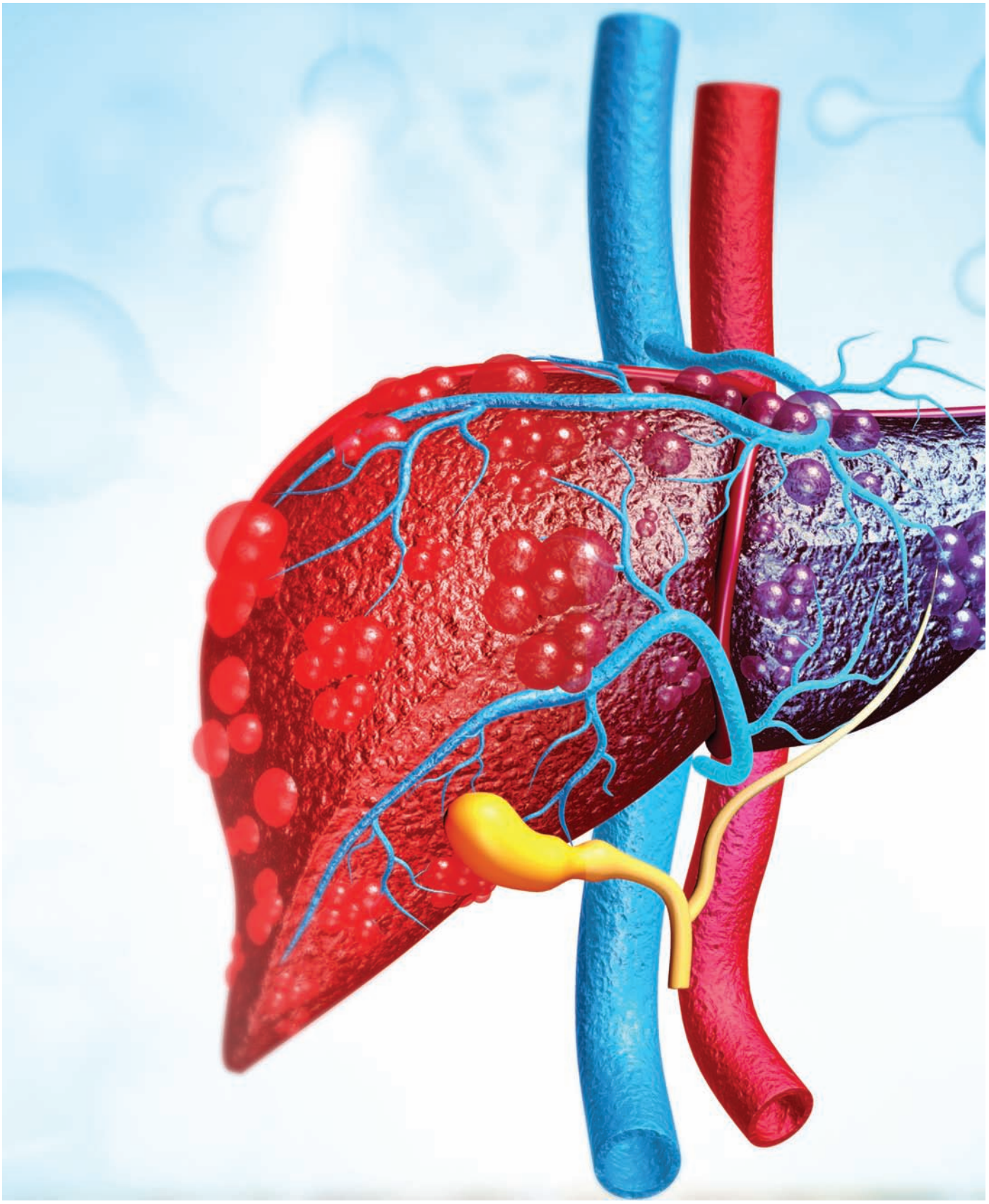

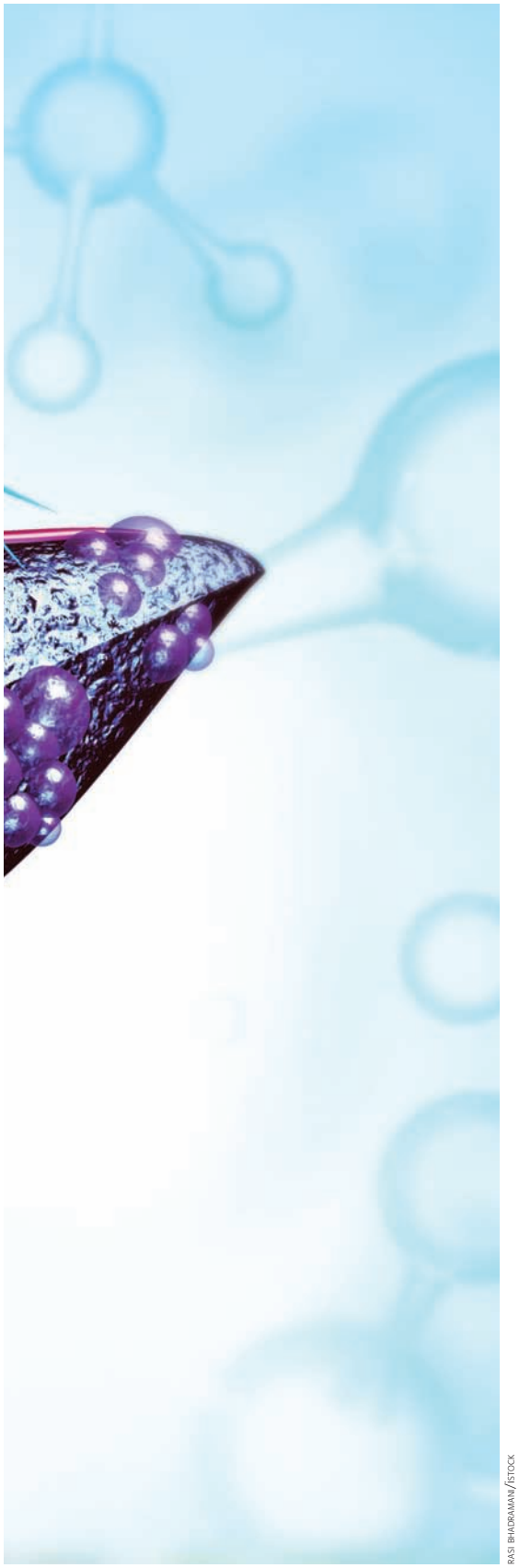

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2.5 ANCC CONTACT HOURS

1.0 PHARMACOLOGY HOUR

Cirrhosis: An evidence-based approach

BY KELLY CASLER, DNP, APRN, FNP-BC, EBP-C, CHSE, AND AMANDA CHANEY, DNP, APRN, FNP-BC, FAANP

Abstract: The role of nurses in managing patients with cirrhosis is increasing due to the growing prevalence of the disease. This article reviews the pathophysiology, diagnosis, complications, and management of patients with cirrhosis, with an emphasis on interdisciplinary collaboration and evidence-based practice.

Keywords: cirrhosis, esophageal varices, evidence-based practice, hepatic fibrosis, interdisciplinary collaboration, liver disease, portal hypertension

CIRRHOSIS IS ONE of the most challenging chronic conditions healthcare providers must manage, yet evidence suggests that primary care providers (PCPs) will take on more of the burden of care as the disease becomes more prevalent.[1] Nurses must understand the challenges and best practices of managing this common chronic disease.

Epidemiology

Cirrhosis prevalence has increased over the last 20 years, with higher disease rates seen in impoverished and Black patients.[2,3] It is the 12th leading cause of death in the US, causing at least 1 million deaths annually.[3,4] Underdiagnosis is common; over two-thirds of patients are unaware that they have liver disease. This is concerning given that cirrhosis confers a higher risk of mortality than many other chronic diseases.[1,3] Annually, $30 billion is spent caring for patients with cirrhosis.[2]

Pathophysiology

Cirrhosis starts with an initial injury or inciting event to the liver that triggers an inflammatory response. The most common inciting events in the US are viral infections (hepatitis B or C), nonalcoholic steatohepatitis (due to excess carbohydrates and calories), and alcoholic liver disease due to excess alcohol use (see *Chronic liver conditions that can lead to cirrhosis*).[5,6]

