Hepatic and Biliary System

PHYSIOLOGY OF THE HEPATIC AND BILIARY SYSTEM

Organs of the Hepatic and Biliary System

A. Liver.
1. Located in the upper right portion of the abdominal cavity just under the diaphragm; vascular organ; protected by the rib cage.
2. Blood flow into the liver is from two sources.
   a. Portal vein carries venous blood from the stomach, intestines, pancreas, and spleen into the liver. The venous blood is rich in nutrients absorbed from the gastrointestinal (GI) system.
   b. The hepatic artery provides oxygenated blood to the liver.
   c. The portal vein and hepatic artery enter the liver via a common vessel and flow through the liver tissue; blood then leaves the liver via the hepatic vein and empties into the inferior vena cava.
3. Because of pressure differences in the hepatic and portal veins, the liver may normally store 200 to 400 mL of blood.
4. The liver produces approximately 600 to 1200 mL of bile daily.
   a. Bile drains from the liver via the common bile duct.
   b. The common bile duct enters the duodenum, either close to or in conjunction with the pancreatic duct.
5. It can sustain 90% damage with loss of tissue and still remain functional.

B. Gallbladder.
1. A muscular, elastic sac located on the undersurface of the liver.
2. The cystic duct from the gallbladder joins the common bile duct from the liver.
3. The gallbladder is capable of storing 20 to 50 mL of bile. When food enters the duodenum, the gallbladder contracts; the sphincter of Oddi, which controls the release of bile, relaxes; and bile enters the intestine via the common duct.
4. When the sphincter of Oddi closes, bile flows back into the gallbladder for storage.
5. The primary function of the gallbladder is concentration and storage of bile.

Functions of the Liver

A. Synthesis of absorbed nutrients.
1. Serum glucose regulation.
   a. Glucose from carbohydrate metabolism is converted to glycogen, which is stored in the liver and released according to the body’s needs.
   b. Gluconeogenesis refers to the ability of the liver to produce glucose from noncarbohydrate sources, such as amino acids and the glycerol portion of fats. This process is initiated when the body’s requirements for glucose are in excess of the stored glycogen in the liver.
2. Lipid (fat) metabolism.
   a. Preliminary breakdown of fatty acids as a source of body energy.
   b. When the glucose available for metabolism is limited, fatty acids may be broken down for production of energy. This results in formation of ketone bodies.
   c. Utilization of fatty acids for production of cholesterol, lipoprotein, and phospholipid.
3. Protein metabolism.
   b. Deamination: breakdown of amino acids for energy or for conversion to glucose or fat.
   c. Synthesis of nonessential amino acids.
   d. Ammonia is a by-product of protein metabolism. It is converted to urea by the liver and excreted by the kidneys.

B. Synthesis of prothrombin for normal clotting mechanisms. Vitamin K is necessary for adequate prothrombin production.

C. Vitamin and mineral storage.
1. Produces and stores vitamins A and D.
2. Vitamin B₁₂ and iron are stored in the liver.

D. Drug metabolism: barbiturates, amphetamines, and alcohol are metabolized by the liver.
E. Production of bile and bile salts.
   1. Bile is continuously formed in the liver.
   2. Bile salts are produced in the liver; cholesterol is a necessary constituent of bile salts.
   3. Bile and bile salts emulsify fat for digestion and absorption in the intestine.
   4. Bilirubin, a bile pigment, is excreted by the liver.
      a. The spleen removes and breaks down the hemoglobin in worn-out red blood cells. This results in the production of bilirubin.
      b. Bilirubin is carried from the spleen to the liver for excretion.
      c. Bilirubin is conjugated in the liver (made water soluble) and secreted into the bile.
         1. A small amount of unconjugated bilirubin (indirect) is released into the circulation and is not water soluble.
         2. Conjugated bilirubin (direct) has been processed through the liver to form a water-soluble substance.
         3. Conjugated bilirubin is secreted into the bile and flows into the small intestine for fat digestion.
         4. Conjugated bilirubin is converted into urobilinogen in the large intestine and is reabsorbed and returned to the liver or excreted in feces. Normally, only a small amount of urobilinogen is excreted in the urine.

System Assessment (Box 19-1)

A. History.
   1. History of liver, gallbladder, or jaundice problems.
   3. History of reproductive problems.
   5. Recent association with anyone with jaundice.
   6. Alcohol consumption.

B. Physical assessment.
   1. Inspection.
      a. Skin.
         1. Presence of vascular angiomas, skin lesions, or petechiae.
         2. Hydration status.
         3. Color of the skin (jaundiced).
         4. Presence of peripheral edema.

Pathophysiology of Jaundice

A. Jaundice may begin so gradually that it is not noticed immediately.

B. The increased levels of bilirubin cause a yellowish discoloration of the skin. It may be first observed as a yellow color in the sclera of the eyes. Serum bilirubin levels must exceed 2 mg/dL for jaundice to occur. The yellow discoloration is due to deposits of bilirubin in the skin and body tissue.

C. Types of jaundice.
   1. Hemolytic jaundice.
      a. Occurs with an increase in the breakdown of red blood cells, which causes an increase in the amount of unconjugated bilirubin in the blood.
      b. The liver cannot handle the increased level of unconjugated bilirubin. The bilirubin is not water soluble; therefore it cannot be excreted. Unconjugated bilirubin is lipid soluble and is capable of entering nerve cells and causing brain damage.
      c. The increased production of urobilinogen will increase the amount of bilirubin excreted in the urine and feces.
      d. Causes of hemolytic jaundice.
         2. Sickle cell crisis.
         3. Hemolytic anemias.
         4. Hemolytic disease of the newborn.
   2. Hepatocellular jaundice.
      a. Results from the inability of the liver to clear normal amounts of bilirubin from the blood.
      b. Increase in serum levels of unconjugated and conjugated bilirubin.
      c. Causes of hepatocellular jaundice.
         1. Hepatitis.
         2. Cirrhosis.
         3. Hepatic cancer.
   3. Obstructive jaundice.
      a. Results from an impediment to bile flow through the liver and the biliary system.
      b. The obstruction may be within the liver, or it may be outside the liver.
      c. Causes of obstructive jaundice.
         1. Hepatitis.
         2. Liver tumors.
         3. Cirrhosis.
         4. Obstruction of the common bile duct by a stone.

