Benign Gallbladder Diseases

US is most commonly used as the primary examination of gallstone disease due to its high diagnostic accuracy and ready availability. CT scan occasionally has difficulty in delineating small stones or pure cholesterol stones.

Adenomyomatosis is an acquired, hyperplastic lesion of the gallbladder (GB) characterized by excessive proliferation of surface epithelium with invaginations into a thickened muscularis propria. US may reveal a thickened gallbladder wall with intramural diverticula filled with anechoic fluid or debris producing comet-tail or V-shaped artifact extending down from the GB wall. MRCP typically shows small cystic spaces within the thickened GB wall. CT is often inconclusive in differentiating adenomyomatosis from GB cancer, requiring further imaging with ultrasound or MRI. The involvement of adenomyomatosis may be generalized or segmental. Segmental form often involves the fundus.

GB polyps are very frequently found incidentally on routine ultrasound owing to the improvement of US scanners. Although the majority of GB polyps are benign, most commonly cholesterol polyps, malignant transformation is a concern. GB polyps smaller than 10 mm rarely progress to malignancy or produce symptoms or complications of biliary disease. Problems remain in selecting patients with GB polyps for surgery or follow-up. A recent large retrospective study suggested that polyps between 5 and 10 mm should undergo US surveillance and polyps larger than 10 mm or growing polyps should be removed [1]. A study by Corwin et al suggested that incidentally detected polyps measuring 6 mm or less may require no additional follow-up [2].

US is the test of choice for acute cholecystitis. Gallstones in a distended GB and a positive sonographic Murphy’s sign are two most reliable US findings. It is sometimes possible to detect an obstructing stone in the cystic duct on US. The absence of gallstones is against cholecystitis; however, acalculous cholecystitis can occur in severely debilitated, immobile, or postoperative patients. Thickened GB wall is common in acute cholecystitis, but is nonspecific as several other entities, including acute hepatitis, portal hypertension, ascites, and hypoalbuminemia, may produce this finding. The presence of irregular, striated sonolucencies in the thickened GB wall suggests necrosis indicating gangrenous cholecystitis. US exam should include careful evaluation of common bile duct (CBD) to rule out associated CBD stones. US or CT occasionally demonstrates perforation of GB by demonstrating focal disruption of GB wall continuity.

Porcelain GB is defined as diffuse calcification of the wall and is rarely symptomatic. The incidence of associated GB cancer is 10-20%; and prophylactic cholecystectomy is recommended. US demonstrates highly echogenic, shadowing curvilinear structure in the wall. CT readily shows wall calcification.

Xanthogranulomatous cholecystitis is a variant of chronic cholecystitis characterized by multiple, yellowish-brown intramural nodules, fibrosis, and foamy histiocytic infiltration. Both US and CT show a thick, nodular, enhancing GB wall which is difficult to be differentiated from carcinoma. The presence of hypoattenuating nodules in the thickened wall is suggestive of this uncommon disease [3].

Malignant Gallbladder Diseases

Cholelithiasis is the most important risk factor for GB carcinoma. The risk of GB carcinoma is 2.3-34.4 times higher in patients with gallstones than in individuals without gallstones [4]. Other risk factors include porcelain GB [5], anomalous junction of the pancreaticobiliary duct, gallbladder polyps, chronic typhoid fever, adenomyomatosis, and inflammatory bowel disease [6].

Imaging patterns of GB carcinoma of CT scan have been described as a mass replacing the GB in 40–65% of cases, focal or diffuse GB wall thickening in 20–30%, and an intraluminal polypoid mass in 15–25% [7]. In the imaging pattern of a mass replacing the GB, CT scan shows a heterogeneous solid mass replacing the GB fossa often associated with soft-tissue extension to the adjacent liver, pericholecystic fat, and porta hepatitis as well as metastatic lymphadenopathy. The mass frequently contains gallstones and areas of hypoattenuating necrosis. After regional lymph nodes, the most common sites of distant metastasis are peritoneum and liver.

Diagnosis of focal or diffuse wall thickening pattern of GB carcinoma can be challenging because benign GB wall thickening such as chronic cholecystitis can show similar findings. Enhancement pattern of thickened GB wall on MSCT may help to differentiate the two conditions. A recent study by Kim [8] reported that a strongly enhancing thick inner layer and weakly enhancing outer layer are typical for GB carcinoma. Intraluminal polypoid GB carcinoma is least common and is seen as a well-defined mass with round or oval shape on imaging. The presence of contrast enhancement of the mass can distinguish tumor mass from tumefactive sludge. Vascular invasion or distant metastasis is uncommon [9].
Benign Bile Duct Diseases

Choledochal cyst is congenital cystic dilatation of the biliary tree which is common in Asian population. It is frequently associated with anomalous union of pancreaticobiliary duct where a union of the pancreatic and biliary ducts is located outside of the duodenal wall [10]. US, CT, and MR imaging easily make the diagnosis if the radiologist is familiar with the disease entity. Choledochal cysts with types 1 and 4 consist principally of congenital dilation of the extrahepatic bile duct with a variable amount of intrahepatic involvement. Because of complications including biliary malignancy, biliary cirrhosis and cholangitis, surgical treatment is mandatory. Other types of choledochal cysts, including choledochal diverticulum, choledochocele, and Caroli's disease, have different etiologies and are unrelated to anomalous union of pancreaticobiliary duct [11].

