



Case report

Moynihan's Lump as an unusual variant of right hepatic artery during a laparoscopic cholecystectomy approach. A case report

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ABSTRACT

Introduction and importance: One of the most important measures during the cholecystectomy procedure is based on a "Culture for Safe Cholecystectomy (CSC)". Vascular injury reports an open surgery conversion rate of 0 to 1.9% and a mortality of less than 0.02%. The caterpillar or Moynihan's hump configuration is characterized by a tortuous right hepatic artery (RHA) running proximal and/or parallel to the cystic duct and predisposes to a small and/or short cystic artery (CA).

Case presentation: A 65-year-old woman with no relevant clinical history underwent a laparoscopic cholecystectomy (LC) for cholelithiasis; during the procedure a caterpillar or Moynihan's hump was identified.

Clinical discussion: Anatomical variations represent 20-50% of all cases; therefore, CVS is required. The incidence of caterpillar or Moynihan's hump varies between 1% and 13% of all cases. To date, the scientific literature on this topic is limited. The most accepted etiology is related to embryological formation.

Conclusion: Biliary and arterial variations are more frequent than we think, so an anatomical knowledge, CSC and CVS represent a fundamental rule, increasing the safety of the surgical procedure.

1. Introduction

Since the first descriptions made in ancient Babylon two thousand years ago, the possibility of anatomical variants in the formation of the biliary tract has been taken into consideration, which at that time limited the therapeutic possibilities, making its management completely medical until the advent of biliary tract surgery by Joenisius, Jean Louis Petit, John Bobs, Kocher and William Halsted [1].

Until the appearance of minimally invasive surgery, and the increased risk of biliary tract injury, hemorrhagic and/or ischemic arterial injury, greater emphasis was placed on the importance of studying the anatomical variants, as well as their frequency, through the "Culture for Safe Cholecystectomy (CSC)" proposed by Strasberg and standardizing these variants through the classifications of Blumgart and Michael, emphasizing the insertion site of the biliary duct and cystic artery (CA), respectively [2].

Despite having a range of incidence of conversion to open surgery of 0–1.9% associated with vascular injury, and a mortality of less than

0.02%, there are multiple patterns of insertion and branching of the hepatobiliary triangle or Calot's triangle that have been reported [3].

The configuration of a tortuous pattern of the RHA giving an image associated with a caterpillar or a hump (caterpillar hump or Moynihan's hump) that runs proximal or parallel to the cystic duct and gallbladder, is frequently associated with the presence of a short CA, with high risk of vascular injury, being one of the most serious lesions described despite its low frequency [4].

At present, there is no percentage of incidence of conversion to open surgery and mortality associated with this vascular variant. Due to its low frequency, there are only case reports in the world literature to date.

2. Presentation of case

A 65-year-old female patient with a history of systemic arterial hypertension (SAH) and rheumatoid arthritis (RA) under control with oral antihypertensives and oral corticosteroids, respectively; other medical history without relevant data. The patient entered in the emergency

Abbreviations: CA, cystic artery; RHA, right hepatic artery; LC, laparoscopic cholecystectomy; CVS, critical view of safety; CSC, Culture for Safe Cholecystectomy; RA, rheumatoid arthritis; SAH, systemic arterial hypertension.

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service of the Regional Hospital “General Ignacio Zaragoza” on October 3, 2020 with gallbladder colic, was evaluated by the general surgery service and underwent elective LC secondary to symptomatic cholelithiasis on October 4, 2020. Surgery was performed with a minimally invasive approach with four trocars placed in the usual manner described (procedure realized between a general surgeon with more than 20 years of experience and a 3rd year general surgery resident).