Box 19-1  FOCUSED ASSESSMENT: LIVER AND BILIARY

Skin color: jaundice
Changes in abdominal girth
Changes in stool: pale, frothy, fatty
History of contact with infectious individuals
Issues with indigestion and food intolerance
Type of pain
Psychosocial problems associated with alcohol use
Widespread inflammation of the liver tissue is called hepatitis. A. Types of hepatitis (Table 19-1).
      a. Primarily a disease of children because of mode of transmission and interaction of large numbers of children in daycare centers.

      a. Identification of HBsAg (Australian antigen).
         (1) Identification of antigen in potential blood donors has significantly decreased transmission via blood transfusions.

   3. Hepatitis C virus (HCV).

<table>
<thead>
<tr>
<th>Transmission Modes</th>
<th>Hepatitis A (HAV)</th>
<th>Hepatitis B (HBV)</th>
<th>Hepatitis C (HCV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predominately fecal-oral</td>
<td>Percutaneous inoculation with contaminated needles or instruments is the primary mode</td>
<td>Percutaneous (parenteral)/mucosal exposure to blood and blood products</td>
<td></td>
</tr>
<tr>
<td>Poor personal hygiene</td>
<td>Skin or mucous membrane break by inoculation (needle-sticks, cuts, ear piercing, tattooing, or contaminated drug paraphernalia)</td>
<td>High-risk sexual contact</td>
<td></td>
</tr>
<tr>
<td>Oral-anal sexual practices</td>
<td>Blood and blood products</td>
<td>Perinatal contact</td>
<td></td>
</tr>
<tr>
<td>Contaminated food, water, and shellfish (commonly spread by infected food handlers)</td>
<td>Nonpercutaneous transmission—contact with body fluids containing hepatitis B surface antigen (HBsAg) (e.g., sexual contact)—is the second most common mode</td>
<td>Closely associated with HBV</td>
<td></td>
</tr>
<tr>
<td>Carriers are most contagious just before onset of symptoms (jaundice)</td>
<td>Infants of mothers with HBV may contract the disease in utero, at birth, or after delivery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transmission through sexual contact and percutaneous transmission are possible, but these are not primary modes of transmission</td>
<td>Infected asymptomatic carrier</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Incubation Period</th>
<th>2 to 6 weeks (average: 4 weeks); also the most contagious period</th>
<th>6 weeks to 6 months (average: 12 weeks)</th>
<th>2 weeks to 6 months (average: 8 weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virus is present in feces for 7 to 10 days before a person becomes ill</td>
<td>Contagious as long as serum marker (surface antigen; HBsAg) appears</td>
<td>Most contagious 1 to 2 weeks before symptoms appear; infectivity continues during clinical course</td>
<td>Large number of cases (75%-85%) develop chronic HCV</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High-Risk Individuals</th>
<th>Household contacts</th>
<th>Sexual contacts</th>
<th>Dental, laboratory, and medical personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household contacts</td>
<td>Sexual contacts</td>
<td>Multiple blood transfusion recipients</td>
<td></td>
</tr>
<tr>
<td>Sexual contacts</td>
<td></td>
<td>Sexual contacts</td>
<td></td>
</tr>
<tr>
<td>Institutions, daycare centers, schools</td>
<td>Dental, laboratory, and medical personnel</td>
<td>IV drug users</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multiple blood transfusion recipients</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sources of Infection and Spread of Infection</th>
<th>Contaminated needles, syringes, and blood products</th>
<th>Sexual activity with infected partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crowded living conditions; poor hygiene and sanitation</td>
<td>Sexual activity with infected partners</td>
<td>Sexual activity with infected partners</td>
</tr>
<tr>
<td>Contaminated food, milk, water, and shellfish</td>
<td>Asymptomatic carriers</td>
<td></td>
</tr>
<tr>
<td>Infected food handlers</td>
<td>Tattoo-body piercing with contaminated needles; bites</td>
<td></td>
</tr>
<tr>
<td>Sexual contact</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ALERT** Follow infection control guidelines; standard precautions include blood and body fluids.
(2) Antigen is present in blood, vaginal secretions, menstrual fluid, semen, saliva, and respiratory secretions (see Table 19-1).

b. Administration of hepatitis B immunoglobulin will provide some temporary immunity.

c. HBV vaccine should be administered to everyone as a standard immunization (see Table 2-1).

3. Hepatitis C (HCV).
   a. Transmission is very similar to that of HCV, with multiple causative agents; percutaneous inoculation (IV drug use), blood transfusions.
   b. Increased incidence occurs with crowded living conditions.

   a. Toxic: systemic poisons: carbon tetrachloride, gold compounds.
   b. Drug–induced: isoniazid (INH), Diuril, methotrexate, methyldopa.

5. Autoimmune hepatitis.
   a. Cause is unknown; associated with other autoimmuno diseases.
   b. Different treatment than viral hepatitis; treated with corticosteroids and immunosuppressants.

B. The inflammatory process causes hepatic cell degeneration and necrosis. Hepatitis A is generally self-limiting with liver regeneration and complete recovery. Hepatitis B and hepatitis C are more serious and can progress to total destruction of the liver.

**ALERT** Teach health promotion information; follow infection control guidelines/protocols. Prevent transmission in the hospital in addition to teaching the importance of personal hygiene.

### Assessment

Regardless of the type of hepatitis, the clinical picture is similar.

