**Introduction**

Cirrhosis of the liver refers to scarring of the liver which results in abnormal liver function as a consequence of chronic (long-term) liver injury. Cirrhosis is a leading cause of illness and death in the United States. In the United States, approximately 5.5 million people (2% of the U.S. population) are affected by cirrhosis. Cirrhosis causes 26,000 deaths each year and is the seventh leading cause of death in the United States among adults between the ages of 25 and 64. It is expected that the number of people affected by cirrhosis will continue to increase in the near future.

Cirrhosis of the liver is a consequence of long-term liver injury of many types. While excess alcohol use and chronic infection with hepatitis viruses (such as hepatitis B and hepatitis C) are the most common causes of cirrhosis in the United States, cirrhosis can be caused by other conditions including fatty liver disease, inherited disorders, drug-induced injury, bile duct disorders and autoimmune diseases. Some patients may have more than one cause for cirrhosis (such as alcohol excess and viral hepatitis). A large portion of patients (up to 20%) do not have an identifiable cause for cirrhosis. This is known as *cryptogenic cirrhosis*.

**What is the Function of the Liver?**

Blood from the digestive system (stomach, intestines) passes through the liver on its way back to the heart. The liver is the largest internal organ and is involved in many complex metabolic functions essential to life.

- The liver extracts nutrients from the blood and processes them for later use.
- The liver makes bile, which is used by the digestive system to help absorb fat and certain vitamins.
- The liver also removes medications and toxic waste-products from the blood and excretes them into bile.
- The liver is the body’s main factory for blood proteins, including the proteins involved in normal blood clotting function. Your doctor may check blood clotting tests (prothrombin time or INR) as a measure of your liver function.
How Does Cirrhosis Develop?
There are many causes of liver injury such as excessive alcohol consumption, viruses, inherited disorders, drug-related injury and environmental toxin exposure. Injury to the liver leads to inflammation which may be detected by abnormalities in liver-related blood tests. Over time, ongoing injury leads to the development of scar tissue in the liver, a process called fibrosis. Since the liver has a substantial amount of reserve function, mild to moderate amounts of fibrosis usually do not lead to symptoms. However, as the amount of fibrosis increases it can lead to disruptions in the normal shape and function of the liver.

Cirrhosis occurs when the normal structure of the liver is disrupted by bands of scar tissue. One of the normal functions of the liver is to filter blood returning to the heart from the digestive system. When cirrhosis is present, the presence of scar tissue causes increased resistance to blood flow through the liver. This results in high pressures developing in the veins that drain into the liver, a process called portal hypertension. Many of the complications of liver disease, such as fluid retention and esophageal bleeding, are caused by the presence of portal hypertension.

What are the Symptoms of Cirrhosis?
The signs and symptoms of liver cirrhosis may be absent or non-specific at early stages. Early non-specific symptoms include fatigue and itching. As scar tissue replaces healthy tissue and liver function worsens, a variety of liver-related symptoms may develop.

- **Fatigue**: Fatigue is a common symptom of cirrhosis. Many patients with cirrhosis also develop loss of muscle mass which can worsen fatigue. Fatigue due to cirrhosis can be difficult to treat and it is important to seek out other causes of fatigue may be unrelated to liver disease.

- **Itching**: Itching (also called pruritus) is a common symptom of cirrhosis. Itching is most common in patients with cirrhosis due to bile duct disorders, but itching can occur in any type of liver disease. Patients with itching due to liver disease typically have itching over large parts of their body and the itching can be severe. A variety of medications can be used to treat cirrhosis-related itching.

- **Edema** is the retention of abnormal amounts of fluid in the body, most frequently in the legs.

- When significant fluid retention occurs in the abdomen (belly) this is called ascites. Ascites can cause abdominal discomfort and shortness of breath when the amount of fluid is large enough to restrict the normal expansion of the chest during breathing.

