

Review

Imaging in laparoscopic cholecystectomy—What a radiologist needs to know



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ARTICLE INFO

Article history:

Received 13 November 2013

Received in revised form 16 February 2014

Accepted 18 February 2014

Keywords:

Laparoscopic cholecystectomy

Cholelithiasis

Biliary tract surgical procedure

Post-cholecystectomy syndrome

ABSTRACT

Laparoscopic cholecystectomy is the gold standard treatment option for cholelithiasis. In order to properly assess for the complications related to the procedure, an understanding of the normal biliary anatomy, its variants and the normal postoperative imaging is essential. Radiologist must be aware of benefits and limitations of multiple imaging modalities in characterizing the complications of this procedure as each of these modalities have a critical role in evaluating a symptomatic post-cholecystectomy patient. The purpose of this article is describe the multi-modality imaging of normal biliary anatomy and its variants, as well as to illustrate the imaging features of biliary, vascular, cystic duct, infectious as well as miscellaneous complications of laparoscopic cholecystectomy. We focus on the information that the radiologist needs to know about the radiographic manifestations of potential complications of this procedure.

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1. Introduction

Laparoscopic cholecystectomy was first introduced in Europe in 1980s [1]. It immediately gained widespread popularity due to shorter hospital stay and earlier recovery to normal activities [2]. However, in the hands of less experienced practitioners, rates of complications secondary to the procedures have reported to be higher than traditional cholecystectomy [3]. Since laparoscopic cholecystectomy has become the gold standard treatment of choice for cholelithiasis, an understanding of normal biliary anatomy, its variants and normal postoperative imaging of laparoscopic cholecystectomy is essential to properly assess for the complications related to the procedure. Additionally, as sonography, computed tomography (CT), Endoscopic retrograde cholangiopancreatography (ERCP), and Magnetic resonance cholangiopancreatography (MRCP) all have a role to play in evaluating a symptomatic post-cholecystectomy patient [4], radiologist must be aware of relative

benefits and limitations of each modality in characterizing complications of the procedure. In this article, after describing the imaging of normal biliary anatomy and its variants, we systematically illustrate imaging features of biliary, vascular, cystic duct complications, along with infections and miscellaneous complications of laparoscopic cholecystectomy.

2. Technique of laparoscopic cholecystectomy

Basic surgical steps of performing a laparoscopic cholecystectomy are as follows [5]: after insufflating the peritoneal cavity with 3–4 L of carbon dioxide through a periumbilical incision, the primary trocar and laparoscope are placed. After ruling out any injury resulting from placing of the primate trocar, three accessory trocars are placed. Subsequently, the gallbladder is grasped at the fundus; retracted cephalad and both cystic duct and artery are isolated. A double clip is then placed on the cystic duct and artery. The cystic duct is incised; the gallbladder is dissected off the liver bed, and is subsequently removed.

Before ligating the cystic duct and artery, contents of the hepatocystic triangle, the area formed by the gallbladder and cystic duct medially, common hepatic duct laterally and inferior liver edge superiorly, should be carefully identified. Misidentification of anatomy in this area is in fact a major cause of complications

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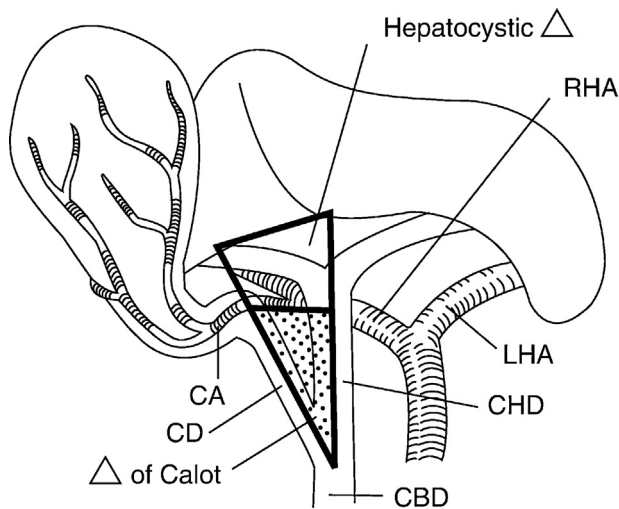


Fig. 1. Schematic presentation showing Hepatocystic triangle. The hepatocystic triangle is formed by the common hepatic duct (CHD) to the left, the proximal part of the gallbladder and cystic duct (CD) to the right, and the margin of the right lobe of the liver superiorly. Originally, the triangle was described by Calot as having cystic artery (CA) as the upper boundary. CBD, Common bile duct. LHA/RHA, Left and right hepatic arteries.

