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Case Report

Right hepatic artery: primum discere anatomia-first, learn anatomy

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ABSTRACT

Laparoscopic cholecystectomy (LC) is the most commonly performed surgical procedure and considered as the gold standard treatment of gallstone disease. However, the overall rate of complications like injury to bile duct and hepatic artery in LC remains higher than that seen in open cholecystectomy. Hence complete knowledge of the anatomy and anatomical relationship of biliary tree and liver plays a key role in the laparoscopic hepatobiliary surgeries. Being an end artery, blood supply to the right lobe of the liver solely depends on the right hepatic artery. Identification of variations in hepatic arterial anatomy is important in the planning and performing of hepatobiliary surgeries varying from simple LC to pancreaticoduodenectomy. In the current study, the authors referenced laparoscopic dissection results to examine another rare case showing "anterior" relationship of aberrant right hepatic artery (ARHA) with the common hepatic duct having clinically important implications in LC. The objective of this study is to highlight the importance of learning anatomy as the first step for a successful surgery and with the help of this case contribute to existing knowledge of the right hepatic artery to improve surgical safety.

Keywords: LC, Hepatic artery variation, ARHA, Anterior relationship, Caterpillar hump, Calot's triangle

INTRODUCTION

In the United States 90% of cholecystectomies are performed laparoscopically.[1] Laparoscopic surgery has multiple benefits. However, incidence of injury to important anatomical structures like hepatic artery as well as bile duct is higher in LC compared to traditional open cholecystectomy.[2,3] Variations of liver blood supply are frequent. An aberrant anatomy is frequently associated with inadvertent or iatrogenic hepatobiliary vascular injury.[4] According to anatomy textbooks, in 55-88% of cases the common hepatic branch of the celiac trunk (CT) supplies the liver. But the liver may be supplied by aberrant branches of the superior mesenteric artery (SMA), left gastric artery, the superior other gut arteries or aorta. These aberrant arteries may be accessory or replaced.[5,6,8,9]

Hiatt et al classified hepatic artery variations in six types; type 1-normal (the common hepatic artery (CHA) branched from celiac trunk) (75.7 %); type 2-replaced (accessory) left hepatic artery branches from left gastric (9.7%); type 3-replaced (accessory) right hepatic artery branches from SMA (10.6%); type 4- replaced or accessory right hepatic artery +replaced or accessory left hepatic artery (2.3%); type 5- the CHA branched from SMA (1.5%) and type 6-the CHA originated from abdominal aorta (0.2%).[8] Most frequently encountered variation is presence of an ARHA and this may be either a replacement or an accessory (Hiatt type III, 10.6% incidence).[5,8] Hepatic necrosis and fatal haemorrhage are the dangerous complications resulting from injury to this aberrant artery during abdominal surgeries.[5,6,8,9]

During LC, only two structures (the cystic artery and the cystic duct) should usually be ensured entering the gallbladder within Calot's triangle, which is bounded by the cystic duct, the common hepatic duct (CHD) and the liver. This is different from the earlier description of Calot: the Calot's triangle is demarcated by the cystic duct on the right side, the CHD on left side, and the cystic artery above.[10-12]

CASE REPORT

A 64-year-old female with no medical comorbidity presented with pain in the right hypochondriac region and epigastric discomfort for 1-2 days. She had a history of similar complaints in the past which were managed conservatively. There was no history of fever, jaundice and altered bowel habits. On examination, scar of the Pfannenstiel incision seen over the suprapubic area and abdomen was non distended. On palpation, the abdomen was soft and showed no signs of peritonitis. Normal bowel sounds were present in all four quadrants. Patient is evaluated with routine haematological, biochemical tests and ultrasonography of abdomen. She is diagnosed with gallstone disease with chronic cholecystitis.

Elective LC was planned after conservatively treating the episode of biliary colic. During LC at the department of Surgery in the Wockhardt Hospital, the time of dissection of the Calot's triangle an ARHA was noted. Adhesiolysis done. ARHA which was seen anterior to common hepatic duct dissected off from the surface of the gallbladder (Figure 1). Calot's triangle dissection done. Critical view of safety achieved. Single cystic artery arising from ARHA and single cystic duct identified, clipped and divided. Gall bladder dissected from cystic plate (CP). After achieving haemostasis and retrieving the specimen, ports closed over a small drain in the right hepatic fossa. Post-operative recovery was uneventful. Patient discharged on 2nd post-operative day after drain removal.