In response to inflammation, new blood vessels form, extracellular matrix proliferates, and new hepatocytes migrate to the area, replicating excessively. Angiogenesis becomes abnormal and fibrosis develops. The fibrosis coalesces, causing nodules to replace normal liver tissue. This advances from mild to severe, with the most severe fibrosis leading to cirrhosis. The liver attempts to regenerate normal functioning liver tissue around the diseased areas, with these regenerative nodules giving the cirrhotic liver its hallmark

lumpy appearance (see *Progression to cirrhosis*).[7]

The recovery and regression of early fibrosis is possible if the damaging event is removed. However, liver transplant has been traditionally thought of as the only cure once cirrhosis develops.[7] But new research is exploring the reversibility of liver cirrhosis.[8,9] Because progression toward cirrhosis is slow, taking 2 to 3 decades, cirrhosis is most often diagnosed in patients' fourth or fifth decade of life. However, recent data reveal that diagnosis is occurring at younger ages than in past decades.[2,3]

A healthy liver performs a wide range of functions, including carbohydrate and lipid metabolism; breakdown of medications, ammonia, and bilirubin; and synthesis of albumin and coagulation factors.[10] Kupffer cells help with immune system regulation, and hepatocytes produce bile, which is critical for digestion and absorption of fat-soluble vitamins.[10] Cirrhosis can cause dysfunction in one or more of these primary liver functions. Additionally, persistent alterations in cellular homeostasis during cirrhosis can lead to increased propensity for hepatocellular neoplasm.[8]

