis
6. Osteopathia striata with osteopetrosis
7. Osteopoikilosis with progressive diaphyseal dysplasia

Reference
LETHAL FORMS OF DWARFISM AND SKELETAL DYSPLASIAS*

COMMON
1. Achondrogenesis (types I & II)
2. Achondroplasia (homozygous form)
+3. Campomelic dysplasia
4. Chondrodysplasia punctata (rhizomelic type)
+5. [Congenital transplacental infection (eg, cytomegalovirus infection; herpes simplex; rarely rubella)]
6. Hypochondrogenesis
7. Hypophosphatasia, severe
8. Osteogenesis imperfecta (type II)
9. Short rib syndromes (with or without polydactyly)
   a. Type I (Saldino-Noonan)
   b. Type II (Majewski)
   c. Type III (lethal thoracic dysplasia)
10. Thanatophoric dysplasia (with or without cloverleaf skull deformity (kleeblattschädel anomaly)

UNCOMMON
+1. Arthrogryposis
+2. Asphyxiating thoracic dysplasia (Jeune S.)
3. Atelosteogenesis
4. Cephaloskeletal dysplasia (Taybi-Linder S.)
5. Diastrophic dysplasia (rare lethal form)
6. Dyssegmental dysplasia
7. Fibrochondrogenesis
8. Metatropic dysplasia (rare lethal form)
9. Neu-Laxova S.
10. Opsismodysplasia
11. Osteodysplasty (Melnick-Needles S.) (lethal male)
12. Osteopetrosis with precocious manifestations (rarely lethal)
13. Potter S.
14. Pseudodiastrophic dysplasia
15. Schneckenbecken dysplasia
16. Spondylcocostal dysostosis (Jarcho-Levin S.)
+17. Spondyloepiphyseal dysplasia congenita

18. Spondylometaphyseal dysplasia (Sedaghatian type)
19. Warfarin embryopathy

* Death usually occurs in perinatal period or within first month of life; however, some of these entities are not invariably fatal, especially those preceded by the plus sign (+).

References

LATE-ONSET DWARFISM
(IDENTIFIABLE BEYOND INFANCY)

COMMON
1. Dyschondrosteosis
2. Hypochondroplasia
3. Multiple epiphyseal dysplasia (Fairbank and other forms)
4. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
5. Spondyloepimetaphyseal dysplasia (several forms)
6. Spondyloepiphyseal dysplasia tarda and other forms
7. Spondylometaphyseal dysplasia (Kozlowski and other types)
8. Stickler S. (arthro-ophthalmopathy)

UNCOMMON
1. Acrodysplasia with retinitis pigmentosa and nephropathy (Saldino-Mainzer S.)
2. Brachyolmia
3. Dyggve-Melchior-Clausen dysplasia (Smith-McCort S.)
4. Metaphyseal chondrodysplasia (Jansen, Schmid, McKusick, Shwachman types)
5. Otospondyloepiphyseal dysplasia (OSMED)
6. Parastremmatic dysplasia
7. Progressive pseudorheumatoid chondrodysplasia
8. Schwartz-Jampel S. (chondrodystrophic myotonia)
9. Spondyloepimetaphyseal dysplasia
10. Trichorhinophalangeal dysplasia

References
MAJOR SYNDROMES OF SHORT LIMB DWARFISM—ACROMELIC DWARFISM
(Distal segment shortening—hands, feet)

COMMON
1. Achondroplasia
2. Acrodysostosis (peripheral dysostosis)
3. Asphyxiating thoracic dysplasia (Jeune S.)
4. Chondroectodermal dysplasia (Ellis-van Creveld S.)
5. Diastrophic dysplasia
6. Otopalatodigital S. (types I and II)
7. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
8. Thanatophoric dysplasia

UNCOMMON
1. Acrodysostosis with retinitis pigmentosa and nephropathy (Saldino-Mainzer S.)
2. Acromesomelic dysplasia
3. Acromicric dysplasia
4. Brachydactyly syndromes (esp. type E)
5. Chondrodysplasia punctata (brachytelephalangic type)
6. Grebe chondrodysplasia (achondrogenesis, Brazilian type)
7. Spondylometaphyseal dysplasia (Sedaghatian type)
8. Spondyloperipheral dysplasia

References

CONGENITAL SYNDROMES AND SKELETAL DYSPLASIAS WITH SHORT LIMBS

COMMON
1. Achondroplasia
2. Chondrodysplasia punctata (all types)
3. Dyschondrosteosis; Madelung deformity
4. Enchondromatosis (Ollier disease); Maffucci S.
5. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
6. Hypophosphatasia
7. Mucopolysaccharidoses (eg, Hurler S.) (See J-4)
8. Multiple epiphyseal dysplasia (Fairbank)
9. Osteogenesis imperfecta (type II)
10. Phocomelia (incl. thalidomide embryopathy; infant of diabetic mother)
11. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
12. Thanatophoric dysplasia
13. Turner S.

UNCOMMON
1. Acrodysostosis (peripheral dysostosis)
2. Acromesomelic dysplasia
3. Aminopterin fetopathy
4. Asphyxiating thoracic dysplasia (Jeune S.)
5. Atelosteogenesis
6. Bloom S.
7. Brachmann-de Lange S. (de Lange S.)
8. Campomelic dysplasia
9. Cephaloskeletal dysplasia (Taybi-Linder S.)
10. CHILD S. (ichthyosis-limb reduction S.)
11. Chondroectodermal dysplasia (Ellis-van Creveld S.)
12. Diastrophic dysplasia
13. Dyggve-Melchior-Clausen dysplasia
14. Dyssegmental dysplasia
15. Fibrochondrogenesis
16. GM1 gangliosidosis

References
17. Grebe chondrodysplasia (achondrogenesis, Brazilian type)
18. Holt-Oram S.
19. Hyperphosphatasia
20. Hypochondroplasia
21. Kniest dysplasia
22. Larsen S.
23. Mesomelic dysplasia (Langer, Nievergelt, Robinow types)
24. Metaphyseal chondrodysplasia (Jansen, McKusick, Schmid types)
25. Metatropic dysplasia
26. Mietens-Weber S.
27. Orofaciodigital syndrome I (Papillon-Leage and Psaume S.)
28. Oto-spondylo-megaepiphyseal dysplasia (OSMED)
29. Patterson S.
30. Roberts S. (pseudothalidomide S.)
31. Seckel S. (bird-headed dwarfism)
32. Short rib-polydactyly syndromes
33. Spondyloepiphyseal dysplasias
34. Spondylometaphyseal dysplasia
35. TAR S. (thrombocytopenia-absent radius S.)
36. Warfarin embryopathy
37. Weill-Marchesani S.

References

Gamut D-7

SHORT SQUAT BONES

COMMON
1. Achondroplasia

References
Bowed Bones, Single or Multiple

Common

*1. Achondroplasia
*2. Bow legs, physiologic (See D-185)
3. Enchondromatosis (Ollier disease); Maffucci S.
4. Fibrous dysplasia (incl. polyostotic fibrous dysplasia; McCune-Albright S.)
5. Fracture, traumatic or pathologic (esp. greenstick fracture; plastic bowing; healed fracture)
6. Hydatid disease
7. Hyperparathyroidism (osteitis fibrosa cystica)
*8. Neurofibromatosis (esp. tibia, fibula)
*9. Osteogenesis imperfecta
10. Osteomalacia (See D-44)
11. Osteomyelitis, severe (eg, bacterial; tuberculous; smallpox residual)
12. Paralysis's disease
13. Paralysis or restricted movement during growth (eg, neuromuscular disorder; poliomyelitis; muscular dystrophy; juvenile rheumatoid arthritis)
*14. Prenatal bowing of long bones
15. Renal osteodystrophy (secondary hyperparathyroidism)
16. Rickets (all types)
17. Syphilis (saber shin); yaws (boomerang tibia)
18. Tibia vara (Blount disease)

Uncommon

*1. Achondrogenesis (types I and II)
*2. Acromesomelic dysplasia
*3. Antley-Bixler S.
*4. Asphyxiating thoracic dysplasia (Jeune S.)
*5. Atelosteogenesis
*6. Brachmann-de Lange S. (de Lange S.)
*7. Campomelic dysplasia
*8. Chondroectodermal dysplasia (Ellis-van Creveld S.)
*9. Cloverleaf skull deformity (kleeblattschädel anomaly) with thanatophoric dysplasia
*10. Congenital pseudoarthrosis
*11. Contractural arachnoidactyly
*12. Diastrophic dysplasia
13. Dyschondrosteosis (radius and tibia); Madelung deformity
*14. Dyssegmental dysplasia
*15. Epidermal nevus S.
*16. Fibrochondrogenesis
*17. Frontometaphyseal dysplasia
18. Hajdu-Cheney S.
19. Homocystinuria
*20. Hydrolethalus S.
*21. Hyperphosphatasia
*22. Hypochondroplasia
*23. Hypophosphatasia
*24. Infantile cortical hyperostosis (Caffey disease) (late)
*25. Intratuerine positional deformity
*26. Isolated anomaly
*27. Kyphomelic dysplasia
*28. Larsen S.
*29. Mesomelic dysplasia
*30. Metaphyseal chondrodysplasia (Jansen and other types)
*31. Mucopolysaccharidosis (Morquio; Maroteaux-Lamy); mucolipidosis; GM1 gangliosidosis
*32. Schwartz-Jampel S. (chondrodystrophic myotonia)
*33. Occipital horn S.
*34. Opsimodysplasia
*35. Osteodysplasty (Melnick-Needles S.)
*36. Osteopetrosis
*37. Otopalatodigital S. (types I and II)
*38. Pallister-Hall S.
*39. Parastremmatic dysplasia
*40. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
*41. Pseudohypparathyroidism
*42. Roberts S.
*43. Short rib-polydactyly syndromes
*44. Spondyloepimyseal dysplasia
*45. Spondylometaphyseal dysplasia (Kozlowski and Sedaghian types)
*46. Thanatophoric dysplasia
*47. Tibial bowing with or without absent fibula
48. Weismann-Netter S. (saber shin)

* Bowed limbs in infancy.
TWISTED BONES

COMMON
1. Fibrous dysplasia
2. Hyperparathyroidism (osteitis fibrosa cystica)
3. Neurofibromatosis
4. Osteodysplasty (Melnick-Needles S.)
5. Osteogenesis imperfecta
6. Osteomyelitis (late sequela)
7. Posttraumatic; postoperative (esp. regenerated rib)

UNCOMMON
1. Frontometaphyseal dysplasia
2. Gorlin S. (nevoid basal cell carcinoma S.)
3. Idiopathic
4. Otopalatodigital S. (types I and II)
5. Pyle dysplasia

OVERCONSTRICTION OR OVERTUBULATION (NARROW DIAMETAPHYSIS, LONG THIN BONES)

COMMON
1. Chronic illness with hypotonia or immobilization
2. Disuse atrophy
3. Marfan S.
4. Muscular disorders (eg, arthrogryposis; amyotonia congenita {Oppenheim disease}; progressive muscular dystrophy; Werdnig-Hoffmann disease; myotubular myopathy; myotonic dystrophy)
5. Paralytic disorders (eg, poliomyelitis; cerebral palsy; congenital malformation of brain or spinal cord)

UNCOMMON
1. Acromegaly (phalanges)
2. Antley-Bixler S.
3. Atelosteogenesis
4. Brachmann-de Lange S. (de Lange S.)
5. Caudal dysplasia sequence (caudal regression S.)
7. Cockayne S.
8. Congenital pseudoarthrosis
9. Contractural arachnodactyly
10. Dermatomyositis
11. Epidermolysis bullosa
12. Fetal akinesia deformation sequence (Pena-Shokeir S. type I)
13. Fetal hydantoin S. (Dilantin embryopathy)
14. Glycogen storage disease type I (von Gierke disease)
15. Hallermann-Streiff S. (oculomandibulofacial S.)
16. Homocystinuria
17. Hypopituitarism (eg, primordial dwarfism)
18. Juvenile rheumatoid arthritis
19. Marden-Walker S.
20. Marshall-Smith S
21. Mulibrey nanism

(continued)
22. Multiple pterygium S.
23. Neurofibromatosis
24. Osteogenesis imperfecta (type III)
25. Prader-Willi S.
26. Progeria
27. Restrictive dermopathy (stiff skin S.)
28. Schwartz-Jampel S. (chondrodystrophic myotonia)
29. Silver-Russell S.
30. Spondylocostal dysostosis (Jarcho-Levin S.)
31. Stickler S. (arthro-ophthalmopathy)
32. 3-M syndrome
33. Trisomy 8 S.
34. Trisomy 18 S.
35. Tubular stenosis dysplasia (Kenny-Caffey S.)
36. Werner S.
37. Winchester S.

References

Gamut D-11

UNDERCONSTRICTION OR UNDERTUBULATION (WIDE DIAMETAPHYSIS), LOCALIZED OR GENERALIZED (See D-34)

COMMON
1. Achondroplasia; other chondrodysplasias (See D-1)
2. Anemia (eg, thalassemia; sickle cell disease)
3. Bone cyst or benign expansile neoplasm
4. Fibrous dysplasia
5. Gaucher disease; Niemann-Pick disease
6. Healing or healed fracture; metaphyseal injury
7. Osteomyelitis, chronic productive (eg, Garré sclerosing osteomyelitis; congenital syphilis)
8. Paget’s disease

UNCOMMON
1. Achondrogenesis (types I and II)
2. Acrodysostosis (peripheral dysostosis)
3. Cleidocranial dysplasia
4. Craniometaphyseal dysplasia; Craniodiaphyseal dysplasia
5. Diaphyseal dysplasia (Camurati-Engelmann disease)
6. Dysosteosclerosis
7. Dyssegmental dysplasia
8. Enchondromatosis (Ollier disease)
9. Endosteal hyperostosis (van Buchem and Worth types)
10. Fibrogenesis imperfecta ossium
11. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
12. Hyperphosphatasia
13. Hypervitaminosis A or D
14. Hypochondrogenesis
15. Hypochondroplasia
16. Hypophosphatasia
17. Infantile cortical hyperostosis (Caffey disease)
18. Kyphomelic dysplasia
19. Lead poisoning (late)
20. Lenz-Majewski dysplasia
21. Léri S. (pleonosteosis)
22. Mastocytosis
23. Mesomelic dysplasia (Langer type)
24. Metaphyseal chondrodysplasia (Jansen type)
25. Mucopolysaccharidoses (esp. Morquio S., Hurler S.); mucolipidoses; GM1 gangliosidosis (See J-4)
26. Neu-Laxova S.
27. Oculodentosseous dysplasia
28. Omodysplasia
29. Opsismodysplasia
30. Osteogenesis imperfecta (type II)
31. Osteopetrosis
32. Pyle dysplasia
33. Rickets (healing)
34. Schinzel-Giedion S.
35. Scurvy (healing)
36. Trisomy 8 S.
37. Weill-Marchesani S.

References

Gamut D-12

BALLOONED BONES (WIDE DIAPHyses, OFTEN THIN CORTICES): LOCALIZED OR GENERALIZED BROAD TUBULAR BONES

COMMON
*1. Anemia, severe (esp. thalassemia; sickle cell disease)
*2. Bone cyst or benign expansile neoplasm (eg, enchondroma)
*3. Fibrous dysplasia
4. Osteomyelitis, esp. spina ventosa* (tuberculosis); also chronic productive (eg, Garré sclerosing osteomyelitis; syphilis; yaws; tropical ulcer)
5. Paget’s disease
6. Subperiosteal hemorrhage (eg, trauma; fracture; battered child S.; leukemia; hemophilia; scurvy)

UNCOMMON
*1. Craniodiaphyseal dysplasia
*2. Diaphyseal dysplasia (Camurati-Engelmann disease)

*3. Dysostosis clefs syndrome
4. Endosteal hyperostosis (van Buchem and Worth types)
*5. Gaucher disease; Niemann-Pick disease
*6. Hyperparathyroidism, severe (eg, brown tumor)
7. Hyperphosphatasia
*8. Hypophosphatasia
*9. Infantile cortical hyperostosis (Caffey disease)
10. Infantile multisystem inflammatory disease (NOMID)
11. Léri S. (pleonosteosis)
*12. Mastocytosis
13. Mesomelic dysplasia (Langer, Nievelgelt types)
14. Metaphyseal chondrodysplasia (Jansen type)
15. Mucopolysaccharidoses; mucolipidosis II (I-cell disease); GM1 gangliosidosis (See J-4)
16. Neu-Laxova S.
17. Oculodentoosseous dysplasia
18. Osteopetrosis
*19. Otopalatodigital S. (types I and II)
20. Pachydermoperiostosis
*21. Pyle dysplasia
22. Schwarz-Lélek S.
23. Singleton-Merten S.
24. Thanatophoric dysplasia

* Thin cortices.

References
ASYMMETRY IN SIZE OF A BONE OR LIMB (HEMIHYPERTROPHY OR HEMIATROPHY), LOCALIZED OR GENERALIZED (See D-14, D-29)

WITH BONE DYSPLASIA, DYSOSTOSIS, OR SYNDROME
1. Beckwith-Wiedemann S.
2. Chondrodysplasia punctata (Conradi-Hünermann type)
3. Coffin-Lowry S.
4. Dysplasia epiphysealis hemimelica (Trevor disease)
5. Enchondromatosis (Ollier disease); Maffucci S.
6. Femoral hypoplasia-unusual facies S.
7. Fibrous dysplasia (incl. McCune-Albright S.)
8. Goltz S. (focal dermal hypoplasia)
9. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
10. Idiopathic; congenital hemihypertrophy
11. Melorheostosis
12. Oculoauriculovertebral spectrum (Goldenhar S.)
13. Osteogenesis imperfecta
14. Phocomelia (eg, thalidomide embryopathy); other congenital limb hypoplasias
15. Prader-Willi S.
16. Proteus S.
17. Seckel S. (bird-headed dwarfism)
18. Silver-Russell S.

WITH VASCULAR MALFORMATIONS
1. Hemangioma; arteriovenous malformation; Klippel-Trenaunay S.; Parkes Weber S.; Maffucci S.
2. Lymphangioma
3. Lymphatic abnormality

WITH NEOCUTANEOUS OR CUTANEOUS SYNDROMES OR SOFT TISSUE ABNORMALITY
1. CHILD S. (ichthyosis-limb reduction S.)
2. Hypomelanosis of Ito
3. Incontinentia pigmenti
4. Macrodystrophia lipomatosa
5. Neurofibromatosis
6. Poland S. (pectoral muscle aplasia-syndactyly)
7. Romberg S. (esp. mandible)
8. Sturge-Weber S.
9. Tuberous sclerosis
10. von Hippel-Lindau S.

WITH NEOPLASM ASSOCIATION
1. Adrenal gland neoplasm (adrenocortical carcinoma, adenoma)
2. Gonadal neoplasm (gonadoblastoma)
3. Hepatic neoplasm (hepatoblastoma)
4. Renal neoplasm (Wilms’ tumor)

WITH ACQUIRED (SECONDARY) ASYMMETRY
1. Endocrine disorder (eg, adrenogenital S.)
2. Hyperemia, any cause (eg, from chronic infection; juvenile chronic arthritis; juvenile rheumatoid arthritis; hemophilia); also conditions leading to decreased blood supply to a limb
3. Hypospadias; cryptorchidism
4. Infantile cortical hyperostosis (Caffey disease)
5. Lymphangiectasia (extremity)
6. Neuromuscular disorder (eg, cerebral palsy; poliomyelitis)
7. Osteomyelitis (eg, bacterial; yaws; smallpox residual)
8. Radiation injury
9. Scurvy (with epiphyseal trauma)
10. Trauma (eg, burn; epiphyseal injury; impacted or distracted fracture; surgical procedure)

References

**Gamut D-14**

**LOCALIZED ACCELERATED MATURATION, ELONGATION, OR OVERGROWTH OF A BONE, DIGIT, OR LIMB**

**COMMON**
1. Arteriovenous fistula; hemangioma; lymphangioma
2. Chronic arthritis (eg, tuberculous; juvenile rheumatoid)
3. Chronic osteomyelitis (eg, Garré sclerosing osteomyelitis; tuberculosis; tropical ulcer)
4. Hemihypertrophy (See D-13)
5. Hyperemia, any cause
6. Idiopathic
7. Neurofibromatosis
8. Trauma; injury (eg, healing fracture)

**UNCOMMON**
1. Congenital macrodactyly
2. Dysplasia epiphysealis hemimelica (Trevor disease)
3. Epidermal nevus S.
4. Fibrous dysplasia
5. Hemophilia (hemarthrosis)
6. Infantile cortical hyperostosis (Caffey disease)
8. Lymphatic obstruction, chronic (eg, lymphangiectasia; congenital hypoplasia of lymphatics; filariasis; elephantiasis; neoplasm)
9. Macrodystrophia lipomatosa
10. Maffucci S. (enchondromatosis with hemangiommas)
11. Melorheostosis
12. Neoplasm (eg, infiltrating angiolipoma)
13. Proteus S.

**Reference**

**Gamut D-15**

**GENERALIZED OR WIDESPREAD OVERGROWTH OR ELONGATION OF THE SKELETON (GIGANTISM)**

**COMMON**
1. Adrenogenital S. (prior to premature closure of epiphyses)
2. Beckwith-Wiedemann S.
3. Congenital total lipodystrophy (lipoatrophic diabetes)
4. Constitutional or familial tall stature
5. Hemihypertrophy (See D-13)
6. Homocystinuria
7. Hyperpituitarism; pituitary gigantism; acromegaly
8. Hyperthyroidism (in early childhood)
9. Klinefelter S. (XXY S.)
10. Marfan S.
11. Neurofibromatosis
12. Polyostotic fibrous dysplasia (McCune-Albright S.)
13. Sotos S. (cerebral gigantism)

**UNCOMMON**
1. Bannayan-Riley-Ruvalcaba S.
2. Fragile X S.
3. Infant of diabetic mother
4. Marshall-Smith S.
5. Perlman S.
6. Sclerosteosis
7. Simpson-Golabi-Behmel S. (gigantism-dysplasia S.)
8. Weaver-Smith S.
9. XXX S.; XYY S.

**References**
GENERALIZED ACCELERATED SKELETAL MATURATION (INCREASED BONE AGE)

COMMON
1. Adrenogenital S. (adrenocortical tumor or hyperplasia)
2. Constitutional or familial tall stature
3. Excessive androgen, estrogen or steroid administration or production (eg, virilizing adrenal or gonadal neoplasm or hyperplasia; Cushing S.)
4. Hypothalamic or parahypothalamic lesion with sexual precocity (eg, craniopharyngioma; astrocytoma; hamartoma; optic chiasm glioma; tuberculosis)
5. Idiopathic isosexual precocious puberty
6. Pituitary gigantism; hyperpituitarism
7. Polyostotic fibrous dysplasia (McCune-Albright S.)
8. Sotos S. (cerebral gigantism)

UNCOMMON
1. Congenital syndromes and skeletal dysplasias, other
   a. Acrodysostosis (peripheral dysostosis)
   *b. Asphyxiating thoracic dysplasia (Jeune S.) (hips)
   *c. Bannayan-Riley-Ruvalcaba S.
   *d. Beckwith-Wiedemann S.
   e. Chondroectodermal dysplasia (Ellis-van Creveld S.)
   f. Congenital total lipodystrophy (lipoatrophic diabetes)
   g. Contractural arachnodactyly
   h. Diastrophic dysplasia (hands)
   *i. Greig cephalopolysyndactyly S.
   *j. Marshall-Smith S.
   k. Otopalatodigital S. (type II)
   l. Otospondylomegaepiphyseal dysplasia (OSMED)
   m. Pseudohypoparathyroidism (hands)
   *n. Schneckenbecken dysplasia (carpals, tarsals)
   o. Trisomy 8 S.
   p. Tuberal sclerosis (with sexual precocity)
   *q. Weaver S.
2. Ectopic gonadotropin production (hepatoma; choriocarcinoma; teratoma)
3. Encephalitis
4. Exogenous obesity with overgrowth and tall stature
5. Homocystinuria
6. Hyperthyroidism (maternal or acquired)
7. Pinealoma, primary or ectopic
8. Primary hyperaldosteronism (Conn S.)

* Advanced bone age in the newborn.

References

GENERALIZED RETARDED SKELETAL MATURATION (DELAYED BONE AGE)

COMMON
1. Congenital heart disease (esp. cyanotic)
2. Congenital syndromes of dwarfism or mental retardation (See D-17-2)
3. Constitutional delay of growth and adolescence; nonspecific or idiopathic retardation
4. Cretinism; hypothyroidism
5. Deprivation (psychosocial) dwarfism
6. Diabetes, juvenile
7. Hypogonadism (eg, Turner S.)
8. Hypopituitarism with growth hormone deficiency (eg, idiopathic; craniopharyngioma)
9. Idiopathic; familial short stature
10. Intrauterine growth retardation (IUGR); infant of toxemic mother
11. Malnutrition; failure to thrive
12. Neurologic disorders (cerebral hypoplasia)
13. Renal disease (eg, nephrosis; chronic renal failure; cystinosis; renal tubular acidosis)
14. Severe constitutional disease or chronic illness (eg, celiac disease; cystic fibrosis (mucoviscidosis); ulcerative colitis)
15. Small for gestational age neonate

UNCOMMON
1. Addison disease (adrenal insufficiency)
2. Aminopterin fetopathy
3. Anemia (chronic (eg, sickle cell disease; thalassemia)
4. Copper deficiency, nutritional; Menkes S. (kinky-hair S.)
5. Hypoparathyroidism
6. Idiopathic juvenile osteoporosis
7. Langerhans cell histiocytosis
8. Lesch-Nyhan S. (congenital hyperuricosuria)
9. Phenylketonuria
10. Rickets (all types)
11. Steroid therapy; Cushing S.

References

Gamut D-17-2

CONGENITAL SYNDROMES AND SKELETAL DYSPLASIAS WITH RETARDED OR DYSHARMONIC SKELETAL MATURATION*

COMMON
1. Achondroplasia
2. Hypothyroidism; cretinism
3. Mucopolysaccharidoses (esp. Morquio S.); mucolipidosis II (I-cell disease) and III (pseudo-Hurler polydystrophy); fucosidosis (See J-4)
4. Trisomy 21 S. (Down S.)
5. Turner S.

UNCOMMON
1. Achondrogenesis
2. Aminopterin fetopathy
3. Brachmann-de Lange S. (de Lange S.)
4. Campomelic dysplasia
5. Celiac disease (gluten-induced enteropathy)
6. Cephaloskeletal dysplasia (Taybi-Linder S.)
7. Chondroectodermal dysplasia (Ellis-van Creveld S.)
8. Cleidocranial dysplasia
9. Cloverleaf skull deformity (kleeblattschädel anomaly)
10. Cockayne S.
11. Coffin-Lowry S.
12. Coffin-Siris S.
13. Cystinosis
14. de Morsier S.
15. Diastrophic dysplasia
16. Dubowitz S.
17. Fanconi anemia (pancytopenia-dysmelia S.)
18. Fetal rubella infection
19. Floating-harbor S.
20. Freeman-Sheldon S. (whistling face S.)
21. GAPO S.
22. Glycogen storage disease type I (von Gierke disease)
23. Incontinentia pigmenti
24. Infant of toxemic mother

(continued)
25. Johanson-Blizzard S.
26. Kocher-Debré-Sémélaigne S.
27. Laron S. (pituitary dwarfism II)
28. Larsen S.
29. Lenz-Majewski dysplasia
30. LEOPARD syndrome (multiple lentigines S.)
31. Leprechaunism; Patterson S.
32. Léri S. (pleonosteosis)
33. Lesch-Nyhan S. (congenital hyperuricosuria)
34. Lowe S. (oculocerebrorenal S.)
35. Mauriac S.
36. Metatropic dysplasia
37. Multiple epiphyseal dysplasia (Fairbank)
38. Noonan S.
39. Opitz trigonocephaly S. (C syndrome)
40. Osseodysplasty (Melnick-Needles S.)
41. Papillon-Lefèvre S.
42. Phenylketonuria
43. Pituitary dwarfism (Levi-Lorain S.); hypopituitarism
44. Prader-Willi S.
45. Prasad S. (geophagia S.)
46. Riley-Day S. (familial dysautonomia)
47. Rubinstein-Taybi S.
48. Silver-Russell S.
49. Spondyloepimetaphyseal dysplasia
50. Spondyloepiphyseal dysplasia
51. Spondylometaphyseal dysplasia (esp. Kozlowski type)
52. Thanatophoric dysplasia
53. 3-M syndrome
54. Trichorhinophalangeal dysplasia, type I (Giedion S.)
55. Trisomy 18 S.
56. Tubular stenosis dysplasia (Kenny-Caffey S.)
57. Weill-Marchesani S.
58. Wilson disease (hepatolenticular degeneration)
59. XXXXY S.
60. Zellweger S. (cerebrohepatorenal S.)

* Most skeletal dysplasias, especially those with epiphyseal abnormalities, have delayed or dysharmonic skeletal maturation. The same is true for many dysmorphology syndromes.

References

Gamut D-18

PSEUDOEPIPHYSES AND ACCESSORY EPIPHYSES

COMMON
1. Cleidocranial dysplasia
2. Idiopathic; normal variant
*3. Otopalatodigital S. (types I and II)
*4. Trisomy 21 S. (Down S.)

UNCOMMON
1. Acrodysostosis (peripheral dysostosis)
2. Acromicric dysplasia
3. Brachydactyly C
4. Catel-Manzke S.
6. Chromosome 9: dup(9p) S.
*7. Cockayne S.
8. Diastrophic dysplasia
9. Dyggve-Melchior-Clausen dysplasia
10. Fanconi anemia (pancytopenia-dysmelia S.)
   (thumb)
11. Fetal hydantoin S. (Dilantin embryopathy)
12. Fibrodysplasia (myositis) ossificans progressiva
14. Hand-foot-genital S.
15. Hypoglossia-hypodactyly S. (aglossia-adactyly S.)
16. Hypothyroidism; cretinism
17. Kniest dysplasia
18. Larsen S.
19. Pseudoachondroplasia
20. Pseudohypoparathyroidism
21. Silver-Russell S.
22. Spondyloepiphyseal dysplasia
23. 3-M syndrome
24. Townes-Brocks S.
25. XXXXY S.; XXXXX S.

* Affecting primarily the second metacarpal.

References

Gamut D-19

IRREGULARITY, FRAGMENTATION, OR STIPPLING OF MULTIPLE EPiphySEAL OSSIFICATION CENTERS

COMMON
1. Avascular necrosis (eg, Legg-Perthes disease; steroid therapy; sickle cell disease) (See D-48)
2. Congenital syndromes (See D-19-2)
3. Cretinism; hypothyroidism
4. Normal, age related (eg, distal femur, capitellum)
5. Osteochondroses

UNCOMMON
1. Dysplasia epiphysealis hemimelica (Trevor disease)
2. Frostbite
3. Hypo-hyperparathyroidism
4. Hypopituitarism (anterior lobe) with growth hormone deficiency

5. Juvenile chronic arthritis (eg, juvenile rheumatoid arthritis)
6. Osteomyelitis (eg, Listeria monocytogenes*);
   congenital transplacental infections
7. Pituitary gigantism
8. Rickets
9. Thiemann disease (hand)
10. Trauma
*11. Vitamin K reductase deficiency

*Stippled epiphyses.

Reference

Gamut D-19-2

CONGENITAL SYNDROMES AND BONE DYSPLASIAS WITH IRREGULARITY, FRAGMENTATION, OR STIPPLING OF MULTIPLE EPiphySEAL OSSIFICATION CENTERS

COMMON
*1. Chondrodysplasia punctata (all types)
   a. Conradi-Hünermann (CP-CH)
   b. Brachytelephalangic type (CP-BT)
   c. Rhizomelic type
   d. Sheffield type
   e. Tibial-metacarpal type (CP-MT)
   f. X-linked dominant (Happle) type
   g. X-linked recessive (Curry) type
2. Cretinism; hypothyroidism
3. Dysplasia epiphysealis hemimelica (Trevor disease)
4. Mucopolysaccharidoses (eg, Morquio S.) (See J-4)
*5. Multiple epiphyseal dysplasia (Fairbank)
*6. Osteopoikilosis
*7. Pseudoachondrodplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)

(continued)
Spondyloepiphyseal dysplasia (congenita or tarda)

Trisomy 21 S. (Down S.)

**UNCOMMON**
1. Acrodysostosis (peripheral dysostosis)
2. Brachmann-de Lange S. (de Lange S.)
3. CHILD S.
4. Chromosome disorders, many
5. Congenital transplacental infections (TORCH)
6. Cutis laxa (hips)
7. Diastrophic dysplasia
8. Dyggve-Melchior-Clausen dysplasia (Smith-McCort S.)
9. Enchondromatosis (Ollier disease); Maffucci S.
10. Fetal alcohol S. (esp. lower extremities, calcaneus)
11. Fetal hydantoin S.
12. Homocystinuria
13. Infantile multisystem inflammatory disease (NOMID)
14. Kniest dysplasia
15. Metatropic dysplasia
16. Meyer dysplasia of femoral head
17. Mucolipidosis II (I-cell disease); GM1 gangliosidosis
18. Nail-patella S. (osteo-onychodysplasia)
19. Osteopathia striata (Voorhoeve disease)
20. Pacman dysplasia
21. Parastreptomatis dysplasia
22. Smith-Lemli-Opitz S.
23. Spondyloepimetaryphal dysplasia (short limb-hand type)
24. Stickler S. (arthro-ophthalmopathy)
25. Trichorhinophalangeal dysplasia (hips)
26. Trisomy 18 S.
27. Warfarin embryopathy
28. Winchester S.
29. Zellweger S. (cerebrohepatorenal S.)

* Stippled epiphyses.

References
2. Kozlowski K. Beighton P; Gamut Index of Skeletal Dysplasias. Berlin: Springer-Verlag, 1984, pp. 68–69

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**STIPPLED OR PUNCTATE EPIPHYSES**

**COMMON**
1. Chondrodysplasia punctata (all types)
   a. Conradi-Hünermann (CP-CH)
   b. Brachytelephalangic type (CP-BT)
   c. Rhizomelic type
   d. Sheffield type
   e. Tibial-metacarpal type (CP-MT)
   f. X-linked dominant (Happle) type
   g. X-linked recessive (Curry) type
2. Normal, age related (eg, distal femur, capitellum)
3. Osteopoikilosis
4. Pseudoachondroplasia (pseudochondroplastic spondyloepiphyseal dysplasia)
5. Spondyloepiphyseal dysplasia (congenita or tarda)
6. Trisomy 21 S. (Down S.)

**UNCOMMON**
1. Brachmann-de Lange S. (de Lange S.)
2. CHILD S.
3. Chromosome disorders, many
4. Congenital transplacental infections (TORCH)
5. Fetal alcohol S. (esp. lower extremities, calcaneus)
6. Fetal hydantoin S.
7. Hypopituitarism (anterior lobe) with growth hormone deficiency
8. Listeria monocytogenes osteomyelitis
9. Mucolipidosis II (I-cell disease); GM1 gangliosidosis
10. Pacman dysplasia
11. Smith-Lemli-Opitz S.
12. Trisomy 18 S.
13. Vitamin K reductase deficiency
14. Warfarin embryopathy
15. Zellweger S. (cerebrohepatorenal S.)

References

Gamut D-20

ALTERATION IN SIZE OR APPEARANCE OF MULTIPLE EPIDPHYSIES (See D-19, D-21 to D-27)

COMMON
1. Arthritis (eg, juvenile chronic; juvenile rheumatoid; rheumatoid; psoriatic)
2. Avascular necrosis (eg, sickle cell disease; steroid therapy; Cushing S.); osteochondroses (See D-48, D-48-S)
3. Cone-shaped epiphyses (See D-27)
4. Congenital syndromes with irregular, fragmented, or stippled epiphyses (See D-19)
5. Cretinism; hypothyroidism
6. Delayed or increased skeletal maturation (See D-16, 17)
7. Dense (ivory) epiphyses (See D-26)
8. Diabetes, juvenile
9. Hemophilia
10. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
11. Malnutrition; malabsorption
12. Mucopolysaccharidoses (eg, Hurler; Hunter; Morquio) (See J-4)
13. Multiple epiphyseal dysplasia (Fairbank)
14. Neurologic disorders
15. Normal variant
16. Osteomyelitis (eg, tuberculosis; smallpox residual; Listeria monocytogenes); congenital transplacental infections (TORCH)
17. Osteoporosis
18. Radiation injury
19. Rickets; osteomalacia
20. Scurvy
21. Thermal injury (eg, frostbite; burn; electrical injury)
22. Trauma (incl. battered child S.)

UNCOMMON
1. Achondroplasia
2. Acrodysostosis (peripheral dysostosis)
3. Adrenogenital S.
4. Beckwith-Wiedemann S.
5. Chondrodysplasia punctata (all forms)
6. Chondroectodermal dysplasia (Ellis-van Creveld S.)
7. Chromosome disorders, many
8. Congenital heart disease, cyanotic
9. Cutis laxa (hips)
10. Deprivation (psychosocial) dwarfism
11. Diastrophic dysplasia
12. Dyggve-Melchior-Clausen dysplasia (Smith-McCort S.)
13. Dysplasia epiphysealis hemimelica (Trevor disease)
14. Enchondromatosis (Ollier disease); Maffucci S.
15. Homocystinuria
16. Hormone-secreting neoplasm leading to precocious puberty (eg, gonadal tumor; teratoma; pinealoma; hepatoblastoma)
17. Hyperthyroidism
18. Hypochondroplasia
19. Hypo-hyperparathyroidism
20. Hypophosphatasia
21. Hypopituitarism (anterior lobe) with growth hormone deficiency
22. Idiopathic isosexual precocious puberty
23. Infantile multisystem inflammatory disease (NOMID)
24. Kniest dysplasia

(continued)
25. Metaphyseal chondrodysplasia (Jansen and other types)
26. Metatropic dysplasia
27. Meyer dysplasia of femoral head
28. Mucolipidosis II (I-cell disease) and III (pseudo-Hurler polydystrophy); GM<sub>1</sub> gangliosidosis
29. Nail-patella S. (osteo-onychodysplasia)
30. Osteogenesis imperfecta
31. Osteopathia striata (Voorhoeve disease); osteopathia striata with cranial sclerosis
32. Osteopoikilosis
33. Otospondylomegaepiphyseal dysplasia (OSMED)
34. Parastremmatic dysplasia
35. Pituitary gigantism
36. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
37. Schwartz-Jampel S. (chondrodystrophic myotonia)
38. Smith-Lemli-Opitz S.
39. Sotos S. (cerebral gigantism)
40. Spondyloepimeta physeal dysplasia (short limb-hand type)
41. Spondyloepiphyseal dysplasia (congenita or tarda)
42. Spondylo-megaepiphyseal-metaphyseal dysplasia
43. Stickler S. (arthro-ophthalmopathy)
44. Thiemann disease (hand)
45. Trichorhinophalangeal dysplasia
46. Trisomy 18 S.
47. Trisomy 21 S. (Down S.)
48. Warfarin embryopathy
49. Winchester S.
50. Zellweger S. (cerebrohepatorenal S.)

References

Gamut D-21-1

**SMALL EPIPHYES—GENERALIZED**

**COMMON**
1. Cretinism; hypothyroidism
2. Delayed skeletal maturation, any cause (See D-17)
3. Normal variant

**UNCOMMON**
1. Acromesomelic dysplasia
2. Congenital heart disease, cyanotic
3. Deprivation (psychosocial) dwarfism
4. Diabetes, juvenile
5. Diastrophic dysplasia
6. Hypopituitarism (eg, idiopathic; cranio-pharyngioma)
7. Juvenile chronic arthritis (eg, juvenile rheumatoid arthritis)
8. Malnutrition; malabsorption
9. Microepiphyseal dysplasia (proximal femur)
10. Mucolipidosis III (pseudo-Hurler polydystrophy)
11. Mucopolysaccharidoses (esp. Morquio S.)
12. Multiple epiphyseal dysplasia (Fairbank)
13. Progressive pseudorheumatoid chondrodysplasia
14. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
15. Rickets
16. Spondyloepimeta physeal dysplasias
17. Spondyloepiphyseal dysplasia (congenita or tarda)
18. Steroid therapy, prolonged; Cushing S.
19. Stickler S. (arthro-ophthalmopathy)
20. Winchester S.

References
**Gamut D-21-2**

### SMALL EPIPHYES—LOCALIZED

**COMMON**
1. Developmental dysplasia of the hip—DDH (congenital hip dysplasia or dislocation)
2. Disuse of an extremity (eg, neuromuscular disorder; arthritis)
3. Infection
4. Legg-Perthes disease, early; other avascular necrosis (See D-48)
5. Trauma

**UNCOMMON**
1. Metaphyseal chondrodysplasia (McKusick type) (proximal femur)
2. Meyer dysplasia of femoral head
3. Nail-patella S. (osteo-onychodysplasia)
4. Osteopathia striata with cranial sclerosis (proximal femur)
5. Otospondylomegaepiphyseal dysplasia (OSMED) (proximal femur)
6. Small patella S.
7. Trichorhinophalangeal dysplasia, type I (Giedion S.) and II (Giedion-Langer S.) (proximal femur)

**References**

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**Gamut D-22-1**

### LARGE EPIPHYES—GENERALIZED

**COMMON**
1. [Diseases leading to thin diaphyses (eg, neurologic disorders; osteogenesis imperfecta)] (See D-10)
2. Juvenile chronic arthritis (eg, juvenile rheumatoid arthritis)

**UNCOMMON**
1. Adrenogenital S.
2. Beckwith-Wiedemann S.
4. Cockayne S.
5. Congenital total lipodystrophy (lipoatrophic diabetes)
6. Hemophilia
7. Hormone-secreting neoplasm leading to precocious puberty (eg, gonadal tumor; teratoma; pinealoma; hepatoblastoma)
8. Hyperthyroidism
9. Idiopathic isosexual precocious puberty
10. Infantile multisystem inflammatory disease (NOMID)
11. Kniest dysplasia (hands)
12. Mesomelic dysplasia (Langer type)
13. Metaphyseal chondrodysplasia (Jansen type)
14. Otospondylomegaepiphyseal dysplasia (OSMED)
15. Progressive pseudorheumatoid chondrodysplasia
16. Sotos S. (cerebral gigantism)
17. Spondyloepiphyseal dysplasia with macroepiphyses (Kozlowski type)
18. Spondylomegaepiphyseal-metaphyseal dysplasia

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**

(continued)
Gamut D-22


Gamut D-22-2

LARGE EPIPHYSES—LOCALIZED

COMMON

1. Arthritis (chronic sequelae from septic, tuberculous, or fungal)
2. Coxa magna and plana (eg, healed Legg-Perthes disease)
3. Hemophilic hemarthrosis
4. Juvenile chronic arthritis (eg, juvenile rheumatoid arthritis)
5. Posttraumatic; healing fracture

UNCOMMON

1. Angiomatous lesion (esp. hemangioma); arteriovenous malformation
2. Dysplasia epiphysealis hemimelica (Trevor disease)
3. Idiopathic localized gigantism
4. Localized hyperemia; other causes
5. Metaphyseal chondrodysplasia (Schmid type) (proximal femur)
6. Neurofibromatosis
7. Postsurgical (eg, open reduction with internal fixation)
8. Proteus S. (Perthes-like femoral heads)

References

Gamut D-23

THIN EPIPHYSES

COMMON

1. Hypothyroidism; cretinism
2. Renal osteodystrophy (secondary hyperparathyroidism)
3. Rickets

UNCOMMON

1. Acromesomelic dysplasia
2. Diastrophic dysplasia
3. Dyggve-Melchior-Clausen dysplasia
4. Kniest dysplasia
5. Microepiphyseal dysplasia (Elsbach)
6. Multiple epiphyseal dysplasia (Fairbank)
7. Schwartz-Jampel S. (chondrodystrophic myotonia)
8. Stickler S. (arthro-ophthalmopathy)
9. Thiemann disease

References

Gamut D-24

INDISTINCT OR FUZZY EPIPHYSES

COMMON

1. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
2. Hypothyroidism; cretinism
3. Osteomalacia
4. Rickets

References
UNCOMMON
1. Hypophosphatasia
2. Metaphyseal chondrodysplasia (Jansen type)
3. Mucolipidosis II (I-cell disease); GM₁ gangliosidosis

Reference

RING EPIPHyses (DENSE CORTEX WITH LUCENT CENTER)

COMMON
1. Osteoporosis, severe (esp. disuse atrophy)
2. Scurvy (Wimberger ring)

UNCOMMON
1. Hemophilia
2. Hyperparathyroidism, primary or secondary (renal osteodystrophy), healing
3. Hypothyroidism, healing
4. Juvenile osteoporosis
5. Lead poisoning
6. Osteogenesis imperfecta
7. Rickets, healing
8. Williams S. (idiopathic hypercalcemia)

References

DENSE (IVORY) EPIPHYSes OF HANDs AND FEET

ACQUIRED

COMMON
1. Hypopituitarism
2. Normal variant (esp. distal phalanges)
3. Retarded skeletal maturation (See D-17)

UNCOMMON
1. Connective tissue disease (collagen disease) eg
   (eg, lupus erythematousus; scleroderma)
2. Deprivation (psychosocial) dwarfism
3. Hypothyroidism
4. Renal osteodystrophy (secondary hyperparathyroidism)

CONGENITAL

COMMON
1. Multiple epiphyseal dysplasia (Fairbank)
2. Thiemann disease
3. Trichorhinophalangeal dysplasia, type I (Giedion S.) and II (Giedion-Langer S.)

UNCOMMON
1. Cockayne S.
2. Coffin-Lowry S.
3. Coffin-Siris S.
4. Dyggve-Melchior-Clausen dysplasia
5. Homocystinuria
6. Lesch-Nyhan S. (congenital hyperuricosuria)
7. Morquio S.
8. Mucolipidosis III (pseudo-Hurler polydystrophy)
9. Osteopetrosis
10. Robinow S.
11. Seckel S. (bird-headed dwarfism)
12. Silver-Russell S.
13. Spondyloepiphyseal dysplasia congenita

(continued)
14. Stickler S. (arthro-ophthalmopathy)
15. Trisomy 21 S. (Down S.)
16. Turner S.
17. Williams S. (idiopathic hypercalcemia)

References

Gamut D-27

CONE-SHAPEP EPIPHYES

COMMON
1. Dactylitis (esp. bone infarction—sickle cell disease, vasculitis; osteomyelitis-postmeningococcemia; smallpox residual; frostbite; burn)
2. Idiopathic or normal
3. Trauma; epiphyseal-metaphyseal fracture; battered child S.

UNCOMMON
1. Achondroplasia
2. AcrocephaIosyndactyIy (Apert type)
3. Acrodysostosis (peripheral dysostosis)
4. Acrodysplasia with retinitis pigmentosa and nephropathy (Saldino-Mainzer S.); other conoIenal syndromes
5. Acromesomelic dysplasia
6. Acromicric dysplasia
7. Asphyxiating thoracic dysplasia (Jeune S.)
8. BrachydactyIy syndromes (esp. type E)
9. Chondroectodermal dysplasia (Ellis-van Creveld S.)
10. Cleidocranial dysplasia
11. Cockayne S.
12. Coffin-Siris S.
13. Diastrophic dysplasia
14. DOOR S.
15. Dyggve-Melchior-Clausen dysplasia
16. Hereditary multiple exostoses (multiple cartilagirous exostoses; osteochondromatosis) (lateral cone)
17. Hyperthyroidism, neonatal
18. Hypervitaminosis A, chronic
19. Hypochondroplasia
20. Hypophosphatasia (knees)
21. Infantile multisystem inflammatory disease (NOMID)
22. Kashin-Beck disease
23. Metaphyseal chondrodysplasia (Jansen, McKusick and Schmid types)
24. Multiple epiphyseal dysplasia (Fairbank)
25. Orofaciodigital syndrome I (Papillon-Leage and Psaume S.)
26. Osteogenesis imperfecta
27. Osteoglophonic dysplasia
28. Osteopenosis
29. Otopalatodigital S. (type I)
30. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
31. Pseudohypoparathyroidism; pseudopseudohy- poparathyroidism
32. Radiation injury
33. Ruvalcaba S. (trichorhinophalangeal S., type III)
34. Scurvy
35. Seckel S. (bird-headed dwarfism)
36. SpondyloepimetaIaphyseal dysplasia (cone-shaped epiphyses type)
37. Trichorhinophalangeal dysplasia, type I (Giedion S.) and II (Giedion-Langer S.)
38. Weill-Marchesani S.

References
WIDE EPIPHYSEAL PLATE (PHYSIS)—GENERALIZED

COMMON
1. Growth hormone excess (eg, pituitary tumor; gigantism; treatment with growth hormone)
2. Hyperparathyroidism, primary or esp. secondary (renal osteodystrophy)
3. Maturation delay (endocrine, constitutional, other causes) (wide for age)
4. Rickets (all types) (See D-44)

WIDE EPIPHYSEAL PLATE (PHYSIS)—LOCALIZED

COMMON
1. Pathologic fracture (eg, scurvy; rickets; leukemia; metastasis)
2. Slipped capital femoral epiphysis
3. Trauma, esp. epiphyseal-metaphyseal fracture (Salter-Harris)

UNCOMMON
1. Congenital insensitivity to pain (fracture)
2. Infection (incl. congenital transplacental infection—syphilis, rubella)
3. Kirner deformity
4. Metaphyseal dysplasia (Shwachman type) (proximal femur)
5. Myelodysplasia (with absent or diminished pain sensitivity) (fracture)
6. Radiation injury
7. Riley-Day S. (familial dysautonomia) (fracture)
8. Spondylometaphyseal dysplasias

REFERENCES
LOCALIZED EPIPHYSEAL OR METAPHYSEAL LESION RESULTING IN PREMATURE CLOSURE OF GROWTH PLATE AND A SHORTENED BONE

COMMON
1. Local hyperemia (eg, infection; juvenile chronic arthritis; juvenile rheumatoid arthritis; hemophilia; arteriovenous malformation)
2. Osteomyelitis (eg, bacterial; tuberculous; meningococcal; yaws; smallpox residual)
3. Trauma; battered child S.; surgical trauma

UNCOMMON
1. Bone infarction (eg, sickle cell disease)
2. Disuse (eg, immobilization; postfracture)
3. Enchondromatosis (Ollier disease); Maffucci S.
4. Hypervitaminosis A
5. Infantile multisystem inflammatory disease (NOMID)
6. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
7. Neoplasm invading growth plate
8. Pseudohypoparathyroidism; pseudopseudohypoparathyroidism
9. Radiation injury
10. Rickets
11. Scurvy
12. Thermal injury (burn; frostbite)

References

GROSS DISRUPTION OF EPIPHYSEAL-METAPHYSEAL REGION

COMMON
1. Battered child S.; other severe trauma with epiphyseal-metaphyseal fracture
2. Fracture in neurologic or neuromuscular disorder
3. Fracture in weakened bone
   a. Bone infarction (esp. sickle cell disease)
   b. Congenital transplacental infection (eg, syphilis; rubella; cytomegalovirus infection)
   c. Hyperparathyroidism
   d. Metastatic disease
   e. Osteomyelitis (eg, bacterial; smallpox residual)
   f. Rickets (all types)

UNCOMMON
1. Bone sarcoma
2. Langerhans cell histiocytosis (esp. eosinophilic granuloma)
3. Metaphyseal chondrodysplasia (Jansen type)
4. Osteogenesis imperfecta
5. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
6. Scurvy
7. Sensory neuropathy
   a. Amyotrophic lateral sclerosis
   b. Congenital insensitivity to pain
   c. Diabetes
   d. Leprosy
   e. Myelodysplasia
   f. Peripheral nerve injury
   g. Syphilis (tabes dorsalis)
   h. Syringomyelia; hydromyelia
8. Spondyloepimetaphyseal dysplasia (Strudwick type)

Reference
Gamut D-31

RADIOLUCENT METAPHYSEAL BANDS

COMMON

*1. Congenital transplacental infection (eg, toxoplasmosis; rubella; cytomegalovirus infection; herpes; syphilis)
2. Leukemia
3. Metastatic disease (esp. neuroblastoma)
4. Normal variant (esp. in neonate); prematurity
*5. Systemic illness or stress in childhood, infancy, or in utero (eg, asthma; diabetes; cystic fibrosis {mucoviscidosis}; juvenile chronic arthritis; juvenile rheumatoid arthritis; malnutrition)
*6. Trauma; fractures; battered child S.; deprivation (psychosocial) dwarfism

UNCOMMON

*1. Chemotherapy; radiation injury
2. Erythroblastosis fetalis
3. Fetal hydantoin S. (Dilantin embryopathy)
4. Heavy metal or chemical poisoning, esp. lead (alternating with dense lines)
5. Hypervitaminosis D
6. Hypophosphatasia
7. Infection, postnatal (eg, brucellosis)
8. Intruterine gut perforation with meconium peritonitis
*9. Osteopetrosis
10. Oxalosis
11. Prolonged parenteral hyperalimentation; total parenteral nutrition
*12. Rickets, healing
13. Scurvy
*14. Williams S. (idiopathic hypercalcemia)

* May have alternating radiolucent and radiopaque transverse metaphyseal bands.

References


Gamut D-32

TRANSVERSE LINES OR ZONES OF INCREASED DENSITY IN THE METAPHYSES

COMMON

1. Anemia, chronic (eg, sickle cell disease; thalassemia)
2. Chemotherapy (eg, methotrexate)
3. Growth acceleration lines following growth arrest due to systemic illness or stress in infancy or childhood (eg, asthma; diabetes; cystic fibrosis {mucoviscidosis}; juvenile chronic arthritis; juvenile rheumatoid arthritis; malnutrition)
4. Lead poisoning
5. Leukemia, treated
6. Normal variant (esp. in neonate—dense zone of provisional calcification)
7. Renal osteodystrophy (secondary hyperparathyroidism), healing
8. Rickets, healing
9. Trauma; battered child S.; stress fracture

UNCOMMON

1. Aminopterin fetopathy
2. Biphosphonate therapy
3. Chronic recurrent multifocal osteomyelitis

(continued)
4. Congenital transplacental infection, healing (eg, toxoplasmosis; rubella; cytomegalovirus infection; herpes; syphilis)
5. Deprivation (psychosocial) dwarfism with trauma
6. Drug or hormone therapy in high dosage (eg, steroids; parathormone; methotrexate; estrogen or heavy metal therapy to mother during pregnancy)
7. Dysosteosclerosis
8. Heavy metal or chemical poisoning, other (eg, bismuth; arsenic; phosphorus; fluoride; mercury; lithium; radium; thorotrast)
9. Hypervitaminosis D
10. Hypoparathyroidism; pseudohypoparathyroidism
11. Hypothyroidism; cretinism (treated)
12. Meconium peritonitis (neonatal dense bands)
13. Metaphyseal chondrodysplasias
14. Osteopetrosis
15. Oxalosis
16. Parathormone therapy
17. Patterson S.
18. Radiation injury from bone-seeking isotopes (Sr\textsuperscript{90}, Y\textsuperscript{90}, P\textsuperscript{32})
19. Sclerosteosis (esp. knees)
20. Scurvy, healing
21. Spondyloepimeta physeal dysplasias
22. Spondylometaphyseal dysplasias
23. Vascular injury
24. Williams S. (idiopathic hypercalcemia)

References
1. Follis RH Jr, Park EA: Some observations on bone growth, with particular respect to zones and transverse lines of increased density in the metaphysis. AJR 1952; 68:709–724

Gamut D-33

DENSE VERTICAL METAPHYSEAL LINES

COMMON
1. Congenital transplacental infections (“celery stalk” metaphyses) (eg, rubella; cytomegalovirus infection; syphilis)
2. Metaphyseal injury (localized)
3. Osteopathia striata (Voorhoeve disease)

UNCOMMON
1. Enchondromatosis, early (Ollier disease); Maffucci S.
2. Goltz S. (focal dermal hypoplasia)
3. Hypophosphatasia
4. Metaphyseal chondrodysplasias
5. Mixed sclerosing bone dysplasias
6. Normal variant
7. Osteopathia striata with cranial sclerosis
8. Phenylketonuria
9. Sponastrime dysplasia

References

Gamut D-34-1

SPLAYING, FLARING, OR WIDENING OF THE METAPHYES (INCLUDING ERLENMEYER FLASK DEFORMITY)
(See D-34-2 and -3)

COMMON
*1. Anemia, primary (eg, thalassemia; sickle cell disease)
2. Bone cyst or benign expansile bone neoplasm
3. Fibrous dysplasia (incl. McCune-Albright S.)
4. Fracture; epiphyseal-metaphyseal injury
*5. Gaucher disease; Niemann-Pick disease
6. Normal variant
7. Rickets, incl. biliary rickets

**UNCOMMON**

*1. Congenital syndromes and bone dysplasias (esp. osteopetrosis; achondroplasia; Pyle dysplasia) (See D-34-2)
2. Fetal hydantoin S. (Dilantin embryopathy)
3. Hypervitaminosis A
4. Hypophosphatasia
5. Immunologic disorders
6. Langerhans cell histiocytosis
*7. Lead poisoning, chronic
*8. Mastocytosis
9. Phenylketonuria
10. Renal osteodystrophy (secondary hyperparathyroidism)
11. Scurvy

*May have Erlenmeyer flask-like deformity.

**References**

Gamut D-34-2

**CONGENITAL SYNDROMES AND SKELETAL DYSPLASIAS WITH SPLAYING, FLARING, OR WIDENING OF THE METAPHYSES**

**COMMON**
1. Achondroplasia
2. Enchondromatosis (Ollier disease); Maffucci S.
3. Chondrodysplasia punctata (multiple types, esp. rhizomelic)
4. Chondroectodermal dysplasia (Ellis-van Creveld S.)
*5. Gaucher disease; Niemann-Pick disease
*6. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
*7. Osteopetrosis
*8. Pyle dysplasia

**UNCOMMON**

1. Achondrogenesis
2. Acromesomelic dysplasia
3. Cephaloskeletal dysplasia (Taybi-Linder S.)
4. Cockayne S.
*5. Craniometaphyseal dysplasia; craniodiaphyseal dysplasia
6. de la Chapelle dysplasia
7. Diastrophic dysplasia
*8. Dysostosclerosis
9. Dyssegmental dysplasia
10. Fibrochondrogenesis
*11. Frontometaphyseal dysplasia
12. Hypochondroplasia
*13. Hypophosphatasia (adult)
14. Infantile multisystem inflammatory disease (NOMID)
*15. Kniest dysplasia
*16. Membranous lipodystrophy
17. Mesomelic dysplasia (Langer type)
18. Metaphyseal chondrodysplasia (Jansen, McKusick, Schmid types)
19. Metatropic dysplasia
20. Morquio S.
21. Mucolipidosis II (I-cell disease)
22. Oculodento-osseous dysplasia
*23. Osteodosplasty (Melnick-Needles S.)
24. Osteogenesis imperfecta (rare “cystic” form)
25. Otopalatodigital S. (type I)
26. Phenylketonuria
27. Progressive pseudorheumatoid chondrodysplasia
28. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
*29. Schwarz-Lélek S.

(continued)
30. Short rib-polydactyly syndromes  
31. Spondyloepiphyseal dysplasia congenita  
32. Spondyloepi- and metaphyseal dysplasia  
33. Spondylometaphyseal dysplasia (Sedaghatian and  
   corner fracture types)  
34. Stickler S. (arthro-ophthalmopathy) (infants)  
35. Thanatophoric dysplasia  
*36. Weaver S.  
37. Weissenbacher-Zweymüller phenotype  
38. Williams S. (idiopathic hypercalcemia) (distal  
   femurs)  
* May have Erlenmeyer flask-like deformity.

References  
1. Kozlowski K, Beighton P: Gamut Index of Skeletal Dys-  
   plasias. Berlin: Springer-Verlag, 1984, p 63  
2. Swischuk LE, John SD: Differential Diagnosis in Pediatric  
   Radiology. (ed 2) Baltimore: Williams & Wilkins, 1995,  
   pp 257–259  
3. Taybi H, Lachman RS: Radiology of Syndromes, Metabolic  
   Disorders, and Skeletal Dysplasias. (ed 4) St. Louis: Mosby-  
   Year Book Inc, 1996, pp 1030, 1037–1038

Gamut D-34

34. Erlenmeyer flask deformity of metaphysis (See D-34-1 and -2)  

COMMON  
1. Anemia g, primary (eg, thalassemia; sickle cell  
   disease)  
2. Gaucher disease; Niemann-Pick disease  
3. Hereditary multiple exostoses (multiple cartilagi-  
   nous exostoses; osteochondromatosis)  
4. Osteopetrosis  
5. Pyle dysplasia (familial metaphyseal dysplasia)  

UNCOMMON  
1. Craniometaphyseal dysplasia  
2. Dysostosclerosis  
3. Frontometaphyseal dysplasia  
4. Hypophosphatasia (adult)  
5. Kniest dysplasia  
6. Lead poisoning, chronic  
7. Mastocytosis  
8. Membranous lipodystrophy  
9. Osteodysplasty (Melnick-Needles S.)  
10. Otopalatodigital S. (type I)  
11. Rickets, healing  
12. Schwarz-Lélek S.  
13. Weaver S.

References  
1. Greenfield GB: Radiology of Bone Diseases. (ed 5) Phila-  
   delphia: Lippincott, 1990  
2. Swischuk LE, John SD: Differential Diagnosis in Pediatric  
   Radiology. (ed 2) Baltimore: Williams & Wilkins, 1995,  
   pp 257–259  
3. Taybi H, Lachman RS: Radiology of Syndromes, Metabolic  
   Disorders, and Skeletal Dysplasias. (ed 4) St. Louis: Mosby-  
   Year Book Inc, 1996, pp 1030, 1037–1038

Gamut D-35

DUMBBELL BONES (SHORT LONG  
   BONES WITH PRONOUNCED  
   METAPHYSEAL FLARING)

COMMON  
1. Achondroplasia  
2. Kniest dysplasia  
3. Metatropic dysplasia  
4. Pseudoachondroplasia (pseudoachondroplastic  
   spondyloepiphyseal dysplasia), severe  

UNCOMMON  
1. Chondrodysplasia punctata, rhizomelic type  
2. Chondroectodermal dysplasia (Ellis-van Creveld S.)  
3. Diastrophic dysplasia  
4. Dyssegmental dysplasia  
5. Fibrochondrogenesis  
6. Omodyplasia
7. Osteogenesis imperfecta (type III)
8. Otospondyloepiphyseal dysplasia (OSMED)
9. Weissenbacher-Zweymüller phenotype

References

Gamut D-36-1
METAPHYSEAL CUPPING

COMMON
1. Cone-shaped epiphyses (See D-27)
2. Congenital syndromes and bone dysplasias (See D-36-2)
3. Normal variant (eg, distal ulna and fibula; triangular-shaped finger and toe phalanges)
4. Prolonged immobilization of joints causing distal metaphyseal cupping (eg, poliomyelitis; tuberculosis or pyarthrosis of hip; slipped capital femoral epiphysis; developmental dysplasia of the hip—DDH {congenital hip dysplasia or dislocation})
5. Rickets (all types) (See D-44)
6. Trauma (to cartilage); epiphyseal-metaphyseal injury

UNCOMMON
1. Bone infarction; hypovascularity
2. Hypervitaminosis A
3. Leukemia
4. Osteomyelitis (eg, bacterial-esp. meningococcemia; syphilis; yaws; smallpox-prior to eradication)
5. Radiation injury
6. Scurvy (after a compression fracture)
7. Sickle cell disease
8. Thermal injury (frostbite; burn)

References

Gamut D-36-2
CONGENITAL SYNDROMES AND SKELETAL DYSPLASIAS WITH METAPHYSEAL CUPPING

COMMON
1. Achondroplasia
2. Chondroectodermal dysplasia (Ellis-van Creveld S.)
3. Congenital insensitivity to pain
4. Hypophosphatasia

UNCOMMON
1. Achondrogenesis (type II)
2. Acrodysostosis (peripheral dysostosis)
3. Cephaloskeletal dysplasia (Taybi-Linder S.)
4. Chondrodysplasia punctata (rhizomelic and X-linked recessive types)
5. Copper deficiency, nutritional; Menkes S. (kinky-hair S.) (spurs)
6. Diastrophic dysplasia
7. Dyssegmental dysplasia
8. Hyperparathyroidism, neonatal
9. Hypochondroplasia
10. Immune deficiency syndromes (eg, metaphyseal dysplasia with thymolymphopenia; Shwachman S.; adenosine deaminase deficiency)
11. Infantile multisystem inflammatory disease (NOMID)
12. Metaphyseal chondrodysplasia (all types)
13. Metatropic dysplasia
14. Mucolipidosis II (I-cell disease) (in infants); GM
tangliosidosis

(continued)
15. Mucopolysaccharidoses (See J-4)
16. Opsismodysplasia
17. Osteodysplasty (Melnick-Needles S.)
18. Phenylketonuria
19. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
20. Schneckenbecken dysplasia
21. Short rib-polydactyly S. type III
22. Spondylomegaepiphyseal-metaphyseal dysplasia
23. Spondylometaphyseal dysplasia (Kozlowski and Sedaghatian types)
24. Thanatophoric dysplasia
25. Trichorhinophalangeal dysplasia, type I (Giedion S.) and type II (Langer-Giedion S.)
26. Vitamin K deficiency embryopathy

**References**

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**Gamut D-37**

**METAPHYSEAL BEAKS, SPURS, OR FRAGMENTATION**

**COMMON**
1. Bow legs, other causes (See D-185)
2. Fracture, epiphyseal-metaphyseal (eg, normal bones; battered child S.; breech delivery)
3. Normal, esp. knees with physiologic bow legs
4. Osteomyelitis; congenital transplacental infections (eg, rubella; cytomegalovirus infection; syphilis)
5. Rickets (all types)
6. Tibia vara (Blount’s disease)

**UNCOMMON**
1. Adenosine deaminase deficiency
2. Copper deficiency, nutritional; Menkes S. (kinky-hair S.)
3. Deferoxamine-induced bone dysplasia
4. Dyschondrosteosis (medial tibial metaphysis)
5. Hyperparathyroidism
6. Hypophosphatasia
7. Leukemia
8. Maroteaux-Lamy S.
9. Metaphyseal dysplasia (Jansen and anadysplasia types)
10. Metastatic disease (esp. neuroblastoma)
11. Neurologic disease with bone atrophy
12. Opsismodysplasia
13. Patterson S.
14. Scurvy (Pelkan spurs)
15. Short rib-polydactyly S. type II (Majewski) and III
16. Spondyloepimetaphyseal dysplasia (Strudwick type)
17. Spondylometaphyseal dysplasia (corner fracture type)

**References**
INDISTINCT FRAYED METAPHYSSES

COMMON
1. Osteomalacia
2. Rickets (all types) (See D-44)

UNCOMMON
1. Chronic stress (eg, in wrists of adolescent gymnasts)
2. Congenital transplacental infections (rubella; syphilis)
3. Copper deficiency, nutritional; Menkes S. (kinky-hair S.)
4. Dyggve-Melchior-Clausen dysplasia
5. Hyperparathyroidism, severe
6. Hypophosphatasia
7. Metaphyseal chondrodysplasia (Jansen and other types)
8. Morquio S.
9. Oxalosis
10. Patterson S.
11. Scurvy

References

EROSION OF THE MEDIAL ASPECT OF THE PROXIMAL METAPHYSSES OF LONG BONES (ESPECIALLY THE HUMERUS, FEMUR, AND TIBIA)

COMMON
1. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
2. Leukemia
3. Metastatic neuroblastoma
4. Rheumatoid arthritis (humeral notch)

UNCOMMON
1. Gaucher disease; Niemann-Pick disease (esp. humerus)
2. Hurler S.
3. Juxtacortical chondroma
4. Normal variant
5. Rickets
6. Syphilis, congenital

Reference
D. Bone, Joints, and Soft Tissues

Gamut D-40-S

DIFFERENTIAL DIAGNOSIS OF VARIOUS METAPHYSSEAL DISTURBANCES

<table>
<thead>
<tr>
<th>Disturbance</th>
<th>Epiphysis</th>
<th>Physis</th>
<th>Zone of Provisional Calcification</th>
<th>Fraying</th>
<th>Cupping</th>
<th>Radiolucent Metaphyseal Fracture</th>
<th>Metaphyseal Periosteal Reaction</th>
<th>Age of Onset (May be present at)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rickets</td>
<td>Ill-defined</td>
<td>Widened</td>
<td>Early stage ill-defined</td>
<td>+</td>
<td></td>
<td>+</td>
<td>-</td>
<td>6 months—rarely at birth (osteomalacic mothers)</td>
</tr>
<tr>
<td>Scurvy</td>
<td>Ringed</td>
<td>Narrow, normal</td>
<td>Widened</td>
<td>-</td>
<td>From infarction</td>
<td>+</td>
<td>+</td>
<td>3 months</td>
</tr>
<tr>
<td>Hypophosphatiasia</td>
<td>Ill-defined</td>
<td>Widened</td>
<td>Ill-defined</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>Birth</td>
</tr>
<tr>
<td>Metaphyseal dysplasia</td>
<td>Normal</td>
<td>Widened</td>
<td>Ill-defined</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>Birth</td>
</tr>
<tr>
<td>Phenylketonuria</td>
<td>May be retarded</td>
<td>Spicules of calcium protrude</td>
<td>Normal</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>1 month</td>
</tr>
<tr>
<td>Infantile trauma</td>
<td>May be displaced</td>
<td>May be widened</td>
<td>Normal</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>Birth injury</td>
</tr>
<tr>
<td>Rubella</td>
<td>Ill-defined</td>
<td>Normal</td>
<td>Absent</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>Birth</td>
</tr>
<tr>
<td>Syphilis</td>
<td>Normal</td>
<td>Widened</td>
<td>Widened</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Birth</td>
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<td>Ill-defined, destructive foci</td>
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<td>Normal</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>Birth</td>
</tr>
</tbody>
</table>

Reference

Gamut D-41

SUBPERIOSTEAL BONE RESORPTION
(See D-39, D-105)

COMMON
*1. Chronic avulsive injury of cortex (eg, cortical/periosteal desmoid)
2. Hyperparathyroidism, primary or secondary (renal osteodystrophy)

UNCOMMON
1. Erdheim-Chester disease
+2. Farber disease (disseminated lipogranulomatosis)
+3. Metaphyseal chondrodysplasia (Jansen type)
+4. Mucolipidoses; GM1 gangliosidosis
5. Pseudohypohyperparathyroidism
6. Rickets, severe
*7. Subperiosteal hematoma
*8. Subperiosteal osteomyelitis

* Focal.
+ In infants.
References

Gamut D-41-S
SITES OF OSSEOUS RESORPTION IN PRIMARY AND SECONDARY HYPERPARATHYROIDISM

A. Subperiosteal
1. Hands (middle phalanges of 2nd and 3rd fingers, radial aspect; also terminal phalangeal tufts; sesamoid bones)
2. Femur, tibia, humerus (predominantly proximal medial aspect)
3. Other long bones (proximal or distal)
4. Lamina dura of teeth
5. Ribs (upper or lower border)

B. Subchondral
1. Clavicle (acromioclavicular and sternoclavicular joints)
2. Pubic symphysis
3. Hands and feet (interphalangeal joints, MCP and MTP joints)
4. Sacroiliac joint (greater on iliac side)
5. Discovertebral junction
6. Patellofemoral joint
7. Tibiofemoral joint
8. Glenohumeral joint
9. Sella turcica (endosteal resorption)
10. Calvarium, inner and outer table (endosteal resorption)

C. Subligamentous or Subtendinous
1. Clavicle (distal undersurface—coracoclavicular ligament)

2. Humerus (proximal—rotator cuff)
3. Olecranon process of ulna (anconeus attachment)
4. Anterior superior iliac spine (sartorius attachment)
5. Anterior inferior iliac spine (rectus femoris attachment)
6. Ischial tuberosities (hamstring attachment)
7. Calcaneus (posterior superior and inferior surfaces—achilles and aponeurosis attachments)

References
1. Murphey MD, Sartoris DJ, Quale JL, Pathria MN, Martin NL: Musculoskeletal manifestations of chronic renal insufficiency.

Gamut D-42
LOCALIZED OR REGIONAL OSTEOPOROSIS; BONE ATROPHY (INCLUDING SUDECK’S ATROPHY)

COMMON
1. Acro-osteolysis (See D-127)
2. Arthritis (esp. rheumatoid; juvenile chronic; juvenile rheumatoid; Reiter S.; septic; tuberculous; fungal—mycetoma) (See D-228); synovitis
3. Disuse atrophy; immobilization (eg, fracture; cast); neural or muscular paralysis
4. Hemorrhage (eg, trauma; hemophilia)
5. Neoplasm, benign or malignant (esp. myeloma; osteolytic metastasis)
6. Osteomyelitis (eg, bacterial; tuberculous; fungal)
7. Osteonecrosis (incl. radiation); bone infarct or avascular necrosis, early
8. Soft tissue infection adjacent to bone; human or animal bite
9. Sudeck’s atrophy (reflex sympathetic dystrophy)
10. Thermal injury (eg, burn; frostbite); electroshock

(continued)
11. Trauma with or without fracture; fracture complications (eg, nonunion; malunion; infection)
12. Vascular insufficiency, arterial or venous (eg, arteriosclerosis obliterans; Buerger disease (thromboangiitis obliterans); Raynaud disease)

UNCOMMON
1. Arteriovenous malformation; hemangioma
2. Bone marrow edema S. (transient osteoporosis of hip)
3. Congenital pseudarthrosis
4. Denervation or tendon transection
5. Diabetes (diabetic osteopathy)
6. Idiopathic
7. Paget’s disease (eg, osteoporosis circumscripta of skull)
8. Regional migratory osteoporosis of legs
9. Sarcoidosis
10. Shoulder-hand S. (eg, myocardial infarction; scalenus anticus S.)

UNCOMMON
1. Copper deficiency, nutritional; Menkes S. (kinky-hair S.) (in infants)

III. DISUSE ATROPHY (MUSCLE WEAKNESS; LACK OF STRESS STIMULUS OR WEIGHT BEARING)

COMMON
1. Cerebral palsy
2. Immobilization (eg, chronic disease; major fracture; cast)
3. Muscular dystrophy; neuromuscular disorder
4. Spinal cord disease

UNCOMMON
1. Arthrogryposis
2. Space flight osteoporosis

IV. ENDOCRINE

COMMON
1. Adrenocortical abnormality (eg, adrenal atrophy—adrenopause; Addison disease; Cushing S.)
2. Hypogonadism
   a. Ovarian—estrogen deficiency (eg, menopause; oophorectomy; Turner S.)
   b. Testicular (eg, eunuchoidism; prepubertal castration S.; Klinefelter S. (XXY S.)
3. Pancreatic abnormality (eg, poorly controlled diabetes; pancreatic insufficiency; cystic fibrosis {mucoviscidosis}; pancreatitis)
4. Parathyroid abnormality (eg, hyperparathyroidism, primary or secondary {renal osteodystrophy}; hypoparathyroidism with steatorrhea)
5. Thyroid abnormality (eg, hyperthyroidism; thyrotoxicosis; hypothyroidism; cretinism)

UNCOMMON
1. Pituitary abnormality (eg, acromegaly; Cushing S. due to basophilic adenoma; hypopituitarism; cranio-pharyngioma)
2. Steroid-producing nonendocrine neoplasm (eg, oat cell carcinoma of lung)

V. MISCELLANEOUS

COMMON
1. Anemia (eg, sickle cell disease; thalassemia; spherocytosis; pyruvate kinase deficiency; severe iron deficiency)
2. Connective tissue disease (collagen disease) (eg, lupus erythematosus; scleroderma; dermatomyositis; CREST syndrome; MCTD)
3. Iatrogenic; drug therapy (eg, excessive steroids, heparin); hypervitaminosis A and D; bisphosphonate therapy; chemotherapy; aluminum-induced bone disease; experimental hyperoxia
4. Idiopathic (eg, idiopathic juvenile osteoporosis)
5. Liver disease (eg, jaundice; biliary atresia; Wilson disease {hepatolenticular degeneration}; large or multiple liver tumors or cysts with protein disturbance)
6. Metastatic disease (eg, carcinomatosis)
7. Multiple myeloma
8. [Osteomalacia]
9. Pregnancy
10. Renal disease (eg, nephrosis; renal tubular acidosis; oxalosis; renal osteodystrophy—secondary hyperparathyroidism)
11. Rheumatoid arthritis
12. Senile or postmenopausal osteoporosis

UNCOMMON
1. Amyloidosis
2. Deprivation (psychosocial) dwarfism
3. Epidermolysis bullosa (dystrophic and acquired)
4. Gaucher disease; Niemann-Pick disease
5. Hemochromatosis
6. Hemophilia
7. Histiocytic medullary reticulocytosis
8. Hydroxypatite deposition disease (HADD)
9. Hypoxemia (eg, chronic pulmonary disease; congenital heart disease)
10. Kawasaki S.
11. Leukemia, acute
12. Mastocytosis
13. Ochronosis (alkaptonuria)
14. Reflex sympathetic dystrophy, widespread
15. Seronegative spondyloarthropathy (esp. ankylosing spondylitis)
16. Tylosis
17. Vascular tumors of bone, widespread (eg, angiomatosis; massive osteolysis {Gorham vanishing bone disease})
18. Waldenström macroglobulinemia
19. Wegener granulomatosis

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References

CONGENITAL SYNDROMES AND SKELETAL DYSPLASIAS WITH GENERALIZED OSTEOPOROSIS

COMMON
1. Anemia (eg, sickle cell disease; thalassemia; spherocytosis; pyruvate kinase deficiency)
2. Cystic fibrosis (mucoviscidosis)
3. Metabolic error (eg, homocystinuria; hypophosphatemia; phenylketonuria)
4. Neuromuscular disorders and dystrophies (eg, arthrogryposis; myotonica congenita; Duchenne muscular dystrophy)
5. Osteogenesis imperfecta (all types)

(continued)
UNCOMMON

1. Aspartylglucosaminuria
2. Cerebro-oculo-facial-skeletal S. (Pena-Shokeir S. type II)
3. Cockayne S.
4. Contractural arachnodactyly
5. Cranioectodermal dysplasia
6. Ehlers-Danlos S.
7. Familial Mediterranean fever (familial recurrent polyserositis)
8. Fanconi anemia (pancytopenia-dysmelia S.)
9. Farber disease (disseminated lipogranulomatosis)
10. Fibrodysplasia (myositis) ossificans progressiva
11. Fibrogenesis imperfecta ossium
12. Gaucher disease; Niemann-Pick disease
13. Geroderma osteodysplastica
14. Glycogen storage disease type I (von Gierke disease)
15. Goltz S. (focal dermal hypoplasia)
16. Hallermann-Streiff S. (oculomandibulofacial S.)
17. Infantile multisystem inflammatory disease (NOMID)
18. Infantile Refsum disease
19. Klinefelter S. (XXY S.)
20. Laron S. (pituitary dwarfism II)
21. Lowe S. (oculocerebrorenal S.)
22. Mauriac S.
23. Membranous lipodystrophy
24. Menkes S. (kinky-hair S.)
25. Metachromatic leukodystrophies
26. Mucopolysaccharidoses; mucolipidoses; GM1 gangliosidosis; mannosidosis (See J-4)
27. Osteochondrodysplasias (eg, Pyle dysplasia; diaphyseal dysplasia; metaphyseal dysplasia [Jansen type]; achondrogenesis)
28. Osteolysis syndromes (incl. Hajdu-Cheney S.; osteolysis with nephropathy)
29. Osteoporosis-pseudoglioma S.
30. Otopalatodigital S.
31. Papillon-Lefèvre S.
32. Parastremmatic dysplasia
33. Prader-Willi S.
34. Progeria; Werner S.
35. Pseudohypoparathyroidism; pseudopseudo-hypoparathyroidism
36. Rothmund-Thomson S.
37. Singleton-Merten S.
38. Thevenard S. (acrodystrophic neuropathy)
39. Trisomy 13 S.
40. Trisomy 18 S.
41. Turner S.
42. Williams S. (idiopathic hypercalcemia), late
43. Wilson disease (hepatolenticular degeneration)
44. Winchester S.
45. Wolman disease (familial xanthomatosis)

References


OSTEOMALACIA AND RICKETS

I. DEFICIENT ABSORPTION OF CALCIUM OR PHOSPHORUS

A. Malabsorption states

1. Cathartic abuse (esp. oily cathartics; phenolphthalein; magnesium sulfate)
2. Mesenteric disease
3. Pancreatic insufficiency (exocrine); pancreatitis
4. Postoperative gastric or small bowel resection; small bowel bypass
5. Primary small bowel disease (eg, celiac disease; sprue; amyloidosis; scleroderma; Crohn’s disease; lymphoma; small bowel fistula; blind loop S.)
6. Steatorrhea, idiopathic
B. Obstructive jaundice or liver failure
   1. Acquired chronic biliary obstruction
   2. Biliary atresia

II. EXCESSIVE RENAL EXCRETION OF CALCIUM OR PHOSPHORUS

A. Glomerular (hyperphosphatemic)
   1. Renal osteodystrophy (secondary hyperparathyroidism)
   2. Renal osteomalacia

B. Tubular (hypophosphatemic)
   1. Fanconi syndromes (de Toni-Debré-Fanconi S.)
      (osteomalacia or rickets, growth retardation, renal tubular acidosis, phosphaturia, glycosuria, aminoaciduria, and proteinuria)
      a. Primary (idiopathic)
         i. Childhood type, with cystinosis
         ii. Adult type, without cystinosis
      b. Secondary (acquired)
         i. Beryllium poisoning
         ii. Drugs (eg, amphotericin B; lithium salts; outdated tetracycline)
         iii. Heavy metal poisoning (eg, lead; cadmium; fluoride)
         iv. Hypervitaminosis D in adults
         v. Multiple myeloma
         vi. Nephrotic syndrome
         vii. Neurofibromatosis
         viii. Renal transplantation
   2. Inborn metabolic disturbances (eg, galactosemia; oxalosis; tyrosinosis; Wilson disease [hepatosplenic degeneration]; GM₁ gangliosidosis; hereditary fructose intolerance)
   3. Vitamin D-resistant rickets (hypophosphatemic familial rickets)

III. EXCESSIVE UTILIZATION OF CALCIUM AS FIXED BASE
   1. Chronic obstructive renal disease
   2. Idiopathic hypercalciuria
   3. Polycystic kidney disease
   4. Renal tubular acidosis
   5. Ureterosigmoidostomy (hyperchloremia)

IV. MISCELLANEOUS
   1. Aluminum-induced bone disease (eg, phosphate deficiency from aluminum hydroxide hemodialysis; antacid-induced osteomalacia and nephrolithiasis)
   2. Anticonvulsant drug therapy (eg, Dilantin; tranquilizers) (accelerated hepatic degradation of vitamin D3 and 25-HCC)
   3. Congenital rickets (maternal magnesium sulfate therapy; mother with osteomalacia)
   4. Decreased deposition of calcium in bone (eg, diphosphonate treatment for Paget’s disease)
   5. Dietary calcium deficiency (rare)
   6. Enzyme abnormality (eg, hypophosphatasia)
   7. Excessive excretion of calcium or phosphorus via breast or placenta (puerperal osteomalacia)
   8. Fibrogenesis imperfecta ossium; axial osteomalacia (with acquired vitamin D resistance)
   9. Immunologic disorders
   10. Paraneoplastic syndromes (humoral syndromes)
       (See D-44-S)
   11. Pernicious anemia
   12. Pseudovitamin D-deficiency rickets or osteomalacia
   13. Vitamin D deficient rickets (dietary or lack of sunshine)

NOTE: In infants less than 6 months of age, consider chiefly:
   1. Biliary atresia
   2. Hypophosphatasia
   3. Maternal magnesium sulfate therapy
   4. Neonatal rickets (premature infants with combined dietary deficiency and impaired hepatic hydroxylation of vitamin D)
   5. Vitamin D-dependent rickets (associated with severe myopathy; dietary intake of vitamin D is adequate)

References

(continued)
ONCOGENIC (TUMOR-INDUCED) OSTEOMALACIA: BONE AND SOFT TISSUE NEOPLASM ASSOCIATIONS*

COMMON
1. Hemangiopericytoma
2. Hemangioma, cavernous or sclerosing
3. Mesenchymal tumor (prominent fibrous and vascular components)

UNCOMMON
1. Angiosarcoma
2. Fibrous dysplasia
3. Giant cell granuloma (reparative)
4. Giant cell tumor (benign and malignant)
5. Gorlin S. (nevus basal cell carcinoma S.)
6. Malignant fibrous histiocytoma
7. Malignant peripheral nerve sheath tumor (MPNST)
8. Metastatic disease (esp.lastic-prostate; also neuroblastoma)
9. Nasopharyngeal angiofibroma
10. Nonossifying fibroma (fibroxanthoma); fibrous cortical defect
11. Osteoblastoma

* All related to production of ectopic humoral substance.

References

CAUSES OF ALTERED CALCIUM AND PHOSPHORUS CONCENTRATIONS

HYPERCALCEMIA
1. Adrenal insufficiency
2. Hyperparathyroidism
3. Hyperthyroidism
4. Hypervitaminosis D
5. Hypophosphatasia
6. Hypothyroidism
7. Leukemia; lymphoma
8. Metaphyseal chondrodysplasia (Jansen type)
9. Milk-alkali S.
10. Multiple myeloma (myelomatosis)
11. Reticuloses
12. Sarcoidosis
13. Secretion of parathormone-like substance from malignant neoplasms
14. Skeletal metastases (carcinomatosis)
15. Werner S. (familial multiple endocrine neoplasms-MEN S., type I)
16. Widespread bone destruction; rapid deossification
17. Williams S. (idiopathic hypercalcemia)

HYPERPHOSPHATEMIA
1. Acromegaly
2. Glomerular failure
3. Hypervitaminosis D
4. Hypoparathyroidism; pseudohypoparathyroidism
5. Skeletal metastases (carcinomatosis)

HYPOCALCEMIA
1. Acidosis
2. Hypoalbuminemia
3. Hypoparathyroidism; pseudohypoparathyroidism
4. Malabsorption with reduced calcium absorption from intestine
5. Normal neonate
6. Pancreatitis
7. Uremia; renal osteodystrophy (secondary hyperparathyroidism)
8. Vitamin D deficiency (hypovitaminosis D)

**HYPOPHOSPHATEMIA**
1. Dietary deficiency
2. Hyperparathyroidism
3. Hypovitaminosis D (eg, Vitamin D-deficiency rickets; osteomalacia)
4. Increased carbohydrate metabolism
5. Malabsorption
6. Pregnancy
7. Renal tubular dysfunction (eg, Fanconi S.; Vitamin D-resistant rickets)
8. Skeletal metastases (canceromatosis)

**HYPERCALCIURIA**
1. Acidosis
2. Hypercalcemia
3. Hypervitaminosis D
4. Hyperparathyroidism, primary
5. Osteoporosis, active
6. Renal tubular dysfunction
7. Sarcoidosis
8. Widespread bone destruction; rapid deossification

**HYPOCALCIURIA**
1. Active reconstruction of bone
2. Alkalosis
3. Decreased glomerular filtration rate
4. Hypocalcemia
5. Malabsorption with reduced calcium absorption from intestine
6. Vitamin D deficiency (hypovitaminosis D)

**Reference**

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**Gamut D-46**
**WIDESPREAD OR GENERALIZED DEMINERALIZATION WITH COARSE TRABECULATION**

**COMMON**
1. Anemia, primary (esp. sickle cell disease, thalassemia)
2. Carcinomatosis
3. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
4. Multiple myeloma (myelomatosis)
5. Osteomalacia, rickets (eg, biliary atresia; alimentary tract disorder) (See D-44)
6. Osteoporosis (See D-43)
7. Paget's disease
8. Paralysis

**UNCOMMON**
1. Acromegaly
2. Fibrogenesis imperfecta ossium
3. Gaucher disease
4. Hemophilia
5. Idiopathic axial osteomalacia
6. Leukemia
7. Osteogenesis imperfecta
8. Recalcification after disuse osteoporosis

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**Gamut D-47**
**SCATTERED AREAS OF DECREASED AND INCREASED BONE DENSITY IN THE SKELETON**

**COMMON**
1. Lymphoma, leukemia
2. Metastases (esp. breast)
3. Osteomyelitis (esp. unusual infection—eg, tuberculosis; syphilis)

(continued)
4. Paget’s disease
5. Renal osteodystrophy (secondary hyperparathyroidism)

UNCOMMON
1. Fibrous dysplasia
2. Hyperparathyroidism, primary
3. Hyperphosphatasia
4. Langerhans cell histiocytosis
5. Mastocytosis
6. Tuberous sclerosis

Gamut D-48

AVASCULAR NECROSIS (EPIPHYSEAL ISCHEMIA)

COMMON
1. Anemia, primary (esp. sickle cell disease)
2. Idiopathic; Legg-Perthes disease
3. Occlusive vascular disease (eg, arteriosclerosis; Leriche S.; thromboembolic disease; giant cell arteritis)
4. Osteochondritis dissecans (localized form of avascular necrosis)
5. Steroid therapy; Cushing S.
6. Trauma (eg, fracture—esp. of femoral neck or proximal scaphoid; dislocation; surgical correction of congenital hip; slipped capital femoral epiphysis; hip nailing; microfracture; battered child S.; congenital insensitivity to pain)

UNCOMMON
1. Burn; frostbite; electrical injury
2. Caisson disease (dysbaric osteonecrosis)
3. Connective tissue disease (collagen disease) (eg, lupus erythematosus; polyarteritis nodosa; scleroderma)
4. Diabetes

5. Drug therapy (eg, anti-inflammatory agents—Butazolidin, Indocin; immunosuppressives; cytotoxic therapy; methotrexate)
6. Fabry disease
7. Fat embolism (eg, alcoholism; liver disease; pancreatitis; trauma)
8. Gaucher disease
9. Gout
10. Hemophilia
11. Hyperlipoproteinemia
12. Hypothyroidism
13. Infection (eg, pyogenic arthritis; osteomyelitis; subacute bacterial endocarditis)
14. Langerhans cell histiocytosis
15. Lymphoma; leukemia
16. Meyer dysplasia of femoral head
17. Multiple epiphyseal dysplasia (Fairbank) (femoral heads)
18. Neuropathic arthropathy (Charcot joint)
19. Osteoporosis, generalized
20. Polycythemia vera
21. Pregnancy
22. Radiation injury; radium poisoning
23. Rheumatoid arthritis
24. Spontaneous osteonecrosis of the knee
25. Thiemann disease (phalanges)
26. Trichorhinophalangeal dysplasia, type I (Giedion S.)
27. Winchester S.

References

**Gamut D-48-S**

**SITEs OF PREDileCTION AND EPONYMS FOR AVASCULAR NECROSIS**

**COMMON**

1. Carpal lunate Kienböck 1910
2. Femoral capital epiphysis Legg-Calvé-Perthes 1910
3. Medial femoral condyle (occasionally lateral femoral condyle) Blount 1937
4. Medial tibial condyle Blount 1937
5. [Osteochondritis dissecans] König 1887
6. Second metatarsal head (occasionally third or fourth) Freiberg 1914
7. Secondary patellar center Sinding-Larsen 1921
8. Talus (trocchlea) Diaz 1928
9. Tarsal navicular Köhler 1908
10. Tibial tubercle Osgood-Schlatter 1903
11. Vertebral body Calvé and Kümmell 1925
12. Vertebral epiphysis Scheuermann 1921

**UNCOMMON**

1. Bases of phalanges Thiemann 1909
2. Calcaneal apophysis Sever 1912
3. Capitolum of humerus Panner 1927
4. Carpal scaphoid Preiser 1911
5. Distal tibial epiphysis Liffert and Arkin 1950
6. Distal ulna Burns 1921
7. Entire carpus bilaterally Caffey 1945
8. Fifth metatarsal base Iselin 1912
9. Greater trochanter of femur Mandl 1922
10. Head of humerus Hass 1921
11. Head of radius Brailsford 1927
12. Heads of metacarpals Mauclaire 1927; Dietrich 1932
13. Iliac crest Buchman 1927
14. Intercondylar spines of tibia Caffey 1956
15. Ischial apophysis Milch 1953
16. Ischiopubic synchondrosis Van Neck 1924
17. Os tibiale externum Haglund 1908
18. Primary patellar center Köhler 1908
19. Symphysis pubis Pierson 1929

* Now considered a normal variant.

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**Reference**

BONE INFARCT (DIAMETAPHYSEAL ISCHEMIA)

COMMON
1. Anemia, primary (esp. sickle cell disease)
2. Idiopathic
3. Occlusive vascular disease (arteriosclerosis; Buerger disease {thromboangiitis obliterans}; thromboembolic disease)

UNCOMMON
1. Caisson disease (dysbaric osteonecrosis)
2. Connective tissue disease (collagen disease) (eg, lupus erythematosus, scleroderma)
3. Fat embolism (eg, alcoholism)
4. Gaucher disease
5. Infection; osteomyelitis
6. Pancreatitis with fat necrosis
7. Pheochromocytoma
8. Polyarteritis nodosa (vasculitis)
9. Radiation injury; radium poisoning

References

“BONE WITHIN A BONE” APPEARANCE

COMMON
1. Bone infarct (eg, sickle cell disease)
2. Growth arrest and recovery, “growth lines” (eg, due to severe childhood disease; infection; scurvy; rickets; stress; immobilization; leukemia chemotherapy)
3. Idiopathic
4. Normal neonate (esp. spine)
5. Osteopetrosis
6. Paget’s disease

UNCOMMON
1. Acromegaly
2. Bone diseases with a split or double layer cortex (See D-103)
3. Chronic osteomyelitis with sequestrum and involucrum (eg, pyogenic; syphilis)
4. Erdheim-Chester disease
5. Heavy metal poisoning (eg, lead; phosphorus; bismuth; cadmium; fluoride)
6. Hypervitaminosis D
7. Oxalosis
8. Prostaglandin E1 therapy
9. Subcortical osteoporosis (eg, Sudeck’s atrophy {reflex sympathetic dystrophy} involving carpals or tarsals; leukemia; metastatic disease)
10. Subperiosteal hemorrhage
11. Thorotrast; radiation osteitis

References
2. Frager DH, Subbarao K: The bone within a bone. JAMA 1983; 249:77–79
**Gamut D-51**

**BONE LESION WITH SEQUESTRUM OR SEQUESTRUM-LIKE REGION**

**COMMON**
1. Brodie abscess; osteomyelitis
2. Button sequestrum in skull (See A-22)
3. Osteoid osteoma
4. Osteonecrosis; bone infarct

**UNCOMMON**
1. Langerhans cell histiocytosis (esp. eosinophilic granuloma)
2. Lymphoma
3. Malignant fibrous histiocytoma; fibrosarcoma
4. Metastasis (esp. breast or other carcinoma with button sequestrum in skull)
5. Osteoblastoma
6. Syphilis; yaws
7. Tropical ulcer
8. Tuberculosis

* Lesions which contain true sequestra (devitalized bone surrounded by granulation tissue) are the result of infection or infarction.

**Gamut D-52**

**MULTIPLE SCLEROTIC FOCI OR CALCIFIC STREAKING IN INFANTS AND CHILDREN (See D-33)**

**NEONATES AND INFANTS**
1. Chondrodysplasia punctata (all types)
2. Chromosomal disorders (esp. trisomy 18 and 21)
3. Congenital transplacental infections (“celery stalk” metaphyses) (eg, rubella; cytomegalovirus infection; syphilis)
4. Healed fractures (eg, stress fracture; battered child S.; osteogenesis imperfecta)
5. Mucolipidosis II (I-cell disease); GM₁ gangliosidosis
6. Phenylketonuria
7. Smith-Lemli-Opitz S.
8. Sponastriome dysplasia
9. Warfarin embryopathy
10. Zellweger S. (cerebrohepatorenal S.)

**OLDER CHILDREN**
1. Angiometasis (rarely)
2. Bone infarcts; avascular necroses (eg, sickle cell disease; acute pancreatitis)
3. Bone islands (enostoses)
4. Enchondromatosis (Ollier disease); Maffucci S.
5. Gardner S.
6. Goltz S. (focal dermal hypoplasia)
7. Gorlin S. (nevoid basal cell carcinoma S.) (osteopoikilosis-like changes)
8. Healed fractures (incl. osteogenesis imperfecta)
9. Langerhans cell histiocytosis, healed or healing
10. Lymphoma
11. Mastocytosis
12. Melorheostosis
13. Metaphyseal chondrodysplasia (Jansen type)
14. Mixed sclerosing bone dysplasia
15. Osteomyelitis, multiple sites, healed or healing; yaws; fungal-mycetoma
16. Osteopathia striata (Voorhoeve disease); osteopathia striata with cranial sclerosis
17. Osteopetrosis
18. Osteopoikilosis
19. Osteosarcomatosis; osteoblastic metastases
20. Parastremmatic dysplasia
21. Patterson S.
22. Pyle dysplasia, in infancy; craniometaphyseal dysplasia; frontometaphyseal dysplasia; craniodiaphyseal dysplasia
23. Tuberous sclerosis

**References**
**Gamut D-53**

**SOLITARY OSTEOSCLEROTIC BONE LESION (See D-54)**

**COMMON**
1. Avascular necrosis (See D-48)
2. Bone infarct (See D-49)
3. Bone island or enostosis; idiopathic sclerosis
4. Callus (healed or healing fracture); stress fracture
5. Chondroid lesion (eg, enchondroma; osteochondroma)
6. Healed or healing benign bone lesion (eg, bone cyst; nonossifying fibroma {fibroxanthoma}; fibrous cortical defect; brown tumor of hyperparathyroidism; Langerhans cell histiocytosis; esp. eosinophilic granuloma)
7. Hyperostosis frontalis interna (skull)
8. Osteoblastic metastasis (esp. breast; prostate)
9. Osteochondritis dissecans
10. Osteoid osteoma
11. Osteoma
12. Osteomyelitis, chronic or healed (eg, Garré sclerosing osteomyelitis; Brodie abscess; granuloma; mycetoma; tropical ulcer)
13. Osteonecrosis (eg, radiation)
14. Paget’s disease

**UNCOMMON**
1. Bone sarcoma (eg, osteosarcoma; chondrosarcoma; Ewing sarcoma; parosteal sarcoma)
2. Condensing osteitis of clavicle
3. Fibrous dysplasia
4. Lymphoma; leukemia
5. Lytic metastasis following radiation or chemotherapy
6. Medullary calcification in a long bone following removal of an intramedullary rod
7. Mastocytosis
8. Melorheostosis
9. Meningioma (skull)
10. Ossifying fibroma (face, jaws)
11. Osteitis condensans ilii (unilateral)
12. Osteoblastoma
13. Plasma cell granuloma
14. Sternotococlavicular hyperostosis (SAPHO S.)
15. Syphilis; yaws

**References**

**Gamut D-54**

**MULTIPLE OSTEOSCLEROTIC BONE LESIONS**

**COMMON**
1. Bone infarcts
2. Bone islands (enostoses)
3. Callus (eg, healed rib fractures; battered child S.)
4. Osteitis condensans ilii
5. Osteoblastic metastases (esp. breast; prostate)
6. Osteomyelitis, chronic or healed (eg, tuberculous; fungal)
7. Paget’s disease

**UNCOMMON**
1. Avascular necroses
2. Chondrodysplasia punctata
3. Congenital total lipodystrophy (lipoatrophic diabetes)
4. Enchondromatosis (Ollier disease); Maffucci S.
5. Erdheim-Chester disease
6. Fibrous dysplasia
7. Heavy metal poisoning (eg, lead; phosphorus; bismuth; cadmium; fluoride)
8. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
9. Infantile cortical hyperostosis (Caffey disease)
10. Lymphoma; leukemia
11. Lytic metastases or multiple myeloma following radiation or chemotherapy
12. Mastocytosis
13. Melorheostosis
14. Mixed sclerosing bone dysplasia
15. Multiple enchondromas; osteochondromas
16. Multiple healed or healing benign bone lesions (eg, nonossifying fibromas; fibroxanthomas; fibrous cortical defects; brown tumors of hyperparathyroidism; Gaucher disease; Langerhans cell histiocytosis; angiomatosis)
17. Multiple myeloma (rarely); POEMS S.
18. Osteomas (eg, Gardner S.)
19. Osteomesopyknosis
20. Osteopathia striata (Voorhoeve disease); osteopathia striata with cranial sclerosis
21. Osteopoikilosis
22. Osteosarcomatosis
23. Pyknodysostosis
24. Sarcoidosis
25. Sternocostoclavicular hyperostosis (SAPHO S.)
26. Syphilis; yaws
27. Tuberous sclerosis

References
*19. Infantile cortical hyperostosis (Caffey disease)
20. Lymphoma; leukemia (treated)
21. Mastocytosis
*22. Melorheostosis
23. Multiple myeloma (rare); POEMS S.
*24. Neurofibromatosis
25. Osteodystrophy (Melnick-Needles S.)
26. Osteomalacia, rickets (healing)
27. Osteopathia striata (Voorhoeve disease); osteopathia striata with cranial sclerosis
28. Osteopetrosis
29. Osteopoikilosis
30. Osteosarcomatosis
31. Oxalosis
*32. Pachydermoperiostosis
33. Polyostotic fibrous dysplasia (McCune-Albright S.)
34. Pyknodysostosis
35. Pyle dysplasia, in infancy; craniometaphyseal dysplasia
36. Sarcoidosis
37. Syphilis; yaws
38. Tuberous sclerosis
39. Tubular stenosis dysplasia (Kenny-Caffey S.)
40. Williams S. (idiopathic hypercalcemia)

* Changes predominantly on bone surface.

References

Gamut D-55-2

CONGENITAL SYNDROMES AND SKELETAL DYSPLASIAS WITH GENERALIZED OR WIDESPREAD OSTEOSCLEROSIS

COMMON
1. Diaphyseal dysplasia (Camurati-Engelmann disease)
2. Endosteal hyperostosis (van Buchem and Worth types)
3. Gaucher disease
4. Hyperphosphatasia
5. Hypothyroidism; cretinism
6. Infantile cortical hyperostosis (Caffey disease)
7. Melorheostosis
8. Neurofibromatosis
9. Osteodysplasty (Melnick-Needles S.)
10. Osteopathia striata (Voorhoeve disease); osteopathia striata with cranial sclerosis
11. Osteopetrosis
12. Osteopoikilosis
13. Pachydermoperiostosis
14. [Physiologic osteosclerosis of newborn]
15. Polyostotic fibrous dysplasia (McCune-Albright S.)
16. Pseudohypoparathyroidism
17. Pyknodysostosis
18. Pyle dysplasia, in infancy; craniometaphyseal dysplasia; frontometaphyseal dysplasia; cranio-diaphyseal dysplasia
19. Tuberous sclerosis
20. Williams S. (idiopathic hypercalcemia)

UNCOMMON
1. Congenital total lipodystrophy (lipoatrophic diabetes)
2. Dysosteosclerosis
3. Epidermal nevus S.
4. Erdheim-Chester disease
5. Gardner S.
6. Idiopathic osteosclerosis (familial)
7. Lenz-Majewski dysplasia
8. Lethal osteosclerotic skeletal dysplasias
9. Mixed sclerosing bone dysplasia
10. Oculodentodisoseous dysplasia
11. Osteomesopyknosis
12. Otopalatodigital S.
13. Oxalosis
14. Patterson S.
15. POEMS S.
16. Robinow S.
17. Rothmund-Thomson S.
18. Schwarz-Lélek S.
19. Sclerosteosis
20. Stanescu dysostosis
21. Trichodentoosseous S.
22. Tubular stenosis dysplasia (Kenny-Caffey S.)
23. Weismann-Netter S.

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut D-56-S

GENERALIZED OR WIDESPREAD OSTEOSCLEROSIS: A CLASSIFICATION BASED ON ITS LOCATION WITHIN BONE

PREDOMINANTLY INVOLVING MEDULLARY BONE
1. Erdheim-Chester disease
2. Fluorosis
3. Gaucher disease; Niemann-Pick disease
4. Hyperparathyroidism, primary (esp. in children)
5. Hypervitaminosis D
6. Lymphoma; leukemia
7. Mastocytosis
8. Multiple myeloma
9. Myelofibrosis; myelosclerosis
10. Osteoblastic metastases (See D-85)
11. Osteosclerotic striata (Voorhoeve disease); osteopathia striata with cranial sclerosis
12. Osteopokilosis
13. Osteosarcomatosis
14. Oxalosis
15. Polycythemia vera
16. Polyostotic fibrous dysplasia (McCune-Albright S.)
17. Renal osteodystrophy (secondary hyperparathyroidism)
18. Rickets (hypophosphatemic vitamin D-resistant rickets in adults)
19. Sarcoidosis
20. Sickle cell disease and variants

PREDOMINANTLY INVOLVING CORTICAL BONE
1. Congenital cyanotic heart disease
2. Diaphyseal dysplasia (Camurati-Engelmann disease)
3. Diffuse idiopathic skeletal hyperostosis (DISH)
4. Endosteal hyperostosis (van Buchem and Worth types)
5. Hypertrophic osteoarthropathy (See D-98)
6. Hypervitaminosis A
7. Hypothyroidism; cretinism
8. Infantile cortical hyperostosis (Caffey disease)
9. Melorheostosis
10. Pyle dysplasia; craniometaphyseal dysplasia; craniodiaphyseal dysplasia
11. Osteosclerosis, autosomal dominant
12. Pachydermoperiostosis
13. Ribbing disease (hereditary multiple diaphyseal sclerosis)
INVolVING MEDULLARY AND CORTICAL BONE

1. Dysosteosclerosis
2. Hypoparathyroidism; pseudohypoparathyroidism; pseudopseudohypoparathyroidism
3. Neurofibromatosis
4. Osteomalacia, rickets (healing)
5. Osteopetrosis
6. Osteosclerosis with dentine dysplasia
7. Paget’s disease
8. Physiologic osteosclerosis of newborn
9. Pyknodysostosis
10. Sclerosteosis
11. Syphilis; yaws
12. Tuberal sclerosis
13. Tubular stenosis dysplasia (Kenny-Caffey S.)
14. Williams S. (idiopathic hypercalcemia)

References

Gamut D-57-1

PREFERENTIAL SITE WITHIN BONE OF VARIOUS OSSEOUS LESIONS—EPIPHYSIS/APOPHYSIS/SESAMOID
(See D-58)

1. Chondroblastoma (Codman tumor)
2. Clear cell chondrosarcoma
3. Giant cell tumor (after fusion of epiphyseal plate; originates in metaphysis)
4. Intraosseous ganglion
5. Langerhans cell histiocytosis (esp. eosinophilic granuloma)
6. Osteoid osteoma
7. Osteomyelitis (esp. infants and adults)
8. Subchondral cyst (related to osteoarthritis, inflammatory arthritis, or osteochondral injury)

Gamut D-57-2

PREFERENTIAL SITE OF VARIOUS OSSEOUS LESIONS—METAPHYSIS
(See D-59)

1. Aneurysmal bone cyst
2. Bone cyst (active)
3. Chondromyxoid fibroma
4. Chondrosarcoma
5. Cortical/periosteal desmoid
6. Desmoplastic fibroma
7. Enchondroma
8. Giant cell tumor (rare in skeletally immature patient)
9. Lipoma
10. Malignant fibrous histiocytoma; fibrosarcoma
11. Metastasis
12. Nonossifying fibroma (fibroxanthoma); fibrous cortical defect
13. Osteoblastoma
14. Osteochondroma; exostosis
15. Osteomyelitis (child)
16. Osteosarcoma (90% in metaphysis)
17. Parosteal sarcoma
18. Periosteal chondroma or fibroma
1. Bone cyst (late-latent)
2. Bone infarct
3. Chondromyxoid fibroma
4. Chondrosarcoma
5. Enchondroma
6. Ewing sarcoma
7. Fibrous dysplasia
8. Hemangioma; lymphangioma
9. Lipoma
10. Lymphoma
11. Malignant fibrous histiocytoma; fibrosarcoma
12. Metastasis
13. Multiple myeloma; plasmacytoma
14. Nonossifying fibroma (fibroxanthoma); fibrous cortical defect
15. Osteomyelitis
16. Periosteal chondroma or fibroma

1. Adamantinoma (esp. tibia)
2. Bone cyst (late-latent)
3. Chondrosarcoma (esp. arising from previous benign chondroid lesion)
4. Enchondroma
5. Ewing sarcoma
6. Fibrous dysplasia
7. Hemangioma (esp. tibia)
8. Langerhans cell histiocytosis
9. Lymphoma
10. Malignant fibrous histiocytoma; fibrosarcoma (esp. arising in fibrous lesion or bone infarct)
11. Metastasis
12. Multiple myeloma; plasmacytoma
13. Osteofibrous dysplasia (esp. tibia)
14. Osteoid osteoma
15. Osteosarcoma (10% in diaphysis)
FAVORED SITES OF ORIGIN OF VARIOUS BONE LESIONS (THE “FIELD THEORY” OF THE ORIGIN OF BONE TUMORS)

Composite diagram illustrating frequent sites of bone tumors. The diagram depicts the end of a long bone that has been divided into the epiphysis, metaphysis, and diaphysis. The typical sites of common primary bone tumors are labeled. Bone tumors tend to predominate in those ends of long bone that undergo the greatest growth and remodeling, and hence have the greatest number of cells and amount of cell activity (shoulder and knee regions). When small tumors, presumably detected early, are analyzed, preferential sites of tumor origin become apparent within each bone, as shown in this illustration. This suggests a relationship between the type of tumor and the anatomic site affected. In general, a tumor of a given cell type arises in the field where the homologous normal cells are most active. These regional variations suggest that the composition of the tumor is affected or may be determined by the metabolic field in which it arises.

References
SOLITARY LYtic EPIPHYSEAL OR EPIPHYSEAL-METAPHYSEAL LESION OF BONE

COMMON
1. Arthritic lesion (eg, gout; rheumatoid arthritis; tuberculosis; hemophilic pseudotumor; osteoarthritis with degenerative cyst or geode)
2. Avascular necrosis (See D-48)
3. Chondroblastoma (Codman tumor)
4. Giant cell tumor
5. [Normal femoral condylar or femoral head defect (eg, fovea centralis)]
6. Osteochondritis dissecans (See D-48-S)
7. Osteomyelitis (infant or adult-epiphysis; child-metaphysis—esp. tuberculous or poorly treated bacterial); Brodie abscess
8. Synovial lesion (eg, pigmented villonodular synovitis); synovial herniation pit or erosion in metaphysis of femoral neck

UNCOMMON
1. Amyloidosis
2. Aneurysmal bone cyst
3. Angiomatous lesion
4. Bone cyst
5. Bone sarcoma (eg, arising in benign fibrous or chondroid lesion; clear cell chondrosarcoma)
6. Defect from avulsion fracture (esp. knee)
7. Enchondroma
8. Hydatid cyst
9. Intraosseous ganglion
10. Langerhans cell histiocytosis (eosinophilic granuloma)
11. Lipoma
12. Metastasis
13. Osteoid osteoma
14. Plasmacytoma (myeloma)

*Epiphyseal-metaphyseal location.

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

SOLITARY LYtic METAPHYSEAL OR DIAMETAPHYSEAL LESION—WELL-DEFINED GEOGRAPHIC LESION

1. Adamantinoma (esp. tibia)
2. Angiomatous lesion (eg, hemangioma; lymphangioma, cystic type)
3. Bone cyst
4. Bone infarct
5. Brown tumor of hyperparathyroidism
6. Chondromyxoid fibroma
7. Cortical/periosteal desmoid
8. Enchondroma
9. Fibrous dysplasia
10. Giant cell tumor (rare in skeletally immature patient)
11. Langerhans cell histiocytosis
12. Lipoma
13. Metastasis
14. Multiple myeloma (punched out lesion)
15. Nonossifying fibroma (fibroxanthoma); fibrous cortical defect
16. Osteoblastoma
17. Osteoid osteoma
18. Osteomyelitis, subacute to chronic (Brodie abscess) or due to unusual/low virulent organism
19. Periosteal chondroma or fibroma
20. Tropical ulcer, benign
**Gamut D-59-2**

**SOLITARY LYTIC METAPHYSEAL OR DIAMETAPHYSEAL LESION—ILL-DEFINED GEOGRAPHIC LESION**

1. Adamantinoma (esp. tibia)
2. Bone infarct (eg, in sickle cell disease—usually well-defined)
3. Bone sarcoma (eg, osteosarcoma; chondrosarcoma; fibrosarcoma)
4. Chondromyxoid fibroma (usually well-defined)
5. Cortical/periosteal desmoid
6. Desmoplastic fibroma
7. Giant cell granuloma
8. Giant cell tumor (rare in skeletally immature patient)
9. Hydatid cyst
10. Langerhans cell histiocytosis<sup>g</sup>
11. Lymphoma<sup>g</sup>
12. Malignant fibrous histiocytoma
13. Metastasis
14. Multiple myeloma; plasmacytoma
15. Osteomyelitis
16. Syphilis (eg, Wimberger sign); yaws
17. Tropical ulcer, malignant

4. Malignant fibrous histiocytoma
5. Metastasis
6. Multiple myeloma
7. Osteomyelitis (usually acute bacterial)

**Gamut D-60**

**SOLITARY LYTIC DIAPHYSEAL LESION**

**COMMON**

1. Bone cyst (late-latent)
2. Bone infarct
3. Bone sarcoma (esp. round cell neoplasm such as Ewing sarcoma)
4. Diametaphyseal lesion extending into diaphysis (eg, nonossifying fibroma) (See D-59)
5. Enchondroma
6. Fibrous dysplasia
7. Langerhans cell histiocytosis<sup>g</sup> (esp. eosinophilic granuloma)
8. Metastasis
9. Myeloma; plasmacytoma
10. Osteoid osteoma
11. Osteomyelitis

**UNCOMMON**

1. Adamantinoma (esp. tibia)
2. Brown tumor of hyperparathyroidism
3. Osteofibrous dysplasia (esp. tibia)
4. Hemophiliac pseudotumor
5. Hydatid cyst
6. Lymphoma<sup>g</sup>
7. Malignant fibrous histiocytoma; fibrosarcoma
8. Osteosarcoma
9. Paget's disease
10. Syphilis; yaws
11. Tropical ulcer

*May be motheaten or permeative pattern.*
Schematic diagram of patterns of bone destruction (types IA, IB, IC, II, III) and their margins. Arrows indicate the most frequent transitions or combinations of these margins. Transitions imply increased activity and a greater probability of malignancy.

Reference
This diagram delineates common bone tumors and their typical patterns of bone destruction. IA, Geographic destruction, well-defined, with sclerosis in margin. IB, Geographic destruction, well-defined, but no sclerosis in margin. IC, Geographic destruction with ill-defined margin. II, Motheaten (regionally invasive). III. Permeative (diffusively invasive). Note that most benign tumors occur on the left-hand side, from IA to IC, whereas most malignant tumors occur on the right-hand side, from IC to III. This illustrates the general principle that the biologic activity and probability of malignancy increase from left to right. Chondrosarcoma and fibrosarcoma can present with any of the five patterns. In our experience, they frequently arise in preexisting benign lesions. In such cases, the radiographic pattern may lag behind the histologic activity, producing a radiographic discrepancy (slow-appearing lesions with malignant histology).

Reference
## Gamut D-63-S

### RELATIONSHIP OF BIOLOGIC ACTIVITY (GROWTH RATE) TO TYPE OF BONE MARGIN AND PERIOSTEAL REACTION

<table>
<thead>
<tr>
<th>Growth Rate</th>
<th>Internal Margins</th>
<th>Periosteal Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slow</td>
<td>Geographic (I)</td>
<td>Solid or Shells</td>
</tr>
<tr>
<td></td>
<td>IA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IB</td>
<td>Ridged</td>
</tr>
<tr>
<td></td>
<td>IC</td>
<td>lobulated, or smooth</td>
</tr>
<tr>
<td>Intermediate</td>
<td>Motheaten (II)</td>
<td>Codman Triangle</td>
</tr>
<tr>
<td></td>
<td>Shells or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>lamellated</td>
<td></td>
</tr>
<tr>
<td>Fast</td>
<td>Permeative (III)</td>
<td>Lamellated or</td>
</tr>
<tr>
<td></td>
<td>spiculated</td>
<td></td>
</tr>
<tr>
<td>Fastest</td>
<td>Nonvisible</td>
<td>Spiculated or none</td>
</tr>
</tbody>
</table>

8. Healed or healing benign bone cyst or fibrocystic lesion (eg, nonossifying fibroma {fibroxanthoma}; fibrous cortical defect; osteofibrous dysplasia)
9. Osteoid osteoma
10. Subchondral cyst related to osteoarthritis, inflammatory arthritis or traumatic osteochondral injury

### UNCOMMON

1. Chondromyxoid fibroma
2. Clear cell chondrosarcoma
3. Intraosseous ganglion
4. Langerhans cell histiocytosis (esp. eosinophilic granuloma—occasionally)
5. Lipoma
6. Liposclerosing myxofibrous tumor (LSMFT)
7. Osteoblastoma
8. Unusual infection (eg, syphilis; yaws; fungal; mycobacteria; hydatid disease)

### Reference

---

## Gamut D-64

### LUCENT LESION OF BONE SURROUNDED BY MARKED SCLEROTIC REACTION OR RIM

**COMMON**
1. Bone infarct
2. Brodie abscess
3. Chondroblastoma (Codman tumor)
4. Cortical/periosteal desmoid
5. Cystic osteomyelitis (esp. poorly treated bacterial or tuberculous infection)
6. Enchondroma (esp. hand, foot or rib lesion)
7. Fibrous dysplasia (esp. monostotic)

---

## Gamut D-65

### SOLITARY WELL-DEMARCADED LYtic LESION OF BONE

**COMMON**

++1. Arthritic or synovial lesion (eg, subchondral cyst related to osteoarthritis, inflammatory arthritis or traumatic osteochondral injury; intraosseous ganglion; amyloidosis; villonodular synovitis)
++2. Bone cyst
++3. Bone infarct
++4. Brown tumor of hyperparathyroidism
++5. Cortical/periosteal desmoid
++6. Enchondroma

(continued)
*7. Fibrous dysplasia  
8. Giant cell tumor  
+9. Gouty tophus  
*10. Langerhans cell histiocytosis (esp. eosinophilic granuloma)  
11. Metastasis (esp. from hypernephroma; thyroid carcinoma)  
*12. Nonossifying fibroma (fibroxanthoma); fibrous cortical defect  
+*13. Osteomyelitis, cystic (esp. poorly treated bacterial; tuberculous; fungal); Brodie abscess

**UNCOMMON**
1. Adamantinoma (esp. tibia)  
+*2. Ameloblastoma (jaws)  
+3. Aneurysmal bone cyst  
+4. Angiomatous lesion (eg, hemangioma; lymphangioma, cystic type)  
*5. Bone sarcoma arising in previously benign lesion (eg, chondrosarcoma; fibrosarcoma)  
*6. Chondroblastoma (Codman tumor)  
+*7. Chondromyxoid fibroma  
8. Desmoplastic fibroma  
+9. Epidermoid inclusion cyst (phalanx)  
+10. Fungus disease (eg, coccidioidomycosis; blastomycosis; histoplasmosis duboisii)  
11. Glomus tumor (phalanx)  
*12. Granuloma (esp. tuberculous; fungal; foreign body or “thorn”)  
+13. Hemophilic pseudotumor  
+14. Hydatid cyst  
+*15. Lipoma  
+*16. Liposclerosing myxofibrous tumor (LSMFT)  
17. Malignant fibrous histiocytoma; fibrosarcoma  
18. Myeloma; plasmacytoma  
+19. Myxoma (fibromyxoma)  
20. Neurofibroma  
21. Osteoblastoma  
*22. Osteofibrous dysplasia (esp. tibia)  
*23. Osteoid osteoma  
+24. Osteosarcoma (telangiectatic variety)  
25. Paget’s disease  
+*26. Periosteal chondroma

*27. Periosteal fibroma  
28. Sarcoïdosis  
*29. Tropical ulcer, benign  
*30. Tuberculosis

*Often has sclerotic rim.
+ Has high water content on CT (low attenuation) or MRI (very low signal intensity on T1 and very high signal intensity on T2).

---

**Gamut D-66**

**WELL-DEFINED, OFTEN CYST-LIKE, INFECTIOUS LESION OF BONE**

1. Brodie abscess (bacterial, usually \textit{Staph. aureus})  
2. Cystic osteomyelitis (esp. poorly treated bacterial infection)  
3. Fungus disease (eg, coccidioidomycosis; blastomycosis; histoplasmosis duboisii; mycetoma)  
4. Hydatid disease  
5. Leprosy (lepromas)  
6. Spina ventosa; other cyst-like dactylitis (incl. yaws) (See D-132)  
7. Tuberculosis; atypical mycobacterial infections

---

**Gamut D-67**

**SOLITARY LESION OF BONE WITH EXPANSILE REMODELING**

**BENIGN NEOPLASM OF BONE**

**COMMON**

1. Angiomatous lesion (eg, hemangioma; lymphangioma)  
2. Enchondroma (esp. lesions of hand or foot)  
3. Giant cell tumor  
4. Nonossifying fibroma (fibroxanthoma)  
5. Osteochondroma (esp. with multiple lesions)
UNCOMMON
1. Ameloblastoma (jaws)
2. Chondroblastoma (Codman tumor)
3. Chondromyxoid fibroma
4. Desmoplastic fibroma
5. Lipoma
6. Liposclerosing myxofibrous tumor (LSMFT)
7. Ossifying fibroma (face, jaws)
8. Osteoblastoma
9. Periosteal chondroma or fibroma

MALIGNANT NEOPLASM OF BONE

COMMON
1. Chondrosarcoma
2. Metastasis (esp. from carcinoma of kidney, thyroid, or lung; hepatoma; melanoma)
3. Myeloma; plasmacytoma

UNCOMMON
1. Adamantinoma (esp. tibia)
2. Ameloblastoma (jaws)
3. Hemangioendothelioma; angiosarcoma
4. Lymphoma (esp. Burkitt)
5. Malignant fibrous histiocytoma; fibrosarcoma
6. Malignant giant cell tumor
7. Osteosarcoma (esp. telangiectatic)

TUMOR-LIKE LESION OF BONE

COMMON
1. Aneurysmal bone cyst
2. Bone cyst
3. Cortical/periosteal desmoid
4. Fibrous cortical defect
5. Fibrous dysplasia
6. Gouty tophus
7. Osteomyelitis (esp. chronic with unusual organism—eg, tuberculous; fungal; yaws)

UNCOMMON
1. Brown tumor of hyperparathyroidism
2. Epidermoid inclusion cyst

3. Gaucher disease; Niemann-Pick disease
4. Hemophilic pseudotumor
5. Hydralid cyst
6. Langerhans cell histiocytosis (esp. eosinophilic granuloma)
7. Osteofibrous dysplasia (esp. tibia)

Reference

BONE BLISTER (SOLITARY ECCENTRIC LESION WITH EXPANSILE REMODELING)

COMMON
1. Aneurysmal bone cyst
2. Chondroid lesion (eg, osteochondroma; enchondroma)
3. Giant cell tumor
4. Nonossifying fibroma (fibroxanthoma); fibrous cortical defect

UNCOMMON
1. Angiomatous lesion (eg, hemangioma; lymphangioma)
2. Brown tumor of hyperparathyroidism
3. Chondromyxoid fibroma
4. Cortical/periosteal desmoid
5. Desmoplastic fibroma
6. Fibrosarcoma (esp. arising in benign fibrous lesion)
7. Osteofibrous dysplasia (esp. tibia)
8. Gouty tophus
9. Malignant fibrous histiocytoma
10. Metastasis to cortex (esp. lung, breast)
11. Osteoblastoma
12. Osteosarcoma, intracortical
13. Periosteal chondroma or fibroma
BLOW-OUT LESION OF BONE (SOLITARY LESION WITH MARKED “ANEURYSMAL” EXPANSILE REMODELING) (See D-69-2)

COMMON
1. Aneurysmal bone cyst, primary or secondary
2. Chondrosarcoma
3. Fibrous dysplasia
4. Giant cell tumor
5. Metastatic carcinoma (esp. kidney, thyroid, or lung; hepatoma)
6. Myeloma; plasmacytoma

UNCOMMON
1. Adamantinoma (esp. tibia)
2. Ameloblastoma (jaws)
3. Brown tumor of hyperparathyroidism
4. Burkitt lymphoma
5. Chondromyxoid fibroma
6. Chordoma; parachordoma
7. Desmoplastic fibroma
8. Enchondroma (usually hand or foot lesions)
9. Gouty tophus
10. Hemangioendothelioma; angiosarcoma
11. Hemophilic pseudotumor
12. Hydatid cyst
13. Malignant fibrous histiocytoma; fibrosarcoma
14. Meningocele
15. Nonossifying fibroma associated with neurofibromatosis (type 1) or Jaffe-Campanacci S.
16. Osteoblastoma
17. Osteochondroma
18. Osteofibrous dysplasia (esp. tibia)
19. Osteosarcoma (telangiectatic)
20. Sacrococcygeal teratoma

LARGE DESTRUCTIVE BONE LESION (OVER 5 CM IN DIAMETER)

COMMON
1. Aneurysmal bone cyst, primary or secondary
2. Angiomatous lesion (eg, hemangioma; lymphangioma); hemangioendothelioma; angiosarcoma
3. Bone cyst
4. Bone sarcoma (eg, osteosarcoma; chondrosarcoma; fibrosarcoma; Ewing sarcoma)
5. Enchondroma
6. Fibrous dysplasia
7. Giant cell tumor
8. Langerhans cell histiocytosis
9. Lymphoma; Burkitt lymphoma
10. Metastasis
11. Myeloma; plasmacytoma
12. Osteomyelitis; mycetoma
13. Paget’s disease

UNCOMMON
1. Adamantinoma (esp. tibia)
2. Ameloblastoma (jaws)
3. Brown tumor of hyperparathyroidism
4. Chondromyxoid fibroma
5. Chordoma; parachordoma
6. Desmoplastic fibroma
7. Gaucher disease
8. Hemophilic pseudotumor
9. Hydatid cyst
10. Lesion arising in spinal canal (eg, meningocele; ependymoma; neurofibroma; sacrococcygeal teratoma)
11. Malignant fibrous histiocytoma
12. Massive osteolysis (Gorham vanishing bone disease)
13. Nonossifying fibroma associated with neurofibromatosis (type 1) or Jaffe-Campanacci S.
14. Osteoblastoma
15. Osteofibrous dysplasia (esp. tibia)
16. [Soft tissue tumor destroying bone (eg, synovial sarcoma)]
17. Syphilis; yaws
18. Tropical ulcer

Gamut D-70

SOLITARY POORLY DEMARCATED OSTEOLYTIC LESION

COMMON
1. Bone sarcoma (esp. Ewing sarcoma; osteosarcoma; chondrosarcoma; fibrosarcoma; angiosarcoma)
2. Langerhans cell histiocytosis
3. Lymphoma
4. Metastasis
5. Myeloma; plasmacytoma
6. Osteomyelitis (eg, tuberculous, fungal, bacterial)

UNCOMMON
1. Adamantinoma (esp. tibia)
2. Aneurysmal bone cyst
3. Angiomatous lesion (eg, hemangioma; lymphangioma)
4. Brown tumor of hyperparathyroidism
5. Chordoma
6. Fibrous dysplasia
7. Giant cell tumor
8. Hemangioendothelioma
9. Hydatid cyst
10. Malignant fibrous histiocytoma
11. Paget’s disease
12. Syphilis; yaws

Gamut D-71

MOTHEATEN OR PERMEATIVE OSTEOLYTIC LESION(S)

COMMON
1. Ewing sarcoma
2. Lymphoma; leukemia
3. Metastasis (incl. neuroblastoma)
4. Multiple myeloma
5. Osteomyelitis
6. Osteosarcoma

UNCOMMON
1. Adamantinoma (esp. tibia)
2. Chondrosarcoma
3. Giant cell tumor (at margins)
4. Hemangioendothelioma; angiosarcoma
5. Landing-Shirkey disease (multifocal granulomatous osteomyelitis in a compromised child)
6. Langerhans cell histiocytosis (esp. eosinophilic granuloma in children)
7. Malignant fibrous histiocytoma; fibrosarcoma
8. Rhabdomyosarcoma
9. Syphilis; yaws

Gamut D-72

OSTEOLYTIC LESION CONTAINING CALCIUM OR BONE DENSITY OR MATRIX

COMMON
*1. Chondrosarcoma
*2. Enchondroma
*3. Fibrous dysplasia
*4. Lymphoma (reactive osteoid)
5. Metastasis (esp. from breast, thyroid, or mucinous gastrointestinal carcinoma)

(continued)
6. Nonossifying fibroma or bone cyst (healed or healing with sclerosis)
*7. Osteoid osteoma
*8. Osteosarcoma
9. Paget’s disease
10. Sequestrum-producing lesions (eg, avascular necrosis; osteochondrosis dissecans; bone infarct; osteomyelitis; tropical ulcer; button sequestrum in skull (See A-22)

UNCOMMON
*1. Chondroblastoma (Codman tumor)
*2. Chondromyxoid fibroma (identifiable mineralization unusual)
3. Ewing sarcoma (reactive bone)
4. Langerhans cell histiocytosis (esp. eosinophilic granuloma)
5. Lipoma (metaplastic and reactive bone/cartilage)
6. Liposclerosing myxofibrous tumor (LSMFT) (metaplastic and reactive bone/cartilage)
7. Malignant fibrous histiocytoma; fibrosarcoma (reactive bone or sequestrum)
*8. Osteoblastoma
* Mineralized matrix formation.

Gamut D-73

BONE LESION WITH PROMINENT FLUID-FLUID LEVEL (CT OR MRI)

COMMON
1. Aneurysmal bone cyst, primary (See D-80-S3)
2. Bone cyst (esp. after fracture)
3. Chondroblastoma (Codman tumor)
4. Giant cell tumor
5. Osteoblastoma
6. Osteosarcoma (telangiectatic)

UNCOMMON
1. Brown tumor of hyperparathyroidism
2. Chondromyxoid fibroma
3. Fibrous dysplasia
4. Giant cell granuloma
5. Hemangioma
6. Hemangioendothelioma; hemangiopericytoma
7. Hemophilic pseudotumor
8. Malignant fibrous histiocytoma (MFH); fibrosarcoma
9. Metastasis (esp. renal)
10. Nonossifying fibroma (fibroxanthoma)

Reference

Gamut D-74

MULTIPLE RADIOLUCENT LESIONS OF BONE (See D-107)

COMMON
*1. Arthritis (eg, gout; rheumatoid; subchondral cysts or geodes associated with osteoarthritis, inflammatory arthritis, or traumatic osteochondral injury)
2. Metastases
3. Multiple myeloma
4. Osteomyelitis, multifocal (eg, septic; unusual low virulence organisms—cystic tuberculosis; fungal)
5. Paget’s disease

UNCOMMON
*1. Amyloidosis, primary or secondary
2. Angiomatosis (hemangiomatosis; lymphangiomatosis, cystic type)
3. Brown tumors of hyperparathyroidism
4. Electrical injury
5. Enchondromatosis (Ollier disease); Maffucci S.
6. Fibromatosis (esp. multicentric infantile myofibromatosis)
*7. Fungus disease (esp. blastomycosis; coccidioidomycosis; histoplasmosis duboisii)
8. Gaucher disease; Niemann-Pick disease
9. Hemangioendothelioma; angiosarcoma
10. Hemophilia; hemophilic pseudotumors
11. Hydatid disease
12. Infantile cortical hyperostosis (Caffey disease)
*13. Jackhammer operator’s (driller’s) disease of wrists
14. Kaposi sarcoma
15. Landing-Shirkey disease (multifocal granulomatous osteomyelitis in a compromised child)
16. Langerhans cell histiocytosis
*17. Leprosy (lepromas)
18. Leukemia; lymphoma; Burkitt lymphoma
19. Lipomatosis
*20. Massive osteolysis (Gorham vanishing bone disease)
21. Mastocytosis
22. Membranous lipodystrophy
23. Nonossifying fibromas associated with neurofibromatosis (type 1) or Jaffe-Campanacci S.
24. Osteoglophonic dysplasia
*25. Polycystic osteodysplasia with progressive dementia (hands and feet)
26. Polyostotic fibrous dysplasia (McCune-Albright S.)
*27. Polyvinyl chloride osteolysis
28. Primary bone neoplasms, multiple
29. Radium poisoning
30. Rothmund-Thomson S.
*31. Sarcoidosis
32. Sickle cell disease with bone infarction (esp. hand-foot S.); other dactylitis (See D-132)
*33. Silastic arthropathy
*34. Small particle disease (eg, granulomatous pseudotumors adjacent to joint replacements)
35. Syphilis; yaws
36. Tuberous sclerosis
37. Weber-Christian disease
* Often periarticular.

Reference

WIDESPREAD AREAS OF BONE DESTRUCTION

COMMON
1. Arthritis (esp. rheumatoid; gout)
2. Lymphoma; leukemia; Burkitt lymphoma
3. Osteomyelitis (pyogenic; tuberculous)
4. Metastases (esp. carcinomatosis)
5. Multiple myeloma (esp. myelomatosis)
6. Paget’s disease

UNCOMMON
1. Angiomatosis (hemangiomatosis; lymphangiomatosis, cystic type)
2. Bone sarcoma, multicentric (eg, Ewing sarcoma; osteosarcoma)
3. Brown tumors of hyperparathyroidism (esp. osteitis fibrosa cystica)
4. Fibromatosis (esp. multicentric infantile myofibromatosis)
5. Fungus disease (eg, blastomycosis; coccidioidomycosis; histoplasmosis duboisii; actinomycosis, nocardiosis—mycetoma)
6. Gaucher disease
7. Hemophilia with pseudotumors
8. Hydatid disease
9. Langerhans cell histiocytosis
10. Leprosy
11. Massive osteolysis (Gorham vanishing bone disease)
12. Membranous lipodystrophy
13. Polyostotic fibrous dysplasia (McCune-Albright S.)
14. Sarcoidosis
15. Syphilis; yaws
16. Waldenström macroglobulinemia
17. Weber-Christian disease

Reference
OSTEOLYSIS

COMMON
1. Acro-osteolysis (See D-127)
2. Chronic articular disorder (eg, psoriasis; multicentric reticulohistiocytes [lipoid dermatoarthritis]; neuroarthropathy)
3. Connective tissue disease (collagen disease), (esp. scleroderma)
4. Hyperparathyroidism
5. Trauma

UNCOMMON
1. Ainhum
2. Congenital osteolyses
   a. Multicentric predominantly carpal and tarsal
      i. Multicentric carpal-tarsal osteolysis with and without nephropathy
      ii. Shinohara carpal-tarsal osteolysis
   b. Multicentric predominantly carpal, tarsal, and interphalangeal
      i. Francois S.
      ii. Torg S.
      iii. Winchester S.
      iv. Whyte Hemingway carpal-tarsal phalangeal osteolyses
   c. Predominantly distal phalanges
      i. Giacci familial neurogenic acro-osteolysis
      ii. Hajdu-Cheney S.
      iii. Mandibuloacral dysplasia
   d. Predominantly involving diaphyses and metaphyses
      i. Familial expansile osteolysis
      ii. Juvenile hyaline fibromatosis
3. Calcium pyrophosphate dihydrate crystal deposition disease (CPPD) (unusual neuropathic appearance)
4. Massive osteolysis (Gorham vanishing bone disease)
5. Osteolysis with detritic synovitis
6. Rapidly progressive coxarthrosis
7. Sarcoidosis
8. Thermal injury (eg, burn; frostbite)

References

AGE RANGE OF HIGHEST INCIDENCE OF VARIOUS BONE NEOPLASMS AND TUMOR-LIKE LESIONS

<table>
<thead>
<tr>
<th>TUMOR</th>
<th>AGE (YEARS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Adamantinoma (esp. tibia)</td>
<td>15–35</td>
</tr>
<tr>
<td>2. Aneurysmal bone cyst</td>
<td>10–30</td>
</tr>
<tr>
<td>3. Bone cyst</td>
<td>5–20</td>
</tr>
<tr>
<td>4. Chondroblastoma (Codman tumor)</td>
<td>10–25</td>
</tr>
<tr>
<td>5. Chondromyxoid fibroma</td>
<td>10–30</td>
</tr>
<tr>
<td>6. Chondrosarcoma</td>
<td>30–60</td>
</tr>
<tr>
<td>7. Chordoma</td>
<td>30–70</td>
</tr>
<tr>
<td>8. Cortical/periosteal desmoid</td>
<td>10–20</td>
</tr>
<tr>
<td>9. Desmoplastic fibroma</td>
<td>10–40</td>
</tr>
<tr>
<td>10. enchondroma</td>
<td>5–50</td>
</tr>
<tr>
<td>11. Ewing sarcoma</td>
<td>5–25</td>
</tr>
<tr>
<td>12. Fibrosarcoma</td>
<td>20–70</td>
</tr>
<tr>
<td>13. Fibrous dysplasia</td>
<td>2–30</td>
</tr>
<tr>
<td>14. Giant cell tumor</td>
<td>20–45</td>
</tr>
<tr>
<td>15. Hemangioma</td>
<td>30–70</td>
</tr>
<tr>
<td>16. Langerhans cell histiocytosis</td>
<td>0–15</td>
</tr>
<tr>
<td>17. Lymphoma</td>
<td>15–40</td>
</tr>
<tr>
<td>18. Malignant fibrous histiocytoma</td>
<td>20–60</td>
</tr>
<tr>
<td>19. Metastasis</td>
<td>40–80</td>
</tr>
<tr>
<td>20. Multiple myeloma</td>
<td>40–80</td>
</tr>
<tr>
<td>21. Neuroblastoma, metastatic</td>
<td>0–10</td>
</tr>
</tbody>
</table>
22. Nonossifying fibroma (fibroxanthoma); fibrous cortical defect 5–20
23. Ossifying fibroma (face, jaws) 5–30
24. Osteoblastoma 10–25
25. Osteochondroma 10–25
26. Osteofibrous dysplasia (esp. tibia) 0–15
27. Osteoid osteoma 10–30
28. Osteoma 30–50
29. Osteosarcoma 5–25, 60–75
30. Parosteal sarcoma 30–50

References

SEX PREDOMINANCE OF VARIOUS BONE LESIONS

<table>
<thead>
<tr>
<th>Tumor Type</th>
<th>Male Predominance</th>
<th>Ratio*</th>
<th>No Predominance</th>
<th>Female Predominance</th>
<th>Ratio*</th>
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<tbody>
<tr>
<td>Malignant</td>
<td>PNET</td>
<td>&gt;2:1</td>
<td>Adamantinoma</td>
<td>Parosteal osteosarcoma</td>
<td>slight</td>
</tr>
<tr>
<td></td>
<td>Osteosarcoma, telangiectatic</td>
<td>slight</td>
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<tr>
<td></td>
<td>Chondrosarcoma</td>
<td>2:1</td>
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</tr>
<tr>
<td></td>
<td>Chordoma</td>
<td>2:1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Osteosarcoma, conventional</td>
<td>slight</td>
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<td></td>
</tr>
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<td>Ewing sarcoma</td>
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</tr>
<tr>
<td></td>
<td>Myeloma</td>
<td>slight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lymphoma of bone</td>
<td>slight</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td></td>
<td>MFH of bone</td>
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<tr>
<td>Benign</td>
<td>Simple cyst</td>
<td>3:1</td>
<td>Enchondroma</td>
<td>Giant cell tumor</td>
<td>slight</td>
</tr>
<tr>
<td></td>
<td>Osteoid osteoma</td>
<td>3:1</td>
<td>Fibrous dysplasia</td>
<td>Aneurysmal bone cyst</td>
<td>slight</td>
</tr>
<tr>
<td></td>
<td>Osteoblastoma</td>
<td>2:1</td>
<td></td>
<td>Hemangioma</td>
<td>slight</td>
</tr>
<tr>
<td></td>
<td>Osteochondroma</td>
<td>2:1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Periosteal chondroma</td>
<td>2:1</td>
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</tr>
<tr>
<td></td>
<td>Chondroblastoma</td>
<td>2:1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chondromyxoid fibroma</td>
<td>2:1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fibrous cortical defect</td>
<td>2:1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nonossifying fibroma</td>
<td>2:1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eosinophilic granuloma</td>
<td>2:1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Desmoplastic fibroma</td>
<td>slight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intraosseous lipoma</td>
<td>slight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intraosseous ganglion</td>
<td>slight</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PNET = primitive neuroectodermal tumor; MFH = malignant fibrous histiocytoma
*Ratio are approximate and rounded

Fletcher RE, Mills SE. Tumors of the Bones and Joints. Washington DC, Armed Forces Institute of Pathology, 1993
BONE NEOPLASMS CLASSIFIED BY TUMOR MATRIX OR TISSUE OF ORIGIN

CHONDROID (Cartilage-Forming) TUMORS

BENIGN
1. Chondroblastoma (Codman tumor)
2. Chondromyxoid fibroma
3. Enchondroma, incl. enchondromatosis (Ollier disease; Maffucci S.)
4. Osteochondroma, incl. hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
5. Periosteal (juxtacortical) chondroma

MALIGNANT
1. Chondrosarcoma (multiple types) (See D-81-S3)

OSTEOID (Bone-Forming) TUMORS

BENIGN
1. Bone island; enostosis (incl. osteopoikilosis and osteopathia striata)
2. Ossifying fibroma (face, jaws)
3. Osteoblastoma
4. Osteofibrous dysplasia (esp. tibia)
5. Osteoid osteoma
6. Osteoma

MALIGNANT
1. Osteosarcoma (multiple types) (See D-81-S2)

FIBROUS CONNECTIVE TISSUE TUMORS

BENIGN
1. Cortical/periosteal desmoid (cortical avulsive injury)
2. Desmoplastic fibroma
3. Fibromatosis (esp. multicentric infantile myofibromatosis)
4. Fibromyxoma
5. Nonossifying fibroma (fibroxanthoma)
6. Periosteal (juxtacortical) fibroma

MALIGNANT
1. Fibrosarcoma
2. Malignant fibrous histiocytoma

TUMORS OF FATTY TISSUE ORIGIN

BENIGN
1. Lipoma, intraosseous or parosteal
2. Liposclerosing myxofibrous tumor (LSMFT)

MALIGNANT
1. Liposarcoma

TUMORS OF VASCULAR ORIGIN

BENIGN
1. Angiomatosis (hemangiomatosis; lymphangiomatous)
2. Glomus tumor
3. Hemangioma
4. Hemangioendothelioma (benign)
5. Hemangiopericytoma (benign)
6. Lymphangioma
7. Massive osteolysis (Gorham vanishing bone disease)

MALIGNANT
1. Angiosarcoma
2. Hemangioendothelioma (malignant)
3. Hemangiopericytoma (malignant)
4. Kaposi sarcoma
TUMORS OF NEURAL ORIGIN  
(RARE IN BONE)

BENIGN
1. Neurilemoma (schwannoma)  
2. Neurofibroma (incl. neurofibromatosis)

MALIGNANT
1. Malignant peripheral nerve sheath tumor (MPNST)  
   (neurofibrosarcoma)

GIANT CELL-CONTAINING TUMORS

BENIGN
1. Aneurysmal bone cyst  
2. Bone cyst (complicated by fracture)  
3. Brown tumor of hyperparathyroidism  
4. Chondroblastoma (Codman tumor)  
5. Chondromyxoid fibroma  
6. Fibrous dysplasia  
7. Giant cell granuloma  
8. Giant cell tumor (benign)  
9. Osteoblastoma  
10. Osteofibrous dysplasia (esp. tibia)

MALIGNANT
1. Giant cell tumor (malignant)  
2. Malignant fibrous histiocytoma  
3. Osteosarcoma

References
BENIGN TUMOR-LIKE LESIONS OF BONE (NONNEOPLASTIC) (See D-80-S1 and S2)

COMMON
1. Avascular necrosis
2. Bone cyst
3. Bone infarct
4. Bone island (enostosis)
5. Brown tumor of hyperparathyroidism
6. Cortical/periosteal desmoid (cortical avulsive injury)
7. Fibrous cortical defect
8. Fibrous dysplasia
9. Gouty tophus
10. Langerhans cell histiocytosis
11. Myositis ossificans (parosteal)
12. Osteochondrosis dissecans
13. Osteoid osteoma
14. Osteomyelitis (eg, bacterial; tuberculous; fungal—mycetoma)
15. Paget’s disease
16. Stress fracture, healing
17. Subchondral cyst (related to osteoarthritis, inflammatory arthritis, or osteochondral injury)

UNCOMMON
1. Aneurysmal bone cyst (See D-80-S3)
2. Epidermoid; dermoid (skull)
3. Epidermoid inclusion cyst; foreign body or “thorn” granuloma
4. Fibromatosis (esp. multicentric infantile myofibromatosis)
5. Giant cell granuloma
6. Hemophilic pseudotumor
7. Hydatid cyst
8. Intraosseous ganglion
9. Osteofibrous dysplasia (esp. tibia)
10. Plasma cell granuloma
11. Posttraumatic cyst or osteolysis
12. Sarcoidosis
13. Small particle disease (eg, granulomatous pseudotumors adjacent to joint replacements) (foreign body reaction)
14. Soft tissue lesion secondarily involving bone (eg, amyloidosis; glomus tumor; giant cell tumor of tendon sheath; pigmented villonodular synovitis)
15. Sternocostoclavicular hyperostosis (SAPHO S.)
16. Xanthomatous lesion (See D-80-S2)

BENIGN FIBROCYSTIC LESIONS OF BONE

COMMON
1. Bone cyst
2. Fibrocytic changes of degenerative arthritis (esp. in hip)
3. Fibrous dysplasia, monostotic or polyostotic (Jaffe-Lichtenstein type; McCune-Albright S.)
4. Nonossifying fibroma (fibroxanthoma); fibrous cortical defect

UNCOMMON
1. Ameloblastoma, fibrous type; ameloblastic fibroma (jaws)
2. Cementifying fibroma (jaws)
3. Cherubism (face, jaws), incl. Ramon S.
4. Chondromyxoid fibroma
5. Desmoplastic fibroma
6. Fibrogenesis imperfecta
7. Fibromatosis (esp. multicentric infantile myofibromatosis)
8. Fibromyxoma
9. Foreign body reaction (silastic arthropathy or small particle disease {eg, granulomatous pseudotumors adjacent to joint replacements})
10. Intraosseous ganglion
11. Jaffe-Campanacci S. (disseminated nonossifying fibromas, fractures, kyphoscoliosis)
12. Liposclerosing myxofibrous tumor (LSMFT)
13. Mazabraud S. (fibrous dysplasia and intramuscular myxomas)
14. Ossifying fibroma (face, jaws)
15. Osteofibrous dysplasia (esp. tibia)
16. Xanthoma (xanthofibroma)

Reference

Gamut D-80-S2

XANTHOMATOUS LESIONS OF BONE

PRIMARY XANTHOMATOUS LESIONS
1. Erdheim-Chester disease (multiple sclerotic lipogranulomatous lesions or xanthofibromas of bone)
2. Xanthoma (xanthofibroma; benign fibrous histiocytoma)
3. Xanthomatosis, cerebrotendinous

SECONDARY XANTHOMATOUS REACTION
1. Aneurysmal bone cyst
2. Bone abscess (Brodie abscess)
3. Bone cyst
4. Langerhans cell histiocytosis (esp. eosinophilic granuloma)
5. Fibrous dysplasia
6. Giant cell tumor
7. Nonossifying fibroma (fibroxanthoma)

References

Gamut D-80-S3

LESIONS ASSOCIATED WITH ANEURYSMAL BONE CYST (ABC)

COMMON
1. Chondroblastoma (Codman tumor)
2. Giant cell tumor
3. Osteoblastoma
4. Osteosarcoma, telangiectatic
5. Primary ABC

UNCOMMON
1. Angiomatous lesion (hemangioma; lymphangioma, cystic type)
2. Bone cyst
3. Chondromyxoid fibroma
4. Fibrous dysplasia
5. Giant cell granuloma
6. Hemangioendothelioma
7. Hemangiopericytoma
8. Hemophilic pseudotumor
9. Metastasis (esp. renal or thyroid carcinoma; hematoma)
10. Nonossifying fibroma (fibroxanthoma)
11. Trauma (ossifying hematoma)

Gamut D-81

PRIMARY MALIGNANT BONE NEOPLASMS

COMMON
1. Chondrosarcoma (See D-81-S3)
2. Ewing sarcoma
3. Fibrosarcoma
4. Lymphoma (incl. Burkitt lymphoma; leukemia)
5. Malignant fibrous histiocytoma
6. Multiple myeloma

(continued)
7. Osteosarcoma (See D-81-S2)
8. Undifferentiated sarcoma

**UNCOMMON**
1. Adamantinoma (esp. tibia)
2. Angiosarcoma
3. Chordoma
4. Giant cell tumor, malignant
5. Hemangioendothelioma, malignant
6. Hemangiopericytoma, malignant (rare)
7. [Kaposi sarcoma (secondary bone involvement)]
8. Liposarcoma (rare)
9. Malignant peripheral nerve sheath tumor (MPNST) (rare)

---

**Gamut D-81-S1**

**RADIOLOGIC CRITERIA SUGGESTING MALIGNANT BONE NEOPLASM**

1. Bone destruction (esp. motheaten or permeative, but may be geographic -particularly with wide transition zone 1C margin) (See D-61-S)
2. Irregular ill-defined margins of lesion (“wide transition zone” between normal and abnormal bone)
3. Cortical erosion or destruction
4. Codman triangle
5. Periosteal lamellation (“onion skin”)
6. Periosteal right angle spiculation (“sunburst” or “hair-on-end”)
7. Soft tissue mass adjacent to bone destruction
8. Chondroid or osteoid matrix (esp. in extraosseous tissues)
9. Metastasis to distant site

**References**

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**Gamut D-81-S2**

**TYPES OF OSTEOSARCOMA**

**PRIMARY**
1. Chondroblastic (chondrogenic)
2. Extraskeletal (eg, soft tissue; renal)
3. Fibroblastic (fibrogenic)
4. Giant cell (osteoclast) rich
5. Gnathic (mandibular)
6. High-grade surface
7. Intracortical
8. Intramedullary, high-grade (central, conventional, or classical)
9. Intramedullary, low-grade (sclerosing osteosarcoma)
10. Mesenchymal
11. Osteosarcomatosis
12. Parosteal (juxtacortical)
13. Periosteal
14. Small-cell
15. Telangiectatic

**SECONDARY, ARISING IN OR ASSOCIATION WITH**
1. Bone following radiation therapy
2. Bone infarct; osteonecrosis
3. Fibrous dysplasia
4. Fracture (healed)
5. Metallic implants
6. Osteoblastoma
7. Osteogenesis imperfecta
8. Osteomyelitis, chronic
9. Paget’s disease
10. Retinoblastoma (esp. familial bilateral type)
11. Rothmund-Thomson S.

**References**

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312 D. Bone, Joints, and Soft Tissues
**Gamut D-81-S3**

### TYPES OF CHONDROSARCOMA

**PRIMARY**
1. Classical or central (medullary)
2. Clear cell
3. Dedifferentiated
4. Juxtacortical or periosteal
5. Mesenchymal; soft tissue
6. Myxoid; soft tissue

**SECONDARY, ARISING IN**
1. Bone following radiation therapy
2. Enchondroma (incl. Ollier disease; Maffucci S.)
3. Osteochondroma (incl. hereditary multiple exostoses [multiple cartilaginous exostoses; osteochondromatosis])
4. Other preexisting benign cartilaginous lesion (eg, chondroblastoma (Codman tumor); chondro-myxoid fibroma)
5. Paget’s disease

**Gamut D-81-S4**

### ROUND CELL LESIONS OF BONE

1. Langerhans cell histiocytosis *g* (esp. eosinophilic granuloma)
2. Ewing sarcoma
3. Leukemia; lymphoma *g*; Burkitt lymphoma
4. Multiple myeloma; plasmacytoma
5. Neuroblastoma
6. Osteomyelitis
7. Primitive neuroectodermal tumor (PNET)

* Small blue round cell tumor that is identical radiologically with Ewing sarcoma but can often be distinguished histologically, particularly with immunohistochemical studies.

**Gamut D-81-S5**

### FREQUENCY OF PRIMARY MALIGNANT BONE TUMORS*

<table>
<thead>
<tr>
<th>TYPE OF TUMOR</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple myeloma</td>
<td>44%</td>
</tr>
<tr>
<td>Osteosarcoma (incl. variants)</td>
<td>20%</td>
</tr>
<tr>
<td>Chondrosarcoma (incl. variants)</td>
<td>12%</td>
</tr>
<tr>
<td>Lymphoma <em>g</em></td>
<td>8%</td>
</tr>
<tr>
<td>Ewing sarcoma</td>
<td>6%</td>
</tr>
<tr>
<td>Chordoma</td>
<td>4%</td>
</tr>
<tr>
<td>Fibrosarcoma/malignant fibrous histiocytoma</td>
<td>4%</td>
</tr>
<tr>
<td>Hemangioendothelioma</td>
<td>1%</td>
</tr>
<tr>
<td>Others</td>
<td>1%</td>
</tr>
</tbody>
</table>

* Based on 8,591 primary malignant bone tumors in the Mayo Clinic series.

**Reference**
### PRECURSORS OF MALIGNANCY IN BONE

<table>
<thead>
<tr>
<th>Precursor Condition</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enchondroma</td>
<td>very low risk with solitary lesion, higher risk with multiple lesions</td>
</tr>
<tr>
<td>Osteochondroma</td>
<td>very low risk with solitary lesion, higher risk with multiple lesions</td>
</tr>
<tr>
<td>Paget’s disease</td>
<td>higher risk with more extensive, polyostotic disease</td>
</tr>
<tr>
<td>Radiation injury</td>
<td>low risk with 7000 rads or less</td>
</tr>
<tr>
<td>Osteomyelitis with chronic sinus tract</td>
<td>long latency period (20+ years)</td>
</tr>
<tr>
<td>Bone infarct</td>
<td>rare, 90% or more have multiple infarcts</td>
</tr>
<tr>
<td>Fibrous dysplasia</td>
<td>case reports</td>
</tr>
<tr>
<td>Metallic implants</td>
<td>case reports</td>
</tr>
<tr>
<td>Bone cysts</td>
<td>case reports</td>
</tr>
<tr>
<td>Osteogenesis imperfecta</td>
<td>case reports</td>
</tr>
<tr>
<td>Genetic predisposition</td>
<td>association with mutant Rb gene and retinoblastoma</td>
</tr>
<tr>
<td>Synovial chondromatosis</td>
<td>case reports</td>
</tr>
<tr>
<td>Giant cell tumor</td>
<td>rare malignant recurrence after treatment</td>
</tr>
<tr>
<td>Osteoblastoma</td>
<td>rare locally aggressive form that does not metastasize</td>
</tr>
<tr>
<td>Osteofibrous dysplasia</td>
<td>coexistent with adamantinoma, possibly subsets of of the same disease</td>
</tr>
</tbody>
</table>

### MALIGNANT BONE NEOPLASM WITH GROSS DESTRUCTION AND LITTLE OR NO PERIOSTEAL REACTION

#### COMMON
1. Chondrosarcoma
2. Lymphoma, leukemia in an adult
3. Malignant fibrous histiocytoma
4. Metastasis
5. Multiple myeloma
6. Osteosarcoma (osteolytic type)

#### UNCOMMON
1. Adamantinoma (esp. tibia)
2. Angiosarcoma
3. Chordoma
4. Ewing sarcoma
5. Fibrosarcoma
6. Giant cell tumor, malignant
7. Hemangioendothelioma, malignant
8. Hemangiopericytoma, malignant (rare)
9. Liposarcoma (rare)
Gamut D-83

MALIGNANT BONE NEOPLASM WITH MARKED PERIOSTEAL REACTION (MAY BE CONFUSED WITH OSTEOMYELITIS)

1. Burkitt lymphoma
   *2. Ewing sarcoma
   3. Leukemia in a child
   4. Metastasis (esp. neuroblastoma in a child; prostate or gastrointestinal carcinoma in adult)
   *5. Osteosarcoma
   6. Primitive neuroectodermal tumor (PNET)

* Often onion-skin periosteal reaction.

Gamut D-84

MALIGNANT BONE NEOPLASM WITH MARKED MINERALIZATION RELATIVE TO DESTRUCTION

1. Bone sarcoma or carcinoma superimposed on chronic osteomyelitis or tropical ulcer
2. Bone sarcoma (previously treated) with recurrence
3. Chondrosarcoma (esp. arising in benign cartilaginous lesion)
   *4. Ewing sarcoma (esp. lesion in flat bone such as pelvis)
   *5. Lymphoma; leukemia (rarely)
   *6. Osteoblastic metastasis
   7. Osteosarcoma
   8. Parosteal or periosteal osteosarcoma or chondrosarcoma
   *9. Primitive neuroectodermal tumor (PNET), esp. lesion in flat bone

* Mineralization represents reactive bone.

Gamut D-85

OSTEOBLASTIC METASTASES

COMMON
1. Carcinoma of breast
2. Carcinoma of prostate
3. Lymphoma

UNCOMMON
1. Carcinoid, pulmonary
2. Cerebellar medulloblastoma or sarcoma
3. Meningiosarcoma
4. Osteosarcoma (incl. osteosarcomatosis)
5. Other carcinoma (esp. nasopharynx; urinary bladder—transitional cell; stomach, colon, pancreas—mucinous; lung—rarely small cell)
6. Retinoblastoma

Gamut D-86

OSTEOLYTIC METASTASES

COMMON
1. Carcinoma of breast
   *2. Carcinoma of kidney (hypernephroma)
   3. Carcinoma of lung
   4. Leukemia; lymphoma

UNCOMMON
1. Bone sarcoma (eg, Ewing sarcoma)
   *2. Carcinoma of adrenal; pheochromocytoma
   3. Carcinoma of gastrointestinal tract (eg, esophagus; stomach; colon; rectum)
   4. Carcinoma of prostate
   5. Carcinoma of skin (squamous cell)
   *6. Carcinoma of thyroid
   7. Carcinoma of cervix or uterus
   *8. Hepatoma

(continued)
*9. Malignant melanoma
10. Neuroblastoma
11. Other primary neoplasms (eg, urinary bladder; ovary; testis; Wilms tumor)

* Often expansile lytic lesion.

---

### Gamut D-87-S1

**RATE OF FREQUENCY OF METASTASES TO BONE FROM VARIOUS PRIMARY CARCINOMAS**

<table>
<thead>
<tr>
<th>Tumor Type</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast (incl. osteoblastic)</td>
<td>35%</td>
</tr>
<tr>
<td>Prostate (incl. osteoblastic)</td>
<td>30%</td>
</tr>
<tr>
<td>Lung</td>
<td>10%</td>
</tr>
<tr>
<td>Kidney</td>
<td>5%</td>
</tr>
<tr>
<td>Stomach</td>
<td>2%</td>
</tr>
<tr>
<td>Thyroid</td>
<td>2%</td>
</tr>
<tr>
<td>Uterus</td>
<td>2%</td>
</tr>
<tr>
<td>Colon</td>
<td>1%</td>
</tr>
<tr>
<td>Other organs</td>
<td>13%</td>
</tr>
</tbody>
</table>

**Reference**

---

### Gamut D-87-S2

**DISTRIBUTION OF METASTATIC BONE DISEASE**

<table>
<thead>
<tr>
<th>Location</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axial skeleton (incl. thoracolumbar spine, sacrum and pelvis)</td>
<td>75%</td>
</tr>
<tr>
<td>Skull</td>
<td>10%</td>
</tr>
<tr>
<td>Upper and lower extremities</td>
<td>11%</td>
</tr>
<tr>
<td>Forearm, hand, leg, foot</td>
<td>4%</td>
</tr>
</tbody>
</table>

**Reference**

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### Gamut D-88

**PERIOSTEAL OR PAROSTEAL NEOPLASM OR TUMOR-LIKE SURFACE LESION OF BONE**

**COMMON**
1. Cortical/periosteal desmoid (cortical avulsive injury)
2. Myositis ossificans, parosteal (juxtacortical)
3. Osteochondroma (osteocartilaginous exostosis)
4. Osteoid osteoma, subperiosteal
5. Osteosarcoma, parosteal
6. Turret exostosis

**UNCOMMON**
1. Aneurysmal bone cyst, subperiosteal
2. Bizarre parosteal pseudotumor (BPOP)
3. Chondrosarcoma, periosteal
4. Chondrosarcoma, secondary peripheral in osteochondroma
5. Florid reactive periostitis (ossifying fasciitis; parosteal fasciitis)
6. Ganglion, periosteal or subperiosteal
7. Hemangioma, parosteal
8. Lipoma, parosteal
9. Malignant fibrous histiocytoma; fibrosarcoma
10. Osteoblastoma, subperiosteal
11. Osteoma
12. Osteosarcoma, high-grade surface
13. Osteosarcoma, periosteal
14. Periosteal chondroma
15. Periosteal fibroma
16. Soft tissue tumor in a parosteal location (eg, gouty tophus; synovial sarcoma; giant cell tumor of tendon sheath; glomus tumor; Kaposi sarcoma)

**References**
Schematic diagram of periosteal reactions. The arrows indicate that the continuous reactions may be interrupted.