The procedure begins with the exploration of the Calot's triangle by traction upwards of the vesicular fundus and lateral traction of the Hartman's pouch, we start with the dissection of the peritoneum medially at the level of the infundibulum, and we perform the dissection to free the lateral and medial face of the peritoneum corresponding to the cystic plate in order to obtain an adequate “CVS”. We continued with the dissection of the hepatocystic triangle expecting to find the entrance of two structures to the gallbladder in the usual way; however, an anatomical variant became evident (Figs. 1 and 2), corresponding to the RHA, which appears as a loop in the form of a caterpillar inside the Calot's triangle, anterior to the cystic duct, with a single and short CA with respect to its usual situation irrigating the gallbladder (Fig. 3). During the surgical procedure, we adhered to the requirements described for “CVS”, for a safe cholecystectomy, correctly identifying the structures and performing the ligation close to the gallbladder avoiding inadvertent injury to the RHA, as well as bleeding or significant liver damage. Retrograde cholecystectomy was then safely completed and the postoperative course was uneventful, with discharge at 24 h post-operatively and follow-up by the outpatient clinic with a histopathological study of the specimen that report: chronic lithiasic cholecystitis.

3. Discussion

Since the introduction of open gallbladder surgery until LC, surgeons have been very interested in the anatomy of the hepatobiliary triangle to perform a safe surgical procedure. Anatomical variations within and around the hepatobiliary triangle (biliary tree and cystic artery) are common, accounting for 20–50% in patients [2,5–7]. As a result, the position and possible variations of the CA assume a crucial role in surgical strategies, especially in laparoscopic settings, to avoid vascular injuries that often lead to conversion. Moreover, the CA pathway is difficult to establish before surgery and can only be recognized after careful dissection of the Calot's triangle and the gallbladder [8,9].

The incidence of caterpillar hump or Moynihan's hump and RHA varies from approximately 1.3 to 13.3% [2,6,10,11]. The etiology is still not entirely clear, however, there are some theories described in the

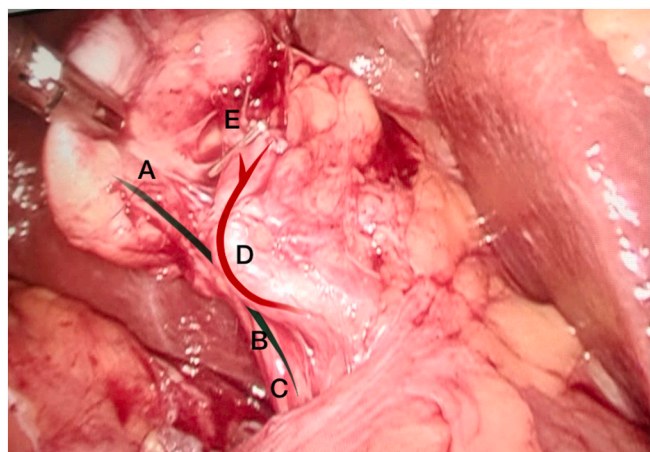


Fig. 1. Laparoscopic view of safety with Moynihan's Lump. An elongated RHA is observed, anterior to the cystic duct and common bile duct in the hepatocystic triangle, with a single loop and a short cystic artery arising from its convexity. A: Infundibulum of gallbladder; B: cystic duct; C: common bile duct; D: RHA; E: CA and proximal clip ligation.

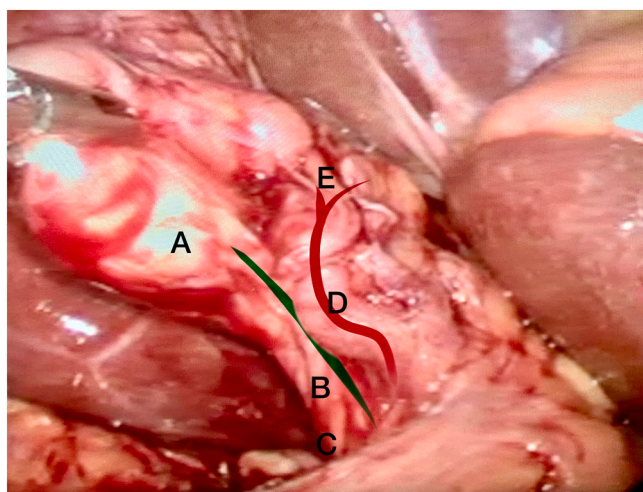


Fig. 2. Green line reference: cystic duct and common bile duct; red line reference: RHA and CA.



