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Case Report

Caterpillar chronicles: adventuring through Moynihan's legacy in laparoscopic cholecystectomy

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ABSTRACT

Before the introduction of minimally invasive surgery, there was a heightened focus on studying anatomical variants and their frequency due to the increased risk of biliary tract injury and hemorrhagic and ischemic arterial injury. This was done through the "Culture for safe cholecystectomy (CSC)" proposed by Strasberg, which underscored the significance of standardizing these variants using the classifications of Blumgart and Michael. These classifications centered on the insertion site of the biliary duct and cystic artery (CA), respectively. A tortuous pattern of the right hepatic artery (RHA) resembling a caterpillar or a hump (caterpillar hump or Moynihan's hump) that runs proximal or parallel to the cystic duct and gallbladder is often associated with the presence of a short CA, posing a high risk of vascular injury. The tortuous RHA can form a single or double loop and pass posteriorly or anteriorly to the common hepatic duct, with the posterior presentation being the most common. This represents one of the most serious lesions described, despite its low frequency, with an incidence reported to be between 1.3% and 13.3%. We present a case of a 33 years old woman with acute cholecystitis and a Moynihan's hump or caterpillar configuration of the RHA, which was identified during laparoscopic cholecystectomy.

Keywords: Cholecystectomy, Calot's triangle, Hepatic artery, Moynihan's hump

INTRODUCTION

Gallbladder stones are quite common and affect roughly 4% of the population in India.[1,2] When they become symptomatic or when acute cholecystitis is diagnosed, laparoscopic cholecystectomy is typically recommended for treatment, unless the patient has contraindication for anesthesia or is in septic shock. In such cases, conservative management with antibiotics is suggested.[1,2] For patients in septic shock or in cases where conservative management fails after 24 to 48 hours, gallbladder drainage can be performed to reduce local inflammation by removing the infected material from the gallbladder.

Although laparoscopic cholecystectomy is less invasive, reduces postoperative pain and hospital stay and yields better cosmetic results, it carries a higher risk of biliary tract lesions and haemorrhage compared to open surgery. Specifically, the rate of bile leakage after open cholecystectomy ranges from 0.1% to 0.5%, whereas it is 3% with the laparoscopic method.[3,5] Therefore, the surgeon must have a thorough understanding of the gallbladder's anatomy and its potential variations to minimize complications.

The right hepatic artery (RHA) is traditionally known to originate from the proper hepatic artery and ascend towards the right lobe of the liver, intersecting the common hepatic duct. It is responsible for supplying blood to the right lobe of the liver and a segment of the common bile duct. Originating from the RHA, the cystic artery provides blood to the gallbladder and traverses a region known as Calot's triangle or the hepatocystic triangle.[3,4,6] Calot's triangle is delineated by the common hepatic duct, the cystic duct and gallbladder neck and the inferior portion of the liver and it is akin to the modern definition of the hepatocystic triangle. Both serve as crucial landmarks for surgeons performing cholecystectomy, particularly

Calot's triangle, as incomplete dissection and misidentification of the cystic artery and cystic duct can result in inadvertent vascular or ductal injuries. To address this concern, in 1995, Strasberg et al, introduced the concept of the "critical view of safety" to ensure the precise identification of the two cystic structures before gallbladder removal.[7]

Numerous anatomical variations of the RHA have been documented, among which the Moynihan's hump or caterpillar configuration of the RHA is considered particularly perilous.[4-6] In this scenario, the RHA forms a loop that may be oriented upwards or downwards and closely follows the path of the cystic duct, accompanied by a short cystic artery that can originate from the distal or proximal loop. This configuration predominantly occupies Calot's triangle and injury to this vessel can lead to significant mortality and morbidity.[5,6] We present a case of a 33 years old woman with acute cholecystitis and a Moynihan's hump or caterpillar configuration of the RHA, which was identified during laparoscopic cholecystectomy.

CASE REPORT

A 33 years old woman known to have gallstones with episodes of biliary colic in the past presented herself to the Department of General Surgery with abdominal pain in the right upper quadrant for a week, which subsided with oral analgesics and antibiotics. USG abdomen and pelvis showed distended gall bladder with multiple calculi with minimal sludge within it. Laparoscopic cholecystectomy using a 4-port technique was performed the following week.