Reference
**Gamut D-90**

**CODMAN TRIANGLE**

**COMMON**
1. Malignant bone neoplasm, primary (See D-81)

**UNCOMMON**
1. Aneurysmal bone cyst
2. Healing fracture
3. Metastasis
4. Osteomyelitis (incl. mycetoma)
5. Subperiosteal hemorrhage (eg, hemophilia)

**References**

**Gamut D-91**

**PARALLEL SPICULATED (“HAIR-ON-END”) OR DIVERGENT SPICULATED (“SUNBURST”) PERIOSTEAL REACTION**

**COMMON**
1. Anemia (eg, thalassemia or sickle cell disease involving cranial vault with “hair-on-end” pattern)
2. Ewing sarcoma
3. Osteosarcoma
4. Leukemia
5. Meningioma
6. Osteomyelitis (incl. mycetoma)
7. Thyroid acropachy

**UNCOMMON**
1. Adamantinoma (esp. tibia)
2. Bone sarcoma, other (See D-81)
3. Healing fracture (esp. march fracture)
4. Hemangioma (esp. skull)
5. Infantile cortical hyperostosis (Caffey disease)
6. Leukemia
7. Meningioma
8. Metastasis (esp. neuroblastoma metastasis in skull; carcinoma of prostate)
9. Osteomyelitis (incl. mycetoma)
10. Thyroid acropachy

**Reference**

**Gamut D-92**

**LOCALIZED PERIOSTEAL REACTION**
(See D-90 to D-100)

**COMMON**
1. Arthritis (eg, juvenile rheumatoid; psoriatic; Reiter S.) (See D-232)
2. Dactylitis (See D-132)
3. Fracture, healing with callus; battered child S.
4. Langerhans cell histiocytosis (esp. eosinophilic granuloma)
5. Malignant bone neoplasm (esp. Ewing sarcoma; osteosarcoma) (See D-81, D-83)
6. Osteoid osteoma
7. Osteomyelitis (pyogenic; tuberculous; fungal—incl. mycetoma)
8. Reactive periostitis (eg, idiopathic; traumatic)
9. Soft tissue lesion adjacent to bone (eg, diabetic or decubitus ulcer; cellulitis; deep abscess; vascular tumor)
10. Subperiosteal hemorrhage (eg, trauma; hemophilia)
11. Vascular stasis (eg, chronic venous, arterial or lymphatic insufficiency or obstruction)

**UNCOMMON**
1. Benign bone cyst or neoplasm with expansion or pathologic fracture
2. Bone infarct (esp. in sickle cell disease)
3. Chondroblastoma (Codman tumor) invading metaphysis
4. Hypertrophic osteoarthropathy (See D-98)
5. Infantile cortical hyperostosis (Caffey disease)
6. Leukemia; lymphoma
7. Melorheostosis
8. Metastasis (eg, neuroblastoma)
9. Osteoblastoma
10. Radiation injury
11. Syphilis; yaws
12. Thermal injury (eg, burn; frostbite; electrical)
13. Tropical ulcer (‘‘ivory osteoma’’)

---

**COMMON**
1. Arthritis (eg, juvenile rheumatoid; psoriatic; Reiter S.) (See D-232)
2. Fractures, traumatic or pathologic; battered child S.
3. Prematurity; physiologic periostitis of newborn (up to 6 months)
4. Vascular stasis (eg, chronic venous, arterial or lymphatic insufficiency or obstruction)

**UNCOMMON**
1. Acromegaly (hands, feet)
2. Bizarre parosteal pseudotumor (BPOP)
3. Bone infarction, multiple (esp. hand-foot S. in sickle cell disease)
4. Congenital transplacental infection (eg, syphilis; rubella; cytomegalovirus infection)
5. Connective tissue disease (collagen disease) with arteritis (eg, lupus erythematosus; polyarteritis nodosa)
6. Copper deficiency, nutritional; Menkes S. (kinky-hair S.)
7. Cushing S. with excess callus
8. Diaphyseal dysplasia (Camurati-Engelmann disease)
9. Fibromatosis (esp. multicentric infantile myofibromatosis)
10. Florid reactive periostitis of the phalanges
11. Fluorosis
12. Gaucher disease; Niemann-Pick disease
13. Hemophilia; Christmas disease
14. Hyperphosphatasia
15. Hypertrophic osteoarthropathy (See D-98)
16. Hypervitaminosis A and D
17. Idiopathic
18. Infantile cortical hyperostosis (Caffey disease)
19. Langerhans cell histiocytosis
20. Leukemia; lymphoma
21. Macrodystrophia lipomatosa
22. Mastocytosis (early)
23. Medication induced (eg, Prostaglandin E; methotrexate)
24. Melorheostosis
25. Metastases (eg, neuroblastoma; Ewing sarcoma)
26. Mucolipidosis II (I-cell disease); GM₁ gangliosidosis
27. Neurofibromatosis (subperiosteal hemorrhages)
28. Neurogenic disorder (eg, congenital insensitivity to pain; spinal cord injury; meningomyelocele; leprosy)
29. Osteomalacia with fractures (eg, Milkman S.; aluminum-induced bone disease)
30. Osteomyelitis, widespread (eg, pyogenic; tuberculous; fungal)
31. Pachydermoperiostosis
32. Renal osteodystrophy (secondary hyperparathyroidism)

(continued)
33. Rickets, healing
34. Scurvy
35. Syphilis; yaws
36. Thermal injury (frostbite; burn; electrical)
37. Thyroid acropachy (hands, feet)
38. Tuberous sclerosis

References

**Gamut D-94**

**PERIOSTEAL NEW BONE FORMATION IN A CHILD**

**COMMON**
1. Arthritis (eg, septic; juvenile chronic; juvenile rheumatoid; fungal—mycetoma, *Candida*)
2. Bone sarcoma (eg, Ewing sarcoma; osteosarcoma)
3. Congenital transplacental infection (eg, syphilis; rubella; cytomegalovirus infection)
4. Dactylitis (See D-132)
5. Langerhans cell histiocytosis (esp. eosinophilic granuloma)
6. Leukemia; Burkitt lymphoma
7. Metastasis (eg, neuroblastoma; retinoblastoma; embryonal rhabdomyosarcoma)
8. Osteomyelitis (pyogenic; tuberculous; fungal; mycetoma; smallpox—prior to eradication)
9. Prematurity; physiologic periostitis of newborn (up to 6 months)
10. Rickets (all types), healing
11. Sickle cell disease (hand-foot S.)
12. Trauma (eg, callus; traumatic periostitis; battered child S.; stress fracture; osteogenesis imperfecta; campomelic dysplasia)

**UNCOMMON**
1. Benign bone cyst or neoplasm with expansion or pathologic fracture
2. Copper deficiency, nutritional; Menkes S. (kinky-hair S.)
3. Diaphyseal dysplasia (Camurati-Engelmann disease)
4. Gaucher disease; Niemann-Pick disease
5. Hemophilia; Christmas disease
6. Hyperphosphatasia
7. Hypertrophic osteoarthropathy (See D-98)
8. Hypervitaminosis A and D
9. Idiopathic
10. Infantile cortical hyperostosis (Caffey disease)
11. Infantile multisystem inflammatory disease (NOMID)
12. Medication-induced (eg, Prostaglandin E; methotrexate)
13. Melorheostosis
14. Mucolipidosis II (I-cell disease); GM$_1$ gangliosidosis
15. Osteoid osteoma
16. Pachydermoperiostosis
17. Radiation injury
18. Scurvy
19. Soft tissue lesion adjacent to bone (eg, diabetic or decubitus ulcer; cellulitis; deep abscess; vascular tumor)
20. Thermal injury (eg, burn; frostbite; electrical)
21. Tuberous sclerosis
22. Yaws

References

Gamut D-95-S

CLUES TO THE BATTERED CHILD

SKELETAL INJURIES

HIGH SPECIFICITY
1. Classic metaphyseal lesion (corner fracture; bucket handle fracture; avulsion fracture; metaphyseal in-fraction)
2. Rib fractures (esp. posterior)
3. Scapular fractures
4. Spinous process fractures
5. Sternal fractures

MODERATE SPECIFICITY
1. Multiple fractures
2. Bilateral fractures
3. Fractures at different stages of healing
4. Epiphyseal separations
5. Vertebral fractures or subluxations
6. Fractures of digits of hands or feet
7. Complex skull fractures

COMMON BUT LOW SPECIFICITY
1. Subperiosteal new bone formation
2. Excessive callus formation
3. Clavicular fractures
4. Fractures of shafts of long bones
5. Simple linear skull fractures

OTHER FEATURES
1. Unsuspected or inadequately or inappropriately explained fractures or other injuries
2. Multiple bruises; healed lacerations; burns

3. Thoracic findings consistent with contusion (eg, focal infiltrate without respiratory infection or fever; pneumothorax; pneumomediastinum; hemothorax; chylothorax)
4. Intramural intestinal hematoma
5. Pneumoperitoneum
6. Pseudocyst of pancreas
7. Solid organ laceration
8. Subdural hematoma
9. Underdevelopment; failure to thrive; poor hygiene
10. Inappropriate affect by the child’s caregiver (profound indifference or exaggerated concern)

Reference

Gamut D-96

EXCESS CALLUS FORMATION

COMMON
1. Steroid therapy; Cushing S.
2. Trauma, unrecognized; battered child S.; stress or march fracture (esp. metatarsal)

UNCOMMON
1. Congenital insensitivity to pain
2. Familial
3. Multiple myeloma (with pathologic fractures)
4. Paralytic disorders
5. Neuropathic arthropathy (eg, Charcot joint)
6. Osteogenesis imperfecta
7. Renal osteodystrophy (secondary hyperparathyroidism)
SCLEROSIS OF BONE WITH PERIOSTEAL REACTION

COMMON
1. Healing fracture with callus
2. Malignant bone neoplasm (eg, Ewing sarcoma; osteosarcoma; chondrosarcoma; lymphoma)
3. Osteoid osteoma
4. Osteomyelitis, bacterial, subacute to chronic (incl. Garré sclerosing osteomyelitis; Brodie abscess)

UNCOMMON
1. Chondroblastoma (Codman tumor)
2. Infantile cortical hyperostosis (Caffey disease)
3. Melorheostosis
4. Osteoblastic metastasis (esp. prostate)
5. Osteoblastoma
6. Osteomyelitis, unusual/low virulent organism (incl. tuberculosis; fungus disease—mycetoma; syphilis; yaws)
7. Ribbing disease (hereditary multiple diaphyseal sclerosis)
8. Tropical ulcer
9. Tuberous sclerosis

HYPERTROPHIC OSTEOARTHROPATHY

COMMON
1. Carcinoma of lung

UNCOMMON
1. Abscess of lung
2. Arteriovenous fistula of lung
3. Carcinoid, bronchial
4. Chronic gastrointestinal disease (eg, carcinoma; lymphoma; celiac disease; Crohn’s disease; ulcerative colitis; Whipple’s disease; amebic or bacillary dysentery; juvenile polyposis)
5. Chronic liver disease; cirrhosis (esp. biliary)
6. Chronic pulmonary infection (eg, tuberculosis; fungus disease—mycetoma; empyema; cystic fibrosis {mucoviscidosis})
7. Cyanotic congenital heart disease (clubbing but rarely a periosteal reaction)
8. Emphysema; chronic obstructive pulmonary disease (COPD)
9. Familial
10. Idiopathic
11. Lymphoma of lung
12. Mesothelioma, malignant; localized benign fibrous pleural tumor
13. Metastasis to lung (esp. from osteosarcoma)
14. Nasopharyngeal carcinoma (Schmincke tumor)
15. Pachydermoperiostosis (primary hypertrophic osteoarthropathy)
16. Polyarteritis nodosa
17. Renal osteodystrophy (secondary hyperparathyroidism)
18. Thyroid acropachy

Reference
MARKED CORTICAL HYPEROSTOSIS AND/OR THICK, SOLID, WAVY, OR BALLOONED PERIOSTEAL REACTION INVOLVING THE SHAFT OF A BONE

COMMON
1. Fracture (eg, ordinary, stress or march fracture; battered child S.; neurogenic fracture; osteogenesis imperfecta)
2. Osteoid osteoma
3. Osteomyelitis (esp. chronic, low grade, or subperiosteal; Garré sclerosing osteomyelitis; fungus disease—mycetoma)
4. Reactive periostitis (idiopathic—usually due to trauma)
5. Subperiosteal hemorrhage (eg, trauma; hemophilia or other bleeding disorder; leukemia; scurvy; neurofibromatosis)
6. Venous or lymphatic stasis

UNCOMMON
1. Cellulitis; adjacent soft tissue inflammation
2. Fluorosis
3. Hyperphosphatasia
4. Hypertrophic osteoarthropathy (See D-98)
5. Infantile cortical hyperostosis (Caffey disease)
6. Langerhans cell histiocytosis
7. Melorheostosis
8. Mucolipidosis II (I-cell disease); GM₁ gangliosidosis
9. Osteofibrous dysplasia (esp. tibia)
10. Pachydermoperiostosis
11. Ribbing disease (hereditary multiple diaphyseal sclerosis)
12. Rickets, healing (esp. ribs)
13. Sickle cell disease with bone infarction (esp. hand-foot S.); other dactylitis (See D-132)
14. Syphilis, yaws (healing)
15. Thyroid acropachy
16. Tropical ulcer osteoma
17. Tuberous sclerosis (esp. rib)

LOCALIZED CORTICAL THICKENING (ONE OR A FEW BONES) (See D-101)

COMMON
1. Bowed bones (See D-8)
2. Fracture, healing or healed; traumatic periostitis; battered child S.
3. Hypertrophic osteoarthropathy (See D-98)
4. Osteoid osteoma
5. Osteomyelitis with involucrum; Garré sclerosing osteomyelitis; mycetoma; syphilis, yaws (healing)
6. Paget’s disease
7. Venous or lymphatic stasis

UNCOMMON
1. Angiomatous lesion (eg, hemangioma; angiomatosis)
2. Bone neoplasm (esp. enchondroma; low-grade chondrosarcoma; benign tumor after pathological fracture)
3. Fibrous dysplasia
4. Hypervitaminosis A (esp. ulna)
5. Infantile cortical hyperostosis (Caffey disease)
7. Melorheostosis
8. Pachydermoperiostosis
9. Sickle cell disease (eg, with infarction or osteomyelitis)
10. Subperiosteal hemorrhage, old (eg, trauma; hemophilia; scurvy)
11. Thyroid acropachy
12. Tropical ulcer osteoma
WIDESPREAD CORTICAL THICKENING

COMMON
1. Conditions in which periosteal new bone has blended with the cortex (esp. widespread osteomyelitis or trauma) (See D-99)
2. Paget’s disease

UNCOMMON
1. Acromegaly; gigantism
2. Beckwith-Wiedemann S.
3. Craniodiaphyseal dysplasia (ribs, clavicles)
4. Dentino-osseous dysplasias (esp. trichodento-osseous S.)
5. Dubowitz S.
6. Endosteal hyperostosis (van Buchem and Worth types)
7. Diaphyseal dysplasia (Camurati-Engelmann disease)
8. Erdheim-Chester disease
9. Fluorosis
10. Frontometaphyseal dysplasia
11. Hyperostosis generalisata with striation of bones
12. Hyperphosphatasia
13. Hypertrophic osteoarthropathy (See D-98)
14. Hypervitaminosis A or D
15. Infantile cortical hyperostosis (Caffey disease)
16. Melorheostosis
17. Pachydermoperiostosis
18. Physiologic osteosclerosis of newborn
19. Polyostotic fibrous dysplasia (McCune-Albright S.)
20. Prostaglandin-induced hyperostosis
21. Pyknodysostosis
22. Ribbing disease (hereditary multiple diaphyseal sclerosis)
23. Stanescu dysostosis
24. Tuberous sclerosis
25. Tubular stenosis dysplasia (Kenny-Caffey S.)
26. Weismann-Netter S.

References
Gamut D-103

“SPLIT” OR DOUBLE-LAYER CORTEX

COMMON
1. Bone infarct (eg, sickle cell disease)
2. Healing fracture; battered child S.
3. Normal infants, esp. premature (physiologic periostitis of newborn)
4. Osteomyelitis
5. Osteoporosis (esp. disuse; immobilization)
   (See D-43)
6. Postsurgical removal of intramedullary rod

UNCOMMON
1. Bone graft (local)
2. Gaucher disease
3. Hyperphosphatasia
4. Osteopetrosis
5. Scurvy

Reference

Gamut D-104

SCALLOPING, EROSION, OR RESORPTION OF THE INNER CORTICAL MARGIN

COMMON
1. Anemia (esp. thalassemia; sickle cell disease)
2. Bone cyst
3. Chondroid lesion (eg, enchondroma; chondroblasta
oma {Codman tumor}; chondromyxoid fibroma; chondrosarcoma; periosteal chondroma)
4. Fibrous dysplasia
5. Hyperparathyroidism

Gamut D-105

DESTRUCTION OR EROSION OF THE EXTERNAL CORTICAL SURFACE OF A BONE (See D-39, D-41)

COMMON
1. Acro-osteolysis (absorption of terminal phalanx) (See D-127)
2. Aneurysm or arteriovenous fistula adjacent to bone (esp. traumatic)
3. Cortical/periosteal desmoid (cortical avulsive injury, esp. lower posterior femur)
4. Gouty tophus
5. Hyperparathyroidism; renal osteodystrophy (secondary hyperparathyroidism)
6. Juxta-articular erosion from rheumatoid or other arthritis or amyloidosis
7. Leukemia; lymphoma (g)
8. Metastasis (esp. carcinoma of lung; neuroblastoma)
9. Nonossifying fibroma (fibroxanthoma); fibrous cortical defect
10. Primary bone neoplasm

(continued)
11. Soft tissue infection or cellulitis adjacent to bone
12. Soft tissue neoplasm adjacent to bone (eg, hemangioma; neurofibroma; fibroma; lipoma; chondroma; sarcoma)
13. Subperiosteal bone resorption (See D-41)
14. Subperiosteal osteomyelitis; unusual/low virulent organism (eg, syphilis; yaws; tuberculosis; fungus disease—mycetoma)
15. Synovial lesion (eg, giant cell tumor of tendon sheath; pigmented villonodular synovitis; synovial sarcoma)
16. Trauma (eg, tendon avulsion)

UNCOMMON
1. Ainhum
2. Bacillary angiomatosis
3. Foreign body or thorn granuloma
4. Glomus tumor
5. Kaposi sarcoma
6. Periosteal chondroma or fibroma
7. Periosteal or parosteal neoplasm, other (eg, periosteal osteosarcoma; periosteal chondrosarcoma) (See D-88)
8. Squamous cell carcinoma of skin; malignant tropical ulcer
9. Subperiosteal hematoma

Gamut D-107-1

POLYOSTOTIC BONE LESIONS IN ADULTS (See D-74)

COMMON
1. Arthritic or synovial-based lesions
2. Bone infarcts; aseptic necroses
3. Fibrous lesions, incl. nonossifying fibromas (fibroxanthomas); polyostotic fibrous dysplasia (McCune-Albright S.)
4. Hyperparathyroidism, primary or secondary (renal osteodystrophy) with brown tumors
5. Metastases
6. Multiple myeloma
7. Osteomyelitis (bacterial; tuberculous; fungal; smallpox residual)
8. Paget’s disease
9. Trauma (fractures; dislocations)

UNCOMMON
1. Acro-osteolysis (See D-127)
2. Amyloidosis
3. Anemia, primary
4. Angiomatosis (hemangiomatosis; lymphangiomatosis; bacillary angiomatosis)
5. Enchondromatosis (Ollier disease); Maffucci S.
D. Bone, Joints, and Soft Tissues

Gamut D-107-2

POLYOSTOTIC BONE LESIONS IN CHILDREN 5–15 YEARS (See D-74)

COMMON

1. Anemia, primary
2. Fibrous lesions, incl. nonossifying fibromas (fibroxanthomas); fibrous cortical defects; polyostotic fibrous dysplasia (McCune-Albright S.)
3. Hyperparathyroidism, primary or secondary (renal osteodystrophy) with brown tumors
4. Langerhans cell histiocytosis
5. Leukemia; lymphoma; Burkitt lymphoma
6. Osteochondrodysplasias and dysostoses (See D-1)
7. Osteomyelitis (bacterial; tuberculous; fungal; small-pox residual)
8. Trauma (fractures; dislocations)

UNCOMMON

1. Angiomatosis (hemangiomatosis; lymphangiomatosis, cystic type)
2. Arthritis (eg, juvenile chronic; juvenile rheumatoid)
3. Bone infarcts (esp. sickle cell disease)
4. Cortical/periosteal desmoids (cortical avulsive injuries—esp. lower posterior femurs)
5. Dactylitis (See D-132)
6. Enchondromatosis (Ollier disease); Maffucci S.
7. Ewing sarcoma
8. Fibromatosis (esp. multicentric infantile myofibromatosis)
9. Gaucher disease; Niemann-Pick disease
10. Hemophilia
11. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
12. Hypervitaminosis A and D
13. Landing-Shirkey disease (multifocal granulomatous osteomyelitis in a compromised child)
14. Leprosy
15. Macrodystrophia lipomatosa
16. Mastocytosis
17. Melorheostosis
18. Metastases (incl. neuroblastoma)
19. Mucopolysaccharidoses; mucolipidoses (See J-4)
20. Neurofibromatosis (incl. type 1 with multiple nonossifying fibromas or Jaffe-Campanacci S.)
21. Osteosarcomatosis
22. Pachydermoperiostosis
23. Syphilis; yaws
24. Tuberosous sclerosis
POLYOSTOTIC BONE LESIONS IN INFANTS AND CHILDREN UP TO 5 YEARS (See D-74)

COMMON
1. Anemia, primary
2. Battered child S.
3. Congenital transplacental infection (toxoplasmosis; rubella; cytomegalovirus infection; herpes; syphilis)
4. Fibrous lesions, incl. nonossifying fibromas (fibroxanthomas); fibrous cortical defects; polyostotic fibrous dysplasia (McCune-Albright S.)
5. Langerhans cell histiocytosis
6. Leukemia; Burkitt lymphoma
7. Metastases (esp. neuroblastoma)
8. Osteochondrodysplasias and dysostoses (See D-1)
9. Osteomyelitis (bacterial; tuberculous; fungal
10. Physiologic periostitis of newborn (up to 6 months)
11. Rickets
12. Trauma (fractures; dislocations)

UNCOMMON
1. Fibromatosis (esp. multicentric infantile myofibromatosis)
2. Hypervitaminosis A
3. Infantile cortical hyperostosis (Caffey disease)
4. Macrogydrosis lipomatosa
5. Mucopolysaccharidoses; mucolipidoses (See J-4)
6. Neurofibromatosis (incl. type 1 with multiple nonossifying fibromas or Jaffe-Campanacci S.)
7. Osteogenesis imperfecta
8. Osteopetrosis
9. Scurvy
10. Tetanus (collapsed vertebrae)
11. Yaws

MULTIPLE FRACTURES—CONGENITAL SKELETAL DISORDERS WITH INCREASED BONE FRAGILITY

COMMON
1. Enchondromatosis (Ollier disease); Maffucci S.
2. Osteogenesis imperfecta (all types)
3. Polyostotic fibrous dysplasia (McCune-Albright S.)

UNCOMMON
1. Achondrogenesis type I
2. Antley-Bixler S.
3. Cleidocranial dysplasia
4. Congenital insensitivity to pain
5. Cutis laxa
6. Dysostosclerosis
7. Fibrogenesis imperfecta ossium
8. Geroderma osteodysplastica
9. Juvenile idiopathic osteoporosis
10. Metaphyseal chondrodysplasia (Jansen type)
11. Osteopetrosis
12. Progeria
13. Pyknodyostosis
14. Pyle dysplasia
15. Riley-Day S. (familial dysautonomia)
16. Spondyloepiphyseal dysplasia (corner fracture type)
17. Stiff-man S.
18. Thevenard S. (acrodystrophic neuropathy)
19. Trichorhinophalangeal dysplasia, type II (Giedion-Langer S.)
20. Werdnig-Hoffman disease
21. Campomelic dysplasia

References
MULTIPLE FRACTURES—METABOLIC DISORDERS

COMMON
1. Hyperparathyroidism, primary; osteitis fibrosa cystica
2. Renal osteodystrophy (secondary hyperparathyroidism); renal tubular acidosis
3. Rickets, severe (multiple types); Milkman S.
4. Scurvy (metaphyseal chip fractures)

UNCOMMON
1. Aspartylglucosaminuria
2. Copper deficiency, nutritional; Menkes S. (kinky-hair S.)
3. Cystinosis
4. Gaucher disease; Niemann-Pick disease
5. Glycogen storage disease type I (von Gierke disease)
6. GM₁ gangliosidosis
7. Homocystinuria
8. Hyperphosphatasia
9. Hypophosphatasia
10. Lowe S. (oculocerebrorenal S.)
11. Membranous lipodystrophy
12. Mucolipidosis II (I-cell disease)
13. Oxalosis
14. Wilson disease (hepatolenticular degeneration)

Reference

MULTIPLE FRACTURES—OTHER SKELETAL DISORDERS IN WHICH FRACTURES MAY OCCUR

COMMON
1. Metastases (esp. carcinomatosis)
2. Multiple myeloma (esp. myelomatosis)
3. Osteomalacia (See D-44)
4. Osteoporosis (See D-43)
5. Paget’s disease
6. Steroid therapy; Cushing S.

UNCOMMON
1. Aluminum-induced bone disease
2. Anemia, primary (esp. thalassemia)
3. Angiomatosis (hemangiomatosis; lymphangiomatosis, cystic type)
4. Arthrogryposis
5. Langerhans cell histiocytosis
6. Leukemia
7. Osteomyelitis, diffuse (eg, congenital syphilis)

MULTIPLE FRACTURES—SKELETAL FRACTURES IN OTHERWISE NORMAL BONES

COMMON
1. Trauma; battered child S.

UNCOMMON
1. Seizures; electroshock therapy
2. Tetanus
COMMON SITES OF AVULSION INJURIES

1. Ankle (medial and lateral collateral ligaments)
2. Calcaneus (achilles tendon)
3. Elbow (triceps, collateral ligaments)
4. Fingers (volar plate, mallet finger)
5. Foot (eg, site of external digitorum brevis, peroneus brevis, plantar aponeurosis, and sesamoid of great toe—“turf toe”)
6. Greater trochanter of femur (abductors)
7. Iliac crest
8. Iliac spines (anterior superior and inferior)
9. Ischial tuberosity (hamstrings and abductor muscle origins)
10. Knee (esp. cruciate ligament origin or insertion)
11. Lesser trochanter of femur (usually pathologic)
12. Shoulder (esp. greater tuberosity, rotator cuff)
13. Spine (anterior longitudinal ligament C2, clay shoveler’s fracture)
14. Symphysis pubis (eg, separation of symphysis or avulsion of fragment inferiorly at insertion of gracilis)
15. Wrist (hook of hamate)

Reference

PSEUDOFRACTURES*

COMMON
1. Osteomalacia (concave side of bone) (See D-44)
2. Paget’s disease (convex side of bone)
3. Rickets (See D-44)
4. [Spondylolysis]
5. [Stress fracture] (See D-111-S)

UNCOMMON
1. Hyperphosphatasia
2. Hypophosphatasia
3. Idiopathic
4. Neuropathic disorder (eg, leprosy)
5. Osteogenesis imperfecta
6. Osteoporosis
7. Osteopetrosis
8. Polyostotic fibrous dysplasia (McCune-Albright S.)
9. Postoperative (eg, graft donor site)
10. Pyknody sostosis
11. Radiation osteitis
12. Renal osteodystrophy (secondary hyperparathyroidism)
13. Rheumatoid arthritis
14. Steroid therapy; Cushing S.

* Incomplete stress (insufficiency) fractures, presenting as narrow radiolucent bands perpendicular to the bony cortex.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
**Gamut D-110-S**

**SITES OF PSEUDOFRACTURES (LOOSER’S ZONES, MILKMAN SYNDROME)**

1. Femur (neck and shaft)
2. Ischial and pubic rami
3. Scapula, outer margin
4. Clavicle
5. Ribs
6. Other long bones (esp. proximal ulna shaft; distal radius shaft)
7. Metacarpals, metatarsals and phalanges

**Reference**


**Gamut D-111-S**

**STRESS FRACTURE (SITES OF PREDILECTION AND CAUSATIVE ACTIVITIES)**

1. Athlete (midtibia-shin splints; pubis)
2. Ball thrower; pitcher (distal humeral shaft; coronoid process of ulna)
3. Ballet dancer (spondylolysis of lumbar vertebra; femoral neck and shaft; midtibia; metatarsals)
4. Bowler (pelvis-obturator ring)
5. Chronic coughing (lower ribs); dyspnea (first rib)
6. Clay-shoveler (cervicodorsal spinous process)
7. Golfer (ribs; hook of hamate)
8. Gymnast (pelvis-obturator ring; femoral shaft)
9. Heavy pack-bearer (first rib)
10. Holding golf club, baseball bat, or tennis racquet (hook of hamate)
11. Hurdler (patella)
12. Javelin-thrower (coronoid process of ulna)
13. Lifting or moving heavy objects; scrubbing floors (spondylolysis of lumbar vertebra)
14. Long-distance runner (femoral neck and shaft; tibia; distal fibular shaft)
15. March fracture (metatarsals and proximal phalanges, esp. of 2nd, 3rd and 4th toes; tarsal navicular; femoral shaft)
16. Parachutist; jumper (dorsolumbar vertebrae; proximal fibula; calcaneus)
17. Pitchfork-handler (ulnar shaft)
18. Postoperative-radical neck dissection (clavicle)
19. Prolonged standing (calcaneus; metatarsals; sesamoids)
20. Stamping on ground (tarsal navicular; metatarsals)
21. Stooping (obturator ring)
22. Tic (clavicle)
23. Trapshooter (coracoid process of scapula)
24. Wheelchair operator (ulnar shaft)

**References**


**Gamut D-112**

**PSEUDOARTHROSIS**

**COMMON**

1. Neurofibromatosis (esp. tibia and fibula; also clavicle and radius)
2. Nonunion fracture in a normal bone
3. Pathologic fracture (eg, neoplasm; cyst; osteomyelitis; postradiation)

**UNCOMMON**

1. Amniotic band S. (Streeters bands)
2. Ankylosing spondylitis (in fused bamboo spine)
3. Cleidocranial dysplasia (esp. clavicle, femur)

(continued)
4. Congenital (esp. clavicle, tibia, fibula, radius, ulna); proximal femoral focal deficiency
5. Fibrous dysplasia
6. Idiopathic; isolated anomaly; familial
7. Increased bone fragility (eg, osteogenesis imperfecta; osteoporosis; osteomalacia)
8. Kuskokwim S. (clavicle)
9. Osteofibrous dysplasia (esp. tibia)
10. Osteopetrosis

References

EXOSTOSIS

COMMON
1. [Bunion]
2. [Calcaneal spur] (See D-233)
3. [Fracture fragment; healed avulsion injury]
4. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
5. [Hypertrophic spur; degenerative arthritis]
6. [Myositis ossificans (traumatic exostosis)]
7. Osteochondroma (metaphyseal)
8. [Pronounced medial tibial metaphyseal beaks in bowed legs]

UNCOMMON
1. Acrodysostosis (peripheral dysostosis) (proximal tibia)
2. [Acromegaly]
3. Adenosine deaminase deficiency
4. Arteriohepatic S. (Alagille S.)
5. Campomelic dysplasia (Ellis-van Creveld S.)
6. Chondroectodermal dysplasia (Ellis-van Creveld S.) (tibia, humerus)
7. [Copper deficiency, nutritional; Menkes S. (kinky-hair S.)]
8. [Costoclavicular ligament exostosis—midclavicle]
9. [Fibrodysplasia (myositis) ossificans progressiva]
10. [Fluorosis]
11. Iliac spur with tethered cord-sacral lipoma S.

Gamut D-113
PENCIL-POINTING OF SHAFT OR END OF BONE (VASCULAR DEOSSIFICATION)*

1. Calcium pyrophosphate dihydrate crystal deposition disease (CPPD)
2. Diabetes
3. Leprosy; other neuropathic arthropathy
4. Massive osteolysis (Gorham vanishing bone disease)
5. Psoriatic arthritis
6. Reiter S.
12. Intracapsular osteochondroma; dysplasia epiphysealis hemimelica (Trevor disease) (esp. knee and ankle epiphyses)
13. [Metachondromatosis (hands, feet, knees)]
14. Nail-patella S. (osteo-onychodysplasia) (iliac horns)
15. Occipital horn S. (Ehlers-Danlos S., type IX)
16. Pachydermoperiostosis
17. Pelvic “digit” or “rib”
18. Posthemorrhagic (eg, hemophilia)
19. Pseudohypoparathyroidism; pseudopseudohypoparathyroidism
20. Radiation injury
21. Short rib-polydactyly S. type II (Majewski) and III
22. Spondyloepimetaepiphyseal dysplasia with joint laxity
23. Subungual exostosis
24. Supracondylar spur of humerus
25. [Tibia vara (Blount disease)]
26. Trichorhinophalangeal dysplasia, type II (Giedion-Langer S.)
27. Tuberous sclerosis
28. Turner S. (medial tibial condyle)
29. Turret exostosis (phalanx)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

SYNOSTOSIS OF TUBULAR BONES
(See D-163, D-166)

1. Acrocephalosyndactyly (Pfeiffer type)
2. Chromosome 4: del(4p) S. (Wolf-Hirschhorn S.)
3. Cloverleaf skull deformity (kleeblattschädel anomaly)
4. Diastrophic dysplasia (metatarsals)
5. Ehlers-Danlos S.
6. Fetal alcohol S.
7. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
8. Holt-Oram S.
9. Humeroradial-humeroulnar synostosis (See D-166)
10. Inflammatory periostitis, severe (eg, infantile cortical hyperostosis {Caffey disease})
11. Klinefelter S. (XXY S.)
12. Lenz-Majewski dysplasia
13. Mesomelic dysplasia
14. Multiple synostosis S.
15. Nager acrofacial dysostosis
16. Posttraumatic (esp. following severe bleeding)
17. Radioulnar synostosis (See D-163)
18. Trisomy 18 S.
19. XXXXY S.; XXXXX S.; XXXY S.

References
Gamut D-116

GAS WITHIN BONE
(ESPECIALLY ON CT)

1. Intraosseous ganglion
2. Methylmethacrylate prosthesis
3. Neoplasm (esp. after radiation therapy)
4. Osteomyelitis (gas forming organism)
5. Osteonecrosis
6. Postoperative; posttraumatic
7. Subchondral bone cyst (“vacuum cyst” or pneumatocyst)

References

Gamut D-117-1

CONGENITAL THUMB ABNORMALITIES—ABSENT THUMB

1. Fanconi anemia (pancytopenia-dysmelia S.)
2. Franceschetti S.
3. Holt-Oram S.
4. Phocomelia (eg, thalidomide embryopathy)
5. Poland S. (pectoral muscle aplasia—syndactyly)
6. Rothmund-Thomson S.
7. Seckel S. (bird-headed dwarfism)
8. Trisomy 18 S.
9. Yunis-Varón S.

References

Gamut D-117-2

HYPOPLASTIC THIN OR SHORT THUMB

1. Acrocephalopolysyndactyly (Carpenter S.)
2. Acrocephalosyndactyly (Apert type)
3. Acrodysostosis (peripheral dysostosis)
4. Aminopterin fetopathy
5. Baller-Gerold S. (craniosynostosis-radial aplasia S.)
6. Brachmann-de Lange S. (de Lange S.)
7. Cephaloskeletal dysplasia (Taybi-Linder S.)
8. Christian S. (adducted thumbs S.)
9. Chromosome 18: del(18q) S.
10. Desbuquois dysplasia
11. Diastrophic dysplasia
12. Dyggve-Melchior-Clausen dysplasia (Smith-McCort S.)
13. Dyssegmental dysplasia
14. Ectodermal dysplasia
15. Familial brachydactyly C or D; hereditary shortness of thumbs
16. Fanconi anemia (pancytopenia-dysmelia S.)
17. Fibrodysplasia (myositis) ossificans progressiva
18. Gorlin S. (nevoad basal cell carcinoma S.)
19. Hand-foot-genital S.
20. Holt-Oram S.
21. Isolated anomaly
22. IVIC S.
23. Juberg-Hayward S.
24. Mesomelic dysplasia (Werner type)
25. Otopalatodigital S. (types I and II)
26. Phocomelia (eg, thalidomide embryopathy)
27. Popliteal pterygium S.
28. Radial hypoplasia syndromes
29. Rubinstein-Taybi S.
30. Smith-Lemli-Opitz S.
31. Symphalangism-surdity S. (symphalangism-brachydactyly S. or WL S.)
32. TAR S. (thrombocytopenia-absent radius S.)
33. Trisomy 9p S.
34. Trisomy 18 S.
35. V ATER association
36. Werner S.

References
TRIPHALANGEAL THUMB

1. Aase S.
2. Diamond-Blackfan S.
3. DOOR S.
4. Duane-radial S. (DR S.)
5. Fanconi anemia (pancytopenia-dysmelia S.)
6. Fetal hydantoin S. (Dilantin embryopathy)
7. Goodman S.
8. Holt-Oram S.
9. Hypomelanosis of Ito
10. IVIC S.
11. Juberg-Hayward S.
12. Lacrimo-auriculo-dento-digital S. (LADD S.) (Levy-Hollister S.)
13. Mesomelic dysplasia (Werner type)
14. Normal variant; isolated anomaly
15. Poland S. (pectoral muscle aplasia-syndactyly)
16. Thalidomide embryopathy
17. Townes-Brocks S.
18. Trichorhinophalangeal dysplasia, type II (Giedion-Langer S.)
19. Trisomy 13 S.
20. Trisomy 22 S.
21. VATER association

References
THUMB APPEARANCE IN VARIOUS SYNDROMES*

<table>
<thead>
<tr>
<th>Cone Epiphysis</th>
<th>Distal Phalanx</th>
<th>Proximal Phalanx</th>
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<tr>
<td>Trisomy 18</td>
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</tbody>
</table>

(Modified from Poznanski AK, Garn SM, Holt JF: Radiology 1971;100:115-129)

* O = occasional; X = frequent; P1 = proximal phalanx of thumb; D1 = distal phalanx of thumb

Reference

Gamut D-119-2

SHORT DISTAL PHALANX OF THE THUMB—THIN AND SMALL

1. Brachmann-de Lange S. (de Lange S.)
2. Fanconi anemia (pancytopenia-dysmelia S.)
3. Fibrodysplasia (myositis) ossificans progressiva
4. Holt-Oram S.
5. Radial hypoplasia syndromes (See D-161)
6. Trisomy 18 S.

Reference
1. Poznanski AK: The Hand in Radiologic Diagnosis. (ed 2)
   Philadelphia: WB Saunders, 1984, p 905

Gamut D-120

SHORT PROXIMAL PHALANX OF THE THUMB AND/OR OTHER DIGITS

ACQUIRED
1. Arthritis
2. Infection (eg, osteomyelitis; yaws; smallpox residual)
3. Neoplasm
4. Trauma
5. Sickle cell disease

CONGENITAL
1. Acrocephalopolysyndactyly (Carpenter S.)
2. Acrocephalosyndactyly (Apert and Pfeiffer types)
3. Diastrophic dysplasia
4. DOOR S.
5. Familial brachydactyly A-1, A-2, and C
6. Fibrodysplasia (myositis) ossificans progressiva
7. Gorlin S. (nevoid basal cell carcinoma S.)
8. Rubinstein-Taybi S.
9. Trisomy 18 S.

Gamut D-121-1

“DRUMSTICK” DISTAL PHALANGES*

2. Coffin-Lowry S.
3. Holt-Oram S.
4. Normal variant
5. Trisomy 21 (Down S.)
6. Turner S.

* The phalangeal shaft is disproportionately thinned in comparison to the tuft.

References
1. Poznanski AK: The Hand in Radiologic Diagnosis. (ed 2)
   Philadelphia: WB Saunders, 1984
2. Swischuk LE, John SD: Differential Diagnosis in Pediatric Radiology. (ed 2)
   Baltimore: Williams & Wilkins, 1995, p 266

Gamut D-121-2

BROAD DISTAL PHALANX OF THE THUMB

1. Acrocephalopolysyndactyly (Carpenter S.)
2. Acrocephalosyndactyly (Apert and Pfeiffer types)
3. Familial brachydactyly B and D
4. Mesomelic dysplasia (Robinow type)
5. Otopalatodigital S.
6. Rubinstein-Taybi S.
7. Syndactyly

Reference
1. Poznanski AK: The Hand in Radiologic Diagnosis. (ed 2)
   Philadelphia; WB Saunders, 1984, p 901
Gamut D-121-3

BROAD DISTAL PHALANGES
OF OTHER DIGITS

1. Atelosteogenesis (type I)
2. Distal brachydactyly
3. Larsen S.
4. Pachyonychia congenita
5. Warfarin embryopathy

Reference
1. Poznanski AK: The Hand in Radiologic Diagnosis. (ed 2) Philadelphia; WB Saunders, 1984, p 901

Gamut D-121-4

BROAD MIDDLE PHALANGES
OF OTHER DIGITS

1. Achondroplasia (infant)
2. Acrodysostosis (peripheral dysostosis)
3. Acrodysplasia with retinitis pigmentosa and nephropathy (Saldino-Mainzer S.)
4. Acromesomelic dysplasia
5. Campomelic dysplasia
6. Chondrodysplasia punctata (infant)
7. Chondroectodermal dysplasia (Ellis-van Creveld S.) (infant)
8. Familial brachydactyly A-1
9. Frontometaphyseal dysplasia
10. Marshall S.
11. Mucolipidosis III (pseudo-Hurler polydystrophy)
12. Noonan S.
13. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
14. Trichorhinophalangeal dysplasia, type I (Giedion S.) and II (Giedion-Langer S.)

Reference
1. Poznanski AK: The Hand in Radiologic Diagnosis. (ed 2) Philadelphia; WB Saunders, 1984, p 901

Gamut D-122-1

CONGENITAL ABNORMALITY
OF THE GREAT TOE

COMMON
1. Acrocephalosyndactyly (Apert, Pfeiffer, and Saethre-Chotzen types)
2. Brachmann-de Lange S. (de Lange S.)
3. Fibrodysplasia (myositis) ossificans progressiva
4. Otopalatodigital S.
5. Rubinstein-Taybi S.

Reference
1. Poznanski AK: The Hand in Radiologic Diagnosis. (ed 2) Philadelphia; WB Saunders, 1984, p 901

UNCOMMON
1. Acrocephalopolysyndactyly (Carpenter S.)
2. Acrocallosal S.
4. Cleidocranial dysplasia
5. Craniofrontonasal dysplasia
6. Diastrophic dysplasia
7. Femoral hypoplasia—unusual facies S.
8. Freeman-Sheldon S. (whistling face S.)
9. Frontodigital S.
10. Greig cephalopolysyndactyly S.
11. Hand-foot-genital S.
12. Larsen S.
13. Léri pleonosteosis
14. Orofaciodigital syndrome I (Papillon-Leage and Psaume S.) and II (Mohr S.)
15. Popliteal pterygium S.
16. Trisomy 13 S.
17. Trisomy 18 S.
18. XXXXY S.

Reference
DUPLICATION OF THE GREAT TOE (HALLUCAL POLYDACTYLY)

1. Acrocallosal S.
2. Acrocephalosyndactyly (Apert, Pfeiffer, and Saethre-Chotzen types)
4. Craniofrontonasal dysplasia
5. Femoral hypoplasia—unusual facies S.
6. Rubinstein-Taybi S.

References

CLINODACTYLY OF THE FIFTH FINGER (INCURVING OF FIFTH DIGIT WITH HYPOPLASTIC SHORT MIDDLE PHALANX)

COMMON
1. Brachmann-de Lange S. (de Lange S.)
2. Ehlers-Danlos S.
3. Familial brachydactyly A1, A2, A3, A4, C
4. Fanconi anemia (pancytopenia-dysmelia S.)
5. Fetal alcohol S.
6. Fibrodysplasia (myositis) ossificans progressiva
7. Hand-foot-genital S.
8. Holt-Oram S.
9. [Kirner deformity (distal phalanx—seen as isolated anomaly or in Brachmann-de Lange S. {de Lange S.} or Silver-Russell S.)]
10. Klinefelter S. (XXY S.)
11. Local disorder (eg, trauma; arthritis; contracture)
12. Marfan S.
13. Metaphyseal chondrodysplasia (Shwachman type)
14. Mitral valve prolapse S.
15. Nail-patella S. (osteo-onychodysplasia)
16. Noonan S.
17. Normal variant; isolated anomaly
18. Oculodento-osseous dysplasia
19. Orofaciodigital syndrome I (Papillon-Leage and Psaume S.) and II (Mohr S.)
20. Otopalatodigital S. (type I)
21. Poland S. (pectoral muscle aplasia—syndactyly)
22. Silver-Russell S.
23. TAR S. (thrombocytopenia-absent radius S.)
24. Trisomy 21 S. (Down S.)
25. Williams S. (idiopathic hypercalcemia)

UNCOMMON
1. Aarskog S.
2. Acrocephalopolysyndactyly (Carpenter S.)
3. Acrocephalosyndactyly (Saethre-Chotzen type)
4. Aminopterin fetopathy
5. Bardet-Biedl S.; Laurence-Moon S.
6. Bloom S.
7. Campomelic dysplasia
8. Cat cry S. (cri du chat S.)
10. Coffin-Siris S.
11. Cohen S.
12. DOOR S.
13. Dubowitz S.
14. EEC syndrome
15. Fibrochondrogenesis
16. Goltz S. (focal dermal hypoplasia)
17. Goodman S.
18. Hypomelanosis of Ito
20. Lenz microphthalmia S.
21. Meckel S.
22. Mesomelic dysplasia (Nievergelt type)
23. Popliteal pterygium S.
24. Prader-Willi S.
25. Rieger S.
26. Roberts S. (pseudothalidomide S.)
27. Robinow S.
28. Rubinstein-Taybi S.
29. Ruvalcaba S. (trichorhinophalangeal S., type III)
30. Seckel S. (bird-headed dwarfism)
31. Symphalangism-surdity S. (symphalangism-brachydactyly S. or WL S.)
32. Treacher Collins S.
33. Trichorhinophalangeal dysplasia, type I (Giedion S.) and II (Giedion-Langer S.)
34. Triploidy
35. Trisomy syndromes (8, 9p, 13, 18)
36. Weill-Marchesani S.
37. XXXX S.; XXXY S.; XXXXX S.; XXXXY S.
38. Zellweger S. (cerebrohepatorenal S.)

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut D-124

CONGENITAL SYNDROMES WITH ONE OR MORE SHORT MIDDLE PHALANGES (OTHER THAN FIFTH FINGER)

1. Aarskog S.
2. Acrocephalopolysyndactyly (Carpenter S.)
3. Acrocephalosyndactyly (Apert type)
4. Acrodysplasia with retinitis pigmentosa and nephropathy (Saldino-Mainzer S.)
5. Asphyxiating thoracic dysplasia (Jeune S.)
6. Atelosteogenesis
7. Campomelic dysplasia
8. Cleidocranial dysplasia
9. Cloverleaf skull deformity (kleeblattschädel anomaly)
10. Familial brachydactilies A1, A4, B, and C (A2 and A3—second finger)
12. Poland S. (pectoral muscle aplasia-syndactyly)
13. Pseudohypoparathyroidism; pseudopseudohypoparathyroidism (second finger)
14. Ruvalcaba S. (trichorhinophalangeal S., type III)
15. Sclerosteosis (second finger)
16. Symphalangism-surdity S. (symphalangism-brachydactyly S. or WL S.)
17. Trichorhinophalangeal dysplasia, type I (Giedion S.) and II (Giedion-Langer S.)

References
Gamut D-125-1

GENERALIZED SHORT DISTAL PHALANGES OF THE HAND—SHORT AND BROAD

1. Achondroplasia
2. Acrodysostosis (peripheral dysostosis)
3. Acro-osteolysis (eg, frostbite; burn; leprosy; trauma) (See D-127)
4. Asphyxiating thoracic dysplasia (Jeune S.)
5. Cleidocranial dysplasia
6. Coffin-Lowry S.
7. Diastrophic dysplasia
8. DOOR S.
9. Hypochondroplasia
10. Larsen S.
11. Metaphyseal chondrodysplasia (Jansen type)
12. Pachydermoperiostosis
13. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
14. Pseudohyopoparathyroidism; pseudopseudohypoparathyroidism
15. Robinow S.
16. Warfarin embryopathy

Reference

Gamut D-125-2

GENERALIZED SHORT DISTAL PHALANGES OF THE HAND—THIN AND SMALL

1. Acrocephalopolysyndactyly (Carpenter S.)
2. Acro-osteolysis (eg, frostbite; burn; leprosy; trauma) (See D-127)
3. Asphyxiating thoracic dysplasia (Jeune S.)
4. Chondroectodermal dysplasia (Ellis-van Creveld S.)
5. Christian S. (adducted thumbs S.)
6. Coffin-Siris S.
7. Fetal alcohol S.
8. Fetal hydantoin S. (Dilantin embryopathy)
9. Hypoplastic nails S.
10. Marshall S.
11. Mucolipidosis II (I-cell disease)
12. Opitz trigonocephaly S. (C syndrome)
13. Osteodysplasty (Melnick-Needles S.)
14. Pseudohypoparathyroidism
15. Symphalangism-surdity S. (symphalangism-brachydactyly S. or WL S.)
16. Trisomy 9p S.
17. Trisomy 13 S.
18. Trisomy 18 S.
19. Warfarin embryopathy

Reference

Gamut D-126

HYPOPLASTIC (SPINDLE-SHAPED OR STUBBY) TERMINAL PHALANGES

COMMON
1. Acro-osteolysis (eg, hyperparathyroidism; frostbite; burn; leprosy; trauma; idiopathic) (See D-127)
2. Brachmann-de Lange S. (de Lange S.)
3. Cleidocranial dysplasia
4. Congenital insensitivity to pain
5. Fanconi anemia (pancytopenia-dysmelia S.)
6. Fibrodysplasia (myositis) ossificans progressiva
7. Holt-Oram S.
8. Normal (foot)
9. Pseudohypoparathyroidism; pseudopseudohypoparathyroidism
10. Pyknodysostosis
11. Spade hand
ACRO-OSTEOLYSIS (EROSION OR DESTRUCTION OF MULTIPLE TERMINAL PHALANGEAL TUFTS)

COMMON
1. Arteriosclerosis obliterans
2. Diabetic gangrene
+3. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
4. Infection (eg, meningococcemia); osteitis
5. Neuropathic disease (esp. diabetes; leprosy; tabes dorsalis; syringomyelia; meningomyelocele) (See D-150)
6. Psoriatic arthritis
7. Raynaud disease
8. Rheumatoid arthritis; juvenile rheumatoid arthritis (+)
*9. Scleroderma; dermatomyositis; mixed connective tissue disease (MCTD)
10. Thermal injury (eg, burn; frostbite; electrical)
11. Trauma (biomechanical stress; guitar player)

UNCOMMON
1. Amniotic band S. (Streeter bands)
2. Buerger disease (thromboangiitis obliterans)
+3. Cleidocranial dysplasia
4. Clubbing of fingers (See D-133)
+5. Congenital (familial or idiopathic) acro-osteolysis (eg, Hajdu-Cheney S.)
*6. Congenital insensitivity to pain
7. Familial brachydactyly B
8. Farber disease (disseminated lipogranulomatosis)
9. Drug therapy (eg, Dilantin; phenobarbital; ergot reaction)
10. Dysosteoosclerosis
11. Ectodermal dysplasia
*12. Ehlers-Danlos S.
*13. Epidermolysis bullosa
*14. Gout
15. Hunger osteopathy

References
16. Hypertrophic osteoarthropathy
17. Lesch-Nyhan S.
18. Mandibuloacral dysplasia
19. Metastasis
20. Multicentric reticulohistiocytosis (lipoid dermatoarthitis)
21. Osteomalacia (eg, malabsorption syndromes)
22. Osteopetrosia
23. Osteopoikilosis
24. Pachydermoperiostosis
25. Papillon-Lefèvre S.
26. Pityriasis rubra
27. Plantar warts
+28. Polyvinyl chloride osteolysis; chemical acro-osteolysis
29. Porphyria
30. Progeria; Werner S.
31. Pseudoxanthoma elasticum
32. Pyknody sostosis
33. Radiation injury
*34. Rothmund-Thomson S.
35. Sarcoïdose
36. Singleton-Merten S.
37. Stögren S.
38. Snake or scorpion venom
39. Thevenard S.
40. Thrombotic thrombocytopenic purpura
41. Winchester S.

* May be associated with calcification.
+ Band-like resorption of midportion of phalanx.

References

Gamut D-127-2

ACQUIRED ACRO-OSTEOLYSIS
CONFINED TO ONE DIGIT

1. Angioma
2. Carcinoma of nail bed
3. Epidermoid inclusion cyst
4. Fibroma
5. Giant cell tumor of tendon sheath
6. Glomus tumor
7. Infection (eg, osteomyelitis, paronychia)
8. Lymphoma
9. Metastasis
10. Neurofibroma
11. Subungual exostosis
12. Thermal injury (eg, burn; frostbite; electrical)

Gamut D-127-3

BAND-LIKE DESTRUCTION
OR EROSION OF THE MIDPORTION
OF A TERMINAL PHALANX

1. Ainhum (usually proximal phalanx)
2. Chemical acro-osteolysis (eg, polyvinyl chloride)
3. Cleidocranial dysplasia
4. Congenital (familial or idiopathic) acro-osteolysis (eg, Hajdu-Cheney S.)
5. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
6. Juvenile rheumatoid arthritis

Reference
ACRO-OSTEOSCLEROSIS (TERMINAL PHALANGEAL SCLEROSIS)

COMMON
1. Idiopathic, normal variant
2. Rheumatoid arthritis

UNCOMMON
1. Lupus erythematosus
2. Melorheostosis
3. Osteopetrosis
4. Osteopoikilosis
5. Sarcoidosis
6. Scleroderma

References

AMPUTATION OR ABSENCE OF A PHALANX, DIGIT, HAND, OR FOOT—ACQUIRED

COMMON
1. Diabetes
2. Infection; severe osteomyelitis (eg, mycetoma)
3. Leprosy
4. Neurologic disorder
5. Scleroderma
6. Surgical amputation
7. Thermal injury (eg, frostbite; burn; electrical)
8. Trauma; battered child
9. Vascular insufficiency (eg, arteriosclerosis; ergot reaction; gangrene)

UNCOMMON
1. Ainhum
2. Congenital insensitivity to pain
3. Constriction (eg, bandages; bands; strings; hair)
4. Disseminated intravascular coagulation (eg, meningococcemia)
5. Lesch-Nyhan S.
6. Psoriasis, severe
7. Psychotic states
8. Radiation, radium injury

References

AMPUTATION OR ABSENCE OF A PHALANX, DIGIT, HAND, OR FOOT—CONGENITAL

COMMON
1. Amniotic band S. (Streeter bands)
2. Thalidomide embryopathy

UNCOMMON
1. Aglossia-adactyia S.; hypoglossia-hypodactyia S.)
2. Aplasia cutis congenita
3. Arthrogryposis (toe)
4. Brachmann-de Lange S. (de Lange S.)
5. Claw hand
6. Fetal hydantoin S. (Dilantin embryopathy)
7. Grebe chondrodysplasia (achondrogenesis, Brazilian type)
8. Keratosis palmaris et plantaris familiaris (tylosis)
9. Möbius S.
10. Poland S. (pectoral muscle aplasia—syndactyly)
11. Popliteal pterygium S.
12. Radial and ulnar ray syndromes (See D-161, D-162)
13. Roberts S. (pseudothalidomide S.)

References

Gamut D-129-3

SELF-MUTILATION OF Digits

1. Congenital insensitivity to pain
2. Congenital sensory neuropathy with or without anhidrosis
3. Diabetic neuropathy
4. Leprosy
5. Lesch-Nyhan S.
6. Psychotic states
7. Riley-Day S. (familial dysautonomia)

Gamut D-130

GANGRENE OF A FINGER OR TOE

COMMON
1. Arteriosclerosis obliterans
2. Arteritis (eg, hypersensitivity angiitis; Kawasaki S.; ergot reaction)
3. Connective tissue disease (collagen disease), eg, scleroderma; polyarteritis nodosa
4. Diabetes
5. Neuropathic disease, eg, leprosy (See D-150)
6. Trauma, external or postoperative

UNCOMMON
1. Autoimmune disorder; macroglobulinemia
   (Waldenström macroglobulinemia; tumor-produced globulins)
2. Blood disorder (eg, leukemia; myeloid metaplasia; polycythemia vera)
3. Buerger disease (thromboangiitis obliterans)
4. Constriction (eg, bandage; baby mittens; hair ring or band; ainhum)
5. Disseminated intravascular coagulation (eg, sepsis; meningococcemia)
6. Electrical or chemical injury
7. Iatrogenic (eg, radial artery catheterization)
8. Infection; osteomyelitis
9. Raynaud disease
10. Thermal injury (frostbite; burn)
11. Trench foot
12. Trophic ulcer with underlying destruction

Reference

Gamut D-131

LYTIC LESION(S) IN A PHALANX (OFTEN CYST-LIKE)

COMMON
*1. Arthritis (esp. gout; rheumatoid arthritis; osteoarthritis)
+*2. Enchondroma
+*3. Osteomyelitis, incl. tuberculosis (spina ventosa)

UNCOMMON
1. Amyloidosis (esp. with renal failure)
2. Aneurysmal bone cyst
3. Angioma
4. Bone cyst
+5. Carcinoma of skin and nail-bed (incl. keratoacanthoma)
6. Chondroblastoma (Codman tumor)
7. Chondromyxoid fibroma
8. Chondrosarcoma (slow growing)
+9. Epidermoid inclusion cyst
10. Fibrous dysplasia
11. Ganglion
12. Giant cell tumor
+13. Glomus tumor
14. Hemophilic pseudotumor
*15. Leprosy (leproma)
*16. Lymphoma; leukemia
+*17. Metastasis (esp. lung, breast)
*18. Multiple myeloma
19. Osteoblastoma
20. Osteoid osteoma
21. Periosteal chondroma or fibroma (incl. subungual)
*22. Sarcoidosis
*23. Synovial lesion (eg, villonodular synovitis; giant cell tumor of tendon sheath)
+24. Thorn granuloma
+*25. Tuberous sclerosis
*26. Wilson disease (hepatolenticular degeneration)
27. Xanthoma

* May be multiple.
+ Frequent cause of a lytic lesion in the distal phalanx.

Reference

Gamut D-132

DACTYLITIS*

COMMON
1. Pyogenic osteomyelitis (esp. Salmonella)
2. Sickle cell disease; hand-foot S. (infarction with or without osteomyelitis)
3. Tuberculosis (spina ventosa)

UNCOMMON
1. Atypical mycobacterial infection; BCG vaccination
2. Chronic granulomatous disease of childhood
3. Fungus disease g (eg, mycetoma; sporotrichosis)
4. Leprosy
5. [Neoplasm (eg, leukemia; metastasis, esp. neuroblastoma; Ewing sarcoma; angioma; osteoid osteoma)]
6. Pancreatic fat necrosis (with elevated lipase)
7. Phalangeal microgeodic S.
8. Radiation necrosis
9. Sarcoidosis
10. Smallpox—prior to eradication
11. Syphilis; yaws
12. Thermal injury (eg, frostbite; burn; electrical)
13. Tuberous sclerosis

* Varying degrees of bone destruction and expansion, periosteal reaction, and soft tissue swelling involving one or more bones of the hands and/or feet.

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
CLUBBING OF THE FINGERS OR TOES

COMMON
1. Alveolar capillary block (e.g., pulmonary interstitial fibrosis—sarcoidosis; scleroderma; pneumoconiosis)
2. Bronchogenic carcinoma
3. Cirrhosis
4. Congenital heart disease (e.g., chronic cyanotic—tetralogy of Fallot; also pulmonary stenosis; large PDA or VSD)
5. Emphysema
6. Hypertrophic osteoarthropathy (See D-98)

UNCOMMON
1. Acromegaly
2. Colitis, chronic (e.g., ulcerative; Crohn’s disease; amebic; tuberculous)
3. Cystic fibrosis (mucoviscidosis)
4. Familial idiopathic osteoarthropathy (Currarino S.)
5. Gastrointestinal disease, chronic (e.g., sprue; carcinoma; Cronkite-Canada S.)
6. Hajdu-Cheney S.
7. Hyperthyroidism; thyroid acropachy
8. Hypothyroidism; myxedema
9. Idiopathic
10. Immotile cilia S.
11. Larsen S.
12. Mesothelioma of pleura
13. Pachydermoperiostosis
14. POEMS S.
15. Polycythemia
16. Pulmonary AVMs or telangiectasia (e.g., Rendu-Osler-Weber S.)
17. Seckel S. (bird-headed dwarfism)
18. Subacute bacterial endocarditis
19. Urinary tract infection, chronic

SYMPHALANGISM (FUSION OF PHALANGES IN A DIGIT)

COMMON
1. Isolated anomaly, esp. PIP joints of fingers (“mark of Shrewsbury”) and DIP joints of toes

UNCOMMON
1. Acrocephalosyndactyly S. (Apert and other types)
2. Carpal-tarsal coalition
3. Cushing symphalangism
4. Diastrophic dysplasia
5. Familial brachydactyly B and C
6. Hand-foot-genital S.
7. Multiple synostosis S.
8. Oculodentoosseous dysplasia
9. Popliteal pterygium S.
10. Short rib-polydactyly S. type I (Saldino-Noonan)
11. Symphalangism-surdity S. (symphalangism-brachydactyly S. or WL S.)

References
CONTRACTURE OF A DIGIT

1. Ainhum
2. Arthrogryposis (amyoplasia)
3. Camptodactyly (See D-136)
4. Congenital contractural arachnodactyly
5. Congenital or acquired ring contraction, annular band
6. Dupuytren contracture
7. Thermal injury (esp. burn)
8. Volkmann ischemic contracture

Reference

CAMPTODACTYLY (FLEXION DEFORMITY OF ONE OR MORE DIGITS)

ACQUIRED

COMMON
1. Arthritis (esp. rheumatoid)
2. Contracture (eg, Dupuytren; Volkmann)
3. Digital fibroma (esp. in the elderly)
4. Infection
5. Thermal injury (burn; frostbite; electrical)
6. Trauma; fracture

UNCOMMON
1. Ainhum
2. Neoplasm

CONGENITAL

COMMON
1. Arthrogryposis
2. Holt-Oram S.
3. Marfan S.; congenital contractural arachnodactyly
4. Nail-patella S. (osteo-onychodysplasia)
5. Poland S. (pectoral muscle aplasia—syndactyly)
6. Trisomy 18 S.

UNCOMMON
1. Aarskog S.
2. Antley-Bixler S.
3. Arthropathy-camptodactyly S.
4. Camptobrachydactyly
5. Camptodactyly-ankylosis-pulmonary hypoplasia S.
6. Cerebro-oculo-facio-skeletal S. (Pena-Shokeir S. type II)
7. Christian S. (adducted thumbs S.)
8. Craniofrontonasal dysplasia
9. Fetal akinesia deformation sequence (Pena-Shokeir S. type I)
10. Fetal alcohol S.
11. Freeman-Sheldon S. (whistling face S.)
12. Goltz S. (focal dermal hypoplasia)
13. Goodman camptodactyly S., A and B
15. Grebe chondrodysplasia (achondrogenesis, Brazilian type)
16. Greig cephalopolysyndactyly S.
17. Isolated absence or hypoplasia of a phalanx
18. Kyphomelic dysplasia
19. Lenz microphthalmia S.
20. Meckel S.
21. Monosomy 21 S.
22. Neu-Laxova S.
23. Noonan S.
24. Oculodentosseous dysplasia
25. Orofaciodigital syndrome I (Papillon-Leage and Psaume S.)
26. Otopalatodigital S. (type II)
27. Popliteal pterygium S.
28. Pseudodystrophic dysplasia
29. Roberts S. (pseudothalidomide S.)
30. Spondylocostal dysostosis (Jarcho-Levin S.)
31. Tel Hashomer camptodactyly S.
32. Trisomy 8 S.
33. Trisomy 13 S.
SYNDACTRYLY (SOFT TISSUE UNION, WITH OR WITHOUT OSSEOUS UNION, BETWEEN ADJACENT DIGITS)

COMMON
1. Acrocephalopolysyndactyly (Carpenter and other types)
2. Acrocephalosyndactyly (Apert, Pfeiffer, Saethre-Chotzen types)
3. Brachmann-de Lange S. (de Lange S.)
4. Fanconi anemia (pancytopenia-dysmelia S.)
5. Holt-Oram S.
6. Isolated anomaly
7. Oculodentoosseous dysplasia
8. TAR S. (thrombocytopenia-absent radius S.)
9. Thermal injury (esp. burn)
10. Trisomy 13 S.
11. Trisomy 18 S.

UNCOMMON
1. Aarskog S.
2. Acrorenal S.
3. Aminopterin fetopathy
4. Aplasia cutis congenita
5. Arthrogryposis

6. Bardet-Biedl S.; Laurence-Moon S.
7. Bloom S.
8. Chondrodysplasia punctata
9. Chondroectodermal dysplasia (Ellis-van Creveld S.)
10. Cloveleaf skull deformity (kleeblattschädel anomaly)
11. Cohen S.
12. Craniofrontonasal dysplasia
13. DOOR S.
14. Dubowitz S. (toes)
15. EEC syndrome
16. Ehlers-Danlos S.
17. Epidermolysis bullosa
18. Familial brachydactyly A2 and B
19. Fetal hydantoin S. (Dilantin embryopathy)
20. Fibrodysplasia (myositis) ossificans progressiva
21. Fraser S. (cryptophthalmos-syndactyly S.)
22. Goltz S. (focal dermal hypoplasia)
23. Gorlin S. (nevoid basal cell carcinoma S.)
24. Greig cephalopolysyndactyly S.
25. Hallermann-Streiff S. (oculomandibulofacial S.)
26. Hypoglossia-hypodactylia S. (aglossia-adactylia S.)
27. Hypomelanosis of Ito
28. Incontinentia pigmenti
29. Lacrimo-auriculo-dento-digital S. (LADD S.) (Levy-Hollister S.)
30. Lenz microphthalmia S.
31. Meckel S.
32. Mesomelic dysplasia (Werner type)
33. Möbius S.
34. Multiple synostosis S.
35. Nager acrofacial dysostosis
36. Neu-Laxova S.
37. Opitz trigonocephaly S. (C syndrome)
38. Orofacciodigital syndrome I (Papillon-Leage and Psaume S.) and II (Mohr S.)
39. Otopalatodigital S. (types I and II)
40. Pallister-Hall S.
41. Poland S. (pectoral muscle aplasia—syndactyly)
42. Popliteal pterygium S.
43. Prader-Willi S.
44. Roberts S. (pseudothalidomide S.)
45. Robin sequence (Pierre Robin S.)
46. Robinow-Silverman S.
47. Rothmund-Thomson S.
48. Rubinstein-Taybi S.
49. Sclerosteosis
50. Short rib-polydactyly S. type I (Saldino-Noonan)
51. Silver-Russell S.
52. Smith-Lemli-Opitz S.
53. Spondylocostal dysostosis (Jarcho-Levin S.)
54. Trichorhinophalangeal dysplasia, type I (Giedion S.) and II (Giedion-Langer S.)
55. Triploidy (fetal triploidy S.)
56. Trisomy 21 S. (Down S.) (toes)

NOTE: There are over 30 other minor congenital syndromes with syndactyly that are listed in the books by Poznanski and Taybi.

References

Gamut D-138-1

POLYDACTYLY
(PREAXIAL—RADIAL SIDE)

COMMON
1. Acrocephalopolysyndactyly (Carpenter and other types)
2. Fanconi anemia (pancytopenia-dysmelia S.)
3. Holt-Oram S.
4. Isolated anomaly
5. VATER association

UNCOMMON
1. Acro-pectoro-vertebral dysplasia
2. Bloom S.
3. Cerebro-renal-digital syndromes
4. Chondrodysplasia punctata
5. Craniofrontonasal dysplasia
6. Diamond-Blackfan S.
7. Dubowitz S.
8. Fibrodysplasia (myositis) ossificans progressiva
9. Grebe chondrodysplasia (achondrogenesis, Brazilian type) (toes)
11. Lissencephaly syndromes (congenital agyria)
12. Möbius S.
13. Nager acrofacial dysostosis
14. Poland S. (pectoral muscle aplasia—syndactyly)
15. Prune-belly S. (Eagle-Barrett S.)
16. Rieger S.
17. Short rib-polydactyly S. type II (Majewski)
18. Silver-Russell S.
19. Stickler S. (arthro-ophthalmopathy)
20. Townes-Brocks S. (thumbs)
21. Trisomy 21 S. (Down S.)

Gamut D-138-2

POLYDACTYLY
(POSTAXIAL—ULNAR SIDE)

COMMON
1. Acrocephalopolysyndactyly (Carpenter and other types)
2. Bardet-Biedl S.; Laurence-Moon S.
3. Chondroectodermal dysplasia (Ellis-van Creveld S.)
4. Isolated anomaly
5. Rubinstein-Taybi S.

UNCOMMON
1. Acrocallosal S.
2. Acrorenal S.
3. Asphyxiating thoracic dysplasia (Jeune S.)
4. Biemond S. II
5. Cerebro-renal-digital syndromes

(continued)
6. Goltz S. (focal dermal hypoplasia)
7. Greig cephalopolysyndactyly S.
8. Kaufman-McKusick S. (hereditary hydrometrocolpos)
9. Meckel S.
10. Mesomelic dysplasia (Werner type)
11. Opitz trigonocephaly S. (C syndrome)
12. Orofaciiodigital S. II (Mohr S.)
13. Pallister-Hall S.
14. Pseudotrisomy 13 S. (holoprosencephaly-polydactyly S.)
15. Short rib-polydactyly syndromes
16. Smith-Lemli-Opitz S.
17. Trisomy 13 S.
18. Weyers acrodental dysostosis

NOTE: There are over 30 other minor congenital syndromes with polydactyly that are listed in the books by Poznanski and Taybi.

References
ARACHNODACTYLY (LONG FINGERS)

COMMON
1. Homocystinuria
2. Marfan S.

UNCOMMON
1. Antley-Bixler S.
2. Cleidocranial dysplasia (long 2nd and 5th metacarpals)
3. Congenital contractural arachnodactyly
4. Ehlers-Danlos S.
5. Frontometaphyseal dysplasia
6. Goodman camptodactyly S. B
7. Gorlin S. (nevoid basal cell carcinoma S.)
8. Ichthyosis syndromes
9. Marden-Walker S.
10. Multiple endocrine neoplasia (MEN) S., type IIB
11. Myotonic dystrophy
12. Rieger S.
13. Sotos S. (cerebral gigantism)
14. Stickler S. (arthro-ophthalmopathy)
15. XYY S.

References

LOCALIZED BRACHYDACTYLY WITH SHORT PHALANGES, METACARPALS OR METATARSALS (EXCLUDING GENERALIZED SHORTENING)

COMMON
1. Acro-osteoalasis (eg, congenital; leprosy) (See D-127)
2. Arthritis (esp. juvenile rheumatoid; septic)
3. Congenital syndromes with short metacarpals or metatarsals (See D-143)
4. Congenital syndromes with short phalanges (See D-123–127)
5. Idiopathic; isolated anomaly
6. Osteomyelitis; dactylitis (eg, bacterial, tuberculous, yaws; smallpox residual)
7. Pseudohypoparathyroidism; pseudopseudohypoparathyroidism
8. Sickle cell disease with infarction (hand-foot S.)
9. Trauma (eg, epiphyseal cartilage injury; fracture; thermal—burn, frostbite, electrical)

UNCOMMON
1. Ainhum
2. Amniotic band S. (Streeter bands)
3. Cone-shaped epiphyses (See D-27)
4. Enchondromatosis (Ollier disease)
5. Familial brachydactylies
6. Fibrodysplasia (myositis) ossificans progressiva
7. Gorlin S. (nevoid basal cell carcinoma S.)
8. Kashin-Beck disease (in Manchuria and Russia)
9. Myotonic dystrophy
10. Radiation or radium injury
11. Turner S.

References

(continued)
CONGENITAL SYNDROMES WITH GENERALIZED BRACHYDACTYLY, SHORT HANDS AND FEET (ACROMELIA); ALSO SPADE HANDS

(Small Square Hands With Shortening of All Bones)

COMMON
1. Achondroplasia
2. Chondroectodermal dysplasia (Ellis-van Creveld S.)
3. Congenital syndromes with short metacarpals or metatarsals (See D-143)
4. Congenital syndromes with short phalanges (See D-123–127)
5. Enchondromatosis (Ollier disease)
6. Hypophosphatasia
7. Hypopituitarism
8. Hypothyroidism, cretinism
9. Mucopolysaccharidoses (eg, Hurler; Hunter; Morquio; Maroteaux-Lamy); mucolipidosis II (I-cell disease) and III (pseudo-Hurler polydystrophy) (See J-4)
10. Pseudohyopoparathyroidism; pseudopseudohypo-parathyroidism
11. Trisomy 21 S. (Down S.)

UNCOMMON
1. Aarskog S.
2. Achondrogenesis (types I and II)
3. Acrocallosal S.
4. Acrocephalopolysyndactyly (Carpenter and other types)
5. Acrocephalosyndactyly (Apert and other types)
6. Acro-cranio-facial dysostosis
7. Acrodysostosis (peripheral dysostosis)
8. Acromesomelic dysplasia
9. Acrorenal S.
10. Asphyxiating thoracic dysplasia (Jeune S.)
11. Atelosteogenesis
12. Brachmann-de Lange S. (de Lange S.)
13. Cephaloskeletal dysplasia (Taybi-Linder S.)
14. Chondrodysplasia punctata (brachytelephalangic type)
15. Diastrophic dysplasia
16. DOOR S.
17. Familial brachdactyly syndromes
18. Fanconi anemia (pancytopenia-dysmelia S.) (esp. thumbs and toes)
19. Fetal alcohol S.
20. Fibrochondrogenesis
21. Goltz S. (focal dermal hypoplasia)
22. Grebe chondrodysplasia (achondrogenesis, Brazilian type)
23. Hand-foot-genital S. (esp. feet)
24. Hanhart S.
25. Hypochondrogenesis
26. Hypochondroplasia
27. Hypoparathyroidism
28. Isolated anomaly
29. Juberg-Hayward S.
30. Keutel S.
31. Larsen S.
32. Léri pleonosteosis
33. Mesomelic dysplasia (Nieergelt and Werner types)
34. Metaphyseal chondrodysplasia (McKusick type)
35. Metatropic dysplasia
36. Möbius S.
37. Neu-Laxova S.
38. Noonan S.
39. Oculo-dento-osseous dysplasia
40. Opitz trigonocephaly S. (C syndrome)
41. Orofaciodigital syndomes (esp. type I—Papillon-Leage and Psaume S.)
42. Oromandibular-limb hypogenesis syndromes (eg, Hanhart S.)
43. Osteosclerosis-dominant type, Stanescu
*44. Otopalatodigital S. (types I and II)
45. Patterson S.
46. Poland S. (pectoral muscle aplasia-syndactyly)
47. Popliteal pterygium S.
48. Progeria
*49. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
50. Refsum disease
51. Rothmund-Thomson S.
52. Schneckenbecken dysplasia
*53. Short rib-polydactyly syndromes type I (Saldino-Noonan), II (Majewski) and III
54. Smith-Lemli-Opitz S.
55. Spondyloepiphysseal dysplasias (multiple types)
56. Spondyloepiphyseal dysplasia (Sedaghatian type)
57. Spondyloperipheral dysplasia
58. Symphalangism-surdity S. (symphalangism-brachydactyly S. or WL S.)
59. TAR S. (thrombocytopenia-absent radius S.)
*60. Thanatophoric dysplasia
61. Trichorhinophalangeal dysplasia, type I (Giedion S.) and II (Giedion-Langer S.)
62. Trisomy 13 S.
63. Trisomy 18 S.
64. Weill-Marchesani S.
65. XXXXX S.; XXXXY S.

* Small square hands with shortening of all bones.
NOTE: There are over 20 other minor congenital syndromes with brachydactyly that are listed in the books by Poznanski and Taybi.

References

Gamut D-143-1

CONGENITAL SYNDROMES
WITH SHORT METACARPALS OR METATARSALS

COMMON
1. Achondroplasia
2. Chondrodysplasia punctata (brachytelephalangic and tibial-metacarpal types)
3. Brachmann-de Lange S. (de Lange S.) (1st metacarpal)
4. Diastrophic dysplasia (“hitchhiker” thumb)
5. Enchondromatosis (Ollier disease)
6. Fibrodysplasia (myositis) ossificans progressiva (thumb and great toe)
7. Gorlin S. (nevoid basal cell carcinoma S.)
8. Holt-Oram S. (esp. thumb)
9. Hypothyroidism; cretinism
10. Idiopathic; isolated anomaly or normal variant
11. Mucopolysaccharidoses (eg, Hurler; Hunter); mucolipidosis II (I-cell disease) (See J-4)
12. Pseudohypoparathyroidism; pseudopseudohypoparathyroidism
13. Radial ray syndromes (1st metacarpal) (See D-161)
14. Rubinstein-Taybi S. (thumb and great toe)
15. Turner S. (4th metacarpal)

UNCOMMON
1. Acrocephalosyndactyly (Saethre-Chotzen type) (4th metacarpal)
2. Acrodysostosis (peripheral dysostosis)
3. Acromesomelic dysplasia
4. Aplasia cutis congenita (absent metacarpals)

(continued)
5. Atelosteogenesis
6. Beckwith-Wiedemann S.
7. Biemond S. I (4th metacarpal)
8. Camptobrachydactyly
9. Cat cry S. (cri du chat S.) (5th metacarpal)
10. Cephaloskeletal dysplasia (Taybi-Linder S.)
11. CHILD S. (ichthyosis-limb reduction S.)
12. Christian S. (adducted thumbs S.) (1st metacarpal)
13. Chromosome 18: del(18q) S. (1st metacarpal)
14. Cockayne S.
15. Coffin-Siris S.
16. Cohen S.
17. Desbuquois dysplasia
18. Diastrophic dysplasia (1st metacarpal)
19. Du Pan S.
20. Dyggve-Melchior-Clausen dysplasia (Smith-McCort S.) (1st metacarpal)
21. Dyschondrosteosis (4th metacarpal)
22. Dyssegmental dysplasia (1st metacarpal)
23. Familial brachydactyly A1, C, E
24. Fanconi anemia (pancytopenia-dysmelia S.) (1st metacarpal)
25. Fetal alcohol S.
26. Goltz S. (focal dermal hypoplasia)
27. Grebe chondrodysplasia (achondrogenesis, Brazilian type)
28. Hand-foot-genital S. (1st metacarpal and metatarsal)
29. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
30. Hypochondroplasia
31. Hypoparathyroidism
32. Ichthyosis syndromes
33. Juberg-Hayward S. (1st metacarpal)
34. Larsen S.
35. Megaepiphyseal dwarfism
36. Metaphyseal chondrodysplasia (McKusick type)
37. Multiple epiphyseal dysplasia (Fairbank)
38. Myotonic dystrophy (4th metacarpal)
39. Nager acrofacial dysostosis
40. Omodyplasia (1st metacarpal)
41. Opitz trigonocephaly S. (C syndrome)
42. Osteoglophonic dysplasia
43. Otopalatodigital S. (types I and II) (esp. short thumb and great toe)
44. Pallister-Hall S. (4th metacarpal)
45. Poland S. (pectoral muscle aplasia-syndactyly) (absent 1st or other metacarpals)
46. Pseudodiastrophic dysplasia
47. Refsum disease
48. Robinow S.
49. Rothmund-Thomson S.
50. Short rib-polydactyly syndromes
51. Silver-Russell S. (5th metacarpal)
52. Sjögren-Larsson S.
53. Spondyloepimetaphyseal dysplasia
54. Spondyloperipheral dysplasia
55. Thanatophoric dysplasia
56. Trichorhinophalangeal dysplasia, type I (Giedion S.) and II (Giedion-Langer S.)
57. Trisomy 9p S. (1st metacarpal)
58. Trisomy 18 S. (1st metacarpal)
59. VATER association (1st metacarpal)
60. Weill-Marchesani S.
61. Yunis-Varón S. (absent thumb)

References

Gamut D-143-2

SHORT FIRST METACARPAL OR METATARSAL

COMMON
1. Brachmann-de Lange S. (de Lange S.)
2. Diastrophic dysplasia
3. Dyggve-Melchior-Clausen dysplasia
4. Fanconi anemia (pancytopenia-dysmelia S.)
5. Fibrodysplasia (myositis) ossificans progressiva
6. Holt-Oram S.
7. Idiopathic; isolated anomaly
8. Radial ray syndromes (See D-161)
9. Trisomy 18 S.

UNCOMMON
1. Christian S. (adducted thumbs S.)
2. Chromosome 18: del(18q) S.
3. Dyssegmental dysplasia
4. Hand-foot-genital S.
5. Juberg-Hayward S.
6. Omodyplasia
7. Otopalatodigital S.
8. Poland S. (pectoral muscle aplasia-syndactyly)
   (thumb may be absent)
9. TAR S. (thrombocytopenia-absent radius S.)
10. Trisomy 9p S.
11. VATER association
12. Yunis-Varón S. (absent thumbs)

References

* Positive metacarpal sign: a line tangential to the heads of the fourth and fifth metacarpals passes through (rather than distal to) the head of the third metacarpal.

References

ACQUIRED DISEASES CAUSING SHORT HANDS AND FEET

1. Acro-osteolysis (See D-127)
2. Hypopituitarism
3. Leprosy
4. Multicentric reticulohistiocytosis (lipoid dermatoarthritis)
5. Osteomyelitis, severe (eg, bacterial; yaws; smallpox residual)
6. Rheumatoid arthritis; arthritis mutilans
7. Sickle cell disease (hand-foot S.)
8. Trauma; surgery; ritual (eg, Chinese bound feet)
CONTRACTED HAND (CLAW-HAND)

ACQUIRED
1. Arthritis (esp. rheumatoid)
2. Diabetes
3. Dupuytren contracture
4. Epidermolysis bullosa
5. Leprosy
6. Neoplasm
7. Neurologic disorder
8. Reflex sympathetic dystrophy (Sudeck’s atrophy)
9. Thermal injury (frostbite; burn; electrical)
10. Trauma

CONGENITAL
1. Arthrogryposis
2. Chondrodysplasia punctata
3. Congenital contractural arachnodactyly
4. Diastrophic dysplasia
5. Digitotalar dysmorphism (ulnar drift)
6. EEC syndrome
7. Fetal akinesia deformation sequence (Pena-Shokeir S. type I)
8. Freeman-Sheldon S. (whistling face S.)
9. Gordon S. (distal arthrogryposis)
10. Larsen S.
11. Léri pleonosteosis
12. Mucopolysaccharidoses; mucolipidoses (See J-4); GM, gangliosidosis
13. Myotonic dystrophy
14. Trisomy 13 S.
15. Trisomy 18 S.

LARGE HANDS FOR AGE

COMMON
1. Acromegaly; pituitary gigantism
2. Hyperthyroidism, active or treated (eg, thyroid acropachy)
3. Marfan S.
4. Precocious puberty
5. Sotos S. (cerebral gigantism)

UNCOMMON
1. Beckwith-Wiedemann S.
2. Coffin-Lowry S.
3. Congenital total lipodystrophy (lipoatrophic diabetes)
4. Frontometaphyseal dysplasia
5. Pachydermoperiostosis
6. Patterson S.
7. Stickler S. (arthro-ophthalmopathy)

References

ASYMMETRY IN SIZE OF HAND BONES—SMALL BONES OF ONE HAND (See D-13)

1. Acro-osteolysis (See D-127)
2. Ainhum
3. Amniotic band S. (Streeter bands)
4. Aplasia; hypoplasia

References
5. Arrested epiphyseal growth
   a. Fracture
   b. Juvenile chronic arthritis (eg, juvenile rheumatoid arthritis)
   c. Osteomyelitis (eg, septic; yaws; smallpox residual)
   d. Radiation injury
   e. Surgery
   f. Thermal injury (eg, burn; frostbite; electrical)
   g. Wringer injury
6. Chondrodysplasia punctata
7. Paralysis
8. Poland S. (pectoral muscle aplasia-syndactyly)
9. Warfarin embryopathy

Reference

Gamut D-147-2
ASYMMETRY IN SIZE OF HAND BONES—LARGE BONES OF ONE HAND (See D-13, D-14)

1. Bone neoplasm
2. Enchondromatosis (Ollier disease); Maffucci S.
3. Fibrous dysplasia
4. Hyperemia
   a. Hemangioma; arteriovenous fistula
   b. Infection
   c. Juvenile chronic arthritis (eg, juvenile rheumatoid arthritis
5. Klippel-Trenaunay S.; Parkes Weber S.
6. Lymphangiectasia
7. Macrodactyly (See D-139)
8. Macrodystrophia lipomatosa
9. Melorheostosis
10. Neurofibromatosis
11. Paget’s disease
12. Proteus S.

Gamut D-148
GENERALIZED FAILURE OF MODELING OR TUBULATION IN THE HAND (WIDE OR THICK BONES) (See D-11, D-12)

ACQUIRED
1. Anemia g (esp. thalassemia; sickle cell disease)
2. Fluorosis
3. Fractures, healed
4. Infarction (eg, hand-foot S.)
5. Infection; osteomyelitis
6. Neoplasm
7. Rickets (healing); biliary rickets in infancy
8. Subperiosteal hemorrhage (eg, hemophilia; osteogenesis imperfecta with trauma)

CONGENITAL
1. Achondroplasia
2. Craniodiaphyseal dysplasia

(continued)
3. Craniometaphyseal dysplasia
4. Diaphyseal dysplasia (Camurati-Engelmann disease)
5. Enchondromatosis (Ollier disease); Maffucci S.
6. Fibrous dysplasia
7. Hyperphosphatasia
8. Melorheostosis
9. Mucolipidoses (See J-4); fucosidosis; mannosidosis; GM1 gangliosidosis
10. Niemann-Pick disease
11. Oculodento-osseous dysplasia
12. Osteopetrosis
13. Pyle dysplasia
14. Sclerosteosis
15. Singleton-Merten S.

Reference

Gamut D-149-1
PROXIMAL TAPERING OF SHORT TUBULAR BONES OF THE HANDS AND FEET
1. Brachmann-de Lange S. (de Lange S.)
2. Mucopolysaccharidoses (eg, Hurler; Hunter; Morquio); mucolipidoses (See J-4)

Gamut D-149-2
DISTAL TAPERING OF SHORT TUBULAR BONES OF THE HANDS AND FEET
1. Acro-osteolysis (See D-127)
2. Ainhum
3. Diabetes
4. Epidermolysis bullosa
5. Hyperparathyroidism
6. Leprosy; other neuropathic diseases
7. Raynaud disease
8. Scleroderma
9. Thermal injury (eg, burn; frostbite; electrical)

Reference

Gamut D-150
NEUROPATHIC BONE CHANGES (POINTED OR SPINDLED BONES) IN THE HANDS OR FEET

COMMON
1. [Amputation (congenital, traumatic, or surgical)]
2. Arteriosclerosis obliterans; Raynaud disease; Buerger disease (thromboangiitis obliterans)
3. Diabetes
4. Leprosy
5. Psoriatic arthritis
6. Rheumatoid arthritis
7. Scleroderma; dermatomyositis
8. Septic arthritis (pyarthrosis)
9. Spinal cord injury or disease (eg, pernicious anemia; syringomyelia; spina bifida; meningomyelocele; neoplasm)
10. Thermal injury (eg, burn; frostbite; electrical)
11. Trophic ulcer of soft tissue with underlying destruction

UNCOMMON
1. Acrodystrophic neuropathy
2. [Acro-osteolysis] (See D-127)
3. Ainhum
4. Amyloid neuropathy
5. Charcot-Marie-Tooth S.
6. [Clubbing of fingers]
7. Congenital insensitivity to pain
8. Congenital pseudarthrosis
9. Ergot intoxication
10. Hicks S. (familial sensory neural radiculopathy)
11. Idiopathic
12. Malnutrition (alcoholism or nutritional neuropathy)
13. Peripheral nerve injury
14. Porphyria
15. [Pyknodysostosis]
16. Riley-Day S. (familial dysautonomia)
17. Tabes dorsalis
18. Trench foot

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut D-151

WELL-DEFINED SOLITARY OR MULTIPLE LUCENT DEFECTS IN BONES OF THE HANDS, WRISTS, FEET, OR ANKLES

COMMON
1. Enchondroma
2. Gout
3. Intraosseous ganglion
4. Osteoarthritis
5. Posttraumatic (eg, avascular necrosis with cystic radiolucency following scaphoid or lunate fracture)

6. Rheumatoid arthritis (adult, juvenile, or seronegative)

UNCOMMON
1. Amyloidosis (esp. secondary, related to renal failure)
*2. Aneurysmal bone cyst
*3. Bone cyst, developmental cyst
*4. Carcinoma of skin or nail-bed (incl. keratoacanthoma)
*5. Chondroblastoma (Codman tumor)
*6. Chondromyxoid fibroma
7. Enchondromatosis (Ollier disease)
*8. Epidermoid inclusion cyst (distal phalanx)
9. Fibromatosis (esp. multicentric infantile myofibromatosis)
10. Fibrous dysplasia
*11. Giant cell granuloma
*12. Giant cell tumor
13. Glomus tumor (distal phalanx)
14. Granuloma (eg, foreign body; palm thorn)
15. Hemangioma; Maffucci S.
16. Hemochromatosis
17. Hemophilic pseudotumor
18. Jackhammer operator’s (driller’s) disease of wrists (carpals)
*19. Kienböck disease (lunate necrosis)
20. Langerhans cell histiocytosis
*21. Lipoma (esp. calcaneus)
22. Metastasis (esp. lung and breast)
23. Mucopolysaccharidosis I-S (Scheie)
24. Multiple myeloma
25. Nonossifying fibroma (fibroxanthoma)
*26. Osteoid osteoma
27. Osteomyelitis (eg, tuberculous; atypical mycobacterial infection; fungal; partially treated bacterial infection)
28. Phalangeal microgeodic S.
29. Sarcomatosis
30. Sickle cell disease (hand-foot S.)
31. Silastic arthropathy
32. Sinus histiocytosis (Rosai Dorfman disease)
*33. Subungual keratoma (distal phalanx)

(continued)
34. Tuberous sclerosis
35. Vascular channels, esp. phalanges
36. Villonodular synovitis
37. Xanthoma; xanthomatosis

* Solitary lesions; all others in this list may be multiple.

Reference

Gamut D-152

SCLEROTIC FOCUS IN BONES
OF THE HANDS OR FEET

COMMON
1. Avascular necrosis (eg, steroid therapy; trauma to scaphoid or lunate)
2. Bone island (enostosis)
3. Enchondroma
4. Healing fracture with callus; florid reactive periostitis
5. Osteomyelitis, chronic; mycetoma

UNCOMMON
1. Arthritis, inflammatory (esp. seronegative psoriatic arthritis or Reiter S.—“ivory phalanx”)
2. Bizarre parosteal pseudotumor (BPOP)
3. Bone sarcoma (eg, osteosarcoma; chondrosarcoma; Ewing sarcoma)
4. Connective tissue disease (collagen vascular disease) (eg, lupus erythematosus; scleroderma)
5. Enchondromatosis (Ollier disease)
6. Fibrous dysplasia
7. Gardner S.
8. Gout (with intraosseous tophus calcification)
9. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
10. Infarct (eg, sickle cell disease)
11. Melorheostosis
12. Nonossifying fibroma (fibroxanthoma), healing
13. Osteoblastic metastasis
14. Osteoblastoma
15. Osteochondroma
16. Osteoid osteoma
17. Osteopathia striata (Voorhoeve disease)
18. Osteopoikilosis
19. Paget’s disease
20. Sarcoidosis
21. Syphilis
22. Tuberous sclerosis
23. Werner S.
24. Yaws

References

Gamut D-153

TROPICAL DISEASES INVOLVING
THE HANDS AND FEET

COMMON
1. Filariasis; elephantiasis
2. Leprosy
3. Sickle cell dactylitis (hand-foot S.)
4. Tuberculosis
5. Yaws; syphilis

UNCOMMON
1. Ainhum
2. Cysticercosis
3. Guinea worm infection (dracunculiasis)
4. Kaposi sarcoma
5. Loiasis (Loa loa)
6. Mycetoma (Madura foot); fungus diseases
7. Smallpox residual
8. Tropical ulcer (usually tibia)
CONGENITAL CONDITIONS ASSOCIATED WITH CLUBFOOT, METATARSUS ADDUCTUS, OR OTHER FOOT DEFORMITY

COMMON
1. Faulty intrauterine positioning
2. Idiopathic
*3. Neurologic or neuromuscular disease (eg, myotonic dystrophy; meningomyelocele; spina bifida)

UNCOMMON
1. Aarskog S.
2. Aminopterin fetopathy (varus)
3. Amniotic band S. (Streeter bands)
4. Antley-Bixler S.
5. Arthrogryposis
6. Bloom S.
7. Brachmann-de Lange S. (de Lange S.)
8. Caudal dysplasia sequence
9. Cephaloskeletal dysplasia (Taybi-Linder S.)
10. Chondrodysplasia punctata
11. Chondroectodermal dysplasia (Ellis-van Creveld S.) (valgus)
12. Christian S. (adducted thumbs S.)
14. Chromosome 18: del(18q) S.
15. Desbuquois dysplasia
16. Diastrophic dysplasia
17. Dubowitz S.
18. Ehlers-Danlos S.
19. Femoral hypoplasia—unusual facies S.
20. Fetal akinesia deformation sequence (Pena-Shokeir S. type I)
21. Freeman-Sheldon S. (whistling face S.)
22. Homocystinuria (pes planus or cavus; everted feet)
23. Kniest dysplasia
24. Larsen S.
25. Marfan S. (long great toes; hammer toes)
26. Meckel S.
27. Mesomelic dysplasia (Nievergelt type)
28. Metatropic dysplasia
29. Mietens-Weber S. (pes valgus planus)
30. Möbius S.
31. Mucopolysaccharidoses (eg, Hurler; Hunter; Morquio) (pes planus or cavus; misshapen tarsals) (See J-4)
32. Nager acrofacial dysostosis
33. Nail-patella S. (osteo-onychodysplasia)
34. Neurofibromatosis (pes planus)
35. Noonan S.
36. Otopalatodigital S. (tarsal fusion)
37. Popliteal pterygium S.
38. Potter S. (renal agenesis)
39. Pseudodiastrophic dysplasia
40. Roberts S. (pseudothalidomide S.)
41. Smith-Lemli-Opitz S.
42. Spondyloepimetaphyseal dysplasia with joint laxity
43. TAR S. (thrombocytopenia—absent radius S.)
*44. Trisomy 13 S.
*45. Trisomy 18 S.
46. Weaver-Smith S.
47. XXXXX S.
48. XXXXY S. (pes planus)
49. Zellweger S. (cerebrohepatorenal S.)

* May have vertical talus.

References
### LUCENT LESION OF THE CALCANEUS

#### COMMON
1. Bone cyst
2. Lipoma
3. Osteomyelitis, pyogenic
4. [Pseudocyst (normal thinning of trabeculae)]

#### UNCOMMON
1. Aneurysmal bone cyst
2. Brown tumor of hyperparathyroidism
3. Chondroblastoma (Codman tumor)
4. Chondromyxoid fibroma
5. Chronic recurrent multifocal osteomyelitis
6. Enchondroma
7. Eosinophilic granuloma
8. Fungal osteomyelitis (eg, mycetoma; cryptococcosis)
9. Giant cell tumor
10. Hemophilic pseudotumor
11. Lymphangioma
12. Metastasis, osteolytic
13. Multiple myeloma
14. Myxoma; fibroma; myxofibroma
15. Sarcoma (eg, fibrosarcoma)

### References

### CONGENITAL SYNDROMES WITH ACCESSORY CARPAL OR TARSAL BONES

1. Anatomic variant
2. Chondroectodermal dysplasia (Ellis-van Creveld S.)
3. Diastrophic dysplasia
4. [Dysplasia epiphysealis hemimelica (Trevor disease)]
5. Familial brachydactyly A1
6. Grebe chondrodysplasia (achondrogenesis, Brazilian type)
7. Hand-foot-genital S.
8. Holt-Oram S.
9. Larsen S.
10. Otopalatodigital S.
11. Stickler S. (arthro-opthalmopathy)

* Distal carpal row.

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

### References

### FRAGMENTED, IRREGULAR, OR SCLEROTIC CARPAL OR TARSAL BONES

#### COMMON
1. Arthritis (esp. rheumatoid; septic; gout)
2. Avascular necrosis (esp. scaphoid; lunate; tarsal navicular)

### References
3. Infection (eg, mycetoma; osteomyelitis)
4. Normal variant (tarsals)
5. Trauma; postoperative changes

**UNCOMMON**
1. Chondrodysplasia punctata (all types)
2. Congenital bipartite bone
3. Diastrophic dysplasia
4. Dyggve-Melchior-Clausen dysplasia
5. Dysostoeosclerosis
6. Kniest dysplasia
7. Larsen S. (bipartite calcaneus)
8. Melorheostosis
9. Metatropic dysplasia
10. Mixed sclerotic bone dysplasia
11. Morquio S.
12. Mucolipidosis II (I-cell disease); fucosidosis
13. Multiple epiphyseal dysplasia (Fairbank)
14. Osteoglophonic dysplasia
15. Osteolysis with nephropathy; osteolysis without nephropathy (carpal and tarsal osteolysis)
16. Osteopetrosis
17. Osteopoikilosis
18. Parastremmatic dysplasia
19. Pseudorheumatoid dysplasia
20. Seckel S. (bird-headed dwarfism)
21. Spondyloepiphyseal dysplasia (congenita and tarda)
22. Spondyloepimphyeal dysplasia (Kozlowski type)
23. Warfarin embryopathy (stippled calcanei)
24. Winchester S.

**COMMON**
1. [Arthritis (esp. rheumatoid)]
2. Arthrogryposis
3. [Avascular necrosis of lunate (Kienbock)]
4. Chondrodysplasia punctata
5. Morquio S.
*6. Multiple epiphyseal dysplasia (Fairbank)
7. Spondyloepiphyseal dysplasia (congenita and tarda)

**UNCOMMON**
1. Aarskog S.
2. Diastrophic dysplasia
3. Dyggve-Melchior-Clausen dysplasia
*4. Farber disease (disseminated lipogranulomatosis)
5. Frontometaphyseal dysplasia
6. Fucosidosis
7. Gordon S. (distal arthrogryposis)
8. Hypochondrogenesis (esp. calcaneus and talus)
9. Kniest dysplasia
10. Metatropic dysplasia
*11. Osteoglophonic dysplasia
*12. Osteolysis with nephropathy; osteolysis without nephropathy (carpal and tarsal osteolysis)
*13. Parastremmatic dwarfism
14. Pseudoachondroplasia
15. Seckel S. (bird-headed dwarfism)
16. Spondyloepimphyeal dysplasia (Strudwick type)
17. Spondyloepimphyeal dysplasia (Kozlowski type)
*18. Winchester S.
19. Campomelic dysplasia (talus not ossified)

* With erosions or irregular margins.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

(continued)
CARPAL AND/OR TARSAL FUSION

COMMON
1. Arthritis (esp. rheumatoid; juvenile chronic; septic; fungal)
2. Arthrogryposis
3. Chondroectodermal dysplasia (Ellis-van Creveld S.) (capitate-hamate)
4. Normal variant, isolated anomaly (esp. triquetrum-lunate, talus-calcaneus, capitate-hamate, trapezium-trapezoid or scaphoid) as in Yoruba tribe of Nigeria
5. Traumatic; surgical

UNCOMMON
1. Acrocephalopolysyndactyly (Carpenter S.)
2. Acrocephalosyndactyly (Apert and Pfeiffer types)
3. Acromegaly
4. Antley-Bixler S.
5. Baller-Gerold S. (craniosynostosis—radial aplasia S.)
6. Chromosomal abnormalities
7. Cleft hand or foot
8. Crouzon S. (craniofacial dysostosis) (calcaneus-cuboid)
9. Diastrophic dysplasia
10. Dyschondrosteosis; Madelung deformity
11. EEC syndrome
12. F syndrome
13. Fetal alcohol S.
14. Frontometaphyseal dysplasia
15. Hand-foot-genital S.
16. Holt-Oram S.
17. Kniest dysplasia
18. LEOPARD S. (multiple lentigines S.)
19. Mesomelic dysplasia (Nievergelt type)
20. Multiple synostosis S.
21. Osteomyelitis
22. Otopalatominal S. (type I) (capitate-hamate)
23. Rothmund-Thomson S.
24. Ruvalcaba S. (trichorhinophalangeal S., type III)
25. Scleroderma; dermatomyositis
26. Spondyloarthropatocapital fusion S.
27. Symphalangism-surdity S. (symphalangism-brachydactyly S. or WL S.)
28. Thalidomide embryopathy
29. Townes-Brocks S.
30. Turner S.
31. Tylosis (keratosis palmaris et plantaris familiaris)

References
CONGENITAL SYNDROMES ASSOCIATED WITH A DECREASED CARPAL ANGLE* (Less than 124°)

1. Dyschondrosteosis
2. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
3. Madelung deformity (See D-164-2)
4. Mesomelic dysplasia (Langer type)
5. Mucopolysaccharidoses (esp. Morquio; Hurler) (See J-4)
6. Turner S.

* Normal carpal angle is 131.5° (+ or –7.2°)

References

CONGENITAL SYNDROMES ASSOCIATED WITH AN INCREASED CARPAL ANGLE* (Greater than 139°)

1. Arthrogryposis
2. Chondroectodermal dysplasia (Ellis-van Creveld S.)
3. Cleidocranial dysplasia
4. Frontometaphyseal dysplasia
5. Larsen S.
6. Marfan S.
7. Multiple epiphyseal dysplasia (Fairbank)
8. Otopalatodigital S.
9. Pfeiffer-like S.
10. Sotos S. (cerebral gigantism)
11. Stickler S. (arthro-ophthalmopathy)
12. Trichorhinophalangeal dysplasia

* Normal carpal angle is 131.5° (+ or –7.2°).

Reference
Gamut D-160-S

CARPAL ANOMALIES SEEN IN COMMON CONGENITAL SYNDROMES*

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<th>Syndrome</th>
<th>Os Centrale (one or more)</th>
<th>Extra Distal Carpals</th>
<th>Os Triangularis</th>
<th>Irregular Carpal Margins</th>
<th>Abnormally Shaped Scaphoid</th>
<th>Absent or Hypoplastic Scaphoid</th>
<th>Scaphoid Fused to Other Carpals</th>
<th>Abnormally Shaped Capitate</th>
<th>Absent or Hypoplastic Capitate</th>
<th>Some Carpal Fusion</th>
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(Modified from Poznanski AK, Holt JF; AJR 1971;112:443-459)
* X = commonly present; O = occasionally present

Gamut D-161

RADIAL RAY SYNDROMES
(HYPOPLASIA OR APLASIA OF THE RADIUS+ AND/OR THUMB AND LATERAL CARPAL BONES)

COMMON
*1. Brachmann-de Lange S. (de Lange S.)
2. Fanconi anemia (pancytopenia-dysmelia S.)
3. Holt-Oram S.
*4. Isolated anomaly
*5. Phocomelia (eg, thalidomide embryopathy)
6. TAR S. (thrombocytopenia—absent radius S.)

UNCOMMON
1. Aase S.
2. Aminopterin fetopathy
3. Baller-Gerold S. (craniosynostosis-radial aplasia S.)
4. de la Chapelle dysplasia
5. Diamond-Blackfan S.
6. Duane-radial dysplasia S. (DR S.)
7. Dyschondrosteosis
8. Ectodermal dysplasia
9. Facioauriculoradial dysplasia
10. Fetal varicella S.
11. Ives-Houston S.
12. IVIC S.
13. Juberg-Hayward S.
14. Klippel-Feil S.
15. Lacrimo-auriculo-dento-digital S. (LADD S.)
   (Levy-Hollister S.)
16. Mesomelic dysplasias
17. Mietens-Weber S.
18. Nager acrofacial dysostosis
19. Poland S. (pectoral muscle aplasia-syndactyly)
20. Roberts S. (pseudothalidomide S.)
21. Rothmund-Thomson S.
22. Seckel S. (bird-headed dwarfism)
23. Treacher Collins S.
24. Trisomy 18 S.
25. VATER association

* May or must have ulnar hypoplasia or absence as well.
+ Radial hypoplasia may be seen with certain congenital heart diseases; renal anomalies; esophageal, duodenal, or anal atresia; rib anomalies; Klippel-Feil S.; kyphoscoliosis; and hypoplasia or spina bifida of the lumbosacral spine.

References
**Gamut D-163**

**RADIOULNAR SYNOSTOSIS**

**COMMON**
1. Ehlers-Danlos S.
2. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis) (distal forearm)
3. Holt-Oram S.
4. Idiopathic; isolated anomaly
5. Trauma (interosseous ligament ossification)

**UNCOMMON**
1. Acrocephalosyndactyly (Pfeiffer type)
2. Chromosome 4: del(4p) S. (Wolf-Hirschhorn S.)
3. Cloverleaf skull deformity (kleeblattschädel anomaly)
4. Femoral hypoplasia–unusual facies S.
5. Fetal alcohol S.
6. Infantile cortical hyperostosis (Caffey disease)
7. Klinefelter S. (XXY S.)
9. Mesomelic dysplasia (Nievergelt type)
10. Multiple synostosis S.
11. Nager acrofacial dysostosis
12. Thalidomide embryopathy
13. Thanatophoric dysplasia
14. Trisomy 18 S.
15. XXXY S.; XXXXX S.; XXXXY S.

*References*

**Gamut D-164-1**

**DEFORMITY OF THE FOREARM**

**COMMON**
1. Galeazzi fracture (fracture of radial shaft with dislocation of distal ulna)
2. Generalized bone growth disturbance (eg, underconstriction or overconstriction of diametaphyses) (See D-10, D-11)
3. Monteggia fracture (fracture of ulnar shaft with dislocation of radial head)
4. Proximal radioulnar dislocation (See D-165)

**UNCOMMON**
1. Congenital radioulnar synostosis (See D-163)
2. Enchondromatosis (Ollier disease) or Maffucci S. with shortened ulna
3. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis) with short ulna, curved radius, and often radial head dislocation
4. Hypoplasia or aplasia of radius or ulna (radial or ulnar ray syndromes) (See D-161, 162)
5. Isolated anomaly
6. Madelung deformity (See D-164-2).
7. Osteogenesis imperfecta (bowed radius and ulna)
8. Osteomyelitis or smallpox with residual deformity

*Reference*
DISORDERS ASSOCIATED WITH MADELUNG (OR MADELUNG-LIKE) DEFORMITY*

1. Dyschondrosteosis
2. Enchondromatosis (Ollier disease); Maffucci S.
3. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
4. Hurler S. (tilt of distal radius and ulna toward each other)
4. LEOPARD S. (multiple lentigenes S.)
6. Trauma in childhood (pseudo-Madelung deformity)
7. Turner S.

* Premature fusion of ulnar aspect of distal radial epiphysis resulting in (1) ulnar and volar angulation of distal radial articular surface, (2) decreased carpal angle, and (3) dorsal subluxation of distal ulna.

References

CONGENITAL SYNDROMES WITH ELBOW ANOMALY (INCLUDING RADIAL HEAD HYPOPLASIA, PROXIMAL RADIOULNAR DISLOCATION, CUBITUS VALGUS)

COMMON
*1. Brachmann-de Lange S. (de Lange S.)
2. Diastrophic dysplasia
*3. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
4. Larsen S.
*5. Nail-patella S. (osteo-onychodysplasia)
*6. Neurofibromatosis
*7. Noonan S.
*8. Otopalatodigital S. (types I and II)
+9. Turner S.

UNCOMMON
1. Aase-Smith S.
2. Acromesomelic dysplasia
3. Aminopterin fetopathy
*4. Campomelic dysplasia
5. Cerebro-costo-mandibular S.
6. Chondroectodermal dysplasia (Ellis-van Creveld S.)
*7. Chromosomal abnormalities (chromosome 18: del(18p) S., chromosome 20: dup(20p) S.)
8. Cleidocranial dysplasia
9. Cloverleaf skull deformity (kleeblattschädel anomaly)
*10. Coffin-Siris S.
*11. Crouzon S. (craniofacial dysostosis)
12. Cutis laxa
**13. Dyschondrostosis
14. Enchondromatosis (Ollier disease)
*15. Fanconi anemia (pancytopenia-dysmelia S.)
16. Frontometaphyseal dysplasia

(continued)
*17. Hajdu-Cheney S.
18. Holt-Oram S.
*19. Humerospinal dysostosis
20. Idiopathic; isolated anomaly
+22. Léri pleonosteosis
*23. Mesomelic dysplasia (Nievergelt type)
*24. Mietens-Weber S.
25. Multiple epiphyseal dysplasia (Fairbank)
26. Multiple synostosis S.
*27. Occipital horn S.
28. Oculodento-osseous dysplasia
*29. Opitz trigonocephaly S. (C syndrome)
*30. Seckel S. (bird-headed dwarfism)
*31. Spondyloepimetaphyseal dysplasia with joint laxity
32. TAR S. (thrombocytopenia—absent radius S.)
33. Trisomy 8 S.
+34. Trisomy 22 S.
*35. XXXXY S.; XXXXX S.
+36. Zellweger S. (cerebrohepatorenal S.)

* Proximal radioulnar subluxation (dislocation of radial head).
+ Increased carrying angle (cubitus valgus).

References

Gamut D-166

RADIOHUMERAL SYNOSTOSIS

1. Acrocephalosyndactyly, Pfeiffer type (Pfeiffer S.)
2. Antley-Bixler S.
3. Femoral hypoplasia—unusual facies S.
4. Lenz-Majewski dysplasia
5. Multiple synostosis S.
6. Roberts S. (pseudothalidomide S.)
7. Smallpox residual

Gamut D-167

DISPLACED ELBOW FAT PAD

COMMON
1. Infection; synovitis
2. Rheumatoid arthritis
3. Trauma with hemorrhage

UNCOMMON
1. Calcium pyrophosphate dihydrate crystal deposition disease (CPPD)
2. Gout
3. Hemophilia
4. Leukemia
5. Metastasis
6. Neuropathic arthropathy (See D-223)
7. Osteoarthritis (usually secondary)
8. Osteochondritis dissecans
9. Osteoid osteoma
10. Synovial osteochondromatosis
11. Synovial sarcoma
12. Villonodular synovitis

Reference
GROOVED DEFECT, EROSION, OR DEFORMITY OF THE HUMERAL HEAD

COMMON
1. Arthritis (esp. rheumatoid; ankylosing spondylitis; gout; infectious)
2. Avascular necrosis (esp. steroid therapy; sickle cell disease)
3. Chronic dislocation (Hill-Sachs defect)
4. Fracture (esp. of greater tuberosity)

UNCOMMON
1. Arteriovenous fistula, traumatic
2. Erb’s palsy with disuse
3. Glenohumeral dysplasia
4. Hemophilia
5. Multicentric reticulohistiocytosis (lipoid dermatitis)
6. Periarthritis humeroscapularis
7. Pigmented villonodular synovitis
8. Rickets
9. Rotator cuff tear with atrophy and upward subluxation
10. Syringomyelia (neuroarthropathy)
11. Tuberculosis

References

CONGENITAL SYNDROMES WITH ABNORMAL SCAPULA (USUALLY HYPOPLASIA, ESPECIALLY OF GLENOID)*

COMMON
*1. Acrocephalosyndactyly (Apert type)
2. Campomelic dysplasia
3. Cleidocranial dysplasia
*4. Familial glenoid hypoplasia
*5. Holt-Oram S.
*6. Isolated anomaly; idiopathic
*7. Mucopolysaccharidoses (eg, Hurler S.; Maroteaux-Lamy S.); mucolipidosis II (I-cell disease); fucosidosis; mannosidosis (See J-4)
*8. Nail-patella S. (osteo-onychodysplasia)
9. Sprengel deformity (eg, Klippel-Feil S.)
10. Short rib-polydactyly syndromes

UNCOMMON
1. Achondrogenesis (types 1 and 2)
2. Achondroplasia (flat inferior angle)
3. Antley-Bixler S.
4. CHILD S. (ichthyosis-limb reduction S.)
5. Cloverleaf skull deformity (kleeblattschädel anomaly)
6. de la Chapelle dysplasia
*7. Diastrophic dysplasia
*8. Dyggve-Melchior-Clausen dysplasia
9. Dyssegmental dysplasia
*10. Erb’s palsy with disuse
11. Fetal varicella S.
*12. Fibrochondrogenesis
13. Gorlin S. (nevoid basal cell carcinoma S.)
*14. Grant S.
15. Hallermann-Streiff S. (oculomandibulofacial S.)
16. Hypophosphatasia (perinatal lethal form)
17. LEOPARD S. (multiple lentigenes S.)
18. Menkes S. (kinky-hair S.)
*19. Occipital horn S.

(continued)
20. Platyspondylic lethal skeletal dysplasia (PLSD-Luton type)
*21. Poland S. (pectoral muscle aplasia—syndactyly)
22. Proteus S.
23. Scapuloiliac dysostosis
*24. TAR S. (thrombocytopenia—absent radius S.)
25. Thanatophoric dysplasia
*26. Trisomy 8 S.
* Hypoplasia of glenoid fossa.

References

Gamut D-170

**LESION OF THE SCAPULA IN AN INFANT OR CHILD**

**COMMON**
1. Benign bone neoplasm (esp. osteochondroma; also enchondroma; hemangioma; lymphangioma; aneurysmal bone cyst)
2. Congenital syndromes with scapular hypoplasia (See D-169)
3. Fracture (esp. battered child S.)
*4. Langerhans cell histiocytosis, g

**UNCOMMON**
1. Arthritis involving glenohumeral joint (incl. neuroarthropathy due to syringomyelia)
2. Bone cyst
3. Brachial plexus injury (winged scapula)
4. Erb’s palsy with disuse
*5. Fibrous dysplasia
*6. Infantile cortical hyperostosis (Caffey disease)
7. Leukemia; lymphoma g
*8. Malignant fibrous histiocytoma
*9. Metastasis
*10. Osteomyelitis
*11. Sarcoma (esp. Ewing sarcoma)
12. Sprengel deformity (eg, Klippel-Feil S.)
* May cause enlargement or expansion of scapula.

References

Gamut D-171

**LESION OF THE CLAVICLE IN AN INFANT OR CHILD (See D-172–175)**

**COMMON**
1. Langerhans cell histiocytosis, g
2. [Normal rhomboid fossa]
3. Osteomyelitis (incl. chronic recurrent multifocal osteomyelitis)
4. Trauma (fracture; dislocation; battered child S.)

**UNCOMMON**
1. Benign bone neoplasm (eg, enchondroma; hemangioma)
2. Condensing osteitis of the clavicle
3. Congenital hypoplasia or absence (eg, cleidocranial dysplasia; pyknodysostosis) (See D-172-1)
4. Endosteal hyperostosis (van Buchem and Worth types)
5. Fibrous dysplasia; other fibrocystic lesion
6. Handlebar (hypoplastic, squat) clavicle (See D-172-2)
7. Hyperparathyroidism (esp. secondary)
8. Infantile cortical hyperostosis (Caffey disease)
9. Juvenile chronic arthritis (eg, juvenile rheumatoid arthritis)
10. Leukemia; lymphoma
11. Malignant bone neoplasm (esp. Ewing sarcoma; osteosarcoma)
12. Metastasis
13. Mucopolysaccharidoses (eg, Hurler S.) (See J-4)
14. Oculodentoosseous dysplasia; craniodiaphyseal dysplasia (expansion of clavicles)
15. Osteodysplasty (Melnick-Needles S.)
16. Osteogenesis imperfecta
17. Osteopetrosis
18. Posttraumatic osteolysis
19. Progeria
20. Pseudoarthrosis, congenital or traumatic
21. Pyle dysplasia
22. Sternocostoclavicular hyperostosis (SAPHO S.)
23. Syphilis
24. Tuberculosis

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference
5. Mucopolysaccharidoses (esp. Hurler S.); mucolipidoses (short, thick clavicle)
6. [Normal variant (eg, improper positioning of chest)]
7. TAR S. (thrombocytopenia—a absent radius S.)
8. Trisomy 18 S.

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

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ELONGATED CLAVICLE

COMMON
1. Trisomy 18 S.

UNCOMMON
1. Atelosteogenesis
2. Fibrochondrogenesis
3. Metatropic dysplasia
4. Pseudodiastrophic dysplasia
5. Schinzel-Giedion S.
6. Schneckenbecken dysplasia

Reference

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BROAD, THICKENED, OR ENLARGED CLAVICLE (See D-174-2)

COMMON
1. Neoplasm, benign (eg, cartilaginous tumor; osteoma) or malignant (eg, osteosarcoma; Ewing sarcoma; metastasis; myeloma)
2. [Normal variant or improper positioning of chest, esp. in a child]
3. Osteomyelitis, chronic productive (incl. Salmonella; syphilis)
4. Paget’s disease
5. Posttraumatic (healed fracture with callus)

UNCOMMON
1. Copper deficiency, nutritional; Menkes S. (kinky-hair S.)
2. Craniodiaphyseal dysplasia
3. Diaphyseal dysplasia (Camurati-Engelmann disease)
4. Distal osteosclerosis
5. Dysostosclerosis
6. Endosteal hyperostosis (van Buchem and Worth types)
7. Fibrous dysplasia
8. Holt-Oram S.
9. Hyperphosphatasia
10. Infantile cortical hyperostosis (Caffey disease)
11. Langerhans cell histiocytosis (esp. healed)
12. Lenz-Majewski dysplasia
13. Lymphoma (esp. leukemia)
14. Pyle dysplasia
15. Mucolipidoses; fucosidosis; mannosidosis; GM1 gangliosidosis
16. Mucopolysaccharidoses (esp. Hurler S.)
17. Oculodentosseous dysplasia
18. Osteodysplasty (Melnick-Needles S.)
19. Sclerosteosis
20. Sternaloclavicular hyperostosis (SAPHO S.)
21. Winchester S.

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
SCLEROSIS AND/OR PERIOSTEAL REACTION INVOLVING THE CLAVICLE

COMMON
*1. Arthritis of sternoclavicular or acromioclavicular joint (eg, osteoarthritis; septic arthritis)
2. Bone sarcoma (eg, Ewing sarcoma; osteosarcoma)
3. Fracture with callus
4. Langerhans cell histiocytosis
5. Metastasis (esp. osteoblastic)
6. Osteomyelitis (incl. Salmonella; syphilis; Garré sclerosing osteomyelitis)
7. Paget’s disease

UNCOMMON
1. Avascular necrosis
2. Condensing osteitis of the clavicle
3. Endosteal hyperostosis (van Buchem and Worth types)
4. Hypertrophic osteoarthropathy (See D-98)
5. Hypervitaminosis A
6. Infantile cortical hyperostosis (Caffey disease)
7. Leukemia; lymphoma (esp. Hodgkin disease)
8. Osteoid osteoma
9. Osteoma
*10. Sternocostoclavicular hyperostosis (SAPHO S.)
*11. Tietze S.

* Involves sternal end of clavicle.

References

EROSION, DESTRUCTION, PENCILING, OR DEFECT OF THE OUTER END OF THE CLAVICLE

COMMON
*1. Hyperparathyroidism, primary and secondary (renal osteodystrophy)
2. Metastasis
3. Multiple myeloma
*4. Osteomyelitis (esp. pyogenic; tuberculous)
*5. Posttraumatic osteolysis (esp. weight lifter)
*6. Rheumatoid arthritis
7. Rickets
8. Surgical procedure
9. Trauma (eg, dislocation of acromioclavicular joint; fracture; battered child S.)

UNCOMMON
1. Amyloidosis
2. Congenital syndromes with hypoplasia of the clavicle (eg, cleidocranial dysplasia) (See D-172)
3. Gout
4. Langerhans cell histiocytosis (eosinophilic granuloma)
5. Leukemia; lymphoma (esp. Hodgkin disease)
6. Mucopolysaccharidoses; mucolipidoses (See J-4)
7. Multicentric reticulohistiocytosis (lipoid dermatitis)
8. Neurogenic osteolysis
9. Primary bone neoplasm (eg, Ewing sarcoma)
*10. Progeria
11. Pyknodysostosis
12. Reiter S.
13. Sarcoidosis
*14. Scleroderma
* Penciled or pointed distal end of clavicle.

References

(continued)

Gamut D-176
TIBIOTALAR TILT

CONGENITAL

UNCOMMON
1. Dysplasia epiphysealis hemimelica (Trevor disease)
2. Endosteal hyperostosis (van Buchem type)
3. Metaphyseal chondrodysplasia (Jansen and other types)
4. Multiple epiphyseal dysplasia (Fairbank)
5. Nail-patella S. (osteo-onychodysplasia)
6. Spondyloepiphyseal dysplasia

DEVELOPMENTAL

COMMON
1. Fibrous dysplasia
2. Neurofibromatosis

UNCOMMON
1. Enchondromatosis (Ollier disease)
2. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)

ACQUIRED

COMMON
1. Fracture (eg, Salter III or IV fracture of distal tibia; fractured femur with abnormal stress)
2. [Pseudotibiotalar tilt (flexing knee and externally rotating foot during radiography)]
3. Rheumatoid arthritis (esp. juvenile)
4. Tibia vara (Blount disease)

UNCOMMON
1. Avascular necrosis (eg, with chronic renal failure)
2. Bleeding disorder, with chronic hemarthrosis (esp. hemophilia; leukemia)
3. Cretinism, hypothyroidism
4. Femoral bowing
5. Hypoparathyroidism
6. Hypophosphatasia
7. Osteomyelitis of tibia, chronic (incl. syphilis; yaws; tropical ulcer)
8. Poliomyelitis
9. Rickets
10. Sickle cell disease

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

Gamut D-177
ISOLATED TIBIAL BOWING

COMMON
1. Absence or hypoplasia of fibula (See D-179)
2. Neurofibromatosis (usually lateralbowing); congenital pseudoarthrosis (usually with fibula)
3. Osteomyelitis (esp. syphilis—saber shin; yaws—boomerang tibia; tropical ulcer)
4. Paget's disease
5. Physiological (idiopathic) anterior or posterior tibial bowing (usually with fibula)
6. Plastic bending or bowing fracture of infancy or childhood
   a. Faulty intrauterine fetal positioning
   b. Greenstick fracture
   c. Weakened tibia (eg, osteogenesis imperfecta; hyperparathyroidism; rickets; hypophosphatasia; hyperphosphatasia; scurvy; leukemia)
7. Tibia vara (Blount disease)
8. Trauma, other (e.g., epiphyseal injury; malunited fracture; battered child S.)

UNCOMMON
1. Elongation of fibula (See D-178)
2. Fibrous dysplasia
3. Klippel-Trenaunay S., Parkes Weber S., or limb hypertrophy (See D-14)
4. Weismann-Netter S. (usually with fibula)

References

Gamut D-178
ELONGATION OF FIBULA
1. Achondroplasia
2. Hypochondroplasia
3. Mesomelic dysplasia
4. Metaphyseal chondrodysplasia (McKusick type)
5. Muscular disorder
6. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
7. Spondyloepimetaphyseal dysplasias

Reference

Gamut D-179
APLASIA, HYPOPLASIA, OR SHORTENING OF FIBULA*

1. Atelosteogenesis (types I and III)
2. Campomelic dysplasia
3. Chondroectodermal dysplasia (Ellis-van Creveld S.)
4. Chromosomal abnormalities
5. Cleidocranial dysplasia
6. de la Chapelle dysplasia
7. Du Pan S.
8. Femur-fibula-ulna S.
9. Fibrochondrogenesis
10. Grebe chondrodysplasia (achondrogenesis, Brazilian type)
11. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
12. Mesomelic dysplasia (Langer, Nievergelt, Werner types)
13. Mietens-Weber S.
14. Otopalatodigital S. (type II)
15. Proximal femoral focal deficiency
16. Seckel S. (bird-headed dwarfism)
17. Short rib-polydactyly S. type I (Saldino-Noonan)
18. Weyers oligodactyly S.

* Usually seen with tibial hypoplasia, but predominant fibular changes may be seen in above dysplasias. There are over ten other rare syndromes listed in the Taybi-Lachman text.

References
**CONGENITAL SYNDROMES WITH ABSENT, HYPOPLASTIC, DYSPLastic, BIPARTITE, OR DISLOCATED PATELLA**

**COMMON**
1. Arthrogryposis (dislocated)
2. Nail-patella S. (osteo-onychodysplasia) (absent or hypoplastic)
3. Neuromuscular disorders (esp. cerebral palsy) (fragmented lower pole)
4. Normal variant (bipartite)
5. Sinding-Larsen-Johansson disease (fragmented inferior tip)

**UNCOMMON**
1. Acrocephalopolysyndactyly (Carpenter S.) (dislocated)
2. Chondrodysplasia punctata (calcific flecks in patella)
3. Diastrophic dysplasia (dislocated, hypoplastic, or multipartite)
4. Familial absence of patella
5. Kuskokwim S. (hypoplastic)
6. Mesomelic dysplasia (Werner type)
7. Multiple epiphyseal dysplasia (Fairbank) (dislocated or bipartite)
8. Neurofibromatosis type I (absent)
9. Popliteal pterygium S. (absent or bipartite)
10. Rubinstein-Taybi S. (dislocated)
11. Seckel S. (bird-headed dwarfism) (absent)
12. Small patella S.
13. Spondyloepimetaphyseal dysplasia
14. Spondyloepiphyseal dysplasia (incl. pseudoachondroplasia)
15. Stickler S. (arthro-ophthalmopathy) (dislocated)
16. Trisomy 8 S. (absent or hypoplastic)
17. Warfarin embryopathy (calcific flecks)
18. Zellweger S. (cerebrohepatorenal S.) (calcific flecks in patella)

**References**

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**ABNORMAL POSITION OF THE PATELLA—PATELLA ALTA (HIGH PATELLA)**

1. Arthritis with joint effusion
2. Chondromalacia of patella
3. Idiopathic; isolated anomaly
4. Neuromuscular disorders (eg, poliomyelitis; cerebral palsy)
5. Osgood-Schlatter disease
6. Osteomyelitis of femur
7. Rupture of patellar tendon
8. Sinding-Larsen disease (avascular necrosis of inferior ossification center of patella)
9. Subluxation, recurrent or chronic

**References**

ABNORMAL POSITION OF THE PATELLA—PATELLA BAJA OR PROFUNDA (LOW PATELLA)

1. Achondroplasia; other bone dysplasias
2. Juvenile rheumatoid arthritis
3. Paresis of quadriceps muscle (eg, poliomyelitis)
4. Rupture of quadriceps tendon
5. Surgical transposition of tibial tuberosity

References

LYTIC PATELLAR LESION

COMMON
1. Chondroblastoma (Codman tumor)
2. Dorsal defect of patella
3. Giant cell tumor
4. Subchondral cyst (associated with osteochondritis dissecans or chondromalacia)

UNCOMMON
1. Aneurysmal bone cyst
2. Bone cyst

3. Brown tumor of hyperparathyroidism
4. Enchondroma
5. Gout
6. Hemangioma
7. Intraosseous ganglion
8. Langerhans cell histiocytosis (esp. eosinophilic granuloma)
9. Metastasis
10. Multiple myeloma; plasmacytoma
11. Osteoblastoma
12. Osteomyelitis; Brodie abscess; tuberculosis

References

ENLARGEMENT OF THE DISTAL FEMORAL INTERCONDYLAR NOTCH

COMMON
1. Hemophilia
2. Juvenile chronic arthritis (esp. juvenile rheumatoid arthritis)

UNCOMMON
1. Diastrophic dysplasia
2. Dysplasia epiphysealis hemimelica (Trevor disease)
3. Metatropic dysplasia
4. Mesomelic dysplasia (Langer type)
5. Mucopolysaccharidoses (Morquio S.; Maroteaux-Lamy S.)
6. Parastremmatic dysplasia
7. Psoriatic arthritis
8. Septic arthritis
9. Tuberculous arthritis

(continued)
**ENLARGED MEDIAL FEMORAL CONDYLE**

1. Brachmann-de Lange S. (de Lange S.)
2. Chondrodystrophies
3. Dyschondrosteosis
4. Posttraumatic
5. Prader-Willi S.
6. Tibia vara (Blount disease)
7. Turner S.
8. Vitamin D-resistant rickets

**COMMON**

1. Achondroplasia
2. Femoral anteversion
3. Idiopathic; prenatal bowing
4. Osteoarthritis, primary or secondary (may be associated with medial displacement of femur—genu laxum)
5. Rickets (all causes)
6. Physiologic tibial torsion in infants
7. Tibia vara (Blount disease)
8. Trauma (fracture of medial condyle of femur or tibia)

**UNCOMMON**

1. Acrodysostosis
2. Anadysplasia
3. Campomelic dysplasia
4. Dysplasia epiphysealis hemimelica (Trevor disease)
5. Epiphyseal-physeal-metaphyseal injury (trauma; infection; radiation)
6. Fluorosis
7. Hyperparathyroidism
8. Hyperphosphatasia
9. Hypochondroplasia
10. Hypophosphatasia
11. Infantile multisystem inflammatory disease (NOMID)
12. Metaphyseal chondrodysplasia (McKusick, Jansen, Schmid types)
13. Multiple epiphyseal dysplasia (Fairbank)
14. Neoplasm, localized (eg, osteochondroma; juxta-articular chondroma of lateral aspect of knee)
15. Neurofibromatosis
16. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
17. Spondyloepimeta physeal dysplasia
18. Spondyloepiphyseal dysplasia congenita
19. TAR S. (thrombocytopenia—absent radius S.)
20. Thanatophoric dysplasia
21. Turner S.

* Usually or always unilateral.

**References**


Gamut D-186

GENU VALGUM (KNOCK-KNEES)

COMMON
*1. Arthritis (eg, juvenile rheumatoid arthritis; osteoarthritis involving lateral compartment of knee, primary or secondary to rupture of lateral meniscus or severe rheumatoid arthritis)
2. Pes planus (flat feet)
3. Physiologic
4. Regional muscular weakness from neurologic or neuromuscular disease

UNCOMMON
1. Acrocephalopolysyndactyly (Carpenter S.)
2. Acrocephalosyndactyly (Apert type)
3. Arthrogryposis
4. Bardet-Biedl S.
5. Chondroectodermal dysplasia (Ellis-van Creveld S.)
6. Cohen S.
7. Diaphyseal dysplasia (Camurati-Engelmann disease)
8. Dyschondrosteosis
*9. Dysplasia epiphysealis hemimelica (Trevor disease)
*10. Epiphyseal-metaphyseal injury (trauma; infection; radiation)
11. Fanconi anemia (pancytopenia-dysmelia S.)
12. Freeman-Sheldon S. (whistling face S.)
13. Frontometaphyseal dysplasia

14. Hajdu-Cheney S.
15. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
16. Homocystinuria
17. Hypophosphatasia
18. Mesomelic dysplasia (esp. Langer, Nievergelt types)
19. Metaphyseal chondrodysplasia (Jansen and other types)
20. Mucopolysaccharidoses (eg, Hurler, Morquio) (See J-4)
21. Multiple epiphyseal dysplasia (Fairbank)
22. Nail-patella S. (osteo-onychodysplasia)
*23. Neoplasm, localized (eg, osteochondroma; juxta-articular chondroma of medial aspect of knee)
24. Neurofibromatosis
25. Noonan S.
26. Occipital horn S.
27. Osteodysplasty (Melnick-Needles S.)
28. Otopalatodigital S. (types I and II)
29. Parastremmatic dysplasia
30. Pyle dysplasia
31. Renal osteodystrophy (secondary hyperparathyroidism)
32. Rickets (all types) (with hypotonia—late)
33. Spondyloenchondrodysplasia (enchondromatosis with severe platyspondyly)
34. Spondyloepiphyseal dysplasia congenita (late)
35. Spondylometaphyseal dysplasia (Algerian and Murdoch types)
36. Trisomy 21 S. (Down S.)

* Usually or always unilateral.

References

(continued)
COXA VARA
(Unilateral or Bilateral)

Common
1. Avascular necrosis of femoral head (eg, steroid therapy; sickle cell disease; connective tissue disease (collagen vascular disease); Gaucher disease; radiation injury) (See D-48)
2. Legg-Perthes disease (late)
3. Malunited fracture of femoral neck (incl. epiphyseal-physeal-metaphyseal fracture; battered child S.)
4. Paget’s disease
5. Rickets (all types); osteomalacia (See D-44)
6. Slipped capital femoral epiphysis (late) (See D-190)

Uncommon
1. Congenital (idiopathic) coxa vara (femoral neck defect; hypoplasia of proximal femur {proximal femoral focal deficiency})
2. Congenital syndromes (See D-187-2)
3. Femoral neck lesion; other (eg, osteomyelitis; hydatid disease)
4. Fibrous dysplasia
5. Hyperparathyroidism (esp. secondary—renal osteodystrophy)
6. Hypophosphatemia
7. Hypothyroidism (slipped capital femoral epiphysis)
8. Rheumatoid arthritis (incl. juvenile)

Reference

CONGENITAL SYNDROMES
With Coxa VarA

Common
1. Achondroplasia
2. Fibrous dysplasia
3. Multiple epiphyseal dysplasia (Fairbank)
4. Osteogenesis imperfecta
5. Spondyloepiphyseal dysplasia (congenita or tarda)

Uncommon
1. Arthrogryposis
2. Cleidocranial dysplasia
3. Congenital (idiopathic) coxa vara (femoral neck defect; hypoplasia of proximal femur {proximal femoral focal deficiency})
4. Cretinism; hypothyroidism
5. Diastrophic dysplasia
6. Dyggve-Melchior-Clausen dysplasia
7. Enchondromatosis (Ollier disease)
8. Femoral hypoplasia—unusual facies S.
9. Frontometaphyseal dysplasia
10. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
11. Hyperphosphatasa
12. Hypophosphatasa
13. Kniest dysplasia
14. Metaphyseal chondrodysplasia (Schmid and Shwachman types)
15. Metatropic dysplasia
16. Meyer dysplasia of femoral head
17. Osteodysplasty (Melnick-Needles S.)
18. Osteopetrosis
19. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
20. Pseudohypoparathyroidism; pseudopseudohypoparathyroidism
21. Schwartz-Jampel S. (chondrodystrophic myotonia)
22. Spondyloepimetaaphyseal dysplasias
23. Spondylometaphyseal dysplasia (Kozlowski and corner fracture types)

References

Gamut D-188

COXA VALGA

COMMON
1. Chronic leg injury
2. Chronic muscular hypotonia; paralytic disorder; neuromuscular disorder; (eg, meningomyelocele; cerebral palsy; muscular dystrophy; poliomyelitis)
3. Developmental dysplasia of the hip—DDH (congenital hip dysplasia or dislocation), untreated
4. Rheumatoid arthritis (incl. juvenile)

UNCOMMON
1. Acrocephalopolysyndactyly (Carpenter S.)
2. Arthrogryposis
3. Baller-Gerold S. (craniosynostosis-radial aplasia S.)
4. Chromosome 18: del(18q) S.
5. Cleidocranial dysplasia
6. Cockayne S.
7. Coffin-Lowry S.
8. Coffin-Siris S.
9. Dyschondrosteosis
10. Dysplasia epiphysealis hemimelica (Trevor disease)
11. Frontometaphyseal dysplasia
12. Glycogen storage disease type I (von Gierke disease)
13. Hallermann-Streiff S. (oculomandibulofacial S.)
14. Hypoplasia or agenessis of sacrum; caudal dysplasia sequence (caudal regression S.)
15. Mucopolysaccharidoses (eg, Hurler; Hunter; Morquio; Maroteaux-Lamy); mucolipidosis II (I-cell disease) and III (pseudo-Hurler polydystrophy); sialidosis; mannosidosis; fucosidosis (See J-4)
16. Niemann-Pick disease
17. Occipital horn S.
18. Osteodysplasty (Melnick-Needles S.)
19. Otopalatodigital S. (type I)
20. Prader-Willi S.
21. Progeria
22. Pseudohypoparathyroidism
23. Pyknody sostosis
24. Pyle dysplasia
25. Schwartz-Jampel S. (chondrodystrophic myotonia)
26. Spondyloepiphyseal dysplasia with joint laxity
27. Stickler S. (arthro-ophthalmopathy)
28. TAR S. (thrombocytopenia-absent radius S.)
29. Turner S.
30. Weaver S.
31. XXXXY S.; XXXXX S.

References
Gamut D-189-1

ABSENT, HYPOPLASTIC, OR DEFORMED PROXIMAL FEMUR

CONGENITAL
1. Amniotic band sequence
2. Atelosteogenesis
3. Boomerang dysplasia
4. Femoral hypoplasia-unusual facies S.
5. Proximal femoral focal dysplasia
6. Roberts S. (pseudothalidomide S.)
7. Thalidomide embryopathy

ACQUIRED
1. Congenital dislocation of the hip (complication of treatment)
2. Fibrous dysplasia, incl. McCune-Albright S.
3. Fracture with secondary deformity, nonunion
4. Hydatid disease
5. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
6. Malignant bone tumor, primary or metastatic
7. Osteomyelitis (esp. meningococcemia)
8. Paget’s disease
9. Septic arthritis, severe sequelae

Gamut D-189-2

FEMORAL HEAD DYSPLASIA

COMMON
1. Cretinism; hypothyroidism
2. Legg-Perthes disease
3. Meyer dysplasia of femoral head
4. Multiple epiphyseal dysplasia (Fairbank and Ribbing types)
5. Osteochondritis dissecans (subchondral dysplasia)

UNCOMMON
1. Bardet-Biedl S.
2. Elsbach dysplasia (bilateral hereditary microepiphyseal dysplasia)
3. Geleophysic dysplasia
4. Kniest dysplasia
5. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
6. Rubinstein-Taybi S.
7. Silver-Russell S.
8. Spondyloepiphyseal dysplasias
9. Trichorhinophalangeal dysplasia, type I (Giedion S.) and II (Giedion-Langer S.)

Gamut D-189-3

FRAGMENTED OR IRREGULAR FEMORAL HEAD

COMMON
1. Arthritis, advanced (eg, rheumatoid; septic; degenerative; posttraumatic; associated with inflammatory bowel disease; gout; neuroarthropathy)
2. Avascular necrosis, all causes (See D-48)
3. Cretinism; hypothyroidism
4. Developmental dysplasia of the hip—DDH (congenital hip dysplasia or dislocation) (complication of treatment)
5. Legg-Perthes disease (osteochondrosis of femoral epiphysis)
6. Meyer dysplasia of femoral head
7. Multiple epiphyseal dysplasia (Fairbank and Ribbing types)
8. Occlusive vascular disease; thromboembolic disease
9. Sickle cell disease
10. Steroid therapy; Cushing S.
11. Traumatic dislocation; fracture of femoral neck; surgical or manipulative trauma
UNCOMMON
1. Acrodysplasia with retinitis pigmentosa and nephropathy (Saldino-Mainzer S.)
2. Adrenogenital S.
3. Behçet S.
4. Chondrodysplasia punctata
5. Diabetes
6. Diastrophic dysplasia
7. Dyggve-Melchior-Clausen dysplasia
8. Dysplasia epiphysealis hemimelica (Trevor disease)
9. Elsbach dysplasia (bilateral hereditary microepiphyseal dysplasia)
10. Enchondromatosis (Ollier disease)
11. Fabry disease
12. Gaucher disease
13. Geleophysic dysplasia
14. Hemophilia; Christmas disease
15. Infection
16. Kniest dysplasia
17. Leukemia
18. Metachondromatosis
19. Metaphyseal chondrodysplasia (McKusick and Shwachman types)
20. Mucopolysaccharidoses (esp. Hurler; Hunter; Morquio; Maroteaux-Lamy); mucolipidosis II (I-cell disease) and III (pseudo-Hurler polydystrophy) (See J-4)
21. Osteochondritis dissecans
22. Pancreatitis, acute or chronic; alcoholism
23. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
24. Radiation therapy
25. Renal osteodystrophy (secondary hyperparathyroidism); post renal transplantation
26. Rickets (all types)
27. Sarcoidosis
28. Schwartz-Jampel S. (chondrodystrophic myotonia)
29. Slipped capital femoral epiphysis (late)
30. Spondyloepiphyseal dysplasia
31. Spondylometaphyseal dysplasia (Kozlowski type)
32. Stickler S. (arthro-ophthalmopathy)
33. Trichorhinophalangeal dysplasia, type I (Giedion S.) and II (Giedion-Langer S.)
34. Winchester S.

References

Gamut D-190
SLIPPED CAPITAL FEMORAL EPIPHYSIS

COMMON
1. Idiopathic (age 9–17)
2. Renal osteodystrophy (secondary hyperparathyroidism)
3. Trauma

UNCOMMON
1. Congenital (idiopathic) coxa vara (femoral neck defect; hypoplasia of proximal femur)
2. Drug therapy (eg, chemotherapy; chorionic gonadotropin therapy)
3. Gaucher disease
4. Gigantism (hyperpituitarism); rapid growth spurt; growth hormone deficiency and therapy; pituitary tumor
5. Hemophilia
6. Hyperparathyroidism
7. Hypopituitarism
8. Hypothyroidism
9. Marfan S.
10. Metaphyseal chondrodysplasia (esp. Shwachman type)
11. Multiple endocrine neoplasia, type IIB (MEN IIB)
12. Multiple epiphyseal dysplasia (Fairbank)

(continued)
13. Obesity; mechanical stress
14. Pseudohypoparathyroidism; pseudopseudohypoparathyroidism
15. Radiation therapy
16. Rickets; poor nutrition
17. Schwartz-Jampel S. (chondrodystrophic myotonia)
18. Scurvy
19. Steroid therapy; Cushing S.
20. Syphilis
21. Trisomy 21 S. (Down S.)

References
2. Steinbach HL, Young DA: The roentgen appearance of pseudohypoparathyroidism (PH) and pseudo-pseudohypoparathyroidism (PPH). AJR 1966; 97:49–66

PROTRUSIO ACETABULI (UNILATERAL OR BILATERAL)

COMMON
1. Degenerative joint disease, primary (osteoarthritis) or secondary (incl. hemophilia; hemochromatosis)
2. Hyperparathyroidism
3. Normal variant (children age 4–12)
4. Osteomalacia
5. Osteoporosis
6. Paget’s disease
7. Primary or idiopathic (Otto pelvis) (eg, coxa vara with retroversion of femoral neck)
8. Renal osteodystrophy (secondary hyperparathyroidism)
9. Rheumatoid arthritis (incl. juvenile)
10. Rickets
11. Trauma (acetabular fracture with medial dislocation of hip)

UNCOMMON
1. Acrodysostosis
2. Arthritis, other (eg, ankylosing spondylitis; juvenile chronic arthritis; gout; psoriatic)
3. Fibrous dysplasia
4. Homocystinuria
5. Hydatid disease
6. Hyperphosphatasia
7. Infectious arthritis (eg, septic; tuberculous)
8. Marfan S.
9. Mucopolysaccharidoses (esp. Morquio S.) (See J-4)
10. Neoplasm involving acetabulum, primary or metastatic (incl. multiple myeloma), with medial dislocation of hip
11. Ochronosis (alkaptonuria)
12. Osteogenesis imperfecta
13. Postsurgical (eg, medial dislocation of femoral head prosthesis following total hip replacement)
14. Radiation therapy (esp. in a child)
15. Sickle cell disease
16. Stickler S. (arthro-ophthalmopathy)
17. Turner S.

References
CONGENITAL SYNDROMES WITH AN ABNORMAL PELVIS (See D-193 to D-195)

COMMON
1. Achondroplasia (small trident pelvis; short sacroiliac notches)
2. Mucopolysaccharidoses (eg, Hurler; Morquio) (flared iliac wings; steep acetabular roofs; narrow pelvic inlet; coxa valga)
3. Trisomy 21 S. (Down S.) (hypoplastic, flared iliac wings; decreased acetabular and iliac angles; ischial tapering)

UNCOMMON
1. Achondrogenesis (types I and II) (hypoplastic pelvis; sacral, pubic, ischial bones not ossified; flat acetabula)
2. Arthrogryposis
3. Asphyxiating thoracic dysplasia (Jeune S.) (flared ilia; small trident pelvis)
4. Campomelic dysplasia (narrow pelvis with poor ossification)
5. Caudal dysplasia sequence (caudal regression S.) (caudal hypoplasia or aplasia—narrow pelvis with absence or hypoplasia of sacrum)
6. Cephaloskeletal dysplasia (Taybi-Linder S.) (short iliac wings; flat acetabular angles; narrow sciatic notches)
7. Chondrodysplasia punctata (trapezoid ilium)
8. Chondroectodermal dysplasia (Ellis-van Creveld S.) (trident pelvis)
9. Chromosome 4: del(4p) S. (Wolf-Hirschhorn S.) (small pelvis with underdeveloped pubic rami; increased iliac angles)
10. Cleidocranial dysplasia (wide pubic symphysis)
11. Cockayne S. (small square pelvis)
12. Diastrophic dysplasia (short thick iliac bones)
13. Dyggve-Melchior-Clausen dysplasia (small sciatic notches; serrated iliac crests)
14. Dyssegmental dysplasia (wide flared ilia with small sacrosciatic notches; broad pubis and ischia)
15. Enchondromatosis (Ollier disease)
16. Fibrochondrogenesis (hypoplastic pelvis; squared iliac wings; trident roof)
17. Goltz S. (focal dermal hypoplasia) (hypoplastic pelvis; pubic diastasis)
18. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
19. Hypochondroplasia (hypoplastic iliac wings; flat acetabular roofs; unossified pubic bones; vertical ischia)
20. Hypochondroplasia (small pelvis with short ilia; flat acetabular roofs; small sacroiliac incisura; small sacrum)
21. Kniest dysplasia (trefoil-shaped pelvis; coxa vara; delayed pubic ossification)
22. Marfan S. (wide pelvic cavity; vertical ilia)
23. Metaphyseal chondrodysplasia (Shwachman type) (abnormal acetabula)
24. Metatropic dysplasia (small iliac height and sacrosciatic notches)
25. Nail-patella S. (osteo-onychodysplasia) (iliac horns)
26. Osteodysplasty (Melnick-Needles S.) (narrow pelvis with flared iliac wings; flat acetabula and tapered ischia)
27. Osteogenesis imperfecta (protrusio acetabuli)
28. Osteopetrosis (alternating bands of increased density)
29. Parastremmatic dysplasia (small sciatic notches; serrated iliac crests)
30. Pelvic “digit” or “rib”
31. Polyostotic fibrous dysplasia (McCune-Albright S.)
32. Rubinstein-Taybi S. (flared ilia; small iliac index)
33. Schneckenbecken dysplasia (small sciatic notches)
34. Spondyloepimetaphyseal dysplasia with joint laxity (also Strudwick type) (small sciatic notches)
35. Spondyloepiphyseal dysplasia congenita (squared ilia; delayed pubic and femoral head ossification)
36. Stickler S. (arthro-ophtalmopathy) (hypoplastic iliac wings; protrusio acetabuli)
37. Thanatophoric dysplasia (squared ilia with small sacrosciatic notches; trident pelvis)
38. Trisomy 13 S. (hypoplastic pelvis; low acetabular angles)
39. Trisomy 18 S. (small “antimongoloid” pelvis with vertical ilia; steep acetabular angles)
40. Tuberous sclerosis (patchy sclerotic densities)
41. Weaver S. (small iliac wings)

References

Gamut D-193-1

ABNORMAL PELVIC CONFIGURATION IN AN INFANT OR CHILD—SMALL SACROILIAC (SCIATIC) NOTCHES

1. Achondroplasia
2. Cephaloskeletal dysplasia (Taybi-Linder S.)
3. Chondroectodermal dysplasia (Ellis-van Creveld S.)
4. Dyggve-Melchior-Clausen dysplasia
5. Dyssegmental dysplasia
6. Hypochondroplasia
7. Metaphyseal chondrodysplasia (Shwachman type)
8. Metatropic dysplasia
9. Parastremmatic dysplasia
10. Schneckenbecken dysplasia
11. Short rib-polydactyly S. type I (Saldino-Noonan)
12. Spondyloepimetaphyseal dysplasia with joint laxity (also Strudwick type)
13. Thanatophoric dysplasia and variants

References

Gamut D-193-2

CRENATED OR SERRATED ILIAC CRESTS IN AN INFANT OR CHILD

1. Dyggve-Melchior-Clausen dysplasia
2. Fluorosis
3. Parastremmatic dysplasia

References

Gamut D-193-3

NARROW PELVIS IN AN INFANT OR CHILD

1. Campomelic dysplasia
2. Caudal dysplasia sequence (caudal regression S.); sacral agenesis
3. Mucopolysaccharidoses (Hurler; Morquio)
4. Osteodysplasty (Melnick-Needles S.)

Reference
PELVIC EXOSTOSIS, ILIAC HORN, DIGIT OR RIB IN AN INFANT OR CHILD

1. Avulsion fracture of anterior superior or inferior iliac spine (healed)
2. Exostosis (incl. radiation-induced osteochondroma)
3. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
4. Metachondromatosis
5. Nail-patella S. (osteo-onychodysplasia) (iliac horns)
6. Pelvic “digit” or “rib”

References

TRIDENT PELVIS (TRIRADIATE ACETABULUM) IN AN INFANT OR CHILD

1. Asphyxiating thoracic dysplasia (Jeune S.)
2. Chondroectodermal dysplasia (Ellis-van Creveld S.)
3. Fibrochondrogenesis
4. Thanatophoric dysplasia

Reference

CONGENITAL SYNDROMES WITH FLAT OR DECREASED ACETABULAR ANGLE—TYPE A PELVIS
(Small, squared iliac wings and irregular acetabular roofs)

COMMON
1. Achondroplasia

UNCOMMON
1. Achondrogenesis (types I and II)
2. Asphyxiating thoracic dysplasia (Jeune S.)
3. Caudal dysplasia sequence (caudal regression S.); sacral agenesis
4. Cephaloskeletal dysplasia (Taybi-Linder S.)
5. Chondrodisplasia punctata (rhizomelic form)
6. Chondroectodermal dysplasia (Ellis-van Creveld S.)
7. Dyggve-Melchior-Clausen dysplasia
8. Dyssegmental dysplasia
9. Fibrochondrogenesis
10. Hypochondrogenesis
11. Hypochondroplasia
12. Kniest dysplasia
13. Metaphyseal chondrodysplasia (esp. Shwachman type—advanced)
14. Metatropic dysplasia
15. Morquio S.
16. Schneckenbecken dysplasia
17. Short rib-polydactyly S. type I (Saldino-Noonan)
18. Spondyloepimetaphyseal dysplasia
19. Spondyloepiphyseal dysplasia congenita
20. Spondylometaphyseal dysplasia (Kozlowski type)
21. Thanatophoric dysplasia and variants

References
CONGENITAL SYNDROMES  
WITH ABNORMAL ACETABULAR ANGLE, USUALLY FLAT OR DECREASED—TYPE B PELVIS  
(Iliac wings less hypoplastic, outwardly flared, and more tapered than square)  

COMMON  
1. Arthrogryposis  
2. Developmental dysplasia of the hip—DDH (congenital hip dysplasia or dislocation)  
3. Hypothyroidism; cretinism  
4. Trisomy 21 S. (Down S.)  

UNCOMMON  
1. Acrocephalopolysyndactyly (Carpenter S.)  
2. Acrocephalosyndactyly (Waardenburg type)  
3. Aminopterin fetopathy  
4. Brachmann-de Lange S. (de Lange S.)  
5. Cleidocranial dysplasia  
6. Cockayne S.  
7. Exstrophy of bladder  
8. Frontometaphyseal dysplasia  
9. Hypophosphatasia  
10. Larsen S.  
11. Metaphyseal dysplasia (Jansen and other types) (mild)  
12. Mucolipidosis II (I-cell disease) and III (pseudo-Hurler polydystrophy)  
13. Mucopolysaccharidoses (Hurler; Sanfilippo) (See J-4)  
14. Nail-patella S. (osteo-onychodysplasia)  
15. Osteodysplasty (Melnick-Needles S.)  
16. Osteogenesis imperfecta (types II and III)  
17. Otopalatodigital S. (type II)  
18. Popliteal pterygium S.  
19. Prune-belly S. (Eagle-Barrett S.)  
20. Rubinstein-Taybi S.  
21. Sacral agenesis  
22. Stickler S. (arthro-ophthalmopathy)  
23. Trisomy 13 S.  
*24. Trisomy 18 S.  
25. Weissenbacher-Zweymüller phenotype  
* Usually have steep acetabular angles.  

References  

CONGENITAL SYNDROMES  
WITH DELAYED OR DEFECTIVE PELVIC AND/OR PUBIC OSSIFICATION (WIDE SYMPHYSIS)  

COMMON  
1. Chondrodystrophies (See D-1)  
2. Cleidocranial dysplasia  
3. Ehlers-Danlos S. (distraction during delivery)  
4. Prune-belly S. (Eagle-Barrett S.)  
5. Spondyloepiphyseal dysplasia congenita  

UNCOMMON  
1. Achondrogenesis I and II  
2. Asphyxiating thoracic dysplasia (Jeune S.)  
3. Atelosteogenesis  
4. Boomerang dysplasia  
5. Campomelic dysplasia  
6. Caudal dysplasia sequence (caudal regression S.)  
7. Cephaloskeletal dysplasia (Taybi-Linder S.)  
8. Chondrodysplasia punctata  
9. Chondroectodermal dysplasia (Ellis-van Creveld S.)  
11. Dyggve-Melchior-Clausen dysplasia  
12. Familial pubic diastasis
13. Femoral hypoplasia–unusual facies S.
14. Fraser S. (cryptophthalmos-syndactyly S.)
15. Goltz S. (focal dermal hypoplasia)
16. Hypochondrogenesis
17. Hypophosphatasia, severe
18. Hypothyroidism; cretinism (newborn)
19. Kniest dysplasia
20. Larsen S.
21. Metaphyseal chondrodysplasia (Jansen type)
22. Osteosclerosis
23. Osteodysplasty (Melnick-Needles S.)
24. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
25. Schinzel-Giedion S.
26. Sjögren-Larsson S.
27. Spondyloepimetaphyseal dysplasia (Strudwick type)
28. Spondyloepiphyseal dysplasia
29. Thanatophoric variants
30. Trisomy 9p S.

References

Gamut D-197
BRIDGING OR FUSION OF THE PUBIC SYMPHYSIS

COMMON
1. Ankylosing spondylitis (late)
2. Degenerative changes; osteoarthritis
3. Idiopathic
4. Infection, healed (eg, tuberculous or pyogenic osteomyelitis)
5. Osteitis pubis, healed
6. Posttraumatic; postparturition

(continued)
UNCOMMON
1. Fluorosis
2. Juvenile chronic arthritis (eg, juvenile rheumatoid arthritis)
3. Myositis ossificans (pseudomarsupial bones)
4. Ochronosis (alkaptonuria)
5. Postradiation therapy
6. Psoriatic arthritis
7. Rheumatoid arthritis (late)
8. Sternocostoclavicular hyperostosis (SAPHO S.)
9. Surgical fusion

References

CONGENITAL SYNDROMES WITH ELEVEN PAIRS OF RIBS

COMMON
1. Campomelic dysplasia
2. [Normal variant]
3. Trisomy 21 S. (Down S.)

UNCOMMON
1. Asphyxiating thoracic dysplasia (Jeune S.)
2. Atelosteogenesis
3. Cleidocranial dysplasia
4. Femoral hypoplasia—unusual facies S.
5. Kyphomelic dysplasia
6. Short rib-polydactyly syndromes
7. Spondylocecostal dysostosis (Jarcho-Levin S.)
8. Trisomy 18 S.

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

CONGENITAL SYNDROMES WITH THIRTEEN PAIRS OF RIBS

COMMON
1. Aarskog S.
2. Alagille S. (arteriohepatic S.)
3. Fetal akinesia deformation sequence (Pena-Shokier S., type I)
4. Holt-Oram S.
5. Idiopathic
6. Incontinentia pigmenti
7. Turner S.

Reference

THIN, RIBBON-LIKE, OR TWISTED RIBS

COMMON
1. Idiopathic; congenital hypoplasia; cervical rib
2. Intrauterine growth retardation (IUGR)
*3. Neurofibromatosis (type 1)
4. Neuromuscular disorders, eg, myotonic dystrophy; myotubular myopathy; hypotonia; Werdnig-Hoffmann disease
5. Osteoporosis, severe
*6. Regenerated rib (after resection)
UNCOMMON

1. Achondrogenesis (type 1)
2. Aminopterin fetopathy
3. Angiomatosis
4. Antley-Bixler S.
5. Campomelic dysplasia
6. Cockayne S.
7. Contractural arachnodactyly
*8. Gorlin S. (nevoid basal cell carcinoma S.)
9. Hallermann-Streiff S. (oculomandibulofacial S.)
10. Hyperparathyroidism
11. Larsen S.
12. Metaphyseal chondrodysplasia (Jansen type)
13. Morquio S. (posterior portion)
*14. Osteodysplasty (Melnick-Needles S.)
15. Osteogenesis imperfecta (types I, III, IV)
16. Otopalatodigital S. (type II)
17. Paraplegia; poliomyelitis
18. Progeria
19. Rheumatoid arthritis
20. Scleroderma
*21. Spondylocostal dysostosis (Jarcho-Levin S.)
*22. Spondylothoracic dysplasia
23. 3-M syndrome
24. Trisomy 8 S.
25. Trisomy 13 S.
26. Trisomy 18 S.
27. Trisomy 21 S. (Down S.)
28. Turner S.

* Ribs may be twisted.

References

Gamut D-200

WIDE OR THICKENED RIBS

COMMON

1. Achondroplasia
2. Acromegaly
3. Anemia g (esp. thalassemia; sickle cell disease)
4. Fibrous dysplasia
5. Fluorosis
6. Mucopolysaccharidoses (See J-4)
7. Normal variant
8. Osteomyelitis, healed (eg, actinomycosis)
9. Paget’s disease
10. Posttraumatic (healed fractures with callus)
11. Ricketts (rosary)

UNCOMMON

1. Adenosine deaminase deficiency with severe combined immunodeficiency and chondro-osseous dysplasia
2. Craniodiaphyseal dysplasia
3. Cranio- or metaphyseal dysplasia
4. Dysostosis (van Buchem and Worth types)
5. Endosteal hyperostosis (van Buchem and Worth types)
6. Erdheim-Chester disease
7. Freeman-Sheldon S. (whistling face S.)
8. Fryns S.
9. Fucosidosis; mannosidosis; GM1 gangliosidosis
10. GAPO S.
11. Gaucher disease; Niemann-Pick disease
12. Geleophysic dysplasia
13. Gorlin S. (nevoid basal cell carcinoma S.)
14. Hyperphosphatasia
15. Hypochondroplasia
16. Hypophosphatasia (childhood form)
17. Infantile cortical hyperostosis (Caffey’s disease)
18. Lenz-Majewski dysplasia
19. Melorheostosis
20. Metaphyseal chondrodysplasia (Schmid type)
21. Mucolipidosis II (I-cell disease) and III (pseudo-Hurler polydystrophy)

(continued)
22. Oculodento-osseous dysplasia
23. Osteogenesis imperfecta (thick bone type II)
24. Osteopetrosis
25. Pachydermoperiostosis
26. Polycythemia
27. Prostaglandin periostosis
28. Proteus S.
29. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
30. Pyle dysplasia
31. Schinzel-Giedion S.
32. Sclerosteosis
33. Scurvy
34. Sterneocostoclavicular hyperostosis (SAPHO S.)
35. Trisomy 8 S.
36. Tuberous sclerosis
37. Weill-Marchesani S.
38. Winchester S.

References

COMMON
1. Achondroplasia
2. Rickets (all types)

UNCOMMON
1. Achondrogenesis (types I and II)
2. Adenosine deaminase deficiency with severe combined immunodeficiency and chondro-osseous dysplasia
3. Asphyxiating thoracic dysplasia (Jeune S.)
4. Atelosteogenesis
5. Campomelic dysplasia
6. Cerebro-costo-mandibular S.
7. Chondroectodermal dysplasia (Ellis-van Creveld S.)
8. Cleidocranial dysplasia
9. Dysostosclerosis
10. Dyssegmental dysplasia
11. Enchondromatosis (Ollier disease)
12. Fibrochondrogenesis
13. Hypochondrogenesis
14. Hypophosphatasia
15. Kyphomelic dysplasia
16. Mandibulocral dysplasia
17. Metaphyseal chondrodysplasia (Jansen type)
18. Metatropic dysplasia
19. Mucolipidosis II (I-cell disease) and III (pseudo-Hurler polydystrophy)
20. Mucopolysaccharidoses (esp. Morquio S.)
21. Osteodysplasty (Melnick-Needles S.)
22. Osteogenesis imperfecta (type II)
23. Otopalatodigital S. (type II)
24. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia)
25. Pseudodiastrophic dysplasia
26. Schneckenbecken dysplasia
27. Short rib-polydactyly syndromes
28. Spondylocostal dysostosis (Jarch-Levin S.)
29. Spondyloepimetheusfaseal dysplasias
30. Spondyloepiphyseal dysplasia congenita
31. Thanatophoric dysplasia and variants
32. Weaver S.

* Usually associated with small thorax.

References
MULTIPLE SYMMETRICAL ANTERIOR RIB ENLARGEMENT, FLARING, OR CUPPING

COMMON
1. Achondroplasia
2. Normal variant
3. Rickets (all types)
4. Scurvy
5. Thanatophoric dysplasia

UNCOMMON
1. Achondrogenesis (types I and II)
2. Adenosine deaminase deficiency with severe combined immunodeficiency and chondro-osseous dysplasia
3. Asphyxiating thoracic dysplasia (Jeune S.); other narrow thorax-short rib syndromes
4. Copper deficiency, nutritional; Menkes S. (kinky-hair S.)
5. Dyggve-Melchior-Clausen dysplasia
6. Dyssegmental dysplasia
7. Farber disease (disseminated lipogranulomatosis)
8. Fibrochondrogenesis
9. GM₁ gangliosidosis
10. Hypochondrogenesis
11. Hypophosphatasia
12. Kyphomelic dysplasia
13. Leukemia (chloromas)
14. Metaphyseal chondrodysplasia (anadysplasia, Jansen, McKusick, Schmid, Shwachman types)
15. Metatropic dysplasia
16. Osteopetrosis
17. Pseudodiastrophic dysplasia
18. Schneckenbecken dysplasia
19. Short rib-polydactyly syndromes
20. Spondyloepimetaphyseal dysplasia (Strudwick type)
21. Spondyloepiphyseal dysplasia congenita
22. Spondylometaphyseal dysplasia
23. Thalassemia
24. Craniodiaphyseal dysplasia

References

CLASSIFICATION OF RIB NOTCHING

ARTERIAL
1. High aortic obstruction
   a. Aortitis
   b. Coarctation of aorta
   c. Coarctation of aorta involving left subclavian artery or anomalous right subclavian artery (unilateral)
2. Low aortic obstruction (eg, aortic thrombosis)
3. Subclavian artery obstruction
   a. Blalock-Taussig operation (unilateral)
   b. Pulseless disease (eg, Takayasu’s arteritis); advanced arteriosclerosis
4. Pulmonary oligemia
   a. Absent pulmonary artery (unilateral)
   b. Ebstein’s anomaly
   c. Emphysema
   d. Pseudotruncus arteriosus
   e. Pulmonary valvular stenosis or atresia
   f. Tetralogy of Fallot

VENOUS
1. Obstruction of superior vena cava, innominate or subclavian vein

ARTERIOVENOUS
1. Arteriovenous fistula of chest wall (intercostal artery—vein)
2. Pulmonary arteriovenous fistula

(continued)
NEUROGENIC
1. Intercostal neurofibroma or neurilemmoma
2. Neurofibromatosis (type 1)
3. Bulbar poliomyelitis; quadriplegia

OSSEOUS
1. Hyperparathyroidism
2. Osteodysplasty (Melnick-Needles syndrome)
3. Thalassemia

MISCELLANEOUS
1. Idiopathic; normal variant
2. Indwelling catheter

References

RESORPTION OR NOTCHING OF THE SUPERIOR RIB MARGINS

COMMON
1. Connective tissue disease (collagen disease)\(^g\) (eg, rheumatoid arthritis; scleroderma; lupus erythematosus)
2. Hyperparathyroidism
3. Localized pressure effect (eg, thoracic drainage tube; rib retractor; intercostal neurofibroma; hereditary multiple exostoses)

UNCOMMON
1. Coarctation of thoracic aorta (superior and inferior margins)
2. Idiopathic
3. Intercostal muscle atrophy in restrictive lung disease
4. Marfan S.
5. Neurofibromatosis (type 1)
6. Osteogenesis imperfecta
7. Paralysis (eg, poliomyelitis)
8. Radiation therapy
9. Sjögren S.

