



Cirrhosis in adults: Overview of complications, general management, and prognosis

AUTHORS: [Eric Goldberg, MD, Sanjiv Chopra, MD, MACP](#)

SECTION EDITOR: [Bruce A Runyon, MD, FAASLD](#)

DEPUTY EDITOR: [Kristen M Robson, MD, MBA, FACP](#)

All topics are updated as new evidence becomes available and our [peer review process](#) is complete.

Literature review current through: **Mar 2024**.

This topic last updated: **Mar 28, 2023**.

Please read the [Disclaimer](#) at the end of this page.

INTRODUCTION

Cirrhosis represents a late stage of progressive hepatic fibrosis characterized by distortion of the hepatic architecture and the formation of regenerative nodules. It is generally considered to be irreversible in its advanced stages, at which point the only option may be liver transplantation. In earlier stages, specific treatments aimed at the underlying cause of liver disease may improve or even reverse cirrhosis.

Patients with cirrhosis are susceptible to a variety of complications, and their life expectancy can be markedly reduced. Cirrhosis accounted for approximately 49,500 deaths and was the eighth leading cause of death in the United States in 2010 [1]. In addition, there were an estimated 19,500 deaths due to liver cancer, which often occurs in the setting of cirrhosis. Similarly, a study that used data from the National Death Index from the Centers for Disease Control and Prevention and the Rochester Epidemiology Project estimated that liver disease was responsible for 66,007 deaths in 2008, of which 18,175 were due to hepatobiliary cancer [2].

This topic will review the complications, general management, and prognosis of cirrhosis. An overview of the causes and diagnosis of cirrhosis is presented separately. (See "[Cirrhosis in adults: Etiologies, clinical manifestations, and diagnosis](#)".)

MAJOR COMPLICATIONS

Major complications of cirrhosis include ([table 1](#)):

- Variceal hemorrhage
- Ascites
- Spontaneous bacterial peritonitis
- Hepatic encephalopathy
- Hepatocellular carcinoma
- Hepatorenal syndrome
- Hepatopulmonary syndrome

Once these complications develop, patients are considered to have decompensated cirrhosis. Multiple factors can predispose to decompensation in a patient with cirrhosis. Risk factors for decompensation include bleeding, infection, alcohol intake, medications, dehydration, and constipation [3-5]. In addition, patients with obesity are at increased risk for decompensation [6]. Once decompensation has developed, patients should be considered for liver transplantation. (See "[Liver transplantation in adults: Patient selection and pretransplantation evaluation](#)" and "[Liver transplantation in adults: Patient selection and pretransplantation evaluation](#)", section on 'Cirrhosis'.)

Other major complications of cirrhosis include portal vein thrombosis and cardiomyopathy. However, patients with these complications alone are not considered to have decompensated cirrhosis.

This section provides an overview of the complications of cirrhosis. The individual complications are discussed in detail in their respective topic reviews.

Complications of portal hypertension — Many of the complications of cirrhosis are the result of portal hypertension (increased pressure within the portal venous system). This can lead to the formation of venous collaterals (varices) as well as circulatory, vascular, functional, and biochemical abnormalities that contribute to the pathogenesis of ascites and other complications. (See "[Portal hypertension in adults](#)" and "[Pathogenesis of ascites in patients with cirrhosis](#)", section on 'Portal hypertension'.)

Complications of portal hypertension include:

- Ascites
- Hepatic encephalopathy
- Variceal hemorrhage
- Spontaneous bacterial peritonitis
- Hepatorenal syndrome
- Portal hypertensive gastropathy
- Hepatic hydrothorax
- Hepatopulmonary syndrome

- Portopulmonary hypertension
- Cirrhotic cardiomyopathy

Variceal hemorrhage — Patients with variceal hemorrhage typically present with hematemesis and/or melena. It is typically treated with endoscopic variceal band ligation. Other treatments include endoscopic sclerotherapy and placement of a transjugular intrahepatic portosystemic shunt (TIPS). (See ["Overview of the management of patients with variceal bleeding"](#).)

Variceal hemorrhage is associated with high mortality rates. In the past, the mortality rate of a single variceal hemorrhage was 30 percent, and only one-third of patients survived for one year [7,8]. Although survival has improved with modern techniques for controlling variceal hemorrhage, mortality rates remain high (15 to 20 percent 30-day mortality) [9].

Portal hypertensive gastropathy — Portal hypertensive gastropathy (congestive gastropathy), while extremely common in patients with portal hypertension, is an uncommon cause of significant bleeding in these patients. When portal hypertensive gastropathy is the sole cause of bleeding, there is diffuse mucosal oozing with no other lesions, such as varices, to account for the GI bleeding and anemia. The mucosa is friable, and bleeding presumably occurs when the ectatic vessels rupture. The severity of gastropathy is related to the level of portal pressure, the level of hepatic vascular resistance, and the degree of reduction in hepatic blood flow. (See ["Portal hypertensive gastropathy"](#).)

Ascites — Ascites is the accumulation of fluid within the peritoneal cavity. It is the most common complication of cirrhosis. The first step leading to fluid retention and ultimately ascites in patients with cirrhosis is the development of portal hypertension. Patients without portal hypertension do not develop ascites or edema. Those with ascites have several circulatory, vascular, functional, and biochemical abnormalities that contribute to the pathogenesis of fluid retention. (See ["Pathogenesis of ascites in patients with cirrhosis"](#).)

Ascites is typically treated with a combination of diuretics and sodium restriction, though some patients require repeated therapeutic paracenteses or TIPS placement. Among patients with refractory ascites or spontaneous bacterial peritonitis, the use of nonselective beta blockers may be associated with increased mortality [10,11]. This may occur because reduced mean arterial blood pressure has been correlated with reduced survival in patients with advanced cirrhosis. (See ["Ascites in adults with cirrhosis: Initial therapy"](#) and ["Ascites in adults with cirrhosis: Diuretic-resistant ascites"](#), section on 'Discontinuing beta blockers' and 'Decompensated cirrhosis' below and ["Spontaneous bacterial peritonitis in adults: Treatment and prophylaxis"](#), section on 'Discontinue nonselective beta blockers'.)

Spontaneous bacterial peritonitis — Spontaneous bacterial peritonitis (SBP) is an infection of preexisting ascitic fluid without evidence for an intra-abdominal secondary

source, such as a perforated viscus. SBP is almost always seen in the setting of end-stage liver disease. Clinical manifestations of SBP include fever, abdominal pain, abdominal tenderness, and altered mental status. Some patients are asymptomatic and present with only mild laboratory abnormalities. (See ["Spontaneous bacterial peritonitis in adults: Clinical manifestations"](#).)

