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Gastrointestinal Interventional Radiology

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Preface

The idea of GI interventional radiology came from my GI colleague trying to educate his fellows how IR could help with the management of variceal bleed. It struck me at the moment that our referring physicians especially at the grassroots level need a refresher on the procedures IR can offer and also update on the new IR techniques, especially since IR has grown rapidly in the last few decades.

The book is authored by experts in their fields and is designed for referring medical, surgical, GI, and IR physicians. The book describes the common day-to-day procedures such as enteral tube feeding and abscess drainage, to more complex interventions like TIPS shunt creation and vessel embolization for GI bleeds, often a lifesaving procedure.

The goal is to briefly describe the indications and basic techniques, help in getting patients prepared for the procedure, and to be aware and manage post-procedure course and any complications.

I acknowledge the authors who took time from their busy schedules to write the chapters. I also thank my parents, my family, daughters, and work colleagues for being an inspiration for academic work. Hopefully, you will enjoy reading the book and it can provide some tips in improving day-to-day patient care.

Farmington, CT, USA　　　　　　　　　　　　　　　　Charan K. Singh

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Chapter 1
Gastrointestinal Imaging

Samantha Huq, Marco Molina, and Charan K. Singh

Abdominal radiograph, ultrasonography (US), computed tomography (CT), and nuclear medicine (NM) scans are often used alone or in combination to provide the maximum diagnostic information and guidance for therapeutic interventions.

Abdominal Radiograph

Abdominal X-ray can be used to detect calcifications. It may be the initial study performed in a patient presenting with right upper quadrant pain. Depending on their composition, gallstones can appear densely calcified, rim calcified, or laminated (Fig. 1.1). Approximately 15–20% of gallstones show up on plain film [1].

Appendicoliths can also be identified using plain films (Fig. 1.2). Layered calcium in the right lower quadrant that moves when comparing supine with upright film is an appendicolith [1].

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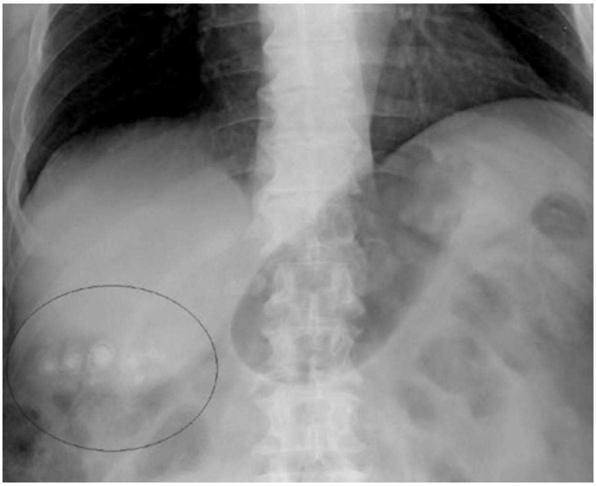

Fig. 1.1 Calcified gallstones identified on plain film. Depending on their composition, gallstones can be densely calcified, laminated in appearance, or rim calcified as in the image shown above

Fig. 1.2 Arrow points to a calcification in the right lower quadrant, which may be an appendicolith or a fecalith. In the setting of right lower quadrant pain, this is suspicious for acute appendicitis

Ultrasonography (US)

US is a valuable diagnostic tool in evaluating patient's with right upper quadrant abdominal pain. It has become the method of choice for identifying cholelithiasis and has been recommended as the study of choice for cholecystitis when an immediate diagnosis is needed (Fig. 1.3). US is nearly 100% accurate in detecting gallbladder calculi. However, the mere presence of cholelithiasis is not diagnostic of acute cholecystitis. The most sensitive US finding in acute cholecystitis is the presence of cholelithiasis in combination with the sonographic Murphy sign, which is defined as maximal abdominal tenderness from pressure of the US probe over the visualized gallbladder. Both gallbladder wall thickening (>3 mm) and pericholecystic fluid are secondary findings. Other less specific findings include gallbladder distension and sludge [2].