A. Risk factors/etiology and sources/spread of disease (see Table 19-1).

B. Clinical manifestations: all clients experience inflammation of the liver tissue and exhibit similar symptoms.

1. Anicteric phase.
   a. Anorexia, nausea, malaise, headache.
   b. Upper right quadrant discomfort.
   c. Low-grade fever, hepatomegaly.

2. Icteric phase (jaundiced).
   a. Dark urine caused by increased excretion of bilirubin.
   b. Pruritus.
   c. Stools light and clay colored.
   d. Liver remains enlarged and tender.

3. Posticteric phase (after jaundice).
   a. Malaise, easily fatigued.
   b. Hepatomegaly remains for several weeks.

   a. Frequently occurs in children.
   b. Many clients with hepatitis A and hepatitis C (non-A, non-B) may not show clinical jaundice.

c. Unexplained fever, general GI disturbances.

d. Anorexia and malaise.

**PEDIATRIC PRIORITY** Children often have diarrhea, and their symptoms are frequently attributed to gastroenteritis rather than hepatitis. Jaundice is seldom noted.

5. Onset of hepatitis A is more acute; symptoms are generally less severe.

6. Onset of hepatitis B is more insidious; symptoms are more severe.

7. Most cases of hepatitis C are asymptomatic or mild, but they tend to be persistent and lead to chronic liver disease.

C. Diagnostics (see Appendix 19-1).

1. Increased alanine aminotransferase, aspartate aminotransferase, and serum bilirubin levels.

2. Presence of HBsAg in serum of client with hepatitis B.

3. Presence of anti-HAV antibodies in blood with hepatitis A.

4. ELISA is initial screening test for hepatitis C. Recombinant immunoblot assay (RIBA) is confirmation test.

### Treatment

A. No specific medications for HAV.

1. Chronic HBV and HCV: α-interferon and antivirals.

2. Encourage good nutrition; no specific dietary modifications; client will probably not tolerate a high-fat diet.

3. Decreased activity; promote rest.

### Complications

A. Chronic, active hepatitis.

B. Fulminant hepatitis: severe, acute case of hepatitis.

C. Permanent destruction of liver cells, leading to cirrhosis.

D. Total destruction of the liver.

### Nursing Interventions

**Goal:** To control and prevent hepatitis.

A. Understand characteristics of transmission and preventive measures for hepatitis A.

1. Good personal hygiene, especially handwashing.

2. Participate in community activities for health education, (e.g., environmental sanitation, food preparation, etc.).

3. Identify individuals at increased risk for exposure: those with household contact, intimate sexual contact, and/or institutional contact with those with active disease.

4. Administer immune serum globulin (immunoglobulin G) within 2 weeks of exposure, if they do not have presence of anti–HAV antibodies (antibody to HAV).

5. Preexposure prophylaxis: hepatitis A vaccine (single dose).

6. Implement standard precautions.

7. Client should abstain from sexual activity during periods of communicability.
OLDER ADULT PRIORITY Older adult clients are at higher risk for liver damage and complications of hepatitis.

B. Understand characteristics of transmission and preventive measures for hepatitis B.
   1. Identify individuals at increased risk for exposure: those with oral or percutaneous contact with HBsAg-positive fluid and those who have had sexual contact with carriers within 4 weeks of the appearance of jaundice.
   2. Administration of hepatitis B vaccine.
   3. Postexposure prophylaxis: HBV vaccine series started and hepatitis B immune globulin (HBIG) given within 24 hours of exposure.

C. Understand characteristics of transmission and preventive measures for hepatitis C.
   1. No vaccine for HCV.
   2. Immunoglobulin G, antivirals, or α-interferon are not recommended.

D. Maintain strict contact-based standard precautions for hospitalized client with questionable diagnosis of hepatitis (see Appendix 6-8).

Goal: To promote healing and regeneration of liver tissue.

A. Bed rest with bathroom privileges initially; progressive activity according to liver function test results.

B. Promote psychologic and emotional rest.
   1. Strict bed rest may increase anxiety.
   2. Frequently, young adults are very concerned about body image; encourage verbalization and emphasize temporary nature of symptoms.
   3. Maintain communication and frequent contact.

C. Promote nutritional intake.
   1. Anorexia and decreased taste for food potentiate nutritional deficits.
   2. Small frequent feedings of favorite foods, good oral hygiene, and food served in a pleasant atmosphere.

D. Encourage increased fluid intake.

Home Care

A. Continued need for adequate rest and nutrition until liver function test results are normal.

B. Avoid alcohol and over-the-counter medications, especially those containing acetaminophen and phenothiazine.

Hepatic Cirrhosis

Hepatic cirrhosis is a chronic, progressive disease of the liver, characterized by degeneration and destruction of liver cells.

A. Liver regeneration is disorganized and results in the formation of scar tissue, which in time, will exceed the amount of normal liver tissue.

B. Types of cirrhosis.
   1. Alcoholic (previously called Laënnec's): also called portal or nutritional cirrhosis; associated with alcohol abuse; accumulation of fat in liver cells leading to widespread inflammation and destruction of liver cells, which results in widespread scar formation.
   2. Postnecrotic: can follow hepatitis or exposure to hepatotoxin.
   3. Biliary: diffuse fibrosis and scarring caused by chronic biliary obstruction and infection.
   4. Cardiac: increase in venous pressure associated with long-term right-sided heart failure.