Cirrhosis also alters the hepatic vasculature, which results in portal hypertension, a state of increased pressure in the portal venous system. As the pressure inside the liver increases, blood flow is restricted, and blood vessels become congested and engorged with blood. As this occurs over months to years, the pressure increase can cause damage to the vessel walls and chronic inflammation. Ultimately, portal hypertension can lead to complications of esophageal varices, portal hypertensive gastropathy, and ascites. Additionally, patients may develop portal vein thrombosis, further complicating blood flow to and from portal circulation.[8,10]

Cirrhosis is classified as either compensated or decompensated. ***Compensated cirrhosis*** is often asymptomatic and may therefore go undetected.[1] Conversely, ***decompensated cirrhosis*** is manifested by complications; the most common are ascites, esophageal varices, and hepatic encephalopathy. Comorbidities such as diabetes predispose patients to an increased risk of decompensation.[11] Prognosis is poor following decompensation.[12] While life expectancy for compensated cirrhosis is estimated at 12 years or longer, life expectancy for decompensated cirrhosis is approximately 2 years.[12] Therefore, when a patient moves from compensated to decompensated cirrhosis, referral to a transplant center for liver transplant evaluation is warranted.

Evaluation of patients with cirrhosis

As with any chronic illness, a thorough history, physical exam, and diagnostic evaluation is important. Healthcare providers (HCPs) should evaluate for signs and symptoms of cirrhosis, identify the underlying etiology of liver disease, and intervene for improved outcomes (see *Signs and symptoms of cirrhosis and underlying pathophysiology*). Treatment of hepatitis C and abstinence from alcohol can improve patient outcomes and life expectancy.[8,13]

Two of the most common lab tests to monitor and evaluate cirrhosis are alanine aminotransferase (ALT) and aspartate aminotransferase (AST). Although it is frequently assumed that AST and ALT levels are elevated in patients with cirrhosis, these can be normal during compensated cirrhosis and sometimes even decompensated cirrhosis.[12,14] Consequently, although these tests are frequently referred to as "liver function tests," they should actually be referred to as liver enzyme tests or liver transaminase tests because they do not reflect liver function.[14]

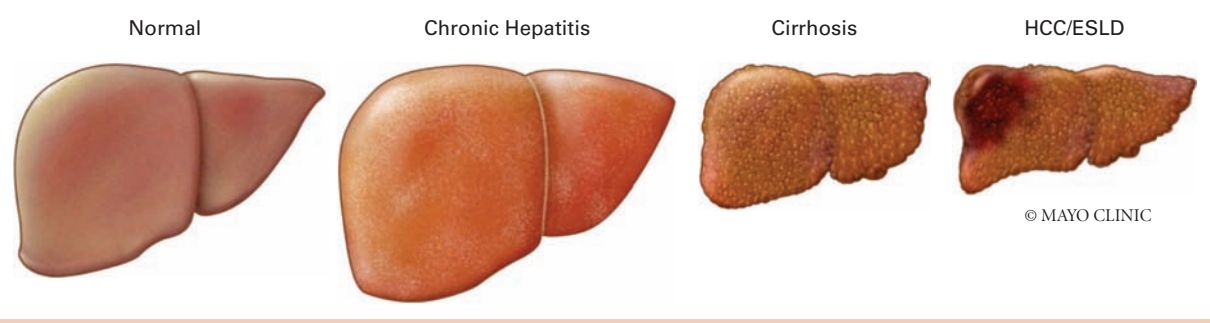
True liver function tests include albumin, prothrombin time (PT)/international normalized ratio (INR), and bilirubin. However, these tests may not show variation until late in decompensated cirrhosis, at which point albumin levels will be reduced and PT/INR will be elevated. Thrombocytopenia screening may represent an early clue to cirrhosis, as it occurs in the early stages of portal hypertension.[12,15] Patients should be evaluated for possible cirrhosis when their platelet levels fall below 160,000/mm^3 (normal: 150,000 to 400,000/mm^3).[13,16]

Several diagnostic tests are used in the evaluation and monitoring of cirrhosis. Ulltrasound will often show splenomegaly during cirrhosis, as well as portosystemic collateral veins with worsening cirrhosis.[15] The gold standard to diagnose fibrosis and cirrhosis is liver biopsy, but the invasiveness of the procedure limits its usefulness. Therefore, transient liver elastography is used to evaluate for advanced fibrosis.[17] Other screening options for fibrosis and cirrhosis diagnosis, such as serum biomarkers, are being studied but have not yet received FDA approval.[18]

Chronic liver conditions that can lead to cirrhosis[6]

More common	Less common
Nonalcoholic steatohepatitis	Primary sclerosing cholangitis
Infectious hepatitis	Primary biliary cholangitis
Alcoholic liver disease	Autoimmune hepatitis

Progression to cirrhosis



Key: HCC, hepatocellular carcinoma; ESLD, end-stage liver disease

Evaluation and management

Ascites, hepatic encephalopathy, and esophageal/gastric varices are the three most common complications seen in decompensated cirrhosis. However, there are several other possible complications that require monitoring (see *Complications of cirrhosis*).