Percutaneous gallbladder drainage (cholecystostomy) is indicated for the treatment for acute calculous or acalculous cholecystitis in patients who are not surgical candidates. Cholecystostomy is a temporizing measure for treatment of calculous cholecystitis prior to cholecystectomy whereas it may be a curative measure in acalculous cholecystitis. Under sonographic guidance, percutaneous gallbladder drainage tube is either placed using transhepatic or transperitoneal approach (Figs. 1.4 and 1.5] [2].

Visualization of the biliary tree can be accomplished using US guidance to inject contrast into the biliary system, known as percutaneous transhepatic cholangiography (PTC) (Fig. 1.6). If the biliary system is obstructed, PTC may be used to perform biliary drainage until a more permanent solution to obstruction is performed. PTC is the first step in a number of percutaneous biliary interventions (e.g., percutaneous transhepatic biliary stent placement) [2].

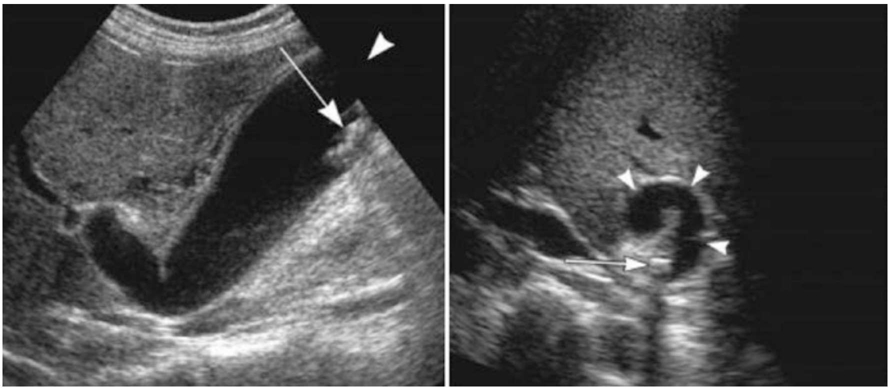

Fig. 1.3 Sagittal sonogram shows stones (arrow) in a distended gallbladder. The patient experienced maximal tenderness when the transducer was pressed over the fundus of the gallbladder (arrowhead) (sonographic Murphy sign) (left). Transverse oblique intercostal sonogram of the neck of the gallbladder (arrowheads) shows an obstructing stone (arrow) (right)

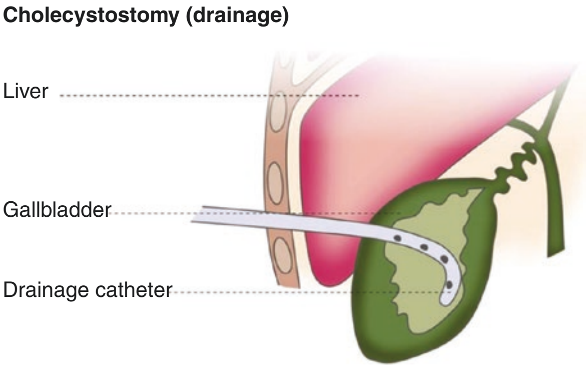

Fig. 1.4 Illustration of percutaneous gallbladder drainage tube

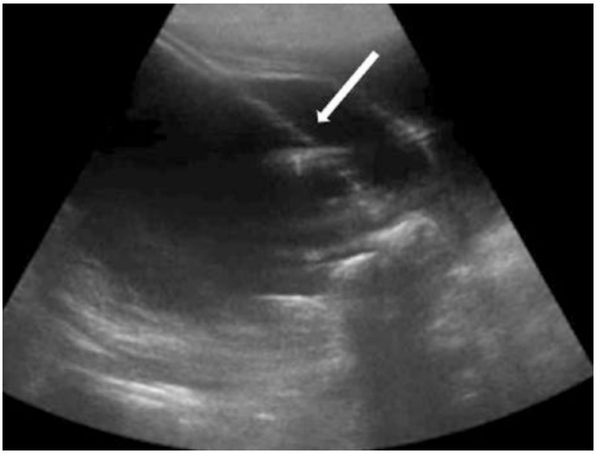

Fig. 1.5 Longitudinal gray-scale image of the right upper quadrant. US guided needle insertion into the gallbladder lumen. Arrow points to the needle within the gallbladder lumen