C. Complications of cirrhosis.
   1. Portal hypertension.
      a. Structural changes in the liver result in obstruction of normal hepatic blood flow, which causes increased pressure in the portal circulation.
      b. Collateral circulation develops as the body attempts to reduce the increased portal pressure. Common areas for collateral channels are:
         (1) Lower esophagus at the area of the gastric vein.
         (2) Anterior abdominal wall.
         (3) Parietal peritoneum.
         (4) Rectum.
      c. Esophageal varices form from collateral vessels in the lower esophagus.
      d. Splenomegaly occurs from the increase of congestion in the splenic bed; may lead to leukopenia and thrombocytopenia.
      e. Caput medusae: dilated veins around the umbilical area.
   2. Peripheral edema and ascites.
      a. Edema results from:
         (1) Impaired liver synthesis of protein, resulting in decreased colloid osmotic pressure (hypoalbuminemia).
         (2) Portal hypertension, malnutrition.
      b. Ascites: accumulation of serous fluid in the peritoneal cavity.
         (1) With increased pressure in the liver, excessive protein and water leak out of the liver into the abdomen.
         (2) The presence of hypoalbuminemia results in decreased colloid osmotic pressure, which facilitates movement of fluid and protein into the abdominal cavity.
         (3) Hyperaldosteronism causes increased amounts of sodium and water to be retained.

Alert Evaluate client’s use of over-the-counter medications.
3. Hepatic encephalopathy (coma) results from the inability of the liver to detoxify ammonia.
   a. Ammonia is a by-product of protein metabolism.
   b. Large quantities of ammonia remain in the systemic circulation and cross the blood-brain barrier, producing toxic neurologic effects.

**Alert** Identify changes in mental status.

**Assessment**

A. Risk factors/etiology.
   1. Excessive, prolonged alcohol consumption.
   2. Nutritional deficiencies.
   3. Frequent use of alcohol and nutritional deficiency.
   4. Predisposing chronic hepatic and biliary infections.
B. Clinical manifestations.
   1. GI disturbances: anorexia, indigestion, change in bowel habits, weight loss.
   2. Changes in the skin.
      a. Jaundice (hepatocellular and biliary), pruritus.
      b. Spider angiomata on the face, neck, and shoulders.
      c. Palmar erythema: red areas on the palms that blanch with pressure.
   5. Changes in sexual characteristics: gynecomastia, impotence in males; amenorrhea, vaginal bleeding in females.
   6. Peripheral neuropathy: probably caused by inadequate intake of vitamin B complex.
   7. Hepatomegaly, splenomegaly.
      a. Esophageal varices that bleed easily.
      b. Hemorrhoids.
      c. Collateral veins visible on abdominal wall.
      d. Development of edema and ascites.
      e. Edema generally occurs in feet, ankles, and pre-sacral area.
      f. Severe abdominal distention and weight gain with ascites.
      g. Presence of fluid waves in the abdomen.
   9. Portal-systemic encephalopathy (Figure 19-1).
      a. Changes in mental responsiveness.
      b. Level of concentration: ask client to repeat a series of numbers; if client has encephalopathy, he or she will be unable to repeat a 4- to 6-digit sequence.
      c. Memory: determine client’s ability to recall recent events (yesterday or past week) and remote events (last year).
      d. Apraxia: deterioration in writing and drawing; inability to construct or draw a figure.
      e. Asterixis (flapping tremors): clients with asterixis are unable to hold their hands out in front of them when asked; a flapping of the hands will occur.
      f. Fetor hepaticus: musty, sweet odor to breath due to inability of liver to degrade digestive products.
C. Diagnostics (see Appendix 19-1).

**Treatment**

A. Cirrhosis.
   1. Rest.
   2. Dietary modification: increase calories and carbohydrates; protein and fat may be consumed as tolerated.
   3. Vitamin supplement, especially vitamin B complex.
   4. Abstinence from alcohol.
B. Ascites.
   1. IV albumin or other volume replacement after a high volume paracentesis.
   2. Sodium restriction in diet.
   3. Fluid restriction for cases of severe ascites.
   4. Diuretics.
   5. Paracentesis for temporary relief.
   7. Surgical procedures to decrease portal hypertension by shunting portal blood flow: transjugular intrahepatic portosystemic shunt (TIPS).
C. Esophageal varices.
   1. Blood transfusions to restore volume from bleeding varices.
   2. Administration of IV vasopressin (Pitressin) produces vasoconstriction of the splanchic arterial bed, decreases portal blood flow, and portal hypertension.
   3. Endoscopic sclerotherapy: injection of a sclerosing agent directly into esophageal varices; bleeding may recur because there has been no reduction in portal hypertension.
4. Endoscopic ligation or banding of the varices: often used in combination with sclerotherapy.
5. Balloon tamponade: mechanical compression of bleeding varices via esophageal gastric balloon tamponade (Minnesota or Sengstaken-Blakemore tube).
6. Shunting surgical procedures: decrease portal hypertension by shunting portal blood flow; usually performed after second major bleeding episode.
7. Management to prevent bleeding: beta adrenergic blockers (Inderal), repeated sclerotherapy, endoscopic ligation, and portosystemic shunts.
D. Decrease portal systemic encephalopathy.
1. Restriction of dietary protein intake.
2. Neomycin: decreases the normal flora in the intestines to reduce bacterial activity on protein.
3. Lactulose: used to reduce the amount of ammonia in the blood of clients with liver disease by drawing ammonia from the blood into the colon where it is removed from the body. May also be used to treat constipation, because it pulls water into the colon to facilitate movement of waste through the GI system.
4. Control of GI hemorrhage to decrease protein available in the intestine.

Nursing Interventions

**Goal:** To promote health in the client with cirrhosis.
A. Proper diet: increased protein as tolerated, adequate carbohydrates, vitamin supplements.
B. Adequate rest.

**ALERT** Monitor client’s hydration and nutritional status.

C. Avoid potential hepatotoxic over-the-counter drugs (aspirin and acetaminophen).
D. Check all body secretions for frank or occult blood.
E. Abstinence from alcohol.
F. Attention and care should be given the alcoholic client without being judgmental or moralizing.
G. Client should understand symptoms indicative of complications and when to seek medical advice.
H. Regular medical checkups.