References

CONGENITAL

COMMON
1. Achondroplasia
2. Bifid rib; supernumerary rib; synostosis
3. Cervical rib
4. Coarctation of aorta (rib notching)
5. Hypoplasia or absence of rib
6. Thalassemia; sickle cell disease

UNCOMMON
1. Congenital syndromes and dysplasias, other (See D-1)
2. Gorlin S. (nevoid basal cell carcinoma S.)
3. Mucopolysaccharidoses (eg, Hurler; Morquio) (See J-4)
4. Neurofibromatosis (type 1)
5. Osteopetrosis
### INFLAMMATION

**COMMON**
1. Osteomyelitis (eg, bacterial; tuberculous; fungal)

**UNCOMMON**
1. Infantile cortical hyperostosis (Caffey’s disease)
2. Granulomatous disease of childhood
3. Hydatid disease

### NEOPLASM

**COMMON**
1. Angiomatous lesion (eg, hemangioma; lymphangioma)

**UNCOMMON**
1. Chondromyxoid fibroma
2. Enchondroma, esp. in enchondromatosis (Ollier disease)
3. Leukemia; lymphoma
4. Mesenchymal hamartoma of chest wall
5. Metastasis (esp. neuroblastoma)
6. Neurofibroma
7. Nonossifying fibroma, fibroxanthoma (often sclerosing type)
8. Osteoblastoma
9. Osteochondroma
10. Osteoma
11. Sarcoma (eg, Ewing sarcoma; osteosarcoma)

**MISCELLANEOUS**

**COMMON**
1. Fibrous dysplasia
2. Langerhans cell histiocytosis
3. Postoperative (rib removal or regeneration)
4. Rib notching, other causes (See D-203)
5. Rickets (all types) (See D-44)
6. Trauma (eg, fracture; callus)

**UNCOMMON**
1. Bone cyst
2. Scurvy
LONG Lesion of a rib
(over 6 cm—usually expansile)
(see D-206)

common
1. Bone sarcoma (eg, chondrosarcoma; osteosarcoma; Ewing sarcoma)
2. Fibrous dysplasia
3. Fused or bifid rib (incl. basal cell nevus S.)
4. Metastasis (esp. from carcinoma of breast, prostate, lung, or kidney; neuroblastoma)
5. Osteomyelitis (eg, bacterial; tuberculous; fungal)
6. Plasmacytoma; multiple myeloma
7. Surgical removal; regeneration

uncommon
1. Aneurysmal bone cyst
2. Bone cyst
3. Chondromyxoid fibroma
4. Gaucher disease
5. Hydatid cyst
6. Langerhans cell histiocytosis (esp. eosinophilic granuloma)
7. Malignant fibrous histiocytes; fibrosarcoma
8. Melorheostosis
9. Mesenchymal hamartoma of chest wall
10. Paget’s disease

References

multiple expanding rib lesions

common
1. Anemia (eg, thalassemia; sickle cell disease)
2. Metastases
3. Multiple myeloma
4. Osteomyelitis (esp. fungal; actinomycosis; blastomycosis; coccidioidomycosis; histoplasmosis duboisii)

uncommon
1. Amyloidomas, primary or secondary
2. Angiomatosis (hemangioma; lymphangiomatosis, cystic variety)
3. Brown tumors of hyperparathyroidism
4. Diaphyseal dysplasia (Camurati-Engelmann disease)
5. Enchondromatosis (Ollier disease)
6. Endosteal hyperostosis (van Buchem and Worth types)
7. Gaucher disease
8. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
9. Hydatid disease
10. Hypophosphatasia
11. Infantile cortical hyperostosis (Caffey disease)
12. Langerhans cell histiocytosis
13. Leukemia (chloromas); lymphoma
14. Mesenchymal hamartomas of chest wall
15. Mucopolysaccharidoses (esp. Hurler; Morquio) (see J-4)
16. Osteogenesis imperfecta
17. Pachydermoperiostosis
18. Paget’s disease
19. Polyostotic fibrous dysplasia (McCune-Albright S.)
20. Rickets (rosary)
21. Scurvy
CONGENITAL STERNAL ABNORMALITY—HYPERSEGMENTATION OR UNDERSEGMENTATION

HYPERSEGMENTATION
1. Trisomy 21 S. (Down S.)

UNDERSEGMENTATION (OFTEN WITH HYPOPLASIA AND PREMATURE FUSION OF STERNUM)
1. Campomelic dysplasia
2. Brachmann-de Lange S. (de Lange S.)
3. Noonan S.
4. Trisomy 18 S.

Reference

PECTUS CARINATUM (PIGEON BREAST) (Same as F-129)

COMMON
1. Congenital heart disease, esp. cyanotic
2. Ehlers-Danlos S.
3. Fetal alcohol S.
4. Homocystinuria
5. Idiopathic; isolated finding
6. Marfan S.
7. Mucopolysaccharidoses (esp. Morquio S.) (See J-4)
8. Osteogenesis imperfecta

UNCOMMON
1. Asphyxiating thoracic dysplasia (Jeune S.)
2. Coffin-Lowry S.
3. Currarino-Silverman S.

PECTUS EXCAVATUM (Same as F-130)

COMMON
1. Congenital heart disease
2. Ehlers-Danlos S.
3. Fetal alcohol S.
4. Homocystinuria
5. Idiopathic; isolated finding
6. Marfan S.
7. Myotonic dystrophy
8. Newborn with respiratory distress (eg, infantile respiratory distress S.)
9. Osteogenesis imperfecta
10. Osteomalacia
11. Turner S.

UNCOMMON
1. Aarskog S.
2. Coffin-Lowry S.

References

(continued)
3. Cowden S. (multiple hamartoma S.)
4. Cutis laxa
5. F syndrome
6. Freeman-Sheldon S. (whistling face S.)
7. Gorlin S. (nevoid basal cell carcinoma S.)
8. LEOPARD S. (multiple lentigenes S.)
9. Mitral valve prolapse syndrome (MVPS)
10. Noonan S.
11. Osteodysplasty (Melnick-Needles S.)
12. Prune-belly S. (Eagle-Barrett S.)
13. 3-M syndrome
14. Trauma with flail chest

References

EROSION, SCLEROSIS, AND/OR FUSION OF THE STERNOMANUBRIAL SYNCHONDROSIS OR STERNOClavicular JOINTS

COMMON
1. Ankylosing spondylitis
2. Degenerative arthritis
3. Posttraumatic; postsurgical
4. Psoriatic arthritis
5. Rheumatoid arthritis (esp. juvenile)

UNCOMMON
1. Congenital fusion anomaly
2. Enteropathic arthritis
3. Fluorosis
4. Infection (pyogenic; tuberculous)
5. Reiter S.
6. Relapsing polychondritis

Common
1. Achondroplasia (elbow)
2. Arthrogryposis
3. Bony exostoses or synostoses around a joint
(See D-114, D-115)
4. Mucopolysaccharidoses; mucolipidoses (See J-4)
5. Neuromuscular disorders (eg, Duchenne muscular dystrophy)
6. Radioulnar synostosis syndromes (See D-163)

Uncommon
1. Aase-Smith S.
2. Acrocephalosyndactyly (Apert type)
3. Antley-Bixler S.
4. Aplasia cutis congenita
5. Cerebro-oculo-facio-skeletal S. (Pena-Shokeir S. type II)
6. Chondrodysplasia punctata, severe (Conradi-Hünermann and rhizomelic types)
7. Chondroectodermal dysplasia (Ellis-van Creveld S.)
8. Cockayne S.
9. Contractural arachnodactyly
10. Brachmann-de Lange S. (de Lange S.) (elbow)
11. Diabetes, juvenile
12. Diastrophic dysplasia
13. Dyggve-Melchior-Clausen dysplasia
14. Dyschondrosteosis; Madelung deformity (elbow, wrist)
15. Dysplasia epiphysealis hemimelica (Trevor disease)

Reference
<table>
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<tr>
<th>No.</th>
<th>Condition</th>
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<tr>
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<td>Dyssegmental dysplasia</td>
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<td>17.</td>
<td>Fabry disease</td>
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<td>18.</td>
<td>Familial dwarfism with stiff joints</td>
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<td>19.</td>
<td>Farber disease (disseminated lipogranulomatosis)</td>
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<td>20.</td>
<td>Femoral hypoplasia—unusual facies S.</td>
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<td>21.</td>
<td>Fetal akinesia deformation sequence (Pena-Shokeir S. type I)</td>
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<td>22.</td>
<td>Fetal alcohol S.</td>
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<td>23.</td>
<td>Fibrodysplasia (myositis) ossificans progressiva</td>
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<td>24.</td>
<td>Freeman-Sheldon S. (whistling face S.)</td>
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<td>25.</td>
<td>Frontometaphyseal dysplasia</td>
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<td>26.</td>
<td>Geleophysic dysplasia</td>
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<td>27.</td>
<td>GM, gangliosidosis</td>
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<td>28.</td>
<td>Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)</td>
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<td>29.</td>
<td>Infantile multisystem inflammatory disease (NOMID)</td>
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<td>30.</td>
<td>Kniest dysplasia</td>
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<td>31.</td>
<td>Kuskokwim S.</td>
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<td>32.</td>
<td>Léri’s pleonosteosis</td>
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<td>33.</td>
<td>Macrodytrosphoria lipomatosa</td>
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<td>34.</td>
<td>Marden-Walker S.</td>
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<td>35.</td>
<td>Melorheostosis</td>
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<td>36.</td>
<td>Mesomelic dysplasia (Nievergelt type)</td>
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<td>37.</td>
<td>Metaphyseal chondrodysplasia (Jansen and other types)</td>
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<td>38.</td>
<td>Metatropic dysplasia</td>
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<td>40.</td>
<td>Multiple epiphyseal dysplasia (Fairbank) (hip)</td>
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<td>41.</td>
<td>Multiple synostosis S.</td>
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<td>42.</td>
<td>Nail-patella S. (osteonychodysplasia)</td>
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<td>43.</td>
<td>Osteogenesis imperfecta (incl. Bruck S.)</td>
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<td>Otopalatodigital S. (elbow)</td>
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<td>45.</td>
<td>Pachydermoperiostosis</td>
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<td>46.</td>
<td>Parastreptommaic dysplasia</td>
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<td>47.</td>
<td>Popliteal pterygium S.</td>
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<td>48.</td>
<td>Progeria</td>
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<td>49.</td>
<td>Progressive pseudorheumatoid chondrodysplasia</td>
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<td>Pseudoachondroplasia (pseudochondrodplastic spondyloepiphyseal dysplasia)</td>
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<td>Pseudadiastrophic dysplasia</td>
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<td>52.</td>
<td>Rigid spine S.</td>
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<td>53.</td>
<td>Schwartz-Jampel S. (chondrodystrophic myotonia)</td>
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<td>54.</td>
<td>Seckel S. (bird-headed dwarfism)</td>
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<td>55.</td>
<td>Spondyloepimetafphyseal dysplasias</td>
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<td>56.</td>
<td>Spondyloepiphysyeal dysplasia tarda</td>
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<td>57.</td>
<td>Spondylometaphyseal dysplasia</td>
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<td>58.</td>
<td>Stickler S. (arthro-ophthalmopathy)</td>
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<td>59.</td>
<td>Symphalangism-surdity S. (symphalangism-brachydactyly S. or WL S.)</td>
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<td>60.</td>
<td>Trisomy 8 S.</td>
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<td>61.</td>
<td>Trisomy 13 S. (fingers)</td>
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<td>62.</td>
<td>Trisomy 18 S.</td>
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<td>63.</td>
<td>Weill-Marchesani S.</td>
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<td>64.</td>
<td>Winchester S.</td>
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<td>65.</td>
<td>XXXXX S.; XXXXY S. (radioulnar synostosis)</td>
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<tr>
<td>66.</td>
<td>Zellweger S. (cerebrohepatorenal S.) (third and fifth fingers)</td>
</tr>
</tbody>
</table>

**References**


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Gamut D-212

**CONGENITAL SYNDROMES WITH JOINT LAXITY OR HYPERMOBILITY**

**COMMON**

1. Ehlers-Danlos S.
2. Marfan S.
3. Morquio S.
4. Trisomy 21 S. (Down S.)

**UNCOMMON**

1. Aarskog S.
2. Bannayan-Riley-Ruvalcaba S. (Ruvalcaba-Myhre-Smith S.)
3. Coffin-Lowry S.
4. Coffin-Siris S.
5. Cohen S.

(continued)
CONGENITAL SYNDROMES WITH JOINT DISLOCATION OR SUBLUXATION (See D-212)

COMMON
1. Arthrogryposis
2. Congenital dislocation of radial head (See D-165)
3. Developmental dysplasia of the hip—DDH (congenital hip dysplasia or dislocation)
4. Dyschondrosteosis; Madelung deformity (distal ulna)
5. Ehlers-Danlos S.
6. Marfan S.
7. Trisomy 21 S. (Down S.) (hip, elbow)

UNCOMMON
1. Aminopterin fetopathy (hip)
2. Atelosteogenesis
3. Brachmann-de Lange S. (de Lange S.) (elbow)
4. Campomelic dysplasia (hips, radial heads)
5. Cat-eye S. (hip)
6. Coffin-Siris S.
7. Cutis laxa
8. Desbuquois dysplasia
9. Diastrophic dysplasia
10. Fanconi anemia (pancytopenia-dysmelia S.) (hip)
11. Farber disease (disseminated lipogranulomatosis) (hip)
12. Fetal hydantoin S. (Dilantin embryopathy)
13. Fetal trimethadione S.
14. Freeman-Sheldon S. (whistling face S.)
15. Frontometaphyseal dysplasia (radial head)
16. Genu recurvatum (knee)
17. Geroderma osteodysplastica (hip)
18. Hajdu-Cheney S.
19. Humerospinal dysostosis (elbow, knee)
20. Keratosis palmaris et plantaris familiaris (tylosis)
21. Kniesch dysplasia (hip)
22. Larsen S. (elbow, knee, hip)
23. Mesomelic dysplasia (Robinow and Werner types)

References
24. Mucopolysaccharidoses (eg, Morquio S.) (hip, elbow, fingers)
25. Nager acrofacial dysostosis (hip)
26. Nail-patella S. (oste-onychodysplasia)
27. Neurofibromatosis (type I)
28. Noonan S. (elbow)
29. Oculodentoosseous dysplasia (hip)
30. Osteogenesis imperfecta (type I)
31. Otopalatodigital S. (types I and II) (elbow)
32. Pallister-Hall S. (radial head)
33. Potter sequence
34. Pseudoachondroplasia (pseudoachondroplastic spondyloepiphyseal dysplasia) (hip)
35. Pseudodiastrophic dysplasia
36. Pterygium syndromes
37. Riley-Day S. (familial dysautonomia) (hip)
38. Seckel S. (bird-headed dwarfism) (hip)
39. Silver-Russel S. (hip, elbow)
40. Spondyloepimetaphyseal dysplasia with joint laxity
41. Stickler S. (arthro-opthalmopathy)
42. TAR S. (thrombocytopenia-absent radius S.)
43. Trichorhinophalangeal dysplasia, type I (Giedion S.) (radial head, hip)
44. Turner S.
45. XXXXX S. (elbow); XXXXY S. (radial head)

References

MONOARTICULAR JOINT DISEASE

COMMON
1. Avascular necrosis (See D-48)
2. Gout
*3. Infectious arthritis (eg, septic; tuberculous; fungal; Lyme disease)
4. Juvenile chronic arthritis (esp. juvenile rheumatoid arthritis)
5. Osteoarthritis, secondary (eg, trauma; excess wear or mechanical stress; deformity or malalignment)

UNCOMMON
1. Amyloidosis
2. Calcium pyrophosphate dihydrate crystal deposition disease (CPPD); other causes of chondrocalcinosis (occasionally)
3. Neuropathic arthropathy (Charcot joint) (See D-223)
4. Pigmented villonodular synovitis
*5. Regional migratory osteoporosis of legs
*6. Reiter S.
*7. Rheumatoid monoarthritis (rare in adults)
8. Sternocostoclavicular hyperostosis (SAPHO S.)
*9. Sympathetic joint effusion (eg, secondary to neoplasm in adjacent bone)
10. Synovial neoplasm (esp. synovial sarcoma), cyst, or other lesion (See D-238)
11. Synovial chondromatosis
*12. Transient osteoporosis of hips
13. Tumoral calcinosis

* Associated with marked periarticular demineralization.
POLYARTICULAR JOINT DISEASE

COMMON

1. Ankylosing spondylitis
2. Chondrocalcinosis (eg, calcium pyrophosphate dihydrate crystal deposition disease {CPPD})
   (See D-242)
3. Gout
4. Juvenile chronic arthritis (esp. juvenile rheumatoid arthritis)
5. Osteoarthritis, primary or secondary (incl. erosive osteoarthritis)
6. Psoriatic arthritis
7. Reiter S.; Reiter/reactive arthritis
8. Rheumatoid arthritis

UNCOMMON

1. Acromegaly
2. AIDS (HIV)—associated arthritis
3. Amyloidosis
4. Connective tissue disease (collagen disease)
   (eg, lupus erythematosus; scleroderma; CREST S.; dermatomyositis; mixed connective tissue disease
   {MCTD}; polyarteritis nodosa)
5. Diffuse idiopathic skeletal hyperostosis (DISH)
6. Enteropathic arthritis (eg, ulcerative colitis;
   Crohn’s disease; Whipple’s disease)
   (esp. sacroiliitis)
7. Familial Mediterranean fever (familial recurrent polyserositis)
8. Hemochromatosis
9. Hemophilia
10. Infectious arthritis (eg, septic; tuberculous; fungal)
11. Jaccoud’s arthritis (post-rheumatic fever)
12. Kashin-Beck disease
13. Lyme disease
14. Multicentric reticulohistiocytosis (lipoid dermatitis)
15. Neuropathic arthropathy (Charcot joint)
   (See D-223)
16. Ochronosis (alkaptonuria)
17. Regional migratory osteoporosis of legs
18. Relapsing polychondritis
19. Sarcoidosis
20. Sjögren S.
21. Smallpox residual (esp. elbows)
22. Sternocostoclavicular hyperostosis (SAPHO S.)
23. Viral synovitis, transient (eg, rubella; mumps;
   serum hepatitis)
24. Wilson disease (hepatolenticular degeneration)

* Associated with periarticular demineralization.

ARTHRITIS OCCURRING PREDOMINANTLY IN MEN

1. AIDS (HIV)—associated arthritis
2. Ankylosing spondylitis
3. Diffuse idiopathic skeletal hyperostosis (DISH)
4. Gout
5. Hemophilia
6. Ochronosis (alkaptonuria)
7. Psoriatic arthritis
8. Reiter S.

TRANSIENT ARTHRITIS OR ARTHRALGIAS

1. Behçet S.
2. Connective tissue disease (collagen disease)
   (eg, lupus erythematosus; scleroderma; CREST S.; dermatomyositis; mixed connective tissue disease
   {MCTD}; polyarteritis nodosa)
3. Enteropathic arthritis (eg, ulcerative colitis; Crohn’s disease; Whipple’s disease)
   (esp. sacroiliitis)
4. Jaccoud’s arthritis (post-rheumatic fever)
5. Lyme disease
6. Regional migratory osteoporosis of legs
7. Relapsing polychondritis
8. Sarcoidosis
9. Sjögren S.
10. Transient osteoporosis of hips
11. Viral (eg, rubella; mumps; serum hepatitis; AIDS)

* Transient episodes of arthritic symptoms and/or joint effusions that usually subside without residual joint damage.

Reference

Gamut D-218
RHEUMATOID-LIKE ARTHRITIS

COMMON
1. Ankylosing spondylitis
2. Erosive osteoarthritis, acute
3. Gout
4. Juvenile chronic arthritis (See D-219-S)
5. Lupus erythematosus
6. Psoriatic arthritis
7. Reiter S.; Reiter/reactive arthritis
8. Scleroderma; CREST S.
9. Sudeck’s atrophy

UNCOMMON
1. Dermatomyositis
2. Enteropathic arthritis (eg, ulcerative colitis; Crohn’s disease; Whipple’s disease)
3. Hemochromatosis
4. Jaccoud’s arthritis (post-rheumatic fever)
5. Mixed connective tissue disease (MCTD)
6. Multicentric reticulohistiocytosis (lipoid dermatitis)
7. Sjögren S.

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Gamut D-219-S
CLASSIFICATION OF JUVENILE CHRONIC ARTHRITIS

1. Juvenile-onset adult type (seropositive) rheumatoid arthritis
2. Juvenile chronic arthritis (eg, juvenile rheumatoid arthritis)
   a. Classic systemic disease (Still’s disease)
   b. Polyarticular disease
   c. Pauciarticular or monoarticular disease
3. Juvenile-onset ankylosing spondylitis
4. Psoriatic arthritis
5. Enteropathic arthritis
6. Miscellaneous arthritis

Reference

Gamut D-220
DEGENERATIVE JOINT DISEASE IN A YOUNG ADULT (PREMATURE OSTEOARTHRITIS)

COMMON
1. Acromegaly
2. Avascular necrosis (See D-48)
3. Calcium pyrophosphate dihydrate crystal deposition disease (CPPD)
4. Chondromalacia of patella
5. Developmental dysplasia of the hip—DDH (congenital hip dysplasia or dislocation)
6. Diffuse idiopathic skeletal hyperostosis (DISH; Forestier’s disease)
7. Erosive osteoarthritis
8. Gout
9. Hemophilia

(continued)
10. Infectious arthritis (septic; tuberculous; fungal; smallpox residual)
11. Juvenile chronic arthritis
12. Neuropathic arthropathy (Charcot joint)
13. Obesity; mechanical stress; malalignment
14. Rheumatoid arthritis (esp. juvenile)
15. Scoliosis
16. Spondylosis deformans
17. Thermal injury (burn; frostbite; electrical)
18. Trauma; postoperative

UNCOMMON
1. Amyloidosis
2. Congenital bone dysplasias
3. Diabetes, juvenile
4. Ehlers-Danlos S.; other causes of joint laxity and subluxation (See D-212, D-213)
5. Exostosis; intra-articular chondroma; dysplasia epiphysealis hemimelica (Trevor disease)
6. Familial Mediterranean fever (familial recurrent polyserositis)
7. Hemochromatosis
8. Hydroxyapatite deposition disease (HADD)
9. Idiopathic
10. Jackhammer operator’s (driller’s) disease of wrists
11. Kashin-Beck disease
12. Macrodystrophia lipomatosa
13. Multiple epiphyseal dysplasia (Fairbank)
14. Ochronosis (alkaptonuria)
15. Osteochondritis dissecans
16. Scheuermann disease
17. Slipped capital femoral epiphysis
18. Spondyloepiphyseal dysplasia
19. Wilson disease (hepatolenticular degeneration)

Reference

 Gamut D-221

SECONDARY OSTEOARTHRITIS OF THE HIP

COMMON
1. Avascular necrosis of femoral head
2. Athletic activity in adolescence; abnormal stress forces
3. Coxa vara, incl. idiopathic (See D-187-1 and -2); Otto pelvis
4. Developmental dysplasia of the hip—DDH (congenital hip dysplasia or dislocation)
5. Fracture; subluxation
6. Legg-Perthes disease
7. Previous arthritis (eg, rheumatoid; septic; tuberculous)
8. Slipped capital femoral epiphysis

UNCOMMON
1. Acetabular dysplasia
2. Acromegaly
3. Endocrine disorders
4. Multiple epiphyseal dysplasia (Fairbank)
5. Obesity
6. Ochronosis (alkaptonuria)

Reference
LOCAL COMPLICATIONS OF TOTAL HIP, KNEE, OR OTHER JOINT ARTHROPLASTY

COMMON
1. Aseptic loosening; subsidence
2. Chondrolysis (unipolar arthroplasty only)
3. Dislocation
4. Fracture of bone (due to insufficiency or during surgery)
5. Hematoma
6. Heterotopic bone formation (myositis ossificans)
7. Lucent line (fibrous tissue—no loosening)
8. Phlebitis
9. Polyethylene fracture, wear, or dislocation
10. Small particle disease (eg, granulomatous pseudotumors adjacent to joint replacements) (foreign body reaction)

UNCOMMON
1. Cement extrusion
2. Fracture of prosthesis or cement
3. Greater trochanteric bursitis or separation; nonunion of osteotomy
4. Infection
5. Malpositioned prosthetic components
6. Osteolysis, local
7. Patellar avascular necrosis
8. Prosthesis migration or protrusion
9. Silastic arthropathy
10. Vascular or neurologic impairment

* Hip replacement only.
** Knee replacement only.

References

IMAGING FINDINGS SUGGESTING LOOSENING AND/OR INFECTION OF JOINT ARTHROPLASTY

RADIOGRAPHIC FINDINGS
*1. Bone destruction
2. Cement-bone or metal-cement lucency of > 2mm
3. Cement fracture
4. Component fracture (metal or polyethylene)
5. Development or widening of cement-bone or metal-cement lucency > 2 years after surgery
6. Gas formation in or around joint
7. Increasing metallic bead displacement
8. Intraarticular effusion with extraarticular extension (by sonography)
9. Migration of prosthetic components
10. Motion of components (may require stress views or fluoroscopy to demonstrate)
11. Periosteal reaction
12. Prominent prosthetic subsidence (> 10mm femoral component)

* More commonly associated with infection.
+ Highest accuracy in identifying loosening/infection.
# Ingrowth arthroplasty.

ARTHROGRAPHIC FINDINGS
1. Extension of contrast material in the cement-bone or metal-cement interface
**NEUROPATHIC ARTHRPATHY (INCLUDING CHARCOT JOINT)**

**COMMON**
1. Diabetic myelopathy or neuropathy
2. Syphilis (tabes dorsalis)
3. Syringomyelia
4. Trauma to spinal cord or brain (eg, hemiplegia; paraplegia)

**UNCOMMON**
1. Acrodystrophic neuropathy
2. Alcoholism
3. Amyloid neuropathy
4. Calcium pyrophosphate dihydrate crystal deposition disease (CPPD) (rarely)
5. Charcot-Marie-Tooth S.
6. Congenital disease involving spinal cord (eg, meningomyelocele; diastematomyelia; spina bifida vera)
7. Congenital insensitivity to pain
8. Cushing S.; systemic or local steroid therapy
9. Gangrene
10. Inflammatory disease of spinal cord (eg, arachnoiditis; acute myelitis; poliomyelitis)
11. Leprosy
12. Massive osteolysis (Gorham vanishing bone disease) (rarely)
13. Multiple sclerosis; other neurological diseases
14. Myelopathy of pernicious anemia
15. Neoplasm of spinal cord
16. Peripheral nerve injury
17. Post-renal transplantation
18. Riley-Day S. (familial dysautonomia)

**SCINTIGRAPHIC FINDINGS**
1. Diffuse uptake, especially around all components, suggests infection (> 9 months after surgery)
2. Focal uptake about any component (> 6-9 months after surgery—seen in septic or aseptic loosening)
3. Increased gallium uptake compared to that with bone scintigraphy suggests infection but is insensitive
4. Increased labeled WBC uptake (increased sensitivity for infection—can be false positive at femoral stem tip up to 2 years after surgery)

**References**

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*a. In zone 2 (or multiple zones including 2) about acetabulum (90% accuracy)*
*b. In zone 1 and/or 3 about acetabulum (57% accuracy)*
*c. Greater than 2mm—any zone (95% accuracy)*
+d. Below intertrochanteric line (> 90% accuracy including nuclear medicine arthrography)

2. Lymphatic filling
3. Filling defects in surrounding bursa or fistulous tracts indicate infection

* Acetabular component of total hip replacement only.
+ Femoral component of total hip replacement only.
BILATERAL SYMMETRICAL SACROILIAC JOINT DISEASE

COMMON
1. Ankylosing spondylitis
2. Inflammatory bowel disease (Crohn’s disease; ulcerative colitis; Whipple’s disease)
3. Osteitis condensans ilii
4. Osteoarthritis
5. Psoriatic arthritis
6. Reiter/reactive disease
7. Rheumatoid arthritis

UNCOMMON
1. Behçet S.
2. Familial Mediterranean fever
3. Gout
4. Hyperparathyroidism
5. Juvenile rheumatoid arthritis
6. Mixed connective tissue disease (overlap S.)
7. Relapsing polychondritis
8. SAPHO S.

BILATERAL ASYMMETRICAL SACROILIAC JOINT DISEASE

COMMON
1. Osteoarthritis
2. Psoriatic arthritis
3. Reiter/reactive disease
4. Rheumatoid arthritis

UNCOMMON
1. Behçet S.
2. Familial Mediterranean fever

UNILATERAL SACROILIAC JOINT DISEASE

COMMON
1. Infection
2. Osteoarthritis
3. Psoriatic arthritis
4. Reiter/reactive disease

UNCOMMON
1. Behçet S.
2. Familial Mediterranean fever
3. Gout
4. Juvenile rheumatoid arthritis
5. Mixed connective tissue disease (overlap S.)
6. Relapsing polychondritis
7. Rheumatoid arthritis
8. SAPHO S.
NARROWED JOINT SPACE
(Note: Most arthritides cause joint space narrowing in their advanced stages)

COMMON
1. Ankylosing spondylitis
2. Avascular necrosis (See D-48)
3. Degenerative arthritis, primary or secondary (eg, posttraumatic)
4. Erosive osteoarthritis
5. Juvenile chronic arthritis (esp. juvenile rheumatoid arthritis)
6. Other chronic arthritides in their more advanced stages (eg, gout; enteropathic; neuropathic; lupus erythematosus; scleroderma; tuberculous; fungal)
7. Psoriatic arthritis
8. Rheumatoid arthritis
9. Septic arthritis

UNCOMMON
1. Calcium pyrophosphate dihydrate crystal deposition disease (CPPD)
2. Farber disease (disseminated lipogranulomatosis)
3. Hemophilic arthropathy; other bleeding disorders
4. Pigmented villonodular synovitis
5. Postoperative (eg, repair of slipped capital femoral epiphysis)
6. Reiter S.; Reiter/reactive arthritis
7. Sarcoidosis
8. Smallpox residual
9. Sternocostoclavicular hyperostosis (SAPHO S.)
10. Stickler S. (arthro-ophthalmopathy)
11. Synovial neoplasm (esp. hemangioma)
12. Winchester S.

References

WIDENED JOINT SPACE
(Note: Many arthritides cause joint widening in their early stages)

COMMON
1. Congenital syndromes with joint laxity or subluxation (eg, neuromuscular disorders) (See D-212, D-213)
2. Developmental dysplasia of the hip (DDH) or other joints
3. Hemarthrosis (eg, trauma; hemophilia or other bleeding disorder)
4. Legg-Perthes disease, early
5. Septic arthritis, early
6. Serous effusion (eg, rheumatoid arthritis; connective tissue disease (collagen disease); tuberculous arthritis)
7. Toxic (transient) synovitis, severe
8. Traumatic dislocation

UNCOMMON
1. Acromegaly (cartilage hypertrophy)
2. Inflammatory synovial thickening
   a. Rheumatoid arthritis
   b. Gout
   c. Tuberculous or fungal arthritis
   d. Hemophilic arthropathy
   e. Farber disease (disseminated lipogranulomatosis)
   f. Pigmented villonodular synovitis
3. Ligamentum teres rupture; retained cartilage fragment (hip)
4. Multicentric reticulohistiocytosis (lipoid dermatopathy)
5. Neuropathic arthropathy (atrophic type with bone resorption)
6. Sarcoidosis
7. Synovial chondromatosis
8. Synovial neoplasm (esp. hemangioma)
References

Gamut D-227

JOINT EFFUSION

COMMON
1. Gout
2. Infectious arthritis (septic; tuberculous; fungal; Lyme disease)
3. Psoriatic arthritis
4. Reiter S.; Reiter/reactive arthritis
5. Rheumatoid arthritis (incl. juvenile)
6. Synovitis (acute or chronic)
7. Trauma with hemorrhage

UNCOMMON
1. Allergic reaction (eg, drugs; insect bite)
2. Bone neoplasm, primary or metastatic
3. Calcium pyrophosphate dihydrate crystal deposition disease (CPPD)
4. Hemophilia or other bleeding disorder
5. Juvenile chronic arthritis
6. Leukemia; lymphoma
7. Neuropathic arthropathy (Charcot joint) (See D-223)
8. Pigmented villonodular synovitis
9. Rheumatic fever (acute)
10. Synovial chondromatosis
11. Synovial neoplasm (esp. hemangioma)

References

Gamut D-228

ARTHRITIS WITH OSTEOPOROSIS*

COMMON
1. Rheumatoid arthritis (incl. juvenile)
2. Septic arthritis

UNCOMMON
1. AIDS (HIV)-associated arthritis
2. Amyloidosis
3. Dermatomyositis; polymyositis
4. Enteropathic arthritis (eg, ulcerative colitis; Crohn’s disease; Whipple’s disease)
5. Familial Mediterranean fever (familial recurrent polyserositis)
6. Fungal arthritis; mycetoma
7. Hemophilia
8. Juvenile chronic arthritis
9. Lupus erythematosus (late)
10. Lyme disease
11. Mixed connective tissue disease (MCTD)
12. [Regional migratory osteoporosis of legs]
13. Reiter S. (acute); Reiter/reactive arthritis
14. Scleroderma
15. Sjögren S.
16. [Sudeck’s atrophy]
17. Transient osteoporosis of the hips
18. Tuberculous arthritis

* All arthritis in late chronic stages may have osteoporosis.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
ARTHRITIS WITH LITTLE OR NO OSTEOPOROSIS*

COMMON
1. Ankylosing spondylitis
2. Calcium pyrophosphate dihydrate crystal deposition disease (CPPD)
3. Diffuse idiopathic skeletal hyperostosis (DISH)
4. Gout
5. Neuropathic arthropathy (Charcot joint) (See D-223)
6. Osteoarthritis (degenerative, traumatic, erosive)
7. Psoriatic arthritis

UNCOMMON
1. Amyloidosis
2. Jaccoud’s arthritis (post-rheumatic fever)
3. Lupus erythematosus (early)
4. Multicentric reticulohistiocytosis (lipoid dermatitis)
5. Pigmented villonodular synovitis
6. Reiter S. (chronic or recurrent); Reiter/reactive arthritis
7. Sarcoidosis

* All arthritis in late chronic stages may have osteoporosis.

ARTHRITIS WITH “SWAN-NECK” DEFORMITY*

COMMON
1. Jaccoud’s arthritis (post-rheumatic fever)
2. Lupus erythematosus
3. Mixed connective tissue disease (MCTD)
4. Psoriatic arthritis
5. Rheumatoid arthritis
6. Scleroderma
7. Trauma

* Extension at the PIP joint and flexion at the DIP joint of a finger.

Reference
**Gamut D-232**

**ARTHITIS ASSOCIATED WITH PERIOSTITIS OR OTHER NEW BONE PRODUCTION***

**COMMON**
1. Ankylosing spondylitis (bony whiskering)
2. Gout (overhanging edges)
3. Juvenile chronic arthritis (esp. juvenile rheumatoid arthritis)
4. Psoriatic arthritis
5. Reiter S.; Reiter/reactive arthritis
6. Rheumatoid (carpus and tarsus)
7. Septic arthritis

**UNCOMMON**
1. AIDS (HIV)-associated arthritis
2. Enteropathic arthritis (rarely)
3. Fungus disease; mycetoma
4. Hemophilia
5. Hypertrophic osteoarthopathy
6. Sternotostoclavicular hyperostosis (SAPHO S.)
7. Tuberculosis

* Bone production includes periostitis, whiskering, excrescences and/or osseous ankylosis.

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**Gamut D-233**

**CALCANEAL SPUR (PLANTAR SURFACE)**

*1. Ankylosing spondylitis
2. Diffuse idiopathic skeletal hyperostosis (DISH)
3. Hypertrophic osteoarthritis (esp. from running or other chronic trauma)
4. Idiopathic
5. Plantar fasciitis
*6. Psoriatic arthritis
*7. Reiter S.; Reiter/reactive arthritis

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**Gamut D-234**

**CALCANEAL BONE RESORPTION (PLANTAR OR POSTERIOR SURFACE)**

**COMMON**
1. Psoriatic arthritis
2. Reiter S.
3. Rheumatoid arthritis

**UNCOMMON**
1. Ankylosing spondylitis
2. Gout
3. Hyperparathyroidism
4. Multicentric reticulohistiocytosis (lipoid dermatitis)
5. Osteomyelitis; decubitus ulcer

* Usually a fluffy rather than sharp spur.

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**Gamut D-235**

**ARTHRITIS WITH SOFT TISSUE NODULES***

**COMMON**
1. Gout
2. Rheumatoid arthritis (incl. rheumatoid nodulosis)

**UNCOMMON**
1. Amyloidosis
2. Multicentric reticulohistiocytosis (lipoid dermatitis)

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*8. Rheumatoid arthritis
*9. Sternotostoclavicular hyperostosis (SAPHO S.)

* Bone production includes periostitis, whiskering, excrescences and/or osseous ankylosis.
3. Pigmented villonodular synovitis
4. Sarcoidosis
5. Xanthomas (esp. with hyperlipidemia)

* Nodular or “lumpy-bumpy” arthritis.

Reference

Gamut D-236

SOFT TISSUE MASS ABOUT A JOINT

COMMON
1. Aneurysm; arteriovenous fistula
2. Bunion (esp. great toe)
3. Bursal fluid collection; bursitis
4. Calcific tendonitis
5. Fluid or blood in joint
6. Ganglion
7. Gouty tophus
8. Infection (esp. abscess)
9. Myositis ossificans
10. Neuropathic arthropathy (Charcot joint) (See D-223)
11. Osteoarthritis with Heberden/Bouchard nodes or mucoid cyst
12. Periarticular calcification (eg, connective tissue disease; secondary hyperparathyroidism) (See D-243)
13. Synovial cyst (eg, Baker cyst) (See D-237)
14. Synovial hypertrophy secondary to arthritis
15. Synovial chondromatosis or osteochondromatosis

UNCOMMON
1. Amyloidosis
2. Calcium pyrophosphate dihydrate crystal deposition disease (CPPD) (tophaceous pseudogout)
3. Chondroma, articular or para-articular
4. Hydatid disease
5. Lipoma; lipoma arborescens
6. Meniscal cyst; perilabral cyst
7. Multicentric reticulohistiocytosis (lipoid dermatitis)
8. Myxoma (juxtaarticular type)
9. Neuroma
10. Parosteal sarcoma (esp. osteosarcoma or chondrosarcoma); other parosteal neoplasm (See D-88)
11. Pigmented villonodular synovitis
12. Synovial hemangioma
13. Synovial sarcoma
14. Synovitis, localized nodular (giant cell tumor of tendon sheath; xanthoma)
15. Tumoral calcinosis

Gamut D-237

POPLITEAL (BAKER) CYST

COMMON
1. Chronic joint effusion (any cause)
2. Internal derangement of knee (meniscal tear; cruciate tear; intraarticular loose body)
3. Osteoarthritis
4. Rheumatoid arthritis (incl. juvenile)

UNCOMMON
1. Arthritis, other (eg, septic; gout; calcium pyrophosphate dihydrate crystal deposition disease {CPPD}; lupus erythematosus; Reiter S.)
2. Chondromalacia of patella
3. Granulomatous synovitis (eg, tuberculosis; brucellosis)
4. Idiopathic (esp. in adolescent)
5. Osteochondritis dissecans
6. Pigmented villonodular synovitis
7. Sjögren S.

References

Gamut D-238

BENIGN SYNOVIAL LESION INVOLVING A MAJOR JOINT

COMMON
1. Ganglion (intraarticular type)
2. Meniscal cyst; perilabral cyst
3. Pigmented villonodular synovitis
4. Synovial chondromatosis or osteochondromatosis
5. Synovial cyst (eg, Baker cyst) (See D-237)
6. Synovial hypertrophy secondary to arthritis or infection
7. Synovitis, localized nodular

UNCOMMON
1. Amyloidosis (esp. secondary associated with renal failure)
2. Intracapsular chondroma
3. Lipoma; lipoma arborescens
4. Synovial hemangioma

Gamut D-239

BONE LESIONS INVOLVING BOTH SIDES OF A JOINT

COMMON
*1. Arthritic cysts or erosions (eg, degenerative arthritic cysts or geodes; gouty, rheumatoid, neuropathic or psoriatic erosions)
*2. Infection (esp. granulomatous-tuberculosis; fungus disease; mycetoma; sarcoidosis)
3. Metastases
4. Multiple myeloma

UNCOMMON
*1. Amyloidosis
2. Angiomatic lesions (esp. hemangiomatosis or lymphangiomatosis, synovial type)
3. Enchondromas; enchondromatosis (Ollier disease); Maffucci S.
*4. Hemophilia
5. Hereditary multiple exostoses (multiple cartilaginous exostoses; osteochondromatosis)
*6. Hydatid disease
*7. Jackhammer operator’s disease (driller’s disease; vibration S.)
8. Osteopathia striata (Voorhoeve disease)
9. Osteopoikilosis
*10. Pigmented villonodular synovitis
*11. Synovial sarcoma

* With joint involvement.
MULTIPLE FILLING DEFECTS
IN THE KNEE OR OTHER JOINTS
ON ARTHROGRAPHY

COMMON
1. Cartilage or bone fragments from trauma or degenerative joint disease
2. Rheumatoid arthritis
3. Synovial chondromatosis
4. Synovitis (inflammatory, crystal, infectious or non-specific)

UNCOMMON
1. Blood clots; hemophilic arthritis; other bleeding disorder
2. Gouty tophi
3. Lipoma arborescens
4. Neoplasm (eg, synovial hemangioma)
5. Pigmented villonodular synovitis
6. Tuberculosis

Reference

CALCIFIED INTRAARTICULAR
(OPFEN LOOSE) BODY IN A JOINT

COMMON
1. [Chondrocalcinosis (eg, calcium pyrophosphate dihydrate crystal deposition disease {CPPD})] (See D-242)
2. Degenerative arthritis with detached osteochondral fragment
3. Meniscus fragmentation with calcification
4. Neuropathic arthropathy (Charcot joint) with debris (See D-223)
5. Osteochondrosis dissecans (osteocondral fragment or “joint mouse”)
6. Synovial osteochondromatosis
7. Trauma (eg, acute fracture with avulsed fragment in joint; intraarticular (often loose) bodies from old avulsed bone or cartilage fragments)

UNCOMMON
1. [Dysplasia epiphysealis hemimelica (Trevor disease —unilateral intracapsular chondroma involving knee or ankle)]
2. Rheumatoid arthritis, chronic
3. Sequestrum from osteomyelitis, tuberculosis, or septic arthritis
4. [Synovial sarcoma]
5. Synovitis (other causes)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

CHONDROCALCINOSIS
(CALCIFICATION IN ARTICULAR CARTILAGE)*

COMMON
1. Calcium pyrophosphate dihydrate crystal deposition disease (CPPD)
2. Degenerative or posttraumatic osteoarthritis
3. Hemochromatosis
4. Hyperparathyroidism, primary or esp. secondary (renal osteodystrophy)
5. Idiopathic (2% of normals; 3% of elderly)
**UNCOMMON**

1. Acromegaly
2. Chronic pyarthrosis; osteomyelitis
3. Diabetes
4. Gout
5. Hydroxyapatite deposition disease (HADD)
6. Hypophosphatasia
7. Ochronosis (alkaptonuria)
8. Oxalosis
9. Pseudoxanthoma elasticum
10. Wilson disease

* Calcium may be calcium pyrophosphate, calcium hydroxyapatite, or calcium orthophosphate.

**References**

4. Jensen PS, Putman CE: Current concepts with respect to chondrocalcinosis and the pseudogout syndrome. AJR 1975; 123:531–539

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**Gamut D-243**

PERIARTICULAR OR INTRAARTICULAR CALCIFICATION
(See D-241, 242)

**COMMON**

+1. Degenerative arthritis (intraarticular osteochondral fragment or “joint mouse”)
2. Calcium pyrophosphate dihydrate crystal deposition disease (CPPD); other causes of chondrocalcinosis (See D-242)
3. Gout

*4. Hyperparathyroidism; renal osteodystrophy (secondary hyperparathyroidism)
5. Myositis ossificans
+6. Neuropathic arthropathy (Charcot joint) (See D-223); paraplegia; paralysis
+7. Osteochondroses dissecans (intraarticular osteochondral fragment or “joint mouse”)
8. Periostitis calcarea (calcific synovitis, bursitis, tendonitis
+9. Posttraumatic (eg, Pellegrini-Stieda disease; avulsed fracture fragment; meniscus fragmentation with calcification)
10. Scleroderma; CREST S.
+11. Synovial osteochondromatosis
12. Vascular (eg, arteriosclerosis; aneurysm; varix)

**UNCOMMON**

1. Acromegaly
2. Burn
3. Calcinosis circumscripta, usually with connective tissue disease (collagen disease)
4. Calcinosis interstitialis universalis
5. Chondrodysplasia punctata
6. Dermatomyositis
7. Diabetes
8. Dysplasia epiphysealis hemimelica (Trevor disease); intracapsular chondroma
9. Fluorosis
10. GM₁ gangliosidosis
11. Hematoma, traumatic or spontaneous; hemophilia
+12. Hemochromatosis
*13. Hemodialysis, chronic (therapy for renal failure with 1-α-OHD₃)
14. Hydroxyapatite deposition disease (HADD)
15. Hypervitaminosis D
16. Hypoparathyroidism
17. Hypothyroidism (stippling before ossification)
18. Lupus erythematosus
19. Metastatic calcification
*20. Milk-alkali S.
21. Mixed connective tissue disease (MCTD)
22. Multiple endocrine neoplasia (MEN) S. (type IIA)
23. Ochronosis (alkaptonuria)

(continued)
24. Osteochondroma; spur
25. Parosteal sarcoma (eg, osteosarcoma; chondrosarcoma)
+26. Rheumatoid arthritis
27. Sarcoidosis
28. Septic arthritis
29. Synovial sarcoma
30. Tuberculous arthritis (healed)
*31. Tumoral calcinosis (bursa)
32. Warfarin embryopathy
33. Werner S.
34. Widespread bone destruction (eg, metastatic disease)
35. Wilson disease
36. Zellweger S. (cerebrohepatorenal S.) (hip)

* May show calcium-fluid levels.
+ Usually intraarticular.

References

Gamut D-245-1
CALCIFICATION IN THE MUSCLES AND SUBCUTANEOUS TISSUES—SYSTEMIC OR WIDESPREAD (See D-247–249)

COMMON
1. Dermatomyositis
2. Gout; hyperuricemia
3. Hyperparathyroidism; renal osteodystrophy (secondary hyperparathyroidism)
4. Hypervitaminosis D
5. Immobilization osteoporosis (eg, paralysis; paraplegia; poliomyelitis)
6. Ligamentous or tendonous (eg, DISH; Reiter S; rheumatoid arthritis; ankylosing spondylitis; psoriatic arthritis; hypervitaminosis A; SAPHO S.) (See D-246-2)
7. Lymph nodes (esp. tuberculosis) (See D-249)
8. Scleroderma; CREST S.; acrosclerosis
9. Vascular—arterial or venous (See D-247)

UNCOMMON
1. Calcinosis universalis
2. Calcium pyrophosphate dihydrate crystal deposition disease (CPPD) (tobaceous pseudogout)
3. Carbon monoxide poisoning
4. Congenital fibromatosis (esp. aponeurotic type)
5. Connective tissue disease (collagen disease), other (lupus erythematosus; MCTD; polymyositis)
6. Copper deficiency, nutritional; Menkes S. (kinky-hair S.)

Gamut D-244
SOFTWARE TISSUE OSSIFICATION

COMMON
1. Myositis ossificans (heterotopic bone formation)
2. Paraplegia; other neuropathic states with prolonged immobilization
3. Posttraumatic degenerative arthritis with ossified debris and osteochondral bodies in and around a joint (esp. hip, knee, ankle)
4. Surgical scar; post-major joint replacement
5. Synovial osteochondromatosis (joint)

UNCOMMON
1. Burn, severe
2. Chondroma
3. Chondrosarcoma (soft tissue or juxtacortical)
4. Fibrodyplasia (myosis) ossificans progressiva
5. Osteosarcoma (soft tissue or parosteal)

Gamut D-244
SOFTWARE TISSUE OSSIFICATION

COMMON
1. Myositis ossificans (heterotopic bone formation)
2. Paraplegia; other neuropathic states with prolonged immobilization
3. Posttraumatic degenerative arthritis with ossified debris and osteochondral bodies in and around a joint (esp. hip, knee, ankle)
4. Surgical scar; post-major joint replacement
5. Synovial osteochondromatosis (joint)
7. Cystic fibrosis (mucoviscidosis) (eg, metastatic calcification)
8. Ehlers-Danlos S.
9. Epidermal nevus S.
10. Epidermolysis bullosa
11. Fat necrosis (pancreatitis; Weber-Christian disease —panniculitis; neonatal subcutaneous fat necrosis—pseudosclerema)
12. Fibrodysplasia (myosis) ossificans progressiva
13. Fibrogenesis imperfecta ossium
14. Fluorosis
15. Gorlin S. (nevoid basal cell carcinoma S.)
16. Homocystinuria (vascular)
17. Hydroxyapatite deposition disease (HADD)
18. Hypoparathyroidism; pseudohypoparathyroidism; pseudopseudohypoparathyroidism
19. Leprosy (nerves)
20. Lipomatosis
21. Maffucci S.
22. Milk-alkali S.
23. Oxalosis
24. Pachydermoperiostosis
25. Parasites (eg, cysticerci; guinea worms; Loa loa; hydatid cysts)
26. Porphyria
27. Progeria; Werner S.
28. Pseudoxanthoma elasticum
29. Rothmund-Thomson S.
30. Widespread bone destruction with hypercalcemia (eg, metastases; myeloma; leukemia)
31. Williams S. (idiopathic hypercalcemia)

References

Gamut D-245-2

CALCIFICATION IN THE MUSCLES AND SUBCUTANEOUS TISSUES—LOCALIZED (See D-246–251)

COMMON
1. Calcinosis circumscripta (esp. with scleroderma or other connective tissue disease (collagen disease)
2. Fracture with avulsed fragment
3. Idiopathic; physiologic
4. Injection or inoculation (eg, calcified sterile abscess or fat necrosis; antibiotic, bismuth, calcium gluconate, insulin, camphorated oil, or quinine injection; BCG vaccination)
5. Ligamentous or tendonous (eg, DISH; Reiter S.; rheumatoid arthritis; ankylosing spondylitis; psoriatic arthritis) (See D-246-2)
6. Lymph nodes (esp. tuberculosis) (See D-249)
7. Myositis ossificans (posttraumatic; postoperative—esp. after total hip or knee replacement; or in paraplegia—esp. around hip); calcified hematoma
8. Peritendinitis calcarea (calcific bursitis or tendonitis)
9. Vascular—arterial or venous (See D-247)

UNCOMMON
1. Epithelioma
2. Foreign body granuloma
3. Healing infection or abscess (eg, tuberculosis; pyogenic myositis or fibrositis)
4. Leprosy (nerves)
5. Melorheostosis
6. Neoplasm, benign (eg, hemangioma; lipoma; chondroma; fibromyxoma; leiomyoma; xanthoma)
7. Neoplasm, malignant (eg, soft tissue or parosteal osteosarcoma or chondrosarcoma; malignant fibrous histiocytoma; fibrosarcoma; liposarcoma; synovial sarcoma)
8. Parasite (eg, guinea worm; Loa loa; hydatid cyst)
9. Radiation therapy
10. Scar
11. Singleton-Merten S. (subungual; forearm)
12. Thermal injury (eg, burn; frostbite; electrical)
13. Tumoral calcinosis
14. Volkmann ischemic contracture

References

Gamut D-246-1

CALCIFICATION IN A BURSA

1. Bursal osteochondromatosis
2. Calcific bursitis
3. Calcium pyrophosphate dihydrate crystal deposition disease (CPPD) (tophaceous pseudogout)
4. Gout
5. Hyperparathyroidism
6. Hypervitaminosis D
7. Kikuya bursa (Africa)
8. Tumoral calcinosis

Reference

Gamut D-246-2

CALCIFICATION IN A TENDON OR LIGAMENT

COMMON
1. Ankylosing spondylitis
2. Avulsive trauma (incl. medial collateral ligament of knee {Pellegrini-Stieda disease})
3. Calcium pyrophosphate dihydrate crystal deposition disease (CPPD)
4. Degenerative change, physiologic (eg, Cooper’s ligament; ligamentum nuchae)
5. Diffuse idiopathic skeletal hyperostosis (DISH)
6. Idiopathic
7. Peritendinitis calcarea (esp. supraspinatus)
8. Psoriatic arthritis
9. Reiter S.; Reiter/reactive arthritis
10. Sternocostoclavicular hyperostosis (SAPHO S.)

UNCOMMON
1. Calcinosi universalis
2. Fibrodysplasia (myositis) ossificans progressiva
3. Fibromatosis (esp. multicentric infantile myofibromatosis and aponeurotic type)
4. De Quervain’s disease (rare)
5. Diabetes
6. Fluorosis
7. Ganglion (rare)
8. Gout
9. Hypervitaminosis A and D (including cis-retinoic acid)
10. Ochronosis (alkaptonuria)
11. Pyoderma gangrenosum
12. Renal osteodystrophy (secondary hyperparathyroidism)
13. Rheumatoid arthritis

Reference
CALCIFICATION IN A NERVE

1. Leprosy
2. Neurofibromatosis

Reference

VASCULAR CALCIFICATION

COMMON
1. Aneurysm
2. Arteriosclerosis
3. Hemangioma; arteriovenous malformation
4. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
5. Mönckeberg’s medial sclerosis
6. Phleboliths (eg, normal; varicose veins; hemangioma; Maffucci S.)
7. Premature atherosclerosis
   a. Familial hyperlipemia
   b. Generalized (idiopathic) arterial calcification of infancy
   c. Osteogenesis imperfecta
   d. Progeria
   e. Secondary hyperlipemia
      i. Congenital total lipodystrophy (lipodystrophic diabetes)
      ii. Cushing S.
      iii. Diabetes
      iv. Glycogen storage disease
      v. Hypothyroidism
      vi. Nephrotic S.
      vii. Renal homotransplantation
   f. Werner S.

UNCOMMON
1. Buerger disease (thromboangiitis obliterans)
2. Calcified thrombus (eg, vena cava; portal vein; left atrium; pulmonary artery; peripheral artery; Leriche S.)
3. Cystic fibrosis (mucoviscidosis)
4. Gout; hyperuricemia
5. Homocystinuria
*6. Hypervitaminosis D
7. Hypoparathyroidism
*8. Immobilization
*9. Milk-alkali S.
10. Ochronosis (alkaptonuria)
11. Oxalosis
12. Pseudoxanthoma elasticum
13. Radiation therapy
14. Raynaud disease
*15. Sarcoidosis
16. Takayasu arteritis
17. Thermal injury (eg, burn; frostbite)
*18. Widespread bone destruction (eg, metastatic disease)
*19. Williams S. (idiopathic hypercalcemia)
* Hypercalcemia.

References
CALCIFICATION ABOUT THE FINGERTIPS

COMMON
1. Scleroderma (incl. CREST S.; acrosclerosis)

UNCOMMON
1. Calcinosi...
SOFT TISSUE MASS WITH UNDERLYING BONE EROSION OR DESTRUCTION

COMMON
1. Abscess; cellulitis
2. Aneurysm (esp. aorta)
3. Carcinoma of skin or mouth
4. Decubitus ulcer
5. Gouty tophus
6. Rheumatoid arthritis

UNCOMMON
1. Amyloidosis (esp. secondary, associated with chronic renal failure)
2. Angiomatous lesion (hemangioma; lymphangioma; arteriovenous fistula)
3. Bacillary angiomasisis
4. Carcinoma developing in sinus tract of chronic osteomyelitis or tropical ulcer
5. Chondroma (soft tissue)
6. Ewing sarcoma / PNET (extraskeletal)
7. Fibromatosis (esp. multicentric infantile myofibromatosis)
8. Fungus disease (eg, actinomycosis; blastomycosis)
9. Ganglion (esp. periosteal type)
10. Glomus tumor
11. Hemophilia or other bleeding disorder
12. Keratosis palmaris et plantaris familiaris (tylosis)
13. Kaposi sarcoma
14. Lymph node (benign or malignant)
15. Malignant fibrous histiocytoma; fibrosarcoma
16. Meningioma
17. Multicentric reticulohistiocytosis (lipoid dermatitis)
18. Neurofibroma; neurofibromatosis (type 1)
19. Neuroma (eg, Morton neuroma of toe)
20. Nodular synovitis; giant cell tumor of tendon sheath
21. Parachordoma
22. Parosteal sarcoma or other neoplasm (See D-88)
23. Pigmented villonodular synovitis
24. Sarcoidosis
25. Synovial chondromatosis (incl. bursal/tenosynovial types)
26. Schwannoma (neurilemmoma)
27. Sebaceous or other cyst
28. Soft tissue sarcoma (chondrosarcoma; osteosarcoma)
29. Sternocostoclavicular hyperostosis (SAPHO S.)
30. Surfer’s knot
31. Synovial sarcoma
32. Tumoral calcinosis (primary or secondary associated with renal disease)
33. Xanthomas (multiple, associated with hyperlipidemia type)

* Rare causes.
MUSCULOSKELETAL LESIONS WITH PROMINENT SURROUNDING EDEMA (CT, MRI)

COMMON
1. Fasciitis
2. Hematoma, acute
3. Infection (osteomyelitis; cellulitis; pyomyositis; abscess)
4. Myositis ossificans
5. Osteoblastoma
6. Osteoid osteoma
7. Popliteal cyst, ruptured
8. Primary bone tumor with pathologic fracture
9. Soft tissue metastasis

UNCOMMON
1. Bursitis
2. Gouty tophus
3. Primary bone or soft tissue sarcoma
4. Synovitis, noninfective

MUSCULOSKELETAL LESIONS WITH PREDOMINANT LOWER SIGNAL ON T2-WEIGHTED MRI*

COMMON
1. Chronic hematoma
2. Dermatofibrosarcoma protuberans (DFSP)
3. Ewing sarcoma/PNET
4. Fibromatosis
5. Fibrous dysplasia (20–40% of cases)
6. Giant cell tumor
7. Gout
8. Lymphoma
9. Osteosarcoma
10. Pigmented villonodular synovitis

UNCOMMON
1. Amyloid (esp. secondary)
2. Brown tumor of hyperparathyroidism
3. Clear cell sarcoma
4. Extensively mineralized mass
5. Granular cell tumor
6. Granuloma annulare
7. Leiomyoma
8. Malignant fibrous histiocytoma/fibrosarcoma
9. Metastases
10. Multiple myeloma
11. Nodular synovitis (giant cell tumor of tendon sheath)

CLASSIFICATION OF SOFT TISSUE TUMORS

BENIGN

Muscle
Leiomyoma
Leiomyoblastoma
Leiomyosarcoma
Rhabdomyoblastoma
Rhabdomyoma

Fat
Lipoma and lipoma variants
Lipomatosis
Lipoblastoma
Liposarcoma
Hibernoma
Fibrolipomatous hamartoma of nerve

Fibrous Connective Tissue
Nodular fasciitis
Proliferative fasciitis
Proliferative myositis
Fibroma (tendon sheath)
Elastofibroma

MALIGNANT

Leiomyosarcoma
Rhabdomyosarcoma
Liposarcoma

* Similar to or equal to fat on non-fat suppressed sequences.
<table>
<thead>
<tr>
<th>BENIGN MALIGNANT</th>
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<tr>
<td><strong>Fibrous Connective Tissue</strong></td>
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<tr>
<td>Ossifying fibromyoid tumor of soft parts</td>
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<tr>
<td>Fibromatoses</td>
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<tr>
<td>Juvenile variants</td>
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<tr>
<td>Myofibromatosis</td>
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<tr>
<td>(multicentric infantile myofibromatosis)</td>
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<tr>
<td>Fibromatosis colli</td>
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<tr>
<td>Fibrous hamartoma of infancy</td>
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<td>Infantile fibromatosis</td>
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<tr>
<td>Infantile digital fibromatosis</td>
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<tr>
<td>Juvenile aponeurotic fibromatosis</td>
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<tr>
<td>Adult variants</td>
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<tr>
<td>Aggressive fibromatoses</td>
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<tr>
<td>Extraabdominal desmoid</td>
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<tr>
<td>Palmar and plantar fibromatosis</td>
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<td>Penile fibromatosis</td>
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<td>Giant cell fibroblastoma</td>
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<td>Idiopathic retroperitoneal fibrosis</td>
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<td>Keloid</td>
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<tr>
<td>Fibrodysplasia (myositis ossificans progressiva)</td>
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<tr>
<td>Calcifying fibrous pseudotumor</td>
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<td><strong>Fibrohistiocytic</strong></td>
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<td>Benign fibrous histiocytoma</td>
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<td>Xanthoma; xanthomatosis</td>
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<td>Atypical fibroxanthoma</td>
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<td>Angiomatoid fibrous histiocytoma</td>
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<td><strong>Peripheral Nerve</strong></td>
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<td>Neurilemmoma (schwannoma)</td>
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<td>Neurofibroma</td>
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<tr>
<td>Neurofibromatosis</td>
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<td>Traumatic neuroma</td>
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<tr>
<td><strong>Peripheral Nerve</strong></td>
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<td>Morton neuroma</td>
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<td>Ganglion of nerve sheath</td>
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<td><strong>Neural Crest</strong></td>
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<td>Granular cell tumor</td>
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<td>Melanotic neuroectodermal tumor of infancy</td>
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<td>Ganglioneuroma</td>
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<td>Pheochromocytoma</td>
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<td>Paraganglioma</td>
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<td>Carotid body tumor</td>
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<td>Malignant granular cell tumor</td>
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<tr>
<td>Neuroblastoma</td>
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<tr>
<td>Ganglioneuroblastoma</td>
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<td>Malignant pheochromocytoma</td>
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<td>Malignant paraganglioma</td>
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<td>Malignant carotid body tumor</td>
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<td>Neuroepithelioma</td>
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<td>Primitive neuroectodermal tumor (PNET)</td>
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<td>Askin tumor (PNET of chest wall)</td>
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<td>Extraskeletal Ewing sarcoma</td>
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<td>Clear cell sarcoma</td>
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<tr>
<td><strong>Synovial</strong></td>
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<tr>
<td>Giant cell tumor of tendon sheath</td>
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<tr>
<td>Pigmented villonodular synovitis</td>
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<td>Synovial cyst; bursitis</td>
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<tr>
<td>Ganglion</td>
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<tr>
<td>Myxoma (juxtaarticular type)</td>
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<tr>
<td>Synovial chondromatosis</td>
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<tr>
<td>Hemangioma (synovial type)</td>
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<td>Xanthoma</td>
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<tr>
<td>Synovial chondrosarcoma</td>
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<tr>
<td>Synovial sarcoma</td>
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<tr>
<td><strong>Angiomatous Lesion (Vascular or Lymphatic)</strong></td>
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<tr>
<td>Hemangioma</td>
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<tr>
<td>Angiomasitis</td>
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<tr>
<td>Angiomatosus syndromes (eg, Maffucci S.; Klippel-Trenaunay S.; Parkes Weber S.)</td>
</tr>
<tr>
<td>Hemangioendothelioma</td>
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<tr>
<td>Hemangiopericytoma</td>
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<td>Glomus tumor</td>
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<td>Angiosarcoma</td>
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<td>Kaposi sarcoma</td>
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<tr>
<td>Pleomorphic hyalinizing angiectatic tumor of soft parts</td>
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<tr>
<td>Malignant hemangiendothelioma</td>
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<td>Malignant hemangiopericytoma</td>
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<tr>
<th>BENIGN</th>
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<tbody>
<tr>
<td><strong>Angiomatous Lesion (Vascular or Lymphatic)</strong></td>
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<tr>
<td>Angiolipoma</td>
<td>Lymphangiosarcoma</td>
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<td>Reactive vascular lesions</td>
<td>Lymphoma&lt;sub&gt;x&lt;/sub&gt; (extranodal)</td>
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<tr>
<td>Lymphangioma, cavernous or cystic</td>
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<tr>
<td>Cystic hygroma</td>
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<tr>
<td>Adventitial cystic disease</td>
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<td>Castleman disease (giant lymph node hyperplasia)</td>
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<tr>
<td><strong>Extraskeletal Osseous and Cartilage</strong></td>
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<tr>
<td>Soft tissue chondroma</td>
<td>Extraskeletal chondrosarcoma</td>
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<td>Osteoma</td>
<td>Extraskeletal osteosarcoma</td>
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<tr>
<td>Myositis ossificans (heterotopic bone formation)</td>
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<tr>
<td>Fibro dysplasia (myositis ossificans progressiva)</td>
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<tr>
<td>Melorheostosis</td>
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<tr>
<td>Giant cell tumor of bone (soft tissue recurrence)</td>
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<tr>
<td>Bizarre parosteal pseudotumor (BPOP)</td>
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<tr>
<td><strong>Uncertain or Mixed Histogenesis</strong></td>
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<tr>
<td>Benign mesenchymoma</td>
<td>Malignant mesenchymoma</td>
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<tr>
<td>Myxoma (intramuscular)</td>
<td>Alveolar soft part sarcoma</td>
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<tr>
<td>Granular cell myoblastoma</td>
<td>Malignant granular cell myoblastoma</td>
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<td>Skin appendage tumors</td>
<td>Skin appendage tumors</td>
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<td>Epithelioid sarcoma</td>
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<td>Malignant mesothelioma</td>
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<td>Parachordoma</td>
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<th>BENIGN</th>
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<tr>
<td><strong>Others, Including Neoplasm Mimics</strong></td>
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<tr>
<td>Primary bone neoplasm invading soft tissue</td>
<td>Primary bone sarcoma invading soft tissue</td>
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<td>Accessory muscle</td>
<td>Malignant teratoma</td>
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<td>Amyloidosis</td>
<td>Metastases</td>
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<td>Aneurysm and pseudoaneurysm</td>
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<td>Arteriovenous malformation or fistula</td>
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<td>Bursal swelling</td>
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<td>Calcific myonecrosis</td>
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<td>Calcific tendinitis</td>
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<td>Cat scratch disease</td>
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<td>Cellulitis; abscess</td>
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<td>Diabetic muscle ischemia</td>
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<td>Epidermal inclusion cyst</td>
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<td>Fasciitis (necrotizing)</td>
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<td>Fungal or unusual infection</td>
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<td>Gout and tophaceous pseudogout</td>
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<td>Granuloma annulare</td>
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<td>Hematoma</td>
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<td>Hydatid disease</td>
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<tr>
<td>Myositis (inflammatory and infectious); pyomyositis</td>
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<td>Noma (cancrum oris)</td>
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<td>Rhinoscleroma (scleroma)</td>
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<td>Tendon or muscle injury or tear</td>
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<tr>
<td>Tumoral calcinosis</td>
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</table>

**References**
BENIGN SOFT TISSUE TUMORS:
INCIDENCE

1. Lipoma and variants 16%
2. Benign fibrous histiocytoma 13%
3. Nodular fasciitis 11%
4. Fibromatosis 10%
5. Hemangioma 8%
6. Giant cell tumor of tendon sheath 5%
7. Neurilemmoma 5%
8. Neurofibroma 5%
9. Fibroma (incl. tendon sheath) 3%
10. Myxoma 3%
11. Chondroma 2%
12. Granular cell tumor 2%
13. Granuloma annulare 2%
14. Hemangiopericytoma, benign 2%
15. Leiomyoma 2%
16. Ganglion 1%
17. Glomus tumor 1%
18. Lipoblastoma 1%
19. Lymphangioma 1%
20. Myositis ossificans 1%

*M Much lower incidence than reality owing to referral bias.

REFERENCE

MALIGNANT SOFT TISSUE TUMORS:
INCIDENCE

1. Malignant fibrous histiocytoma (MFH) 24%
2. Liposarcoma 14%
3. Sarcoma (unspecified) 12%
4. Leiomyosarcoma 8%
5. Dermatofibrosarcoma protuberans (DFSP) 6%
6. Malignant peripheral nerve sheath tumor (MPNST) 6%
7. Fibrosarcoma (adult and infantile) 5%
8. Synovial sarcoma 5%
9. Angiomatoid MFH 2%
10. Angiosarcoma 2%
11. Chondrosarcoma (extraskeletal) 2%
12. Rhabdomyosarcoma 2%
13. Alveolar soft part sarcoma 1%
14. Atypical fibroxanthoma 1%
15. Clear cell sarcoma 1%
16. Epithelioid sarcoma 1%
17. Ewing sarcoma (extraskeletal) 1%
18. Hemangiendothelioma 1%
19. Hemangiopericytoma 1%
20. Kaposi sarcoma 1%
21. Osteosarcoma (extraskeletal) 1%

REFERENCE
**Gamut D-257-S**

**ROUND CELL LESIONS OF SOFT TISSUE**

1. Ewing sarcoma (extraskeletal)
2. Lymphoma; leukemia
3. Multiple myeloma (extraskeletal)
4. Primitive neuroectodermal tumor (PNET)
5. Rhabdomyosarcoma
6. Synovial sarcoma (poorly differentiated types)

**Gamut D-258-1**

**COMMON SOFT TISSUE TUMORS IN CHILDREN (<16 years of age)**

**BENIGN**
1. Fibromatosis
2. Fibrous histiocytoma
3. Granuloma annulare
4. Hemangioma

**MALIGNANT**
1. Malignant fibrous histiocytoma (MFH); fibrosarcoma
2. Malignant peripheral nerve sheath tumor (MPNST)
3. Rhabdomyosarcoma
4. Synovial sarcoma

**Gamut D-258-2**

**COMMON SOFT TISSUE TUMORS IN YOUNG ADULTS (16–45 years of age)**

**BENIGN**
1. Benign fibrous histiocytoma
2. Ganglion
3. Hemangioma
4. Lipoma
5. Neurogenic neoplasm (neurilemmoma; neurofibroma)
6. Nodular fasciitis

**MALIGNANT**
1. Dermatofibrosarcoma protuberans (DFSP)
2. Kaposi sarcoma
3. Liposarcoma
4. Malignant fibrous histiocytoma (MFH); fibrosarcoma
5. Malignant peripheral nerve sheath tumor (MPNST)
6. Synovial sarcoma

**Gamut D-258-3**

**COMMON SOFT TISSUE TUMORS IN OLDER ADULTS (Over 45 years of age)**

**BENIGN**
1. Benign fibrous histiocytoma
2. Ganglion
3. Lipoma
4. Myxoma
5. Neurogenic neoplasm (neurilemmoma; neurofibroma)
6. Nodular fasciitis
MALIGNANT
1. Dermatofibrosarcoma protuberans (DFSP)
2. Kaposi sarcoma
3. Leiomyosarcoma
4. Liposarcoma
5. Malignant fibrous histiocytoma (MFH); fibrosarcoma
6. Malignant peripheral nerve sheath tumor (MPNST)

Gamut D-259-1

SOFT TISSUE TUMORS BY LOCATION:
SUBCUTANEOUS

BENIGN
COMMON
1. Angiomatous lesions
2. Benign fibrous histiocytoma
3. Lipoma
4. Myxoma
5. Nodular fasciitis

UNCOMMON
1. Granuloma annulare (children)
2. Neurogenic neoplasm (neurilemmoma; neurofibroma)
3. Skin appendage tumors

MALIGNANT
COMMON
1. Dermatofibrosarcoma protuberans (DFSP)
2. Malignant fibrous histiocytoma (MFH); fibrosarcoma
3. Metastases (esp. melanoma; carcinoma of breast)

UNCOMMON
1. Kaposi sarcoma
2. Leiomyosarcoma
3. Liposarcoma
4. Lymphoma
5. Malignant peripheral nerve sheath tumor (MPNST)

Gamut D-259-2

SOFT TISSUE TUMORS BY LOCATION:
INTERMUSCULAR

BENIGN
1. Fibromatosis
2. Ganglion; synovial cyst; bursa
3. Lipoma
4. Neurogenic tumor (neurilemmoma; neurofibroma)
5. Nodular fasciitis

MALIGNANT
1. Extraskeletal myxoid chondrosarcoma
2. Leiomyosarcoma
3. Liposarcoma (esp. myxoid and higher grade)
4. Malignant peripheral nerve sheath tumor (MPNST)
5. Synovial sarcoma

Gamut D-259-3

SOFT TISSUE TUMORS BY LOCATION:
INTRAMUSCULAR

BENIGN
COMMON
1. Angiomatous lesions
2. Lipoma

UNCOMMON
1. Myxoma
2. Nodular fasciitis

MALIGNANT
COMMON
1. Liposarcoma (low-grade, well-differentiated)
2. Malignant fibrous histiocytoma (MFH); fibrosarcoma

(continued)
UNCOMMON
1. Ewing sarcoma (soft tissue); PNET
2. Leiomyosarcoma
3. Rhabdomyosarcoma

SOFT TISSUE TUMORS BY LOCATION:
INTRAARTICULAR OR JUXTAARTICULAR

COMMON
1. Giant cell tumor of tendon sheath
2. Pigmented villonodular synovitis
3. Synovial chondromatosis
4. Synovial cyst, bursa, or ganglion
5. Tumoral calcinosis

UNCOMMON
1. Lipoma arborescens
2. Soft tissue chondroma (knee)
3. Synovial hemangioma
4. Synovial sarcoma

SOFT TISSUE TUMORS THAT CAN BE MULTIFOCAL

COMMON
1. Ganglion
2. Hemangioma, lymphangioma (angiomatosis)
3. Lipoma; lipomatosis; lipoblastomatosis
4. Lymphoma, leukemia (chloroma); Burkitt’s lymphoma
5. Metastases
6. Neurofibroma (with type I neurofibromatosis)

UNCOMMON
1. Angiosarcoma
2. Fibromatosis
3. Glomus tumor
4. Kaposi sarcoma
5. Myxoma associated with fibrous dysplasia
   (Mazabraud S.)
6. Neurilemmoma
7. Paraganglioma

References

UNCOMMON
1. Lipoma arborescens
2. Soft tissue chondroma (knee)
3. Synovial hemangioma
4. Synovial sarcoma

SOFT TISSUE TUMORS WITH ASSOCIATED CALCIFICATION OR OSSIFICATION

BENIGN

COMMON
1. Hemangioma (phleboliths)
2. Lipoma
3. Myositis ossificans; calcified or ossified hematoma
4. Synovial chondromatosis

UNCOMMON
1. Benign mesenchymoma
2. Calcifying aponeurotic fibroma; myofibromatosis
3. Chondroma (soft tissue)
4. Desmoid tumor (rare)
5. Hemangioendothelioma or hemangiopericytoma (benign)
6. Leiomyoma
7. Neurogenic tumor, benign (eg, schwannoma; neurofibroma)
8. Tumoral calcinosis
MALIGNANT

COMMON
1. Osteosarcoma
2. Synovial sarcoma

UNCOMMON
1. Chondrosarcoma
2. Epithelioid sarcoma
3. Leiomyosarcoma
4. Liposarcoma
5. Malignant fibrous histiocytoma; fibrosarcoma
6. Malignant hemangioepithelioma or hemangiopericytoma
7. Malignant mesenchymoma
8. Malignant peripheral nerve sheath tumor (MPNST) (eg, malignant schwannoma; neurofibrosarcoma)

References

“CYSTIC” SOFT TISSUE TUMORS (CT, MRI)

1. Bursa
2. Epidermoid cyst
3. Ganglion
4. Mucoid cyst

5. Myxoid benign neurogenic neoplasm (neurilemmoma; neurofibroma)
6. Myxoid sarcoma (liposarcoma; malignant fibrous histiocytoma; malignant peripheral nerve sheath tumor [MPNST]; chondrosarcoma)
7. Myxoma
8. Perilabral cyst (meniscal, shoulder, hip, etc.)
9. Synovial cyst
10. Tropical pyomyositis

SOFT TISSUE TUMORS WITH PROMINENT FLUID-FLUID LEVELS (CT, MRI)

COMMON
1. Angiomatoid fibrous histiocytoma
2. Angiosarcoma
3. Hemangioma
4. Hemangioendothelioma, hemangiopericytoma
5. Hematoma
6. Malignant fibrous histiocytoma (MFH)
7. Synovial sarcoma
8. Tumoral calcinosis

UNCOMMON
1. Alveolar soft part sarcoma
2. Benign neurogenic neoplasms (neurilemmoma; neurofibroma)
3. Lymphangioma
4. Malignant peripheral nerve sheath tumor (MPNST)
5. Rhabdomyosarcoma

Reference
SOFT TISSUE TUMORS WITH PROMINENT VISIBLE VASCULARITY* (CT, MRI)

COMMON
1. Angiosarcoma
2. Alveolar soft part sarcoma
+3. Hemangioma
+4. Hemangioendothelioma; hemangiopericytoma
5. Kaposi sarcoma

UNCOMMON
1. Bacillary angiomatosis (esp. in AIDS)
2. Ewing sarcoma (extraskeletal)
3. Malignant fibrous histiocytoma (MFH); fibrosarcoma
4. Paraganglioma
5. Primitive neuroectodermal tumor (PNET)
6. Rhabdomyosarcoma (esp. alveolar type)
7. Synovial sarcoma

* Identifiable vascular channels or spaces.
+ All above lesions show high flow, but these entities (+) may have low flow as well.

ENNEKING STAGING OF SARCOMAS OF SOFT TISSUE AND BONE

<table>
<thead>
<tr>
<th>STAGE</th>
<th>GRADE</th>
<th>EXTENT</th>
<th>METASTASIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>G1</td>
<td>T1</td>
<td>M0</td>
</tr>
<tr>
<td>IB</td>
<td>G1</td>
<td>T2</td>
<td>M0</td>
</tr>
<tr>
<td>IIA</td>
<td>G2</td>
<td>T1</td>
<td>M0</td>
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<tr>
<td>IIB</td>
<td>G2</td>
<td>T2</td>
<td>M0</td>
</tr>
<tr>
<td>III</td>
<td>G1–G2</td>
<td>T1</td>
<td>M1</td>
</tr>
<tr>
<td></td>
<td>G1–G2</td>
<td>T2</td>
<td>M1</td>
</tr>
</tbody>
</table>

Surgical Grade: **G1**: low risk of metastasis, < 25%; **G2**: high risk of metastasis, > 25%

Site: **T1**: intracompartamental, **T2**: extracompartamental

Metastasis: **M0**: no regional or distant metastases, **M1**: regional or distant metastases present

Stage I. Histologically low grade \((G_1)\); well differentiated; few mitoses; moderate nuclear atypia. Tends to recur locally. Radioisotope uptake moderate.

- **IA** Intraosseous or intracompartamental
- **IB** Extraosseous or extracompartamental; penetrates cortex or compartment boundaries

Stage II. Histologically high grade \((G_2)\); poorly differentiated; high cell-to-matrix ratio; many mitoses; much nuclear atypia, necrosis, neovascularity; permeative; Radioisotope uptake intense. Higher incidence of metastases.

- **IIA** Intraosseous or intracompartamental
- **IIB** Extraosseous or extracompartamental; penetrates cortex or compartment boundaries

Stage III. Metastases; regional or remote (visceral, lymphatic, or osseous)
**AMERICAN JOINT COMMISSION STAGING PROTOCOL FOR SARCOMAS OF SOFT TISSUE**

<table>
<thead>
<tr>
<th>Stage</th>
<th>G</th>
<th>T</th>
<th>N</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>IB</td>
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<td>2</td>
<td>0</td>
<td>0</td>
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<tr>
<td>IIA</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>IIB</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>IIIA</td>
<td>3–4</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>IIIB</td>
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<tr>
<td>IVA</td>
<td>1–4</td>
<td>1–2</td>
<td>1</td>
<td>0</td>
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<tr>
<td>IVB</td>
<td>1–4</td>
<td>1–2</td>
<td>0–1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Histologic grade (G)**
- G1 well differentiated
- G2 moderately well differentiated
- G3–4 poorly differentiated, undifferentiated

**Primary Tumor (T)**
- T1 tumor 5cm or less in greatest dimension
- T2 tumor more than 5cm in greatest dimension

**Regional lymph nodes (N)**
- N0 no regional lymph node metastasis
- N1 regional lymph node metastasis

**Distant metastasis (M)**
- M0 no distant metastasis

*Modified with permission from Arlen M, Marcone R: Sarcoma management based on a standardized TNM classification. Semin Surg Oncol 1992; 8:98–103*

**HADJU CLASSIFICATION OF SOFT TISSUE SARCOMAS**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Size (cm)</th>
<th>Site</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>&lt;5</td>
<td>S</td>
<td>L</td>
</tr>
<tr>
<td>IA</td>
<td>&lt;5</td>
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<td>H</td>
</tr>
<tr>
<td>IB</td>
<td>&lt;5</td>
<td>D</td>
<td>L</td>
</tr>
<tr>
<td>IC</td>
<td>&gt;5</td>
<td>S</td>
<td>L</td>
</tr>
<tr>
<td>IIA</td>
<td>&lt;5</td>
<td>D</td>
<td>H</td>
</tr>
<tr>
<td>IIB</td>
<td>&gt;5</td>
<td>S</td>
<td>H</td>
</tr>
<tr>
<td>IIC</td>
<td>&gt;5</td>
<td>D</td>
<td>L</td>
</tr>
<tr>
<td>III</td>
<td>&gt;5</td>
<td>D</td>
<td>H</td>
</tr>
</tbody>
</table>

**Site (S)**
- S superficial (subcutaneous) to fascia
- D deep to fascia

**Grade (G)**
- L low
- H high

*Modified with permission from Hadju SI. Pathology of soft tissue tumors. Philadelphia 1979, Lea and Febiger.
Based on 8,591 primary malignant bone tumors in the Mayo Clinic series.*
Gamut D-266-S

RATES OF RECURRENTENCE FROM COMMON SOFT TISSUE SARCOMAS

<table>
<thead>
<tr>
<th></th>
<th>Local*</th>
<th>Distant*(^a)</th>
<th>5-yr survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Angiosarcoma</td>
<td>75%</td>
<td>63%</td>
<td>14%</td>
</tr>
<tr>
<td>2. Chondrosarcoma (extraskeletal)</td>
<td>50%</td>
<td>44%</td>
<td>55–85%</td>
</tr>
<tr>
<td>3. Dermatofibrosarcoma protuberans</td>
<td>2–75%</td>
<td>5–6%</td>
<td>95–100%</td>
</tr>
<tr>
<td>4. Fibrosarcoma (adult)</td>
<td>18–79%</td>
<td>60%</td>
<td>39–60%</td>
</tr>
<tr>
<td>5. Leiomyosarcoma</td>
<td>21–60%</td>
<td>10–57%</td>
<td>0–29%</td>
</tr>
<tr>
<td>6. Liposarcoma (dedifferentiated)</td>
<td>100%</td>
<td>36–100%(^b)</td>
<td>0–64%</td>
</tr>
<tr>
<td>7. Liposarcoma (high-grade round cell/pleomorphic)</td>
<td>24–73%</td>
<td>48–90%</td>
<td>56%</td>
</tr>
<tr>
<td>8. Liposarcoma (myxoid)</td>
<td>53–70%</td>
<td>40–50%</td>
<td>88%</td>
</tr>
<tr>
<td>9. Liposarcoma (well-differentiated)</td>
<td>10–60%</td>
<td>Rare</td>
<td>100%</td>
</tr>
<tr>
<td>10. Malignant fibrous histiocytoma</td>
<td>44–66%</td>
<td>23–50%</td>
<td>36–50%</td>
</tr>
<tr>
<td>11. Malignant peripheral nerve sheath tumor (MPNST)</td>
<td>40%</td>
<td>65%</td>
<td>40–50%</td>
</tr>
<tr>
<td>12. Synovial sarcoma</td>
<td>28–83%</td>
<td>50%</td>
<td>36–64%</td>
</tr>
<tr>
<td>13. Rhabdomyosarcoma</td>
<td>26%</td>
<td>20%</td>
<td>55%</td>
</tr>
</tbody>
</table>

* Wide range owing to various initial treatments with higher rates for local excision and lower rates for wide excision.
\(^a\) Cases with a wide range are due to various histologic types or tumor location (i.e., subcutaneous versus retroperitoneal).
\(^b\) Variation owing to size of dedifferentiated focus in well-differentiated liposarcoma.

References

Gamut D-266-1

DISEASES AFFECTING MUSCLE TO FAT RATIO
Diminution of Muscle:Cylinder Ratio (Below 0.64) (Decreased Muscle Mass, Often Increased Fat)

COMMON
1. Muscular dystrophy (eg, myotonic dystrophy)
2. Paralysis (eg, poliomyelitis; meningomyelocele; brain damage)
3. [Steroid therapy; Cushing S. (increased subcutaneous fat)]

UNCOMMON
1. Amyotonia congenita (Oppenheim’s disease)
2. Arthrogryposis
3. Benign congenital hypotonia (Walton)
4. Farber disease (disseminated lipogranulomatosis)
5. Prader-Willi S.
6. Spondyloepiphyseal dysplasia congenita
7. Werdnig-Hoffmann disease (infantile spinal muscular atrophy)

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

(continued)

Gamut D-267-2
DISEASES AFFECTING MUSCLE TO FAT RATIO
Increase of Muscle:Cylinder Ratio (Over 0.72)
Diminution in Subcutaneous Fat

COMMON
1. Malnutrition; cachexia; debilitating disease (eg, anorexia nervosa)

UNCOMMON
1. Congenital total lipodystrophy (lipoatrophic diabetes)
2. Diencephalic S.
3. Hyperthyroidism
4. Mucopolysaccharidoses (eg, Hurler; Morquio) (See J-4)
5. Progeria; Werner S.
6. Renal tubular acidosis
7. Scleroderma; dermatomyositis

References

Gamut D-267-3
DISEASES AFFECTING MUSCLE TO FAT RATIO
Increase in Muscle Mass; Normal Fat

COMMON
1. Exercise hypertrophy

UNCOMMON
1. Congenital muscular hypertrophy
2. Kocher-Debré-Sémélaigne S.
3. Muscle tumor or infection (pyomyositis)
4. Duchenne muscular dystrophy

References

Gamut D-267-4
DISEASES AFFECTING MUSCLE TO FAT RATIO
Increase in Fat; Normal Muscle

COMMON
1. Exogenous obesity
2. Steroid therapy

UNCOMMON
1. Bardet-Biedl S.
2. Cushing S.
3. Prader-Willi S.

References
Gamut D-268

THICKENING OF HEEL PAD
(Greater than 23 mm)

COMMON
1. Acromegaly
2. Generalized edema (eg, congestive heart failure; deep vein thrombosis; lymphedema)
3. Infection of soft tissues (eg, mycetoma)
4. Normal variant; genetic (esp. black and Polynesian males)
5. Obesity; high body weight (over 200 pounds)
6. Trauma

UNCOMMON
1. Dilantin (hydantoin) therapy
2. Myxedema; thyroid acropachy
3. Occupational
4. Pachydermoperiostosis

References

Gamut D-270

SOFT TISSUE EMPHYSEMA OR GAS

1. Gas abscess (pyomyositis from Staph. aureus)
2. Gas phlegmon; gas gangrene (Clostridium infection)
3. Infiltration of air (eg, tracheostomy; thoracotomy; open wound; hypodermoclysis; drainage tube insertion)
4. Mediastinal emphysema (eg, air-trapping from asthma; bronchial foreign body)
5. Trauma (eg, penetrating knife or gunshot injury; explosion; blunt chest trauma with severe contusion; fractured ribs with lung injury; fractured trachea or bronchi)

References

Gamut D-270

SWELLING OF THE SOFT TISSUE
INTERSTITIAL MARKINGS
(“Reticulation” of Soft Tissues)

COMMON
1. Edema, other causes
2. Heart failure
3. Hemorrhage, spontaneous or traumatic
4. Infection of soft tissues (eg, cellulitis; tuberculosis; fungus disease; mycetoma)
5. Lymphatic obstruction; Milroy disease
6. Myxedema; thyroid acropachy
7. Neoplasm primary in soft tissues (eg, vascular or lymphatic tumor—lymphangioma) or edema secondary to bone neoplasm
8. Nephrosis; nephritis
9. Osteomyelitis
10. Thermal injury (eg, burn; frostbite; electrical)

UNCOMMON
1. Acromegaly
2. Erythroblastosis fetalis
3. Fibrodysplasia (myositis) ossificans progressiva (early)
4. Infantile cortical hyperostosis (Caffey disease)
5. Melorheostosis

(continued)
6. Neurofibromatosis (type 1)
7. Sudeck’s atrophy

Reference

LYMPHANGIECTASIA (Lymphatic Vessel Dysplasia)

COMMON
1. Filariasis; elephantiasis
2. Infection (eg, tuberculosis; histoplasmosis; other fungal disease
3. Neoplasm (lymphoma, lymphangioma; metastases to lymph nodes; angiosarcoma arising in chronic lymphedema {Stewart-Treves S.})
4. Postoperative
5. Posttraumatic

UNCOMMON
1. Cirrhosis
2. Noonan S.
3. Primary congenital lymphatic dysplasia (isolated)
4. Turner S.

References

LYMPHANGIOGRAM (Lymphedema)

COMMON
1. Filariasis; elephantiasis
2. [High pressure injection of contrast media]
3. Inflammation; lymphadenitis; phlebitis
4. Lymphoma (esp. Hodgkin)
5. Metastases to lymph nodes
6. Postoperative (eg, following excision of lymph nodes and damage to lymphatics, esp. radical mastectomy); lymphocyst; lymphocele
7. Trauma (peripheral lymphedema from extensive skin loss or burn; injury to cisterna chyli causing chylothorax)

UNCOMMON
1. Lymphangioma (esp. of thoracic duct)
2. [Primary lymphedema]
   a. Lymphedema congenita (eg, Milroy disease; also seen with Turner S.)
   b. Lymphedema praecox (females, ages 9 to 25)
   c. Lymphedema tarda (after age 35)
3. Radiation therapy

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
Gamut D-273-S

ROENTGEN SIGNS OF LYMPHATIC CHANNEL OBSTRUCTION

1. Backflow
2. Collateral circulation
3. Dilatation of lymph vessels
4. Extravasation
5. Stasis of lymph flow

Gamut D-274

FILLING DEFECT IN LYMPH NODE ON LYMPHANGIOGRAM

UNCOMMON
1. Acute lymphadenitis (abscess)
2. Amyloidosis
3. Fatty replacement
4. Multiple myeloma
5. Normal anatomic hilum
6. Reactive hyperplasia of connective tissue disease (collagen disease), esp. rheumatoid arthritis
7. Sjögren S.

References

COMMON
1. Granulomatous disease (eg, sarcoidosis; tuberculosis; fungus disease)
2. Idiopathic
3. Lymphoma
4. Metastatic neoplasm (eg, carcinoma; melanoma; sarcoma)
CONGENITAL DISEASES OF THE HEART AND GREAT VESSELS

E-1 Congenital Syndromes with Congenital Heart Disease or Myocardiopathy
E-2-S Relative Incidence of Various Congenital Heart Diseases (in Order of Decreasing Frequency)
E-3 Key Findings in Neonatal Congenital Heart Disease
E-4 Early Onset (Birth to One Week) of Heart Failure in Neonatal Congenital Heart Disease
E-5 Heart Failure in the First Month of Life
E-6 Cardiomegaly and/or Cardiac Failure In a Neonate, Infant, or Child
E-7 Left to Right Shunt in Congenital Heart Disease
E-7-S Differential Features of Common Left to Right Shunts
E-8 Right to Left Shunt or Admixture Lesion In Congenital Heart Disease
E-8-S Differential Features of Major Cyanotic Congenital Heart Diseases
E-9 Time of Onset and Degree of Cyanosis in Congenital Heart Disease
E-10 Right to Left Shunt at Atrial Level
E-10-S Complicated Atrial Level Shunts
E-11 Right to Left Shunt at Ventricular Level
E-12-S1 Cardiovascular Anomalies Associated with VSD
E-12-S2 Cardiovascular Anomalies Associated with Complete Atrioventricular Canal (CAVC)
E-13 Right to Left Shunt at Ductus Level
E-14 Pulmonary Arterial Vascularity in Common Congenital Heart Diseases (See E-15–19)
E-15 Acyanotic Congenital Heart Disease with Normal Pulmonary Vascularity
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-16</td>
<td>Acyanotic Congenital Heart Disease with Increased Pulmonary Vascularity (Shunt) (See E-51)</td>
</tr>
<tr>
<td>E-17</td>
<td>Cyanotic Congenital Heart Disease with Increased Pulmonary Vascularity (See E-51)</td>
</tr>
<tr>
<td>E-18</td>
<td>Cyanotic Congenital Heart Disease with Precapillary Hypertension Vascularity (High Vascular Resistance, Eisenmenger Physiology)</td>
</tr>
<tr>
<td>E-19</td>
<td>Congenital Heart Disease with Decreased Pulmonary Vascularity (Usually Cyanotic)</td>
</tr>
<tr>
<td>E-20</td>
<td>Flat or Concave Pulmonary Artery Segment in Congenital Heart Disease</td>
</tr>
<tr>
<td>E-21-S</td>
<td>Vascular Ring and Other Anomalies of the Aortic Arch and Brachiocephalic Arteries</td>
</tr>
<tr>
<td>E-22</td>
<td>Congenital Heart Disease Associated with Anterior Right Aortic Arch (Type I—Mirror-Image Branching)</td>
</tr>
<tr>
<td>E-23-S</td>
<td>Positional Anomalies of the Thoracic Aorta and Aortic Arch</td>
</tr>
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<td>E-24</td>
<td>Anomalous Arterial Communication in the Thorax</td>
</tr>
<tr>
<td>E-25-S</td>
<td>Anomalous Pulmonary Venous Return Connections (APVC)</td>
</tr>
<tr>
<td>E-26</td>
<td>Abnormal Cardiac Position; Cardiac Displacement (Congenital or Acquired)</td>
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<tr>
<td>E-26-S</td>
<td>Types of Dextrocardia</td>
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<td>E-27</td>
<td>Right Atrial Enlargement</td>
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<tr>
<td>E-28</td>
<td>Tricuspid Insufficiency</td>
</tr>
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<td>E-29</td>
<td>Right Ventricular Enlargement</td>
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<td>E-30</td>
<td>Filling Defect in Right Ventricle on Angiocardiography</td>
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<tr>
<td>E-31</td>
<td>Left Atrial Enlargement</td>
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<td>E-32</td>
<td>Mitral Insufficiency</td>
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<tr>
<td>E-33</td>
<td>Extra Bump Along the Upper Left Heart Border (the Third Mogul)</td>
</tr>
<tr>
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<td>Radiologic Findings (Pulmonary Vasculature and LV Size) in Common Diseases with Left Ventricular Strain</td>
</tr>
<tr>
<td>E-35</td>
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<td>E-37</td>
<td>Hypertension and Hypertensive Cardiovascular Disease</td>
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<td>E-38</td>
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</tr>
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<td>Complications of Myocardial Infarction Requiring Radiological Evaluation</td>
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</tr>
<tr>
<td>Code</td>
<td>Description</td>
</tr>
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<td>------</td>
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</tr>
<tr>
<td>E-42</td>
<td>Small Heart</td>
</tr>
<tr>
<td>E-43</td>
<td>Cardiac or Pericardial Neoplasm or Cyst</td>
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<td>E-44</td>
<td>Calcification in the Heart or Great Vessels</td>
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<td>E-45</td>
<td>Pericardial Calcification</td>
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<tr>
<td>E-47</td>
<td>Pneumopericardium</td>
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<td>E-48</td>
<td>Constrictive Pericarditis</td>
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<tr>
<td>E-50-S</td>
<td>Common Cardiac Conditions Diagnosed by Echocardiography</td>
</tr>
</tbody>
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### OTHER GREAT VESSEL ABNORMALITIES

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tr>
<td>E-51</td>
<td>Generalized Pulmonary Arterial Hypervascularity (See E-16, 17)</td>
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<td>Increased Pulmonary Arterial Circulation to One Lung</td>
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<td>E-54</td>
<td>Pulmonary Arterial Hypertension (Cor Pulmonale)</td>
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<td>E-55</td>
<td>Pulmonary Artery “Aneurysm”</td>
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<td>E-56</td>
<td>Localized Enlargement of a Pulmonary Vessel</td>
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<td>E-57</td>
<td>Pulmonary Valve or Main Pulmonary Artery Obstruction (Often Leading to Pulmonary Hypovascularity)</td>
</tr>
<tr>
<td>E-58</td>
<td>Generalized Pulmonary Arterial Hypovascularity (See E-19)</td>
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<td>E-59</td>
<td>Pulmonary Venous Obstruction or Hypertension (Increased Venous Vascularity or Vascular Redistribution) (See E-3)</td>
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<td>Systemic to Pulmonary Vascular Shunt on Angiography (See E-24)</td>
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<td>E-61</td>
<td>Small Ascending Aorta or Aortic Arch</td>
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<tr>
<td>E-62</td>
<td>Prominent Ascending Aorta or Aortic Arch</td>
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<tr>
<td>E-63</td>
<td>Aneurysm of Aorta and Other Major Arteries</td>
</tr>
<tr>
<td>E-64</td>
<td>Dissecting Aneurysm of the Ascending Aorta or Arch</td>
</tr>
<tr>
<td>E-65</td>
<td>Aneurysm of Coronary Artery</td>
</tr>
<tr>
<td>E-66</td>
<td>Arterial Stenosis and Thrombosis</td>
</tr>
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<td>E-67</td>
<td>Embolus</td>
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<td>E-68</td>
<td>Digital Ischemia and Raynaud’s Phenomenon</td>
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<tr>
<td>E-69</td>
<td>Azygos Vein Dilatation</td>
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<td>E-70</td>
<td>Superior Vena Cava Dilatation</td>
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<td>E-71</td>
<td>Obstruction of the Inferior Vena Cava or Iliac Veins</td>
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<tr>
<td>E-72-S</td>
<td>Anomalies of the Inferior Vena Cava</td>
</tr>
<tr>
<td>E-73-S</td>
<td>Complications of Central Venous (Subclavian, Jugular) or Pulmonary Artery Catheterization</td>
</tr>
</tbody>
</table>
CONGENITAL SYNDROMES WITH CONGENITAL HEART DISEASE OR MYOCARDIOPATHY

COMMON
1. Adrenogenital S.; Addison disease (aortic, tricuspid, or mitral insufficiency)
2. Asplenia S. (Ivemark S.); polysplenia S. (complex cyanotic conditions)
3. Chondrodysplasia punctata (rhizomelic type) (VSD; PDA)
4. Chondroectodermal dysplasia (Ellis-van Creveld S.) (septal defects; common atrium)
5. Chronic granulomatous disease of childhood (aortic stenosis)
6. Ehlers-Danlos S. (medial necrosis of aorta; dissecting aneurysm; aortic insufficiency; mitral valve prolapse)
7. Eisenmenger S. (pulmonary hypertension with bidirectional or reversed shunt at the atrial, ventricular, or aortopulmonary level)
8. Fetal alcohol S. (septal defect)
9. Fetal rubella S. (PDA; VSD; PS; pulmonary artery branch stenosis)
10. Friedreich ataxia (myocardiopathy)
11. Gaucher disease; Niemann-Pick disease (mitral insufficiency)
12. Hemochromatosis (myocardiopathy)
13. Hemolytic-uremic S. (cardiomegalgy; heart failure)
14. Holt-Oram S. (ASD, VSD)
15. Homocystinuria (medial degeneration of aorta and pulmonary artery causing dilatation, arterial and venous thromboses)
16. Hyperthyroidism (myocardiopathy)
17. Hypothyroidism; cretinism (myocardiopathy)
18. Infant of diabetic mother (cardiomyopathy; idiopathic hypertrophic subaortic stenosis)
19. Kartagener S.; immotile cilia S. (dextrocardia or situs inversus; septal defects)
20. Klinefelter S. (XXY S.) (PDA; ASD)
21. Marfan S. (aortic insufficiency; mitral insufficiency secondary to mitral valve prolapse; cystic medial necrosis of aorta or occasionally pulmonary artery; dissecting aneurysm)
22. Mucolipidosis II (I-cell disease) (myocardiopathy)
23. Mucopolysaccharidoses (eg, Morquio S.; Maroteaux-Lamy S.; Scheie S.—aortic insufficiency; Hunter S.; Hunter S.—intimal thickening of coronary arteries and valves; myocardiopathy)
24. Myotonic dystrophy (conduction abnormalities; mitral valve prolapse)
25. Neurofibromatosis (PS; aortic stenosis; coarctation of aorta; VSD)
26. Noonan S. (stenosis of pulmonary valve or pulmonary artery branches; ASD; VSD; myocardiopathy; constrictive pericarditis)
27. Osteogenesis imperfecta (aortic or mitral insufficiency)
28. Pseudoxanthoma elasticum (premature atherosclerosis; restrictive myocardiopathy; mitral stenosis or insufficiency; myocardial infarction)
29. Trisomy 21 S. (Down S.) (VSD; AS; AV communis)
30. Tuberous sclerosis (myocardiopathy; rhabdomyoma of heart)
31. Turner S. (coarctation of aorta; aortic stenosis; PS; ASD)
32. Venolobar or scimitar S. (partial APVR)
33. Williams S. (idiopathic hypercalcemia) (supravalvular aortic stenosis; pulmonary artery branch stenoses)

UNCOMMON
1. Aase S. (VSD; coarctation of aorta)
2. Acrocephalopolysyndactyly (Carpenter S.) (PDA)
3. Acrocephaaloxydactyly (Apert and other types) (VSD)
4. African myocardiopathy (endomyocardial fibrosis)
5. Aminopterin fetopathy (various)
6. Antley-Bixler S.
7. Aspartylglucosaminuria (myocardiopathy; mitral insufficiency)
8. Bardet-Biedl S. (myocardiopathy; VSD)

(continued)
9. Brachmann-de Lange S. (de Lange S.)
10. Campomelic dysplasia
11. Carcinoid S. (endocardial fibrosis with tricuspid valve lesions; PS)
12. Cardiofacial S. (ASD; VSD; AV canal; PDA; tetralogy; PS; coarctation of aorta)
13. Cardio-facio-cutaneous S. (ASD; PS)
14. Cerebrohepatorenal S. (Zellweger S.) (PDA; septal defects)
15. Chromosome 4: del (4p) S. (Wolf-Hirschhorn S.) (ASD; VSD; PDA)
16. Chromosome 5: del (5p) S. (cat cry S. or cri du chat S.) (ASD; VSD; PDA)
17. Chromosome 18: del (18q) S. (ASD; VSD; PDA)
18. Cutis laxa (coarctation of aorta; pulmonary artery stenoses)
19. Deaf-mutism (PS, mitral insufficiency)
20. Degos S. (myocardiopathy)
21. DiGeorge S. (right aortic arch; coarctation of aorta; tetralogy)
22. Duchenne muscular dystrophy (myocardiopathy)
23. Fabry disease (myocardiopathy)
24. Fanconi anemia (pancytopenia—dysmelia S.) (hypoplastic left heart)
25. Fetal hydantoin S. (Dilantin embryopathy) (various)
26. Glycogen storage disease, type II (Pompe disease) or III (persistence of left supracardinal vein; myocardiopathy)
27. GM1 gangliosidosis (myocardiopathy)
28. Goltz S. (focal dermal hypoplasia) (aortic stenosis)
29. Gorlin S. (nevoid basal cell carcinoma S.) (cardiac fibroma)
30. Hallermann-Streiff S. (oculo-mandibulo-facial S.) (septal defects; PS; tetralogy)
31. Hyperphosphatasia (cardiomegaly; hypertension)
32. Kawasaki disease (coronary artery aneurysms; pericarditis)
33. Kearns-Sayre S. (myocardiopathy; heart block)
34. Kugelberg-Welander S. (myocardiopathy)
35. LEOPARD S. (multiple lentigenes S.) (PS; aortic stenosis; myocardiopathy)
36. Lutembacher S. (rheumatic mitral stenosis and ASD)
37. Mesomelic dysplasia (Rabinow and Werner types) (right-sided lesions; VSD)
38. Neuroacanthocytosis (myocardiopathy)
39. Oculo-auriculovertebral spectrum (Goldenhar S.) (PDA; VSD; tetralogy; coarctation of aorta; total APVC; asplenia S.)
40. Prune-belly S. (Eagle-Barrett S.) (PDA; VSD)
41. Refsum S. (AV conduction defect; acute heart failure)
42. Rubinstein-Taybi S. (PDA; VSD)
43. Seckel S. (bird-headed dwarfism) (VSD; PDA)
44. Shone-Edwards complex (parachute mitral valve; subaortic stenosis)
45. Smith-Lemli-Opitz S. (VSD; PDA)
46. Spondyloepimetaphyseal dysplasia with joint laxity (CHD with cor pulmonale)
47. Spondylometaphyseal dysplasia (Sedaghatian type) (myocardiopathy; ASD)
48. Sternal-cardiac malformations association (pectus carinatum; PDA; VSD; ASD; tetralogy; transposition of GV)
49. Sturge-Weber S. (coarctation of aorta)
50. TAR S. (thrombocytopenia—absent radius S.) (ASD; VSD; tetralogy)
51. Thoracoabdominal wall defect S. (dextrocardia; pericardial hernia; left ventricular diverticulum)
52. Treacher Collins S. (VSD; PDA; ASD)
53. Trichorhinophalangeal dysplasia, type I (Giedion S.)
54. Trisomy 13 S. (VSD; ASD; PDA; dextrocardia)
55. Trisomy 18 S. (VSD; PDA; PS; coarctation of aorta)
56. VATER association (tetralogy; VSD)
57. Velocardiofacial S. (VSD; tetralogy; hypoplastic pulmonary arteries)
58. Weill-Marchesani S. (PDA)
59. XXXY S.; XXYY S.; XXXYY S.; XXXX S. (PDA; ASD; others)
60. Yunis-Varón S. (cleidocranial dysostosis with micrognathia and absent thumbs) (myocardiopathy; tetralogy)

References
Gamut E-2-S

RELATIVE INCIDENCE OF VARIOUS CONGENITAL HEART DISEASES*  
(IN ORDER OF DECREASING FREQUENCY)

<table>
<thead>
<tr>
<th>COMMON</th>
<th>INCIDENCE</th>
</tr>
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<tbody>
<tr>
<td>1. VSD</td>
<td>20–25%</td>
</tr>
<tr>
<td>2. PDA</td>
<td>12–15%</td>
</tr>
<tr>
<td>3. Tetralogy of Fallot</td>
<td>11–15%</td>
</tr>
<tr>
<td>4. Pulmonary stenosis</td>
<td>10–15%</td>
</tr>
<tr>
<td>5. ASD</td>
<td>7–14%</td>
</tr>
<tr>
<td>6. Transposition of great vessels</td>
<td>5–9%</td>
</tr>
<tr>
<td>7. Coarctation of aorta</td>
<td>5–9%</td>
</tr>
<tr>
<td>8. Aortic stenosis</td>
<td>3–6%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNCOMMON</th>
<th>INCIDENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Single ventricle</td>
<td>2–3%</td>
</tr>
<tr>
<td>2. Tricuspid atresia</td>
<td>1.2–3%</td>
</tr>
<tr>
<td>3. Corrected transposition</td>
<td>1.2–3%</td>
</tr>
<tr>
<td>4. Truncus arteriosus</td>
<td>1–3%</td>
</tr>
<tr>
<td>5. Atrioventricular canal defect</td>
<td>2%</td>
</tr>
<tr>
<td>6. APVC, total</td>
<td>2%</td>
</tr>
<tr>
<td>7. Aortic atresia</td>
<td>2%</td>
</tr>
<tr>
<td>8. Pulmonary atresia</td>
<td>1–1.7%</td>
</tr>
<tr>
<td>9. Ebstein anomaly</td>
<td>1%</td>
</tr>
<tr>
<td>10. Endocardial fibroelastosis</td>
<td>&gt;1%</td>
</tr>
</tbody>
</table>

* All others are very rare (less than 1%).

+ Isolated VSD or associated with other complex lesions.

Reference
### KEY FINDINGS IN NEONATAL CONGENITAL HEART DISEASE

#### PULMONARY VASCULARITY

<table>
<thead>
<tr>
<th></th>
<th>CONGESTIVE FAILURE</th>
<th>CYANOSIS</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Early</td>
<td>Late</td>
</tr>
<tr>
<td><strong>I. INCREASED (SHUNT OR OVERCIRCULATION)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>COMMON</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. APVC, total (above diaphragm)</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>2. Coarctation S. (coarctation + VSD and/or PDA)</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>3. Complete atrioventricular canal</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>4. Complete transposition of GV (+ VSD or ASD and/or PDA)</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>5. Hypoplastic left heart S. g (eg, aortic atresia with ASD and PDA)</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>6. PDA—preterm infant</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>7. Persistent fetal circulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Truncus arteriosus</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>9. VSD</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><strong>UNCOMMON</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. ASD</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>2. Common atrium</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>3. Double outlet RV (DORV)</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>4. Hemitruncus</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>5. Peripheral AVM</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>6. Single ventricle with transposition</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><strong>II. PULMONARY VENOUS HYPERTENSION (PVH)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>COMMON</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Aortic atresia or severe stenosis</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>2. APVC, total (below diaphragm)</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>3. Coarctation of aorta, severe (preductal)</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><strong>UNCOMMON</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Anomalous origin of left coronary artery from pulmonary artery</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>2. Cardiac tumor (eg, rhabdomyoma)</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>3. Cor triatriatum</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>4. Endocardial fibroelastosis</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>5. Glycogen storage disease II (Pompe)</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>6. Infant of diabetic mother—myocardiopathy</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>7. Mitral atresia or severe stenosis</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>8. Myocarditis</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>9. Pulmonary vein stenosis</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><strong>III. DECREASED PULMONARY VASCULARITY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>COMMON</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Tetralogy of Fallot</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><strong>UNCOMMON</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Complete transposition with pulmonary atresia + VSD</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>2. Corrected transposition with pulmonary atresia + VSD</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>3. DORV with pulmonary atresia + VSD</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>4. Single ventricle with pulmonary atresia + VSD</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>5. Tricuspid atresia with pulmonary atresia + VSD</td>
<td>+</td>
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</tr>
</tbody>
</table>

* Birth to one week.

**Reference**
Gamut E-4

EARLY ONSET (BIRTH TO ONE WEEK) OF HEART FAILURE IN NEONATAL CONGENITAL HEART DISEASE

COMMON
1. APVC, total (below diaphragm)
2. Hypoplastic left heart syndrome (eg, severe stenosis or atresia of mitral or aortic or aortic arch valve with ASD and PDA)
3. Patent ductus arteriosus (PDA), preterm infant

UNCOMMON
1. Asphyxia (esp. first day)
2. Coarctation of aorta, severe (preductal)
3. Mitral atresia or severe stenosis
4. Myocardiopathy (eg, infant of diabetic mother)
5. Peripheral arteriovenous malformation

Reference

Gamut E-5

HEART FAILURE IN THE FIRST MONTH OF LIFE

COMMON
1. Coarctation of aorta, severe (preductal) or interruption of aortic arch with VSD and/or PDA
2. Left to right shunt, large (VSD; PDA; atroventricular (AV) canal defect)
3. Tetralogy of Fallot, with complete AV canal, anemia, or postoperative shunt
4. Transposition of great vessels, complete

UNCOMMON
1. Arteriovenous fistula or hemangioma (eg, vein of Galen aneurysm, peripheral or pulmonary AVM, cavernous hemangioma of liver or skin)
2. Asphyxia (esp. first day)
3. Asplenia S. (Ivemark S.); polysplenia S. with complete AV canal
4. Common atrium
5. Conduction and rhythm abnormalities (eg, tachycardia, arrhythmia, complete heart block)
6. Cor triatriatum
7. Ebstein anomaly; Uhl anomaly
8. Foramen ovale closure, prenatal
9. Hemitruncus
10. High output state (eg, severe anemia — erythroblastosis; neonatal hyperthyroidism)
11. Hypoplastic left heart S. (eg, severe stenosis or atresia of mitral or aortic valve or aortic arch with ASD and PDA)
12. Hypoplastic right heart S.
13. Iatrogenic (fluid overload; sodium chloride poisoning)
14. Increased intracranial pressure leading to pulmonary venous congestion (eg, cerebral injury at birth)
15. Mitral atresia or severe stenosis; mitral insufficiency
16. Myocardiopathy (eg, endocardial fibroelastosis; glycogen storage disease II (Pompe); infant of diabetic mother; myocarditis — rubella, toxoplasmosis, coxsackie virus; myocardial ischemia — neonatal hypoxia; anomalous left coronary artery arising from pulmonary artery)
17. Polycythemia (eg, maternal-fetal hemorrhage; placental and twin-to-twin transfusion)
18. Pulmonary vein atresia or stenosis
19. Single ventricle with transposition; single ventricle with PS
20. Total APVC (esp. below diaphragm)
21. Tricuspid atresia with transposition and no PS
22. Truncus arteriosus (in infants with large left to right shunt)

References

(continued)

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Gamut E-6

CARDIOMEGALY AND/OR CARDIAC FAILURE IN A NEONATE, INFANT, OR CHILD

COMMON
1. Anemia (esp. erythroblastosis fetalis; sickle cell disease)
2. Coarctation of aorta, severe (preductal); interruption of aortic arch
3. Left to right shunt, large (VSD; PDA; atrioventricular (AV) canal defect)
4. Myocardiopathy (eg, endocardial fibroelastosis; glycogen storage disease type II (Pompe); infant of diabetic mother; myocarditis — rubella, toxoplasmosis, coxsackie virus; myocardial ischemia — neonatal hypoxia; anomalous left coronary artery arising from pulmonary artery)
5. [Pericardial effusion] (See E-49)
6. Rheumatic mitral insufficiency, with or without myocardiitis
7. Tetralogy of Fallot, with complete AV canal, anemia, or postoperative shunt
8. Transposition of great vessels with large shunt (VSD; PDA)

UNCOMMON
1. Aortic stenosis or atresia
2. APVC, total

3. Arrhythmia (eg, congenital heart block, paroxysmal tachycardia)
4. Asphyxia (esp. first day)
5. Asplenia S. (Ivemark S.); polysplenia S. with complete AV canal
6. Arteriovenous fistula or hemangioma, pulmonary or peripheral (incl. vein of Galen aneurysm; cavernous hemangioma of liver or skin)
7. Coronary disease (anomalous origin of left coronary artery from pulmonary artery; progeria; aneurysm in Kawasaki disease)
8. Cor triatriatum
9. Double outlet right ventricle (DORV)
10. Ebstein anomaly; Uhl anomaly
11. Endocardial fibroelastosis
12. Foramen ovale closure, prenatal
13. High-output state, other (eg, neonatal hyperthyroidism)
14. Hypoplastic left heart S.
15. Hypoplastic right heart S.
16. Iatrogenic (eg, fluid overload; sodium chloride poisoning)
17. Increased intracranial pressure (eg, cerebral disease from birth injury)
18. Infant of diabetic mother; neonatal hypoglycemia
19. Mitral atresia or severe stenosis or insufficiency, congenital
20. Neoplasm of heart, primary or metastatic (See E-43)
21. [Pectus excavatum; straight spine S.]
22. Polycythemia (eg, maternal-fetal hemorrhage; placental and twin-to-twin transfusion)
23. [Pulmonary lymphangiectasia]
24. Pulmonary veno-occlusive disease (eg, atresia)
25. Single ventricle
26. Tricuspid atresia
27. Truncus arteriosus

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
3. Coronary artery fistula to right heart or pulmonary artery (incl. anomalous origin of left coronary artery from pulmonary artery)
4. Corrected transposition with VSD
5. Hemitruncus (anomalous origin of right pulmonary artery from ascending aorta)
6. Left ventricular-right atrial shunt
7. Ruptured aortic valve cusp with VSD or into right atrium
8. Ruptured sinus of Valsalva aneurysm into right heart
9. Sequestration of lung (eg, drainage to azygos system)
10. Tetralogy of Fallot, acyanotic (“pink”)

References

Gamut E-7-S

DIFFERENTIAL FEATURES OF COMMON LEFT TO RIGHT SHUNTS

<table>
<thead>
<tr>
<th></th>
<th>PULM VASC</th>
<th>PULM ART</th>
<th>AORTA</th>
<th>SVC</th>
<th>LV</th>
<th>RV</th>
<th>LA</th>
<th>RA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ASD</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>N</td>
<td>+</td>
<td>N</td>
<td>+</td>
</tr>
<tr>
<td>2. PDA</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>N</td>
<td>+</td>
<td>N,+</td>
<td></td>
<td>N</td>
</tr>
<tr>
<td>3. VSD</td>
<td>+</td>
<td>+</td>
<td>N,−</td>
<td>N</td>
<td>N,+</td>
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<td>+</td>
<td>N,+</td>
</tr>
</tbody>
</table>

Abbreviations:
+ = increased
− = decreased
N = Normal
PULM VASC = pulmonary vasculature
PULM ART = pulmonary artery segment
RIGHT-TO-LEFT SHUNT OR ADMIXTURE LESION IN CONGENITAL HEART DISEASE

COMMON
1. APVC, total (above the diaphragm)
2. Double outlet right ventricle (DORV)
3. Left to right shunt progressing to reversal or high resistance vascularity (Eisenmenger physiology)
4. Tetralogy of Fallot
5. Transposition of great vessels
6. Tricuspid atresia
7. Truncus arteriosus

UNCOMMON
1. Anomalous systemic venous return to left atrium (eg, via left superior vena cava)
2. Aortic atresia
3. Coarctation of aorta, severe (preductal)
4. Common atrium
5. Ebstein anomaly with ASD

6. Hypoplastic right heart S.
7. Mitral atresia or stenosis (usually with VSD or PDA)
8. Pulmonary arteriovenous malformation
9. Pulmonary stenosis or atresia with intact ventricular septum and ASD (trilogy of Fallot)
10. Pulmonary vein atresia
11. Right pulmonary artery fistula to left atrium

References
TIME OF ONSET OF AND DEGREE OF CYANOSIS IN CONGENITAL HEART DISEASE

MARKED CYANOSIS AT BIRTH OR IN FIRST WEEK
1. Asplenia S. (Ivemark S.); polysplenia S.
2. Ebstein anomaly
3. Hypoplastic left heart S. (eg, aortic or mitral atresia or severe stenosis; interruption of aortic arch)
4. Hypoplastic right heart S.
5. Persistent fetal circulation
*6. Pulmonary atresia
*7. Tetralogy of Fallot, with severe pulmonary stenosis or atresia (eg, pseudotruncus arteriosus)
8. Transposition of great vessels, complete

* Associated with pulmonary oligemia.

MILD OR INTERMITTENT CYANOSIS AT BIRTH OR SOON AFTER
1. APVC, total (below the diaphragm)
2. Atrioventricular (AV) canal defect (usually complete)
3. Large left to right shunt with failure
4. Truncus arteriosus

LATE ONSET OF CYANOSIS IN NEONATAL CONGENITAL HEART DISEASE
1. Double outlet right ventricle with pulmonary stenosis
2. Single ventricle with pulmonary stenosis
3. Single ventricle with transposition
4. Tetralogy of Fallot
5. Tricuspid atresia
6. Trilogy of Fallot

DIFFERENTIAL FEATURES OF MAJOR CYANOTIC CONGENITAL HEART DISEASES

<table>
<thead>
<tr>
<th>CARDIAC SIZE</th>
<th>PULM VASC</th>
<th>AORTIC ARCH</th>
<th>EKG</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tetralogy of Fallot, incl. pseudotruncus (40%)*</td>
<td>N,+</td>
<td>–</td>
<td>R(25%)</td>
</tr>
<tr>
<td>2. Transportation of great vessels (15%)</td>
<td>+</td>
<td>+</td>
<td>L</td>
</tr>
<tr>
<td>3. Tricuspid atresia (10%)</td>
<td>N,+</td>
<td>–</td>
<td>L</td>
</tr>
<tr>
<td>4. Trilogy of Fallot (pulmonary atresia with ASD) (5%)</td>
<td>+</td>
<td>–</td>
<td>L</td>
</tr>
<tr>
<td>5. Truncus arteriosus (10%)</td>
<td>+</td>
<td>+,—</td>
<td>R(25%)</td>
</tr>
</tbody>
</table>

Abbreviations:
+ = increased  — = decreased  N = normal
* The five T’s comprise approximately 80% of all cyanotic congenital heart disease.
References

Gamut E-10-S

COMPLICATED ATRIAL LEVEL SHUNTS

I. CONVENTIONAL ASD ASSOCIATED WITH ANOTHER USUALLY INDEPENDENT ANOMALY
1. APVC, partial
2. Lutembacher S. (rheumatic mitral stenosis and ASD)
3. Mitral valve regurgitation or prolapse (MVP); cleft mitral valve
4. Pulmonary stenosis (eg, trilogy of Fallot)
5. Ventricular septal defect (VSD)

II. ATRIAL SEPTUM IS INTACT; SITE OF SHUNT IS DISTAL TO ATRIAL SEPTUM BUT MAY DRAIN INTO RA
1. Coronary artery fistula
2. Left ventricular-right atrial shunt
3. Rupture of posterior aortic sinus aneurysm into RA

III. ASD IS PART OF A DEVELOPMENTAL COMPLEX
1. APVC, total
2. Complete atroventricular canal defect (AV communis or total endocardial cushion defect)
3. Pentalogy of Fallot

Reference
RIGHT TO LEFT SHUNT AT VENTRICULAR LEVEL

COMMON
1. Complete transposition of great vessels with VSD
2. Tetralogy of Fallot with pulmonary atresia
3. VSD with pulmonary hypertension (Eisenmenger physiology)

UNCOMMON
1. Corrected transposition with VSD and predominant PS
2. Double outlet right ventricle (DORV)
3. Single ventricle
4. Truncus arteriosus

References
1. Elliott LP: Cardiac Imaging in Infants, Children, and Adults.
   Philadelphia: Lippincott, 1991

CARDIOVASCULAR ANOMALIES ASSOCIATED WITH VSD

VSD AN ESSENTIAL PART OF THE ANOMALY

COMMON
1. Tetralogy of Fallot (incl. pseudotruncus)

UNCOMMON
1. Complete atrioventricular canal (AV communis)
2. Double outlet left ventricle
3. Double outlet right ventricle (DORV)
4. Pentalogy of Fallot (tetralogy + ASD)
5. S. Truncus arteriosus

VSD FREQUENTLY ASSOCIATED WITH THE ANOMALY

COMMON
1. Atrial septal defect (ASD)
2. Coarctation of aorta
3. Complete transposition of great vessels
4. Patent ductus arteriosus (PDA)
5. Pulmonary stenosis

UNCOMMON
1. APVC
2. Chromosomal abnormalities (eg, trisomy anomalies)
3. Corrected transposition of great vessels
4. Ectopia cordis
5. Interruption of aortic arch
6. Left ventricular outflow tract obstruction
7. Prolapse of right aortic cusp with aortic insufficiency
8. Single ventricle
9. Sinus of Valsalva aneurysm
10. Tricuspid atresia

(continued)
References

Gamut E-12-S2
CARDIOVASCULAR ANOMALIES ASSOCIATED WITH COMPLETE ATRIOVENTRICULAR CANAL (CAVC)
1. Asplenia S. (Ivemark S.)
2. Patent ductus arteriosus (PDA)
3. Single ventricle
4. Tetralogy of Fallot
5. Trisomy 21 S. (Down S.)

References

Gamut E-13
RIGHT-TO-LEFT SHUNT AT DUCTUS LEVEL

COMMON
1. Coarctation of aorta, severe (preductal)
2. PDA with severe pulmonary vascular resistance (Eisenmenger physiology)
3. Persistent fetal circulation

UNCOMMON
1. APVC, total
2. Hypoplastic left heart S. (severe stenosis or atresia of mitral valve, aortic valve, or aortic arch)
3. Pulmonary vein atresia

References

Gamut E-14-S
PULMONARY ARTERIAL VASCULARITY IN COMMON CONGENITAL HEART DISEASES (See E-15–19)

SHUNT VASCULARITY (OVERCIRCULATION)
WITH PROMINENT PULMONARY ARTERY SEGMENT

Incidence
1. VSD 22%
2. PDA 12%
3. ASD 11%
4. APVC, total (above diaphragm) 2%
5. Atrioventricular canal defect 2%
6. Aortopulmonary window
7. All other left-to-right shunts with normally related great vessels

SHUNT VASCULARITY WITH FLAT OR CONCAVE PULMONARY ARTERY SEGMENT
*1. Complete transposition of great vessels 6%
*2. Truncus arteriosus (types II and III) 3%
*3. Corrected transposition with VSD
*4. Single ventricle
*5. Tricuspid atresia with normally related vessels
NORMAL VASCULARITY

1. Pulmonary valvular stenosis 10%
2. Coarctation of aorta 7%
3. Aortic stenosis 3%
4. Corrected (L-loop) transposition of great vessels <2%
5. Endocardial fibroelastosis <2%
6. Small left to right shunt
7. Subaortic stenosis

DECREASED VASCULARITY

*1. Tetralogy of Fallot (incl. pseudotruncus) 12%
*2. Tricuspid atresia or stenosis 3%
*3. Ebstein anomaly; Uhl anomaly <2%
*4. Pulmonary atresia or severe stenosis with ASD, transposition, or single ventricle (eg, trilogy of Fallot) >2%
5. Tricuspid insufficiency, congenital (severe) <2%

* Cyanotic lesions.

References
5. Swischuk LE: Plain Film Interpretation in Congenital Heart Disease. (ed 2) Baltimore: Williams & Wilkins, 1979

ACYANOTIC CONGENITAL HEART DISEASE WITH NORMAL PULMONARY VASCULARITY*

COMMON
1. Aortic stenosis
2. Coarctation of aorta
3. Pulmonary stenosis
4. Small left-to-right shunts

UNCOMMON

*1. Anomalous origin of left coronary artery from pulmonary artery
*2. Aortic insufficiency
*3. Cor triatriatum
*4. Endocardial fibroelastosis
*5. Hypoplastic left heart S
*6. Idiopathic hypertrophic subaortic stenosis (IHSS)
*7. Interruption of aortic arch (usually with VSD and PDA)
*8. Mitral insufficiency
*9. Mitral stenosis
*10. Myocardopathy (eg, glycogen storage disease; rubella S.; Noonan S.; mucopolysaccharidoses) (See J-4)

* Normal pulmonary vasculature until left-sided heart failure develops in infancy, at which time pulmonary venous hypertension may be noted.
ACYANOTIC CONGENITAL HEART DISEASE WITH INCREASED PULMONARY VASCULARITY (SHUNT) (See E-51)

COMMON
1. Atrial septal defect (ASD)
2. Atrioventricular (AV) canal defect, partial or complete
3. Patent ductus arteriosus (PDA)
4. Ventricular septal defect (VSD)

UNCOMMON
1. Aortopulmonary window
2. APVC, partial
3. Coronary artery fistula
4. Ruptured sinus of Valsalva aneurysm (into RV or occasionally RA)

References

CYANOTIC CONGENITAL HEART DISEASE WITH INCREASED PULMONARY VASCULARITY (SHUNT) (See E-51)

COMMON
1. APVC, total (above diaphragm)
2. Complete transposition of great vessels
3. Truncus arteriosus (types I, II, and III)

UNCOMMON
1. Aortic atresia
2. Common atrium
3. Double outlet right ventricle (DORV); Taussig-Bing anomaly
4. Left-to-right shunt with reversal (Eisenmenger physiology, esp. PDA, VSD, AV canal)
5. Single ventricle without PS
6. Tricuspid atresia without PS

References

CYANOTIC CONGENITAL HEART DISEASE WITH PRECAPILLARY HYPERTENSION VASCULARITY (High Vascular Resistance, Eisenmenger Physiology)

COMMON
1. ASD, large
2. Atrioventricular (AV) canal
3. PDA, large
4. VSD (all types), large

UNCOMMON
1. Common atrium
2. Double outlet right ventricle (DORV) without PS
3. Single ventricle without PS
4. Transposition of great vessels, complete or corrected, with VSD or PDA, but without PS
5. Tricuspid atresia without PS
6. Truncus arteriosus (Types I, II, III)
CONGENITAL HEART DISEASE WITH DECREASED PULMONARY VASCULARITY (USUALLY CYANOTIC)

COMMON
1. Tetralogy of Fallot, incl. pseudotruncus (systemic collateral vasculature)

UNCOMMON
1. Asplenia S. (Ivemark S.)
2. Double outlet right ventricle with PS
3. Ebstein anomaly with ASD
4. Persistent fetal circulation
5. Pulmonary atresia or severe stenosis (isolated anomaly or associated with ASD)
6. Pulmonary stenosis with intact ventricular septum and ASD (trilogy of Fallot)
7. Single ventricle with PS
8. Transposition of great vessels, complete or corrected, with VSD and PS or atresia
9. Tricuspid atresia or stenosis with PS or atresia
10. Tricuspid insufficiency
11. Truncus arteriosus (rarely types II or III)
12. Uhl anomaly (parchment RV)

References

FLAT OR CONCAVE PULMONARY ARTERY SEGMENT IN CONGENITAL HEART DISEASE

COMMON
1. Complete transposition of great vessels
2. Tetralogy of Fallot (incl. pseudotruncus)

UNCOMMON
1. Asplenia S. (Ivemark S.)
2. Corrected transposition (pulmonary artery medially positioned)
3. Double outlet right ventricle (DORV) with pulmonary stenosis
4. Hypoplastic right heart S.
5. Pulmonary atresia with intact ventricular septum
6. Single ventricle with transposition of great vessels
7. Tricuspid atresia or stenosis with transposition of great vessels
8. Truncus arteriosus (types II and III)

References
3. Swischuk LE: Plain Film Interpretation in Congenital Heart Disease. (ed 2) Baltimore:Williams & Wilkins, 1979
VASCULAR RING AND OTHER ANOMALIES OF THE AORTIC ARCH AND BRACHIOCEPHALIC ARTERIES

COMMON
1. Coarctation of aorta
   a. Preductal (infantile—long segment narrowing)
   b. Postductal (adult—short, discrete narrowing)
2. Double aortic arch
3. Left aortic arch with aberrant right subclavian artery (incl. aortic diverticulum)
4. Pseudocoarctation of aorta
5. Right anterior aortic arch (Type I aortic arch) (mirror image branching of major arteries)
6. Right posterior aortic arch (Type II aortic arch)

UNCOMMON
1. Anomalous innominate artery
2. Anomalous left common carotid artery
3. Cervical aortic arch (right or left)
4. Innominate artery compression S.
5. Left aortic arch, right ductus, and right descending aorta
6. Pulmonary sling (left pulmonary artery arising from right pulmonary artery)
7. Right aortic arch, left descending aorta
8. Right aortic arch, right descending aorta, and aberrant or isolated left subclavian artery (Type III aortic arch)

References

CONGENITAL HEART DISEASE ASSOCIATED WITH ANTERIOR RIGHT AORTIC ARCH (TYPE I—MIRROR IMAGE BRANCHING)

1. Anatomically corrected malposition 50%*
2. Asplenia S. (Ivemark S.) 30–40%
3. Pseudotruncus arteriosus (pulmonary atresia with VSD) 40–50%
4. Tetralogy of Fallot 25%
   “Pink” tetralogy 15%
5. Transposition of great vessels with VSD and PS 5–10%
6. Tricuspid atresia 5%
7. Truncus arteriosus 25–35%
8. VSD (uncomplicated large) 2%

* % refers to approximate percentage of all cases of that anomaly with a right aortic arch.

Reference
### Positional Anomalies of the Thoracic Aorta and Aortic Arch

<table>
<thead>
<tr>
<th>ARCH</th>
<th>DESCENDING</th>
<th>SUBCLAVIAN ARTERY ANOMALY</th>
<th>AORTIC DIVERGENTICULUM</th>
<th>CONGENITAL HEART DISEASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>L + +</td>
<td>0</td>
<td>rare</td>
<td></td>
</tr>
<tr>
<td>Anomalous descending A</td>
<td>L +</td>
<td>rare</td>
<td>rare</td>
<td></td>
</tr>
<tr>
<td>RAA type I</td>
<td>R rare + +</td>
<td>rare</td>
<td>0 com</td>
<td></td>
</tr>
<tr>
<td>RAA type II</td>
<td>R rare + rare</td>
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<td>com rare</td>
<td></td>
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<td>Cervical AA, L</td>
<td>L rare com rare</td>
<td>com</td>
<td>com rare</td>
<td></td>
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<tr>
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<td>rare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anomalous R subclavian artery</td>
<td>L + + com</td>
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<tr>
<td>Double AA</td>
<td>L&amp;R +</td>
<td>0</td>
<td>rare</td>
<td></td>
</tr>
</tbody>
</table>

**Abbreviations:**
- N = Normal
- A = Aorta
- L = Left
- AA = Aortic arch
- R = Right
- com = common
- + = Present
- 0 = Absent

---

### Anomalous Arterial Communication in the Thorax

#### Direct Communication of Aorta and Pulmonary Artery
1. Aortopulmonary window
2. PDA
3. Postoperative shunt (eg, Blalock-Taussig; Waterston; Potts)
4. Pseudotruncus
5. Truncus arteriosus

#### Aortic or Systemic Artery Anomaly
1. Fistula
   a. Aortic—left ventricular tunnel
   b. Brachiocephalic artery to systemic vein (eg, fistula from transverse cervical artery to internal jugular vein)
   c. Coronary artery fistula
   d. Postoperative aortic-cardiac fistula
   e. Ruptured sinus of Valsalva aneurysm into heart
   f. Systemic—pulmonary AV malformation (bronchial, brachiocephalic, or chest wall artery to pulmonary artery, pulmonary vein, or azygos system)
2. Anomalous origin of systemic artery
   a. Left coronary artery from pulmonary artery
   b. Subclavian artery from pulmonary artery

(continued)
PULMONARY ARTERY ANOMALY
1. Fistula
   a. Pulmonary A V malformation
   b. Right pulmonary artery to left atrium fistula
2. Anomalous origin of pulmonary artery
   a. Left pulmonary artery from right pulmonary artery (pulmonary sling)
   b. Left or right pulmonary artery from descending aorta
   c. Left or right pulmonary artery from ascending aorta (hemitruncus)
3. Anomalous artery arising from aorta to supply a lung segment
   a. Sequestration of lung
   b. Venolobar S. (scimitar S.)

References

Gamut E-25-S

ANOMALOUS PULMONARY VENOUS RETURN CONNECTIONS (APVC)

TOTAL (TAPVC)*
1. Left vertical vein 37%
2. Coronary sinus 16%
3. Infracardiac (abdominal) 15%
4. Right SVC 14%
5. Right atrium 11%
6. Mixed 7%

PARTIAL (PAPVC)
1. SVC
2. Azygos vein

3. Right atrium
4. IVC; portal vein; hepatic vein (eg, scimitar S.)
5. Left innominate vein (via vertical vein)
6. Coronary sinus
7. Mixed

* 25% to 30% of patients with TAPVC may have other anomalies, such as VSD, PDA, coarctation or interruption of the aortic arch.

Reference

Gamut E-26

ABNORMAL CARDIAC POSITION;
CARDIAC DISPLACEMENT
(Congenital or Acquired)

CONGENITAL
1. Absence of a pulmonary artery
2. Agenesis or hypoplasia of a lobe or lung; venolobar S. (scimitar S.)
3. Asplenia S. or polysplenia S.
4. Congenital absence of left pericardium
5. Dextrocardia, mirror-image type with situs inversus
6. Dextroposition; mesocardia
7. Dextroversion with situs solitus or situs indeterminate
8. Levoposition (levocardia with situs inversus)
9. Pectus excavatum

ACQUIRED
1. Atelectasis; fibrosis of lung
2. Diaphragmatic hernia; elevation of hemidiaphragm
3. Emphysema, unilateral (esp. bullous)
4. Mass lesion (eg, neoplasm; cyst; hematoma; aneurysm)
5. Pleural fluid or thickening; mesothelioma
6. Pneumonectomy with resultant fibrothorax
7. Pneumothorax (tension)
8. Scoliosis (heart shifted to concave side)
9. Technical (rotation of patient)

References

Gamut E-26-S

TYPES OF DEXTROCARDIA

1. **Situs inversus** (all visceral organs opposite of normal; slightly increased incidence of cardiac anomalies in 5% to 10% of patients)
2. **Dextroposition with situs solitus** (cardiac apex displaced into right hemithorax—eg, hypoplasia of right lung; venolobar S.)
3. **Dextroversion with situs solitus** (anatomic relations are normal, but cardiac apex is in right side of chest—due to abnormal rotation of embryonic cardiac loop)
4. **Dextrocardia with situs ambiguus in asplenia S.** (bilateral right-sidedness—absent spleen; three lobes in each lung; left lobe of liver same size as right lobe; malrotation of bowel; cardiac apex in either hemithorax—cardiac anomalies include common atrium; single ventricle; PS; transposition of great vessels; and TAPVR)
5. **Dextrocardia with situs ambiguus in polysplenia S.** (bilateral left-sidedness—each lung has two lobes; hepatic segment of IVC is absent; cardiac apex is in right hemithorax in 50% of patients—cardiac anomalies include ASD; PAPVR; and interruption of IVC with azygos continuation)

Reference

Gamut E-27

RIGHT ATRIAL ENLARGEMENT

COMMON
1. Left to right shunt into right atrium (eg, ASD; patent foramen ovale; atroventricular canal defect; total or partial APVR; left ventricular–right atrial shunt; ruptured sinus of Valsalva aneurysm into right atrium)
2. [Pericardial cyst, lipoma, or encapsulated fluid]
3. Pulmonary stenosis
4. Right heart failure, any cause
5. Right ventricular enlargement resulting in atrial enlargement (esp. cor pulmonale; mitral stenosis; chronic left heart failure) (See E-54)
6. Tetralogy of Fallot; trilogy of Fallot
7. Tricuspid insufficiency (See E-28)

UNCOMMON
1. Congenital or idiopathic right atrioegaly; atrial aneurysm
2. Coronary artery fistula to RA
3. Ebstein anomaly; Uhl anomaly
4. Endocardial fibroelastosis
5. Endomyocardial fibrosis
6. Hypoplastic left heart S. (stenosis or atresia of mitral valve, aortic valve, or aortic arch with ASD and PDA)

(continued)
7. Neoplasm of right atrium or ventricle (eg, myxoma)  
   (See E-43)
8. Post-mitral valve replacement
9. Pulmonary atresia (with tricuspid insufficiency)
10. Transposition of great vessels with interatrial communication
11. Tricuspid atresia or stenosis (incl. carcinoid S.)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut E-28

TRICUSPID INSUFFICIENCY

COMMON
1. Pulmonary hypertension; cor pulmonale
2. Rheumatic heart disease
3. Right ventricular failure with enlargement

UNCOMMON
1. AV canal defect
2. Bacterial endocarditis (esp. in narcotics abuser)
3. Carcinoid S.
4. Ebstein anomaly
5. Endomyocardial fibrosis
6. Myxoma of right atrium
7. Trauma
8. Tricuspid valve prolapse

References

Gamut E-29

RIGHT VENTRICULAR ENLARGEMENT

COMMON
1. Chronic left heart failure (eg, mitral insufficiency; myocardiopathy) (See E-40)
2. Cor pulmonale; pulmonary arterial hypertension, primary or secondary (eg, COPD; diffuse interstitial fibrosis; pulmonary emboli; Eisenmenger physiology with reversed left-to-right shunt) (See E-54)
3. Left to right shunt (esp. ASD; VSD; PDA) (See E-7)
4. Mitral stenosis, acquired
5. Pseudotruncus arteriosus
6. Pulmonary stenosis with right ventricular failure

UNCOMMON
1. Double outlet right ventricle (DORV)
2. Ebstein anomaly; Uhl anomaly
3. Hypoplastic left heart syndrome, (stenosis or atresia of mitral valve, aortic valve, or aortic arch with ASD and PDA)
4. Infarction of right ventricle
5. Neoplasm of right ventricle or left atrium (eg, myxoma) (See E-43)
6. Pulmonary atresia (with tricuspid insufficiency)
7. Pulmonary insufficiency; absent pulmonary valve
8. Pulmonary venous obstruction (eg, congenital mitral stenosis; cor triatriatum; veno-occlusive disease) (See E-3-S, E-59)
9. Transposition of great vessels
10. Tricuspid insufficiency
11. Trilogy of Fallot
12. Truncus arteriosus

References

Gamut E-30

FILLING DEFECT IN RIGHT VENTRICLE ON ANGIOCARDIOGRAPHY

COMMON
1. Jet of unopacified blood (eg, VSD with left-to-right shunt)
2. Thrombus

UNCOMMON
1. Aneurysm or diverticulum of ventricular septum
2. Anomalous muscle bundle
3. [Bernheim S. (left ventricular hypertrophy encroaching on right ventricle)]
4. Endocardial fibroelastosis (with bulging ventricular septum)
5. Foreign body (eg, catheter)
6. Idiopathic myocardial hypertrophy (eg, IHSS)
7. Neoplasm of heart, primary or metastatic (See E-43)
8. Prolapsed valve

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
MITRAL INSUFFICIENCY

COMMON
1. Bacterial endocarditis
2. Functional—left ventricular dilatation (eg, cardiac failure; coarctation of aorta; aortic insufficiency; myocardiopathy)—(See E-40)
3. Mitral valve prolapse
4. Myxomatous degeneration of valve leaflets
5. Papillary muscle rupture or dysfunction (eg, infarction; ischemic heart disease; trauma)
6. Postoperative (eg, mitral valve repair; valvotomy; balloon valvoplasty; dysfunctional prosthetic mitral valve)
7. Rheumatic endocarditis
8. Ruptured chordae tendineae

UNCOMMON
1. Atrioventricular canal defect
2. Congenital valvular insufficiency
3. Corrected transposition (with anomalous left atrioventricular valve)
4. Ehlers-Danlos S.
5. Endocardial fibroelastosis
6. Idiopathic hypertrophic subaortic stenosis (IHSS)
7. Marfan S.
8. Mitral anulus anomaly or calcification
9. Neoplasm (eg, carcinoid, left atrial myxoma) (See E-43)
10. Polychondritis; osteogenesis imperfecta
11. Takayasu arteritis

References

EXTRA BUMP ALONG THE UPPER LEFT HEART BORDER (THE THIRD MOGUL)

COMMON
1. Aneurysm of left ventricle
2. Left atrial appendage enlargement (esp. rheumatic or congenital heart disease)
3. [Pericardial adhesion, postoperative (eg, CABG) or other]
4. [Pericardial defect, total or partial, with herniation of left atrial appendage]
5. [Thymus gland; mediastinal mass, esp. thymoma; thymic cyst; germ cell lesion; lymphoma g]

UNCOMMON
1. Coronary artery aneurysm; or AV fistula
2. Corrected transposition or single ventricle with left-sided ascending aorta and rudimentary right ventricle in inverted position
3. Cyst (eg, pericardial; hydatid)
4. Ebstein’s anomaly
5. Myocardiopathy (See E-40)
6. Neoplasm of heart or pericardium (See E-43)
7. [Pleural plaque (asbestosis)]
8. Postoperative deformity (eg, pulmonary artery conduit; aneurysm)
9. Right atrial appendage, levoposition
10. Sinus of Valsalva aneurysm (left)
11. Tetralogy of Fallot (eg, postoperative dilatation of patch used for correction of infundibular stenosis)

References
2. Swischuk LE: Plain Film Interpretation in Congenital Heart Disease. (ed 2) Baltimore: Williams & Wilkins, 1979

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
LEFT VENTRICULAR ENLARGEMENT

COMMON
1. Aortic insufficiency (eg, rheumatic heart disease) (See E-35)
2. Aortic stenosis (rheumatic; congenital—bicuspid aortic valve; degenerative—idiopathic calcific stenosis) when in left ventricular failure
3. Athlete’s heart (no disease)
4. Coarctation of aorta when in left ventricular failure
5. Coronary or arteriosclerotic heart disease (incl. myocardial infarction; left ventricular aneurysm) when in left ventricular failure
6. Heart failure (See E-4, E-59)
7. High output heart disease (eg, anemia; thyrotoxicosis; arteriovenous fistula) (See E-39)
8. Hypertension (eg, essential; renal disease; Cushing S.; pheochromocytoma) (See E-37)
9. Mitral insufficiency (See E-32)
10. Myocardiopathy; myocarditis (See E-40)
11. PDA; aortopulmonary window
12. VSD

UNCOMMON
1. Atroventricular canal defect
2. Double outlet right ventricle (DORV)
3. Endocardial fibroelastosis
4. IHSS (subvalvular aortic stenosis)
5. Neoplasm of left ventricle (See E-43)
6. [Pericardial defect, total or partial]
7. Pulmonary atresia with intact ventricular septum
8. Supravalvular aortic stenosis (eg, Williams S.)
9. Subvalvular left ventricular aneurysm (African)
10. Transposition of great vessels
11. Tricuspid atresia or stenosis
12. Truncus arteriosus

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
Gamut E-34

Gamut E-34-S

RADIOLOGIC FINDINGS (PULMONARY VASCULATURE AND LV SIZE) IN COMMON DISEASES WITH LEFT VENTRICULAR STRAIN

PULMONARY VASCULATURE

<table>
<thead>
<tr>
<th>Normal to Slightly Enlarged</th>
<th>Moderately to Markedly Enlarged</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Aortic insufficiency</td>
</tr>
<tr>
<td>Aortic or subaortic stenosis</td>
<td>Myocardiopathy</td>
</tr>
<tr>
<td>Coarctation of aorta</td>
<td>Hypertension</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Pericardial effusion</td>
</tr>
<tr>
<td>Athlete’s heart</td>
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</table>

Venous Congestion

<table>
<thead>
<tr>
<th>Venous Congestion</th>
<th>Normal to Slightly Enlarged</th>
<th>Moderately to Markedly Enlarged</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute myocardial infarction</td>
<td>Heart failure</td>
<td></td>
</tr>
<tr>
<td>Mitral stenosis</td>
<td>Mitral insufficiency</td>
<td></td>
</tr>
<tr>
<td>Hypervolemia</td>
<td>Mitral stenosis with aortic and/or tricuspid insufficiency</td>
<td></td>
</tr>
<tr>
<td>Constrictive pericarditis</td>
<td>Complete AV canal</td>
<td></td>
</tr>
</tbody>
</table>

Arterial and Venous Distention

<table>
<thead>
<tr>
<th>Arterial and Venous Distention</th>
<th>Normal to Slightly Enlarged</th>
<th>Moderately to Markedly Enlarged</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSD (large shunt)</td>
<td>Complete AV canal</td>
<td></td>
</tr>
<tr>
<td>PDA (large shunt)</td>
<td>Combination of 2 to 3 shunts or valve incompetence</td>
<td></td>
</tr>
<tr>
<td>AV malformations</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reference


Gamut E-35

AORTIC INSUFFICIENCY

COMMON

1. Aortic root dilatation with stretched valve ring (eg, cystic medial necrosis of ascending aorta; aortic ectasia; aneurysm of ascending aorta—esp. dissecting aneurysm; atherosclerosis; hypertension)
2. Congenital valvular deformity (eg, bicuspid or fenestrated aortic valve)
3. Dissection of aorta (eg, Marfan S.) (See E-64)
4. Rheumatic fever (aortic valvulitis; endocarditis)

UNCOMMON

1. Aneurysm of left ventricle, subvalvular (African)
2. Aortic—left ventricle tunnel
3. Aortic valve stenosis with calcification
4. Aortitis (eg, syphilitic; rheumatic; rheumatoid arthritis; ankylosing spondylitis; Reiter S.; Takayasu arteritis; giant cell idiopathic)
5. Bacterial endocarditis
6. Behçet S.
7. Blunt chest trauma
8. Connective tissue disease (collagen disease)
9. Mucopolysaccharidoses (See J-4)
10. Myxomatous aortic valve degeneration
11. Postoperative (eg, after valvotomy for aortic stenosis or balloon valvoplasty)
12. Prosthetic aortic valve dysfunction, degeneration, or thrombosis
13. Rupture of aortic cusp, traumatic or other
14. Sinus of Valsalva aneurysm, congenital or acquired (eg, syphilitic, dissecting, traumatic, mycotic, atherosclerotic)
15. Supravalvular aortic stenosis (eg, Williams S.)
16. VSD high in septum with prolapsed noncoronary aortic cusp

* Acute aortic insufficiency.

References
1. Fowler NO: Cardiac Diagnosis and Treatment. (ed 3) Hagerstown, MD: Harper & Row, 1980

1. Change in size of occluding ball or disc
2. Degeneration of xenograft or homograft
3. Infection
4. Strut fracture
5. Suture line dehiscence
6. Thrombosis of prosthesis

* Best evaluated by 2-D echocardiography, pulsed or color flow Doppler, isotope ventriculography, or MRI.

Reference

References
2. Streiter ML: Gamut: Unilateral renal lesion that may result in hypertension. Semin Roentgenol 1981;16:75–76

HYPERTENSION AND HYPERTENSIVE CARDIOVASCULAR DISEASE

COMMON
1. Adrenal disease (eg, adrenocortical adenoma; adrenal carcinoma; pheochromocytoma; adrenogenital S.; aldosteronism; Cushing S.)
2. Essential (idiopathic) hypertension
3. Renal disease (eg, glomerulonephritis; chronic pyelonephritis; renal tumor; renal agenesis or hypoplasia; polycystic kidneys)
4. Renovascular disease (eg, renal artery stenosis; fibromuscular hyperplasia; perirenal hematoma (Page kidney) (See H-59-1, H-59-2)

UNCOMMON
1. Central nervous system disorder (eg, psychogenic; neurogenic; familial dysautonomia (Riley-Day S.)
2. Coarctation of aorta
3. Connective tissue disease (collagen disease), (esp. lupus erythematosus; polyarteritis nodosa)
4. Drug therapy (eg, estrogen-containing oral contraceptives)
5. Hyperthyroidism
6. Pituitary disease (eg, acromegaly; Cushing S.)

Reference
ISCHEMIC HEART DISEASE

COMMON
1. Coronary atherosclerosis
2. Coronary embolism or thrombosis
3. Coronary spasm
4. Myocardial infarction

UNCOMMON
1. Anemia (eg, sickle cell disease; thalassemia; hookworm disease)
2. Hypervolemia (fluid overload; overtransfusion)
3. Pregnancy
4. Thyrotoxicosis

HIGH OUTPUT HEART DISEASE*

COMMON
1. Anemia (eg, sickle cell disease; thalassemia; hookworm disease)
2. Hypervolemia (fluid overload; overtransfusion)
3. Pregnancy
4. Thyrotoxicosis

UNCOMMON
1. Athletes, highly trained
2. AV fistula or malformation —peripheral, pulmonary, abdominal (eg, cavernous hemangioma of liver), or cerebral (eg, vein of Galen aneurysm)
3. Beriberi (vitamin B1 deficiency)
4. Leukemia
5. Liver disease (eg, acute liver failure; advanced cirrhosis)
6. Obesity (Pickwickian S.)
7. Paget’s disease
8. Polycythemia vera
9. Pyrexia; septic shock

* Also referred to as high-flow syndromes or hyperkinetic circulatory states.

References
COMMON
1. Amyloidosis
2. Anemia
3. Connective tissue disease (collagen disease), (esp. scleroderma; lupus erythematosus; dermatomyositis; rheumatoid arthritis)
4. Endocardial fibroelastosis
5. Hypertrophic cardiomyopathy, primary or secondary (eg, aortic stenosis; IHSS; coarctation of aorta; hypertension)
6. Idiopathic dilated cardiomyopathy
7. Infectious myocarditis (rheumatic fever; sepsis; diphtheria; Chagas’ disease; toxoplasmosis; Coxsackie; rubella; other viral disease)
8. Ischemia (incl. coronary artery disease; hypoxia)
9. Nutritional deficiency (eg, beriberi; alcoholism; cirrhosis; starvation)
10. Thyrotoxicosis

UNCOMMON
1. Acromegaly
2. Anomalous origin of left coronary artery from pulmonary artery
3. Congenital syndromes (eg, glycogen storage disease; Hurler S.) (See E-40-2)
4. Coronary artery calcification in infants
5. Cushing S.
6. Endomyocardial fibrosis (African myocardopathy)
7. Familial
8. Hemochromatosis
9. Leukemia; lymphoma
10. Myxedema (hypothyroidism)
11. Neoplasm, metastatic or primary (eg, fibroma; rhabdomyoma—esp. with tuberous sclerosis) (See E-43)
12. Neuromuscular disorder (eg, Friedreich’s ataxia; Duchenne’s progressive muscular dystrophy)
13. Postpartum
14. Potassium or magnesium depletion
15. Pseudoxanthoma elasticum
16. Radiation therapy
17. Sarcoidosis
18. Subvalvular left ventricular aneurysm (African)
19. Toxicity (eg, drugs, esp. cytotoxic, Adriamycin; chemicals; cobalt—beer drinker’s heart)
20. Uremia

* Seen in infants or young children.

References
Gamut E-40

Gamut E-40-2

CONGENITAL SYNDROMES WITH MYOCARDIOPATHY

COMMON
1. Adrenogenital S. (congenital adrenal hyperplasia)
2. Gaucher disease; Niemann-Pick disease
3. Glycogen storage disease, types II (Pompe) and III
4. Hemochromatosis
5. Hyperthyroidism (congenital)
6. Hypothyroidism; cretinism
7. Mucolipidoses, types II (I-cell disease) and III
   (pseudo-Hurler polydystrophy)
8. Mucopolysaccharidoses (esp. Hurler S.) (See J-4)
9. Neuromuscular disorder, eg, Friedreich ataxia;
   Duchenne muscular dystrophy; Werdnig-Hoffmann
disease; Kugelberg-Welander S.
10. Noonan S.

UNCOMMON
1. Aspartylglycosaminuria
2. Congenital rubella S.
3. Degos S.
4. Endomyocardial fibrosis (African cardiomyopathy)
5. Fabry disease
6. Farber disease (disseminated lipogranulomatosis)
7. GM1 gangliosidosis; fucosidosis; mannosidosis
8. Hemolytic-uremic S.
9. Hyperphosphatasia
10. Kearns-Sayre S.
11. Leigh disease
12. LEOPARD S. (multiple lentigenes S.)
13. Neuroacanthocytosis
14. Polymyositis; dermatomyositis
15. Pseudoxanthoma elasticum
16. Refsum disease
17. Spondylometaphyseal dysplasia (Sedaghatian type)
18. Yunis-Varón S.

Reference
1. Taybi H, Lachman RS: Radiology of Syndromes, Metabolic
   Disorders, and Skeletal Dysplasias. (ed 4) St. Louis: Mosby-
   Year Book, 1996, p 970

Gamut E-41

GROSSLY ENLARGED HEART

COMMON
1. Aortic insufficiency
2. Combined valvular disease (esp. mitral and aortic)
3. Heart failure, advanced
4. Large left to right shunt (esp. ASD; VSD; PDA) in
   various combinations
5. Mitral insufficiency
6. Myocardiopathy (See E-40)
7. Pericardial effusion; hemopericardium

UNCOMMON
1. Complete atrioventricular canal
2. Tricuspid insufficiency (eg, Ebstein anomaly)
3. Valvular atresia (esp. pulmonary)

Gamut E-42

SMALL HEART

COMMON
1. Asthenia
2. Cor pulmonale (AP view)
3. [Emphysema (eg, asthma; senile; cystic fibrosis)]
4. Normal
5. Senile atrophy
6. Wasting disease; cachexia (eg, malnutrition; dehy-
   dration; kwashiorkor; tuberculosis; carcinoma; lym-
   phoma; anorexia nervosa; scleroderma)

UNCOMMON
1. Adrenal insufficiency (Addison’s disease)
2. Adrenogenital S.
3. Blood loss, severe
4. Constrictive pericarditis (See E-48)
5. Hypovolemia (eg, burn; dysentery)

[ ] This condition does not actually cause the gamuted imaging finding,
but can produce imaging changes that simulate it.
Reference

Gamut E-43
CARDIAC OR PERICARDIAL NEOPLASM OR CYST

COMMON
1. Invasive pulmonary or mediastinal neoplasm (eg, lymphoma; bronchogenic or esophageal carcinoma; thymoma)
2. Metastasis (eg, from lung; breast; melanoma; lymphoma; leukemia)
*3. Myxoma (esp. left atrial)
4. Pericardial cyst
5. Rhabdomyoma (esp. with tuberous sclerosis)
6. Sarcoma (eg, rhabdomyosarcoma; fibrosarcoma; liposarcoma; hemangiosarcoma; myxosarcoma; undifferentiated sarcoma)

UNCOMMON
1. Angioma (eg, hemangioma; lymphangioma)
2. Bronchogenic cyst (intrapericardial)
*3. Fibroma (fibrous hamartoma)
4. Hydatid cyst
5. Lipoma
*6. Mesenchymoma, benign or malignant
7. Mesothelioma
8. Pericardial diverticulum
9. Pheochromocytoma
10. Teratoma (intrapericardial)

* May show calcification in tumor.

References

Gamut E-44
CALCIFICATION IN THE HEART OR GREAT VESSELS

COMMON
*1. Aneurysm of aorta or sinus of Valsalva (See E-63)
*2. Aortic annulus (atherosclerosis; aging; syphilis) or valve (aortic stenosis; infective endocarditis; bicuspid aortic valve)
3. Aortitis (eg, syphilis; Takayasu S.)
4. Atherosclerosis of aorta
*5. Coronary arteriosclerosis; Mönckeberg’s medial sclerosis (incl. progeria)
6. Mitral annulus (atherosclerosis; Marfan S.) or valve (rheumatic endocarditis with mitral stenosis)
*7. Myocardial infarction, old; myocardial left ventricular aneurysm
*8. [Pericardial calcification; constrictive pericarditis (See E-45, E-48)]

(continued)
UNCOMMON
1. Alkaptonuria (ochronosis)
2. Aneurysm of left ventricle, subvalvular (African)
3. Coronary artery aneurysm (eg, Kawasaki S.)
   (See E-65)
4. Diabetes
*5. Ductus arteriosus or ligamentum arteriosus
*6. Endocardial fibroelastosis
7. Endocardium (eg, jet site from ASD or VSD)
*8. Hydatid cyst
*9. Idiopathic
10. Left atrial wall (rheumatic endocarditis, severe
    mitral valve disease)
*11. Metastatic calcinosus (eg, hyperparathyroidism;
    hypervitaminosis D)
*12. Myocardiopathy (eg, IHSS; Hurler S.)
*13. Neoplasm of heart (eg, myxoma, esp. of left
    atrium; fibroma) (See E-43)
14. Oxalosis
15. Postmyocarditis (esp. rheumatic fever)
16. Pulmonary hypertension
*17. Singleton-Merten S.
18. Thrombus in heart chamber (esp. with myocardial
    infarct or aneurysm or in Chagas’ disease) or in
    great vessel (eg, aorta; inferior vena cava; pul-
    monary artery)
*19. Trauma, external or iatrogenic (eg, incision; coro-
    nary bypass graft; conduit)

* May occur in children.
[ ] This condition does not actually cause the gamuted imaging finding,
but can produce imaging changes that simulate it.

References
1. Arndt RD, Smith LE, Po J, et al: Myocardial calcification of
   the infant heart following infarction. AJR 1974;122:133–136
2. Bisset GS III: Gamut: Cardiac and great vessel calcifica-
   tions in childhood: Semin Roentgenol 1985;20:194–195
   Diagnosis. (ed 3) Philadelphia: Lippincott-Raven, 1997,
   p 266–271
4. Kleiner JP, Way GL, Hamaker WR: Intracardiac calcifica-
5. Littleton JT, Cady JB: Free-floating calculi in the pericar-
   dial cavity. AJR 1978;131:901–903
   distinction between pericardial and myocardial calcifica-
   tions. AJR 1987;148:675–677
7. Meszaros WT: Cardiac Roentgenology. Springfield, IL: CC
   Thomas, 1969, p 8
8. Shabetai R: The Pericardium. New York: Grune & Stratton,
   1981
   tions of the Heart. Springfield, IL: CC Thomas, 1963
10. Shawdon HH, Dinsmore RE: Pericardial calcification: Ra-
    diological features and clinical significance in twenty-six
11. Teplick JG, Haskin ME: Roentgenologic Diagnosis. (ed 3)
    Philadelphia: WB Saunders, 1976

PERICARDIAL CALCIFICATION

COMMON
1. Chronic constrictive pericarditis (esp. tuberculosis)
   (See E-48)
2. Idiopathic pericarditis
3. Purulent pericarditis

UNCOMMON
1. Asbestos plaques along pericardium
2. Hemopericardium
3. Rheumatic fever

References
1. Elliott LP: Cardiac Imaging in Infants, Children, and Adults.
2. Roberts WC, Spray TL: Pericardial heart disease: A study
Gamut E-47

GAS EMBOLISM IN THE HEART OR BLOOD VESSELS (See E-47)

COMMON
1. Fetal death
2. Hyaline membrane disease
3. Intravascular catheterization, cannulation, or therapy (e.g., umbilical vein; central venous pressure line; blood transfusion or other infusion; angiography)
4. Postoperative or intraoperative (e.g., cardiac bypass; lung resection; biopsy; abdominal aortic graft)
5. Respirator therapy (e.g., PEEP)
6. Resuscitation maneuver
7. Trauma, penetrating (e.g., laceration; blast; percutaneous high pressure injection; air hose injection)

UNCOMMON
1. Abortion; parturition; vaginal insufflation (e.g., cunnilingus; douching)
2. Abscess perforation into vessel
3. ARDS
4. Asthmatic episode
5. Decompression sickness (e.g., caisson disease)
6. Dental procedure (root canal treatment; drilling)
7. Emphysematous gastritis; corrosive gastritis
8. Gastrointestinal perforation into vessel (e.g., enema; peptic ulcer)
9. Hydrogen peroxide enema
10. Injection of gas (e.g., cerebral pneumography; arthrography; Rubin’s test; artificial pneumothorax or pneumoperitoneum; suicidal or homicidal attempt)
11. Irrigation (lavage) or drainage of abscess, empyema, or paranasal sinus
12. Malignant neoplasm with invasion of vessel (e.g., bronchovascular fistula; esophageal-aortic fistula)
13. Necrotizing enterocolitis; mesenteric infarction; toxic megacolon
14. Sepsis with gas-producing organism (esp. in a diabetic)
15. Thoracentesis; pericardiocentesis; peritoneocentesis (incl. hemodialysis)
16. Whooping cough (pertussis)

References
3. Kogutt MS: Systemic air embolism secondary to respiratory therapy in the neonate: Six cases including one survivor. AJR 1978;131:425–429

Gamut E-46

PNEUMOPERICARDIUM

COMMON
1. Iatrogenic (e.g., postoperative; intubation; pericardiocentesis; resuscitation; respiratory therapy; positive pressure ventilation)

UNCOMMON
1. ARDS
2. Congenital absence of the pericardium with pneumothorax
3. Hyaline membrane disease
4. Idiopathic
5. [Intracardiac gas (See E-46)]
6. Perforation from adjacent abscess (esp. amebic), neoplasm, or radiation necrosis; cutaneous fistula
7. Pericarditis due to gas-forming organism
8. Pneumomediastinum or interstitial pulmonary leakage with extension into pericardium
9. Trauma, external (e.g., stab wound; tracheal injury)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference
CONSTRUCTIVE PERICARDITIS

COMMON
1. Idiopathic
2. Tuberculosis

UNCOMMON
1. Asbestosis (pleuroperticardial); talciosis
2. Histoplasmosis
3. Neoplasm (eg, primary, metastatic, or locally invasive—esp. mesothelioma; invasive thymoma; lymphoma,) (See E-43)
4. Parasitic disease (eg, amebic abscess from liver or lung rupturing into pericardial sac)
5. Postpericardiotomy S.
6. Pyogenic infection (esp. staphylococcal; pneumococcal)
7. Radiation therapy (esp. for lymphoma, carcinoma of breast)
8. Rheumatic pericarditis
9. Traumatic pericarditis; hemopericardium
10. Uremia; prolonged hemodialysis
11. Viral pericarditis (esp. Coxsackie B)

PERICARDIAL EFFUSION

COMMON
1. Connective tissue disease (collagen vascular disease), esp. lupus erythematosus; rheumatoid disease; scleroderma; MCTD; polyarteritis arteritis)
2. Heart failure
3. Neoplasm of pericardium or heart, primary or invasive from lung, pleura, or mediastinum (eg, bronchogenic carcinoma; mesothelioma; lymphoma; invasive thymoma) or metastatic (eg, carcinoma of lung or breast; melanoma) (See E-43)
4. Pericarditis, infectious (viral; Coxsackie; bacterial; amebic; toxoplasmonic; tuberculous; histoplasmonic; rheumatic)
5. Postmyocardial infarction S. (Dressler S.)
6. Postpericardiotomy S. (incl. coronary artery bypass)
7. Trauma, external or iatrogenic (hemopericardium)
8. Uremia; nephrotic S.

