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. 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.
   2. 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.
   2. Lipid (fat) metabolism.
   3. Protein metabolism.
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.

System Data Collection
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 data collection.
   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.
      b. Abdomen.
         (1) Evidence of jaundice.
         (2) Contour of the abdomen.
         (3) Presence of visible abdominal wall veins.
   2. Palpation of the abdomen.
      a. Pain, tenderness, presence of distention.
      b. Hepatomegaly, splenomegaly.
C. Nutritional assessment.
   1. Weight gain or loss; dietary intake.
   2. Problems of anorexia, nausea and vomiting.

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.
         (1) Blood transfusion reactions.
         (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.

**Hepatitis**

* Widespread inflammation of the liver tissue is called hepatitis.

A. Types of hepatitis (Table 14-1).
      a. Primarily a disease of children because of mode of transmission and interaction of large numbers of children in daycare centers.
      b. The mortality rate is low, but there is an increase in fatalities in the older adult population.
      c. Administration of immune serum globulin (immunoglobulin G) to exposed individuals increases the immune resistance and/or decreases the severity of the illness (passive immunization).

      a. Identification of HBsAg (Australian antigen).
         (1) Identification of antigen in potential blood donors has significantly decreased transmission via blood transfusions.
         (2) Antigen is present in blood, vaginal secretions, menstrual fluid, semen, saliva, and respiratory secretions (see Table 14-1).
      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 (HBV).
      a. Transmission is very similar to that of HBV, with multiple causative agents; percutaneous inoculation (IV drug use), blood transfusions.
      b. Increased incidence occurs with crowded living conditions.

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.

NURSING PRIORITY: Follow infection control guidelines/protocols. Prevent transmission in the hospital in addition to teaching the importance of personal hygiene.

Data Collection

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

A. Risk factors/etiology and sources/spread of disease (see Table 14-1).
B. Clinical manifestations: all clients experience inflammation of the liver tissue and exhibit similar symptoms.
   1. Anorexia, nausea, malaise, headache.
   2. Upper right quadrant discomfort.
   3. Low-grade fever, hepatomegaly.
   4. Dark urine caused by increased excretion of bilirubin.
   5. Pruritus, stools light and clay colored.
   6. Liver remains enlarged and tender.
C. Diagnostics (see Appendix 14-1).
   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.
TABLE 14-1  HEPATITIS

<table>
<thead>
<tr>
<th>HEPATITIS A (HAV)</th>
<th>HEPATITIS B (HBV)</th>
<th>HEPATITIS C (HCV)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transmission Modes</strong></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>
</tr>
<tr>
<td>Predominately fecal-oral</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>
</tr>
<tr>
<td>Poor personal hygiene</td>
<td>Blood and blood products</td>
<td>Perinatal contact</td>
</tr>
<tr>
<td>Oral-anal sexual practices</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>
</tr>
<tr>
<td>Contaminated food, water, and shellfish (commonly spread by infected food handlers)</td>
<td>Infants of mothers with HBV may contract the disease in utero, at birth, or after delivery</td>
<td></td>
</tr>
<tr>
<td>Carriers are most contagious just before onset of symptoms (jaundice)</td>
<td>Infected asymptomatic carrier</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>Hepatitis D (HDV) is very similar to HBV</td>
<td></td>
</tr>
<tr>
<td><strong>Incubation Period</strong></td>
<td>2 weeks to 6 months (average: 12 weeks)</td>
<td>Contagious as long as serum marker (surface antigen; HBsAg) appears</td>
</tr>
<tr>
<td>2 to 6 weeks (average: 4 weeks); also the most contagious period</td>
<td>6 weeks to 6 months (average: 12 weeks)</td>
<td></td>
</tr>
<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></td>
</tr>
<tr>
<td><strong>High-Risk Individuals</strong></td>
<td>Household contacts</td>
<td>Household contacts</td>
</tr>
<tr>
<td>Sexual contacts</td>
<td>Sexual contacts</td>
<td>Sexual contacts</td>
</tr>
<tr>
<td>Institutions, daycare centers, schools</td>
<td>Dental, laboratory, and medical personnel</td>
<td>Multiple blood transfusion recipients</td>
</tr>
<tr>
<td></td>
<td>IV drug users</td>
<td></td>
</tr>
<tr>
<td><strong>Sources of Infection and Spread of Infection</strong></td>
<td>Contaminated needles, syringes, and blood products</td>
<td>Blood and blood products, needles and syringes</td>
</tr>
<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>

*TEST ALERT: Follow infection control guidelines; standard precautions include blood and body fluids.*

*IV, Intravenous.*

**Treatment**

A. No specific medications for HAV.
   1. Chronic HBV and HCV: α-interferon and antivirals.

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

C. Decreased activity; promote rest.

**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.

**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.
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.
   6. Peritoneovenous shunt (LaVeen shunt): a surgical procedure for reinfusion of ascitic fluid into venous system.
   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) for bleeding.
   3. Endoscopic sclerotherapy: injection of a sclerosing agent directly into esophageal varices.
   4. Endoscopic ligation or banding of the varices.
   5. Balloon tamponade: mechanical compression of bleeding varices via esophageal gastric balloon tamponade (Minnesota or Sengstaken-Blakemore tube).