The index of suspicion for SBP must be high with a low threshold for diagnostic paracentesis. The diagnosis is established by a positive ascitic fluid bacterial culture and/or an elevated ascitic fluid absolute polymorphonuclear leukocyte count (≥ 250 cells/mm³). Without early antibiotic treatment, mortality is high. (See ["Spontaneous bacterial peritonitis in adults: Diagnosis"](#) and ["Spontaneous bacterial peritonitis in adults: Treatment and prophylaxis"](#).)

Hepatorenal syndrome — Hepatorenal syndrome refers to the development of renal failure in a patient who has advanced liver disease due to cirrhosis, severe alcoholic hepatitis, acute liver failure, or less often, a metastatic tumor. Rather than being a new disease, hepatorenal syndrome usually represents the end-stage of a sequence of reductions in renal perfusion induced by increasingly severe hepatic injury. Arterial vasodilatation in the splanchnic circulation, which is triggered by portal hypertension, appears to play a central role in the hemodynamic changes and the decline in renal function in hepatorenal syndrome. The initial reductions in glomerular filtration rate are often masked clinically since associated decreases in muscle mass and hepatic urea production minimize elevations in the plasma creatinine concentration and blood urea nitrogen. (See ["Hepatorenal syndrome", section on 'Pathogenesis'](#).)

Hepatorenal syndrome is characterized by a generally benign urine sediment, a very low rate of sodium excretion, and a progressive rise in the plasma creatinine concentration. There is some confusion regarding the presence or absence of oliguria. The percentage of patients with oliguria depends upon the cut-off for defining oliguria. If the cutoff is 400 mL/day, only 44 percent of patients are oliguric. If 500 mL/day is used, approximately two-thirds are oliguric. (See ["Hepatorenal syndrome", section on 'Clinical presentation'](#).)

The diagnosis is one of exclusion, being made when other causes of renal dysfunction have been excluded. In particular, volume depletion (as with overly rapid diuresis) can mimic all of the findings of hepatorenal syndrome. The prognosis is poor unless hepatic function improves or a liver transplantation is performed. (See ["Hepatorenal syndrome", section on 'Diagnosis'](#) and ["Hepatorenal syndrome", section on 'Treatment'](#).)

Hepatic hydrothorax — Hepatic hydrothorax is defined as the presence of a pleural effusion in a patient with cirrhosis and no evidence of underlying cardiopulmonary disease. It results from the movement of ascitic fluid into the pleural space through defects in the diaphragm, and it is usually right-sided. (See ["Hepatic hydrothorax"](#).)

The treatment for hepatic hydrothorax includes diuretics and sodium restriction. Patients who do not respond to conservative therapy may require repeated therapeutic thoracenteses or TIPS. The most important aspect of management is evaluation for liver transplantation. Chest tubes should **not** be placed in patients with hepatic hydrothorax. Placement of chest tubes in this setting can result in massive protein and electrolyte depletion, infection, renal failure, and bleeding.

Hepatopulmonary syndrome — Hepatopulmonary syndrome (HPS) is defined by the following triad (see ["Hepatopulmonary syndrome in adults: Prevalence, causes, clinical manifestations, and diagnosis"](#)):

- Liver disease
- Increased alveolar-arterial gradient while breathing room air
- Evidence for intrapulmonary vascular abnormalities, referred to as intrapulmonary vascular dilatations

Estimates of the prevalence of HPS among patients with chronic liver disease range from 4 to 47 percent, depending on the diagnostic criteria and methods used. Even in those without HPS, mild hypoxemia is common and is presumably caused by ascites, with resulting diaphragmatic elevation and ventilation/perfusion mismatch. There are no effective medical therapies for HPS. Liver transplantation offers the most promise for successful treatment. (See ["Hepatopulmonary syndrome in adults: Natural history, treatment, and outcomes"](#).)

Portopulmonary hypertension — Portal hypertension-associated pulmonary hypertension (portopulmonary hypertension) refers to the presence of pulmonary hypertension in patients with portal hypertension. The prevalence in patients with cirrhosis is approximately 2 percent [12]. Neither the prevalence nor the severity of portopulmonary hypertension appears to correlate with the degree of portal hypertension [12]. (See ["Portopulmonary hypertension"](#).)

Patients with portopulmonary hypertension may present with fatigue, dyspnea, peripheral edema, chest pain, and syncope. The diagnosis may be suggested by echocardiography and confirmed by right heart catheterization. Patients with moderate to severe portopulmonary hypertension are difficult to treat with medical therapy, and the perioperative mortality with liver transplantation is high.

Cirrhotic cardiomyopathy — Up to 50 percent of patients with advanced cirrhosis have features of cardiac dysfunction. The term "cirrhotic cardiomyopathy" has been used to describe such patients, who are characterized as having normal to increased cardiac output and contractility at rest, but a blunted response to pharmacologic, physiologic, or pathologic stress [13]. Patients may also have electrophysiologic abnormalities. It is thought to be related to both portal hypertension and cirrhosis. Cardiomyopathy can occur from any cause

of cirrhosis, although patients with alcoholism or hemochromatosis may have additional contributing causes to cardiac dysfunction. (See ["Definition and classification of the cardiomyopathies"](#), section on 'Cirrhotic cardiomyopathy' and ["Causes and pathophysiology of high-output heart failure"](#), section on 'Cirrhosis'.)

Hepatic encephalopathy — Hepatic encephalopathy describes the spectrum of potentially reversible neuropsychiatric abnormalities seen in patients with liver dysfunction. Disturbance in the diurnal sleep pattern (insomnia and hypersomnia) is a common early feature that typically precedes overt neurologic signs ([figure 1](#) and [figure 2](#)). More advanced neurologic features include the presence of asterix, hyperactive deep tendon reflexes, and, less commonly, transient decerebrate posturing. (See ["Hepatic encephalopathy in adults: Clinical manifestations and diagnosis"](#).)

Treatments for hepatic encephalopathy include addressing any predisposing conditions (eg, infection or gastrointestinal bleeding), synthetic disaccharides (eg, [lactulose](#)), and nonabsorbable antibiotics (eg, [rifaximin](#)). (See ["Hepatic encephalopathy in adults: Treatment"](#).)

