Ultrasound of the Gallbladder and Biliary Tree: Back to Basics

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KEYWORDS

• Bile duct • Portal vein • Cholecystitis • Intrahepatic duct • Common bile duct

KEY POINTS

- Ultrasound is the modality of choice and is well suited for the initial evaluation of the gallbladder and biliary tree.
- Ultrasound imaging benefits include lower cost, faster acquisition time, portability, and the advantage of being a dynamic examination.
- Although ultrasound may be the initial modality that identifies biliary tract malignancy, cross-sectional imaging with computed tomography and MR imaging will be required to evaluate the extent of disease.
- Sonographic findings in the biliary system are often nonspecific, but when combined with clinical history, these can often help to determine the diagnosis.

Videos of Adenomyomatosis, Intrahepatic Biliary Dilation, Gallbladder mass imaging accompany this article at http://www.ultrasound.theclinics.com/

INTRODUCTION

Ultrasound is the initial imaging modality of choice to evaluate the biliary tract. Because acute gallbladder disease is a common cause of right upper quadrant pain and cholecystectomy remains one of the most common abdominal surgeries performed, ultrasound imaging of the gallbladder and biliary tree accounts for a significant portion of the volume in many radiology practices. Although MR imaging, more specifically magnetic resonance cholangiopancreatography (MRCP), and computed tomography (CT) scans are being increasingly ordered as part of the diagnostic workup, ultrasound remains the workhorse modality for initial imaging. Ultrasound imaging benefits include lower cost, faster acquisition time, portability, and the advantage of being a dynamic examination.

The structure and location of the gallbladder and bile ducts lends itself to ultrasound evaluation. The fluid-filled nature of the gallbladder and bile ducts provides a natural contrast resolution from the surrounding organs in the upper abdomen.[1] In addition, the liver typically functions as a solid tissue acoustic window through which the biliary system can be visualized.

The primary goal of this article is to review the fundamentals of gallbladder and biliary imaging as it pertains to the diagnostic radiologist. The basic anatomy, normal measurements, common diseases, and pertinent ultrasound findings of the biliary tract are also reviewed.

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GALLBLADDER ANATOMY

- Ovoid, anechoic viscus
- Lies along posterior liver surface and interlobar fissure
- Three parts: neck, body, fundus
- Wall thickness less than 3 mm
- Less than 10 cm in length and 5 cm in diameter

The gallbladder is an ovoid, hollow viscus normally filled with simple fluid (bile) and therefore predominantly anechoic on ultrasound when distended (**Fig. 1**). The gallbladder wall is thin, smooth, and relatively hyperechoic, measuring less than 3 mm in thickness in a normal, fasting patient.[2] The gallbladder typically lies along the inferior surface of the liver between the left and right lobes, but can vary in orientation from patient to patient.

The gallbladder is divided into 3 main parts: fundus, body, and neck (see **Fig. 1**A). Unlike the stomach, the fundus is the distal most aspect of the gallbladder. The body lies between the neck and the fundus with the neck being the most proximal aspect of the gallbladder, leading into the cystic duct. The neck is a potential site for stones to become impacted, which can lead to cystic duct obstruction and acute cholecystitis (**Fig. 2**).

The gallbladder varies in shape, size, and contour from one normal patient to another. The normal size of the gallbladder should be less than 10 cm in length from neck to fundus and less than 5 cm in diameter at the widest point of the body (see **Fig. 1**). Prominent folds can be noted in the normal gallbladder. A common variation in shape caused by such a fold is the phrygian cap (**Fig. 3**); this is caused by a prominent fold at the junction of the body and fundus. Stones can settle in this folded portion with no clinical significance.

Fig. 2. Gallstone. Echogenic gallstone with posterior shadowing located in the gallbladder neck (*solid arrow*).

BILIARY TREE ANATOMY

- Component of the portal triad
- Divided into intra- and extrahepatic ducts
- Right/left hepatic ducts less than 2 mm in diameter
- Normal common bile duct less than 7 mm in diameter, varies with age and cholecystectomy

The bile ducts can be separated into 2 major categories: intrahepatic and extrahepatic. The intrahepatic biliary ducts are one of the components that form the portal triad. The portal triad is a complex of a bile duct, portal vein, and hepatic artery that branches together throughout the liver (**Fig. 4**). Because there is no consistent orientation

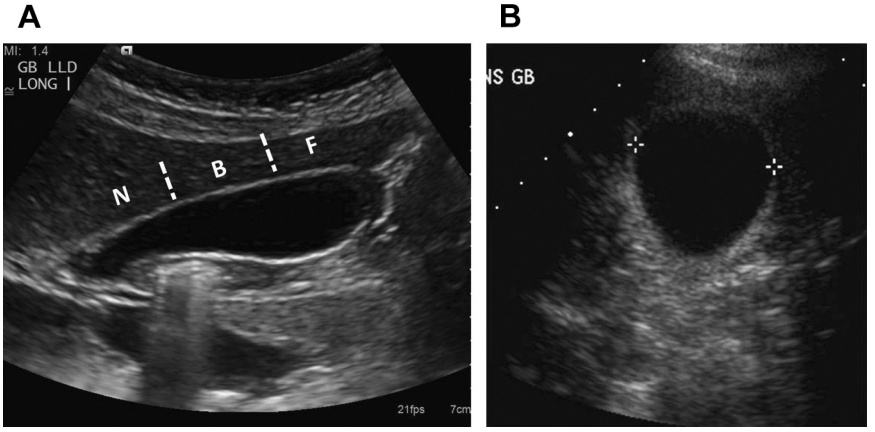

Fig. 1. Normal gallbladder. (*A*) Longitudinal view of the gallbladder. The gallbladder is divided into 3 parts: fundus (F), body (B), and neck (N). Normal gallbladder length less than 10 cm. (*B*) Transverse view of the gallbladder. Normal gallbladder diameter less than 5 cm (*cursors*).