Anatomy
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GALLBLADDER AND BILIARY SYSTEM

1) Other Names:

- N/A

2) Definition/Location:

- The biliary system consists of the right and left hepatic ducts, the common hepatic duct, the common bile duct, the gallbladder, and the cystic duct. (Hagen-Ansert, p. 204, C1/P2/S1)
- The basic function of the biliary system is to drain the liver of bile and to store the bile until it is needed to aid in the digestive process. (Curry-Tempkin, p.153, C1/P2/S1)
- The right and left hepatic ducts emerge from the right lobe of the liver in the porta hepatis and unite to form the common hepatic duct. The hepatic duct runs parallel with the portal vein. (Hagen-Ansert, p. 204, C1/P3/S1)
- The common hepatic duct descends within the edge of the lesser omentum. It joins the cystic duct to form the common bile duct and functions to drain the liver into the common bile duct. (Hagen-Ansert, p. 204, C1/P4/S1)
- The first part of the common bile duct lies in the right free edge of the lesser omentum. The second part of the duct is situated posterior to the first part of the duodenum. The third part lies in a groove on the posterior surface of the head of the pancreas. (Hagen-Ansert, p.204 C2/P1/S2)
- The cystic duct is superior to the gallbladder neck. (Tempkin, p.71, "Location") The cystic duct connects the neck of the gallbladder with the common hepatic duct to form the common bile duct. (Hagen-Ansert, p.204, C2/P4/S1)
- The gallbladder is in the right upper quadrant and lies immediately posterior to the liver. The neck of the gallbladder is fixed in its position at the main lobar fissure. The body and fundus of the gallbladder are extremely variable in position. (Tempkin, p.71, "Location")
- The gallbladder acts as a reservoir for bile. The gallbladder also concentrates the bile by secreting mucus and absorbing water. (Curry-Tempkin, p.153, C1and2/P1and 2)
- A person can live without a gallbladder.

3) Ultrasound Appearance: (Tempkin, p.72, "Sonographic Appearance")

- The bile-filled gallbladder is an anechoic oblong structure with echogenic walls.
- The bile-filled common duct is an anechoic tubular structure with echogenic walls.

4) Normal Size Range(s):

- The overall length of the normal gallbladder is highly variable, depending on the amount of bile within the structure. There are times when the gallbladder is difficult to see because of physiology. When the gallbladder is visualized, it is found to have a length of approximately 8 to 9 cm in many patients, as measured from the neck to the fundus. It is approximately 3 cm in diameter and holds up to approximately 40 ml of fluid. (Curry-Tempkin, p. 156, C2/P1/S1)
- Tempkin states the normal gallbladder is 7 to 10 cm in length. (Tempkin, p. 72, "Anatomy")
- Hagen-Ansert states the normal gallbladder measures 2.5 to 4 cm in diameter. (Hagen-Ansert, p.205, C1/P3/S1)
- The cystic duct is approximately 1 to 4 cm in length and 3 mm in diameter. (Curry-Tempkin, p. 156, C2/P3/S1)
- The common bile duct is 8 to 11.5 cm in length and 1 to 7 mm in diameter. (Curry-Tempkin, p. 157, C1/P1/S2)
- The common hepatic duct is 3 to 4 cm in length and 1 to 7 mm in diameter. (Curry-Tempkin, p.156, C2/P2/S1)
- The walls of the gallbladder are less than 3 mm thick. (Hagen-Ansert, p. 205, C1/P3/S3

5) Pertinent Lab Data: (Curry-Tempkin, p. 164, Laboratory Values)

- Serum Bilirubin:
    1. Adult: Direct (conjugated): <0.5 mg/dl
       Indirect (unconjugated): <1.1 mg/dl
       Urine: Negative
    2. Infant: total: 1 to 12 mg/dl
- Urobilinogen:
    1. Fecal: 50 to 300 mg/ 24 hours
    2. Urine: Men- 0.3 to 2.1 Ehrlich units/ 2 hours
       Women- 0.1 to 1.1 Ehrlich units/ 2 hours

6) Common Pathologies:

- Sludge: Sonographic findings include low-level internal echoes, which may be attributed to thick bile. (Hagen-Ansert, p.214, C2/P4/S1)
- Cholecystitis: There are 5 types:
    1. Acute: Sonographic findings include a gallbladder with an irregular outline of a thickened wall. A sonolucent area probably caused by edema has been found within the thickened wall. (Hagen-Ansert, p.217, C1/P2/S1)
    2. Chronic: Sonographic findings include a contracted bright gallbladder with posterior shadowing. (Hagen-Ansert, p.217, C2/P3/S2)
    3. Acalculous: Sonographic findings include the gallbladder wall that is extremely thickened and echogenic sludge is seen within a dilated gallbladder. (Hagen-Ansert, p.217, C2/P5/S1)

4. Emphysematous: Sonographic findings include a bright echo in the area of the gallbladder with ring down or comet-tail artifact. (Hagen-Ansert, p.218, C1/P2/S1)
5. Gangrenous: Sonographic findings include the presence of diffuse medium to coarse echogenic densities filling the gallbladder lumen in the absence of duct obstruction. (Hagen-Ansert, p.218, C2/P2/S1)

- Cholelithiasis: Sonographic findings include dilated gallbladder with thick wall and hyperechoic intraluminal echoes with posterior acoustic shadowing. (Hagen-Ansert, p.215, Table 7-1)

7) Patient Prep:

- Fasting for 8 to 12 hours to guarantee maximum gallbladder and biliary tract dilation but may be scanned after 4 to 6 hours. (Tempkin, p.73, Patient Prep)

8) Transducer (Probe) Frequency: (Tempkin, p. 73, Transducer)

- 3.0 MHz or 3.5 MHz
- 5.0 MHz for thin patients and anterior-lying gallbladders

9) Protocol: (Tempkin, p. 78-83, Required Images)

- The gallbladder and biliary tract pictures must be taken in two patient positions.
- First position is supine.
    1. Long axis image of the gallbladder.
    2. Longitudinal image of the gallbladder fundus and body.
    3. Longitudinal image of the gallbladder neck.
    4. Longitudinal image of the common hepatic duct.
    5. Longitudinal image of the common bile duct with anterior to posterior measurement.
    6. Longitudinal image of the common bile duct with anterior to posterior measurement without calipers
    7. Transverse image of the gallbladder fundus.
    8. Transverse image of the gallbladder body.
    9. Transverse image of the gallbladder neck.
- Second position is left lateral decubitus.
    1. Long axis image of the gallbladder.
    2. Transverse image of the gallbladder fundus.

10) Image Reference:

- Hagen-Ansert, p. 204, fig 7-1
- Hagen-Ansert, p. 210, fig 7-6
- Hagen-Ansert, p. 211, fig 7-7
- Hagen-Ansert, p. 211, fig7-8
- Hagen-Ansert, p. 216, fig 7-16
- Hagen-Ansert, p. 218, fig 7-19

11) References:

- Curry, R.A. and Tempkin, B.B. (2004). Sonography: Introduction to normal structures and function (2nd ed.). St. Louis, MO: Saunders.
- Hagen-Ansert, S.L. (2006). Textbook of diagnostic ultrasonography (6th ed.)(Vol. 1). St. Louis, MO: Mosby.
- Tempkin, B.B. (1999). Ultrasound scanning: Principles and protocols (2nd ed.). Philadelphia, PA: Saunders.