

REVIEW ARTICLES

Incidence of "Caterpillar hump" of right hepatic artery in the "Calot triangle" among a selected population in Sri Lanka. A chart review

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Abstract

Introduction: "Caterpillar hump" of the right hepatic artery in the triangle of Calot, is a rare variation that increases the risk of vascular and biliary injuries during laparoscopic cholecystectomy. This study aims to determine the prevalence of right hepatic artery forming "caterpillar hump" in a selected cohort of patients who underwent laparoscopic cholecystectomy in a private hospital in Sri Lanka.

Methods: A retrospective chart review was conducted to determine the prevalence of "Caterpillar hump" of the right hepatic artery among patients who underwent laparoscopic cholecystectomy for symptomatic cholelithiasis in a private hospital in Colombo, Sri Lanka, from 2015 to 2022. Data were retrieved from the available records at hospitals from 2015 to 2022. There were 79 patients recode during the study period. These records consist of manually written bed head charts, discharge summaries and electronic medical records. Patient records which did not clearly mention the Calot triangle vasculature or illegible handwriting were excluded from the study. Out of that, only 75 [94.9%] patients' charts were eligible for the study. Data on demographic and Calot triangle vasculature was recorded during surgery and

retrieved from the hospital records. Ethical approval for the study was obtained from the hospital's ethical committee.

Results: Among the patients who underwent laparoscopic cholecystectomy, 50 (66.7%) were female, and 25(33.3%) were male patients, with a mean (\pm SD) age of 57.4 ± 4.8 years (range 18–81). The prevalence of the "caterpillar hump" right hepatic artery in the calot's triangle among the study sample was 4 % (3/75). Two were females and one male. In all cases, the vascular variation was reported in a single-loop fashion, and no double-loop configuration was noted.

Conclusions: This study showed that the right hepatic artery was subjected to this rare anatomical variation. This anomalous presentation increased the risk of vessel ligation or injury during laparoscopic Cholecystectomy. Thus, the awareness of caterpillar hump within Calot triangle, during surgical procedures is useful.

Keywords: Calot's triangle, Caterpillar hump, Cholecystectomy

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Introduction

Laparoscopic cholecystectomy has been widely accepted as the gold standard for patients with symptomatic gallstone disease. [1] However, despite excellent surgical field visualisation, the laparoscopic approach is associated with a slightly increased risk of iatrogenic biliary injury and arterial haemorrhage. [1] The variations in biliary and related vascular anatomy of the gallbladder predispose to iatrogenic injuries during cholecystectomy. [2]

The reported incidence rate of conversion to open surgery due to vascular injuries is approximately 0%–1.9%, [10] with a mortality rate of 0.02%. [1,2] Although several variations in the origin and branching pattern of Calot triangle arteries have been reported, [1,3] the tortuous right hepatic artery configuring an insidious hump is one of the most dangerous anomalies. This configuration is known as caterpillar hump, or Moynihan's hump, [4]; the right hepatic artery runs very close to the gallbladder and cystic duct, forming a U-shaped loop, where the cystic artery is very short. [4,5] [Diagram 01] This misidentifies vascular structures with wrong clipping or uncontrollable bleeding. [5]

Therefore, detailed knowledge of arterial and biliary variants in the Calot triangle is essential to perform safe Cholecystectomy. [3,5] This study aims to assess the prevalence of the right hepatic artery forming caterpillar hump in patients who underwent laparoscopic cholecystectomy for symptomatic gallstone disease.

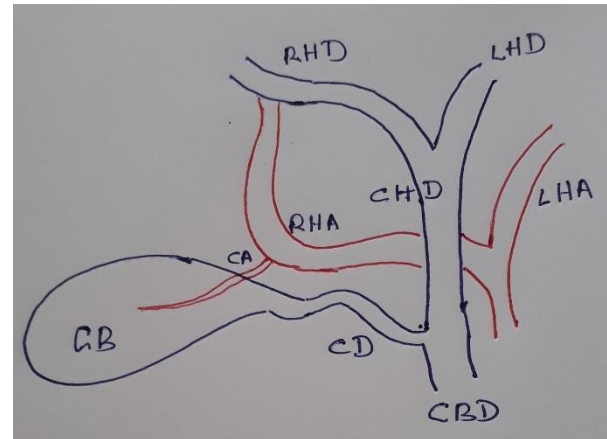


Diagram 01: Showing the tortuous right hepatic artery (RHA) forming a U-shaped loop configuring in the Calot triangle [bounded by the cystic duct (CD), Common Hepatic Duct (CHD) and lower border of the liver], known as caterpillar hump, or Moynihan's hump. The RHA runs very close to the gallbladder (GB) and cystic duct (CD), where the cystic artery (CA) is very short. LHA – Left Hepatic Artery; LHD – Left Hepatic Duct; RHD – Right Hepatic Duct.

Method

A retrospective chart review was conducted to determine the prevalence of "Caterpillar hump" of the right hepatic artery among patients who underwent laparoscopic Cholecystectomy for symptomatic cholelithiasis in a private hospital in Colombo, Sri Lanka, from 2015 to 2022. Data were retrieved from the available records at hospitals from 2015 to 2022. There were 79 patients recode during the study period. These records consist of manually written bed head charts, discharge summaries and electronic medical records. Patient records which did not clearly mention the Calot triangle vasculature

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or illegible handwriting were excluded from the study. Out of that, only 75 [94.9%] patients' charts were eligible for the study. Data on demographic and Calot triangle vasculature was recorded during surgery and retrieved from the hospital records. Ethical approval for the study was obtained from the Hospital's ethical committee.

