

Cystic Artery Originating from Hepatic Capsular Artery: A Case Report

MOHAMMAD BUKHETAN ALHARBI



ABSTRACT

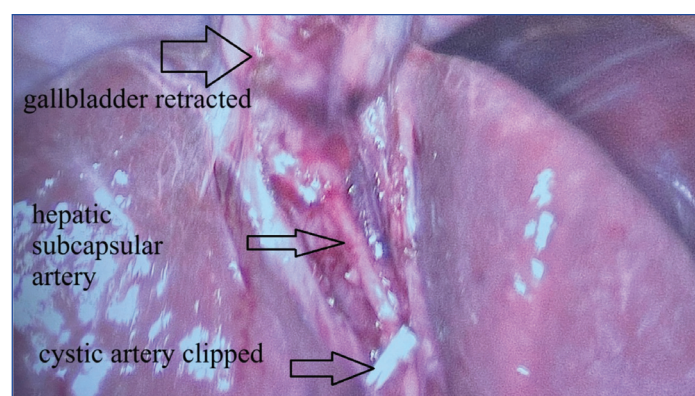
The Cystic Artery (CA) is a crucial structure that is dissected and ligated during Laparoscopic Cholecystectomy (LC). While several studies have explored the varying anatomy of the CA, there are no case reports discussing the hepatic capsular artery as a potential source of the CA. This case report involves a 52-year male who underwent a planned LC using blunt dissection to separate the connective tissue surrounding the gallbladder. Remarkably, the CA in this case originated from the hepatic capsular artery, which may be the first instance of such an observation recorded. Precise surgery with careful dissection of the gallbladder can help minimise the risk of bleeding from an injury to the CA, especially when faced with atypical anatomical variations. Continuous awareness and updates on these variations are essential for achieving a safe surgical outcome.

Keywords: Capsular artery, Laparoscopic cholecystectomy, Right hepatic artery

CASE REPORT

A 52-year-old male presented to the general surgery department with symptoms of biliary colic. He had no history of previous acute gallbladder events, and his family history was unremarkable. His past medical history included a laparoscopic appendectomy 20-year-ago. Upon examination, his vital signs were normal, and the abdominal assessment showed a positive Murphy's sign with no jaundice. Biochemical tests were normal, except for mild leukocytosis.

An ultrasound revealed multiple gallstones with an acoustic shadow and signs of acute cholecystitis. The liver and common bile duct diameters were normal. The patient was scheduled to undergo an elective LC. During the surgery, blunt dissection was performed at Calot's triangle. The hepatic capsular artery was noted entering the liver tissue near the gallbladder fundus. This artery, which supplies the gallbladder via the proper CA, was identified, clipped, and then divided [Table/Fig-1].



[Table/Fig-1]: Hepatic capsular artery.

The procedure was completed smoothly, and the patient recovered well postsurgery. Four weeks later, clinical and biochemical assessments showed normal results. The case received ethical committee approval (682/2024).

DISCUSSION

The CA primarily originates from the right hepatic artery, with additional support from aberrant, proper, and left hepatic arteries. The common hepatic duct and cystic duct are located posterior to the CA. The average length of the CA is approximately 20.77 mm, with an average diameter of 1.91 mm. Notably, around 20% of individuals

exhibit short cystic arteries. Surgical procedures must consider congenital variations, such as the absence or duplication of cystic arteries, despite these occurrences being relatively rare [1].

In a case reported by Dolenšek J, an unusual array of vascular anomalies affecting the liver and gallbladder was observed in a deceased male. This case involved the presence of an additional left hepatic artery and an additional right hepatic artery, each giving rise to two cystic arteries, one of which was positioned lower than usual. This combination of vascular anomalies has not been previously documented. The additional left hepatic artery originated from the left gastric artery, while the additional right hepatic artery arose from the superior mesenteric artery. Such arterial variations occur due to differences in embryonic development [2].