Ascites is the most common complication of cirrhosis, with almost one-half of patients with compensated cirrhosis developing it over a 10-year period.[13,19] Sometimes, the diagnosis of ascites is the first clue to prompt the identification of cirrhosis. Ascites likely occurs due to disrupted equilibrium between the intravascular and extravascular space, which occurs when portal hypertension results in elevated hydrostatic pressure and hypoalbuminemia and leads to decreased osmotic pressure. As a consequence, fluid accumulates in the peritoneal space.[10,15] However, ascites may be hard to diagnose, especially in patients with a large abdominal girth or a small amount of ascitic fluid. An ultrasound can confirm ascites.[19,20]

Diet and medication can help manage ascites. Restricting daily sodium to 2,000 mg is recommended but evidence of success is low.[19-22] Spironolactone, a potassium-sparing diuretic, and furosemide, a loop diuretic, are often used together to manage ascites and maintain normal potassium levels. Single morning dosing will help patients avoid nocturia and increase the likelihood of adherence. It is important to closely monitor kidney function and assess for hyponatremia when initiating and titrating, and high doses, even small increases in creatinine levels within the normal range, can signal acute kidney injury. Diuretics should be stopped if patients present with hepatic encephalopathy, their sodium levels drop below 120 mEq/L, or their creatinine levels rise more than 2.0 mg/dL.[21]

Another method of ascites management is paracentesis. Current clinical guidelines suggest that patients should have paracentesis as soon as possible (within 1 month) of the first episode of ascites in order to evaluate the fluid.[20,23] Paracentesis may also be needed for patients with ascites that is refractory to diuretics and sodium restriction. In order to provide renal protection from volume loss, an albumin infusion is suggested following paracentesis when more than 5 L of fluid has been removed.[19] The need for frequent paracentesis may signal worsening decompensation or patient difficulty with adherence to sodium restrictions or diuretics.[13,19] Other methods for ascites management include transjugular intrahepatic portosystemic shunts (TIPS), which are more effective than paracentesis for severe or refractory ascites (see *Transjugular intrahepatic portosystemic shunt*).[24]

Spontaneous bacterial peritonitis

Spontaneous bacterial peritonitis can be a complication of ascites and is

Signs and symptoms of cirrhosis and underlying pathophysiology[58,59]

Signs and symptoms	Underlying pathophysiology
Splenomegaly and thrombocytopenia	Splenic congestion from portal hypertension
Caput medusae, dilated abdominal wall veins, ascites, peripheral edema	Portal hypertension
Palmar erythema, spider angiomas, gynecomastia, loss of body hair	Increased estrogen levels
Jaundice	Hepatocyte damage
Sarcopenia	Increased metabolism

Complications of cirrhosis[36,59-61]

Monitor for	Methods for monitoring	Management (all complications require care coordination with hepatology or gastroenterology)
Hepatic encephalopathy	Patient history and clinical exam: • daytime sleepiness, disorientation, and asterixis Diagnostics: • varies; use to rule out competing diagnoses	• lactulose/rifaximin
Ascites	Patient history and clinical exam: • early satiety, abdominal distension and/or bloating, peripheral edema • edema Diagnostics: • abdominal ultrasound	• sodium restriction and diuretics • patients should be admitted to the hospital if there is a concern for spontaneous bacterial peritonitis (fever or abdominal pain)
Esophageal and gastric varices	Patient history and clinical exam: • may have no abnormalities Diagnostics: • may require an EGD with a cirrhosis diagnosis	• patients with no varices and compensated cirrhosis may require an EGD every 2 to 3 years • patients with small varices may require an EGD every 1 to 2 years and nonselective beta-blockers • patients with no varices and decompensated cirrhosis may require an annual EGD • patients should be admitted to the hospital if they have signs or symptoms of bleeding
Hepatocellular carcinoma	• abdominal ultrasound at the time of diagnosis and every 6 months	• referral to surgical oncology
Hepatorenal syndrome	Patient history and clinical exam: • may have no abnormalities Diagnostics: • kidney ultrasound, urinalysis (hematuria and proteinuria not expected with HRS), increased creatinine levels greater than 0.3 mg/dL or at 50% of baseline	• referral to nephrology
Portopulmonary hypertension	Patient history and clinical exam: • audible pulmonic valve closure, BP is greater than or equal to 140/90 mm Hg, right ventricular heave Diagnostics: • pulmonary hypertension on echocardiogram or cardiac catheterization	• referral to pulmonology • home oxygen
Hepatopulmonary syndrome	Patient history and clinical exam: • suspect if patient presents with platypnea-orthodeoxia or clubbing Diagnostics: • varies, but may include arterial blood gas, echocardiogram, or pulmonary function tests	• referral to pulmonology • home oxygen

EGD = esophagogastroduodenoscopy; HRS = hepatorenal syndrome

usually caused by a translocation of bacteria from the gut to the ascitic fluid. It is characterized by a polymorphonuclear leukocyte count of 250 cells/mm^3 or more (normal: less than 250 cells/mm^3) in ascitic fluid and/or positive ascitic fluid cultures.[13,25] Spontaneous bacterial peritonitis should be suspected when a patient develops fever, abdominal pain, and/or leukocytosis, and paracentesis should be performed as soon as possible (within 12 hours) to collect cultures and confirm the diagnosis because prompt treatment is associated with better patient outcomes.[13]