Hepatocellular carcinoma — Patients with cirrhosis have a markedly increased risk of developing hepatocellular carcinoma (HCC). Patients with most forms of chronic hepatitis are not at an increased risk until cirrhosis develops. Exceptions to this rule are patients with chronic hepatitis B virus infection, who can develop HCC in the absence of cirrhosis. (See ["Epidemiology and risk factors for hepatocellular carcinoma"](#) and ["Surveillance for hepatocellular carcinoma in adults"](#).)

Certain causes of cirrhosis appear to have a relatively increased risk for HCC. Patients with cirrhosis from hepatitis B, hepatitis C, nonalcoholic steatohepatitis, and hemochromatosis are at the highest risk, while those with cirrhosis from autoimmune hepatitis and Wilson disease appear to have a lower risk. (See ["Epidemiology and risk factors for hepatocellular carcinoma"](#), section on 'Cirrhosis'.)

Because of the large functional reserve of the liver, patients with HCC are frequently asymptomatic early in its course, and the diagnosis is often delayed. Decompensation in a patient with previously compensated cirrhosis should raise the clinical suspicion that HCC has developed. Other common signs and symptoms of HCC are usually related to mass effect from the tumor and include pain, early satiety, obstructive jaundice, and a palpable mass. HCCs can rupture, causing hemoperitoneum. Paraneoplastic manifestations include erythrocytosis, hypercalcemia, hypoglycemia, and diarrhea. (See ["Clinical features and diagnosis of hepatocellular carcinoma"](#).)

The diagnosis of HCC may be suggested by marked elevations of serum alpha-fetoprotein (AFP) or by characteristic radiographic findings. Elevated AFP is not specific for HCC since it

can also be seen in patients with acute or chronic hepatitis, gonadal tumors, and pregnancy. However, rising serum AFP levels in a patient with cirrhosis should raise clinical suspicion for HCC. However, a significant proportion of patients with HCC have normal AFP levels, especially when the tumor is small. As a result, a normal AFP does not preclude a diagnosis. (See ["Clinical features and diagnosis of hepatocellular carcinoma"](#).)

Portal vein thrombosis — Portal vein thrombosis can develop in patients with cirrhosis and contribute to the development of portal hypertension. In patients with cirrhosis, the pathogenesis is likely related to unbalanced hemostasis and slowing of portal flow. Treatment often involves anticoagulation, though the decision to anticoagulate must take into account the patient's risk for bleeding, particularly if esophageal varices are present. (See ["Epidemiology and pathogenesis of portal vein thrombosis in adults"](#), section on 'Pathogenesis' and ["Acute portal vein thrombosis in adults: Clinical manifestations, diagnosis, and management"](#) and ["Chronic portal vein thrombosis in adults: Clinical manifestations, diagnosis, and management"](#).)

GENERAL MANAGEMENT

The major goals of managing patients with cirrhosis include:

- Slowing or reversing the progression of liver disease
- Preventing superimposed insults to the liver
- Identifying medications that require dose adjustments or should be avoided entirely ([table 2](#))
- Managing symptoms and laboratory abnormalities
- Preventing, identifying, and treating the complications of cirrhosis
- Determining the appropriateness and optimal timing for liver transplantation

Slowing or reversing the progression of liver disease — Although cirrhosis is generally considered to be irreversible in its advanced stages, the exact point at which it becomes irreversible is unclear [14,15]. Some chronic liver diseases respond to treatment even when the liver disease has progressed to cirrhosis. Thus, specific therapies directed against the underlying cause of the cirrhosis should be instituted.

As examples:

- Patients with hepatitis C and advanced fibrosis or cirrhosis who achieve a sustained virologic response (SVR) with antiviral treatment have a lower risk of liver-related mortality compared with patients who do not achieve an SVR [16]. (See ["Patient evaluation and selection for antiviral therapy for chronic hepatitis C virus infection"](#), section on 'Benefits of treatment'.)

- Abstinence from alcohol substantially improves survival in alcoholic cirrhosis. (See ["Management of alcohol-associated steatosis and alcohol-associated cirrhosis"](#), section on 'Abstinence'.)
- Successful treatment of chronic viral hepatitis can improve long-term outcomes and may affect fibrosis. In a study of 91 patients with chronic hepatitis C and significant fibrosis based on liver elastography, patients who achieved a sustained virologic response had a significant decrease in liver stiffness (and thus presumably fibrosis) 24 weeks after the end of treatment [17]. (See ["Noninvasive assessment of hepatic fibrosis: Ultrasound-based elastography"](#).)

Nonselective beta blockers (NSBB) have been studied for a possible role in preventing disease progression in patients with compensated cirrhosis, but the implication for clinical practice is uncertain. In a trial including 201 patients with compensated cirrhosis and portal hypertension (ie, hepatic venous pressure gradient [HVPG] ≥ 10 mmHg) with median follow-up of 37 months, patients treated with NSBB had lower rates of decompensated cirrhosis (defined by ascites, bleeding or encephalopathy) or death compared with placebo (16 versus 27 percent; HR 0.51, 95% 0.26-0.97) [18]. Further study is needed to establish a noninvasive method for identifying patients with portal hypertension because HVPG is not routinely measured [19]. (See ["Portal hypertension in adults"](#), section on 'Noninvasive tests'.)

In addition, long-term beta blocker use may not be tolerated by some patients due to adverse effects (fatigue, dizziness). (See ["Major side effects of beta blockers"](#).)

Preventing superimposed insults to the liver

Vaccinations — Vaccination against hepatitis A and B virus infection for those who are not already immune can help prevent superimposed insults to the liver. Other vaccinations, such as a yearly influenza vaccination, are also recommended ([figure 3](#)). (See ["Immunizations for adults with chronic liver disease"](#).)

Patients with chronic liver disease can receive the COVID-19 vaccine, and details regarding administration and efficacy of COVID-19 vaccines are presented separately. (See ["COVID-19: Vaccines"](#) and ["COVID-19: Issues related to liver disease in adults"](#), section on 'COVID-19 vaccination'.)

Avoidance of hepatotoxins — Patients with cirrhosis should avoid medications, supplements, and other substances that are commonly associated with liver injury. This includes substances, such as alcohol, hepatotoxic over-the-counter medications, prescribed drugs with hepatotoxic side effects, and certain herbal remedies. (See ["Drug-induced liver injury"](#) and ["Hepatotoxicity due to herbal medications and dietary supplements"](#) and ["Management of pain in patients with advanced chronic liver disease or cirrhosis"](#).)