- **Digestive Tract Bleeding**: Patients with cirrhosis can develop abnormally enlarged veins (varices) inside the digestive system. Varices typically do not cause symptoms unless they rupture and bleed. Bleeding varices can be identified
by the vomiting of blood or coffee-ground-like material or the passage of maroon or black, tarry stools. Bleeding from esophageal varices is a medical emergency and requires emergency treatment in your nearest hospital.

- **Jaundice** is a yellow discoloration of the skin and whites of the eyes. Darkening of the urine (iced-tea or cola colored) and/or pale (putty-colored) stools often occurs before the yellow discoloration of the skin and whites of the eyes develops.

- Patients with cirrhosis can develop symptoms of mental slowing, confusion, excess drowsiness, and slurring of speech, a condition known as hepatic encephalopathy [pronounced: en-SEF-a-lo-path-e].

**How is Cirrhosis Diagnosed?**
Cirrhosis is best determined by examining a sample of liver tissue under the microscope, a procedure which is called a liver biopsy. In this relatively simple procedure a thin needle is inserted, under local anesthesia, into the liver and removes a small piece of liver tissue. Liver biopsy not only confirms the presence of cirrhosis, but can often provide information as to its cause.

In many cases, a liver biopsy may not be necessary to identify cirrhosis. Frequently, your physician may be able to diagnose cirrhosis by the presence of changes noted during physical examination (such as enlargement of the spleen, enlargement of the breast tissue in men, and certain skin findings) together with the results from blood tests, imaging studies (such as ultrasound, CT or MRI scans) and/or endoscopy. There are several new tests that use ultrasound or MRI to directly measure the stiffness of the liver which may help in diagnosing cirrhosis but these tests are not all widely available.

**What are the Complications of Cirrhosis?**
Since the liver performs many complex metabolic functions, there are many complications that arise from cirrhosis. In addition, some complications arise more commonly in certain diseases that cause cirrhosis (for example, osteoporosis occurs more commonly in patients with liver diseases that predominantly affect the bile ducts). Below is a list of some of the most common complications of liver disease.

- **Ascites:** Ascites is the retention of abnormal amounts of fluid inside the abdominal cavity. When ascites is mild it may be detectable only by ultrasound or CT scan. As the amount of ascites increases, patients develop increasing abdominal size and fullness, decreased appetite and abdominal discomfort. When large amounts of ascites is present, the fluid restricts the normal expansion of the chest during breathing and can lead to shortness of breath. In addition, ascites fluid can become infected, a condition known as spontaneous bacterial peritonitis. Symptoms of spontaneous bacterial peritonitis include fever and abdominal pain, but often symptoms may be mild or absent. Spontaneous bacterial peritonitis is a serious condition requiring treatment with antibiotics, usually given intravenously.
• **Varices:** Varices are abnormally enlarged veins (similar to varicose veins in the legs) that develop within the digestive system of patients with cirrhosis. Varices most commonly occur in the esophagus. Your doctor may recommend an upper endoscopy (also known as an EGD) to see if varices are present. Since the walls of the abnormally enlarged veins are thin, varices can rupture and bleed into the digestive tract. In patients who have large varices without bleeding, medical therapy with blood pressure medication or endoscopic therapy (placing rubber bands over the varices) may be recommended to reduce the risk of future bleeding. Bleeding from esophageal or gastric (stomach) varices is a life-threatening condition and requires emergency medical care. Symptoms of bleeding varices include the vomiting of blood or coffee-ground like material or the passage of maroon or black, tarry stools.

• **Hepatic Encephalopathy:** In cirrhosis, the normal filtering function of the liver is impaired and the blood returning from the intestines is not properly detoxified of waste products from digestion. When these waste products enter the circulation they are delivered to the brain and a condition called hepatic encephalopathy develops. Symptoms of hepatic encephalopathy include mental slowing, confusion, excess drowsiness, and slurring of speech. In severe cases, patients can develop coma. Your doctor may examine you looking for a certain type tremor that can be a clue to the presence of encephalopathy. Your doctor may also check your blood to measure your ammonia level, one of the toxins that is found in increased amounts in the circulation of patients with encephalopathy.