Hepatic encephalopathy

Hepatic encephalopathy (HE) is another common cirrhosis complication, and perhaps the most complex to identify.[13,26] Although the pathophysiology of HE is not fully understood, it is thought to develop due to excess accumulation of ammonia in the bloodstream, which crosses the blood brain barrier and leads to neurotoxicity. Normally, hepatocytes break down the ammonia produced by intestinal bacteria, a process that is impaired in patients with cirrhosis. Portosystemic shunting can lead to HE because it hinders the delivery of ammonia to hepatocytes for detoxification.[10]

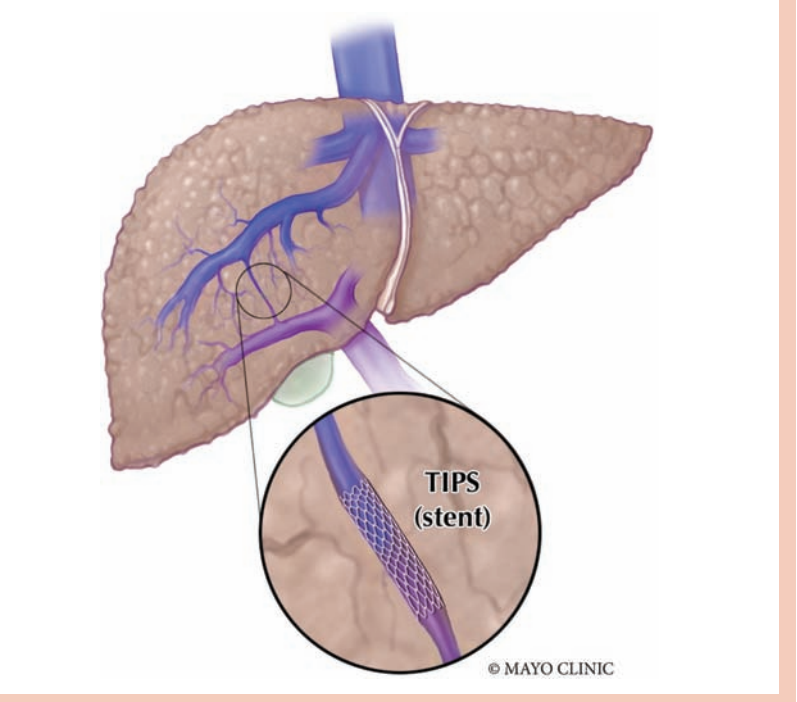
The course of HE is often unpredictable and the diagnosis is challenging.[27] This is partially due to variability and subtle signs and symptoms.[27] HE can be categorized as covert and overt; the West Haven criteria are also used, which categorize HE from Grade 0 (no symptoms) to Grade 4 (coma).[27,28] (See *Cirrhosis resources*.)

Signs and symptoms may be overlooked during early stages and covert HE due to their subtle nature. These include attention deficits, psychomotor slowing, insomnia, daytime sleepiness, apathy, and mild hypokinesia.[13,26,28] Nurses should engage the patient's caregiver in discussions involving the patient's history to achieve accurate evaluations because patients tend to avoid specific questions and hide their confusion. The psychometric hepatic encephalopathy score, the critical flicker frequency, and the Trail Making test are objective tests to supplement the physical exam and identify covert HE.[13] Other tools, such as online applications, are available for diagnostic guidance. Patients with overt HE are more easily diagnosed, as they may exhibit hyperactive deep tendon reflexes or asterixis, which is characterized as bilateral, asynchronous flapping motions of outstretched, dorsiflexed hands.[13,29] Further complicating diagnosis, HE can be episodic, recurrent, or persistent and may be spontaneous or precipitated by problems such as a urinary tract infection (UTI), medication nonadherence, or electrolyte imbalances.[28]

HE is a clinical diagnosis, and the nonspecific signs and symptoms associated with it necessitate ruling out alternate diagnoses.[28] Diagnostic evaluation should include evaluation for a precipitating event; the most common are infection and electrolyte abnormalities. Patient screening typically includes electrolyte and infection evaluations such as lactate levels, blood cultures, urinalysis if the patient presents with symptoms of a UTI, and stool studies.[13,30-33] Although traditionally used in the evaluation of HE, recent research shows that ammonia lacks sufficient sensitivity and specificity to be helpful in HE diagnosis and monitoring

Transjugular intrahepatic portosystemic shunt

In this procedure, a stent (or stents) is passed through the internal jugular vein into the hepatic vein and then advanced into the portal vein. This allows blood to pass through the portal vein into the hepatic vein, bypassing and decompressing dilated esophageal veins.