Fig. 3. Diagram representing Moynihan's hump or caterpillar hump, with a single loop and the cystic artery short in its convexity.

literature. Taylor CR; theorized that both the elongation and tortuosity of the artery could be attributed to architectural distortion of the intrahepatic branches of the hepatic artery in patients with cirrhosis. However, no clinical or statistical correlation has been demonstrated for this hypothesis [2]. Benson and Page [6] proposed the suggestive explanation that the abnormality could be produced by traction during LC. However, the incidence of RHA with caterpillar hump in both live operated and cadaver patients (7% vs. 6.9%) is unlikely due to surgical maneuvers. Another hypothesis can be explained on the basis of embryonic development [12,13]. According to Miyaki [14], the embryonic liver is innervated by three segmental arteries arising from the dorsal aorta. The branch of the middle segmental artery becomes a proper hepatic artery arising from the common hepatic artery and the other two become two accessory hepatic arteries arising from the left gastric and superior mesenteric arteries. Given that the artery arising from the left gastric artery may persist in 25% of cases and the other persists in 18.3%, it could be postulated that partial or complete persistence of the

arterial supply of the fetal liver could sustain the caterpillar hump of the right liver.

The tortuous RHA called the Moynihan's hump or caterpillar hump, can be found anteriorly or posteriorly to the common hepatic duct. The former being the most common. The hump may have a single or double loop. The CA, when arising from the proximal loop, is long and crosses the tortuous RHA to reach the gallbladder. When the CA arises from a distal loop, it is very short, this variant being the most common [2,6,10,11,15–17]. In our case, the hump had a single loop with a short CA arising from its convexity. Because of the proximity of the loop to the gallbladder, the RHA may be confused with the CA and ligated. Injury to the RHA can have several consequences. First, if completely ligated, it results in ischemic necrosis of the right lobe of the liver. Second, partial injury can subsequently lead to hepatic artery pseudoaneurysm, which can result in excessive and potentially fatal bleeding. The third and most important is that any vascular injury leading to hemorrhage during laparoscopic surgery may obscure the surgeon's field of vision, and in an attempt to remedy the situation, blind coagulation or clipping may occur, causing injury and/or disruption to the bile duct. This is the most feared complication of LC and also one of the most frequent causes of lawsuits against surgeons.

Therefore, for safe surgery, we must follow the safety rules discussed and emphasized over and over again by Strasberg; the most important of which is that only two and only two structures entering the gallbladder should be visualized before any cutting or ligation is performed [18,19]. Also, a thorough knowledge of the anatomy and its variations is the key to identifying the structures, since in a way, the surgeon's eyes cannot recognize what the mind ignores. Finally, in the presence of complex cases in which we are faced with severe adhesions or frozen triangles, a call for help or a diagnostic certainty tool, such as a diagnostic cholangiography must be kept in mind. Remember that patient safety comes first [2,20].

However, in training centers with limited resources in emergency surgery like ours, the registry of anatomical variants to be considered for the certainty of a safe cholecystectomy is of great importance. Thus, leaving the conversion to open surgery and preserving the benefits of minimally invasive surgery. Additionally, the importance of this work lies in laying the foundations for future studies and consequently documenting and identifying the most common variants in different populations.

4. Conclusion

The caterpillar hump or Moynihan's hump, as a transoperative finding, is a reminder of how variant the anatomy of the biliary tree can be. In this particular case of the RHA, which is subject to multiple anatomical variations in its course that could increase the risk of inadvertent ligation or injury during LC. Therefore, the recognition of possible variations in the anatomical structures of the Calot's triangle during surgical procedures is of utmost importance to avoid intraoperative and postoperative complications during LC. Remember that each human body is unique and each cholecystectomy is a new procedure. This case report has been arranged in line with SCARE guidelines [21].

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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This case report is exempt from ethical approval in our country.

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Declaration of competing interest

The authors declare that they have no conflict of interests.

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