Medication adjustments — Patients with cirrhosis are at increased risk of adverse events with many medications because of impaired hepatic metabolism or renal excretion. Many medications require dose adjustments or should be avoided entirely ([table 2](#)) [20]. (See "[Overview of medication adjustments for adult patients with cirrhosis](#)".)

Issues related to the use of pain medications in patients with cirrhosis are discussed in detail elsewhere. (See "[Management of pain in patients with advanced chronic liver disease or cirrhosis](#)".)

Management of symptoms and laboratory abnormalities

Muscle cramps — Patients with cirrhosis may experience muscle cramps (eg, leg cramps), which can be severe [21,22]. The cause is incompletely understood, although they may be related to a reduction in effective circulating plasma volume, nerve dysfunction, and alterations in energy metabolism [22]. The diagnostic evaluation for patients with cirrhosis who experience leg cramps is similar to the approach for patients without cirrhosis, with the addition of routinely measuring serum electrolytes and calcium levels in patients with cirrhosis. The management of leg cramps is discussed in detail separately. (See "[Nocturnal muscle cramps](#)".)

For patients with muscle cramps who do not respond to non-pharmacologic (ie, stretching) and initial pharmacologic therapies, small studies suggested a role for other therapies such as branched chain amino acids, taurine, zinc, and magnesium [22-27].

Umbilical hernias — Umbilical hernias pose a management dilemma in patients with cirrhosis, since they often develop in patients with severe liver disease and ascites who are at high risk of complications with surgical repair [28]. Successful management using a variety of minimally invasive surgical techniques has been reported [29-33]. However, clinical experience has tempered our enthusiasm for elective surgical repair. We have witnessed an unacceptably high complication and recurrence rate in our patients referred for elective repair [34]. Liver transplantation surgeons prefer to repair hernias at the time of transplantation and not before because many have observed high postoperative morbidity and mortality when repair was performed before the transplantation.

We have adopted the following approach to managing umbilical hernias in patients with cirrhosis:

- Most patients with ruptured or incarcerated hernias are referred for immediate repair. However, if incarceration is detected early, it can sometimes be reduced.
- Patients with symptomatic hernias or those with marked thinning of the skin overlying the hernia sac (a sign of impending rupture), especially if there is weeping of fluid or an eschar on the apex of the hernia, are referred for elective repair.

- Patients with asymptomatic hernias are managed conservatively, with surgical correction of the hernia performed at the time of liver transplantation. The cornerstone of conservative management in asymptomatic patients with umbilical hernias is aggressive management of ascites. Elastic/Velcro abdominal binders can also help reduce pain and minimize further enlargement of the hernia. (See ["Ascites in adults with cirrhosis: Initial therapy"](#) and ["Ascites in adults with cirrhosis: Diuretic-resistant ascites"](#).)

Hyponatremia — Hyponatremia is a common problem in patients with advanced cirrhosis. The pathogenesis of hyponatremia is directly related to the hemodynamic changes and secondary neurohumoral adaptations that occur in the setting of cirrhosis, resulting in an impaired ability to excrete ingested water. The severity of the hyponatremia is related to the severity of the cirrhosis. The management of hyponatremia is discussed elsewhere. (See ["Hyponatremia in patients with cirrhosis"](#), section on 'Management'.)

Thrombocytopenia or elevated INR — Patients with cirrhosis frequently have low platelet counts and elevated international normalized ratios (INRs). Because the liver makes coagulation factors as well as anticoagulant proteins, liver disease can lead to a hypocoagulable state or a hypercoagulable state. The relative balance or imbalance of these factors is not reflected in conventional indices of coagulation, such as the prothrombin time, activated partial thromboplastin time, or INR. (See ["Hemostatic abnormalities in patients with liver disease"](#), section on 'Physiologic effects of hepatic dysfunction'.)

Patients typically only need treatment for thrombocytopenia if an invasive procedure that is at moderate or high risk for bleeding is planned, or in the setting of active bleeding. It is reasonable to aim for platelet counts of at least 50,000/microL during moderate-risk procedures [35] or interventions and platelet counts closer to 100,000/microL in high-risk situations or in the presence of active bleeding [36]. (See ["Hemostatic abnormalities in patients with liver disease"](#), section on 'Invasive procedures'.)

Because conventional indices of coagulation are not helpful in determining a patient's bleeding risk, patients who require an invasive procedure that is at moderate or high risk for bleeding or who have active bleeding may need additional testing, such as a determination of fibrinogen levels, thromboelastography, or thromboelastometry to guide management. While plasma is commonly given to patients with chronic liver disease and an elevated INR, plasma infusion may have adverse effects on portal vein pressures and collateral vessel flow. In addition, the traditional dose of two units of plasma is unlikely to significantly alter coagulation factor levels. (See ["Clinical use of plasma components"](#), section on 'Plasma products' and ["Hemostatic abnormalities in patients with liver disease"](#), section on 'Laboratory abnormalities'.)

The management of patients with chronic liver disease who require an invasive procedure that is at moderate or high risk for bleeding, or who have active bleeding, is discussed in detail elsewhere. (See "[Hemostatic abnormalities in patients with liver disease](#)", section on 'Bleeding' and "[Hemostatic abnormalities in patients with liver disease](#)", section on 'Invasive procedures'.)

Preventing complications — We monitor patients for the development of complications, and when possible, use strategies to prevent their development.

- **General measures** – General measures to decrease the risk of complications include judicious diuresis and avoiding proton pump inhibitors in patients without clear indications for their use (spontaneous bacterial peritonitis); treating infections (spontaneous bacterial peritonitis, hepatic encephalopathy); avoiding sedatives and treating hypokalemia and hyponatremia (hepatic encephalopathy); avoiding nephrotoxic agents and aggressive diuresis (hepatorenal syndrome); and only using urinary catheters, mechanical ventilation, and central lines when clearly indicated (secondary infections). (See '[Major complications](#)' above.)

Digital tools have been studied for monitoring patients with cirrhosis remotely and sharing patient data (eg, daily blood pressure, weight, and cognitive function) with clinicians [37,38]. In a study comparing use of a smartphone application for home monitoring with standard care in 40 patients with cirrhosis, the smartphone app was associated with good patient engagement and earlier detection of decompensating events [37].