**Goal:** To maintain homeostasis and promote liver function.
A. Rest and activity schedule based on clinical manifestations and lab data.
B. Measures to prevent complications of immobility (see Chapter 3).
C. Assist client to maintain self-esteem.
1. Maintain positive, accepting atmosphere in the delivery of care.
2. Encourage ventilation of feelings regarding disease.
D. Assist in activities of daily living, as necessary, to prevent undue fatigue.
E. Promote nutritional intake.
1. Good oral hygiene; between-meal nourishment.
2. Provide food preferences when possible.
3. Administer antiemetic before meals, if necessary.
4. Iron and vitamin supplements, especially vitamin B complex.
5. Nasogastric or parenteral feeding, if client is unable to maintain adequate intake.
F. Decrease discomfort of pruritus caused by jaundice: cool rather than warm baths, avoid excessive soap.
G. Good skin care to prevent breakdown.
H. Evaluate serum electrolyte levels, especially potassium and sodium levels, because of the use of diuretics to decrease ascites and edema.
I. Monitor temperature closely because of increased susceptibility to infection.
J. Assess for bleeding tendencies and prevent trauma to the mucous membranes.
K. Measure abdominal girth to determine whether it is increasing from ascitic fluid (Figure 19-2).

**Goal:** If esophageal varices are present, decrease risk for active bleeding.
A. Soft, nonirritating foods.
B. Discourage straining at stool.
C. Decrease esophageal reflux.
D. No salicylate compounds (aspirin).
E. Evaluate for active bleeding.
1. Monitor vital signs.
2. Assess for melena and hematemesis.

**Goal:** To decrease bleeding from esophageal and gastric varices.
A. Gastric lavage with iced saline solution.
B. Assess and prevent complications associated with sclerotherapy.
1. Client is sedated and the throat is anesthetized before the procedure.
2. By means of endoscopy, the physician injects the sclerosing agent into the varices.
3. Bleeding from the varices should stop within minutes.
4. Client may experience chest discomfort for 2 to 3 days; administer an analgesic.

5. Esophageal perforation and ulceration are complications associated with treatment; observe client for development of severe chest pain.
6. Observe for return of active bleeding.

**Goal:** To decrease esophageal bleeding by using an esophageal tamponade balloon.
A. Constant observation is required while the balloon is inflated.
B. The client is to receive absolutely nothing by mouth; provide frequent oral and nasal hygiene.
C. Constant tension/tension is applied to maintain the pressure against the esophageal sphincter by the gastric balloon. The gastric balloon is not to be deflated while tension is present and the esophageal balloon is inflated.
D. Keep the head of the bed elevated to decrease gastric regurgitation and nausea.
E. Keep scissors at the bedside in case the esophageal balloon moves into the oropharynx area and causes obstruction of the trachea. If this should occur, the lumen to the esophageal balloon should be cut to immediately deflate the balloon and relieve the obstruction.

**Goal:** To assess for and prevent complications associated with ascites.
A. Decrease sodium intake.
B. Administer diuretics, potassium supplements.
C. Daily measurements of abdominal girth.
D. Maintain semi-Fowler's position to decrease pressure on the diaphragm.
E. Assess weight daily.
F. Monitor pulse oximetry for indications of respiratory distress.

**Goal:** To assess for and prevent complications of hepatic encephalopathy.
A. Frequent assessment of responsiveness.
B. Assess for changes in level of orientation and motor abnormalities (asterixis).
C. Decrease production of ammonia.
   1. Increase carbohydrates and fluids.
   2. Decrease activity, because ammonia is a by-product of metabolism.
   3. GI bleeding will increase ammonia levels as a result of the breakdown of red blood cells.
   4. Lactulose to promote excretion of ammonia in the stool; diarrhea may occur.
   5. Nonabsorbable intestinal antibiotics (Appendix 6-9) will decrease protein breakdown.
D. Prompt treatment of hypokalemia.

**Goal:** To provide appropriate preoperative and postoperative care if surgical procedure is indicated (see Chapter 3).
A. Anastomosis of the high-pressure portal system to the low-pressure systemic venous system to create a shunt to decrease portal hypertension (portosystemic shunt), thereby decreasing problems with esophageal varices and ascites.
B. Client is at increased risk for postoperative complications.
   1. Hemorrhage, electrolyte imbalance.
   2. Seizures, delirium tremens.
C. Surgical procedures do not alter course of progressive hepatic disease.

**Cancer of the Liver**

Primary cancer of the liver is rare. Metastatic cancer is more common.
A. Liver is a common site for metastases because of increased rate of blood flow and capillary network.
B. Metastases are found in the liver in approximately one-half of all clients with late-stage cancer.
C. Prognosis is poor.

**Assessment**
A. Risk factors/etiology: malignancy elsewhere in the body.
B. Clinical manifestations.
   1. Anorexia, weight loss, fatigue, anemia.
   2. Right upper quadrant pain, ascites, jaundice.
C. Diagnostics (see Appendix 19-1).

**Treatment**
Treatment is primarily palliative.
A. Surgical excision of tumor, if it is localized.
B. Chemotherapy: very poor response.
C. Radiofrequency (RF) ablation uses heat to burn tumor (percutaneous approach).
D. Cryosurgery (cryoablation) uses liquid nitrogen to freeze liver tissue; not used for metastatic disease.
E. Percutaneous ethanol injection (PEI) or percutaneous acetic acid injection (PAI) used to treat unresectable liver cancer.

**Nursing Interventions**
Focused on maintaining comfort; nursing care is the same as that for the client with advanced cirrhosis.

**Liver Transplantation**
Therapeutic option for clients with end-stage liver disease; not recommended for widespread malignant disease.

**Assessment**
A. Rigorous prescreening process.
B. Rejection less common than with kidney transplants.

**Treatment**
A. Live liver transplant: portion of liver is donated.
B. Split liver transplant: donor liver is divided and given to two recipients.

