Evaluating Patients with Right Upper Quadrant Pain

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KEYWORDS

• Cholecystitis • Cholelithiasis • Choledocholithiasis • Gallstone ileus • Hepatitis
• Budd-Chiari syndrome • Portal vein thrombosis

KEY POINTS

- Many disorders of the liver, gallbladder, and biliary tree may cause right upper quadrant pain and clinical diagnosis may be challenging. Imaging plays a key role in establishing a prompt diagnosis and guiding appropriate management.
- Although ultrasonography is the initial imaging modality of choice for most hepatobiliary disorders, radionuclide imaging, computed tomography (CT), and MR imaging also play important roles.
- Acute cholecystitis may be associated with many complications, including gangrenous change, emphysematous and hemorrhagic cholecystitis, and perforation. These complications have characteristic imaging features that should be recognized.
- MR cholangiopancreatography achieves high accuracy in diagnosis of choledocholithiasis and allows for noninvasive imaging when ultrasonography and CT are indeterminate.

Right upper quadrant abdominal pain is 1 of the most common reasons for visits to the emergency department. Although acute cholecystitis is often the leading diagnostic consideration, there are many other causes of right upper quadrant pain and establishing a prompt and accurate diagnosis may be challenging. In this article, imaging evaluation of the most common causes of right upper quadrant abdominal pain is reviewed. Although abnormalities of the bowel or pancreas, such as peptic ulcer disease or pancreatitis, may be a cause of right upper quadrant pain, this article focuses on disorders of the liver, gallbladder, and biliary tract. In evaluation of these diseases, radiographs are generally of limited value. Ultrasonography is usually the initial imaging modality of choice for suspected hepatobiliary disease; however, there are also important roles for radionuclide hepatobiliary imaging, computed tomography (CT), and MR imaging. In this article, the complementary roles of these various imaging modalities in evaluation of the patient with right upper quadrant pain are discussed.

HEPATIC CAUSES OF ACUTE RIGHT UPPER QUADRANT PAIN

Hepatic diseases that may present with right upper quadrant pain include acute hepatitis, infection complicated by abscess formation, acute complications of chronic liver disease, and hepatic masses and vascular abnormalities.

Acute Hepatitis

Hepatitis is a nonspecific inflammatory response of the liver to a wide variety of agents that cause hepatobiliary injury. The leading cause of hepatitis, both acute and chronic, is viral infection. Other

Disclosures: The author has no disclosures.
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Radiol Clin N Am 53 (2015) 1093–1130
http://dx.doi.org/10.1016/j.rcl.2015.06.002
0033-8389/15/$ – see front matter

causes include alcohol abuse, toxins, drug-induced injury, inherited metabolic disorders, ischemic injury, and autoimmune diseases.[1–3] Despite extensive evaluation, some cases remain indeterminate in cause. In addition to right upper quadrant pain, patients with hepatitis usually present with an enlarged, tender liver on physical examination, jaundice, and abnormal liver function tests.[4] Depending on the degree of hepatic dysfunction, there may be coagulopathy, ascites, encephalopathy, and ultimate progression to fulminant liver failure. Chronically, there may also be progression to fibrosis and cirrhosis. Clinical history, hepatitis serologies, and serum toxin levels help to establish the diagnosis. An important role of imaging in this setting is to exclude other conditions that may produce similar clinical and laboratory abnormalities, including extrahepatic cholestasis and diffuse metastatic disease.

The incidence of viral infection as a cause of acute liver failure shows wide geographic variation and depends on local prevalence of hepatotropic infections.[1] Hepatitis A and hepatitis E are transmitted via the fecal-oral route, most commonly through contaminated food and water. Acute infection may be self-limited or more fulminant, resulting in acute liver failure in less than 1% of affected patients.[1] Hepatitis B virus and hepatitis C virus are transmitted vertically or horizontally through exposure to contaminated blood or other body fluids via parenteral or mucosal exposure. Fewer than 4% of cases of acute viral hepatitis B lead to liver failure but mortality is higher than with hepatitis A or E.[1] The acute phase of HCV is often asymptomatic or very mild, and chronic hepatitis C infection is more common than fulminant infection in Western countries.[2] Less common viral causes of hepatitis include herpes simplex virus types 1 and 2, varicella zoster virus, Epstein-Barr virus, cytomegalovirus, and parvovirus B19.[1,5]

The imaging findings of the different causes of acute hepatitis are nonspecific and overlap. Hepatomegaly and periportal edema are common findings. At sonography, the edematous, inflamed liver is notable for decreased echogenicity of the parenchyma with increased prominence and brightness of the portal vein walls, which appear more echogenic in the background of the edematous liver.[6,7] This results in the so-called starry-night liver appearance (**Fig. 1**A); however, this pattern is nonspecific and may occasionally be observed in normal patients.[8] This appearance has also been seen in leukemia, lymphoma, and severe hepatic congestion.[9] Because of periportal edema in hepatitis, the gallbladder wall is often markedly thickened with an edematous and striated appearance[10–13] (see **Fig. 1**B). However, unlike acute cholecystitis, the gallbladder lumen in hepatitis is nondistended. Findings of acute hepatitis at CT include an enlarged liver with periportal edema that appears as low-attenuation tracking along the portal vessels, gallbladder wall thickening, and heterogeneous arterial-phase contrast enhancement[14–17] (**Fig. 2**). Reactive lymphadenopathy may be seen in the porta hepatitis.

Gallbladder wall thickening may be observed in 51% to 91% of patients with acute hepatitis and a recent study suggested that the degree of gallbladder wall thickening may be a predictor of the severity of acute hepatitis or prolonged cholestasis.[18] On MR imaging, increased periportal T2 signal in the liver is compatible with periportal edema. Similar to CT, there is often patchy enhancement of the liver parenchyma on arterial-phase images that normalizes on later phases of enhancement, and gallbladder wall thickening.[16,17]

Alcoholic liver disease is one of the main causes of end-stage liver disease worldwide and encompasses a disease spectrum from steatosis, to steatohepatitis, in which there is steatosis,

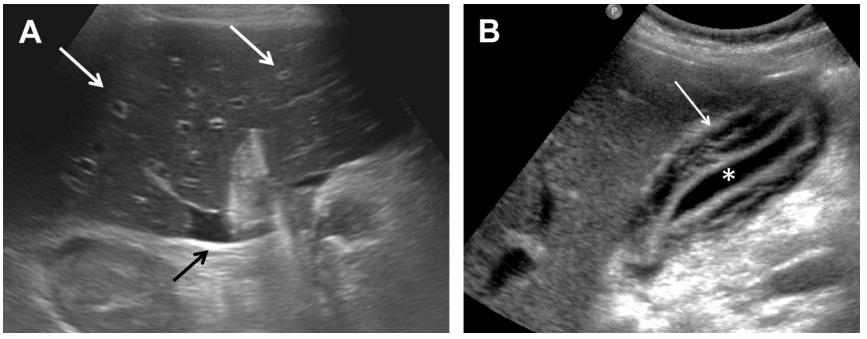

Fig. 1. Acute hepatitis: ultrasonography. (*A*) A 29-year-old man with acute hepatitis. There is increased prominence of the periportal echoes caused by periportal edema (*white arrows*), and a small amount of perihepatic ascites fluid (*black arrow*). (*B*) There is marked thickening and edema of the gallbladder wall (*white arrow*). The gallbladder lumen is collapsed (*asterisk*), helping to distinguish it from acute cholecystitis.