- **Variceal bleeding** – We screen patients with cirrhosis and clinically significant portal hypertension (CSPH) for esophageal varices with upper endoscopy. Strategies to prevent variceal bleeding are discussed in detail separately. (See "[Primary prevention of bleeding from esophageal varices in patients with cirrhosis](#)".)
- **Hepatocellular carcinoma** – We screen patients with cirrhosis for hepatocellular carcinoma, and the approach to surveillance is discussed separately. (See "[Surveillance for hepatocellular carcinoma in adults](#)".)
- **Spontaneous bacterial peritonitis** – The risk of spontaneous bacterial peritonitis (SBP) can be reduced by efforts to diurese patients since diuresis concentrates ascitic fluid, thereby raising ascitic fluid opsonic activity. Early recognition and aggressive treatment of localized infections (eg, cystitis, cellulitis) can also help to prevent bacteremia and SBP. Proton pump inhibitor use has been associated with an increased risk of SBP, so proton pump inhibitors should only be given to patients who have clear indications for their use. Finally, prophylactic antibiotics aimed at decontaminating the gut have a role

in specific clinical settings. (See ["Spontaneous bacterial peritonitis in adults: Treatment and prophylaxis"](#).)

- **Hepatic encephalopathy** – Patients with cirrhosis should be evaluated regularly for hepatic encephalopathy, the earliest features of which can be subtle. Events that can precipitate hepatic encephalopathy include the development of variceal bleeding, infection (such as SBP), the administration of sedatives, hypokalemia, and hyponatremia, all of which should be corrected/avoided whenever possible ([table 3](#)). (See ["Hepatic encephalopathy in adults: Clinical manifestations and diagnosis"](#) and ["Hepatic encephalopathy in adults: Treatment"](#).)
- **Portal vein thrombosis** – Prevention of portal vein thrombosis (PVT) in patients with cirrhosis focuses on optimizing liver function and reducing portal venous pressure. The prevention and treatment of PVT is discussed in detail separately. (See ["Hemostatic abnormalities in patients with liver disease"](#), section on 'Portal vein thrombosis (PVT)').
- **Hepatorenal syndrome** – Nephrotoxic agents (such as aminoglycosides) and vigorous diuresis should be avoided in patients with cirrhosis since they can precipitate renal failure. (See ["Hepatorenal syndrome"](#).)
- **Cirrhosis-associated immune deficiency** – Patients with cirrhosis develop a state of immune deficiency known as cirrhosis-associated immune deficiency [39]. This condition predisposes such patients to common infections including urinary tract infections, pneumonia, and SBP. Patients are also at higher risk for other infections such as cryptococcal meningitis. In addition, patients with cirrhosis and iron overload are more susceptible to *Yersinia enterocolitica* and *Vibrio vulnificus* infections.
- **Secondary infections** – Patients with cirrhosis who are hospitalized often acquire infections while in the hospital. Factors that have been associated with hospital-acquired secondary infections in patients with cirrhosis include the use of urinary catheters, mechanical ventilation, and the placement of central lines [40]. Many of these interventions are performed routinely (such as placement of urinary catheters to measure urine output). However, avoiding these interventions unless they are absolutely necessary may decrease the risk of acquiring an infection while in the hospital, and it is our practice to only use these interventions when clearly indicated.

In a study of 207 patients with cirrhosis who were admitted with or developed an infection during hospitalization, 50 (24 percent) developed a second infection during hospitalization [40]. Respiratory infections were the most common (14 patients), followed by urinary tract infections (13 patients), and *Clostridioides difficile*. Of the urinary tract infections, 6 (46 percent) were related to the use of bladder catheters. Other factors associated with second infections included intensive care unit admission,

the use of central lines, mechanical ventilation, shock, renal replacement therapy, and hepatic encephalopathy. Overall mortality was 39 percent, but it was 48 percent for those who developed a second infection during admission.

Treatment of complications — The treatment of the complications of cirrhosis is discussed in the respective topic reviews. (See '[Major complications](#)' above.)

Liver transplantation — Liver transplantation is the definitive treatment for patients with decompensated cirrhosis. It is important to determine whether patients may be eligible for transplantation and to refer them to a transplant center for evaluation. Several guidelines are available which help determine when referral for liver transplantation may be beneficial. The decision to proceed to liver transplantation (either cadaveric or live donor) depends upon the severity of disease, quality of life, and the absence of contraindications. (See "[Liver transplantation in adults: Patient selection and pretransplantation evaluation](#)".)

PROGNOSIS

The prognosis of cirrhosis is highly variable since it is influenced by a number of factors, including etiology, severity, presence of complications, and comorbid diseases. Once decompensation occurs (eg, the patient develops variceal bleeding, hepatic encephalopathy, or spontaneous bacterial peritonitis), mortality rates are high. (See '[Decompensated cirrhosis](#)' below.)

Compensated cirrhosis — Patients with cirrhosis who have not developed major complications are classified as having compensated cirrhosis. The median survival of patients with compensated cirrhosis is >12 years [41]. Patients with varices but who have not developed variceal bleeding are considered to have compensated cirrhosis, though their prognosis is worse than that of patients who have compensated cirrhosis without varices (3.4 versus 1.0 percent one-year mortality rates) [41].

Decompensated cirrhosis — Patients who have developed complications of cirrhosis, such as variceal hemorrhage, ascites, spontaneous bacterial peritonitis, hepatocellular carcinoma, hepatorenal syndrome, or hepatopulmonary syndrome, are considered to have decompensated cirrhosis and have a worse prognosis than those with compensated cirrhosis. (See '[Major complications](#)' above.)

A systematic review found that the median survival was ≤ 6 months in patients with decompensated cirrhosis and a Child-Pugh score ≥ 12 or a Model for End-stage Liver Disease (MELD) score ≥ 21 [42]. In addition, patients with decompensated cirrhosis who had been hospitalized with an acute liver-related illness (eg, variceal hemorrhage or spontaneous

bacterial peritonitis) had a median survival of ≤ 6 months if the Child-Pugh score was ≥ 12 or the MELD score was ≥ 18 .

An important factor related to survival is mean arterial pressure. In a series of 139 patients with cirrhosis and ascites, a mean arterial pressure of ≤ 82 mmHg was an important predictor of survival [43]. Among patients with a mean arterial pressure ≤ 82 mmHg, survival was 20 percent at 24 months and 0 percent at 48 months (compared with 70 and 50 percent, respectively, for patients with a mean arterial pressure > 82 mmHg).