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and is no longer recommended as a diagnostic tool.[30,31]

Treatment options for HE focus on intestinal elimination of ammonia before it makes its way to the bloodstream or reduction of intestinal ammonia production. Lactulose is a nonabsorbable disaccharide that alters the pH of the colon and reduces the absorption of ammonia, leading to frequent, loose stools. Once HE is resolved, doses are titrated toward a goal of two to three bowel movements per day to prevent future HE episodes. Lactulose is continued indefinitely, but there is increased risk of dehydration and hypernatremia when bowel movements exceed five per day. Once HE has been resolved, doses are titrated with a goal of two to three daily bowel movements to prevent future episodes. Adverse reactions to lactulose include bloating, diarrhea, dehydration, electrolyte abnormalities, cramping, nausea, and vomiting.[31,32,34]

Antibiotics are added to lactulose therapy in the case of continued recurrent HE episodes. Rifaximin is an antibiotic that targets bacteria in the intestines, reducing ammonia production.[28,32] Drawbacks to rifaximin include high cost and prior authorization requirements.[28,32] Less commonly used antibiotics include neomycin, metronidazole, and vancomycin.

HE management includes correcting electrolyte imbalances and optimizing nutrition with a high protein diet to avoid HE exacerbation.[27,28] Additionally, nurses caring for patients with a diagnosis of HE will want to refer to a fitness-to-drive assessment performed by occupational therapists or state agencies to ensure that it is safe for patients to operate a vehicle.[33]

Esophageal and gastric varices

Esophageal and gastric varices represent possible sequelae to portal hypertension with the potential to cause severe blood loss, anemia, and multiorgan failure. Therefore, all patients should be screened for varices within 1 year of their cirrhosis diagnosis using esophagogastroduodenoscopy (EGD).[23]

The goal in management of varices is to prevent bleeding. When bleeding does occur, patients require hospitalization, most often in the ICU, where they are administered blood products to maintain hemoglobin levels (greater than 7 g/dL).[13,35] Beta-blockers may prevent bleeding from existing varices, but they are not effective at preventing the formation of varices.[13] Nonselective beta-blockers such as propranolol, nadolol, and carvedilol should be chosen because optimized blood flow occurs from beta-2 effects rather than beta-1 effects.[15] Carvedilol is unique in that it also exhibits some anti-alpha-1 adrenergic effects, allowing for beneficial vasodilation in intrahepatic circulation.[15] Beta-blockers should be discontinued in patients with mean arterial pressure (MAP) less than 80 mm Hg, systolic BP less than 100 mm Hg, sodium concentration levels less than 120 mEq/L, refractory ascites, hepatorenal syndrome (HRS), or spontaneous bacterial peritonitis.[13]

Endoscopic variceal ligation involves placing rubber bands around the varices to cut off the blood supply. Completed with the initial EGD, it may help manage varices. However, varices often recur after banding because this technique offers no underlying treatment of portal hypertension. In these cases, patients may undergo local therapies such as sclerotherapy. Additionally, patients with severe decompensated cirrhosis and varices may undergo TIPS.[15]

Other complications

Other complications of cirrhosis, such as hepatopulmonary syndrome, hepatic hydrothorax, and portopulmonary hypertension, may cause respiratory dysfunction and require supplemental oxygen. Each of these exhibits specific signs and symptoms with distinct recommendations for clinical management.

Hepatopulmonary syndrome is characterized by intrapulmonary vascular dilation and altered alveolar-arterial oxygen exchange. It is diagnosed by combined testing with arterial blood gas and echocardiography showing a PaO_2 less than 60 mm Hg and the presence of an intrapulmonary shunt, respectively.[36]

Cirrhosis resources

- **Hepatic Encephalopathy Grades/Stages**
  www.mdcalc.com/hepatic-encephalopathy-grades-stages
- **EncephalApp Stroop Test**
  www.encephalapp.com
- **MELDNa/MELD-Na Score for Liver Cirrhosis**
  www.mdcalc.com/meldna-meld-na-score-liver-cirrhosis
- **Child-Turcotte-Pugh Calculator**
  www.hepatitisc.uw.edu/page/clinical-calculators/ctp
- **LiverTox: Clinical and Research Information on Drug-Induced Liver Injury**
  livertox.nih.gov
- **Fibrosis-4 Index**
  www.mdcalc.com/fibrosis-4-fib-4-index-liver-fibrosis
- **Aspartate Aminotransferase to Platelet Ratio Index Score**
  www.mdcalc.com/ast-platelet-ratio-index-apri
- **Alcoholic Liver Disease/Non-Alcoholic Fatty Liver Disease Index**
  www.mdapp.co/ald-nafld-index-ani-calculator-355/

Liver transplant is the only effective treatment for hepatopulmonary syndrome. ***Hepatic hydrothorax*** occurs when ascitic fluid moves into the right pleural space from a defect in the right diaphragm. Initial treatment options are the same as those for ascites.[13] Thoracentesis is an option for patients with large volume effusions and/or severe symptoms.[21] ***Portopulmonary hypertension*** is characterized by cirrhosis-associated pulmonary hypertension and causes fatigue, exertional dyspnea, orthopnea, and sometimes respiratory failure. Each of these complications exhibits specific clinical signs and symptoms with distinct recommendations for management.