UNCOMMON
1. Amyloidosis; Waldenström’s macroglobulinemia; familial Mediterranean fever
2. Anemia, (eg, thalassemia; erythroblastosis fetalis)
3. Behçet S.
4. Beriberi; hypoalbuminemia
5. Bleeding or clotting disorder, (eg, hemophilia; thrombocytopenia; hypoprothrombinemia; anticoagulant therapy)
7. Dissecting aneurysm with leakage
8. Drug reaction
9. Endomyocardial fibrosis (African myocardiopathy)
10. Gout
11. Idiopathic
12. Myxedema; hypothyroidism
13. Pancreatitis
14. Polyserositis

References
15. Radiation therapy (eg, for lymphoma; carcinoma of breast or lung)
16. Reiter S.; Reiter/reactive arthritis
17. Sarcoidosis
18. Stevens-Johnson S.
19. Superior vena cava obstruction
20. Wegener granulomatosis
21. Whipple’s disease

References

Gamut E-51

GENERALIZED PULMONARY ARTERIAL HYPERVASCUlarity
(See E-16, 17)

COMMON
1. High output heart disease (See E-39)
2. Left to right shunt (esp. ASD; VSD; partial or complete AV communis; PDA; AP window) (See E-7)

UNCOMMON
1. Aneurysm of sinus of Valsalva rupture
2. Aorta-pulmonary artery fistula (eg, traumatic; post-operative; ruptured aneurysm)
3. Aortic atresia
4. APVC, partial or total
5. Common atrium
6. Cor biloculare
7. Coronary artery fistula
8. Double outlet right ventricle without PS
9. Eisenmenger physiology (reversal of left to right shunt with development of pulmonary hypertension)
10. Pulmonary arteriovenous malformation
11. Single ventricle without PS
12. Taussig-Bing S.
13. Transposition of great vessels with large VSD
14. Tricuspid atresia without PS
15. Truncus arteriosus

References

(continued)
2. Elliott LP: Cardiac Imaging In Infants, Children, and Adults. Philadelphia: Lippincott, 1991, p 156
6. Swischuk LE: Plain Film Interpretation in Congenital Heart Disease. (ed 2) Baltimore: Williams & Wilkins, 1979

Gamut E-52

INCREASED PULMONARY ARTERIAL CIRCULATION TO ONE LUNG

COMMON
1. Air trapping in contralateral lung (eg, Swyer-James S.; bullous emphysema)
2. Arteriovenous malformation (congenital or acquired)
3. Obstruction of contralateral pulmonary artery (eg, thromboembolism; neoplasm; histoplasmic lymphadenopathy)

UNCOMMON
1. Contralateral scimitar S.; hypogenetic lung; pulmonary artery atresia, stenosis, or coarctation
2. Left-to-right shunt with increased flow to one lung (eg, PDA; AV communis)
3. Postoperative cyanotic congenital heart disease (eg,Waterson, Blalock, or Potts procedure)
4. Unilateral origin of a pulmonary artery from the aorta; truncus arteriosus with single pulmonary artery

Reference

Gamut E-53

PROMINENCE OF THE MAIN PULMONARY ARTERY SEGMENT

COMMON
1. “Aneurysm” of pulmonary artery (See E-55)
2. Cor pulmonale; pulmonary arterial hypertension, primary or secondary (eg, diffuse lung or pulmonary arterial disease; chronic heart disease; obesity) (See E-54)
3. [Enlarged left atrial appendage]
4. Heart failure (See E-4, E-59)
5. High output heart disease (eg, anemia; thyrotoxicosis; fluid overload) (See E-39)
6. Idiopathic
7. Left to right shunt (eg, ASD, VSD, PDA) (See E-7)
8. [Mediastinal or left hilar mass (eg, bronchogenic carcinoma; metastasis)]
9. Mitral stenosis or insufficiency, acquired or congenital
10. Normal in young adults under 25 (esp. women)
11. Pregnancy
12. Pulmonary thromboembolism
13. Pulmonary valvular stenosis (poststenotic dilatation)
14. [Technical or positional factor (eg, lordotic view; patient rotation; cardiac rotation in left lower lobe collapse; dextroscoliosis; pectus excavatum)]

UNCOMMON
1. Absent pulmonary valve
2. Aortopulmonary fistula, traumatic or postoperative (eg, laceration; ruptured aneurysm; Potts procedure)
3. APVC, partial or total
4. Coarctation of pulmonary artery or its branches
5. Congenital absence of the pericardium
6. Cor triatriatum
7. Double outlet right ventricle
8. Eisenmenger physiology (reversal of left to right shunt with development of pulmonary hypertension)
9. Endomyocardial fibrosis (African myocardiopathy)
10. Hypoplastic left heart S. \( g \) (incl. interrupted aortic arch)
11. Left to right shunt, other (eg, aortopulmonary window; atrioventricular canal defect; coronary artery fistula to right heart or PA)
12. Marfan S.
13. Neoplasm of heart (esp. left atrial myxoma) (See E-43)
14. Parachute mitral valve complex
15. Pulmonary insufficiency
16. Tricuspid atresia without pulmonary stenosis
17. Trilogy of Fallot
18. Truncus arteriosus, type 1

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**


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**DIFFUSE LUNG DISEASE**

1. Alveolar microlithiasis
2. Asthma; chronic bronchitis
3. Bronchiolo-alveolar carcinoma
4. Bronchiectasis
5. Connective tissue disease (collagen disease) \( g \) (eg, scleroderma; rheumatoid lung; lupus erythematosus; dermatomyositis)
6. Cystic fibrosis (mucoviscidosis)
7. Emphysema (incl. alpha \(_1\)-antitrypsin deficiency S.)
8. Fat embolism
9. Fungus disease
10. Interstitial fibrosis
11. Langerhans cell histiocytosis \( g \)
12. Metastases, lymphangitic or embolic (eg, trophoblastic)
13. Pneumoconiosis
14. Sarcoidosis
15. Tuberculosis

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**DIFFUSE PULMONARY VASCULAR OR HEART DISEASE**

1. Arteritis (eg, polyarteritis nodosa; lupus erythematosus; Takayasu S.; Wegener granulomatosis)
2. Congenital syndromes (eg, cutis laxa; Ehlers-Danlos S.; Marfan S.; osteodysplasty {Melnick-Needles S.}; mucopolysaccharidoses—Hurler; Scheie; Hunter; Maroteaux-Lamy)
3. Hypoplastic left heart S. \( g \)
4. [Idiopathic (usually young women)]
5. Left-to-right shunt, chronic (esp. ASD, VSD, PDA—with Eisenmenger physiology (reversal of left to right shunt with development of pulmonary hypertension) (See E-7)
6. Left ventricular failure, chronic
7. Mitral stenosis or insufficiency (longstanding)
8. Primary pulmonary hypertension, idiopathic; pulmonary arteriolar sclerosis
9. Pulmonary artery stenoses or coarctations, multiple (incl. Williams S.; Alagille S. {arteriohepatic dysplasia})
10. Pulmonary thromboembolism (eg, multiple pulmonary emboli; intravenous drug abuse; sickle cell disease; polycythemia vera; tumor emboli)
11. Pulmonary venous hypertension (See E-59)
12. Schistosomiasis
13. Tuberous sclerosis
14. Venolobar S. (scimitar S.)
15. Ventriculoatrial shunt for hydrocephalus

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut E-55

PULMONARY ARTERY “ANEURYSM”*

COMMON
1. False aneurysm (external trauma; postoperative)
2. Left to right shunt, large (See E-7)
3. Pulmonary arterial hypertension (eg, emphysema; schistosomiasis) (See E-54)
4. Pulmonary valvular stenosis (poststenotic dilatation)

UNCOMMON
1. Arteriovenous malformation
2. Arteritis (eg, polyarteritis nodosa; Takayasu S.; syphilis)
3. Atherosclerosis
4. Behçet S.
5. Hughes-Stovin S. (venous thrombosis plus pulmonary artery aneurysms)
6. Idiopathic
7. Medial degeneration or necrosis /dissection (eg, Marfan S.; Ehlers-Danlos S.; mucopolysaccharides)—(See J-4)
8. Mycotic aneurysm (esp. drug addiction)

* Marked aneurysmal-like dilatation of the main pulmonary artery.

References

Gamut E-56

LOCALIZED ENLARGEMENT OF A PULMONARY VESSEL

COMMON
*1. AV malformation, congenital or acquired (eg, traumatic)
2. Obstructed pulmonary vein or artery (eg, thrombus; neoplasm; granulomatous lesion)
*3. Varix, congenital or acquired (eg, mitral stenosis)

UNCOMMON
*1. Aneurysm of pulmonary artery (eg, polyarteritis nodosa; Takayasu S.; mycotic aneurysm in drug addiction)
2. Anomalous insertion site of pulmonary vein into left atrium
3. Anomalous pulmonary vein (eg, scimitar or venolobar S.); partial APVC
4. Atresia or stenosis of pulmonary vein (veno-occlusive disease)
*5. Bronchial artery dilatation (eg, tetralogy of Fallot)
6. Cirrhotic aneurysm
*7. Coarctation or stenosis of pulmonary artery or its branches (poststenotic dilatation)
8. Sequestration of lung; anomalous pulmonary artery arising from aorta
9. Systemic artery—pulmonary artery shunt (See E-24, E-60)
*10. Telangiectasia (eg, portal hypertension; Osler-Weber-Rendu S.)
11. Tetralogy of Fallot with absent pulmonary valve

References

Gamut E-57

PULMONARY VALVE OR MAIN PULMONARY ARTERY OBSTRUCTION (OFTEN LEADING TO PULMONARY HYPOVASCULARITY)

COMMON
*1. Lymphadenopathy with compression (eg, sarcoidosis; tuberculosis; histoplasmosis)
*2. Metastatic or locally invasive neoplasm with compression or luminal obstruction (esp. bronchogenic carcinoma; hypernephroma; melanoma; invasive thymoma; lymphoma)
3. Pulmonary valve stenosis or atresia, congenital
*4. Thromboembolism in pulmonary artery

UNCOMMON
*1. Coarctation of pulmonary artery
*2. Compression by aortic aneurysm
3. Constrictive pericarditis
4. Endocardial fibroelastosis
5. Endomyocardial fibrosis
6. Hypertrophy of the left ventricle encroaching on the right ventricle (Bernheim S.)
7. IHSS (African myocardiopathy)
8. Mediastinal fibrosis
*9. Neoplasm of heart or pulmonary artery (esp. carcinoma; sarcoma; metastasis) (See E-43)
10. Pulmonary stenosis, acquired (eg, rheumatic fever; carcinoid S.)
11. Septal and infundibular hypertrophy from VSD (Gasul S.)
*12. Takayasu S. involving pulmonary artery
13. Tetralogy of Fallot

* Often unilateral.

References

Gamut E-58

GENERALIZED PULMONARY ARTERIAL HYPOVASCULARITY (See E-19)

COMMON
1. Congenital heart disease with right-to-left shunt (eg, tetralogy of Fallot; pseudotruncus arteriosus; pulmonary atresia with intact ventricular septum {trilogy of Fallot}; tricuspid atresia or stenosis)
2. Emphysema, diffuse or bullous

(continued)
3. Pulmonary hypertension, primary or secondary (eg, schistosomiasis)
4. Right ventricular failure, esp. with marked tricuspid insufficiency

UNCOMMON
1. Compression of pulmonary artery trunk (eg, neoplasm; histoplasmic lymphadenopathy)
2. Ebstein anomaly; Uhl anomaly
3. Hypoventilation
4. Hypovolemia
5. Mechanical obstruction at, or proximal to, tricuspid valve (eg, right atrial myxoma; hypernephroma extending up IVC into RA; tricuspid stenosis)
6. Mitral stenosis (postcapillary hypertension)
7. Myocardiopathy (See E-40)
8. Pericardial tamponade
9. Pulmonary artery stenosis or coarctation
10. Pulmonary valvular atresia or severe stenosis, congenital or acquired (eg, carcinoid S.)
11. Thromboembolism to many small pulmonary arteriies (incl. trophoblastic embolic metastases)
12. Vasculitis (eg, polyarteritis nodosa)

References
6. Swischuk LE: Plain Film Interpretation in Congenital Heart Disease. (ed 2) Baltimore: Williams & Wilkins, 1979

Gamut E-59

PULMONARY VENOUS OBSTRUCTION OR HYPERTENSION (INCREASED VENOUS VASCULARITY OR VASCULAR REDISTRIBUTION) (See E-3)

COMMON
1. Left ventricular failure, any cause (eg, hypertension; myocardial ischemia; aortic stenosis; high output heart disease; myocardiopathy) (See E-37–40)
2. Mitral stenosis or insufficiency

UNCOMMON
1. Airway obstruction (eg, laryngeal)
2. Aortic insufficiency
3. [Basal emphysema or thromboembolism (redistribution)]
4. Coarctation S. (coarctation of aorta with VSD and/or PDA)
5. Hypoplastic left heart S.; aortic atresia
6. Neoplasm (esp. left atrial myxoma) (See E-43)
7. Obstruction of pulmonary veins
   a. Congenital
      i. APVC, total (below the diaphragm; or above the diaphragm with stenosis of an anomalous venous trunk)
      ii. Atresia or stenosis of the common or individual pulmonary veins
      iii. Cor triatriatum
      iv. Primary pulmonary veno-occlusive disease
   b. Acquired
      i. Constrictive pericarditis (See E-48)
      ii. Mediastinal tumor
      iii. Mediastinitis or mediastinal fibrosis (eg, histoplasmosis)
      iv. Thrombosis of pulmonary veins
8. Parachute mitral valve complex
9. Peripheral AV malformations
10. Thrombus in left atrium (esp. ball-valve)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
References

SYSTEMIC TO PULMONARY VASCULAR SHUNT ON ANGIOGRAPHY (See E-24)

COMMON
1. Bronchiectasis
2. Congenital cyanotic heart disease (eg, tetralogy of Fallot; tricuspid atresia; single ventricle; double outlet right ventricle; complete or corrected transposition of great vessels)
3. Neoplasm of lung (esp. bronchogenic carcinoma)
4. Occlusion of pulmonary artery (eg, thromboembolism; surgical ligation; mediastinal fibrosis or invasive neoplasm; other external compression) (See E-57)
5. Postoperative (eg, Blalock or Potts procedure for tetralogy; Mustard operation for transposition)
6. Sequestration of lung

UNCOMMON
1. Absence or atresia of pulmonary artery
2. Anomalous origin of pulmonary artery (eg, right PA from ascending aorta)
3. AV malformation, congenital or acquired (eg, pulmonary; thoracic wall)
4. Cirrhosis
5. Cystic adenomatoid malformation of the lung
6. Emphysema; chronic bronchitis
7. Infection of chest wall (eg, actinomycosis)
8. Neoplasm of thoracic wall (eg, Hodgkin’s disease)
9. Occlusion of pulmonary vein
10. Venolobar S. (scimitar S.)

SMALL ASCENDING AORTA OR AORTIC ARCH

COMMON
1. [ASD]
2. Coarctation of aorta (long segment infantile type); interrupted aortic arch
3. Decreased cardiac output (eg, endocardial fibroelastosis or other myocardiopathy; small heart; constrictive pericarditis; mitral stenosis) (See E-40, E-42, E-48)
4. [Technical (eg, rotated patient; dextroscoliosis; pectus excavatum)]

UNCOMMON
1. APVC, total
2. Hypoplastic left heart S.; aortic atresia
3. Supravalvular aortic stenosis (incl. Williams S.)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

(continued)
References


Gamut E-62

PROMINENT ASCENDING AORTA OR AORTIC ARCH

COMMON
1. Aneurysm of aorta, incl. dissecting aneurysm (eg, atherosclerosis; hypertension; cystic medial necrosis; Marfan S.; syphilis; mycotic infection; trauma) (See E-63)
2. Aortic arch anomaly (eg, right aortic arch; double aortic arch; cervical aortic arch)
3. Aortic insufficiency (eg, syphilis; infective endocarditis; dissecting aneurysm; Marfan S.) (See E-35)
4. Aortic stenosis (congenital—bicuspid valve; rheumatic; atherosclerotic)
5. Aortitis (eg, syphilitic; giant cell; rheumatoid; Takayasu arteritis, connective tissue disease {collagen vascular disease}, esp. lupus erythematosus)
6. Atherosclerosis (tortuosity, elongation, unfolding, and/or dilatation of aorta)
7. Coarctation of aorta; pseudocoarctation
8. Hypertensive heart disease (See E-37)
9. Medial degeneration of aorta; cystic medial necrosis (eg, Marfan S.; Ehlers-Danlos S.; pseudoxanthoma elasticum; osteogenesis imperfecta) (See E-64, Uncommon no. 3)
10. [Mediastinal mass simulating large aorta (eg, thymoma; lymphoma ; invasive or metastatic carcinoma)]
11. PDA
12. Tetralogy of Fallot (incl. pseudotruncus)

UNCOMMON
1. Aneurysm of sinus of Valsalva or coronary artery (See E-65)
2. Aorta—left ventricle tunnel
3. Aortomegaly, idiopathic
4. Aortopulmonary window
5. Corrected transposition with left-sided ascending aorta and PS
6. Pulmonary atresia with intact ventricular septum
7. Tricuspid atresia without transposition
8. Truncus arteriosus

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References


Gamut E-63

ANEURYSM OF AORTA AND OTHER MAJOR ARTERIES

COMMON
1. Atherosclerosis (degenerative)
2. Congenital (esp. cerebral—circle of Willis)
3. Dissecting (See E-64)
4. Trauma (incl. false aneurysm)

UNCOMMON
1. Angiomyolipoma (renal)
2. Cystic medial necrosis with or without Marfan S.
3. “Inflammatory” aneurysm (degenerative abdominal aortic aneurysm with periarterial fibrosis)
4. Kawasaki disease (coronary aneurysm)
5. Mycotic aneurysm (sepsis; bacterial endocarditis; tuberculosis)
6. Necrotizing vasculitis, arteritis (eg, polyarteritis nodosa; lupus erythematosus; Wegener’s granulomatosis; drug abuse—esp. methamphetamine; idiopathic aortitis; Takayasu S.; acute pancreatitis; atrial myxoma embolization)
7. Neurofibromatosis
8. Osler-Weber-Rendu S.; AV malformation
9. Poststenotic aneurysm, distal to
   a. Atheromatus stenosis in any vessel
   b. Coarctation in thoracic aorta
   c. Fibromuscular dysplasia (esp. in renal artery)
   d. Subclavian stenosis in thoracic inlet S.
10. Pseudoxanthoma elasticum
11. Syphilis

References

Gamut E-64

DISSECTING ANEURYSM OF THE ASCENDING AORTA OR ARCH

COMMON
1. Coarctation of aorta
2. Cystic medial necrosis or degeneration of aorta (esp. Marfan S.)
3. Hypertension

UNCOMMON
1. Aortic stenosis; bicuspid aortic valve
2. Aortitis (eg, collagen disease, esp. lupus erythematosus)
3. Cystic medial necrosis, other causes:
   a. Cogan S.

b. Cutis laxa
c. Ehlers-Danlos S.
d. Idiopathic
e. Mucopolysaccharidoses (See J-4)
f. Osteogenesis imperfecta
g. Pseudoxanthoma elasticum
h. Relapsing polychondritis
i. Turner S.

4. Iatrogenic (eg, catheterization; intramural injection of contrast medium)
5. Infection (eg, syphilis; bacterial endocarditis—mycotic aneurysm)
6. Postoperative prosthetic aortic valve replacement
7. Pregnancy
8. Trauma

References

Gamut E-65

ANEURYSM OF CORONARY ARTERY

COMMON
1. Atherosclerosis
2. Congenital

UNCOMMON
1. Connective tissue disease (collagen disease)
2. Dissection
3. Iatrogenic (eg, catheter or operative injury)
4. Kawasaki S.

(continued)
Gamut E-66

5. Marfan S.
6. Mucopolysaccharides (See J-4)
7. Mycotic (incl. bacterial endocarditis)
8. Necrotizing arteritis
9. Rheumatic heart disease
10. Syphilis
11. Trauma

References

Gamut E-66

ARTERIAL STENOSIS AND THROMBOSIS

1. Arteritis (eg, Takayasu S.; giant cell; mesenteric; idiopathic aortitis)
2. Atherosclerosis with atheromatous plaque (esp. in internal carotid and vertebral artery origins, coronary, renal, iliac and femoral arteries, and abdominal aorta (with thrombosis = Leriche S.)
3. Buerger’s disease (thromboangiitis obliterans)
4. Congenital stenoses (eg, coarctation of thoracic or abdominal aorta, origins of splanchnic or renal arteries, or pulmonary arteries; fibromuscular hyperplasia)
5. Extrinsic compression of artery (eg, thoracic outlet S.; renal artery stenosis due to fibrous band or neurofibromatosis; celiac axis compression S.; popliteal cysts and entrapment)
6. Neoplastic compression or invasion (“cuffing”)

Reference

Gamut E-67

EMBOLUS

COMMON
1. Atheromatous plaque or ulcer with mural thrombus
2. Bacterial endocarditis
3. Iatrogenic (eg, postendarterectomy; arterial or venous catheterization)
4. Septic
5. Venous thrombosis or thrombophlebitis (incl. paradoxical embolus from venous system through patent foramen ovale to systemic circulation)

UNCOMMON
1. Arterial aneurysm with mural thrombus
2. Atrial fibrillation with left atrial thrombus
3. Chagas’ myocardiopathy with intracardiac thrombus
4. Myocardial infarction with left ventricular thrombus
5. Neoplasm (tumor emboli), incl. left atrial myxoma

Gamut E-68

DIGITAL ISCHEMIA AND RAYNAUD’S PHENOMENON

COMMON
1. Atherosclerosis with atheroma
2. Arteritis (incl. Takayasu S.; giant cell)
3. Blood disorder (eg, sickle cell disease; polycythemia; contraceptive pill; cryoagglutination; polyvinylchloride poisoning)
4. Buerger’s disease (thromboangiitis obliterans)
5. Connective tissue disease (collagen disease) (eg, polyarteritis nodosa; scleroderma; rheumatoid disease)
6. Spastic response to cold in healthy individuals
7. Thromboembolism
UNCOMMON
1. African idiopathic aortitis
2. Ergotism
3. Fibromuscular hyperplasia
4. Thoracic outlet S.
5. Vibratory tools

Reference

AZYGOS VEIN DILATATION*

COMMON
1. Congenital absence or interruption of infrahepatic
densegment of inferior vena cava with azygos continua-
tion to SVC (eg, polysplenia S.)
2. Constrictive pericarditis (See E-48)
3. [Enlarged azygos node; mediastinal mass]
4. Heart failure (eg, right ventricular failure secondary to left ventricular failure or mitral stenosis)
5. Normal (expiration, recumbency)
6. Obstruction of inferior vena cava (See E-71)
7. Obstruction of superior vena cava (See E-70)
8. Overhydration
9. Pericardial effusion and tamponade (See E-49)
10. Portal hypertension; splenic or portal vein throm-
    bosis
11. Pregnancy
12. Tricuspid insufficiency (See E-28)

UNCOMMON
1. APVC, total (esp. via the azygos vein)
2. AV malformation (esp. thoracic wall)
3. Idiopathic
4. Mechanical obstruction proximal to or at tricuspid valve (eg, myxoma of RA; hypernephroma extending up IVC into RA; rare tricuspid stenosis)
5. [Right aortic arch with displaced azygos vein]
6. Sequestration of lung (esp. extralobar)
7. Traumatic azygos pseudoaneurysm or AV fistula

* Round or oval density crossing over right main bronchus at the tra-
cheobronchial angle and measuring over 10 mm in diameter on erect PA chest radiograph. Azygos vein decreases in size with inspiration, erect position, or Valsalva maneuver.

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

SUPERIOR VENA CAVA DILATATION*

COMMON
1. Bronchogenic carcinoma (eg, superior sulcus)
2. Increased central venous pressure (eg, congestive heart failure; cardiac tamponade from pericardial effusion or constrictive pericarditis)
3. Lymphadenopathy (eg, oat cell carcinoma of lung; histoplasmosis; tuberculosis)
4. Lymphoma; lymphosarcoma
5. Mediastinal fibrosis or granuloma (eg, histoplasmosis; tuberculosis; ergotrate; radiation therapy; idiopathic)
6. Neoplasm of esophagus, thyroid or mediastinum (eg, goiter; cystic hygroma; thymoma; germ cell tumor)
7. Thrombosis (eg, iatrogenic—broken pacemaker wire; central line catheter; ventriculo-atrial shunt for

(continued)
UNCOMMON

1. Aneurysm of aorta or great artery; AV fistula
2. Axillary vein thrombosis with extension
3. Behçet S.
4. Congenital heart disease (eg, tricuspid insufficiency; total APVC)
5. Idiopathic
6. Mediastinal emphysema, severe; tension pneumothorax
7. Mediastinitis, acute
8. Myxoma of right atrium
9. Osteomyelitis of clavicle
10. Pneumoconiosis (coal-worker’s; silicosis) with conglomerate mass
11. Postoperative (eg, after surgery for congenital heart disease)
12. Sarcoidosis
13. Trauma (eg, laceration; transection; mediastinal hematoma)

* Well-defined, smooth widening of the right side of the upper mediastinum.

References


OBSTRUCTION OF THE INFERIOR VENA CAVA OR IliAC VEnEs

COMMON

1. Direct tumor invasion of IVC (eg, renal cell carcinoma [hypernephroma]; Wilms’ tumor; hepatocellular carcinoma)
2. Extrinsic compression (eg, by lymphadenopathy; retroperitoneal tumor, cyst, hematoma, or abscess; pelvic lymphocele; aortic aneurysm; liver mass or enlarged liver; hydatid cyst)
3. Therapeutic interruption of IVC by ligation or filters (eg, to prevent pulmonary emboli, or as therapy for schistosomiasis)
4. Thromboembolism
5. Transient compression (eg, ascites; pregnancy)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

UNCOMMON

1. Adhesions
2. [Congenital anomaly (eg, absence or hypoplasia of IVC; left-sided or double IVC)]
3. Lymphedema praecox (compression of left common iliac vein by right common iliac artery crossing over it)
4. Pelvic varicosities
5. Posttraumatic; post-radiation therapy
6. Retroperitoneal fibrosis
7. Sarcoma of IVC (eg, leiomyosarcoma; angiosarcoma); lipoma of IVC
8. Web at junction of IVC and right atrium

Reference

ANOMALIES OF THE INFERIOR VENA CAVA

1. Absence of IVC
   Failure to form a prerenal cava
2. Azygos continuation, unilateral or bilateral
   Persistence of left supracardinal vein
3. Bilateral cavae (common in asplenia S.)
   Failure of dominance of right supracardinal vein
4. Circumaortic venous collar
   Failure of regression of superior intersupracardinal anastomosis
5. Left IVC
   Regression of right supracardinal vein
6. Retrocaval ureter
   Failure of regression of right posterior cardinal vein

References

COMPLICATIONS OF CENTRAL VENOUS (SUBCLAVIAN, JUGULAR) OR PULMONARY ARTERY CATHETERIZATION

COMMON
1. Arterial insertion with perforation (esp. subclavian or carotid artery)
2. Catheter embolism; broken, trapped, or occluded catheter
3. Extravascular infusion (eg, mediastinal; intrapleural; subcutaneous)
4. Infection (local or sepsis)
5. Malpositioned or dislodged catheter (eg, in RV, IVC, hepatic vein, jugular vein)
6. Perforation of vessel with hematoma, hemothorax, hydrothorax, hemopericardium, or hemomedastinum
7. Pneumothorax
8. Thrombosis (eg, SVC); thrombophlebitis; pulmonary thromboembolism

UNCOMMON
1. Air embolism
2. AV fistula
3. Cardiac (eg, myocardial perforation; tamponade; arrhythmias)
4. Nerve injury (phrenic nerve or brachial plexus)
5. Subcutaneous or mediastinal emphysema
6. Thoracic duct laceration

References
CONSOLIDATION (ALVEOLAR, AIR SPACE PATTERN)

F-1-S Roentgen Signs of Alveolar Disease (Consolidation, Air Space Pattern)
F-2 Localized Segmental or Lobar Consolidation (Alveolar, Air Space) Pattern, Solitary or Multiple
F-3 Lobar Enlargement (With Bulging Interlobar Fissure)
F-4 Chronic Lobar Consolidation
F-5 Lobar or Segmental Atelectasis (Collapse, Volume Loss)
F-6 Recurrent Pneumonia (See F-7)
F-7 Chronic Aspiration Pneumonia in a Child (See F-4, 6)
F-8 Acute Disseminated Consolidation (Alveolar, Air Space) Pattern (Incl. Bilateral Central Dense Opacification)
F-9 Chronic Disseminated Consolidation (Alveolar, Air Space) Pattern
F-10-1 Pulmonary Edema
F-10-2 Unilateral Pulmonary Edema
F-11-1 Adult Respiratory Distress Syndrome (ARDS)
F-11-2 Acute Lung Injury and ARDS in Children
F-12 Pulmonary Hemorrhage
F-13 Reverse Butterfly Pattern
F-14 Consolidation (Alveolar, Air Space) Pattern in a Patient with Leukemia or Lymphoma
F-15 Multifocal Ill-Defined Densities in the Lungs
F-16 Diffuse Pulmonary Disease with a Mixed Alveolar (Air Space) and Interstitial (Reticulonodular or Small Irregular) Pattern
MILIARY NODULAR, RETICULAR, OR INTERSTITIAL PATTERNS

F-17-S  Roentgen Patterns of Interstitial Disease
F-18  Acute Diffuse Fine Reticular Opacities (Kerley Lines, Acute—A, B, and C) (See F-19)
F-19  Kerley Lines, Chronic—A, B, and C (See F-18)
F-20-1  Widespread Miliary Nodules in the Lungs (Less than 5 mm Diameter)
F-20-2  Widespread Miliary Nodules in the Lungs of a Neonate or Young Infant
F-21  Widespread Small Irregular Opacities (Reticular, Nodular, or Reticulonodular Pattern) (See F-22)
F-22  Interstitial Fibrosis (Including Honeycomb Lung—End-Stage Interstitial Fibrosis)
F-23-S1  Synonyms for Idiopathic or Usual Interstitial Pneumonitis
F-23-S2  Entities that Can Produce Histologic Changes Similar to Usual Interstitial Pneumonitis
F-24  Diffuse Interstitial Disease with Pleural Effusion
F-25  Diffuse Interstitial Disease with Associated Lymphadenopathy

HIGH RESOLUTION CT (HRCT) PATTERNS

F-26  High-Resolution CT (HRCT) Patterns of Chronic Interstitial Lung Disease (CILD)—Septal Thickening
F-27  Ground-glass Opacities on HRCT
F-28  Chronic Air Space Consolidation on HRCT
F-29  Peribronchovascular Interstitial Thickening on HRCT
F-30  Increased Lung Lucency (Usually Cystic Pattern) on HRCT
F-31  Upper Lung Disease on HRCT
F-32  Lower Lung Disease on HRCT

PULMONARY NODULES OR MASSES (INCL. HRCT)

F-33  Small Nodular Opacities on HRCT
F-34-1  Small Nodule Distribution on HRCT—Perilymphatic (Peribronchovascular, Septal, and Subpleural)
F-34-2  Small Nodule Distribution on HRCT—Randomly or Evenly Distributed Throughout Lung
F-34-3  Small Nodule Distribution on HRCT—Centrilobular
F-35-S  World Health Organization Histologic Classification of Lung Neoplasms
F-36-S  Lung Neoplasms in Infants, Children, and Adolescents
F-37  Solitary Pulmonary Nodule (Under 4 cm Diameter)
F-38  Solitary Pulmonary Mass (Greater than 4 cm Diameter)
F-39  Superior Sulcus Lesion
F-40  Mass-Like Perihilar or Central Pulmonary Opacity or Lesion Radiating from the Hilum
F-41  Shaggy Pulmonary Nodule or Mass with Fuzzy Borders, Solitary or Multiple
F-42  Multiple Discrete Pulmonary Nodules or Masses (Nonmiliary)

PULMONARY CYSTIC OR CAVITY LESIONS

F-43-1  Sharply Defined Cavitary Lesion(s) of the Lung—Thin-walled
F-43-2  Sharply Defined Cavitary Lesion(s) of the Lung—Thick-walled
F-44  Cyst-Like or Cavitary Pulmonary Lesion(s) in an Infant or Child
F-45  Solitary Cavitary Pulmonary Lesion (Cyst, Nodule, or Mass) with a Sharp Outline (See F-43-2)
F-46  Solitary Cavitary Lesion of the Lung with a Shaggy (Irregular or Spiculated) Outline
F-47-S  Predisposing Factors for a Lung Abscess
F-48  Pneumatocele
F-49  Multiple Lucent or Cavitary Lesions of the Lung (See F-43, 44)
F-50  Extensive Pulmonary Opacity with Cavitation (Destructive Pattern) (See F-46)
F-51  Mass in a Pulmonary Cavity (Meniscus or Bull’s-Eye Sign), Mobile or Fixed

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Gamut F-1-S

ROENTGEN SIGNS OF ALVEOLAR DISEASE (CONSOLIDATION, AIR SPACE PATTERN)

1. Acinar or peribronchiolar nodules
2. Air alveologram and bronchiologram
3. Air bronchogram
4. Butterfly or “bat’s wing” distribution
5. Coalescence (early)
6. Fluffy, ill-defined margins
7. Perihilar, diffuse, segmental or lobar distribution
8. Present soon after onset of symptoms; rapid change

References

Gamut F-2

LOCALIZED SEGMENTAL OR LOBAR CONSOLIDATION (ALVEOLAR, AIR SPACE) PATTERN, SOLITARY OR MULTIPLE

COMMON
1. Aspiration pneumonia (eg, acute—foreign body in bronchus; chronic—esophageal or neuromuscular disorder) (See F-7)
2. Atelectasis, incl. round atelectasis (See F-5)
3. Contusion of lung (pulmonary hemorrhage)
4. Obstructive pneumonia (eg, bronchogenic carcinoma; carcinoid; bronchial stenosis; foreign body aspiration; mucus plug; mucoid impaction)
5. Pneumonia, infectious, acute or organizing, lobar or lobular—bronchopneumonia (incl. bacterial—Streptococcus, Staph. aureus, H. influenzae, E. coli, Proteus, Klebsiella, Bacteroides, Yersinia pestis (plague), pseudomonas, tularemia, anthrax, legionella, tuberculous, nocardia, actinomyces; varicella; cytomegalovirus; other viral; mycoplasma; rickettsial; AIDS with secondary infection) (See F-74-S)
6. Pulmonary edema, localized
7. Pulmonary thromboembolism with infarction
8. Round pneumonia
9. Tuberculosis, primary or secondary; atypical mycobacterial infection

UNCOMMON
1. Bronchioloalveolar carcinoma
2. Eosinophilic pneumonia, acute (eg, PIE; Löffler syndrome) or chronic
3. Fungus disease, esp. histoplasmosis; coccidioidomycosis; cryptococcosis (torulosis); blastomycosis; zygomycosis (mucormycosis) (See F-74-S)
4. Lipoid pneumonia
5. Lung torsion (trauma in children)
6. Lupus erythematosus (lung base)
7. Lymphoma; pseudolymphoma
8. Mucoid impaction (eg, asthma; hypersensitivity aspergillosis; bronchial obstruction)
9. Parasitic disease* (eg, Pneumocystis carinii (late); ascariasis; strongyloidiasis; amebiasis; paragonimiasis)
10. Pneumoconiosis (conglomerate mass of silicosis or coal-worker’s pneumoconiosis)
11. Pulmonary hemorrhage (See F-12)
12. Pulmonary sequestration (intralobar)
13. Radiation pneumonitis
14. Sarcoidosis

* Note: These parasitic diseases more often cause a diffuse bronchopneumonia or scattered mixed alveolar and interstitial pattern.

References

(continued)
Gamut F-3

**LOBAR ENLARGEMENT (WITH BULGING INTERLOBAR FISSURE)**

**COMMON**
1. Pneumonia (esp. Klebsiella; streptococcal; also tuberculous; pseudomonas; staphylococcal; E. coli; H. influenzae; plague; actinomycosis; mycoplasma)

**UNCOMMON**
1. Abscess
2. Bronchogenic carcinoma with obstructive pneumonia (drowned lung); bronchioloalveolar carcinoma
3. [Interlobar fluid]

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**

Gamut F-4

**CHRONIC LOBAR CONSOLIDATION**

**COMMON**
1. Bronchogenic carcinoma with obstructive pneumonia (“drowned lung”)
2. Pneumonia, slowly resolving or organizing

**UNCOMMON**
1. Bronchioloalveolar carcinoma
2. Fungus disease (esp. cryptococcosis; zygomycosis; blastomycosis); actinomycosis; nocardiosis (See F-74-S)
3. Lipoid pneumonia
4. Lymphoma
5. Radiation pneumonitis
6. Tuberculous pneumonia

**Reference**

Gamut F-5

**LOBAR OR SEGMENTAL ATELECTASIS (COLLAPSE, VOLUME LOSS)**

**COMMON**
1. Bronchiectasis
2. Bronchogenic carcinoma
3. Carcinoid
4. Compression atelectasis (eg, pleural effusion; large lung neoplasm; mesothelioma; diaphragmatic hernia; tension pneumothorax; congenital lobar emphysema; bullous emphysema)
5. Contraction atelectasis; pulmonary fibrosis (IPF)
6. Foreign body aspiration (eg, peanut; meat)
7. Mucous plugs, peripheral (eg, anesthesia; postoperative; pneumonia; chronic bronchitis; asthma, em-
physema; bronchiolitis obliterans; tetanus; bulbar paralysis
8. Postoperative adhesive atelectasis (eg, left lower lobe collapse following CABG or other cardiac or thoracic surgery)

UNCOMMON
1. Amyloidosis
2. Aortic aneurysm
3. Broncholithiasis
4. Bronchomalacia
5. Cardiac enlargement (esp. dilated left atrium—ASD, mitral stenosis) with left lower lobe collapse
6. Cystic fibrosis (mucoviscidosis)
7. Endotracheal tube malposition (too low)
8. Lymphadenopathy, hilar (esp. bronchogenic or metastatic carcinoma; lymphoma, tuberculosis)
9. Mediastinal tumor
10. Metastatic disease to lymph nodes or endobronchial metastasis (esp. from carcinoma of kidney or breast or melanoma)
11. Middle lobe syndrome (chronic lymphadenopathy or bronchial stenosis due to histoplasmosis; tuberculosis; silicosis)
12. Mucoid impaction (eg, asthma; hypersensitivity bronchopulmonary aspergillosis)
13. Neoplasm of lung, other (eg, sarcoma; hamartoma; myoblastoma)
14. Parasitic disease (Ascaris in bronchus)
15. Pertussis
16. Pneumonia, organized
17. Pulmonary thromboembolism with infarction (unusual)
18. Radiation fibrosis; radiation pneumonitis (occasionally)
19. Rounded atelectasis
20. Scoliosis
21. Stricture of bronchus (eg, tuberculosis; histoplasmosis)
22. Trauma (eg, fractured bronchus)
23. Wegener granulomatosis

References
UNCOMMON
1. Anemia, primary (esp. sickle cell disease)
2. Choanal atresia; cleft palate
3. Chronic granulomatous disease of childhood
4. Chronic pneumonia resolving by fibrosis (eg, tuberculosis; fungus disease)
5. Chronic sinusitis (incl. Kartagener S.; immotile cilia S.)
6. Connective tissue disease (collagen vascular disease) (eg, lupus erythematosus)
7. Eosinophilic pneumonia, (eg, PIE; Löffler S.)
8. Esophageal bronchus
9. Extrinsic compression of tracheobronchial tree (eg, vascular ring); laryngeal disease
10. Hypersensitivity pneumonitis (extrinsic allergic alveolitis) (eg, farmer’s lung; silo-filler’s disease with multiple exposures; byssinosis) (See F-69)
11. Pulmonary sequestration (intralobar)
12. Rheumatoid or ankylosing spondylitis
13. Riley-Day S. (familial dysautonomia)
14. Tracheal lesion (See F-81-1)
15. Tracheoesophageal fistula
16. Tracheostomy

References

Gamut F-7

CHRONIC ASPIRATION PNEUMONIA IN A CHILD (See F-4, 6)

COMMON
1. Debilitation; malnutrition
2. Esophageal disease (eg, esophageal atresia or stenosis; achalasia; chalasia; hiatus hernia)
3. Idiopathic
4. Neuromuscular disorder, (eg, brain damage; cerebral palsy; meningomyelocele; poliomyelitis; paraly-
sis; quadriplegia; amyotonia congenita; Duchenne muscular dystrophy; Werdnig-Hoffman disease)
5. Tracheoesophageal fistula (H-type or in association with esophageal atresia)

UNCOMMON
1. Choanal atresia; cleft palate
2. Laryngeal disease (incl. congenital wall deficiency; laryngotracheal cleft)
3. Lipoid pneumonia
4. Micrognathia
5. Riley-Day S. (familial dysautonomia)
6. Tracheal lesion (incl. vascular ring) (See F-81-1)

References

Gamut F-8

ACUTE DISSEMINATED CONSOLIDATION (ALVEOLAR, AIR SPACE) PATTERN (INCL. BILATERAL CENTRAL DENSE OPACIFICATION)

COMMON
1. ARDS; oxygen toxicity
*2. Pneumonia (See F-75-S)
   a. Aspiration
   b. Bacterial (eg, staphylococcal; streptococcal; pseudomonas; plague; Klebsiella; H. influenzae; E. coli; legionella; leptospirosis; tuberculous;
atypical mycobacterial); nocardiosis; actinomycosis
c. Chemical (eg, hydrocarbon)
d. Eosinophilic (eg, Löffler S.; PIE)
e. Fungal, acute (eg, aspergillosis; histoplasmosis; blastomycosis; zygomycosis)
f. Lipoid
g. Mycoplasma
h. Opportunistic or other unusual etiology (esp. Pneumocystis carinii or other parasitic)
i. Rickettsial (eg, Rocky Mountain spotted fever; Q fever)
j. Viral (eg, chickenpox; measles; influenza; cytomegalovirus; hantavirus) or chlamydial (psittacosis)
3. Pulmonary edema (See F-10)
*4. Respiratory distress S.; transient tachypnea of newborn

UNCOMMON
1. Embolism (eg, fat; amniotic fluid; pulmonary thromboembolism with infarction, septic or bland)
*2. Hypersensitivity pneumonitis (extrinsic allergic alveolitis)
3. Pulmonary hemorrhage (See F-12)
*4. Radiation pneumonitis

* Often has a mixed interstitial and alveolar pattern.

References

Gamut F-9

CHRONIC DISSEMINATED CONSOLIDATION (ALVEOLAR, AIR SPACE) PATTERN

COMMON
1. Alveolar proteinosis
2. Bronchioloalveolar carcinoma
3. Desquamative interstitial pneumonitis (DIP); nonspecific interstitial pneumonitis (NSIP); lymphocytic interstitial pneumonitis (LIP); bronchiolitis obliterans with organizing pneumonia (BOOP)
4. Lymphoma
5. Obstructive pneumonia (eg, bronchogenic carcinoma “drowned lung”; carcinoid; foreign body)
6. Recurrent pneumonia (See F-6, F-7)
7. Sarcoidosis (alveolar phase)

UNCOMMON
1. Alveolar microlithiasis
2. Eosinophilic pneumonia, chronic
3. Fungus disease (eg, aspergillosis)
4. Lipoid pneumonia (eg, mineral oil aspiration)
5. Metastases, hemorrhagic (eg, choriocarcinoma)
6. Pulmonary sequestration (intralobar)
7. Silicoproteinosis (resembles alveolar proteinosis but with acute course)
8. Tuberculosis; atypical mycobacterial infection

References
Gamut F-10

Gamut F-10-1

PULMONARY EDEMA

COMMON

*1. Agonal; terminal illness
*2. ARDS (eg, shock lung; respirator lung); cardiopulmonary bypass; open heart surgery; sepsis; oxygen toxicity
*3. Aspiration of gastric contents (Mendelson S.), hydrocarbons, or hypertonic contrast material
*4. Drug reaction (eg, nitrofurantoin; aspirin; hydrochlorothiazide; beta-adrenergic drugs; interleukin-2; radiologic contrast media) (See F-73-S)
*5. Heart failure with pulmonary venous hypertension (eg, left ventricular failure; mitral stenosis or insufficiency; left atrial myxoma or thrombus; thyrotoxicosis; myocardopathy; sickle cell disease; arteriovenous fistula; left-to-right shunt; total APVR; coarctation of aorta; hypoplastic left heart S.) (See E-3, E-59)
6. Hypersensitivity pneumonitis (extrinsic allergic alveolitis) (eg, farmer’s lung; bagassosis) (See F-69)
*7. Iatrogenic (incl. hypervolemia; fluid overload; overtransfusion; drug overdose)
*8. Inhalation of noxious gas, smoke, paint fumes, sulfur dioxide, beryllium, silica, dinitrogen tetroxide, nitrogen dioxide (silo-filler’s disease), carbon monoxide, fluorocarbons, hydrocarbons, paraquat, ammonium, chlorine, hydrogen sulfide, phosgene, cadmium (See F-72-S)
*9. Iatrogenic (incl. hypervolemia; fluid overload; overtransfusion; drug overdose)
*10. Narcotic abuse (esp. heroin; morphine; methadone; cocaine)
*11. Pulmonary thromboembolism with infarction
*12. Renal failure; uremia; acute glomerulonephritis; nephrosis
*13. Shock (eg, insulin reaction; gram-negative septicemia; snake bite; burn; electric shock; anaphylactic reaction to penicillin, blood transfusion, or radiologic contrast medium)
*14. Trauma, thoracic; contusion of lung; blast injury

UNCOMMON

*1. Amniotic fluid embolism
2. Connective tissue disease (collagen vascular disease)
*3. Disseminated intravascular coagulation (DIC)
4. Eclampsia
5. Fat embolism (incl. oily contrast medium)
*6. Hepatic disease (eg, acute hepatitis)
7. High altitude
*8. Hypoproteinemia (eg, malabsorption)
*9. Hypoxia, any cause
*10. Near-drowning
11. Pancreatitis, acute
*12. Parasitic disease (eg, malaria; strongyloidiasis)
13. Pericarditis (esp. constrictive)
14. Pheochromocytoma (catecholamine release)
15. Pleural air or fluid aspiration, rapid or excessive; rapid reexpansion of lung following treatment for a large pneumothorax
*16. [Pneumonia]
17. Pregnancy
18. [Pulmonary hemorrhage (incl. bleeding diathesis; idiopathic hemosiderosis; Goodpasture S.)] (See F-12)
*19. [Pulmonary lymphangiectasia]
20. Radiation pneumonitis
*21. Upper airway obstruction (eg, aspirated food; foreign body; epiglottitis; croup; hanging; suffocation)
*22. Venous or lymphatic obstruction (eg, pulmonary vein thrombosis or veno-occlusive disease; blockage by mediastinal mass; sclerosing mediastinitis)

* May occur in an infant.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
UNILATERAL PULMONARY EDEMA

COMMON
1. Aspiration, unilateral (eg, water; kerosene; ethyl alcohol; gastric juice)
2. Contralateral disease (eg, emphysema; post-lobectomy; occlusion, absence, or hypoplasia of a pulmonary artery—Swyer-James-McLeod S.; pulmonary arterial thromboembolism)
3. Contusion of one lung
4. Idiopathic
5. Pleural air or fluid aspiration, rapid or excessive; rapid reexpansion of lung following treatment for a large pneumothorax
6. Postural (prolonged lateral decubitus position)

UNCOMMON
1. Bronchial obstruction with “drowned lung” (eg, carcinoid; bronchogenic carcinoma; foreign body in bronchus; mucus plug)
2. Catheter malposition with infusion into pulmonary artery and lung
3. Congenital heart disease (eg, unilateral ductus shunt)
4. Obstruction of pulmonary vein (eg, bronchogenic carcinoma or bronchogenic cyst; unilateral veno-occlusive disease)
5. Postoperative systemic-pulmonary artery shunt (eg, Potts, Blalock-Taussig, or Waterston operation)

ADULT RESPIRATORY DISTRESS SYNDROME (ARDS)

COMMON
1. Anaphylactic reaction (eg, penicillin; bee sting; blood transfusion; radiologic contrast media)
2. Multi-system injury or failure
3. Respirator lung (oxygen toxicity)
4. Sepsis (gram-positive or gram-negative septicemia)
5. Shock lung (hemorrhagic, septic, cardiogenic, anaphylactic)
6. Trauma, massive (lung or body)

UNCOMMON
1. Aspiration
2. Disseminated intravascular coagulation (DIC)
3. Electric shock
4. Embolism of fat or amniotic fluid
5. Inhalation of smoke, paint or noxious fumes (eg, phosgene; nitrous oxide)
6. Insulin reaction
7. Narcotics (eg, heroin; methadone); other drugs
8. Near-drowning
9. Near-strangulation
10. Pancreatitis, acute

(continued)
11. Pneumonia, incl. severe viral (eg, varicella)
12. Snake bite

References

Gamut F-11-2
ACUTE LUNG INJURY AND ARDS IN CHILDREN

1. ARDS (acute respiratory distress syndrome)
   (eg, sepsis; pneumonia; aspiration; near-drowning; near-strangulation; smoke inhalation; multi-system injury or failure; anaphylaxis)
2. Aspiration
3. Inhalation of smoke, paint or noxious fumes
4. Near-drowning
5. Oxygen toxicity
6. Trauma (eg, pulmonary laceration or contusion)

Reference

Gamut F-12
PULMONARY HEMORRHAGE

COMMON
1. Contusion of lung; blunt trauma
2. Renal disease with or without immunologic abnormality (incl. Goodpasture S.)

UNCOMMON
1. Anticoagulant therapy; other drug-induced bleeding
2. Aspiration from a bleeding pulmonary lesion (eg, arteriovenous malformation bronchogenic carcinoma; vascular metastasis)
3. Bleeding or clotting disorder (eg, hemophilia; leukemia; thrombocytopenia; Henoch-Schönlein purpura)
4. Bone marrow transplantation
5. Bronchitis; bronchiectasis
6. Connective tissue disease (collagen vascular disease), (esp. lupus erythematosus; polyarteritis nodosa—vasculitis)
7. Disseminated intravascular coagulation (DIC)
8. Drug abuse (esp. heroin)
9. Heart failure
10. Iatrogenic (eg, bronchoscopy; lung biopsy)
11. Idiopathic
12. Idiopathic pulmonary hemosiderosis
13. Infection (eg, Rocky Mountain spotted fever; saprophytic fungal infection; aspergillosis; zygomycosis)
14. Leukocytoclastic vasculitis
15. Mitral stenosis
16. Parasitic disease (eg, malaria; strongyloidiasis)
17. Pulmonary thromboembolism (esp. with infarction)
18. Wegener granulomatosis

References
Gamut F-13

REVERSE BUTTERFLY PATTERN

COMMON
1. ARDS
2. Contusion of lung
3. Eosinophilic pneumonia (PIE; Löeffler syndrome)
4. Pneumonia
5. Sarcoidosis

UNCOMMON
1. Bronchioloalveolar carcinoma
2. Bronchiolitis obliterans with organizing pneumonia (BOOP)
3. Connective tissue disease (collagen vascular disease)
4. Pulmonary edema, atypical
5. Pulmonary thromboembolism with multiple infarctions
6. Parasitic disease (esp. ascariasis; strongyloidiasis)
7. Radiation pneumonitis

Reference

Gamut F-14

CONSOLIDATION (ALVEOLAR, AIR SPACE) PATTERN IN A PATIENT WITH LEUKEMIA OR LYMPHOMA

COMMON
1. Bacterial pneumonia
2. Fungus disease (esp. angioinvasive aspergillosis; cryptococcosis (torulosis); histoplasmosis; moniliasis; zygomycosis) (See F-74-S)
3. Lymphomatous or leukemic infiltration
4. Pneumocystis carinii pneumonia

UNCOMMON
1. Alveolar proteinosis
2. Cytomegalovirus pneumonia
3. Drug reaction (eg, methotrexate)
4. Leukostasis; leukemia cell lysis
5. Mycoplasma pneumonia
6. Parasitic disease (eg, strongyloidiasis)
7. Pulmonary edema (eg, heart failure)
8. Pulmonary hemorrhage
9. Varicella (chickenpox) pneumonia

References

Gamut F-15

MULTIFOCAL ILL-DEFINED OPACITIES IN THE LUNGS*

COMMON
1. ARDS; shock lung; respirator lung (See F-11-1, F-11-2)
2. Aspiration pneumonia
3. Bronchopneumonia (esp. staphylococcal; streptococcal; Pseudomonas; Klebsiella; Legionella; E. coli; other gram-negative bacteria; melioidosis; nocardiosis) (See F-74-S)
4. Eosinophilic pneumonia, idiopathic (eg, Löeffler S.) or secondary to parasitic disease (eg, paragonimiasis; ascariasis; strongyloidiasis; hookworm disease; schistosomiasis; toxocariasis; tropical eosinophilia (filarial))
5. Fungus disease (eg, histoplasmosis; coccidioidomycosis; blastomycosis; candidiasis; actinomycosis; (continued)
aspergillosis; cryptococcosis (torulosis); zygomycosis; sporotrichosis
6. Metastases (eg, choriocarcinoma; vascular tumors)
7. Pneumoconiosis (esp. silicosis; coal worker’s pneumoconiosis; asbestosis)
8. *Pneumocystis carinii* pneumonia (esp. in AIDS)
9. Pulmonary edema
10. Pulmonary thromboembolism with infarctions; septic emboli
11. Sarcoidosis
12. Tuberculosis; atypical mycobacterial infection (esp. in AIDS)
13. Viral and *Mycoplasma* pneumonias (See F-74-S)

**UNCOMMON**
1. Amyloidosis; Waldenström macroglobulinemia
2. Arteriovenous fistulas
3. Bronchiolitis obliterans with organizing pneumonia (BOOP)
4. Bronchioloalveolar carcinoma
5. Drug reaction (esp. chemotherapeutic agents) (See F-73-S)
6. Langerhans cell histiocytosis (eosinophilic granuloma)
7. Hypersensitivity pneumonitis (extrinsic allergic alveolitis) (eg, farmer’s lung; bagassosis)
8. Kaposi sarcoma (esp. in AIDS)
9. Lung abscesses, multiple
10. Lymphoma
11. Neonatal retained fluid S.; bronchopulmonary dysplasia
12. Pneumonia of unusual etiology (eg, lipid; rickettsial—Q fever, Rocky Mountain spotted fever)
13. Pulmonary hemorrhage (eg, Goodpasture S.; hemolytic-uremic S.; idiopathic pulmonary hemosiderosis)
14. Pulmonary sequestration (intralobar)
15. Radiation therapy (pneumonitis or fibrosis)
16. Usual interstitial pneumonitis (UIP); desquamative interstitial pneumonitis (DIP); lymphocytic interstitial pneumonitis (LIP)
17. Vasculitis (eg, collagen vascular disease, esp. polyarteritis nodosa, lupus erythematosus; Wegener granulomatosis; lymphomatoid granulomatosis; zygomycosis; aspergillosis)

* Not confined to lobar or segmental distribution.

**References**

**Gamut F-16**

**DIFFUSE PULMONARY DISEASE WITH A MIXED ALVEOLAR (AIR SPACE) AND INTERSTITIAL (RETICULONODULAR OR SMALL IRREGULAR) PATTERN**

**COMMON**
1. Bronchioloalveolar carcinoma
2. Hypersensitivity pneumonitis (extrinsic allergic alveolitis) (eg, farmer’s lung; bagassosis) (See F-69)
3. *Pneumocystis carinii* pneumonia (esp. in AIDS)
4. Pulmonary edema in heart failure or ARDS
5. Sarcoidosis

**UNCOMMON**
1. Desquamative interstitial pneumonitis (DIP); nonspecific interstitial pneumonitis (NSIP)
2. Drug or poison toxicity (eg, bleomycin; methotrexate; busulfan; Cytoxan; mitomycin; amiodarone; gold)
3. Goodpasture syndrome
4. Pneumonia of unusual etiology (eg, mycoplasma, cytomegalovirus, or
5. *Strongyloides*, esp. in AIDS or other immunocompromised host)
6. Pulmonary hemorrhage, recurrent or chronic (eg, bleeding or clotting disorder; idiopathic pulmonary hemosiderosis)
Gamut F-17-S

ROENTGEN PATTERNS OF INTERSTITIAL DISEASE

1. Bronchial disease (eg, peribronchial thickening; mucoid impaction; bronchiectasis)
2. Discrete miliary nodules
3. Honeycomb lung
4. Kerley lines
5. Small irregular shadows (reticular or reticulonodular pattern)
6. Vascular abnormality (incl. pulmonary arterial, pulmonary venous, or bronchial arterial)

References

Gamut F-18

ACUTE DIFFUSE FINE RETICULAR OPACITIES (KERLEY LINES, ACUTE—A, B, AND C) (See F-19)

COMMON
1. Pneumonia (esp. interstitial—infectious mononucleosis, cytomegalovirus, H. influenzae; Mycoplasma; atypical mycobacterial; Pneumocystis carinii)
2. Pulmonary edema (esp. heart failure; myocardial infarction; valvular heart disease; renal failure; uremia; fluid overload; drug reaction) (See F-10)
3. Transient tachypnea of the newborn (retained fetal lung fluid); Wilson-Mikity S.; bronchopulmonary dysplasia

UNCOMMON
1. Hypersensitivity pneumonitis (extrinsic allergic alveolitis) (eg, farmer’s lung; bagassosis) (See F-69)
2. Hypoproteinemia (eg, cirrhosis; nephrosis; burn; exudative skin disorder)
3. Pulmonary hemorrhage (incl. Henoch-Schönlein purpura) (See F-12)
4. Pulmonary veno-occlusive disease, acute

References

Gamut F-19

KERLEY LINES, CHRONIC—A, B, AND C (See F-18)

COMMON
1. Bronchogenic carcinoma (lymphangitic spread of tumor)
2. Idiopathic pulmonary fibrosis (IPF) (See F-22)
3. Lymphangitic metastases
4. Pneumoconiosis (esp. silicosis) (See F-70-S)
5. Mitral stenosis

UNCOMMON
1. Alveolar proteinosis (late)
2. Bronchioalveolar carcinoma
3. Congenital heart disease (eg, total APVR)
4. Connective tissue disease (collagen vascular disease) (eg, rheumatoid lung; scleroderma)

(continued)
5. Desquamative interstitial pneumonitis (DIP); lymphocytic interstitial pneumonitis (LIP)
6. Hypersensitivity pneumonitis (extrinsic allergic alveolitis) (eg, farmer’s lung; bagassosis) (See F-69)
7. Left atrial neoplasm (esp. myxoma)
8. Lipid pneumonia
9. Lymphoma (esp. alveolar); leukemia
10. Mediastinal mass with lymphatic obstruction; fibrosing mediastinitis
11. Pulmonary hemorrhage, late (eg, idiopathic pulmonary hemosiderosis) (See F-12)
12. Pulmonary lymphangiectasia
13. Pulmonary lymphangioleiomyomatosis; tuberous sclerosis
14. Pulmonary veno-occlusive disease; pulmonary vein atresia
15. Radiation fibrosis
16. Sarcoidosis
17. Thoracic duct ligation, obstruction, or injury

References

Gamut F-20

WIDESPREAD MILIARY NODULES IN THE LUNGS (LESS THAN 5 MM DIAMETER)

COMMON
*1. Fungus disease (esp. histoplasmosis; blastomycosis; coccidioidomycosis; candidiasis) (See F-74-S)
2. Langerhans cell histiocytosis (esp. eosinophilic granuloma)
3. [Interstitial fibrosis (eg, early stage or subliminal honeycombing)]
4. Metastases, hematogenous (esp. carcinoma of thyroid; melanoma); lymphangitic carcinomatosis (esp. carcinoma of breast, lung, stomach, pancreas, prostate)
5. Pneumoconiosis (esp. silicosis; coal-worker’s pneumoconiosis; asbestosis; siderosis; stannosis; berylliosis) (See F-70-S)
6. Sarcoidosis
*7. Tuberculosis, miliary

**UNCOMMON**
1. Alveolar microlithiasis
2. Amyloidosis
*3. Bronchiolitis, acute or chronic
*4. Bronchiolitis obliterans (eg, noxious vapors; chemicals) (See F-72-S, 73-S); Asian panbronchiolitis
5. Bronchioloalveolar carcinoma
*6. Fat embolism (esp. oily contrast medium after lymphangiography or hysterosalpingography)
7. Gaucher disease; Niemann-Pick disease
*8. Hypersensitivity pneumonitis (extrinsic allergic alveolitis) (eg, farmer’s lung; bagassosis; byssinosis) (See F-69)
9. Lymphocytic interstitial pneumonitis (LIP)
10. Lymphoma; leukemia
*11. Melioidosis
*12. Parasitic disease (esp. schistosomiasis; tropical pulmonary eosinophilia [filarial])
*13. Pneumonia of unusual etiology (eg, viral—chickenpox, measles, influenza; pertussis; nocardiosis; listeriosis; chlamydia; opportunistic) (See F-74-S, 75-S)
14. Pulmonary hemosiderosis (eg, mitral stenosis; idiopathic)
15. Pulmonary lymphangioleiomyomatosis
*16. Infantile respiratory distress S. (hyaline membrane disease)
17. Tuberous sclerosis

* Usually acute disease.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
References

Gamut F-21
WIDESPREAD SMALL IRREGULAR OPACITIES (RETICULAR, NODULAR, OR RETICULONODULAR PATTERN) (See F-22)

COMMON
1. Chronic bronchitis; COPD
*2. Hypersensitivity pneumonitis (extrinsic allergic alveolitis) (eg, farmer’s lung; bagassosis; byssinosis; mushroom-worker’s lung) (See F-69)
3. Idiopathic pulmonary fibrosis (IPF); usual interstitial pneumonitis (UIP) (See F-23-S1)
4. Interstitial fibrosis or leiomyomatosis (eg, from recurrent infection; chronic aspiration; radiation; lung trauma; prior thromboembolism) (See F-22)
5. Interstitial pulmonary edema with pulmonary venous hypertension (eg, Kerley lines in chronic mitral valve disease)
6. Metastases, hematogenous (esp. from thyroid carcinoma; melanoma); lymphangitic carcinomatosis (esp. from carcinoma of breast, lung, larynx, stomach, pancreas, cervix, or prostate); leukemia
7. Pneumoconiosis (esp. silicosis; coal-worker’s pneumoconiosis; asbestosis; talcosis; berylliosis; siderosis; stannosis; baritosis; aluminum pneumoconiosis) (See F-70-S)
*8. Pneumonia of unusual etiology (eg, staphylococcal; salmonella; legionella; melioidosis; measles; chickenpox; cytomegalovirus; echovirus; mycoplasma; Pneumocystis carinii; Toxoplasma; other opportunistic) (See F-74-S, 75-S)
9. Sarcoidosis
10. Tuberculosis; atypical mycobacterial infection

UNCOMMON
1. Alveolar microlithiasis
2. Amyloidosis (bronchopulmonary)
*3. Bronchiolitis, acute or chronic with peribronchial cuffing (eg, bronchiolitis obliterans; noxious vapors; Asian panbronchiolitis)

(continued)
4. Bronchioloalveolar carcinoma
5. Connective tissue disease (collagen vascular disease) g (eg, scleroderma; dermatomyositis; polymyositis; lupus erythematosus)
6. Cystic fibrosis (mucoviscidosis)
7. Desquamative interstitial pneumonitis (DIP); lymphocytic interstitial pneumonitis (LIP); nonspecific interstitial pneumonitis (NSIP)
*8. Drug-induced (esp. nitrofurantoin; busulfan; bleomycin; methotrexate; Cytoxan; amiodarone; methysergide; procainamide) (See F-73-S)
*9. Fat embolism g (incl. oily contrast medium)
*10. Fungus disease (esp. histoplasmosis; coccidioidomycosis; cryptococcosis {torulosis}; blastomycosis) (See F-74-S)
11. Gaucher disease; Niemann-Pick disease
12. Goodpasture syndrome
13. Idiopathic pulmonary hemosiderosis (late)
14. Langerhans cell histiocytosis (eosinophilic granuloma)
15. Lymphoma g; leukemia
16. Neurofibromatosis
*17. Oxygen toxicity (usually infants)
*18. Parasitic disease (esp. schistosomiasis; ascariasis; tropical pulmonary eosinophilia (filarial); paramoniasis; toxoplasmosis)
19. Pulmonary lymphangiectasia
20. Pulmonary lymphangioleiomyomatosis; tuberous sclerosis
21. Pulmonary veno-occlusive disease
22. Rheumatoid lung
23. Riley-Day S. (familial dysautonomia)
24. Sjögren S.
25. “Small airways disease”
*26. Thromboembolism of talc in drug addicts or of metallic mercury
*27. Transient tachypnea of the newborn
28. Waldenström macroglobulinemia
29. Wilson-Mikity S.; bronchopulmonary dysplasia
* May be acute.

References

Gamut F-22

INTERSTITIAL FIBROSIS (INCLUDING HONEYCOMB LUNG—END-STAGE INTERSTITIAL FIBROSIS)

COMMON
*1. Connective tissue disease (collagen vascular disease) g (esp. scleroderma; also rheumatoid lung; dermatomyositis; polymyositis)
2. [Cystic bronchiectasis (incl. cystic fibrosis and tuberculosis)]
*3. Idiopathic pulmonary fibrosis (IPF); acute interstitial pneumonitis (formerly Hamman-Rich syndrome); usual interstitial pneumonitis (UIP) (See F-23-S1)
*4. Langerhans cell histiocytosis (eosinophilic granuloma)
*5. Pneumoconiosis (esp. silicosis; coal-worker’s pneumoconiosis; asbestososis; talcosis; berylliosis; siderosis; stannosis; baritosis; aluminum pneumoconiosis) (See F-70-S)
*6. Sarcoidosis
UNCOMMON

1. Amyloidosis
*2. Ankylosing spondylitis (upper lobes)
*3. Desquamative interstitial pneumonitis (DIP); nonspecific interstitial pneumonitis (NSIP)
*4. Drug sensitivity (esp. bleomycin; busulfan; methotrexate; Cytoxan; carmustine; nitrofurantoin; hexamethonium; amiodarone; methysergide; procaïnamide) (See F-73-S)
*5. Gaucher disease; Niemann-Pick disease
*6. Hypersensitivity pneumonitis (extrinsic allergic alveolitis) (eg, farmer’s lung; bagassosis; bird-fancier’s lung; air-conditioner lung) (See F-69)
*7. Inhalation of noxious fumes or chemicals, late (eg, silo-filler’s disease; sulfur dioxide; cadmium; chlorine; phosgene) (See F-72-S)
*8. Lipoid pneumonia; chronic aspiration (usually localized in lower lobe)
*9. Neurofibromatosis (rare)
*10. Oxygen toxicity; shock lung; [ARDS]
11. Pulmonary hemorrhage; idiopathic pulmonary hemosiderosis (late) (See F-12)
*12. Pulmonary lymphangioleiomyomatosis; tuberous sclerosis
13. Radiation fibrosis
14. Schistosomiasis

* Can often progress to development of end-stage interstitial fibrosis or honeycomb lung.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

SYNONYMS FOR IDIOPATHIC OR USUAL INTERSTITIAL PNEUMONITIS

1. Bronchiolar emphysema
2. Chronic interstitial pneumonitis
3. Diffuse chronic fibrosing interstitial pneumonitis
4. Diffuse interstitial fibrosis
5. Fibrosing (or sclerosing) alveolitis
6. Hamman-Rich syndrome (acute form)
7. Idiopathic pulmonary fibrosis (IPF)
8. Muscular cirrhosis
9. Organizing interstitial pneumonia

Reference
ENTITIES THAT CAN PRODUCE HISTOLOGIC CHANGES SIMILAR TO USUAL INTERSTITIAL PNEUMONITIS

1. Connective tissue disease (collagen vascular disease) (scleroderma; rheumatoid lung; lupus erythematosus; erythema nodosum)
2. Drug therapy (eg, bleomycin; busulfan; methotrexate; amiodarone)
3. Idiopathic
4. Noxious gases
5. Pneumoconiosis (eg, asbestosis; talcosis)
6. Radiation injury
7. Viral disease

References

DIFFUSE INTERSTITIAL DISEASE WITH PLEURAL EFFUSION

COMMON
1. Metastatic disease (esp. lymphangitic carcinoma)
2. Pneumonia (eg, viral, mycoplasma)
3. Pulmonary edema (eg, heart failure; renal failure)
4. Tuberculosis

UNCOMMON
1. Amyloidosis
2. Cystic fibrosis (mucoviscidosis)
3. Drug reaction (eg, hydantoin {Dilantin}; trimethadione; methotrexate)
4. Fungus disease (esp. histoplasmosis; coccidioidomycosis; blastomycosis) (See F-74-S)
5. Hypersensitivity pneumonitis (extrinsic allergic alveolitis) (esp. mushroom-worker’s lung—rare in other entities)
6. Langerhans cell histiocytosis (rarely)
7. Lymphoma; leukemia
8. Parasitic disease (eg, acute schistosomiasis; filariasis—tropical pulmonary eosinophilia) (occasionally)

DIFFUSE INTERSTITIAL DISEASE WITH ASSOCIATED LYMPHADENOPATHY

COMMON
1. AIDS (eg, cytomegalovirus or atypical mycobacterial infection; Kaposi sarcoma; lymphoma)
2. Metastatic disease (eg, lymphangitic carcinoma)

UNCOMMON
1. Amyloidosis
2. Cystic fibrosis (mucoviscidosis)
3. Drug reaction (eg, hydantoin {Dilantin}; trimethadione; methotrexate)
4. Fungus disease (esp. histoplasmosis; coccidioidomycosis; blastomycosis) (See F-74-S)
5. Hypersensitivity pneumonitis (extrinsic allergic alveolitis) (esp. mushroom-worker’s lung—rare in other entities)
6. Langerhans cell histiocytosis (rarely)
7. Lymphoma; leukemia
8. Parasitic disease (eg, acute schistosomiasis; filariasis—tropical pulmonary eosinophilia) (occasionally)
9. Pneumoconiosis (eg, silicosis; coal-worker’s pneumoconiosis; berylliosis)
10. Pulmonary lymphangioleiomyomatosis
11. Sarcoidosis
12. Tuberculosis
13. Viral infection (eg, infectious mononucleosis; chickenpox; measles; cat-scratch fever; ECHO virus; *Mycoplasma*; *Chlamydia*—psittacosis

Gamut F-26

HIGH-RESOLUTION CT (HRCT) PATTERNS OF CHRONIC INTERSTITIAL LUNG DISEASE (CILD)—SEPTAL THICKENING*

### COMMON

1. Pulmonary edema
   - Smooth, often associated areas of ground-glass opacity

2. Pulmonary fibrosis (eg, idiopathic; drug-induced; connective tissue disease—esp. scleroderma, rheumatoid lung, dermatomyositis; sarcoidosis; asbestosis; chronic pneumonia; neurofibromatosis)
   - Irregular thickening with architectural distortion and traction bronchiectasis

3. Lymphangitic carcinomatosis (esp. from carcinoma of breast, lung, stomach, and pancreas; leukemia)
   - Interstitial nodules ± peribronchovascular and subpleural thickening and effusion

4. Hypersensitivity pneumonitis (extrinsic allergic alveolitis) (eg, farmer’s lung, bagassosis) (See F-69)
   - Immunologic response to inhaled organic antigens; bilateral small nodules, ground-glass opacities, patchy consolidation and septal lines acutely; chronic exposure leads to fibrosis

5. Infection (eg, viral pneumonia; mycoplasma; miliary tuberculosis; miliary histoplasmosis)
   - Symmetric perihilar interstitial infiltrate; no pleural effusion

6. Sarcoidosis

7. Silicosis or coal-worker’s pneumoconiosis
   - Widely variable pulmonary patterns including interstitial thickening, 2 to 10 mm nodules, perilymphatic distribution, ± lymphadenopathy

### UNCOMMON

1. Alveolar microlithiasis
   - Calcific interlobular septal thickening; 1 mm punctate calcified nodules (microliths), patchy or diffuse

2. Alveolar proteinosis
   - Idiopathic overproduction of surfactant by pneumocytes; diffuse airspace disease ± septal thickening; treatment with BAL; predisposed to infection, particularly *Nocardia*

(continued)
3. Kaposi sarcoma

Lower lobe bronchovascular thickening; skin or mucous membrane lesions invariably present; irregular “flame-shaped” nodules; lymphadenopathy; pleural effusions

4. Lymphoma, leukemia

Uncommon pattern of direct perihilar lymphatic spread

5. Pulmonary lymphangiectasia

Rare; generalized lymphatic dilatation; small effusions

6. Pulmonary lymphangioleiomyomatosis

Rare; extensive septal thickening; pleural effusions; pneumothorax

* Fluid or cellular infiltrates in interlobular septa. Linear opacities (1 to 2 cm) seen best in lung periphery. Visualization of a few peripheral interlobular septa is normal.

Reference
6. Connective tissue disease (esp. lupus erythematosus; scleroderma) In association with interstitial fibrosis, hemorrhage or pneumonia

7. Sarcoidosis Widely variable pulmonary involvement + adenopathy, including interstitial, nodular, and occasional alveolar pattern; peribronchovascular nodules on HRCT

8. BOOP Usually associated with typically peripheral or peribronchial consolidation

9. Bronchiolitis obliterans Small airway inflammation or fibrosis; air trapping on expiration; areas with ground-glass opacity have increased vascularity due to blood flow redistribution (mosaic perfusion)

10. Infection
   a. *Pneumocystis carinii* pneumonia Common AIDS infection; perihilar interstitial or ground-glass pattern early; airspace, nodules, cysts, and pneumothorax when advanced; effusion and adenopathy rare; BAL usually diagnostic
   b. Viral (esp. cytomegalovirus in immunocompromised patients) Often associated with consolidation
   c. Bacterial Usually in association with consolidation
   d. Tuberculosis; atypical mycobacterial infection Usually in association with centrilobular nodules and branching linear opacities (“tree-in-bud”)

**UNCOMMON**

1. Alveolar proteinosis Idiopathic overproduction of surfactant by pneumocytes; diffuse, symmetric airspace disease ± septal thickening; treatment with BAL; predisposing to infection, particularly *Nocardia*

2. Desquamative interstitial pneumonitis (DIP) Lower lung zone and peripheral predominance; mild, if any, fibrosis

3. Eosinophilic pneumonia Usually associated consolidation

4. Langerhans cell histiocytosis (eosinophilic granuloma) Upper lobe-predominant interstitial disease with a variable combination of small nodules and cysts; fibrosis and pneumothorax may develop

5. Lymphocytic interstitial pneumonitis (LIP) Idiopathic condition in children with AIDS or adults with Sjögren syndrome or multicentric Castleman disease; septal thickening and ill-defined nodules

* Partial airspace filling or alveolar septal inflammation that does not obscure vessels. Typically represents an active, acute, and reversible disease process.

**References**

CHRONIC AIRSPACE CONSOLIDATION ON HRCT

1. Bronchiolitis obliterans with organizing pneumonia (BOOP)
2. Bronchioloalveolar carcinoma
3. Chronic eosinophilic pneumonia
4. Lymphoma
5. Sarcoidosis (alveolar phase)

References

PERIBRONCHOVASCULAR INTERSTITIAL THICKENING ON HRCT

COMMON

1. Pulmonary edema
2. Sarcoidosis
3. Lymphangitic carcinomatosis (esp. carcinoma of breast, lung, stomach and pancreas; leukemia)
4. Hypersensitivity pneumonitis (extrinsic allergic alveolitis) (See F-69)
5. Interstitial fibrosis (idiopathic pulmonary fibrosis—IPF)
6. Pneumoconiosis (silicosis; coal worker’s pneumoconiosis; stannosis; siderosis)
7. Asbestosis

Smooth interstitial thickening with cardiomegaly and pleural effusions
Widely variable pulmonary patterns including interstitial thickening and peribronchovascular nodules ± lymphadenopathy
Interstitial nodules ± peribronchovascular and subpleural thickening and effusion; local spread of lung cancer or hematogenous spread of breast cancer are most common
Immunologic response to inhaled organic antigens; bilateral small nodules, ground-glass opacities, patchy consolidation and septal lines acutely that clear over weeks; chronic exposure leads to fibrosis
Reticular pattern and associated traction bronchiectasis
Small, upper lobe predominant, frequently calcified 2 to 5 mm nodules and septal thickening; may coalesce to PMF; calcified nodes common
Basilar reticular pattern, often associated with pleural plaques or thickening and pleural calcification

UNCOMMON

1. Berylliosis
2. Connective tissue disease (esp. scleroderma; dermatomyositis; rheumatoid lung)

Pattern resembles sarcoidosis
Reticular pattern
3. Kaposi sarcoma
   Bronchovascular thickening; skin or mucous membrane lesions invariably present; irregular “flame-shaped” nodules; lymphadenopathy; pleural effusions

4. Lymphoma, leukemia
   Smooth or nodular; usually associated with mediastinal adenopathy ± unilateral hilar adenopathy

References

Gamut F-30

INCREASED LUNG LUCENCY (USUALLY CYSTIC PATTERN) ON HRCT

COMMON
1. Bronchiectasis
   Tram-tracks; cystic lesions

2. Bronchiolitis obliterans
   Peripheral attenuation of vessels; hyperinflation. HRCT shows mosaic pattern of perfusion (Note: Does not show a cystic pattern on HRCT)

3. Emphysema
   Centrilobular, paraseptal, panacinar, bullous

4. Interstitial fibrosis, end-stage
   (eg, idiopathic pulmonary fibrosis (IPF); scleroderma; rheumatoid lung)
   Honeycomb pattern

5. Pneumatocele
   Traumatic or post-infectious (esp. in Pneumocystis carinii or staphylococcal pneumonia)

UNCOMMON
1. Langerhans cell histiocytosis
   (eosinophilic granuloma)
   Cystic lesions; nodules; involves mainly mid and upper lung zones

2. Pulmonary lymphangioleiomyomatosis
   Cystic lesions on high-resolution CT

Reference
### UPPER LUNG DISEASE ON HRCT

#### COMMON
1. Cystic fibrosis (mucoviscidosis)  
   - Bronchiectasis; hyperinflation
2. Sarcoidosis  
   - Nodules; fibrosis; lymphadenopathy
3. Silicosis and coal worker's pneumoconiosis  
   - Nodules or conglomerate masses
4. Tuberculosis  
   - Nodules, cavitation, consolidation and scarring

#### UNCOMMON
1. Ankylosing spondylitis  
   - Upper lobe fibrosis
2. Talcosis  
   - Intravenous drug abuse; small nodules, conglomerate masses, centrilobular emphysema

### LOWER LUNG DISEASE ON HRCT

#### COMMON
1. Asbestosis  
   - Reticulation, honeycombing; pleural thickening
2. Aspiration pneumonia  
   - Dependent lung zones
3. Connective tissue disease (esp. scleroderma; rheumatoid lung; dermatomyositis)  
   - Reticulation and honeycombing
4. Idiopathic pulmonary fibrosis (IPF)  
   - Reticulation and honeycombing
5. Lymphangitic carcinomatosis  
   - Septal lines; pleural effusion; lymphadenopathy

#### UNCOMMON
1. Hypersensitivity pneumonitis (extrinsic allergic alveolitis)  
   - Centrilobular nodules; ground-glass attenuation; reticulation
2. Lipoid pneumonia  
   - Dependent lung zones. HRCT shows areas with fat attenuation

### Reference
SMALL NODULAR OPACITIES ON HRCT*

COMMON

1. Asbestosis
   Subpleural nodules; interstitial fibrosis predominantly in lower lung zones; pleural thickening ± plaques

2. Bronchiolitis (eg, respiratory, cellular, infectious, and panbronchiolitis)
   Small airway inflammation; ground-glass attenuation, small centrilobular nodules, and “tree-in-bud’” opacities on HRCT; expiratory images may show air trapping

3. Bronchopneumonia (eg, Pseudomonas; Staphylococcus; Streptococcus; Klebsiella; bacillary angiomatosis; anaerobes; Mycoplasma; Legionella; Nocardia; Actinomyces; tuberculous; viral; fungal—histoplasmosis, aspergillosis; lipid—chronic oil aspiration)
   Ill-defined focal consolidation

4. Granulomatous disease, old (esp. histoplasmosis; tuberculosis)
   Often calcified

5. Mycobacterial infection (esp. miliary tuberculosis)
   Transbronchial or hematogenous spread

6. Lymphangitic carcinomatosis (esp. from carcinoma of breast, lung, stomach, and pancreas; leukemia)
   Interstitial nodules ± peribronchovascular and subpleural thickening and effusion

7. Pulmonary metastases
   Smooth, round, various size; predominantly lower lobe and peripheral nodules; ill-defined if hemorrhagic

8. Sarcoidosis
   Widely variable pulmonary patterns ± adenopathy, including interstitial thickening and ill-defined nodules; characteristic peribronchovascular nodules on HRCT

9. Silicosis and coal worker’s pneumoconiosis
   Small, upper lobe- and posterior-predominant; frequently calcified nodules and septal thickening; may coalesce to PMF; calcified nodes common

UNCOMMON

1. Amyloidosis
   Variable patterns, including interstitial disease and solitary or multiple nodules, ± calcification or cavitation

2. Bronchioloalveolar cell carcinoma
   Can present as focal or multifocal consolidation, nodules, or a mass

3. Follicular bronchiolitis (lymphoid hyperplasia)
   Centrilobular nodules; peribronchial nodules; patchy ground-glass opacities

4. Hypersensitivity pneumonitis (extrinsic allergic alveolitis) (See F-69)
   Immunologic response to inhaled organic antigens such as moldy hay or bird droppings; patterns include bilateral small nodules, ground-glass opacities, patchy consolidation, and septal thickening

(continued)
5. Lymphoma g (esp. recurrent non-Hodgkin)  
Almost always mediastinal adenopathy; nodules ± air bronchograms

6. Lymphocytic interstitial pneumonitis (LIP)  
Idiopathic pseudolymphomatous condition in children with AIDS or adults with Sjögren syndrome or multicentric Castleman disease; septal thickening and ill-defined centrilobular, peribronchovascular, and septal nodules

6. Langerhans cell histiocytosis  
(eosinophilic granuloma)  
Upper lobe-predominant interstitial disease with a variable combination of small nodules and cysts; fibrosis and pneumothorax may develop

* Usually interstitial.

References

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**Gamut F-34-1**

**SMALL NODULE DISTRIBUTION ON HRCT—PERILYMPHATIC**  
(Peribronchovascular, Septal, and Subpleural)

**COMMON**
1. Lymphangitic carcinomatosis  
(especial from carcinoma of breast, lung, stomach and pancreas; leukemia)  
Interstitial nodular thickening (beaded septa) ± peribronchovascular and subpleural thickening and pleural effusion

2. Sarcoidosis  
Widely variable pulmonary patterns ± adenopathy, including 2–10 mm peribronchovascular and subpleural nodules

3. Silicosis and coal worker’s pneumoconiosis  
Upper lobe- and posterior-predominant; frequently calcified 2–5 mm nodules and septal thickening; may coalesce to PMF; calcified nodes common

**UNCOMMON**
1. Amyloidosis  
Solitary or multiple nodules ± calcification or cavitation

2. Follicular bronchiolitis (lymphoid hyperplasia)  
Centrilobular nodules; peribronchial nodules; patchy ground-glass opacities

3. Lymphocytic interstitial pneumonitis (LIP)  
Idiopathic pseudolymphomatous condition in children with AIDS; septal thickening and ill-defined nodules

4. Lymphoma g; leukemia  
Usually associated mediastinal adenopathy ± unilateral hilar adenopathy
Gamut F-34-2

SMALL NODULE DISTRIBUTION ON HRCT—Randomly or Evenly Distributed Throughout Lung

1. Miliary tuberculosis
   Typically very ill or immunocompromised patient

2. Pulmonary metastases
   Smooth, round, variable size; peripheral and lower lobe predominance; hemorrhagic nodules ill defined

Gamut F-34-3

SMALL NODULE DISTRIBUTION ON HRCT—Centrilobular

COMMON

1. Bronchiolitis
   Ground-glass and “tree-in-bud” opacities. Expiratory images may show air trapping in involved regions

2. Bronchopneumonia due to viruses, mycoplasma, bacteria or Aspergillus
   Ill-defined nodules and ground-glass attenuation; bronchiectasis

3. Cystic fibrosis (mucoviscidosis)
   Hyperinflation; bronchiectasis; mucus plugging; allergic bronchopulmonary aspergillosis; asthma

4. Silicosis and coal worker’s pneumoconiosis
   Upper lobe- and posterior-predominant, frequently calcified 2–5 mm nodules and septal thickening; may coalesce to PMF; calcified nodes common

5. Tuberculosis; atypical mycobacterial infection
   Endobronchial spread with “tree-in-bud” pattern

UNCOMMON

1. Bronchioloalveolar cell carcinoma
   Can present as focal or multifocal consolidation, nodules, or a mass

2. Follicular bronchiolitis (lymphoid hyperplasia)
   Centrilobular nodules; peribronchial nodules; patchy ground-glass opacities

3. Hypersensitivity pneumonitis (extrinsic allergic alveolitis)
   Ill-defined nodules and ground-glass opacities; patchy consolidation, and septal lines

4. Langerhans cell histiocytosis (eosinophilic granuloma)
   Upper lobe-predominant interstitial disease with a variable combination of small nodules and cysts; interstitial fibrosis and pneumothorax may develop

References
WORLD HEALTH ORGANIZATION
1982—HISTOLOGIC CLASSIFICATION
OF LUNG NEOPLASMS
(SLIGHTLY MODIFIED)

I. EPITHELIAL NEOPLASMS

A. BENIGN
1. Papillomas
   a. Squamous cell papilloma
   b. Transitional papilloma
2. Adenomas
   a. Pleomorphic adenoma (mixed tumor)
   b. Monomorphic adenoma
   c. Others

B. DYSPLASIA
1. Carcinoma in situ

C. MALIGNANT
1. Squamous cell carcinoma (epidermoid carcinoma)
   a. Variant
      i. Spindle cell (squamous) carcinoma
2. Small cell carcinoma
   a. oat cell carcinoma
   b. Intermediate cell type
   c. Combined oat cell carcinoma
3. Adenocarcinoma
   a. Acinar adenocarcinoma
   b. Papillary adenocarcinoma
   c. Bronchiolo-alveolar carcinoma
   d. Solid carcinoma with mucus formation
4. Large cell carcinoma
   a. Variants
      i. Giant cell carcinoma
      ii. Clear cell carcinoma
5. Adenosquamous carcinoma
6. Carcinoid
7. Bronchial gland carcinomas
   a. Adenoid cystic carcinoma
   b. Mucoepidermoid carcinoma
   c. Others
8. Others

II. SOFT TISSUE NEOPLASMS

III. MESOTHELIAL NEOPLASMS

A. LOCALIZED FIBROUS PLEURAL TUMOR

B. MALIGNANT MESOTHELIOMA
1. Epithelial
2. Fibrous (spindle cell)
3. Biphasic

IV. MISCELLANEOUS NEOPLASMS

A. BENIGN
1. Hamartoma

B. MALIGNANT
1. Carcinosarcoma
2. Blastoma
3. Melanoma
4. Lymphoma
5. Others

V. SECONDARY NEOPLASMS

VI. UNCLASSIFIED NEOPLASMS

VII. NEOPLASM-LIKE LESIONS

1. Inflammatory pseudotumor
2. Langerhans cell histiocytosis (eosinophilic granuloma)
3. Lymphoproliferative lesions
4. Tumorlet
5. Others

Reference
CHEST TUMORS IN INFANTS, CHILDREN, AND ADOLESCENTS

LUNGS

COMMON
1. [Inflammatory pseudotumor (eg, plasma cell granuloma; sclerosing hemangioma)]
2. Metastatic tumor (esp. Wilms’ tumor; osteosarcoma)

UNCOMMON
1. Askin tumor
2. Bronchogenic carcinoma
3. Carcinoid; cylindroma; mucoepidermoid carcinoma; pleomorphic adenoma
4. Hamartoma
5. Metastatic tumor, other (eg, Ewing sarcoma; rhabdomyosarcoma; lymphoma; leukemia; hepatoblastoma; neuroblastoma; germ cell tumor; carcinoma of thyroid; laryngeal papillomatosis)
6. Pulmonary blastoma
7. Spindle cell tumor (eg, leiomyoma; neurofibroma)

MEDIASTINUM (See Gamuts F-86 to F-91)

HEART
1. Metastatic tumor (eg, lymphoma; neuroblastoma; Wilms’ tumor; sarcomas; hepatoblastoma)
2. Primary tumor (eg, rhabdomyoma; fibroma; lipoma; myxoma—esp. atrial; teratoma; rhabdomyosarcoma; other sarcomas; hemangiopericytoma)

SOLITARY PULMONARY NODULE (UNDER 4 CM DIAMETER)

COMMON
1. Carcinoid
2. Carcinoma, bronchogenic (incl. bronchioloalveolar)
3. [Chest wall lesion (skin tumor; nipple shadow; rib lesion); artifact; foreign body]
4. Fungus disease (esp. histoplasmosis; rarely coccidioidomycosis) (See F-74-S)
5. Hamartoma
6. Idiopathic (incl. postinflammatory scar)
7. Metastasis (esp. from sarcoma; melanoma; carcinoma of breast, colon, kidney, testis)
8. Round pneumonia (eg, atypical viral; pneumococcal; streptococcal; legionella; nocardia)
9. Tuberculoma

UNCOMMON
1. Abscess of lung
2. Amyloidoma
3. Blood vessel (eg, normal vessel seen end-on near hilum; arteriovenous malformation; varix; pulmonary artery aneurysm; anomalous pulmonary vein)
4. Bulla, fluid-filled (infected)
5. Cyst, fluid-filled (bronchial; bronchiectatic)
6. [Diaphragmatic hernia, localized]
7. [Encapsulated pleural fluid; interlobar effusion; fibrin ball]
8. [Extramedullary hematopoiesis; splenosis]
9. Fungus ball (esp. Aspergillus)
10. Granuloma, other (eg, paraffinoma; sarcoidosis)
11. Gumma
12. Hematoma
13. Inflammatory pseudotumor; organized pneumonia
14. Lipoid pneumonia (paraffinoma)
15. [Localized fibrous tumor of pleura; mesothelioma]
16. Lymph node, intrapulmonary; giant lymph node hyperplasia (Castleman disease)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
Lymphoma

Mediastinal mass

Mucoid impaction (eg, obstructive; \textit{Aspergillus} hypersensitivity; asthma; mucocele (bronchial atresia)

Mucus plug (eg, cystic fibrosis {mucoviscidosis})

Neoplasm, benign (eg, spindle cell tumor)

Parasitic disease (eg, hydatid cyst; paragonimiasis; \textit{Dirofilaria immitis})

Plasmacytoma, pulmonary

Pleural plaque (eg, asbestos related pleural disease)

Pneumoconiosis (conglomerate mass from silicosis or coal-worker’s pneumoconiosis; also asbestosis; talcosis) (See F-70-S)

Pulmonary infarct

Pulmonary sequestration (intralobar)

Rheumatoid nodule

 Rounded atelectasis

Sarcoma of lung (eg, leiomyosarcoma; rhabdomyosarcoma); pulmonary blastoma

Wegener granulomatosis

* May show cystic appearance or cavitation.

This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References


SOLITARY PULMONARY MASS
(GREATER THAN 4 CM DIAMETER)

COMMON

*1. Abscess of lung (pyogenic or amebic)

*2. Carcinoma of lung (bronchogenic or bronchioloalveolar)

*3. Metastasis (esp. from sarcoma; melanoma; carcinoma of breast, colon, kidney, testis)

4. Round pneumonia

UNCOMMON

*1. Adenomatoid malformation (fluid-filled)

*2. Amyloidosis

3. Arteriovenous malformation

*4. Bulla (fluid-filled)

5. Carcinoid

6. [Chest wall lesion (eg, lipoma; rib lesion); breast implant or prosthesis]

*7. Cyst, fluid-filled (eg, bronchial; bronchiectatic) *

8. [Diaphragmatic hernia]

9. [Encapsulated pleural fluid; interlobar effusion; fibrin ball]

*10. Fungus ball (esp. \textit{Aspergillus})

*11. Fungus disease (eg, cryptococcosis (torulosis); blastomycosis; histoplasmosis; coccidioidomycosis); actinomycosis, nocardiosis (See F-74-S)

12. Giant lymph node hyperplasia (Castleman disease)

*13. Granuloma (esp. tuberculosis; fungal)

*15. Hematoma of lung

*16. Hydatid cyst

*17. Inflammatory pseudotumor; organized pneumonia

18. Lipoid pneumonia (paraffinoma)

19. [Localized fibrous tumor of pleura; mesothelioma]
*20. Lymphoma
*21. [Mediastinal mass]
22. Neoplasm, benign (eg, spindle cell tumor)
23. Plasmacytoma, pulmonary
24. [Pleural plaque (eg, asbestos-related pleural disease)]
25. Pneumoconiosis (conglomerate mass from silicosis or coal-worker’s pneumoconiosis; also asbestosis) (See F-70-S)
26. Pulmonary blastoma
*27. Pulmonary infarct
*28. Pulmonary sequestration (intralobar)
29. Radiation pneumonitis (nodular)
30. Rounded atelectasis
31. Sarcoma of lung (eg, leiomyosarcoma; rhabdomyosarcoma);
*32. Wegener granulomatosis
* May have cystic appearance or cavitation.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

**SUPERIOR SULCUS LESION**

### COMMON
1. [Artifact (eg, hair braid)]
2. Bulla or bleb
3. Fracture of rib, clavicle, or spine (incl. hematoma and callus)
4. Hemorrhage, extrapleural (eg, trauma; rupture of aorta or other great vessel)
5. Iatrogenic (esp. subclavian catheter perforation)
6. Metastasis
7. Neoplasm, benign (esp. lipoma; schwannoma; neurofibroma)
8. Neoplasm, malignant (esp. bronchogenic carcinoma—Pancoast tumor; rarely liposarcoma)
9. Neoplasm of rib, clavicle, or spine
10. [Normal variant; apical cap; subclavian artery]

### UNCOMMON
1. Abscess, esp. extrapleural with osteomyelitis of rib
2. Arteriovenous fistula
3. Cervical lesion with extension (eg, infection; thyroid goiter or neoplasm)
4. Dilated great vessel (eg, subclavian artery with coarctation of aorta)
5. Localized fibrous tumor of the pleura; mesothelioma
6. Lymphoma
7. Mediastinal fat extension (eg, steroid lipomatosis)
8. Radiation reaction (esp. therapy for carcinoma of breast)
9. Spinal fluid leakage (eg, neoplasm; fracture; avulsion of nerve root)
10. Spinal lesion extension (eg, tuberculosis; metastasis)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

(continued)
References

Gamut F-40

MASS-LIKE PERIHILAR OR CENTRAL PULMONARY OPACITY OR LESION RADIATING FROM THE HILUM

COMMON
1. Bronchogenic carcinoma
2. Lymphadenopathy, hilar (See F-103, 104)
3. Lymphoma
4. Metastasis
5. Pneumonia (incl. chronic aspiration)
6. Pulmonary edema (See F-10)
7. Tuberculosis

UNCOMMON
1. Alveolar proteinosis (rarely)
2. Fungus disease (esp. actinomycosis; blastomycosis)
3. Lipoid pneumonia
4. Pneumoconiosis (conglomerate mass of silicosis or coal-worker’s pneumoconiosis)
5. Pulmonary hemorrhage (eg, bleeding or clotting disorder; hemolytic-uremic S.) (See F-12)

Gamut F-41

SHAGGY PULMONARY NODULE OR MASS WITH FUZZY BORDERS, SOLITARY OR MULTIPLE

COMMON
1. Abscess of lung; infected bulla or cyst
2. Carcinoma of lung (bronchogenic; bronchioalveolar)
3. Fungus disease (eg, histoplasmosis; coccidiodomycosis; blastomycosis; cryptococcosis (torulosis); actinomycosis; nocardiosis (See F-74-S)
4. Metastasis (esp. choriocarcinoma)
5. Pneumoconiosis with conglomerate mass (eg, silicosis; coal-worker’s pneumoconiosis; asbestosis; talcosis)
6. Pulmonary infarct, bland or septic
7. Round pneumonia
8. Tuberculosis

UNCOMMON
1. Amyloidosis
2. Hematoma of lung (esp. traumatic)
3. Inflammatory pseudotumor
4. Lipoid pneumonia
5. Lymphoma
6. Parasitic disease (esp. amebic abscess; complicated hydatid cyst; paragonimiasis)
7. Postoperative scar
8. Pulmonary sequestration (intralobar)
9. Radiation-treated carcinoma
10. Rheumatoid nodule
11. Rounded atelectasis
12. Sarcoidosis (“alveolar” pattern)
13. Wegener granulomatosis

Reference
MULTIPLE DISCRETE PULMONARY NODULES OR MASSES (NONMILIARY)

COMMON

1. Bronchioloalveolar carcinoma
2. [Chest wall lesions (neurofibromatosis; nipple shadows; rib lesions); foreign bodies; artifacts]
3. Fungus disease (esp. histoplasmosis; coccidioidomycosis) (See F-74-S)
4. Metastases
5. Tuberculosis

UNCOMMON

1. Abscesses of lung (usually staphylococcal); bacillary angiomatosis (Bartonella henselae)
2. Amyloidosis
3. Arteriovenous malformations or fistulas; varices; pulmonary arterial coarctations
4. Bronchiectatic cysts, fluid-filled
5. [Encapsulated pleural effusions]
6. Gaucher disease; Niemann-Pick disease
7. Hamartomas (incl. Carney’s triad)
8. Hematomas of lung
9. Hydatid cysts
10. Kaposi sarcoma
11. Langerhans cell histiocytosis (eosinophilic granuloma)
12. Leiomyomatosis (benign metastasizing leiomyomas)
13. Lipoid pneumonia
14. Lymphoma
15. Measles, atypical with round nodule complexes
16. Melioidosis
17. Mucoid impactions (esp. allergic bronchopulmonary aspergillosis)
18. Mucus plugs (eg, cystic fibrosis {mucoviscidosis})
19. Multiple myeloma (plasmacytomas)
20. Papillomatosis of lung
21. Paragonimiasis
22. Pneumoconiosis (eg, conglomerate masses in silicosis or coal-worker’s pneumoconiosis; asbestosis; talcosis; stannosis; berylliosis)

23. Polyarteritis nodosa
24. Pulmonary hemosiderosis with ossification (eg, mitral stenosis)
25. Pulmonary infarcts
26. Rheumatoid nodules (incl. Caplan S.)
27. Sarcoidosis
28. Septic emboli
29. Wegener granulomatosis

* May be calcified.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

SHARPLY DEFINED CAVITARY LESION(S) OF THE LUNG—THIN-WALLED

COMMON

1. Abscess of lung (bacterial, fungal, septic, amebic, opportunistic)
2. Bronchogenic carcinoma
3. Bulla; bleb
4. Cystic bronchiectasis
5. Fungus disease (esp. coccidioidomycosis) (See F-74-S); fungus ball (esp. Aspergillus)
6. Honeycomb lung (See F-22)
7. Metastasis
8. Pneumatocele (esp. staphylococcal or hydrocarbon pneumonia; traumatic) (See F-48)
9. Pneumocystis carinii pneumonia (esp. in AIDS)
10. Tuberculosis (incl. granuloma)

UNCOMMON

1. Amyloidosis
2. Behçet syndrome
3. Cyst (eg, bronchial)

(continued)
4. Cystic adenomatoid malformation M
5. Cystic fibrosis (mucoviscidosis) M
6. Diaphragmatic hernia S
7. Langerhans cell histiocytosis g M
8. Hydatid cyst SM
9. Hydropneumothorax, encapsulated (incl. interlobar bronchopleural fistula); loculated pneumothorax
10. Inflammatory pseudotumor g S
11. Lymphoma g (esp. Hodgkin lymphoma) SM
12. Melioidosis SM
13. Papillomatosis of lung M
14. Parasitic disease, other (esp. paragonimiasis) SM
15. Plombage, lucite M
16. Polyarteritis nodosa; lupus erythematosus M
17. Pulmonary infarct SM
18. Pulmonary sequestration (intralobar) SM
19. Rheumatoid nodule SM
20. Sarcoidosis (cystic) M
21. Septic embolus SM
22. Traumatic lung cyst (hematoma; laceration) SM
23. Wegener granulomatosis g SM

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

SHARPLY DEFINED CAVITARY LESION(S) OF THE LUNG—THICK-WALLED

COMMON
1. Abscess of lung (bacterial—staphylococcal, klebsiella, pseudomonas, proteus; fungal; septic; amebic; opportunistic) SM
2. Bronchogenic carcinoma S
3. Cyst bronchiectasis M
4. Fungus disease (esp. coccidioidomycosis) (See F-74-S) SM
5. Metastasis SM
6. Tuberculosis (incl. granuloma) SM

UNCOMMON
1. Amyloidosis SM
2. Cystic adenomatoid malformation M
3. Cystic fibrosis (mucoviscidosis) M
4. Hydatid cyst SM
5. Hydropneumothorax, encapsulated (incl. interlobar bronchopleural fistula); loculated pneumothorax SM
6. Inflammatory pseudotumor g S
7. Lymphoma g (esp. Hodgkin lymphoma) SM
8. Melioidosis SM
9. Papillomatosis of lung M
10. Parasitic disease, other (esp. paragonimiasis, dirofilariasis) SM
11. Pneumoconiosis (silicosis or coal-worker’s pneumoconiosis with conglomerate mass) S
12. Pneumonia, cavitating SM
13. Pulmonary infarct SM
14. Pulmonary sequestration (intralobar) SM
15. Rheumatoid nodule SM
16. Septic embolus SM
17. Traumatic lung cyst (hematoma; laceration) SM
18. Wegener granulomatosis g SM
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut F-44

CYST-LIKE OR CAVITARY PULMONARY LESION(S) IN AN INFANT OR CHILD

COMMON
1. Abscess of lung (eg, bacterial or amebic)
2. Bronchopulmonary dysplasia (sequel to RDS—ventilator lung); Wilson-Mikity S.; interstitial pulmonary emphysema
3. Cystic bronchiectasis (eg, cystic fibrosis [mucoviscidosis])
4. Pneumatocele (See F-48)
5. Pneumonia with cavititation (eg, staphylococcus; pseudomonas; Klebsiella; S. pneumoniae; bacteroides; mycoplasm; cold agglutinin; or opportunistic—Pneumocystis carinii in AIDS; Aspergillus; Candida; zygomycosis)
6. Pulmonary sequestration (intralobar)
7. Tuberculosis

UNCOMMON
1. Bronchial or bronchogenic cyst
2. Bulla; bleb
3. [Congenital lobar emphysema]
4. Cystic adenomatoid malformation

5. [Diaphragmatic or paraesophageal hiatal hernia]
6. [Eventration with elevation of air-filled stomach]
7. Fungus disease (esp. coccidioidomycosis) (See F-74-S); fungus ball (esp. Aspergillus)
8. Honeycomb lung (eg, Langerhans cell histiocytosis)
9. Kartagener S. with bronchiectasis
10. Lymphoma (eg, Hodgkin disease)
11. Metastasis
12. Mounier-Kuhn S. (tracheobronchomegaly)
13. Papillomatosis (laryngeal or tracheobronchial with spread to lungs)
14. Parasitic disease (esp. hydatid disease; paramonimiasis) (See F-74-S)
15. [Pneumothorax, loculated]
16. Pulmonary blastoma
17. Rheumatoid nodules with cavitation
18. Septic embolus
19. Traumatic lung cyst (laceration of lung)
20. Williams-Campbell S. with saccular bronchiectasis

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
SOLITARY CAVITARY PULMONARY LESION (CYST, NODULE, OR MASS) WITH A SHARP OUTLINE (See F-43-2)

COMMON
1. Abscess (eg, bacterial or amebic)
2. Bronchogenic carcinoma
3. Bulla; bleb
4. Fungus disease (esp. coccidioidomycosis)
5. Metastasis
6. Opportunistic infection (esp. fungus such as Cryptococcus; Candida; zygomycosis; fungus ball—esp. Aspergillus) (See F-75-S)
7. Pneumatocele (See F-48)
8. Tuberculosis

UNCOMMON
1. Amyloidosis
2. Behçet syndrome
3. Cyst (bronchial or traumatic)
4. Granuloma
5. Hamartoma
6. Hydatid cyst
7. [Hydropneumothorax, encapsulated]
8. Lymphoma (esp. Hodgkin disease)
9. Parasitic disease, other (eg, paragonimiasis; dirofilariasis immitis)
10. Pulmonary blastoma
11. Pulmonary infarct
12. Rheumatoid nodule
13. Sequestration of lung (intralobar)
14. Wegener granulomatosis

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

SOLITARY CAVITARY LESION OF THE LUNG WITH A SHAGGY (IRREGULAR OR SPICULATED) OUTLINE

COMMON
1. Abscess (bacterial; amebic; opportunistic infection)
2. Carcinoma (bronchogenic; bronchioloalveolar)
3. Fungus disease (esp. coccidioidomycosis)
4. Metastasis
5. Pneumatocele, infected (See F-48)
6. Pulmonary infarct
7. Sequestration of lung (intralobar)
8. Tuberculosis

UNCOMMON
1. [Diaphragmatic hernia]
2. Granuloma (incl. idiopathic)
3. Hematoma
4. [Hydropneumothorax, encapsulated]
5. Lymphoma (esp. Hodgkin disease)
6. Parasitic disease (eg, hydatid cyst—esp. infected; Paragonimus cyst)
7. Pneumoconiosis (conglomerate mass of silicosis or coal-worker's pneumoconiosis)
8. Pneumonia, localized (eg, staphylococcal; Klebsiella; aspiration)
9. Rheumatoid nodule
10. Wegener granulomatosis

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
PREDISPOSING FACTORS FOR A LUNG ABSCCESS

DEPRESSED GAG REFLEX
1. Alcoholism
2. Anesthesia; postoperative state
3. Cerebral disease (eg, stroke; neoplasm)
4. Debilitation
5. Drug abuse
6. Epilepsy; other convulsive disorders
7. Intubation (eg, indwelling nasogastric tube)

UPPER AIRWAY INFECTION
1. Gingivitis
2. Tonsillitis

ESOPHAGOGASTRIC DISEASE WITH ASPIRATION
1. Achalasia
2. Chalasia (gastroesophageal regurgitation)
3. Other esophageal disease (eg, scleroderma)
4. Peptic disease
5. Tracheoesophageal fistula

PULMONARY DISEASE
1. Actinomycosis; nocardiosis
2. Bronchiectasis
3. Bronchogenic carcinoma
4. Cystic fibrosis (mucoviscidosis)
5. Foreign body (eg, peanut in bronchus)
6. Fungus disease (eg, blastomycosis; aspergillosis; coccidioidomycosis; cryptococcosis; zygomycosis)
7. Immotile cilia S.; Kartagener S.
8. Immunosuppression; opportunistic infection
9. Parasitic disease (esp. amebiasis; hydatid disease)
10. Pneumonia (esp. staphylococcal; Klebsiella; E. coli; pseudomonas; proteus; aspiration)
11. Sequestration of lung (intralobar)
12. Tuberculosis

MISCELLANEOUS
1. Antitrypsinase deficiency
2. Sickle cell disease

Reference

PNEUMATOCELE

1. Hemorrhage in lung with interstitial emphysema
2. Hydrocarbon aspiration
3. Hyperimmunoglobulinemia E syndrome (Buckley S. or Job S.)
4. Pneumonia (eg, staphylococcal; pneumococcal; Klebsiella; E. coli; legionella; H. influenzae; viral; Pneumocystis carinii)
5. Pulmonary infarct
6. Respirator therapy
7. Trauma (contusion, laceration or hematoma of lung)
8. Tuberculosis

References
MULTIPLE LUCENT OR CAVITARY LESIONS OF THE LUNG (See F-43, 44)

COMMON
1. Bronchiectasis
2. Bullae; blebs
3. Fungus disease (esp. coccidioidomycosis) (See F-74-S)
4. Honeycomb lung (end-stage interstitial fibrosis) (See F-22)
5. [Hydropneumothorax, encapsulated; pneumothorax, loculated]
6. Metastases, necrotic
7. Opportunistic infection (esp. Pneumocystis carinii; fungus disease; pseudomonas) (See F-75-S)
8. Pneumatoceles (See F-48)
9. Pulmonary thromboembolism with infarcts
10. Septic emboli or abscesses (eg, narcotic addiction)
11. Tuberculosis (incl. atypical mycobacterial infection)

UNCOMMON
1. Abscesses (usually staphylococcal)
2. Amyloidosis
3. Carcinoma of lung, primary multicentric
4. Cystic adenomatoid malformation
5. [Diaphragmatic hernia]
6. Granulomas
7. Hydatid cysts
8. Langerhans cell histiocytosis (eosinophilic granuloma)
9. Lymphoma (eg, Hodgkin disease); lymphomatoid granulomatosis
10. Melioidosis
11. Papillomatosis (laryngeal or tracheobronchial with spread to lungs)
12. Paragonimiasis
13. Pneumoconiosis (coal-worker’s pneumoconiosis or silicosis with conglomerate masses; progressive massive fibrosis)
14. Pulmonary lymphangioleiomyomatosis; tuberous sclerosis
15. Rheumatoid nodules
16. Sarcoidosis (cystic form)
17. Wegener granulomatosis; pulmonary angitis and granulomatosis

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

EXTENSIVE PULMONARY OPACITY WITH CAVITATION (DESTRUCTIVE PATTERN) (See F-46)

COMMON
1. Abscess of lung, acute or chronic (eg, bacterial; amebic; aspiration)
2. Bronchial obstruction with distal abscess (eg, from bronchogenic carcinoma; carcinoid; lymphadenopathy; foreign body; bronchial stricture)
3. [Bronchiectasis, esp. cystic]
4. Bronchogenic carcinoma
5. Fungus disease, primary (eg, blastomycosis; coccidioidomycosis; cryptococcosis; zygomycosis) or opportunistic (Aspergillus; Candida) (See F-74-S)
6. Pneumonia (esp. Pneumocystis carinii; Staphylococcus aureus; Klebsiella)
7. Sepsis
8. Traumatic laceration of lung
9. Tuberculosis (incl. atypical mycobacterial infection)

UNCOMMON
1. Actinomycosis; nocardiosis
2. Gangrene of lung; infarcted pneumonia
   (esp. *Klebsiella*)
3. Pulmonary thromboembolism with infarction
4. Lymphoma (esp. Hodgkin disease)
5. Melioidosis
6. Metastatic disease
7. Paragonimiasis
8. Sequestration of lung (intralobar)
9. Wegener granulomatosis

[*] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References

Gamut F-51
MASS IN A PULMONARY CAVITY
(MENISCUS OR BULL’S-EYE SIGN), MOBILE OR FIXED

COMMON
*1. Fungus ball (esp. *Aspergillus*; rarely *Cryptococcus; Candida*; Coccidioides)
*2. Hydatid cyst

UNCOMMON
*1. Abscess with inspissated pus
*2. Blood clot in a tuberculous cavity, pulmonary infarct, or laceration of lung

*3. Gangrene of lung; infarcted lung in cavity (esp. *Klebsiella*; angioinvasive fungal disease)
4. Neoplasm (bronchogenic carcinoma; pulmonary blastoma; sarcoma; metastasis)
5. Opportunistic infection (esp. fungus disease; *Pseudomonas*; nocardia)
*6. Paragonimiasis (worm in cyst—corona sign)
   * Usually mobile.

References

Gamut F-52
INCREASED RADIOLUCENCY OF BOTH LUNGS (BILATERAL HYPERINFLATION)

COMMON
1. Asthma
2. Bronchiolitis, acute diffuse of infants (usually viral)
3. Bronchitis, acute or chronic
4. Bronchopulmonary dysplasia sequela (eg, respirator lung)
5. Bullous emphysema, advanced (“vanishing lung” disease)
6. Congenital heart disease (esp. cyanotic—right-to-left shunts, esp. tetralogy of Fallot, pseudotruncus arteriosus; right heart obstruction; Eisenmenger physiology) (See E-8, E-18, E-19)
7. Cystic fibrosis (mucoviscidosis)
8. Emphysema, chronic obstructive (COPD)
9. Hyperventilation (eg, air hunger—metabolic disturbance; acidosis; dehydration; gastroenteritis)
10. Kyphosis (eg, senile “emphysema”)
   (continued)
11. Normal profound inspiration (eg, athlete; horn player)
12. Pectoral muscle absence, congenital (Poland syndrome) or surgical (bilateral mastectomy) or atrophy (eg, polio)
13. Pulmonary hypertension, primary or secondary
14. [Technical factors: overpenetrated film; thin patient]
15. Tracheal or laryngeal obstruction, stenosis, or compression (eg, foreign body; vascular ring; tumor—carcinoma, adenoid cystic carcinoma {cylindroma}, papilloma, hemangioma, cyst; mediastinal neoplasm, cyst, or lymphadenopathy; tracheobronchomegaly; tracheomalacia; cutis laxa; congenital, posttraumatic, postintubation or tracheostomy stenosis; saber-sheath trachea; relapsing polychondritis) (See F-81-1, 83)

UNCOMMON
1. Bronchiolitis obliterans
2. Bronchiolitis, other (eg, thermal; graft versus host disease)
3. Bronchopneumonia, infantile diffuse, with hyperinflation (eg, measles, influenza, pertussis)
4. Immunologic disorder, antitrypsin deficiency
5. Pulmonary thromboembolism, central or widespread
6. Tracheoesophageal fistula

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
*8. Pulmonary sequestration (intralobar)
*9. Pulmonary vein atresia or stenosis
10. Pulmonary thromboembolism
*11. Swyer-James S.; bronchiolitis obliterans
*12. Venolobar S. (scimitar S.)

* Small hyperlucent hemithorax, especially in children.

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References

Gamut F-55

NEONATAL RESPIRATORY DISTRESS

COMMON
1. Aspiration of meconium or amniotic fluid
2. Congenital heart disease (esp. cyanotic)
3. Diaphragmatic hernia
4. Hyaline membrane disease (incl. its sequel—bronchopulmonary dysplasia)
5. Pneumonia
6. Pulmonary immaturity
7. Respirator therapy (eg, PEEP); shock lung; Wilson-Mikity S.
8. Transient tachypnea of the newborn (retained fetal alveolar fluid)

UNCOMMON
1. Choanal atresia
2. Congenital lobar emphysema
3. Cystic adenomatoid malformation
4. Eventration or paralysis of diaphragm
5. Laryngeal atresia
6. Neuromuscular disorder, (eg, Werdnig-Hoffmann disease)
7. Overly medicated mother
8. Persistent fetal circulation

(continued)
9. Pierre Robin S. (Robin sequence)
10. Pneumothorax; chylothorax
11. Pulmonary edema
12. Pulmonary hemorrhage
13. Pulmonary hypoplasia or agenesis (eg, asphyxiating thoracic dysplasia {Jeune S.}; short ribpolydactyly syndromes)
14. Pulmonary lymphangiectasia
15. Tracheoesophageal fistula
16. Vascular ring

References

Gamut F-57

BILATERAL UNDERAERATION
(Esp. in Children)

COMMON
1. Abdominal distention (eg, ascites; mass)
2. Poor inspiration

UNCOMMON
1. Bilateral eventration of diaphragm
2. Cheyne-Stokes breathing in neonate
3. Diaphragmatic paralysis (eg, polio; phrenic nerve injury or paralysis)
4. Inspiratory airway obstruction (eg, tracheal or laryngeal obstruction, stenosis, or compression) (See no. 15 in F-52)
5. Maternal oversedation in neonate
6. Neurologic disorder
7. Primary muscle disorder
8. Pulmonary hypoplasia in neonate

Reference

Gamut F-58

ASYMMETRY OF LUNG SIZE

COMMON
1. Atelectasis (eg, bronchogenic carcinoma; carcinoid; foreign body or mucus plug in bronchus)
2. Displacement of hemidiaphragm by subphrenic mass or abscess, hepatomegaly, splenomegaly, distended stomach or colon
3. Emphysema, unilateral or asymmetrical (eg, bullous emphysema; ball-valve obstruction)
4. Eventration of hemidiaphragm
5. Phrenic nerve paralysis

Reference
6. Pleural effusion or malignancy, diffuse unilateral or asymmetrical (eg, mesothelioma; metastatic adenocarcinoma; invasive thymoma)
7. Postoperative lobectomy or partial lung resection; fibrothorax
8. Pulmonary fibrosis, unilateral (eg, healed tuberculosis; postradiation)

UNCOMMON
1. Bronchial atresia or stenosis
2. Congenital lobar emphysema
3. Cystic adenomatoid malformation
4. Diaphragmatic hernia
5. Hypoplastic lung or pulmonary artery
6. Lung transplantation
7. Swyer-James S.
8. Thoracoplasty
9. Venolobar S. (scimitar S.)

LOCALIZED CHRONIC PULMONARY INFILTRATE

COMMON
1. Abscess of lung (bacterial, fungal, amebic)
2. Aspiration pneumonia, chronic (eg, neurologic or neuromuscular disorder; pharyngeal or esophageal disease—Zenker’s diverticulum; achalasia; chalasia; hiatus hernia; esophageal atresia; tracheoesophageal fistula; scleroderma; carcinoma of esophagus) (See F-7)
3. Bronchial obstruction (eg, carcinoid; bronchogenic carcinoma; foreign body; stricture; mucus plug; mucoid impaction—Aspergillus sensitivity, asthma)
4. Bronchiectasis (See F-80)
5. Infection, esp. untreated or antibiotic resistant (eg, tuberculosis; fungus disease; Klebsiella; Mycoplasma)
6. Opportunistic infection (eg, in immune deficiency disorder; AIDS; steroid or immunosuppressive therapy) (See F-77)
7. Pneumonia, organized; inflammatory pseudotumor

UNCOMMON
1. Alveolar proteinosis
2. Bronchioloalveolar carcinoma
3. Cystic fibrosis (mucoviscidosis)
4. Foreign body in pulmonary tissue (eg, splinter, needle; lycoperdonosis
5. Idiopathic pulmonary fibrosis (IPF)
6. Lipoid pneumonia
7. Lymphoma
8. Parasitic disease (esp. amebiasis; paragonimiasis; ascariasis) (See F-74-S)
9. Pulmonary hemorrhage, late or recurrent (eg, hemophilia; idiopathic pulmonary hemosiderosis)
10. Pulmonary sequestration (intralobar)
11. Radiation pneumonitis or fibrosis

References
*7. Pneumonia (incl. opportunistic)
*8. Pulmonary edema (See F-10)
9. Radiation therapy (eg, for breast or lung carcinoma)
*10. Tuberculosis

**UNCOMMON**
*1. Atelectasis, entire lung, central obstructive or nonobstructive (eg, postoperative, traumatic)
2. Cystic adenomatoid malformation
3. Cysts (esp. hydatid)
4. Esophageal lung, congenital
5. Lymphoma
*6. Pulmonary gangrene
*7. Pulmonary infarcts; septic emboli
* May be acute.

**References**

**Gamut F-61**

**BILATERAL BASILAR PULMONARY DISEASE**

**COMMON**
1. Asbestosis
2. Aspiration pneumonia (incl. hydrocarbon) (see F-7)
3. Atelectasis (eg, immobilization; splinting; post-cardiac surgery—usually unilateral LLL)
4. Bronchiectasis (often secondary to chronic pneumonia)
5. Connective tissue disease (collagen vascular disease) (eg, scleroderma; rheumatoid lung; dermatomyositis; lupus erythematosus; Sjögren syndrome)
6. Interstitial fibrosis (esp. idiopathic pulmonary fibrosis (IPF))
7. Pulmonary edema (See F-10)
8. Viral pneumonia

**UNCOMMON**
1. Alveolar proteinosis
2. Bronchiolitis obliterans with organizing pneumonia (BOOP)
3. Chemotherapy, other drugs (eg, methotrexate; busulfan; bleomycin; amiodarone; nitrofurantoin; BCNU—carmustine; methysergide; cyclophosphamide; procainamide) (See F-73-S)
4. Desquamative interstitial pneumonitis (DIP); lymphocytic interstitial pneumonitis (LIP)
5. Kaposi sarcoma
6. Lipoid pneumonia
7. Lymphomatoid granulomatosis
8. Metastases (esp. lymphangitic)
9. Neurofibromatosis
10. Nonspecific interstitial pneumonitis (NSIP) and nonspecific interstitial pulmonary fibrosis (NIPF)

**References**

**Gamut F-62**

**RETROCARDIAC LESION**

**COMMON**
1. Aortic aneurysm or ectasia
2. Atelectasis of lower lobe
3. Diaphragmatic hernia (eg, hiatal; Bochdalek; traumatic)
4. Esophageal lesion (eg, carcinoma; leiomyoma; varices; achalasia)
5. Granuloma of lung (eg, tuberculoma; fungus disease, esp. histoplasmosis)
6. Left atrial enlargement
7. Lymphadenopathy (eg, inflammatory; lymphoma; metastatic disease)
8. Mediastinal lesion, middle or posterior (eg, bronchogenic cyst; lymphadenopathy; neurogenic tumor; thoracic kidney; extramedullary hematopoiesis) (See F-89, F-90)
9. Neoplasm of lung (eg, bronchogenic carcinoma; bronchioloalveolar carcinoma; carcinoid; hamartoma; metastasis)
10. Pleural effusion
11. Pneumonia or other disease in lower lobe (eg, aspiration pneumonia; tuberculosis; fungus disease; abscess of lung; bronchiectasis—esp. cystic)
12. Pulmonary infarct
13. Pulmonary sequestration (intralobar)
14. Spinal lesion (eg, osteoarthritic spurring; fracture; osteomyelitis; discogenic disease; hemangioma, sarcoma, myeloma or other primary or metastatic neoplasm); paraspinous abscess, hematoma, adenopathy or neoplasm)

UNCOMMON
1. Azygos vein dilatation
2. Cardiac tumor or aneurysm (esp. left ventricular)
3. Cystic adenomatoid malformation
4. Hydatid cyst
5. Neoplasm of pleura (eg, mesothelioma; localized fibrous tumor of pleura; metastasis)

Gamut F-63

BLURRING OF THE HEART BORDER ON PA CHEST FILM

COMMON
1. Idiopathic
2. Infiltrate or edema in left lingula, right middle lobe, or anterior segment of an upper lobe

Gamut F-64

SUBPLEURAL OR PERIPHERAL LESION ARISING IN LUNG (See F-125)

COMMON
1. Asbestosis
2. Carcinoma of lung (esp. Pancoast tumor)
3. Eosinophilic pneumonia (Löffler syndrome; PIE)
4. Granuloma (eg, tuberculosis; histoplasmosis; coccidioidomycosis)
5. Metastasis
6. Pulmonary infarct
7. Rounded atelectasis

UNCOMMON
1. Actinomycosis; nocardiosis
2. Fungus disease (eg, cryptococcosis {torulosis})
3. Inflammatory pseudotumor; organized pneumonia

(continued)
4. Lymphoma
5. [Mesothelioma; localized fibrous tumor of pleura]
6. Pulmonary sequestration (intralobar)
7. Rheumatoid nodule
8. Wegener granulomatosis

Reference

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

LONG LINEAR OR CURVILINEAR SHADOW(S) IN THE LUNG

COMMON
1. Azygos lobe (rarely hemiazygos lobe on left)
2. Bronchial wall thickening, enlarged bronchus (eg, chronic bronchitis, bronchiectasis—“tram lines”)
3. Bulla, pneumatocele, or thin-walled cavity (partially visible)
4. Interlobar fissure, normal or thickened or fluid-filled; accessory fissure
5. Kerley lines
6. Linear (plate-like, discoid) atelectasis, transverse or vertical (Fleischner line)
7. Lymphangitic carcinomatosis
8. Pneumothorax (edge of lung)
9. Pulmonary artery or vein (eg, scimitar syndrome; arteriovenous malformation; other anomalous vessel)
10. Scar (linear)
11. [Skin fold; artifact]

UNCOMMON
1. Bronchial artery (eg, cyanotic congenital heart disease)
2. Mucoid impaction in bronchus
3. Paragonimiasis (with worm burrows or bronchiectasis)
4. [Pleural band or scar]

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References
1. Fleischner F, Hampton AD, Castleman B: Linear shadows in the lung (interlobar pleuritis, atelectasis and healed infarction). AJR 1941;46:610–618

COMBINED SKIN AND WIDESPREAD LUNG OR PLEURAL DISORDER

COMMON
1. Chickenpox; measles
2. Connective tissue disease (collagen vascular disease), (esp. scleroderma; lupus erythematosus, rheumatoid arthritis, dermatomyositis)
3. Immunologic disorder, congenital or acquired (esp. AIDS)
4. Malignant neoplasm of skin with metastasis (eg, melanoma; squamous cell carcinoma)
5. Radiation therapy
6. Sarcoidosis

UNCOMMON
1. Acanthosis nigricans
2. Amyloidosis
3. Bleeding or clotting disorder
4. Burn
5. Cutis laxa
6. Drug reaction; chemotherapy
7. Ectodermal dysplasia
8. Ehlers-Danlos S.
9. Erythema nodosum; erythema multiforme
10. Fungus disease (eg, candidiasis; blastomycosis) (See F-74-S)
11. Kaposi sarcoma
12. Langerhans cell histiocytosis
13. Lymphoma; leukemia; mycosis fungoides
14. Melioidosis
15. Neurofibromatosis
17. Parasitic disease (eg, amebiasis; acute schistosomiasis; strongyloidiasis)
18. Progeria
19. Tuberous sclerosis
20. Wegener granulomatosis
21. Yellow nail S.

References

COMBINED LUNG AND BONE DISORDER

COMMON
1. Bronchogenic carcinoma with thoracic or extrathoracic bone metastasis
2. Connective tissue disease (collagen disease), (esp. scleroderma; dermatomyositis)
3. Immunologic disorder, (esp. AIDS; chronic granulomatous disease of childhood)
4. Infection (eg, osteomyelitis and pneumonia; septic emboli)
5. Langerhans cell histiocytosis, (eosinophilic granuloma)
6. Lymphoma; leukemia
7. Metastatic disease
8. Rheumatoid arthritis
9. Sarcoidosis
10. Sickle cell disease; other primary anemia
11. Trauma
12. Tuberculosis (incl. atypical mycobacterial infection)

UNCOMMON
1. Actinomycosis; nocardiosis
2. Amyloidosis; plasma cell dyscrasia
3. Ankylosing spondylitis
4. Asphyxiating thoracic dysplasia (Jeune S.) and other congenital bone dysplasias (eg, thanatophoric dysplasia; chondroectodermal dysplasia (Ellis-van Creveld S.))
5. Cystic fibrosis (mucoviscidosis)
6. Drug addiction (sepsis)
7. Ehlers-Danlos S.; Marfan S.; homocystinuria; cutis laxa
8. Farber’s disease (disseminated lipogranulomatosis)
9. Fat embolism (traumatic)
10. Fungus disease (esp. blastomycosis; coccidioidomycosis; histoplasmosis) (See F-74-S)
11. Gaucher disease; Niemann-Pick disease
12. Hyperparathyroidism
13. Melioidosis
14. Multiple myeloma
15. Neurofibromatosis
16. Parasitic disease (esp. hydatid disease—Echinococcus granulosus)
17. Radiation fibrosis and osteitis
18. Rubella S.
19. Steroid therapy
20. Tuberous sclerosis
21. Wegener granulomatosis g

(continued)
Gamut F-68

PULMONARY DISEASE WITH EOSINOPHILIA

COMMON
1. Asthma (incl. allergic granulomatosis)
2. Drug reaction (eg, penicillin; sulfonamides; isoniazid; nitrofurantoin; nonsteroid anti-inflammatory drug—NSAID; aminosalicylic acid) (See F-73-S)
3. Eosinophilic leukemia; Hodgkin’s disease
4. Eosinophilic pneumonia, idiopathic acute (Löffler S.) or chronic
5. Hypersensitivity bronchopulmonary aspergillosis (mucoïd impaction)
6. Parasitic disease (eg, ascariasis; paragonimiasis; strongyloidiasis; tropical pulmonary eosinophilia (filarial); schistosomiasis; ancylostomiasis; visceral larval migrans; dirofilariasis immitis) (See F-74-S)
7. PIE (pulmonary infiltrate with eosinophilia)

UNCOMMON
1. Bacterial infection (eg, brucellosis)
2. Carcinoma (esp. bronchogenic)
3. Connective tissue disease (collagen vascular disease) (esp. polyarteritis nodosa)
4. Desquamative interstitial pneumonitis (DIP)
5. Fungus disease (esp. coccidioidomycosis) (See F-74-S)
6. Hyereosinophilic S.
7. Hypersensitivity pneumonitis (extrinsic allergic alveolitis) (eg, farmer's lung; bagassosis) (See F-69)
8. Langerhans cell histiocytosis (eosinophilic granuloma)
9. Rheumatoid lung
10. Sarcoidosis
11. Tuberculosis
12. Wegener granulomatosis

References

Gamut F-69

HYPERSENSITIVITY PNEUMONITIS (EXTRANSCALLERGIC ALVEOLITIS {EAA}, ORGANIC DUST DISEASE)

COMMON
1. Bagassosis (sugarcane)
2. Byssinosis (cotton)
3. Farmer’s lung (moldy hay, wheat dust, tabacosis)
4. Humidifier lung; air-conditioner lung
5. Pigeon-breeder’s lung; bird-fancier’s lung; budgerigar lung; ostrich feather lung
UNCOMMON
1. Auto-worker’s lung (machine operator’s lung)
2. Basement shower EAA
3. Black fat tobacco smoker’s lung
4. Building-associated EAA
5. Castor bean lung
6. Cave explorer’s lung
7. Cheese brusher’s lung
8. Coffee-worker’s lung
9. Detergent-worker’s lung
10. Fish meal-worker’s lung
11. Fog-fever
12. Furrier’s lung
14. Hemp dust inhalation disease
15. Hot-tub lung
16. Isocyanate-associated EAA
17. Japanese summer-type EAA
18. Malt worker’s pneumonia
19. Maple bark stripper’s disease
20. Mushroom-worker’s lung; lycoperdonosis (puff-ball fungus spores from mushrooms)
21. Organophosphate insecticide inhalation
22. Paprika splitter’s lung
23. Pituitary snuff-taker’s lung
24. Prawn-worker’s lung
25. Sequoiosis
26. Starch sprayer’s lung
27. Suberosis (cork)
28. Thatched roof dust disease
29. Thesaurosis (hair spray)
30. Wheat weevil disease
31. Wood pulp-worker’s lung

References
References

Gamut F-71-S

ILO 1980 INTERNATIONAL CLASSIFICATION OF RADIOGRAPHS OF THE PNEUMOCONIOSES: SUMMARY OF DETAILS OF CLASSIFICATION (INTERNATIONAL LABOUR OFFICE, GENEVA)

<table>
<thead>
<tr>
<th>Features</th>
<th>Codes</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECHNICAL QUALITY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PARENCHYMAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABNORMALITIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small Opacities</td>
<td>Profusion</td>
<td></td>
</tr>
<tr>
<td>TECHNICAL QUALITY</td>
<td>1</td>
<td>Good.</td>
</tr>
<tr>
<td>TECHNICAL QUALITY</td>
<td>2</td>
<td>Acceptable, with no technical defect likely to impair classification of the radiograph for pneumoconiosis.</td>
</tr>
<tr>
<td>TECHNICAL QUALITY</td>
<td>3</td>
<td>Poor, with some technical defect but still acceptable for classification purposes.</td>
</tr>
<tr>
<td>TECHNICAL QUALITY</td>
<td>4</td>
<td>Unacceptable.</td>
</tr>
<tr>
<td>PARENCHYMAL</td>
<td>0/- 0/0 0/1</td>
<td>Category 0—small opacities absent or less profuse than the lower limit of category 1.</td>
</tr>
<tr>
<td>ABNORMALITIES</td>
<td>1/0 1/1 1/2</td>
<td>Category 1, 2, and 3—represent increasing profusion of small opacities as defined by the corresponding standard radiographs.</td>
</tr>
<tr>
<td>PARENCHYMAL</td>
<td>2/1 2/2 2/3 3/2 3/3 3/+</td>
<td></td>
</tr>
<tr>
<td>EXTENT</td>
<td>RU RM RL</td>
<td>The zones in which the opacities are seen are recorded. The right (R) and left (L) thorax are both divided into three zones—upper (U), middle (M), and lower (L).</td>
</tr>
<tr>
<td>PARENCHYMAL</td>
<td>LU LM LL</td>
<td>The category of profusion is determined by considering the profusion as a whole over the affected zones of the lung and by comparing this with the standard radiographs.</td>
</tr>
<tr>
<td>Features</td>
<td>Codes</td>
<td>Definitions</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Shape and Size</td>
<td>p/p q/q r/r</td>
<td>The letters p, q, and r denote the presence of small rounded opacities. Three sizes are defined by the appearances on standard radiographs.</td>
</tr>
<tr>
<td>rounded</td>
<td></td>
<td>p = diameter up to about 1.5 mm.</td>
</tr>
<tr>
<td></td>
<td>s/s t/t u/u</td>
<td>q = diameter exceeding about 1.5 mm and up to about 3 mm.</td>
</tr>
<tr>
<td>irregular</td>
<td></td>
<td>r = diameter exceeding about 3 mm and up to about 10 mm.</td>
</tr>
<tr>
<td>mixed</td>
<td>p/s p/t p/u p/q p/r q/s q/t q/u q/p q/r t/s r/t u/p r/q s/p s/q s/r s/t s/u t/p t/q t/r t/s t/u u/p u/q u/r u/s u/t</td>
<td>For mixed shapes (or sizes) of small opacities the predominant shape and size is recorded first. The presence of a significant number of another shape and size is recorded after the oblique stroke.</td>
</tr>
<tr>
<td>Large Opacities</td>
<td>A B C</td>
<td>The categories are defined in terms of the dimensions of the opacities.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Category A—an opacity having a greatest diameter exceeding about 10 mm and up to and including 50 mm, or several opacities each greater than</td>
</tr>
<tr>
<td></td>
<td></td>
<td>about 10 mm, the sum of whose greatest diameters does not exceed about 50 mm.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Category B—one or more opacities larger or more numerous than those in category A whose combined area does not exceed the equivalent of the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>right upper zone.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Category C—one or more opacities whose combined area exceeds the equivalent of the right upper zone.</td>
</tr>
<tr>
<td>Pleural Abnormalities</td>
<td></td>
<td>Two types of pleural thickening of the chest wall are recognized:</td>
</tr>
<tr>
<td>Pleural Thickening</td>
<td></td>
<td>circumscribed (plaques) and diffuse. Both types may occur together.</td>
</tr>
<tr>
<td>Chest Wall</td>
<td></td>
<td>Pleural thickening of the chest wall is recorded separately for the right and left thorax.</td>
</tr>
<tr>
<td>Site</td>
<td>R L</td>
<td>For pleural thickening seen along the lateral chest wall the measurement of maximum width is made from the inner line of the chest wall to</td>
</tr>
<tr>
<td>Width</td>
<td>a b c</td>
<td>the inner margin of the shadow seen most sharply at the parenchymal-pleural boundary. The maximum width usually occurs at the inner margin of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the rib shadow at its outermost point.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a = maximum width up to about 5 mm.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b = maximum width over about 5 mm and up to about 10 mm.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c = maximum width over about 10 mm.</td>
</tr>
</tbody>
</table>
### Features and Definitions

<table>
<thead>
<tr>
<th>Features</th>
<th>Codes</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face on</td>
<td>Y N</td>
<td>The presence of pleural thickening seen face on is recorded even if it can be seen also in profile. If pleural thickening is seen face on only, width cannot usually be measured.</td>
</tr>
</tbody>
</table>
| Extent                | 1 2 3 | Extent of pleural thickening is defined in terms of the *maximum length* of pleural involvement, or as the sum of maximum lengths, whether seen in profile or face on.  
1 = total length equivalent up to one-quarter of the projection of the lateral chest wall.  
2 = total length exceeding one-quarter but not one-half of the projection of the lateral chest wall.  
3 = total length exceeding one-half of the projection of the lateral chest wall. |
<p>| Diaphragm Presence    | Y N   | A plaque involving the diaphragmatic pleura is recorded as present (Y) or absent (N), separately for the right and left thorax.                  |
| Site                  | R L   |                                                                                                                                            |
| Costophrenic Angle    | Y N   | The presence (Y) or absence (N) of costophrenic angle obliteration is recorded separately from thickening over other areas, for the right (R) and left (L) thorax. The lower limit for this obliteration is defined by a standard radiograph. |
| Site                  | R L   |                                                                                                                                            |
| Pleural Calcification  |       | The site and extent of pleural calcification are recorded separately for the two lungs, and the extent defined in terms of <em>dimensions</em>. |
| Site chest wall       | R L   |                                                                                                                                            |
| Site diaphragm        | R L   |                                                                                                                                            |
| Site other            | R L   |                                                                                                                                            |
| Extent                | 1 2 3 | “Other” includes calcification of the mediastinal and pericardial pleura.                                                                  |
| 1                     |       | 1 = an area of calcified pleura with greatest diameter up to about 20 mm, or a number of such areas the sum of whose greatest diameters does not exceed about 20 mm. |
| 2                     |       | 2 = an area of calcified pleura with greatest diameter exceeding about 20 mm and up to about 100 mm, or a number of such areas the sum of whose greatest diameters exceeds about 20 mm but does not exceed about 100 mm. |
| 3                     |       | 3 = an area of calcified pleura with greatest diameter exceeding about 100 mm, or a number of such areas whose sum of greatest diameter exceeds about 100 mm. |
| SYMBOLES              |       | It is to be taken that the definition of each of the symbols is preceded by an appropriate word or phrase such as “suspect,” “changes suggestive of,” or “opacities suggestive of,” etc. |
| ax                    |       | -coalescence of small pneumoconiotic opacities                                                                                             |
| bu                    |       | -bulla(e)                                                                                                                                  |
| ca                    |       | -cancer of lung or pleura                                                                                                                 |
| cn                    |       | -calcification in small pneumoconiotic opacities                                                                                           |
| co                    |       | -abnormality of cardiac size or shape                                                                                                     |</p>
<table>
<thead>
<tr>
<th>Features</th>
<th>Codes</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>cp</td>
<td>–cor pulmonale</td>
<td></td>
</tr>
<tr>
<td>cv</td>
<td>–cavity</td>
<td></td>
</tr>
<tr>
<td>di</td>
<td>–marked distortion of the intrathoracic organs</td>
<td></td>
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<tr>
<td>ef</td>
<td>–effusion</td>
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<tr>
<td>em</td>
<td>–definite emphysema</td>
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<tr>
<td>es</td>
<td>–eggshell calcification of hilar or mediastinal lymph nodes</td>
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<tr>
<td>fr</td>
<td>–fractured rib(s)</td>
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<tr>
<td>hi</td>
<td>–enlargement of hilar or mediastinal lymph nodes</td>
<td></td>
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<tr>
<td>ho</td>
<td>–honeycomb lung</td>
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<tr>
<td>id</td>
<td>–ill-defined diaphragm</td>
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</tr>
<tr>
<td>ih</td>
<td>–ill-defined heart outline</td>
<td></td>
</tr>
<tr>
<td>kl</td>
<td>–septal (Kerley) lines</td>
<td></td>
</tr>
<tr>
<td>od</td>
<td>–other significant abnormality</td>
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</tr>
<tr>
<td>pi</td>
<td>-pleural thickening in the interlobar fissure or mediastinum</td>
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</tr>
<tr>
<td>px</td>
<td>-pneumothorax</td>
<td></td>
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<tr>
<td>rp</td>
<td>-rheumatoid pneumoconiosis</td>
<td></td>
</tr>
<tr>
<td>tb</td>
<td>-tuberculosis</td>
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</table>

**COMMENT**

<table>
<thead>
<tr>
<th>Presence</th>
<th>Y N</th>
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</table>

Comments should be recorded pertaining to the classification of the radiograph, particularly if some other cause is thought to be responsible for a shadow that could be thought by others to have been due to pneumoconiosis, also to identify radiographs for which the technical quality may have affected the reading material.
### Gamut F-71

#### Table:

<table>
<thead>
<tr>
<th>p</th>
<th>-1.5</th>
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<tbody>
<tr>
<td>q</td>
<td>1.5 - 3</td>
<td>t</td>
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<td>r</td>
<td>3 - 10</td>
<td>u</td>
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</tbody>
</table>

#### Diagram:

- **A**: \( \bigcirc + \bigcirc + \bigcirc \) = 1 - 5 cm
- **B**: \( \square + \square + \square \) cm\(^2\) = RU
- **C**: \( \square + \square + \square \) cm\(^2\) > RU

---

**RU**
Gamut F-71

F. Chest
Gamut F-72-S

NOXIOUS VAPORS THAT CAUSE PULMONARY DAMAGE

HALOGENS
1. Bromine
2. Chlorine

HALOGENATED HYDROCARBONS
1. Carbon tetrachloride
2. Chloropicrin
3. Methyl bromide
4. Methyl chloride
5. Trichloroethylene

OXIDES OF NITROGEN
1. Nitric oxide (electric arc welding)
2. Nitrogen dioxide (silo-filler’s disease)

IRRITANT GASES
1. Ammonia
2. Hydrogen fluoride
3. Hydrogen sulfide
4. Lewisite
5. Mustard gas
6. Nickel carbonyl
7. Phosgene
8. Sulfur dioxide

OTHERS
1. Acetone
2. Acrolein
3. Hair spray (thesaurosis)
4. Insecticides
5. Isoamyl acetate
6. Oxygen (high concentration)
7. Ozone
8. Smoke

Gamut F-73-S

DRUGS OR CHEMICALS THAT CAN INDUCE LUNG DISEASE

ANTIBIOTICS
1. Ampicillin
2. Cephalosporin
3. Ethambutol
4. Griseofulvin
5. Isoniazid (INH)
6. Nitrofurantoin
7. Para-aminosalicylic acid (PAS)
8. Penicillin
9. Pyrimethamine
10. Sulfonamides
11. Tetracycline and minocycline

CHEMOTHERAPEUTIC AGENTS
1. 5-Fluorouracil
2. 6-Mercaptopurin
3. Azathioprine
4. Bleomycin
5. Busulfan
6. Chlorambucil
7. Cyclophosphamide (Cytoxan)
8. Cyclosporin A
9. Cytosine arabinoside
10. Etoposide
11. Fludarabine
12. Hormonal agents (tamoxifen; nilutamide)
13. Hydroxyurea

References

(continued)
14. Ifosphamide
15. Interleukin
16. L-Asparaginase
17. Melphalan
18. Methotrexate
19. Mitomycin
20. Nitrosoureas
21. Peplomycin
22. Procarbazine
23. Vinca alkaloids

**ANALGESICS**
1. Acetylsalicylic acid
2. Codeine
3. Colchicine
4. Mesalamine

**NARCOTICS AND SEDATIVES**
1. Bromocarbamide
2. Buprenorphine
3. Chlordiazepoxide (Librium)
4. Codeine
5. Ethchlorvynol (Placidyl)
6. Febarbamate
7. Heroin
8. Methadone
9. Naloxone
10. Paraldehyde
11. Propoxyphene (Darvon)

**ANTICONVULSANTS**
1. Carbamazepine
2. Hydantoin (Dilantin)
3. Trimethadione

**ANTICOAGULANTS**
1. Coumadin
2. Quinidine
3. Warfarin

**ANTIHYPERTENSIVES**
1. Hexamethonium
2. Hydrochlorothiazide; hydralazine

**MISCELLANEOUS AGENTS**
1. 5-Aminosalycilic acid
2. Amiodarone
3. Amitriptyline
4. Beclomethasone dipropionate aerosol
5. Beta-adrenergic blocking agents (beta-blockers)
6. Beta₂ sympathomimetics with corticosteroids
7. Chlorpromazine
8. Chlorpropamide
9. Clomipramine
10. Cocaine
11. Desferioxamine
12. Dipropionate aerosol
13. Ergotamine and derivatives (bromocriptine; mesulergine)
14. Fluoxetine hydrochloride (Prozac)
15. Gold
16. Imipramine
17. Lidocaine
18. Marijuana
19. Mesalamine
20. Methacrylate
21. Methysergide (Sansert)
22. Mineral oil
23. Neocarzinostatin
24. Penicillamine
25. Phentolamines
26. Procainamide (Pronestyl)
27. Propylthiouracil
28. Sulfasalazine
29. Sympathetic drugs (terbutaline; ritodrine; isoxsuprine)
30. Tocainide
31. Trimipramine
32. Verapamil

**References**
### PULMONARY PATHOGENIC MICROORGANISMS

#### BACTERIAL, VIRAL, RICKETTSIAL

1. *Actinobacillus actinomycetemcomitans*
2. *Actinomyces species* *
3. Adenoviruses*
4. Aerobacter species*
5. Aeromonas species*
6. *Bacillus anthracis*
7. Bacteroides species*
8. *Bartonella henselae*
9. *Bordetella pertussis*
10. Brucella species*
11. *Burkholderia (Pseudomonas) cepacia, mallei, pseudomallei*
12. *Chlamydia pneumoniae, trachomatis, and psittaci*
13. *Chromobacterium violaceum*
14. Clostridium species*
15. *Corynebacterium pseudodiphtheriticum*
16. *Coxiella burnetii*
17. Coxsackie virus
18. Cytomegalovirus
19. ECHO viruses
20. *Eikenella corrodens*
21. *Enterobacter-serratia species*
22. Epstein-Barr virus
23. *Escherichia coli*
24. Eubacterium species
25. *Francisella tularensis*
26. *Haemophilus influenzae, parainfluenza*
27. Hanta virus
28. Herpes simplex
29. Herpes zoster
30. Influenza viruses
31. *Klebsiella pneumoniae, oxytoca*
32. Legionella species
33. Leptospora organisms
34. *Listeria monocytogenes*
35. Morganella species
36. *Mycobacterium tuberculosis* (also atypical mycobacteria)
37. *Mycoplasma pneumoniae*
38. *Neisseria meningitides*
39. Parainfluenza virus
40. Nocardia species*
41. *Pasteurella multocida*
42. *Peptococcus*
43. *Peptostreptococcus*
44. Proteus species
45. *Pseudomonas aeruginosa; Ps. cepacia*
46. Respiratory syncytial virus
47. *Rhodococcus (corynebacterium) equi*
48. *Rickettsia tsutsugamushi*
49. Rubeola virus
50. Salmonella species
51. *Staphylococcus aureus and epidermidis*
52. *Streptococcus (Diplococcus) pneumoniae and pyogenes*
53. *Treponema pallidum*
54. *Tropheryma whippelii*
55. Viellonella species
56. *Yersinia pestis (Pasteurella pestis)*

#### PARASITIC

1. *Ancylostoma duodenale*
2. Armillifer species
3. *Ascaris lumbricoides*
4. Babesia species
5. Cysticercus cellulosae
6. Dirofilaria species (esp. Dirofilaria immitis)
7. Echinococcus granulosus; E. multilocularis
8. Entamoeba histolytica
9. Filaria species
10. Hartmanella-Acanthamoeba species
11. Microsporidia species
12. Necator americanus
13. Paragonimus species (esp. P. westermani)
14. Pneumocystis carinii
15. Schistosoma mansoni, haematobium, japonicum
16. Strongyloides stercoralis
17. Toxocara species (esp. T. cani, T. cati)
18. Toxoplasma gondii

MYCOTIC (FUNGAL)
1. Aspergillus species
2. Blastomyces dermatitidis
3. Candida species (moniliasis)
4. Chrysosporium parvum (Emmonsia crescens)
5. Coccidioides immitis
6. Cryptococcus neoformans
7. Geotrichum species
8. Histoplasma capsulatum
9. Paracoccidioides brasiliensis
10. Penicillium marneffei
11. Phycomycetes (zygomycosis)
12. Pseudoallescheria boydii
13. Sporothrix schenckii
14. Torulopsis glabrata

* Actinomyces and Nocardia species, formerly listed as fungal organisms, have been reclassified as bacteria.

Reference

Gamut F-75-S
COMMON PULMONARY OPPORTUNISTIC ORGANISMS

1. Chickenpox (varicella) virus
2. Cytomegalovirus
3. Fungus (esp. Aspergillus; Mucormycetes; Candida; Cryptococcus)
4. Herpes
5. Mycobacterium tuberculosis (incl. atypical mycobacterial infection)
6. Nocardia species
7. Parasites (esp. Strongyloides stercoralis; Toxoplasma; Cryptosporidium) (See F-74-S)
8. Pneumocystis carinii
9. Pseudomonas species; other pyogens (esp. Staphylococcus aureus; Streptococcus; Legionella)

Reference

Gamut F-76-S
CONDITIONS THAT PREDISPOSE TO OPPORTUNISTIC PULMONARY INFECTION

COMMON
1. Antibiotic therapy
2. Debilitating disease (eg, lymphoma, leukemia; carcinoma; myeloma; other malignant neoplasm; parasitic disease; renal failure; tuberculosis; cystic fibrosis)
3. Diabetes
4. Drug therapy (eg, steroids; chemotherapeutic agents)
5. Immune deficiency disorder (incl. AIDS; granulomatous disease of childhood)
6. Malnutrition; alcoholism; senility
7. Organ transplantation
8. Prematurity
9. Radiation therapy

UNCOMMON
1. Connective tissue disease (collagen vascular disease)
2. Foreign material (eg, catheter; prosthesis)
3. Myeloid metaplasia; severe anemia

References

PULMONARY DISEASE IN AIDS OR OTHER IMMUNOCOMPROMISED PATIENTS

COMMON
1. ARDS
2. Drug-induced lung disease (See F-73-S)
3. Infantile respiratory distress syndrome; oxygen toxicity
4. Neoplasm, malignant (eg, bronchogenic carcinoma; metastasis; recurrent; Kaposi sarcoma; lymphoma)
5. Opportunistic infection (esp. Pneumocystis carinii pneumonia; strongyloidiasis; toxoplasmosis; cytomegalovirus infection; fungus disease; Rhodococcus equi; bacillary angiomatosis)
   (See F-75-S)
6. Pulmonary thromboembolism and infarction
7. Tuberculosis and atypical mycobacterial infections
8. Unrelated disease

UNCOMMON
1. Alveolar proteinosis
2. Aspiration pneumonia
3. Graft-versus-host disease
4. Lymphangiolegraphy reaction
5. Lymphocytic interstitial pneumonitis (LIP)
6. Nonspecific interstitial pneumonitis (NSIP)
7. Primary pulmonary hypertension
8. Pulmonary edema due to heart failure or noncardiogenic (eg, leukoagglutination)
9. Pulmonary hemorrhage
10. Radiation injury

References

BRONCHIAL LESION

COMMON
1. Absent bronchus (congenital; surgical)
2. Bronchiectasis (See F-80)
3. Bronchogenic carcinoma
4. Broncholith
5. Carcinoid
6. Extrinsic pressure (eg, lymphadenopathy; mediastinal mass; pulmonary sling; other vascular anomaly; enlarged left atrium)
7. Foreign body
8. Metastasis, endobronchial (esp. renal cell or breast carcinoma; melanoma)

(continued)
9. Mucoid impaction; mucus plug (eg, aspergillosis; obstructing neoplasm) (See F-79)
10. Stricture, inflammatory (incl. tuberculosis; fungus disease)

**UNCOMMON**

1. Adenoid cystic carcinoma (cylindroma)
2. Amyloidosis
3. Bronchopleural fistula
4. Cyst (retention or other)
5. Fracture or laceration of bronchus
6. Hematoma
7. Iatrogenic (eg, misdirected endotracheal tube)
8. Inflammatory pseudotumor
9. Neoplasm, other (eg, hamartoma; lipoma; spindle cell tumor; angioma; granular cell myoblastoma; osteoma; chondrosarcoma; lymphoma)
10. Parasite (Ascaris; Paragonimus)
11. Pneumoconiosis (conglomerate mass) (See F-70-S)
12. Polyp; papilloma
13. Sarcoidosis
14. Scleroma (rhinoscleroma)
15. Tracheopathia osteoplastica
16. Wegener granulomatosis

**References**


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Gamut F-79

**MUCOID IMPACTION IN A BRONCHUS**

**COMMON**

1. *Aspergillus* sensitivity
2. Asthma; other allergic states
3. Bronchogenic carcinoma
4. Carcinoid; metastasis; other endobronchial neoplasm
5. Idiopathic (esp. elderly female)
6. Stricture or granuloma (incl. tuberculosis; fungus disease)

**UNCOMMON**

1. Bronchial atresia
2. Bronchial cyst
3. Broncholith
4. Cystic fibrosis (mucoviscidosis)

**References**

1. Felson B: Mucoid impaction in segmental bronchial obstruction. Radiology 1979;133:9–16

---

Gamut F-80

**CAUSES OF BRONCHIECTASIS**

**COMMON**

1. Chronic aspiration
2. Chronic bronchitis
3. Cystic fibrosis (mucoviscidosis)
4. Foreign body
5. Idiopathic
6. Obstructing bronchial lesion (eg, carcinoma; carcinoid; stricture; broncholithiasis) (See F-78)
7. Postinfection (eg, pneumonia; whooping cough; measles; Swyer-James S.; allergic bronchopulmonary aspergillosis; paragonimiasis)
8. Pulmonary fibrosis (traction bronchiectasis) (eg, idiopathic {IPF}; radiation therapy; sarcoidosis)
9. Tuberculosis
UNCOMMON
1. Bronchial compression (eg, lymphadenopathy) or poststenotic constriction
2. Bronchiolitis obliterans
3. Connective tissue disease (esp. rheumatoid disease)
4. Dyskinetic cilia S.; Kartagener S.
5. Fungus disease (See F-74-S)
6. Immunologic disorder (eg, agammaglobulinemia; chronic granulomatous disease of childhood; AIDS; alpha1-antitrypsin deficiency; Chédiak-Higashi S.; Wiskott-Aldrich S.)
7. Inhalation of noxious fumes, smoke, chemicals
8. Mucoid impaction, mucus plugs (eg, obstructing neoplasm; aspergillosis; asthma; postoperative) (See F-79)
9. Riley-Day S. (familial dysautonomia)
10. Tracheobronchomegaly (Mounier-Kuhn S.)
11. Williams-Campbell S. (bronchial cartilage deficiency)
12. Yellow nail S.
13. Young S.

References

Gamut F-80-S
TYPES OF BRONCHIECTASIS
1. Bronchiolectasis
2. Central
3. Cylindrical, fusiform, tubular
4. Cystic, saccular
5. Reversible (pseudobronchiectasis)
6. Traction
7. Varicose, ampullary

Gamut F-81
1. Bronchial compression (eg, lymphadenopathy) or poststenotic constriction
2. Bronchiolitis obliterans
3. Connective tissue disease (esp. rheumatoid disease)
4. Dyskinetic cilia S.; Kartagener S.
5. Fungus disease (See F-74-S)
6. Immunologic disorder (eg, agammaglobulinemia; chronic granulomatous disease of childhood; AIDS; alpha1-antitrypsin deficiency; Chédiak-Higashi S.; Wiskott-Aldrich S.)
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11. Williams-Campbell S. (bronchial cartilage deficiency)
12. Yellow nail S.
13. Young S.

Gamut F-81-1
INTRATRACHEAL MASS OR NODULE, SOLITARY OR MULTIPLE

COMMON
1. [Endotracheal tube; tracheostomy; foreign body]
2. [Extrinsic mass (eg, esophageal lesion; pulmonary or mediastinal mass; anomalous vessel)]
3. Neoplasm, malignant, primary (incl. squamous cell carcinoma; adenoid cystic carcinoma (cylindroma); mucoepidermoid carcinoma; pleomorphic adenoma; carcinoid; sarcoma)
4. Neoplasm, malignant, secondary (esp. invasive from thyroid, larynx, esophagus, or lung malignancy; metastatic from carcinoma of kidney, colon or breast, or melanoma)
5. [Stricture or stenosis (eg, congenital; inflammatory; burn; posttraumatic; postoperative; intubation)]

UNCOMMON
*1. Amyloidosis
2. Cyst; mucocele
3. Ectopic endotracheal thymus
*4. Granuloma (idiopathic; tuberculosis; fungus disease)
*5. Inspissated mucus (eg, asthma)
6. Lymphoma (esp. chloroma)
7. Neoplasm, benign (eg, spindle cell tumor; {esp. fibroma; leiomyoma}; chondroma; hamartoma; hemangioma; granular cell myoblastoma; histiocytoma; lipoma; angioma; schwannoma; xanthoma)
*8. Papilloma (esp. laryngotracheal papillomatosis)
9. Plasmacytoma; extramedullary myeloma
10. Polyp; pseudopolyp
*11. Relapsing polychondritis
12. Sarcoïdosis
13. Scleroma (rhinoscleroma)
14. Storage diseases
15. Thyroid tissue, ectopic, normal or neoplastic (intratracheal)

(continued)
16. Tracheomalacia
*17. Tracheopathia osteoplastica
18. Trauma (e.g., laceration; fracture; hematoma)
19. [Web]
20. Wegener granulomatosis

* May be multiple.
[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References
1. Felson B: Neoplasms of the trachea and main stem bronchi. Semin Roentgenol 1983;18:23–37

Gamut F-81-2
PEDUNCULATED INTRATRACHEAL MASS

1. Benign tumor (e.g., hamartoma; chondroma; lipoma)
2. Hemangioma
3. Insipissated mucus
4. Metastasis to tracheal mucosa (e.g., from renal cell carcinoma; melanoma)
5. Polyp (e.g., inflammatory; antrochoanal); papilloma
6. Postintubation tracheal granuloma in neonate

References

Gamut F-82
TRACHEAL ENLARGEMENT*

COMMON
1. Cystic fibrosis (mucoviscidosis)
2. Pulmonary fibrosis (esp. post-radiation therapy)

UNCOMMON
1. Immunoglobulin deficiency
2. Ehlers-Danlos S.
3. Relapsing polychondritis
4. Tracheobronchomegaly (Mounier-Kuhn S.)
5. Tracheocele

*Trachea > 26mm in men and > 23mm in women.

Reference

Gamut F-83
DIFFUSE TRACHEAL NARROWING (See B-122)

COMMON
1. Croup
2. Extrinsic mass in superior or middle mediastinum (e.g., intrathoracic goiter; carcinoma of esophagus; hematoma; bronchogenic cyst; lymphadenopathy; lymphoma; metastasis) (See F-86, 89)
3. [Normal in infants (expiratory collapse—“floppy trachea”)]
4. Saber-sheath trachea (advanced emphysema)
5. Stricture, stenosis (e.g., congenital; inflammatory; burn; chemical; traumatic; radiation; postoperative; post-tracheostomy; postintubation)
**UNCOMMON**

1. Amyloidosis
2. Bronchogenic carcinoma (squamous cell; small cell)
3. Cartilage deficiency (eg, tracheomalacia; traumatic; congenital)
4. Congenital (primary) tracheal stenosis
5. Inflammation, other (tuberculosis; sarcoidosis; epidermolysis bullosa)
6. Juvenile xanthogranuloma
7. Mediastinitis, chronic fibrosing
8. Neoplasm, benign (eg, hemangioma)
9. Neoplasm, malignant (eg, squamous cell carcinoma; adenoid cystic carcinoma; lymphoma)
10. Papillomatosis
11. Relapsing polychondritis
12. Scleroma (rhinoscleroma—Klebsiella rhinoscleromatis infection)
13. Tracheomalacia (eg, congenital; postoperative; postintubation; post-tracheostomy)
14. Tracheopathia osteoplastica
15. Vascular ring (eg, right aortic arch with aberrant left subclavian artery; double aortic arch)
16. Wegener granulomatosis

[] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

**References**


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**COMMON**

1. Aortic aneurysm
2. Duplication cyst (eg, bronchogenic; tracheal; enteric; neurenteric)
3. Lymphadenopathy
4. Middle mediastinal mass, other (eg, hematoma; abscess; neurinoma) (See F-89)
5. Neoplasm of esophagus, malignant (esp. carcinoma)
6. [Normal in infants (buckling in expiration)]
7. Thyroid mass (eg, adenoma; goiter; carcinoma; thyroiditis; cyst)
8. [Tracheal lesion] (See F-81-1)
9. Vascular ring (eg, right aortic arch; double aortic arch; aberrant right subclavian artery)

**UNCOMMON**

1. Achalasia or other esophageal dilatation
2. Lymphangioma (cystic hygroma)
3. Neoplasm of esophagus, benign (eg, gastrointestinal stromal tumor, esp. leiomyoma)
4. Posterior mediastinal mass (esp. neurogenic tumor) (See F-90)
5. Zenker’s diverticulum

[] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

**References**

Gamut F-85

WIDENING OF THE RIGHT TRACHEAL STRIPE (5 MM OR OVER)

COMMON
1. Carcinoma of the lung or esophagus
2. Diffuse tracheal narrowing (eg, tracheostomy; postintubation; edema; posttraumatic stenosis; relapsing polychondritis) (See F-83)
3. Hemorrhage (eg, trauma; bleeding disorder)
4. Lymph node enlargement (eg, sarcoidosis; metastasis; lymphoma; tuberculosis; histoplasmosis)
5. Normal variant
6. Pleural effusion (free or encapsulated); pleural fibrosis
7. Postoperative (eg, mediastinal or cardiac surgery; mediastinoscopy; right radical neck dissection)
8. Radiation edema or fibrosis
9. Thyroid mass (eg, intrathoracic goiter or carcinoma)
10. Tracheal mass (eg, squamous cell carcinoma; adenoid cystic carcinoma (cylindroma); fibroma; hemangioma) (See F-81-1)

UNCOMMON
1. Atelectasis of right upper lobe
2. Mediastinitis; mediastinal abscess
3. Mesothelioma
4. Schwannoma of right vagus or phrenic nerve
5. Tracheobronchitis, viral or other
6. Wegener granulomatosis

References

Gamut F-86

SUPERIOR MEDIASTINAL OR THORACIC INLET MASS

COMMON
1. Aortic dilatation or aneurysm of arch; cervical aorta or high arch
2. [Artifact (eg, hair braid)]
3. [Atelectasis of upper lobe]
4. Brachiocephalic vessel ectasia or elongation
5. Esophageal dilatation
6. Hemorrhage, traumatic or spontaneous (eg, bleeding disorder)
7. Lymphadenopathy, inflammatory or metastatic (eg, carcinoma of lung, breast, or head and neck) (See F-103)
8. Lymphoma (esp. nodular sclerosing Hodgkins); leukemia
9. Right aortic arch, other arch anomaly or vascular ring (See E-21-S)
10. Superior vena cava obstruction (See E-70)
11. Thymic lesion (eg, normal (“rebound hyperplasia”) or enlarged—benign or invasive thymoma; thymic cyst; thymic carcinoma) (See F-95)
12. Thyroid mass (eg, intrathoracic goiter, adenoma, carcinoma)
13. Zenker’s diverticulum

UNCOMMON
1. Anomalous left superior vena cava
2. APVR, total
3. Arteriovenous fistula of head, neck, or thorax, with dilated great vessels
4. Cyst, mediastinal (eg, thymic; duplication [bronchogenic; enteric; neurenteric]; hydatid)
5. Lymphangioma (cystic hygroma)
6. Fat deposition (eg, obesity; steroid therapy; Cushing S.) (See F-91-1)
7. Germ cell tumor (esp. teratoma)
8. Mediastinitis
9. Parathyroid adenoma or carcinoma

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that stimulate it.