Another factor that may be associated with survival is the presence of relative adrenal insufficiency [44,45]. In a study of 143 patients who were admitted to the hospital with decompensated cirrhosis, relative adrenal insufficiency was detected in 37 patients (26 percent) [44]. At the time of presentation, compared with patients who did not have relative adrenal insufficiency, patients with relative adrenal insufficiency had lower mean arterial pressures (76 versus 83 mmHg) and serum sodium levels (131 versus 135 mEq/L) and had higher blood urea nitrogen levels (32 versus 24 mg/dL). During three months of follow-up, patients with relative adrenal insufficiency were more likely to develop infection (41 versus 21 percent), severe sepsis (27 versus 9 percent), type 1 hepatorenal syndrome (16 versus 3 percent), and death (22 versus 7 percent). (See "[Determining the etiology of adrenal insufficiency in adults](#)".)

Among patients with cirrhosis and severe septic shock, administration of [hydrocortisone](#) may improve outcomes [46]. (See "[Treatment of adrenal insufficiency in adults](#)", section on '[Glucocorticoid replacement for all patients](#)'.)

Other factors associated with poor survival in patients with decompensated cirrhosis included hepatopulmonary syndrome, rapidly progressive hepatorenal syndrome, and intensive care unit admission for complications of liver disease along with hypotension requiring pressor support, serum creatinine > 1.5 mg/dL, or jaundice.

Patients with decompensated cirrhosis often require liver transplantation. For those who are not candidates, hospice care can be considered for patients with predicted survival of ≤ 6 months. (See "[Liver transplantation in adults: Patient selection and pretransplantation evaluation](#)" and "[Palliative care for patients with end-stage liver disease](#)".)

Predictive models — Multiple studies have attempted to predict the prognosis of patients with cirrhosis based on clinical and laboratory information. Two commonly used models are the Child-Pugh classification and MELD.

Child-Pugh classification — The Child-Pugh classification ([table 4](#)) has been used to assess the risk of non-shunt operations in patients with cirrhosis ([calculator 1](#) and [calculator 2](#)) [47]. It is a modification of the Child-Turcotte classification, which incorporated five variables that were designed to stratify the risk of portacaval shunt surgery in patients with

cirrhosis. The variables included the serum albumin and bilirubin, ascites, encephalopathy, and nutritional status ([table 5](#)) [48]. The Child-Pugh classification replaces nutritional status with prothrombin time. The score ranges from 5 to 15. Patients with a score of 5 or 6 have Child-Pugh class A cirrhosis (well-compensated cirrhosis), those with a score of 7 to 9 have Child-Pugh class B cirrhosis (significant functional compromise), and those with a score of 10 to 15 have Child-Pugh class C cirrhosis (decompensated cirrhosis).

In a review of 92 patients with cirrhosis who underwent abdominal surgery, the mortality rate was 10 percent for patients with Child-Pugh class A cirrhosis, 30 percent for patients with Child-Pugh class B cirrhosis, and 82 percent for patients with Child-Pugh class C cirrhosis [49]. Other studies have validated the utility of the Child-Pugh classification for the assessment of surgical risk [50]. (See "[Assessing surgical risk in patients with liver disease](#)".)

The Child-Pugh classification system also correlates with survival in patients not undergoing surgery; one-year survival rates for patients with Child-Pugh class A, B, and C cirrhosis are approximately 100, 80, and 45 percent, respectively [51,52]. Child-Pugh class is also associated with the likelihood of developing complications of cirrhosis. As an example, patients with Child-Pugh class C cirrhosis are much more likely to develop variceal hemorrhage than those with Child-Pugh class A cirrhosis [53].

MELD score — Another model to predict prognosis in patients with cirrhosis is the MELD score. It is based upon bilirubin levels, creatinine, and INR ([original MELD score](#)). A revision of the original MELD score has been adopted for use in prioritizing patients awaiting liver transplantation. In addition, the MELD score has an expanding role in predicting outcomes in patients with liver disease in the non-transplantation setting. These issues are discussed separately. (See "[Model for End-stage Liver Disease \(MELD\)](#)".)

WHEN TO REFER TO A SPECIALIST

Referral to a hepatologist is recommended if the patient develops decompensated cirrhosis or major complications of cirrhosis. Patients with a MELD score ≥ 10 should be referred to a liver transplantation center for evaluation. In addition, referral to a hepatologist should be considered if the patient requires treatment for the underlying cause of the cirrhosis (eg, hepatitis C, autoimmune hepatitis) or if the clinician managing the patient would like the assistance of a hepatologist in the patient's general management. (See "[Liver transplantation in adults: Patient selection and pretransplantation evaluation](#)", section on 'Cirrhosis'.)

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See ["Society guideline links: Cirrhosis"](#).)

INFORMATION FOR PATIENTS

UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Basics topics (see ["Patient education: Cirrhosis \(The Basics\)"](#) and ["Patient education: Liver cancer \(The Basics\)"](#))
 - Beyond the Basics topics (see ["Patient education: Cirrhosis \(Beyond the Basics\)"](#))
-

SUMMARY AND RECOMMENDATIONS

- **Background** – Cirrhosis represents a late stage of progressive hepatic fibrosis characterized by distortion of the hepatic architecture and the formation of regenerative nodules. It is generally considered to be irreversible in its advanced stages. In earlier stages, specific treatments aimed at the underlying cause of liver disease may improve or even reverse cirrhosis. (See ['Introduction'](#) above.)
- **Complications of cirrhosis** – Patients with cirrhosis are susceptible to a variety of complications, and their life expectancy can be markedly reduced. Major complications of cirrhosis include ([table 1](#)) (see ['Major complications'](#) above):
 - Variceal hemorrhage
 - Ascites
 - Spontaneous bacterial peritonitis
 - Hepatic encephalopathy
 - Hepatocellular carcinoma
 - Hepatorenal syndrome

- Hepatopulmonary syndrome
 - Portal vein thrombosis
 - Cardiomyopathy
- **Goals of management** – The major goals of managing patients with cirrhosis include (see '[General management](#)' above):
 - Slowing or reversing the progression of liver disease (see '[Slowing or reversing the progression of liver disease](#)' above).
 - Preventing superimposed insults to the liver (see '[Preventing superimposed insults to the liver](#)' above).
 - Identifying medications that require dose adjustments or should be avoided entirely ([table 2](#)) (see '[Medication adjustments](#)' above and "[Overview of medication adjustments for adult patients with cirrhosis](#)").
 - Managing symptoms and laboratory abnormalities (see '[Management of symptoms and laboratory abnormalities](#)' above).
 - Preventing and treating the complications of cirrhosis (see '[Preventing complications](#)' above).
 - Determining the appropriateness and optimal timing for liver transplantation (see '[Liver transplantation](#)' above).
 - **Prognosis** – The prognosis of cirrhosis is highly variable since it is influenced by a number of factors, including etiology, severity, presence of complications, and comorbid diseases. Once decompensation occurs (eg, the patient develops variceal bleeding, hepatic encephalopathy, or spontaneous bacterial peritonitis), mortality rates are high. (See '[Decompensated cirrhosis](#)' above.)