Statistical Analysis

The continuous, normally distributed variables are presented as the mean and SD, whereas categorical variables are presented as the portions. All analyses were performed using SPSS 17 software package (SPSS, Inc., Chicago, IL, USA)

Results

Among the patients who underwent laparoscopic Cholecystectomy, 50 (66.7%) were female, and 25(33.3%) were male patients, with a mean (\pm SD) age of 57.4 ± 4.8 years (range 18–81). The prevalence of caterpillar hump right hepatic artery in the calot's triangle among the study sample was 4 % (3/75). Two were females and one male. For the patients who identified as having a "caterpillar hump", the right hepatic artery presented a tortuous configuration arising from the right hepatic artery and coursed behind the common hepatic duct. Inside the Calot's triangle, it made a characteristic unique loop with convexity facing upwards and to the right. The U-shaped loop configured an insidious hump running very close to the gallbladder and cystic duct, and the cystic artery resulted in exceptionally short. (Table 1)

Table 1: The observations of the study populations.

Variable	Right hepatic artery with a capillary hump (N=3)	Right hepatic artery without capillary hump (N=72)
Age (Mean \pm SD) in years	59 \pm 4.8	56 \pm 3.2
Age category (in years)		
Less than 40	0	6 (8.3%)
41 to 50	0	42 (58.3%)
51 to 60	2 (66.6%)	17 (23.6%)
More than 61	1 (33.4%)	7 (9.7%)
Gender		
Female	2 (66.6%)	48 (66.6%)
Male	1 (33.4%)	24 (33.4%)

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Discussion

Well-versed knowledge of the anatomy of the Calot triangle is a must to perform a safe laparoscopic cholecystectomy. Anatomic variations in and around the Calot triangle are frequent [5], accounting for 20%–50% of the patients. The position and variations of the cystic artery are not only an anatomical dissertation but also play a crucial role in laparoscopic surgery, to avoid uncontrolled vascular lesions that usually lead to conversion. [5]

Furthermore, the route of the cystic artery is difficult to establish before surgery, and it can be recognized only after careful dissection of Calot triangle. [6] In previous reports, the incidence of caterpillar or Moynihan's hump of the right hepatic artery ranged between 3% and 13.3%. [4,5,6] Its incidence in the present study was 4%, which is more or less comparable to the literature data. The aetiology of the caterpillar hump is still not well known. The literature [2, 5] hypothesized that the elongation and the tortuosity of the artery could be attributed to architectural distortion with corkscrewing of intrahepatic branches of the hepatic artery. The incidence of caterpillar hump right hepatic artery in both the operative and cadaver groups (7% vs 6.9%, respectively) indicated that a significant vascular anomaly is unlikely due to surgical manoeuvres [2-5]. According to another hypothesis based on embryology, [2, 4, 5, 6], the embryonic liver is supplied by three segmental arteries arising from the dorsal aorta. The branch from the middle segmental artery develops into a proper hepatic artery arising from the common hepatic artery. The

other two become accessory hepatic arteries arising from the left gastric and superior mesenteric arteries. Since the artery arising from the left gastric artery can persist in 25% of cases and the other persists in 18.3%, it could be postulated that the partial or complete persistence of the arterial supply of foetal liver could remain as the caterpillar hump of the right hepatic artery.

The tortuous artery may route anteriorly or posteriorly to the common hepatic duct, [7] representing the posterior presentation of the more common anatomical variation with 60% of incidence. [8] Accordingly, in the current study's three patients with caterpillar hump, the arterial trunk passed dorsally to the common hepatic duct. Due to its tortuous course and closeness to the gallbladder and common hepatic duct, this variant of the right hepatic artery may be injured with catastrophic consequences unless carefully dissected during Cholecystectomy.[9] Furthermore, it may be mistaken for the cystic artery and inadvertently ligated during surgery.[8,9,10] It must be highlighted that an atypically large cystic artery requires careful exploration of the hepatobiliary triangle as it may represent a Moynihan's hump right hepatic artery.[11,12] Vascular variation is reported more commonly in a single-loop fashion (55% of cases), and in the present study, all vascular humps were noted in a single-loop configuration.

The available literature stated that the double-looped hump, the cystic artery usually arises from the distal loop in a very short length, but when it originates from the proximal loop, it is reported that, the long cystic artery crossing the tortuous right hepatic artery reaching the

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gallbladder. [13] In the present study, the cystic artery arose from the convexity single-looped right hepatic artery resulting in an exceptionally short in length. A very short cystic artery could lead to vascular injuries during Cholecystectomy [12,13] such as an accidental avulsion from the right hepatic artery due to excessive traction applied to the gallbladder and for right hepatic artery injury during its dissection and ligation.[11] Therefore, comprehensive knowledge of the hepatobiliary triangle with the possible arterial variant is paramount for the safety in Laparoscopic cholecystectomy.[9,14] Hence, careful dissection and demonstration of safe triangle Strasburg in laparoscopic cholecystectomy before division or ligation of any structure in the Calot triangle will help surgeons to understand the aberrant anatomy and avoid complications with Moynihan's hump of the right hepatic artery.[13,14]

Conclusion

This study showed that the right hepatic artery was subjected to this rare anatomical variation. This anomalous presentation increased the risk of vessel ligation or injury during laparoscopic Cholecystectomy. Thus, the awareness of caterpillar hump within Calot triangle, during surgical procedures is useful. Future high-quality, large-scale reports will be of interest in helping future researchers in this field.

Study limitation

This was a retrospective study with a small size.

Acknowledgements

We acknowledge the staff of the medical record unit and Nawaloka Research and education foundation for supporting us in this study.

Availability of data and materials

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

Data collection and Ethical approval

Nawaloka Research and Education
Foundation,
Nawaloka hospital PLC,
Colombo.

Conflict of interest

None

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