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**Case Report**

# Variant of Right Hepatic Artery During a Laparoscopic Cholecystectomy Approach

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## Abstract

***Introduction:*** The caterpillar or Moynihan's hump is characterized by a tortuous right hepatic artery running proximal and/or parallel to the cystic duct and predisposes to a small and/or short cystic artery. ***Case presentation:*** A 24-year-old woman with no relevant clinical history underwent a laparoscopic cholecystectomy for cholelithiasis; during the procedure a caterpillar or Moynihan's hump was identified. ***Clinical discussion:*** Moynihan's hump varies between 1% and 13% of all cases. ***Conclusion:*** Biliary and arterial variations are more frequent than we think, so an anatomical knowledge, critical view of safety; represent a fundamental rule, increasing the safety of the surgical procedure.

**Keywords:** ***variant of right hepatic artery, Caterpillar Lump, Moynihan's lump.***

## Introduction

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 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, respectively [2]. The configuration of a tortuous pattern of the right hepatic artery 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 cystic artery, with high risk of vascular injury, being one of the most serious lesions described despite its low frequency [3]. At present, there is no percentage of incidence of conversion to open surgery and mortality associated with this vascular variant.

## Methods

***Presentation of case:*** A 24-year-old female patient with no relevant clinical history. The patient came to the clinic of Imam Abdulrahman Alfaisal Hospital (Riyadh, Kingdom of Saudi Arabia) on august 14, 2022 with abdominal pain, was evaluated by the general surgery service and underwent elective Laparoscopic Cholecystectomy secondary to symptomatic cholelithiasis on august 30, 2022. Surgery was performed with a minimally invasive approach with four trocars placed in the usual manner. 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 to obtain an adequate critical view of safety. We continued with the dissection of the hepatocytic triangle expecting to find the entrance of two structures to the gallbladder in the usual way; however, an anatomical variant became evident (**Figs. 1**), corresponding to the Right Hepatic Artery, 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 Cystic Duct with respect to its usual situation irrigating the gallbladder. During the surgical procedure, we adhered to the requirements described for critical view of safety, for a safe cholecystectomy, correctly identifying the structures and performing the ligation close to the gallbladder avoiding inadvertent injury to the Right Hepatic Artery, as well as bleeding or significant liver damage. cholecystectomy was then safely completed, and the postoperative course was uneventful, with discharge at 4 h postoperatively and follow-up by the outpatient clinic with a histopathological study of the specimen that report chronic cholecystitis.

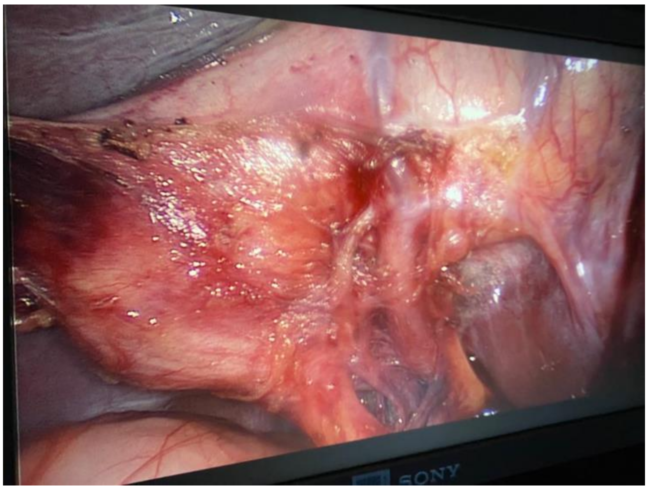


**Fig. 1. [Intra-operative image]**

## Discussion

Since the introduction of open gallbladder surgery until Laparoscopic Cholecystectomy, 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. As a result, the position and possible variations of the Cystic Artery assume a crucial role in surgical strategies, especially in laparoscopic settings, to avoid vascular injuries that often lead to conversion. Moreover, the Cystic Artery pathway is difficult to establish before surgery and can only be recognized after careful dissection of the Calot's triangle and the gallbladder. The incidence of caterpillar hump or Moynihan's hump and Right Hepatic Artery varies from approximately 1.3 to 13.3%. The etiology is still not entirely clear, however, there are some theories described in the 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]. Another hypothesis can be explained based on embryonic development [4,5]. According to Miyaki [6], 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 Right Hepatic Artery 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 Cystic Artery, when arising from the proximal loop, is long and crosses the tortuous Right Hepatic Artery to reach the gallbladder. When the Cystic Artery arises from a distal loop, it is very short, this variant being the most common [2,7-11]. In our case, the hump had a single loop with a short Cystic Artery arising from its convexity. Because of the proximity of the loop to the gallbladder, the Right Hepatic Artery may be confused with the Cystic Artery and ligated. Injury to the Right Hepatic Artery 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 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 Laparoscopic Cholecystectomy and one of the most frequent causes of lawsuits against surgeons. Therefore, for safe surgery, we must follow the safety rules discussed and emphasized repeatedly 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 [12,13]. 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 [2,14]. 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.

## Conclusion

So, when performing cholecystectomy, the surgeon must remember that there are many variations from the normal anatomy of the vessels and bile ducts in Calots triangle. Because of these anatomical variations of cystic artery and right hepatic artery, surgical injuries in the living body can inadvertently and readily be made by even the most experienced surgeon. So, presence of caterpillar hump of right hepatic artery should be suspected when an unusually large cystic artery is viewed through the laparoscope and thus the surgeons can save the patient from the possibility of iatrogenic ischemic necrosis of right lobe of liver [15].

## Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

## Ethical Clearance

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

## Conflict of interest declaration

The authors declare that they have no conflict of interests.

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## Contributors

All author equal contribution

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