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.

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.
C. Avoid potential hepatotoxic over-the-counter drugs (aspirin and acetaminophen).
D. Monitor 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 14-1).
Goal: To decrease risk for active bleeding, if esophageal varices are present.
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. Bleeding from the varices should stop within minutes.
   3. Client may experience chest discomfort for 2 to 3 days; administer an analgesic.
   4. Observe for return of active bleeding.
C. Notify RN immediately of any bright red vomiting (bleeding) or significant changes in vital signs.

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 and for indications of respiratory distress.

Goal: To assess for and prevent complications of hepatic encephalopathy.
A. Frequent assessment of responsiveness and changes in level of orientation and for motor abnormalities (asterixis).
B. 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 will decrease protein breakdown.
C. Prompt treatment of hypokalemia.

Goal: To provide appropriate preoperative and postoperative care if surgical procedure is indicated (see Chapter 3).
A. Client is at increased risk for postoperative complications.
   1. Hemorrhage, electrolyte imbalance.
   2. Seizures, delirium tremens.

B. 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.

Data Collection
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 14-1).

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.

Data Collection
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. Rejection is not as common as it is with kidney transplants.
B. Assess neuro status, monitor for hemorrhage and common respiratory problems of pneumonia, atelectasis, and pleural effusion.

C. Monitor IV fluids, nasogastric tube drainage, Jackson-Pratt drain, and T-tube drainage.

D. Administer antibiotics and analgesics.

E. 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 5).

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 14-2).

Data Collection

A. Cholelithiasis: presence of gallstones.
   1. Increased incidence in females, especially during pregnancy.
   2. Increased incidence after age 40; obesity.

B. Cholecystitis: inflammation of the gallbladder.
   1. Associated with stones.
   2. Escherichia coli is common bacteria involved.
   3. May also be associated with neoplasms, anesthesis, or adhesions.

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.

C. Cholelithiasis: severity of symptoms depends on the mobility of the stone and whether obstruction occurs.
   1. Epigastric distress, feeling of fullness.
   2. Abdominal distention.
   3. Vague pain in the right upper quadrant after eating a meal high in fat.
      a. Severe abdominal pain radiating to the back and shoulder.
      b. Nausea, vomiting, tachycardia, diaphoresis.
      c. Pain occurs 3-6 hours after eating a heavy meal, especially if high in fat.
   5. Jaundice may occur with obstruction of bile flow.
   6. Urine may become very dark, and stools may be clay colored.

D. Cholecystitis.
   1. Abdominal guarding, rigidity, rebound tenderness.
   2. Fever.
   3. Pain exacerbated by deep breathing.
   4. Onset may be sudden with severe pain.

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; day surgery or overnight stay.
   3. Early ambulation and decreased pain.

NURSING PRIORITY: Common postoperative 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.
  E. 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 14-3).
    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. Report severe pain, increased distention, or leakage of bile from puncture sites to the charge nurse.

**FIGURE 14-3 Placement of a T-tube.** (From Black JM, Hawks JH: *Medical-surgical nursing: clinical management for positive outcomes*, ed 8, St. Louis, 2009, Mosby.)

**Study Questions  Hepatic and Biliary System**

1. Which client would be considered at an increased risk for developing hepatitis A?
   1. Older adult with daily alcohol consumption.
   2. Client required to have multiple blood transfusions.
   3. Client who regularly donates blood.
   4. Older client in long-term care facility.

2. Which nursing activity would put the nurse at the greatest increased risk for exposure to hepatitis B virus?
   1. Cleansing the client’s anal area without wearing gloves.
   2. Recapping syringes and needles.
   3. Hand contact with client’s blood.
   4. Spraying of blood into nurse’s eyes.

3. A client is being discharged after treatment for hepatitis B. What is important to teach this client regarding over-the-counter medications?

4. What are critical vaccinations for a person who is working in the health care field?
   1. Hepatitis B.
   2. Hepatitis A.
   3. Human immunodeficiency virus (HIV).
   4. Varicella.

5. Why is it important for a client with end-stage liver failure to be very cautious when taking any form of medication?
   1. The liver metabolizes many medications for utilization and excretion from the body.
2. The liver inactivates most medications.
3. A diseased liver will increase the action of medications.
4. The client will have to take a larger dose to get the actual therapeutic value.

6. What physiological characteristics would the nurse find while checking the skin of a client with cirrhosis of the liver?
   1. Spider angiomas on the chest, yellow-tinted skin color, bruises.
   2. Cyanosis, red- to pink-colored extremities, glassy eyes.
   3. Dusky blue color, fruity breath, yellow-tinted skin color.
   4. Yellow-tinted skin color, varicose veins, glassy eyes.