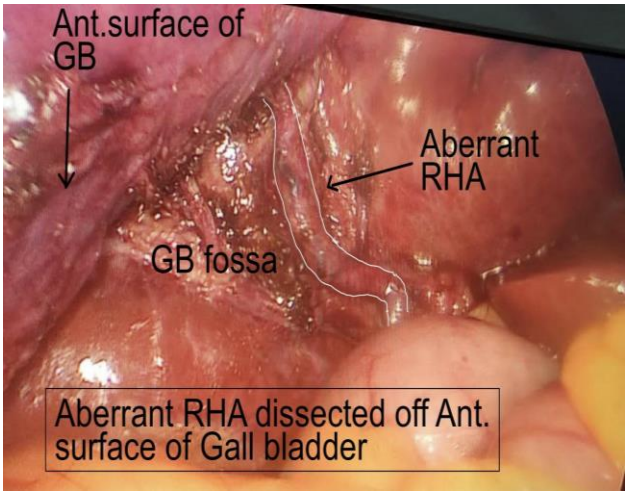

Figure 1: ARHA running anterior to CHD dissected from anterior surface of GB.

DISCUSSION

"Anterior" relationship of ARHA with the common hepatic duct is a rare but clinically important anatomical finding in hepatobiliary surgery. In the past, literature has many studies that reported variations of right hepatic artery. Usha Dandekar et al have reported that the right hepatic artery (normal and aberrant) crossed anteriorly to the CHD in 8.3% and posteriorly to it in 71.6%.[4] They also noted posterior relations with the CBD in 16.7% and in 3.4% it did not cross the CHD or CBD.[4] Hence complete knowledge of the anatomical relationship of biliary tree and liver plays a key role during the laparoscopic hepatobiliary surgeries.

Most common vascular injury reported while performing LC is trauma to the right hepatic artery usually occurring during dissection of Calot's triangle.[13] The RHA, is prone to get injured during LC, as the artery comes in close approximation to bile ducts crossing it near the junction of the cystic duct (CD).[14] The RHA is liable to get ligated for being mistaken as cystic artery (CA).[15] RHA comes in close proximity to gallbladder and CD owing to its variant course. Thus, it results in formation of short CA; and because of which RHA may be mistaken for CA leading to its inadvertent ligation during procedures like cholecystectomy.[16,17] The right hepatic artery is an end artery and injury to which causes necrosis of the right lobe of the liver. The "caterpillar hump" RHA is susceptible to iatrogenic injuries causing serious haemorrhage. This variation of RHA can pass in front of or behind the CHD or common bile duct (CBD) and may be mistaken for the CA and may get ligated.[16] The CA gets easily avulsed when it arises from "caterpillar hump" RHA as its typically short, excessive traction applied to the gallbladder is identified as the cause which leads to fatal haemorrhage.[16,18] In the current study, the authors referenced laparoscopic dissection results to examine another case showing "anterior" relationship of ARHA with the common hepatic duct, a variation with clinically important implications in LC and hepatobiliary surgeries. Once an ARHA is suspected/identified intraoperatively, careful and meticulous dissection of the calot's triangle is done. Only two structures entering the gallbladder must be identified to ensure a critical view of safety. ARHA should be dissected from the adjacent structures and safeguarded to avoid the major iatrogenic complications.

According to the standard textbook, hepatic artery proper (HAP) which is a continuation of the common hepatic artery (CHA) gives RHA as a branch which is usually to the left of the CHD. The RHA enters Calot's triangle after turning to the right and crossing the CHD from behind. Near the cystic duct (CD), it gives off the cystic artery (CA) and enters the right lobe of the liver after a short upward course. When the RHA does not arise from the HAP or CHA, its origin is shifted to the aorta or other vessels like superior mesenteric artery (SMA), right gastric artery, gastroduodenal artery (GDA), or celiac trunk (CT).[19,20] The hepatic artery is considered as an aberrant hepatic, when it arises from a source other than the terminal end of the CT, usually found in one-third of the cases. "Caterpillar hump" or "Moynihan's hump" RHA is an occasional variation, which is a sinuous tortuosity of the artery. It occupies a large portion of Calot's triangle and lies in close approximation with the neck of the gallbladder or CD.[21] Aberrant arterial anatomy is a common cause of injury to the RHA. Significant morbidity and even mortality can occur

considering the problems which surgeons face due to these variations during surgery.

Bergman et al given reference to the findings of Daseler et al regarding the different relations of the RHA with the duct system in 500 specimens. In the study reported by Flint in 200 cadavers and another study by Johnston and Anson, they had mentioned the relationship of RHA with CHD and CBD.[21-24] In above mentioned literature, it's observed that the anterior arterial relations were less frequent compared to posterior arterial relations. Similar to that, in the present study, a rare finding of "anterior" relationship of the ARHA with CHD is observed during intraoperative dissection of the calot's triangle.

CONCLUSION

The RHA is an important anatomical landmark in commonly performed surgeries like LC and other hepatobiliary surgery. It is essential from a surgeon's and a surgical trainee's viewpoint to first learn the anatomy in depth, and have thorough knowledge of anomalies of RHA. Prompt awareness of anatomical relationship and variation of RHA helps to prevent iatrogenic surgical complications.

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