**Nursing Interventions**
**Goal:** To monitor for postoperative complications.
A. Assess neuro status, monitor for hemorrhage and common respiratory problems of pneumonia, atelectasis, and pleural effusion.
B. Monitor IV fluids, nasogastric tube drainage, Jackson-Pratt drain, and T-tube drainage.
C. Administer antibiotics and analgesics.
D. Critical to monitor for infection the first 2 months after surgery; fever may be the only sign.

**Goal:** to provide nursing care of the immunocompromised client (see Chapter 7).

### DISORDERS OF THE BILIARY TRACT

#### Cholelithiasis and Cholecystitis

Cholelithiasis is the presence of stones in the gallbladder; this is the most common form of biliary disease. Cholecystitis is an inflammation of the gallbladder, which is frequently associated with stones; this condition may be acute or chronic (Figure 19-3).

**Assessment**

A. Risk factors/etiology.
   1. Cholelithiasis.
      a. Supersaturation of bile with cholesterol causes precipitate to occur.
      b. Conditions upsetting cholesterol and bile balance include infection and disturbances of cholesterol metabolism.
      c. Increased incidence in females, especially during pregnancy.
      d. Increased incidence after age 40; obesity.
   2. Cholecystitis.
      a. Associated with stones.
      b. *Escherichia coli* is common bacteria involved.
      c. May also be associated with neoplasms, anesthetia, or adhesions.

**FIGURE 19-3** Common sites of gallstones. (From Monahan FD et al: *Medical-surgical nursing: health and illness perspectives*, ed 8, St. Louis, 2007, Mosby.)

#### OLDER ADULT PRIORITY

Incidence of gallstone increases with age. Older adults are more likely to go from asymptomatic gallstones to serious complications of gallstones without biliary colic.

B. Clinical manifestations.
   1. Cholelithiasis: severity of symptoms depends on the mobility of the stone and whether obstruction occurs.
      a. Epigastric distress, feeling of fullness.
      b. Abdominal distention.
      c. Vague pain in the right upper quadrant after consumption of meals high in fat.
   2. Obstruction of cystic ducts by stones, precipitating biliary colic.
      a. Severe abdominal pain radiating to the back and shoulder.
      b. Nausea, vomiting, tachycardia, diaphoresis.
      c. Onset may be sudden with severe pain.
   3. Cholecystitis.
      a. Abdominal guarding, rigidity, rebound tenderness.
      b. Fever.
      c. Pain exacerbated by deep breathing.
      d. Onset may be sudden with severe pain.

C. Diagnostics (see Appendix 19-1).

#### Treatment

A. Cholecystectomy for cholelithiasis: surgical removal of the stones.

B. Cholecystitis.
   1. Anticholinergics to decrease secretions and promote relaxation of the gallbladder.
   2. Analgesics: hydromorphone (Dilaudid) or morphine.
   3. Antibiotics.
   4. Atropine and dicyclomine (Bentyl) will relieve spasms and decrease pain.
   5. Ketorolac (Toradol) may be used to decrease spasms and pain in older adults.

C. Laparoscopic cholecystectomy.
   1. Three small incisions are made.
   2. Decreases risk to client.
   3. Day surgery or overnight stay.
   4. Early ambulation and decreased pain.

#### NURSING PRIORITY

Common postop problem of referred pain to the shoulder due to CO₂ that was not released or absorbed by body, which can irritate the phrenic nerve and diaphragm causing difficulty breathing.

D. Decrease dietary fat intake.
**Nursing Interventions**

**Goal:** To decrease pain and inflammatory response.
A. Low-fat liquid diet during acute attack.
B. Low-fat solids added, as tolerated.
C. IV fluids and gastric decompression if nausea and vomiting are severe.
D. Antibiotics and analgesics.

**Goal:** Assess for indications of infection.

**Goal:** To provide appropriate preoperative nursing care if surgery is indicated (see Chapter 3).

**Goal:** To maintain homeostasis and prevent complications after cholecystectomy.
A. General postoperative care for clients having abdominal surgery (see Chapter 3).
B. Evaluate tolerance to diet and progress diet gradually to low-fat solids.
C. Penrose drain may be in place; client will frequently have large amounts of serosanguineous drainage; change dressing as indicated.
D. Sims’ position to facilitate the movement of CO₂ gas pocket away from the diaphragm.
E. T-tube may be used to maintain patency of bile duct and to facilitate bile drainage until edema subsides (Figure 19-4).
   1. Maintain tube to gravity drainage.
   2. Observe amount and color of bile drainage.
   3. Do not irrigate or clamp tube; do not raise tube above the level of the gallbladder.
   4. Observe for bile drainage around the tube.
   5. Observe and record drainage (bloody initially, then greenish-brown).
   6. Drainage is usually around 500 mL per day for several days after surgery; drainage will gradually decrease, and the doctor will remove the tube.
   7. Typically not placed or used after a laparoscopic cholecystectomy.

F. Monitor urine and stool for changes in color.

**Goal:** To assist client to understand implications of disease process and measures to maintain health after cholecystectomy.
A. Dietary teaching regarding low-fat diet.
B. Weight reduction, if appropriate.
C. Avoid heavy lifting.
D. Understand symptoms indicating bile obstruction (i.e., stool and urine changes) and advise physician accordingly.