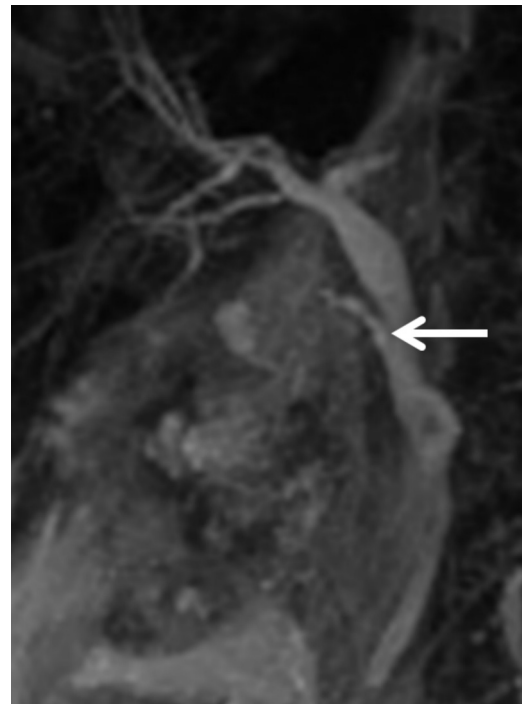


Fig. 2. Coronal thick slab Magnetic resonance cholangiopancreatography (MRCP) image, showing medial insertion of the cystic duct (white arrow).

during the surgery (Fig. 1) [6]. Calot's triangle is the historic name for this space and was originally described to be bounded by the cystic duct, the common hepatic duct, and the cystic artery (Fig. 1). Calot's triangle, containing the cystic artery, may also contain an aberrant/accessory hepatic artery or anomalous bile ducts. Dissection in the triangle of Calot is not recommended until the lateral-most structures have been clearly defined and identification of the cystic duct is ascertained.

3. Biliary anatomy and its variants

Gallbladder, located in the fossa on the undersurface of the liver, is approximately 10 cm long and 5 cm in diameter. It is attached to common bile duct (CBD) via the 2–4 cm long cystic duct. The cystic duct usually enters from the right, approximately half way between the porta hepatis and the ampulla of Vater. The insertion point of the cystic duct is variable [7]. In the first variation seen in 10–17%

of cases, cystic duct joins CBD from the medial aspect (Fig. 2) and drains into its left side. In the second variation seen in 1.5–2.5% of cases, cystic duct has a parallel course relative to the CBD before it spirals around it to insert medially. In the third variation, there is a low cystic duct insertion, usually in the distal third of the CBD, in approximately 9% of cases (Fig. 3). After a laparoscopic cholecystectomy, cystic duct remnant is usually 1–2 cm long; however, remnants up to 6 cm in length have been seen in the case of long parallel or low and medial insertions.

The classic biliary anatomy, which is seen in 50–60% of patients, consists of the right hepatic duct draining the right hepatic lobe, and the left hepatic duct draining the left lobe (Fig. 4) [8]. The right hepatic duct branches into the right anterior duct (RAD), which drains segments V and VIII, and the right posterior duct

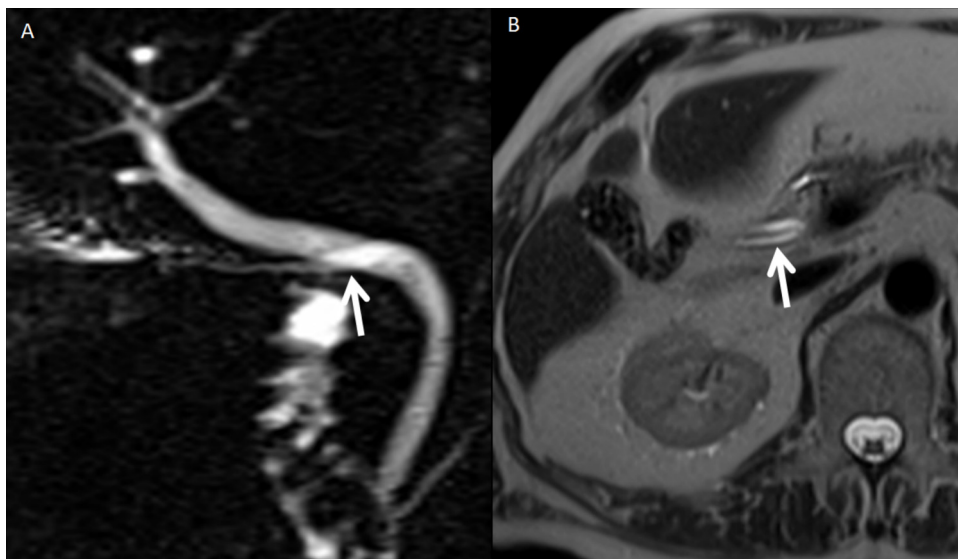


Fig. 3. Coronal MRCP image (A) and axial T2 weighted MR image (B) showing low insertion of the cystic duct (white arrow) with parallel course to common bile duct >2 cm.

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