Fig. 1.6 PTC demonstrates the gallbladder (arrow), cystic duct (star), common hepatic duct (solid circle), and the common bile duct (solid arrow)

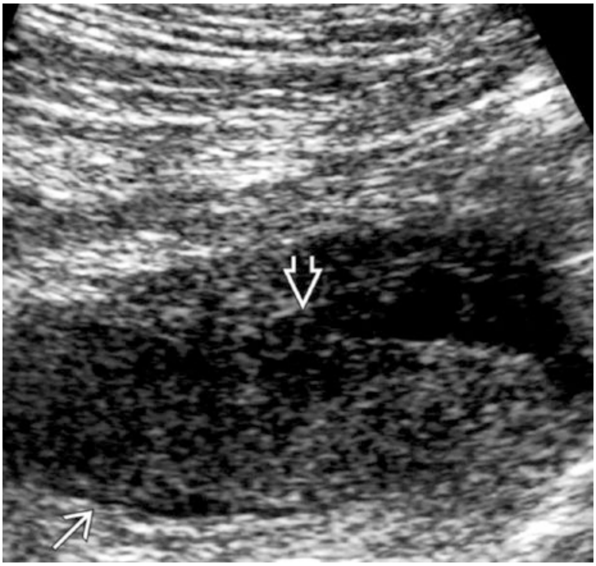

Fig. 1.7 Transverse transabdominal US demonstrates a hypoechoic fluid (arrow) collection with fluid-fluid level (white open arrow) representing an abscess

US is also used to evaluate palpable abdominal masses or fluid collections such as an abscess (Fig. 1.7). It can be used to perform biopsies and abscess drainage. US provides the advantage of continuous visualization of the needle course toward the target. The speed, portability, cost-effectiveness, and lack of ionizing radiation make US a preferred technique. The disadvantages are that images may be hindered by technical factors such as patient obesity or the presence of bowel gas [3].

Computed Tomography (CT)

Gastrointestinal (GI) bleeding can be classified as upper GI (bleeding source proximal to the ligament of Treitz) and lower GI (bleeding source distal to the ligament of Treitz). Endoscopy is the best initial procedure for acute upper GI bleeding, as it can be both diagnostic and therapeutic. For lower GI bleeding, a hemodynamically stable patient should first be evaluated by mesenteric CT angiogram (CTA) or nuclear medicine tagged red blood cell scan to localize the bleed as they are both more sensitive then angiography. CTA provides a relatively noninvasive and effective way of localizing the source of bleeding (Fig. 1.8) [4].

However, a hemodynamically unstable patient with clinical evidence of current GI bleeding should directly go to angiography. Angiography can provide the opportunity for therapeutic intervention at the time of diagnosis.

CT is also the choice for evaluating patients who present with fever and suspected abscess. CT is best suited for small and deep lesions especially those involving the retroperitoneum. Using CT, both the depth of the lesion and the path angle can be determined prior to performing biopsy or abscess drainage (Fig. 1.9). CT allows for the unequivocal visualization of the needle tip and surrounding structures thereby avoiding nearby structures [4].