REFERENCES

1. Murray CJ, Atkinson C, Bhalla K, et al. The state of US health, 1990-2010: burden of diseases, injuries, and risk factors. *JAMA* 2013; 310:591.
2. Asrani SK, Larson JJ, Yawn B, et al. Underestimation of liver-related mortality in the United States. *Gastroenterology* 2013; 145:375.
3. Liao WC, Hou MC, Chang CJ, et al. Potential precipitating factors of esophageal variceal bleeding: a case-control study. *Am J Gastroenterol* 2011; 106:96.
4. Mumtaz K, Ahmed US, Abid S, et al. Precipitating factors and the outcome of hepatic encephalopathy in liver cirrhosis. *J Coll Physicians Surg Pak* 2010; 20:514.
5. Sundaram V, Shaikh OS. Hepatic encephalopathy: pathophysiology and emerging therapies. *Med Clin North Am* 2009; 93:819.
6. Berzigotti A, Garcia-Tsao G, Bosch J, et al. Obesity is an independent risk factor for clinical decompensation in patients with cirrhosis. *Hepatology* 2011; 54:555.

7. Smith JL, Graham DY. Variceal hemorrhage: a critical evaluation of survival analysis. *Gastroenterology* 1982; 82:968.
8. Graham DY, Smith JL. The course of patients after variceal hemorrhage. *Gastroenterology* 1981; 80:800.
9. D'Amico G, De Franchis R, Cooperative Study Group. Upper digestive bleeding in cirrhosis. Post-therapeutic outcome and prognostic indicators. *Hepatology* 2003; 38:599.
10. Ge PS, Runyon BA. The changing role of beta-blocker therapy in patients with cirrhosis. *J Hepatol* 2014; 60:643.
11. Mandorfer M, Bota S, Schwabl P, et al. Nonselective β blockers increase risk for hepatorenal syndrome and death in patients with cirrhosis and spontaneous bacterial peritonitis. *Gastroenterology* 2014; 146:1680.
12. Hadengue A, Benhayoun MK, Lebrec D, Benhamou JP. Pulmonary hypertension complicating portal hypertension: prevalence and relation to splanchnic hemodynamics. *Gastroenterology* 1991; 100:520.
13. Zardi EM, Abbate A, Zardi DM, et al. Cirrhotic cardiomyopathy. *J Am Coll Cardiol* 2010; 56:539.
14. Bonis PA, Friedman SL, Kaplan MM. Is liver fibrosis reversible? *N Engl J Med* 2001; 344:452.
15. Iwaisako K, Brenner DA, Kisseleva T. What's new in liver fibrosis? The origin of myofibroblasts in liver fibrosis. *J Gastroenterol Hepatol* 2012; 27 Suppl 2:65.
16. Singal AG, Volk ML, Jensen D, et al. A sustained viral response is associated with reduced liver-related morbidity and mortality in patients with hepatitis C virus. *Clin Gastroenterol Hepatol* 2010; 8:280.
17. Hézode C, Castéra L, Roudot-Thoraval F, et al. Liver stiffness diminishes with antiviral response in chronic hepatitis C. *Aliment Pharmacol Ther* 2011; 34:656.
18. Villanueva C, Albillos A, Genescà J, et al. β blockers to prevent decompensation of cirrhosis in patients with clinically significant portal hypertension (PREDESCI): a randomised, double-blind, placebo-controlled, multicentre trial. *Lancet* 2019; 393:1597.
19. Abraldes JG, Bureau C, Stefanescu H, et al. Noninvasive tools and risk of clinically significant portal hypertension and varices in compensated cirrhosis: The "Anticipate" study. *Hepatology* 2016; 64:2173.
20. Lewis JH, Stine JG. Review article: prescribing medications in patients with cirrhosis - a practical guide. *Aliment Pharmacol Ther* 2013; 37:1132.
21. Baskol M, Ozbakir O, Coşkun R, et al. The role of serum zinc and other factors on the prevalence of muscle cramps in non-alcoholic cirrhotic patients. *J Clin Gastroenterol* 2004; 38:524.

22. Mehta SS, Fallon MB. Muscle cramps in liver disease. Clin Gastroenterol Hepatol 2013; 11:1385.
23. Sako K, Imamura Y, Nishimata H, et al. Branched-chain amino acids supplements in the late evening decrease the frequency of muscle cramps with advanced hepatic cirrhosis. Hepatol Res 2003; 26:327.
24. Hidaka H, Nakazawa T, Kutsukake S, et al. The efficacy of nocturnal administration of branched-chain amino acid granules to improve quality of life in patients with cirrhosis. J Gastroenterol 2013; 48:269.
25. Matsuzaki Y, Tanaka N, Osuga T. Is taurine effective for treatment of painful muscle cramps in liver cirrhosis? Am J Gastroenterol 1993; 88:1466.
26. Kugelmas M. Preliminary observation: oral zinc sulfate replacement is effective in treating muscle cramps in cirrhotic patients. J Am Coll Nutr 2000; 19:13.
27. Garrison SR, Allan GM, Sekhon RK, et al. Magnesium for skeletal muscle cramps. Cochrane Database Syst Rev 2012; :CD009402.
28. Carbonell AM, Wolfe LG, DeMaria EJ. Poor outcomes in cirrhosis-associated hernia repair: a nationwide cohort study of 32,033 patients. Hernia 2005; 9:353.
29. Marsman HA, Heisterkamp J, Halm JA, et al. Management in patients with liver cirrhosis and an umbilical hernia. Surgery 2007; 142:372.
30. Ozden I, Emre A, Bilge O, et al. Elective repair of abdominal wall hernias in decompensated cirrhosis. Hepatogastroenterology 1998; 45:1516.
31. Sarit C, Eliezer A, Mizrahi S. Minimally invasive repair of recurrent strangulated umbilical hernia in cirrhotic patient with refractory ascites. Liver Transpl 2003; 9:621.
32. Melcher ML, Lobato RL, Wren SM. A novel technique to treat ruptured umbilical hernias in patients with liver cirrhosis and severe ascites. J Laparoendosc Adv Surg Tech A 2003; 13:331.
33. Belli G, D'Agostino A, Fantini C, et al. Laparoscopic incisional and umbilical hernia repair in cirrhotic patients. Surg Laparosc Endosc Percutan Tech 2006; 16:330.
34. Runyon BA, Juler GL. Natural history of repaired umbilical hernias in patients with and without ascites. Am J Gastroenterol 1985; 80:38.
35. Seeff LB, Everson GT, Morgan TR, et al. Complication rate of percutaneous liver biopsies among persons with advanced chronic liver disease in the HALT-C trial. Clin Gastroenterol Hepatol 2010; 8:877.
36. Argo CK, Balogun RA. Blood products, volume control, and renal support in the coagulopathy of liver disease. Clin Liver Dis 2009; 13:73.
37. Kazankov K, Novelli S, Chatterjee DA, et al. Evaluation of CirrhoCare® - a digital health solution for home management of individuals with cirrhosis. J Hepatol 2023; 78:123.