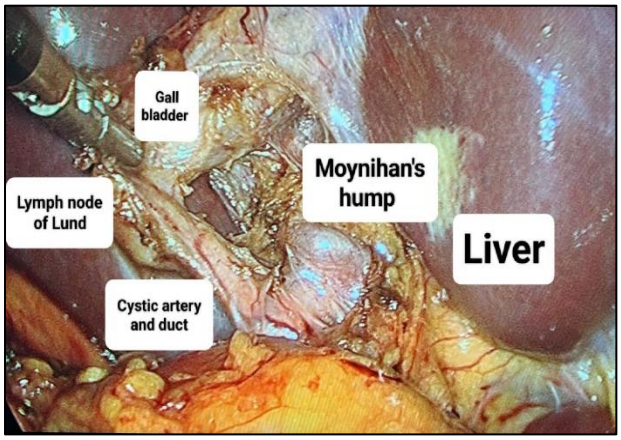

Figure 1: Calot's triangle with Moynihan's hump.

Laparoscopic exploration showed a distended gallbladder with epiploic adhesions to the body from the hepatic flexure. During the dissection of Calot's triangle using a monopolar hook, a large pulsatile vessel forming a loop was found adjacent to cystic duct (Figure 1) which turned out to be the RHA. Once the critical view of safety was obtained in the anterior and posterior aspect, the cystic artery and cystic duct were clipped together using Trutie titanium ligating clips. RHA was undamaged. The ports were closed using triclosan coated Trusynth Plus Neo suture (Healthium Medtech, Bangalore). The surgery and the follow up were uneventful.

DISCUSSION

The Moynihan's hump or caterpillar configuration of the RHA is an anatomical variation that is clinically significant.[4-6] This case report aims to provide a comprehensive overview of this subject to ensure that every surgeon performing a cholecystectomy is well-informed about this variation and can thus avoid serious complications.

Laparoscopic cholecystectomy is a commonly performed surgical procedure worldwide and is considered the gold standard for treating gallstone disease.[2,3] However, not all cholecystectomy surgery are simple, especially in cases involving anatomical variations and severe inflammation of the gallbladder. Anatomical variations around Calot's triangle are present in 20% to 50% of patients but are not always identified before surgery.[1-3]

Most patients with suspected gallbladder disease will undergo an abdominal ultrasound as the initial imaging test.[2] However, ultrasound does not provide detailed anatomy of the biliary and vascular system, which can make procedures challenging, especially in cases of significant gallbladder inflammation combined with anatomical variations.

Miyaki et al, suggested that the RHA variation could be the result of a partial or complete persistence of the fetal arterial blood supply.[8] An injury to the RHA during laparoscopic cholecystectomy can lead to significant bleeding and conversion to an open procedure. If the RHA is ligated, cauterized or sectioned, it can cause right liver ischemia, atrophy, necrosis or abscess formation, as reported in several articles. It can also result in bile duct stenosis due to ischemic injury (the RHA supplying the common bile duct in blood, as mentioned in the introduction) and therefore can result in cholangitis and even cirrhosis.[4,5] Some authors noticed that right hepatic lobectomy was necessary after a lesion of the RHA. However, some authors also suggested that a lesion to the RHA could be asymptomatic because of the presence of collateral circulation from the left hepatic lobe.[5,6]

To ensure safe surgery and avoid potentially serious complications, the surgeon should always strive for the critical view of safety before clipping the cystic duct and artery, as introduced by Strasberg in 1995.[7] Three conditions are necessary to obtain the critical view of safety, the hepatocystic triangle should be identified and cleared of all fibrous and fatty tissue, the infundibulum of the gallbladder should be dissected off the liver bed and only 2 structures should be entering the gallbladder, namely the cystic artery and the cystic duct. Failure to correctly identify all the structures of Calot's triangle can

lead to bile or blood leakage, which is the most common cause of conversion to open cholecystectomy. Reported mortality due to blood vessel injury is 0.02%.[3,5,6]

CONCLUSION

The Moynihan's hump, also known as the caterpillar configuration of the RHA, is an anatomical variation that may be encountered during laparoscopic cholecystectomy, one of the most performed surgical procedures. Although this anomaly is uncommon, a thorough understanding of the anatomy of the biliary tract and the gallbladder is crucial to ensure safe surgery and prevent arterial damage and operative complications. Prior to clipping the cystic artery, it is essential to always obtain a critical view of safety to avoid accidental vascular or ductal injuries.

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