7. When evaluating a client, the nurse notices that the client has yellow-tinted sclera. What term best describes this condition?
   1. Conjunctivitis.
   2. Sclerosis.
   3. Exophthalmos.
   4. Jaundice.

8. A client being treated for ascites is placed on a strict low-sodium diet. Considering his diet, what foods would the nurse encourage the client to select?
   1. Pasta and milk.
   2. Whole wheat bread.
   4. Peanut butter on crackers.

9. The nurse is caring for a client with advanced liver disease. What would the nurse expect to find while evaluating this client?
   1. Client has difficulty maintaining normal blood pressure.
   2. Urine output is significantly decreased.
   3. Stools are black and tarry.
   4. Client has a large abdomen with excessive free fluid.

10. The client is returning to his room following a laparoscopic cholecystectomy. What is the best position for this client?
    1. Left Sims’ position with knees flexed.
    2. Semi-Fowler’s to promote breathing.
    3. Prone to decrease problems with aspiration.
    4. Supine to decrease stress on the suture line.

11. In report the nurse is told that one of the assigned clients has advanced liver disease and has a high level of blood ammonia. What would the nurse expect to find with this client?
    1. Increased breathing problems.
    2. Altered level of consciousness.
    3. Fragile skin and easy bruising.
    4. Yellowish skin discoloration.

12. A client with chronic liver problems is to receive vitamin K before surgery. What is the purpose of this medication?
    1. Decreases bleeding tendencies.
    2. Increases healing after surgery.
    3. Assists to maintain fluid balance.
    4. Prevents nausea and vomiting.

13. The nurse is discharging a client after a laparoscopic removal of the gallbladder. What would be important discharge instructions?
    1. Report any bile-colored drainage from the incisional areas.
    2. Return the day after discharge for lab work.
    3. Take a vitamin K supplement daily for the next 2 weeks.
    4. Evaluate stools for the presence of steatorrhea.

14. A client is being discharged after a diagnosis of hepatitis B. What would be important to discuss with this client?
    1. Use a condom during sexual intercourse.
    2. Decrease alcohol intake.
    3. Increase intake of green, leafy vegetables.
    4. Take acetaminophen for pain or discomfort.

15. A client with advanced cirrhosis is diagnosed with esophageal varices. What would cause the nurse the most concern regarding complications associated with the varices?
    1. Difficulty swallowing.
    2. Coughing up bright red blood.
    3. Decreased gag reflex.
    4. Anorexia and dyspepsia.

16. A client is scheduled for laparoscopic removal of his gallbladder. The nurse is discussing the immediate postoperative care. What will the nurse tell the client?
    1. There will be four small incisions, most often covered with light bandages.
    2. A urinary retention catheter will be in place for the first 12 hours.
    3. Right lower quadrant pain is the most common area of pain.
    4. No food or fluid intake is allowed for the first 24 hours after surgery.

17. A client with cirrhosis is experiencing problem with hepatic encephalopathy. What would be severely restricted in the client’s dietary intake?
    1. Protein.
    2. Carbohydrates.
    3. Fats.

18. The nurse is caring for a client with severe ascites. In what position would the nurse anticipate the client to be most comfortable?
    1. Semi-Fowler’s.
    2. Prone.
    4. Sims’.

Answers and rationales to these questions are in the section at the end of the book titled Chapter Study Questions: Answers and Rationales.
### APPENDIX 14-1 DIAGNOSTICS OF THE HEPATIC AND BILIARY SYSTEM

#### LABORATORY TESTS

<table>
<thead>
<tr>
<th>SERUM LABORATORY TESTS</th>
<th>NORMAL</th>
<th>NURSING IMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bilirubin</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct</td>
<td>0.1 to 0.3 mg/dL</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>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>LDH&lt;sub&gt;5&lt;/sub&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspartate aminotransferase (AST)</td>
<td>10 to 26 units/L</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/L</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.

**NURSING PRIORITY:** Monitor status of client after a procedure. Position the client on right side with a pillow under the costal margin to facilitate compression of the liver.

#### 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.

**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 14-1  DIAGNOSTICS OF THE HEPATIC AND BILIARY SYSTEM—cont’d.

<table>
<thead>
<tr>
<th>LABORATORY TESTS</th>
<th>NURSING IMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ULTRASOUND</strong></td>
<td></td>
</tr>
<tr>
<td>Gallbladder ultrasound</td>
<td>Uses high-frequency sound waves to examine the gallbladder; provides information about presence of tumors and patency of vessels and detects gallstones.</td>
</tr>
<tr>
<td>Hepatobiliary ultrasound</td>
<td>Detects abscesses, cysts, tumors, and cirrhosis.</td>
</tr>
</tbody>
</table>

### ENDOSCOPY

<table>
<thead>
<tr>
<th><strong>Endoscopic retrograde cholangiopancreatography (ERCP)</strong></th>
<th></th>
</tr>
</thead>
</table>
| 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.