Alterations in the anatomy of the CA and surrounding structures can lead to confusion, iatrogenic injury, and prolonged surgical times [3]. Patients with impacted stones in the neck of the gallbladder, significant inflammation in Calot's triangle, or gallbladder perforation are particularly likely to encounter challenges during LC [4]. C-Reactive Protein (CRP) is a key indicator related to these challenges, especially regarding the risk of converting from laparoscopic to open surgery. Patients with elevated pre-treatment CRP levels are at a higher risk of experiencing intraoperative complications and are more likely to require conversion to open surgery. Specifically, preoperative CRP levels that exceed 11 mg/dL are associated with a significantly increased likelihood of complicated LC. This situation raises concerns for the primary surgeon regarding the potential for unexpected anatomical variations or bleeding due to arterial variations associated with the gallbladder during the procedure [5].

Indocyanine green dye has been previously regarded as a surgical option to enhance safety during procedures and reduce CA injury [6], for combined vascular and biliary fluorescence imaging [7], or the indocyanine green reinjection technique for fluorescent angiography alongside cholangiography [8].

Morphological variability, such as the presence of an aberrant CA, raises the likelihood of difficulties after LC. The aberrant architecture involves the presence of two cystic arteries of equal size, on some occasions. The hepatic capsular arteries extend across the surface of the liver and form the circulatory network within the organ. These arteries are crucial for blood circulation in different instances in medicine [9].

It is imperative to evaluate the significance of a Critical View of Safety (CVS) procedures and Rouviere's Sulcus (RS) within the

context of LC and its association with Biliary Duct Injuries (BDIs). The dissection should be performed above the RS. Moreover, it is essential to ascertain the incidence and classification of RS. To mitigate the risk of significant complications, it is vital to accurately identify the RS before severing the CA or duct during LC [10].

In their research, Ibrarullah M et al., determined that a critical view of safety was successfully established in 93% of patients. The most prevalent type identified was Type 1 RS, which accounted for 52% of cases. A cystic duct exhibiting normal characteristics was observed in 68% of the patients. The variety most commonly noted, occurring in 14.2% of cases, was a wide cystic duct of normal length. The predominant presentation, identified in 77% of patients, involved an isolated CA situated superiorly and medially to the cystic duct (Type 1-s). The second most common configuration, observed in 8% of cases, was an inferior CA located infero-laterally to the cystic duct (Type 2). The presence of multiple cystic arteries in the hepatocystic triangle can arise from either early branching of a singular CA (Type 1m) or the existence of two separate cystic arteries (Type 3). Additionally, a Type 4 aberrant right hepatic artery, which included a minor CA, was noted in 3% of cases [11].

An examination of the AFT indicates that to enhance safety during LC, it is critical to recognise and evaluate the specific methods employed during the procedure, rather than solely concentrating on the successful completion of the surgical task [12].

The CA was classified into four categories according to its placement with the cystic duct. The components of the structure consist of the superomedial, superolateral, anterior, and the missing CA with the cystic duct [13]. The use of the posterior Calot's triangle method in LC is a practical and effective technique for surgeries involving complex vascular structures. This approach results in reduced blood loss and improved ease of the procedure without increasing operative risks [14]. Additionally, laparoscopic modified fundus-down cholecystectomy may shorten surgical duration compared to the traditional method, while maintaining comparable complication rates, making it a promising avenue for future research [15], in contrast to the standard technique that was followed in the present study.

CONCLUSION(S)

Surgeons must consider various vascular variations related to the gallbladder during perioperative assessments, as these can

significantly impact surgical planning. Although there are currently no standardised preoperative predictors for difficult surgeries, identifying such variations may enhance surgical preparation. A thorough understanding of gallbladder vascular anatomy is essential to minimise the risk of unexpected bleeding during surgery.

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PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of General and Colorectal Surgery, Medical College, Imam Mohammad ibn Saud Islamic University (IMSIU), Riyadh, Saudi Arabia.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Mohammad Bukhetan Alharbi,
13462, Nada District, Zip Code-11426, Riyadh, Saudi Arabia.
E-mail: harbimbh@gmail.com

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