• **Liver Cancer (Hepatocellular Carcinoma):** Patients with cirrhosis are at increased risk of developing liver cancer, known as hepatocellular carcinoma. The risk for liver cancer varies according to the underlying liver disease, but in patients with hepatitis C infection (one of the most common causes of liver disease in the United States) it is approximately 3% each year. Successful treatment for liver cancer depends on early detection. Liver cancers frequently do not cause any symptoms when they are small and treatment options may be limited by the time symptoms develop. Your doctor may recommend an ultrasound, CT scan or MRI of your liver at a regular interval, typically every 6 months, to detect liver tumors. A blood test called alpha-fetoprotein (AFP) may also be used to help detect tumors, however, it is not reliable enough by itself to replace the need for periodic ultrasound testing.

**What Treatments for Cirrhosis are Available?**

Medical care for patients with cirrhosis has several aims: treating the underlying cause of liver disease, preventing cirrhosis-related complications, and treating the symptoms of cirrhosis. Since cirrhosis is a chronic disease, patients with cirrhosis require ongoing medical care with a physician specializing in the care of patients with liver disease (a gastroenterologist or hepatologist).
Whenever possible, the underlying cause of cirrhosis should be treated. Some conditions improve with medical therapy and treatment can improve or delay worsening of liver function. In some circumstances, patients may not tolerate treatments for their underlying liver disease because their cirrhosis is too advanced. Patients with cirrhosis should not drink alcohol. In patients who consume alcohol regularly, liver function may improve significantly with total avoidance of alcohol.

Your doctor may recommend various treatments aimed at preventing complications of cirrhosis from developing. Infection is an important cause of illness in patients with cirrhosis and your doctor may recommend updating your vaccinations. Typically, patients with cirrhosis should receive a yearly flu (influenza) vaccine and the pneumonia (pneumococcal) vaccine. Your doctor may test you for hepatitis A and hepatitis B and vaccinate you if you are not immune.

Your doctor may prescribe various treatments to help control symptoms from complications of cirrhosis. These may include:

- Dietary salt restriction and diuretic medications (commonly known as “water pills”) are prescribed for the control of ascites and edema. In some cases, a small needle may be inserted into the abdominal cavity under local anesthesia to drain ascites fluid, a procedure known as a paracentesis.

- Patients who have experienced prior episodes of spontaneous bacterial peritonitis are given long-term antibiotic medication to prevent future episodes.

- Various medications may be prescribed for patients with hepatic encephalopathy. These include lactulose and/or oral antibiotics. In rare cases, dietary protein restriction may be recommended.

- Patients with esophageal varices may be treated with blood-pressure reducing medications or treatment may be applied directly to the varices during an endoscopy.

In some cases your doctor may recommend the insertion of a TIPS shunt. The placement of a TIPS shunt is an invasive procedure. A TIPS shunt is a metal tube (also called a stent) placed within the liver under x-ray guidance through an incision in the jugular vein in the neck. A TIPS shunt works by decreasing the pressure against which blood must flow within the liver (that is to reduce portal hypertension). TIPS shunts are used to treat patients with severe difficulty with ascites or bleeding from varices that is not able to be controlled with medication or endoscopy. Not all patients should receive a TIPS shunt. TIPS shunt insertion has associated risks and the placement of TIPS shunt can lead to new or worsening hepatic encephalopathy.

For some patients with severe liver disease, liver transplantation may be considered as a treatment option. During liver transplantation surgery the diseased liver is removed and a
new healthy liver from a deceased-donor or a part of a liver from a living-donor is put in its place. Liver transplantation surgery is a major undertaking and requires life-long anti-rejection medications afterwards. Extensive testing is required before a liver transplant to ensure that a candidate is in good enough health to proceed with a transplant operation. Additionally, transplant centers typically require some period of abstinence from alcohol (often at least 6 months) and/or formal alcohol and drug treatment for patients with alcohol-related liver disease before transplantation. Not all patients with cirrhosis need a liver transplant and transplantation is not the best choice for all patients. Because liver transplantation is so complex it is only performed at large specialty centers and your doctor may need to refer you elsewhere in order to be evaluated for a liver transplant.