CBD stone is mostly secondary to GB stones. But de novo CBD stones are occasionally seen in Asian population. US detection of CBD stone needs experience and efforts as well as proper use of scanning technique. It is sometimes difficult to follow the CBD down into the head of the pancreas, as bowel gas may interfere with clear visualization. CT or MRCP is helpful in cases with inconclusive US results. It is important to obtain unenhanced CT scan to visualize bile duct stones. However, about 20% of CBD stones are still not visualized on CT scan. MRCP with adequate image quality can demonstrate virtually all CBD stones.

Intrahepatic duct (IHD) stones are one of the typical features of recurrent pyogenic cholangitis (RPC) which is characterized by recurrent attacks of abdominal pain, fever, and jaundice. US and CT findings include IHD and/or CBD stones, dilatation of the CBD with relatively mild dilatation of the IHD, and localized dilatation of the lobar or segmental IHD with hepatic atrophy (especially lateral or posterior segment). MRCP can demonstrate morphologic changes of IHD such as focal strictures, acute peripheral tapering, straightening, rigidity, decreased branching, and an increased branching angle of the intrahepatic bile ducts [12]. IHD stones can also occur secondary to stricture of intrahepatic bile ducts from any cause, such as primary sclerosing cholangitis, trauma, or post-liver transplantation. IHD stones are frequently overlooked on US examination since the stones are mildly echogenic and frequently do not show strong shadow. MRCP is more sensitive than ERCP to detect IHD stones [13], but is limited in patients with pneumobilia.

MRCP has been established as the main imaging modality to diagnose primary sclerosing cholangitis (PSC) and can visualize typical findings of primary sclerosing cholangitis in advanced stage; multifocal IHD and EHD strictures and beading with mild or minimal IHD dilatation [14]. US may show thickening of central IHDs and CBD with discontinuous dilatation of peripheral IHDs. IHD calculi are occasionally seen.

Malignant Bile Duct Diseases

The incidence of cholangiocarcinoma (CC) varies greatly depending on the geographic regions, with the highest reported in Southeast Asia [15]. Recent studies from most world regions have shown the incidence and mortality rate of intrahepatic CC are continuously increasing whereas those of extrahepatic CC remain constant or decreasing.

CC can be classified as intrahepatic and extrahepatic CC by anatomic location. Extrahepatic CC can be further divided into hilar CC and distal extrahepatic CC [16]. Morphologic classification of CC is useful for interpreting images as well as predicting tumor behaviour, prognosis and planning appropriate surgery. The morphologic classification proposed by the Liver Cancer Study Group of Japan [17] include mass-forming, periductal infiltrating, and intraductal growing types.

Mass-forming CC is the most common type in intrahepatic CC. The tumor easily penetrates the bile duct wall and grows outward to form a nodular mass in the liver parenchyma. Bile duct narrowing is common and obstructive jaundice occurs when the tumor involves the hepatic hilum. Mass-forming intrahepatic CC is usually large because it is asymptomatic when the mass is small. However, small mass-forming CC is occasionally found during HCC surveillance in cirrhotic liver [18]. The mass typically shows marked hypovascularity in the AP and PVP with or without thin rim-like enhancement [19]. The central portion of the tumor shows substantial enhancement in the delayed phase (> 4-6 minutes after contrast injection) due to abundant fibrous stroma and large interstitial spaces of the tumor [20]. Mass-forming CC infrequently shows hypervascularity in the AP, mimicking the appearance of HCC [18]. The absence of washout (negative enhancement) and persistent positive enhancement of CC may help differentiate it from HCC. CC in PSC is most commonly seen as a hepatic parenchymal mass associated with a dominant stricture of the bile duct on imaging [21]. CC in RPC most commonly manifests as a mass-forming intrahepatic CC and predominantly localizes in segments with severe atrophy. CC can be easily misdiagnosed as an abscess or inflammatory mass because the mass typically shows marked hypovascularity on CT scan [22].

Periductal infiltrating CC is the most common type in hilar CC. The tumor grows along the bile duct wall, resulting in concentric thickening of the bile duct wall to form an elongated, speculated appearance. The involved bile ducts are narrowed or obstructed and the upstream bile ducts are dilated. The tumors are usually small because they are discovered early due to obstructive jaundice. MDCCT or contrast-enhanced MRI is excellent to localize the tumor by demonstrating a focal bile duct thickening or a mass with substantial enhancement accompanied by upstream biliary dilatation. The mucosal/submucosal component of the tumor is often slightly hyperattenuating or isoattenuating relative to the liver on both AP and PVP images [23]. MDCCT is also useful to assess the relationship between the tumor and perihilar structures that can be best evaluated on thin-section images facilitated by MPR images [24-25].
Intraductal growing CC is characterized by intraluminal papillary tumors anywhere in the biliary system associated with partial bile duct obstruction or dilatation. The tumors are usually small and often spread along the mucosal surface of the bile duct resulting in multiple tumors (papillomatosis). The tumor produces a variable amount of mucin which may impede the file flow causing biliary dilatation because of viscous mucin [26].

References