References

Gamut F-87
SUPERIOR MEDIASTINAL WIDENING
IN INFANTS AND CHILDREN

COMMON
1. [Artifact (eg, hair braids)]
2. [Atelectasis of upper lobe]
3. Cyst, mediastinal (eg, thymic; teratoma; hydatid; duplication—bronchogenic; enteric; neurenteric)
4. Esophageal dilatation
5. Fat deposition; lipomatosis (eg, obesity; steroid therapy; Cushing S.) (See F-91-1)
6. Hemorrhage, traumatic or spontaneous (eg, bleeding disorder)
7. Lymphadenopathy (See F-103)
8. Lymphoma; leukemia
9. Mediastinitis, acute; mediastinal abscess (See F-102)
10. Mediastinal tumor (eg, teratoma; mixed germ cell tumor; thymoma; neuroblastoma)
11. Right aortic arch; other arch anomaly or vascular ring (See E-21-S); aortic dilatation
12. Thymus, normal (“hyperplasia”) or enlarged; thymic rebound, posttreatment (See F-95)

UNCOMMON
1. Anomalous left superior vena cava
2. Aortic elongation (eg, pseudocoarctation)—cervical aorta or high arch
3. APVR, total, above the diaphragm (“snowman” or “figure 8”)
4. Arteriovenous fistula of head, neck, or thorax—with dilated great vessels
5. Azygos vein dilatation (See E-69)
6. Lymphangioma (cystic hygroma)
7. Superior vena cava enlargement (eg, obstruction; normal variant) (See E-70)
8. Thyroid mass (eg, thyroiditis; intrathoracic goiter; thyroid carcinoma) (See B-103-1)
9. Zenker’s diverticulum

[ ] This condition does not actually cause the gamutted imaging finding but can produce imaging changes that stimulate it.

References

Gamut F-88
ANTERIOR MEDIASTINAL LESION

Anterior to a curved vertical line along posterior border of heart and anterior margin of trachea; on CT or MRI, alongside and anterior to heart and great vessels

COMMON
*1. Aneurysm of ascending aorta or sinus of Valsalva
2. [Bone lesion, esp. sternum (eg, metastasis; myeloma; sarcoma; osteomyelitis)]

(continued)
3. [Cardiac enlargement]
4. [Diaphragmatic lump, mogul, or eventration]
5. Fat deposition (eg, normal epicardial fat pad; Cushing S.; obesity; steroid therapy; hibernoma; lipomatosis)
6. Germ cell tumor (eg, teratoma; seminoma; choriocarcinoma; embryonal cell carcinoma; endodermal sinus {yolk sac} tumor; mixed germ cell tumors)
7. Hematoma, hemorrhage (eg, traumatic; bleeding disorder)
8. Hernia (eg, Morgagni; hepatic; intrapericardial)
9. Innominate or brachiocephalic artery dilatation, buckling or aneurysm
10. Lymphoma (esp. nodular sclerosing Hodgkin’s); leukemia
11. Pericardial cyst
12. Pericardial disease (eg, effusion; neoplasm; defect)
13. Superior vena cava dilatation (See E-)
14. Thymic lesion (eg, benign thymoma; invasive thymoma; thymic carcinoma; thymic carcinoid; thymic cyst; lymphoid hyperplasia; thymolipoma; lymphoma or leukemia arising in thymus)
15. Thymus, normal (“hyperplasia”)
16. Thyroid mass (intrathoracic adenomatous goiter; carcinoma)

**UNCOMMON**
1. Anomalous left superior vena cava
2. Bronchogenic cyst
3. Cardiac lesion (eg, tumor; aneurysm)
4. Fluid collection (eg, postoperative; perforated central venous catheter)
5. Lymphadenopathy (eg, sarcoidosis; tuberculosis; histoplasmosis; giant lymph node hyperplasia {Castleman disease})
6. Lymphangioma (cystic hygroma)
7. Hydatid cyst
8. Lymphangiomatosis
9. Mediastinitis, acute; mediastinal abscess (See F-102)
10. Mediastinitis, fibrosing (esp. histoplasmosis; idiopathic)
11. Metastasis
12. Neoplasm, other (eg, gastrointestinal stromal tumor, fibroma, schwannoma, lipoma, and their sarcomatous counterparts; hemangioma; epithelioid hemangioendothelioma; hemangiopericytoma; angiosarcoma; benign and malignant fibrous histiocytoma; mesothelioma)
13. Parathyroid adenoma or carcinoma

* May show calcification.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**

**Gamut F-89**

**MIDDLE MEDIASTINAL LESION**

Between anterior and posterior mediastinum on plain film, CT, or MRI (See F-88, F-90–93)

**COMMON**
1. Aneurysm of aorta or major artery (incl. traumatic; infectious); aortic dissection; pseudocoarctation of aorta
2. Azygos vein or SVC dilatation (See E-69, E-70)
3. Bronchogenic carcinoma (squamous cell; small cell; large cell; adenocarcinoma)
4. Duplication cyst, fibrosing (eg, bronchogenic; tracheal; enteric)
5. Esophageal lesion (eg, Zenker or other diverticulum; carcinoma; gastrointestinal stromal tumor, esp. leiomyoma)
6. Hiatal hernia
7. Innominate or brachiocephalic artery tortuosity or buckling
8. Lymphadenopathy (eg, metastasis—esp. bronchogenic carcinoma; lymphoma; leukemia; tuberculosis; histoplasmosis; sarcoidosis; pneumoconiosis—esp. silicosis; giant lymph node hyperplasia {Castleman disease}) (See F-103)
9. Mediastinitis, fibrosing (esp. histoplasmosis; idiopathic)
10. Megaesophagus (eg, achalasia; scleroderma; Chagas’ disease; stricture; neoplasm)
11. Pulmonary artery dilatation (See E-53)
12. Right-sided or double aortic arch; vascular ring (See E-21-S)
13. Thyroid mass (intrathoracic goiter; thyroid carcinoma)
14. Varices, mediastinal or esophageal

UNCOMMON
1. Extramedullary hematopoiesis
2. Fluid collection (eg, postoperative; perforated central venous catheter; ascites extending through esophageal hiatus)
3. Lymphangioma (cystic hygroma)
4. Mediastinal hematoma or hemorrhage
5. Mediastinitis, acute; mediastinal abscess (See F-102)
6. Neoplasm, mediastinal (eg, gastrointestinal stromal tumor, lipoma, and their sarcomatous counterparts; hemangioma; mesothelioma)
7. Schwannoma of vagus or phrenic nerve
8. Pancreatic pseudocyst
9. Paraganglioma, aorticopulmonary (chemodectoma)
10. Parathyroid adenoma or carcinoma
11. Thymic neoplasm
12. Tracheal tumor (eg, squamous cell carcinoma; adenoid cystic carcinoma {cylindroma}; chondrosarcoma; plasmacytoma; metastasis) (See F-81-1)
13. Tracheobronchomegaly (Mounier-Kuhn S.)
14. Vascular lesion, other (eg, azygos continuation of IVC; left superior vena cava; aberrant right subclavian artery; left superior intercostal vein dilatation; angiosarcoma of pulmonary artery; partial APVR; aberrant left pulmonary artery)

* May show calcification.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
6. Reed JC, Sobonya RE: Morphologic analysis of foregut cysts in the thorax. AJR 1974;120:851–860

POSTERIOR MEDIASTINAL LESION

In paravertebral region on plain film, CT, or MRI (See F-89, 91, 92)

COMMON
*1. Aneurysm of descending aorta (incl. traumatic; infectious); aortic dissection
*2. Neurogenic neoplasm arising from cord, nerve root, or sympathetic ganglia
   a. Peripheral nerve tumor, benign or malignant (neurofibroma; schwannoma; malignant tumor of nerve sheath origin)

(continued)
b. Autonomic ganglia tumor (ganglieneuroma; ganglioneuroblastoma; neuroblastoma)

*3. Spinal disease; paraspinal lesion, other (eg, tuberculosis; supplicative spondylitis; abscess; osteomyelitis; fracture)
4. Spinal neoplasm (osteosarcoma*; Ewing sarcoma; hemangioma; aneurysmal bone cyst; giant cell tumor; metastasis)

UNCOMMON
1. Duplication cyst, (eg, enteric; neurenteric; bronchogenic)
2. Extramedullary hematopoiesis (esp. sickle cell disease; thalassemia)
*3. Hematoma or hemorrhage, mediastinal or paraspinal (eg, vertebral fracture); loculated hemothorax
4. Hernia (eg, Bochdalek; traumatic)
5. Hydatid cyst
*6. Lymphadenopathy (eg, lymphoma, metastatic bronchogenic carcinoma; sarcoidosis; tuberculosis; giant lymph node hyperplasia {Castleman disease})
7. Mediastinal varices
8. Mediastinitis, acute; mediastinal abscess (See F-102)
9. Mediastinitis, fibrosing (esp. histoplasmosis; idiopathic)
10. Meningomyelocele or meningocele (lateral or anterior)
11. Neoplasm, other (eg, fibroma; leiomyoma; lipoma; hemangioma; mesothelioma; plasmacytoma; thymoma)
12. Pancreatic pseudocyst
13. Paraganglioma (eg, pheochromocytoma; chemodectoma; glomus tumor)
*14. Pleural thickening or loculated fluid; empyema
15. Pulmonary sequestration (extralobar)
16. Retroperitoneal mass extending into posterior mediastinum (eg, metastasis; teratoma; sarcoma)
*17. Teratoma (occasionally occur here)
18. Thoracic duct cyst or neoplasm
19. Thoracic kidney (high in retroperitoneum)
*20. Thyroid tumor or goiter (intrathoracic)

* May show calcification.

References

Gamut F-91-1

CT OF MEDIASTINAL LESIONS—WITH FAT ATTENUATION (−20 TO −130 HU)

COMMON
1. Hernia (eg, omental; mesenteric)
*2. Lipoma
3. Lipomatosis (Cushing S.; steroid therapy; obesity; diabetes)
4. Normal fat (epicardial fat pad; intrapericardial fat)

UNCOMMON
1. Angiomyolipoma
2. Extramedullary hematopoiesis
3. Liposarcoma
*4. Teratoma (mature)
*5. Thymolipoma

* May show calcification.

References

**Gamut F-91-2**

**CT OF MEDIASTINAL LESIONS—WITH WATER ATTENUATION (0–15 HU)**

**COMMON**

*1. Cyst (eg, pericardial; bronchogenic; enteric; neurenteric; thymic; hydatid)
*2. Cystic neoplasm (thymoma; teratoma; lymphoma, ; neurogenic tumor)
3. Esophageal dilatation, fluid-filled (eg, achalasia; scleroderma; obstruction from tumor or stricture; post-vagotomy S.; Chagas’ disease; diverticulum)
4. Hiatal hernia
*5. Paraspinal abscess
6. Pericardial effusion

**UNCOMMON**

1. Esophagectomy with gastric or colon interposition
2. Fluid collection; other (eg, seroma from trauma or surgery; perforated central venous catheter; loculated paramediastinal pleural effusion; ascites extending through esophageal hiatus)

**Gamut F-91-3**

**CT OF MEDIASTINAL LESIONS—WITH SOFT TISSUE ATTENUATION (15–40 HU)**

**COMMON**

*1. Cyst (bronchogenic; enteric; mature hydatid; other)
2. Esophageal neoplasm (eg, leiomyoma; carcinoma)

(continued)
*3. Hematoma; hemorrhage (mediastinal or paraspinal)
4. Hernia, solid organ or bowel (eg, hepatic; Morgagni; hiatal; Bochdalek)
*5. Lymphadenopathy (metastatic; granulomatous; Castleman disease) (See F-103)
6. Lymphoma
*7. Mediastinal (substernal) goiter; thyroid neoplasm (esp. carcinoma)
8. Mediastinitis, acute; mediastinal abscess (See F-102); fibrosing mediastinitis
9. Metastasis
*10. Neurogenic tumor
*11. Spinal lesion (eg, infectious spondylitis; neoplasm; fracture with hematoma; paraspinal abscess)
12. Thoracic kidney
13. Thymic enlargement (normal; hyperplasia; thymitis)
*14. Thymic lesion (eg, thymoma, benign or invasive; carcinoid; carcinoma)
*15. Vascular lesion or abnormality (eg, aortic aneurysm, dilatation, or tortuosity (See F-92)

UNCOMMON
*1. Cardiac neoplasm (eg, fibroma; sarcoma)
2. Extramedullary hematopoiesis
*3. Germ cell neoplasm (teratoma; seminoma; nonseminomatous malignant germ cell neoplasm)
*4. Hemangioma
5. Lymphangioma (cystic hygroma)
6. Mesothelioma; localized fibrous tumor of pleura
7. Paraganglioma
8. Parathyroid adenoma or carcinoma
9. Pulmonary sequestration (extralobar)
10. Sarcoma
11. Spindle cell tumor
* May show calcification.

References

Gamut F-91-4
CT OF MEDIASTINAL LESIONS—WITH CALCIFICATION

COMMON
1. Aneurysm; atherosclerosis; other vascular lesion
2. Lymphadenopathy (eg, tuberculosis; histoplasmosis; sarcoidosis; silicosis; amyloidosis; Castleman disease)
3. Mediastinal (substernal) goiter

UNCOMMON
1. Abscess, old
2. Cyst (bronchogenic; foregut; thymic)
3. Hemangioma (phleboliths)
4. Hematoma, old
5. Lipoma
6. Lymphoma (post-radiation therapy)
7. Neurogenic tumor (eg, neurilemmoma; ganglioneuroma; neuroblastoma)
8. Teratoma
9. Thymic lesion (eg, thymoma; thymolipoma)
CT OF MEDIASTINAL LESIONS—VASCULAR OR ENHANCING LESIONS

COMMON
1. Aneurysm, aortic or other vessel; aortic dissection
2. Anomalies of aortic arch and subclavian artery; pulmonary sling (See E-21-S)
3. Azygos vein dilatation
4. Mediastinal goiter; thyroid neoplasm
5. Vessels (varices; collaterals; ectatic or dilated vessels; vascular anomalies)

UNCOMMON
1. Carcinoid tumor
2. Hemangioma
3. Localized fibrous tumor of pleura
4. Lymphadenopathy (tuberculous; metastatic; Castleman disease)
5. Mediastinal tumor; other
6. Paraganglioma; pheochromocytoma
7. Parathyroid adenoma
8. May show calcification.

References
AORTIC AND VENOUS ABNORMALITIES IN THE MEDIASTINUM
(Esp. on CT, MRI or Angiography)
(See E-21-S, E-61–65, E-69–70, F-91-S)

COMMON
1. Aneurysm of aorta (eg, atherosclerotic; traumatic; infectious)
2. Atherosclerosis of aorta and brachiocephalic vessels
3. Coarctation of aorta
4. Dissection of aorta
5. High aortic arch
6. Right anterior aortic arch (Type I) with mirror-image branching
7. Superior vena cava dilatation or obstruction (See E-70)

UNCOMMON
1. Aneurysm or fistula of coronary artery
2. Aneurysm of sinus of Valsalva (incl. rupture into heart)
3. Anomalous artery arising from aorta to supply a lung segment
   a. Pulmonary sequestration
   b. Venolobar (scimitar) S.
4. Aortic diverticulum or nipple
5. Aortomegaly (idiopathic)
6. Aortopulmonary window
7. APVR, total (“snow man”)
8. Azygos continuation of interrupted inferior vena cava
9. Circumflex or cervical left aortic arch with right descending aorta
10. Circumflex right aortic arch with left descending aorta
11. Corrected transposition of great vessels
12. Cystic medial necrosis of aorta (eg, Marfan S.)
13. Double aortic arch
14. Left aortic arch with aberrant right subclavian artery
15. Necrotizing vasculitis, arteritis (eg, polyarteritis nodosa; lupus erythematosus; Wegener granulomatosis; syphilis; drug abuse—esp. metamphetamine)
16. Patent ductus arteriosus (ligamentum arteriosus)
17. Persistent left superior vena cava
18. Postoperative shunt (eg, Blalock-Taussig; Waterston; Potts)
19. Pseudocoarctation of aortic arch
20. Right posterior aortic arch (Type II) with aberrant left subclavian artery
22. Takayasu arteritis
23. Transposition of great vessels
24. Truncus arteriosus

Reference

CYSTIC MEDIASTINAL LESION
(Plain Film, CT, or MRI)

COMMON
1. Duplication cyst (eg, bronchogenic; tracheal; enteric; neurenteric)
2. [Hernia, diaphragmatic (containing fluid-filled viscus), esp. hiatal]
3. Pericardial cyst
4. [Pericardial effusion, loculated]

UNCOMMON
1. Cyst, indeterminate or idiopathic
2. [Esophageal diverticulum (fluid-filled)]
3. Granulomatous lymphadenitis (esp. histoplasmic)
4. Hydatid cyst
5. Lymphangioma (cystic hygroma)
6. Lymphocele
7. Mediastinal goiter (intrathoracic thyroid)
8. Mediastinal tumor with cystic degeneration (eg, cystic thymoma; lymphoma, neurogenic tumor)
9. Meningocele (lateral or anterior); myelomeningocele
10. Pancreatic pseudocyst
11. Teratoma (mature)
12. Thymic cyst (acquired, congenital)

[This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.]

References

Gamut F-94

RETROSTERNAL MASS OR SWELLING

COMMON
1. Anterior mediastinal lesion (eg, thymoma; thymic cyst; thymolipoma; mature teratoma; malignant germ cell neoplasm; pericardial cyst or lipoma; hematoma; Morgagni hernia) (See F-88)
2. Bone lesion (eg, osteomyelitis; neoplasm, primary or secondary)
3. Fat; lipomatosis (eg, pericardial fat pad; adiposity; Cushing S.; steroid therapy)
4. Hemorrhage, traumatic (esp. sternal fracture) or bleeding disorder
5. Lymphoma (esp. nodular sclerosing Hodgkin’s)
6. Metastasis to sternum, soft tissues, or lymph nodes (esp. from breast carcinoma)
7. Normal (eg, prominent costal cartilage junction; slight obliquity; internal thoracis muscle; retrosternal line; interface of anterior margin of left lung)
8. Pleural fluid loculation
9. Postoperative (esp. median sternotomy; mediastinal surgery)
10. Thymus, normal (infant) or enlarged (hyperplasia; thymitis; thymic rebound following treatment or stress) (See F-95)

UNCOMMON
1. [Atelectasis of upper lobe]
2. Chest wall lesion with mediastinal involvement, inflammatory or neoplastic (eg, spindle cell tumor, lipoma; soft tissue myeloma)
3. Clavicle dislocation, posterior (sternal end)
4. Collateral blood vessels (eg, coarctation of aorta; inferior or superior vena cava obstruction; portal hypertension with internal mammary varices)
5. Lymphadenopathy, neoplastic or granulomatous (eg, tuberculosis; histoplasmosis) (See F-103)
6. Mediastinitis, acute; mediastinal abscess (See F-102)
7. Mesothelioma; localized fibrous tumor of pleura

(continued)
8. [Pericardial fibrosis (constrictive pericarditis)]
9. Venolobar S. (scimitar S.)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut F-95
THYMIC ENLARGEMENT

COMMON
1. Lymphoma (esp. nodular sclerosing Hodgkin’s disease); leukemia
2. Normal newborn or infant thymus
3. Thymic hyperplasia; thymitis
4. Thymic rebound following treatment or stress
5. Thymoma, benign or invasive

UNCOMMON
1. Germ cell neoplasm
2. Hyperthyroidism
3. Progeria
4. Thymic carcinoid
5. Thymic carcinoma
6. Thymic cyst
7. Thymolipoma

Reference

Gamut F-96
SMALL OR ABSENT THYMUS IN AN INFANT

COMMON
1. Immunologic disorder (eg, agammaglobulinemia; dysgammaglobulinemia; AIDS)
2. Stress from serious illness (eg, burn; birth trauma; sepsis; debilitation; anemia)

UNCOMMON
1. Adrenal hyperplasia, congenital
2. Chemotherapy (eg, nitrogen mustard; Cytoxan)
3. Congenital heart disease, esp. cyanotic (eg, complete transposition of great vessels)
4. Graft-versus-host disease
5. Radiation therapy
6. Steroid therapy
7. Thymic agenesis (DiGeorge S.)
8. Trisomy 8q S.
9. Trisomy 18 S.
10. Zellweger S. (cerebrohepatorenal S.)

References

Gamut F-97
RIGHT ANTERIOR CARDIOPHRENIC ANGLE LESION

COMMON
1. Epicardial fat pad
2. Hiatal hernia; esophagectomy with gastric or colon interposition
3. [Localized paralysis of right hemidiaphragm (“partial eventration”)] (See F-136–137)
4. Morgagni hernia (gut or omentum)
5. Pericardial cyst or diverticulum
6. Pleural effusion (loculated); pleural adhesions
7. [Right atrial dilatation] (See E-27)
8. Right middle lobe disease (eg, neoplasm, esp. bronchogenic carcinoma; pneumonia; atelectasis)

UNCOMMON
1. Cardiac aneurysm or neoplasm
2. [Congenital absence of pericardium]
3. Diaphragmatic neoplasm or rupture (See F-138)
4. Herniation of liver, traumatic or congenital (“ectopic lobe”)
5. Hydatid cyst (cardiac, pericardial, or pulmonary)
6. Localized fibrous tumor of pleura
7. Lymphadenopathy, juxtaperichal (esp. lymphoma,)
8. Mediastinal tumor, anterior (eg, thymoma; thymic carcinoma; thymic cyst; thymolipoma; mature teratoma; malignant germ cell neoplasm) (See F-88)
9. Mesothelioma (pleural or pericardial)
10. Metastasis
11. Pericardial effusion (encapsulated)
12. Pulmonary sequestration (extralobar)

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut F-98
ABNORMALITY OF THE AZYGOSOEPHAGEAL RECESS (ESP. ON CT)

COMMON
1. Azygos vein dilatation (eg, obstruction of SVC or IVC; azygos continuation of IVC)
2. Carcinoma of esophagus
3. Descending aorta dilatation
4. Duplication cyst (esp. bronchogenic; enteric)
5. Esophageal dilatation, any cause (esp. achalasia; obstructing neoplasm)
6. Left atrial enlargement
7. Lymphadenopathy, esp. subcarinal and paraesophageal nodes (eg, carcinoma of lung; metastatic disease; lymphoma, AIDS; tuberculosis; histoplasmosis; sarcoidosis; Castleman disease) (See F-103)

UNCOMMON
1. Esophageal varices
2. Pleural effusion or thickening
3. Pleural tumor (mesothelioma or metastasis; localized fibrous tumor of pleura)
4. Pulmonary lesion (eg, consolidation; atelectasis)

References
DISPLACEMENT OF THE THORACIC PARASPINAL LINE (See F-90)

COMMON
1. Aortic disease (eg, aneurysm; ectasia; laceration)
2. Left atrial enlargement
3. Neoplasm of spine, primary (See C-38-S, C-39) or metastatic
4. Osteophytes
5. Paraspinal hemorrhage or hematoma (eg, spine fracture; bleeding or clotting disorder)
6. Pleural effusion, encapsulated, but may be free on supine film
7. Posterior mediastinal mass (See F-90)
8. Tuberculous or other infectious spondylitis

UNCOMMON
1. Azygos vein dilatation
2. Esophageal dilatation or neoplasm
3. Extramedullary hematopoiesis
4. Lymphoma; other lymphadenopathy
5. Mediastinal edema or hemorrhage (eg, cirrhosis; nephrosis; trauma; bleeding disorder)
6. Neurogenic tumor (eg, schwannoma; neurofibroma; ganglioneuroma; ganglioneuroblastoma; neuroblastoma)
7. Spinal disease, other
8. Varices (mediastinal; esophageal)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

INTRATHORACIC EXTRAMEDULLARY HEMATOPOIESIS

COMMON
1. Anemia, primary hemolytic (esp. thalassemia)

UNCOMMON
1. Aplastic anemia; bone marrow injury (eg, benzene; radiation)
2. Carcinomatosis
3. Cyanotic congenital heart disease
4. Erythroblastosis fetalis
5. Erythroleukemia (Di Guglielmo syndrome)
6. Iron deficiency anemia
7. Leukemia; lymphoma
8. Myelofibrosis; myelosclerosis
9. Paget’s disease
10. Pernicious anemia
11. Polycythemia vera
12. Thrombocythemia
13. Thrombocytopenic purpura

References

MEDIASTINAL WIDENING
(See F-101-2, F-102)

COMMON
1. Achalasia; Chagas’ disease
2. Fibrosing mediastinitis (esp. histoplasmosis; idiopathic)
3. Hematoma or hemorrhage (eg, sternal or vertebral fractures; venous and arterial tears; aortic transection; penetrating trauma from knife or gunshot wound; postoperative; malposition of vascular catheter with vessel injury)
4. Hiatal hernia (large); pericardial hernia
5. Lymphadenopathy (eg, metastatic disease—esp. from carcinoma of lung or esophagus); lymphoma; tuberculosis; histoplasmosis; giant lymph node hyperplasia (Castleman disease) (See F-103)
6. Mediastinal cyst (eg, thymic, bronchogenic, enteric or neurenteric cyst; hydatid cyst)
7. Mediastinal tumor (eg, thymoma; thymic carcinoma; thymolipoma; teratoma; lymphoma; intrathoracic goiter; neurogenic tumor)
8. Mediastinitis, acute; mediastinal abscess (See F-102)
9. [Technical factors (eg, expiration or poor inspiration; rotation; AP supine or lordotic film)]
10. Vascular abnormality (eg, dilated or tortuous aorta; aneurysm, dissection or coarctation of aorta; left superior vena cava; dilated superior vena cava)

**UNCOMMON**
1. Allergic edema of mediastinum
2. Chylomediastinum (eg, thoracic duct obstruction or laceration)
3. Extension of extrathoracic lesion (eg, pharyngeal or abdominal abscess; pancreatitis; pancreatic pseudocyst)
4. Extramedullary hematopoiesis
5. Lipomatosis (eg, obesity; steroid therapy; Cushing S.; normal variant)
6. Pleural disease adjacent to mediastinum (eg, effusion; metastatic disease; mesothelioma)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**Reference**

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**Gamut F-102-1**

**ACUTE DIFFUSE MEDIASTINAL WIDENING**

**TECHNICAL**
1. [Radiograph obtained in expiration or poor inspiration, with patient rotated or in supine or lordotic position, or with short target-film distance]

**HEMORRHAGE**
1. Aneurysm (ruptured)
2. Aortic dissection
3. Bleeding or clotting disorder
4. Idiopathic
5. Postoperative
6. Trauma to heart, aorta, or other great vessel; sternal or vertebral fracture

**LYMPH ACCUMULATION**
1. Lymphangioma with rupture
2. Postthoracotomy lymphocele
3. Thoracic duct obstruction or laceration

**EDEMA**
1. Heart failure
2. Leakage from clysis (catheter malposition)
3. Postoperative
4. Superior vena cava obstruction

**INFLAMMATION, SUPPURATION (EG, ACUTE MEDIASTINITIS) (See F-102)**
1. Drug abuse
2. Esophageal perforation
3. Opportunistic infection (esp. in AIDS)
4. Osteomyelitis
5. Pancreatitis; subphrenic abscess (upward extension)
6. Pharyngitis; tonsillitis; parotitis; dental infection (downward extension)
7. Pulmonary or pleural infection

(continued)
LYMPHADENOPATHY
1. Acute leukemia; lymphoma
2. Anthrax
3. Bacterial infection, other
4. Fungus disease (esp. histoplasmosis; coccidioidomycosis)
5. Infectious mononucleosis
6. Lymphadenitis, acute
7. Plague
8. Sarcoidosis
9. Tuberculosis
10. Tularemia

PNEUMOMEDIASTINUM
1. Spontaneous
2. Traumatic
3. Other (See F-110)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

UNCOMMON
1. Drug abuse
2. Opportunistic infection (eg, atypical mycobacterial infection), esp. in AIDS
3. Osteomyelitis of sternum or spine
4. Pancreatitis; pancreatic pseudocyst; subphrenic abscess (upward extension)
5. Pharyngeal abscess; tonsillitis; dental infection (downward extension)
6. Pleural infection; empyema
7. Pneumonia; lung abscess
8. Trauma with tracheal or bronchial rupture

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

Gamut F-103

MEDIASTINAL AND/OR HILAR LYMPH NODE ENLARGEMENT

COMMON
1. AIDS (eg, Pneumocystis carinii; Mycoplasma pneumoniae; cytomegalovirus, or atypical mycobacterial infection; bacillary angiomatosis; Kaposi sarcoma; lymphoma)
2. Bronchogenic carcinoma
3. [Expansory or supine film]
4. Fungus disease (esp. histoplasmosis; coccidioidomycosis; blastomycosis) (See F-74-S)
5. [Heart disease with pulmonary artery enlargement (eg, left to right shunt, heart failure; high output heart disease; pulmonary arterial or venous hypertension; cor pulmonale; valvular pulmonary stenosis; absent pulmonary valve; transposition of great vessels; truncus arteriosus; TAPVR below diaphragm; left atrial myxoma; aortic aneurysm]
6. Lymphoma; leukemia

ACUTE MEDIASTINITIS OR MEDIASTINAL ABSCESS

COMMON
1. Esophageal perforation (eg, carcinoma; trauma; Boerhaave S.)
2. Histoplasmosis or other fungus disease (eg, coccidioidomycosis); actinomycosis (See F-74-S)
3. Iatrogenic (eg, postoperative; endoscopic trauma; dilatation of esophageal stricture)
4. [Sclerosing or fibrosing mediastinitis, chronic (esp. histoplasmosis; idiopathic)]
5. Tuberculosis
7. Metastatic disease (esp. bronchogenic squamous or small cell carcinoma; carcinoma of head and neck, breast, kidney, testis; carcinoid; invasive thymoma; malignant teratoma; lymphangitic carcinomatosis; mesothelioma)
8. Pneumoconiosis (esp. coal-worker’s pneumoconiosis; silicosis; berylliosis) (See F-70-S)
9. Sarcoidosis
10. Tuberculosis, primary

UNCOMMON
1. Amyloidosis; plasma cell dyscrasia (eg, Waldenström macroglobulinemia; heavy chain disease)
2. Aspiration, chronic (eg, tracheo-esophageal fistula; achalasia; neurologic disorders)
3. Connective tissue disease (collagen vascular disease) (esp. rheumatoid arthritis; lupus erythematosus; mixed—MCTD)
4. Cystic fibrosis (mucoviscidosis)
5. Drug reaction (eg, hydantoin [Dilantin]; trimethadione; methotrexate)
6. Erythema nodosum
7. Giant lymph node hyperplasia (Castleman disease)
8. Hypersensitivity pneumonitis (extrinsic allergic alveolitis, esp. mushroom-worker’s lung—rare in other entities) (See F-69)
9. Langerhans cell histiocytosis
10. Lymphadenitis, idiopathic or other infectious (eg, tularemia; pertussis; plague; anthrax; brucellosis; lung abscess)
11. [Mediastinal mass; prominent right or persistent left superior vena cava]
12. Parasitic disease (eg, occasionally in tropical eosinophilia {filarial}; acute schistosomiasis)
13. [Polycythemia vera]
14. Pulmonary lymphangioleiomyomatosis (rarely)
15. [Pulmonary thromboembolism]
16. Reactive airways disease in children
17. Recurrent childhood pneumonia
18. Sinus histiocytosis
19. Viral infection (eg, psittacosis; infectious mononucleosis; chickenpox; rubeola; cat-scratch fever; ECHO virus; mycoplasma) (See F-74-S)
20. Wegener granulomatosis

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

MARKED HILAR LYMPHADENOPATHY

COMMON
1. Lymphadenitis, infectious (incl. AIDS; tuberculosis; histoplasmosis; plague; tularemia; idiopathic)
2. Lymphoma; lymphosarcoma
3. Metastatic disease (esp. undifferentiated or small cell carcinoma of lung)
4. Sarcoidosis

UNCOMMON
1. Drug reaction (esp. hydantoin {Dilantin})
2. Erythema nodosum
3. Giant lymph node hyperplasia (Castleman disease)
BILATERAL HILAR ENLARGEMENT
(See F-103)

COMMON
1. Congenital heart disease (eg, left to right shunts—ASD, VSD, PDA; cyanotic admixture lesions; truncus arteriosus. type I)
2. Lymphadenopathy (esp. tuberculosis; histoplasmosis; bronchogenic carcinoma; lymphoma; sarcoidosis; silicosis; Castleman disease) (See F-103)
3. Pulmonary arterial hypertension, primary or secondary (eg, COPD; Eisenmenger S.; multiple pulmonary artery stenoses or coarctations; schistosomiasis)
4. Pulmonary thromboembolism
5. Pulmonary venous hypertension (eg, heart failure; mitral stenosis)

UNCOMMON
1. Polycythemia

Reference

UNILATERAL HILAR ENLARGEMENT

COMMON
1. Bronchogenic carcinoma (squamous cell; small cell)
2. Carcinoid
3. Fungus disease (esp. histoplasmosis; coccidiodomycosis; blastomycosis; sporotrichosis) (See F-74-S)
4. Lymphadenopathy, other infectious (eg, bacterial or viral pneumonia; lung abscess; tularemia; plague; actinomycosis; pertussis; mycoplasma; psittacosis; infectious mononucleosis; AIDS) (See F-103)
5. Lymphoma; leukemia
6. Metastatic disease (eg, from carcinoma of lung, breast, head and neck, kidney, or testis)
7. [Normal prominence of main pulmonary artery under age 25, esp. in women]
8. [Pneumonia in superior segment of a lower lobe; atelectasis in RUL or RML]
9. [Pulmonary stenosis, valvular (poststenotic dilatation of left pulmonary artery)]
10. [Rotation of patient during radiography; scoliosis]
11. Tuberculosis, primary

UNCOMMON
1. Aneurysm of pulmonary artery
2. Arteriovenous malformation
3. Bronchioloalveolar carcinoma
4. Coarctation of a central pulmonary artery (poststenotic dilatation)
5. Cystic fibrosis (mucoviscidosis)
6. [Mediastinal mass superimposed on hilum (eg, thymoma; thymic cyst; bronchogenic cyst; germ cell neoplasm; neurogenic tumor)]
7. Obstructed, hypoplastic, or absent contralateral pulmonary artery (eg, neoplasm; histoplasmosis; embolus; Swyer-James S.; congenital absence of pulmonary artery or valve)
8. Pericardial defect
9. Postoperative systemic-pulmonary shunt in CHD (Blalock-Taussig; Waterston-Cooley; Potts-Smith procedures)
10. Pulmonary thromboembolus lodged in a main pulmonary artery
11. Sarcoidosis (usually bilateral)

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut F-107

UNILATERAL SMALL HILAR SHADOW

COMMON
1. Air trapping, unilateral (eg, bronchial foreign body, neoplasm, stricture)
2. Hyperaeration, unilateral
3. Lobar atelectasis with hilum displaced behind heart
4. Normal variant (esp. left side)
5. Postoperative (eg, lobectomy)
6. Rotation of patient (scoliosis; poor positioning)

UNCOMMON
1. Central pulmonary artery obstruction, unilateral (eg, neoplasm; thromboembolism; fibrosing mediastinitis)
2. Congenital absence (proximal interruption), hypoplasia, or coarctation of pulmonary artery
3. Congenital lobar emphysema (neonatal lobar hyperinflation) (See F-54)
4. Pulmonary agenesis, aplasia or hypoplasia
5. Swyer-James syndrome

References

Gamut F-108

UNILATERAL OR BILATERAL HILAR DISPLACEMENT

COMMON
1. Atelectasis
2. Bronchiectasis (See F-80)
3. Bronchogenic carcinoma
4. Emphysema
5. Lobectomy
6. Mediastinal mass
7. Pneumoconiosis, esp. with conglomerate mass (eg, silicosis; coal-worker’s pneumoconiosis; asbestosis) (See F-70-S)
8. Pneumothorax (See F-111)
9. Tuberculosis, fungus disease, or other chronic pulmonary inflammatory process

UNCOMMON
1. Absent or anomalous pulmonary artery
2. Bronchial atresia
3. Congenital lobar emphysema
4. Cystic adenomatoid malformation
5. Diaphragmatic hernia
6. Lobar agenesis
7. Lobar torsion
8. Radiation fibrosis
9. Sarcoidosis (fibrotic)
10. Sequestration of lung (intralobar)
11. Swyer-James syndrome

References
**Gamut F-109**

### MEDIASTINAL SHIFT

**COMMON**
1. Atelectasis
2. Emphysema, unilateral (esp. bullous)
3. Mediastinal, pleural or pulmonary mass, large unilateral (eg, invasive thymoma; teratoma; thymolipoma; mesothelioma; bronchogenic carcinoma)
4. Pectus excavatum
5. Pleural effusion, large unilateral
6. Pneumothorax with tension
7. Postoperative (eg, lobectomy; pneumonectomy)
8. [Scoliosis]

**UNCOMMON**
1. Bronchiolitis obliterans (incl. Swyer-James S.)
2. Bronchogenic cyst (air-filled in children)
3. Congenital lobar emphysema (infants)
4. Cystic adenomatoid malformation (infants)
5. Diaphragmatic hernia, large
6. Foreign body (eg, peanut) occluding a large bronchus (esp. in a child on expiratory film)
7. Hypoplasia or agenesis of one lung
8. Partial absence of pericardium (cardiac shift)
9. Pulmonary interstitial emphysema (eg, PEEP)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**

**Gamut F-110**

### PNEUMOMEDIASTINUM

**COMMON**
1. Asthma
2. Barotrauma (overinflation during anesthesia or respiratory therapy, including ARDS; intermittent positive pressure ventilation (PEEP), esp. in newborns)
3. Birth trauma (newborn)
4. [Esophageal air in normal or dilated esophagus]
5. [Hiatal hernia]
6. Iatrogenic (eg, surgical procedure; sternotomy; esophagectomy; endoscopy; intubation; needle biopsy of lung or kidney; pericardial drainage; retroperitoneal or other gas insufflation)
7. [Pneumopericardium; pneumothorax]
8. Respiratory distress syndrome, infantile or adult
9. Sudden increase in intrathoracic pressure associated with tear of lung parenchyma (eg, cough paroxysm; pertussis; vomiting; resuscitation; Heimlich maneuver; marijuana smoking enhancement; cocaine abuse; convulsion)
10. Trauma to upper or lower respiratory tract or chest wall (incl. blunt or penetrating trauma; stab or gunshot wound; foreign body; rib fracture with pulmonary laceration; fractured bronchus)

**UNCOMMON**
1. [Abscess, mediastinal]
2. Anorexia nervosa
3. Bronchial dehiscence after lung transplant
4. Caisson disease
5. [Colon interposition, postesophagectomy]
6. Cystic fibrosis (mucoviscidosis)
7. Diabetic ketoacidosis
8. [Esophageal diverticulum; communicating duplication cyst]
9. Esophageal perforation (eg, carcinoma; dilatation; Boerhaave S.; endoscopy; prolonged vomiting with Mallory-Weiss S.)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
10. Extension of air from the neck; subcutaneous emphysema (eg, facial fracture; dental drilling; surgical procedure—neck dissection)
11. High altitude exercise
12. Infection with gas-forming organism (esp. in diabetic)
13. Parturition
14. Pneumoperitoneum; pneumoretroperitoneum (retroperitoneal perforation of gastrointestinal tract with upward extension of gas)
15. Rupture of trachea or main bronchus following bronchoscopy or blunt chest trauma
16. “Spontaneous” (eg, ruptured bulla)
17. Tracheal or esophageal fistula (eg, neoplasm; infection)

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References

Gamut F-111

PNEUMOTHORAX

COMMON
1. ARDS
2. [Artifact (eg, skin fold)]
3. Bronchopleural fistula (eg, postoperative; tuberculosis; fungus disease; amebiasis; suppurative pneumonia; lung abscess; empyema; radiation therapy) (See F-112)
4. Cystic fibrosis (mucoviscidosis)
5. [Giant bulla]
6. Iatrogenic (eg, surgical procedure; thoracotomy; endoscopy; thoracentesis; percutaneous or transbronchial biopsy; resuscitation; tracheotomy; subclavian puncture; central line or pacemaker insertion; barotrauma—overinflation with positive pressure ventilation during anesthesia or respirator therapy)
7. Mediastinal emphysema with pleural leak
8. Obstructive emphysema (eg, foreign body; neoplasm)
9. Pneumonia (esp. Pneumocystis carinii in AIDS or necrotizing staphylococcal pneumonia)
10. Respiratory distress syndrome (esp. after PEEP therapy); pulmonary interstitial emphysema; meconium aspiration (neonates)
11. Primary “spontaneous” (eg, ruptured bulla)
12. Trauma (eg, rib fracture; blunt or penetrating chest injury; tracheobronchial injury)
13. Wilson-Mikity S.

UNCOMMON
1. Asthma
2. Drug therapy (esp. cytotoxic chemotherapy)
3. Endometriosis (catamenial)
4. Esophageal rupture (eg, endoscopy; carcinoma; Boerhaave S.)
5. Honeycomb lung, interstitial pulmonary fibrosis (esp. sarcoidosis; Langerhans cell histiocytosis; eosinophilic granuloma; pneumoconiosis—bauxite {Shaver’s disease}; familial fibrocystic dysplasia—familial form of IPF) (See F-22)
6. Idiopathic pulmonary hemosiderosis
7. Marfan S.; Ehlers-Danlos S.; cutis laxa
8. Metastasis (esp. osteosarcoma or other sarcomas; carcinoma of pancreas or adrenals; Wilms’ tumor)
9. Neoplasm, malignant (eg, bronchogenic carcinoma)
10. Noxious gases (See F-72-S)
11. Parasitic disease (esp. paragonimiasis; ruptured pulmonary hydatid cyst or amebic abscess)
12. Parturition

(continued)
13. Pneumatocele or cyst rupture (eg, staphylococcal pneumonia)
14. Pneumoperitoneum with extension through diaphragm
15. Pulmonary lymphangioleiomyomatosis; tuberous sclerosis
16. Pulmonary thromboembolism with infarction
17. Renal agenesis (Potter S.); intrauterine anuria
18. Tuberculosis (cavitary)
19. Whooping cough (pertussis)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut F-112
BRONCHOPLEURAL FISTULA

COMMON
1. Empyema
2. Iatrogenic (eg, intubation; therapeutic pneumothorax; needle, brush or other biopsy)
3. Lung abscess; suppurative or necrotizing pneumonia
4. Neoplasm, malignant (esp. carcinoma of lung or esophagus)
5. Postoperative (eg, lobectomy; pneumonectomy; local resection; thoracoplasty; intubation)
6. Trauma to lung, pleura, or chest wall
7. Tuberculosis

UNCOMMON
1. Fungus disease (see F-74-S)
2. Metastatic disease (esp. sarcoma)
3. Parasitic disease (esp. amebiasis)
4. Pneumothorax (spontaneous)
5. Pulmonary infarct
6. Radiation pneumonitis

References

Gamut F-113
PLEURAL EFFUSION WITH NORMAL LUNGS (See F-114)

COMMON
1. Abscess, subphrenic or hepatic (eg, amebic; pyogenic)
2. Asbestos-related pleural disease
3. Ascites with permeation through diaphragm (eg, cirrhosis; Meigs S.; peritoneal metastases; extension of retroperitoneal urine collection; peritoneal dialysis)
4. Connective tissue disease (collagen vascular disease) (esp. lupus erythematosus; rheumatoid disease)
5. Heart failure (esp. posttreatment)
6. Idiopathic
7. Infection (eg, bacterial; rheumatic fever; viral; infectious mononucleosis; mycoplasma; fungal; actinomycosis; nocardiosis) (See F-74-S)
8. Lymphoma, mediastinal or retroperitoneal; leukemia
9. Metastasis to pleura (esp. from breast, pancreas, GI tract, ovary, kidney)
10. Normal, physiologic (up to 5 cc); pregnancy
11. Postmyocardial infarction S. (Dressler S.); postpericardiotomy S.
12. Postoperative, following thoracic, cardiac, abdominal, or retroperitoneal surgery (eg, splenectomy; renal surgery)
13. Pulmonary thromboembolism
14. Trauma to chest wall (eg, rib fracture; blunt or penetrating injury) or great vessels (hemothorax)
15. Tuberculosis

UNCOMMON
1. Bleeding or clotting disorder
2. Chest wall neoplasm (eg, Ewing sarcoma; osteosarcoma; chondrosarcoma)
3. Chylothorax (eg, lymphedema; Milroy’s disease; trauma to thoracic duct) (See F-120)
4. Drug reaction (eg, methysergide; nitrofurantoin, busulfan; methotrexate; bromocriptine, procarbazine; also lupus reaction from hydantoin (Dilantin), hydralazine, isoniazid, procainamide, propylthiouracil)
5. Empyema from retropharyngeal or neck abscess, or in postpneumonectomy space
6. Esophageal rupture or fistula
7. Familial Mediterranean fever (familial recurrent polycystosis)
8. Hypoproteinemia (incl. hepatic failure)
9. Iatrogenic (eg, fluid overload; ventriculopleural or other shunt; improperly inserted intravenous catheter; instillation of medication)
10. Mesothelioma
11. Multiple myeloma
12. Myxedema
13. Pancreatitis; pancreatic pseudocyst, abscess, or neoplasm
14. Parasitic disease (eg, amebiasis; filariasis; malaria; paragonimiasis)
15. Pericarditis (eg, viral; tuberculous; metastatic; idiopathic; constrictive)
16. Pleural fistula (eg, gastric; esophageal; bronchopleural)
17. Radiation therapy
18. Renal disease (eg, renal failure; nephrosis; pyelonephritis; acute glomerulonephritis; hydronephrosis; uremic pleuritis; hemolytic-uremic S.)

References

Gamut F-114
PLEURAL EFFUSION WITH ASSOCIATED PULMONARY, CARDIAC, OR MEDIASTINAL DISEASE

COMMON
1. Abscess, lung or subphrenic
2. ARDS; shock lung; ventilator lung
3. Bronchogenic carcinoma
4. Heart failure
5. Infection, other (eg, rheumatic fever; fungal; actinomycosis; nocardiosis; bacillary angiomatosis; mycoplasma; viral)
6. Lymphoma; leukemia
7. Metastatic disease, hematogenous or lymphangitic (esp. from carcinoma of lung, breast, pancreas, GI tract, or kidney; osteosarcoma and other sarcomas; Wilms’ tumor)
8. Parasitic disease (eg, malaria; amebiasis; hydatid disease; paragonimiasis) (See F-74-S)
9. Pneumonia (esp. bacterial, usually with empyema—staphylococcal; streptococcal; Klebsiella; plague; tularemia) (See F-74-S)

(continued)
10. Postoperative (e.g., pneumonectomy; left effusion post-cardiac surgery)
11. Pulmonary thromboembolism and infarction
12. Trauma with hemothorax or chylothorax (esp. laceration of lung; rib fracture; knife or gunshot wound; pulmonary or mediastinal hematoma; aortic rupture; esophageal perforation)
13. Tuberculosis

UNCOMMON
1. Asbestos exposure (usually with asbestos-related pleural disease and/or asbestosis)
2. Bronchopleural fistula
3. Churg-Strauss S.
4. Connective tissue disease (collagen vascular disease) (esp. lupus erythematosus; rheumatoid disease)
5. Dressler S. (recent myocardial infarction or cardiac surgery)
6. Drug-induced pulmonary disease, usually diffuse interstitial (e.g., nitrofurantoin; hydralazine; procaainamide) (See F-73-S)
7. Eosinophilic lung disease (e.g., Löffler S.)
8. Esophageal rupture or fistula
9. Iatrogenic (e.g., fluid overload; ventriculopleural or other shunt; improperly inserted intravenous catheter; instillation of medication)
10. Lymphomatoid granulomatosis
11. Malignant neoplasm, other (e.g., bronchioalveolar carcinoma; mesothelioma; multiple myeloma; rib or chest wall sarcoma; Askin tumor)
12. Obstruction of superior vena cava orazygos vein
13. Pericarditis (e.g., viral; tuberculous; metastatic; idiopathic; constrictive)
14. Pulmonary lymphangioleiomyomatosis; tuberous sclerosis
15. Pulmonary lymphangiomatosis
16. Radiation therapy
17. Sarcoidosis
18. Uremia (with pulmonary edema)
19. Waldenström macroglobulinemia
20. Wegener granulomatosis

References

Gamut F-115

SMALL PLEURAL EFFUSION WITH SUBSEGMENTAL ATELECTASIS

1. Abdominal disease (e.g., subphrenic abscess; amebiasis; pancreatitis; neoplasm)
2. Ascites
3. Postoperative (e.g., thoracotomy—esp. CABG; splenectomy; renal surgery)
4. Pulmonary infarct
5. Trauma (e.g., rib fractures)

Reference
PLEURAL EFFUSION WITH ENLARGED HEART

1. Connective tissue disease (collagen vascular disease)\(^g\) (esp. lupus erythematosus; rheumatoid disease)
2. Heart failure
3. Malignant neoplasm with direct or metastatic extension to pleura, pericardium and/or heart (eg, mesothelioma; invasive thymoma; malignant germ cell neoplasm; carcinoma of lung, breast or esophagus; lymphoma\(^g\))
4. Myocardiopathy
5. Myocarditis or pericarditis with pleuritis (eg, tuberculous; rheumatic fever, viral infection)
6. Postpericardiotomy S. (esp. CABG); Dressler S.
7. Pulmonary thromboembolism, usually with infarction

References

PLEURAL EFFUSION ASSOCIATED WITH ABDOMINAL DISEASE

COMMON
1. Abdominal neoplasm, primary or secondary (eg, peritoneal metastases)
2. Ascites with permeation through diaphragm (eg, cirrhosis)
3. Meigs S.
4. Pancreatitis
5. Renal disease (eg, nephrotic S.; acute glomerulonephritis; uremia; dialysis; urinoma)
6. Subphrenic abscess; perinephric abscess
7. Trauma, abdominal (eg, knife or gunshot wound; ruptured diaphragm)

UNCOMMON
1. Amebic liver abscess
2. Aneurysm\(^g\), thoracoabdominal, with rupture
3. Diaphragmatic hernia, incarcerated
4. Hemolytic-uremic S.
5. Lipoma or liposarcoma, thoracoabdominal
6. Lymphoma\(^g\)
7. Ovarian hyperstimulation S.

References

PLEURAL EFFUSION CONTAINING EOSINOPHILS

COMMON
1. Eosinophilic lung disease\(^g\) (esp. Löffler S.)
2. Hodgkin’s lymphoma
3. Idiopathic
4. Parasitic disease (eg, paragonimiasis; amebiasis; strongyloidiasis) (See F-74-S)

UNCOMMON
1. Asthma
2. Churg-Strauss S.
3. Cirrhosis
4. Connective tissue disease (collagen vascular disease)\(^g\) (eg, rheumatoid disease; lupus erythematosus; polyarteritis nodosa)
5. Drug reaction (See F-73-S); pulmonary granulomatosis in addicts

(continued)
6. Foreign material injection (oil; iodine; protein)
7. Infection (eg, fungus) (See F-74-S)
8. Leukemia (eosinophilic)
9. Malignant neoplasm
10. Pulmonary infarct
11. Trauma (blood, lymph)
12. Wegener granulomatosis

References

Gamut F-118-S2

TYPE OF PLEURAL FLUID—TRANSUDATE (Protein < 3 g/dl)

COMMON
1. Cirrhosis
2. Fluid overload
3. Heart failure
4. Renal failure; uremia

UNCOMMON
1. Ascites
2. Constrictive pericarditis
3. Hypoproteinemia
4. Myxedema
5. Nephrotic syndrome
6. Peritoneal dialysis
7. Superior vena cava obstruction (eg, bronchogenic carcinoma; fibrosing mediastinitis) (See E-70)

Reference

Gamut F-118-S3

TYPE OF PLEURAL FLUID—EXUDATE (Protein > 3 g/dl)

COMMON
1. Lymphoma; leukemia
2. Metastases to pleura (esp. bronchogenic carcinoma)
3. Pneumonia (esp. bacterial); lung abscess
4. Pulmonary thromboembolism
5. Tuberculosis

UNCOMMON
1. Connective tissue disorder (collagen vascular disease), esp. lupus erythematosus
2. Dressler S. (recent cardiac surgery or myocardial infarction)
3. Drug reaction
4. Fungus disease
5. Meigs’ S. (benign ovarian fibroma)
6. Mesothelioma
7. Pericardial disease
8. Postpartum
9. Subphrenic abscess

Reference

Gamut F-119

HEMOTHORAX

COMMON
1. Iatrogenic (eg, thoracentesis; lung biopsy; chest tube or central venous catheter placement)
2. Malignancy (eg, bronchogenic carcinoma; pleural metastases; mesothelioma)
3. Trauma to chest (eg, rib fracture; lacerated intercostal vessel; contusion)
UNCOMMON
1. Catamenial (eg, endometriosis)
2. Bleeding or clotting disorder (eg, anticoagulation therapy; hemophilia)
3. Dissecting aortic aneurysm
4. Extramedullary hematopoiesis
5. Pleural adhesion tear

Reference

CHYLOTHORAX (LYMPHOTHORAX)*

COMMON
1. Iatrogenic (esp. surgical or catheter injury to thoracic duct; surgery for congenital heart disease)
2. Idiopathic; spontaneous
3. Neoplasm involving thoracic duct or mediastinum (eg, metastatic disease; lymphoma; carcinoma of esophagus or lung; intrathoracic thyroid)
4. Trauma to thoracic duct

UNCOMMON
1. Aneurysm of thoracic duct with rupture
2. Cirrhosis
3. Congenital anomaly (eg, atresia or fistula of thoracic duct; yellow nail S.; Noonan S.; congenital lymphangiectasia)
4. Fibrosing mediastinitis
5. Filariasis; elephantiasis
6. Lymphadenopathy (eg, tuberculous; fungal; other infection) (See F-103)
7. Lymphangioma (cystic hygroma)
8. Neonatal
9. Nephrosis
10. Nonneoplastic mass compressing the thoracic duct (eg, aortic aneurysm; spinal disease)
11. Pulmonary lymphangioleiomyomatosis; tuberous sclerosis
12. Pulmonary lymphangiomatosis
13. Thromboembolism of left subclavian or innominate vein, or superior vena cava (central venous obstruction)

* Effusion with high lipid content—may be less dense than water on CT.

References
2. Freundlich IM: The role of lymphangiography in chylothorax. A report of six nontraumatic cases. AJR 1975;125: 617–627

MASSIVE PLEURAL EFFUSION

COMMON
1. Ascites (leaky diaphragm)
2. Emphyema
3. Heart failure
4. Hemothorax (eg, traumatic; bleeding disorder; catamenial)
5. Malignant intrathoracic neoplasm (eg, carcinoma, blastoma or sarcoma of lung; lymphoma; mesothelioma; neuroblastoma; teratoma)
6. Metastatic disease (eg, carcinoma of lung, esp. adenocarcinoma)
7. Nephrosis; acute glomerulonephritis
8. Postoperative
9. Subphrenic or liver abscess or neoplasm
10. Tuberculosis

(continued)
UNCOMMON
1. Actinomycosis; nocardiosis (empyema)
2. Amebiasis
3. Chylothorax (See F-120)
4. Fungus disease (See F-74-S)
5. Iatrogenic (eg, perforation by venous catheter)
6. Idiopathic
7. Pancreatitis
8. Perforation of esophagus or stomach
9. Polyserositis
10. Pulmonary thromboembolism with infarction

References

OPACIFICATION OF ONE HEMITHORAX

COMMON
1. Atelectasis of one lung
2. Consolidation of one lung (eg, pneumonia)
3. Pleural effusion, massive hydrothorax; empyema; hemothorax; chylothorax (See F-119–121)
4. Postpneumonectomy fibrothorax; thoracoplasty
5. [Rotoscoliosis, advanced]

UNCOMMON
1. Agenesis of one lung
2. [Artifact due to faulty radiographic technique (eg, malpositioned filter)]
3. Cardiomegaly, massive
4. Cystic adenomatoid malformation (type III)
5. Diaphragmatic hernia (congenital or traumatic)
6. Eventration of diaphragm
7. Fibrosis of lung or pleura
8. Hematoma of chest wall
9. Mediastinal or pulmonary mass, huge
10. Mesothelioma
11. Metastatic disease to pleura (esp. from adenocarcinoma of ipsilateral lung or from osteosarcoma)

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References

PLEURAL THICKENING

COMMON
1. Asbestos-related pleural disease: pleural plaque; talcosis
2. Bronchogenic carcinoma (esp. Pancoast tumor)
3. Empyema, prior
4. [Extrathoracic musculature; lateral pleural stripe; apical pleural capping; extrapleural fat deposition]
5. Metastatic disease
6. Pleural effusion, organized; pleural fibrosis; prior pleuritis or localized effusion, incl. prior interlobar fluid
7. Postoperative; prior drainage via catheter tubes
8. Rib lesion (eg, fracture; osteomyelitis; neoplasm; metastasis)
9. Trauma (old hemothorax)
10. Tuberculosis; atypical mycobacterial infection

UNCOMMON
1. Actinomycosis; nocardiosis
2. Chylothorax, prior
3. Connective tissue disease (collagen vascular disease), (esp. rheumatoid disease)
4. Fungus disease (See F-74-S)
5. Invasive thymoma with pleural involvement
6. Lymphoma, leukemia
7. Melioidosis
8. Mesothelioma
9. Parasitic disease (eg, paragonimiasis; amebiasis; ruptured hydatid cyst)
10. Pulmonary lymphangiomatosis
11. Pulmonary or mediastinal fibrosis, advanced
12. Rounded atelectasis
13. Sarcoidosis
14. Splenosis
15. Subpleural collaterals in pulmonary venous or arterial atresia

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References
PLEURAL MASS (See also F-126)

COMMON
1. Empyema
2. [Extrapleural tumor (eg, lipoma; liposarcoma; desmoid; neurofibroma; schwannoma)] (See F-126)
3. Hematoma
4. Lymphoma
5. Mesothelioma
6. Metastatic disease (esp. from adenocarcinoma of lung; also carcinoma of breast, prostate, ovary, pancreas, GI tract)
7. [Pancoast or superior sulcus tumor]
8. Pleural fluid (loculated or interlobar)
9. Pleural plaque (asbestos-related pleural disease)
10. Pleural thickening, localized (eg, prior infection, hemorrhage, or surgery)
11. [Rib or chest wall lesion (eg, callus; bone sarcoma; myeloma; metastasis)]

UNCOMMON
1. Cyst (eg, mesothelial; hydatid)
2. Fibrin ball
3. Invasive thymoma with pleural involvement
4. Localized fibrous tumor of pleura
5. [Mediastinal mass (along mediastinal pleura)]
6. Splenosis

* Often multiple lesions.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

MULTIPLE PLEURAL MASSES

COMMON
1. Loculated pleural effusions (eg, postoperative; tuberculosis)
2. Metastases to pleura (eg, from ipsilateral carcinoma of lung; breast; prostate)
3. Pleural plaques (asbestos-related pleural disease)

UNCOMMON
1. Endometriosis
2. Invasive thymoma
3. Localized fibrous tumor of pleura (usually solitary)
4. Lymphoma
5. Mesothelioma
6. Parasitic disease (eg, paragonimiasis or amebiasis with loculated effusions; pentastomiasis or cysticercoisis with calcifications; hydatid disease)
7. Splenosis (thoracic)

Reference

EXTRAPLEURAL OR CHEST WALL LESION (ESP. ON CT, MRI) (INCL. THOSE ASSOCIATED WITH RIB DESTRUCTION) (See F-125-1)

COMMON
1. Abscess; osteomyelitis of rib, sternum, or spine (eg, pyogenic infection; tuberculosis; actinomycosis; nocardiosis; blastomycosis; aspergillosis)
2. [Asbestos-related pleural disease]
3. Benign bone lesion (eg, cyst; aneurysmal bone cyst; fibrous dysplasia; enchondroma; osteochond-
droma; angioma; giant cell tumor; chondromyxoid fibroma; brown tumor of hyperparathyroidism)

*4. Bone sarcoma (eg, Ewing sarcoma; osteosarcoma; chondrosarcoma; fibrosarcoma)

*5. Chest wall invasion by bronchogenic carcinoma (eg, Pancoast tumor) or breast carcinoma

*6. Fracture of rib, sternum or spine (esp. with callus or hematoma)

*7. Hematoma

8. Lipoma (subcutaneous, extrapleural intrathoracic, transmural)

*9. Lymphoma

10. [Mediastinal mass]

*11. Metastasis to rib, chest wall, soft tissue, or spine (esp. from carcinoma of prostate, breast, lung)

*12. Multiple myeloma

13. [Superimposed density, esp. breast or breast implant; nipple; hair braids; artifact; skin lesion (eg, mole; neurofibroma); extrathoracic muscles; retrosternal soft tissue band]

*14. Postoperative (eg, soft tissue deformity; pleurectomy; plombage)

UNCOMMON

*1. Chronic empyema with associated malignancy (eg, lymphoma; sarcoma; mesothelioma)

2. Desmoid tumor, extraabdominal (aggressive fibromatosis)

*3. Empyema necessitatis (esp. tuberculous)

*4. Extramedullary hematopoiesis (esp. thalassemia)

*5. Hydatid disease

*6. Langerhans cell histiocytosis g (esp. eosinophilic granuloma)

7. Liposarcoma

8. [Lobar agenesis with extrapleural tissue plane anteriorly on lateral view]

9. Lymphangioma (cystic hygroma)

*10. Malignant fibrous histiocytoma

*11. Massive osteolysis (Gorham’s vanishing bone disease)

*12. Mesenchymal hamartoma of chest wall

*13. Mesotheioma

14. Muscle tumor (esp. rhabdomyosarcoma)

*15. Neurogenic tumor (eg, schwannoma; neurofibroma; malignant peripheral nerve sheath tumor; neuroblastoma; Akin tumor)

*16. Pleural-based lesion eroding rib (See F-125-1)

17. Spindle cell tumor g; fibroma

*18. Vascular tumor (eg, hemangioma; arteriovenous malformation; hemangiopericytoma; angiosarcoma)

* May be associated with erosion or destruction of rib, sternum, or spine.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References


AXILLARY MASS (CT, MRI)

COMMON

1. Lymphoma g; leukemia
2. Metastatic disease (esp. from carcinoma of breast; also lung, kidney and head and neck tumors)

UNCOMMON

1. Desmoid tumor
2. Empyema necessitans
3. Lipoma
4. Lymphadenopathy, other (eg, sarcoidosis; tuberculosis; plague; toxoplasmosis; cat-scratch fever)
5. Lymphangioma
6. Primary malignancy of axilla

Reference

PEDIATRIC CHEST WALL
OR RIB CAGE LESION,
OSSEOUS OR SOFT TISSUE
(ESP. ON CT, MRI)

CHEST WALL (RIB CAGE)—Benign Bone Tumors

COMMON
1. Aneurysmal bone cyst
2. Enchondroma
3. [Fibrous dysplasia]

UNCOMMON
1. Chondroblastoma (Codman tumor)
2. Mesenchymal hamartoma
3. Osteoblastoma
4. Osteochondroma

CHEST WALL (RIB CAGE)—Malignant Bone Tumors

COMMON
1. Ewing sarcoma
2. Metastasis (eg, neuroblastoma; leukemia)
3. Osteosarcoma

UNCOMMON
1. Askin tumor ( primitive neuroectodermal tumor {PNET}); may be same as extraosseous Ewing sarcoma
2. Lymphoma
3. Pleuropulmonary blastoma

References

CHEST WALL—Benign Soft Tissue Tumors

COMMON
1. Hemangioma; lymphangioma

CHEST WALL—Malignant Soft Tissue Tumors

COMMON
1. Rhabdomyosarcoma

UNCOMMON
1. Askin tumor ( primitive neuroectodermal tumor {PNET}); may be same as extraosseous Ewing sarcoma
2. Lymphoma
3. Pleuropulmonary blastoma

CONGENITAL SYNDROMES
WITH PECTUS CARINATUM
(PIGEON BREAST) (Same as D-209-2)

COMMON
1. Congenital heart disease (esp. cyanotic)
2. Ehlers-Danlos S.
3. Fetal alcohol S.
4. Homocystinuria
5. Idiopathic; isolated finding
6. Marfan S.
7. Mucopolysaccharidoses (esp. Morquio S.)
8. Osteogenesis imperfecta
9. [Rickets]
10. Undersegmentation or hypoplasia of sternum (See D-209-1)

UNCOMMON
1. Asphyxiating thoracic dysplasia (Jeune S.)
2. Coffin-Lowry S.
3. Currarino-Silverman S.
4. Dyggve-Melchior-Clausen dysplasia (Smith-McCort S.)
5. Hyperphosphatasia
6. LEOPARD S. (multiple lentigenes S.)
7. Noonan S.
8. Prune-belly S. (Eagle-Barrett S.)
9. Schwartz-Jampel S. (osteochondromuscular dystrophy)
10. Spondyloepimetaephys real dysplasia (Strudwick type)
11. Spondyloepiphyseal dysplasia congenita
12. 3-M syndrome

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut F-131
CONGENITAL SYNDROMES WITH A SHORT, NARROW THORACIC CAGE

COMMON
1. Achondroplasia (esp. homozygous)
2. Asphyxiating thoracic dysplasia (Jeune S.)
3. Chondroectodermal dysplasia (Ellis-van Creveld S.)
4. Cleidocranial dysplasia
5. Metaphyseal chondrodysplasia (Jansen type)
6. Pulmonary hypoplasia, unilateral or bilateral; venolobar S. (scimitar S.)
7. Short rib-polydactyl syndromes (types I {Saldino-Noonan} and II {Majewski})
8. Thanatophoric dysplasia; thanatophoric variants
9. Trisomy 21 S. (Down S.) (bell-shaped thorax)

UNCOMMON
1. Achondrogenesis; hypochondrogenesis
2. Antley-Bixler S.
3. Atelosteogenesis
4. Barnes S.
5. Campomelic dysplasia
6. Cerebro-costo-mandibular S.
7. Diastrophic dysplasia
8. Dyssegmental dysplasia
9. Fibrochondrogenesis
10. Hypophosphatasia
11. Lethal osteosclerotic skeletal dysplasias (many types)
12. Metatropic dysplasia
13. Noonan S.
14. Osteodysplasty (Melnick-Needles S.)
15. Osteogenesis imperfecta
16. Progeria
17. Pseudoachondroplasia
18. Shwachman-Diamond S.
19. Spondylocostal dysostosis (Jarcho-Levin S.)
20. Spondyloepimetaphyseal dysplasia with joint laxity
21. Spondyloepiphyseal dysplasia congenita

References

Gamut F-132

FETAL OR NEONATAL CHEST ANOMALIES OR MALFORMATIONS (US, PLAIN FILM)

1. Congenital heart defects
2. Congenital lobar emphysema
3. Congenital syndromes with thoracic malformation (eg, asphyxiating thoracic dysplasia {Jeune S.}; thanatophoric dysplasia; achondrogenesis; spondylocostal dysostoses {Jarcho-Levin S.}; chondroectodermal dysplasia (Ellis-van Creveld S.) (See F-129–131)
4. Cystic adenomatoid malformation
5. Developmental (duplication) cyst (eg, bronchogenic; enteric; neurenteric)
6. Diaphragmatic hernia (congenital)
7. Esophageal atresia; tracheoesophageal fistula
8. Fetal hydrothorax
9. Laryngotracheal or bronchial atresia
10. Lymphangioma (cystic hygroma)
11. Pulmonary lymphangiectasia
12. Pulmonary hypoplasia
13. Pulmonary sequestration
14. Tracheal bronchus

Reference

Gamut F-133

FLAT OR DEPRESSED DIAPHRAGM (UNILATERAL OR BILATERAL)

UNILATERAL
1. Intrathoracic mass (large unilateral)
2. Pleural effusion, hemothorax, chylothorax, empyema
3. Obstructive emphysema (COPD)
4. Tension pneumothorax

**BILATERAL**

**COMMON**
1. Asthma
2. COPD
3. Viral infection (incl. bronchiolitis in infants)

**UNCOMMON**
1. Air hunger (eg, severe congenital heart disease)
2. Hyperaeration with acidosis and dehydration
3. Obstructive emphysema, other causes (eg, cystic fibrosis {mucoviscidosis}; alpha-1 antitrypsin deficiency; cutis laxa; central or bilateral foreign bodies; vascular rings and anomalies; intratracheal lesions; paratracheal masses and cysts)
4. Pleural effusion, hemothorax, chylothorax (bilateral)
5. Tension pneumothorax (bilateral)

**References**

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**Gamut F-134**

**BILATERAL ELEVATED DIAPHRAGM**

**COMMON**
1. Abdominal neoplasm or cyst (eg, huge ovarian)
2. Ascites; peritoneal hemorrhage or lavage; peritonitis
3. Expiratory or poor inspiratory film
4. Hepatomegaly and splenomegaly
5. Obesity
6. Pneumoperitoneum
7. Postmyocardial infarction S. (Dressler S.); post-pericardiotomy S.
8. Pregnancy

**UNCOMMON**
9. [Subpulmonic pleural effusion, bilateral]
10. Trauma (incl. bilateral rib fractures with guarding)

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**Gamut F-135**

**UNILATERAL ELEVATED HEMIDIAPHRAGM**

**COMMON**
1. Atelectasis
2. Distended stomach or splenic flexure of colon
3. Eventration
4. Idiopathic; normal variant
5. Inflammatory disease in abdomen (eg, subphrenic, perinephric, hepatic, or splenic abscess; pancreatitis; cholecystitis; perforated ulcer)
6. Interposition of colon between liver and right hemidiaphragm (Chilaiditi S.)

[continued]
7. [Normal lateral decubitus view (dependent side)]
8. Paralysis (eg, phrenic nerve palsy or paralysis, esp. from bronchogenic carcinoma; primary or metastatic mediastinal malignancy; extrinsic pressure from intrathoracic goiter or aortic aneurysm; trauma; iatrogenic-surgical transection) (See F-136)
9. Pleural disease (eg, acute pleurisy; fibrosis; old empyema, hemothorax or pleural tuberculosis; mesothelioma)
10. Postoperative (eg, lobectomy; pneumonectomy); postpericardiotomy S. (post-CABG)
11. Ruptured spleen or liver (esp. subphrenic hematoma)
12. Scoliosis (on side of concavity)
13. Splinting of diaphragm or guarding from acute process (eg, fractured rib; chest wall trauma; pulmonary infarct; pneumonia)
14. Subphrenic mass (eg, enlargement, tumor, cyst, or abscess of liver or spleen; carcinoma of stomach)
15. [Subpulmonic pleural effusion]
16. Trauma to phrenic nerve, thorax, cervical spine, or brachial plexus

UNCOMMON
1. [Diaphragmatic cyst or tumor, intrinsic or adjacent (eg, mesothelioma; metastasis; localized fibrous tumor of pleura; lipoma)]
2. [Diaphragmatic hernia (Morgagni; Bochdalek; traumatic; large hiatal)]
3. [Emphysema of contralateral lung]
4. Hydatid cyst of liver or spleen
5. Hypoplasia or agenesis of one lung
6. Neurologic or neuromuscular disease (eg, polio; Erb’s palsy; hemiplegia)
7. Retroperitoneal neoplasm
8. Thoracic kidney
9. Traumatic rupture of diaphragm
10. Venolobar S. (scimitar S.) (incl. accessory diaphragm)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
References

Gamut F-137
PHRENIC NERVE PARALYSIS OR DYSFUNCTION

COMMON
1. Iatrogenic (eg, surgical injury; chest tube; therapeutic avulsion or injection; subclavian vein puncture)
2. Infection (eg, tuberculosis; fungus disease; abscess)
3. Neoplastic invasion or compression (esp. carcinoma of lung)

UNCOMMON
1. Aneurysm, aortic or other
2. Birth trauma (Erb’s palsy)
3. Herpes zoster
4. Neuritis, peripheral (eg, diabetic neuropathy)
5. Neurologic disease (eg, hemiplegia; encephalitis; polio; Guillain-Barré S.)
6. Pneumonia
7. Trauma

Reference

Gamut F-138
SEGMENTAL OR LOCALIZED ELEVATION (SCALLOPING), MOGUL OR MASS OF A HEMIDIAPHRAGM

COMMON
1. Abscess of liver, lung, or pleura (esp. amebic)
2. Asbestos-related pleural disease (pleural plaque)
3. Atelectasis of an upper lobe
4. Eventration (localized)
5. Hernia (eg, hepatic; Morgagni; Bochdalek; traumatic)
6. Normal scalloping
7. Pleural mass adjacent to diaphragm, other (eg, mesothelioma; localized fibrous tumor of pleura; lipoma; liposarcoma)
8. Subphrenic, hepatic or splenic abscess, neoplasm or cyst
9. Thoracic kidney

UNCOMMON
1. Cyst (eg, hydatid; bronchogenic)
2. Neoplasm of diaphragm (eg, fibroma; myoma; cystic teratoma)
3. Pulmonary sequestration (extralobar)
4. Segmental paralysis of phrenic nerve (See F-137)
5. Venolobar syndrome (scimitar S.) (pulmonary hypoplasia)

References
JUXTADIAPHRAGMATIC LESIONS IN CHILDREN

**COMMON**
1. Lymphoma, other lymphadenopathy
2. Neurogenic neoplasm (eg, neurofibroma; ganglioneuroma; ganglioneuroblastoma; neuroblastoma)
3. Pleural effusion, free or loculated, benign or malignant; empyema
4. Pleural thickening

**UNCOMMON**
1. Diaphragmatic hernia (hiatal; Morgagni; Bochdalek; traumatic)
2. Cyst (pericardial; bronchogenic; hydatid)
3. Germ cell neoplasm, benign or malignant (esp. teratoma)
4. Hemangiopericytoma
5. Sarcoma (esp. Ewing sarcoma; also liposarcoma; osteosarcoma; rhabdomyosarcoma)

**Reference**

SOLITARY THORACIC CALCIFICATION

**COMMON**
1. Asbestos related pleural disease; asbestos pleural plaque
2. Cardiovascular (eg, arteriosclerosis; aneurysm of mitral or aortic valve; coronary artery; intracardiac myxoma or thrombus; ligamentum arteriosum; old myocardial infarct) (See E-44)
3. Chest wall (esp. rib callus; costal cartilage calcification)
4. Granuloma (eg, tuberculosis; histoplasmosis, other fungus disease; nonspecific)
5. Lymphadenopathy (eg, tuberculosis; histoplasmosis; sarcoidosis; silicosis)
6. Mediastinal neoplasm or cyst (eg, mature teratoma; bronchogenic cyst; hemangioma; thymoma, intrathoracic thyroid; neurogenic neoplasm—schwannoma; ganglioneuroma; neuroblastoma)
7. Pericardial (eg, calcific pericarditis) (See E-45)
8. Pleural, other (eg, old empyema or hemothorax; tuberculosis) (See F-124)

**UNCOMMON**
1. Abscess of lung, chronic
2. Amyloidoma
3. Bronchogenic carcinoma engulfing a granuloma
4. Broncholith
5. Carcinoid.
6. Chest wall, other (eg, myositis ossificans; neoplasm of rib, breast, or chest wall; parasitic infection—guinea worm)
7. [Foreign body]
8. Fungus ball (mycetoma)
9. Hamartoma
10. Hematoma, old
11. Idiopathic
12. Lymphoma, treated; other necrotic or treated neoplasm
13. Measles pneumonia, atypical with nodular complex
14. Metastasis (See F-142)
15. Mucoïd impaction
16. Neoplasm of lung, other rare (eg, leiomyosarcoma; intrapulmonary teratoma)
17. Pneumonia, organized; inflammatory pseudotumor (plasma cell granuloma—rarely)
18. Pulmonary artery aneurysm or hypertension
19. Pulmonary thromboembolism
20. Thrombus in IVC or SVC
21. Varix or hemangioma of lung (phleboliths)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
MULTIFOCAL OR WIDESPREAD
THORACIC CALCIFICATIONS

COMMON
1. Chest wall (eg, costal cartilages; rib fractures with callus)
2. Fungus disease, nodal and parenchymal (esp. histoplasmosis; coccidioidomycosis; candidiasis—late)
3. Lymphadenopathy (eg, tuberculosis; histoplasmosis; sarcoidosis; silicosis)
4. Pleural (eg, asbestos-related pleural disease; talcosis; tuberculosis; old empyema or hemothorax))
   (See F-124)
5. Silicosis; coal-worker’s pneumoconiosis
6. Tracheobronchial cartilage (physiologic)
7. Tuberculosis (not miliary)
8. Vascular (diffuse/extensive atherosclerosis)

UNCOMMON
1. Alveolar microlithiasis
2. Amyloidosis
3. [Bronchography; lymphangiography]
4. Broncholithiasis
5. Chickenpox pneumonia, healed
6. [Foreign bodies]
7. Hamartomas of lung, multiple (incl. Carney’s triad)
8. Idiopathic pulmonary ossification (osteopathia)
9. Lymphoma after radiation therapy
10. Metastases (See F-142)
11. Metastatic calcification (metabolic calcinosis)  
   (eg, hyperparathyroidism, primary or secondary 
   {renal osteodystrophy with renal failure; uremia; 
   hemodialysis}; hypervitaminosis D; milk-alkali syndrome; excessive calcium administration)
12. Parasitic disease in lung, pleura, thoracic muscles, or subcutaneous tissues (eg, paragonimiasis; pentastomiasis—Armillifer infection; dracunculiasis—guinea worm infection; cysticercosis)
13. Pseudoxanthoma elasticum
14. Pulmonary artery atherosclerosis (eg, pulmonary hypertension; Eisenmenger complex)
15. Pulmonary hemosiderosis (mitral stenosis; idiopathic {Ceelen S.}, esp. on CT)
16. Rheumatoid nodules
17. Sarcoidosis
18. [Tin, barium, or antimony pneumoconiosis]
19. Tracheopathia osteoplastica

[This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.]

References
CALCIFIED PULMONARY METASTASES

COMMON
1. Chondrosarcoma
2. Mucinous (colloid) adenocarcinoma (eg, colon; breast)
3. Osteosarcoma
4. Papillary (psammomatous) adenocarcinoma (eg, ovary; thyroid)

UNCOMMON
1. Cystosarcoma phylloides
2. Dystrophic calcification in metastatic foci (esp. post-radiation or chemotherapy)
3. Epithelioid hemangioendothelioma
4. Germ cell neoplasm
5. Leiomyomatosis (benign metastasizing leiomyomas)
6. Medullary carcinoma of thyroid
7. Mesenchymoma, malignant
8. Synovial sarcoma

References

EGGSHELL CALCIFICATIONS IN THE CHEST (ESP. MEDIASTINAL LYMPH NODES)

COMMON
1. Aneurysm of great vessels
*2. Idiopathic
*3. Silicosis; coal-worker’s pneumoconiosis

UNCOMMON
*1. Amyloidosis
*2. Fungus disease (esp. histoplasmosis) (See F-74-S)
*3. Hodgkin’s lymphoma, treated
*4. Pulmonary artery calcification in chronic pulmonary hypertension (eg, atrial septal defect (ASD); cor pulmonale)
*5. Sarcoidosis
*6. Tuberculosis
* Primarily in mediastinal or hilar lymph nodes.

References
# Gastrointestinal Tract and Abdomen

## ESOPHAGUS

| G-1 | Retention of Barium in the Hypopharynx (Esp. Cricopharyngeal Achalasia) (Roentgen Counterpart of Dysphagia) |
| G-2 | Esophageal Motility Disorder (Aperistalsis, Tertiary Contractions, Spasm, and other Forms) |
| G-3 | Achalasia (Cardiospasm) of the Esophagus |
| G-4 | Air in the Esophagus |
| G-5 | Extrinsic Impression on the Cervical Esophagus |
| G-6 | Extrinsic Impression on the Thoracic Esophagus |
| G-7 | Extrinsic Vascular Impression on the Esophagus (See E-18) |
| G-8 | Tracheoesophageal or Esophagobronchial Fistula |
| G-9 | Double-Barrel Esophagus |
| G-10-1 | Diverticulum of the Esophagus—Upper Third |
| G-10-2 | Diverticulum of the Esophagus—Middle Third |
| G-10-3 | Diverticulum of the Esophagus—Lower Third |
| G-10-4 | Diverticula of the Esophagus—Diffuse |
| G-11 | Solitary Intramural or Intraluminal Filling Defect of the Esophagus |
| G-12 | Localized Constriction or Narrowing of the Esophagus |
| G-13 | Thickening of the Esophageal Wall (CT, US, MRI) |
| G-14 | Esophageal Ulceration(s) |
| G-15 | Transverse Mucosal Folds in the Esophagus |
| G-16 | Widespread Irregular or Nodular Esophageal Mucosa |
| G-17 | Esophageal Plaques |
| G-18 | Esophageal Varices |
| G-19 | Esophageal Lesion in a Child |

## STOMACH

| G-20 | Abnormal Position of the Stomach (Rotation or Displacement) |
G-21 Filling Defect(s) in the Stomach (Intraluminal, Mucosal, or Intramural)
G-22 Filling Defect in a Gastric Remnant
G-23 Lesion Involving the Gastric Fundus (Intrinsic or Extrinsic)
G-24 Gastric Ulceration
G-25 Erosive Gastritis
G-26 Large Gastric Folds (Local or Widespread); Also Thickening of the Stomach Wall on CT, US, or MRI
G-27 Linitis Plastica Pattern of the Stomach (See G-28)
G-28 Narrowing or Deformity of the Gastric Antrum (See G-27)
G-29 Combined Gastric Antral and Duodenal Disease
G-30 Gastric Outlet Obstruction
G-31 Dilatation of the Stomach without Obstruction
G-32 Interstitial Emphysema of the Stomach
G-33 Gastrocolic or Gastroduodenocolic Fistula
G-34 Increased Retrogastric or Retroduodenal Space

DUODENUM

G-35 Extrinsic Indentation on the Duodenum (See G-36)
G-36 Widening of the Duodenal C-Loop (See G-35)
G-37 Solitary Intrinsic Duodenal Mass
G-38 Multiple or Diffuse Filling Defects in the Duodenum
G-39 Diminished or Absent Fold Pattern in the Duodenum and Small Bowel
G-40 Nodular or Thickened Folds in the Duodenum; Also Thickening of the Duodenal Wall on CT, US, or MRI
G-41 Postbulbar Duodenal Ulceration
G-42 Duodenal Narrowing or Obstruction (See G-43, G-44)
G-43 Duodenal Obstruction in an Infant (Double Bubble Sign)
G-44 Superior Mesenteric Artery Syndrome (Band-Like Constriction of Transverse Duodenum)
G-45 Duodenal Dilatation without Obstruction

SMALL BOWEL

G-46 Abnormal Position of Small Bowel Loops
G-47 Separation or Displacement of Small Bowel Loops
G-48 Solitary Mass in the Small Bowel with Preserved Mucosa
G-49-S1 Benign Tumors of the Small Bowel
G-49-S2 Malignant Tumors of the Small Bowel
G-50 Multiple Intraluminal, Mucosal, or Intramural Filling Defects in the Small Bowel
G-51-1 Small Bowel Diverticulum
G-51-2 Small Bowel Pseudodiverticulum
| G-52 | Thickening of the Small Bowel Wall, Generalized or Localized (Barium, US, CT, MRI) |
| G-53 | Mucosal Destruction of the Small Bowel with or without Stricture (Local or Widespread) |
| G-54 | Regular Thickening of Small Bowel Folds (> 3 mm) |
| G-55 | Generalized Irregular or Distorted Small Bowel Folds |
| G-56 | Simultaneous Fold Thickening of the Stomach and Small Bowel |
| G-57 | Malabsorption Pattern in the Small Bowel |
| G-58 | Blind Loop Syndrome |
| G-59 | Small Bowel Dilatation with Thickened Mucosal Fold Pattern |
| G-60 | Small Bowel Dilatation with Normal Fold Pattern |
| G-61 | Acute Nonobstructive Small Bowel Distention (“Paralytic Ileus”) |
| G-62 | Chronic Nonobstructive Small Bowel Distention |
| G-63 | Terminal Ileum Lesion |

**SMALL AND LARGE BOWEL**

| G-64-S | Nondiaphragmatic Hernias |
| G-65 | Abnormalities of Bowel Rotation |
| G-66 | Congenital Syndromes Associated with Intestinal Malrotation |
| G-67 | Aphthoid Ulcers in the Small Bowel or Colon |
| G-68 | Innumerable Tiny Nodules (Sand-like or Granular Lucencies Smaller Than 5 mm) in the Small Bowel or Colon |
| G-69 | Mesenteric Vascular Compromise (Intestinal Ischemia, Infarction) |
| G-70 | Gas in the Bowel Wall (Pneumatosis Intestinalis) |
| G-71-1 | Small and Large Bowel Wall Thickening: Homogeneous (Stratified or Mixed) Attenuation on Postcontrast CT |
| G-71-2 | Small and Large Bowel Wall Thickening: Heterogeneous (Stratified or Mixed) Attenuation on Postcontrast CT |
| G-72-1 | Mild Thickening (<2 cm) of Bowel Wall on Postcontrast CT |
| G-72-2 | Marked Thickening (>2 cm) of Bowel Wall on Postcontrast CT |
| G-73 | Symmetric versus Asymmetric Thickening of Bowel Wall on Postcontrast CT |
| G-74-1 | Focal Bowel Wall Thickening (<10 cm) on Postcontrast CT |
| G-74-2 | Segmental Bowel Wall Thickening (10–30 cm) on Postcontrast CT |
| G-74-3 | Diffuse Bowel Wall Thickening on Postcontrast CT |
| G-75 | Residual Intestinal Barium After Gastrointestinal Study (More Than One Week) |
| G-76 | Intestinal Obstruction in a Newborn |
| G-77 | Intestinal Obstruction in a Child (See G-76) |
G-78 Intestinal Obstruction in an Adult
G-79 Intestinal Pseudo-Obstruction (Ogilvie Syndrome); Bowel Obstruction in the Absence of Mechanical Blockage
G-80 Sentinel Loop (Localized Dilatation of Small and/or Large Bowel)

APPENDIX, COLON, AND RECTUM
G-81 Appendiceal Lesion or Mass Adjacent to Appendix
G-82-S Congenital Anomalies and Variations of the Appendix
G-83 Solitary Filling Defect in the Colon
G-84-S Classification of Colonic Tumors and Tumor-Like Lesions
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Gamut G-1

RETENTION OF BARIUM IN THE HYPOPHARYNX (ESP. CRICOPHARYNGEAL ACHALASIA) (ROENTGEN COUNTERPART OF DYSPHAGIA)

COMMON
1. Connective tissue disease (collagen vascular disease), (esp. scleroderma; dermatomyositis)
2. Cricopharyngeal achalasia (minor to severe muscular incoordination)
3. Esophageal obstruction (eg, achalasia; carcinoma)
4. Muscular disorder (eg, myasthenia gravis; myotonic dystrophy; steroid or thyrotoxic myopathy; oculopharyngeal myopathy)
5. Neurologic disorder (eg, stroke; bulbar or pseudobulbar palsy; bulbar poliomyelitis; high unilateral cervical vagotomy; multiple sclerosis; parkinsonism; amyotrophic lateral sclerosis; syringomyelia; Riley-Day S. (familial dysautonomia); peripheral or central cranial nerve palsy; diphtheria; tetanus)
6. Postradiation therapy for pharyngeal or neck malignancy
7. Zenker’s diverticulum

UNCOMMON
1. Abscess; cellulitis (esp. pharyngeal; peritonsillar)
2. Esophageal web (eg, congenital; Plummer-Vinson S.)
3. Foreign body
4. Hematoma of neck
5. Lymphadenopathy, cervical
6. [Pseudodefect from total laryngectomy]
7. Stricture (eg, lye)
8. Thyroid neoplasm

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut G-2

ESOPHAGEAL MOTILITY DISORDER (APERISTALSIS, TERTIARY CONTRACTIONS, SPASM, AND OTHER FORMS)

COMMON
+*1. Achalasia (cardiospasm) (See G-3)
2. Chalasia (infantile gastroesophageal regurgitation)
3. Cricopharyngeal achalasia
+4. Diffuse esophageal spasm, idiopathic
+*5. Esophagitis (eg, reflux or peptic; radiation; caustic; monilial; herpes; viral)
+6. Neurologic disorder (eg, stroke; peripheral or central cranial nerve palsy; pseudobulbar palsy; bulbar poliomyelitis; syringomyelia; high unilateral cervical vagotomy; multiple sclerosis; parkinsonism; amyotrophic lateral sclerosis; cerebral disease; Riley-Day S. {familial dysautonomia})
+7. Obstructive lesion, extrinsic or intrinsic (eg, Schatzki ring; stricture; esophageal neoplasm; foreign body; web; mediastinal tumor, cyst, or lymphadenopathy; mediastinitis)
+*8. Postsurgical repair of esophageal atresia, tracheoesophageal fistula, or hiatal hernia
+9. Presbyesophagus
*10. Scleroderma
11. Zenker’s diverticulum

UNCOMMON
1. Alcoholic neuropathy
2. Amyloidosis

(continued)
3. Behçet S.
*4. Chagas’ disease
5. Congenital syndromes (eg, Ehlers-Danlos S.; cutis laxa; G syndrome)
*6. Connective tissue disease (collagen vascular disease), other (eg, dermatomyositis; polymyositis; mixed connective tissue disease {MCTD}; lupus erythematosus; rheumatoid arthritis)
*7. Crohn’s disease
+8. Diabetic neuropathy
*9. Drug reaction (atropine; curare; Pro-Banthine)
+10. Hypertensive lower esophageal sphincter
11. Iatrogenic (eg, postvagotomy S.; sclerotherapy for varices)
12. Intramural diverticulosis of esophagus
+13. Muscular disorder, (esp. myasthenia gravis; ocu-
lopharyngeal myopathy; muscular or myotonic dystrophy; steroid or thyrotoxic myopathy)
+14. Neoplasm, infiltrative (eg, diffuse esophageal carcinoma; leukemia)
+15. Nutcracker esophagus
16. Paraneoplastic S.
17. Thyroid disease (myxedema; thyrotoxicosis)
18. Tylosis (keratosis palmaris et plantaris familiaris)
* Esophagus may be aperistaltic.
+ Tertiary contractions often present.

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Gamut G-3

ACHALASIA (CARDIOSPASM)
OF THE ESOPHAGUS

COMMON
1. [Carcinoma, esophageal or gastric]
2. Idiopathic
3. [Stricture from esophagitis]

UNCOMMON
1. Amyloidosis
2. Cerebrovascular accident (stroke)
3. Chagas’ disease
4. Chronic idiopathic intestinal pseudo-obstruction
5. Connective tissue disease (collagen disease)
   (esp. scleroderma)
6. Diabetic neuropathy
7. Drug reaction (esp. atropine; Pro-Banthine)
8. Hypertensive lower esophageal sphincter
9. iatrogenic (eg, vagotomy)
10. Nerve destruction (myenteric plexus, sympathetic, 
or vagus), esp. by neoplasm

[ ] This condition does not actually cause the gamuted imaging finding, 
but can produce imaging changes that simulate it.
**Air in the Esophagus**

**Common**
1. Achalasia (See G-3)
2. Infant respiratory distress syndrome (hyaline membrane disease)
3. Normal
4. Respirator therapy; intubation
5. Scleroderma

**Uncommon**
1. Caustic esophagitis
2. Chagas’ disease
3. Diverticulum, esophageal
4. Gastroesophageal regurgitation, infantile or adult
5. Hypertensive lower esophageal sphincter
6. Obstruction of esophagus (eg, neoplasm of esophagus; mediastinal tumor, cyst, or lymphadenopathy; mediastinitis)
7. Postoperative (eg, esophageal or pulmonary surgery)

**References**
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**Extrinsic Impression on the Cervical Esophagus**

**Common**
1. Cricopharyngeal muscle
2. [Esophageal web]
3. Lymph node enlargement
4. Osteophyte of cervical spine
5. Pharyngeal venous plexus (postcricoid impression)
6. Soft tissue abscess or hematoma (esp. retro-laryngeal)
7. Thyroid mass (eg, goiter; adenoma; carcinoma; thyroiditis)

**Uncommon**
1. Aneurysm or buckling of carotid or innominate artery
2. Cervical spine lesion, other (eg, osteomyelitis; neoplasm; anteriorly herniated disk)
3. Ectopic gastric mucosa
4. Parathyroid tumor (eg, adenoma; carcinoma)
5. [Gastrointestinal stromal tumor (esp. leiomyoma) or lipoma of esophagus]
6. Tracheal or laryngeal neoplasm

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**
EXTRINSIC IMPRESSION ON THE THORACIC ESOPHAGUS

COMMON
1. Cardiac enlargement (esp. left atrium)
2. Duplication cyst (bronchogenic or enteric)
3. Hiatal hernia (esp. paraesophageal)
4. Mediastinal lymphadenopathy (eg, metastasis; lymphoma; tuberculosis; histoplasmosis; sarcoidosis)
5. Mediastinal mass (eg, tumor; cyst; mediastinitis)
6. Normal structure (left main stem bronchus; aortic knob; confluence of left pulmonary veins)
7. Pericardial lesion (eg, effusion; cyst; tumor)
   (See E-43)
8. Pleuropulmonary fibrosis at lung apex, esp. tuberculosis (pseudoimpression)
9. Pulmonary mass (esp. carcinoma of lung)
10. Vascular impression, abnormal (eg, aortic aneurysm or tortuosity; coarctation of aorta; right, cervical, or double aortic arch; truncus arteriosus; aberrant right or left subclavian artery; pulmonary sling) (See G-7)

UNCOMMON
1. Neurinoma of vagus or phrenic nerve
2. Spinal abnormality (eg, kyphosis; scoliosis; osteophyte; DISH; neoplasm; osteomyelitis)
3. Tracheal neoplasm (See B-111, F-81-1)

References

EXTRINSIC VASCULAR IMPRESSION ON THE ESOPHAGUS (See E-18)

COMMON
1. Aberrant right or left subclavian artery
2. Aortic abnormality, acquired (eg, aneurysm; tortuosity)
3. Aortic knob
4. Coarctation of aorta
5. Right aortic arch (esp. posterior or type II aortic arch)

UNCOMMON
1. Anomalous innominate artery
2. Aortic diverticulum
3. APVC, total (below diaphragm)
4. Arteriovenous malformation
5. Azygos or hemiazygos vein dilatation
6. Cervical aortic arch
7. Corrected transposition (medially placed pulmonary artery)
8. Double aortic arch
9. Enlarged “bronchial” artery (incl. truncus arteriosus; absent main pulmonary artery)
10. Pulmonary artery “sling” (anomalous origin of left pulmonary artery)
11. Pulmonary vein confluence draining into back of left atrium
12. Sequestration of lung (anomalous artery from aorta)

References
Gamut G-8

TRACHEOESOPHAGEAL OR ESOPHAGOBRONCHIAL FISTULA

COMMON
1. Carcinoma of esophagus, lung or trachea
2. Congenital, with or without esophageal atresia

UNCOMMON
1. Abscess, pulmonary or mediastinal
2. Actinomycosis
3. Behçet S.
4. Caustic esophagitis (esp. lye)
5. Crohn’s disease
6. Diverticulum of esophagus, perforated
7. Esophageal lung (sequestration)
8. Granulomatous lymphadenitis (esp. histoplasmosis; tuberculosis; syphilis)
9. Infected pulmonary or mediastinal cyst or sequestration of lung
10. Lymphoma
11. Radiation therapy
12. Rupture of esophagus, “spontaneous” or traumatic (eg, foreign body; missile), or iatrogenic (surgery; instrumentation)

References

Gamut G-9

DOUBLE-BARREL ESOPHAGUS*

COMMON
1. Dissecting intramural hematoma or hemorrhage
   a. Severe vomiting (eg, Boerhaave S. with esophageal perforation, or Mallory-Weiss S. with esophageal tear)
   b. Trauma
   c. Instrumentation (eg, nasogastric intubation; endoscopy)
   d. Ingestion of sharp foreign body
   e. Spontaneous (eg, bleeding diathesis)

UNCOMMON
1. Esophageal duplication
2. Crohn’s disease
3. Intraluminal diverticulum
4. Intramural abscess (eg, postendoscopy or foreign body perforation)
5. Intramural pseudodiverticulosis

* Barium opacification of an intramural dissecting channel separated from the normal esophageal lumen by an intervening radiolucent mucosal stripe.

References

G. Gastrointestinal Tract and Abdomen 615
DIVERTICULUM OF THE ESOPHAGUS—UPPER THIRD

COMMON
1. Zenker’s diverticulum (pulsion type, posterior wall)

UNCOMMON
1. Killian-Jamieson diverticulum
2. Lateral pharyngeal pouch (pharyngocele), congenital or acquired (eg, glass blower; trumpet player)
3. Traction diverticulum (esp. after upper lobectomy, laryngectomy, or neck infection)

References

DIVERTICULUM OF THE ESOPHAGUS—MIDDLE THIRD

COMMON
1. Acquired pulsion diverticulum due to esophageal dysmotility
2. Traction diverticulum (esp. from adherent granulomatous lymph node)

UNCOMMON
1. Congenital pulsion diverticulum (interaortico-bronchial)
2. [Neurenteric or duplication cyst, communicating]

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

DIVERTICULUM OF THE ESOPHAGUS—LOWER THIRD

1. Epiphrenic (“lower Zenker’s”)
2. [Mucosal tear, spontaneous (Mallory-Weiss S.) or postinstrumentation]
3. [Penetrating peptic ulcer]
4. Postoperative (eg, for achalasia)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

DIVERTICULA OF THE ESOPHAGUS—DIFFUSE

1. Intramural diverticulosis
2. [Pseudodiverticulosis, esp. with Candida or herpes esophagitis]

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
References

Gamut G-11
SOLITARY INTRAMURAL OR INTRALUMINAL FILLING DEFECT OF THE ESOPHAGUS

COMMON
1. Air bubble; meat impaction; coin; other foreign body
2. Carcinoma of esophagus or stomach
3. Extrinsic lesion invading the esophageal wall (eg, carcinoma of lung; granulomatous lymph node)
4. Gastrointestinal stromal tumor (esp. leiomyoma)
5. Papilloma, squamous
6. Plaque-like lesion (eg, candidiasis—usually multiple) (See G-17)
7. Polyp (eg, adenomatous; fibrovascular; inflammatory esophagogastric)
8. Varix

UNCOMMON
1. Abscess
2. Angioma
3. Duplication cyst (bronchogenic or enteric)
4. Hematoma, intramural
5. Lipoma
6. Lymphoma; leukemia
7. Melanoma
8. Metastasis

Gamut G-12
LOCALIZED CONSTRICTION OR NARROWING OF THE ESOPHAGUS

COMMON
1. Achalasia (cardiospasm)
2. Congenital atresia or stenosis, with or without T-E fistula
3. Duplication cyst (eg, bronchogenic cyst; gastroenteric cyst; neureneric cyst)
4. Extrinsic pressure (eg, aortic knob; left main stem bronchus; aortic aneurysm or tortuosity, right aortic arch) (See G-5 to G-7)
5. Lower esophageal ring (Schatzki ring)
6. Neoplasm, benign (esp. gastrointestinal stromal tumor—leiomyoma; lipoma)
7. Neoplasm, malignant (esp. carcinoma or leiomyosarcoma of esophagus or gastric cardia)
8. Physiologic (muscular ring; inferior esophageal sphincter; normal sling fibers of diaphragm)
9. Postoperative (fundoplication; repair of hiatal hernia or esophageal atresia); postgastrectomy alkaline reflux esophagitis
10. Spasm, localized (eg, lower esophageal spasm)

References

(continued)
11. Stricture (eg, peptic or reflux esophagitis; corrosive esophagitis—lye; oral medication; postradiation; nasogastric intubation; Barrett esophagus; congenital)
12. Web or diaphragm of esophagus

UNCOMMON
1. Benign mucous membrane pemphigoid
2. Cartilaginous ring (tracheobronchial rest)
3. Chronic granulomatous disease of childhood
4. Crohn’s disease
5. Epidermolysis bullosa
6. Graft-versus-host disease
7. Hemorrhage in distal esophagus with adherent thrombus (eg, Mallory-Weiss S.; varices)
8. Hiatal hernia (esp. with short esophagus)
9. Infectious or inflammatory esophagitis (eg, candidiasis; herpes simplex; tuberculosis; histoplasmosis; actinomycosis; syphilis; eosinophilic esophagitis; Behçet S.)
10. Intramural esophageal pseudodiverticulosis
11. Lymphoma
12. Metastasis or direct spread from adjacent malignancy
13. Peptic esophageal ulcer
14. Postinstrumentation stricture (eg, nasogastric intubation; endoscopic perforation)
15. Sclerotherapy of esophageal varices
16. Tylosis (keratosis palmaris et plantaris familiaris)
17. Zollinger-Ellison S.

References

THICKENING OF THE ESOPHAGEAL WALL (CT, US, MRI)

COMMON
1. Carcinoma (squamous cell carcinoma in proximal 4/5; adenocarcinoma in distal fifth)
2. Corrosive esophagitis (eg, lye; oral medication)
3. Duplication cyst (eg, bronchogenic cyst; gastroenteric cyst; neureneric cyst)
4. Infectious or inflammatory esophagitis (eg, candidiasis; herpes simplex; tuberculosis; histoplasmosis; actinomycosis; syphilis; eosinophilic esophagitis; Behçet S.)
5. Metastasis or direct spread from adjacent malignancy
6. Neoplasm, other (esp. gastrointestinal stromal tumor, leiomyoma; leiomyosarcoma; lipoma
7. Postoperative (fundoplication; repair of hiatal hernia or esophageal atresia)
8. Reflux esophagitis (incl. Zollinger-Ellison S.; postgastrectomy alkaline reflux esophagitis)
9. Varices

UNCOMMON
1. Barrett esophagus
2. Benign mucous membrane pemphigoid
3. Chronic granulomatous disease of childhood
4. Crohn’s disease
5. Epidermolysis bullosa
6. Hemorrhage or hematoma involving esophagus
7. [Hiatal hernia (esp. with short esophagus)]
8. Intramural esophageal pseudodiverticulosis
9. Lymphoma
10. Papillomatosis of esophagus
11. Peptic esophageal ulcer with edema
12. Tylosis (keratosis palmaris et plantaris familiaris)

References
ESOPHAGEAL ULCERATION(S)

COMMON
1. Barrett esophagus
2. Carcinoma of esophagus
3. Corrosive esophagitis
4. Drug-induced esophagitis (e.g., potassium chloride; tetracycline; quinidine; ascorbic acid; ferrous sulfate; bromide)
5. Intubation esophagitis
6. Opportunistic esophagitis (esp. *Candida*; herpes; cytomegalovirus)
7. Reflux or peptic esophagitis (e.g., hiatal hernia; vomiting; chalasia; scleroderma; pregnancy; surgery)

UNCOMMON
1. Alcoholic esophagitis, acute
2. Behçet syndrome
3. Benign mucous pemphigoid
4. Eosinophilic esophagitis
5. Epidermolysis bullosa
6. Granulomatous esophagitis (e.g., tuberculosis; histoplasmosis; syphilis; Crohn’s disease)
7. Human immunodeficiency virus (HIV) infection
8. Intramural esophageal pseudodiverticulosis
9. Lymphoma
10. Metastasis
11. Radiation esophagitis
12. Sclerotherapy of esophageal varices

[This condition does not actually cause the gamut imaging finding, but can produce imaging changes that simulate it.]

References

TRANSVERSE MUCOSAL FOLDS IN THE ESOPHAGUS

COMMON
1. Esophagitis (e.g., reflux; candidiasis)
2. Normal (feline esophagus)
3. Scleroderma
4. [Tertiary contractions]

UNCOMMON
1. Achalasia
2. Corrosive esophagitis
3. [Linear transverse ulcerations]

[This condition does not actually cause the gamut imaging finding, but can produce imaging changes that simulate it.]

References
### Gamut G-16

#### WIDESPREAD IRREGULAR OR NODULAR ESOPHAGEAL MUCOSA

**COMMON**
1. [Artifacts (esp. air bubbles)]
2. Corrosive esophagitis
3. Glycogenic acanthosis
4. Intubation esophagitis
5. Opportunistic esophagitis (eg, *Candida*; herpes; cytomegalovirus)
6. Peptic esophagitis (incl. Barrett type)
7. Reflux esophagitis (eg, hiatal hernia; chalasia; scleroderma)
8. Varices

**UNCOMMON**
1. Acanthosis nigricans
2. Behçet S.
3. Carcinoma, superficial spreading type
4. Cowden S. (multiple hamartoma S.)
5. Crohn’s disease
6. Diverticulosis, intramural; pseudodiverticulosis
7. Ectopic sebaceous glands
8. Eosinophilic esophagitis
9. Epidermolysis bullosa
10. Esophagitis cystica
11. [Feline esophagus]
12. Granulomatous esophagitis (eg, tuberculosis; histoplasmosis; syphilis)
13. Hirsute esophagus (‘skin tube’ esophagus created during reconstructive surgery of pharynx and esophagus)
14. Leukoplakia
15. Lymph follicles
16. Lymphoma
17. Papillomatosis of esophagus
18. Pemphigus; bullous pemphigoid
19. Radiation esophagitis
20. Scleroderma

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

### References

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### Gamut G-17

#### ESOPHAGEAL PLAQUES

**COMMON**
1. Candidiasis (moniliasis)

**UNCOMMON**
1. Acanthosis nigricans
2. Barrett esophagus
3. Carcinoma, early or superficial spreading
4. Corrosive esophagitis
5. Crohn’s disease
6. Leukoplakia
7. Reflux esophagitis
8. Tuberculosis
9. Viral esophagitis (herpes; cytomegalovirus)

### References
ESOPHAGEAL VARICES

COMMON
1. Portal hypertension (esp. cirrhosis; portal vein thrombosis; schistosomiasis) (See G-191)
   *2. Superior vena cava obstruction (downhill varices) (esp. bronchogenic carcinoma, mediastinal tumor or fibrosis; retrosternal goiter) (See E-70)

UNCOMMON
1. Arteriovenous malformation
2. Idiopathic
3. Noncirrhotic liver disease (eg, primary or metastatic carcinoma of liver; heart failure)
   *4. Postsurgical (resection of retrosternal tumor)
5. [Varicoid lesions of esophagus (esp. varicoid carcinoma; lymphoma; esophagitis)] (See G-16)

* Varices may be confined to upper esophagus.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

ESOPHAGEAL LESION IN A CHILD

COMMON
1. Atresia
2. Chalasia (infantile gastroesophageal regurgitation)
3. Duplication cyst (enteric; neurenteric; bronchogenic)
4. Esophagitis (corrosive; reflux; peptic; radiation; infectious; intubation; instrumentation)
5. Extrinsic compression (See G-5-7)
6. Foreign body (esp. coin)
7. Hiatal hernia (esp. with short esophagus)
8. Opportunistic esophagitis (eg, Candida; herpes; cytomegalovirus)
9. Postsurgical repair of esophageal atresia, tracheoesophageal fistula, or hiatal hernia
10. Stricture (eg, congenital or secondary to esophagitis)
11. Vascular impression (eg, right aortic arch; double aortic arch; cervical aortic arch; aberrant right or left subclavian artery; pulmonary sling) (See G-7)

UNCOMMON
1. Achalasia
2. Congenital syndromes (eg, Riley-Day S. {familial dysautonomia}; Ehlers-Danlos S.)
3. Diverticulum (See G-10)
4. Epidermolysis bullosa
5. Metastasis
6. Neoplasm, benign or malignant (incl. lymphoma)
7. Pemphigus
8. Peptic ulcer; Barrett esophagus
9. Trauma
10. Varices
11. Web; diaphragm; Schatzki ring

References
ABNORMAL POSITION OF THE STOMACH (ROTATION OR DISPLACEMENT)

COMMON
1. Cascade stomach
2. Displacement by enlarged adjacent organ (eg, liver; spleen; left kidney; pancreas; aorta) or by adjacent mass, or lesser sac abscess or hernia
3. Eventration or paralysis of left hemidiaphragm
4. Hernia (eg, hiatal; paraesophageal; Morgagni; Bochdalek; traumatic; intrapericardial)
5. Inversion of left hemidiaphragm (pleural effusion; thoracic mass)
6. Obesity; emphysema (anterior displacement)

UNCOMMON
1. Absent hemidiaphragm
2. “Upside-down” stomach
3. Volvulus (organoaxial or mesenteroaxial)

REFERENCES

FILLING DEFECT(S) IN THE STOMACH (INTRALUMINAL, MUCOSAL, OR INTRAMURAL)

COMMON
*1. Adenomatous polyp (eg, in chronic atrophic gastritis; familial polyposis of colon; Cronkhite-Canada S.)
*2. [Areae gastricae]
*3. Bezoar
*4. Blood clot; intramural hematoma
5. Carcinoma
6. Ectopic pancreas
7. [Extrinsic mass (eg, from spleen, liver, pancreas, kidney, colon)]
*8. Foreign body (eg, coin)
9. Giant rugal fold; hypertrophied prepyloric antral fold
*10. Hyperplastic polyp
*11. Leiomyoma, other gastrointestinal stromal tumor
*12. Lymphoma
*13. Metastasis (esp. melanoma; Kaposi sarcoma; carcinoma of lung or breast)
*14. Neoplasm, other (eg, carcinoid; tubular adenoma; angioma; lipoma; villous adenoma; plasmacytoma)
*15. Peptic ulcer
16. Postoperative defect (eg, suture granuloma; fundoplication)
17. Sarcoma (esp. leiomyosarcoma)
*18. Varix

UNCOMMON
*1. Amyloidosis
*2. Candidiasis
3. [Double pylorus]
4. Duplication cyst
*5. Fundic gland polyposis
6. Gallstone
7. Granuloma with eosinophils (inflammatory fibroid polyp)
*8. Hamartoma (eg, Peutz-Jeghers S. (alimentary tract polyposis); Cowden S. (multiple hamartoma S.); Ruvalcaba-Myhre-Smith S.)
9. Jejunogastric intussusception
*10. Lymphoid hyperplasia; pseudolymphoma
*11. Parasites (esp. Ascaris; Anisakis)
12. Prolapse of esophageal mucosa
*13. Thickened folds simulating nodules or filling defects (eg, Ménétrier’s disease; Crohn’s disease;...
tuberculosis; sarcoidosis; eosinophilic gastritis
(See G-26)
14. Tumefactive extramedullary hematopoiesis

* May be multiple.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut G-23

LESION INVOLVING THE GASTRIC FUNDUS (INTRINSIC OR EXTRINSIC)

COMMON
1. Bezoar
2. Carcinoma of stomach (adenocarcinoma) or esophagus (squamous cell)
3. Diverticulum of fundus
4. Extragastric malignancy (eg, carcinoma of tail or body of pancreas or splenic flexure of colon; liver, kidney, or adrenal neoplasm; lymphoma, metastases involving adjacent nodes)
5. Extrinsic pressure from normal or enlarged structure (eg, liver; spleen; splenic flexure of colon; left kidney; heart; aortic aneurysm)
6. Giant rugal folds (incl. Ménétrier’s disease)
7. Hiatal hernia with esophagogastrectomy
8. Leiomyoma; neurofibroma; other gastrointestinal stromal tumor; lipoma
9. Lymphoma
10. Peptic ulcer
11. Polyp (esp. hyperplastic or adenomatous)
12. Postsurgical deformity (eg, Nissen repair of hiatal hernia with fundoplication; postsplenectomy)
13. Varices (eg, cirrhosis; schistosomiasis); portal hypertensive gastropathy

(continued)
UNCOMMON
1. Hematoma, intramural or extrinsic
2. Sarcoma (esp. leiomyosarcoma)
3. Splenosis following splenectomy
4. Subphrenic abscess

References

GASTRIC ULCERATION

COMMON
1. Carcinoma of stomach
*2. Gastritis (eg, alcohol; aspirin; anti-inflammatory drugs)
3. Lymphoma
4. Marginal ulcer (postsubtotal gastrectomy)
5. Peptic ulcer

UNCOMMON
1. [Ectopic pancreas (duct)]
2. Carcinoid
3. Chemotherapy (hepatic arterial infusion)
4. Corrosive gastritis
*5. Crohn’s disease
6. Cryptosporidium antritis
7. Eosinophilic gastritis
8. Kaposi sarcoma
9. Ménétrier’s disease (giant hypertrophic gastritis)
10. Metastasis (often bull’s-eye lesion, esp. melanoma)
   (See G-105)
11. Pseudolymphoma
12. Radiation therapy
13. Gastrointestinal stromal tumor (benign or malignant (esp. leiomyoma; leiomyosarcoma; neurofibroma)
14. Suture line ulceration (esp. after gastric surgery for morbid obesity)
15. Tuberculosis

* May cause aphthoid ulcerations.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

EROSIVE GASTRITIS*

COMMON
1. Acute gastritis (eg, alcohol abuse)
2. Crohn’s disease
3. Drugs (eg, aspirin; NSAID; steroids)
4. Helicobacter pylori infection
5. Idiopathic
6. [Normal areae gastricae]
7. Peptic ulcer; hyperacidity

UNCOMMON
1. Corrosive gastritis
2. Cryptosporidium antritis
3. [Lymphoma]
4. Opportunistic infection (eg, candidiasis; herpes simplex; cytomegalovirus)
5. Postoperative gastritis
6. Radiation therapy
7. Zollinger-Ellison S.; multiple endocrine neoplasia (MEN) S.

* Superficial erosions or aphthoid ulcerations seen especially with double contrast technique.

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References

Gamut G-26

LARGE GASTRIC FOLDS (LOCAL OR WIDESPREAD); ALSO THICKENING OF THE STOMACH WALL ON CT, US, OR MRI

COMMON
1. Carcinoma
2. Gastritis (esp. hypertrophic; alcoholic; antral; Helicobacter pylori)
3. Lymphoma
4. Ménétrier’s disease (giant hypertrophic gastritis)
5. Normal variant (hyperrugosity of fundus and greater curvature)
6. Pancreatitis, acute
7. Peptic ulcer disease; hyperacidity
8. Postoperative stomach
9. Varices (eg, cirrhosis; schistosomiasis); portal hypertensive gastropathy

UNCOMMON
1. Amyloidosis
2. Diffuse cystic gastric disease
3. Drug related gastritis (eg, aspirin; NSAID); chemotherapy toxicity
4. [Food retention]
5. Gastritis, other (eg, eosinophilic, corrosive, phlegmonous, or postradiation)
6. Granulomatous infiltration of stomach wall (eg, Crohn’s disease; sarcoidosis; tuberculosis; histoplasmosis; actinomycosis; syphilis)
7. Infectious gastritis, other (eg, botulism; dysentery; diphtheria; candidiasis, cryptosporidiosis or cytomegalovirus—esp. in AIDS)
8. Metastasis; extension from carcinoma of pancreas
9. Neoplasm, other (eg, gastrointestinal stromal tumor—esp. leiomyoma, leiomyosarcoma; carcinoma; Kaposi sarcoma)
10. Parasitic disease (esp. strongyloidiasis; anisakiasis; schistosomiasis with varices)
11. Polyposis of stomach (See G-21, G-106)
12. Pseudolymphoma
13. Zollinger-Ellison S.; multiple endocrine neoplasia (MEN) S. (See J-5)

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References
LINITIS PLASTICA PATTERN OF THE STOMACH (See G-28)

COMMON
1. Carcinoma of stomach
2. Peptic ulcer (acute ulcer with spasm; chronic ulcer with fibrosis)
3. Stenosing antral gastritis

UNCOMMON
1. Amyloidosis
2. Chemotherapy (hepatic arterial infusion)
3. Corrosive gastritis (esp. acids; ferrous sulfate)
4. Eosinophilic gastritis
5. [Extrinsic mass compressing stomach (esp. marked hepatomegaly)]
6. Granulomatous infiltration of stomach wall (eg, Crohn’s disease; sarcomiosis; tuberculosis; histoplasmosis; actinomycosis; syphilis)
7. Idiopathic gastritis
8. Intramural gastric hematoma
9. Lymphoma (esp. Hodgkins disease and non-Hodgkins lymphoma)
10. Metastasis (esp. breast carcinoma); direct extension from carcinoma of pancreas or transverse colon; omental “cakes”
11. Opportunistic infection, esp. in AIDS (eg, cytomegalovirus; Cryptosporidium gastritis)
12. Parasitic disease (eg, strongyloidiasis; schistosomiasis)
13. Perigastric adhesions
14. Phlegmonous gastritis
15. Postoperative (eg, gastroplasty)
16. Postradiation or postfreezing gastritis
17. Pseudolymphoma

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

NARROWING OR DEFORMITY OF THE GASTRIC ANTRUM (See G-27)

COMMON
1. Antral gastritis
2. Carcinoma of stomach
3. Hypertrophic pyloric stenosis (infantile, adult)
4. Pancreatitis; carcinoma of pancreas; pseudocyst
5. Peptic ulcer scarring
6. Prolapse of gastric mucosa or polyp
7. Pylorospasm

UNCOMMON
1. Aberrant pancreatic tissue
2. Adhesions
3. Amyloidosis
4. Antral diaphragm or web
5. Congenital peritoneal bands (Ladd’s bands)
6. Corrosive gastritis
7. Cryptosporidium antritis
8. Duplication cyst of stomach
9. Eosinophilic gastritis
10. Gastroenterostomy
11. Granulomatous disease of infancy (neutrophil dysfunction)
12. Granulomatous infiltration of stomach wall (eg, Crohn’s disease; sarcoidosis; tuberculosis; histoplasmosis; actinomycosis; syphilis)

13. Lymphoma

14. Metastasis

15. Parasitic disease (esp. strongyloidiasis; schistosomiasis; anisakiasis)

16. Peptic ulcer perforation (walled off)

17. Radiation therapy

References

Gamut G-29

COMBINED GASTRIC ANTRAL AND DUODENAL DISEASE

COMMON
1. Carcinoma of stomach extending to involve duodenum
2. Involvement of stomach and duodenum from adjacent malignancy (esp. carcinoma of pancreas) or pancreatitis
3. Lymphoma
4. Peptic ulcer disease (incl. Zollinger-Ellison S.)
5. Prolapse of gastric mucosa, inflamed antral-pyloric fold, or polyp into duodenal bulb

UNCOMMON
1. Crohn’s disease
2. Eosinophilic gastroenteritis
3. Ménétrier’s disease

4. Parasitic disease (eg, strongyloidiasis; schistosomiasis)
5. Tuberculosis

Gamut G-30

GASTRIC OUTLET OBSTRUCTION

COMMON
1. Extrinsic compression (eg, pancreatic, renal, retroperitoneal, duodenal, or colonic lesion)
2. Neoplasm, esp. malignant (eg, carcinoma of gastric antrum or head of pancreas; lymphoma)
3. Peptic ulcer disease (eg, antral, pyloric, or duodenal)
4. [Physiologic (eg, gastric atony with poor peristalsis and emptying; post-drug therapy; gastric distension)] (See G-31)
5. Prepyloric inflammation, scarring or stricture (eg, corrosive gastritis; Crohn’s disease; tuberculosis; sarcoidosis; syphilis; amyloidosis)
6. Pyloric hypertrophy, adult or infantile (hypertrophic pyloric stenosis)
7. Pylorospasm

UNCOMMON
1. Annular pancreas
2. Bezoar
3. Diaphragm or web, antral or duodenal
4. Gastric duplication
5. Hematoma, intramural
6. Intussusception, gastroduodenal
7. Pancreatitis; cholecystitis

(continued)
Gamut G-31

DILATATION OF THE STOMACH
WITHOUT OBSTRUCTION

COMMON
1. Aerophagia; emotional distress; hyperventilation; crying
2. Carbonated beverages; bicarbonate of soda; double contrast; gas pills
3. Coma (uremic or hepatic)
4. Diabetic gastropathy (gastric paresis)
5. Drug therapy (eg, Atropine; morphine; ganglion-blocking agent; Pro-Banthine)
6. Gastritis, acute
7. Iatrogenic (intubation; oxygen tube in esophagus)
8. Immobilization (eg, body cast; paraplegia)
9. Inflammation, acute (eg, pancreatitis; cholecystitis; subphrenic abscess; septicemia)
10. Pain (eg, colic due to renal, ureteral, or biliary stone; porphyria; lead poisoning; sickle cell crisis; migraine)
11. Peritonitis (eg, perforated appendix or peptic ulcer)
12. Postoperative, recent (incl. vagotomy)
13. Small bowel obstruction, proximal
14. Traumatic gastric ileus (eg, spine fracture; ruptured spleen; retroperitoneal hematoma; renal injury)

UNCOMMON
1. Chagas’ disease
2. Electrolyte or acid-base imbalance (eg, hypercalcemia; hypocalcemia; hypokalemia; uremia; insulin shock; diabetic ketoacidosis)
3. Idiopathic
4. Muscular disorder (esp. muscular dystrophy)
5. Myxedema (hypothyroidism)
6. Neurologic disorder (eg, brain tumor; cerebral palsy; bulbar poliomyelitis; tabes dorsalis)
7. Scleroderma; dermatomyositis
8. Tracheoesophageal fistula with esophageal atresia

Gamut G-32

INTERSTITIAL EMPHYSEMA
OF THE STOMACH

COMMON
1. Emphysematous or phlegmonous gastritis (gas-forming organism, esp. in diabetic or alcoholic)
2. Traumatic or iatrogenic emphysema (eg, gastroscopy; intubation; recent surgery; respiratory therapy—esp. PEEP)

UNCOMMON
1. Corrosive gastritis
2. Distention of stomach (eg, bicarbonate of soda; oxygen tube in esophagus) (See G-31)
3. Gastric outlet obstruction (eg, malignancy; volvulus; prepyloric inflammation or stricture) (See G-30)
4. Ischemic gastritis; infarction

References

References
5. Necrotizing gastroenterocolitis
6. Peptic ulcer with intramural perforation
7. Perforated appendicitis
8. Pneumatosis cystoides
9. Pneumomediastinum (eg, from emphysema or asthma)

References

Gamut G-34
INCREASED RETROGASTRIC OR RETRODUODENAL SPACE

COMMON
1. Ascites
2. Hepatomegaly, marked (esp. caudate lobe)
3. Normal variant
4. Obesity
5. Pancreatic mass (esp. carcinoma; pancreatitis; abscess; pseudocyst; cystadenoma) (See G-213, 214)
6. Renal or adrenal mass (eg, renal cell carcinoma (hypernephroma); renal cyst; hydronephrosis; adenoma or carcinoma of adrenal gland; pheochromocytoma; neuroblastoma; Wilms’ tumor; perinephric abscess or hematoma) (See H-38–44, H-118)
7. Retroperitoneal mass (eg, sarcoma; lymphoma g; metastasis; lymphadenopathy; tuberculosis; cyst; abscess; hematoma)

UNCOMMON
1. Actinomycosis
2. Amebic colitis
3. Biliary tract perforation (eg, calculus)
4. Crohn’s disease
5. Diverticulum, perforated (eg, colonic, duodenal)
6. Foreign body
7. Idiopathic
8. Lymphoma g
9. Marginal ulcer
10. Metastatic disease

11. Tuberculosis
12. Typhoid fever

References

Gamut G-33
GASTROCOLIC OR GASTRODUODENOCOLIC FISTULA

COMMON
1. Carcinoma of colon, stomach, pancreas, or kidney
2. Pancreatitis; pancreatic abscess
3. Peptic ulcer, perforated (incl. aspirin or NSAID-induced greater curvature ulcer)
4. Postoperative (eg, gastrostomy; retained sponge)
5. Trauma with gastric, duodenal, or colonic perforation

UNCOMMON
1. Actinomycosis
2. Amebic colitis
3. Biliary tract perforation (eg, calculus)
4. Crohn’s disease
5. Diverticulum, perforated (eg, colonic, duodenal)
6. Foreign body
7. Idiopathic
8. Lymphoma g
9. Marginal ulcer
10. Metastatic disease

(continued)
5. Postoperative
6. Retroperitoneal edema, cellulitis, urinary leakage
7. Retroperitoneal fibrosis

Reference

Gamut G-35

EXTRINSIC INDENTATION
ON THE DUODENUM (See G-36)

COMMON
1. Coloduodenal apposition
2. Colon lesion (esp. carcinoma of hepatic flexure or transverse colon; amebic pericolic abscess or ameboma)
3. Common duct dilatation or neoplasm (See G-130, G-134)
4. Duodenal diverticulitis or abscess (esp. with giant duodenal diverticulum)
5. Gallbladder, normal or enlarged (eg, hydrops; carcinoma; “Courvoisier gallbladder”)
6. Hematoma, intramural or mesenteric
7. Hepatic enlargement (esp. caudate lobe) (eg, liver abscess; hepatocellular carcinoma {hepatoma} (See G-141)
8. Renal or adrenal mass (eg, renal cell carcinoma {hypernephroma}; renal cyst; hydronephrosis; adenoma or carcinoma of adrenal gland; pheochromocytoma; neuroblastoma; Wilms’ tumor; perinephric abscess or hemATOMA) (See H-38–44, 118)
9. Lymph node enlargement (eg, metastasis; lymphoma; tuberculosis)
10. Pancreatic mass (eg, carcinoma; pseudocyst; pancreatitis; abscess; annular pancreas) (See G-213, 214)
11. Papilla of Vater enlargement (See G-138)
12. [Postbulbar peptic ulcer]
13. Retroperitoneal mass (eg, sarcoma; lymphadenopathy; abscess; cyst)
14. Superior mesenteric artery compression (See G-44)

UNCOMMON
1. Aortic aneurysm
2. Choledochal cyst
3. Congenital peritoneal bands (Ladd’s bands)
4. Gastric neoplasm (esp. leiomyosarcoma; carcinoma)
5. Idiopathic
6. Mesenteric or celiac artery collaterals
7. Pericholecystic abscess
8. Varices, duodenal or retroperitoneal

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

Gamut G-36

WIDENING OF THE DUODENAL C-LOOP (See G-35)

COMMON
1. Normal variant
2. Pancreatic mass (eg, acute or chronic pancreatitis; abscess; pseudocyst; carcinoma; cystadenoma; cystadenocarcinoma) (See G-213, 214)

UNCOMMON
1. Aortic aneurysm
2. Choledochal cyst
3. Duodenal diverticulitis
4. Duodenal hematoma
5. Gastrointestinal stromal tumor of duodenum (esp. leiomyosarcoma)
6. Mesenteric or celiac artery collaterals
7. Mesenteric or omental mass (eg, metastasis; hematoma; cystic lymphangioma)
8. Neoplasm of stomach, colon, or kidney (esp. with spread to head of pancreas)
9. Parasitic disease (eg, strongyloidiasis; amebiasis with pericolic abscess)
10. Retroperitoneal lymphadenopathy (eg, metastasis; lymphoma; tuberculosis; sarcoidosis)
11. Retroperitoneal cyst or neoplasm, primary or metastatic

Reference

Gamut G-37
SOLITARY INTRINSIC DUODENAL MASS

COMMON
1. Ectopic pancreas
2. Metastasis (esp. hypernephroma; melanoma)
3. Neoplasm, primary (Brunner’s gland adenoma; leiomyoma; neurofibroma; lipoma; myxoma; hamartoma; hemangioma; lymphangioma; islet cell tumor; carcinoid; villous adenoma)
4. Normal variant (eg, redundant duodenal fold; flexure “defect”; normal papilla of Vater)
5. Pancreatic lesion, attached or invading (esp. carcinoma of pancreas; pancreatitis; pseudocyst) (See G-213, 214)
6. Papilla of Vater enlargement (See G-138)
7. Peptic ulcer with edema or deformity
8. Polyp
9. Prolapsed gastric mucosa or polyp

UNCOMMON
1. Abscess, juxtaduodenal
2. Blood clot
3. Carcinoma of duodenum or ampulla
4. Cyst (eg, duplication; choledochal—choledochocele)
5. Foreign body in lumen (eg, fruit pit)
6. Gallstone impaction at papilla
7. Intraluminal diverticulum
8. Intramural hematoma
9. Intussusception, gastroduodenal
10. Lymphoma
11. Mesenteric or celiac artery collateral
12. Parasite (eg, Ascaris)
13. Postoperative defect; stitch abscess; prolapsed gastrostomy tube
14. Sarcoma (gastrointestinal stromal tumor; esp. leiomyosarcoma; Kaposi sarcoma)
15. Varix

References

Gamut G-38
MULTIPLE OR DIFFUSE FILLING DEFECTS IN THE DUODENUM

COMMON
1. Brunner’s gland hyperplasia
2. Heterotopic gastric mucosa
3. Metastases (esp. malignant melanoma)
4. Nodular, thickened, or edematous folds (incl. nonerosive duodenitis) (See G-40)
5. Prolapsed gastric mucosa

(continued)
**Gamut G-39**

**UNCOMMON**
1. Ascariasis
2. Blood clots
3. Crohn’s disease (cobblestone pattern)
4. Cronkhite-Canada S.
5. Foreign bodies in lumen (eg, fruit pits)
6. Lymphoma; Kaposi sarcoma; other bull’s-eye lesions (See G-105)
7. Mastocytosis
8. Mesenteric or celiac artery collaterals
9. Nodular lymphoid hyperplasia (esp. in dysgammaglobulinemia)
10. Polyps (adenomatous or hamartomatous)
11. Varices

**Reference**

**Gamut G-40**

**NODULAR OR THICKENED FOLDS IN THE DUODENUM; ALSO THICKENING OF THE DUODENAL WALL ON CT, US, OR MRI**

**COMMON**
1. Brunner’s gland hyperplasia
2. Cystic fibrosis (mucoviscidosis)
3. Duodenitis
4. Edema (eg, hypoproteinemia; cirrhosis; nephrotic S.; uremia; chronic dialysis; angioneurotic edema; heart failure)
5. Metastatic disease or direct invasion from adjacent neoplasm (esp. carcinoma of pancreas, stomach, or colon)
6. Normal variant
7. Pancreatitis, acute or chronic
8. Parasitic disease (esp. giardiasis; strongyloidiasis; hookworm disease; intestinal capillariasis)
9. Peptic ulcer disease
10. Zollinger-Ellison S.; multiple endocrine neoplasia (MEN) S. (See J-5)

**UNCOMMON**
1. AIDS-related infection (eg, Cryptosporidium; cytomegalovirus; atypical mycobacterial infection) or neoplasm (eg, Kaposi sarcoma; lymphoma)
2. Amyloidosis
3. Cholecystitis
4. Corrosive disease
5. Crohn’s disease
6. Cronkhite-Canada S.
7. Drug therapy (eg, Pro-Banthine); chemotherapy toxicity
8. Duodenal diverticulitis
9. Ectopic gastric mucosa
10. Eosinophilic enteritis
11. Intestinal lymphangiectasia
12. Intramural hemorrhage (eg, trauma; hemophilia or other bleeding disorder; anticoagulant therapy)
13. Ischemia; vasculitis (eg, connective tissue disease (collagen vascular disease)); Henoch-Schönlein purpura
14. Neoplasm, primary (eg, carcinoma; lymphoma; Kaposi sarcoma; gastrointestinal stromal tumor — esp. leiomyoma, leiomyosarcoma, or neurofibroma; lipoma; carcinoid)
15. Mastocytosis
16. Ménétrier’s disease
17. Mesenteric or celiac artery collaterals following occlusion of main trunks
18. Nodular lymphoid hyperplasia (esp. in dysgammaglobulinemia)
19. Postoperative
20. Radiation injury, acute or chronic
21. Sprue; celiac disease
22. Tuberculosis
23. Varices
24. Whipple’s disease

References

Gamut G-41

POSTBULBAR DUODENAL ULCERATION

COMMON
1. [Diverticulum]
2. Neoplasm, malignant, extrinsic (eg, invasion from pancreas, colon, right kidney, or gallbladder)
3. Peptic ulcer
4. Zollinger-Ellison S.

UNCOMMON
1. Aorticoduodenal fistula (esp. aortic graft)
2. Carcinoma of duodenum
3. Ectopic pancreas
4. Fistula, duodenocolic or other (See G-107)
5. Gastrointestinal stromal tumor (esp. leiomyoma; leiomyosarcoma; neurofibroma)
6. Granulomatous disease (eg, Crohn’s disease; tuberculosis)
7. Intramural duodenal pseudodiverticulosis
8. Lymphoma
9. Metastasis (eg, melanoma; Kaposi sarcoma)
10. Parasitic disease (eg, strongyloidiasis)

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it

References
DUODENAL NARROWING OR OBSTRUCTION (See G-43, 44)

COMMON
1. Congenital atresia, esp. with trisomy 21 S. (Down S.), stenosis, diaphragm or web
2. Extrinsic mass (eg, mesenteric or para-aortic lymphadenopathy; invasive neoplasm from pancreas, kidney, or colon; aortic aneurysm; choledochal cyst)
3. Pancreatitis, acute or chronic; pseudocyst
4. Postbulbar duodenal ulcer or scar
5. Superior mesenteric artery syndrome (See G-44)

UNCOMMON
1. Adhesions
2. Annular pancreas
3. Aorticoduodenal fistula
4. Cholecystitis
5. Congenital peritoneal bands (Ladd’s bands)
6. Duplication cyst
7. Gallstone impaction
8. Hematoma (intramural or extrinsic)
9. Inflammatory disease of duodenum (eg, Crohn’s disease; tuberculosis; strongyloidiasis; giardiasis with spasm)
10. Internal hernia (eg, paraduodenal)
11. Intraluminal diverticulum
12. Midgut volvulus with malrotation
13. Neoplasm of duodenum, primary (esp. carcinoma; leiomyosarcoma) or metastatic; also Burkitt lymphoma
14. Preduodenal portal vein
15. Prolapsed gastric lesion (eg, polyp G)
16. Pseudo-obstruction, idiopathic
17. Stricture (eg, traumatic; radiation)

DUODENAL OBSTRUCTION IN AN INFANT (DOUBLE BUBBLE SIGN)

COMMON
1. Annular pancreas
2. Congenital peritoneal bands (Ladd’s bands)
3. Duodenal atresia or stenosis, esp. with trisomy 21 S. (Down S.)
4. Midgut volvulus with malrotation

UNCOMMON
1. Choledochal cyst
2. Diaphragm or web; intraluminal diverticulum
3. Duplication cyst
4. Intramural hematoma
5. Preduodenal portal vein
6. Retroperitoneal tumor (eg, teratoma) or lymphadenopathy

References
SUPERIOR MESENTERIC ARTERY SYNDROME
(BAND-LIKE CONSTRICTION OF TRANSVERSE DUODENUM)

COMMON
1. Immobilization or prolonged bed rest (eg, postsurgery; severe burn; body cast)
2. Normal variant
3. Pancreatic mass; pancreatitis
4. Scleroderma; dermatomyositis; lupus erythematosus
5. Severe weight loss with loss of retroperitoneal fat

UNCOMMON
1. Adhesions; congenital peritoneal bands (Ladd’s bands)
2. Aortic aneurysm; postrepair aorticoduodenal fistula
3. Chronic idiopathic intestinal pseudo-obstruction
4. Internal hernia, paraduodenal
5. Loss of abdominal muscle tone (eg, multiple pregnancies)
6. Retroperitoneal inflammatory or neoplastic disease
7. Small vascular (aortomesenteric) angle
8. Thickening of root of mesentery (eg, Crohn’s disease; pancreatitis; tuberculosis; metastatic disease; other lymphadenopathy)

DUODENAL DILATATION WITHOUT OBSTRUCTION

COMMON
1. Drug therapy (eg, Pro-Banthine; atropine; morphine; Lomotil)
2. Idiopathic
3. Ileus, localized (eg, acute pancreatitis; cholecystitis; peptic ulcer disease; severe trauma or burn)
4. Immobilization (eg, body cast; burn; paraplegia)
5. Normal variant
6. Postoperative (incl. vagotomy)
7. Scleroderma; dermatomyositis; lupus erythematosus

UNCOMMON
1. Chagas’ disease (aganglionosis)
2. Diabetes (incl. acidosis; coma; insulin shock)
3. Emotional state alteration; hyperventilation; aerophagia
4. Pain (eg, lead colic; tabetic crisis; porphyria)
5. Sprue; other malabsorption syndromes
6. Thiamine deficiency neuropathy
7. Zollinger-Ellison S.

ABNORMAL POSITION OF SMALL BOWEL LOOPS

COMMON
1. Anterior abdominal hernia (eg, umbilical; ventral; postoperative incisional)
2. Inguinal or femoral hernia

(continued)
3. Lesser sac hernia
4. Malrotation (incl. midgut volvulus)
5. Paraduodenal hernia (right or esp. left)

**UNCOMMON**
1. Diaphragmatic hernia
2. Internal hernias (pericecal; small bowel mesentery; sigmoid mesentery; pelvic [broad ligament])
3. Obturator hernia (esp. on right)
4. Omphalocele; Cantrell S.
5. Spigelian hernia

References

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**Gamut G-47**

**SEPARATION OR DISPLACEMENT OF SMALL BOWEL LOOPS**

**COMMON**
1. Abscess, intraperitoneal (eg, appendiceal; diverticular; interloop)
2. Adhesions
3. Ascites or other peritoneal fluid (eg, cirrhosis; congestive heart failure; peritoneal carcinomatosis)
4. Bladder enlargement
5. Crohn’s disease
6. Intestinal neoplasm, primary (eg, carcinoid or carcinoma of small bowel)
7. Lymphadenopathy in mesentery or retroperitoneum
8. Mesenteric mass (eg, cyst; leiomyosarcoma; lipomatosis; lymphangioma) (See G-228, 229)
9. Metastatic disease to mesentery, bowel, peritoneum, or retroperitoneal nodes
10. Neoplasm or cyst in abdomen, pelvis or retroperitoneum, other (eg, gastrointestinal stromal tumor; ovarian cyst or tumor; retroperitoneal sarcoma; renal mass; pancreatic pseudocyst; hydatid cyst; mesothelioma; plexiform neurofibroma)
11. Peritonitis (eg, bacterial; tuberculous; typhoid fever)
12. Postoperative (eg, resection)

**UNCOMMON**
1. Amyloidosis
2. Graft-versus-host disease
3. Hematoma or hemorrhage (trauma or bleeding disorder involving abdominal wall, mesentery, or bowel wall)
4. Hernia (internal; retroperitoneal)
5. Lymphoma
6. Mesenteric infarction
7. Mesenteritis (eg, retractile); Weber-Christian disease
8. Radiation enteritis
9. Tuberculosis
10. Whipple’s disease

References

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**Gamut G-48**

**SOLITARY MASS IN THE SMALL BOWEL WITH PRESERVED MUCOSA**

**COMMON**
1. Benign neoplasm (eg, adenoma; angioma; hamartoma; lipoma; leiomyoma, neurofibroma or other gastrointestinal stromal tumor)
2. Carcinoid (esp. in ileum)
3. Food particle; fruit pit; bezoar; enterolith; pill; foreign body
4. Polyp (eg, adenomatous; hamartomatous; inflammatory fibroid)
UNCOMMON
1. Carcinoma, early or atypical (usually destroys mucosa)
2. Cyst (eg, duplication)
3. Endometrial implant
4. Gallstone
5. Heterotopic gastric mucosa; ectopic pancreas
6. Intraluminal diverticulum
7. Intramural hematoma; blood clot
8. Inverted Meckel’s diverticulum
9. Lymphoma
10. Meconium ileus (cystic fibrosis {mucoviscidosis})
11. Metastasis (esp. melanoma)
12. Parasite (eg, Ascaris bolus; tapeworm—Taenia aginata or T. solium; Anisakis with ileocecal phlegmon)
13. Sarcoma (eg, leiomyosarcoma; Kaposi sarcoma)
14. Varix

Reference

Gamut G-49-S1
BENIGN TUMORS OF THE SMALL BOWEL
1. Adenoma
2. Carcinoid
3. Fibroma
4. Gastrointestinal stromal tumor (esp. leiomyoma; neurofibroma)
5. Hamartoma (Peutz-Jeghers S.)
6. Hemangioma; lymphangioma
7. Lipoma

References
2. Good CA: Tumors of the small intestine. AJR 1963; 89:685–705

Gamut G-49-S2
MALIGNANT TUMORS OF THE SMALL BOWEL
1. Adenocarcinoma
2. Carcinoid
3. Gastrointestinal stromal tumor (esp. leiomyosarcoma)
4. Kaposi sarcoma
5. Lymphoma
6. Metastasis (esp. melanoma)

References
2. Good CA: Tumors of the small intestine. AJR 1963; 89:685–705

Gamut G-50
MULTIPLE INTRALUMINAL, MUCOSAL, OR INTRAMURAL FILLING DEFECTS IN THE SMALL BOWEL
COMMON
1. Brunner’s gland hyperplasia (duodenum)
2. Food particles; seeds; foreign bodies; pills
3. Meconium ileus (cystic fibrosis {mucoviscidosis})
4. Metastases (esp. melanoma; carcinoma of breast, lung, or ovary; Kaposi sarcoma)
5. Nodular lymphoid hyperplasia (esp. in dysgammaglobulinemia)
6. Parasites (ascarids; tapeworms—Taenia saginata)
7. Polyposis syndromes (esp. Peutz-Jeghers S.; Gardner S.; Cronkhite-Canada S.) (See G-106)

(continued)
UNCOMMON
1. Amyloidosis
2. Behçet S.
3. Benign neoplasms (eg, hemangiomas; lipomas; leiomyomas, neurofibromas and other gastrointestinal stromal tumors)
4. Blood clots
5. Carcinoids
6. Crohn’s disease (cobblestone pattern)
7. Gallstones
8. Hyperplastic Peyer’s patches in ileum (typhoid fever)
9. Lymphoma
10. Mastocytosis (duodenum)
11. Varices

References

SMALL BOWEL DIVERTICULUM

COMMON
1. Duodenal diverticulum

UNCOMMON
1. Diverticulosis of small bowel (esp. jejunal diverticulosis)
2. Giant duodenal diverticulum
3. Jejunal diverticulum
4. Ileal diverticulum
5. Meckel’s diverticulum

Reference

SMALL BOWEL PSEUDODIVERTICULUM

COMMON
1. Chronic duodenal ulcer disease with pseudodiverticular outpouchings
2. Crohn’s disease (pseudodiverticula; fistulae)

UNCOMMON
1. Communicating ileal duplication
2. [Giant duodenal ulcer]
3. Intraluminal duodenal diverticulum
4. [Lymphoma (“aneurysmal” dilatation)]
5. Scleroderma

[] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

Reference

THICKENING OF THE SMALL BOWEL WALL, GENERALIZED OR LOCALIZED (BARIUM, US, CT, MRI)

COMMON
1. Crohn’s disease
2. Edema (eg, heart failure; constrictive pericarditis; angioneurotic edema; portal hypertension)
3. Eosinophilic enteritis; amyloidosis (fold thickening may be regular in early stages of these diseases)
4. Hemorrhage, intramural (eg, trauma; anticoagulant therapy; hemophilia; other bleeding or clotting disorders; vasculitis; Henoch-Schönlein purpura)
5. Hypoproteinemia (eg, cirrhosis; Budd-Chiari S.; nephrosis; malnutrition; burn; dysproteinemia)
6. Intestinal lymphangiectasia, primary or secondary (eg, mesenteric neoplasm)
7. Ischemic bowel disease or infarction (eg, atherosclerosis; thromboembolism; vasculitis; polyarteritis nodosa; hypotension)
8. Metastatic disease (esp. malignant melanoma; carcinoma of breast, lung or ovary; Kaposi sarcoma)
9. Neoplasm, primary (eg, carcinoma; carcinoid; lipoma; gastrointestinal stromal tumor — leiomyoma; leiomyosarcoma)
10. Opportunistic infection, esp, in AIDS (eg, Cryptosporidium; Campylobacter fetus [jejuni]; Candida; Mycobacterium avium-intracellulare; cytomegalovirus)
11. Parasitic disease (giardiasis; strongyloidiasis; intestinal capillarisis; hookworm disease; schistosomiasis); terminal ileum — amebiasis; anisakiasis; angiostrongyliasis costaricensis
12. Peptic ulcer; Zollinger-Ellison S.; multiple endocrine neoplasia (MEN) S. (See J-5)

UNCOMMON
1. A-beta-lipoproteinemia
2. Alpha chain disease
3. Amyloidosis
4. Behçet disease
5. Cystic fibrosis (mucoviscidosis)
6. Enterocolitis (eg, typhoid fever; Yersinia)
7. Eosinophilic enteritis
8. Graft-versus-host disease
9. Infections, other (eg, *E. coli*; *Vibrio*; histoplasmosis)
10. Interloop abscess
11. Intestinal lymphangiectasia, primary or secondary (eg, mesenteric neoplasm)
12. Lymphoma, leukemic infiltration; pseudolymphoma
13. Mastocytosis
14. Menetrier’s disease (stomach and duodenum)
15. Pancreatitis
16. Radiation enteropathy, acute or chronic
17. Tuberculous enteritis or peritonitis

18. Waldenström’s macroglobulinemia
19. Whipple’s disease
20. Xanthomatosis

**References**

**G. Gastrointestinal Tract and Abdomen**

**Gamut G-53**

**MUCOSAL DESTRUCTION OF THE SMALL BOWEL WITH OR WITHOUT STRicture (LOCAL OR WIDESPREAD)**

**COMMON**
*1. Crohn’s disease; other nonspecific enteritis
*2. Lymphoma

**UNCOMMON**
1. [Abscess, interloop]
2. [Adhesions]
*3. Amyloidosis
4. Carcinoid
5. Carcinoma
*6. Eosinophilic enteritis

(continued)
7. Fungus disease (eg, histoplasmosis; actinomycosis)
8. Mastocytosis
9. Metastatic disease (esp. from melanoma; carcinoma of breast, lung, ovary, uterus, pancreas, or GI tract)
10. Pancreatitis
11. Parasitic disease (giardiasis; strongyloidiasis; intestinal capillariasis; hookworm disease; schistosomiasis; also amebiasis, anisakiasis, angiostrongyliasis costaricensis in terminal ileum)
12. Potassium enteritis
13. Radiation enteritis
14. Sarcoma (eg, leiomyosarcoma; Kaposi sarcoma)
15. Scleroderma
16. Tuberculosis
17. Typhoid fever
18. Ulcerative colitis (“backwash ileitis”)
19. Vascular occlusion; ischemia
20. Yersinia enterocolitis

* May be widespread.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut G-54

REGULAR THICKENING OF SMALL BOWEL FOLDS (> 3 mm)

1. Angioneurotic edema
2. Eosinophilic enteritis; amyloidosis (fold thickening may be regular in early stages of these diseases)
3. Heart failure; constrictive pericarditis
4. Hypoproteinemia (eg, cirrhosis; Budd-Chiari S.; nephrosis; malnutrition; burn; dysproteinemia; A-beta-lipoproteinemia)
5. Hemorrhage, intramural (eg, trauma; anticoagulant therapy; hemophilia; other bleeding or clotting disorder; vasculitis; Henoch-Schönlein purpura)
6. Infection (eg, giardiasis; typhoid fever)
7. Intestinal lymphangiectasia, primary or secondary (eg, mesenteric neoplasm)
8. Ischemic bowel disease or infarction (eg, atherosclerosis; thromboembolism; vasculitis; polyarteritis nodosa; hypotension)
9. Radiation enteropathy
10. Xanthomatosis

References

Gamut G-55

GENERALIZED IRREGULAR OR DISTORTED SMALL BOWEL FOLDS

COMMON
1. Crohn’s disease
2. Opportunistic infection, esp, in AIDS (eg, Cryptosporidium, Candida, Mycobacterium avium-intercellulare, cytomegalovirus)
3. Parasitic disease (giardiasis; strongyloidiasis; intestinal capillariasis; hookworm disease; schistosomiasis); terminal ileum—amebiasis; anisakiasis; angiostrongyliasis costaricensis
4. Peptic ulcer; Zollinger-Ellison S.; multiple endocrine neoplasia (MEN) S. (See J-5)

**UNCOMMON**
1. A-beta-lipoproteinemia
2. Alpha chain disease
3. Amyloidosis
4. Cystic fibrosis (mucoviscidosis)
5. Enterocolitis (eg, typhoid fever; *Yersinia*)
6. Eosinophilic enteritis
7. Infections, other (eg, *Campylobacter fetus* [jejuni]; *Shigella*; *E. coli*; *Vibrio*; histoplasmosis)
8. Interloop abscess
9. Intestinal lymphangiectasia, primary or secondary (eg, mesenteric neoplasm)
10. Lymphoma; pseudolymphoma
11. Mastocytosis
12. Ménétrier’s disease (stomach and duodenum)
13. Pancreatitis
14. Radiation injury, acute or chronic
15. Tuberculous enteritis or peritonitis
16. Waldenström’s macroglobulinemia
17. Whipple’s disease

**References**

**Gamut G-56**

**SIMULTANEOUS FOLD THICKENING OF THE STOMACH AND SMALL BOWEL**

**COMMON**
1. Crohn’s disease
2. Zollinger-Ellison S.; peptic ulcer disease

**UNCOMMON**
1. Amyloidosis
2. Eosinophilic gastroenteritis
3. Gastric varices with hypoproteinemia
4. Lymphoma; pseudolymphoma
5. Ménétrier’s disease
6. Opportunistic infection, esp. in AIDS (eg, *Cryptosporidium*; *Candida*; *Mycobacterium avium-intercellulare*; cytomegalovirus)
7. Pancreatitis
8. Parasitic disease (eg, strongyloidiasis; schistosomiasis; anisakiasis)
9. Tuberculosis
10. Whipple’s disease

**Reference**

**Gamut G-57**

**MALABSORPTION PATTERN IN THE SMALL BOWEL**

**COMMON**
1. Blind loop S. (See G-58)
2. Crohn’s disease
3. Cystic fibrosis (mucoviscidosis)
4. Pancreatic disease (insufficiency; chronic pancreatitis; carcinoma; gastrinoma)

*(continued)*
5. Parasitic disease (giardiasis; hookworm disease; strongyloidiasis; schistosomiasis japonica; intestinal capillariasis)
6. Postoperative (eg, postgastrectomy steatorrhea; gastroileostomy; short bowel S.; pancreatectomy)
7. Sprue, tropical or nontropical (celiac disease)
8. Steatorrhea, idiopathic

**UNCOMMON**
1. A-beta-lipoproteinemia
2. Acrodermatitis enteropathica
3. Acute bacterial infection
4. AIDS
5. Allergy (eg, angioneurotic edema)
6. Amyloidosis
7. Bile duct obstruction
8. Carcinoid syndrome
9. Chronic granulomatous disease of childhood
10. Cronkhite-Canada S.
11. Diabetes
12. Disaccharidosis (eg, lactase deficiency)
13. Drug therapy (eg, antimetabolites)
14. Ehlers-Danlos S.
15. Emotional states; anorexia nervosa
16. Eosinophilic gastroenteritis
17. Fistula (See G-107)
18. Henoch-Schönlein purpura
19. Hepatobiliary disease (eg, biliary cirrhosis; biliary atresia)
20. Hypoparathyroidism
21. Hypopituitarism
22. Hypothyroidism (cretinism); hyperthyroidism
23. Immunologic disorder
24. Intestinal lymphangiectasia
25. Ischemia of intestine, chronic
26. Jejunal diverticulosis
27. Johanson-Blizzard S.
28. Lymphoma
29. Mastocytosis
30. Metastases, peritoneal
31. Multiple endocrine neoplasia (MEN) S. (eg, gastrinoma; pancreatic non-beta islet cell tumor (VIPoma) or hyperplasia) (See J-5)
32. Nephrotic syndrome
33. Nutritional deficiency (kwashiorkor; pellagra)
34. Protein-losing enteropathy
35. Radiation gastroenteritis
36. Scleroderma; dermatomyositis
37. Tuberculous peritonitis
38. Waldenström’s macroglobulinemia; alpha chain disease
39. Whipple’s disease
40. Wolman’s disease (familial xanthomatosis)
41. Zollinger-Ellison S.

**References**

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**BLIND LOOP SYNDROME**

**COMMON**
1. Postoperative (eg, side-to-side anastomosis; gastroileostomy; bypass procedure; short bowel syndrome)
2. Small bowel stricture with proximal dilatation

**UNCOMMON**
1. Diverticulosis of small bowel (esp. jejunum)
2. Duplication of intestine
3. Meckel’s diverticulum, large
4. Sluggish transit (eg, myxedema; cretinism; scleroderma)

Reference

Gamut G-59

SMALL BOWEL DILATATION WITH THICKENED MUCOSAL FOLD PATTERN

COMMON
1. Crohn’s disease
2. Infectious enteritis, esp. in AIDS (eg, cryptosporidiosis; cytomegalovirus; Candida; Salmonella; Mycobacterium avium-intracellulare)
3. Mesenteric infarction (venous or embolic arterial) or advanced ischemia (atherosclerosis)
4. Metastatic disease to bowel wall or mesentery
5. Zollinger-Ellison S.

UNCOMMON
1. A-beta-lipoproteinemia; A-alpha-lipoproteinemia
2. Amyloidosis
3. Compensatory dilatation of remaining bowel after extensive small bowel resection
4. Hypoalbuminemia (eg, cirrhosis; nephrotic S.)
5. Lymphoma
6. Parasitic disease (eg, thickened folds with malabsorption and dilated loops can be seen in strongyloidiasis, hookworm disease, intestinal capillariasis, and schistosomiasis japonica)
7. Radiation enteritis
8. Tropical sprue
9. Tuberculosis

Reference

Gamut G-60

SMALL BOWEL DILATATION WITH NORMAL FOLD PATTERN

COMMON
1. Adynamic (“paralytic”) ileus
2. Drug effect (esp. anticholinergics)
3. Mechanical obstruction
4. Mesenteric ischemia (eg, atherosclerosis; lupus erythematosus)
5. Postvagotomy; gastrectomy (dumping syndrome)
6. Sprue (esp. nontropical); celiac disease; other malabsorption syndromes (See G-57)

UNCOMMON
1. Amyloidosis
2. Chagas’ disease
3. Chronic idiopathic intestinal pseudo-obstruction
4. Hypokalemia (esp. in diabetic)
5. Lactase deficiency
6. Scleroderma; dermatomyositis

References

Gamut G-61

ACUTE NONOBSTRUCTIVE SMALL BOWEL DISTENTION (“PARALYTIC ILEUS”)

COMMON
1. Drug effect (eg, atropine; morphine; barbiturates; Lomotil; Pro-Banthine; hexamethonium; L-dopa)
2. Electrolyte imbalance (eg, hypokalemia; hypochloremia; calcium or magnesium abnormality)

(continued)
3. Gastroenteritis, acute; food poisoning
4. Pain in abdomen (eg, renal, ureteral, or common bile duct stone; torsion of uterine fibroid or ovarian cyst or tumor; lead colic; sickle cell crisis; tabetic crisis; porphyria)
5. Peritonitis, acute
6. Pneumonia; other acute thoracic disease (eg, myocardial infarction; heart failure)
7. Postoperative (abdominal or pelvic surgery)
8. Retroperitoneal hemorrhage
9. “Sentinel loop,” localized ileus (eg, acute cholecystitis; appendicitis; acute pancreatitis; acute diverticulitis) (See G-80)
10. Shock; gram-negative septicemia; hypoxia
11. Trauma (esp. spine or lower rib; abdominal contusion; intramural hematoma)
12. Vascular occlusion (eg, mesenteric infarction)

UNCOMMON
1. Adrenal insufficiency
2. Aerophagia; assisted respiration
3. Ceroidosis (malabsorption with prolonged vitamin E depletion)
4. Chronic idiopathic intestinal pseudo-obstruction
5. Diabetic acidosis; insulin shock
6. Enterocolitis (eg, typhoid fever; Yersinia)
7. Hypoparathyroidism
8. Hypothyroidism
9. Interloop abscess
10. Myotonic dystrophy; muscular dystrophy
11. Neonatal dynamic ileus (eg, septicemia; hypoxia-induced vasculitis; infantile respiratory distress S.; intestinal infection; peritonitis; mesenteric thrombosis)
12. Neonatal necrotizing enterocolitis
13. Renal failure; uremia; acute glomerulonephritis
14. Urinary retention

References

Gamut G-62

CHRONIC NONOBSTRUCTIVE SMALL BOWEL DISTENTION

COMMON
1. Ascites
2. Connective tissue disease (collagen disease) (esp. scleroderma)
3. Neurologic or muscular disorder (eg, parkinsonism; myotonic dystrophy; tabes; spinal cord lesion)
4. Sprue, tropical or nontropical (celiac disease)
5. Vagotomy

UNCOMMON
1. Adrenal insufficiency
2. Allergic enterocolitis
3. Amyloidosis
4. Ceroidosis (prolonged malabsorption and vitamin E depletion)
5. Chronic idiopathic intestinal pseudo-obstruction
6. Congenital short intestine
7. Cystic fibrosis (mucoviscidosis)
8. Diabetes with hypokalemia
9. Disaccharidase deficiency (eg, lactase deficiency)
10. Drug effect (eg, Lomotil; morphine)
11. Eosinophilic gastroenteritis
12. Hypoparathyroidism
13. Hypoproteinemia (eg, cirrhosis; nephrosis; malnutrition; burn; A-beta-lipoproteinemia)
14. Intestinal lymphangiectasia
15. Jejunal diverticulosis
16. Lymphoma
17. Malrotation; internal hernia
18. Mesenteritis
19. Myxedema; hypothyroidism
20. Parasitic disease (esp. Chagas’ disease; chronic strongyloidiasis; schistosomiasis japonica)
21. Postoperative (eg, gastrectomy; colectomy; intestinal bypass)
22. Renal failure; uremia; peritoneal dialysis
23. Vascular insufficiency (mesenteric ischemia); vasculitis (eg, lupus erythematosus; polyarteritis nodosa)
24. Waldenström’s macroglobulinemia
25. Whipple’s disease

References

TERMINAL ILEUM LESION

COMMON
1. Appendicitis
2. Carcinoid
3. Crohn’s disease
4. Intussusception
5. Mass, extrinsic (eg, ovarian or other pelvic neoplasm; aneurysm of iliac artery)
6. Meconium ileus (cystic fibrosis {mucoviscidosis})
7. Nodular lymphoid hyperplasia; normal lymphoid follicles

UNCOMMON
1. Diverticulitis
2. Endometrial implant
3. Food particles; foreign body; gallstone
4. Fungus disease (eg, actinomycosis; histoplasmosis)
5. Intramural hematoma
6. Laxative abuse
7. Meckel’s diverticulum
8. Mesenteric infarction; ischemic enteritis
9. Metastasis (esp. from gastric, colonic or ovarian neoplasm)
10. Neoplasm, benign or malignant (eg, gastrointestinal stromal tumor, carcinoma; sarcoma; lymphoma)
11. Parasitic disease
   a. Intraluminal worms (eg, Ascaris; tapeworm—Taenia saginata)
   b. Inflammatory changes (eg, schistosomiasis; amebiasis; strongyloidiasis; rarely giardiasis; intestinal capillariasis; anisakiasis; angiostrongyliasis costaricensis)
12. Polyp. (See G-106)
13. Radiation enteritis
14. Tuberculosis
15. Typhoid fever
16. Ulcerative colitis (“backwash ileitis”)
17. Yersinia enterocolitis

References

NONDIAPHRAGMATIC HERNIAS

COMMON
1. Femoral
2. Incisional
3. Inguinal
4. Umbilical (incl. omphalocele)
5. Ventral

UNCOMMON
1. Lesser sac (foramen of Winslow)
2. Lumbar

(continued)
3. Mesenteric (small bowel; sigmoid)
4. Obturator
5. Paracecal
6. Paraduodenal
7. Pelvic (broad ligament)
8. Perineal
9. Retroperitoneal
10. Sciatic
11. Spigelian

Reference

Gamut G-65

ABNORMALITIES OF BOWEL ROTATION

COMMON
1. Malrotation
2. Midgut volvulus with malrotation
3. Mobile cecum (high or midline)
4. Nonrotation

UNCOMMON
1. Exomphalos
2. Extroversion of cloaca
3. Paraduodenal hernia
4. Reverse rotation

References

Gamut G-66

CONGENITAL SYNDROMES ASSOCIATED WITH INTESTINAL MALROTATION

1. Abdominal heterotaxy
2. Asplenia or polysplenia S.
3. Brachmann-de Lange S.
4. Cantrell S.
5. Coffin-Siris S.
6. FG syndrome
7. Mobile cecum S.
8. Prune-belly S. (Eagle-Barrett S.)
9. Trisomy 13 S.
10. Trisomy 18 S.
11. Trisomy 21 S. (Down S.)

References

Gamut G-67

APHTHOID ULCERS IN THE SMALL BOWEL OR COLON*

COMMON
1. Crohn’s disease

UNCOMMON
1. Amebiasis
2. [Artifacts (eg, fecal debris; flocculated barium; innominate grooves of colon)]
3. Behçet S.
4. Candidiasis
5. Cytomegalovirus infection of ileum and colon (also esophagus and stomach)
6. Ischemic colitis
7. [Lymphoid hyperplasia of colon]
8. Salmonellosis
9. Tuberculosis
10. *Yersinia* enterocolitis

* Tiny discrete central ulcer containing barium surrounded by a halo of edematous mucosa, best seen on air-contrast examination.

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References

Gamut G-68

INNUMERABLE TINY NODULES (SAND-LIKE OR GRANULAR LUCENCIES SMALLER THAN 5 MM) IN THE SMALL BOWEL OR COLON

COMMON
1. Crohn’s disease (“cobblestone” pattern)
2. [Food particles; seeds; air bubbles]
3. Nodular lymphoid hyperplasia (eg, dysgamma-globulinemia)
4. Normal lymphoid follicles
5. Polyposis syndromes (esp. Cronkhite-Canada S.) (See G-106)

UNCOMMON
1. A-beta-lipoproteinemia
2. Amyloidosis

Gamut G-69

MESENTERIC VASCULAR COMPROMISE (INTESTINAL ISCHEMIA OR INFARCTION)

COMMON
1. Arterial thromboembolism (eg, secondary to myocardial infarction; rheumatic heart disease; atrial fibrillation)
2. Arteriosclerosis
3. Digitalis toxicity

(continued)
4. Heart failure
5. Iatrogenic (eg, catheter arteriography; drug instillation)
6. Idiopathic (normal vessels)
7. Intestinal obstruction (esp. strangulation)
8. Peritoneal band or adhesion
9. Septicemia (eg, drug abuse; bacterial endocarditis)
10. Vascular compression by extrinsic mass
11. Venous thrombosis

**UNCOMMON**
1. Abdominal or pelvic inflammatory disease
2. Arteritis (eg, Takayasu’s arteritis; polyarteritis nodosa)
3. Coarctation of aorta (esp. postoperative)
4. Dissecting aneurysm
5. Fibromuscular hyperplasia of mesenteric artery
6. Polycythemia
7. Postoperative (esp. surgical ligation)
8. Radiation injury
9. Transient ischemia of children
10. Trauma to the intestine or its vessels

**References**

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**GAS IN THE BOWEL WALL (PNEUMATOSIS INTESTINALIS)**

**COMMON**
1. Colitis (eg, ulcerative; tuberculous; amebic; Crohn’s disease)
2. Necrosis of the intestine
   a. Necrotizing enterocolitis (esp. in premature or debilitated infants)
   b. Mesenteric thrombosis with infarction
   c. Gangrenous, pseudomembranous, or other enterocolitis
   d. Strangulated hernia, volvulus, or other intestinal obstruction
   e. Primary infection of bowel wall
   f. Ingestion of corrosives
3. Primary, idiopathic (pneumatosis cystoides intestinalis)
4. Toxic megacolon (See G-94)

**UNCOMMON**
1. Adynamic ileus (esp. postoperative)
2. Air hose injury of rectum (“goose”)
3. Colonic irrigation; hydrogen peroxide enema
4. Congenital obstruction (eg, atresia; stenosis; web; diaphragm; imperforate anus; meconium plug)
5. Connective tissue disease (collagen disease) (esp. scleroderma)
6. Diabetes with gas-forming organism
7. Graft-versus-host disease (esp. involving cecum)
8. Hirschsprung’s disease or other megacolon (See G-93)
9. Iatrogenic (eg, endoscopy; colonoscopy; catheter jejunostomy; umbilical artery catheterization)
10. Idiopathic
11. Leukemia
12. Malabsorption (eg, sprue)
13. Obstructive pulmonary disease, esp. with coughing (eg, emphysema; bullous disease; asthma; chronic bronchitis)
14. Perforated jejunal diverticulum
15. Pneumomediastinum with abdominal extension of air
16. Postoperative (esp. jejunointerleal bypass; postoperative intramural leakage)
17. Pyloroduodenal obstruction (eg, peptic ulcer, esp. with intramural perforation; pyloric stenosis)
18. Steroid and other immunosuppressive therapy
19. Trauma to gut

References

Gamut G-71-2
SMALL AND LARGE BOWEL WALL THICKENING: HETEROGENEOUS (STRATIFIED OR MIXED) ATTENUATION ON POSTCONTRAST CT

COMMON
1. Bowel edema related to cirrhosis or hypoproteinemia
2. Crohn’s disease
3. Henoch-Schönlein purpura
4. Infectious enterocolitis
5. Ischemia
6. Lupus erythematosus
7. Radiation injury
8. Ulcerative colitis
9. Vasculitis

UNCOMMON
1. Infiltrating scirrhous carcinoma (usually colon or rectum)
2. Pneumatosis
3. [Residual fluid and contrast material]
4. Submucosal fat deposition

Reference

Gamut G-71-1
SMALL AND LARGE BOWEL WALL THICKENING: HOMOGENEOUS ATTENUATION ON POSTCONTRAST CT

COMMON
1. Carcinoma of small bowel and/or colon
2. Lymphoma
3. Submucosal hemorrhage or hematoma

UNCOMMON
1. Crohn’s disease, chronic
2. Infarcted bowel
3. [Pseudothickening related to incomplete distention and residual fluid]
4. Radiation injury, chronic

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference
MIXED ATTENUATION+

1. Carcinoma (esp. mucinous adenocarcinoma)
2. Gastrointestinal stromal tumor

* Alternating (stratified) layers of attenuation in a thickened bowel segment may take the form of a double halo or a target configuration. The double halo sign represents an inner low-attenuation (edema) ring surrounded by an outer higher attenuation ring on postcontrast CT. In the target sign, inner and outer layers of high attenuation surround a central area of decreased (edema) attenuation. The high attenuation in these signs is related to hyperemia.