38. Bloom P, Wang T, Marx M, et al. A Smartphone App to Manage Cirrhotic Ascites Among Outpatients: Feasibility Study. *JMIR Med Inform* 2020; 8:e17770.
39. Campbell KA, Trivedi HD, Chopra S. Infections in Cirrhosis: A Guide for the Clinician. *Am J Med* 2021; 134:727.
40. Bajaj JS, O'Leary JG, Reddy KR, et al. Second infections independently increase mortality in hospitalized patients with cirrhosis: the North American consortium for the study of end-stage liver disease (NACSELD) experience. *Hepatology* 2012; 56:2328.
41. D'Amico G, Garcia-Tsao G, Pagliaro L. Natural history and prognostic indicators of survival in cirrhosis: a systematic review of 118 studies. *J Hepatol* 2006; 44:217.
42. Salpeter SR, Luo EJ, Malter DS, Stuart B. Systematic review of noncancer presentations with a median survival of 6 months or less. *Am J Med* 2012; 125:512.e1.
43. Llach J, Ginès P, Arroyo V, et al. Prognostic value of arterial pressure, endogenous vasoactive systems, and renal function in cirrhotic patients admitted to the hospital for the treatment of ascites. *Gastroenterology* 1988; 94:482.
44. Acevedo J, Fernández J, Prado V, et al. Relative adrenal insufficiency in decompensated cirrhosis: Relationship to short-term risk of severe sepsis, hepatorenal syndrome, and death. *Hepatology* 2013; 58:1757.
45. Tsai MH, Peng YS, Chen YC, et al. Adrenal insufficiency in patients with cirrhosis, severe sepsis and septic shock. *Hepatology* 2006; 43:673.
46. Fernández J, Escorsell A, Zabalza M, et al. Adrenal insufficiency in patients with cirrhosis and septic shock: Effect of treatment with hydrocortisone on survival. *Hepatology* 2006; 44:1288.
47. Pugh RN, Murray-Lyon IM, Dawson JL, et al. Transection of the oesophagus for bleeding oesophageal varices. *Br J Surg* 1973; 60:646.
48. Child CG III, Turcotte JG. Surgery and Portal Hypertension. In: *The Liver and portal hypertension*, Child CG III (Ed), WB Saunders, Philadelphia 1964. p.50.
49. Mansour A, Watson W, Shayani V, Pickleman J. Abdominal operations in patients with cirrhosis: still a major surgical challenge. *Surgery* 1997; 122:730.
50. Garrison RN, Cryer HM, Howard DA, Polk HC Jr. Clarification of risk factors for abdominal operations in patients with hepatic cirrhosis. *Ann Surg* 1984; 199:648.
51. Infante-Rivard C, Esnaola S, Villeneuve JP. Clinical and statistical validity of conventional prognostic factors in predicting short-term survival among cirrhotics. *Hepatology* 1987; 7:660.
52. Albers I, Hartmann H, Bircher J, Creutzfeldt W. Superiority of the Child-Pugh classification to quantitative liver function tests for assessing prognosis of liver cirrhosis. *Scand J Gastroenterol* 1989; 24:269.

53. de Franchis R, Primignani M. Why do varices bleed? *Gastroenterol Clin North Am* 1992; 21:85.

Disclaimer: This generalized information is a limited summary of diagnosis, treatment, and/or medication information. It is not meant to be comprehensive and should be used as a tool to help the user understand and/or assess potential diagnostic and treatment options. It does NOT include all information about conditions, treatments, medications, side effects, or risks that may apply to a specific patient. It is not intended to be medical advice or a substitute for the medical advice, diagnosis, or treatment of a health care provider based on the health care provider's examination and assessment of a patient's specific and unique circumstances. Patients must speak with a health care provider for complete information about their health, medical questions, and treatment options, including any risks or benefits regarding use of medications. This information does not endorse any treatments or medications as safe, effective, or approved for treating a specific patient. UpToDate, Inc. and its affiliates disclaim any warranty or liability relating to this information or the use thereof. The use of this information is governed by the Terms of Use, available at <https://www.wolterskluwer.com/en/know/clinical-effectiveness-terms>. 2024© UpToDate, Inc. and its affiliates and/or licensors. All rights reserved.

Topic 1263 Version 49.0

Contributor Disclosures

Eric Goldberg, MD No relevant financial relationship(s) with ineligible companies to disclose. **Sanjiv Chopra, MD, MACP** No relevant financial relationship(s) with ineligible companies to disclose. **Bruce A Runyon, MD, FAASLD** No relevant financial relationship(s) with ineligible companies to disclose. **Kristen M Robson, MD, MBA, FACG** No relevant financial relationship(s) with ineligible companies to disclose.

Contributor disclosures are reviewed for conflicts of interest by the editorial group. When found, these are addressed by vetting through a multi-level review process, and through requirements for references to be provided to support the content. Appropriately referenced content is required of all authors and must conform to UpToDate standards of evidence.

[Conflict of interest policy](#)

→