Gallbladder scanning techniques and normal findings

Accurate gallbladder ultrasound requires at least 6 to 8 hours of fasting to ensure optimal distension. While a standard 3.5–5 MHz convex probe is typically used, a high-frequency transducer is highly beneficial for high-resolution imaging of fundal lesions, especially in slender patients. The examination begins in the supine position using subcostal or lower intercostal scanning planes. Shifting to the left lateral decubitus position can improve the acoustic window and is essential for assessing the mobility of intraluminal structures such as stones or sludge.

In a fasting state, the normal gallbladder appears as an oval, anechoic structure (< 10 × 4 cm) with a uniform, thin wall (< 3 mm). Wall thickness should be measured on the anterior wall where the ultrasound beam is perpendicular to the wall. Although the wall usually appears as a single layer, a three-layer architecture often emerges in postprandial or contracted states. These layers correlate with specific histological structures: the inner hyperechoic layer is primarily an interface echo; the middle hypoechoic layer encompasses the mucosa, muscularis propria, and the fibrous layer of the subserosa; and the outer hyperechoic layer consists of the adipose layer of the subserosa and the serosa.

Pitfalls and ultrasound artifacts for the gallbladder

When the gallbladder is not clearly visualized on ultrasound, a prior cholecystectomy should be the first consideration. However, non-visualization can also result from dense gallstones or intraluminal air, porcelain gallbladder or emphysematous changes, a severely contracted state, or congenital anomalies. In such cases, the major interlobar fissure of the liver serves as a critical anatomical landmark to locate the gallbladder neck.

Practitioners must also recognize common artifacts to avoid diagnostic errors. Reverberation artifact originating from the abdominal wall potentially obscures the lumen and causes clinicians to miss small fundal lesions, while section thickness and side lobe artifacts from adjacent structures can mimic intraluminal lesions. Posterior shadowing is helpful for detecting stones, but shadowing from the gallbladder neck can mask real pathology or be mistaken for a stone.

Bile duct scanning techniques and normal findings

The biliary tree is typically evaluated using a 3.5–5 MHz transducer. with 6–8 hours of fasting recommended to minimize obscuration of the extrahepatic ducts (EHD) by bowel gas. Beyond the supine position, the left lateral decubitus position helps straighten and enhance the visibility of the proximal EHD, while a semi-erect position is useful for visualizing the intrapancreatic portion of the common bile duct (CBD).

Normal IHDs travel alongside the portal vein and hepatic artery branches. Though often difficult to trace entirely, they can appear as anechoic tubular structures ≤ 2 mm. IHD dilatation is suspected when "two tubular structures" are seen where only the portal vein is expected. In ambiguous cases, color Doppler helps distinguish a dilated bile duct from the hepatic artery.

The proximal common duct is located anterior to the portal vein, which serves as a key landmark for localization. The right hepatic artery is positioned between the two structures in approximately 85% of cases. The distal CBD can be identified as a tubular structure at the posterior portion of the pancreatic head. The internal diameter of the common duct is traditionally measured at its proximal segment, with a value of ≤ 6 mm considered normal, but measurement sites and cutoff values vary across studies. Furthermore, ductal diameter may increase due to several factors, including advanced age, prior cholecystectomy, prior gastrectomy or bariatric surgery, or a history of biliary obstruction. Therefore, findings should be interpreted in conjunction with clinical presentations and other imaging signs, such as concomitant IHD or pancreatic duct dilatation.