+ The grossly thickened bowel wall has several irregular zones of lower attenuation haphazardly located next to areas of higher attenuation. These findings are related to ischemia and necrosis and are seen in high-grade, poorly differentiated neoplasms such as adenocarcinoma and stromal cell tumors.

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

Gamut G-72-2

MARKED THICKENING (> 2 CM) OF BOWEL WALL ON POSTCONTRAST CT

COMMON
1. Carcinoma
2. Colitis, severe
3. Gastrointestinal stromal tumor
4. Lupus erythematosus
5. Lymphoma
6. Metastatic disease involving bowel wall

UNCOMMON
1. Crohn’s disease
2. Cytomegalovirus infection
3. Histoplasmosis
4. Submucosal hemorrhage
5. Tuberculosis

Reference

Gamut G-72-1

MILD THICKENING (< 2 CM) OF BOWEL WALL ON POSTCONTRAST CT

COMMON
1. Bowel edema in cirrhosis
2. Crohn’s disease
3. Infectious enterocolitis
4. Ischemia
5. Radiation injury
6. Submucosal hemorrhage
7. Ulcerative colitis

UNCOMMON
1. Adenocarcinoma
2. Lymphoma

Reference

Gamut G-73

SYMMENTRIC VERSUS ASYMMETRIC THICKENING OF BOWEL WALL ON POSTCONTRAST CT

SYMMENTRIC
1. Bowel edema in cirrhosis
2. Crohn’s disease
3. Infectious enterocolitis
4. Ischemia
5. Lymphoma
6. Radiation injury
7. Submucosal hemorrhage
8. Ulcerative colitis
ASYMMETRIC
1. Carcinoma
2. Gastrointestinal stromal tumor

Reference

Gamut G-74-1
FOCAL BOWEL WALL THICKENING (<10 CM) ON POSTCONTRAST CT

COMMON
1. Carcinoma (esp. adenocarcinoma)
2. Appendicitis
3. Diverticulitis

UNCOMMON
1. Crohn’s disease
2. Lymphoma
3. Tuberculosis

Reference

Gamut G-74-2
SEGMENTAL BOWEL WALL THICKENING (10–30 CM) ON POSTCONTRAST CT

COMMON
1. Carcinoma (eg, mucinous or colloid carcinoma of colon; scirrhous carcinoma of colon or rectum)
2. Crohn’s disease
3. Infectious ileitis
4. Ischemia
5. Lymphoma
6. Radiation injury
7. Submucosal hemorrhage

UNCOMMON
1. Lupus erythematosus

Reference

Gamut G-74-3
DIFFUSE BOWEL WALL THICKENING ON POSTCONTRAST CT

COMMON
1. Edema from cirrhosis or hypoproteinemia
2. Infectious enterocolitis
3. Lupus erythematosus
4. Ulcerative colitis

(continued)
UNCOMMON
1. Ischemia
2. Pseudomembranous colitis

Reference

Gamut G-75
RESIDUAL INTESTINAL BARIUM AFTER GASTROINTESTINAL STUDY (MORE THAN ONE WEEK)

COMMON
1. Barium in appendix or diverticula of small bowel or colon
2. Fecal impaction
3. Gastric obstruction
4. Nonobstructive ileus (See G-61)

UNCOMMON
1. Aganglionosis of colon (eg, Hirschsprung disease; Chagas’ disease)
2. Blind loop syndrome (See G-58)
3. [Calcification (esp. milk of calcium)]
4. Cryptosporidiosis
5. Drug effect (eg, morphine)
6. Duplication of intestine
7. Hypothyroidism (eg, myxedema; cretinism)
8. Meckel’s diverticulum
9. [Medication, opaque]
10. Perforation of intestine
11. Postoperative (eg, side-to-side anastomosis; gastro-ileostomy; bypass procedure)
12. Scleroderma
13. Stricture of intestine

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Gamut G-76
INTESTINAL OBSTRUCTION IN A NEWBORN*

COMMON
*1. Congenital stenosis or atresia of stomach, duodenum, small bowel, colon*, rectum*, or anus (imperforate anus)*
2. Hernia, incarcerated, internal or external (eg, inguinal, femoral, umbilical, diaphragmatic, mesenteric defects)
*3. Hirschsprung disease
4. Malrotation with midgut volvulus
*5. Meconium ileus (cystic fibrosis {mucoviscidosis})
*6. Meconium plug S.
*7. Small left colon S.

UNCOMMON
1. Apple peel intestinal atresia
2. Choledochal cyst
3. Congenital peritoneal bands (Ladd’s bands)
4. Inspissated milk S.
5. Intestinal duplication
6. Intraluminal diaphragm or web
7. Intramural hematoma (eg, trauma)
*8. Intussusception (rare in newborn)
9. Meconium peritonitis (eg, meconium ileus)
*10. Megacystis-microcolon-intestinal hypoperistalsis S. (Berdon S.)
11. Neoplasm (usually distention without obstruction)
12. [Paralytic ileus (eg, from drugs given during labor)]
13. Preduodenal portal vein
14. Segmental dilatation of ileum

* Low intestinal obstruction in a newborn.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
INTESTINAL OBSTRUCTION IN A CHILD (See G-76)

COMMON
1. Adhesions (inflammatory; postoperative); congenital peritoneal bands (Ladd’s bands)
2. Appendicitis (esp. perforated)
3. Hernia, incarcerated (internal or external)
4. Hirschsprung disease
5. Intussusception (eg, ameboma; intestinal duplication; Henoch-Schönlein purpura; idiopathic; Meckel’s diverticulum; polyp, lymphoma, other neoplasm)

UNCOMMON
1. Cast S. (cast treatment for scoliosis causing superior mesenteric artery S.)
2. Chronic granulomatous disease of childhood
3. Crohn’s disease
4. Cystic fibrosis (mucoviscidosis)
5. Familial Mediterranean fever
6. Fecal impaction
7. Foreign body; bezoar
8. Kawasaki S.
9. Neoplasm, benign or malignant (eg, gastrointestinal stromal tumor; lymphoma; sarcoma)
10. Neurofibromatosis I (von Recklinghausen disease)
11. Parasitic disease (esp. Ascaris bolus; ameboma)
12. [Pseudo-obstruction, idiopathic]
13. Stenosis, congenital (eg, duodenum; small bowel; rectum)
14. Tuberculous enteritis
15. Volvulus, midgut or other

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References

INTESTINAL OBSTRUCTION IN AN ADULT

COMMON
1. Abscess, abdominal (eg, periappendiceal; tubovarian)
2. Adhesions (inflammatory; postoperative); congenital peritoneal bands (Ladd’s bands)
3. Carcinoma of colon, rectum, or rarely, small bowel
4. Crohn’s disease
5. Diverticulitis (esp. colonic)
6. Fecal impaction
7. Hernia, incarcerated, internal or external (See G-64-S)
8. Intussusception
9. Metastatic disease (esp. melanoma; carcinoma of ovary, breast, lung; peritoneal carcinomatosis) or invasion of bowel by adjacent pelvic or abdominal malignancy
10. Stricture (eg, neoplastic; inflammatory—lymphogranuloma venereum; radiation; potassium-induced; ischemic; posttraumatic; postoperative)
11. Volvulus (esp. cecal or sigmoid)

(continued)
UNCOMMON
1. Amyloidosis
2. Bezoar; enterolith; foreign body
3. Endometriosis
4. Extrinsic pressure from large adjacent neoplasm, distended bladder, or pregnant uterus
5. Familial Mediterranean fever
6. Gallstone ileus
7. Granulomatous disease (eg, actinomycosis; tuberculosis)
8. Hirschsprung disease
9. [Immobilization; Cast S.]
10. Intestinal duplication
11. [Intestinal pseudo-obstruction, idiopathic] (See G-79)
12. Intramural hematoma
13. Lymphoma
14. Neoplasm, other (gastrointestinal stromal tumor — esp. leiomyoma; carcinoid; sarcoma); cyst
15. Neurofibromatosis I (von Recklinghausen disease)
16. Parasitic disease (Ascaris bolus; amebiasis; Chagas’ disease; schistosomiasis)
17. Retractile mesenteritis
18. [Spasm (eg, sickle cell crisis; plumbism; porphyria; tabes; diabetic ketosis; potassium deficiency)]
19. Superior mesenteric artery S.
20. Ulcerative colitis, chronic
21. Vascular occlusion (arterial or venous); mesenteric infarction; ischemic colitis (See G-69)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut G-79

INTESTINAL PSEUDO-OBSTRUCTION (OGILVIE SYNDROME); BOWEL OBSTRUCTION IN THE ABSENCE OF MECHANICAL BLOCKAGE

COMMON
1. Idiopathic (“primary”)
2. Paralytic ileus (eg, trauma; hypokalemia; pneumonia; myocardial infarction; pancreatitis; sickle cell crisis)

UNCOMMON
1. Amyloidosis
2. Celiac disease; sprue
3. Ceroidosis (prolonged malabsorption and vitamin E depletion)
4. Connective tissue disorder (collagen disease)
5. Diverticulosis of small bowel
6. Drug reaction (eg, phenothiazine; antidepressant; anti-Parkinsonism drugs; morphine)
7. Endocrine disorder (eg, myxedema; diabetes; hypoparathyroidism; pheochromocytoma)
8. Enteric muscle disorder (eg, myotonic dystrophy; scleroderma)
9. Jejunoileal bypass
10. Neonatal adynamic ileus
11. Neurologic disorder (eg, parkinsonism, stroke, paralysis, brain damage)
12. Parasitic disease (eg, Chagas’ disease; chronic strongyloidiasis)
13. Pelvic surgery (eg, hysterectomy)
14. Porphyria, acute intermittent
15. Retractile mesenteritis
16. Urinary retention
17. Vitamin D deficiency

References

654 G. Gastrointestinal Tract and Abdomen

Gamut G-80

SENTINEL LOOP (LOCALIZED DILATATION OF SMALL AND/OR LARGE BOWEL)

COMMON
1. Acute appendicitis (right lower quadrant)
2. Acute cholecystitis (right upper quadrant)
3. Acute diverticulitis (left lower quadrant)
4. Acute pancreatitis (upper or mid-abdomen)
5. Acute ureteral colic (stone)
6. Infarction or ischemia of bowel
7. “Paralytic ileus” (See G-61)
8. Perforated peptic ulcer (upper abdomen)
9. [Small bowel obstruction, early or incomplete]

UNCOMMON
1. Abdominal trauma
2. Drug effect
3. Gastroenteritis
4. [Normal variant]
5. [Volvulus]

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut G-81

APPENDICEAL LESION OR MASS ADJACENT TO APPENDIX

COMMON
1. Appendiceal abscess
2. Appendiceal fecalith (calculus)
3. Appendicitis, acute or resolving
4. Carcinoid
5. Ileoceleal valve, normal or prolapsed
6. Postoperative (eg, inverted stump; surgical deformity; adhesions)

UNCOMMON
1. [Appendix hernia]
2. Crohn’s disease
3. [Diverticulum]
4. Endometrial implant
5. Extrinsic mass
6. Foreign body
7. Invagination or intussusception of appendix
8. Mucocele
9. Myxoglobulosis
10. Neoplasm, benign (eg, gastrointestinal stromal tumor; lipoma; polyp)
11. Neoplasm, malignant, primary (eg, carcinoma; lymphoma) or metastatic implant or extension
12. Parasitic disease (eg, amebiasis; trichuriasis; ascariasis; anisakiasis; schistosomiasis; angiostrongyliasis costaricensis)
13. Tuberculosis
14. Typhoid fever
15. Ulcerative colitis
16. Yersinia enterocolitis

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

(continued)
Gamut G-82


Gamut G-82-S

CONGENITAL ANOMALIES AND VARIATIONS OF THE APPENDIX

COMMON
1. Abnormal length (under 2 cm or over 25 cm)
2. Abnormal location (eg, retrocecal appendix; malposition or malrotation of cecum)
3. Abnormal origin (eg, close to or far from ileocecal valve; high on cecum)

UNCOMMON
1. Absence of appendix
2. Double appendix
3. Primitive appendix (very thin lumen)

References

Gamut G-83

SOLITARY FILLING DEFECT IN THE COLON

COMMON
1. Carcinoma
2. Diverticulitis; pericolonic abscess (See G-89)
3. Fecal mass or impaction
4. Intussusception; ileal prolapse
5. Polyp (esp. adenomatous; hyperplastic; juvenile; or hamartomatous) (See G-84-S)

UNCOMMON
1. Amyloidoma
2. Carcinoid
3. Crohn’s disease
4. Cyst (duplication or other)
5. Endometrioma
6. Extramedullary plasmacytoma
7. Foreign body; gallstone; food particle; bezoar
8. Intramural hematoma
9. Inverted colonic diverticulum
10. Lymphoma
11. Metastasis (incl. invasive neoplasm)
12. Mucormycoma
13. Neoplasm, benign (eg, lipoma; hemangioma; leiomyoma or other gastrointestinal stromal tumor)
14. Parasitic disease (esp. ameboma; schistosomal granuloma; helminthoma; anisakiasis, *Ascaris* bolus)
15. Periappendiceal abscess
16. Postoperative (eg, anastomosis; suture granuloma)
17. Pseudopolyp, “giant” type (in ulcerative colitis)
18. Pseudotumor (eg, fibrous band; adhesion)
19. Sarcoma (incl. Kaposi)
20. Solitary rectal ulcer syndrome
21. Tuberculoma
22. Varix; hemorrhoid
23. Villous adenoma

References
CLASSIFICATION OF COLONIC TUMORS AND TUMOR-LIKE LESIONS

I. EPITHELIAL TUMORS

BENIGN—ADENOMA
1. Tubular
2. Villous
3. Tubulovillous

MALIGNSANT
1. Adenocarcinoma
2. Adenoacanthoma
3. Adenosquamous carcinoma
4. Squamous cell carcinoma
5. Basaloid (cloacogenic) carcinoma
6. Carcinosarcoma

II. NEUROENDOCRINE TUMORS
1. Adenocarcinoid tumor
2. Carcinoid tumor

III. NONEPITHELIAL TUMORS

BENIGN
1. Smooth-muscle tumor
2. Neurilemmoma
3. Lipoma
4. Vascular tumor

IV. HEMATOPOIETIC AND LYMPHOID TUMORS

V. UNCLASSIFIED TUMORS

VI. SECONDARY (METASTATIC) TUMORS

VII. NONNEOPLASTIC (TUMOR-LIKE) LESIONS

HAMARTOMA
1. Peutz-Jeghers polyp
2. Juvenile polyp

HETEROTOPIA
1. Colitis cystica profunda
2. Hyperplastic polyp
3. Lymphoid polyp
4. Inflammatory polyp

References

ANNULAR (“APPLE CORE” OR “NAPKIN RING”) LESION OF THE COLON

COMMON
1. Carcinoma

UNCOMMON
1. Ameboma
2. [Circular muscle contraction (colonic “sphincter”)]
3. Diverticulitis (esp. with submucosal abscess)
4. Helminthoma
5. Lymphoma
6. Stricture, chronic localized (eg, Crohn’s disease; ulcerative colitis; ischemic colitis; lymphogranuloma venereum)
7. Tuberculoma
8. Villous adenoma

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

(continued)
SEGMENTAL NARROWING OF THE COLON

COMMON
1. Abscess or other extrinsic inflammatory process (eg, pericolic) (See G-89)
2. Carcinoma (esp. “apple-core” adenocarcinoma or scirrhous)
3. [Circular muscle contraction or spasm, usually transient]
4. Crohn’s disease
5. Diverticulitis
6. Endometriosis
7. Ischemic colitis (See G-69)
8. Postoperative deformity (eg, adhesion; narrow anastomosis)
9. Ulcerative colitis

UNCOMMON
1. Actinomycosis
2. Adhesive bands
3. Amyloidosis
4. Carcinoid
5. Carcinoma developing in ulcerative colitis or Crohn’s disease or adjacent to ureterosigmoidostomy stoma
6. Cathartic colon; caustic colitis
7. Colitis, other (eg, herpes; cytomegalovirus; fungal)
8. Foreign body perforation with pericolic abscess
9. Intramural hematoma
10. Lymphogranuloma venereum
11. Lymphoma
12. Metastatic disease (eg, hematogenous or lymphangitic spread; peritoneal seeding; or direct extension to colon)
13. Neoplasm of colon, benign (eg, lipoma, gastrointestinal stromal tumor)
14. Neoplasm, extrinsic (eg, pancreatic; ovarian; renal)
15. Pancreatitis with direct spread to transverse colon or splenic flexure
16. Parasitic disease (eg, amebiasis/ameboma; schistosomiasis; helminthoma; strongylidiasis; angiostrongyliasis costaricensis)
17. Pelvic lipomatosis
18. Radiation fibrosis
19. Retractile mesenteritis
20. Sarcoma (incl. Kaposi)
21. Stricture, idiopathic
22. Tuberculosis
23. Typhlitis
24. Ulcer of colon (esp. solitary rectal ulcer syndrome)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

MULTIPLE FILLING DEFECTS IN THE COLON

COMMON
1. Artifacts (eg, feces; air bubbles; corn or other food particles; mucus strands or globules; oil droplets; foreign bodies)
2. [Diverticulosis]
3. Normal lymphoid follicles
4. Polyposis, familial
5. Polyps (See G-84-S)
6. Pseudopolyps (esp. in ulcerative colitis)

UNCOMMON
1. Amebomas
2. Amyloidosis
3. Bannayan-Riley-Ruvalcaba S.
4. Carcinomas, multiple
5. Colitis cystica profunda
6. Colitis, other types (eg, pseudomembranous; ischemic; Yersinia; cytomegalovirus; Behçet S.)
7. Cowden S. (multiple hamartoma S.)
8. Cronkhite-Canada S.
9. Cystic fibrosis (mucoviscidosis)
10. Endometriosis
11. Gardner S.
12. Hemangiomas
13. Juvenile polyposis
14. Lipomatous polyposis
15. Lymphoma; leukemic infiltration
16. Malakoplakia
17. Metastases
18. Neurofibromatosis
19. Nodular lymphoid hyperplasia (if over 4 mm in size, may be due to AIDS with lymphoid hyperplasia; lymphomatous polyps
20. Parasites, intraluminal (eg, Ascaris; Trichurus)
21. Peutz-Jeghers S. ( alimentary tract polyposis)
22. Pneumatosis cystoides intestinalis
23. Polyposis syndromes, other (See G-106)
24. Schistosomiasis (inflammatory polyps)
25. Turcot S.
26. Urticaria, incl. hives, blebs, submucosal edema (secondary to chronic ischemia; colon obstruction; herpes zoster or Yersinia colitis; Chagas’ disease)
27. Varices; hemorrhoids

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
10. Drug therapy (esp. steroids; NSAIDs; antibiotics; chemotherapeutic agents; cimetidine; anti-fungal flucytosine; gold; methyldopa)
11. Fungus disease (eg, histoplasmosis; mucormycosis; candidiasis)
12. Graft-versus-host disease
13. Lymphogranuloma venereum (chlamydia infection)
14. Lymphoma; leukemic infiltration (diffuse)
15. Mercury poisoning
16. Metastatic disease
17. Neoplasm, other (eg, gastrointestinal stromal tumor; Kaposi sarcoma)
18. Nonspecific benign ulceration of colon
19. Pancreatitis with involvement of transverse colon or splenic flexure
20. Parasitic disease, other (esp. schistosomiasis; strongyloidiasis; helminthoma; Chagas’ disease; anisakiasis and angiostrongyliasis costaricensis—ileocecal region)
21. Postoperative colitis (incl. diversion colitis in isolated segment after proximal colostomy or ileostomy; postrectal biopsy ulceration)
22. Proctitis (nonspecific; chemical—paraldehyde; in male homosexuals, often due to gonorrhea, lymphogranuloma venereum, or herpes simplex)
23. Pseudomembranous or necrotizing colitis (eg, *Clostridium difficile* infection, esp. after antibiotic therapy; postoperative; or proximal to colon obstruction)
24. Radiation colitis
25. *Salmonella* colitis
26. Solitary rectal ulcer S.
27. Staphylococcal colitis (eg, after oral tetracycline therapy)
28. Stercoral colitis (in obstruction)
29. Tuberculosis
30. Typhlitis
31. Uremic colitis; hemolytic-uremic S.
32. Urticaria (“colon hives” secondary to chronic ischemia; colon obstruction; herpes zoster or *Yersinia* colitis; Chagas’ disease)
33. Viral infection (eg, herpes simplex-anorectal herpes; herpes zoster; cytomegalovirus—esp. in AIDS; rotavirus)
34. *Yersinia* colitis

**References**


**Gamut G-89**

**PERICOLIC ABSCESS**

**COMMON**
1. Appendicitis
2. Crohn’s disease
3. Diverticulitis
4. Neoplasm of colon, perforated primary (esp. carcinoma) or metastatic
5. Pancreatitis
6. Trauma, external or iatrogenic (eg, enema)
7. Tubo-ovarian abscess

**UNCOMMON**
1. Actinomycosis
2. Foreign body perforation
3. Idiopathic
4. Ischemic colitis
5. Lymphogranuloma venereum (Chlamydia infection)
6. Parasitic disease (esp. amebiasis; schistosomiasis; helminthoma; anisakiasis or angiostrongyliasis costaricensis—ileocecal region)
7. Postoperative (eg, suture leak; talc granuloma)
8. Renal infection or abscess
9. Tuberculosis
10. Ulcerative colitis

References

Gamut G-90

DOUBLE TRACKING OF BARIUM IN THE DISTAL COLON*

COMMON
1. Crohn’s disease
2. Diverticulitis

UNCOMMON
1. Carcinoma of colon

* Barium in an extraluminal sinus tract paralleling the bowel lumen.

Reference

Gamut G-91

SMOOTH COLON

COMMON
1. Cathartic or enema abuse
2. Chronic obstruction (eg, megacolon; Chagas’ disease)
3. Ischemic colitis, late (See G-69)
4. Ulcerative colitis, chronic

UNCOMMON
1. Amyloidosis
2. Bacillary dysentery, chronic (shigellosis)
3. Carcinoma, scirrhous
4. Lymphogranuloma venereum, late (Chlamydia infection)
5. Lymphoma
6. Parasitic disease, late (eg, schistosomiasis; strongyloidiasis; amebic stricture)
7. Radiation colitis, late

References

Gamut G-92

COLONIC DISTENTION WITHOUT OBSTRUCTION

COMMON
1. Acute nonobstructive distention, “paralytic ileus” (eg, postoperative; peritonitis; appendicitis; pancreatitis; typhoid fever) (See G-61)
2. Chronic constipation; cathartic abuse
3. Electrolyte imbalance (hypokalemia; hypochloremia; calcium abnormality)

(continued)
*4. Functional megacolon (psychogenic; idiopathic)
*5. Hirschsprung’s disease
6. Mesenteric infarction (See G-69)
7. Shock; septicemia; hypoxia
8. Toxic megacolon (See G-94)
9. Trauma (esp. spine or lower rib injury; intramural hematoma)
10. Ureteral colic

**UNCOMMON**
1. Aerophagia
2. Amyloidosis; familial Mediterranean fever (familial recurrent polyserositis)
3. Ceroidosis (vitamin E depletion)
4. Chagas’ disease
5. Connective tissue disease (collagen disease); (esp. scleroderma; polyarteritis nodosa)
6. Cystic fibrosis (mucoviscidosis)
7. Drug therapy (eg, Pro-Banthine; hexamethonium; chlorpromazin; benztropine; morphine; L-dopa; atropine)
8. Endocrine disturbance (eg, adrenal insufficiency; multiple endocrine neoplasia (MEN) S.; hypothyroidism; hypoparathyroidism)
9. Functional (eg, diabetic coma; lead colic; sickle cell crisis; tabes; porphyria; pheochromocytoma)
10. Idiopathic intestinal pseudo-obstruction
11. Kawasaki disease
12. Muscular, neurologic, or psychiatric disorder (eg, amyotonia congenita {Oppenheim’s disease}; multiple sclerosis; parkinsonism, Riley-Day S. {familial dysautonomia}; senility; schizophrenia; brain damage; paralysis)
13. Neurofibromatosis (esp. plexiform)
14. Pneumonia or other acute thoracic disease (eg, myocardial infarction; heart failure)
15. Renal failure; uremia; urinary retention
16. Retroperitoneal hemorrhage
17. Spinal cord lesion; paraplegia
18. Sprue

* Chronic.

**References**

**Gamut G-93**

**MEGACOLON**

**COMMON**
1. Distal obstructing lesion (esp. carcinoma)
*2. Functional (psychogenic; idiopathic)
*3. Hirschsprung disease
*4. Imperforate anus; colon or rectal atresia; anal stenosis
*5. Nonobstructive distention (“paralytic ileus”)
6. Scleroderma; dermatomyositis
*7. Toxic megacolon (See G-94)

**UNCOMMON**
1. Aerophagia
2. Amyloidosis
3. Chagas’ disease
*4. Chronic idiopathic intestinal pseudo-obstruction
*5. Cystic fibrosis (mucoviscidosis); meconium plug S. (dilated colon proximal to plug)
6. Diabetes
*7. Drug therapy (esp. Pro-Banthine; phenothiazine; anti-Parkinsonism agents)
*8. Duplication
*9. Fetal cytomegalovirus infection
*10. Hypothyroidism (esp. myxedema; cretinism)
*11. Immobilization, prolonged (eg, cast S.)
*12. Multiple endocrine neoplasia (MEN) S. (See J-5)
*13. Muscular disorder (eg, muscular dystrophy)
*14. Neurologic disorder (eg, plexiform neurofibromatosis; meningo(myelo)cele; spina bifida; paralysis; neuronal intestinal dysplasia; Parkinsonism, brain damage)
*15. Obstruction of colon from chronic stricture (eg, lymphogranuloma venereum or other rectal stricture; Crohn’s disease; postoperative scarring*; post-necrotizing enterocolitis*)
*16. Purgative abuse
*17. Riley-Day S. (familial dysautonomia)
*18. Sacrococcygeal teratoma; other pelvic neoplasm
*19. Small left colon S. (dilated colon proximally)
*20. Sotos S. (cerebral gigantism)
*21. Steatorrhea; celiac disease; sprue

* Megacolon in an infant or child.

References

Gamut G-95-1

COLON OF REDUCED CALIBER (MICROCOLON) IN A NEWBORN

1. “Apple peel” intestinal atresia S.
2. Berdon S. (megacystis-microcolon-intestinal hypoperistalsis S.)
3. Colon atresia (microcolon to point of atresia)
4. Congenital ileal stenosis, web
5. Distal jejunal atresia (occas. total microcolon of disuse)
6. Hirschsprung disease (ganglionic distal segment may be small)
7. Ileal atresia (total microcolon of disuse)
8. Meconium ileus, esp. with cystic fibrosis (mucoviscidosis) (total microcolon of disuse)
9. Meconium plug S. (entire colon may be slightly small)
10. Microcolon of prematurity
11. Small left colon S. (rectum normal, colon small to splenic flexure)
12. Total aganglionosis coli (entire colon may be slightly small—question mark colon)

(continued)
MECONIUM PLUG IN A NEWBORN

1. Cystic fibrosis (mucoviscidosis) with meconium ileus
2. Hirschsprung disease
3. Meconium plug S.
4. Small left colon S.

References

CECAL LESION

COMMON
1. Amebiasis
2. Appendiceal stump or lesion (See G-81)
3. Carcinoma
4. Crohn’s disease
5. [Fecal matter; pill; food particle; foreign body]
6. Ileocecal valve, normal or fatty (“lipoma”);
   ileocecal prolapse
7. Ileocecal intussusception (eg, idiopathic; lymphoma;
   Meckel’s diverticulum; appendix)
8. Polyp g
9. Ulcerative colitis
10. Volvulus

UNCOMMON
1. Actinomycosis
2. Benign neoplasm (esp. villous adenoma; angioma;
   gastrointestinal stromal tumor g; lipoma)
3. Carcinoid
4. Cathartic abuse
5. Cecal diaphragm, web, or adhesion
6. Cytomegalovirus infection (esp. in AIDS)
7. Diverticulosis; diverticulitis
8. Duplication
9. Endometriosis
10. Enterolith
11. Foreign body perforation
12. [Gallstone]
13. Ileus of cecum
14. Lymphoma g (incl. Burkitt lymphoma)
15. Metastasis (esp. colon, stomach, pancreas, ovary)
16. Parasitic disease, other (eg, schistosomiasis;
   strongyloidiasis; ascariasis; trichuriasis; anisakiasis;
   helminthoma; angiostrongyliasis costaricensis)
17. Pneumatosis cystoides intestinalis
18. Tuberculosis
19. Typhilitis
20. Typhoid fever
21. Ulcer, solitary
22. Yersinia enterocolitis

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
**Gamut G-97**

**CONICAL OR CONTRACTED CECUM**

**COMMON**
1. Amebiasis
2. Appendicitis; appendiceal abscess
3. Crohn’s disease

**UNCOMMON**
1. Actinomycosis; South American blastomycosis
2. Anisakiasis; angiostrongyliasis costaricensis
3. Carcinoma
4. Cathartic abuse
5. Cytomegalovirus colitis (esp. in AIDS)
6. Diverticulitis of cecum (esp. following perforation)
7. Idiopathic
8. Lymphoma; leukemia (esp. in children after treatment)
9. Metastatic disease (eg, from carcinoma of stomach, colon, pancreas, ovary)
10. Radiation therapy
11. Tuberculosis (Stierlin sign)
12. Typhilitis
13. Typhoid fever
14. Ulcerative colitis
15. *Yersinia* enterocolitis

**References**

**Gamut G-98**

**ENLARGEMENT OF THE ILEOCECAL VALVE**

**COMMON**
1. Amebiasis
2. Crohn’s disease
3. Fatty infiltration (lipomatosis)
4. Intussusception
5. Neoplasm, benign or malignant (esp. villous adenoma; polyp, lipoma; carcinoid; adenocarcinoma; lymphoma)
6. Normal variant (“hypertrophy”)

**UNCOMMON**
1. Actinomycosis
2. Anisakiasis
3. Cathartic abuse
4. Foreign body, impacted
5. Gallstone, impacted
6. Ileocolic prolapse
7. Intramural hematoma
8. Lymphoid hyperplasia
9. Tuberculosis
10. Typhoid fever
11. Ulcerative colitis
12. *Yersinia* enterocolitis

**Reference**
**Gamut G-99**

**ANTERIOR INDENTATION ON THE RECTOSIGMOID JUNCTION**

**COMMON**
1. Abscess, pelvic (eg, bacterial; PID; amebiasis; schistosomiasis; LGV)
2. Ascites (in erect position)
3. Carcinoma of ovary, cervix, uterus, bladder, or rectosigmoid colon
4. Endometriosis
5. Extrinsic pelvic neoplasm, other (eg, teratoma; dermoid or other ovarian cyst; uterine fibroid)
6. Metastasis, peritoneal (Blumer shelf) (esp. from carcinoma of colon, stomach, pancreas, ovary)

**UNCOMMON**
1. Aneurysm of internal iliac artery
2. Hematoma
3. Hydatid cyst
4. Lymphocele
5. Lymphoma, other lymphadenopathy
6. Pelvic lipomatosis
7. Postsurgical sling repair for rectal prolapse
8. Rectovaginal fistula (eg, LGV) (See G-101)
9. Retroperitoneal fibrosis
10. Urinoma
11. Vaginal lesion (eg, carcinoma; hematocolpos)

**Reference**

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**Gamut G-100**

**RECTAL DISEASE ON BARIUM ENEMA**

**COMMON**
1. Abscess
2. Carcinoma (adenocarcinoma; scirrhous; cloacogenic; anal)
3. Congenital anomaly (eg, Hirschsprung disease; imperforate anus)
4. Crohn’s disease
5. Endometriosis
6. Metastasis; invasion from adjacent neoplasm
7. Polyp
8. Prolapse
9. Radiation proctitis
10. Trauma (sexual; iatrogenic; puerperal or other)
11. Ulcerative colitis
12. Villous adenoma

**UNCOMMON**
1. Actinomycosis
2. Amyloidosis
3. Bacillary dysentery (shigellosis)
4. Carcinoid
5. Colitis cystica profunda
6. Diverticulitis
7. Ischemic colitis
8. Lymphogranuloma venereum (Chlamydia infection)
9. Lymphoma
10. Neoplasm, benign (eg, gastrointestinal stromal tumor; lipoma; angioma)
11. Opportunistic infection (eg, herpes)
12. Parasitic disease (esp. amebiasis; schistosomiasis; trichuriasis; Chagas’ disease)
13. Pelvic lipomatosis
14. Pneumatosis cystoides intestinalis
15. Proctitis (idiopathic; gonorrheal; chemical—paraldehyde)
16. Retroperitoneal fibrosis

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Reference
17. Solitary rectal ulcer syndrome
18. Tuberculosis
19. Varices; hemorrhoids

Reference

Gamut G-102

INCREASED RETRORECTAL OR PRESACRAL SPACE (See C-50)

COMMON
1. Abscess, presacral or pelvic (eg, perforated colon from diverticulitis or carcinoma; tubovarian or periappendiceal abscess)
2. Carcinoma of rectum (esp. adenocarcinoma; also scirrhous; cloacogenic; anal)
3. Crohn’s disease
4. Diverticulitis
5. Extrinsic soft tissue mass (incl. ovarian cyst or neoplasm; dermoid; teratoma; enteric duplication cyst; tail gut cyst; lipoma)
6. Hematoma (eg, sacral fracture)
7. Lymphadenopathy
8. Metastatic or invasive malignant neoplasm (eg, from bladder, prostate, ovary, cervix)
9. Normal variant
10. Postoperative (eg, resection of rectosigmoid)
11. Radiation proctitis or fibrosis
12. Sacral or coccygeal lesion (eg, metastasis; myeloma; chordoma; osteosarcoma; chondrosarcoma; giant cell tumor; neurofibroma; sacrococcygeal teratoma; hydatid cyst)
13. Trauma (external; sexual; puerperal; iatrogenic— instrumentation)
14. Ulcerative colitis
15. Urinoma

UNCOMMON
1. Amebiasis
2. Amyloidosis of colon
3. Anterior sacral meningocele
4. Colitis cystica profunda; pneumatosis intestinalis
5. Cushing S. (fat deposition)
6. Endometriosis
7. Hemorrhoidal injection
8. Inferior vena cava obstruction (pelvic edema)
9. Inguinal hernia with rectal traction

Reference
10. Ischemic colitis (See G-69)
11. Lymphocèle
12. Lymphogranuloma venereum (*Chlamydia* infection)
13. Lymphoma of rectum or retrorectal soft tissues
14. Neoplasm, benign, of soft tissues or rectum (incl. hemangioma; hemangioendothelioma; gastrointestinal stromal tumor; lipoma)
15. Pelvic lipomatosis
16. Pneumoretroperitoneum
17. Proctitis (idiopathic; traumatic; gonorrheal; chemical—paraldehyde)
18. Retroperitoneal fibrosis
19. Sarcoma (e.g., rhabdomyosarcoma)
20. Schistosomiasis
21. Tuberculosis

**References**

**Gamut G-103**

"THUMBPRINTING" OF THE GASTROINTESTINAL TRACT (MULTIPLE INTRAMURAL DEFECTS)

**COMMON**
1. Crohn’s disease
2. Diverticulitis
3. Ischemic colitis with hemorrhage into bowel wall (See G-69)
4. Ulcerative colitis

**UNCOMMON**
1. Amyloidosis
2. Angioneurotic edema
3. Carcinoid S.
4. Cytomegalovirus colitis in AIDS
5. Endometriosis
6. Hemolytic-uremic S. (ischemic enterocolitis preceding onset of renal failure in infants)
7. Intramural hematoma or hemorrhage (e.g., trauma; hemophilia or other bleeding diathesis; anticoagulant therapy)
8. Lymphoma of rectum or retrorectal soft tissues
9. Metastasis, mural or peritoneal
10. Parasitic disease (esp. amebiasis; strongyloidiasis; schistosomiasis; anisakiasis)
11. Pericolic abscess (See G-89)
12. Pneumatosis cystoides intestinalis
13. Pseudomembranous or necrotizing colitis
14. Retractile mesenteritis, other mesenteric or peritoneal lesion (See G-228 to G-231)
15. Toxic megacolon (See G-94)
16. Typhlitis
17. Urticaria (“colon hives” secondary to chronic ischemia; colon obstruction; herpes zoster or *Yersinia* colitis; Chagas’ disease)

**References**
Gamut G-104

INTRAMURAL HEMATOMA OF THE GASTROINTESTINAL TRACT

COMMON
1. Anticoagulant therapy
2. Hemophilia; Christmas disease; other bleeding or clotting disorder
3. Trauma

UNCOMMON
1. Connective tissue disease (collagen vascular disease) (esp. polyarteritis nodosa)
2. Drug therapy (eg, cytotoxin)
3. Henoch-Schönlein purpura
4. Idiopathic thrombocytopenic purpura
5. Leukemia

Reference

Gamut G-105

BULL’S-EYE LESION (SOLITARY OR MULTIPLE NODULES IN THE GASTROINTESTINAL TRACT WITH LARGE CENTRAL ULCERATION)

COMMON
*1. Gastrointestinal stromal tumor (esp. leiomyoma; leiomyosarcoma; neurofibroma)
*2. Lymphoma
*3. Metastatic melanoma
*4. Peptic ulcer

UNCOMMON
1. Amyloid tumor
2. Carcinoid
3. Carcinoma
4. Ectopic pancreas
5. Eosinophilic granuloma
*6. Kaposi sarcoma
*7. Metastases (esp. from kidney; pancreas; breast; lung)

* May be multiple.

References

Gamut G-106

POLYPOSIS SYNDROMES

1. Behçet S.
2. Blue rubber bleb nevus S.
3. Cowden S. (multiple hamartoma S.)
4. Cronkhite-Canada S.
5. Familial adenomatous polyposis (eg, familial polyposis; Gardner S.)
6. Juvenile polyposis of infancy; generalized juvenile polyposis
7. Lipomatous polyposis
8. Peutz-Jeghers S. ( alimentary tract polyposis)
9. [Polyps, multiple adenomatous]
This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut G-107
INTERNAL OR EXTERNAL FISTULA INVOLVING THE GASTROINTESTINAL TRACT

COMMON
1. Abscess, (eg, appendiceal; perirenal)
2. Carcinoma; other malignant neoplasm, primary or metastatic
3. Crohn’s disease
4. Diverticulitis
5. Postoperative (eg, surgical complication; dehiscence; ileostomy; colostomy; gastrostomy)

UNCOMMON
1. Actinomycosis
2. Amebiasis
3. Biliary-enteric fistula (See G-139)
4. Colovesical fistula (esp. diverticulitis; malignancy)
5. Duodenal-renal fistula (eg, tuberculosis; pyelonephritis; duodenal ulcer)
6. Entero-ovarian fistula
7. Foreign body (eg, pin; bone; toothpick)
8. Infarction; ischemic colitis (See G-69)
9. Lymphoma
10. Peptic ulcer; marginal ulcer
11. Pancreatic fistula (pancreatitis; ruptured pseudocyst; posttraumatic; postsurgical; external drainage of pseudocyst)
12. Prosthetic aortic graft
13. Radiation therapy
14. Rectovaginal, pelvic, or perineal fistula (esp. pelvic inflammatory disease; lymphogranuloma venereum; diverticulitis; Crohn’s disease; malignancy) (See G-101)
15. Schistosomiasis
16. Trauma, external or iatrogenic (eg, enema)
17. Tuberculosis
18. Ulcerative colitis

References

Gamut G-108
NONVISUALIZATION OF THE GALLBLADDER (US, CT, NM)

COMMON
1. [Calcified gallbladder wall (porcelain gallbladder); milk of calcium bile]
2. Cholecystitis (acute or chronic; gangrenous; emphysematous)
3. Contracted gallbladder (esp. postprandial)
4. Prior cholecystectomy
5. Technical factors, esp. on ultrasound (eg, gallbladder obscured by gas; obese patient or thin patient with superficial gallbladder)
UNCOMMON
1. [Anomalous position of gallbladder (eg, ectopic gallbladder; situs inversus)]
2. Biliary atresia
3. Carcinoma of gallbladder
4. Compression by adjacent mass
5. Congenital absence or hypoplasia
6. Fibrosis of gallbladder
7. Hepatization of the gallbladder (sludge-filled)
8. Hyperalimentation; nonfasting patient
9. Metastatic disease involving gallbladder
10. Pregnancy (last trimester)
11. Syndromes (eg, Dubin-Johnson S.; Kawasaki S.; Mirizzi S.)

This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References

COMMON
1. Acute hepatitis
2. Chronic cholecystitis
3. Postprandial status

UNCOMMON
1. Adenomyomatosis of gallbladder
2. Congenital hypoplasia or multiseptate gallbladder
3. Cystic fibrosis (mucoviscidosis)

References

ENLARGED GALLBLADDER (US, CT, MRI)

COMMON
1. Acute cholecystitis with cholelithiasis causing obstruction of cystic or common duct
2. Diabetes
3. Drugs (eg, anticholinergics; narcotics)
4. Hydrops; empyema
5. Hyperalimentation
6. Neoplasm arising in head of pancreas, ampulla of Vater, or lower common bile duct (Courvoisier gallbladder)

(continued)
7. Pancreatitis obstructing Vaterian segment
8. Postvagotomy; postsurgical
9. Pregnancy
10. Prolonged fasting

UNCOMMON
1. Acromegaly
2. AIDS-related cholangiopathy (cytomegalovirus; Cryptosporidium)
3. Alcoholism
4. Bedridden patient with chronic illness
5. Chagas’ disease
6. Kawasaki S.
7. Leptospirosis
8. Mucocele
9. Normal variant

References

Gamut G-112
MULTISEPTATE GALLBLADDER (US, CT)

1. Adenomyomatosis
2. Cholesterolosis
3. Congenital malformation
4. Desquamated gallbladder mucosa
5. Normal folded gallbladder (incl. Phrygian cap)

References
GALLBLADDER DISEASE SECONDARY TO CYSTIC DUCT OR INFUNDIBULUM OBSTRUCTION

COMMON
1. Cholecystitis
2. Hydrops; empyema; mucocele of gallbladder
3. Milk of calcium bile
4. Porcelain gallbladder (calcified gallbladder wall)

UNCOMMON
1. Choledochoenteric fistula; gallstone ileus (eg, from gallstone perforation)
2. Emphysematous cholecystitis
3. Ruptured gallbladder

Reference

ARTIFACTS THAT MIMIC GALLSTONES

COMMON
1. Gallstone (eg, calcium bilirubinate or calcium carbonate)
2. \[Other right upper quadrant density (eg, stone in kidney or retrocecal appendix; calcified aneurysm; barium in diverticulum)\]

UNCOMMON
1. Milk of calcium bile
2. Mucinous adenocarcinoma of gallbladder

3. Porcelain gallbladder
4. Schistosomiasis
5. Stone in common duct or cystic duct remnant

[ ] This condition does not actually cause the gamuted imaging finding, but can produce similar imaging changes that simulate it.

References

CALCIFICATION IN THE GALLBLADDER OR COMMON BILE DUCT

COMMON
1. Gallstone (eg, calcium bilirubinate or calcium carbonate)

UNCOMMON
1. Milk of calcium bile
2. Mucinous adenocarcinoma of gallbladder

3. Porcelain gallbladder
4. Schistosomiasis
5. Stone in common duct or cystic duct remnant

[ ] This condition does not actually cause the gamuted imaging finding, but can produce similar imaging changes that simulate it.

References

ARTIFACTS THAT MIMIC GALLSTONES

1. Inspissated sludge
2. Intraluminal defect, any cause (See G-116)
3. Partial volume artifact with duodenal impression
4. Refraction from folds in gallbladder neck

References
Gamut G-115-S2

STRUCTURES THAT SONOGRAPHICALLY MIMIC THE GALLBLADDER (US)

1. Abscess (esp. Near ligamentum teres)
2. Choledochal cyst
3. Dilated cystic duct remnant
4. Fluid-filled duodenal bulb
5. Hepatic cyst
6. Omental cyst
7. Renal cyst

Reference

Gamut G-116

FIXED POLYPOID LESION(S) OR FILLING DEFECT(S) IN THE GALLBLADDER (US, CT, MRI)

COMMON
*1. Adenomyoma; adenomyomatosis; hyperplastic cholecystosis
*2. Cholesterol polyp
*3. Cholesterolosis (“strawberry” gallbladder)
*4. Gallstone, adherent
5. [Phrygian cap]

UNCOMMON
*1. Adenoma (incl. adenomatous polyp; villous adenoma; papilloma; fibroadenoma; cystadenoma)
*2. Cholecystitis glandularis proliferans
3. Congenital fold or septum
4. Cyst (epithelial; mucous retention)

5. Ectopic pancreatic or gastric tissue
*6. Hamartomas in Peutz-Jeghers S.
*7. Inflammatory polyp
8. Metachromatic leukodystrophy
*9. Metastasis (esp. melanoma)
10. Neoplasm, benign (eg, carcinoid; neurinoma; angioma)
11. Neoplasm, malignant (eg, adenocarcinoma; leiomyosarcoma)
*12. Parasitic granuloma (eg, Ascaris)
13. Postoperative defect
14. [Pseudodefect in neck of gallbladder; other pseudopolyps]
*15. Vascular lesion (eg, varix; aneurysm; tortuous artery)
16. Xanthogranulomatous cholecystitis

* May be multiple.

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
NONSHADOWING LESION IN THE GALLBLADDER (US)

COMMON
1. Gallstone, nonshadowing or not in the transducer focal zone
2. Polyp (adenomatous or cholesterol)
3. Sludge

UNCOMMON
1. Adenomyomatosis
2. Carcinoma of gallbladder
3. Desquamated mucosa
4. Fibrinous debris
5. Hematoma
6. Inspissated pus
7. Metastasis
8. Parasites (eg, *Ascaris; Clonorchis; Fasciola*)
9. Precipitated contrast medium from ERCP

ECHO(ES) WITHIN THE GALLBLADDER (US)

COMMON
1. Acute cholecystitis
2. Calculus
3. Fold in gallbladder wall
4. Polyp (adenomatous)
5. Sludge

UNCOMMON
1. AIDS-related cholangiopathy
2. Carcinoma of gallbladder
3. Clonorchiasis; fascioliasis
4. Ectopic pancreas or gastric mucosa
5. Emphysematous cholecystitis
6. Empyema of gallbladder
7. Feces (via fistula)
8. Food particles after cholecystojejunostomy
9. Gangrenous cholecystitis
10. Hemobilia
11. Hemorrhagic cholecystitis
12. Metastasis
13. Milk of calcium
14. Papilloma
15. Sarcoma of gallbladder

References
Gamut G-119-1

**ECHOCgenic Bile/Gallbladder Sludge (US); High Density Bile (CT)**

1. [Artifact (side lobe and slice thickness artifact on US; volume averaging of normal liver on CT)]
2. Cholelithiasis
3. Extrahepatic biliary obstruction
4. Hemolysis
5. Hemorrhage; hematobilia (esp. posttraumatic)
6. Inflammatory debris or pus
7. Milk of calcium
8. Prolonged fasting
9. Sickle cell disease; thalassemia
10. Vicarious excretion of contrast media (eg, renal failure; recent ERCP; occasionally normal)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut G-120

**Increased Attenuation of Gallbladder Lumen (CT)**

**COMMON**
1. Gallstones
2. Prior endoscopic retrograde cholangiopancreatography (ERCP) or oral cholecystography
3. Sludge; debris

**UNCOMMON**
1. Empyema of gallbladder with pus
2. Feces (via fistula)
3. Food particles after cholecystojejunostomy
4. Hemobilia
5. Hemorrhagic cholecystitis
6. Hydrops of gallbladder
7. Milk of calcium bile
8. Mucinous adenocarcinoma of the gallbladder
9. Polyp or papilloma projecting into lumen
10. Vicarious excretion of contrast medium
11. Volume averaging with adjacent structures

References

Gamut G-121

HYPERECHOIC FOCUS IN THE GALLBLADDER WALL (US)

COMMON
1. Adenomyomatosis, cholesterolosis (“hyperplastic cholecystoses”)
2. Gallstone (embedded)
3. Polyp, cholesterol or other

UNCOMMON
1. Cholecystitis glandularis proliferans
2. Emphysematous cholecystitis
3. Microabscess
4. Rokitansky-Aschoff sinuses

References

Gamut G-122

FOCAL THICKENING OF THE GALLBLADDER WALL (>3MM) (US, CT)

COMMON
1. Adenomyomatosis
2. Adherent gallstone or sludge
3. Carcinoma of gallbladder
4. Polyp, inflammatory

UNCOMMON
1. Benign neoplasm (eg, adenoma; carcinoid; papilloma)
2. Ectopic mucosa
3. Gangrenous or hemorrhagic cholecystitis
4. Hematoma
5. Metastasis (esp. melanoma)
6. Varices

References
DIFFUSE THICKENING OF THE GALLBLADDER WALL (US, CT, MRI)

COMMON
1. AIDS-related cholangiopathy (cytomegalovirus; Cryptosporidium)
2. Ascites with edema of gallbladder wall (eg, cirrhosis; renal failure; hypoalbuminemia; heart failure)
3. Carcinoma of gallbladder
4. Cholecystitis, acute or chronic, usually with cholelithiasis
5. Cirrhosis; schistosomiasis; liver failure
6. Hepatitis (viral or alcoholic)
7. Portal hypertension
8. Postprandial (physiologic contraction); incomplete distension; inadequate fasting
9. Total parenteral nutrition

UNCOMMON
1. Adenomyomatosis; hyperplastic cholecystosis
2. Brucellosis
3. Extrahepatic portal vein obstruction (eg, pancreatitis; carcinoma of pancreas)
4. Folds in gallbladder wall
5. Gangrenous gallbladder
6. Graft-versus-host disease
7. Hemorrhagic cholecystitis
8. Infectious mononucleosis
9. Kaposi sarcoma (in AIDS)
10. Lymphatic obstruction at porta hepatis
11. Lymphoma
12. Multiple myeloma
13. Necrotizing enterocolitis in infants
14. Peptic ulcer adjacent to gallbladder
15. Pyelonephritis of right kidney
16. Sclerosing cholangitis
17. Torsion of gallbladder
18. Varices of gallbladder wall
19. Xanthogranulomatous cholecystitis

References

STRIATIONS IN A THICKENED GALLBLADDER WALL (US, CT)

COMMON
1. AIDS-related cholangiopathy (cytomegalovirus; Cryptosporidium)
2. Gangrenous cholecystitis
3. Non-biliary related edema or inflammation (eg, heart failure; renal failure; liver failure; hypoalbuminemia; ascites)

UNCOMMON
1. Adenomyomatosis
2. Blockage of lymphatic and venous drainage of gallbladder
3. Hepatitis
4. Pancreatitits
5. Varices of gallbladder wall
6. Xanthogranulomatous cholecystitis

References

Gamut G-125
EXTRINSIC DEFORMITY OR DISPLACEMENT OF THE GALLBLADDER (CAG, MRCP, CT)

COMMON
1. Liver mass (eg, hepatocellular carcinoma; hemangiom; metastases; regenerating nodule; abscess; hydatid cyst; polycystic disease)
2. Normal duodenum or colon

UNCOMMON
1. Choledochal cyst
2. Duodenal mass (eg, neoplasm; hematoma)
3. Lymphadenopathy (eg, lymphoma; metastases)
4. Pancreatic mass (eg, neoplasm; pseudocyst)
5. Retroperitoneal tumor or cyst (eg, renal, adrenal, soft tissue); polycystic kidney

Reference

Gamut G-126
PERICHOLECTYSTIC FLUID ON ULTRASOUND

COMMON
1. Acute cholecystitis (with or without perforation)
2. Ascites

UNCOMMON
1. AIDS-related cholangiopathy (cytomegalovirus; Cryptosporidium)
2. Hematoma
3. Pancreatitits
4. Peptic ulcer disease
5. Perforated appendix or diverticulum
6. Pericholecystic abscess
7. Peritonitis
8. Torsion of gallbladder

References

Gamut G-127
DELAYED VISUALIZATION OF THE GALLBLADDER ON SCINTIGRAPHY

COMMON
1. Chronic cholecystitis

UNCOMMON
1. Acalculus cholecystitis
2. Carcinoma of gallbladder

(continued)
3. Dubin-Johnson syndrome
4. Hepatocellular disease (eg, cirrhosis; hepatitis)
5. Pancreatitis
6. Total parenteral nutrition

Reference

Gamut G-128
GAS IN THE GALLBLADDER OR BILIARY TRACT

COMMON
1. Biliary-enteric fistula to duodenum or colon (eg, perforated ulcer or adenocarcinoma of duodenum, ampulla, bile duct, gallbladder, stomach, pancreas, or colon; metastasis; lymphoma) (See G-139)
2. Cholecystitis with perforation
3. Emphysematous cholecystitis, cholangitis (esp. in diabetic)
4. [Gas in portal vein]
5. Postoperative (eg, sphincterotomy; biliary-intestinal anastomosis {cholecystoenterostomy; choledochoenterostomy; Whipple procedure}; internal or external biliary drainage)
6. Recent passage of gallstone from gallbladder or common duct (eg, gallstone ileus)

UNCOMMON
1. Common duct entry into duodenal diverticulum
2. Crohn’s disease
3. [Gas in gallstone]
4. [Normal periductal fat]
5. Pancreatitis
6. Parasitic disease (clonorchiasis; ascariasis; ruptured amebic abscess of liver; strongyloidiasis of duodenum)
7. Peptic ulcer with perforation into common duct and fistula
8. Physiologic (incompetent, patulous sphincter, esp. in elderly)
9. Postbulbar duodenal ulcer adjacent to ampulla with spasm (acute) or fibrosis (healing)
10. Trauma, external penetrating or iatrogenic (eg, intubation; ERCP)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut G-129
CONGENITAL DISORDERS OR SYNDROMES WITH AN ABNORMAL BILIARY TRACT

COMMON
1. Asplenia S. (Ivemark S.); polysplenia S.
2. Biliary atresia
3. Caroli disease
4. Cholelithiasis
5. Cystic fibrosis (mucoviscidosis)

UNCOMMON
1. Bardet-Biedl S.
2. Bile duct hypoplasia (Alagille S. or arteriohepatic S.)
3. Bile plug S.
4. Hepatic fibrosis-renal cystic disease
5. Meckel S.
6. Spontaneous (idiopathic) perforation of common bile duct

References
5. Siegel MJ: Pediatric Body CT. Philadelphia: Lippincott Williams & Wilkins, 1999

Gamut G-130

DILATATION OF BILE DUCTS (CAG, MRCP, US, CT, MRI)

COMMON
1. Advanced age
2. Calculus in biliary duct (choledocholithiasis)
3. Chronic pancreatitis
4. Lymphadenopathy with extrinsic compression
5. Neoplasm of pancreas, ampulla of Vater, common duct, or major bile duct (eg, papilloma; adenocarcinoma; mucin-producing cholangiocarcinoma)
6. Papillitis or fibrosis of ampulla of Vater
7. Parasitic disease (eg, ascariasis; clonorchiasis; opisthorchiasis; fascioliasis; hydatid disease)
8. Sclerosing cholangitis
9. Stricture of distal biliary duct (eg, postoperative; intubation; inflammatory; congenital)

UNCOMMON
1. Aneurysm of hepatic artery or aorta (compression)
2. Biliary atresia, extrahepatic
3. Biliary duct web or diaphragm
4. Caroli disease
5. Cholangitis, infectious (eg, AIDS-related; bacterial; parasitic)
6. Choledochal cyst
7. Choledochocoele
8. Diverticulum of duodenum or biliary duct (compression)
9. Duodenal ulcer, penetrating
10. Hepatic fibrosis-renal cystic disease
11. Liver abscess (pyogenic, amebic, or fungal)
12. Liver infarcts following transcatheter embolization of hepatic artery branches
13. Lymphadenopathy in periportal area with ductal compression (eg, metastatic carcinoma of liver, stomach, or pancreas; lymphoma; sarcoidosis)
14. Metastasis
15. Mirizzi syndrome
16. Papillitis or fibrosis of ampulla
17. [Periportal edema]
18. Retroperitoneal fibrosis

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
Gamut G-131

BILIARY DILATATION WITHOUT JAUNDICE OR OBSTRUCTION

1. Advanced age
2. Choledochal cyst (type I)
3. Common duct exploration sequela
4. Early ductal obstruction
5. Nonobstructive gallstone
6. Normal variant
7. Parasitic disease (eg, Ascaris; Clonorchis; Fasciola; Opisthorchis; ruptured hydatid cyst or amebic abscess into duct)
8. Postcholecystectomy
9. Post-ductal obstruction
10. Recent passage of stone with ampullary edema

Reference

Gamut G-132

BILIARY OBSTRUCTION WITHOUT DILATATION

1. Acute severe biliary obstruction (first 3 days)
2. Cholangiocarcinoma with tumor encasement
3. Cholangitis (eg, ascending; sclerosing; recurrent pyogenic)
4. Hemobilia
5. Pancreatitis
6. Parasitic disease (eg, solitary or few Ascaris, Clonorchis, or Fasciola; ruptured hydatid cyst or amebic abscess into duct with debris)

Reference

Gamut G-133-1

CYSTIC AND SACCULAR LESIONS OF THE BILE DUCTS—WITH NORMAL-SIZED INTRAHEPATIC BILE DUCTS (CAG, MRCP)

1. Choledochal cyst (common duct)
2. Choledochocele (intraduodenal)
3. Cystic duct remnant
4. Diverticulum of common duct or rarely, an intrahepatic duct
5. Simple central dilatation of common duct

References

Gamut G-133-2

CYSTIC AND SACCULAR LESIONS OF THE BILE DUCTS—WITH DILATATION OF INTRAHEPATIC BILE DUCTS (CAG, MRCP)

1. Bacterial cholangitis with tiny saccular abscesses (acute, suppurative, ascending cholangitis)
2. Caroli disease
3. Choledochal cyst
4. Hepatic fibrosis-renal cystic disease
5. Parasitic disease (esp. opisthorchiasis; also clonorchiasis; ascariasis)
6. Recurrent pyogenic cholangitis (Oriental cholangiohepatitis)

Reference
7. Reversible dilatation of intrahepatic bile ducts
8. Sclerosing cholangitis with prestenotic saccular outpouchings

References

Gamut G-134

FILLING DEFECT OR SEGMENTAL LESION IN THE BILE DUCTS (CAG, MRCP, CT)

COMMON
1. Air bubble
2. Calculus
3. Contraction of choledochal sphincter (pseudo-calculus) in distal common duct
4. Edema of ampullary segment (eg, after passage of calculus; pancreatitis)
5. Extrinsic vascular impression (eg, right hepatic artery; bile duct varices)
6. Malignant neoplasm of bile duct (cholangiocarcinoma), gallbladder, ampulla, duodenum, or pancreas; hepatocellular carcinoma (hepatoma); Klatskin tumor
7. Stricture (eg, cholangitis or Oriental cholangiohepatitis with dilated ducts and calculi)

UNCOMMON
1. Blood clot
2. Congenital membranous diaphragm (web) of common hepatic duct
3. Debris or mucus in ducts from obstructing tumor or parasites
4. Foreign body or food particle
5. Lymphadenopathy in porta hepatitis
6. Metastasis (eg, lung; melanoma; lymphoma)
7. Mirizzi syndrome
8. Neoplasm, benign (eg, adenoma; papilloma; carcinoid; gastrointestinal stromal tumor; lipoma; hamartoma; polyp)
9. Normal variant (eg, cystic duct insertion; valves of Heister; redundant walls of tortuous duct)
10. Parasite (Ascaris; Clonorchis; Fasciola; hydatid cyst)
11. Pericholedochal adhesions
12. Postoperative defect (eg, plication defect at the site of duct-to-duct anastomosis)
13. Sarcoma botryoides (child)
14. Spasm of sphincter of Oddi

References
THICKENING OF BILE DUCT WALLS (US)

COMMON
1. AIDS-related cholangiopathy
2. Ascending (bacterial) cholangitis
3. Choledocholithiasis
4. Pancreatitis (common duct)
5. Recurrent pyogenic cholangitis (Oriental cholangiohepatitis)
6. Sclerosing cholangitis

UNCOMMON
1. Cholangiocarcinoma
2. Parasitic disease (liver flukes {clonorchiasis; opisthorchiasis}; ascariasis; schistosomiasis; ruptured amebic hepatic abscess into bile ducts)

References

ECHOES WITHIN THE BILE DUCTS (US)

COMMON
1. Calculus
2. Hemobilia
3. Pneumobilia
4. Pus
5. Sludge

UNCOMMON
1. Cholangiocarcinoma
2. Feces (via fistula)
3. Food particles (via reflux)
4. Hepatoma
5. Mesenchymal tumor, benign
6. Metastasis
7. Parasites (Ascaris; Clonorchis; Fasciola; hydatid debris)
8. Recurrent pyogenic cholangitis (Oriental cholangiohepatitis)
9. Surgical clips

References

BILE DUCT NARROWING OR OBSTRUCTION (CAG, MRCP)

COMMON
1. Calculus in biliary duct (choledocholithiasis)
   (eg, impacted stone in Vaterian segment; papillary edema from recent passage of stone; Mirizzi syndrome)
2. Cholangitis
3. Contraction of choledochal sphincter (pseudocalculus); papillary stenosis
4. Iatrogenic or posttraumatic (eg, surgical injury; trauma; radiation therapy; hepatic artery chemother-apy or embolization)
5. Neoplasm, malignant (eg, cholangiocarcinoma; ampullary, pancreatic, duodenal, or gallbladder carcinoma; hepatocellular carcinoma; Klatzkin tumor; villous tumor)
6. Pancreatitis, acute or chronic (incl. pseudocyst)
7. Sclerosing cholangitis
UNCOMMON
1. Abscess (pyogenic, amebic, or fungal)
2. AIDS-related cholangiopathy (eg, cytomegalovirus or Cryptosporidium infection)
3. Artifact from post-processing technique of MRCP
4. Biliary hypoplasia or atresia
5. Caroli disease (complicated)
6. Congenital membranous diaphragm (web)
7. Debris or mucus in ducts from obstructing tumor or parasites
8. Duodenal diverticulum
9. Hepatic fibrosis-renal cystic disease
10. Hepatocellular disease, advanced (eg, cirrhosis; cholangiolytic hepatitis)
11. Liver cyst, neoplasm, or abscess
12. Lymphadenopathy in porta hepatis (eg, metastasis; lymphoma; tuberculosis; sarcoidosis)
13. Metastasis (esp. from carcinoma of pancreas, gallbladder, stomach)
14. Neoplasm, benign (incl. adenoma; papilloma; gastrointestinal stromal tumor; myoblastoma; cystadenoma)
15. Papillitis of ampulla
16. Parasitic disease of bile ducts, liver, or duodenum (esp. ascariasis; clonorchiasis; fascioliasis; hydatid disease; amebic abscess; schistosomiasis; strongyloidiasis)
17. Postbulbar duodenal ulcer with scarring or perforation
18. Recurrent pyogenic cholangitis {Oriental cholangiohepatitis}
19. Stricture, traumatic or iatrogenic (eg, postoperative; intubation)
20. Vascular compression (eg, aneurysm of aorta or hepatic artery; calcified portal vein)

References

Gamut G-138
ENLARGED PAPILLA OF VATER

COMMON
1. Calculus impacted in distal common duct
2. Carcinoma of Vaterian segment
3. Idiopathic; normal variant
4. Mucinous (ductectatic) adenocarcinoma of pancreas
5. Pancreatitis
6. Papillitis

UNCOMMON
1. Edema secondary to active duodenal ulcer
2. Heterotopic pancreatic tissue
3. Neoplasm (eg, adenomatous polyp of papilla; carcinoid; gastrointestinal stromal tumor of duodenum)
4. Pancreatic abscess
5. Parasitic disease (eg, strongyloidiasis; ascariasis)
6. Postoperative; instrumentation
7. Zollinger-Ellison syndrome

References

(continued)

Gamut G-139

BILIARY-ENTERIC FISTULA
(See G-128)

COMMON
1. Cholecystitis (perforative, acute or chronic)
2. Gallstone fistula from gallbladder or bile duct (eg, choledochoduodenal fistula)
3. Malignant neoplasm of gallbladder, bile duct, pancreas, or intestine
4. Postoperative (eg, sphincterotomy; biliary-intestinal anastomosis—Whipple procedure)

UNCOMMON
1. Abscess (pancreatic; hepatic; pericolic; pericholecystic)
2. Common duct entry into duodenal diverticulum
3. Diverticulitis of duodenum or hepatic flexure of colon
4. Granulomatous disease of duodenum or colon (eg, Crohn’s disease; tuberculosis; actinomycosis)
5. Lymphoma
6. Parasitic disease (esp. amebiasis; ascariasis; hydatid disease)
7. Passage of common duct stone
8. Peptic ulcer perforation into biliary tract
9. [Physiologic reflux at ampulla; incompetent sphincter]
10. Trauma, external or iatrogenic (eg, intubation; ERCP)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut G-140

BILIARY-PLEURAL (OR BRONCHIAL) FISTULA

1. Biliary obstruction
2. Congenital
3. Parasitic disease (eg, amebic abscess; hydatid disease)
4. Trauma, external or iatrogenic

References

Gamut G-141-1

HEPATOMEGALY (See G-141-2)

COMMON
1. Abscess, solitary or multiple (pyogenic, amebic, or fungal)
2. Cirrhosis, early
3. Congenital hepatomegaly (See G-141-2)
4. Cyst (bile duct cyst; simple; posttraumatic; hydatid) (See G-157)
5. Elevated venous pressure (eg, heart failure; constrictive pericarditis; tricuspid stenosis or insufficiency)
6. Fatty change (steatosis) (See G-144)
7. Hemochromatosis
8. Hepatitis (viral, infectious, or serum)
9. Infectious disease, other (eg, infectious mononucleosis; candidiasis; brucellosis; miliary tuberculosis or histoplasmosis; malaria)
10. Metastases
11. Neoplasm (esp. hepatocellular carcinoma (hepatoma); cholangiocarcinoma; hepatoblastoma; giant hemangioma; hemangioendothelioma; angiosarcoma)
12. Obstruction of common bile duct (biliary cirrhosis) (See G-137)

**UNCOMMON**
1. Amyloidosis
2. Anemia, primary (eg, thalassemia major)
3. Chronic granulomatous disease of childhood
4. Extramedullary hematopoiesis
5. Gaucher disease; Niemann-Pick disease
6. Glycogen storage disease (eg, type I—von Gierke)
7. Hematoma
8. Hydatid disease (*Echinococcus granulosus* and *E. multilocularis*)
9. Kala-azar
10. Langerhans cell histiocytosis
11. Lymphoma
12. Myeloid metaplasia; myelofibrosis
13. Polycystic disease of liver
14. Polycythemia vera
15. Reye S.
16. Sarcoidosis
17. Schistosomiasis
18. Thrombosis of hepatic vein or upper inferior cava (Budd-Chiari S.); veno-occlusive disease (See G-189)
19. Wilson disease

**Reference**

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**Gamut G-141-2**

**CONGENITAL HEPATOMEGALY**

**COMMON**
1. Anemia, primary (esp. thalassemia; sickle cell disease)
2. Cystic fibrosis (mucoviscidosis)
3. Gaucher disease; Niemann-Pick disease
4. Glycogen storage disease, types I (von Gierke), III and IV
5. Infant of diabetic mother
6. Langerhans cell histiocytosis
7. Mucopolysaccharidoses (esp. Hurler S., Hunter S.; I-cell disease) (See J-4)
8. Polycystic disease of liver

**UNCOMMON**
1. Aase S.
2. Alagille S. (arteriohepatic S.)
3. Alpha-1-antitrypsin deficiency
4. Beckwith-Wiedemann S.
5. Budd-Chiari S.
6. Chédiak-Higashi S.
7. Cholesterol ester storage disease
8. Chronic granulomatous disease of childhood
9. Congenital transplacental infection (eg, toxoplasmosis; rubella; cytomegalovirus; herpes simplex)
10. Cystinosis
11. Ethanolaminosis
12. Farber disease (lipogranulomatosis)
13. Felty S.
14. Galactosemia
15. Galactosialidosis
16. GM<sub>1</sub> gangliosidosis; fucosidosis; mannosidosis
17. Hepatic fibrosis-renal cystic disease
18. Homocystinuria
19. Hyperlipoproteinemia
20. Infantile multisystem inflammatory disease (NOMID)
21. Lipoatrophic diabetes
22. Mauriac S.
23. Osteopetrosis

*(continued)*
24. POEMS S.
25. Pyruvate kinase deficiency
26. Sea-blue histiocyte S.
27. Tyrosinemia (type I)
28. Weber-Christian S.
29. Wilson disease
30. Wolman disease (familial xanthomatosis)
31. Zellweger S. (cerebrohepatorenal S.)

References

DIFFUSE HEPATIC CALCIFICATIONS (PF, US, CT)

COMMON
1. Hyperparathyroidism, secondary (incl. chronic renal failure; uremia; hemodialysis)
2. Ischemia, with or without shock; infarction (chronic)
3. Metastatic disease (eg, mucinous adenocarcinoma of colon, stomach, breast, or thyroid; carcinoma of ovary, pancreas, or lung; islet cell carcinoma; melanoma; neuroblastoma; osteosarcoma; chondrosarcoma; teratoma; also postradiation and post-chemotherapy)
4. [Neoplasm of liver, large, advanced, often necrotic (eg, hepatocellular carcinoma; cholangiocarcinoma; hemangiomata; infantile hemangioendothelioma; hepatoblastoma; fibrolamellar carcinoma; mesenchymal hamartoma)—calcifications may be extensive in a localized area or even multifocal, but not truly diffuse]

UNCOMMON
1. Amyloidosis
2. Chronic granulomatous disease of childhood
3. Congenital transplacental infection (eg, toxoplasmosis; rubella; cytomegalovirus; herpes simplex; varicella)
4. Granulomas, multiple healed (eg, tuberculosis; histoplasmosis; coccidioidomycosis; brucellosis)
5. Hemoschromatosis
6. Hydatid disease (*Echinococcus multilocularis* or multiple calcified *E. granulosus* cysts)
7. Infection, severe (eg, multiple healed abscesses)
8. Pentastomiasis (*Armillifer* infection)
9. [Peritoneal calcifications overlying liver capsule in infancy (eg, meconium peritonitis; ruptured hydro- metocolpos)]
10. Schistosomiasis (esp. *S. japonica*)
11. [Thorotrast residual]

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
FETAL OR NEONATAL LIVER CALCIFICATION

**COMMON**
1. Congenital transplacental infection (eg, toxoplasmosis; rubella; cytomegalovirus; herpes simplex; varicella)
2. Metastatic neuroblastoma
3. Peritoneal calcifications overlying liver capsule (eg, meconium peritonitis; ruptured hydrometrocolpos)

**UNCOMMON**
1. Infarcts
2. Primary liver tumor (eg, hemangioma; hepatoblastoma; infantile hemangioendothelioma; hamartoma; teratoma)
3. Thromboemboli in portal vein [or IVC]

*This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.*

**References**

FATTY CHANGE IN THE LIVER (STEATOSIS) (US, CT, MRI)

**COMMON**
*1. AIDS
2. Alcoholism; cirrhosis
*3. Cystic fibrosis (mucoviscidosis)
4. Diabetes mellitus
*5. Drug therapy (esp. tetracycline; steroids; chemotherapy with cytotoxic agents)
*6. Idiopathic
*7. Obesity

**UNCOMMON**
1. Carbon tetrachloride exposure
*2. Cushing S.
*3. Fever, prolonged
*4. Hepatitis, acute or viral
*5. Hepatotoxins
6. Hyperalimentation
7. Hyperlipidemia, familial
8. Jejunoileal bypass
*9. Lipoatrophic diabetes (congenital total lipodystrophy)
*10. Malabsorption syndrome (See G-57)
11. Peritoneal dialysis
12. Pregnancy
*13. Reye S.
*14. Starvation, acute or chronic (incl. malnutrition; kwashiorkor)
*15. Storage diseases (eg, Gaucher disease; Niemann-Pick disease; glycogen storage disease, type I—von Gierke)

* Children affected.

**References**

(continued)

PERFUSION ABNORMALITIES OF THE LIVER

LOBAR OR SEGMENTAL
1. Cirrhosis with arterial-portal shunt
2. Hypervascular gallbladder disease
3. Mass effect due to tumor, cyst, abscess within liver
4. Portal vein ligation, obstruction or thrombosis

SUBSEGMENTAL
1. Acute cholecystitis
2. Ethanol ablation
3. Obstruction of peripheral portal branches
4. Percutaneous needle biopsy

References

Gamut G-146

PATCHY HEPATOGRAH (AREAS OF LOW DENSITY ON ANGIOGRAPHY OR POSTCONTRAST CT)

COMMON
1. Budd-Chiari syndrome
2. Cirrhosis
3. Heart failure
4. Hepatitis
5. Portal vein thrombosis

UNCOMMON
1. Lymphomatous infiltration
2. Sarcoidosis
3. Schistosomiasis
4. Thyrotoxicosis
5. Tricuspid atresia

References
GENERALIZED OR MULTIFOCAL DECREASED ECHOGENICITY OF THE LIVER ON ULTRASOUND (HYPOECHOIC)

COMMON
1. Hepatitis, acute viral
2. Malignant infiltration of liver by primary or metastatic neoplasm
3. Schistosomiasis, early

UNCOMMON
1. Amyloidosis
2. Leukemia; lymphoma; Burkitt lymphoma
3. [Renal disease, end stage; nephrocalcinosis]

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

GENERALIZED OR MULTIFOCAL INCREASED ECHOGENICITY OF THE LIVER ON ULTRASOUND (HYPERECHOIC)

COMMON
1. AIDS
2. Fatty infiltration (eg, alcoholism; various toxins; diabetes; malabsorption S.; jejunoileal bypass; protein deficiency; starvation—malnutrition, kwashiorkor; familial hyperlipidemia) (See G-144)
3. Fibrosis of liver parenchyma (eg, alcoholism; cirrhosis; schistosomiasis; chronic hepatitis; glycogen storage disease)
4. Hepatocellular carcinoma (hepatoma), diffuse
5. Hydatid disease (Echinococcus multilocularis or multiple healed, calcified E. granulosus cysts)
6. Idiopathic
7. Lipoatrophic diabetes
8. Obesity
9. Technical—excessive gain

UNCOMMON
1. Budd-Chiari S. (focal)
2. Carbon tetrachloride exposure
3. Cystic fibrosis (mucoviscidosis)
4. Drug therapy (esp. tetracycline; steroids; chemotherapy)
5. Gaucher disease
6. Hyperalimentation
7. Lipoatrophic diabetes (congenital total lipodystrophy)
8. Lymphoma; leukemia
9. Miliary tuberculosis
10. Pregnancy
11. Reye S.
12. Tyrosinemia
13. Wilson disease

References

(continued)
Gamut G-149

GENERALIZED HIGH DENSITY LIVER (NONENHANCED CT)

COMMON
1. Hemochromatosis
2. Hemosiderosis

UNCOMMON
1. Chronic arsenic poisoning
2. Drug therapy (eg, amiodarone; gold; cisplatin)
3. Glycogen storage disease, type I—von Gierke (may be low density liver)
4. Iron overload of liver (eg, multiple transfusions)
5. Storage diseases (usually low density)
6. Thorotragt
7. Wilson disease

References

Gamut G-150

GENERALIZED OR MULTIFOCAL LOW DENSITY LIVER (NONENHANCED CT)

COMMON
1. Diffuse malignancy, primary or metastatic (incl. lymphoma)
2. Fatty infiltration (steatosis) (See G-144)
3. Hepatic congestion (eg, heart failure; constrictive pericarditis; tricuspid stenosis or insufficiency)

UNCOMMON
1. Amyloidosis
2. Budd-Chiari syndrome, acute or chronic
3. Cysts, numerous (eg, hydatid disease; Caroli disease; polycystic liver disease; Von Hippel-Lindau disease)
4. Storage diseases (eg, Gaucher disease; Niemann-Pick disease; glycogen storage disease, type I—von Gierke)

References
MULTIPLE HYPOINTENSE LIVER LESIONS ON T2-WEIGHTED MR IMAGES

COMMON
1. Calcified granulomas
2. Regenerating nodules in cirrhosis

UNCOMMON
1. Gamma-Gandy bodies
2. Gas in biliary ducts or portal vein
3. Hydatid disease (*Echinococcus granulosus* or *E. multilocularis* with multiple calcified cysts)
4. Multifocal acute intrahepatic hemorrhages
5. Osler-Weber-Rendu disease
6. Periportal vascular collaterals

**References**

G. Gastrointestinal Tract and Abdomen
NEOPLASM OF THE LIVER
(CHILD OR ADULT)

COMMON
1. Hepatocellular adenoma
2. Cholangiocarcinoma, intrahepatic
3. [Cyst (eg, simple; posttraumatic; hydatid)]
4. Hemangioma (cavernous; capillary)
5. Hepatocellular carcinoma (hepatoma)
6. Metastasis
7. Multiple bile duct hamartoma (von Meyenburg complex) (microbiliary hamartoma)
8. [Nodular regenerative hyperplasia; focal nodular hyperplasia]

UNCOMMON
1. [Adrenal rest]
2. Biliary cystadenoma
3. Carcinoid of liver, primary or metastatic
4. Cholangioma
5. Epithelioid hemangioendothelioma
6. Fibrolamellar carcinoma
7. Gastrointestinal stromal tumor (eg, leiomyoma; fibroma)
8. Mesenchymal hamartoma (child)
9. Infantile hemangioendothelioma of liver (child)
10. Hepatoblastoma
11. Lymphangioma
12. Lymphoma
13. [Pancreatic rest]
14. Sarcoma (esp. angiosarcoma; also nonvascular sarcomas; Kaposi sarcoma)
15. [Splenosis]
16. Teratoma

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

SOLID LIVER LESION—ADULT
(US, CT, MRI)

COMMON
1. Abscess (pyogenic, amebic, or fungal)
2. Focal fatty change (focal steatosis)
3. Focal nodular hyperplasia; adenomatous hyperplastic nodule
4. Hemangioma, cavernous or capillary
5. Hematoma
6. Hepatocellular adenoma
7. Hepatocellular carcinoma (hepatoma)—usually in cirrhotic or other damaged liver (eg, postradiation)
8. Metastasis (esp. from carcinoma of lung, breast, colon, kidney)
9. Multiple bile duct hamartoma (von Meyenburg complex) (microbiliary hamartoma)
10. Regenerating or dysplastic nodule (cirrhosis)

UNCOMMON
1. Aneurysm of hepatic artery
2. Angiomyolipoma of liver
3. Angiosarcoma of liver
4. Bacillary angiomatosis (in AIDS)
5. Biliary cystadenoma, cystadenocarcinoma
6. Cholangiocarcinoma
7. Extramedullary hematopoiesis
8. Fibrolamellar carcinoma
9. Fungus disease (esp. histoplasmosis; candidiasis)
10. Hydatid disease (Echinococcus multilocularis or healed E. granulosus cyst)
11. Infarct
12. Kaposi sarcoma
13. Lipoma
14. Lymphoma
15. Tuberculosis; other granulomatous disease
16. Visceral larval migrans granuloma

References

References (continued)
SOLID LIVER LESION—INFANT OR YOUNG CHILD (Under Age 5)

COMMON
*1. Hemangioma
2. Hepatoblastoma
*3. Infantile hemangioendothelioma

UNCOMMON
1. Abscess
2. Hematoma
3. Mesenchymal hamartoma
4. Metastasis (esp. neuroblastoma; sarcoma)

* Especially newborn to 6 months.

References
CYSTIC LIVER LESION(S) (US, CT, MRI) (Usually Anechoic or Hypoechoic on US and Low Density on CT)

COMMON
1. Abscess (pyogenic, amebic, or fungal)
2. Cyst, congenital or acquired (eg, epithelial; post-traumatic; hydatid)
3. Cystic metastasis (eg, mucinous adenocarcinoma of colon, stomach; cystadenocarcinoma of pancreas, ovary, or uterus; melanoma, carcinoid, or sarcoma with necrosis)
4. Chilaiditi disease (interposition of colon between liver and diaphragm)
5. Hematoma, acute
6. Hydatid disease (*Echinococcus granulosus* and *E. multilocularis*)

UNCOMMON
1. Aneurysm of hepatic artery or portal vein
2. Biliary cystadenoma, cystadenocarcinoma
3. Biloma
4. Caroli disease
5. Cat-scratch disease
6. Cholangiocarcinoma
7. Choledochal cyst
8. Cystic duct remnant with mucocele
9. Cystic hepatocellular carcinoma (hepatoma)
10. Cystic lymphangioma, mesenchymal hamartoma, or other unusual cystic or necrotic tumor
11. Intrahepatic gallbladder
12. Mesenchymal hamartoma
13. Multiple bile duct hamartoma (Von Meyenburg complex)
14. Polycystic liver disease
15. Undifferentiated (embryonal) sarcoma
16. Von Hippel-Lindau disease

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References
LIVER LESION CHARACTERIZED BY LINEAR OR STELLATE CENTRAL SCAR (CT, US, ANGIO)

1. Cholangiocarcinoma
2. Fibrolamellar carcinoma
*3. Focal nodular hyperplasia
4. Hemangioma, giant cavernous
5. Hepatocellular adenoma
*6. Hepatocellular carcinoma (hepatoma)
7. Metastasis, hypervascular

* Usually isoechoic mass with hyperechoic linear or stellate central scar on ultrasound.

References

LIVER LESION WITH CENTRAL SCAR ON MRI

1. Cavernous hemangioma: hypo- or hyperintense T2-weighted image (either inflammatory or fibrous scar)
2. Fibrolamellar hepatocellular carcinoma: hypointense T1-WI, hyperintense T2-WI (fibrotic-repair of scar)
3. Focal nodular hyperplasia: hypointense T1-WI, hyperintense T2-WI (inflammatory scar)
4. Hepatocellular adenoma: variable signal

References

LIVER LESION CHARACTERIZED BY BLOOD OR HEMORRHAGE

COMMON
1. Hemangioma
2. Hematoma
3. Hepatocellular adenoma
4. Hepatocellular carcinoma (hepatoma)

UNCOMMON
1. Angiosarcoma of liver
2. Bacillary angiomatosis (in AIDS)
3. Kaposi sarcoma
4. Peliosis hepatis

References
LIVER LESION CHARACTERIZED BY CALCIFICATION

COMMON
1. Abscess, healed (pyogenic, amebic, or fungal)
2. Calculus(i) in biliary tract
3. Granuloma (eg, tuberculosis; histoplasmosis; coccidiodomycosis; brucellosis)
4. Hemangioma, cavernous
5. Hematoma, old
6. Hepatocellular carcinoma (hepatoma), esp. treated
7. Hydatid disease (Echinococcus granulosus or E. multilocularis)
8. Metastases (eg, from osteosarcoma; chondrosarcoma; mucinous or colloid adenocarcinoma of colon, rectum, ovary, breast, pancreas, stomach, or thyroid; islet cell carcinoma; carcinoid; teratocarcinoma; leiomyosarcoma; neuroblastoma; pheochromocytoma; treated melanoma or lymphoma)

UNCOMMON
1. Biliary cystadenocarcinoma
2. Calcified gallbladder (porcelain gallbladder)
3. Calcified hepatic artery (incl. aneurysm)
4. Cholangiocarcinoma
5. Cyst, nonparasitic, congenital or acquired
6. Fibrolamellar carcinoma
7. Gumma (hepar lobatum)
8. Hemangioendothelioma (epithelioid or infantile)
9. Hepatoblastoma
10. Hepatocellular adenoma
11. Mesenchymal hamartoma
12. Regenerating nodules in cirrhosis (rarely)

13. Schistosomiasis (turtleshell appearance, esp. S. japonica)
14. Thromboembolus of portal vein, calcified

References

LIVER LESION CHARACTERIZED BY FAT (CT, MRI)

1. Angiomyolipoma of liver
2. Focal fatty change
3. Focal nodular hyperplasia
4. Hepatocellular adenoma
5. Hepatocellular carcinoma (hepatoma)
6. Langerhans cell histiocytosis
7. Lipoma
8. Metastasis (eg, liposarcoma; teratoid tumor)
9. Myelolipoma

References
Gamut G-162

LIVER LESION CHARACTERIZED BY BULL’S-EYE APPEARANCE

1. Fungus disease (eg, candidiasis, usually in immunocompromised individual); other opportunistic infections
2. Kaposi sarcoma
3. Lymphoma, leukemia
4. Metastasis
5. Sarcoidosis
6. Septic emboli

References

Gamut G-163

LIVER LESION CHARACTERIZED BY FLUID-FLUID LEVEL

1. Biliary cystadenoma
2. Hemangioma
3. Hematoma
4. Hepatic cyst (with hemorrhage or infection)
5. Hepatocellular adenoma (hemorrhagic)
6. Hepatocellular carcinoma (hepatoma), cystic
7. Metastasis (eg, leiomyosarcoma; adenocarcinoma of lung or ovary; carcinoid)

Reference

Gamut G-164

LIVER LESION CHARACTERIZED BY “FILL-IN” (ANGIO, POSTCONTRAST CT OR MRI)

1. Cholangiocarcinoma
2. Focal nodular hyperplasia
3. Hemangioendothelioma (epithelioid or infantile)
4. Hemangioma
5. Hepatocellular carcinoma (hepatoma)
6. Kaposi sarcoma
7. Leiomyosarcoma
8. Lymphoma
9. Metastasis
10. Vascular malformation

References
2. Shirkhoda A, Salmanzadeh A: Hepatic lesions which “fill-in” on contrast-enhanced CT and MR imaging: patterns and diagnostic pitfalls

Gamut G-165-S

LIVER LESIONS—CLINICAL CONSIDERATIONS

Nonsurgical Liver Lesions
1. Abscess (except for possible drainage)
2. Cyst (eg, simple; posttraumatic; hydatid)
3. Fatty liver
4. Focal nodular hyperplasia
5. Hemangioma

Painless Liver Lesions
1. Cyst (eg, simple; hydatid)
2. Focal nodular hyperplasia
3. Hemangioma
4. Hepatocellular adenoma (small)
Liver Lesions Related to Excessive Steroids
1. Focal nodular hyperplasia
2. Hemangioma
3. Hepatocellular adenoma
4. Hepatocellular carcinoma (hepatoma)
5. Nodular regenerative hyperplasia

Liver Neoplasms With Elevated Alpha Fetal Protein (AFP)
1. Hepatoblastoma
2. Hepatocellular carcinoma (hepatoma)

Sex Predilection for Liver Neoplasms
1. Hepatic neoplasm is usually benign in women
2. Hepatic neoplasm is usually malignant in men

Reference

Liver Metastases—Calcified
COMMON
1. Endocrine carcinoma of pancreas (esp. islet cell tumor)
2. Malignant melanoma
3. Medullary or colloid carcinoma of breast or thyroid
4. Mucinous adenocarcinoma of colon or stomach
5. Neuroblastoma
6. Papillary serous cystadenocarcinoma of ovary
7. Sarcoma (esp. osteosarcoma; chondrosarcoma; leiomyosarcoma)

UNCOMMON
1. Carcinoma of lung or testis
2. Lymphoma, treated
3. Mesothelioma
4. Renal cell carcinoma

Reference

Liver Metastases—Hypervascular
COMMON
1. Carcinoid
2. Carcinoma of breast
3. Carcinoma of colon
4. Choriocarcinoma
5. Endocrine carcinoma of pancreas (esp. islet cell tumor)
6. Malignant melanoma
7. Renal cell carcinoma (hypernephroma)

UNCOMMON
1. Cystadenocarcinoma of ovary
2. Pheochromocytoma
3. Sarcoma (esp. osteosarcoma; chondrosarcoma; leiomyosarcoma)

Reference
LIVER METASTASES—HEMORRHAGIC

COMMON
1. Carcinoma of breast
2. Carcinoma of colon
3. Carcinoma of thyroid
4. Choriocarcinoma
5. Malignant melanoma
6. Renal cell carcinoma (hypernephroma)

References

LIVER METASTASES—CYSTIC

COMMON
1. Carcinoma of colon
2. Choriocarcinoma
3. Malignant melanoma
4. Mucinous carcinoma of ovary
5. Sarcoma (eg, osteosarcoma; chondrosarcoma; leiomyosarcoma)

UNCOMMON
1. Carcinoid
2. Carcinoma of lung (esp. small cell)
3. Carcinoma of stomach
4. Endometrial carcinoma of uterus

Reference

LIVER METASTASES—ULTRASOUND CHARACTERISTICS

HYPOECHOIC LESIONS (37.5%)

COMMON
1. Carcinoma of breast
2. Carcinoma of pancreas (36%)
3. Carcinoma of cervix (20%)
4. Lymphoma

UNCOMMON
1. Adenocarcinoma of lung
2. Carcinoma of nasopharynx

MIXED ECHOCENICITY (37.5%)  

COMMON
1. Carcinoma of breast
2. Carcinoma of rectum
3. Carcinoma of lung
4. Carcinoma of stomach
5. Hepatocellular carcinoma (hepatoma)

UNCOMMON
1. Anaplastic carcinoma
2. Carcinoma of cervix
3. Vascular primaries (carcinoid; islet cell carcinoma of pancreas; choriocarcinoma; renal cell carcinoma)

HYPERECHOIC LESIONS WITH SHADOWING (25%)

COMMON
1. Adenocarcinoma of stomach
2. Cystadenocarcinoma of pancreas
3. Melanoma
4. Mucinous or colloid carcinoma of colon or breast
5. Pseudomucinous cystadenocarcinoma of ovary
**UNCOMMON**
1. Chondrosarcoma
2. Neuroblastoma
3. Osteosarcoma
4. Teratocarcinoma

**CYSTIC METASTASES (See G-169)**
1. Central necrosis of any malignant lesion, esp. sarcomas
2. Mucin-secreting metastases from carcinoma of the ovary, colon, pancreas, or stomach

**BULL’S-EYE OR TARGET PATTERN**
1. Carcinoma of lung
2. Other carcinomas (occasionally)

**INFIGITRATIVE PATTERN**
1. Carcinoma of breast
2. Carcinoma of lung
3. Melanoma

**References**

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**AVASCULAR OR HYPOVASCULAR LIVER LESION (ANGIO, POSTCONTRAST CT OR MRI)**

**COMMON**
*1. Abscess (eg, pyogenic, amebic, or fungal)*
2. Cholangiocarcinoma
*3. Cyst (congenital; inflammatory; hydatid; traumatic)*
4. [Extrinsic mass (eg, gallbladder; adrenal neoplasm; subphrenic abscess)]
*5. Focal fatty change*
*6. Metastasis*

**UNCOMMON**
1. Adrenal rest
2. [Biloma, traumatic or iatrogenic (eg, needle biopsy)]
3. Hematoma
*4. Lymphoma*
5. Mesenchymal hamartoma
6. Neoplasm, benign or malignant, other (eg, gastrointestinal stromal tumor; teratoma; lipoma)
*7. Polycystic disease of liver*

* May be multiple.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**
HYPERVASCULAR OR HYPERDENSE LIVER LESION
(ANGIO, POSTCONTRAST CT OR MRI)

COMMON
*1. Focal fatty sparing (simulates enhancing mass)
*2. Focal nodular hyperplasia
*3. Hemangioma, cavernous or capillary
4. Hepatoblastoma
5. Hepatocellular adenoma
6. Hepatocellular carcinoma (hepatoma)
*7. Metastasis, hypervascular (eg, carcinoid; islet cell tumor of pancreas; pheochromocytoma; leiomyosarcoma; other sarcomas; choriocarcinoma; carcinoma of breast, colon, kidney, or thyroid; malignant melanoma)

UNCOMMON
1. Aneurysm of hepatic artery, true or false (incl. arterio-biliary fistula) or portal vein
2. Angiosarcoma of liver
*3. Arteriovenous fistula (eg, congenital; traumatic; iatrogenic); arterio-portal shunt in some hepatomas
4. Fibrolamellar carcinoma
5. Hemangioendothelioma, epithelioid
6. Vascular phenomena (eg, SVC obstruction; Budd-Chiari S.; transient hepatic attenuation difference (THAD))

* May be multiple.

References

ANECHOIC LIVER LESION
(USUALLY CYSTIC ON US)

COMMON
*1. Caroli disease
*2. Congenital simple cyst
3. Metastasis, cystic (eg, from mucinous carcinoma of colon; carcinoma of stomach or uterus; cystadeno-carcinoma of ovary or pancreas; squamous cell carcinoma, esp. bronchogenic; carcinoid; malignant melanoma; sarcoma, esp. leiomyosarcoma)

UNCOMMON
1. Abscess (pyogenic, amebic, or fungal)
*2. Acquired cyst (eg, posttraumatic; inflammatory)
*3. Aneurysm of hepatic artery or portal vein
4. Biliary cystadenoma, cystadenocarcinoma
*5. Biloma
*6. Chilaiditi disease (interposition of colon between liver and diaphragm)

* May be multiple.

References

* Usually unilocular with smooth walls and distal acoustic enhancement.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
HYPOECHOIC LIVER LESION (US)

COMMON
1. Abscess (pyogenic, amebic, or fungal)
2. Cyst, complicated (eg, with cholesterol crystals)
3. Cystic liver tumor (eg, cholangiocarcinoma; biliary cystadenoma or cystadenocarcinoma; lymphangioma; mesenchymal hamartoma)
4. Focal nodular hyperplasia
5. Hematoma, acute
6. Hepatocellular carcinoma (hepatoma)
7. Infarct
8. Lymphoma; Burkitt lymphoma
9. Metastasis, incl. cystic metastasis (eg, from carcinoma of breast, lung, colon, stomach, ovary, pancreas)

UNCOMMON
1. Biloma
2. Candidiasis (wheel within a wheel)
3. Extramedullary hematopoiesis
4. Focal hepatic necrosis
5. Focal sparing in fatty liver (steatosis)
6. Granuloma (eg, tuberculosis)
7. Hemangioendothelioma of liver
8. Hemangioma, cavernous (more often hyperechoic)

+9. Hepatocellular adenoma
+10. Hydatid disease (*Echinococcus granulosus* or *E. multilocularis*)

* Usually a multicystic image on ultrasound.
+ Hepatic mass with hypoechoic halo.

HYPERECHOIC LIVER LESION (US)

COMMON
1. Cirrhosis (multifocal regenerating nodules)
2. Focal fatty infiltration (focal steatosis)
3. Hemangioma
4. Hepatocellular adenoma
5. Hepatocellular carcinoma (hepatoma)
6. Lipoma
7. Metastasis {esp. from carcinoma of colon, stomach, ovary, kidney or pancreas {incl. islet cell carcinoma}; carcinoid*; choriocarcinoma}

UNCOMMON
1. Angiomyolipoma
2. Debris inside abscess or hematoma
3. Dysplastic nodule
4. Focal nodular hyperplasia
5. Hemangioendothelioma
6. Hepatic fissure

(continued)
7. Hydatid disease (old healed, calcified *E. granulosus* cyst; *Echinococcus multilocularis*—multifocal)
8. Infection (eg, cytomegalovirus or *Candida*)
9. Lymphoma
10. Omentum inserted into bed of hepatic resection
*11. Peliosis hepatitis
12. Postradiation therapy
13. Solitary fibrous tumor of the liver

* Hyperechoic hepatic mass(es) with punctate calcifications and/or acoustic enhancement on ultrasound.

References

ISOECHOIC LIVER LESION (US)

1. Focal nodular hyperplasia
2. Hepatocellular adenoma
3. Hepatocellular carcinoma (hepatoma)

Reference

Gamut G-177

HETEROGENEOUS HEPATIC ECHOGENICITY ON ULTRASOUND (COMPLEX HEPATIC MASS OR DIFFUSE PARENCHYMAL INVOLVEMENT)

COMMON
1. Abscess
2. Cavernous hemangioma
*3. Cirrhosis
*4. Fatty change in liver
5. Focal nodular hyperplasia
6. Hepatocellular carcinoma (hepatoma)
7. Hydatid cyst (with collapsed daughter cysts)
*8. Metastasis with mixed echogenicity or diffuse infiltration (eg, from carcinoma of breast, lung, or ovary; melanoma)
9. Neoplasm with liquefaction necrosis (hypoechoic) and infarcted nonliquefied areas (hyperechoic)

UNCOMMON
1. Biliary cystadenoma
2. Cholangiocarcinoma
3. Hemangioendothelioma; angiosarcoma
4. Hepatic adenoma, esp. after oral contraceptive use, or in glycogen storage disease, type I (von Gierke disease)
5. Hepatoblastoma
*6. Peliosis hepatitis

* Usually generalized or multifocal.

References
HEPATIC PSEUDOLESION (US)

1. Diaphragmatic leaflets: peripheral echogenic pseudolesion may simulate hemangiomas
2. Falciform ligament: echogenic “mass” (pseudolesion) in left lobe
3. Focal fatty infiltration: echogenic pseudolesion may simulate metastases
4. Focal hepatic sparing in steatosis: hypoechoic pseudolesion often seen in porta hepatis
5. Gallbladder inflammation: hypoechoic hepatic pseudolesion in adjacent parenchyma
6. Ligamentum venosum: fibrous tissue attenuates sound, causing hypoechoic pseudolesion in caudate lobe
7. Perihepatic fat may invaginate liver causing hyperechoic masses

Reference

INTRAHEPATIC ACOUSTIC SHADOWING (LINEAR VERSUS FOCAL) ON US

LINEAR OR BRANCHING SHADOWING
1. Air in biliary tract
2. Air in portal vein
3. Calculi in biliary ducts

FOCAL SHADOWING
1. Calcification (eg, primary or metastatic tumor; granuloma; healed abscess; aneurysm)
2. Foreign material (eg, surgical clips, drains, catheters, stents, sponges)

FOCAL LOW DENSITY (DECREASED ATTENUATION) LIVER LESION (NONENHANCED CT)

COMMON
1. Abscess (pyogenic, amebic, or fungal)
2. Cyst (eg, congenital; epithelial; posttraumatic; hydatid)
3. Focal fatty infiltration (focal steatosis)
4. Focal nodular hyperplasia
5. Hemangioma
6. Hematoma; laceration (posttraumatic)
7. Hepatocellular adenoma
8. Hepatocellular carcinoma (hepatoma)
9. Hydatid disease (*Echinococcus granulosis* and *E. multilocularis*)
10. Lymphoma
11. Metastasis (esp. from carcinoma of lung, breast, colon, kidney)

References

(continued)
UNCOMMON
1. Angiosarcoma of liver (may have high density regions with hemorrhage)
2. Biliary cystadenoma, cystadenocarcinoma (near water density on CT)
3. Biloma
4. Caroli disease
5. Cholangiocarcinoma
6. Choledochal cyst
7. Fibrolamellar carcinoma
8. Fungus disease with multiple microabscesses (eg, Candida; Cryptococcus)
9. Hemangioendothelioma
10. Hepatoblastoma
11. Infarct
12. Mesenchymal hamartoma
13. Multiple bile duct hamartoma
14. Polycystic liver disease
15. Radiation therapy (fatty replacement)
16. Schistosomiasis
17. Von Hippel-Lindau disease

References

FOCAL LOW DENSITY LIVER LESION (POSTCONTRAST CT)

COMMON
1. Abscess (pyogenic, amebic, or fungal)
2. Cyst (eg, congenital; epithelial; posttraumatic; hydatid)
3. Focal fatty infiltration (focal steatosis)
4. Hemangioma, giant
5. Hematoma
6. Hydatid disease (Echinococcus granulosus and E. multilocularis)
7. Metastasis (esp. from carcinoma of lung, breast, colon, kidney)
8. Regenerating nodules

UNCOMMON
1. Biloma
2. Caroli disease
3. Cholangiocarcinoma (late enhancement)
4. Fungus disease with multiple microabscesses (eg, Candida; Cryptococcus)
5. Lymphangioma
6. Polycystic liver disease
7. Radiation therapy (fatty replacement)
8. Schistosomiasis
9. Von Hippel-Lindau disease

References

Gamut G-182

FOCAL HIGH DENSITY LIVER LESION (NONENHANCED CT)

1. Granuloma (esp. tuberculoma)
2. Hematoma, subcapsular or intrahepatic (first few days)
3. Hepatic tumor (eg, hepatocellular carcinoma {hepatoma}; hepatoblastoma; hemangioendothelioma)
4. Hepatocellular adenoma with acute hemorrhage
5. Hydatid disease (old healed, calcified E. granulosus cyst; Echinococcus multilocularis—with calcification)
6. Metastasis with calcification (eg, from colon, rectum, stomach, ovary)

References
MRI CHARACTERISTICS OF VARIOUS LIVER LESIONS

1. Adenoma
   - T1W: Hyperintense
   - T2W: Hypointense
   - Gadolinium: 

2. Focal nodular hyperplasia
   - central scar: Hypointense
   - margins: Isointense

3. Hemangioma
   - T1W: Hypointense
   - T2W: Hyperintense

4. Hemochromatosis
   - Iron deposition

5. Hepatocellular carcinoma
   - Hypo-, iso-, or hyperintense (due to fat degeneration)

6. Metastasis
   - T1W: Hypointense
   - T2W: Hyperintense
   - Gadolinium: +

7. Regenerating nodule
   - T1W: Hypointense
   - T2W: Hypointense

References

Gamut G-184-S

LIVER LESIONS WITH CIRCUMFERENTIAL RIM ON MRI

HYPOINTENSE RIM ON T1-WEIGHTED IMAGE
1. Abscess, pyogenic or amebic (one or two concentric rings of mixed signal intensity)
2. Hematoma, subacute to chronic (white rim also seen on T1-weighted images)
3. Hydatid cyst (thick, homogeneous rim; no perilesional edema; high signal cyst contents on T2)
4. Metastasis (peritumoral edema with double ring pattern)

NO RIM
1. Cavernous hemangioma
2. Cyst, simple

HYPOINTENSE RIM ON T2-WEIGHTED IMAGE
1. Abscess, pyogenic or amebic (one or two concentric rings of mixed signal intensity)
2. Hematoma, subacute to chronic (white rim also seen on T1-weighted images)
3. Hydatid cyst (thick, homogeneous rim; no perilesional edema; high signal cyst contents on T2)
4. Metastasis (peritumoral edema with double ring pattern)

(continued)
3. Focal nodular hyperplasia
4. Hepatocellular adenoma

References

Gamut G-186

FOCAL HIGH SIGNAL INTENSITY LIVER LESION ON T1-WEIGHTED MR IMAGES

1. [Contrast agent (eg, gadolinium; lipiodol)]
2. Dysplastic nodule(s)
3. Fatty lesion (eg, lipoma; angiomyolipoma; focal fatty deposit; surgical defect packed with omental fat; occasional hepatoma with fatty degeneration)
4. Focal nodular hyperplasia
5. Hematoma or hemorrhage, acute (eg, trauma; blood dyscrasia; anticoagulants)
6. Hepatocellular adenoma
7. Hepatocellular carcinoma (hepatoma)
8. Metastasis (esp. melanoma)
9. Normal signal intensity liver surrounded by low signal intensity liver (eg, hemochromatosis; hemosiderosis; cirrhosis with regenerating nodules; edema)
10. Proteinaceous material in dependent portion of abscess or hematoma
11. [Pulsation artifact from aorta]

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References

Gamut G-187

DAMPING OF HEPATIC VEIN DOPPLER WAVEFORM (US)

1. Budd-Chiari syndrome
2. Cirrhosis
3. Extrinsic compression of hepatic veins
4. Passive hepatic congestion
5. Various parenchymal abnormalities of liver

Reference
HEPATIC VEIN DILATATION

COMMON
1. Constrictive pericarditis
2. Inferior vena cava obstruction or thrombus
3. Normal with Valsalva maneuver in young patient
4. Right-sided congestive heart failure
5. Thrombus in hepatic vein
6. Tricuspid atresia or stenosis

UNCOMMON
1. Right atrial tumor

Reference

HEPATIC VEIN THROMBOEMBOLISM OR OBSTRUCTION (BUDD-CHIARI S.) (INCL. OBSTRUCTION OF UPPER INFERIOR VENA CAVA)

COMMON
1. Cirrhosis
2. Heart failure
3. Idiopathic
4. Neoplasm invading inferior vena cava (esp. renal cell carcinoma; hepatocellular carcinoma)
5. Thrombophlebitis

UNCOMMON
1. Alkaloid ingestion (bush tea disease)
2. Behçet syndrome
3. Coagulopathy (incl. polycythemia vera; sickle cell disease)
4. Iatrogenic (eg, catheterization; vena cavography)
5. Infection of liver (eg, aspergillosis)
6. Intravenous web
7. Metastasis, hepatic
8. Neoplastic compression (eg, carcinoma of pancreas; retroperitoneal sarcoma; lymphoma)
9. Oral contraceptive use
10. Parasitic disease (eg, amebic liver abscess; schistosomiasis; hydatid disease)
11. Postoperative (eg, splenectomy)
12. Pregnancy; postpartum
13. Trauma

References

PORTAL VEIN THROMBOSIS OR OBSTRUCTION*

COMMON
1. Cirrhosis plus portal hypertension
2. Extrinsic compression or invasion by carcinoma of pancreas or stomach; lymphadenopathy of porta hepatitis
3. Hepatocellular carcinoma (hepatoma) or cholangiocarcinoma (tumor thrombus or invasion)
4. Hypercoagulable state (eg, blood dyscrasia; clotting disorder; polycythemia vera; protein c or s deficiency; paroxysmal nocturnal hemoglobinuria)

(continued)
5. Iatrogenic (eg, TIPS; umbilical venous catheterization; estrogen therapy; oral contraceptive use)
6. Idiopathic
7. Neonatal sepsis; perinatal omphalitis
8. Pancreatitis
9. Postoperative (esp. postsplenectomy)
10. Schistosomiasis (periportal fibrosis causing presinusoidal intrahepatic obstruction)
11. Sclerosing cholangitis

UNCOMMON
1. Behçet S.
2. [Budd-Chiari S. causing reversal of portal venous blood return]
3. Dehydration, severe
4. Liver transplantation
5. Portal phlebitis (from abdominal infection)
6. Postpartum
7. Trauma

* May result in cavernous transformation of portal vein.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
4. Pancreatic disease with portal obstruction (eg, neoplasm; pancreatitis)
5. Portal vein thrombosis
6. Schistosomiasis (periportal fibrosis causing presinusoidal intrahepatic obstruction)
6. Splenic vein thrombosis

UNCOMMON
1. Alagille S. (arteriohepatic S.)
2. Alpha 1-antitrypsin deficiency
3. Banti S.
4. Budd-Chiari S.
5. Caroli disease
6. [Cavernous transformation of portal vein]
7. Cholesterol ester storage disease
8. Cruveilhier-Baumgarten S.
9. Cystic fibrosis (mucoviscidosis)
10. Fatty change in liver (steatosis) (See G-144)
11. Gaucher disease
12. Glycogen storage disease, types III and IV
13. Hemochromatosis; multiple transfusion effect
14. Hepatic fibrosis-renal cystic disease
15. Increased portal flow (eg, splenomegaly; splenic, mesenteric, or hepatic arteriovenous fistula)
16. Nodular regenerative hyperplasia
17. Osler-Weber-Rendu S.
18. Polycythemia vera
19. Retropertitoneal inflammatory disease
20. Tropical splenomegaly S.
21. Wilson disease

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

GAS IN THE PORTAL VEINS

COMMON
1. Abscess, abdominal, or pelvic (eg, gas abscess of pancreas; diverticulitis)
2. Gas in the biliary tract
3. Iatrogenic (eg, catheterization of umbilical or mesenteric artery or vein; percutaneous abscess drainage; hydrogen peroxide enema or gastric lavage; post-hepatic artery embolization)
4. Mechanical bowel obstruction with ischemia (incl. closed loop obstruction)
5. Mesenteric ischemia or occlusion and bowel infarction (See G-69)
6. Necrotizing enterocolitis

UNCOMMON
1. Acute gastric dilatation
2. Carcinoma of colon, necrotic
3. Corrosive ingestion causing gastritis
4. Diabetic acidosis or coma
5. Emphysematous cholecystitis
6. Erythroblastosis fetalis
7. Gastric emphysema
8. Hemorrhagic pancreatitis
9. Neonatal gastroenteritis
10. Peptic ulcer eroding into mesenteric vein
11. Postcolonoscopy or post-air contrast barium enema in inflammatory bowel disease (eg, diverticulitis; Crohn’s disease; ulcerative colitis;)
12. Postoperative (eg, bowel resection; operation for congenital bowel obstruction)
13. Pseudomembranous colitis
14. Sepsis
15. Toxic megacolon

[ ] This condition does not actually cause the gamut imaging finding, but can produce imaging changes that simulate it.

References
Gamut G-193

PERIPORTAL HYPOECHOGENICITY ON US/PERIPORTAL LOW DENSITY ON CT

1. AIDS-related cholangitis
2. Cholangitis
3. Congestive hepatomegaly
4. Liver transplant rejection (occasionally seen in non-rejecting liver transplant)
5. Malignant lymphatic obstruction
6. Schistosomiasis mansoni
7. Trauma, blunt abdominal
8. Viral hepatitis

References

Gamut G-194

PROMINENT PERIPORTAL ECHOES (STARRY SKY LIVER) IN ADULTS (US)

COMMON
1. Air in biliary tree (pneumobilia)
2. Cholangiocarcinoma
3. Cholangitis
4. Cholecystitis, acute or chronic
5. Hepatitis
6. Hepatocellular carcinoma (hepatoma)
7. Recurrent pyogenic cholangitis (Oriental cholangio-hepatitis)
8. Sclerosing cholangitis

UNCOMMON
1. Cystic fibrosis (mucoviscidosis)
2. Embolism of oily contrast medium after lymphangiogram
3. Infectious mononucleosis
4. Kaposi sarcoma of liver
5. Lymphoma, Burkitt lymphoma, leukemia
6. Periportal fibrosis (incl. schistosomiasis)
7. Right heart failure
8. Toxic shock syndrome

References

Gamut G-195

PROMINENT PERIPORTAL ECHOES IN NEONATES ON ULTRASOUND

COMMON
1. Acute hepatitis
2. Biliary atresia
3. [Idiopathic; transient (disappears within a year)]
4. Idiopathic neonatal jaundice

UNCOMMON
1. [Air in portal venous system]
2. Alpha-1-antitrypsin deficiency
3. Cytomegalovirus infection

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
INCREASED PERIPORTAL SIGNAL INTENSITY ON MRI

1. Acute hepatitis
2. AIDS-related cholangitis
3. Cholangiocarcinoma
4. Cholangitis
5. Cirrhosis
6. Obstructive jaundice

NEOPLASM

1. Benign neoplasm (eg, fibroma; hamartoma)
2. Cyst, epidermoid (simple, primary); dermoid; posts- traumatic; hydatid
3. Hemangioma; cystic lymphangioma
4. Lymphoma
5. Metastases (esp. from carcinoma of breast, lung, colon, ovary; melanoma)
6. Sarcoma (esp. angiosarcoma)

PORTAL HYPERTENSION

1. Cirrhosis, nutritional or alcoholic
2. Congestive splenomegaly (Banti syndrome)
3. Schistosomiasis
4. Splenic or portal vein obstruction (eg, thrombosis; pancreatic neoplasm; lymphadenopathy)

STORAGE DISEASES

1. Gaucher disease
2. Glycogen storage disease
3. Langerhans cell histiocytosis
4. Mucopolysaccharidoses (incl. gargoylism); mucolipidoses (See J-4)
5. Niemann-Pick disease

(continued)
TRAUMA
1. Hematoma (subcapsular; intrasplenic; perisplenic)
2. Hemorrhagic pseudocyst

OTHER
1. Alpha-1-antitrypsin deficiency
2. Amyloidosis
3. Congenital syndromes (See G-198)
4. Connective tissue diseases, (collagen vascular diseases) (esp. lupus erythematosus)
5. Cystic fibrosis (mucoviscidosis)
6. Diabetes
7. Heart failure
8. Hemodialysis
9. Infarction
10. Rheumatoid arthritis (Felty S.); juvenile rheumatoid arthritis; juvenile chronic arthritis (Still’s disease)
11. Sarcoidosis
12. Tropical splenomegaly

References

CONGENITAL SYNDROMES WITH SPLENOMEGALY

COMMON
1. Anemia (eg, sickle cell disease; thalassemia; spherocytosis; pyruvate kinase deficiency)
2. Chronic granulomatous disease of childhood
3. Dysgammaglobulinemia
4. Fetal infection (eg, rubella; cytomegalovirus; herpes simplex)
5. Gaucher disease; Niemann-Pick disease
6. Glycogen storage disease, type I (von Gierke disease) and type III
7. Hemochromatosis
8. Langerhans cell histiocytosis
9. Mucopolysaccharidoses; mucolipidoses; GM1 gangliosidosis (See J-4)

UNCOMMON
1. Aase S.
2. Alpha-1-antitrypsin deficiency
3. Aspartylglucosaminuria
4. Beckwith-Wiedemann S.
5. Chédiak-Higashi S.
6. Cholesterol ester storage disease
7. Cogan S.
8. Cruveilhier-Baumgarten S.
9. Cystinosis
10. Ethanolaminosis
11. Farber disease (lipgranulomatosis)
12. Felty S.
13. Fucosidosis; galactosialidosis; mannosidosis
14. Hepatic fibrosis-renal cystic disease
15. Hyperlipoproteinemia
16. Infantile multisystem inflammatory disease (NOMID)
17. Lipoatrophic diabetes
18. Osteopetrosis
19. POEMS S.
20. Sea-blue histiocyte S.
21. Tyrosinemia, type I
22. Vaquez-Osler S.
23. Wilson disease
24. Wolman disease

Reference

Gamut G-199

SPLENOMEGALY WITH NORMAL ECHOGENICITY (US)

1. Congestion from portal hypertension
2. Felty syndrome
3. Hemolysis
4. Hereditary spherocytosis
5. Infection
6. Juvenile chronic arthritis (Still’s disease) (eg, juvenile rheumatoid arthritis)
7. Myelofibrosis
8. Leukemia, myelogenous
9. Parasitic disease (eg, malaria; leishmaniasis [kala-azar]; schistosomiasis)
10. Polycythemia vera
11. Sickle cell disease (early)
12. Wilson disease

Reference

Gamut G-200

SPLENOMEGALY WITH DIFFUSE HYPOECHOIC PATTERN (US)

1. Congestion from portal hypertension
2. Leukemia (esp. chronic lymphocytic)
3. Lymphoma
4. Multiple myeloma
5. Noncaseating granulomatous disease

Reference

Gamut G-201

SPLENOMEGALY WITH DIFFUSE HYPERECHOIC PATTERN (US)

COMMON
1. Hematoma
2. Infection (eg, malaria; brucellosis; tuberculosis—esp. miliary)
3. Leukemia (acute lymphocytic, chronic lymphocytic, or myelogenous after chemotherapy or radiation therapy)
4. Lymphoma
5. Myelofibrosis (hypersplenism)

UNCOMMON
1. Dysgammaglobulinemia
2. Hereditary spherocytosis
3. Malignant neoplasm (esp. angiosarcoma)
4. Metastasis
5. Polycythemia
6. Portal vein thrombosis
7. Sarcoidosis

Reference

(continued)
References

Gamut G-202
SMALL OR NONVISUALIZED SPLEEN
1. Asplenia S.; polysplenia S.
2. Atrophy
3. Hereditary hypoplasia
4. Inflammatory bowel disease
5. Postinfarction (esp. sickle cell disease)
6. Postradiation therapy
7. Sickle cell disease
8. Traumatic fragmentation
9. Wandering spleen

References

Gamut G-203
SPLENIC CALCIFICATION—SOLITARY
COMMON
1. Splenic artery aneurysm
2. Splenic artery atherosclerosis

UNCOMMON
1. Abscess, healed (eg, pyogenic; Candida; tuberculous)
2. Capsular ascites (“zuckerguss” spleen)
3. Cyst (eg, congenital; dermoid; epidermoid; hydatid; posttraumatic)
4. Granuloma (esp. tuberculosis)
5. Hamartoma
6. Hemangioma; phlebolith
7. Hematoma, healed
8. Infarct, healed
9. Metastasis

References

Gamut G-204
SPLENIC CALCIFICATIONS—MULTIPLE
COMMON
1. Granulomas, healed (eg, tuberculosis; histoplasmosis)
2. Phleboliths; hemangioma
3. Splenic artery

UNCOMMON
1. AIDS (healed Pneumocystis carinii infection)
2. Brucellosis
3. Hematomas
4. Hemochromatosis
5. Hemosiderosis
6. Infarcts
7. Metastases
8. Parasitic disease, esp. pentastomiasis (*Armillifer* infection); hydatid disease
9. Sarcoidosis
10. Sickle cell disease (stippled)
11. [Thorotrast residual]

[This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.]

**References**

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**Gamut G-205**

**SOLITARY LESION OF THE SPLEEN (US, CT, MRI)**

**COMMON**
1. Aneurysm of splenic artery
2. Cyst (congenital; epidermoid; dermoid or teratoma; hydatid; traumatic)
3. Hemangioma, cavernous or capillary
4. Hematoma (posttraumatic)
5. Infarct (esp. sickle cell disease)
6. Lymphoma; leukemia

**UNCOMMON**
1. Abscess (pyogenic; *Candida; Pneumocystis carinii*)
2. Arteriovenous malformation
3. Cyst (congenital; epidermoid; dermoid or teratoma; hydatid; posttraumatic)
4. Hematoma
5. Infarction

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**Gamut G-206**

**FOCAL CYSTIC OR LOW DENSITY SPLENIC LESION (CT, MRI—USUALLY HYPOECHOIC ON US)**

**COMMON**
1. Abscess (pyogenic; *Candida; Pneumocystis carinii*)
2. Aneurysm of splenic artery
3. Cyst (congenital; epidermoid; dermoid or teratoma; hydatid; posttraumatic)
4. Hematoma
5. Infarction

**UNCOMMON**
1. Cystic lymphangioma
2. Hamartoma
3. Hemangioma, cavernous or capillary

(continued)
4. Hemangiosarcoma
5. Metastasis
6. Peliosis
7. Pseudocyst (secondary to pancreatitis)

References

Gamut G-207
FOCAL HYPERECHOIC SPLENIC LESION (US)

COMMON
1. Hematoma
2. Infarct
3. Lymphoma

UNCOMMON
1. Abscess with gas bubbles
2. Hemangioma
3. Hemangiosarcoma
4. Hydatid cyst with “hydatid sand”
5. Metastasis
6. Plasmacytoma
7. Simple cyst with cholesterol crystals

References

Gamut G-208
DIFFUSE INCREASED SPLENIC DENSITY ON CT

1. Fanconi anemia
2. Hemochromatosis
3. Hemosiderosis
4. Lymphoma, (treated)
5. Sickle cell disease
6. Thorotrast residual

References

Gamut G-209
MULTIPLE SPLENIC HYPOINTENSITY ON MRI*

COMMON
*1. Abscesses (pyogenic)
*2. Cysts (eg, congenital; hydatid; posttraumatic)
3. Gamma-Gandy bodies
4. Granulomas, calcified
*5. Hemangiomas
*6. Hematomas
*7. Infarcts

References
*8. Metastases (incl. hemorrhagic choriocarcinoma)
*9. Lymphoma

UNCOMMON
1. Amyloidosis
2. Flow void in arteriovenous malformation or Osler-Weber-Rendu S.
3. Fungemia with multifocal microabscess formation
*4. Peliosis
5. Sarcoidosis

* On T1-weighted images.

References

Gamut G-211

MULTIPLE SPLENIC HYPERINTENSITIES ON T2-WEIGHTED MR IMAGES

COMMON
1. Abscesses (pyogenic)
2. Cysts (eg, congenital; hydatid; posttraumatic)
3. Hemangiomas
4. Hematomas
5. Infarcts
6. Metastases

UNCOMMON
1. Fungemia with multifocal microabscess formation
2. Lymphangioma (T1 and T2-WI)
3. Peliosis

References

Gamut G-211

ABNORMALITY ON SPLENIC ARTERIOGRAPHY

COMMON
1. Accessory spleen
2. Anomalous origin of splenic or celiac artery
3. Splenic artery arteriosclerosis; aneurysm; fibromuscular hyperplasia (incl. stenosis; occlusion)
4. Splenic vein abnormality (See G-212)

UNCOMMON
1. Arteriovenous fistula; angiomaticus malformation
2. Avascular mass
   a. Abscess
   b. Cyst (eg, dermoid; epidermoid; hydatid; posttraumatic)
   c. Infarction
   d. Lymphoma
   e. Metastasis
3. Displacement by extrinsic mass
4. Splenic artery encasement (eg, pancreatic carcinoma)
5. Splenic laceration; pericapsular hematoma
6. Thromboembolism
7. Vascular mass (eg, metastasis, esp. melanoma; hemangiosarcoma of spleen)
SPLENIC VEIN OBSTRUCTION (US, POSTCONTRAST CT, MRI, OR ANGIO)

COMMON
1. Lymphadenopathy (eg, lymphoma; metastases)
2. Neoplasm (eg, pancreatic; retroperitoneal sarcoma)
3. Pancreatitis (incl. pancreatic pseudocyst)
4. Thromboembolism of portal or splenic vein
   (esp. portal hypertension; polycythemia vera; heart failure)

UNCOMMON
1. Aneurysm of splenic artery or aorta
2. Postoperative
3. Retroperitoneal inflammation
4. Schistosomiasis
5. Trauma; hematoma

References

SOLID PANCREATIC LESION (US, CT, MRI)

COMMON
1. Adenocarcinoma
2. Pancreatitis, focal

UNCOMMON
1. [Accessory spleen]
2. Aneurysm, thrombosed
3. Annular pancreas; pancreatic divisum
4. Hemangioma
5. Islet cell tumor (eg, insulinoma; gastrinoma; glucagonoma; somatostatinoma; VIPoma; non-functioning)
6. Lipoma
7. [Lymphadenopathy in celiac axis (eg, metastatic; tuberculous; Castleman disease)]
8. Lymphoma
9. Metastasis (esp. from carcinoma of breast, lung, stomach, gallbladder, kidney; melanoma)
10. Pancreaticoblastoma
11. Sarcoma
12. Serous cystadenoma (microcystic adenoma)
13. Solid and papillary epithelial neoplasm

References
**Gamut G-214**

**CYSTIC OR LOW DENSITY PANCREATIC LESION (CT, MRI—HYPOECHOIC ON US)**

**COMMON**
1. Acute pancreatitis, focal
2. Chronic pancreatitis (inhomogeneous, often hyperechoic)
3. Fluid collection, peripancreatic
4. Mucinous cystadenoma or cystadenocarcinoma (macrocystic adenoma)
5. Pancreatic duct dilatation, ectasia, or obstruction (from carcinoma; calculus; stricture)
6. Pancreatic ductal adenocarcinoma (eg, duct ectatic mucinous adenocarcinoma; papillary intraductal adenocarcinoma; anaplastic adenocarcinoma)
7. Pseudocyst of pancreas
8. Serous cystadenoma (microcystic adenoma)

**UNCOMMON**
1. Abscess
2. [Aneurysm or pseudoaneurysm of aorta, pancreaticoduodenal arcade, or splenic artery]
3. [Biloma]
4. [Cystic lymphangioma, retroperitoneal]
5. Cystic teratoma
6. Cysts, congenital (in adult polycystic kidney disease; Von Hippel-Lindau disease; or cystic fibrosis)
7. [Duodenal cyst or diverticulum]
8. Hemangioma
9. Hematoma
10. Hydatid cyst
11. Islet cell tumor or insulinoma, cystic
12. Liquefaction necrosis of pancreas
13. Lymphoma
14. Metastasis, cystic (eg, renal cell carcinoma; hepatoma; carcinoma of lung, breast, or ovary; melanoma)
15. Posttraumatic cyst

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**

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**Gamut G-215**

**COMPLEX PANCREATIC LESION (US)**

**COMMON**
1. Mucinous cystadenoma or cystadenocarcinoma (macrocystic adenoma)
2. Pseudocyst of pancreas

**UNCOMMON**
1. Hematoma, nonacute
2. Metastasis
3. Serous cystadenoma (microcystic adenoma)

**References**
INCREASED ECHOCENDICITY OF PANCREAS (US)

COMMON
1. Advanced age
2. Chronic pancreatitis
3. Fatty infiltration
4. Hemorrhagic pancreatitis

UNCOMMON
1. Adenocarcinoma of pancreas
2. Cystic fibrosis
3. Diabetes
4. Hereditary pancreatitis
5. Malabsorption
6. Pancreatic insufficiency
7. Shwachman-Diamond S.
8. Steroid ingestion

References

FOCAL SHADOWING PANCREATIC LESION (US)

COMMON
1. Calcifications in chronic pancreatitis
2. Calculi in pancreatic duct

UNCOMMON
1. Arterial calcification
2. Gas in pancreatic abscess

References
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

PANCREATIC CALCIFICATION WITHOUT MASS

COMMON
1. Chronic pancreatitis

UNCOMMON
1. Acute pancreatitis (saponification)
2. [Aneurysm or atherosclerosis of aorta or its branches]
3. Cystic fibrosis (mucoviscidosis)
4. Hemochromatosis
5. Hemorrhage (eg, trauma; infarction)
6. Hereditary pancreatitis (large clumps of calcium)
7. Hyperparathyroidism with pancreatitis
8. Idiopathic (pancreatic duct stenosis)
9. Kwashiorkor
10. Pancreatitis due to biliary disease (eg, gallstone in common duct)

References

Gamut G-219

PANCREATIC LESION CHARACTERIZED BY CALCIFICATION

COMMON
1. [Aneurysm of aorta, pancreaticoduodenal arcade, or splenic artery, thrombosed]
2. Chronic pancreatitis, focal
3. Hemorrhage, intraparenchymal (eg, old abscess; hematoma; infarction)

UNCOMMON
1. Adenocarcinoma of pancreas (rarely)
2. Hemangioma (plebolith)
3. Hydatid cyst
4. Islet cell tumor
5. Lymphangioma, cavernous
6. Lymphoma (treated)
7. Metastasis (esp. mucinous adenocarcinoma of colon)
8. Mucinous cystadenoma or cystadenocarcinoma (macrocystic adenoma) (peripheral calcium)
9. Pancreaticoblastoma
10. Pseudocyst of pancreas
11. Serous cystadenoma (microcystic adenoma) (central stellate calcium)
12. Solid and papillary epithelial neoplasm
13. Teratoma

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

Gamut G-220

PANCREATIC LESION CHARACTERIZED BY BLOOD OR HEMORRHAGE

1. [Aneurysm of aorta, pancreaticoduodenal arcade, or splenic artery]
2. Hemangioma
3. Hemorrhagic pancreatitis
4. Hemorrhagic pseudocyst
5. Islet cell tumor
6. Metastasis (esp. from carcinoma of colon)
7. Serous cystadenoma (microcystic adenoma)
8. Sarcoma
9. Solid and papillary epithelial neoplasm

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

Gamut G-221

PANCREATIC LESION CHARACTERIZED BY FAT

UNCOMMON
1. Focal fat deposit
2. Lipoma
3. Liposarcoma (possible in well-differentiated type)
4. Shwachman-Diamond S.
5. Teratoma

Reference

G. Gastrointestinal Tract and Abdomen 725
FATTY REPLACEMENT OR INFILTRATION OF PANCREAS

COMMON
1. Aging
2. Cystic fibrosis (mucoviscidosis)
3. Obesity
4. Steroid therapy

UNCOMMON
1. Chronic pancreatitis
2. Diabetes mellitus
3. Hemochromatosis
4. Hereditary pancreatitis
5. Johanson-Blizzard S.
6. Lipomatous pseudohypertrophy
7. Malnutrition
8. Shwachman-Diamond S.

References
5. Siegel MJ: Pediatric Body CT. Philadelphia: Lippincott Williams & Wilkins, 1999

HYPERVERVASCULAR PANCREATIC LESION (POSTCONTRAST CT, MRI, OR ANGIO)

COMMON
1. Acute pancreatitis
2. Adenocarcinoma, pancreatic ductal (hypovascular but with neovascularity)
3. Aneurysm or pseudoaneurysm of hepatic, gastroduodenal, pancreaticoduodenal or splenic arteries
4. Islet cell tumor, incl. insulinoma; gastrinoma (esp. with Zollinger-Ellison S. or MEN S. Type I (tumor blush); glucagonoma; nonfunctioning islet cell tumor; somatostatinoma)
5. Metastasis, hypervascular (eg, from angiosarcoma; leiomyosarcoma; carcinoid; melanoma; renal cell carcinoma; carcinoma of adrenal or thyroid)
6. Mucinous cystadenoma or cystadenocarcinoma (macrocystic adenoma)
7. Serous cystadenoma (microcystic adenoma)

UNCOMMON
1. Abscess of pancreas
2. Castleman disease
3. Hemangioma
4. Intraductal papillary mucinous tumor of pancreas
5. Solid and papillary epithelial neoplasm (hypovascular but with enhanced solid tissue toward center of mass)

References

Gamut G-224

PANCREATIC ANGIOGRAPHIC ABNORMALITY (VIA CELIAC, SUPERIOR MESENTERIC, OR SUBSELECTIVE ARTERIOGRAPHY)

DISPLACEMENT OF VESSELS
1. Gallbladder enlargement
2. Lymphoma
3. Pancreatic mass (See G-213)

ENCASEMENT
1. Irregular (esp. carcinoma of pancreas)
2. Long segment with arterial cuffing (esp. carcinoma)
3. Smooth (eg, carcinoma; pancreatitis)

EXTRAVASATION
1. Pancreatic abscess
2. Pancreatitis

HYPERVASCULARITY (See G-223)
1. Carcinoma
2. Cystadenoma; cystadenocarcinoma (florid neovascularity)
3. Islet cell tumor, esp. Zollinger-Ellison S.; MEN S. Type I (tumor blush)
4. Pancreatic abscess
5. Pancreatitis

HYPOVASCULARITY
1. Lymphoma
2. Metastasis
3. Pancreatic pseudocyst
4. Pancreatitis

OTHER
1. Microaneurysms (esp. pancreatitis; polyarteritis nodosa)
2. Occlusion or truncation, arterial or venous (eg, carcinoma; surgical ligation; vascular disease)

Gamut G-225

DILATED PANCREATIC DUCT

1. Aging
2. Calculus in distal common duct
3. Chronic pancreatitis
4. Pancreatic or ampullary mass (esp. carcinoma of pancreas or ampulla; focal acute pancreatitis)

NOTE: NATURE OF DILATATION

Suggesting Pancreatitis
1. Calculi in duct
2. Irregular dilatation of duct

Suggesting Neoplasm
1. Duct occupies >50% of anteroposterior gland diameter
2. Smooth and beaded appearance of duct

References
Gamut G-226

PANCREATIC DUCT STRUCTURE (ERCP, MRCP)

WITH NORMAL PANCREATIC PARENCHYMA
1. Osteophyte of spine
2. Vascular compression (eg, aneurysm or pseudo-aneurysm of aorta, gastroduodenal, pancreatico-duodenal, or splenic arteries)

WITH ABNORMAL PARENCHYMA
1. Carcinoma of pancreas
2. Chronic pancreatitis
3. Duct hyperplasia

Reference

Gamut G-227

GAS IN PANCREATIC DUCT

COMMON
1. Abscess
2. Patulous Vaterian sphincter
3. Post-endoscopic retrograde cholangiopancreatography (ERCP)
4. Prior Vaterian papillotomy

UNCOMMON
1. Duodenal diverticulum communication
2. Enteropancreatic fistula (spontaneous; surgical)

Reference

Gamut G-228

CYSTIC MESENTERIC OR INTRAPERITONEAL LESION (US, CT, MRI)

COMMON
1. Abscess
2. Cystic lymphangioma
3. Hematoma
4. Mesenteric cyst

UNCOMMON
1. Ascites, complicated
2. Cystic mesothelioma
3. Cystic or necrotic stromal cell tumor (eg, leiomyoma; leiomyosarcoma)
4. Duplication cyst (enteric)
5. Hydatid disease
6. Lymphadenopathy, cystic or necrotic (eg, bacillary angiomatosis in AIDS)
7. Papillary serous carcinoma of peritoneum
8. Pseudocyst of pancreas invading mesentery
9. Pseudomyxoma peritonei
10. Teratoma

References
**Gamut G-229**

**SOLID LESION OF THE MESENTERY OR MESENTERIC ROOT (US, CT, MRI)**

**COMMON**
1. Abscess
2. Hematoma (trauma; bleeding disorder)
3. Lymphadenopathy (eg, metastatic carcinoma; tuberculosis; Crohn’s disease; Castleman disease; AIDS—bacillary angiomatosis)
4. Lymphoma
5. Metastasis (esp. from colon or ovary)
6. Omental “cakes” (eg, metastatic disease; carcinoid; lymphoma; tuberculosis)
7. Stromal cell tumor (esp. leiomyosarcoma; leiomyoma; neurofibroma)

**UNCOMMON**
1. Desmoid tumor (mesenteric fibromatosis); desmoplastic small round cell tumor
2. Hemangioma
3. Hydatid disease
4. Lipoma; lipomatosis; liposarcoma
5. Lymphangioma
6. Malignant fibrous histiocytoma
7. Mesothelioma
8. Phlegmon (pancreatitis); pseudocyst of pancreas
9. Retractile mesenteritis (chronic fibrosing mesenteritis; mesenteric lipodystrophy; panniculitis; Weber-Christian disease)
10. Splenosis
11. Teratoma

**References**

**Gamut G-230**

**ALTERATION IN DENSITY OF THE MESENTERIC FAT ON CT (“Misty Mesentery”)**

1. Hemorrhage (eg, trauma)
2. Inflammation (eg, Crohn’s disease)
3. Lymphedema
4. Mesenteric edema
5. Neoplasm, eg, carcinomatosis; mesothelioma (esp. after chemotherapy)
6. Retractile mesenteritis (chronic fibrosing mesenteritis; mesenteric lipodystrophy; panniculitis; Weber-Christian disease)

**References**

**Gamut G-231**

**PERITONEAL DISEASE**

**COMMON**
1. Abscess, abdominal or pericolic (See G-89)
2. Adhesions (eg, inflammatory; postoperative); congenital peritoneal bands (Ladd’s bands)
3. Crohn’s disease
4. Endometriosis
5. Fluid, ascites (See G-233, 234)
6. Lymphoma
7. Metastasis, implantation, or invasion by malignant neoplasm
8. Obesity

(continued)
9. Pancreatitis (incl. saponification)
10. Peritonitis
11. Tuberculosis

**UNCOMMON**
1. Amyloidosis
2. Carcinoid
3. Cyst of mesentery
4. Desmoid tumor (mesenteric fibromatosis), isolated or with Gardner S.
5. Fungus disease (eg, actinomycosis)
6. Medication (eg, practolol peritonitis; Sansert)
7. Mesothelioma
8. Parasitic disease (esp. hydatid disease; amebiasis; pentastomiasis- Armillifer infection)
9. Pseudomyxoma peritonei
10. Radiation peritonitis
11. Retractile mesenteritis (chronic fibrosing mesenteritis; mesenteric lipodystrophy; panniculitis; Weber-Christian disease)
12. Sarcoma
13. Typhoid fever

**References**

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**DIFFUSE PERITONEAL THICKENING**
**(US, CT, MRI)**

**COMMON**
1. Carcinomatosis
2. Peritonitis
3. Postoperative state

**UNCOMMON**
1. Lymphoma
2. Mesothelioma
3. Pseudomyxoma peritonei
4. Sarcomatosis
5. Tuberculosis

**Reference**

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**PERITONEAL FLUID COLLECTION**
**(ASCITES) IN AN ADULT**
**(ESP. ON US, CT, MRI)**

**INFECTION OR INFLAMMATION OF THE PERITONEAL CAVITY (PERITONITIS)**
1. Abscess
2. Pancreatitis
3. Pelvic inflammatory disease (PID)
4. Rupture of a hollow viscus (eg, appendicitis; diverticulitis; empyema of gallbladder; peptic ulcer; typhoid fever)
5. Tuberculosis or other primary infection causing peritonitis
LYMPHATIC OBSTRUCTION WITH CHYLOUS OR LYMPH ASCITES (See G-235)

Congenital
1. Milroy disease
2. Tuberous sclerosis

Elevated lymphatic pressure
1. Cirrhosis
2. Constrictive pericarditis
3. Heart failure

Infection
1. Filariasis

Neoplastic disease
1. Lymphoma; leukemia
2. Metastatic disease in lymphatics

Radiation therapy

Trauma
1. Rupture of abdominal lymphatics

NEOPLASM
1. Benign (eg, Meigs S.—benign ovarian tumor)
2. Malignant (eg, carcinoma of gastrointestinal tract or
   ovary with mesenteric or peritoneal metastases;
   mesothelioma)

VENOUS OBSTRUCTION

Cardiac disease with chronic elevation of venous pressure
1. Chronic right heart failure due to other causes
2. Constrictive pericarditis
3. Mitral stenosis

External pressure on the portal vein
1. Inflammatory lymph nodes (eg, tuberculosis)
2. Lymphoma
3. Malignant tumor, primary or metastatic
4. Sarcoidosis

Obstruction of the inferior vena cava above the hepatic vein
1. Mediastinal mass
2. Thrombosis of IVC

Portal vein obstruction secondary to diffuse hepatic disease
1. Hepar lobatum
2. Portal cirrhosis
3. Schistosomiasis

Portal vein thrombosis
1. Chronically ill patients
2. Invasion by neoplastic disease

Veno-occlusive disease

Thrombosis or web in inferior vena cava

OTHER CAUSES
1. Bile peritonitis
2. Ectopic pregnancy
3. Hemoperitoneum (eg, trauma; surgery)
4. Hypoalbuminemia (eg, nephrotic S.; protein-losing gastroenteropathy)
5. Peritoneal lavage; dialysis

[CONDITIONS THAT MAY MIMIC ASCITES]
1. [Mesenteric cyst]
2. [Ovarian cyst]
3. [Pancreatic pseudocyst]
4. [Pregnancy]

References
PERITONEAL FLUID (ASCITES) IN AN INFANT OR CHILD

COMMON
1. Appendiceal perforation
2. Cardiac disease (eg, anasarca; constrictive pericarditis)
3. Cirrhosis, portal or biliary (eg, biliary atresia; polycystic liver)
4. Hemorrhage
5. Hydrops fetalis; erythroblastosis fetalis
6. Hypoproteinemia (eg, malnutrition; kwashiorkor; intestinal lymphangiectasia)
7. Peritonitis (eg, meconium; sepsis; toxoplasmosis; rubella S.; cytomegalovirus infection; typhoid fever; amebiasis)
8. Portal vein or IVC obstruction, extrahepatic (eg, neoplasm; lymphadenopathy; thromboembolism)
9. Renal failure (eg, nephrotic S. with hypoproteinemia; glomerulonephritis; uremia)
10. Trauma; surgery
11. Urinary outlet obstruction with hydronephrosis (urine ascites)
12. Ventriculoperitoneal shunt

13. Thromboembolism of inferior vena cava, renal vein, or hepatic veins
14. Tuberculosis
15. Wilson disease

References

CHYLOUS OR LYMPHATIC ASCITES*

COMMON
1. Filariasis
2. Lymphoma
3. Metastatic disease (esp. to lymph nodes)
4. Neoplasm, benign (esp. lymphangioma)
5. Neoplasm, malignant, compressing or invading lymphatic system (eg, carcinoma of pancreas, lung, esophagus; mediastinal tumor)
6. Postoperative
7. Trauma

UNCOMMON
1. Adhesive bands
2. Cirrhosis (hepatic lymphatics visible)
3. Congenital absence or hypoplasia of lymphatic system

Gamut G-235

Gamut G-234
4. Idiopathic
5. Lymphangioleiomyomatosis; tuberous sclerosis
6. Lymphangiomatosis, disseminated (benign metastasizing lymphangiomatosis)
7. Tuberculosis; histoplasmosis

* Obstruction of abdominal lymphatic vessels, cisterna chyli, or thoracic duct on lymphangiography.

References

Gamut G-236

SPONTANEOUS PNEUMOPERITONEUM WITHOUT PERITONITIS

COMMON
1. Iatrogenic (incl. postoperative; anesthesia; respiratory therapy; peritoneal dialysis; Rubin test; bronchoscopy; endoscopy; diagnostic pneumoperitoneum)
2. Idiopathic
3. Perforation of GI tract, forme fruste type (eg, peptic ulcer; neoplasm; Crohn’s disease; bowel infarction or obstruction)
4. Vaginal “aspiration” (eg, douching; sudden squatting; oral sex; postpartum exercises)

UNCOMMON
1. ARDS
2. Distention of stomach (eg, aerophagia; gastroscopy; sodium bicarbonate ingestion; misplaced oxygen tube)
3. Idiopathic dilatation of colon (eg, pseudo-obstruction)
4. Jejunal diverticulosis

Gamut G-237

PNEUMOPERITONEUM WITH PERITONITIS

COMMON
1. Perforated hollow viscus (eg, peptic ulcer; intestinal obstruction; diverticulitis; appendicitis; necrotic tumor; penetrating or blunt abdominal trauma; emphysematous cholecystitis) (See G-238)

UNCOMMON
1. Meconium peritonitis
2. Megacolon with rupture (eg, Chagas’ disease; Hirschsprung disease)
3. Perforation of colon following immunosuppressive therapy in renal transplant patient
4. Septic peritonitis with gas forming organism

References

(continued)
5. Ulcerating bowel disease (eg, typhoid fever; amebiasis; toxic megacolon; ulcerative colitis; Crohn’s disease; tuberculosis; pseudomembranous colitis; necrotizing enterocolitis; ischemic colitis; lymphogranuloma venereum)

References

Gamut G-238

PERFORATED HOLLOW VISCUS IN AN INFANT

COMMON
1. Iatrogenic (eg, intubation; rectal thermometer; enema; resuscitation; intrauterine transfusion)
2. Intestinal obstruction (eg, atresia; volvulus)
3. Meconium ileus (cystic fibrosis {mucoviscidosis})
4. Necrotizing enterocolitis
5. Respirator therapy
6. Trauma; battered child S.

UNCOMMON
1. Gastric rupture of newborn
2. Hirschsprung disease
3. Idiopathic
4. Ischemic enteritis (eg, umbilical artery thromboembolism; sepsis; malrotation with midgut volvulus)
5. Meconium plug S.
6. Perforated peptic or stress ulcer
7. [Pneumoperitoneum without peritonitis] (See G-236)
8. Small left colon S.

References

Gamut G-239

ABNORMAL GAS COLLECTION IN THE RIGHT UPPER QUADRANT

COMMON
1. Abscess, abdominal (eg, subphrenic, hepatic, pericolic, renal, or perirenal) (See G-243)
2. Colon interposition (Chilaiditi S.; colon distention
3. Gas in the biliary tract; biliary fistula (See G-128, G-139)
4. Pneumoperitoneum, free or loculated (eg, perforation of hollow viscus; postoperative) (See G-236–238)
5. Subhepatic gas or abscess (eg, perforated duodenal ulcer or appendix)

UNCOMMON
1. Abdominal wall gas or abscess (postoperative; traumatic; drainage tube)
2. Emphysematous cholecystitis
3. Gastric rupture of newborn
4. Iatrogenic pneumoretroperitoneum (incl. interventional embolization of a viscus; needle or catheter drainage; postnephrectomy; endoscopy)
5. Pneumatosis intestinalis (See G-70)
6. Pneumomediastinum with retroperitoneal extension
7. Portal vein gas (See G-192)
8. Retroperitoneal rupture of gut (esp. duodenum or rectum)
9. Stomach (heterotaxy)

References

Gamut G-240

ABNORMAL GAS COLLECTION IN THE LEFT UPPER QUADRANT

COMMON
1. Abscess, other abdominal (eg, subphrenic, splenic, pericolic, renal or perirenal)
2. Pneumoperitoneum, free or loculated (eg, perforation of hollow viscus; postoperative) (See G-236–238)

UNCOMMON
1. Abdominal wall gas or abscess (postoperative; traumatic; drainage tube)
2. Emphysematous gastritis
3. Iatrogenic pneumoretroperitoneum (incl. interventional embolization of a viscus; needle or catheter drainage; postnephrectomy; endoscopy)
4. Lesser sac gas or abscess (eg, postsplenectomy; perforation of gut; pancreatic abscess or infected pseudocyst)
5. Pancreatic gas abscess (peritoneal fat necrosis)
6. Pneumatosis intestinalis
7. Pneumomediastinum with retroperitoneal extension
8. Retroperitoneal rupture of gut (esp. duodenal or rectum)

References

Gamut G-241

LARGE ABDOMINAL GAS POCKET

COMMON
1. Abscess, abdominal (eg, subphrenic, splenic, renal or perirenal, pericolic, pancreatic, lesser sac, abdominal wall)
2. Bladder distended with air (eg, iatrogenic; emphysematous cystitis)
3. Cecal distention (eg, nonobstructive “paralytic” ileus; pseudo-obstruction; colon obstruction)
4. Diabetic gastropathy; acute gastric dilatation (eg, cast S.)
5. Duodenal obstruction (See G-42, 43)
6. Gastric outlet obstruction (See G-30)
7. Hernia, obstructed (eg, hiatal; diaphragmatic; internal; external)
8. Pneumoperitoneum, free or loculated (subphrenic; lesser sac; greater sac)
9. Retroperitoneal or extraperitoneal gas (eg, duodenal or rectal perforation)
10. Sentinel loop (localized ileus) (See G-80)
11. Small bowel or colon obstruction, chronic (eg, Crohn’s disease; adhesions; congenital stenosis)

UNCOMMON
1. Abdominal wall gas (postoperative)
2. Amnionitis; endometritis (physometra); infected fetus
3. Blind loop S. (esp. postoperative) (See G-58)
4. Diverticulum of colon or duodenum (giant size)
5. Duplication cyst, communicating
6. Emphysematous cholecystitis
7. Emphysematous peritonitis
8. Fibroid, infected

(continued)
9. Gangrene of liver
10. Hydropneumometrocolpos; vaginitis emphysematosa
11. Meckel’s diverticulum (giant size)
12. Ovarian cyst (eg, gas infection; intestinal fistula)

References

Gamut G-242

ABDOMINAL OR PELVIC ABSCESS

COMMON
1. Appendicitis
2. Carcinoma or other malignancy with perforation
3. Crohn’s disease
4. Diverticulitis
5. Pancreatitis
6. Pelvic inflammatory disease (eg, endometritis)
7. Peptic ulcer perforation
8. Postoperative
9. Posttraumatic (eg, gunshot or knife wound)
10. Tubo-ovarian (eg, sexually transmitted diseases; ectopic pregnancy)

UNCOMMON
1. Intestinal perforation, other (eg, intestinal obstruction; meconium ileus)
2. Ischemic colitis
3. Lymphogranuloma venereum
4. Parasitic disease (eg, amebiasis; schistosomiasis; ascariasis)
5. Perinephric abscess; pyelonephritis
6. Tuberculosis
7. Typhoid fever

Gamut G-243

RIGHT ANTERIOR PARARENAL SPACE ABSCESS (ESPECIALLY ON US, CT, OR MRI)

1. Duodenal perforation secondary to
   a. Ulcer
   b. Foreign body
   c. Inflamed diverticulum of duodenum
2. Crohn’s disease of small bowel or ascending colon
3. Colitis involving ascending colon
   a. Amebiasis
   b. Diverticulitis
   c. Tuberculosis
4. Ruptured retrocecal or retroperitoneal appendix
5. Pancreatic abscess or infected pseudocyst
6. Renal or perirenal abscess extending into pararenal space

Reference
**Gamut G-244-S**

**ABSCESS MIMICS ON ABDOMINAL US, CT, OR MRI**

**COMMON**
1. Cyst (eg, ovarian; renal; splenic; dermoid; mesenteric; hepatic; hydatid)
2. Hematoma
3. Loop of bowel
4. Necrotic neoplasm (eg, hepatoma; metastasis)
5. Pseudocyst of pancreas

**UNCOMMON**
1. Biloma
2. Iatrogenic (eg, retained Foley catheter)
3. Herniation of bowel through diaphragm
4. Lymphocele
5. Seroma
6. Urinoma

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**Gamut G-245**

**DECREASED ABDOMINAL GAS IN A NEWBORN**

**COMMON**
1. Congenital diaphragmatic hernia
2. Duodenal atresia or stenosis; annular pancreas
3. Endotracheal intubation
4. Esophageal obstruction (eg, atresia without T-E fistula; web) (See G-12, G-19)
5. Medication (esp. maternal)
6. Neonatal sepsis
7. Obstruction of pylorus (eg, hypertrophic pyloric stenosis at 2 to 8 weeks), duodenum, or proximal jejunum (esp. atresia or stenosis)
8. Suction, orogastric or nasogastric

**UNCOMMON**
1. Dehydration
2. Dysphagia; impaired swallowing physiology (eg, severe prematurity; depressed swallowing reflex; impending death)
3. Fluid-filled bowel
4. Large abdominal mass
5. Midgut volvulus
6. Normal
7. Peritoneal fluid (ascites)
8. Vomiting (eg, gastroenteritis; electrolyte imbalance)

**References**

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**Gamut G-246**

**DECREASED ABDOMINAL GAS IN AN ADULT**

**COMMON**
1. Acute pancreatitis
2. Ascites
3. Normal

**UNCOMMON**
1. Dysphagia
2. Fluid-filled bowel (eg, closed loop obstruction)
3. Hernia (esp. hiatal)
4. Large abdominal mass displacing bowel laterally
5. Mesenteric infarction, early
6. Obstruction of esophagus (eg, cardiospasm; neoplasm), stomach (eg, volvulus; pyloric obstruction from ulcer or neoplasm), or duodenum (eg, neoplasm)
7. Vomiting; inanition
ABDOMINAL CALCIFICATION(S) IN AN INFANT OR CHILD
(See G-143, G-203, 204, G-247-2)

COMMON
1. Adrenal calcification (See H-123)
2. Appendiceal fecalith (calculus)
3. [Foreign material; pills; pica; medication; contrast medium; heavy metal]
4. Histoplasmosis or tuberculosis in liver, spleen, lymph node, peritoneum
5. Meconium in peritoneum (meconium peritonitis from intestinal perforation), intestinal lumen or wall
6. Neuroblastoma; other neurogenic neoplasm
7. Urinary tract calcification (See H-24)

UNCOMMON
1. Abscess, abdominal (esp. liver)
2. Arterial calcification (eg, metastatic calcinosis; primary or secondary hyperparathyroidism)
3. Calculus in Meckel’s diverticulum or urachal cyst
4. Chronic granulomatous disease of childhood
5. Congenital syndromes (See G-247-2)
6. Cyst of spleen, kidney, pancreas, ovary, mesentery
7. Dermoid cyst; teratoma; fetus in fetus
8. Duplication, atresia, other obstruction of gut (mural or luminal calcification)
9. Enterolith; also enterolithiasis associated with anal atresia
10. Fetal infection (toxoplasmosis; rubella; cytomegalovirus; herpes simplex; varicella)
11. Gallstone (esp. thalassemia; sickle cell disease; other hemolytic anemia)
12. Hemangioma; lymphangioma (phlebolith; lymphantholith)
13. Hematoma, old (liver; spleen; retroperitoneal)
14. Hemochromatosis of liver
15. Hydrometrocolpos (ruptured) with plastic peritonitis
16. Ischemic infarct or necrosis of liver
17. Liver neoplasm (hemangioma; hamartoma; metastatic neuroblastoma; occasionally hepatoma; hepatoblastoma) (See G-154, 155)
18. Mucocele of appendix
19. Pancreatitis, chronic
20. Parasitic disease (eg, hydatid cysts or Armillifer infestation of peritoneum or mesentery; guinea worm infection or cysticercosis of abdominal wall or back)
21. Retroperitoneal neoplasm
22. Thromboembolism of inferior vena cava, portal vein, renal vein
23. Tuberculous psoas abscess

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
5. Cushing S. (adrenal)
6. Cystic fibrosis (mucoviscidosis) (pancreas; meconium peritonitis)
7. Cystinosis (urinary calculi)
8. Fetal cytomegalovirus infection (gonads)
9. Fetal herpes simplex infection (liver; adrenal)
10. Fetal toxoplasmosis infection (liver)
11. Fetal varicella infection (liver)
12. Gorlin S. (nevoid basal cell carcinoma S.) (ovarian)
13. Hirschsprung disease (enterolith)
14. Milk-alkali S. (nephrocalcinosis)
15. Multiple endocrine neoplasia (MEN) S., type IIA and IIB
   (eg, pheochromocytoma) (See J-5)
16. Oxalosis (nephrocalcinosis)
17. Prune-belly S. (Eagle-Barrett S.) (bladder wall; renal)
18. Renal tubular acidosis S. (nephrocalcinosis)
19. Wolman disease (familial xanthomatosis) (adrenal)

References

Gamut G-248
NONVISCERAL ABDOMINAL CALCIFICATION

COMMON
1. Aneurysm; arteriovenous malformation
*2. Appendiceal fecalith (calculus), extruded into peritoneal sac
3. Atherosclerosis
*4. Dermoid cyst; teratoma; fetus in fetu
*5. [Foreign material (eg, pill; pica; medication; contrast medium; heavy metal)]
*6. Gallstone extruded into peritoneal sac
*7. Lymph nodes (eg, tuberculosis; histoplasmosis)
*8. Meconium in peritoneum, intestinal wall or lumen
*9. Phlebolith; lympholith (incl. hemangioma; lymphangioma)
*10. [Rib cartilage]

UNCOMMON
1. [Barium in peritoneum]
2. [Bone lesion with matrix or sclerosis]
*3. Epiploic appendage
4. Fluorosis (ligamentous)
5. Hydrometrocolpos
6. Lipoma
*7. Lithopedion; extrauterine pregnancy
8. Mesenteric cyst
9. Mesothelioma of peritoneum
10. Metastasis (esp. from colloid carcinoma; papillary cystadenocarcinoma of ovary)
*11. Mineral oil granuloma (instilled in peritoneum)
12. Myositis (fibrodrasplasia) ossificans progressiva
13. Neoplasm of soft tissues (eg, osteoma; osteosarcoma; chondrosarcoma; undifferentiated abdominal malignancy)
14. Neuroblastoma
15. Pancreatitis with saponification; fat necrosis; Weber-Christian disease
*16. Parasitic disease (eg, hydatid cysts or Armillifer infestation of peritoneum or mesentery; guinea worm infection or cysticercosis of abdominal wall or back)
17. Pheochromocytoma
18. Pseudomyxoma peritonei (eg, from pseudomucinous cystadenoma of ovary; mucocele of appendix)
19. Retroperitoneal hematoma
20. Retroperitoneal neoplasm
21. Scar or burn (abdominal wall)
22. Scleroderma; dermatomyositis
23. Thrombosis of portal vein, renal vein, or inferior vena cava
24. Tuberculous peritonitis, psoas abscess

* May be mobile.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

(continued)
References

Gamut G-249
ABDOMINAL CALCIFICATIONS THAT LAYER IN THE UPRIGHT POSITION

COMMON
1. Bladder calculi
2. Gallstones

UNCOMMON
1. [Contrast medium; barium]
2. Dermoid cyst (eg, teeth)
3. Enteroliths in small bowel or Meckel’s diverticulum
4. Milk of calcium (eg, in gallbladder or kidney, Pott’s abscess, meconium, granulomatous lymph node, or chronic tubo-ovarian abscess)
5. Myxoglobulosis of appendix
6. Renal calculi (eg, in calyceal diverticulum or hydrenephrosis)
7. Urachal cyst calculi

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

Gamut G-250
ABDOMINAL CALCIFICATION(S) WITH A CONCRETION OR ANNULAR MORPHOLOGY

COMMON
1. Aneurysm; arteriovenous malformation; atherosclerosis
2. Appendiceal fecalith (calculus)
3. [Foreign body (eg, pill)]
4. Gallstone
5. Meconium
6. Pancreatic calculus
7. Phlebolith or lympholith (eg, normal pelvic veins; splenolith or hepatolith; hemangioma or lymphangioma; varicocele)
8. Prostatic calculus
9. Urinary tract calculus
10. Varix

UNCOMMON
1. Cyst (mesenteric; ovarian; renal; splenic)
2. Dermoid cyst
3. Diverticulum calculus (eg, colonic; duodenal; Meckel’s)
4. Enterolith
5. Epiploic appendage
6. Lithopedion
7. Mineral oil granuloma
8. Mucocele or myxoglobulosis of appendix
9. Parasitic disease (esp. hydatid disease—Echinococcus granulosus or E. multilocularis; Armillifer infection; guinea worm infection or cysticercosis of abdominal wall or back)
10. Pseudomyxoma peritonei (eg, from pseudomucinous cystadenoma of ovary; mucocele of appendix)
11. Urachal calculus
12. Urethral calculus

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
WIDESPREAD ABDOMINAL CALCIFICATIONS

COMMON
1. Atherosclerosis
2. Phleboliths (eg, normal; hemangioma)
3. Tuberculosis or histoplasmosis in liver, spleen, lymph nodes, or peritoneum

UNCOMMON
1. Fat necrosis (esp. pancreatitis; Weber-Christian disease)
2. Hypercalcemic state; idiopathic calcinosis
3. Myositis (fibrodysplasia) ossificans progressiva; myositis ossificans
4. Neoplasm of abdominal wall (incl. osteoma; osteosarcoma; chondrosarcoma)
5. Opaque medication
6. Parasitic disease (esp. guinea worm infection or cysticercosis of abdominal wall or back; Armillifer infection of peritoneum)
7. Scar; burn
8. Scleroderma; dermatomyositis
9. Skin nodule; tattoo; colostomy orifice

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
**Gamut G-253**

**ABDOMINAL WALL MASS**  
(ESP. ON US, CT, OR MRI)

**COMMON**
1. Abscess
2. Hematoma
3. Umbilical or ventral hernia

**UNCOMMON**
1. Endometrioma in scar
2. Neoplasm (eg, desmoid tumor; lipoma; neurofibroma; malignant fibrous histiocytoma; metastasis)
3. Omphalomesenteric cyst
4. Seroma; cellulitis
5. Urachal cyst

**References**
2. Siegel MJ: Pediatric Body CT. Philadelphia: Lippincott Williams & Wilkins, 1999

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**Gamut G-254**

**CYSTIC ABDOMINAL MASS IN A FETUS OR NEWBORN (US)**

**COMMON**
1. Dilated bladder
2. [Dilated bowel]
3. Hydronephrosis
4. Multicystic dysplastic kidney
5. Ovarian cyst

**UNCOMMON**
1. Choledochal cyst
2. Dilated ureter
3. Enteric duplication cyst
4. Hepatic cyst or cystic tumor (eg, mesenchymal hamartoma)
5. Hydrometrocolpos
6. Lymphangioma (incl. mesenteric cyst)
7. Persistent cloaca
8. Splenic cyst
9. Urachal cyst
10. Urinoma

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**

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**Gamut G-255**

**UPPER ABDOMINAL MASS IN A NEONATE OR CHILD**

**COMMON**
1. Abscess, abdominal (eg, retrocecal appendiceal)
2. Adrenal hemorrhage, cyst, or tumor (See H-124)
3. Fecal masses (esp. Hirschsprung disease)
4. Gastric dilatation (fluid filled stomach)
5. Hematoma (esp. splenic)
6. Hepatomegaly (See G-141-1 and -2)
7. Hydronephrosis
8. Intestinal obstruction (fluid-filled loop)
9. Intussusception
10. Lymphoma
11. Metastasis
12. Multicystic dysplastic kidney
13. Neuroblastoma; other neural tumor
14. Pyloric stenosis
15. Renal neoplasm (eg, Wilms’ tumor; mesoblastic nephroma) (See H-42)
16. Splenomegaly (See G-197, 198)

UNCOMMON
1. Bezoar, gastric
2. Bone lesion (eg, aneurysmal bone cyst or sarcoma of spine)
3. Cyst (eg, mesenteric; omental; renal; splenic; pancreatic; hepatic; choledochal; duplication; dermoid; hydatid)
4. Hepatic mass (eg, abscess; cyst; hepatoblastoma; hemangioma; hemangioendothelioma; hepatoma) (See G-154–157)
5. Infantile polycystic kidneys
6. Lymphangioma of mesentery or omentum
7. Meconium (eg, in cystic fibrosis)
8. Meningocele (anterior; lateral)
9. Renal vein thrombosis
10. Retroperitoneal lesion (eg, teratoma; sarcoma; hematoma)
11. Urinoma; lymphocele

References
7. Siegel MJ: Pediatric Body CT. Philadelphia: Lippincott Williams & Wilkins, 1999

ABDOMINAL LYMPHADENOPATHY
(US, CT, MRI)

BENIGN
+1. AIDS (eg, bacillary angiomatosis); AIDS related complex
2. Amyloidosis
3. Castleman disease
4. Cavitary mesenteric lymph node syndrome
5. Cirrhosis (alcohol induced); primary biliary cirrhosis
6. Crohn’s disease
7. Diverticulitis
*8. Mycobacterial infection (eg, Mycobacterium tuberculosis; M. avium intracellulare)
9. Pyogenic infection
10. Sarcoidosis
11. Sclerosing cholangitis
12. Whipple’s disease

MALIGNANT
+1. Kaposi sarcoma
2. Lymphoma; Hodgkin disease; leukemia
*3. Metastatic disease

* Lymph nodes may show low attenuation.
+ Lymph nodes may show very high attenuation.