HRS is a consequence of splanchnic vasodilation and subsequent decreased kidney perfusion. These patients may present with ascites and hyponatremia.[37] Hypovolemia and acute kidney injury should be ruled out before diagnosing HRS.[13] HRS is prevented through avoidance of nephrotoxic agents and hypotension. Volume expansion with albumin is recommended as first-line treatment; if no response is seen after 48 hours, vasoactive medications such as midodrine and octreotide may be used.[21]

Hepatocellular carcinoma (HCC) is the fifth most common tumor and the fourth leading cause of cancer-related mortality in the US.[38,39] Patients with cirrhosis are at an increased risk for developing HCC, regardless of their etiology; 80% of newly diagnosed HCC cases occur in patients with cirrhosis. The prognosis is favorable when the disease is diagnosed in early stages, and it can be treated by resection, radiofrequency ablation, or chemoembolization. Transplant is also an option for those who meet the criteria, which is generally based on the Milan criteria but may vary by healthcare facility.[40] These include one lesion that is 5 cm or less, as many as three lesions under 3 cm, and no evidence of gross vascular invasion or regional nodal or distant metastases.[40] Screening for HCC should be completed twice a year, although recent research has questioned whether screening improves mortality.[38,39,41]

Clinical management

Coordinating care between PCPs, hepatology and gastroenterology specialists, and other healthcare professionals can improve patient outcomes and reduce hospital readmission rates for patients with cirrhosis.[13] However, many patients perceive that communication and coordination among healthcare professionals is poor.[42] Thus, it is important for healthcare providers work together to achieve quality of care. The care coordination process should focus on monitoring for changes in prognosis, educating patients and families, promoting healthy living and nutrition, and providing medication reconciliation.

Patients should be referred to hepatology or gastroenterology specialists as soon as possible after cirrhosis is suspected. After hospitalization for decompensated cirrhosis, patients should follow up with their PCP within 1 week of discharge, although this recommendation is extrapolated from heart failure research.[19]

Patients with cirrhosis should be routinely monitored for changes in prognosis. One method for monitoring prognosis and patients' need for a liver transplant is calculation of the Model for End-stage Liver Disease-Sodium (MELD-Na) score.[43] The MELD-Na score uses INR, bilirubin, creatinine, serum sodium, and the need for dialysis to predict the severity of cirrhosis and possible poor patient outcomes.[44,45] Specialists begin liver transplant planning once the MELD score rises above 17 or a patient develops a cirrhotic complication.[19,30] Liver transplant planning is also indicated when medical interventions for complications become ineffective.[43]

Palliative care and hospice services are often underutilized and should be considered for patients with cirrhosis.[46] All patients with cirrhosis qualify for palliative care and should receive education.[42] Palliative care can provide an additional support system to reduce symptoms and improve quality of life by using an interdisciplinary team approach.[46] Another important aspect of palliative care is the assistance of social workers in helping the patient and family make advanced care planning decisions. If a patient meets the criteria for a liver transplant but is unable to safely proceed then a hospice referral is recommended. Other indications for hospice referrals are for those experiencing oliguria and refractory or recurrent cirrhosis.[46]

Communicating with patients and caregivers while supporting and educating them is essential. Caregivers of patients with cirrhosis may experience significant stress, and, therefore, the importance of supporting them cannot be understated.[46] Patients sometimes lack the knowledge needed to manage their disease successfully and may require education on signs and symptoms and how they relate to the diagnosis and any complications.[42,47] They may also require education on the special nutrition needs of cirrhosis, so involvement of a registered dietitian is beneficial especially since malnutrition occurs in over 80% of patients (including those with an elevated body mass index).[13,22,48,49]

Patients should be advised about the hypermetabolic state seen in cirrhosis, as well as consuming a high-protein diet of 1.0 to 1.5 g of protein per kg of body weight daily.[13] Late evening meals with protein or protein nutritional supplements may help patients achieve this goal. Additional nutrition education may be warranted based on other complica-

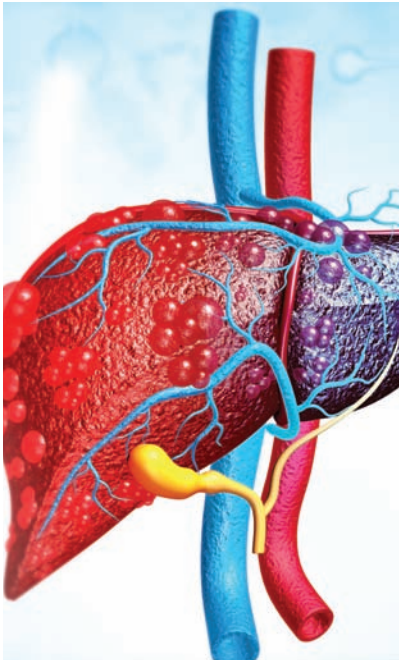
tions; for example, low-sodium diets can help with ascites, fluid restriction may be beneficial for hyponatremia, and low-carbohydrate diets are recommended for diabetes.[13]