**FIGURE 19-4** Placement of a T-tube. (From Black JM, Hawks JH: *Medical-surgical nursing: clinical management for positive outcomes*, ed 8, St. Louis, 2009, Mosby.)
# Diagnostics of the Hepatic and Biliary System

## Laboratory Tests

### Serum Laboratory Tests

<table>
<thead>
<tr>
<th>Test</th>
<th>Normal</th>
<th>Nursing Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bilirubin</strong></td>
<td></td>
<td>A rise in the serum level of bilirubin will occur if there is excessive destruction of red blood cells or if the liver is unable to excrete normal amounts of bilirubin.</td>
</tr>
<tr>
<td>Direct</td>
<td>0.1 to 0.3 mg/dL</td>
<td></td>
</tr>
<tr>
<td>Indirect</td>
<td>0.1 to 1.0 mg/dL</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0.2 to 1.3 mg/dL</td>
<td></td>
</tr>
<tr>
<td><strong>Protein Studies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total serum protein</td>
<td>6.0 to 8.0 g/dL</td>
<td>Proteins are responsible for maintaining the colloid oncotic pressure in the serum.</td>
</tr>
<tr>
<td>Serum albumin</td>
<td>3.5 to 5.0 g/dL</td>
<td>Synthesis of protein and normal serum protein levels are affected by various liver impairments.</td>
</tr>
<tr>
<td>Serum globulin</td>
<td>2.0 to 3.5 g/dL</td>
<td></td>
</tr>
<tr>
<td><strong>Serum Enzymes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lactic dehydrogenase (LDH)</td>
<td>50-150 units/L</td>
<td>Elevated in heart failure, hemolytic disorders, hepatitis, liver damage.</td>
</tr>
<tr>
<td>LDH₅</td>
<td></td>
<td>LDH₅ isoenzyme elevated in hepatitis.</td>
</tr>
<tr>
<td>Aspartate aminotransferase (AST)</td>
<td>10 to 26 units</td>
<td>Elevated in liver disease, acute hepatitis, myocardial infarction, pulmonary infarction.</td>
</tr>
<tr>
<td>Alanine aminotransferase (ALT)</td>
<td>10 to 35 units</td>
<td>Elevated in liver disease, shock.</td>
</tr>
<tr>
<td>Alkaline phosphatase (ALP)</td>
<td>30-120 units/L</td>
<td>Primary sources of ALP in body are bone and liver. Abnormally high readings may be associated with either liver or bone disease and must be correlated with presenting clinical symptoms.</td>
</tr>
<tr>
<td><strong>Serum Blood Ammonia</strong></td>
<td>30-70 mcg/dL</td>
<td>Increasing blood ammonia is indicative of the inability of the liver to convert ammonia to urea.</td>
</tr>
<tr>
<td><strong>Hepatitis Antigens and Antibodies</strong></td>
<td>Negative for antigens</td>
<td>Antigens indicate hepatitis (hepatitis B surface antigen [HBsAg] elevated in hepatitis B). Antibodies indicate exposure, current disease, or hepatitis B immunization.</td>
</tr>
</tbody>
</table>

### Biopsy

#### Liver Biopsy

Percutaneous needle aspiration of liver tissue

1. Informed consent procedure.
2. Client’s status is NPO for 6 hours before procedure.
3. Blood coagulation study results should be available on the chart before biopsy procedure.
4. Immediately before needle insertion, have client take a deep breath, exhale completely, and hold breath. This immobilizes the chest wall and decreases the risk for penetration of the diaphragm with the needle.
5. Keep client on bed rest for 12-14 hr. Client should be positioned on the right side for 2 hr postprocedure to apply pressure and decrease risk for hemorrhage.
6. Assess for complications of pneumothorax and hemorrhage immediately after biopsy; assess for right upper abdominal pain or referred shoulder pain; observe for development of bile peritonitis.

### Cholangiography

#### Percutaneous Transhepatic Cholangiography (PTC)

IV injection of radiopaque dye to visualize the biliary duct system

1. Client’s status is NPO for 8 hr before the test.
2. Assess for sensitivity to iodine.
3. Evaluate for iodine reaction after the test.
4. Client should drink large amounts of fluid after test to increase excretion of dye.

### Nuclear Imaging Scans (Scintigraphy)

#### Hepatobiliary Scintigraphy (HIDA)

Shows size, shape and position of biliary system. Radionuclide (Tc-99m) injected IV; client positioned under a camera or counter to record distribution of tracer

1. Explain to client that traces of radionuclide pose minimal danger.
2. Needs to lie flat during scanning procedure.
### Appendix 19-1 DIAGNOSTICS OF THE HEPATIC AND BILIARY SYSTEM—cont’d

<table>
<thead>
<tr>
<th>LABORATORY TESTS</th>
<th>NORMAL</th>
<th>NURSING IMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ultrasound</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| *Gallbladder ultrasound* | Uses high-frequency sound waves to examine the gallbladder, provides information about presence of tumors and patency of vessels and detects gallstones | 1. Client is NPO for 8-12 hours, since gas can reduce quality of images and food can cause gallbladder contraction.  
2. Explain to client that a conductive gel (lubricant) will be applied to the skin and a transducer placed on the area. |
| *Hepatobiliary ultrasound* | Detects abscesses, cysts, tumors, and cirrhosis |  |
| **Endoscopy**    |        |                      |
| *Endoscopic retrograde cholangiopancreatography (ERCP)* | Fiberoptic endoscope and fluoroscopy inserted orally, descended into duodenum, then into common bile duct and pancreatic ducts, where contrast medium is injected for visualization of the structures. | 1. Client is NPO for 8 hours before procedure.  
2. Explain that sedative will be given before and during procedure.  
3. Check for allergy to contrast medium.  
4. Informed consent must be signed.  
5. Check vital signs—monitor for perforation or infection; pancreatitis is most common complication.  
6. Check for return of gag reflex before giving fluids. |

*ALP,* Alkaline phosphatase; *ALT,* alanine aminotransferase; *AST,* aspartate aminotransferase; *INR,* international normalized ratio; *IV,* intravenous; *NPO,* nothing by mouth.
Study Questions  Hepatic and Biliary System