References

FAT DENSITY IN THE ABDOMEN
(CT, MRI)

COMMON
1. Dermoid cyst; teratoma
2. Fatty change in liver or pancreas
3. Lipoma; liposarcoma
4. Lipomatosis (pelvic; retroperitoneal; renal sinus)
5. Obesity

UNCOMMON
1. Angiomyolipoma of kidney or liver
2. Omental or mesenteric hernia
3. Steroid therapy; Cushing hernia
4. Xanthogranulomatous pyelonephritis

Reference
"PSEUDOKIDNEY" OR "BULL'S-EYE" SIGN IN THE ABDOMEN (US)

COMMON
1. Gastroesophageal junction
2. Hypertrophic pyloric stenosis
3. Inflammatory bowel disease with wall thickening (eg, amebiasis; Crohn’s disease; diverticulitis; Whipple’s disease)
4. Intussusception (multiple concentric rings)
5. Malignant neoplasm with thickening of bowel wall (eg, carcinoma; lymphoma; leiomyosarcoma; metastasis to serosa)

UNCOMMON
1. Amyloidosis
2. Intramural hematoma (eg, trauma; anticoagulants; blood dyscrasia)

Reference

ABNORMAL ABDOMINAL VESSELS ON ANGIOGRAPHY

COMMON
1. Aneurysm
2. Anomalous origin or congenital absence of a vessel (eg, sequestration of lung)
3. Arterial occlusion, incl. collateral circulation (eg, via artery of Drummond; arc of Riolan; meandering mesenteric artery)
4. Arteritis, microaneurysms (eg, Behçet S.; Takayasu arteritis; necrotizing angiitis from drug abuse; my-
cotic aneurysms; polyarteritis nodosa; other connective tissue disease {collagen disease})
5. Atherosclerosis
6. Fibromuscular dysplasia
7. Neoplasm, incl. neovascularity (eg, angiomylipoma; pheochromocytoma; renal cell carcinoma) or vascular cuffing or displacement (esp. carcinoma)
8. Thromboembolism
9. Trauma (lacerated or transected vessel)
10. Varices (eg, portal venous hypertension or obstruction; inferior vena cava obstruction)

UNCOMMON
1. Anomalous pulmonary vein draining below the diaphragm (incl. venolobar S.)
2. Arteriovenous communication
3. Azygos continuation of inferior vena cava
4. Coarctation of abdominal aorta
5. Neurofibromatosis, arterial
6. Phlebitis (esp. pylephlebitis)
7. Portal vein occlusion (“cavernous transformation”)
8. Pregnancy (eg, hypertrophied uterine vessels; compression of iliac vein)
9. Pseudoxanthoma elasticum
10. Telangiectasia (eg, Osler-Weber-Rendu S.)

References
COMPLICATIONS OF AIDS IN THE GASTROINTESTINAL TRACT AND ABDOMEN

ESOPHAGITIS
1. Candidiasis (moniliasis)
2. Cytomegalovirus
3. Herpes
4. HIV

GASTRITIS
1. Cryptosporidium antritis
2. Cytomegalovirus infection (aphthoid ulcers; thick rugae, esp. at esophagogastric junction and antrum)

ENTERITIS WITH THICK IRREGULAR FOLDS, SPASM, AND OCCASIONAL DILATATION
1. Cryptosporidiosis
2. Cytomegalovirus infection
3. Mycobacterium avium-intracellulare infection
4. Parasitic disease (esp. giardiasis; strongyloidiasis)

COLITIS
1. Acute appendicitis
2. Cytomegalovirus infection of ileum and colon
3. Infectious colitis, esp. in rectum of homosexual men (eg, amebiasis; shigellosis; lymphogranuloma venereum; chlamydial proctitis; gonorrhea)
4. Pseudomembranous colitis

NEOPLASM OF GI TRACT, OCCASIONALLY WITH INTUSUSCEPTION OR OBSTRUCTION
1. Kaposi sarcoma
2. Lymphoma

LIVER AND BILE DUCT INVOLVEMENT
1. AIDS-related cholangitis (eg, cytomegalovirus; Cryptosporidium)

2. Liver abscess, infection (eg, Mycobacterium avium-intracellulare; Pneumocystis carinii; cytomegalovirus; histoplasmosis; cryptococcosis; bacillary angiomatosis)
3. Neoplasm (incl. lymphoma)
4. Peliosis hepatitis

SPLENIC INVOLVEMENT
1. Lymphoma
2. Splenic abscess, infection (eg, Mycobacterium avium-intracellulare; histoplasmosis; cryptococcosis; cytomegalovirus; Pneumocystis carinii)
3. Splenic infarcts (septic emboli)
4. Splenomegaly

References
Genitourinary Tract, Retroperitoneum, Pelvis, GYN Ultrasound

KIDNEY

CONGENITAL SYNDROMES

H-1 Congenital Syndromes with Renal or Ureteral Malformation or Anomaly
H-2 Congenital Syndromes with Renal Insufficiency or Nephropathy

DISPLACEMENT

H-3 Misplaced or Displaced Kidney
H-4 Mass Displacing a Kidney
H-5 Unilateral Absence or Blurring of Renal Outline

SIZE

H-6 Decreased Size of Part of a Kidney
H-7 Unilateral Small Kidney
H-8 Bilateral Small Kidneys
H-9 Unilateral Large Kidney
H-10 Bilateral Large Kidneys
H-11 Bilateral Large Kidneys with Multifocal Masses

NEPHROGRAM AND RENAL FUNCTION ON IVP

H-12 Diminished or Absent Nephrogram
H-13 Focal Defect(s) in the Nephrogram
H-14 Dense or Prolonged Nephrogram on IV Urography
H-15 Striated Nephrogram
H-16-1 Nonvisualization or Nonfunction of One Kidney on IV Urography or Nuclear Scan (See H-16-2)
H-16-2 Nonvisualization or Nonfunction of a Calyx or Part of a Kidney on IV Urography or Nuclear Scan
### COLLECTING SYSTEM

| H-17-1 | Diminished Concentration of Contrast Medium in Pelvocalyceal System on IV Urography—Unilateral |
| H-17-2 | Diminished Concentration of Contrast Medium in Pelvocalyceal System on IV Urography—Bilateral |

### CALCIFICATION

| H-18 | Intrarenal Contrast Collections (IVP, CT) |
| H-19 | Clubbing or Destruction of Renal Calyces |
| H-20 | Renal Papillary Necrosis |
| H-21 | Infundibular Narrowing or Amputation (Focal or Diffuse) |
| H-22 | Filling Defect or Mass in a Renal Pelvis, Infundibulum, or Calyx |

### CYSTIC DISEASES

| H-23-S | Classification of Renal Cystic Disease |
| H-30 | Cystic Diseases of the Kidney |
| H-31 | Congenital Syndromes Associated with Renal Cystic Disease |
| H-32 | Multiloculated Renal Lesions Containing Multiple Internal Cystic Areas |
| H-33 | Bilateral or Multiple Cystic Renal Masses on Ultrasound or CT (esp. in Children) |
| H-34 | High Density Renal Cyst(s) on CT (62–82 HU) |

### SCARS AND PSEUDOTUMORS

| H-35-1 | Focal Renal Parenchymal Scar(s) |
| H-35-2 | Depression or Scar in Renal Margin (Solitary or Multiple) |
| H-36 | Localized Bulge of Renal Outline |
| H-37 | Renal Pseudotumor (Normal Structure) |

### MASSES

| H-38-S | Tumors of the Renal Collecting System, Pelvis, and Ureters |
| H-39 | Tumors of the Renal Parenchyma (Benign and Malignant) |
| H-40 | Pediatric Renal Masses (Benign and Malignant) |
| H-41 | Congenital Syndromes or Anomalies Associated with Wilms’ Tumor |
| H-42 | Neonatal Renal Mass |
| H-43 | Solid Renal Mass (US, CT) |
H-44  Cystic Renal Mass (US, CT)
H-45  Cystic Renal Mass with Internal Debris (US, CT)
H-46  Cystic Renal Mass with Wall Calcification
H-47  Renal Mass with Calcification
H-48  Renal Mass with Fat on CT

MISCELLANEOUS

H-49  Hydronephrosis
H-50  Renal Hemorrhage
H-51  Renal Parenchymal Gas
H-52  Nephrointestinal Fistula
H-53  Dark Kidney on T2-Weighted MRI

PERIRENAL LESIONS

H-54  Lesions Involving the Perirenal Space (See G-243)
H-55-1 Perirenal Fluid Collection
H-55-2 Perinephric Abscess
H-55-3 Perinephric Hemorrhage or Hematoma
H-56  Peripelvic Extravasation (Sinus Leakage) (See H-95)

RENAL ANGIOGRAPHY

H-57  Peripheral Rim Enhancement (Angio, IVP)
H-58  Renal Angiography: Renal Ischemia
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H-59-2 Renal Angiography: Unilateral Renal Lesion that May Cause Hypertension (Renal Parenchymal Disease and Other Causes)
H-60  Renal Angiography: Renal Artery Aneurysms or Microaneurysms
H-61  Renal Angiography: Avascular Renal Mass
H-62  Renal Angiography: Early Venous Opacification (Less than 5 Sec)
H-63  Renal Angiography: Renal Vein Thrombosis

SONOGRAPHY OF RENAL MASSES

H-64  Echo-Free (Anechoic) Renal Mass
H-65  Hypoechoic Renal Mass
H-66  Isoechoic Renal Mass
H-67  Hyperechoic Renal Mass
H-68-1 Multilocular or Complex Renal Mass
H-68-2 Ill-Defined Renal Parenchymal Mass
H-69  Mass in Renal Collecting System or Pelvis with Acoustical Shadowing

MISCELLANEOUS RENAL SONOGRAPHY
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H-71  Hyperechoic Renal Cortex (With Normal Medulla)
H-72  Hyperechoic Renal Medulla
H-73  Hyperechoic Renal Parenchyma (Cortex and Medulla)
H-74  Renal Collecting System Echoes

RENALE ARTERY FLOW ON DOPPLER SONOGRAPHY
H-75  Increased Renal Artery Diastolic Flow (Low Resistive Index)
H-76  Decreased Renal Artery Diastolic Flow (Increased Resistive Index > 0.70)

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H-77  Doppler Sonography: Renal Transplant—Increased Renal Arterial Resistance Index (> 0.70)
H-78  Sonography: Enlargement of Renal Transplant
H-79  Sonography: Diminished Size of Renal Transplant
H-80  Diminished Function of Transplanted Kidney
H-81-S  Complications of Renal Transplantation

URETER
H-82  Medial Deviation of the Upper Ureter
H-83  Lateral Deviation of the Upper Ureter
H-84  Displacement of the Pelvic Ureter
H-85  Ureteral and Renal Pelvic Calcification
H-86  Ureteral Intraluminal Filling Defect(s) (See H-87)
H-87  Ureteral Mural Filling Defect(s) (See H-86)
H-88  Ureteral Tumors
H-89  Multiple Ureteral Filling Defects
H-90  Vascular Indentations on the Ureter or Renal Pelvis (Notching)
H-91  Dilatation of the Ureter (Segmental or Diffuse Ureterectasis)
H-92  Vesicoureteral Reflux
H-93  Obstruction of the Ureter (With or Without Hydronephrosis)
H-94  Ureteral Stricture
H-95  Ureteral Extravasation or Fistula (See H-56)

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H-96  Distended Bladder
H-97  Small or Contracted Bladder
H-98  Neurogenic Bladder
H-99  Extrinsic Pressure Deformity of the Bladder (incl. Teardrop or Pear-Shaped Bladder)
H-100  Focal Thickening of the Bladder Wall
H-101  Generalized Thickening of the Bladder Wall
H-102  Cystitis
H-103  Bladder Tumors
H-104  Filling Defect(s) in the Bladder Wall or Lumen
H-105  Calcification in the Bladder Wall or Lumen (See H-85)
H-106  Causes for Bladder Stones
H-107  Gas in the Bladder Wall or Lumen
H-108  Bladder Fistula
H-109  Bladder Diverticula
H-110  Bladder Outlet Obstruction

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H-111  Urinary Tract Obstruction Below the Bladder in a Child
H-112  Stricture of Anterior Urethra
H-113  Dilated Posterior Urethra
H-114  Urethral Tumors
H-115  Urethral Filling Defect(s), Intrinsic or Extrinsic
H-116  Urethral Outpouching
H-117  Urethral Fistula

ADRENAL GLANDS
H-118  Unilateral Adrenal Mass or Enlargement
H-119  Bilateral Adrenal Enlargement
H-120  Cystic Adrenal Lesion
H-121  Adrenal Tumors
H-122  Adrenal Pseudotumors
H-123  Adrenal Calcification
H-124  Adrenal Hemorrhage
H-125  Adrenal Insufficiency (Addison’s Disease)
H-126-S1  Cushing Syndrome
H-126-S2  Pheochromocytoma Syndromes

RETROPERITONEUM
H-127  Aneurysm of the Abdominal Aorta or its Branches (See H-60)
H-128  Retroperitoneal Fibrosis
H-129  Retroperitoneal Lymphadenopathy
H-130  Enlarged Iliopsoas Muscle or Compartment
H-131  Cystic Retroperitoneal Mass (US, CT, MRI)
H-132  Extraperitoneal Gas (See H-139)
PELVIS

H-133 Large Soft Tissue Mass in the Pelvis (See H-134–137)
H-134 Solid Pelvic Mass (US, CT)
H-135 Cystic Pelvic Mass (US, CT)
H-136 Complex Pelvic Mass (US, CT)
H-137 Lower Abdominal or Pelvic Mass in an Infant or Child (See H-133–136)
H-138 Pelvic or Lower Quadrant Calcification (See G-247–251)
H-139 Abnormal Gas Collection in the Pelvis and Female Genital Tract (See H-132)

PROSTATE

H-140 Enlarged Prostate
H-141 Sonography: Anechoic (Usually Cystic) Lesion in or Near the Prostate
H-142 Sonography: Hypoechoic Prostate Lesion
H-143 Sonography: Isoechoic Prostate Lesion
H-144 Sonography: Hyperechoic Prostate Lesion
H-145 Hypervascular Prostate Lesion on Color Doppler Ultrasound
H-146 Low-Intensity Peripheral Zone of Prostate on T2-Weighted MR Images

SEMINAL VESICLES AND TESTES

H-147 Low-Intensity Seminal Vesicle on T2-Weighted MR Images
H-148 Cystic Structure Near Seminal Vesicle
H-149 Calcification in the Seminal Vesicle, Vas Deferens, or Fallopian Tube
H-150 Abnormalities Involving the Entire Testis
H-151 Solid Testicular Mass (US, MRI)
H-152 Cystic Testicular Mass (US, MRI)
H-153 Unilateral Testicular Mass (US, MRI)
H-154 Bilateral Testicular Masses (US, MRI)
H-155-S Germ Cell Tumors of the Testes
H-156-S Non-Germ Cell Tumors of the Testes
H-157 Testicular Tumor in a Child (US)
H-158 Testicular Calcification (PF, US)
H-159 Epididymal Lesion (US, MRI)

SCROTUM

H-160 Mass in the Scrotum
H-161 Extratesticular Tumors in the Scrotum
H-162 Solid Extratesticular Mass in the Scrotum (US, MRI)
H-163 Cystic Extratesticular Mass in the Scrotum (US, MRI)
H-164 Calcifications in the Scrotum (PF, US)
H-165 Fluid Collection in the Scrotum (US)
OTHER GENITAL LESIONS

H-166 Congenital Syndromes with Hypospadias or Other Ambiguous External Genitalia
H-167 Calcifications in the Female Genital Tract
H-168 Vaginal Fistula

GYN ULTRASOUND—UTERUS

H-169-S Common Indications for Gynecological Ultrasound
H-170 Hyperechoic Focal Uterine Lesions
H-171 Diffuse Uterine Enlargement
H-172 Endometrial Thickening
H-173 Endometrial Fluid
H-174 Indefinite Uterus Sign (“Silhouette Sign”)
H-175 Prominence of Central Uterine Echo
H-176 Cervical Mass

GYN ULTRASOUND—ADNEXA AND OVARIIES

H-177 Free Fluid in Culs-de-sac
H-178 Fallopian Tube Mass
H-179 Simple Anechoic or Hypoechoic Cystic Adnexal Lesion
H-180 Complex (Usually Cystic) Adnexal Mass
H-181 Adnexal Lesions with Low Resistive Index (< 0.4) On Doppler Ultrasound
H-182 Solid Ovarian Tumor
H-183 Ovarian Neoplasm or Cyst in a Child
CONGENITAL SYNDROMES WITH RENAL OR URETERAL MALFORMATION OR ANOMALY

COMMON
1. Adrenogenital S.
2. Asplenia S. (Ivemark S.); polysplenia S.
3. Ehlers-Danlos S.
4. Fetal alcohol S.
5. Fetal rubella infection
6. Glycogen storage disease
7. Hepatic fibrosis-renal cystic disease
8. Potter sequence (absent or multicystic dysplastic kidneys)
9. Prune-belly S. (Eagle-Barrett S.)
10. Turner S.

UNCOMMON
1. Acrorenal S.
2. Aminopterin fetopathy
3. Anorectal malformation
4. Antley-Bixler S.
5. Baller-Gerold S. (craniosynostosis-radial aplasia S.)
6. Bartter S.
7. Beckwith-Wiedemann S.
8. Brachmann de Lange S. (de Lange S.)
9. Branchio-oto-renal S.
10. Cat-eye S. (chromosome 22 trisomy/tetrasomy)
11. Cocaine abuse (maternal)
12. Craniosynostosis syndromes
13. Dietl S.
14. EEC syndrome
15. Fanconi anemia (pancytopenia-dysmelia S.)
16. Femoral hypoplasia-unusual facies S.
17. Fetal trimethadione S.
18. Fraser S. (cryptophthalmia S.)
19. Freeman-Sheldon S. (whistling face S.)
20. Frontometaphyseal dysplasia
21. Fryns S.
22. Hemihypertrophy
23. Johanson-Blizzard S.
24. Kallmann S.
25. Klippel-Feil S.
26. Lenz microphthalmia S.
27. Mayer-Rokitansky-Küster S.
28. Mesomelic dysplasia (multiple types)
29. MURCS association
30. Noonan S.
31. Perlman S.
32. Poland sequence
33. Renal-hepatic-pancreatic dysplasia
34. Roberts S.
35. Robinow S.
36. Ruvalcaba S. (trichorhinophalangeal dysplasia, type III)
37. Schinzel-Giedion S.
38. Sirenomelia
39. TAR S. (thrombocytopenia-absent radius S.)
40. Trisomy 13 S.
41. Trisomy 18 S.
42. VATER association
43. Zellweger S. (cerebrohepatorenal S.)

References

Gamut H-2
CONGENITAL SYNDROMES WITH RENAL INSUFFICIENCY OR NEPHROPATHY

COMMON
1. AIDS (congenital)
2. Alkaptonuria (ochronosis)
3. Fanconi S. (de Toni-Debré-Fanconi S.)
4. Glycogen storage disease (types I and V)

(continued)
5. Hemophilia
6. Polycystic kidneys and liver
   a. Autosomal recessive (infants and children with massive renomegaly, numerous cysts less than 2 cm, dilated collecting tubules, and progressive hepatic fibrosis and liver cysts)
   b. Autosomal dominant (adults and children with multiple cysts in kidneys and liver)
7. Potter sequence (absent or multicystic dysplastic kidneys)
8. Prune-belly S. (Eagle-Barrett S.)
9. Renal tubular acidosis
10. Sickle cell disease

UNCOMMON
1. Acrodysplasia with retinitis pigmentosa and nephropathy (Saldino-Mainzer S.)
2. Alagille S. (arteriohepatic S.)
3. Alport S. (hereditary nephritis)
4. Asphyxiating thoracic dysplasia
5. Bardet-Biedl S.
6. Bartter S.
7. Behcet S.
8. Chondroectodermal dysplasia (Ellis-van Creveld S.)
9. Cockayne S.
10. Cystinosis; cystinuria
11. Drash S.
12. Fabry disease
13. Familial hyperuricosuria
14. Familial Mediterranean fever
15. Gaucher disease
16. Hemolytic-uremic S.
17. Henoch-Schönlein purpura
18. Hepatic fibrosis-renal cystic disease
19. Laurence-Moon-Biedl S.
20. Lesch-Nyhan S.
21. Lowe S. (oculocerebrorenal S.)
22. Nail-patella S. (osteochondrodysplasia)
23. Nephronophthisis
24. Osteolysis with nephropathy
25. Oxalosis
26. Paraneoplastic syndromes
27. Riley-Day S. (familial dysautonomia)
28. Senior-Loken S.
29. Tyrosinemia
30. Wilson disease
31. Wiskott-Aldrich S.
32. Zellweger S. (cerebrohepatorenal S.)

Reference

Gamut H-3

MISPLACED OR DISPLACED KIDNEY

COMMON
1. [Absent kidney (congenital; nephrectomy)]
2. Ectopic kidney (pelvic, thoracic, crossed)
3. Hepatomegaly or splenomegaly displacing kidney
4. Horseshoe kidney
5. Malrotation
6. Mass displacing kidney (intra- or extrarenal) (See H-4)
7. Ptosis
8. Transplanted kidney

UNCOMMON
1. Colon distention
2. Hepatic atrophy; cirrhosis (elevated right kidney)
3. Hernia
4. Psoas muscle hypertrophy
5. Retroperitoneal lipomatosis or fibrosis

References
2. Silverman PM, Kelvin FM, Korobkin M: Lateral displacement of the right kidney by the colon: An anatomic variation demonstrated by CT. AJR 1983;140:313–314
Gamut H-4

MASS DISPLACING A KIDNEY

COMMON
1. Abscess (retroperitoneal, peri- or pararenal, renal)
2. Hematoma (retroperitoneal)
3. Hepatomegaly; splenomegaly
4. Intrarenal neoplasm (eg, renal cell carcinoma; Wilms’ tumor)

UNCOMMON
1. Aneurysm of aorta
2. Intracapsular extrarenal neoplasm (eg, lipoma)
3. Lymphadenopathy (eg, tuberculosis; sarcoidosis; metastases, esp. from testicular tumor)
4. Lymphoma
5. [Psoas muscle hypertrophy]
6. Retroperitoneal neoplasm (eg, sarcoma)
7. Suprarenal neoplasm (eg, neuroblastoma; adrenal adenoma or carcinoma; pheochromocytoma)

Gamut H-5

UNILATERAL ABSENCE OR BLURRING OF RENAL OUTLINE

COMMON
1. Abscess, perinephric or paranephric (See H-55-2)
2. Congenital absence or aplasia of kidney
3. Displaced kidney (See H-3)
4. Hemorrhage or hematoma (perirenal or retroperitoneal)
5. Nephrectomy
6. Normal (eg, technical factors; insufficient perirenal fat; overlying intestinal gas)

UNCOMMON
1. Atrophic kidney
2. Ectopic kidney (eg, presacral, thoracic)
3. Lymphocele
4. Thromboembolism of renal artery or vein, or inferior vena cava
5. Urinoma

References

Gamut H-6

DECREASED SIZE OF PART OF A KIDNEY

COMMON
1. Ischemia; infarction
2. Postobstructive atrophy (eg, from calculus)
3. Postoperative (eg, partial resection)
4. Reflux nephropathy (chronic atrophic pyelonephritis)
5. Traumatic atrophy

UNCOMMON
1. Abscess, healed
2. Interstitial nephritis
3. Papillary necrosis
4. Radiation therapy
5. Segmental hypoplasia (Ask-Upmark S.)
6. Thromboembolism of renal vein
7. Tuberculosis
UNILATERAL SMALL KIDNEY

Small Smooth Kidney

COMMON
1. Congenital hypoplasia (incl. Ask-Upmark kidney with focal hypoplasia)
2. Ischemia, renal artery stenosis (eg, arteriosclerosis; thromboembolism; fibromuscular hyperplasia; polyarteritis nodosa)
3. Postobstructive atrophy (eg, calculus)
4. Postoperative (partial nephrectomy)
5. Posttraumatic atrophy
6. Reflux nephropathy (chronic atrophic pyelonephritis)

UNCOMMON
1. Papillary necrosis (late after analgesic abuse)
2. Postinflammatory atrophy following acute bacterial nephritis (esp. in diabetic)
3. Radiation nephritis
4. Renal infarction, total, late (eg, embolus; thrombosis)
5. Thrombosis of renal vein (chronic with atrophy)

Small Scarred or Irregular Kidney
1. Multicystic dysplastic kidney (diminutive form)
2. Renal infarction (lobar)
3. Reflux nephropathy (chronic atrophic pyelonephritis)
4. Segmental hypoplasia (Ask-Upmark S.)
5. Tuberculosis (eg, autonephrectomy)

References


BILATERAL SMALL KIDNEYS

COMMON
1. Arteriolar nephrosclerosis (benign or malignant)
2. Glomerulonephritis, chronic
3. Ischemia, bilateral renal artery stenosis (eg, arteriosclerosis; fibromuscular hyperplasia; thromboembolism; polyarteritis nodosa; chronic arteritis)
4. Normal variant; idiopathic
5. Pyelonephritis, chronic atrophic
6. Reflux atrophy
7. Senile atrophy

UNCOMMON
1. Alport S. (hereditary chronic nephritis)
2. Amyloidosis (late)
3. Arterial hypotension, acute (eg, shock; reaction to contrast medium)
4. Bardet-Biedl S.
5. Collagen vascular disease (eg, scleroderma)
6. Congenital hypoplasia
7. Cortical necrosis (late)
8. Diabetic nephropathy, late (eg, Kimmelsteil-Wilson S.)
9. Gouty nephropathy
10. Hyperparathyroidism, primary or secondary (renal osteodystrophy)
11. Hypertension, chronic (hypertensive nephropathy)
12. Infarction, bilateral
13. Interstitial nephritis, chronic
14. Juvenile nephronophthisis (medullary cystic disease)
15. Lead nephropathy
16. Multiple myeloma
17. Oxalosis (late)
18. Papillary necrosis, late
19. Postinflammatory atrophy
20. Postobstructive atrophy
21. Radiation nephritis
22. Segmental hypoplasia, bilateral (Ask-Upmark S.)
23. Thromboembolism of renal veins or inferior vena cava

References

Gamut H-9

UNILATERAL LARGE KIDNEY

COMMON
1. Abscess, renal (eg, carbuncle; nephronia) or perirenal
2. Compensatory hypertrophy due to disease or absence of opposite kidney
3. Cyst (simple; hydatid; parapelvic) (See H-30)
4. Double or triple collecting system
5. Hydronephrosis (See H-49); obstructive uropathy
6. Idiopathic; normal variant
7. [Malrotation]
8. Multicystic dysplastic kidney with numerous cysts in infants and children (they decrease in size by adulthood)
9. Neoplasm, malignant (eg, renal cell carcinoma; Wilms’ tumor; sarcoma; metastasis)
10. Polycystic kidney disease with unilateral enlargement
11. Pyelonephritis, acute

UNCOMMON
1. Bartter S.
2. Congenital megacalycyes
3. Crossed fused renal ectopy; horseshoe kidney
4. Hemihypertrophy, congenital
5. Hemorrhage (eg, hemophilia; anticoagulant therapy; trauma)
6. Infarction, acute arterial
7. Malakoplasia
8. Multilocular cystic nephroma
9. Neoplasm, benign, esp. angiomyolipoma (hamartoma)
10. Renal vein thrombosis
11. Transplant rejection, acute
12. Trauma (eg, contusion; hematoma; urinoma)
13. Xanthogranulomatous pyelonephritis

References

(continued)
BILATERAL LARGE KIDNEYS

COMMON
1. Diabetic nephropathy (eg, glomerulosclerosis; Kim-
melstiel-Wilson S.)
2. Duplication of pelvocalyceal systems, bilateral
3. Glomerulonephritis (eg, acute {streptococcal infec-
tion}; lobular; hereditary; idiopathic; glomerulo-
sclerosis)
4. Hydronephrosis (See H-49)
5. Multiple simple cysts
6. Nephrosis (eg, nephrotic S.; toxic nephrosis; lipid nephrosis; bile nephrosis)
7. Normal variant; idiopathic
8. Polycystic kidney disease, adult autosomal domi-
nant or infantile autosomal recessive; other cystic disease (See H-30)

UNCOMMON
1. Acquired cystic disease (eg, in hemodialysis for chronic renal failure)
2. Acromegaly
3. Acute cortical necrosis
4. Acute interstitial nephritis (allergic reaction to drugs—eg, methicillin)
5. Acute tubular necrosis
6. Agnogenic myeloid metaplasia
7. Allergic angitis (necrotizing vasculitis)
8. Amyloidosis
9. Angiomyolipomas, multiple (esp. with tuberous sclerosis)
10. Bartter S.
11. Beckwith-Wiedemann S.
12. Bilateral renal neoplasms (eg, renal cell carcinoma {hypernephroma}; Wilms’ tumor)
13. Bleeding disorder g (eg, hemophilia; Henoch-
Schönlein purpura)
14. Collagen vascular disease g (esp. lupus nephritis;
polyarteritis nodosa; thrombotic thrombocytopenic purpura)
15. Congenital megacalices
16. Cyst in one kidney, hypernephroma in the other
17. Diuresis or vasodilatation secondary to diuretics or contrast media
18. Gaucher disease; Niemann-Pick disease
19. Glycogen storage disease, type I (von Gierke S.)
20. Goodpasture S.
21. Hemolytic-uremic S.
22. [Horseshoe kidney]
23. Infant of diabetic mother
24. Infarction (acute arterial)
25. Langerhans cell histiocytosis g
26. Leukemia; lymphoma g
27. Lipodystrophy (lipoatrophic diabetes)
28. Metastases (esp. from carcinoma of lung, breast, contralateral kidney)
29. Multiple myeloma; POEMS S.
30. Nephroblastomatosis
31. Nephromegaly with other conditions (eg, neonatal transient nephromegaly; hyperalimentation {total parenteral nutrition}; cirrhosis; Fabry’s disease; paroxysmal nocturnal hemoglobinuria; AIDS nephropathy)
32. Pyelonephritis (acute)
33. Sarcoidosis
34. Sickle cell disease (homozygous)
35. Steroid therapy (prolonged)
36. Subacute infective endocarditis (glomerulonephritis)
37. Thromboembolism of renal veins or vena cava
38. Tuberous sclerosis
39. Tyrosinosis (hereditary)
40. Urate nephropathy (acute)
41. von Hippel-Lindau S.
42. Waldenström’s macroglobulinemia
43. Wegener’s granulomatosis
44. Wolman’s disease
45. Work hypertrophy (eg, beer-drinker kidneys; diabetes insipidus)
Gamut H-11

BILATERAL LARGE KIDNEYS WITH MULTIFOCAL MASSES

COMMON
1. Multiple cysts (simple or hydatid)
2. Polycystic kidney disease (adult—autosomal dominant)

UNCOMMON
1. Acquired cystic disease (eg, from dialysis)
2. Angiomyolipomas (eg, with tuberous sclerosis)
3. Bilateral renal neoplasms (eg, renal cell carcinoma; Wilms’ tumor)
4. Cyst in one kidney, neoplasm in the other

Gamut H-12

DIMINISHED OR ABSENT NEPHROGRAM

UNILATERAL

COMMON
1. Ureteral obstruction

UNCOMMON
1. Renal artery occlusion
2. Renal vein occlusion
3. Trauma

BILATERAL

COMMON
1. Contrast administration error
2. Hypotension
3. Renal failure (acute or chronic)

5. Lymphoma (incl. Burkitt’s lymphoma)
6. Metastases
7. Nephroblastomatosis
8. von Hippel-Lindau disease

Reference
FOCAL DEFECT(S)
IN THE NEPHROGRAM

COMMON
1. Acute pyelonephritis
2. Cyst (simple; hydatid; parapelvic)
3. Infarction; arterial branch occlusion
4. Lipomatosis of renal sinus
5. Neoplasm, malignant (eg, renal cell carcinoma; transitional cell carcinoma of renal pelvis; Wilms’ tumor; sarcoma)
6. Polycystic kidney disease, adult
7. Trauma (eg, contusion; laceration)

UNCOMMON
1. Abscess, acute or chronic
2. Aneurysm of renal artery (intrarenal); arteriovenous malformation
3. Angiomyolipoma (hamartoma), esp. with tuberous sclerosis
4. Hematoma, intrarenal
5. Localized hydronephrosis (due to congenital or tuberculous obstruction)
6. Lymphoma
7. Medullary cystic disease
8. Metastasis
9. Tuberculosis
10. Xanthogranulomatous pyelonephritis

References

DENSE OR PROLONGED NEPHROGRAM ON IV UROGRAPHY

COMMON
1. Contrast reaction (acute contrast nephropathy)
2. Glomerulonephritis, acute or chronic
3. Hydronephrosis, severe (See H-49)
4. Hypotension; shock
5. Ischemia (reduced flow; acute renal arterial insufficiency) (See H-58)
6. Normal kidneys with rapid bolus contrast medium injection
7. Obstruction of bladder (See H-110)
8. Obstructive uropathy (eg, calculus or blood clot in ureter)
9. Pyelonephritis, acute severe (esp. in diabetic)
10. Renal failure (acute oliguric)
11. Traumatic reflex anuria

UNCOMMON
1. Collagen disease (esp. polyarteritis nodosa)
2. Cortical necrosis
3. Iatrogenic (eg, ureteral catheter)
4. Idiopathic
5. Lymphoma with urate nephropathy
6. Medullary cystic disease (early stage)
7. Nephrosis
8. Papillary necrosis (acute tubular obstruction by necrotic papillary tips)
9. Polycystic kidney disease, infantile type
10. Thromboembolism of renal vein or inferior vena cava
11. Trueta phenomenon
12. Tubular blockage (eg, sulfonamide therapy; multiple myeloma; amyloidosis; hemoglobinuria; myoglobinuria; hyperuricemia {urate nephropathy}; Tamm-Horsfall proteinuria)
13. Tubular necrosis, acute
14. Waldenström’s macroglobulinemia
References

Gamut H-15

STRIATED NEPHROGRAM

COMMON
*1. Acute obstruction
2. Acute renal failure
3. Medullary sponge kidney
4. Medullary tubular ectasia
*5. Pyelonephritis
*6. Trauma

UNCOMMON
*1. Arterial emboli
2. Arteritis (eg, polyarteritis nodosa; drug abuse; Wegener’s granulomatosis)
3. Polycystic kidney disease (infantile—autosomal recessive)
*4. Renal vein thrombosis
* Usually unilateral. Others are usually or always bilateral.

Reference

Gamut H-16

NONVISUALIZATION OR NONFUNCTION OF ONE KIDNEY ON IV UROGRAPHY, CT, OR NUCLEAR SCAN (See H-16-2, H-17-1)

COMMON
1. [Ectopic kidney]
2. Hydronephrosis (See H-49)
3. Neoplasm (eg, renal cell carcinoma)
4. Obstruction of ureter (esp. calculus) (See H-93)
5. Postoperative (eg, nephrectomy)
6. Renal artery obstruction (eg, stenosis; thromboembolism; trauma)
7. Trauma (esp. fractured kidney)

UNCOMMON
1. Abscess; carbuncle; nephrosia; pyonephrosis
2. Absence or hypoplasia of kidney (congenital)
3. Acute bacterial nephritis (esp. diabetes)
4. Arteriovenous malformation of kidney
5. Lymphoma
6. Multicystic dysplastic kidney
7. Perinephric hematoma
8. Radiation injury
9. Renal vein obstruction (eg, thromboembolism; neoplasm)
10. Tuberculosis (autonephrectomy); other severe infection (eg, xanthogranulomatous pyelonephritis)

References
Gamut H-16

Gamut H-16-2

NONVISUALIZATION OR NONFUNCTION OF A CALYX OR PART OF A KIDNEY ON IV UROGRAPHY, CT, OR NUCLEAR SCAN

1. Abscess; carbuncle; nephronia
2. Cyst (See H-30)
3. Duplication of collecting system with obstruction of one division (eg, ectopic ureterocele)
4. Metastasis
5. Neoplasm, benign or malignant (esp. transitional cell or renal cell carcinoma)
6. Obstruction (eg, calculus; crossing vessel)
7. Postoperative (eg, partial nephrectomy)
8. Trauma (esp. fractured kidney)
9. Tuberculosis or other infection

Gamut H-17-1

DIMINISHED CONCENTRATION OF CONTRAST MEDIUM IN PELVOCALICEAL SYSTEM ON IV UROGRAPHY—UNILATERAL

1. Compression of kidney by adjacent mass (eg, splenomegaly; neoplasm)
2. [Contralateral hyperconcentration (eg, renal artery stenosis involving opposite kidney)]
3. Cyst (esp. parapelvic)
4. Infection, acute (eg, bacterial pyelonephritis) or chronic (eg, tuberculosis)
5. Neoplasm
6. Radiation injury
7. Renal parenchymal disease, unilateral (eg, tuberculosis; abscess; carbuncle)
8. Renal vein thrombosis (See H-63)
9. Trauma with spasm of pelvocaliceal system
10. Urinary tract obstruction; hydronephrosis (See H-49)

Gamut H-17-2

DIMINISHED CONCENTRATION OF CONTRAST MEDIUM IN PELVOCALICEAL SYSTEM ON IV UROGRAPHY—BILATERAL

1. Arteriolar nephrosclerosis; hypertensive renal disease
2. Hydronephrosis (See H-49)
3. Idiopathic
4. Infection, acute (eg, bacterial pyelonephritis)
5. Lipomatosis of renal sinus
6. Myeloma kidney; amyloidosis
7. Overhydration or inadequate dehydration
8. Polyuria (eg, diuresis; diabetes insipidus or mellitus with renal disease)
9. Renal artery stenosis or thromboembolism
10. Renal failure; uremia
11. Tamm-Horsfall proteinuria
12. [Technical (eg, inadequate contrast dose)]
13. Thromboembolism of renal veins or inferior vena cava (See H-63)
14. Trauma

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Gamut H-18

INTRARENAL CONTRAST COLLECTIONS (IVP, CT)

COMMON
1. Calyceal diverticulum
2. Dilated calyx

UNCOMMON
1. Communicating cyst (eg, ruptured hydatid)
2. Communicating urinoma
3. Medullary sponge kidney (“paint brush” effect)
4. Papillary necrosis
5. Trauma (eg, fractured kidney or calyces)

Reference

Gamut H-19

CLUBBING OR DESTRUCTION OF RENAL CALYCES

COMMON
1. Caliectasis, localized, from obstruction of infundibulum (eg, stone; neoplasm; stricture; clot; anomalous vessel)
2. Hydronephrosis
3. Papillary necrosis (See H-20)
4. Pyelonephritis (incl. xanthogranulomatous)
5. Tuberculosis
6. Vesicopelvic reflux

UNCOMMON
1. Abscess
2. [Congenital megacalyx]
3. Fungus disease
4. Neoplasm (esp. transitional cell carcinoma)
5. Postoperative scarring

Gamut H-20

RENA L PAPILLARY NECROSIS

COMMON
1. Analgesic abuse (eg, phenacetin; aspirin)
2. Diabetes mellitus
3. Obstruction of urinary tract
4. Pyelonephritis
5. Sickle cell disease

UNCOMMON
1. Abscess or carbuncle of kidney
2. Arteritis (eg, thromboembolism; polyarteritis nodosa; necrotizing)
3. Cirrhosis
4. Contrast medium reaction (intravenous; retrograde)
5. Disseminated intravascular coagulation (DIC); sepsis
6. Renal vein thrombosis
7. Shock; asphyxia; dehydration (esp. child)
8. Tuberculosis

References

Gamut H-21

INFUNDIBULAR NARROWING OR AMPUTATION (FOCAL OR DIFFUSE)

COMMON
1. Carcinoma (eg, transitional cell; renal cell)
2. Normal variant (eg, crossing vessel)
3. Renal sinus lipomatosis or mass
4. Spasm or irritability (eg, acute pyelonephritis; trauma; hemorrhage)

(continued)
**UNCOMMON**

1. Abscess; carbuncle; nephronia
2. Congenital infundibular stenosis (Fraley S.)
3. Extrarenal pelvis
4. Extrinsic compression
5. Infarct (renal)
6. Neoplasm, other benign or malignant (eg, angio-myolipoma; lymphoma; squamous cell carcinoma)
7. Parapelvic cyst (simple; hydatid)
8. Postoperative (eg, partial resection)
9. Stricture, inflammatory
10. Tuberculosis; other infection (eg, brucellosis)

**References**


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**FILLING DEFECT OR MASS IN A RENAL PELVIS, INFUNDIBULUM, OR CALYX**

**COMMON**

1. Blood clot (eg, trauma; neoplasm)
2. Calculus (See H-24–26)
3. Gas (eg, air from retrograde pyelogram; percutaneous or retrograde stone removal; sinus tract or fistula; gas infection; ureterointestinal anastomosis)
4. Metastasis
5. Neoplasm (eg, hemangioma; hamartoma; angiomyolipoma; papilloma; oncocytoma; transitional cell carcinoma; hypernephroma; Wilms’ tumor; lymphoma)
6. Normal anatomic variation (eg, bifid pelvis; duplication; overlapping calyces; calyx on end)
7. Normal renal artery or vein impression
8. Renal sinus lipomatosis
9. [Technical (incomplete filling with contrast medium; overlying intestinal gas)]

**UNCOMMON**

1. Amyloidosis
2. Cholesteatoma (squamous metaplasia of urothelium)
3. Cyst (eg, parapelvic, parenchymal, hydatid)
4. Fungus ball (esp. Candida)
5. Inflammatory polyp
6. Leukoplakia
7. Malakoplakia
8. Multicystic kidney with pelvoinfundibular atresia (congenital)
9. Papilla, aberrant or sloughed (eg, papillary necrosis) (See H-20)
10. Polycystic kidney
11. Pyelitis cystica
12. Pyelonephritis with inspissated pus, necrotic debris (eg, suppurative; xanthogranulomatous; tuberculous)
13. Saccular aneurysm
14. Urinoma

* May fill entire renal pelvis.

**References**

Gamut H-23
FOCAL OR ANNULAR CALCIFICATION IN THE KIDNEY

COMMON
1. Aneurysm of renal artery
2. Atherosclerosis of renal artery
3. Calculus (See H-24-26)
4. Neoplasm, malignant (eg, renal cell carcinoma; chondrosarcoma; neuroblastoma; osteosarcoma; transitional cell carcinoma; Wilms’ tumor; metastasis)

UNCOMMON
1. Abscess (renal or perinephric)
2. [Adrenal cyst or neoplasm]
3. Arteriovenous communication; angioma
4. Caliceal diverticulum containing calculus or milk of calcium
5. [Cortical necrosis]
6. Cyst (eg, simple; hydatid)
7. [Glomerulonephritis, chronic (cortical)]
8. Hematoma
9. Hydronephrosis or pyonephrosis containing calculus or milk of calcium
10. Infarction
11. Leukoplakia
12. Multicystic kidney; polycystic kidney
13. Neoplasm, benign (eg, dermoid; teratoma; angiomylipoma; hemangioendothelioma; medullary fibroma; hamartoma; spindle cell tumor, r.; adenoma; multilocular cystic nephroma [Perlman tumor] oncocytooma)
14. Papillary necrosis
15. Thromboembolus
16. Tuberculosis

References

Gamut H-24
CAUSES OF RENAL AND OTHER URINARY TRACT CALCULI
(See also H-25-S)

COMMON
1. Hyperparathyroidism
2. Idiopathic
3. Infection
4. Osteoporosis (eg, senile; postmenopausal; immobilization) (See D-43-1)
5. Stasis (eg, urinary tract obstruction; neurogenic bladder; paralysis)

UNCOMMON
1. Bone destruction (eg, osteolytic bone metastases; multiple myeloma)
2. Cushing’s disease; steroid therapy
3. Dehydration
4. Excessive calcium intake (eg, milk-alkali S.) or absorption
5. Hyperthyroidism
6. Hyperuricosuria
7. Hypervitaminosis D
8. Idiopathic hypercalciuria
9. Malabsorption S. (See G-57)
10. Medullary sponge kidney
11. Osteomalacia (See D-44)
12. Oxaluria
13. Paget’s disease

(continued)
14. Papillary necrosis
15. Renal osteodystrophy
16. Renal tubular acidosis
17. Sarcoidosis
18. Schistosomiasis haematobium
19. Tuberculosis
20. Williams S. (idiopathic hypercalcemia)

References
1. Kirks DR: John Caffey Award: Lithiasis due to interruption of the enterohepatic circulation of bile salts. AJR 1979;133: 383–388

Gamut H-25-S

CLASSIFICATION OF CALCIUM STONES IN THE URINARY TRACT*

IDIOPATHIC

Hypercalciuria
1. Increased intestinal absorption of calcium
2. “Renal leak” of calcium

Hyperuricosuria

No Metabolic Abnormality Yet Defined
1. ? Decreased inhibitors of stone formation
2. ? Increased promoters of stone formation
3. ? Decreased urine volume

HYPERCALCEMIC HYPERCALCIURIA

Increased Bone Resorption
1. Hyperparathyroidism, primary
2. Hyperthyroidism
3. Immobilization
4. Neoplasm, widespread (eg, carcinomatosis; multiple myeloma)
5. Paget’s disease

Increased Intestinal Absorption of Calcium
1. Milk-alkali S.
2. Sarcoidosis
3. Vitamin D intoxication

RENAL TUBULAR ACIDOSIS

Hyperoxaluria
1. Malabsorption S.
2. Primary hyperoxaluria

* Noncalcium stones are excluded: uric acid, struvite (magnesium ammonium phosphate), and cystine stones.

References
1. Kirks DR: John Caffey Award: Lithiasis due to interruption of the enterohepatic circulation of bile salts. AJR 1979;133:383–388

Gamut H-26-S

DENSE VERSUS LUCENT CALCULI ON RADIOGRAPHY

RADIODENSE CALCULI

COMMON
1. Calcium oxalate

UNCOMMON
1. Calcium phosphate
2. Cystine (slightly radiopaque)
3. Struvite plus calcium phosphate
RADIOLUCENT CALCULI

COMMON
1. Uric acid (urates of ammonium, magnesium, potassium, or sodium)

UNCOMMON
1. Indinavir crystals
2. Matrix (mucoproteinaceous material)
3. Struvite (magnesium ammonium phosphate)
4. Xanthine

References

NEPHROCALCINOSIS (CORTICAL AND MEDULLARY)

CORTICAL

COMMON
1. Chronic glomerulonephritis
2. Renal cortical necrosis (eg, shock; abruptio placenta; hypotension; dehydration)

UNCOMMON
*1. AIDS-associated infection (eg, Mycobacterium avium intracellulare; Pneumocystis carinii; cytomegalovirus)
2. Alport S. (hereditary nephritis)
3. Chronic hypercalcemia; paraneoplastic hypercalcemia
4. Drug therapy (eg, cyclophosphamide)
5. Ethylene glycol (antifreeze) or mercury poisoning
6. Methoxyflurane anesthesia
*7. Oxalosis (primary or secondary hyperoxaluria)
8. Pyridoxine deficiency; xanthine oxidase deficiency
9. Renal transplant rejection
10. Renal vein thrombosis

* May show medullary as well as cortical nephrocalcinosis.

MEDULLARY

COMMON
1. Hyperparathyroidism, primary or secondary
2. Hypercalcemia (eg, widespread bone destruction or metastatic disease {carcinomatosis; myelomatosis}; Cushing S.; steroid therapy; milk-alkali S.; excessive calcium intake or absorption; Paget’s disease; hypervitaminosis D; sarcoidosis)
3. Medullary sponge kidney
4. Osteoporosis (esp. immobilization; postmenopausal; senile)
5. Renal tubular acidosis (deTon-Fanconi S.; cystinuria)

UNCOMMON
*1. AIDS-associated infection (eg, Mycobacterium avium intracellulare; Pneumocystis carinii; cytomegalovirus)
2. Alkaptonuria (ochronosis)
3. Aminoaciduria
4. Bartter S.
5. Blue diaper S. (tryptophan malabsorption)
6. Chondroectodermal dysplasia (Ellis-van Creveld S.)
7. Dialysis therapy
8. Drug therapy (acetazolamide; amphotericin B; adrenocorticotrophic hormone; furosemide; triamterene; sulfonamide)
9. Ehlers-Danlos S.
10. Familial hypercholesterolemia
11. Glycogen storage disease (type I)
12. Hepatic fibrosis-renal cystic disease
13. Hyperthyroidism
14. Hyperuricemia (eg, gout; antimetabolite treatment of leukemia)
15. Hypochloremic acidosis
16. Hypophosphatasia
17. Hypothyroidism, juvenile; cretinism
18. Idiopathic renal hypercalciuria

(continued)
19. McCune-Albright S.
20. Metaphyseal chondrodysplasia (Jansen and Shwachman types)
21. Nail-patella S. (osteo-onychodysplasia)
*22. Oxalosis (hyperoxaluria)
23. Papillary necrosis (See H-20)
24. Pseudohypoparathyroidism
25. Pyelonephritis, chronic
26. Radiation therapy
27. Renal medullary necrosis
*28. Sickle cell disease
29. Sjögren S.
30. Tuberculosis (autonephrectomy)
31. Vesicoureteral reflux
32. Vitamin D-resistant rickets
33. Williams S. (idiopathic hypercalcemia)
34. Wilson’s disease
35. Zollinger-Ellison S.

* May show cortical as well as medullary nephrocalcinosis.

References

Gamut H-28-S

RENAI CORTICAL NECROSIS

Shock or Hypotension related to:
1. Aortic dissection
2. Burn
3. Dehydration
4. Diabetic ketoacidosis
5. Hemolytic-uremic S.
6. Hemorrhage
7. Myocardial failure
8. Obstetrical bleeding complications (eg, abruptio placentae)
9. Pancreatitis
10. Peritonitis
11. Renal transplantation
12. Scarlet fever
13. Sepsis
14. Sickle cell disease
15. Snakebite
16. Thrombotic thrombocytopenic purpura
17. Transfusion reaction
18. Tuberculosis

Reference
CLASSIFICATION OF RENAL CYSTIC DISEASE

Simple renal cyst

Hydatid cyst

Cysts of the renal medulla
1. Medullary cystic disease
2. Medullary sponge kidney

Cysts of the renal sinus
1. Parapelvic cyst

Multicystic dysplastic kidney
1. Hydronephrotic multicystic kidney
2. Pyeloinfundibular atresia

Polycystic kidney disease
1. Adult—autosomal dominant polycystic kidney disease
2. Juvenile—autosomal recessive polycystic kidney disease

Miscellaneous cystic diseases
1. Congenital syndromes including renal cysts (see H-31)
2. Glomerulocystic kidney disease
3. Microcystic disease

Renal cystic disease associated with multiple renal neoplasms
1. Acquired renal cystic disease
2. Tuberous sclerosis
3. von Hippel-Lindau S.

Reference

COMMON
1. Acquired cystic disease (eg, from dialysis)
2. Caliceal diverticulum (pyelogenic cyst)
*3. Congenital syndromes (See H-31)
*4. [Cyst secondary to tuberculosis, pyelonephritis, medullary necrosis, or trauma]
5. Hydronephrosis (focal)
*6. Medullary sponge kidney
*7. Multicystic dysplastic kidney
8. [Neoplasm with cystic degeneration (esp. necrotic renal cell carcinoma)
9. Parapelvic cyst
*10. Polycystic kidney disease (adult type—autosomal dominant)
*11. Simple cortical cyst (solitary or multiple)

UNCOMMON
1. Cortical sponge kidney; congenital cortical cystic disease (trisomy syndromes; tuberous sclerosis; von Hippel-Lindau disease; Zellweger S.)
*2. Cystic dysplasia of cortex (esp. associated with urethral valves or other low obstruction)
3. Dermoid cyst; teratoma
4. Endometrial cyst
*5. Hepatic fibrosis—renal cystic disease
*6. Hydatid cyst
*7. Juvenile nephronopthosis (medullary cystic disease—incl. small fibrotic kidneys with uremia)
8. Multilocular cyst
9. Multilocular cystic renal tumor (cystic nephroma; cystic partially differentiated nephroblastoma)
10. Pericaliceal lymphangiectasis
*11. Polycystic kidney disease, infantile or juvenile type—autosomal recessive (incl. large sponge kidneys with cystic liver)
12. [Urinoma]
* May be multiple.

(continued)
CONGENITAL SYNDROMES ASSOCIATED WITH RENAL CYSTIC DISEASE

COMMON
1. Hepatic fibrosis-renal cystic disease
2. Polycystic kidney disease (adult—autosomal dominant)
3. Polycystic kidney disease (juvenile—autosomal recessive)
4. Potter S.
5. Tuberous sclerosis

UNCOMMON
1. Acrocephalosyndactyly (Apert type)
2. Aplasia cutis congenita
3. Asphyxiating thoracic dysplasia (Jeune S.)
4. Asplenia S. (Ivemark S.)
5. Axial osteomalacia
6. Bardet-Biedl S.
7. Beckwith-Wiedemann S.
8. Brachymesomelia-renal S.
9. Branchio-oto-renal S.
10. Caroli disease
11. Cerebro-costo-mandibular S.
12. Cutis laxa
13. Darier disease
14. DiGeorge sequence
15. Ehlers-Danlos S.
16. Eronen S. (digito-reno-cerebral S.)
17. Femoral hypoplasia-unusual facies S.
18. Fetal alcohol S.
19. Fetal hydantoin S.
20. Fryns S.
21. Glomerulocystic kidney disease
22. Goldston S.
23. Hemihypertrophy
24. Joubert S.
25. Kaufman-McKusick S.
26. Lissencephaly
27. Marden-Walker S.
28. Meckel S.
29. Nail-patella S. (oste-onychodysplasia)
30. Nephronophthisis
31. Noonan S.
32. Oculoauriculovertebral spectrum (Goldenhar S.)
33. Opitz trigonocephaly S. (C syndrome)
34. Orofaciodigital S. I
35. Polysplenia S.
36. Renal-hepatic-pancreatic dysplasia
37. Roberts S. (pseudothalidomide S.)
38. Short-rib polydactyly S. (types I and II)
39. Trisomy 13-15 S. (Patau S.)
40. Trisomy 18 S. (Edwards S.; E syndrome)
41. Trisomy 21 (Down S.)
42. Turner S.
43. von Hippel-Lindau S.
44. Zellweger S. (cerebrohepatorenal S.)

References
MULTILOCALIZED RENAL LESIONS CONTAINING MULTIPLE INTERNAL CYSTIC AREAS

COMMON
1. Cystic or necrotic neoplasm (esp. renal cell carcinoma (hypernephroma))
2. Wilm’s tumor

UNCOMMON
1. Abscess
2. Arteriovenous fistula
3. Hematoma (organizing)
4. Hydatid cyst
5. Localized renal cystic disease
6. Malakoplakia
7. Multicystic dysplastic kidney (segmental)
8. Multilocular cystic nephroma
9. Septated cyst
10. Xanthogranulomatous pyelonephritis (segmental)

References

BILATERAL OR MULTIPLE CYSTIC RENAL MASSES ON CT OR ULTRASOUND (ESPECIALLY IN CHILDREN)

COMMON
1. Acquired cystic disease (from dialysis)
2. Multiple simple cysts
3. Polycystic kidney disease (infantile—autosomal recessive, or esp. adult—autosomal dominant)

UNCOMMON
1. Glomerulocystic disease
2. Hydatid cysts
3. Juvenile nephronophthisis (medullary cystic disease)
4. Multicystic dysplastic kidney (usually unilateral)
5. Multiple abscesses
6. Tuberous sclerosis
7. von Hippel-Lindau S.

References

HIGH DENSITY RENAL CYST(S) ON CT (62–82 HU)

1. Cystic or necrotic neoplasm (eg, renal cell carcinoma)
2. Hemorrhagic cyst
3. Hydatid cyst
4. Multicystic dysplastic kidney
5. Polycystic kidney disease
FOCAL RENAL PARENCHYMAL
SCAR(S)

COMMON
1. Calyceal calculi
2. Infarct (old)
3. Vesicoureteral reflux

UNCOMMON
1. Papillary necrosis
2. Postoperative
3. Pyelonephritis, acute
4. Radiation injury
5. Renal artery branch stenosis or emboli
6. Trauma (including lithotripsy)
7. Tuberculosis

References

DEPRESSION OR SCAR IN RENAL MARGIN (SOLITARY OR MULTIPLE)

COMMOM
1. Arterionephrosclerosis
2. Extrinsic pressure (eg, spleen)
3. Fetal lobulation
4. Infarct
5. Postoperative defect
6. Pyelonephritis (chronic atrophic)
7. Trauma (laceration of kidney)

UNCOMMON
1. Chronic interstitial nephritis
2. Glomerulonephritis
3. Papillary necrosis
4. Radiation therapy
5. Tuberculosis

References

Gamut H-37

RENAL PSEUDOTUMOR (NORMAL STRUCTURE)

COMMON
1. Dromedary hump
2. Duplicated collecting system
3. Fetal lobulation
4. Hypertrophy, localized (regenerated nodule)
5. Lipomatosis of renal pelvis
6. Malrotation
7. Prominent column of Bertin (lobar dysmorphism)
8. Prominent hilar lip; hilum profile
9. Splenic imprint
10. Superimposed abdominal shadow (eg, gallbladder; duodenal bulb; gastric fundus; accessory spleen)
11. Vascular impression

UNCOMMON
1. Aberrant papilla
2. Renunculus

References

Gamut H-38-S

TUMORS OF THE RENAL COLLECTING SYSTEM, PELVIS, AND URETERS

Epithelial Neoplasms
1. Inverted papilloma
2. Papilloma and transitional cell carcinoma
3. Transitional cell carcinoma with squamous, glandular, or mixed differentiation
4. Squamous cell carcinoma (pure or predominantly squamous)
5. Adenocarcinoma (pure or predominantly adenocarcinoma)
6. Carcinosarcoma
7. Small cell (undifferentiated) carcinoma

Mesodermal Neoplasms
1. Smooth Muscle
   a. Leiomyoma
   b. Leiomyoblastoma
   c. Leiomyosarcoma
2. Neural Neoplasms
   a. Neurilemmoma
   b. Neurofibroma
3. Vascular Neoplasms
   a. Hemangioma
   b. Lymphangioma
   c. Hemangiosarcoma
4. Fibrous Tissue
   a. Fibroepithelial polyp
   b. Renal medullary fibroma
5. Mixed Neoplasms
   a. Fibromyxoma
   b. Fibromyxoma
   c. Fibrolipoma
6. Lymphoma; Burkitt lymphoma
7. Other Sarcomas
   a. Spindle cell sarcoma
   b. Osteosarcoma Secondary Neoplasms (Metastases)

(continued)
Secondary Neoplasms (Metastases)
1. Direct invasion from renal medullary tumor (esp. renal cell carcinoma) or adjacent extrinsic neoplasms (eg, gastrointestinal or pancreatic carcinoma or retroperitoneal sarcoma)
2. Seeding (eg, transitional cell carcinoma)
3. Lymphohematogenous spread

UNCOMMON
1. Carcinoid tumor
2. Carcinoma, other (eg, small cell {undifferentiated}; renal medullary; invasive renal pelvic)
3. Lymphoma, Burkitt lymphoma; leukemia
4. Malignant mesenchymal tumors (eg, leiomyosarcoma; liposarcoma; rhabdomyosarcoma; angiosarcoma; osteosarcoma; malignant fibrous histiocytoma and fibrosarcoma; hemangiopericytoma)
5. Metastasis (eg, carcinoma; sarcoma; melanoma)
6. Neoplasm invading from an adjacent organ (eg, gastrointestinal or pancreatic carcinoma; retroperitoneal sarcoma)
7. Plasmacytoma; myeloma

References

Gamut H-40

PEDiAtRIC RENAL MASSES
(BENiGn AND MALGiNANT)

BENiGn
1. Abscess
2. Angiomyolipoma (esp. with tuberous sclerosis)
3. Benign adenomatous neoplasm (eg, embryonal adenoma; nephrogenic adenofibroma)
4. Cyst (simple; hydatid; parapelvic; traumatic)
5. Fibroepithelial polyp of renal pelvis or ureter
6. Hydronephrosis (focal)
7. Mesoblastic nephroma (mesenchymal hamartoma)
8. Multilocular cystic renal tumor
   a. Multilocular cystic nephroma (multilocular renal cyst or cystic adenoma)

COMMON
1. Renal cell carcinoma (hypernephroma)
2. Wilm’s tumor

UNCOMMON
1. Benign mesenchymal tumor (eg, leiomyoma; lipoma; myolipoma; hemangioma; benign hemangiopericytoma; lymphangioma)
2. Juxtaglomerular cell tumor (reninoma)
3. Multilocular cystic renal tumor (multilocular cystic nephroma)
4. Oncocytoma
5. Renomedullary interstitial cell tumor (fibroma)
b. Cystic partially differentiated nephroblastoma (CPDN)

*9. Nephroblastomatosis
   a. Multifocal (juvenile)
   b. Superficial diffuse (late infantile)—high association with Wilms’ tumor
   c. Universal/panlobar (infantile)

10. Ossifying renal tumor of infancy

*11. Polycystic kidney disease

MALIGNANT

1. Clear cell sarcoma
*2. Leukemia; lymphoma; Burkitt lymphoma
*3. Metastasis (eg, neuroblastoma with direct invasion)
4. Renal cell carcinoma
5. Rhabdoid tumor; rhabdomyosarcoma
*6. Wilms’ tumor

* May be multiple.

References

Gamut H-42

NEONATAL RENAL MASS

COMMON
1. Hydronephrosis (esp. UPJ obstruction; duplication of collecting system) (See H-49)
2. Multicystic dysplastic kidney (pelvoinfundibular or hydronephrotic types)

UNCOMMON
1. Mesoblastic nephroma
2. Metastasis (eg, neuroblastoma with direct invasion)
3. Multilocular cystic renal tumor
   a. Multilocular cystic nephroma (multilocular renal cyst or cystic adenoma)
   b. Cystic partially differentiated nephroblastoma (CPDN)
4. Neoplasm, other (eg, teratoma; ossifying renal tumor of infancy)
5. Nephroblastomatosis
   a. Multifocal (juvenile)
   b. Superficial diffuse (late infantile)—high association with Wilms’ tumor
   c. Universal/panlobar (infantile)
6. Polycystic kidney disease
7. Wilms’ tumor

References

Gamut H-41

CONGENITAL SYNDROMES OR ANOMALIES ASSOCIATED WITH WILMS’ TUMOR

1. Aniridia-Wilms’ tumor association
2. Beckwith-Wiedemann S.
3. Drash S. (male pseudohermaphroditism)
4. Hemihypertrophy
5. Horseshoe kidney
7. Perlman S.
8. Trisomy 13 S.
9. Trisomy 18 S.

Reference
SOLID RENAL MASS (US, CT)

COMMON
1. Abscess; carbuncle
2. Angiomyolipoma (hamartoma), esp. in tuberous sclerosis
3. Calculus
4. Cyst (calcified; hemorrhagic; infected; multilocular; hydatid)
5. Hematoma or contusion (intrarenal or subcapsular)
6. Infarct
7. Metastasis (esp. from carcinoma of lung, breast, stomach, colon, cervix, pancreas, contralateral kidney, or choriocarcinoma)
8. Normal parenchyma; pseudotumor (eg, hypertrophic column of Bertin; regenerated nodule; dromedary hump; lobar dysmorphism)
9. Renal cell carcinoma (hypernephroma)
10. Wilms’ tumor

UNCOMMON
1. Arteriovenous malformation; hemangioma (cavernous)
2. Benign neoplasm, other (eg, adenoma; oncocytoma; lipoma; fibroma; mesoblastic nephroma)
3. Calcified renal mass (eg, hydatid cyst; abscess; hematoma)
4. Granuloma (eg, tuberculosis)
5. Leukoplakia; cholesteatoma
6. Lipomatosis of renal sinus
7. Lymphoma, leukemia; Burkitt lymphoma
8. Malakoplakia
9. Polycystic kidney disease (infantile—autosomal recessive)
10. Pyelonephritis, acute focal bacterial (nephronia) (on postcontrast scan)
11. Sarcoma (eg, osteosarcoma)
12. Transitional cell carcinoma
13. Xanthogranulomatous pyelonephritis (focal)

References

CYSTIC RENAL MASS (US, CT)

COMMON
1. Abscess; carbuncle; nephronia
2. Cyst (simple; hydatid; parapelvic)
3. Hydronephrosis (focal)
4. Necrotic neoplasm (esp. cystic renal cell carcinoma)
5. Polycystic kidney disease (adult—autosomal dominant)

UNCOMMON
1. Acquired cystic disease (dialysis)
2. Calyceal diverticulum
3. Cystic hematoma
4. Infection with necrosis (eg, tuberculosis)
5. Multicystic dysplastic kidney
6. Multilocular cystic renal tumor (multilocular cystic nephroma, multilocular renal cyst)
7. Urinoma
8. Vascular anomaly (aneurysm; pseudoaneurysm; arteriovenous fistula)

References
Gamut H-45

**CYSTIC RENAL MASS WITH INTERNAL DEBRIS (US, CT)**

1. Abscess, renal or perinephric (thick wall)
2. Cystic or necrotic neoplasm (eg, renal cell carcinoma {hypernephroma})
3. Hemorrhagic cyst
4. Hydatid cyst
5. Infected cyst
6. Multilocular cystic nephroma (multilocular renal cyst)

**Reference**


Gamut H-46

**CYSTIC RENAL MASS WITH WALL CALCIFICATION**

1. Aneurysm; arteriovenous malformation
2. Hydatid cyst
3. Polycystic kidney disease
4. [Renal artery or its branches]
5. Renal cell carcinoma (hypernephroma), necrotic
6. Simple cortical cyst

**Reference**


Gamut H-47

**RENAL MASS WITH CALCIFICATION**

**COMMON**

1. Calcified stone with hydronephrosis
2. Hemorrhagic cyst; complicated simple cyst
3. Renal cell carcinoma (hypernephroma)

**UNCOMMON**

1. Acquired polycystic kidney disease (from dialysis)
2. Brucellosis
3. Hematoma
4. Hydatid cyst
5. Multilocular cystic kidney, segmental
6. Multilocular cystic nephroma
7. Polycystic kidney disease (adult—autosomal dominant)
8. Sarcoma (eg, leiomyosarcoma; osteosarcoma)
9. Transitional cell carcinoma
10. Tuberculosis
11. Wilms’ tumor
12. Xanthogranulomatous pyelonephritis

**References**


H. Genitourinary Tract, Retroperitoneum, Pelvis, GYN Ultrasound 779
Gamut H-48

RENAL MASS WITH FAT ON CT

COMMON
1. Angiomyolipoma (eg, with tuberous sclerosis)

UNCOMMON
1. Lipoma; liposarcoma
2. Renal cell carcinoma (entrapping perinephric or sinus fat, or intratumoral metaplasia)
3. Teratoma
4. Wilms’ tumor
5. Xanthogranulomatous pyelonephritis

Reference

Gamut H-49

HYDRONEPHROSIS

COMMON
1. Neurogenic bladder (See H-98)
2. Pregnancy
3. Ureteral or ureteropelvic obstruction (eg, calculus; stricture; neoplasm (esp. transitional cell carcinoma)) (See H-93)
4. Ureterectasis (See H-91)
5. Urethral or bladder outlet obstruction (eg, urethral valves; stricture) (See H-110, 111)
6. Urinary tract infection with stricture (incl. tuberculosis; schistosomiasis haematobium)
7. Vesicoureteral reflux (See H-92)

UNCOMMON
1. Bardet-Biedl S.
2. Bartter S.
3. Beckwith-Wiedeman S.

4. Bladder distention (See H-96)
5. Constipation; fecal impaction; colon distention
6. Diuresis
7. Extrarenal pelvis
8. Megaureter (congenital)
9. Papillary necrosis (obstruction by sloughed papilla)
10. Prune-belly S. (Eagle-Barrett S.)
11. Pyonephrosis (debris or fluid-fluid level in collecting system)
12. Urinary flow increase, overhydration (eg, diabetes insipidus; beer-drinker kidneys)

References

Gamut H-50

RENAL HEMORRHAGE

COMMON
1. Anticoagulant therapy
2. Biopsy and other invasive procedure
3. Bleeding disorder (eg, hemophilia)
4. Coagulopathy
5. Neoplasm (eg, angiomyolipoma; hemangioma; renal cell carcinoma; other primary malignancy; metastasis)
6. Trauma

UNCOMMON
1. Aneurysm
2. Arteritis (eg, polyarteritis nodosa; drug abuse; Wegener’s granulomatosis)
3. Arteriovenous malformation
4. Glomerulonephritis
5. Hydronephrosis, severe
6. Postoperative
7. Pyelonephritis, severe

Reference

Gamut H-51

RENNAL PARENCHYMAL GAS

1. Abscess
2. Acute pyelonephritis
3. Empysematous pyelonephritis
4. Infected or ruptured cyst (eg, hydatid)
5. Nephrointestinal fistula (See H-52)
6. Post-instrumentation

Reference

Gamut H-52

NEPHROINTESTINAL FISTULA

1. Chronic renal infection
2. Carcinoma or other malignancy of colon or duodenum
3. Foreign body
4. Peptic ulcer disease (perforating from duodenum)
5. Renal calculus (perforating)
6. Trauma

Reference

Gamut H-53

DARK KIDNEY ON T2-WEIGHTED MRI

COMMON
1. Hemolytic anemia
2. Multiple blood transfusions

UNCOMMON
1. Hemochromatosis
2. Nephrocalcinosis
3. Paroxysmal nocturnal hemoglobinuria

Reference

Gamut H-54

LESIONS INVOLVING THE PERIRENAL SPACE (See G-243)

COMMON
1. Hemorrhage (See H-55-3)
2. Neoplasm, metastatic or invasive (eg, carcinoma of kidney or colon)
3. Neoplasm, primary renal (eg, hypernephroma; Wilms’ tumor; lymphoma)
4. Pancreatitis
5. Perinephric abscess originating from infection in kidney, colon, duodenum, or retrocecal appendix (See H-55-2)
6. Urinoma (traumatic or postoperative)

UNCOMMON
1. Lipomatosis
2. Lymphocele (traumatic; postoperative; lymphangioma; obstruction to thoracic duct)
3. Lymphoma of retroperitoneum

(continued)
4. Retroperitoneal fibrosis (See H-128)
5. Spindle cell neoplasm of retroperitoneum (esp. sarcoma)
6. Suprarenal lesion (eg, adrenal cyst, adenoma, or carcinoma; neuroblastoma; pheochromocytoma)

References

Gamut H-55-1

PERIRENAL FLUID COLLECTION

COMMON
1. Cyst
2. Loculated ascites

UNCOMMON
1. Abscess (See H-55-2)
2. Adrenal cyst
3. Hemorrhage or hematoma (See H-55-3)
4. Hepatic cyst
5. Lymphocele (common after renal transplant)
6. Pancreatic pseudocyst
7. Urinoma (common after renal transplant)

References

Gamut H-55-2

PERINEPHRIC ABSCESS

1. Extraurinary infection with direct or hematogenous spread
   a. Deep infection (eg, osteomyelitis; pharyngitis; tonsillitis; perforated ulcer; diverticulitis; pancreatitis)
   b. Superficial infection (eg, furuncle; carbuncle; wound infection)
2. Gas abscess
3. Iatrogenic (eg, removal of ureteral calculus; ureteral catheterization)
4. Obstructive uropathy
5. Trauma to kidney or ureter
6. Tuberculosis; fungus infection
7. Urinary tract infection (esp. in diabetic)
8. Urinoma or hematoma (infected)

Reference

Gamut H-55-3

PERINEPHRIC HEMORRHAGE OR HEMATOMA

COMMON
1. Aneurysm, aortic, renal artery, or other (incl. atherosclerotic; mycotic; dissecting)
2. Iatrogenic (eg, needle biopsy; catheter; surgery)
3. Neoplasm, adrenal or renal (eg, carcinoma; angioma; angiomyolipoma)
4. Thromboembolism of inferior vena cava or renal vein
5. Trauma, external
UNCOMMON
1. Arterial disease (fibromuscular disease; polyarteritis nodosa)
2. Arteriovenous fistula (congenital or traumatic)
3. Bleeding disorder (incl. anticoagulant therapy)
4. Calculus, perforated
5. Hypertension
6. Idiopathic
7. Infarction of kidney
8. Infection (eg, abscess; tuberculosis)
9. Rupture of kidney (eg, spontaneous; infarct; hydronephrosis; cyst)
10. Sickle cell disease
11. Stress (adrenal bleeding)

References

Gamut H-57

PERIPHERAL RIM ENHANCEMENT (ANGIO, IVP)

COMMON
1. Abscess
2. Neoplasm (eg, necrotic or cystic, esp. at periphery of cortex)
3. Severe hydronephrosis

UNCOMMON
1. Acute renal artery occlusion
2. Acute renal vein thrombosis

Reference

Gamut H-56

PERIPELVIC EXTRAVASATION (SINUS LEAKAGE) (See H-95)

COMMON
1. Abdominal compression (binder)
2. Iatrogenic (instrumentation; retrograde pyelography; accidental ureteral ligation; postoperative)
3. Trauma
4. Ureteral calculus

UNCOMMON
1. [Communicating renal cyst or hydatid]
2. Hydronephrosis (eg, ureteral tumor or stricture)
3. Neoplasm of renal pelvis (esp. with rupture or hemorrhage)
4. Parturition
5. Polycystic kidney

References
RENAL ANGIOGRAPHY: RENAL ISCHEMIA

**COMMON**
1. Arteriolar nephrosclerosis
2. Atherosclerosis
3. Chronic pyelonephritis
4. Thromboembolism, spasm, or stenosis of renal artery
5. Trauma (eg, fractured kidney; avulsion of renal artery)

**UNCOMMON**
1. Arteritis (eg, polyarteritis nodosa; Takayasu S.)
2. Arteriovenous communication
   a. Congenital
   b. Iatrogenic (eg, stump fistula following partial nephrectomy; needle biopsy)
   c. Renal carcinoma eroding renal vein
   d. Ruptured aneurysm
   e. Traumatic
3. Extrinsic pressure on the renal artery (eg, neoplasm; cyst; aortic aneurysm; lymphadenopathy; fibrous band)
4. Fibromuscular hyperplasia (intimal, medial, sub-adventitial)
5. [Lipomatosis of renal sinus]
6. Renal artery aneurysm
7. Renal compression (eg, perirenal or subcapsular hematoma; splenomegaly)
8. Thrombosis of renal vein (See H-63)

**References**

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RENAL ANGIOGRAPHY: UNILATERAL RENAL LESION THAT MAY CAUSE HYPERTENSION (NARROWING OR OTHER LESION OF RENAL ARTERY OR ITS BRANCHES)

1. [Acute glomerulonephritis (bilateral)]
2. Aneurysm (See H-60)
3. [Arteriolar nephrosclerosis (bilateral)]
4. Arteriovenous malformation
5. Arteritis (eg, Takayasu S.; thromboangiitis obliterans; congenital rubella S.; syphilis; idiopathic)
6. Atherosclerosis
7. [Collagen vascular disease (eg, polyarteritis nodosa; scleroderma; lupus erythematosus) (bilateral)]
8. Congenital narrowing
9. Dissection
10. Drug abuse
11. Extrinsic pressure from adjacent mass
12. Fibromuscular hyperplasia
13. Neurofibromatosis
14. Perivascular fibrosis
15. Radiation injury
16. Thrombosis or embolism
17. Transplant rejection
18. Trauma

**References**
RENAL ANGIOGRAPHY:
UNILATERAL RENAL LESION
THAT MAY CAUSE HYPERTENSION
(RENAL PARENCHYMAL DISEASE
AND OTHER CAUSES)

RENAL PARENCHYMAL DISEASE
1. Neoplasm, malignant (eg, carcinoma; sarcoma; Wilms’ tumor; metastasis)
2. Obstructive uropathy
3. Ptosis of kidney
4. Pyelonephritis
5. Radiation nephritis

RENAL VEIN THROMBOEMBOLISM

RENAL COMPRESSION (PAGE KIDNEY)
1. Extrarenal mass (eg, aortic aneurysm; retroperitoneal hematoma or neoplasm; peripelvic cyst)
2. Subcapsular hemorrhage

References

Gamut H-60

RENAL ANGIOGRAPHY:
RENAL ARTERY ANEURYSMS
OR MICROANEURYSMS

COMMON
1. Atherosclerosis
2. Iatrogenic (eg, post-needle biopsy; postsurgical)
3. Polyarteritis nodosa

UNCOMMON
1. Angiomyolipoma (esp. with tuberous sclerosis)
2. Arteriolar nephrosclerosis, malignant
3. Atrial myxoma (metastatic)
4. Arteriovenous communication (congenital; acquired)
5. Bacterial endocarditis
6. Collagen disease, other (eg, lupus erythematosus)
7. Dissecting aneurysm
8. Drug abuse angitis
9. Fibromuscular hyperplasia
10. Homocystinuria
11. Myotic aneurysm
12. Neurofibromatosis
13. Renal cell carcinoma (hypernephroma)
14. Renal transplant rejection
15. Rheumatic or rheumatoid arteritis
16. Takayasu’s arteritis
17. Thrombocytopenic purpura
18. Traumatic aneurysm
19. Wegener’s granulomatosis; hypersensitivity angitis

* May be solitary.

References

(continued)

Gamut H-61

RENAL ANGIOGRAPHY:
AVASCULAR RENAL MASS

COMMON
1. Abscess
2. [Arterial occlusion; infarction]
3. Cyst (eg, simple; hydatid) (See H-30)
4. Hematoma
5. Polycystic kidney disease

UNCOMMON
1. [Dilated calyx]
2. Lymphoma
3. Metastasis
4. Multilocular cystic nephroma (multilocular renal cyst)
5. Neoplasm, benign (eg, adenoma; spindle cell tumor; lipoma)
6. Neoplasm, malignant, necrotic (eg, renal cell carcinoma; Wilms’ tumor)
7. Xanthogranulomatous pyelonephritis

Gamut H-62

RENAL ANGIOGRAPHY:
EARLY VENOUS OPACIFICATION
(LESS THAN 5 SEC)

COMMON
1. Arteriovenous communication, congenital or acquired (eg, traumatic; needle biopsy; postoperative)
2. Renal neoplasm (eg, hemangioma; angiomyolipoma; renal cell carcinoma)
3. [Arterial occlusion; infarction]
4. Cyst (eg, simple; hydatid) (See H-30)

Gamut H-63

RENAL ANGIOGRAPHY:
RENAL VEIN THROMBOSIS

COMMON
1. Dehydration; diarrhea (in a child)
2. Idiopathic (primary)
3. Neoplasm with renal vein invasion or obstruction (esp. renal cell carcinoma; sarcoma, esp. of inferior vena cava)
4. Thromboembolism of inferior vena cava with retrograde extension

UNCOMMON
1. Amyloidosis; multiple myeloma
2. Ascending phlebitis
3. Clotting disorder; polycythemia vera; sickle cell disease
4. Congenital heart disease
5. Diabetic glomerulosclerosis
6. Glomerulonephritis (membranous or proliferative)
7. Nephrotic S.
8. Postoperative
9. Postpartum
10. Pyelonephritis
11. Renal hypertension
12. Trauma

Reference
References

Gamut H-64
SONOGRAPHY: ECHO-FREE (ANECHOIC) RENAL MASS

COMMON
1. Abscess, renal or perirenal
2. Cyst (eg, simple; hydatid; parapelvic) (See H-30)
3. Hydronephrosis, focal (See H-49)
4. Neoplasm (esp. lymphoma; necrotic renal cell carcinoma; cyst with small mural tumor)
5. Polycystic kidney disease (autosomal dominant—adult)

UNCOMMON
1. Aneurysm (noncalcified) of renal artery
2. Arteriovenous malformation
3. Calyceal diverticulum
4. Caliectasis (esp. duplication with ectopic ureterocele)
5. Fluid collection, renal or perirenal (eg, hemorrhage; seroma; urinoma; lymphocele)
6. Medullary cystic disease
7. Multicystic dysplastic kidney
8. Pyonephrosis
9. Tuberculous cavity

References
2. Brondum V, Fiirgaard B: Renal artery aneurysm detected by pulsed Doppler ultrasound. Röntgen-Blatter 1990;43:510–511

Gamut H-65
SONOGRAPHY: HYPOECHOIC RENAL MASS

COMMON
1. Abscess with debris
2. Cyst with debris (eg, simple; hydatid; parapelvic; hemorrhagic)
3. Pyelonephritis, acute
4. Renal cell carcinoma (hypernephroma)

UNCOMMON
1. Calyceal diverticulum with debris
2. Duplication of collecting system (obstructed with debris)
3. Hematoma
4. Infarction (focal)
5. Localized hydronephrosis with debris
6. Lymphoma; leukemia
7. Metastasis
8. Oncocytoma

(continued)
9. Transitional cell carcinoma
10. Xanthogranulomatous pyelonephritis

References

Gamut H-66
SONOGRAPHY: ISOECHOIC RENAL MASS
1. Hypertrophied column of Bertin
2. Lymphoma
3. Pyelonephritis (focal)
4. Renal cell carcinoma (hypernephroma)
5. Renal pseudotumor (eg, dromedary hump; focal compensatory hypertrophy)
6. Transitional cell carcinoma

Gamut H-67
SONOGRAPHY: HYPERECHOIC RENAL MASS

COMMON
1. Angiomyolipoma (incl. tuberous sclerosis)
2. Nephrocalcinosis (focal)
3. Renal cell carcinoma (hypernephroma)
4. Renal sinus lipomatosis or duplication

UNCOMMON
1. Abscess with microbubble gas formation
2. Benign renal neoplasm (eg, cavernous hemangioma; oncocytoma; hamartoma; lipoma; juxtaglomerular cell tumor)

3. Calcified or complicated renal cyst (esp. hydatid)
4. Calcified or thrombosed renal artery aneurysm
5. Focal renal dysplasia
6. Hematoma; hemorrhage; hemorrhagic pyelonephritis
7. Hypertrophied column of Bertin (viewed en face)
8. Infarct with focal scar
9. Malakoplakia
10. Multilocular cystic nephroma
11. Sarcoma (eg, angiosarcoma; liposarcoma; undifferentiated sarcoma)
12. Tuberculosis (early)
13. Wilms’ tumor

References

Gamut H-68-1
SONOGRAPHY: MULTILOCULAR OR COMPLEX RENAL MASS

NEOPLASM
1. Angiomyolipoma (esp. with tuberous sclerosis)
2. Cystic Wilms’ tumor
3. Mesoblastic nephroma
4. Metastasis
5. Multilocular cystic nephroma (multilocular renal cyst)
6. Necrotic tumor with debris
7. Renal cell carcinoma (hypernephroma) (incl. von Hippel-Lindau S.)
RENAL CYSTIC DISEASE
1. Cyst containing debris (eg, infected cyst; ruptured hydatid cyst) or clot (hemorrhagic cyst)
2. Multicystic dysplastic kidney (segmental)
3. Polycystic kidney
4. Segmental cystic disease
5. “Septated” cyst

INFLAMMATION/INFECTION
1. Abscess with debris
2. Fungus ball (renal candidasis)
3. Hydatid cyst
4. Pyonephrosis (infected hydronephrosis)
5. Malakoplakia of renal parenchyma
6. Tuberculosis (late)
7. Xanthogranulomatous pyelonephritis (segmental)

MISCELLANEOUS
1. Arteriovenous malformation
2. Hemorrhage
3. Hemorrhagic infarct (as in renal vein thrombosis)
4. Posttraumatic (organizing hematoma)

References

SONOGRAPHY:
ILL-DEFINED RENAL PARENCHYMAL MASS

COMMON
1. Acute pyelonephritis
2. Normal variant (eg, hypertrophied column of Bertin; focal compensatory hypertrophy)
3. Renal cell carcinoma (hypernephroma)

UNCOMMON
1. Contusion; hematoma
2. Oncocytoma
3. Lymphoma; leukemia
4. Metastasis
5. Renal vein thrombosis
6. Transitional cell carcinoma
7. Tuberculosis (early)

Reference

SONOGRAPHY:
MASS IN RENAL COLLECTING SYSTEM OR PELVIS WITH ACOUSTICAL SHADOWING

COMMON
1. Calculus (uric acid or calcium)
2. Renal artery calcification (eg, aneurysm, atherosclerosis)
3. Renal gas or air

(continued)
UNCOMMON
1. Calcification in cyst wall (esp. hydatid)
2. Transitional cell carcinoma with calcification

References

Gamut H-70
SONOGRAPHY:
DECREASED RENAL CORTICAL ECHOGENICITY

COMMON
1. Acute glomerulonephritis
2. Acute pyelonephritis
3. Renal vein thrombosis
4. Transplant rejection

UNCOMMON
1. Multicentric renal cell carcinoma
2. Lupus nephritis
3. Lymphoma
4. Xanthogranulomatous pyelonephritis

References

Gamut H-71
SONOGRAPHY:
HYPERECHOIC RENAL CORTEX (WITH NORMAL MEDULLA)

COMMON
1. Acute interstitial nephritis
2. Acute pyelonephritis (hemorrhagic)
3. Acute tubular necrosis
4. AIDS nephropathy
5. Diabetic nephropathy
6. Glomerulonephritis (acute or chronic)
7. Nephrosclerosis
8. Renal vein thrombosis
9. Transplant rejection

UNCOMMON
1. Acute cortical necrosis
2. Alport S. (hereditary nephritis)
3. Amyloidosis
4. Beckwith-Wiedemann S.
5. Hypercalcemia (eg, Williams S.)
6. Leukemia
7. Lupus nephritis; scleroderma
8. Myoglobinuria
9. Nephrocalcinosis (cortical)
10. Oxalosis
11. Papillary necrosis (eg, sickle cell disease; phenacetin abuse)
12. Pre-eclampsia

References
SONOGRAPHY: HYPERECHOIC RENAL MEDULLA

COMMON
1. Dehydration
2. Medullary sponge kidney
3. Nephrocalcinosis (medullary)
4. Renal pyramidal fibrosis
5. Sepsis

UNCOMMON
1. Aldosteronism (primary)
2. Glycogen storage disease (type 1)
3. Gout
4. Hypokalemia
5. Lesch-Nyhan S.
6. Pseudo-Bartter S.
7. Pyelonephritis
8. Renal candidiasis
9. Renal tubular necrosis
10. Sjögren S.
11. Tamm-Horsfall proteinuria
12. Williams S. (idiopathic hypercalcemia)
13. Wilson’s disease

References

SONOGRAPHY: HYPERECHOIC RENAL PARENCHYMA (CORTEX AND MEDULLA)

COMMON
1. Chronic glomerulonephritis
2. Chronic pyelonephritis
3. Chronic renal failure

UNCOMMON
1. Acquired cystic disease (eg, from dialysis)
2. AIDS nephropathy
3. Infarction (healing)
4. Medullary cystic disease
5. Nephronia (focal bacterial pyelonephritis)
6. Nephrotic S.
7. Polycystic renal disease (infantile type—autosomal recessive, or adult type—autosomal dominant)
8. Renal tubular ectasia

References
SONOGRAPHY: RENAL COLLECTING SYSTEM ECHOES

COMMON
1. Blood clot
2. Calculus
3. Emphysematous pyelonephritis
4. Nephrostomy tube or stent
5. Pyonephrosis

UNCOMMON
1. Fungus ball (renal candidasis)
2. Sloughed papilla (papillary necrosis)
3. Transitional cell carcinoma

References

DOPPLER SONOGRAPHY: DECREASED RENAL ARTERY DIASTOLIC FLOW (Increased Resistance Index > 0.70)

1. Compression of kidney from perinephric abscess or hematoma (Page kidney; lymphocele)
2. Edema of kidney (severe pyelonephritis or trauma)
3. Hemolytic-uremic S.
4. Hepatorenal S.
5. Medical renal disease (eg, acute tubular necrosis—flow may be reversed; diabetes mellitus; vasculitis)
6. Obstructive uropathy (eg, ureteral obstruction)
7. Renal transplant rejection
8. Renal vein thrombosis or occlusion (flow may be reversed)

Reference

DOPPLER SONOGRAPHY: INCREASED RENAL ARTERIAL RESISTANCE INDEX (> 0.70)

1. Arteriovenous fistula
2. Inflammation (eg, acute pyelonephritis; renal abscess)
3. Renal malignancy (esp. renal cell carcinoma)

Reference

DOPPLER SONOGRAPHY: INCREASED RENAL ARTERY DIASTOLIC FLOW (Low Resistive Index)

1. Arteriovenous fistula
2. Inflammation (eg, acute pyelonephritis; renal abscess)
3. Renal malignancy (esp. renal cell carcinoma)

Reference
UNCOMMON
1. Hydronephrosis (high grade obstruction)
2. Page kidney (eg, renal compression by perirenal collection {urinoma; hematoma; lymphocele; abscess})
3. [Renal compression by transducer]
4. Renal vein thrombosis

References

SONOGRAPHY: ENLARGEMENT OF RENAL TRANSPLANT

1. Hypertrophy of transplanted kidney
2. Rejection of transplanted kidney (acute)
3. Renal infection
4. Renal vein thrombosis
5. Ureteral obstruction

Reference

SONOGRAPHY: DIMINISHED SIZE OF RENAL TRANSPLANT

1. Chronic rejection
2. Renal ischemia

Reference

DIMINISHED FUNCTION OF TRANSPLANTED KIDNEY

COMMON
1. Chronic rejection
2. Cyclosporine toxicity

UNCOMMON
1. Acute or hyperacute rejection
2. Renal arterial insufficiency
3. Renal vein thrombosis
4. Ureteral obstruction

Reference
COMPLICATIONS OF RENAL TRANSPLANTATION

CARDIOPULMONARY
1. Mediastinal widening due to steroid-induced fat deposition
2. Metastatic pulmonary calcinosis
3. Opportunistic infection
4. Pleural effusion
5. Pulmonary edema or hemorrhage

GASTROINTESTINAL
1. Appendicitis
2. Cholecystitis
3. Esophagitis
4. Fecal impaction
5. Hemorrhage
6. Hepatitis
7. Ileus (nonobstructive)
8. Infarction
9. Inflammation (diffuse)
10. Pancreatitis
11. Perforation
12. Peritonitis
13. Pneumatosis intestinalis
14. Ulceration

BONE AND SOFT TISSUE
1. Hyperparathyroidism, secondary
2. Osteomalacia
3. Osteomyelitis
4. Osteonecrosis
5. Osteoporosis
6. Periostitis
7. Slipped epiphysis
8. Soft tissue calcifications
9. Tendon rupture
10. Vascular calcification

UROLOGIC
1. Acute tubular necrosis
2. Bladder neck contraction
3. Calculus formation
4. Extraaurinary fluid collections
   a. Abscess
   b. Hematoma
   c. Lymphocele (most common)
   d. Urinoma
5. Fistula
6. Malignant neoplasm
7. Obstruction
8. Papillary necrosis
9. Rejection
10. Vascular (arterial or venous obstruction; hemorrhage; arteriovenous fistula)
11. Vesicoureteral reflux

Reference

MEDIAL DEVIATION OF THE UPPER URETER

COMMON
1. Horseshoe kidney; crossed renal ectopia
2. Normal (eg, prominent psoas muscle)
3. Postoperative (eg, renal or ureteral surgery)

UNCOMMON
1. Hydronephrosis
2. Lymph node enlargement (eg, lymphoma; metastasis)
3. Neoplasm, extrinsic, benign or malignant (eg, renal; adrenal; colonic; retroperitoneal)
4. Ptosis of kidney; displacement (eg, large liver or spleen)
5. Renal cyst (eg, parapelvic or lower pole)
6. Retrocaval ureter
7. Retroperitoneal fibrosis, lipomatosis, or hemorrhage
8. Tortuous aorta
9. Urinoma; lymphocele

References

Gamut H-83

LATERAL DEVIATION
OF THE UPPER URETER

COMMON
1. Aneurysm (esp. aortic) (See H-127)
2. Fat deposition (retroperitoneal)
3. Hemorrhage or hematoma in retroperitoneum (traumatic or bleeding disorder)
4. Horseshoe kidney; crossed renal ectopia
5. Lymph node enlargement, para-aortic (eg, lymphoma; sarcoïdosis; metastasis)
6. Neoplasm, extrinsic, benign or malignant (eg, renal; adrenal; colonic; retroperitoneal)
7. Normal (eg, prominent psoas muscle)
8. Postoperative (eg, ureteroileal diversion; renal transplantation)
9. Psoas abscess
10. Ptsis or displacement of kidney (eg, enlarged liver or spleen)
11. Spinal lesion (eg, tuberculosis; metastasis)
12. Urinoma; lymphocele

UNCOMMON
1. Duplication of kidney with dilated ectopic ureterocele

Gamut H-84

DISPLACEMENT OF THE PEYVIC URETER

COMMON
1. Abscess, pelvic (eg, appendiceal; retroperitoneal; tubovarian; pericolic)
2. Bone lesion of spine, sacrum, or pelvis
3. Diverticulitis of colon
4. Diverticulum of bladder (esp. Hutch type)
5. Hematoma, traumatic or other
6. Lymph node enlargement (eg, lymphoma; metastasis)
7. Neoplasm, extrinsic or malignant (eg, carcinoma of uterus, adnexa, bladder, rectum, prostate; retroperitoneal sarcoma or lymphoma)
8. Postoperative (eg, abdominoperineal resection; renal transplantation; ureteral reimplantation)

UNCOMMON
1. Aneurysm, iliac artery or other (See H-127)
2. Ectopic kidney
3. Endometriosis
4. Hernia (eg, obturator; sciatic; inguinal; femoral)
5. Pelvic lipomatosis
6. Radiation fibrosis

(continued)
7. Retroperitoneal fibrosis
8. Venous anomaly (eg, ovarian vein S.)

References

Gamut H-85

URETERAL AND RENAL PELVIC CALCIFICATION

COMMON
1. Calculus (See H-24)

UNCOMMON
*1. Amyloidosis
*2. [Argyrosis (etched ureter)]
*3. Brucellosis
4. [Foreign body]
5. Milk of calcium ureter
*6. Neoplasm, benign (eg, hemangioma; papilloma; lipoma)
*7. Neoplasm, malignant (eg, primary transitional cell carcinoma; metastatic or invasive from ovarian cystadenocarcinoma or colloid colon carcinoma)
8. Papillary necrosis (sloughed calcified renal papilla)
*9. Postoperative (eg, osteocartilaginous metaplasia after ureterotomy)
*10. Radiation effect
*11. Schistosomiasis haematobium
*12. Tuberculosis

* Mural calcification. Others are intraluminal.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut H-86

URETERAL INTRALUMINAL FILLING DEFECT(S) (See also H-87)

COMMON
1. Air bubble from catheter
2. Blood clot; hemorrhage; inspissated pus; necrotic debris
3. Calculus
4. [Malacoplakia]
5. Neoplasm (eg, papilloma; polyp; transitional cell carcinoma, primary or seeding from kidney)
6. [Technical (incomplete filling with contrast medium; artifact)]

UNCOMMON
1. Eosinophilic ureteritis
2. Fungus ball
3. Leukoplakia (squamous metaplasia; cholesteatoma)
4. Sloughed papilla from papillary necrosis
5. Ureteritis cystica

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
Gamut H-87

URETERAL MURAL FILLING DEFECT(S) (See also H-86)

COMMON
1. Neoplasm, benign (eg, papilloma; polyp; spindle cell tumor; lipoma; hamartoma; hemangioma)
2. Neoplasm, malignant (esp. transitional cell carcinoma, primary or seeding from kidney)
3. [Peristaltic wave; transverse folds (kinks)]
4. Ureteritis cystica

UNCOMMON
1. Endometriosis
2. Eosinophilic ureteritis
3. Granuloma or stricture (eg, tuberculosis; schistosomiasis haematobium)
4. Hematoma
5. [Leukoplakia (squamous metaplasia; cholesteatoma)]
6. Malakoplakia
7. Metastasis (eg, ureteral; lymph node)
8. [Neoplasm, extrinsic, compression or invasion (eg, retroperitoneal lymphoma, sarcoma; carcinoma of cervix; ovarian cyst; uterine fibroid)]
9. Postoperative
10. Renal vein thrombosis; varicosities
11. Striations (from reflux or relieved obstruction)

Reference

Gamut H-88

URETERAL TUMORS

COMMON
1. Direct invasion by extrinsic malignancy (eg, carcinoma of colon, cervix, bladder, or prostate)
2. Transitional cell carcinoma

UNCOMMON
1. Carcinoma, other (adenocarcinoma; squamous cell carcinoma)
2. Fibroepithelial polyp
3. Lymphoma
4. Mesenchymal tumors
5. Metastasis
6. Papilloma; inverted papilloma

Reference

Gamut H-89

MULTIPLE URETERAL FILLING DEFECTS

COMMON
1. Air bubbles
2. Blood clots
3. Multiple calculi
4. [Ureteral peristalsis; kinks]
5. Vascular indentations (eg, arterial or venous collaterals; varicosities) (See H-90)

UNCOMMON
1. Endometriosis
2. Eosinophilic ureteritis
3. Granulomas or strictures (eg, tuberculosis; schistosomiasis haematobium)

(continued)
4. Hemorrhage, submucosal (esp. anticoagulant therapy)
5. Leukoplakia (squamous metaplasia; cholesteatoma)
6. Malacoplakia
7. Neoplasms, multiple (eg, papillomatosis; polyps; seeding from transitional cell carcinoma of kidney)
8. Striations (from reflux or relieved obstruction)
9. Ureteritis cystica

References
3. Hughes FA III, Davis CS Jr: Multiple benign ureteral fibrous polyps. AJR 1976;126:723–727

Gamut H-90

VASCULAR INDENTATIONS ON THE URETER OR RENAL PELVIS (NOTCHING)

COMMON
1. Collateral arterial circulation (eg, aortic, renal artery, or iliac artery stenosis or occlusion)
2. Collateral venous circulation (eg, obstruction of inferior or superior vena cava, renal, gonadal, azygos, splenic, or portal vein)
3. Normal accessory renal artery
4. Normal iliac artery

UNCOMMON
1. Aneurysm of aorta or iliac artery (See H-127)
2. Arteriovenous communication of renal or juxtarenal vessels
3. Azygos continuation of inferior vena cava
4. Cirrhotic aneurysm of renal artery
5. Lymphangiectasis; lymphangioma
6. Normal gonadal vein
7. Varices of ureter, gonad, or broad ligament (idiopathic or from portal hypertension)

References

Gamut H-91

DILATATION OF URETER (SEGMENTAL OR DIFFUSE URETERECTASIS)

COMMON
*1. Congenital or idiopathic (fusiform terminal ureterectasis; primary megaureter)
2. Infection
*3. Mid-ureteral “spindle” proximal to iliac artery crossing
4. Neurogenic bladder (See H-98)
*5. Obstruction of ureter, intrinsic or extrinsic, esp. at ureterovesical junction (eg, stone, stricture or stenosis, neoplasm, clot, sloughed papilla, postoperative, radiation, pelvic lipomatosis, endometriosis, bladder prolapse) (See H-93)
6. Obstruction of urethra (eg, valve; stricture; diverticulum) or bladder outlet (eg, prostatic enlargement)
7. Ureteral duplication with obstruction
*8. Ureterocele
9. Vesicoureteral reflux (See H-92)
UNCOMMON
1. Aganglionosis; Chagas’ disease
2. Bartter S.
3. Fluid overload (eg, polydypsia; diabetes insipidus; beer-drinker’s kidneys)
4. Prune-belly S. (Eagle-Barrett S.)

* Segmental ureterectasis (focal ureteral dilatation).

References

References

VESICOURETERAL REFLUX

COMMON
1. Idiopathic
2. Infection (severe cystitis—eg, tuberculosis; schistosomiasis haematobium; chemotherapy-induced; interstitial))
3. Neurogenic bladder (See H-98)
4. Postoperative (prior ureterovesical surgery)

UNCOMMON
1. Anomaly of ureterovesical junction
2. Diverticulum of bladder
3. Duplication of ureters
4. Ectopic ureter emptying into bladder neck or urethra
5. Exstrophy of bladder
6. Iatrogenic; irritative contrast medium
7. Megacolon
8. Megaureter-megacystis S.
9. Nonfunctioning or absent kidney
10. Pelvic mass
11. Postradiation
12. Prune-belly S. (Eagle-Barrett S.)
13. Urethral obstruction (eg, valve or stenosis)

References

OBSTRUCTION OF THE URETER (WITH OR WITHOUT HYDRONEPHROSIS)

COMMON
1. Blood clot; inspissated pus
2. Calculus
3. Congenital ureteropelvic junction obstruction (eg, band; valve; vessel)
4. Cystitis or carcinoma of bladder (obstruction of intramural ureter)
5. Inflammation, edema (eg, pelvic inflammatory disease)
6. Metastasis to ureter or retroperitoneal lymph nodes
7. Neoplasm, extrinsic, compression or invasion (eg, retroperitoneal lymphoma or sarcoma; carcinoma of cervix; ovarian cyst; uterine fibroid)
8. Postoperative (eg, ligature; edema)
9. Pregnancy
10. Stricture (eg, congenital; traumatic; postoperative; postradiation; inflammatory—tuberculosis; schistosomiasis)
11. Ureterocele
12. Vascular compression (eg, normal or abnormal vessel; aneurysm)
Gamut H-94

**URETERAL STRICTURE**

**COMMON**
1. Neoplasm (primary, esp. transitional cell carcinoma; invasive or metastatic)
2. [Pseudostricture (vascular indentation; crossing vessels {eg, ovarian vein}; peristaltic wave)]
3. Schistosomiasis haematobium
4. Tuberculosis

**UNCOMMON**
1. Amyloidosis
2. Congenital
3. Endometriosis
4. Eosinophilic ureteritis
5. Inflammatory bowel disease (eg, Crohn’s disease; amebiasis)
6. Leukoplakia
7. Lymphoma
8. Pelvic inflammatory disease
9. Polymarteritis nodosa
10. Postoperative
11. Postradiation therapy
12. Posttraumatic
13. Pseudodiverticulosis

**Gamut H-95**

**URETERAL EXTRAVASATION OR FISTULA (See H-56)**

**COMMON**
1. Instrumentation (eg, retrograde pyelography)
2. Postoperative (eg, ureteral injury)
3. Trauma

**UNCOMMON**
1. Actinomycosis
2. Calculus in ureter
3. Crohn’s disease
4. Diverticulitis (colonic)
5. Endometriosis
6. Neoplasm, malignant (eg, transitional cell carcinoma of ureter; carcinoma of cervix or intestinal tract)
7. Tuberculosis

**Reference**

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
DISTENDED BLADDER

COMMON
1. Calculus in bladder neck
2. Fluid overload (eg, polydypsia; diabetes mellitus or insipidus)
3. Infrequent voiding
4. Malignant neoplasm with bladder outlet obstruction (carcinoma of bladder neck, urethra, or prostate; metastasis)
5. Neurogenic bladder (eg, cerebral palsy; multiple sclerosis; paralysis) (See H-98)
6. Postoperative
7. Prostatic hypertrophy
8. Urethral obstruction (See H-111–115)

UNCOMMON
1. Bartter S.
2. Drug therapy (eg, ephedrine; levodopa; diuretic)
3. Foreign body obstruction
4. Hydrometrocolpos
5. Idiopathic
6. Intraluminal mass (eg, large clots; calculi; fungus ball)
7. Megacystis-microcolon-intestinal hypoperistalsis S. (Berdon S.)
8. Prune-belly S. (Eagle-Barrett S.)
9. Psychogenic
10. Ureterocele (ectopic)

References

SMALL OR CONTRACTED BLADDER

COMMON
1. Carcinoma of bladder, infiltrating
2. Cystitis, severe (eg, aseptic, eosinophilic, interstitial, or hemorrhagic cystitis)
3. Drug reaction (eg, cyclophosphamide {Cytoxan} cystitis)
4. Hypertrophy from bladder outlet obstruction (eg, chronic urethral obstruction by stricture or prostatic hypertrophy)
5. Neurogenic bladder (See H-98)
6. Pelvic hematoma or hemorrhage
7. Pelvic inflammatory disease
8. Pelvic lipomatosis
9. Postoperative (eg, ileal conduit, bladder diversion; partial resection)
10. Radiation therapy
11. Recent voiding
12. Retropertitoneal fibrosis
13. Total incontinence (eg, postprostatectomy)

UNCOMMON
1. Bladder hernia (eg, inguinal; femoral)
2. [Congenital small bladder]
3. Cystitis glandularis
4. Lymphoma
5. Schistosomiasis haematobium
6. Tuberculosis

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
NEUROGENIC BLADDER

COMMON
1. Cerebral palsy
2. Detrusor areflexia
   a. Cord neoplasm
   b. Disk disease
   c. Neuropathy
   d. Sacral anomaly; caudal regression S. (eg, sacral agenesis or hypoplasia; scoliosis; hemisacrum)
   e. Tethered cord
3. Detrusor hyperreflexia/detrusor-external sphincter dyssynergia
   a. Cord arteriovenous malformation
   b. Cord neoplasm
   c. Cord trauma
   d. Disk disease
   e. Multiple sclerosis
   f. Myelodysplasia
4. Idiopathic uninhibited bladder
5. Neoplasm of spine, spinal cord, or brain
6. Paralytic disorder
7. Parkinson’s disease
8. Spina bifida vera with meningomyelocele
9. Stroke

UNCOMMON
1. Arachnoiditis
2. Block vertebrae
3. Diabetes mellitus
4. Diastematomyelia
5. Neurofibromatosis
6. Neurosyphilis
7. Normal pressure hydrocephalus
8. Syringomyelia
9. Transverse myelitis
10. Tuberculosis of spine (Pott’s disease) or meninges

References

EXTRINSIC PRESSURE DEFORMITY OF THE BLADDER
(Incl. Teardrop or Pear-Shaped Bladder)

COMMON
*1. Abscess (eg, tubo-ovarian; appendiceal; pericolic)
2. Bone lesion of sacrum or pelvis (eg, osteophyte of pubic symphysis; bone sarcoma)
3. Colon distention
4. [Diverticulum of bladder or female urethra]
*5. Hematoma; hemorrhage (traumatic; bleeding disorder)
*6. Lymph node enlargement (eg, metastasis; lymphoma)
7. [Neoplasm of bladder, intrinsic]
*8. Pelvic lipomatosis
9. Pelvic mass (eg, carcinoma of cervix, uterus, or ovary; uterine fibroid; gastrointestinal neoplasm; mesenchymal neoplasm)
10. Pregnancy
11. Prostatic enlargement (hypertrophy; carcinoma)

UNCOMMON
1. Aneurysm of iliac artery (See H-127)
2. Anterior myelomeningocele
3. [Carcinoma in a bladder diverticulum]
4. Cyst (eg, ovarian; hydatid; Müllerian duct cyst; seminal vesicle cyst)
*5. Inferior vena cava obstruction (eg, thromboembolism) with venous collaterals
6. [Inguinal hernia]
*7. Lymphocele; urinoma; extravasated urine or lymph
*8. Normal or prominent soft tissue structure (eg, levator ani muscle; iliopsoas muscle; sacrospinous liga-
9. Postoperative (eg, hip replacement)
*10. Retroperitoneal fibrosis
*11. Retroperitoneal sarcoma
12. Rheumatoid synovial cyst of hip joint
13. Urachal remnant
14. Ureterocele (ectopic)
15. Ureteral neoplasm
16. Vaginal neoplasm
17. Varices

* May be teardrop or pear-shaped bladder. [ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut H-100
FOCAL THICKENING OF THE BLADDER WALL

COMMON
1. Cystitis which may at times be localized (eg, cyclophosphamide {Cytoxan} cystitis; cystitis cystica {glandularis})
2. Indwelling catheter
3. Invasion by adjacent tumor
4. Transitional cell carcinoma
5. Ureterocele
6. Ureterovesicle junction edema (eg, from calculus at UVJ)

UNCOMMON
1. Adjacent abscess

2. Amyloidosis
3. Endometriosis
4. Fistula (eg, colovesical; vaginovesical)
5. Gastrointestinal inflammatory disease (esp. Crohn’s disease; diverticulitis)
6. Hematoma
7. Leukoplakia
8. Malacoplakia
9. Neoplasm of bladder, benign (eg, leiomyoma; pheochromocytoma; neurofibroma; hemangioma; nephrogenic adenoma)
10. Pelvic inflammatory disease
11. Postoperative
12. Schistosomiasis haematobium
13. Tuberculosis

References

Gamut H-101
GENERALIZED BLADDER WALL THICKENING

COMMON
1. Cystitis (eg, bacterial, eosinophilic, hemorrhagic or acute radiation cystitis; cyclophosphamide {Cytoxan} cystitis; cystitis cystica {glandularis})
2. Muscular hypertrophy and trabeculation (eg, chronic bladder outlet obstruction; neurogenic bladder)

UNCOMMON
*1. Amyloidosis
*2. Carcinoma, extensive (transitional cell; squamous cell; adenocarcinoma)
*3. Endometriosis
*4. Lymphoma
5. Schistosomiasis haematobium

(continued)
6. Radiation therapy (late fibrosis)
7. Tuberculosis

* Infiltrative and proliferative diseases of the bladder.

**Reference**

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**Gamut H-102**

**CYSTITIS**

**COMMON**
1. Bacterial (gram negative) cystitis

**UNCOMMON**
1. Cyclophosphamide (Cytoxan) cystitis
2. Cystitis cystica (cystitis glandularis)
3. Emphysematous cystitis
4. Eosinophilic cystitis
5. Interstitial cystitis
6. Malakoplakia
7. Postradiation therapy
8. Schistosomiasis haematobium
9. Tuberculosis

**Reference**

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**Gamut H-104**

**FILLING DEFECT(S) IN THE BLADDER WALL OR LUMEN**

**COMMON**
1. Air bubbles
2. Blood clot
3. Calculus
4. Carcinoma (esp. transitional cell; also squamous cell; adenocarcinoma; carcinosarcoma)
5. Instrument (eg, Foley or other catheter)
6. Polyp (fibrous or inflammatory; papilloma)
7. Prostatic enlargement (hypertrophy of median lobe; carcinoma)
8. Ureterocele, simple or ectopic

**UNCOMMON**
1. Amyloidosis
2. Brunn’s nests
3. Condyloma acuminata

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**Gamut H-103**

**BLADDER TUMORS**

**COMMON**
1. Direct invasion by carcinoma of colon, cervix, vagina, or prostate
2. Transitional cell carcinoma

**UNCOMMON**
1. Carcinoma, other (eg, adenocarcinoma; squamous cell carcinoma; carcinosarcoma; urachal)
2. [Cyst (eg, hydatid)]
3. Fibroepithelial polyp
4. [Hematoma]
5. Lymphoma
6. Metastasis
7. Mesenchymal neoplasm
8. Papilloma
9. Pheochromocytoma
10. Schistosomiasis haematobium (eg, granulomatous polyp, urticarial edema, or complicating carcinoma)

**Reference**
4. Cystitis (eg, bullous; eosinophilic; cystitis cystica (cystitis glandularis))
5. Endometriosis
6. Foreign body
7. Fungus ball (eg, Candida, esp. in diabetic)
8. Hematoma (intramural)
9. Hydatid cyst
10. Infection; granuloma; fistula; abscess (eg, Crohn’s disease; diverticulitis; tuberculosis; lymphogranuloma venereum)
11. Leukoplakia
12. Malakoplakia
13. Metastasis
14. Mural edema or hemorrhage (eg, impacted ureteral calculus; hemorrhagic cystitis)
15. Nephrogenic adenoma
16. Non-epithelial neoplasm (eg, mesenchymal tumor; pheochromocytoma; neurofibroma; sarcoma; lymphoma; mixed mesodermal neoplasm)
17. Postoperative (eg, suture granuloma; ureteral anastomosis)
18. Prolapsing urethral polyp
19. Schistosomiasis haematobium (granuloma; inflammatory polyp; urticarial edema)
20. Squamous metaplasia

References

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CALCIFICATION IN THE BLADDER WALL OR LUMEN (See H-85)

COMMON
1. Calculus (See H-24, 106)

UNCOMMON
1. Alkaptonuria (ochronosis)
2. Amyloidosis
3. Calculus in urachal cyst or in bladder diverticulum
4. Carcinoma, esp. transitional cell (encrusted)
5. Cystinuria
6. Cystitis (alkaline encrusted)
7. Drug reaction (esp. cyclophosphamide {Cytoxan} cystitis; Mitomycin C instillation)
8. [Fetal head]
9. Foreign body or blood clot (encrusted)
10. Hematoma
11. Hyperparathyroidism, primary or secondary
12. Neoplasm, benign (eg, hemangioma)
13. Neoplasm, invasive (esp. ovarian cystadenocarcinoma; rectal colloid carcinoma)
14. Neuroblastoma; pheochromocytoma
15. Oxalosis
16. Prune-belly S. (Eagle-Barrett S.)
17. Radiation reaction
18. Renal tubular acidosis
19. Schistosomiasis haematobium
20. Stevens-Johnson S.
21. Tuberculosis
22. Wilson’s disease

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

(continued)
CAUSES FOR BLADDER STONES

**COMMON**
1. Bladder outlet obstruction
2. Chronic catheterization
3. Chronic infection (incl. *Schistosoma haematobium*)
4. Diverticulum of bladder
5. Neurogenic bladder (See H-98)
6. Urea-splitting microorganisms

**UNCOMMON**
1. Bladder wall sutures
2. Cystinuria
3. Foreign body
4. Hypercalcuria
5. Hyperuricosuria

*Reference*

GAS IN THE BLADDER WALL OR LUMEN

**COMMON**
1. Bladder fistula (See H-108)
2. Emphysematous cystitis (gas-forming organism, esp. in a diabetic)
3. Iatrogenic (eg, air cystogram; instrumentation)
4. Postoperative (eg, ureteral transposition; ileal bladder)
5. Trauma

**UNCOMMON**
1. Abscess (incl. appendiceal, pericolic)
2. Fungus ball in bladder

*References*

BLADDER FISTULA

**COMMON**
1. Congenital anal atresia
2. Crohn’s disease
3. Diverticulitis of colon
4. Iatrogenic (eg, instrumentation)
5. Neoplasm, malignant (eg, carcinoma of colon, bladder, cervix, ovary, genital system)
6. Pelvic inflammatory disease; endometritis
7. Postoperative
8. Postpartum
9. Radiation therapy
10. Trauma

**UNCOMMON**
1. Appendiceal perforation
2. Calculus eroding through bladder wall
3. Foreign body
4. Lymphogranuloma venereum
5. Schistosomiasis
6. Tuberculous enterocolitis
7. Ulcerative colitis

*References*
BLADDER OUTLET OBSTRUCTION

COMMON
1. Bladder neck obstruction (anatomical versus functional)
2. Bladder sphincter dyssynergia
3. Prostatic enlargement (hypertrophy; carcinoma)
4. Urethral obstruction (eg, neoplasm; stricture; valve)

UNCOMMON
1. Acquired bladder neck stricture (postsurgical; post-traumatic)
2. Hydrocolpos; hydrometrocolpos; hematometrocolpos
3. Leiomyoma of cervix or lower uterine segment
4. Miscellaneous (eg, calculus; Brunn’s cyst; epidermolysis bullosa; gelatinous plug; trigonal polyp; prolapsing ectopic ureterocele)
5. Pelvic neoplasm, large (eg, malignant schwannoma; fibrous mesothelioma)
6. Prostatic lesions, other (Wegener’s granulomatosis; lymphomatosis; lymphoma; hemangiopericytoma; rhabdomyosarcoma)
7. Vaginal neoplasm (eg, carcinoma; leiomyoma; fibroma; rhabdomyosarcoma)

References

URINARY TRACT OBSTRUCTION BELOW THE BLADDER IN A CHILD

COMMON
1. Foreign body
2. Meatal stenosis
3. [Neurogenic bladder]
4. Trauma
5. Ureterocele (ectopic)
6. Urethral stricture
7. Urethral valve

UNCOMMON
1. Hydrometrocolpos
2. Neoplasm (esp. urethral)
3. Normal folds
4. Prostatic enlargement (fibroelastosis)
5. Prune-belly S. (Eagle-Barrett S.)
6. Urethral calculus
7. Urethral diverticulum
8. Urethral polyp
9. Urethritis
10. Verumontanum hypertrophy

References

STRicture of anterior urethra

COMMON
1. Iatrogenic (eg, post-instrumentation or catheterization)
2. Postoperative
3. Posttraumatic
4. Urethritis (eg, gonococcal; non-gonococcal; chlamydia)
5. [Urinal defect]

UNCOMMON
1. Amyloidosis
2. Balanitis xerotica obliterans
3. Carcinoma (eg, transitional cell; squamous cell)
4. Congenital
5. Reiter S.; Reiter/reactive arthritis
6. Schistosoma haematobium infection
7. Tuberculosis
8. Wegener’s granulomatosis

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference
Gamut H-113

DILATED POSTERIOR URETHRA

COMMON
1. Neurogenic voiding dysfunction (esp. detrusor/external sphincter dyssynergy)
2. Posterior urethral valve
3. Previous prostatectomy
4. Stricture of anterior urethra (See H-112)

UNCOMMON
1. Prune-belly S. (Eagle-Barrett S.)

Reference

Gamut H-114

URETHRAL TUMORS

BENIGN
1. Adenomatous polyp
2. Condyloma acuminata/penile squamous papilloma
3. Fibroepithelial polyp
4. [Inflammatory polyp]
5. Papillary adenoma
6. Transitional cell papilloma

MALIGNANT

COMMON
1. Squamous cell carcinoma

UNCOMMON
1. Adenocarcinoma
2. Melanoma
3. Metastasis (from carcinoma of bladder or prostate)
4. Sarcoma (eg, rhabdomyosarcoma; fibrosarcoma)
5. Transitional cell carcinoma

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut H-115

URETHRAL FILLING DEFECT(S), INTRINSIC OR EXTRINSIC

COMMON
1. Abscess (periurethral)
2. Carcinoma (esp. squamous cell; also transitional cell carcinoma; adenocarcinoma)
3. Foreign body
4. Hematoma (traumatic; iatrogenic)
5. Postoperative (eg, scar; granulation tissue; blood clot; sinus tract)
6. Stricture (gonorrheal, iatrogenic, or other)
7. Valve, anterior or posterior

UNCOMMON
1. Calculus
2. Condyloma acuminata
3. Diverticulum, congenital or acquired
4. Hemangioma; lymphangioma
5. Melanoma, primary or metastatic
6. Metastasis, implantation or invasion by neoplasm of prostate, testis, or urinary tract
7. Müllerian duct cyst
8. Neoplasm, other (spindle cell; rhabdomyosarcoma)
9. Nephrogenic adenoma
10. Papilloma
11. Polyp (eg, fibroepithelial; adenomatous; inflammatory)

(continued)
12. Ureterocele (ectopic)
13. Urethritis (incl. urethritis cystica)
14. Verumontanum hypertrophy

References

Gamut H-116

URETHRAL OUTPOUCHING

COMMON
1. Diverticulum
2. False passage (eg, iatrogenic or gonorrheal)
3. Fistula, gonorrheal or other
4. Postoperative (esp. prostatectomy; urethroplasty)

UNCOMMON
1. Ambiguous genitalia
2. Cowper’s glands, normal or enlarged
3. Glands of Littré, enlarged
4. Prolapse
5. Utriculus masculinus
6. Valve

Gamut H-117

URETHRAL FISTULA

COMMON
1. Postoperative; post-instrumentation

UNCOMMON
1. Gonorrhea
2. Schistosomiasis haematobium
3. Tuberculosis

Reference

Gamut H-118

UNILATERAL ADRENAL MASS OR ENLARGEMENT

SMALL (LESS THAN 4 CM)
1. Adenoma
2. Ganglioneuroma
3. Hyperplasia
4. Metastasis (esp. lung, breast)
5. Pheochromocytoma

LARGE (GREATER THAN 4 CM)
1. Carcinoma of adrenal cortex
2. Cyst
3. Hemorrhage; hematoma
4. Infection (eg, abscess; tuberculosis; histoplasmosis)
5. Metastasis (esp. from carcinoma of lung or breast)
6. Myelolipoma
7. Neuroblastoma; ganglioneuroblastoma; ganglioneuroma
8. Pheochromocytoma associated with multiple endocrine neoplasia S., type IIA (MEN IIA) and type IIB (MEN IIB)
References

Gamut H-119

BILATERAL ADRENAL ENLARGEMENT

COMMON
1. Hemorrhage (spontaneous, esp. in infants; traumatic; bleeding disorder)
2. Histoplasmosis
3. Hyperplasia
4. Metastases (esp. from carcinoma of lung or breast)
5. Neuroblastomas
6. Tuberculosis

UNCOMMON
1. Addison’s disease (See H-125)
2. Adenomas
3. Amyloidosis
4. Carcinomas, multiple primary
5. Infection, other
6. Lymphomas
7. Pheochromocytomas associated with multiple endocrine neoplasia S., type IIA (MEN IIA) and type IIB (MEN IIB)
8. Wolman’s disease (familial xanthomatosis)

References

Gamut H-120

CYSTIC ADRENAL LESION

1. Abscess
2. Cystic or necrotic neoplasm (eg, pheochromocytoma)
3. Endothelial cyst
4. Epithelial cyst
5. Hemorrhage
6. Hydatid cyst
7. Lymphatic cyst
8. Pseudocyst

Reference

Gamut H-121

ADRENAL TUMORS

COMMON
1. Adenomas (functioning and non-functioning)
2. Metastasis (esp. from carcinoma of lung, breast, or kidney)
3. Neuroblastoma
4. Pheochromocytoma

UNCOMMON
1. Adrenocortical carcinoma
2. Fibroma
3. Hemangioma
4. Lipoma
5. Lymphangioma
6. Lymphomas
7. Myelolipoma
8. Neurogenic tumors, other (eg, neurofibroma; neurilemoma; schwannoma; ganglioneuroma; ganglioneuroblastoma)

References

(continued)
ADRENAL PSEUDOTUMORS*

COMMON
1. Fluid-filled bowel
2. Pancreatic tail
3. Pseudomyelolipoma
4. Splenule; accessory spleen
5. Stomach fundus
6. Upper pole renal neoplasms
7. Varices

UNCOMMON
1. Diverticulum of stomach
2. Duplication of stomach
3. Hepatic mass
4. Pancreatic pseudocyst
5. Splenic artery aneurysm

* Entities that can be mistaken for an adrenal lesion.

ADRENAL CALCIFICATION

COMMON
1. Hemorrhage (neonatal or other) (See H-124)
2. Histoplasmosis
3. Idiopathic
4. Neuroblastoma
5. Tuberculosis

UNCOMMON
1. Bleeding disorder (eg, hemophilia)
2. Coagulopathy
3. Neonatal
4. Neoplasm
5. Primary antiphospholipid S.
6. Sepsis (Waterhouse-Friderichsen S.)

ADRENAL HEMORRHAGE

COMMON
1. Post-biopsy

UNCOMMON
1. Addison’s disease (See H-125)
2. Amyloidosis
3. Beckwith-Wiedemann S.
4. Cushing S.
5. Cyst
6. Metastasis (mucinous primary or post hemorrhagic)
7. Neoplasm of adrenal, other (eg, adenoma; adrenocortical carcinoma; dermoid; aldosteronoma; hemangioma; ganglioneuroma; myelolipoma)
8. Pheochromocytoma
9. Waterhouse-Friderichsen S.
10. Wolman’s disease (familial xanthomatosis)

References
7. Shock
8. Trauma

Reference

Gamut H-125
ADRENAL INSUFFICIENCY
(ADDISON’S DISEASE)

COMMON
1. Histoplasmosis
2. Idiopathic
3. Metastases (esp. from carcinoma of lung or breast)
4. Post-adrenalectomy
5. Post-withdrawal of exogenous steroids
6. Tuberculosis

UNCOMMON
1. Amyloidosis
2. Hemochromatosis
3. Hemorrhage (spontaneous; traumatic; bleeding diathesis)
4. Infarction
5. Lymphoma
6. Neoplasm, primary (adenoma; carcinoma; neuroblastoma)
7. Postoperative
8. Wolman’s disease (familial xanthomatosis)

Reference

Gamut H-126-S1
CUSHING SYNDROME

COMMON
1. Exogenous steroids
2. Hyperplasia from pituitary or ectopic ACTH

UNCOMMON
1. Adrenal adenoma
2. Adrenocortical carcinoma

Reference

Gamut H-126-S2
PHEOCHROMOCYTOMA SYNDROMES

1. Carney’s triad
2. Multiple endocrine neoplasia S. (IIA and IIB)
3. Neurofibromatosis
4. von Hippel-Lindau S.

Reference
ANEURYSM OF THE ABDOMINAL AORTA OR ITS BRANCHES (See H-60)

COMMON
1. Atherosclerosis
2. Dissecting aneurysm
3. Drug abuse (necrotizing angiitis)

UNCOMMON
1. Angiomyolipoma
2. Arteritis (eg, polyarteritis nodosa; other collagen disease; syphilis; Takayasu S.)
3. Fibromuscular dysplasia
4. Mycotic aneurysm (sepsis, usually Salmonella or Streptococcus; bacterial endocarditis; tuberculosis)
5. Neurofibromatosis
6. Pseudoxanthoma elasticum
7. Osler-Weber-Rendu S.; arteriovenous malformation
8. Trauma (false aneurysm)

RETROPERITONEAL FIBROSIS

COMMON
1. Drug reaction (eg, methysergide; ergotamine; hydralazine)
2. Idiopathic

UNCOMMON
1. Amyloidosis
2. Appendicitis, perforated
3. Carcinoid tumor
4. Collagen disease
5. Crohn’s disease (fistula)
6. Diverticulitis of colon
7. Extravasated contrast medium (esp. Thorotrast)
8. Fungus disease (esp. histoplasmosis)
9. Hemorrhage, traumatic or bleeding disorder
10. Lymphogranuloma venereum
11. Lymphoma (esp. nodular sclerosing Hodgkin’s disease)
12. Mediastinitis (extension)
13. Mesenteritis, retractile; Weber-Christian S.
14. Pancreatitis
15. [Pelvic lipomatosis]
16. Postoperative
17. [Psoas muscle hypertrophy]
18. Radiation fibrosis
19. Retroperitoneal extension of scirrhous or desmoplastic carcinoma of stomach, colon, or prostate
20. Riedel struma
21. Sclerosing agent (for hemorrhoids)
22. Tuberculosis
23. Urinary extravasation (eg, trauma)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce changes that simulate it.

References
UNCOMMON

1. AIDS
2. Chronic granulomatous disease (eg, tuberculosis; *Mycobacterium avium-intracellulare* infection; sarcoidosis; histoplasmosis)
3. Inflammatory bowel disease (eg, Crohn’s disease)
4. Lymphangioleiomyomatosis
5. Mesenteritis
6. Whipple’s disease

References

Gamut H-131

4. Metastatic lymphadenopathy
5. Muscle tumor (eg, rhabdomyosarcoma; fibrosarcoma)
6. Neurogenic tumor (eg, neuroblastoma; neurofibroma; ganglioneuroma)
7. Retroperitoneal sarcoma

Miscellaneous
1. Fluid collections (eg, urinoma; lymphocele; pancreatic pseudocyst; fluid in iliopsoas bursa)
2. Pseudoenlargement of psoas muscle (compared to atrophy of contralateral muscle)
3. Thrombosis of pelvic veins with diffuse swelling (edema) of muscles

Reference

Gamut H-131

CYSTIC RETROPERITONEAL MASS (US, CT, MRI)

COMMON
1. Abscess
2. Hematoma (late)
3. Hydronephrosis
4. Pseudocyst of pancreas
5. Renal cystic disease (eg, simple cyst; polycystic kidney; multicystic dysplastic kidney; cystic renal cell carcinoma)

UNCOMMON
1. Cystadenoma or cystadenocarcinoma of pancreas
2. Cystic para-aortic lymphadenopathy (eg, carcinoma of cervix; teratoma of testis)
3. Hemangiopericytoma
4. Hydatid cyst
5. Leiomyosarcoma
6. Lymphangioma
7. Lymphocele
8. Meningocele
9. von Hippel-Lindau S.

References

Gamut H-132

EXTRAPERITONEAL GAS (See H-139)

COMMON
1. Abscess
2. Iatrogenic (eg, postoperative; rectal biopsy; enema; needle aspiration; gas insufflation)
3. [Interposition of colon (Chilaiditi S.)]
4. Perforation of gastrointestinal tract (eg, peptic ulcer; diverticulum; carcinoma; Crohn’s disease)
5. Trauma (eg, gunshot wound; duodenal or colonic rupture)

UNCOMMON
1. Emphysematous cholecystitis (perforated)
2. Pneumatosis intestinalis with leakage
3. Pneumomediastinum with caudal tracking (eg, spontaneous; traumatic; tracheotomy)
4. [Portal vein gas]

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
Gamut H-133

LARGE SOFT TISSUE MASS
IN THE PELVIS (See also H-134–137)

COMMON
1. Abscess
2. Bladder enlargement (See H-96)
3. Feces in colon
4. Fluid-filled loop of bowel
5. Hematoma
6. Hydrosalpinx
7. Ovarian cyst or neoplasm (eg, dermoid; carcinoma)
   (See H-182, H-183)
8. Pregnancy (incl. ectopic pregnancy)
9. Uterine neoplasm (eg, fibroid; mole; carcinoma)

UNCOMMON
1. Bone tumor (eg, chordoma; Ewing sarcoma; osteosarcoma; chondrosarcoma)
2. Extraperitoneal neoplasm, other (lymphoma; Burkitt lymphoma; spindle cell tumor; neurogenic tumor)
3. Hemato- or hydrometrocolpos
4. Hydatid cyst
5. Meningocele, anterior sacral
6. Pelvic kidney
7. Pelvic lipomatosis
8. Soft tissue sarcoma (eg, rhabdomyosarcoma; liposarcoma; leiomyosarcoma)
9. Teratoma (eg, retroperitoneal; presacral; ovarian)

Gamut H-134

SOLID PELVIC MASS (US, CT)

COMMON
1. [Bowel, fluid-filled]
2. Ectopic kidney
3. Fat, intraperitoneal
4. Leiomyoma (fibroid) of uterus
5. Lymph node enlargement
6. Lymphoma
7. Metastasis
8. Neoplasm of ovary (eg, carcinoma; dysgerminoma; yolk sac tumor; granulosa and theca cell tumors; fibroma)
9. Neoplasm of uterus, malignant (eg, carcinoma of cervix or endometrium; leiomyosarcoma)
10. Prostatic enlargement (eg, benign prostatic hyper trophy; carcinoma; prostatitis; abscess) (See H-140)
11. Torsion of ovary
12. Trophoblastic tumor (eg, hydatidiform mole; choriocarcinoma)

Gamut H-135

CYSTIC PELVIC MASS (US, CT)*

COMMON
1. Dermoid cyst
2. Ectopic pregnancy
3. Endometrioma
4. Hydrosalpinx

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

(continued)
5. Ovarian cyst, physiologic (follicular; corpus luteum; theca lutein; retention)
6. Ovarian serous or mucinous cystic lesion (cystadenoma or cystadenocarcinoma)
7. Paraovarian cyst
8. Urinary tract mass (eg, bladder enlargement; diverticulum; urinoma; ureterocele; hydroureter; urachal cyst)

UNCOMMON
1. Abscess (incl. appendiceal; tubo-ovarian)
2. Ascites (loculated)
3. Hemato- or hydrometrocolpos
4. Hematoma
5. Hydatid cyst
6. Lymphocele
7. Mesenteric cyst
8. Peritoneal inclusion cyst
9. Polycystic ovary

* Cystic (homogeneous, septated, or with few solid foci).

References

Gamut H-137
LOWER ABDOMINAL OR PELVIC MASS IN AN INFANT OR CHILD
(See H-133–136)

COMMON
1. Appendiceal abscess
2. Bladder enlargement (See H-96)
3. Bone lesion of spine or pelvis
4. Hematoma (trauma; bleeding or coagulation disorder)
5. Ovarian cyst or neoplasm (See H-182–183)

UNCOMMON
1. Anterior sacral meningocele
2. Duplication cyst of gut or genital tract
3. Ectopic kidney
4. Fecal impaction (eg, Hirschsprung’s disease)
5. Foreign body, vaginal or rectal
6. Hemato- or hydrometrocolpos
7. Hydatid cyst
8. Hydroureter
9. Intestinal obstruction
10. Intussusception
11. Lymphoma, Burkitt lymphoma
12. Meconium (eg, imperforate anus; meconium ileus; meconium plug S.)
13. Mesenteric or omental cyst
14. Metastasis
15. Neurogenic neoplasm (eg, neuroblastoma)
16. Perirectal abscess
17. Retroperitoneal neoplasm (eg, teratoma; sarcoma)
18. Rhabdomyosarcoma (botryoides) of bladder or vagina
19. Tubo-ovarian abscess; hydrosalpinx; pyosalpinx
20. Urachal cyst

References

Gamut H-138

PELVIC OR LOWER QUADRANT CALCIFICATION (See also G-247-1 to G-251)

COMMON
1. Appendiceal calculus (fecalith)
2. Dermoid cyst
3. [Foreign material: eg, pica; foreign body; intrauterine device; vaginal pessary; medicinal injections (eg, bismuth); residual barium (eg, in appendix or diverticula); pills; contrast medium (eg, Pantopaque, Ethiodol); radon seeds; metallic clips and sutures; catheter; gauze sponge]
4. Leiomyoma or leiomyosarcoma of uterus
5. Lithopedion
6. Lymph node (eg, tuberculosis; histoplasmosis)
7. Pregnancy (fetus; placenta)
8. Prostatic calculi
9. [Soft tissue or skin lesion]
10. Urinary tract calculus (in ureter, bladder, bladder diverticulum, urethra, pelvic kidney) (See H-24, 106)
11. Vas deferens, seminal vesicle, fallopian tube (eg, diabetes; tuberculosis; schistosomiasis)
12. Vascular (eg, arteries; phleboliths)

UNCOMMON
1. Bladder neoplasm
2. Bladder or ureteral wall calcification (eg, schistosomiasis; tuberculosis) (See H-85, 105)
3. Bone neoplasm (eg, osteochondroma; chondrosarcoma; osteosarcoma)
4. Calcified epiploic appendage; omental fat
5. Calculus in Meckel’s diverticulum or colon diverticulum
6. Colloid carcinoma of colon or appendix
7. Cystadenoma or cystadenocarcinoma of ovary with psammomatous calcifications
8. Enterolith (esp. with small bowel tuberculosis)
9. Fluorosis (ligament calcification)
10. Gallstone in ileum (gallstone ileus)
11. Hemangioma (phleboliths)
12. Hydatid cyst
13. Lymphoma (radiation treated)
14. Myxoglobulosis or mucocele of appendix
15. Neuroblastoma
16. Ovarian neoplasm; other (eg, fibroma; gonadoblastoma; teratoma; dysgerminoma; sclerosing stromal neoplasm, corpus albicans; nevoid basal cell carcinoma S. {Gorlin S.})

(continued)
17. Parasites (Cysticercus; Armillifer; guinea worm)
18. Pseudomyxoma peritonei

[ ] This condition does not actually cause the gamut di imaging finding, but can produce imaging changes that simulate it.

Gamut H-139

ABNORMAL GAS COLLECTION
IN THE PELVIS AND
FEMALE GENITAL TRACT (See H-132)

COMMON
1. Abscess
2. Bladder (eg, emphysematous cystitis; colovesical fistula) (See H-107)
3. Endometritis
4. Perforated appendix or colon (eg, diverticulum)
5. Pneumatosis cystoides of pelvic colon
6. Recent instrumentation
7. Rectal laceration or fistula

UNCOMMON
1. Carcinoma of cervix or endometrium with fistula to intestinal tract
2. Clostridium infection (gas gangrene of abdominal wall or uterus, esp. after septic abortion)
3. Emphysematous vaginitis
4. Gas in dead fetus
5. Giant colon diverticulum
6. Hydrogen peroxide enema (mural gas)
7. Infected uterine leiomyoma (fibroid)
8. Intestinal necrosis
9. Ovarian gas abscess (esp. in neoplasm)
10. Pyometra from obstruction by carcinoma of cervix

Reference

Gamut H-140

ENLARGED PROSTATE

COMMON
1. Benign prostatic hypertrophy (BPH)
2. Carcinoma of prostate
3. Prostatitis

UNCOMMON
1. Abscess
2. Amyloidosis
3. Sarcoma

Reference

Gamut H-141

SONOGRAPHY: ANECHOIC (USUALLY CYSTIC) LESION IN OR NEAR PROSTATE

COMMON
1. Cystic degeneration in benign prostatic hypertrophy (BPH)
2. Ejaculatory duct cyst
3. Müllnerian duct cyst
4. Seminal vesicle cyst
5. Surgical defect (eg, transurethral prostatectomy—TURP)

UNCOMMON
1. Abscess
2. Cavitary/diverticular prostatitis (from fibrosis of chronic prostatitis—“Swiss cheese” prostate)
3. Cystic carcinoma of prostate
4. Cystocele
5. Ureterocele (ectopic)
6. Utricle cyst

References

Gamut H-143
SONOGRAPHY: ISOECHOIC PROSTATE LESION

1. Atypical hyperplasia
2. Carcinoma of prostate
3. Fibrosis
4. Granulomatous prostatitis
5. Hematoma
6. Infarct

Reference

Gamut H-142
SONOGRAPHY: HYPOECHOIC PROSTATE LESION

COMMON
1. Acute prostatitis / abscess
2. Atypical prostatic hyperplasia
3. Carcinoma of prostate
4. Normal prostatic tissue (eg, prostate retention cysts in a cluster; prominent ejaculatory ducts; vessel)

UNCOMMON
1. Atrophy or dysplasia of prostate
2. Complex cyst
3. Fibrosis
4. Granulomatous prostatitis (eg, tuberculosis; BCG bacillus)
5. Hematoma
6. Infarct

References

Gamut H-144
SONOGRAPHY: HYPERECHOIC PROSTATE LESION

1. Calcification
2. Carcinoma of prostate (esp. comedocarcinoma)
3. Chronic prostatitis

Reference
Gamut H-145

HYPERVASCULAR PROSTATE LESION ON COLOR DOPPLER ULTRASOUND

1. Arteriovenous fistula (post biopsy); other vascular malformation
2. Carcinoma of prostate
3. Infection (prostatitis)

Reference

Gamut H-146

LOW-INTENSITY PERIPHERAL ZONE OF PROSTATE ON T2-WEIGHTED MR IMAGES

COMMON
1. Carcinoma of prostate
2. Hematoma
3. Prostatitis (chronic and granulomatous)

UNCOMMON
1. Amyloidosis
2. Benign prostatic hypertrophy (atypical)
3. Infarct
4. Intraepithelial neoplasia of prostate
5. Post-hormonal therapy
6. Post-radiation therapy

Reference

Gamut H-147

LOW-INTENSITY SEMINAL VESICLE ON T2-WEIGHTED MR IMAGES

COMMON
1. Blood
2. Carcinoma
3. [Vasa deferentia]

UNCOMMON
1. Amyloidosis
2. Post-hormonal therapy
3. Post-radiation therapy
4. Seminal vesiculitis

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Gamut H-148

CYSTIC STRUCTURE NEAR SEMINAL VESICLE

1. Müllerian remnant cyst
2. Seminal vesicle cyst
3. Ureterocele (ectopic)
4. Utricle

Reference
CALCIFICATION IN THE SEMINAL VESICLE, VAS DEFERENS, OR FALLOPIAN TUBE

COMMON
1. Aging; degenerative
2. Atherosclerosis
3. Diabetes
4. Idiopathic
5. Tuberculosis

UNCOMMON
1. Calculus
2. Chronic nonspecific infection
3. Hemorrhage (traumatic or other)
4. Paraplegia
5. Schistosomiasis haematobium
6. Syphilis

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

ABNORMALITIES INVOLVING THE ENTIRE TESTIS

COMMON
1. Orchitis
2. Torsion

UNCOMMON
1. Testicular neoplasms (rarely)
2. Trauma (hemorrhage; hematoma)

SOLID TESTICULAR MASS (US, MRI)

COMMON
1. Hematoma
2. Infarct
3. Infection
4. Lymphoma; leukemia
5. Neoplasm, benign or malignant (See H-155–157)

UNCOMMON
1. Adrenal rest
2. Metastasis
CYSTIC TESTICULAR MASS (US, MRI)

1. Abscess
2. Cystic dysplasia
3. Cystic or necrotic neoplasm, benign or malignant
   (See H-155–157)
4. Hematoma
5. Intratesticular tubular ectasia (dilatation of rete testis)
6. Simple testicular cyst (often with spermatocyte)
7. Tunica albuginea cyst

UNILATERAL TESTICULAR MASS (US, MRI)

COMMON
1. Choriocarcinoma
2. Embryonal cell carcinoma
3. Seminoma
4. Teratoma
5. Yolk sac tumor (endodermal sinus tumor)

UNCOMMON
1. Leydig cell tumor
2. Metastasis
3. Sertoli cell tumor

BILATERAL TESTICULAR MASSES (US, MRI)

COMMON
1. Lymphoblastic leukemia (acute or chronic)
2. Lymphoma (non-Hodgkins)
3. Metastases

UNCOMMON
1. Adrenal rest hyperplasia

GERM CELL TUMORS OF THE TESTES

COMMON
1. Mixed germ cell tumor
   a. Embryonal cell carcinoma plus seminoma
   b. Seminoma plus teratoma
   c. Teratocarcinoma (teratoma plus embryonal cell carcinoma)
2. Seminoma

UNCOMMON
1. Choriocarcinoma
2. Embryonal cell carcinoma
3. Polyembryoma
4. Spermatocytic seminoma
5. Teratoma
6. Yolk sac tumor (endodermal sinus tumor)

Reference
NON-GERM CELL TUMORS OF THE TESTES

COMMON
1. Lymphoma, leukemia

UNCOMMON
1. Adrenal rest tumor
2. Adenocarcinoma of rete testis
3. Carcinoid tumor
4. Epidermoid cyst
5. Extramedullary plasmacytoma
6. Fibroma
7. Gonadoblastoma
8. Granulosa cell tumor
9. Leydig cell tumor
10. Metastasis
11. Papillary adenocarcinoma of rete testis
12. Sertoli cell tumor

Reference

TESTICULAR TUMOR IN A CHILD (US)

COMMON
1. Teratoma
2. Yolk sac tumor

UNCOMMON
1. Gonadoblastoma
2. Granulosa cell tumor
3. Leydig cell tumor
4. Sertoli cell tumor

Reference

TESTICULAR CALCIFICATION (PF, US)

COMMON
1. Embryonal cell carcinoma
2. Hematoma (old)
3. Metastatic neuroblastoma
4. Microlithiasis of testis (may occur with pulmonary alveolar microlithiasis)
5. Scar
6. Spermatic granuloma
7. Tumor (posttreatment)

UNCOMMON
1. Cryptorchidism
2. Epidermoid cyst
3. Germ cell tumor (“burned-out”)
4. Granulomatous orchitis (eg, tuberculosis)
5. Kleinfelter S. (XXY S.)
6. Leydig cell tumor
7. Phlebolith
8. Sertoli cell tumor

Reference

EPIDIDYMAL LESION (US, MRI)

COMMON
1. Adenomatoid tumor
2. Epididymitis
3. Spermatocele
4. Torsion

UNCOMMON
1. Abscess
2. Cyst

(continued)
3. Cystadenoma
4. Mesenchymal tumor (eg, leiomyoma)

References

Gamut H-160

MASS IN THE SCROTUM

COMMON
1. Cyst of testis, epididymis, vas deferens, or seminal vesicle
2. Hematoma
3. Hydrocele
4. Infection, chronic (eg, epididymitis; seminal vesiculitis)
5. Malignant neoplasm of testis or testicular adnexa (eg, seminoma; choriocarcinoma; embryonal cell carcinoma; teratoma; lymphoma; rhabdomyosarcoma of spermatic cord)
6. Orchitis (traumatic or other)
7. Varicocele

UNCOMMON
1. Abscess
2. Benign hypertrophy of testis
3. Benign neoplasm of testis or testicular adnexa (eg, adenomatoid tumor; fibroma)
4. Hernia
5. Hydatid of Morgagni (appendix testis)
6. Metastasis
7. Torsion of testicle
8. Tuberculosis (esp. epididymis)
9. Ureterocele (ectopic)

References

Gamut H-161

EXTRATESTICULAR TUMORS IN THE SCROTUM

COMMON
1. Adenomatoid tumor
2. Fibrous pseudotumor (fibroma)
3. Rhabdomyosarcoma of spermatic cord

UNCOMMON
1. Cystadenoma
2. Dermoid cyst; teratoma
3. Fibrosarcoma; malignant fibrous histiocytoma
4. Leiomyoma; leiomyosarcoma
5. Lipoma (esp. of spermatic cord); liposarcoma
6. Mesothelioma
7. Metastases
8. Myxochondrosarcoma

Reference
Gamut H-162

SOLID EXTRATESTICULAR MASS IN THE SCROTUM (US, MRI)

COMMON
1. Hematoma
2. Hernia
3. Infection; phlegmon
4. Neoplasm, benign or malignant (esp. adenomatoid tumor; rhabdomyosarcoma; fibroma) (See H-161)

UNCOMMON
1. Adrenal rest
2. Metastasis

Gamut H-163

CYSTIC EXTRATESTICULAR MASS IN THE SCROTUM (US, MRI)

1. Abscess
2. Epididymal cyst
3. Hematoma
4. Hernia
5. Hydrocele
6. Post-vasectomy
7. Spermatocele
8. Varicocele

Gamut H-164

CALCIFICATIONS IN THE SCROTUM (PF, US)

COMMON
1. Aging; degenerative
2. Atherosclerosis (esp. diabetic)
3. Hemorrhage, old; hematoma (traumatic or other)
4. Testicular calcification (eg, microlithiasis)
   (See H-158)
5. Varicocele, hemangioma (phleboliths)

UNCOMMON
1. Hydrocele
2. Idiopathic scrotal calcinosis
3. Infarction of testis
4. Meconium peritonitis (in hydrocele)
5. Neoplasm (eg, teratoma)
6. Parasites (esp. guinea worm; Armillifer; filariasis)
7. Sebaceous cyst
8. Spermatocele
9. Syphilis
10. Testicular atrophy
11. Tuberculosis
12. Vas deferens calcification (See H-149)

References
FLUID COLLECTION IN THE SCROTUM (US)

1. Abscess
2. Cyst of testis or epididymis
3. Hematoma
4. Hernia
5. Hydrocele
6. Spermatocele
7. Varicocele

Reference

CONGENITAL SYNDROMES WITH HYPOSPADIAS OR OTHER AMBIGUOUS EXTERNAL GENITALIA

1. Bardet-Biedl S. (Laurence-Moon-Biedl S.)
2. Chondroectodermal dysplasia (Ellis-van Creveld S.)
3. Chromosomal syndromes (eg, 4 p - S.; trisomy 3, 13, and 18 S.; XXXXY S.)
4. Dubowitz S.
5. Familial hypospadias
6. Fanconi anemia (pancytopenia-dysmelia S.)
7. Fetal primidone S.
8. Fraser S. (cryptophthalmia S.)
9. Hand-foot-genital S.
10. Hypertelorism-hypospadias S.
11. Lenz microphthalmia S.
12. LEOPARD S. (multiple lentigenes S.)
13. Male pseudohermaphroditism
14. Opitz BBBG S. (hypertelorism-hypospadias S. or GS.)
15. Popliteal pterygium S.
16. Reifenstein S. (hereditary familial hypogonadism)
17. Rieger S.
18. Schinzel-Giedion S.
19. Silver-Russell S.
20. Smith-Lemli-Opitz S.
21. VATER association
22. Zellweger S. (cerebrohepatorenal S.)

Reference

CALCIFICATIONS IN THE FEMALE GENITAL TRACT

OVARIES
1. Cystadenocarcinoma
2. Dermoid cyst
3. Gonadoblastoma
4. Papillary cystadenoma (psammomatous bodies)
5. Pseudomyxoma peritonei
6. Torsion of ovary (chronic)

UTERUS
1. Arcuate arteries
2. Leiomyoma (fibroid)
3. Lithopedion
4. Placenta

FALLOPIAN TUBES
1. Aging
2. Diabetes
3. Schistosomiasis haematobium
4. Tuberculous salpingitis
VAGINAL FISTULA

COMMON
1. Abscess (esp. pelvic; appendiceal; colon diverticulitis)
2. Crohn’s disease
3. Endometriosis
4. Lymphogranuloma venereum
5. Metastatic disease
6. Neoplasm, malignant (eg, carcinoma of rectum, sigmoid, vagina, uterus, or bladder)
7. Parturition (eg, arrested fetal passage; dystocia)
8. Pelvic inflammatory disease; endometritis
9. Postoperative (eg, pelvic surgery)
10. Radiation therapy (esp. radium)
11. Trauma (external; iatrogenic; sexual)

UNCOMMON
1. Amebiasis
2. Congenital
3. Ectopic pregnancy
4. Foreign body perforation
5. Fungus infection (esp. actinomycosis)
6. Hemato- or hydrometrocolpos
7. Osteomyelitis of pelvic bones
8. Polyarteritis nodosa
9. Tuberculosis
10. Vaginitis

References

COMMON INDICATIONS FOR GYNECOLOGICAL ULTRASOUND
1. Evaluation of location, size, and consistency of a pelvic mass (eg, ovarian, tubal, uterine)
2. Evaluation of pelvic pain
3. Evaluation of vaginal bleeding (eg, endometrial hyperplasia, polyp, or carcinoma)
4. Follicular monitoring and guided aspiration
   a. Gamete intrafallopian transfer (GIFT)
   b. In vitro fertilization; embryo transfer
   c. Ovulation induction
5. IUD complications

Reference

SONOGRAPHY: HYPERECHOIC FOCAL UTERINE LESIONS
1. Calcified arcuate artery
2. Calcified leiomyoma (fibroid)
3. Endometrial calcification (post D&C or infection)
4. Gas (from recent instrumentation)
5. Intrauterine contraceptive device (IUD)
6. Retained products of conception

Reference
SONOGRAPHY: DIFFUSE UTERINE ENLARGEMENT

COMMON
*1. Carcinoma of endometrium
*2. Leiomyomas (fibroids)
3. Multiparity
4. Normal parous uterus
5. Postpartum uterus
6. Pregnancy
7. Recent abortion

UNCOMMON
*1. Adenomyosis (endometriosis) of uterus
2. Arteriovenous malformation involving uterus
3. Congenital anomaly
4. Hemato-, hydro-, or pyometrocolpos
*5. Obstruction of uterus (eg, extensive carcinoma of cervix; fibroids)
6. Precocious puberty
7. Pseudocyesis (false pregnancy)
*8. Sarcoma of uterus
9. Trophoblastic disease (eg, hydatidiform mole; choriocarcinoma)

* Seen especially in postmenopausal women.

References
1. Lawson TL, Albarelli JN: Diagnosis of gynecologic pelvic masses by gray scale ultrasonography: (A) Analysis of specificity and accuracy. AJR 1977;128:1003–1006

SONOGRAPHY: ENDOMETRIAL THICKENING

COMMON
*1. Adenomyosis (endometriosis) of uterus
*2. Carcinoma of endometrium
3. Early pregnancy
4. Ectopic pregnancy
5. Endometritis
6. Gestational trophoblastic disease
7. Hematometria
*8. Hormone therapy
*9. Hyperplasia of endometrium
10. Intrauterine contraceptive device (IUD)
*11. Leiomyoma (fibroid)
12. Missed abortion
13. Normal secretory phase
*14. Polyp of endometrium
15. Pyometria
16. Retained products of conception
*17. Tamoxifen therapy

* Seen especially in postmenopausal women.

References

SONOGRAPHY: ENDOMETRIAL FLUID

COMMON
*1. Carcinoma of cervix
*2. Carcinoma of endometrium
*3. Cervical stenosis
*4. Degenerating leiomyomas (fibroids)
*5. Dilatation and curettage (D&C), recent
*6. Hyperplasia of endometrium
7. Imperforate hymen
*8. Infection (endometritis)
9. Normal (menstrual phase)
*10. Polyps of endometrium
11. Pregnancy-related (incomplete abortion; ectopic pregnancy)

UNCOMMON
1. Duplication anomaly with obstruction
2. Vaginal or cervical atresia
* Seen especially in postmenopausal women.

Reference

Gamut H-174
SONOGRAPHY: INDEFINITE UTERUS SIGN ("SILHOUETTE SIGN")

1. Endometriosis
2. Hemorrhage (trauma; bleeding or coagulation disorder)
3. Leiomyoma (fibroid) of uterus
4. Malignant neoplasm
5. Pelvic inflammatory disease (acute)
6. Ruptured ectopic pregnancy

References
2. Lawson TL, Albarelli JN: Diagnosis of gynecologic pelvic masses by gray scale ultrasonography: (A) Analysis of specificity and accuracy. AJR 1977;128:1003–1006

Gamut H-175
SONOGRAPHY: PROMINENCE OF CENTRAL UTERINE ECHO

COMMON
1. Endometrial hyperplasia
2. Endometritis (incl. tuberculous)
3. Hydatidiform mole
4. Intrauterine device
5. Neoplasm, malignant (eg, carcinoma of endometrium; leiomyosarcoma; choriocarcinoma; invasive ovarian carcinoma)
6. Normal menstrual endometrium
7. Placenta (tangential scan)
8. Polyp of endometrium
9. Pregnancy (early intrauterine or ectopic)
10. Retained products of conception; missed abortion

UNCOMMON
1. Atrophic endometrium
2. Foreign body
3. Gas; physometra
4. Leiomyoma (degenerating)
5. Multiple gestation (early)

References
SONOGRAPHY: CERVICAL MASS

1. Carcinoma of cervix
2. Ectopic pregnancy
3. Leiomyoma (fibroid) of cervix
4. Nabothian cyst
5. Polyp

Reference

SONOGRAPHY: FREE FLUID IN CUL-DE-SAC

1. Ascites
2. Ectopic pregnancy
3. Follicular rupture
4. Neoplasm (esp. of ovary)
5. Ovulation
6. Pelvic inflammatory disease
7. Postcelsocentesis

Reference

SONOGRAPHY: FALLOPIAN TUBE MASS

1. Carcinoma
2. Ectopic pregnancy
3. Hydrosalpinx
4. Paratubal cyst
5. Pyosalpinx
6. Tubo-ovarian abscess

Reference

SONOGRAPHY: SIMPLE ANECHOIC OR HYPOECHOIC CYSTIC ADNEXAL LESION

1. [Bladder diverticulum]
2. [Bowel loop]
3. Corpus luteum cyst
4. Follicular cyst
5. Functional/retention cyst
6. Hydrosalpinx
7. Hydroureter
8. Loculated ascites
9. Lymphocele
10. Mesenteric cyst
11. Paraovarian or paratubal cyst
12. Peritoneal inclusion cyst
13. Theca lutein cyst
14. Varices

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
SONOGRAPHY: COMPLEX (USUALLY CYSTIC) ADNEXAL MASS

1. Abscess (tubo-ovarian; appendiceal; diverticular; postoperative)
2. Cystic ovarian tumor (eg, dermoid; mucinous or serous cystadenoma or cystadenocarcinoma)
3. Degenerated pedunculated uterine leiomyoma (fibroid)
4. Ectopic pregnancy
5. Endometrioma
6. Fallopian tube carcinoma
7. Hematoma
8. Hemorrhagic cyst of ovary
9. Hydatid cyst
10. Hydrosalpinx
11. Peritoneal inclusion cyst
12. Polycystic ovary S.
13. Theca lutein cyst
14. Torsion of adnexa

References

ADNEXAL LESIONS WITH LOW RESISTIVE INDEX (< 0.4) ON DOPPLER ULTRASOUND

1. Adenofibroma
2. Dermoid cyst of ovary
3. Ectopic pregnancy
4. Endometrioma
5. Luteal cyst
6. Luteal phase of functioning ovary
7. Malignant neoplasm (eg, carcinoma of ovary)
8. Pedunculated leiomyoma (fibroid) of uterus
9. Tubo-ovarian abscess

Reference

SONOGRAPHY: SOLID OVARIAN TUMOR

1. Adenocarcinoma of ovary
2. Brenner tumor
3. Burkitt lymphoma
4. Dysgerminoma
5. Endometrioma
6. Fibroma
7. Germ cell tumor (non-teratomatous)
8. Granulosa cell tumor
9. Metastasis
10. Sarcoma of ovary
11. Sertoli-Leydig cell tumor
12. Teratoma
13. Thecoma
14. Yolk sac tumor (endodermal sinus tumor)

References

(continued)
OVARIAN NEOPLASM OR CYST IN A CHILD

1. Cystadenoma, serous or mucinous
2. Paraovarian cyst (mesonephric origin)

CYST OF GRAAFIAN FOLLICLE ORIGIN

1. Follicular cyst
2. Theca lutein cyst

References

TUMOR OF OVARIAN STROMAL ORIGIN

1. Granulosa-thecal cell tumor
2. Pure granulosa cell tumor (benign or malignant)
3. Thecoma

GERM CELL TUMOR

1. Dysgerminoma
2. Endodermal sinus tumor (yolk sac tumor)
3. Gonadoblastoma (dysgenetic ovary)
4. Teratoma, cystic
5. Teratoma, immature (embryonal)
6. Teratoma with malignant elements

BURKITT LYMPHOMA

Reference
1. Kevin E Bove, Department of Pathology, Cincinnati Children’s Hospital: Personal communication
Diseases of the Breast

I-1-1 Circumscribed Breast Lesion Evaluated by Size of Lesion—Small to Intermediate (Less than 4 cm)
I-1-2 Circumscribed Breast Lesion—Large (Over 4 cm)
I-2 Well-Defined Circumscribed Lesion of the Breast
I-3 Halo Sign or Capsule Around the Periphery of a Breast Lesion
I-4 Poorly Defined or Irregularly Marginated Lesion of the Breast
I-5 Spiculated Lesion of the Breast (Including Stellate Lesion)
I-6 Breast Lesion Containing Fat
I-7-1 Breast Calcifications—Coarse
I-7-2 Breast Calcifications—Semicircular, Circular, or Eggshell
I-7-3 Breast Calcifications—Lobular (Homogeneous, Solid, Well-defined, Spherules or Pearls)
I-7-4 Breast Calcifications—Linear
I-7-5 Breast Calcifications—Microcalcifications Localized into Groups
I-7-6 Breast Calcifications—Diffuse Scattered Microcalcifications
I-8 Prominent (Dense) Ductal Pattern on Mammography
I-9 Diffuse Breast Changes
I-10 Skin Thickening Over the Breast
I-11-S Lesions or Artifacts That Can Mimic a True Breast Lesion
I-12 Gynecomastia
I-13 Anechoic Breast Lesions on Ultrasound
I-14 Hypoechoic Breast Lesions on Ultrasound
I-15 Hyperechoic or Mixed Echogenicity Breast Lesions on Ultrasound
| I-16 | Axillary Lymphadenopathy Seen on Mammography (Usually on MLO View) |
| I-17 | Asymmetry of Pectoralis Muscle on Mammograph (Usually on MLO View) |
| I-18-S | Mammography Mistakes and Pitfalls for Radiologists and Physicians |
| I-19-S | Mammography Mistakes and Pitfalls for Technologists |
CIRCUMSCRIBED BREAST LESION EVALUATED BY SIZE OF LESION—
SMALL TO INTERMEDIATE (LESS THAN 4 CM)

COMMON
1. Axillary lymph node (eg, lymphoma, leukemia, metastasis, tuberculosis) (See I-17)
2. Carcinoma (esp. mucinous or papillary)
3. Cyst
4. Fibroadenoma
5. Fibrocystic change (esp. sclerosing adenosis)
*6. Intramammary lymph node
*7. Oil or lipid cyst (posttraumatic or postsurgical fat necrosis)
8. Papilloma, papillomatosis
9. Skin lesion (eg, wart; mole; neurofibroma; sebaceous cyst; nipple out of profile)

UNCOMMON
*1. Galactocele
2. Hemangioma (cavernous)
*3. Hematoma or seroma
*4. Lipoma
5. Metastasis
6. Phyllodes tumor (formerly cystosarcoma phyllodes)
*Radiolucent or partially lucent lesions containing fat.

References

CIRCUMSCRIBED BREAST LESION — LARGE (OVER 4 CM)

COMMON
1. Carcinoma (unusual to be circumscribed at this size)
2. Cyst (simple or complicated)

UNCOMMON
1. Abscess
2. Axillary or unusual intramammary lymphadenopathy (eg, lymphoma, metastasis) (See I-17)
*3. Fibroadenolipoma (hamartoma)
4. Hematoma
*5. Lipoma
6. Metastasis to breast
*7. Oil or lipid cyst, large (posttraumatic or postsurgical fat necrosis)
8. Phyllodes tumor (formerly cystosarcoma phyllodes; giant fibroadenoma)
9. Postoperative seroma (eg, after implant removal—usually not well circumscribed)
10. Sarcoma
11. [Sebaceous cyst]

*Radiolucent or partially lucent lesions containing fat.
[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References

WELL-DEFINED CIRCUMSCRIBED LESION OF THE BREAST

COMMON
1. Carcinoma, usually not “well” circumscribed on magnification views (eg, ductal in situ; invasive ductal; medullary; colloid or mucinous; papillary; intracystic papillary)

*2. Cyst
*3. Fibroadenoma
*4. Fibrocystic change (esp. sclerosing adenosis)
5. Intramammary (or axillary) lymph node
6. [Normal variant (circumscribed parenchyma of puberty; retracted or normal nipple out of profile; end-on vein)]
7. Oil or lipid cyst (posttraumatic or postsurgical fat necrosis)
*8. Papilloma (intraductal)
*9. [Skin lesion (eg, mole; wart; neurofibroma; epidermal inclusion or sebaceous cyst)]

UNCOMMON
1. Abscess
*2. Fibroadenolipoma (hamartoma)
3. Galactocele
4. Granular cell myoblastoma
5. Hemangioma (cavernous)
6. Hematoma
7. Lipoma
8. Lymphoma, primary
*9. Metastasis to breast (eg, from melanoma; carcinoma of lung, ovary, GI or GU tract; lymphoma; sarcoma)
10. Phyllodes tumor (formerly cystosarcoma phylloides; giant fibroadenoma)
11. Pseudoangiomatous stromal hyperplasia (PASH)
12. Sarcoma of breast (eg, angiosarcoma)
*13. [Silicone globule or implant artifact]

* May be multiple.
[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References
Gamut I-3

HALO SIGN OR CAPSULE AROUND THE PERIPHERY OF A BREAST LESION

COMMON
1. Benign well-circumscribed mass esp. cyst; fibroadenoma; fibrocystic change (solid nodule); sebaceous cyst (contiguous with skin); nipple out of profile

RARE
1. Carcinoma (intracystic, papillary, or arising in or near a fibroadenoma) (rarely holds up on magnification views)

Gamut I-4

POORLY DEFINED OR IRREGULARLY MARGINATED lesION OF THE BREAST

COMMON
*1. Carcinoma (esp. scirrhous; invasive ductal; invasive lobular; medullary; mucinous; papillary)
*2. Fat necrosis (traumatic; postsurgical; postbiopsy scar; idiopathic)
*3. Fibrocystic change (esp. sclerosing adenosis)
4. [Superimposed densities or summation shadows creating a “pseudomass”]

UNCOMMON
*1. Abscess, acute or chronic
2. Complicated cyst (hemorrhagic, inspissated, or infected)
*3. Fibroadenoma (hyalinized)
*4. Fibromatosis (extra-abdominal desmoid)
5. Foreign body granuloma (eg, suture)
*6. Granular cell myoblastoma
7. Hematoma
8. Lymphoma
9. Plasma cell mastitis
*10. Radial scar (complex sclerosing lesion)
11. Sarcoma
12. Tuberculosis; fungus disease; nocardiosis

*May present as a spiculated lesion.
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
Gamut I-5

SPICULATED LESION OF THE BREAST
(INCLUDING STELLATE LESION)

COMMON
1. Carcinoma (esp. scirrhous infiltrating ductal; also tubular, invasive lobular, intraductal)
2. Fat necrosis (traumatic; postsurgical; postbiopsy scar; idiopathic)
3. Radial scar (sclerosing duct hyperplasia; complex sclerosing lesion; indurative mastopathy)
4. Scarring (posttraumatic; postoperative)
5. [Summation shadows]

UNCOMMON
1. Abscess (occasionally)
2. Fibroadenoma, hyalinized with fibrosis and myxoid degeneration

Gamut I-6

BREAST LESION CONTAINING FAT

COMMON
1. Intramammary lymph node
2. Lipoma

3. Fibrocystic change (esp. sclerosing adenosis)
4. Fibromatosis (extra-abdominal desmoid)
5. Granular cell myoblastoma

*Associated carcinoma of breast is present in about 25% of radial scars (20% in situ, 5% invasive carcinoma).
[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

References
3. Normal fat lobule
4. Oil or lipid cyst (posttraumatic or postsurgical fat necrosis)
5. Radial scar (central lucency)

**UNCOMMON**
1. Fibroadenolipoma (hamartoma)
2. Galactocele
3. Hematoma, acute (fat-fluid level)
4. Liposarcoma
5. Steatocystoma (simple or complex)

**References**

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**Gamut I-7-1**

**BREAST CALCIFICATIONS—COARSE**

**COMMON**
1. Carcinoma with central necrosis
2. Fat necrosis (traumatic; postsurgical; postbiopsy scar; idiopathic)
3. Fibroadenoma (bizarre or popcorn-like calcifications)

**UNCOMMON**
1. Granulomatous disease (tuberculosis and fungus disease, usually in axillary lymph nodes)
2. Renal osteodystrophy (secondary hyperparathyroidism; hypercalcemia)

**Reference**
1. See References listed under I-7-6

**Gamut I-7-2**

**BREAST CALCIFICATIONS—SEMICIRCULAR, CIRCULAR, OR EGGSHELL**

**COMMON**
1. Calcified sebaceous gland cysts; other skin lesions
2. Fibroadenoma
3. Oil or lipid cyst (posttraumatic or postsurgical fat necrosis)

**UNCOMMON**
1. Galactocele (in capsule)
2. Lipoma with fat necrosis
3. Liponecrosis microcystica calcificans (subcutaneous fat necrosis)
4. Panniculitis nodularis, nonsuppurative (Weber-Christian disease)
5. Papilloma
6. Plasma cell mastitis* (periductal mastitis; also known as secretory disease)
7. Postradiation therapy (dystrophic round or ring-like calcifications)
8. Silicone globules

* May occasionally show dense, regular, elongated, linear or branching intraductal calcifications as well as more common large, smooth, dense, round, or oval calcifications.