Recommendations for patients with cirrhosis should be based on their age, gender, and comorbidities. Additionally, all patients with cirrhosis should be vaccinated for hepatitis A and B to prevent new insults to the liver in the future.[23] Immunization for pneumococcal disease with pneumococcal polysaccharide vaccine is required regardless of age.[50] Alcohol cessation can also help stabilize cirrhosis symptoms, and alcohol intake is linked to cirrhosis decompensation.[15,19]

Astute medication management is important in cirrhosis. Some medication dosages may need to be reduced because cirrhosis results in decreased metabolism of drugs.[51] Additionally, medications should be evaluated for hepatotoxicity using resources such as LiverTox.[52] Unlike chronic kidney disease, for which the glomerular filtration rate guides dosage adjustments, no single lab value is available to reflect the severity of cirrhosis for medication dose adjustments. Prescribing references often suggest dosage adjustments based on the Child-Turcotte-Pugh score.[51] Pharmacist consultation is also helpful to determine optimal dosages.

Managing comorbidities

Cardiovascular disease is a common comorbidity that poses unique patient management concerns. Despite popular belief, statins can and should be continued during compensated cirrhosis. In fact, statins improve liver function by enhancing hepatic blood flow through intrahepatic vessel dilation.[15] Statins also partially reverse the endothelial dysfunction and fibrosis that is seen in portal hypertension.[15] The benefit of aspirin to prevent cerebrovascular events and/or myocardial infarction



Care coordination should focus on monitoring prognosis, educating patients and families, promoting healthy living and nutrition, and providing medication reconciliation.

should be carefully balanced with the increased risk of azotemia or gastrointestinal bleeding seen in cirrhosis. Additionally, nonsteroidal anti-inflammatory drugs should be used with caution or avoided, if possible, due to decreased urinary sodium excretion and azotemia risks.[21]

BP should be monitored closely in patients with cirrhosis who are also hypertensive, as they may transition from hypertension to normotension and possibly hypotension. As portal hypertension progresses, systemic vasodilation, increased nitric oxide release, and splenic artery vasodilation create excessive blood vessel relaxation. Initially, the body compensates by increasing its vasoconstrictors, but it loses this compensatory mechanism over time.[19] When a patient's BP starts trending downward, antihypertensive medications may be discontinued. An MAP less than 80 mm Hg is associated with poor health outcomes and decreased survival rates in patients with cirrhosis.[13,19]

Patients with cirrhosis may experience pruritus; management of this complaint has mainly been studied in those with primary sclerosing cholangitis and primary biliary cholangitis.[53,54] Antihistamines are ineffective because the pruritus is due to cholestasis, rather than histamine release.[54] Cholestyramine is considered a first-line approach, but it is considered an off-label use. Doses should be taken before or with meals and a minimum of 4 hours before other medications.[53,54] Naltrexone and sertraline may be used if cholestyramine is ineffective, but these are considered off-label uses. Patients should also be counseled to use moisturizing lotions and cooling ointments such as menthol twice a day and advised to keep their nails trimmed short to prevent injury from scratching.

Up to 30% of patients with cirrhosis may experience depression.[55] Anxiety and insomnia are also common. Selective serotonin reuptake inhibitors are the safest drug class for treating depression and anxiety in this patient population. Because medication clearance is reduced in patients with cirrhosis, a maintenance dose at half of the usual dose is recommended.[55] Benzodiazepines should be avoided due to an increased risk of HE. Hydroxyzine or trazodone at bedtime may be safe and effective choices for insomnia, but these are considered off-label uses. Zolpidem and diphenhydramine should be avoided, as they are associated with an increased risk of HE.[13]

Pain management for patients with cirrhosis can be challenging. Acet-

aminophen is considered safe, but some patients may require stronger pain relievers.[13,56] These patients are at an increased risk of opioid toxicity and caution is advised. If opioids are prescribed, only immediate-release forms should be administered due to a risk of toxicity from slowed clearance of extended-release forms. Medications to prevent constipation are also recommended. For neuropathic pain management, medications such as gabapentin and pregabalin may be considered because they are not metabolized in the liver.[56]

Osteoporosis occurs more frequently in patients with cirrhosis due to physiologic alterations related to hypogonadism and poor nutrition.[43,57] Patients with cirrhosis related to autoimmune disease are also at an increased risk for osteoporosis due to the need for daily corticosteroid use. Therefore, patients should be counseled and educated on adequate vitamin D and calcium intake. They should also be evaluated for other osteoporosis risk factors such as postmenopausal status or smoking. Similarly, densitometry screening may be warranted for both patients at risk for osteoporosis and those undergoing a liver transplant.[43,58] If indicated based on densitometry results, bisphosphonates such as weekly alendronate and monthly ibandronate may be prescribed.[58]

The management of patients with cirrhosis is complex and requires an interdisciplinary team approach. Understanding its pathophysiology, diagnosis, and clinical management allows nurses to become more adept at caring for these patients. ■

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