1. After administering diuretics to a client with ascites, which of the following nursing actions most ensures safe care?
   1. Monitoring serum potassium for hyperkalemia
   2. Assessing the client for hypervolemia
   3. Weighing client weekly
   4. Documenting accurate intake and output

2. A client with hepatitis B has a headache. Which analgesic(s) would be appropriate for this client? Select all that apply.
   1. Ibuprofen
   2. Naproxen
   3. Aspirin
   4. Acetaminophen
   5. Morphine
   6. Demerol

3. An obese 44-year-old woman with a history of chronic cholecystitis is to receive vitamin K before surgery. What is the purpose of this medication?
   1. To increase the digestion and utilization of fats
   2. To support the immune system and promote healing
   3. To aid in the emptying of bile from the gallbladder
   4. To facilitate coagulation activities of the blood

4. A client with cirrhosis is receiving neomycin sulfate. The nurse understands that the purpose of this medication is to
   1. Decrease gastric acidity.
   2. Acidify feces and trap ammonia in the bowel.
   3. Decrease bacterial flora.
   4. Reduce portal hypertension.

5. What statement would indicate to the nurse that the client understands the discharge teaching regarding his cirrhosis?
   1. “I will decrease vitamin B intake.”
   2. “I need to continue Tylenol daily.”
   3. “I will weigh myself every day in the morning.”
   4. “I can eat my regular diet.”

6. The nurse is caring for a client with chronic hepatitis B (HBV). What will the teaching plan for this client include?
   1. Avoid sexual activity.
   3. Eat a high-protein diet.
   4. Perform daily urine bilirubin checks.

7. The client returns to his room after liver biopsy. The nurse positions the client on his left side and assesses for bleeding. What is a priority nursing assessment?
   1. Assess the vital signs.
   2. Observe for frank bleeding.
   3. Check prothrombin time and partial thromboplastin time values.

8. A client with portal hypertension and ascites has had a paracentesis to relieve respiratory compromise. What medication will the nurse anticipate the client will receive?
   1. D$_{5}$W
   2. Meperidine (Demerol)
   3. IV albumin
   4. Furosemide (Lasix)

9. The nurse is making a home visit to a client with hepatitis A (HAV). Before assessing the client, the nurse will gather the equipment and perform what action next?
   1. Wipe the bedside table with alcohol preps.
   2. Place the supplies on the bedside table.
   3. Place paper towels on the bedside table.
   4. Put on a gown and gloves.

10. While talking with a client with a diagnosis of end-stage liver disease, the nurse notices the client is unable to stay awake and seems to fall asleep in the middle of a sentence. The nurse recognizes these symptoms to be indicative of what condition?
    1. Hyperglycemia
    2. Increased bile production
    3. Increased blood ammonia levels
    4. Hypocalcemia

11. What is the primary purpose of giving lactulose (Enulose) to a client with advanced liver disease?
    1. To ensure regular bowel movements
    2. To prevent bowel obstruction
    3. To decrease ammonia levels in the blood
    4. To promote clotting

12. Which position is best for the client who has undergone a traditional abdominal cholecystectomy?
    1. Side-lying position, to prevent aspiration
    2. Semi-Fowler's position, to facilitate breathing
    3. Supine, to decrease strain on the incision line
    4. Prone, to reduce nausea

13. A client who underwent cholecystectomy 3 days ago has a T-tube that has stopped draining. What is the best nursing action?
    1. Flush the tube with 5 mL of normal saline solution.
    2. Reposition the client.
    3. Continue to monitor.

14. The nurse is caring for a client with hepatitis A. Which type of infection precautions are appropriate for this client?
    1. Standard precautions
    2. Droplet precautions
    3. Contact precautions
    4. Bloodborne precautions
15. A new employee at a facility needs to receive the hepatitis vaccine. Which statement reflects accurate understanding of the immunization?
   1. “I need to receive six shots—one a month until I show positive antibodies to hepatitis.”
   2. “Once I receive the hepatitis vaccine, I will be immune to all types of hepatitis.”
   3. “I will receive three injections over a period of months, which should protect me from hepatitis B.”
   4. “The hepatitis vaccine is an oral vaccine with live attenuated virus.”

16. A client asks how her body can continue to function normally after a laparoscopic cholecystectomy. Which response by the nurse would be the most accurate answer to the client’s question?
   1. “You should never eat a diet that is high in fat now that you do not have a gallbladder.”
   2. “The primary function of the gallbladder is concentration and storage of bile.”
   3. “The liver continues to secrete bile and takes over the function of the gallbladder.”
   4. “The gallbladder has no known function in the human body, so removal is okay.”

17. Clients with liver disease frequently develop a problem with jaundice. What would the nurse identify as the physiologic cause of jaundice?
   1. Increased levels of ammonia
   2. Increased alanine aminotransferase (ALT) level
   3. Bilirubin levels above 4 mg/dL
   4. Increased red blood cell breakdown

18. The client who has undergone a traditional cholecystectomy has a T-tube in place after surgery. What is the purpose of the T-tube in the care of this client?
   1. To remove bile leaking from the incision
   2. To provide a means of wound irrigation
   3. To drain bile from the common bile duct
   4. To prevent rupture of the inflamed gallbladder

19. What is the most important nursing intervention for the safety of a client with altered clotting mechanisms caused by hepatic cirrhosis?
   1. Promote independence in the client’s activities of daily living.
   2. Administer antibiotics to decrease ammonia.
   3. Implement bleeding precautions.
   4. Increase vitamin supplements and nutritional intake.

20. A client has a diagnosis of hepatitis B. What would be the most important information for the nurse to include in a teaching plan for this client?
   1. How to sanitize all bathroom facilities
   2. Avoid sexual contact.
   3. Maintain droplet precautions.
   4. Follow up with hepatitis B vaccinations.

*Answers and rationales to these questions are in the section at the end of the book titled Chapter Study Questions: Answers and Rationales.*