Reference
1. See References listed under I-7-6

Gamut I-7-3

BREAST CALCIFICATIONS—LOBULAR (HOMOGENEOUS, SOLID, WELL-DEFINED, SPHERULES OR PEARLS IN DILATED DUCTULES AND LOBULES)

1. Atypical lobular hyperplasia
2. Blunt duct adenosis
3. Fibrocystic change (esp. sclerosing adenosis) with “milk of calcium” crystals in cyst fluid

Reference
1. See References listed under I-7-6

Gamut I-7-4

BREAST CALCIFICATIONS—LINEAR

COMMON
1. Arterial (Mönckeberg’s medial sclerosis and atherosclerosis)
2. Carcinoma (intraductal)
3. Fibrocystic change with “milk of calcium” crystals in cyst fluid

*4. Plasma cell mastitis (periductal mastitis; secretory disease)

UNCOMMON
1. Parasites (Loa Loa; Dracunculus medinensis (guinea worm) (serpiginous outline in subcutaneous tissues of breast)

* May occasionally show dense, regular, elongated, linear or branching intraductal calcifications as well as more common large, smooth, dense, round, or oval calcifications.

Reference
1. See References listed under I-7-6

Gamut I-7-5

BREAST CALCIFICATIONS—MICROCALCIFICATIONS LOCALIZED INTO GROUPS

1. Carcinoma, intraductal (may present as (a) casts of the ductal lumen, or as (b) tiny granular, dot-like or elongated, multiple, irregularly grouped microcalcifications very close together)
2. Carcinoma (lobular in situ)
3. Early calcification within a fibroadenoma or artery
4. Fibrocystic change (sclerosing adenosis)
5. Papilloma; papillomatosis (intraductal)
6. Scar calcification

Reference
1. See References listed under I-7-6
Gamut I-7-6

**BREAST CALCIFICATIONS—DIFFUSE SCATTERED MICROCALCIFICATIONS**

1. [Artifacts or pseudocalcifications from powders, creams, ointments, or deodorants on skin surface of breast or axilla]
2. Atrophic
3. Carcinoma (intraductal or multicentric lobular)
4. Fibrocystic change (esp. sclerosing adenosis)
5. Involutional glandular
6. Plasma cell mastitis* (secretory disease; periductal mastitis; ductal ectasia)

*May occasionally show dense, regular, elongated, linear or branching intraductal calcifications as well as more common large, smooth, dense, round or oval calcifications.

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**


Gamut I-8

**PROMINENT (DENSE) DUCTAL PATTERN ON MAMMOGRAPHY**

**COMMON**

1. Carcinoma (intraductal)
2. [Dense breast]
3. Ductal ectasia; periductal inflammation and fibrosis
4. Lactation
5. Papilloma (solitary or multiple, intraductal)
6. Papillomatosis (intraductal)

**UNCOMMON**

1. Ductal adenoma
2. Ductal hyperplasia

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**


Gamut I-9

**DIFFUSE BREAST CHANGES**

**COMMON**

1. Carcinoma, “inflammatory” or diffuse spread within breast
2. Fibrocystic change
3. Hormone replacement therapy
4. Lymphatic obstruction (eg, postsurgical or secondary to infiltrating neoplasm or lymph node metastases)
5. Mastitis, extensive acute
SKIN THICKENING OVER THE BREAST

COMMON
1. Carcinoma, esp. scirrhous (locally advanced with focal skin thickening, or recurrent after lumpectomy and radiation therapy)
2. Fluid overload, systemic (eg, heart failure; renal failure; anasarca hypoalbuminemia; cirrhosis)
3. “Inflammatory” carcinoma (neoplastic lymphatic obstruction)
4. Lymphatic obstruction (eg, following axillary node dissection or secondary to axillary or mediastinal nodal metastases from breast or other primary malignancy)
5. Mastitis (incl. bacterial, fungal, tuberculous, filarial infection)

6. Postoperative (recent); postbiopsy; reduction mammoplasty
7. Radiation therapy

UNCOMMON
1. Edema (eg, heart, liver, or kidney failure)
2. Fibroliposarcoma
3. Filariasis (with lymphedema)
4. Hemorrhage
5. Lymphoma
6. Tuberculosis, fungus disease, or nocardiosis (diffuse)

References

LESIONS OR ARTIFACTS THAT CAN MIMIC A TRUE BREAST LESION

1. Fat necrosis (oil or lipid cyst, posttraumatic or postsurgical)
2. Film or screen artifacts (scratches; fingerprints)
3. Foreign substance on skin surface (eg, medicinal ointment; bandage; axillary deodorant)
4. Lymph nodes (in axilla, axillary tail of breast, or intramammary)
5. Lymphedema (eg, obstruction of lymph drainage from metastases or surgery; heart failure)
6. Nipple out of profile; retracted nipple
7. Postbiopsy scar
8. Silicone injection
9. Skin calcifications
10. Skin lesion (eg, wart; mole; neurofibroma; sebaceous or epidermal inclusion cyst)
11. Superimposition of fibroglandular breast tissue

### SYNDROMES

1. Cowden S. (multiple hamartoma S.)
2. Gorlin S. (nevoid basal cell carcinoma S.)
3. Paraneoplastic syndromes

*Common.

### References


### Gamut I-13

**ANECHOIC BREAST LESIONS ON ULTRASOUND**

**COMMON**

1. Cyst (simple)
2. [Ultrasound equipment, malfunctioning or with very incorrect settings]

**UNCOMMON**

1. Fibroadenoma (rarely)
2. Lymphoma; leukemia

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

### References

5. Smathers RL: Personal communication.
**HYPOECHOIC BREAST LESIONS ON ULTRASOUND**

**COMMON**
1. Abscess
2. Carcinoma
3. Cyst, complicated (proteinaceous; punctured by partial needle aspiration; inflammatory; infected; mildly hemorrhagic)
4. Fibroadenoma
5. Fibrocystic change
6. Intramammary lymph node
7. Papilloma
8. Sebaceous cyst

**UNCOMMON**
1. Keratinaceous cyst
2. Lactational adenoma
3. Lymphoma, leukemia
4. Phyllodes tumor (formerly cystosarcoma phyllodes; giant fibroadenoma)
5. Pseudoangiomatous stromal hyperplasia
6. Steatocystoma (simple or complex)
7. Superficial thrombophlebitis (Mondor’s disease)
8. Tubular adenoma

**References**
5. Smathers RL: Personal communication.

---

**HYPERECHOIC OR MIXED ECHOGENICITY BREAST LESIONS ON ULTRASOUND**

**COMMON**
1. Carcinoma (calcified)
2. Fat necrosis (traumatic; postsurgical; postbiopsy scar; idiopathic)
3. Fibroadenoma (calcified)
4. [Metallic or other artifact; biopsy marker; foreign body]
5. “Milk of calcium” crystals in cyst fluid (dependent crystal layer in hyperechoic)
6. Scarring with or without scar calcification
7. Silicone extravasation (leakage or rupture)

**UNCOMMON**
1. Lipoma
2. Cyst, complex (inspissate, hemorrhagic)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**
5. Smathers RL: Personal communication.
Gamut I-16

AXILLARY LYMPHADENOPATHY SEEN ON MAMMOGRAPHY (USUALLY ON MLO VIEW)

COMMON
1. Dermatopathic (psoriasis; rheumatoid arthritis)
2. Lymphoma, leukemia
3. Metastatic disease from breast primary
4. Tuberculosis or fungus disease (may calcify)

UNCOMMON
1. Metastatic disease, other (eg, from melanoma; carcinoma of lung or ovary)

Reference

Gamut I-17

ASYMMETRY OF PECTORALIS MUSCLE ON MAMMOGRAPH (USUALLY ON MLO VIEW)

1. Inadequate or improper positioning
2. Muscular dystrophy
3. Normal variant
4. Poland syndrome (pectoral muscle aplasia-syndactyly)
5. Poliomyelitis
6. Prior surgery injuring pectoralis with atrophy (eg, multiple difficult implant placements and removals with or without silicone extravasation)
7. Stroke
8. Trauma (esp. in childhood)

Reference

Gamut I-18

MAMMOGRAPHY MISTAKES AND PITFALLS FOR RADIOLOGISTS AND PHYSICIANS

1. Reading mammograms under poor viewing conditions:
a. With any room light reflected off films (overhead lights, lamps, hallway, other viewboxes)
b. Without large, good quality magnifier
c. With regular viewbox or dim light source (strong light source needed for mammogram reading)
2. Assuming a lesion is benign (especially a nodule) based on screening films only without proper workup (eg, magnification views or ultrasound).
3. Recommendation for biopsy of benign milk of calcium crystals due to failure to perform true lateral views or magnification views.
4. Mistaking a hypoechoic mass for an anechoic cyst on ultrasound. Many solid lesions including carcinomas can appear as hypoechoic masses with acoustic enhancement.
5. Failure to recommend biopsy for a carcinoma because it was thought to be a benign radial scar.
6. Incomplete or inaccurate assessment of a palpable lesion due to failure to correlate the palpable area with the imaging findings (esp. during ultrasound).
7. Failure to recognize microcalcification pattern of DCIS when there is no associated mass density.
8. Calling a patient back or recommending biopsy for the muscle shadow sometimes seen medially on the CC view (sternalis muscle or medial extension of the pectoralis muscle).
9. Correct assessment of the margins of a nodule or mass as poorly circumscribed, circumscribed, or well circumscribed. Also halo versus moat distinction.
10. Failure to do an axillary view for abnormal lymph nodes during diagnostic workup of a probable carcinoma in the breast.
11. Recommend unnecessary workup or biopsy due to failure to recognize benign axillary or intramammary lymph node characteristics.
12. Failure to make diagnosis of lymphadenopathy due to not looking in axillary region or not recognizing signs of lymph node abnormalities.
13. Failure to spot an early breast cancer developing when
multiple bilateral lesions are present (nodules, calcification clusters, or both).

14. Recommending unnecessary biopsy of post-traumatic or postbiopsy fat necrosis.

15. Attempting to biopsy dermal calcifications due to failure to obtain tangential views.

16. Leaving the tip of the localization wire short or proximal to the lesion due to bad positioning or use of a needle that is insufficiently long.

17. Calling a patient back or recommending biopsy of a lesion which appears to show an interval change on comparison to one prior mammogram when review of older mammograms show the lesion is actually unchanged for years.

18. Recommending biopsy of a complicated cyst because the gauge of the needle used for aspiration was too small and no fluid was drained. Some complicated cysts require an 18 gauge needle and a 10 cc syringe to aspirate thick or inspissated fluid, mucin, or grumous contents.

19. False ultrasound diagnosis of a hypoechoic lesion in the retroareolar region due to shadowing caused by the skin of the nipple and areola.

20. Absent, vague, or indecisive recommendation in written report leading to failure or delay of patient or physician to proceed to the next appropriate procedure. One common example is the ultrasound report which ends with just the impression "complicated cyst" without giving a specific recommendation such as biopsy or aspiration.

21. Failure to call a patient back or recommend biopsy of a lesion which appears to be stable on comparison to prior mammograms over a less than 3 year interval when it is actually an indolent carcinoma (esp. DCIS).

22. Calling a patient back or recommending biopsy for a false microcalcification cluster due to a fingerprint or scratch artifact.

23. Failure to notice unilateral diffuse increase in breast density due to widespread malignancy such as inflammatory carcinoma.

24. Interventional biopsy of the wrong lesion due to the presence of multiple lesions. This most often occurs when a partial field preliminary view is done which happens to make a second area look like the area of concern when actually the area of concern is outside the field of view.

Reference

Multiple Systems: Miscellaneous

DEVELOPING COUNTRIES

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A LISTING OF DISEASES COMMON TO THE TROPICS AND DEVELOPING COUNTRIES BASED ON THE BODY SYSTEM AND ORGAN INVOLVED*

ABNORMALITIES OF THE ALIMENTARY TRACT

**Esophagus**
1. Chagas’ disease (megaesophagus)
2. Fungus diseases (esp. candidiasis)
3. Malignant disease (esp. carcinoma)
4. Schistosomiasis (varices)
5. Tuberculosis
6. Other (eg, corrosive strictures; achalasia; hiatus hernia)

**Stomach**
1. Anisakiasis
2. Ascariasis
3. Fungus diseases (esp. candidiasis)
4. Malignant disease (incl. carcinoma; Burkitt’s lymphoma; Kaposi sarcoma)
5. Schistosomiasis
6. Strongyloidiasis
7. Tuberculosis
8. Other (eg, peptic ulcer disease; gastric outlet obstruction; hiatus hernia)

**Duodenum and Small Bowel**
1. Amebiasis
2. Anisakiasis
3. Angiostrongylia costaricensis
4. Ascariasis
5. Chagas’ disease
6. Fungus diseases (esp. candidiasis; histoplasmosis)
7. Giardiasis
8. Hookworm disease
9. Intestinal capillariosis
10. Kwashiorkor; malnutrition
11. Malignant disease (incl. carcinoma; lymphoma; Burkitt’s lymphoma; Kaposi sarcoma)
12. *Salmonella* infections
13. Schistosomiasis
14. Strongyloidiasis
15. Taeniasis saginata (beef tapeworm)
16. Tropical sprue
17. Tuberculosis
18. Typhoid and paratyphoid fever
19. Other (eg, intestinal obstruction; intussusception; small bowel volvulus, hernia; obstructed hernia)

**Colon**
1. Amebiasis
2. Angiostrongylia costaricensis
3. Ascariasis
4. Bacillary dysentery (shigellosis)
5. Chagas’ disease (megacolon)
6. Fungus diseases; actinomycosis
7. Helminthoma
8. Lymphogranuloma venereum
9. Malignant disease (esp. carcinoma)
10. *Salmonella* infections
11. Schistosomiasis
12. Strongyloidiasis
13. Trichuriasis
14. Tuberculosis
15. Other (eg, intestinal obstruction; intussusception; sigmoid volvulus; hernia; obstructed hernia; polyps)

**Rectum and Anus**
1. Amebiasis
2. Bacillary dysentery (shigellosis)
3. Chagas’ disease
4. Lymphogranuloma venereum
5. Malignant disease (esp. carcinoma)
6. Schistosomiasis
7. Trichuriasis
8. Tuberculosis
9. Other (eg, hemorrhoids; fissures; strictures; recto-vaginal fistulae)

*continued*
Liver
1. Amebiasis
2. Ascariasis
3. Clonorchiasis; opisthorchiasis; fascioliasis
4. Fungus diseases (esp. histoplasmosis; actinomycosis
5. Hydatid disease
6. Kala-azar
7. Kwashiorkor
8. Malignant disease (esp. hepatoma; cholangiocarcinoma; Burkitt’s lymphoma)
9. Pentastomiasis (Armillifer infection)
10. Schistosomiasis
11. Toxoplasmosis
12. Tuberculosis
13. Other (eg, cirrhosis; portal hypertension)

Gallbladder and Biliary Tract
1. Ascariasis
2. Biliary calculi (esp. in hemoglobinopathies)
3. Clonorchiasis; opisthorchiasis; fascioliasis
4. Oriental cholangiohepatitis

Jaundice
1. Ascariasis (esp. in children)
2. Calculi
3. Cirrhosis
4. Clonorchiasis; opisthorchiasis; fascioliasis
5. Hydatid disease
6. Oriental cholangiohepatitis

Spleen
1. Hemoglobinopathies (esp. sickle cell disease; thalassemia)
2. Hydatid disease
3. Kala-azar
4. Malaria
5. Malignant disease (esp. lymphoma,)
6. Melioidosis
7. Pentastomiasis (Armillifer infection)
8. Schistosomiasis
9. Tropical splenic abscess
10. Tropical splenomegaly syndrome
11. Tuberculosis
12. Typhoid and paratyphoid fever

Pancreas
1. Carcinoma
2. Pancreatitis
3. Pancreatic lithiasis

RESPIRATORY TRACT

Nasopharynx, Mouth, Hypopharynx, and Trachea
1. Fungus diseases (esp. zygomycosis; {mucormycosis}; phycomycosis; rhinosporidiosis; rhinoentomophthoromycosis)
2. Malignant disease (eg, postnasal carcinoma; Burkitt’s lymphoma)
3. Noma (cancrum oris)
4. Rhinoscleroma
5. Yaws; syphilis

Lungs
1. Amebiasis
2. Ascariasis
3. Capillariasis philippinensis
4. Fungus diseases
5. Gnathostomiasis
6. Hookworm disease
7. Hydatid disease
8. Malaria (pulmonary edema and shock lung)
9. Malignant disease, primary or metastatic carcinoma; Kaposi sarcoma
10. Melioidosis
11. Paragonimiasis
12. Plague
13. Pneumocystis carinii pneumonia, cytomegalovirus, and other opportunistic infections (esp. in AIDS)
14. Pentastomiasis (Armillifer infection)
15. Schistosomiasis
16. Strongyloidiasis
17. Tropical eosinophilia
18. Tuberculosis; atypical mycobacterial infections
19. Other (eg, bronchiectasis; unusual pneumonias—esp. measles; whooping cough; blackfat lipid pneumonia)

**Mediastinum, Pleura, and Chest Wall**
1. Amebiasis
2. Cysticercosis
3. Dracunculiasis (guinea worm infection)
4. Fungus diseases; actinomycosis; nocardiosis
5. Hydatid disease
6. Malignant disease (incl. Burkitt’s lymphoma; metastatic disease)
7. Melioidosis
8. Paragonimiasis
9. Plague
10. Pentastomiasis (Armillifer infection)
11. Tuberculosis; atypical mycobacterial infections
12. Other (eg, rib and pleural lesions)

**CARDIOVASCULAR SYSTEM**

**Heart**
1. Amebiasis (pneumopericardium after abscess rupture)
2. Aneurysms (subvalvular or idiopathic aortic)
3. Aortitis, idiopathic
4. Burkitt’s lymphoma
5. Cardiomegaly (idiopathic; puerperal)
6. Chagas’ disease
7. Cysticercosis
8. Endomyocardial fibrosis (African myocardiopathy)
9. Hemoglobinopathies
10. Hydatid disease
11. Hypertension, systemic or pulmonary (eg, secondary to schistosomiasis)
12. Kwashiorkor; malnutrition
13. Tuberculosis

**Pericardial Effusion**
1. Amebiasis
2. Hemoglobinopathies
3. Hydatid disease
4. Kaposi sarcoma
5. Malignant disease

**Aorta, Pulmonary Arteries, Peripheral Arteries and Veins**
1. Aneurysms
2. Idiopathic arteritis (Takayasu’s disease)
3. Peripheral vascular disease; idiopathic gangrene; varicose veins
4. Pulmonary embolus and infarction
5. Pulmonary hypertension (secondary to schistosomiasis)

**GENITOURINARY TRACT**

**Kidneys**
1. Calculi
2. Filariasis (with chyluria)
3. Fungus diseases (esp. candidiasis)
4. Hemoglobinopathies (eg, sickle cell disease with papillary necrosis)
5. Hydatid disease
6. Idiopathic arteritis (Takayasu’s disease)
7. Malaria
8. Malignant disease (incl. Burkitt’s lymphoma)
9. Schistosomiasis
10. Tuberculosis

**Ureters and Bladder**
1. Calculi; calcification of ureteral or bladder wall (eg, schistosomiasis; tuberculosis)
2. Fungus diseases (esp. candidiasis)
3. Hydatid disease
4. Malignant disease
5. Schistosomiasis
6. Tuberculosis

**Urethra, Vagina, Penis, Seminal Vesicles, **
**and Prostate**
1. Amebiasis
2. Filariasis; elephantiasis

*(continued)*
3. Lymphogranuloma venereum
4. Malignant disease
5. Rectovaginal and vesicovaginal fistulae
6. Schistosomiasis
7. Tuberculosis
8. Urethral strictures

**CENTRAL NERVOUS SYSTEM**

**Brain and Meninges**
1. African trypanosomiasis
2. Amebiasis
3. Angiostrongylisis cantonensis
4. Cysticercosis
5. Fungus diseases (esp. cryptococcosis)
6. Hydatid disease
7. Malaria
8. Malignant disease
9. Neurotrichinosis
10. Paragonimiasis
11. Schistosomiasis
12. Sparganosis
13. Toxoplasmosis, cytomegalovirus, other opportunistic infections (esp. in AIDS)
14. Tuberculosis

**Spine, Including Paraplegia**
1. Brucellosis
2. Cysticercosis
3. Fungus diseases
4. Hemoglobinopathies
5. Hydatid disease
6. Malignant disease (incl. Burkitt’s lymphoma)
7. Schistosomiasis
8. Spondylitis (eg, typhoid; pyogenic)
9. Syphilis
10. Tetanus
11. Tuberculosis

**Peripheral Nerves**
1. Leprosy

**SOFT TISSUES**

**Soft Tissue Nodules Without Obvious Calcification**
1. Dracunculiasis (guinea worm infection)
2. Filariasis (esp. onchocerciasis)
3. Fungus diseases; mycetoma
4. Gnathostomiasis
5. Hydatid disease
6. Kala-azar
7. Leprosy
8. Malignant disease (esp. Burkitt’s lymphoma; Kaposi sarcoma)
9. Sparganosis
10. Tropical ulcer
11. Tuberculosis
12. Tumoral calcinosis
13. Yaws; syphilis

**Calcifications in the Soft Tissue**
1. Cysticercosis
2. Dracunculiasis (guinea worm infection)
3. Filariasis
4. Hydatid disease
5. Kikuyu bursa
6. Loiasis (*Loa loa*)
7. Medicinal injection sites
8. Onchocerciasis
9. Pentastomiasis (*Armillifer* infection)
10. Sarcocystis
11. Tuberculosis (lymph nodes)
12. Tumoral calcinosis

**Other Soft Tissue Abnormalities (eg, Edema, Inflammation, Ulceration, Malignancy)**
1. Ainhum
2. Amebiasis
3. Cysticercosis
4. Dracunculiasis (guinea worm infection)
5. Filariasis; elephantiasis
6. Fungus diseases; mycetoma
7. Gnathostomiasis
8. Hydatid disease
9. Leprosy
10. Loiasis (*Loa loa*)
11. Lymphogranuloma venereum
12. Malignant disease (eg, Kaposi sarcoma)
13. Melioidosis
14. Noma (cancrum oris)
15. Onchocerciasis
16. Rhinoscleroma
17. Trauma
18. Tropical pyomyositis
19. Tropical ulcer; Buruli ulcer
20. Tumoral calcinosis
21. Yaws; endemic syphilis

Lymphadenopathy (In addition to all the usual “nontropical” diseases, consider the following)
1. Brucellosis
2. Dracunculiasis (guinea worm infection)
3. Filariasis
4. Fungus diseases
5. Kala-azar
6. Leprosy
7. Lymphogranuloma venereum
8. Malignant disease (incl. Burkitt’s lymphoma; Kaposi sarcoma)
9. Plague
10. Tuberculosis; atypical mycobacterial infection
11. Yaws

SKELETON

Skull, Facial Bones, and Spine
1. Brucellosis
2. Cysticercosis
3. Fluorosis
4. Fungus diseases; mycetoma
5. Hemoglobinopathies
6. Hydatid disease
7. Leprosy
8. Malignant disease (incl. Burkitt’s lymphoma)
9. Noma (cancrum oris)
10. Rhinoscleroma
11. Spondylitis (eg, typhoid; pyogenic)
12. Tetanus
13. Tuberculosis
14. Yaws; endemic syphilis

Long Bones, Hands, and Feet
1. Ainhum
2. Brucellosis
3. Fungus diseases (esp. mycetoma)
4. Hemoglobinopathies
5. Hydatid disease
6. Leprosy
7. Malignant disease (incl. Burkitt’s lymphoma; Kaposi sarcoma)
8. Melioidosis
9. Osteomyelitis (eg, salmonella; other pyogenic)
10. Smallpox (residual effects only)
11. Tropical ulcer
12. Tuberculosis
13. Yaws; endemic syphilis
14. Others (eg, anomalies; carpal fusions; congenital hip dislocation; tibia vara)

Arthritis and Other Joint Diseases (Acute, Chronic, Neuropathic)
1. Brucellosis
2. Dracunculiasis (guinea worm infection)
3. Filariasis
4. Fungus diseases
5. Hemoglobinopathies
6. Hydatid disease
7. Leprosy
8. Malignant disease (eg, synovial sarcoma)
9. Smallpox (residual effects only)
10. Tropical “arthritis”
11. Tuberculosis
12. Tumoral calcinosis
13. Yaws; syphilis

* When searching for the differential diagnosis of an abnormal finding on a radiograph of a patient or visitor from the tropics, it will be helpful to consult this list, which refers to the major parasitic, infectious, neoplastic, and other diseases that affect specific organs or systems. When used in conjunction with Gamut J-2, which details the geographic distribution of these diseases, a tentative diagnosis may often be suggested in such a patient.
GEOGRAPHIC DISTRIBUTION OF TROPICAL INFECTIOUS AND PARASITIC DISEASES*

DISEASES FOUND WORLDWIDE THROUGHOUT THE TROPICS AND OCCASIONALLY IN TEMPERATE ZONES

1. AIDS
2. Amebiasis
3. Ascariasis
4. Bacillary dysentery (shigellosis)
5. Brucellosis
6. Cysticercosis
7. Filarial diseases
8. Fungus diseases
9. Giardiasis
10. Hookworm disease
11. Hydatid disease (more common in temperate zones)
12. Kala-azar
13. Kwashiorkor
14. Leprosy
15. Lymphogranuloma venereum
16. Malaria
17. Plague
18. Pyomyositis
19. Schistosomiasis (Bilharziasis)
20. Strongyloidiasis
21. Taeniasis saginata or solium (tapeworm infection)
22. Tetanus
23. Toxoplasmosis
24. Trichinosis (esp. neurotrichinosis)
25. Trichuriasis (whipworm infection)
26. Tropical myositis
27. Tuberculosis
28. Typhoid and paratyphoid fever
29. Yaws and syphilis

WEST INDIES AND CARIBBEAN
Diseases in Worldwide list, plus
1. Tropical sprue

CENTRAL AMERICA, MEXICO, AND PANAMA
Diseases in Worldwide list, plus
1. Angiostrongyloidiasis costaricensis
2. Chagas’ disease
3. Paragonimiasis (rare)
4. Tropical ulcer

SOUTH AMERICA
Diseases in Worldwide list, plus
1. Chagas’ disease
2. Melioidosis (rare)
3. Paragonimiasis (rare)
4. Sparganosis

EAST AFRICA, NORTH AFRICA, ARABIA, AND MIDDLE EAST
Diseases in Worldwide list, plus
1. Dracunculiasis (guinea worm infection)
2. Gnathostomiasis (Israel)
3. Helminthoma
4. Pentastomiasis (Armillifer infection)
5. Smallpox (residual effects only)
6. Sparganosis

WEST AFRICA
Diseases in Worldwide list, plus
1. Dracunculiasis (guinea worm infection)
2. Helminthoma
3. Loiasis
4. Paragonimiasis
5. Pentastomiasis (Armillifer infection)
6. Smallpox (residual effects only)
CENTRAL AND SOUTHERN AFRICA
Diseases in Worldwide list, plus
1. Dracunculiasis (guinea worm infection)
2. Helminthoma
3. Pentastomiasis (Armillifer infection)
4. Smallpox (residual effects only)

INDIA AND SRI LANKA
Diseases in Worldwide list, plus
1. Dracunculiasis (guinea worm infection)
2. Gnathostomiasis
3. Paragonimiasis
4. Pentastomiasis (Armillifer infection)
5. Tropical sprue

ASIA (INCLUDING JAPAN AND THE PACIFIC ISLANDS)
Diseases in Worldwide list, plus
1. Angiostrongyloidiasis cantonensis
2. Anisakiasis (esp. Japan)
3. Clonorchiasis, opisthorchiasis, and other liver fluke diseases; Oriental cholangiohepatitis
4. Gnathostomiasis
5. Intestinal capillarisis
6. Melioidosis (esp. Southeast Asia)
7. Paragonimiasis
8. Pentastomiasis (Armillifer infection) (esp. Philippines)
9. Sparganosis

* This list is arranged alphabetically and the order does not in any way suggest the relative risks or frequencies of the various diseases. If used together with the list of differential diagnoses based on the organ or system involved (Gamut J-1), the possible cause of illness in a traveler or immigrant from the tropics may be suggested. Only infectious and parasitic diseases are listed.

Reference
1. Palmer PES, Reeder MM: The Imaging of Tropical Diseases, with Epidemiological, Pathological and Clinical Correlation. (ed 2) Heidelberg: Springer-Verlag, 2001, pp XIX–XXIV

Gamut J-3-S

DISORDERS ASSOCIATED WITH AMYLOIDOSIS

CHRONIC INFLAMMATORY DISEASES
1. Bronchiectasis
2. Cholecystitis
3. Crohn’s disease
4. Leprosy
5. Osteomyelitis
6. Pyelonephritis
7. Reiter S.
8. Schistosomiasis
9. Syphilis
10. Tuberculosis
11. Ulcerative colitis
12. Whipple’s disease

DERMATOSES
1. Dystrophic epidermolysis bullosa
2. Hidradenitis suppurativa
3. Psoriatic arthritis
4. Stasis ulcer

OTHER CHRONIC DISEASES
1. Collagen disease, (esp. scleroderma; dermatomyositis; lupus erythematosus)
2. Diabetes
3. Paraplegia
4. Rheumatoid arthritis
5. Senility

PLASMA CELL DYSCRASIAS AND NEOPLASIAS
1. Heavy chain disease (Franklin’s disease)
2. Plasma cell myeloma
3. Waldenström’s macroglobulinemia

NEOPLASMS
1. Calcifying odontogenic tumor of Pindborg
2. Hodgkin’s disease

(continued)
3. Medullary carcinoma of thyroid
4. Renal cell carcinoma (hypernephroma)

**HEREDOFAMILIAL DISEASES**
1. Amyloid cardiopathy
2. Amyloid nephropathy
3. Amyloid polyneuropathy
4. Cutaneous amyloid
5. Mediterranean fever

**References**

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**GLYCOPROTEIN STORAGE DISEASES (OLIGOSACCHARIDOSES)**
1. Aspartylglucosaminuria
2. Fucosidosis, types I and II
3. GM\(_1\) gangliosidosis
4. Mannosidosis

* Producing dysostosis multiplex.

**References**

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**MULTIPLE ENDOCRINE NEOPLASIA (MEN) SYNDROMES**

**Men S. Type I (Wermer S.)**

**COMMON (PPP)**
1. **Pancreatic** islet cell tumor or hyperplasia
   (See J-5-S-2)
2. **Parathyroid** neoplasm or hyperplasia
3. **Pituitary** adenoma (microadenoma)

**UNCOMMON**
1. Adrenal cortical hyperplasia or adenoma
2. Carcinoid tumor (gastrointestinal, bronchial, thymic)
3. Thyroid adenoma, hyperplasia, medullary carcinoma
4. Zollinger-Ellison S.

**MEN S. TYPE IIA OR APUDOMA S.**
(Аmine Precursor Uptake and Decarboxylation)

**COMMON (PTA)**
1. **Parathyroid** neoplasm or hyperplasia
2. Thyroid medullary carcinoma
3. Adrenal pheochromocytoma
**Men S. Type IIB (Sipple S.)**

**COMMON (TAG)**
1. Thyroid medullary carcinoma
2. Adrenal pheochromocytoma
3. Ganglioneuromas, multiple (incl. gastrointestinal)

**Men S., Mixed**

**References**
2. Dodd GD: The radiologic features of multiple endocrine neoplasia Type IIA and IIB. Semin Roentgenol 1985;20:64–90

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**Types of Islet Cell Tumor**

1. Gastrinoma
2. Glucagonoma
3. Insulinoma
4. Mixed
5. Somatostatinoma
6. VIPoma (Vasoactive Inhibitory Polypeptide)

**References**
INTRODUCTION

The organization of the MRI gamuts is heavily based on the appearance of lesions on T1- and T2-weighted images. For those readers less familiar with magnetic resonance imaging, let me add that a T1-weighted spin echo image is one with a short repetition time (TR) and a short echo delay time (TE) (which are both operator-selectable imaging parameters). (“Short” in the context of TR is less than 500 msec and “short” in the context of TE is ideally less than 20 msec—for a high-field system—or 30 msec for a low or mid field system.) T1-weighted gradient echo images are acquired with flip angles larger than 45 degrees and echo delay times generally less than 10 msec. If the repetition times are less than 200 msec, then either RF or gradient spoiling should be used. Such T1-weighted gradient echo techniques are known as FLASH (Siemens), SPGR (for spoiled GRASS, GE), or RF-Spoiled FAST (Picker).

T2-weighted spin echo images are those produced with a long TR and a long TE. “Long” in the context of TR is greater than 2000 msec for applications outside the brain at any field strength. For brain imaging, a long TR at 0.5 Tesla (or below) is 2000 msec while above 0.5 Tesla the TR should be in the 2500–3000 msec range for a T2-weighted image. “Long” in the context of TE is generally on the order of 80 msec or greater. While gradient echo images are never truly T2-weighted, there are certain parameter adjustments that can increase the T2 (or, more correctly, T2*) influence on image contrast. These include a long TE (greater than 18 msec), a short TR (less than 100 msec without spoiling), and a low flip angle (less than 30°). (While the low flip angle actually results in proton density weighting, T2 and proton density tend to track together in disease.)

The organization of the MRI gamuts is slightly different than that of the preceding x-ray-based gamuts. The reader is therefore advised to become familiar with the main, organ-systems based organization as well as the suborganization for the brain in Section A prior to extensive use.

A project of this magnitude is rarely the result of one person’s thinking; therefore, I would like to acknowledge a number of unwitting contributors. After an initial “free association” phase, I went through the textbook Magnetic Resonance Imaging (3rd edition) edited by David Stark and myself (Mosby, St. Louis, 1999) in some detail. Thus, I wish to acknowledge the authors of many of the clinical chapters in that textbook who inadvertently contributed to the gamuts that follow. I would like to thank my colleagues, Louis Teresi, MD; John Barrow, DO; and William Mullin, MD, for manuscript editing.

Finally, I owe a great deal of thanks to my personal assistant of 13 years, Kaye Finley, for the untold hours spent in formatting, reformatting, editing, and reorganizing this material. Without her help over many evenings and weekends, this project would not have been possible.

William G. Bradley, Jr., MD, PhD, FACR
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**HEAD AND NECK**

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- **M-134** Absent Bow-Tie Sign in Knee Menisci
- **M-135** Bright Intramedullary Signal on T2-Weighted Image of Knee with Intact Cortex
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- **M-137** Marked Low Signal in Marrow (Diffuse) on T1- and T2-Weighted Images
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### ABDOMEN—PELVIS

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M-141-3  Focal Signal Abnormality in the Liver (Dark on T2-Weighted Image)
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M-153-2  Adrenal Mass (Intermediate Signal on T2-Weighted Image)
M-153-3  Adrenal Mass (Bright on T1-Weighted Image)
<table>
<thead>
<tr>
<th>KIDNEY</th>
<th>M-154-1</th>
<th>Renal Mass (Intermediate Signal Intensity on T2-Weighted Image)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M-154-2</td>
<td>Renal Mass (Bright on T2-Weighted Image)</td>
</tr>
<tr>
<td></td>
<td>M-154-3</td>
<td>Renal Mass (Dark on T2-Weighted Image)</td>
</tr>
<tr>
<td></td>
<td>M-154-4</td>
<td>Renal Mass (Bright on T1-Weighted Image)</td>
</tr>
<tr>
<td>UTERUS</td>
<td>M-155-1</td>
<td>Endometrial Uterine Mass (Very Bright on T2-Weighted Image—Compared with Myometrium)</td>
</tr>
<tr>
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<td>M-155-2</td>
<td>Endometrial Uterine Mass (Intermediate Signal on T2-Weighted Image—Mildly Bright Compared with Myometrium)</td>
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<tr>
<td></td>
<td>M-155-3</td>
<td>Endometrial Uterine Mass (Dark on T2-Weighted Image)</td>
</tr>
<tr>
<td></td>
<td>M-155-4</td>
<td>Endometrial Uterine Mass (Bright on T1-Weighted Image)</td>
</tr>
<tr>
<td></td>
<td>M-156-1</td>
<td>Myometrial Uterine Mass (Bright on T2-Weighted Image)</td>
</tr>
<tr>
<td></td>
<td>M-156-2</td>
<td>Myometrial Uterine Mass (Intermediate on T2-Weighted Image—Increased Signal Compared with Myometrium)</td>
</tr>
<tr>
<td></td>
<td>M-156-3</td>
<td>Myometrial Uterine Mass (Dark on T2-Weighted Image)</td>
</tr>
<tr>
<td></td>
<td>M-156-4</td>
<td>Myometrial Uterine Mass (Bright on T1-Weighted Image)</td>
</tr>
<tr>
<td>ADNEXA</td>
<td>M-157-1</td>
<td>Adnexal Mass (Bright on T2-Weighted Image)</td>
</tr>
<tr>
<td></td>
<td>M-157-2</td>
<td>Adnexal Mass (Dark on T2-Weighted Image)</td>
</tr>
<tr>
<td></td>
<td>M-157-3</td>
<td>Adnexal Mass (Bright on T1-Weighted Image)</td>
</tr>
<tr>
<td>PROSTATE</td>
<td>M-158-1</td>
<td>Prostate Mass (Bright on T2-Weighted Image)</td>
</tr>
<tr>
<td></td>
<td>M-158-2</td>
<td>Prostate Mass (Dark on T2-Weighted Image)</td>
</tr>
<tr>
<td></td>
<td>M-158-3</td>
<td>Prostate Mass (Bright on T1-Weighted Image)</td>
</tr>
</tbody>
</table>
Gamut M-1

ISOINTENSE TO GRAY MATTER ON T1- AND T2-WEIGHTED IMAGES, NONSPECIFIC PARENCHYMAL LOCATION, MASS EFFECT

1. Hamartoma
2. Heterotopic gray matter
3. Meningioma
4. Tuberous sclerosis

References

Gamut M-2

DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, NONSPECIFIC PARENCHYMAL LOCATION, NO MASS EFFECT, NONENHANCING

1. Glioma, low-grade, small
2. Gliomatosis cerebri
3. Gliosis (following trauma; infarction; infection)
4. Multiple sclerosis
5. Shearing injury, bland
6. Tuberous sclerosis

References

Gamut M-3

DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, NONSPECIFIC PARENCHYMAL LOCATION, NO MASS EFFECT, ENHANCING

1. [Flow artifact]
2. Glioma, small
3. Infection, indolent
4. Metastasis, small
5. Multiple sclerosis, acute
6. [Normal vein]
7. Scarring (eg, following surgery)
8. Sterile tissue (eg, tumor following radiation)
9. Vascular malformation, small

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
Gamut M-4

DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, NONSPECIFIC PARENCHYMAL LOCATION, MASS EFFECT, NONENHANCING

1. Acute disseminated encephalomyelitis (ADEM) (postviral leukoencephalopathy)
2. Cerebritis, early
3. Contusion
4. Encephalitis, viral
5. Glioma, low-grade
6. Hemorrhage, hyperacute (dark border on T2-weighted image) (See A-99 and M-4-S-1)
7. Infarction, acute
8. Multiple sclerosis, tumefactive
9. Parasitic disease (*Cysticercus; Paragonimus;* hydatid cyst)

References

Gamut M-4-S1

PARENCHYMAL HEMORRHAGE
(See A-99)

1. Amyloid angiopathy (peripheral location; elderly patients)
2. Aneurysm, ruptured
3. Angioma, cavernous
4. Arteriovenous malformation
5. Infarction, hemorrhagic (embolic; mass effect)
6. Infarction, subacute, hemorrhagic (petechial; no mass effect)
7. Infarction, venous (with dural sinus thrombosis) (See M-4-S3)
8. Postoperative
9. Shearing injury, hemorrhagic (diffuse axonal injury)
10. Trauma
11. Tumor (usually high grade)
12. Vasculitis (See M-4-S4)

Gamut M-4-S2

STAGES OF HEMORRHAGE ON MRI

<table>
<thead>
<tr>
<th>Stage</th>
<th>Time</th>
<th>Compartment</th>
<th>Hemoglobin</th>
<th>T1</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperacute*</td>
<td>0–24 hours</td>
<td>intracellular</td>
<td>oxyhemoglobin</td>
<td>gray</td>
<td>bright</td>
</tr>
<tr>
<td>Acute</td>
<td>1–3 days</td>
<td>intracellular</td>
<td>deoxyhemoglobin</td>
<td>gray</td>
<td>dark</td>
</tr>
<tr>
<td>Early subacute</td>
<td>3–7 days</td>
<td>intracellular</td>
<td>methemoglobin</td>
<td>bright</td>
<td>dark</td>
</tr>
<tr>
<td>Late subacute</td>
<td>7–14 days</td>
<td>extracellular</td>
<td>methemoglobin</td>
<td>bright</td>
<td>bright</td>
</tr>
<tr>
<td>Chronic</td>
<td>14+ days</td>
<td>center</td>
<td>hemichromes</td>
<td>gray</td>
<td>bright</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rim</td>
<td>hemosiderin</td>
<td>gray</td>
<td>dark</td>
</tr>
</tbody>
</table>

* All hyperacute parenchymal hematomas have a deoxyhemoglobin border around them.

References
DURAL SINUS THROMBOSIS

1. Angioma
2. Arteriovenous malformation
3. Antithrombin III deficiency
4. Birth control pills
5. Heart failure
6. Dehydration
7. Disseminated intravascular coagulation (DIC)
8. Infection
9. Lupus anticoagulant
10. Malignant neoplasm invasion
11. Polycythemia vera
12. Pregnancy
13. Sickle cell disease
14. Thrombocytosis
15. Vasculitis, primary

Reference

PROBABLY IMMUNE COMPLEX DESPOSITION MECHANISM

1. Allergic angitis and granulomatosis
2. Connective tissue disease (collagen vascular disease), with vasculitis (eg, lupus erythematosus; polyarteritis nodosa; mixed connective tissue disease {MCTD})
3. Henoch-Schönlein purpura
4. Hypersensitivity vasculitis
5. Hypocomplemenemic vasculitis
6. Malignancy with vasculitis
7. Mixed cryoglobulinemia
8. Necrotizing angitis (eg, polyarteritis nodosa; rheumatic fever; hypersensitivity angitis; giant cell arteritis; temporal arteritis)
9. Serum sickness (or serum sickness-like) vasculitis
10. Systemic necrotizing vasculitis

PROBABLY CELL-MEDIATED MECHANISM WITH ROUND CELL GRANULOMA FORMATION

1. Granulomatous angitis
2. Lymphomatoid granulomatosis
3. Takayasu’s arteritis
4. Wegner’s granulomatosis

MISCELLANEOUS

1. Amphetamine/cocaine abuse
2. Arterial spasm (eg, subarachnoid or cerebral hemorrhage; migraine)
3. Arteriovenous malformation
4. Behçet S.
5. Bowel bypass dermatitis
6. Cerebral thrombosis (eg, sickle cell disease; oral contraceptives)
7. Cogan S.
8. Embolism (eg, subacute bacterial endocarditis; atrial myxoma)
9. Erythema nodosum
10. Idiopathic
11. [Increased intracranial pressure]
12. Infection (eg, herpes, tuberculosis, syphilis–rare)
13. Inflammatory disease of brain (eg, abscess; purulent or tuberculous meningitis)
14. Kawasaki S. (mucocutaneous lymph node S.)
15. Multiple progressive intracranial artery occlusions with telangiectasia (moyamoya)
16. Neurocutaneous syndromes (eg, neurofibromatosis; Sturge-Weber S.; tuberous sclerosis)
17. Radiation therapy
18. Sarcoidosis
19. Thromboangiitis obliterans (Buerger’s disease)
20. Trauma

[ ] This condition does not actually cause the gamutted imaging finding, but can produce imaging changes that simulate it.

(continued)
References

References

Gamut M-5
DARK ON T1-WEIGHTED IMAGE,
BRIGHT ON T2-WEIGHTED IMAGE,
PARENCHYMAL, POSTERIOR PARAMEDIAN LOCATION,
NONENHANCING
1. Cyclosporine toxicity (negative DWI—diffusion weighted imaging)
2. Hypertensive encephalopathy (eg, pre-eclampsia; negative DWI)
3. Infarction of posterior circulation (positive DWI)
4. Thrombosis of superior sagittal sinus (venous infarct)
5. Tuberous sclerosis

Gamut M-6
DARK ON T1-WEIGHTED IMAGE,
BRIGHT ON T2-WEIGHTED IMAGE,
NONSPECIFIC PARENCHYMAL LOCATION, MASS EFFECT,
ENHANCING
CENTRALLY ENHANCING
1. Cerebritis
2. Ganglion cell tumors (rare)
3. Glioma, high grade
4. Lymphoma (primary or metastatic)
5. Metastasis
6. PNET (primitive neuroectodermal tumor)
7. Radiation necrosis

RIM ENHANCING
1. Abscess
2. ADEM (acute disseminated encephalomyelitis) (partial rim)
3. Cysticercosis
4. Lymphoma (occas.)
5. Metastasis (occas.)
6. Multiple sclerosis, tumefactive (partial rim)
7. Paragonimiasis

References
Gamut M-7

DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, SUBEPENDYMAL, NONENHANCING

SMOOTH
1. Edema, centrally tracking vasogenic
2. Interstitial edema
3. [Normal caudate body]
4. Small vessel ischemic change
5. Subependymal demyelination following interstitial edema

LUMPY
1. Hamartomas of tuberous sclerosis
2. Heterotopic gray matter

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut M-8-1

DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, SUBEPENDYMAL, ENHANCING

SMOOTH
1. Subependymal tumor spread, early (See M-8-2)
2. Ventriculitis/ependymitis (eg, cytomegalovirus infection)

LUMPY
1. Giant cell astrocytoma (tuberous sclerosis)
2. Subependymal hamartomas (tuberous sclerosis)
3. Subependymal tumor spread, late (See M-8-2)

Gamut M-8-2

SUBEPENDYMAL TUMOR SPREAD

1. Ependymoma
2. Glioblastoma
3. Lymphoma
4. Medulloblastoma
5. Metastatic disease (eg, carcinoma of breast or lung; melanoma)

Reference
DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, PERIVENTRICULAR, NO MASS EFFECT, NONENHANCING

PATIENT UNDER 40

COMMON
1. ADEM (acute disseminated encephalomyelitis; postviral leukoencephalopathy)
2. AIDS (HIV) encephalitis (See M-10-2)
3. Lupus erythematosus
4. Migraine
5. Multiple sclerosis

UNCOMMON
1. Leukodystrophies (rare) (See M-10-S)
2. Lyme disease
3. Neurofibromatosis type I (spongiform change)
4. [Normal late myelinating fibers (thalamoparietal tracts)]
5. Periventricular leukomalacia
6. Sickle cell disease
7. Subacute sclerosing panencephalitis (SSPE) (rare)

PATIENT OVER 40
1. Marchiafava-Bignami disease (rare)
2. Multiple sclerosis
3. [Normal (ependymitis granularis)]
4. Radiation-induced white matter changes
5. Small vessel ischemic change in deep white matter

NONSPECIFIC WITH RESPECT TO AGE
1. Diffuse necrotizing leukoencephalopathy (DNL)
2. Hamartomas of tuberous sclerosis
3. Heterotopic gray matter
4. Neurofibromatosis
5. Shearing injury

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
PERIVENTRICULAR DISEASE IN AIDS

1. Cytomegalovirus (CMV) infection
2. AIDS (HIV) encephalitis
3. Kaposi sarcoma
4. Lymphoma
5. Progressive multifocal leukoencephalopathy (PML)
6. Toxoplasmosis

LEUKODYSTROPHIES

WITH MACROCEPHALY (IN INFANTS)

1. Alexander’s disease (anterior, sparing of internal capsule, enhances with gadolinium)
2. Canavan’s disease (peripheral to central, early involvement of subcortical U-fibers)

WITH NORMOCEPHALY

1. Adrenoleukodystrophy (males, posterior, enhances with gadolinium)
2. Krabbe’s disease (central to peripheral, non-enhancing)
3. Metachromatic leukodystrophy (central to peripheral, nonenhancing)
4. Pelizaeus-Merzbacher disease (males, central to peripheral, nonenhancing, brain stem atrophy)

DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, PERIVENTRICULAR, MASS EFFECT, NONENHANCING

1. Acute disseminated encephalomyelitis (ADEM) (postviral leukoencephalopathy)
2. Glioma of visual pathway, low grade (neurofibromatosis)
3. Hamartoma (eg, in tuberous sclerosis)
4. Infarction (eg, from vasculitis; sickle cell disease)
5. Multiple sclerosis, tumefactive
6. Porencephalic cysts (porencephaly)

References


DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, PERIVENTRICULAR, MASS EFFECT, ENHANCING

1. Abscess (eg, cytomegalovirus infection; toxoplasmosis; cryptococcosis)
2. Astrocytoma, giant cell (tuberous sclerosis)
3. Glioma of visual pathway, degenerated (neurofibromatosis)
4. Lymphoma
5. Metastasis, parenchymal or intraventricular drop (eg, from glioblastoma)
6. Multiple sclerosis, tumefactive

Reference


(continued)
**Gamut M-13**

**DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, SUBCORTICAL, NO MASS EFFECT, NONENHANCING**

1. Infarction, embolic (See M-13-S)
2. Progressive multifocal leukoencephalopathy (PML)
3. Shearing injury (nonhemorrhagic)
4. Tuberous sclerosis

**Gamut M-13-S**

**CAUSES OF CEREBRAL EMBOLI**

**SOURCE DISTAL TO LUNGS**

1. Embolus (from cardiac mural thrombus; carotid dissection; open heart surgery; angiogram)
2. Infection (eg, infective endocarditis; subacute bacterial endocarditis)
3. Platelet embolus (from ulcerated carotid plaque)
4. Thrombus, cardiac mural
5. Tumor (atrial myxoma; choriocarcinoma; marantic endocarditis)

**SOURCE PROXIMAL TO LUNGS—requires right to left shunt (rare)**

1. Amniotic fluid embolism
2. Fat embolus (following trauma)
3. Thrombus (from inferior vena cava or thrombophlebitis)

**Reference**


**Gamut M-14**

**DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, SUBCORTICAL, NO MASS EFFECT, ENHANCING**

1. Carcinomatosis, leptomeningeal
2. Lymphoma
3. Meningitis
4. Sarcoidosis

**References**


**Gamut M-15**

**DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, SUBCORTICAL, MASS EFFECT, NONENHANCING**

1. Glioma, low grade
2. Heterotopic gray matter
3. Progressive multifocal leukoencephalopathy (PML)

**References**


---

**Gamut M-16**

**DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, SUBCORTICAL, MASS EFFECT, ENHANCING**

1. Abscess
2. Emboli (See M-13-S)
3. Metastasis
4. Multiple sclerosis, acute tumefactive
5. Sarcoidosis

**References**


---

**Gamut M-17**

**DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, CORTICAL, NO MASS EFFECT, NONENHANCING**

1. Gliosis, postbleed
2. Gliosis, postinfarct
3. Gliosis, postinfection
4. Gliosis, postoperative
5. Gliosis, posttraumatic

**References**


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**Gamut M-18**

**DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, CORTICAL, NO MASS EFFECT, ENHANCING**

1. Angiomatosis, leptomeningeal (Sturge-Weber S.)
2. Carcinomatosis, leptomeningeal
3. Infarction, subacute
4. Lymphoma
5. Meningitis

**References**


*(continued)*

Gamut M-19

**COMMON**
1. Cortical dysplasia
2. Glioma, low grade
3. Hamartoma (cortical tuber; tuberous sclerosis)
4. Infarction, acute
5. Vasculopathy, ischemic (eg, lupus erythematosus)

**UNCOMMON**
1. Dysembryoplastic neuroepithelial tumor (DNET)
2. Gangliocytoma
3. Pleomorphic xanthoastrocytoma

References

Gamut M-20

**DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, CORTICAL, MASS EFFECT, ENHANCING**

1. Carcinomatosis, leptomeningeal
2. Infarct, acute (vascular enhancement due to stasis, pial collaterals)
3. Infarct, subacute (gyral enhancement)
4. Meningitis, fungal

References

Gamut M-21

**DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, BASAL GANGLIA**

**COMMON**
1. Infarcts, lacunar
2. Ischemic-anoxic events (eg, near-drowning)
3. Multiple sclerosis
4. Neurofibromatosis type I (spongiform change)

**UNCOMMON**
1. Aminoacidemia
2. Behçet S.
3. Extrapontine myelinolysis
4. Jakob-Creutzfeld disease (nearly isointense on T1WI)
5. Leigh’s disease (necrotizing encephalopathy)
6. MELAS
7. MERRF
8. Methanol intoxication
9. Oligopontocerebellar degeneration
10. Poisoning (eg, carbon monoxide; cyanide; ethylene glycol)
11. Wernicke encephalopathy (alcoholism)

References

Gamut M-22
DARK ON T1-WEIGHTED IMAGE,
BRIGHT ON T2-WEIGHTED IMAGE,
BRAIN STEM, NO MASS EFFECT,
NONENHANCING

1. Amyotrophic lateral sclerosis
2. [CSF flow artifact (rare)]
3. Glioma, small, low-grade
4. Infarct
5. Ischemic change, small vessel (isointense on T1WI)
6. Lupus erythematosus
7. Multiple sclerosis
8. Myelinolysis, central pontine
9. Progressive multifocal leukoencephalopathy (PML)
10. Shearing injury (posterolateral upper brain stem)
11. Wallerian degeneration (eg, secondary to stroke or adrenoleukodystrophy)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
Gamut M-23

DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, BRAIN STEM, NO MASS EFFECT, ENHANCING

1. Capillary telangectasia (may be isointense on T1- and T2-weighted images)
2. Multiple sclerosis, acute
3. Tumor, small (primary or metastasis)
4. Wernicke encephalopathy (alcoholism)

References

Gamut M-24

DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, BRAIN STEM, MASS EFFECT, NONENHANCING

1. Encephalitis
2. Glioma, low-grade
3. Infarct
4. Ramsey Hunt S. (retrograde spread of varicella virus)

References

Gamut M-25

DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, BRAIN STEM, MASS EFFECT, ENHANCING

1. Abscess
2. Behçet S. with encephalitis
3. Encephalitis, brain stem
4. Ependymoblastoma (rare)
5. Ependymoma
6. Glioma of brain stem
7. Lymphoma
8. Metastasis
9. Multiple sclerosis, tumefactive
10. Myelinolysis, acute central pontine
11. Perineural spread of carcinoma (squamous cell and adenoid cystic)
12. Primitive neuroectodermal tumor (PNET)

References
Gamut M-26-1

CEREBELLAR MASS IN A CHILD

1. Astrocytoma, cystic or pilocytic
2. Lhermitte Duclos disease (rare)
3. Medulloblastoma (PNET)

Reference

Gamut M-26-2

CEREBELLAR MASS IN AN ADULT

1. Astrocytoma
2. Hemangioblastoma
3. Metastasis
4. Multiple sclerosis, tumefactive

Reference

Gamut M-27

DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, CRANIAL NERVE, ENHANCING

1. Carcinomatosis, leptomeningeal
2. Neuritis, viral (eg, Bell’s palsy)
3. Perineural spread of carcinoma (eg, squamous cell and adenoid cystic)
4. Schwannoma (neurinoma)

Reference
**Gamut M-29**

**DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, SELLA REGION LESION, ENLARGED PITUITARY STALK, ENHANCING**

1. Carcinomatosis, leptomeningeal (esp. from breast or lung)
2. Langerhans cell histiocytosis
3. Leukemia; lymphoma
4. Meningitis
5. Metastasis (rare)
6. Sarcoidosis

**References**

**Gamut M-30**

**DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, SELLA REGION LESION, HYPOTHALAMIC ORIGIN, NONENHANCING**

1. Glioma, low grade hypothalamic
2. Hamartoma of tuber cinereum (rare: usually iso-intense to brain)

**Reference**

**Gamut M-31**

**DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, SMALL PITUITARY LESION, NONENHANCING**

1. Cyst of pars intermedia
2. Fibrosis
3. Hemorrhage, chronic
4. [Partial volume averaging cavernous carotid artery]
5. Pituitary microadenoma

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**Reference**

**Gamut M-32**

**DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, PINEAL REGION TUMOR**

**PINEAL ORIGIN**
1. [Benign cystic pineal gland]
2. Pineoblastoma
3. Pineocytoma

**GERM CELL ORIGIN**
1. Choriocarcinoma (rare)
2. Embryonal carcinoma (rare)
3. Germinoma (common; usually males)
4. Teratoma

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
Gamut M-33

CSF INTENSITY LESION, PARENCHYMAL DISEASE, NO MASS EFFECT

1. Cryptococcal pseudocysts (early)
2. Cyst, developmental parenchymal
3. Encephalomalacia, macrocystic (following stroke, trauma, bleed, surgery)
4. Marchiafava-Bignami disease (corpus callosum)
5. Mucopolysaccharidosis
6. Myelinolysis, extrapontine
7. Neuroepithelial cyst (eg, choroid fissure)
8. [Perivascular (“Virchow-Robin”) space]
9. Porencephalic cyst

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

Gamut M-34

CSF INTENSITY LESION, PARENCHYMAL DISEASE, MASS EFFECT, NONENHANCING

1. Arachnoid cyst
2. Cryptococcal pseudocysts (late)
3. Cysticercus cyst (alive)
4. Hydatid cyst (alive)
5. Parenchymal cyst

Reference

Gamut M-35

CSF INTENSITY LESION, PARENCHYMAL DISEASE, MASS EFFECT, ENHANCING RIM OR NODULE

1. Cysticercus cyst (dead)
2. Hydatid cyst (dead)
3. Metastasis, cystic (eg, from ovarian carcinoma)

Reference

Gamut M-36

CSF INTENSITY LESION, BRAIN STEM

1. Infarct, old
2. Myelinolysis, central pontine
3. [Perivascular space]
4. Syringobulbia

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference
Gamut M-37

CSF INTENSITY LESION, SELLAR/SUPRASELLAR REGION

1. Arachnoid cyst
2. Cephalocele, sphenoid
3. Empty sella

References

Gamut M-38

CSF INTENSITY LESION, POSTERIOR FOSSA

1. Arachnoid cyst
2. Cysticercosis
3. Dandy-Walker cyst (or variant)
4. Epidermoid
5. Mega cisterna magna
6. Trapped fourth ventricle

References

Gamut M-39

DARK ON T1- AND T2-WEIGHTED IMAGES, NONSPECIFIC LOCATION, NO MASS EFFECT

1. Calcification, esp. from old infection (eg, cysticercosis; tuberculosis; TORCH: toxoplasma, rubella, cytomegalovirus, herpes)
2. Cavernous or venous angioma (hemosiderin from chronic bleeding)
3. Contusion, old hemorrhagic
4. Shearing injury, hemorrhagic, acute (deoxyhemoglobin) or chronic (hemosiderin)

References

Gamut M-40

DARK ON T1- AND T2-WEIGHTED IMAGES, NONSPECIFIC LOCATION, MASS EFFECT

1. Aneurysm, acutely clotted
2. Cavernous angioma, old
3. Chloroma (leukemia)
4. Hemorrhage, acute (intracellular deoxyhemoglobin) (See A-99)
5. Leukoencephalopathy, hemorrhagic (autoimmune)
6. Lymphoma
7. Metastases, hemorrhagic (from carcinoma of breast, lung, kidney or thyroid; choriocarcinoma; melanoma)
8. Metastases, Short T2 (mucinous adenocarcinoma of colon; carcinoma of prostate; melanoma; osteosarcoma)
**Gamut M-41**

**DARK ON T1- AND T2-WEIGHTED IMAGES, CORTICAL, NO MASS EFFECT, NONENHANCING**

1. Infarct, old hemorrhagic (hemosiderin)
2. Siderosis, superficial (following surgery or subarachnoid hemorrhage)

**Reference**


**Gamut M-42**

**DARK ON T1- AND T2-WEIGHTED IMAGES, CORTICAL, NO MASS EFFECT, ENHANCING**

1. Infarction, hemorrhagic (subacute)
2. Metastases, leptomeningeal, hemorrhagic (Short T2)
3. [Vein]
4. Venous angioma

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**Reference**


**Gamut M-43**

**DARK ON T1- AND T2-WEIGHTED IMAGES, CORTICAL, MASS EFFECT**

1. Contusion, acute hemorrhagic (deoxyhemoglobin)
2. Infarction, acute hemorrhagic

**Reference**


**Gamut M-44**

**DARK ON T1- AND T2-WEIGHTED IMAGES, BASAL GANGLIA**

1. Calcification, idiopathic
2. Carbon monoxide poisoning
3. Ferrocalcinosis (eg, hemorrhagic lacunar infarct)
4. Hallervorden-Spatz disease
5. Hemorrhage, acute (intracellular deoxyhemoglobin)
6. Iron deposition following ischemic-anoxic event in child (eg, near-drowning)
7. [Normal ferritin deposition (globus pallidus; putamen)]
8. Parkinson’s plus (eg, Shy-Drager S.; progressive supranuclear palsy)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**

Gamut M-45

DARK ON T1-AND T2-WEIGHTED IMAGES, INTRAVASCULAR

1. Calcific atherosclerosis
2. [Normal flow void]
3. Thrombosis, acute (deoxyhemoglobin)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

Gamut M-46

DARK ON T1- AND T2-WEIGHTED IMAGES, BRAIN STEM

NORMAL STRUCTURES
1. [Corticospinal tracts]
2. [Medial lemnisci]
3. [Medial longitudinal fasciculi]

ABNORMAL
1. Arteriovenous malformation (AVM)
2. Cavernous angioma (hemosiderin)
3. Hemorrhage, acute (eg, from hypertension) (intracellular deoxyhemoglobin)
4. Tortuous basilar or vertebral artery

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut M-47

BRIGHT ON T1- AND T2-WEIGHTED IMAGES, NONSPECIFIC LOCATION

1. Aneurysm, late subacute thrombosis
2. Cavernous angioma (methemoglobin)
3. [Flow artifact]
4. Hemorrhage, late subacute (extracellular methemoglobin) (See A-99, M-4-S-2)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut M-48

BRIGHT ON T1- AND T2-WEIGHTED IMAGES, SELLA REGION

1. Aneurysm, thrombosed cavernous carotid (late subacute hemorrhage)
2. Colloid cyst
3. Craniopharyngioma (cystic)
4. Dermoid (cystic)
5. [Diamagnetic susceptibility artifact]
6. Pituitary hemorrhage, late subacute, esp. Sheehan S. (Simmonds disease) (postpartum pituitary necrosis or following bromocryptine therapy)
7. Rathke cleft cyst

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut M-49

BRIGHT ON T1-WEIGHTED IMAGE, DARK ON T2-WEIGHTED IMAGE,
NONSPECIFIC LOCATION

1. Aneurysm, clotted (early subacute hemorrhage)
2. Calcification (“milk of calcium”)
3. Dermoid
4. [Flow artifact]
5. Hemorrhage, early subacute (intracellular methemoglobin) (See M-4-S2)
6. Lipoma (on conventional spin echo only; bright on T2-weighted fast spin echo)
7. Shearing injury (early subacute)
8. “White” epidermoid (liquid triglyceride)

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut M-50

BRIGHT ON T1-WEIGHTED IMAGE, DARK ON T2-WEIGHTED IMAGE,
PUTAMEN

1. Aluminum toxicity
2. Calcification, idiopathic
3. Hepatic encephalopathy
4. Hyperalimentation
5. Wilson’s disease

Reference

Gamut M-51

BRIGHT ON T1-WEIGHTED IMAGE, DARK ON T2-WEIGHTED IMAGE,
SELLA REGION

1. Dermoid (fatty)
2. Ectopic posterior lobe of pituitary (following distal stalk transection)
3. Lipoma
4. [Normal posterior lobe of pituitary]
5. Pituitary hemorrhage, early subacute (intracellular methemoglobin)
6. “White” epidermoid (liquid triglyceride)

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

(continued)
Gamut M-52

SIGNAL VOID, NONSPECIFIC LOCATION

1. Aneurysm
2. Arteriovenous malformation; venous angioma
3. Bone fragment (posttrauma)
4. Calcification, dense (See M-53-S)
5. Hemosiderin
6. Metallic artifact (eg, aneurysm clip)
7. [Normal vessel (artery; dural sinus)]
8. Pneumocephalus
9. Shunt tube
10. Medullary vein, enlarged
11. Collateral vessels (eg, in basal ganglia due to moyamoya)

[] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut M-53-S

DENSE INTRACRANIAL CALCIFICATION(S) (See A-46–50)

1. Congenital transplacental infection (eg, TORCH [toxoplasma, rubella, cytomegalovirus, herpes]; AIDS)
2. Hemorrhage, old (ferrocalciosis)
3. Infection, old (eg, tuberculosis; cysticercosis; paragonimiasis; syphilis)
4. Tumor, benign (eg, oligodendroglioma)

Reference

Gamut M-54

SIGNAL VOID, SUBEPENDYMAL

1. Arteriovenous malformation; venous angioma
2. Hamartoma, calcified (tuberous sclerosis)
3. Shunt tube

References
**Gamut M-55**

**SIGNAL VOID, SELLA REGION**

1. Aneurysm (cavernous or supraclinoid carotid; basilar tip)
2. Carotid-cavernous fistula
3. “Kissing carotids”
4. Meningioma, densely calcified
5. [Metallic artifact (from clipped aneurysm)]
6. Pneumatized posterior clinoid

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**


**Gamut M-56**

**SMALL VENTRICLES, SMALL SULCI**

1. Edema, diffuse brain
2. [Normal variant]
3. Pseudotumor cerebri

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**Reference**


**Gamut M-57**

**SYMMETRICALLY ENLARGED VENTRICLES, SMALL SULCI**

1. Central atrophy (eg, deep white matter ischemia; near-drowning or other ischemia-anoxia event; chronic multiple sclerosis)
2. Culpocephaly (dilated occipital horns only)
3. Hydrocephalus, communicating, chronic (See A-114, M-57-2)
4. Hydrocephalus, obstructive (See A-114, M-57-3)

**References**


**Gamut M-58-1**

**ASYMMETRICALLY ENLARGED LATERAL VENTRICLES**

1. Dyke-Davidoff-Masson S. (hemiatrophy)
2. Entrapment/obstruction at one foramen of Monro
3. Mesial temporal sclerosis (temporal horn only)
4. Normal variant
5. Paragonimiasis

**Reference**

ENLARGED TEMPORAL HORN (ISOLATED)

1. Entrapment (by atrial mass-unilateral)
2. Mesial temporal sclerosis (usually unilateral, leading to partial complex seizures)

Reference

ENLARGED VENTRICLES, LARGE SULCI

1. Alcoholism
2. Atrophy (due to AIDS; Alzheimer’s disease; chronic multiple sclerosis; radiation therapy; chemotherapy; postinfectious; posttraumatic; global ischemia; dehydration)
3. Catabolic steroids
4. Cushing S.
5. Jakob-Creutzfeldt disease
6. Protein and/or calorie deprivation (eg, starvation; malnutrition; kwashiorkor; anorexia nervosa)

Reference

ABNORMAL VENTRICULAR CONFIGURATION

1. Agenesis of corpus callosum (high-riding third ventricle between lateral ventricles)
2. Asymmetry of lateral ventricles (See M-58-1)
3. Cavum of the velum interpositum (triangular CSF space separating posterior lateral ventricular bodies)
4. Cavum septum pellucidum and vergae (separation of lateral ventricles)
5. Hemimegalencephaly (single, enlarged, misshapen lateral ventricle with surrounding heterotopic gray matter)
6. Holoprosencephaly, alobar and semilobar (single ventricle)
7. Parasitic disease (esp. paragonimiasis; neurocysticercosis)
8. Periventricular leukomalacia (enlarged, irregular lateral ventricles)
9. Schizencephaly (lateral ventricular wall tethered laterally by gray matter-lined cleft)

Reference
Gamut M-61

INTRAVENTRICULAR MASS, CSF INTENSITY

1. Arachnoid cyst
2. “Black” epidermoid (solid cholesterol/cholesterin)
3. Cysticercosis
4. Dandy-Walker cyst or variant (enlarged fourth ventricle)

References

Gamut M-62

INTRAVENTRICULAR MASS, DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, NONENHANCING

1. “Black” epidermoid (solid cholesterol/cholesterin)
2. Colloid cyst (third ventricle)
3. Neuroepithelial cyst (choroid plexus)

Gamut M-63

INTRAVENTRICULAR MASS, DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, ENHANCING

1. Astrocytoma
2. Central neurocytoma (rare)
3. Choroid plexus papilloma or carcinoma
4. Colloid cyst
5. Ependymoma
6. Giant cell astrocytoma (in tuberous sclerosis—increases in size)
7. Hamartoma, subependymal (in tuberous sclerosis—does not increase in size)
8. Meningioma
9. Metastasis to choroid plexus (esp. from carcinoma of lung, colon, or breast; melanoma)
10. Metastasis, intraventricular (eg, spread of high-grade glioma)
11. Subependymoma (rare)

References
**Gamut M-64**

**INTRAVENTRICULAR MASS, DARK ON T1- AND T2-WEIGHTED IMAGES**

1. Glomus of choroid plexus, calcified
2. Hematoma, acute (deoxyhemoglobin)
3. Meningioma, densely calcified

**References**


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**Gamut M-65**

**INTRAVENTRICULAR MASS, BRIGHT ON T1-WEIGHTED IMAGE, DARK ON T2-WEIGHTED CONVENTIONAL SPIN ECHO IMAGE**

1. Dermoid
2. Hemorrhage, early subacute (intracellular methemoglobin)
3. Lipoma
4. Pantopaque
5. Xanthogranuloma of choroid plexus

**References**


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**Gamut M-66**

**INTRAVENTRICULAR MASS, BRIGHT ON T1- AND T2-WEIGHTED IMAGES**

1. Hemorrhage, late subacute (extracellular methemoglobin)
2. Lipoma (fast spin echo)

**References**


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**Gamut M-67**

**INTRAVENTRICULAR SIGNAL VOID**

1. Arteriovenous malformation (AVM)
2. Hyperdynamic CSF flow (communicating hydrocephalus; shunt-responsive normal pressure hydrocephalus)
3. Normal CSF flow (near aqueduct and foramen of Monro)
4. Pneumocephalus (postoperative; posttraumatic)
5. Vein of Galen “aneurysm” (posterior third ventricle)

**References**

Gamut M-68

SUBARACHNOID SPACE LESION,
HYPERINTENSE TO BRAIN ON FLAIR

1. [CSF flow related enhancement]
2. Hemorrhage, acute subarachnoid (protein effect)
3. Meningitis

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut M-69

SUBARACHNOID SPACE LESION,
HYPERINTENSE TO BRAIN ON T1-WEIGHTED IMAGE

1. [CSF flow-related enhancement]
2. Dermoid
3. Hemorrhage, subacute subarachnoid (methemoglobin)
4. Lipoma (eg, cerebellopontine angle)
5. Pantopaque
6. “White” epidermoid (liquid triglyceride)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut M-70

SUBARACHNOID SPACE LESION,
ISOINTENSE TO CSF

1. Arachnoid cyst
2. Cysticercosis (basilar racemose form)

Reference

Gamut M-71

SUBARACHNOID SPACE, SIGNAL VOID

1. [Juxta-arterial CSF dephasing]
2. [Metallic (clip) artifact]
3. [Normal flow in artery]
4. [Normal CSF flow]
5. Third ventriculostomy

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References
**Gamut M-72**

**MASS IN THE CEREBELLOPONTINE ANGLE CISTERN—ENHANCING**

**COMMON**
1. Acoustic schwannoma
2. Meningioma
3. Trigeminal schwannoma (may have “dumbbell” shape with second mass in cavernous sinus)

**UNCOMMON**
1. Aneurysm of vertebral artery
2. Chordoma
3. Exophytic tumor (ependymoma or brain stem glioma)
4. Glomus tumor (jugulare, tympanicum, vagale)

References

**Gamut M-73**

**MASS IN THE CEREBELLOPONTINE ANGLE CISTERN—NONENHANCING**

1. Arachnoid cyst
2. Epidermoid
3. Lipoma

Reference

**Gamut M-74**

**FOCAL LEPTOMENINGEAL ENHANCEMENT**

1. Carcinomatosis, leptomeningeal (eg, from carcinoma of breast or lung; melanoma)
2. Hyperemia, post-ictal
3. Infarction, subjacent acute (leptomeningeal collaterals) or subacute
4. Lymphoma
5. Meningitis, localized (eg, tuberculous)
6. Sarcoidosis
7. Scar, postoperative
8. Vasculitis

References

**Gamut M-75**

**DIFFUSE LEPTOMENINGEAL ENHANCEMENT**

1. Carcinomatosis, leptomeningeal (eg, from carcinoma of breast or lung; melanoma; or ependymoma)
2. Hemorrhage, post-subarachnoid
3. Hypotension, intracranial (after lumbar puncture or CSF leak)
4. Meningitis
5. Sarcoidosis
6. Postoperative (late finding)
7. Posttraumatic (late finding)
References

Gamut M-76
PACHYMENINGEAL (DURAL) NONENHANCING LESION
1. Calcification, dense (black)
2. Meningioma, densely calcified
3. Ossification of falx (black rim, fatty center)

Reference

Gamut M-77
PACHYMENINGEAL (DURAL) ENHANCEMENT
1. Fibrosis, benign meningeal (following shunt, subarachnoid hemorrhage, or surgery)
2. Hypotension, intracranial (after lumbar puncture or CSF leak)
3. Local tumor spread (eg, from glioblastoma)
4. Meningioma, dural tail
5. Meningitis (eg, tuberculous)
6. Metastasis, dural (eg, neuroblastoma)
7. [Normal (esp. at high field with high-dose gadolinium)]

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Gamut M-78
EXTRAAXIAL FLUID COLLECTION, CSF INTENSITY
1. Arachnoid cyst
2. Arachnoid rent, posttraumatic (“subdural hygroma”)
3. Benign external hydrocephalus (immature arachnoidal granulations under age 1)
4. Benign subdural effusions (in neonatal meningitis)
5. Brain atrophy
6. Cysticercosis

References

Gamut M-79
EXTRAAXIAL FLUID COLLECTION, DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE
1. Empyema, subdural/epidural
2. Hematoma, chronic subdural/epidural

Reference
Gamut M-80

EXTRAAXIAL FLUID COLLECTION, DARK ON T1- AND T2-WEIGHTED IMAGES

1. Air, extraaxial (postoperative; posttraumatic)
2. Hematoma, acute subdural/epidural

Reference

Gamut M-81

EXTRAAXIAL FLUID COLLECTION, BRIGHT ON T1- AND T2-WEIGHTED IMAGES

1. Hematoma, early subacute epidural (extracellular methemoglobin)
2. Hematoma, early subacute subdural (intracellular methemoglobin)

Reference

Gamut M-82

EXTRAAXIAL FLUID COLLECTION, BRIGHT ON T1-WEIGHTED IMAGE, DARK ON T2-WEIGHTED IMAGE

1. Hematoma, early subacute epidural (intracellular methemoglobin)
2. Hematoma, early subacute subdural (intracellular methemoglobin)

Reference

Gamut M-83

EXTRAAXIAL MASS, NONENHANCING

1. Arachnoid cyst (dark on diffusion imaging)
2. Epidermoid (bright on diffusion imaging)

Reference

Gamut M-84

EXTRAAXIAL MASS, ENHANCING

1. Hemangiopericytoma of meninges (angioblastic meningioma), rare
2. Meningioma
3. Metastasis to dura
4. Neurofibroma, upper cervical, extending through foramen magnum
5. Schwannoma of cranial nerve (eg, acoustic)
**Gamut M-85**

**EXTRACRANIAL MASS, CSF INTENSITY**

1. Encephalocele
2. Meningocele
3. Pseudomeningocele (postoperative CSF leak)

**Gamut M-86**

**EXTRACRANIAL MASS, DARK ON T1-WEIGHTED IMAGE**

1. Cephalohematoma, acute (dark on T2-weighted image) (intracellular deoxyhemoglobin)
2. Cephalohematoma, chronic (bright on T2-weighted image)
3. Hemangioma
4. Lymphangioma
5. Sebaceous cyst

**Gamut M-87**

**EXTRACRANIAL MASS, BRIGHT ON T1-WEIGHTED IMAGE**

1. Cephalohematoma, subacute (methemoglobin)
2. Lipoma

**Gamut M-88**

**INTRAMEDULLARY LESION, CSF INTENSITY**

1. Cysticercosis
2. Hydromyelia (See M-89-S)
3. Posttraumatic cystic myelomalacia
4. Syringomyelia (See M-89-S)
5. [Truncation artifact]

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**References**

CAUSES OF SYRINGOMYELIA AND HYDROMYELIA

1. Arachnoiditis
2. Chiari I malformation
3. Chiari II (Arnold Chiari malformation)
4. Communicating hydrocephalus
5. Herniation of cerebellar tonsils through foramen magnum due to posterior fossa mass
6. Postinfarction
7. Posttraumatic
8. Spinal stenosis
9. Spondylosis, severe
10. Tumor (rostral or caudal to cyst; intra- or extramedullary)
11. Vascular impression

Reference

INTRAMEDULLARY LESION, DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, NO MASS EFFECT

1. Acute disseminated encephalomyelitis (ADEM) (postviral leukoencephalopathy)
2. Amyotrophic lateral sclerosis
3. Arteriovenous malformation (AVM)
4. [CSF flow artifact]
5. Cord edema (eg, due to herniated disk)
6. Devic’s syndrome (demyelination of cord and optic neuritis)
7. Gliosis
8. HIV myelopathy
9. Lyme disease
10. Multiple sclerosis
11. Nitrous oxide
12. Small glioma
13. Small nonhemorrhagic contusion
14. Subacute combined degeneration (B12 deficiency)
15. Subacute infarct
16. [Truncation artifact]

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

COMMON

1. Acute disseminated encephalomyelitis (ADEM) (postviral leukoencephalopathy)
2. Astrocytoma
3. Contusion, acute
4. Ependymoma
5. Hemangioblastoma
6. Leptomeningeal carcinomatosis (eg, breast)
7. Myelitis, viral
8. Tumefactive multiple sclerosis

UNCOMMON

1. Acute infarct (arterial or venous occlusion)
2. Drop metastasis to central canal (eg, medulloblastoma)
3. Gangliocytoma; ganglioglioma
4. Lymphoma
5. Meningitis, spinal
6. “Pre-syrinx”
7. Radiation necrosis

References

Gamut M-92
POTENTIALLY ENHANCING CORD LESIONS

1. Acute disseminated encephalomyelitis (ADEM) (postviral leukoencephalopathy)
2. Arteriovenous malformation (AVM)
3. Devic’s syndrome (demyelination of cord and optic neuritis)
4. Glioma
5. Hemangioblastoma
6. Leptomeningeal carcinomatosis
7. Lyme disease
8. Lymphoma
9. Metastasis to central canal (eg, medulloblastoma)
10. Multiple sclerosis
11. Subacute infarct
12. Syphilis
13. Tuberculosis
14. Atrophy
15. Collapsed syrinx
16. Cord tethering
17. Cord transection
18. Diffuse multiple sclerosis
19. Juvenile amyotrophy
20. Kyphoscoliosis
21. Post-radiation therapy
22. Postsurgical
23. Primary lateral sclerosis
24. Subacute combined degeneration
25. Wallerian degeneration

References

Gamut M-94
FOCALLY SMALL CORD

1. Bony spinal stenosis
2. Collapsed syrinx
3. Compression due to herniated disk, epidural tumor, or extramedullary mass (eg, arachnoid cyst)
4. Multiple sclerosis
5. Myelomalacia
6. Post-infarct
7. Postsurgical
8. Posttraumatic

Gamut M-93
DIFFUSELY SMALL CORD

1. AIDS myelopathy
2. Amyotrophic lateral sclerosis
Gamut M-95

INTRAMEDULLARY LESION, DARK ON T1- AND T2-WEIGHTED IMAGES, NO MASS EFFECT

1. Focal calcification
2. Hemosiderin (eg, from cavernous angioma or AVM)
3. [Metallic artifact from previous surgery]
4. Osseous spur in diastematomyelia

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Gamut M-96

INTRAMEDULLARY LESION, BRIGHT ON T1- AND T2-WEIGHTED IMAGES

1. Late subacute hematomyelia (extracellular methemoglobin from tumor, AVM, trauma)
2. Tumor cyst

Gamut M-97

INTRAMEDULLARY LESION, BRIGHT ON T1-WEIGHTED IMAGE, DARK ON T2-WEIGHTED IMAGE

1. Early subacute hematomyelia (intracellular methemoglobin from tumor, AVM, trauma)

Gamut M-98

EXTRAMEDULLARY, INTRADURAL LESION WITH CSF INTENSITY

1. Arachnoid cyst
2. Cysticercosis
3. Epidermoid (bright on diffusion imaging)
4. Multicystic arachnoiditis

Gamut M-99

EXTRAMEDULLARY, INTRADURAL LESION, DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, NO MASS EFFECT

1. Cytomegalovirus infection
2. Drop metastases, small
3. [Flow artifact]
4. Fungal meningitis
5. Postradiation (enlarged vessels)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut M-100

EXTRAMEDULLARY, INTRADURAL LESION, DARK ON T1-WEIGHTED IMAGE, BRIGHT ON T2-WEIGHTED IMAGE, MASS EFFECT

NONENHANCING
1. Arachnoiditis, chronic
2. “Black” epidermoid (solid cholesterol/cholesterin) (bright on diffusion imaging)
3. Dermoid (cystic)
4. Hemorrhage, hyperacute
5. Neurenteric cyst

ENHANCING
1. Arachnoiditis, acute
2. Drop metastasis, large
3. Exophytic glioma (apparent extramedullary)
4. Meningioma
5. Neurofibroma
6. Schwannoma

References

Gamut M-101-S

SOURCES OF DROP METASTASES TO SPINAL SUBARACHNOID SPACE

CNS SOURCES

COMMON
1. Astrocytoma
2. Ependymoma
3. Glioblastoma multiforme
4. Medulloblastoma

UNCOMMON
1. Choroid plexus carcinoma
2. Pineoblastoma
3. Pineocytoma
4. Teratoma

NON-CNS SOURCES
1. Metastatic carcinoma of breast
2. Metastatic carcinoma of lung
3. Metastatic lymphoma
4. Metastatic malignant melanoma

Reference
### Extramedullary, Intradural Lesion, Bright on T1-Weighted Image, Dark on T2-Weighted Image*

1. Dermoid (fatty)
2. Fatty filum terminale
3. Lipoma
4. Pantopaque
5. “White” epidermoid (liquid triglyceride)

* Dark on T2-weighted conventional spin echo—bright on T2-weighted fast spin echo.

### Reference


### Extramedullary, Intradural Signal Void

1. Acute hemorrhage (deoxyhemoglobin)
2. Air (eg, post-lumbar puncture)
3. Arteriovenous malformation (AVM)
4. [CSF flow artifact]
5. [Metallic artifact]

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

### Nerve Root Enhancement

1. Arachnoiditis
2. Compression (from disk herniation or spinal stenosis)
3. Cytomegalovirus infection (esp. in AIDS)
4. Fungal meningitis
5. Guillain-Barré S.
6. Leptomeningeal carcinomatosis (“zücherguss”—German: sugar coating)
7. Lymphomatous meningitis
8. [Normal]
9. Postradiation (enlarged vessels)
10. Postoperative
11. Sarcoidosis
12. Tuberculosis
13. Viral neuritis

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

### Enlarged Nerve Roots

1. Charcot-Marie-Tooth S.
2. Déjérine-Sottas S.
3. Guillain-Barré S.
4. Langerhans cell histiocytosis
5. Leptomeningeal carcinomatosis
6. Leukemia
7. Lymphoma
8. Neuritis
9. Neurofibromatosis
10. Sarcoidosis
11. Toxic neuropathy

### Reference

EXTRADURAL LESION WITH NORMAL ADJACENT BONE (See C-63)

AT LEVEL OF DISK ONLY
1. Disk bulge
2. Disk extrusion
3. Disk protrusion
4. Epidural scar (eg, after disk surgery)
5. Marginal osteophyte
6. [Normal epidural veins]
7. [Spondylolisthesis (axial image only)]

NOT NECESSARILY AT LEVEL OF DISK
1. Amyloidosis
2. Arachnoid cyst
3. Arachnoiditis
4. Conjoined root sleeve
5. Epidural abscess
6. Epidural granuloma (eg, tuberculosis; fungus disease; sarcoidosis)
7. Epidural hematoma
8. Epidural lipomatosis (eg, obesity; steroid therapy; Cushing S.)
9. Epidural metastases (eg, lymphoma
10. Extramedullary hematopoiesis
11. Extruded or sequestered disk
12. [Iatrogenic (needle point defect; extradural injection of Pantopaque)]
13. Ligamentum flavum thickening: intraspinal ligament ossification (eg, DISH; primary—esp. in Japanese)
14. Lipoma (spinal dysraphism)
15. Lymphoma
16. Meningioma (with intradural component)
17. Neurogenic tumor (eg, neurofibroma)
18. Parasitic disease (eg, cysticercosis; schistosomiasis)
19. “Pseudomass” at dens due to C1-2 subluxation in rheumatoid arthritis, etc.
20. Retroperitoneal neoplasm extending through intervertebral foramen (eg, neuroblastoma; lymphoma

21. Root sleeve avulsion (pseudomeningocele)
22. Root sleeve diverticulum
23. Root sleeve ectasia
24. Synovial cyst from facet joint
25. Tarlov (perineural) cyst
26. Teratoma; dermoid; epidermoid

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

EXTRADURAL LESION WITH ABNORMAL ADJACENT BONE
(See C-63)

1. Extramedullary hematopoiesis
2. Hydatid disease
3. Langerhans cell histiocytosis (esp. eosinophilic granuloma)
4. Lymphoma
5. Neoplasm of spine, benign or malignant (eg, aneurysmal bone cyst; giant cell tumor; hemangioma; osteoblastoma; osteochondroma; bone sarcoma; multiple myeloma; chordoma) (See C-38-S)
6. Neurogenic tumor (eg, neurofibroma; ganglioneuroma; neuroblastoma)
7. Osseous metastasis with epidural soft tissue extension
8. Osteomyelitis with adjacent cellulitis; epidural abscess or granuloma (esp. tuberculosis; brucellosis; pyogenic)
9. Osteoporosis with fracture and granulation tissue
10. Paget’s disease (uncalcified osteoid)

(continued)
11. Posttraumatic fracture fragment, dislocation, or hematoma
12. Spinal stenosis; spondylosis; spondylolisthesis; osteophyte

References

Gamut M-108

FOCAL VERTEBRAL BODY ABNORMALITY WITH LOW SIGNAL ON T1-WEIGHTED IMAGE, HIGH SIGNAL ON T2-WEIGHTED IMAGE

1. [Flow artifact from aorta or iliac arteries]
2. Fracture, acute
3. GCSF (granulocyte colony stimulating factor) therapy (eg, post bone marrow transplant)
4. Infection (from osteomyelitis or diskitis)
5. Marrow replacement
6. Osseous metastasis
7. Plasmacytoma; multiple myeloma
8. Primary bone tumor (eg, Ewing sarcoma; osteosarcoma; lymphoma)
9. Type I degenerative endplate changes

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

Gamut M-109

FOCAL VERTEBRAL BODY ABNORMALITY WITH HIGH SIGNAL ON T1-WEIGHTED IMAGE, LOW SIGNAL ON T2-WEIGHTED IMAGE

1. Fat island
2. Fatty replacement following radiation
3. Type II degenerative endplate changes

References

Gamut M-110

FOCAL VERTEBRAL BODY ABNORMALITY WITH HIGH SIGNAL ON T1-WEIGHTED IMAGE, HIGH SIGNAL ON T2-WEIGHTED SPIN ECHO IMAGE

1. Fat island on fast/turbo spin echo images
2. Hemangioma

References
Gamut M-111

DIFFUSE VERTEBRAL BODY ABNORMALITIES, BRIGHT ON T1-WEIGHTED IMAGE

1. Aplastic anemia
2. Postradiation
3. Menstruating woman
4. Myelophthisic marrow replacement (eg, Gaucher disease)
5. Normal elderly with osteoporosis
6. Polycythemia vera

[This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.]

Gamut M-112

DIFFUSE VERTEBRAL BODY ABNORMALITIES, INTERMEDIATE INTENSITY ON T1-WEIGHTED IMAGE

1. Anemia
2. Diffuse marrow replacement by tumor (multiple myeloma; diffuse metastatic disease)
3. [Menstruating woman]
4. Myelophthisic marrow replacement (eg, Gaucher disease)
5. [Normal elderly with osteoporosis]
6. Polycythemia vera

Gamut M-113

DIFFUSE VERTEBRAL BODY ABNORMALITIES, DARK ON T1-WEIGHTED IMAGE

1. Hemochromatosis
2. Hemosiderosis
3. Myelofibrosis; myelosclerosis
4. Osteoblastic metastases (eg, carcinoma of prostate or breast)
5. Osteopetrosis
6. Renal osteodystrophy (secondary hyperparathyroidism)

References


Gamut M-114

LESION OF THE GLOBE

BRIGHT ON T2-WEIGHTED IMAGE

COMMON
1. Choroidal metastasis (esp. from carcinoma of breast or lung)
2. Retinal detachment

UNCOMMON
1. Choroidal hemangioma
2. Retinal cyst

DARK ON T2-WEIGHTED IMAGE

COMMON
1. Melanoma (primary or metastatic)
2. Retinoblastoma (child)

UNCOMMON
1. Astrocytic hamartoma
2. Endophthalmitis
3. Glass prosthesis
4. Melanocytoma (benign)
5. Phthisis bulbi
6. Pseudotumor of orbit
7. Sarcoidosis

Reference

OPTIC NERVE/NERVE SHEATH LESION

INTERMEDIATE SIGNAL ON T2-WEIGHTED IMAGE

COMMON
1. Meningioma of optic nerve sheath
2. Optic glioma
3. Optic neuritis

HIGH SIGNAL ON T2-WEIGHTED IMAGE

COMMON
1. Meningioma of optic nerve sheath
2. Optic glioma
3. Optic neuritis

UNCOMMON
1. Dural ectasia

Reference

BRIGHTER THAN FAT ON T2-WEIGHTED IMAGE

COMMON
1. Cavernous hemangioma
2. Dermoid
3. Extraconal meningioma
4. Hematoma following trauma or surgery
5. Lacrimal gland tumor (See B-23)
6. Plexiform neurofibroma
7. Schwannoma

UNCOMMON
1. Bacterial infection
2. Brown tumor of hyperparathyroidism
3. Langerhans cell histiocytosis
4. Lymphangioma
5. Metastasis (children: neuroblastoma, leukemia, Ewing sarcoma; adults: carcinoma of breast or lung)

Reference

RETROBULBAR MASS

ISOINTENSE TO FAT ON T2-WEIGHTED IMAGE

COMMON
1. Dermoid
2. Lacrimal gland tumor (See B-23)
3. Lymphoma
4. Meningioma of optic nerve sheath
5. Pseudotumor of orbit
6. Thyroid orbitopathy (Graves’ disease)

UNCOMMON
1. Amyloidosis
2. Arteriovenous malformation (AVM)

EXTRAOCULAR MUSCLE ENLARGEMENT

ISOINTENSE TO FAT ON T2-WEIGHTED IMAGE

COMMON
1. Acromegaly
2. Infection
3. Pseudotumor of orbit
4. Sarcoidosis
5. Thyroid orbitopathy (bilateral)
6. Venous obstruction

UNCOMMON
1. Amyloidosis
2. Arteriovenous malformation (AVM)
**Gamut M-119**

**ENLARGED SUPERIOR OPHTHALMIC VEIN**

1. Carotid—cavernous fistula (traumatic; dural AVM)
2. [Normal variant]
3. Orbital apex mass
4. Pseudotumor of orbit
5. Thyroid orbitopathy
6. Varix; varicocele; venous angioma

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**Reference**


**Gamut M-120**

**THROMBOSIS OF SUPERIOR OPHTHALMIC VEIN**

1. Adjacent orbital infection
2. Cavernous-sinus thrombosis (secondary to tumor, inflammation, trauma)
3. Dural arteriovenous malformation (AVM)
4. Varix

**Reference**


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**Gamut M-118**

**LATERAL EXTRACONAL LESION**

**BRIGHT ON T2-WEIGHTED IMAGE**

1. Inflammation of lacrimal gland (eg, sarcoidosis—generally bilateral)
2. Metastatic disease
3. Primary tumor of lacrimal gland (benign mixed tumor; adenoid cystic carcinoma; lymphoma g [usually bilateral])

**DARK ON T2-WEIGHTED IMAGE**

1. Extraconal meningioma
2. [Normal lacrimal gland]

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

**Reference**


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**Gamut M-120**

**THROMBOSIS OF SUPERIOR OPHTHALMIC VEIN**

1. Adjacent orbital infection
2. Cavernous-sinus thrombosis (secondary to tumor, inflammation, trauma)
3. Dural arteriovenous malformation (AVM)
4. Varix

**Reference**


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**BRIGHTER THAN FAT ON T2-WEIGHTED IMAGE**

1. Bacterial infection (from adjacent sinus infection)
2. Carotid—cavernous fistula (traumatic; dural AVM)
3. Hematoma
4. Leukemia
5. Lymphangioma
6. Lymphoma g
7. Metastasis (esp. from carcinoma of breast or lung)
8. Rhabdomyosarcoma (child)
9. Trauma

**Reference**

ORBITAL WALL LESION

HYPOINTENSE ON T2-WEIGHTED IMAGE
1. Chondrosarcoma
2. Fibrous dysplasia
3. Langerhans cell histiocytosis
4. Meningioma with hyperostosis
5. Osteoblastic osteosarcoma
6. Osteoma

HYPERINTENSE ON T2-WEIGHTED IMAGE
1. Chondrosarcoma (cystic)
2. Epidermoid
3. Ewing sarcoma
4. Frontonasal encephalocele
5. Giant cell granuloma
6. Giant cell tumor
7. Infection
8. Lymphangioma
9. Lymphomatous
10. Metastatic disease
11. Mucocele
12. Neuroblastoma (child)

SINONASAL MASS
WHEN BONE CHANGES

BRIGHT ON T2-WEIGHTED IMAGE

COMMON
1. Acute infection (sinusitis)
2. Mucous retention cyst
3. Polyp

UNCOMMON
1. Epidermoid
2. Lymphomatous

DARK ON T2-WEIGHTED IMAGE
1. [Air]
2. Dentigerous (follicular) cyst
3. Dried secretions
4. Hemorrhage (acute)
5. Mycetoma (eg, aspergillosis)
6. Osteoma
7. Sinolith
8. Undescended maxillary tooth

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

References
**Gamut M-123**

**SINONASAL MASS WITH BONY REMODELING WITHOUT EROSION**

**COMMON**
1. Mucocele
2. Pyomucocele

**UNCOMMON**
1. Esthesioneuroblastoma
2. Histiocytic lymphoma
3. Inverting papilloma
4. Minor salivary gland tumor
5. Sarcoma
6. Schwannoma

**Reference**

**Gamut M-124**

**SINONASAL MASS WITH BONY EROSION**

**COMMON**
1. Adenoid cystic carcinoma (perineural extension)
2. Angiofibroma (boys)
3. Squamous cell carcinoma (adults)

**UNCOMMON**
1. Adenocarcinoma
2. Extracranial meningioma
3. Minor salivary gland carcinoma (high-grade)

**Reference**

**Gamut M-125**

**VASCULAR SINONASAL MASS WITH FLOW VOIDS**

**COMMON**
1. Juvenile angiofibroma (boys)
2. Metastatic disease (esp. from carcinoma of kidney or thyroid)

**UNCOMMON**
1. Hemangioma
2. Hemangiopericytoma

**Reference**

**Gamut M-126**

**FIBRO-Osseous or Osteogenic Lesion of a Paranasal Sinus**

**DARK ON T2-WEIGHTED IMAGE**
1. Fibrous dysplasia
2. Nonossifying fibroma
3. Ossifying fibroma
4. Osteoma

**BRIGHT ON T2-WEIGHTED IMAGE**
1. Osteoblastoma
2. Osteosarcoma

**Reference**

M. MRI 911
SKULL BASE LESION

BRIGHT ON T2-WEIGHTED IMAGE

COMMON
1. Chondroma; osteochondroma
2. Epidermoid
3. Ewing sarcoma
4. Hemangioma/vascular hamartoma of facial nerve
5. Osseous metastasis
6. Paraganglioma (glomus tympanicum)
7. Schwannoma of fifth and eighth cranial nerves
8. Squamous cell carcinoma extending through basal foramina

UNCOMMON
1. Aneurysmal bone cyst
2. Chordoma
3. Cholesterol granuloma
4. Fibrosarcoma (complicating Paget’s disease; fibrous dysplasia; osteomyelitis; radiation therapy)
5. Giant cell tumor
6. Petrous apicitis
7. Pituitary macroadenoma
8. Plasmacytoma
9. Schwannoma of cranial nerves VII and IX–XII

DARK ON T2-WEIGHTED IMAGE
1. Langerhans cell histiocytosis (child)
2. Meningioma

Reference

SALIVARY GLAND LESION

INTERMEDIATE ON T2-WEIGHTED IMAGE

COMMON
1. Benign mixed tumors (pleomorphic adenomas {most common in superficial lobe of parotid})
2. Epidemic parotitis (mumps)
3. Intraparotid lymphadenopathy (See M-129)
4. Lipoma
5. Mucoepidermoid carcinoma (low grade)
6. Sarcoidosis
7. Schwannoma/neurofibroma
8. Lymphoma (systemic)

UNCOMMON
1. Actinomycosis
2. Acute suppurative sialadenitis
3. Carcinoma (eg, adenocarcinoma; adenoid cystic carcinoma; high-grade mucoepidermoid carcinoma {more often in deep lobe of parotid}; squamous cell carcinoma; undifferentiated carcinoma)
4. Chronic recurrent sialadenitis
5. Chronic sialectasis
6. Lymphoepithelial sialadenopathy
7. Lymphoma (primary)
8. Metastatic disease (from cutaneous squamous cell carcinoma; melanoma; carcinoma of lung, breast, or kidney)
9. Sarcoma
10. Sialolithiasis
11. Syphilis
12. Tuberculosis

Reference

Gamut M-129

INTRAPAROTID LYMPHADENOPATHY

1. AIDS
2. Chronic autoimmune sialadenitis (Sjögren syndrome)
3. Lymphadenitis
4. Metastatic disease
5. Sarcoidosis
6. Toxoplasmosis
7. Tuberculosis

Reference

Gamut M-130

MASS IN THE NECK

INTERMEDIATE ON T2-WEIGHTED IMAGE

COMMON
1. Goiter
2. Jugular thrombophlebitis (acute; early subacute)
3. Lipoma
4. Lymphadenopathy (infectious; metastatic disease; lymphoma)
5. Thyroid adenoma
6. Thyroid carcinoma

UNCOMMON
1. Neuroblastoma (child)
2. Plexiform neurofibroma
3. Teratoma (fatty or solid)

BRIGHT ON T2-WEIGHTED IMAGE

COMMON
1. Abscess
2. Hemangioma
3. Jugular thrombophlebitis (late subacute; chronic)
4. Thyroglossal duct cyst (midline)

UNCOMMON
1. Colloid cyst of thyroid gland
2. Hygroma
3. Laryngocele
4. Lymphocele
5. Paraganglioma (glomus caroticum)
6. Schwannoma
7. Second branchial cleft cyst (lateral)
8. Teratoma (cystic)
9. Thymic cyst
10. Tracheoesophageal cyst

Reference
Gamut M-131

INCREASED SIGNAL IN SUPRASPINATUS TENDON ON PROTON DENSITY-WEIGHTED IMAGE

1. Contusion
2. [Magic angle effect (nonthickened tendon)]
3. [Normal (fat between tendinous insertions)]
4. Tear
5. Tendonitis (thickened tendon)
6. Tendinosis (degeneration)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference

Gamut M-132

INCREASED SIGNAL IN SUPRASPINATUS TENDON ON T2-WEIGHTED IMAGE

1. Partial tear or tendonitis (nondisplaced musculotendinous junction)
2. Posttraumatic contusion
3. Tear (displaced musculotendinous junction)

Reference

Gamut M-133

LINEAR SIGNAL IN KNEE MENISCUS

1. Degeneration
2. Frank tear
3. Intrasubstance tear
4. Postoperative repair (scar)
5. Pitfalls (See M-133-S)

Reference

Gamut M-133-S

PITFALLS INVOLVING POSTERIOR HORN OF LATERAL MENISCUS

1. Magic angle
2. Meniscofemoral ligament insertion
3. Popliteus tendon sheath
4. Posterior ligaments of Humphry and Wrisberg
5. Pulsation artifact from popliteal artery
6. Transverse ligaments
7. Truncation artifact

Gamut M-134

ABSENT BOW-TIE SIGN IN KNEE MENISCI*

1. Bucket handle tear
2. Medial flipped flap tear
3. Osteoarthritis
4. Postoperative
5. Radial tear

* On sagittal MR images of the knee two consecutive body segments of the meniscus should be seen.
Gamut M-135

BRIGHT INTRAMEDULLARY SIGNAL ON T2-WEIGHTED IMAGE OF KNEE WITH INTACT CORTEX

1. Bone bruise (contusion; trabecular fracture)
2. Leukemia
3. Lymphoma
4. Metastasis
5. Osteosarcoma
6. Regional migratory osteoporosis
7. Regrowth of hemopoietic marrow

Reference

Gamut M-136

HIGH INTRAMEDULLARY SIGNAL ON T2-WEIGHTED IMAGE OF KNEE WITH DISRUPTED CORTEX

1. Osteochondritis dessicans (chronic recurrent trauma)
2. Posttraumatic osteonecrosis
3. Spontaneous osteonecrosis
4. Type II bone contusion

Reference

Gamut M-137

MARKED LOW SIGNAL IN MARROW (DIFFUSE) ON T1- AND T2-WEIGHTED IMAGES

1. Granulocyte colony stimulating factor (GCSF) therapy
2. Hemochromatosis
3. Hemosiderosis
4. Myelofibrosis

Gamut M-138

INTRA-ARTICULAR MASS WITH LOW SIGNAL ON T2-WEIGHTED IMAGE

1. Amyloidosis
2. Gout
3. Pigmented villonodular synovitis

Gamut M-139

HOFFA’S FAT PAD MASS IN INFRAPATELLAR REGION

1. Chondroma
2. Ganglion
3. Pigmented villonodular synovitis
4. Synovial osteochondromatosis

Reference
CHRONIC LATERAL ANKLE PAIN

1. Anterolateral impingement
2. Lateral ligament tears
3. Longitudinal split tear of peroneus brevis
4. Loose body
5. Osteoarthritis
6. Sinus tarsi syndrome

FOCAL SIGNAL ABNORMALITY IN THE LIVER (BRIGHT ON T2-WEIGHTED IMAGE)

COMMON
1. Abscess (pyogenic, amebic, fungal, hydatid)
2. Biloma
3. Cholangiocarcinoma
4. Cyst
5. Dilated bile ducts
6. Fibrosis, confluent (usually wedge shaped)
7. [Flow artifact from aorta]
8. Focal nodular hyperplasia
9. Granuloma (eg, sarcoidosis or tuberculosis)
10. Hemangioma (incl. cavernous)
11. Hepatitis (post-radiation)
12. Hepatocellular adenoma
13. Hepatocellular carcinoma
14. Hematoma
15. Hydatid cyst
16. Infarct (usually wedge shaped)
17. Lymphoma
18. Metastasis
19. [Normal portal veins]
20. Peribiliary cyst (cirrhosis)
21. Portal vein thrombosis

UNCOMMON
1. Angiomyolipoma
2. Angiosarcoma
3. Biliary cystadenoma/cystadenocarcinoma
4. Biliary hamartoma
5. Caroli’s disease (saccular biliary dilatation)
6. Ciliated hepatic foregut cyst
7. Extramedullary hematopoiesis
8. Fibrolamellar hepatocellular carcinoma
9. Hemangioendothelioma (children)
10. Hepatoblastoma (children)
11. Hepatic vein thrombosis (Budd-Chiari S.)
12. Inflammatory pseudotumor
13. Mesenchymal hamartoma (children)
14. Regenerative nodules (cirrhosis; Budd-Chiari S.)
15. Undifferentiated (embryonal) sarcoma of liver (children)

References
FOCAL SIGNAL ABNORMALITY IN THE LIVER (BRIGHT ON T1-WEIGHTED IMAGE)

COMMON
1. Abscess
2. [Flow artifact from aorta]
3. Focal fatty infiltration
4. Hematoma, intratumoral (eg, in angiomyolipoma, hepatocellular adenoma, hepatocellular carcinoma, metastasis) or posttraumatic
5. Hepatic vein thrombosis
6. Hepatocellular adenoma
7. Hepatocellular carcinoma
8. Metastasis (esp. from mucin-producing carcinoma of colon, ovary, or pancreas; melanoma; multiple myeloma)
9. Nodule, dysplastic or regenerative
10. Portal vein thrombosis

UNCOMMON
1. Angiosarcoma
2. Angiomyolipoma
3. Biliary cystadenoma/cystadenocarcinoma
4. Cholangiocarcinoma
5. Ciliated hepatic foregut cyst
6. Cyst (hemorrhagic)
7. Hemangioma (>3 cm; heterogeneous)
8. Lipoma
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

FOCAL SIGNAL ABNORMALITY IN THE LIVER (DARK ON T2-WEIGHTED IMAGE)

COMMON
1. Aneurysm of hepatic artery or portal vein
2. [Flow artifact from aorta]
3. Gas
4. Granuloma (eg, sarcoidosis or tuberculosis)
5. Hematoma, acute posttraumatic
6. Intratumoral hemorrhage, acute (in angiomyolipoma, hepatocellular adenoma, hepatocellular carcinoma, or metastasis)
7. Lymphoma
8. Metastasis (esp. treated or from melanoma)
9. Neoplasm (treated)
10. Nodule, siderotic (dysplastic or regenerative)
11. Vascular malformation

UNCOMMON
1. Hepatocellular carcinoma (low grade)
2. Iron deposition (focal)
3. Mesenchymal hamartoma
[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

continued

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Gamut M-142-1

GADOLINIUM ENHANCEMENT CHARACTERISTICS OF FOCAL LIVER LESIONS WITH ABNORMAL SIGNAL—ARTERIAL HYPERENHANCEMENT

COMMON
1. Fibrolamellar hepatocellular carcinoma
2. [Flow artifact from aorta]
3. Focal nodular hyperplasia
4. Hemangioma (peripheral and nodular)
5. Hepatoblastoma (child)
6. Hepatocellular adenoma
7. Hepatocellular carcinoma
8. Metastasis (from carcinoma of breast, kidney, or thyroid; islet cell carcinoma; carcinoid; melanoma)
9. Nodule, dysplastic

UNCOMMON
1. Angiomyolipoma
2. Angiosarcoma
3. Biliary cystadenoma/cystadenocarcinoma
4. Extramedullary hematopoiesis
5. Hemangioendothelioma (child)
6. Inflammatory pseudotumor
7. Lymphoma
8. Nodule, regenerative (Budd-Chiari S.)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

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Gamut M-142-2

GADOLINIUM ENHANCEMENT CHARACTERISTICS OF FOCAL LIVER LESIONS WITH ABNORMAL SIGNAL—PORTAL VENOUS HYPERENHANCEMENT

COMMON
1. Abscess (pyogenic, amebic, fungal, hydatid) (rim enhancement)
2. Cholangiocarcinoma (may be seen best on equilibrium phase)
3. Granuloma (eg, sarcoidosis or tuberculosis)
4. Hemangioma (seen on arterial phase also)
5. Hepatocellular adenoma
6. Hepatocellular carcinoma
7. Lymphoma
8. Metastasis (from carcinoma of colon, lung, ovary, pancreas, prostate, or stomach; also transitional cell carcinoma)
9. [Normal portal veins]

UNCOMMON
1. Biliary hamartoma
2. Fibrosis, confluent (usually wedge-shaped)
3. Focal nodular hyperplasia
4. Mesenchymal hamartoma (child)
5. Nodules, dysplastic or regenerative
6. Undifferentiated embryonal sarcoma of liver (child)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.
GADOLINIUM ENHANCEMENT CHARACTERISTICS OF FOCAL LIVER LESIONS WITH ABNORMAL SIGNAL—NO ENHANCEMENT

COMMON
1. Biloma
2. Cyst, simple hepatic
3. Dilated bile ducts
4. [Flow artifact from aorta]
5. Hematoma
6. Hydatid cyst
7. Infarct
8. Metastasis (treated)
9. Peribiliary cyst
10. Portal vein thrombosis

UNCOMMON
1. Biliary cystadenoma
2. Caroli’s disease (saccular biliary dilatation)
3. Ciliated hepatic foregut cyst
4. Hepatic vein thrombosis (Budd-Chiari S.)

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

FOCAL ARTERIAL OR PORTAL VENOUS ENHANCEMENT IN ISOINTENSE (T1 AND T2) LIVER

Arterial Enhancement

COMMON
1. Focal nodular hyperplasia
2. Vascular shunting (adjacent hypervascular mass; cirrhosis; portal or hepatic venous compression or thrombosis; posttraumatic) (frequently wedge shaped)

UNCOMMON
1. Hepatocellular adenoma
2. Hepatocellular carcinoma

Portal Venous Enhancement

UNCOMMON
1. Lymphoma

References
CENTRAL SCAR IN FOCAL LIVER LESION ON MRI

COMMON
1. Fibrolamellar hepatocellular carcinoma
2. Focal nodular hyperplasia (scar is bright on T2 and shows delayed enhancement)
3. Hemangioma (>3 cm)

UNCOMMON
1. Cholangiocarcinoma
2. Hepatocellular adenoma
3. Hepatocellular carcinoma
4. Metastasis
5. Nodule, regenerative (Budd-Chiari S.)

References

DIFFUSE SIGNAL ABNORMALITY IN THE LIVER (BRIGHT ON T1- AND DARK ON T2-WEIGHTED IMAGES)

COMMON
1. Fatty liver

UNCOMMON
1. Glycogen storage disease

DIFFUSE SIGNAL ABNORMALITY IN THE LIVER (DARK ON T1- AND BRIGHT ON T2-WEIGHTED IMAGES)

COMMON
1. Cirrhosis
2. Infectious hepatitis

UNCOMMON
1. Postradiation hepatitis
DIFFUSE SIGNAL ABNORMALITY IN THE LIVER (DARK ON T1- AND T2-WEIGHTED IMAGES)

COMMON
1. Hemochromatosis
2. Hemosiderosis (multiple transfusions; cirrhosis; anemia with hyperplastic marrow; intravascular hemolysis)

References

PORTAL VEIN THROMBOSIS

COMMON
1. Cholangiocarcinoma
2. Cirrhosis with portal hypertension
3. Compression or obstruction of portal vein by lymphadenopathy or mass
4. Fibrolamellar hepatocellular carcinoma
5. Hepatocellular carcinoma
6. Hypercoagulable states
7. Inflammation secondary to pancreatitis, appendicitis, diverticulitis
8. Sclerosing cholangitis

UNCOMMON
1. Metastasis

References

PERIPORTAL BRIGHT SIGNAL ON T2-WEIGHTED IMAGE

COMMON
1. Bile leak
2. Cholangitis (pyogenic, viral or AIDS)
3. Hemorrhage, posttraumatic
4. Hepatitis, acute or chronic
5. Liver transplant
6. Malignant infiltration (cholangiocarcinoma; leukemia; lymphoma; metastasis)
7. Metastases to porta hepatitis (obstructs lymphatics)
8. Peribiliary cysts (cirrhosis)
9. Portal hypertension
10. Portal vein thrombus
11. Sclerosing cholangitis
12. Vascular resuscitation (posttrauma patients)

UNCOMMON
1. Budd-Chiari syndrome

References
MASS IN THE PORTA HEPATIS

1. Adenocarcinoma of gallbladder
2. Carcinoma of pancreas with direct invasion
3. Cavernous transformation of portal vein
4. Cholangiocarcinoma
5. Choledochal cyst
6. Lymphadenopathy
7. Pancreatic pseudocyst
8. Peritoneal metastasis

References

DILATATION OF BILIARY AND/OR PANCREATIC DUCTS ON MRCP

DILATED INTRAHEPATIC DUCTS

COMMON
1. Calculus, biliary
2. Cholangitis (pyogenic, viral or AIDS)
3. Compression of biliary ducts by lymphadenopathy or mass
4. Neoplasm of biliary ducts
5. Sclerosing cholangitis
6. Stricture of common bile duct (inflammatory; postoperative; posttraumatic)

UNCOMMON
1. Caroli’s disease
2. Primary biliary cirrhosis
3. Recurrent pyogenic cholangitis

DILATED COMMON BILE DUCT AND INTRAHEPATIC DUCTS

COMMON
1. Ampullary stenosis
2. Calculus, biliary (present or recent passage)
3. Cholangitis (pyogenic, viral or AIDS)
4. Choledochal cyst
5.Compression of biliary ducts by lymphadenopathy or mass
6. Neoplasm of pancreas, common duct, or ampulla
7. Pancreatitis, chronic
8. Stricture of distal common bile duct (inflammatory; postoperative; posttraumatic)

UNCOMMON
1. Caroli’s disease
2. Choledochocele
3. Recurrent pyogenic cholangitis
4. Sclerosing cholangitis

DILATED COMMON BILE DUCT, INTRAHEPATIC DUCTS AND PANCREATIC DUCT (“DOUBLE DUCT SIGN”)

COMMON
1. Ampullary stenosis
2. Calculus, biliary (present or recent passage)
3. Intraductal papillary mucinous tumor
4. Neoplasm of pancreas, common duct, or ampulla
5. Pancreatitis, chronic
6. Stricture of distal common bile duct (inflammatory; postoperative; posttraumatic)

UNCOMMON
1. Choledochocele
2. Sclerosing cholangitis

ISOLATED PANCREATIC DUCT DILATATION

COMMON
1. Calculus in pancreatic duct
2. Carcinoma of pancreas
3. Intraductal papillary mucinous tumor
4. Pancreatitis, chronic
5. Stricture of pancreatic duct

UNCOMMON
1. Metastasis
2. Neuroendocrine tumor

References

Gamut M-150
FILLING DEFECT IN THE BILIARY TRACT ON MRCP

COMMON
1. [Air bubble]
2. [Arterial pulsation (band-like)]
3. Blood clot
4. Calculus, biliary
5. Cholangiocarcinoma
6. [Flow artifact, biliary]
7. Pseudocalcium (distal common bile duct)
8. Sludge
9. Stent
10. [Surgical clips; metallic susceptibility]

UNCOMMON
1. Neoplasm, benign (adenoma; cystadenoma; granular cell tumor; neurofibroma)
2. Parasites (Ascaris; Clonorchis; Opisthorchis; Fasciola); remnants of perforated amebic abscess or hydatid cyst

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

References

Gamut M-151-1
INTRALUMINAL GALLBLADDER SIGNAL ABNORMALITY (DARK ON T2-WEIGHTED IMAGE—COMARED WITH LIVER SIGNAL)

COMMON
1. Gallstone
2. Gas
3. Hematoma, posttraumatic
4. Iodinated contrast media
5. Sludge, tumefactive

UNCOMMON
1. Cholecystitis, hemorrhagic
Gamut M-151-2

INTRALUMINAL GALLBLADDER SIGNAL ABNORMALITY (BRIGHT ON T2-WEIGHTED IMAGE—COMARED WITH LIVER SIGNAL)

COMMON
1. Adenomyomatosis
2. Carcinoma of gallbladder
3. Hematoma, posttraumatic
4. Polyp, cholesterol or inflammatory

UNCOMMON
1. Cholecystitis, hemorrhagic
2. Metastasis
3. Neoplasm, benign (adenoma; carcinoid; granular cell tumor; neurofibroma)
4. Neoplasm, other malignant (carcinoid; lymphoma)
5. Xanthogranulomatous cholecystitis

References

Gamut M-152

ABNORMAL SIGNAL IN THE INFERIOR VENA CAVA

COMMON
1. Blood clot
2. Carcinoma with direct invasion of IVC (eg, adrenal, hepatocellular, or renal cell carcinoma)
3. [Flow-related enhancement]
4. IVC filter (eg, for thromboembolism or schistosomiasis)
5. Nephroblastoma with invasion of IVC (child)

UNCOMMON
1. Angiosarcoma
2. Leiomyosarcoma
3. Malignant fibrous histiocytoma

[ ] This condition does not actually cause the gamuted imaging finding, but can produce imaging changes that simulate it.

Reference
Gamut M-153-1

ADRENAL MASS (BRIGHT ON T2-WEIGHTED IMAGE)

COMMON
1. Adrenocortical carcinoma
2. Cyst (posttraumatic or simple)
3. Hemorrhage (newborn or posttraumatic)
4. Metastasis (necrotic)
5. Neuroblastoma
6. Pheochromocytoma

UNCOMMON
1. Adenoma
2. Ganglioneuroma/ganglioneuroblastoma
3. Granuloma (esp. tuberculosis)
4. Hemangioma
5. Myelolipoma

Gamut M-153-2

ADRENAL MASS (INTERMEDIATE SIGNAL ON T2-WEIGHTED IMAGE)

COMMON
1. Adenoma
2. Adrenocortical carcinoma
3. Hyperplasia (due to ectopic ACTH production)
4. Metastasis
5. Myelolipoma
6. Neuroblastoma

UNCOMMON
1. Ganglioneuroblastoma/ganglioneuroma
2. Granuloma (esp. tuberculosis)
3. Lymphoma
4. Pheochromocytoma

Gamut M-153-3

ADRENAL MASS (BRIGHT ON T1-WEIGHTED IMAGE)

COMMON
1. Hematoma (newborn or posttraumatic)
2. Hemorrhage, intratumoral (in adrenocortical carcinoma; adenoma; metastasis; neuroblastoma; pheochromocytoma)
3. Myelolipoma

UNCOMMON
1. Adenoma (mild hyperintensity)

References

Gamut M-154-1

RENAL MASS (INTERMEDIATE SIGNAL INTENSITY ON T2-WEIGHTED IMAGE)

COMMON
1. Adenoma
2. Angiomyolipoma
3. Hematoma
4. Infarction
5. Lymphoma
6. Metastasis
7. Oncocytoma
8. Pyelonephritis
9. Renal cell carcinoma (hypernephroma)
10. Transitional cell carcinoma
11. Wilms’ tumor (child)
UNCOMMON
1. Granulocytic sarcoma (chloroma)
2. Mesoblastic nephroma (child)
3. Nephroblastomatosis
4. Teratoma
5. Xanthogranulomatous pyelonephritis

Gamut M-154-2

RENAL MASS (BRIGHT ON T2-WEIGHTED IMAGE)

COMMON
1. Abscess (renal or perinephric)
*2. Acquired cystic disease of dialysis
3. Angiomyolipoma (esp. with tuberous sclerosis)
4. Adenoma
5. Calyceal diverticulum
*6. Cyst, simple
7. Hemorrhage (posttraumatic or intratumoral)
8. Hydronephrosis
9. Infarction
*10. Parapelvic cyst
11. Polycystic kidney disease
12. Pyelonephritis
13. Renal cell carcinoma (cystic, hemorrhagic or necrotic)
14. Renal vein thrombus
15. Urinoma

Gamut M-154-3

RENAL MASS (DARK ON T2-WEIGHTED IMAGE)

1. Gas
2. Hemorrhage (posttraumatic; intratumoral; hemorrhagic cyst)
3. Leukemic infiltrate
4. Lymphoma

Gamut M-154-4

RENAL MASS (BRIGHT ON T1-WEIGHTED IMAGE)

1. Abscess
2. Angiomyolipoma (fat)
3. Cyst (hemorrhagic or proteinaceous)
4. Hematoma, posttraumatic
5. Hemorrhage, intratumoral (in angiomyolipoma; renal cell carcinoma; Wilms’ tumor)
6. Lymphoma
7. Renal vein thrombus

References

UNCOMMON
*1. Medullary cystic disease
2. Multilocular cystic nephroma

* No enhancement post-gadolinium injection.
**Gamut M-155-1**

**ENDOMETRIAL UTERINE MASS**
(VERY BRIGHT ON T2-WEIGHTED IMAGE—COMPARED WITH MYOMETRIUM)

**COMMON**
1. Carcinoma of endometrium
2. Endometrial hyperplasia
3. Endometrial polyp
4. Endometritis
5. Gestational trophoblastic disease
6. Hematometra
7. Intrauterine pregnancy
8. Obstructed endometrium or cervix with fluid/mucous
9. Pyometra
10. Retained products of conception
11. Tamoxifen changes

**UNCOMMON**
1. Leiomyoma (submucosal with degeneration or edema)

**Gamut M-155-2**

**ENDOMETRIAL UTERINE MASS**
(INTERMEDIATE SIGNAL ON T2-WEIGHTED IMAGE—MILDLY BRIGHT COMPARED WITH MYOMETRIUM)

**COMMON**
1. Carcinoma of cervix
2. Carcinoma of endometrium
3. Endometrial polyp
4. Hematometra

**UNCOMMON**
1. Sarcoma (usually mixed Müllerian tumor)
2. Leiomyoma (submucosal with degeneration or edema)

**Gamut M-155-3**

**ENDOMETRIAL UTERINE MASS**
(DARK ON T2-WEIGHTED IMAGE)

**COMMON**
1. Hematometra, chronic (especially in imperforate hymen or cervical stenosis)
2. Intrauterine device (IUD)
3. Leiomyoma (submucosal)
4. Septate uterus

**UNCOMMON**
1. Tamoxifen changes

**Gamut M-155-4**

**ENDOMETRIAL UTERINE MASS**
(BRIGHT ON T1-WEIGHTED IMAGE)

**COMMON**
1. Carcinoma of endometrium with hemorrhage
2. Endometritis
3. Gestational trophoblastic disease with hemorrhage
4. Hematometra, secondary to obstructed endometrium or cervix (carcinoma; cervical stenosis; obstructed horn in uterine didelphys; imperforate hymen)
5. Retained products of conception with hemorrhage

**UNCOMMON**
1. Leiomyoma (submucosal with hemorrhage)
2. Sarcoma with hemorrhage (usually mixed Müllerian tumor)

* Usually heterogeneous.

**References**

(continued)

Gamut M-156-1

MYOMETRIAL UTERINE MASS
(BRIGHT ON T2-WEIGHTED IMAGE)

*1. Adenomyosis (ectopic endometrial rests or cystic changes)
2. Hematoma
*3. Leiomyoma (with degeneration or edema)
4. Myometritis
5. Postoperative changes
6. Vessels
*7. Sarcoma with necrosis (usually leiomyosarcoma)

Gamut M-156-2

MYOMETRIAL UTERINE MASS
(INTERMEDIATE ON T2-WEIGHTED IMAGE—INCREASED SIGNAL COMPARED WITH MYOMETRIUM)

COMMON
1. Carcinoma of cervix, invasive
2. Carcinoma of endometrium, invasive
*3. Leiomyoma (with degeneration)
4. Lymphoma
*5. Sarcoma with necrosis (usually leiomyosarcoma)

UNCOMMON
1. Metastasis

Gamut M-156-3

MYOMETRIAL UTERINE MASS
(DARK ON T2-WEIGHTED IMAGE)

COMMON
1. Adenomyosis (thickened junctional zone)
2. Contraction of uterus
3. Hematoma
4. Leiomyoma

UNCOMMON
1. Lymphoma
*2. Sarcoma (usually leiomyosarcoma)

Gamut M-156-4

MYOMETRIAL UTERINE MASS
(BRIGHT ON T1-WEIGHTED IMAGE)

COMMON
*1. Adenomyosis (ectopic hemorrhagic endometrial rests)
2. Hematoma
*3. Leiomyoma with hemorrhage

UNCOMMON
1. Lipoleiomyoma
*2. Sarcoma with hemorrhage (usually leiomyosarcoma)

* Usually heterogeneous.

References

Gamut M-157-1

ADNEXAL MASS (BRIGHT ON T2-WEIGHTED IMAGE)

COMMON
1. Clear cell adenocarcinoma
2. Cystadenoma/cystadenocarcinoma (serous or mucinous)
3. Ectopic pregnancy
4. Endometrioid carcinoma
5. Hydrosalpinx
6. Leiomyoma (submucosal or broad ligament, with degeneration or edema)
7. Malignant germ cell tumors
8. Metastasis (from carcinoma of breast, gastrointestinal tract, pancreas, or uterus)
9. Ovarian cyst, simple (corpus luteum; paraovarian; polycystic ovary disease; theca lutein)
10. Ovarian torsion
11. Pyosalpinx
12. Sex cord stromal tumor (granular cell tumor)
*13. Teratoma (mature)
14. Tubo-ovarian abscess
15. Varices

UNCOMMON
*1. Brenner tumor (cystic degeneration)
2. Carcinoma of fallopian tube
*3. Endometrioma
*4. Fibrothecoma (cystic degeneration)
5. Hematosalpinx
6. Struma ovarii

* Usually heterogeneous.

Gamut M-157-2

ADNEXAL MASS (DARK ON T2-WEIGHTED IMAGE)

COMMON
1. Arteriovenous malformation
2. Brenner tumor
3. Endometrioma
4. Leiomyoma (subserosal or broad ligament)
5. Fibrothecoma
*6. Metastasis, Krukenberg subtype (small foci or peripheral dark signal)
7. Ovarian cyst (hemorrhagic)
*8. Teratoma (mature with calcification)

UNCOMMON
1. Hematosalpinx
2. Struma ovarii

* Usually heterogeneous.

Gamut M-157-3

ADNEXAL MASS (BRIGHT ON T1-WEIGHTED IMAGE)

COMMON
1. Cystadenoma/cystadenocarcinoma (mucinous)
2. Ectopic pregnancy with hemorrhage
3. Endometrioma
4. Metastasis (Krukenberg subtype)
5. Ovarian cyst (hemorrhagic)
*6. Ovarian torsion with hemorrhage
7. Pyosalpinx
*8. Teratoma (mature)
9. Tubo-ovarian abscess

* Usually heterogeneous.

(continued)
UNCOMMON
1. Hematosalpinx
2. Leiomyoma (subserosal or broad ligament, with hemorrhage)
*3. Struma ovari

* Usually heterogeneous.

References

Gamut M-158-1

PROSTATE MASS
(BRIGHT ON T2-WEIGHTED IMAGE)

COMMON
1. Abscess
2. Benign prostatic hypertrophy
3. Hematoma (usually post-biopsy)
4. Müllerian duct cyst
5. Prostatitis, acute
6. Retention cyst
7. Utricle cyst

UNCOMMON
1. Adenocarcinoma (high mucin content)

Gamut M-158-2

PROSTATE MASS
(DARK ON T2-WEIGHTED IMAGE)

1. Adenocarcinoma
2. Benign prostatic hypertrophy
3. Calcification
4. Hematoma (usually post-biopsy)
5. Infarction
6. Intraglandular dysplasia
7. Prostatitis, chronic

Gamut M-158-3

PROSTATE MASS
(BRIGHT ON T1-WEIGHTED IMAGE)

COMMON
1. Hematoma (usually post-biopsy)

UNCOMMON
1. Adenocarcinoma (high mucin content)

References
FETAL ABNORMALITIES

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COMMON INDICATIONS FOR OBSTETRICAL ULTRASOUND

1. Confirmation of intrauterine pregnancy and viability
2. Detection of fetal anomalies
3. Detection of placenta previa or abruptio
4. Diagnosis of ectopic pregnancy
5. Estimation of gestational age
6. Evaluation of complicated pregnancy (early)
7. Guidance for amniocentesis, chorionic villus sampling, cordocentesis

Reference

FETAL ANOMALIES DETECTABLE BY ULTRASOUND

FACE AND NECK
1. Cervical teratoma
2. Cleft lip or palate
3. Cyclops
4. Hypertelorism; hypotelorism
5. Lymphangioma (cystic hygroma)

CHEST
1. Cardiac arrhythmias
2. Congenital heart disease
3. Congenital diaphragmatic hernia
4. Mediastinal tumor
5. Pleural effusion

GASTROINTESTINAL TRACT AND ABDOMEN
1. Abdominal cyst (eg, mesenteric, choledochal, gut duplication, ovarian, urachal, or renal cyst; cystic teratoma)
2. Body stalk anomaly (absent umbilicus and cord)
3. Congenital diaphragmatic hernia
4. Esophageal atresia
5. Gastrochisis; omphalocele; Cantrell S.
6. Meconium peritonitis
7. Small bowel obstruction (eg, duodenal, jejunal or ileal atresia or stenosis; annular pancreas)

URINARY TRACT
1. Bladder dilatation (eg, posterior urethral valves)
2. Infantile polycystic kidney disease
3. Megaureter
4. Multicystic dysplastic kidney
5. Prune-belly S. (Eagle-Barrett S.)
6. Renal agenesis (bilateral)
7. Ureteropelvic junction obstruction

SPINE AND EXTREMITIES
1. Dwarfism; other skeletal dysplasias
2. Meningocele; meningomyelocele
3. Osteogenesis imperfecta
4. Sacral agenesis or deformity

(continued)
5. Sacrococcygeal teratoma
6. Vertebral defects; spina bifida

References

LARGE FOR DATES FETUS

COMMON
1. Inaccurate dating
2. Multiple gestation
3. Maternal obesity
4. Maternal diabetes

UNCOMMON
1. Beckwith-Wiedemann syndrome

Reference

SMALL FOR DATES FETUS

FETAL FACTORS
1. Aneuploidy (trisomy; triploidy)
2. Skeletal dysplasias
3. Structural anomalies (syndromes)

MATERNAL FACTORS
COMMON
1. Hypertension
2. Medication (Warfarin; hydantoin {Dilantin}; cytotoxic drugs; isotretinoin)
3. Renal failure
4. Substance abuse

UNCOMMON
1. Collagen vascular disease
2. Cyanotic cardiopulmonary disease
3. Infection (syphilis; viral infections; malaria; Chagas disease; listeria)
4. Thyrotoxicosis

Reference

INTRAUTERINE GROWTH RETARDATION

FETAL OR PLACENTAL FACTORS
1. Chorioangioma of placenta
2. Congenital infection (toxoplasmosis; rubella; cytomegalic inclusion disease; herpes; syphilis)
3. Congenital malformation or syndrome
4. Fetal chromosomal abnormality; trisomy
5. Multiple gestation
6. Placental vascular insufficiency or infarction
7. Twin-to-twin transfusion S.

MATERNAL FACTORS
1. Age below 17 years or over 35 years
2. Maternal illness (eg, cardiovascular disease; renal disease; malnutrition; anemia)
3. Substance abuse (drugs; alcohol; tobacco)
Gamut O-6

FAILURE OF FETAL HEAD TO ENGAGE DURING LABOR

FETAL FACTORS
1. Hydrops, hydrocephalus, or other fetal deformity
2. Low-lying placenta
3. Multiple gestation
4. Umbilical cord twist or shortening

MATERNAL FACTORS
1. Cephalopelvic disproportion
2. Distended bladder or rectum
3. Extrauterine pregnancy
4. Pelvic neoplasm or cyst
5. Spondylolisthesis; ischial spine prominence; other pelvic girdle deformity
6. Uterine malformation; persistent uterine contraction ring

Reference

Gamut O-7

FETAL CRANIAL DEFORMITY

COMMON
1. Anencephaly
2. Cephalocele
3. Exencephaly
4. Fetal demise
5. Microcephaly
6. Open neural tube defect

UNCOMMON
1. Cloverleaf skull deformity (Kleeblatt-Schädel anomaly)
2. Craniosynostosis (See A-1)
3. Limb-body wall complex (body stalk anomaly)
4. Osteogenesis imperfecta

Reference

Gamut O-8

FETAL BRAIN—MIDLINE CYSTIC MASS

COMMON
1. Agenesis of corpus callosum
2. Aneurysm of Vein of Galen
3. Dandy-Walker malformation
4. Holoprosencephaly

UNCOMMON
1. Arachnoid cyst
2. Cystic neoplasm

Reference
Gamut O-9

FETAL BRAIN—LATERAL OR ASYMMETRICAL CYSTIC MASS

COMMON
1. Arachnoid cyst
2. Choroid plexus cyst
3. Porencephaly
4. Schizencephaly

UNCOMMON
1. Cystic neoplasm
2. Hydrocephalus (unilateral)
3. Intracranial hemorrhage

Reference

Gamut O-10

FETAL VENTRICULOMEGALY (HYDROCEPHALUS)

COMMON
1. Agenesis of corpus callosum
2. Aqueductal stenosis
3. Cephalocele
4. Dandy-Walker malformation
5. Holoprosencephaly
6. Hydranencephaly
7. Open neural tube defect (Arnold-Chiari II malformation)

UNCOMMON
1. Achondroplasia
2. Acrocephalosyndactyly (Apert type)

3. Fragile X S
4. Intracranial mass (brain neoplasm; arachnoid cyst)
5. Lissencephaly
6. Meckel-Gruber S
7. Nasal-facial-digital S
8. Osteogenesis imperfecta
9. Osteopetrosis (Albers Schönberg disease)
10. Posthemorrhagic
11. Postinflammatory
12. Roberts S
13. Smith-Lemli-Opitz S
14. Thanatophoric dysplasia
15. Trisomy 13 S
16. Trisomy 18 S
17. Vein of Galen aneurysm
18. Walker-Warburg S

Reference

Gamut O-11

MASSIVE FETAL INTRACRANIAL FLUID COLLECTIONS

1. Alobar holoprosencephaly
2. Hydranencephaly
3. Massive hydrocephalus

Reference
Gamut O-12

FETAL INTRACRANIAL CALCIFICATIONS

COMMON
1. Cytomegalovirus infection in utero
2. Herpes simplex type II infection in utero
3. Toxoplasmosis infection in utero

UNCOMMON
1. Brain tumor
2. Rubella infection in utero (congenital rubella S.)

Reference

Gamut O-13

STRAIGHT FETAL SPINE

COMMON
1. Abdominal pregnancy
2. Breech presentation
3. Hydramnios; anencephaly
4. Hydrops fetalis
5. Multiple gestation
6. Placental abnormality (enlarged or malpositioned)

UNCOMMON
1. Fetal abdominal mass (eg, Wilms’ tumor; infantile polycystic kidneys; hydronephrosis; hepatic tumor)
2. Maternal pelvic mass (eg, uterine fibroids)
3. Meconium peritonitis

References

Gamut O-14

FETAL NECK MASS

COMMON
1. Hydrops fetalis
2. Lymphangioma (cystic hygroma)
3. Nonfused amnion (1st trimester)
4. Nuchal cord

UNCOMMON
1. Branchial cleft cyst
2. Cephalocele
3. Goiter
4. Hemangioendothelioma
5. Hemangioma
6. Iniencephaly
7. Meningomyelocele (cervical)
8. Neuroblastoma
9. Nuchal thickening (Down S.)
10. Teratoma (cervical)
11. Twin sac of blighted ovum

References

Gamut O-15

FETAL CHEST MASS

COMMON
1. Bronchogenic cyst
2. Congenital diaphragmatic hernia
3. Cystic adenomatoid malformation

(continued)
4. Hydrothorax
5. Neurenteric cyst
6. Sequestration of lung

**UNCOMMON**
1. Bronchial atresia
2. Neuroblastoma
3. Rhabdomyoma
4. Teratoma

**References**

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**Gamut O-16**

**FETAL CARDIAC MASS**

**UNCOMMON**
1. Aneurysm of foramen ovale
2. Fibroma
3. Hemangioma
4. Myxoma
5. Rhabdomyoma
6. Teratoma
7. Thickening of chordae tendineae

**Reference**

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**Gamut O-17**

**NONVISUALIZATION OF FETAL STOMACH**

**COMMON**
1. CNS disorder
2. Diaphragmatic hernia
3. Esophageal atresia
4. Normal (empty stomach)
5. Oligohydramnios

**UNCOMMON**
1. Facial clefts
2. [Situs inversus]

**Reference**

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**Gamut O-18**

**ECHOCGENIC FETAL BOWEL**

**COMMON**
1. Artifact (excessive gain)
2. Normal variant (2nd trimester)
3. Trisomy 21 S. (Down S.)

**UNCOMMON**
1. Blood in amniotic fluid
2. Cytomegalovirus infection
3. Meconium ileus (cystic fibrosis)

**Reference**
Gamut O-19

FETAL HEPATOSPLENOMEGALY

COMMON
1. Congenital transplacental infection (toxoplasmosis; rubella; cytomegalovirus; herpes; hepatitis)
2. Fetal anemia
3. Heart failure
4. Hydrops fetalis

UNCOMMON
1. Beckwith-Wiedemann S.
2. Leukemia
3. Metastatic neuroblastoma
4. Neoplasm of liver or spleen (eg, hepatoblastoma; hemangioendothelioma)

Reference

Gamut O-20-1

FETAL CYSTIC ABDOMINAL MASS

COMMON
1. Choledochal cyst
2. Cystic renal disease (eg, multicystic dysplastic kidney; infantile polycystic kidney disease)
3. Hepatic cyst
4. Hydronephrosis/hydroureter
5. Ovarian cyst

UNCOMMON
1. Anterior sacral meningocele
2. Hydrometrocolpos
3. Intestinal atresia
4. Meconium pseudocyst
5. Megacystic-microcolon-hypoperistalsis syndrome
6. Mesenteric or omental cyst
7. Sacrococcygeal teratoma
8. Splenic cyst
9. Umbilical vein varix
10. Urachal cyst
11. Ureterocele
12. Urinoma

Reference

Gamut O-20-2

FETAL CYSTIC ABDOMINAL MASS—UPPER ABDOMEN

RIGHT UPPER QUADRANT
1. Choledochal cyst
2. Hepatic cyst

LEFT UPPER QUADRANT
1. Splenic cyst

Gamut O-20-3

FETAL CYSTIC ABDOMINAL MASS—MID ABDOMEN AND POSTERIOR (RENAL)

POSTERIOR RENAL
1. Hydronephrosis
2. Renal cyst
3. Urinoma

(continued)
MID-ABDOMEN
1. Meconium pseudocyst
2. Mesenteric cyst
3. Omental cyst
4. Umbilical vein varix

LOWER ABDOMEN AND PELVIS
COMMON
1. Hydrometrocolpos
2. Ovarian cyst
3. Ureterocele
4. Urachal cyst

UNCOMMON
1. Anterior sacral meningocele
2. Sacrococcygeal teratoma

Reference

Gamut O-21
FETAL INTRA-ABDOMINAL CALCIFICATIONS

COMMON
1. Meconium peritonitis

UNCOMMON
1. Cholelithiasis
2. Congenital viral infection (cytomegalovirus; varicella; rubella; toxoplasmosis)
3. Hepatic infarction
4. Tumor (hemangioma; hepatoblastoma; teratoma; neuroblastoma)

Reference

Gamut O-22
LARGE FETAL ABDOMEN DURING LAST TRIMESTER

COMMON
1. Ascites (incl. urine ascites) (See O-23)
2. Edema, generalized (eg, hemolytic disease; hydrops fetalis; maternal diabetes)
3. Hydronephrosis, massive
4. Polycystic kidneys

UNCOMMON
1. Gastrointestinal neoplasm or cyst
2. Hepatic neoplasm (eg, hepatoblastoma; hemangiendothelioma) or cyst (eg, polycystic liver disease)
3. Hydrometrocolpos
4. Neuroblastoma
5. Ovarian tumor or cyst (eg, teratoma)
6. Prune-belly S. (Eagle-Barrett S.)
7. Wilms’ tumor

Reference

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Gamut O-23

FETAL ASCITES

COMMON
1. Dead fetus
2. Heart failure, fetal (eg, atroventricular shunt; arrhythmia; myocardial disorder; coarctation or interruption of aorta; placental tumor)
3. Hydrops fetalis (with pleural and/or pericardial effusions and skin edema)
4. Idiopathic
5. Posterior urethral valves with bladder outlet obstruction (urine ascites)
6. [Pseudoascites]
7. Rh isoimmunization

UNCOMMON
1. Biliary atresia
2. Intestinal obstruction with perforation (eg, atresia; stenosis; volvulus)
3. Turner S.
4. Twin to twin transfusion S.
5. Viral infection (eg, cytomegalovirus)

References

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Gamut O-24

FETAL ANTERIOR ABDOMINAL WALL DEFECT

COMMON
1. Gastroschisis
2. Normal bowel herniation (8th–12th weeks)
3. Omphalocele; Cantrell S.

UNCOMMON
1. Allantoic cyst
2. Beckwith-Wiedemann S.
3. Ectopia cordis
4. Exstrophy of bladder
5. Exstrophy of cloaca
6. Limb-body wall complex (body stalk anomaly)
7. Omphalomesenteric cyst
8. Urachal cyst

References

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Gamut O-25

FETAL SKIN THICKENING (DIFFUSE HYPERTRICHOSIS)

COMMON
1. Hydrops fetalis
2. Lymphangiectasis (eg, Turner S.)

(continued)
UNCOMMON
1. Fetal akinesia deformation sequence (Pena-Shokeir S. type I)
2. Myotonic dystrophy
3. Thanatophoric dysplasia

Reference

OLIGOHYDRAMNIOS

COMMON
1. Fetal distress
2. Fetal malformations, other
3. Intrauterine growth retardation (IUGR) (See O-5)
4. Normal (reduction in amniotic fluid late in pregnancy; postmaturity)
5. Polycystic renal disease (infantile or adult)
6. Posterior urethral valves
7. Premature rupture of membranes
8. Prune-belly S. (Eagle-Barrett S.)
9. Renal agenesis (bilateral)
10. Renal or bladder obstruction

UNCOMMON
1. Caudal regression S.
2. Cytogenetic-triploidy S.
3. Idiopathic
4. Impending fetal death
5. Multicystic dysplastic kidneys (bilateral)
6. Trisomies
7. Urethral agenesis

References

Gamut O-26

Gamut O-27-1

FETAL ABNORMALITIES ASSOCIATED WITH POLYHYDRAMNIOS

CENTRAL NERVOUS SYSTEM
1. Anencephaly
2. Cephalocele
3. Encephalocele; meningocele
4. Hydrocephalus; hydranencephaly
5. Porencephalus; hydranencephaly

GASTROINTESTINAL
1. Biliary atresia
2. Diaphragmatic hernia
3. Duodenal obstruction (atresia; annular pancreas)
4. Esophageal atresia
5. Gastrochisis
6. Omphalocele

CARDIOVASCULAR
1. Chorioangioma of placenta
2. Coarctation or interruption of fetal aorta
3. Fetal anemia
4. Fetal arteriovenous fistulas
5. Myocardial abnormalities; cardiac dysrhythmias
6. Twin-twin transfusion in monochorionic twins

MISCELLANEOUS
1. Chest or abdominal mass, other (eg, pancreatic cyst)
2. Congenital chylothorax
3. Fetal hydrops
4. Idiopathic

Gamut O-26

Gamut O-27-1
5. Mesonephric nephroma
6. Multicystic dysplastic kidneys
7. Pulmonary hypoplasia
8. Short limb dwarf syndromes (eg, thanatophoric dysplasia; asphyxiating thoracic dysplasia {Jeune S.})
9. Teratoma (sacroccocygeal or cervical)
10. Trisomy 18 S.

References

MATERNAL FACTORS ASSOCIATED WITH POLYHYDRAMNIOSES

1. Diabetes mellitus
2. Heart failure
3. Idiopathic
4. Pre-eclampsia
5. Rh incompatibility
6. Syphilis

THICKENED PLACENTA

COMMON
1. Hydrops (nonimmune)
2. Maternal diabetes mellitus
3. Maternal or fetal anemia
4. Normal variant
5. Rh isoimmunization

UNCOMMON
1. Beckwith-Wiedemann S.
2. Congenital fetal anomaly
3. Hydatidiform mole
4. Infection
5. Maternal heart failure
6. Neoplasm of uterus (chorioangioma)
7. Placental hemorrhage
8. Sacrococcygeal teratoma
9. Triploidy; other chromosomal abnormalities

Reference
Gamut O-30

SOLID PLACENTAL MASS

COMMON
1. Chorioepithelioma (chorioangioma)

UNCOMMON
1. Teratoma

Gamut O-31

HYPOECHOIC PLACENTAL LESIONS

COMMON
1. Gestational trophoblastic disease (eg, hydatiform mole)
2. Intervillous thrombosis
3. Maternal lake
4. Mature placenta
5. Normal subplacental complex
6. Septal cyst
7. Subchorionic lake

UNCOMMON
1. Choriangioma
2. Circumvallate placenta
3. Hematoma
4. Infarct
5. Metastasis
6. Perivillous or subchorionic fibrin deposition
7. Subchorionic thrombosis
8. Teratoma

* Anechoic or hypoechoic intraplacental collection, usually of no clinical significance.

References

Gamut O-32

RETROPLACENTAL MASS

1. Abruptio placentae
2. Leiomyoma (fibroid) of uterus
3. Retroploental hematoma
4. Submembranous hematoma

Reference

Gamut O-33

UMBILICAL CORD ENLARGEMENT OR MASS

COMMON
1. Hydrops (diffuse swelling)
2. Knotted umbilical cord
3. Localized deposition of Wharton’s jelly
4. Thrombosis of umbilical vessels
5. Umbilical cord angioma
6. Umbilical cord cyst

UNCOMMON
1. Teratoma
2. Umbilical artery aneurysm
3. Umbilical vein varix

References
**Gamut O-34-S**

**RADIOLOGICAL SIGNS OF INTRAUTERINE PREGNANCY (FIRST TRIMESTER)**

1. Double decidual sign
2. Fetal pole with uterine cavity
3. Gestational sac with yolk sac within endometrial cavity
4. Intradecidual sign

**Gamut O-35**

**ENDOMETRIAL FLUID COLLECTION WITH POSITIVE BETA HCG**

1. Decidual cyst (ectopic pregnancy)
2. Gestational sac (intrauterine pregnancy)
3. Missed abortion
4. Pseudogestational sac (ectopic pregnancy)

**Gamut O-36**

**OVARIAN MASS IN PREGNANCY**

**COMMON**

1. Corpus luteum cyst (1st trimester)
2. Dermoid cyst of ovary
3. Endometrioma
4. Hemorrhagic corpus luteum cyst
5. Torsion of ovary

**UNCOMMON**

1. Malignant ovarian neoplasm

Reference

## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADEM</td>
<td>Acute disseminated encephalomyelitis</td>
<td>ie</td>
<td>That is</td>
</tr>
<tr>
<td>AIDS</td>
<td>Acquired immune deficiency syndrome</td>
<td>incl</td>
<td>Including</td>
</tr>
<tr>
<td>ANGIO</td>
<td>Angiography, arteriography</td>
<td>IUD</td>
<td>Intrauterine device</td>
</tr>
<tr>
<td>AP</td>
<td>Anteroposterior</td>
<td>IUGR</td>
<td>Intrauterine growth retardation</td>
</tr>
<tr>
<td>APVC</td>
<td>Anomalous pulmonary venous connection, total (T) or partial (P)</td>
<td>IVC</td>
<td>Inferior vena cava</td>
</tr>
<tr>
<td>ARDS</td>
<td>Adult respiratory distress syndrome</td>
<td>L</td>
<td>Left</td>
</tr>
<tr>
<td>ASD</td>
<td>Atrial septal defect</td>
<td>LA</td>
<td>Left atrium</td>
</tr>
<tr>
<td>AV</td>
<td>Atrioventricular (communis or canal)</td>
<td>LLL</td>
<td>Left lower lobe</td>
</tr>
<tr>
<td>AVM</td>
<td>Arteriovenous malformation</td>
<td>LUL</td>
<td>Left upper lobe</td>
</tr>
<tr>
<td>CABG</td>
<td>Coronary artery bypass graft</td>
<td>LV</td>
<td>Left ventricle</td>
</tr>
<tr>
<td>CHF</td>
<td>Congestive heart failure</td>
<td>MCTD</td>
<td>Mixed connective tissue disease</td>
</tr>
<tr>
<td>CNS</td>
<td>Central nervous system</td>
<td>MRI</td>
<td>Magnetic resonance imaging</td>
</tr>
<tr>
<td>COPD</td>
<td>Chronic obstructive pulmonary disease</td>
<td>Occas</td>
<td>Occasionally</td>
</tr>
<tr>
<td>CPPD</td>
<td>Calcium pyrophosphate dihydrate crystal deposition disease</td>
<td>PA</td>
<td>Posteroanterior</td>
</tr>
<tr>
<td>CREST S.</td>
<td>Calcinos-Raynaud’s-sclerodactyly-telangiectasia</td>
<td>PDA</td>
<td>Patent ductus arteriosus</td>
</tr>
<tr>
<td>CSF</td>
<td>Cerebrospinal fluid</td>
<td>PEEP</td>
<td>Positive end-expiratory pressure</td>
</tr>
<tr>
<td>CT</td>
<td>Computed tomography</td>
<td>PIE</td>
<td>Pulmonary infiltrate with eosinophilia (a clinical entity almost exclusively of young women)</td>
</tr>
<tr>
<td>DIP</td>
<td>Distal interphalangeal (joint)</td>
<td>PIP</td>
<td>Proximal interphalangeal (joint)</td>
</tr>
<tr>
<td>DISH</td>
<td>Diffuse idiopathic skeletal hyperostosis</td>
<td>PML</td>
<td>Progressive multifocal leukoencephalopathy</td>
</tr>
<tr>
<td>eg</td>
<td>For example</td>
<td>PNET</td>
<td>Primitive neuroectodermal tumor</td>
</tr>
<tr>
<td>g</td>
<td>Consult Glossary</td>
<td>PS</td>
<td>Pulmonary stenosis</td>
</tr>
<tr>
<td>GI</td>
<td>Gastrointestinal</td>
<td>pulm</td>
<td>Pulmonary</td>
</tr>
<tr>
<td>GU</td>
<td>Genitourinary</td>
<td>R</td>
<td>Right</td>
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<tr>
<td>GYN</td>
<td>Gynecology</td>
<td>RA</td>
<td>Right atrium</td>
</tr>
<tr>
<td>HADD</td>
<td>Hydroxyapatite deposition disease</td>
<td>RLL</td>
<td>Right lower lobe</td>
</tr>
<tr>
<td>HIV</td>
<td>Human immunodeficiency syndrome</td>
<td>RML</td>
<td>Right middle lobe</td>
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<tr>
<td>IHSS</td>
<td>Idiopathic hypertrophic subaortic stenosis</td>
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<tr>
<td>Abbreviation</td>
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<tr>
<td>RUL</td>
<td>Right upper lobe</td>
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<tr>
<td>RV</td>
<td>Right ventricle</td>
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<tr>
<td>S</td>
<td>Syndrome</td>
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<tr>
<td>SVC</td>
<td>Superior vena cava</td>
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</tr>
<tr>
<td>TORCH</td>
<td>Toxoplasmosis, rubella, cytomegalovirus, herpes simplex transplacental fetal infections</td>
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<tr>
<td>US</td>
<td>Ultrasound</td>
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<tr>
<td>VATER S.</td>
<td>Vertebral (or vascular) anomalies; anal anomalies (or auricular defects); tracheoesophageal fistula; esophageal atresia (or ring), renal anomalies (or radial defects, rib anomalies)</td>
<td></td>
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</tr>
<tr>
<td>VSD</td>
<td>Ventricular septal defect</td>
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</tbody>
</table>
GLOSSARY

ABSCESS, ABDOMINAL Abdominal wall, appendiceal, flank, greater or lesser sac, hepatic, pancreatic, psoas, renal, splenic, subhepatic, subphrenic, tuboovarian

ALVEOLAR PATTERN See CONSOLIDATION PATTERN

ANEMIA, PRIMARY Erythroblastosis, hemolytic anemia, pyruvate kinase deficiency, sickle cell disease and variants, spherocytosis, thalassemia and variants

ANEURYSM Arteriosclerotic, dissecting, false, mycotic, poststenotic, syphilitic, berry, fusiform, saccular

ANGIOMA Arteriovenous malformation, cirrhotic aneurysm, hemangioma (incl. capillary and cavernous), lymphangioma, varices

ARDS Adult respiratory distress syndrome, shock lung, respirator lung, adult hyaline membrane disease, and many other synonyms: A confusing term, widely used and poorly defined, associated with widespread pulmonary involvement

ARTERIOSCLEROTIC HEART DISEASE Coronary artery disease

ARTERIOVENOUS MALFORMATION (AVM) See Angioma

BLEEDING OR CLOTTING DISORDER Anticoagulant effect, coagulopathy (eg, disseminated intravascular coagulation {DIC}), hemophilia, Christmas disease, leukemia, purpura (eg, Henoch-Schönlein), thrombocytopenia

BRONCHOGENIC OR BRONCHIAL CYST OF LUNG A cyst containing air and/or fluid, lined by respiratory mucosa. Unrelated to mediastinal bronchogenic cyst

CONNECTIVE TISSUE DISEASE (COLLAGEN VASCULAR DISEASE) Rheumatoid disease, lupus erythematosus, scleroderma, dermatomyositis, polyarteritis nodosa, mixed connective tissue disease (MCTD), CREST syndrome (calcinosis-Raynaud’s-sclerodactyly-telangiectasia), Sjögren’s syndrome

CONSOLIDATION PATTERN Alveolar pattern, airspace pattern, peripheral airways pattern: identified by fluffy margins, early coalescence, air bronchogram or alveologram, and butterfly distribution

DUPLICATION (BRONCHOGENIC OR ENTERIC) CYST OF MEDIASTINUM Bronchogenic, enteric, or neurenteric cyst: a congenital cyst related to anomalous foregut development. Unrelated to bronchogenic cyst of lung (bronchial cyst)

EOSINOPHILIC LUNG DISEASE Acute eosinophilic pneumonia, idiopathic Löffler syndrome; chronic eosinophilic pneumonia; hypereosinophilic syndrome, PIE (pulmonary infiltrate with eosinophilia), drug-induced, parasite-induced (tropical pulmonary eosinophilia), fungus induced, eosinophilic lung disease with connective tissue disease and/or vasculitis

FAT EMBOLISM Incl. diffuse embolization of fatty bone marrow (after fracture), amniotic fluid, or oily contrast medium

FUNGUS DISEASE Aspergillosis, blastomycosis, coccidiomycosis, cryptococcosis (torulosis), moniliasis (candidiasis), histoplasmosis, paracoccidiomycosis (South American blastomycosis), sporotrichosis, zygomycosis (mucormycosis). Actinomycosis and nocar-
diosis have been reclassified as gram-positive bacteria, resembling fungi.

GASTROINTESTINAL STROMAL TUMOR Fibroma, leiomyoma, neurofibroma, and their sarcomatous counterparts.

GLYCOGEN STORAGE DISEASE von Gierke (Type I), Pompe (Type II), Cori (Type III), McArdle (Type V)

HAMARTOMA A benign nodule composed of mature cells that normally occur in the affected part. In the lung it is usually a slow-growing chondroma, sometimes called a hamartochondroma.

HYDROCARBON ASPIRATION Aspiration of furniture polish, gasoline, kerosene, lighter fluid, turpentine

HYPOPLASTIC LEFT HEART SYNDROME Includes aortic stenosis or atresia, cor triatriatum, hypoplastic aorta, hypoplastic left ventricle, interrupted aortic arch, infantile coarctation, severe mitral stenosis or atresia

IATROGENIC Instrumentation; catheterization; intubation; endoscopy; biopsy; instillation of fluid, blood, or drugs

IMMUNOLOGIC DISORDERS AIDS, agammaglobulinemia (Bruton S.) or dysgammaglobulinemia, ataxia-telangiectasia S., Bloom S., DiGeorge S., chronic granulomatous disease of childhood, Job S.

INTERSTITIAL FIBROSIS Synonyms: end-stage (honeycomb) lung, fibrosing alveolitis, Hamman-Rich syndrome, idiopathic interstitial fibrosis, muscular cirrhosis of the lung, usual interstitial pneumonitis (UIP)

LANGERHANS CELL HISTIOCYTOSIS Eosinophilic granuloma, Hand-Schüller-Christian disease, Letterer Siwe’s disease (nonlipid histiocytosis), formerly called histiocytosis X

LIPOID PNEUMONIA Mineral oil granuloma, oil aspiration pneumonia, paraffinoma

LYMPHOMA Includes Burkitt’s lymphoma, Hodgkin’s disease, non-Hodgkin’s lymphoma, leukemia (all varieties, including chloroma), pseudolymphoma, Sezary syndrome, angioimmunoblastic lymphadenopathy

MASS Tumor, neoplasm, cyst, abscess, hematoma, aneurysm, hernia

MEDIASTINITIS Mediastinal abscess, cellulitis, edema, fibrosis, granuloma, phlegmon, acute mediastinitis, chronic sclerosing (fibrosing) mediastinitis

MUCOPOLYSACCHARIDOSES Also mucolipidoses and other lysosomal storage diseases (See Gamut J-4)

MUSCULAR DISORDERS Duchenne muscular dystrophy, myasthenia gravis, muscular dystrophy, myotonic dystrophy, myotonia congenita, oculopharyngeal myopathy, steroid or thyrotoxic myopathy, visceral myopathy, other myopathies, myotonias, and myositis (See also NEUROLOGIC AND NEUROMUSCULAR DISORDERS)

NEOPLASMS, BENIGN Adenoma, chemodectoma, chondroma, endometrioma, hamartoma, hemangioma, hemangiopericytoma, lipoma, polyp, pseudotumor, teratoma (See also SPINDLE CELL TUMOR)

NEUROGENIC NEOPLASM Ganglioneuroma and paragangliomeuroma, ganglioneuroblastoma, neurilemma, neuroblastoma, neurofibroma, neurosarcoma, schwannoma (neurinoma)

NEUROLOGIC AND NEUROMUSCULAR DISORDERS Alzheimer’s disease, amyotonia congenita (Oppenheim disease), amyotrophic lateral sclerosis, brain damage, bulbar or pseudobulbar palsy, cerebral palsy, Duchenne syndrome, meningomyelocele, multiple sclerosis, parkinsonism, poliomyelitis, paraplegia, quadriplegia, stroke, syringomyelia, Werdnig-Hoffmann disease (infantile spinal muscular atrophy) (See also MUSCULAR DISORDERS)

PARALYTIC DISORDER Bulbar paralysis, paraplegia, peripheral paralysis, poliomyelitis, quadriplegia

PARASITIC DISEASES WITH IMAGING CHANGES Amebiasis, armillifer infestation, anisakiasis, ascariasis, capillariasis, Chagas’ disease (trypanosomiasis), clonorchiasis, cysticercosis, dirofilariasis (heartworm), filariasis, giardiasis, guinea worm infestation, hookworm disease, hydatid disease (echinococcosis), loiasis, malaria, paragonimiasis, schistosomiasis, strongyloidiasis, taeniasis, toxoplasmosis, tropical pulmonary eosinophilia (microfilaria)

PNEUMOCONIOSIS WITH CONGLOMERATE MASS Silicosis, coal-worker’s pneumoconiosis, asbestosis

PNEUMONIA Pneumonia, common bacterial (Actinomyces, E. coli, H. influenzae, Klebsiella, Legionella, Mycoplasma, plague, Pseudomonas, staphylococcal, streptococcal); actinomycosis; nocardiosis pneumonia; common viral (eg, chickenpox, Coxsackie, cy-
tomegalovirus, ECHO virus, influenza, measles) pneumonia; common parasitic (Pneumocystis carinii, amebiasis, ascariasis, paragonimiasis, strongyloidiasis, toxoplasmosis, tropical pulmonary eosinophilia (microfilaria) pneumonia, chlamydial (eg, psittacosis) pneumonia; rickettsial (eg, Rocky Mountain spotted fever, Q fever)

PRIMITIVE NEUROECTODERMAL TUMOR (PNET)
Cerebellar medulloblastoma, ependymoblastoma, medulloepithelioma, pigmented medulloblastoma, supratentorial PNET (cerebral neuroblastoma, pineoblastoma)

PSEUDOTUMOR (OF LUNG), INFLAMMATORY
Synonyms: Organized pneumonia, fibroxanthoma, plasma cell granuloma, sclerosing hemangioma

POLYP
Adenomatous, eosinophilic, hamartomatous, hyperplastic, inflammatory (fibrous, granulomatous), juvenile, papilloma, villous

SPINDLE CELL TUMOR
Fibroma, leiomyoma, neurofibroma, rhabdomyoma, and their malignant counterparts

TETRALOGY OF FALLOT
Includes also pentalogy of Fallot (tetralogy of Fallot plus ASD), pseudotruncus arteriosus, pulmonary atresia with VSD and systemic pulmonary collateral arteries, trilogy of Fallot (pulmonary stenosis with ASD)

THYROID MASS
Adenoma, carcinoma, goiter, intrathoracic goiter (substernal, retrosternal), struma, thyroiditis, ectopic thyroid tissue

VASCULAR RING
Aberrant right subclavian artery, double aortic arch, right aortic arch types I and II

WEGENER’S GRANULOMATOSIS
Includes also bronchocentric granulomatosis, Churg and Strauss or other granulomatosis, hypersensitivity angitis of Zeek, lymphomatoid granulomatosis, midline lethal granuloma
References

The following books and articles provided invaluable source material in the preparation of this book. Their excellent lists and tables formed a nucleus for many gamuts.

GENERAL REFERENCES
CONGENITAL SYNDROMES
AND BONE DYSPLASIAS

SECTION A: SKULL AND BRAIN

SECTION B: HEAD AND NECK

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