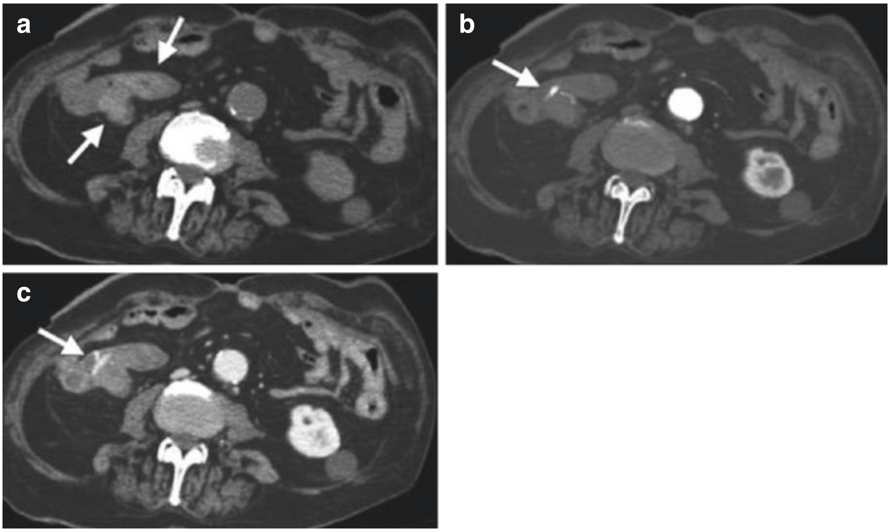

Fig. 1.8 (a) Axial unenhanced CTA image shows intraluminal hyperattenuation (arrows). (b, c) Axial arterial phase (b) and portal venous phase (c) CTA images show an intraluminal jet (arrow) of contrast material in the arterial phase, which changes in size and morphology in the portal venous phase. This represents an active GI bleed

Fig. 1.9 Axial contrast-enhanced CT demonstrates pigtail catheter (white open arrow) placed percutaneously in encapsulated fluid collection in the right lower quadrant from a ruptured appendix

Radionuclide Scanning

When the diagnosis of acute cholecystitis is equivocal on US, hepatobiliary scan can be performed, which has nearly 100% accuracy in identifying acute cholecystitis. Technetium 99m hepatobiliary iminodiacetic acid (HIDA) is taken up in the liver and excreted in the bile. Visualization of the liver, the gallbladder, and the biliary tree is thereby accomplished (Fig. 1.10). If visualization of the gallbladder within an hour of administration of the radionuclide is accomplished, a diagnosis of acute cholecystitis is virtually excluded, even in acalculous disease. Hepatobiliary scanning has been demonstrated to be 95–100% specific and sensitive in diagnosing acute cholecystitis, respectively [5].

In addition to CTA, lower GI bleeds can also be detected using erythrocytes labelled with technetium-99m after which serial scintigraphy is performed (tagged red blood cell scan) to detect focal collections of radiolabeled material (Fig. 1.11). It can help localize the general area of active bleeding to guide subsequent treatment course including angiography or surgery [6].

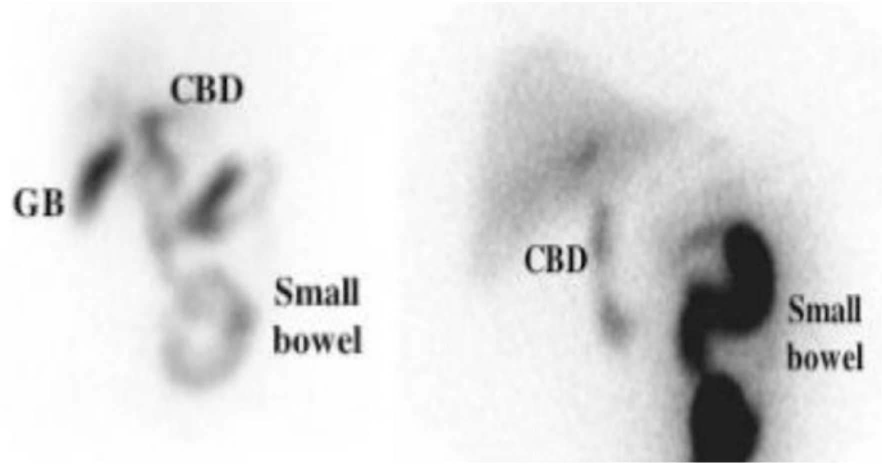

Fig. 1.10 Normal HIDA scan (left) shows tracer in the gallbladder (GB), common bile duct (CBD), and the small bowel. On the right, no filling of the GB, tracer is present in the CBD and the small bowel indicating acute cholecystitis