E-ISSN: 2708-1508
P-ISSN: 2708-1494
IJCRS 2025; 7(2): 83-85
www.casereportsofsurgery.com
Received: 30-05-2025
Accepted: 02-07-2025

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Aberrant course of right hepatic artery - A case report

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DOI: https://www.doi.org/10.22271/27081494.2025.v7.i2b.206

Abstract
Cholelithiasis is one of the commonly encountered ailments among the surgeons. Laparoscopic cholecystectomy is the treatment of choice in the presence of the symptoms. Although a safe surgery, risk of hemorrhage, bile leaks and conversion to open procedure due to several reasons are not uncommon. Presence of variant arterial anatomy is seen on 16.8% of the patients. Here we report a case where there was a aberrant right hepatic artery coursing along the gall bladder wall to reach the liver. It was identified because of its in appropriate caliber to be a cystic artery. Further dissection of the artery was carried out to delineate its course reaching the liver in the gall bladder fossa. Had it been clipped assuming it to be a cystic artery, right lobe of liver would have been devoid of arterial supply leading to potential complications like ischemic hepatic necrosis.

Keywords: Laparoscopic cholecystectomy, variant anatomy, hemorrhage, bile leak

Introduction
Laparoscopic cholecystectomy is a common surgery performed across the world. Even though surgery is performed regularly, complications are not uncommon. Bile leaks, conversion to open procedure, bleeding are routinely encountered. These complications can be attributed to severe inflammation obscuring the anatomy, variant anatomy most of the time. Cystic and hepatic artery variant anatomy are commonly encountered and warrant caution. Cystic artery variations were seen in 16.8% of the patient undergoing laparoscopic cholecystectomy [1]. The risk of conversion to open procedure (3 vs. 0), bile leaks 15.7% vs. 6.4%) and bleeding (16.8% vs. 1.9%) are higher in the presence of a variant anatomy when compared to classic anatomy [1]. Here we like to present a case report with a variant anatomy of the hepatic and cystic artery which was identified and successfully tackled during laparoscopic cholecystectomy.

Case report
A 48-year-old female presented with pain abdomen on and off since 3 months, pain was more whenever she had a heavy fatty meal. She had no known comorbidities. She was evaluated with ultrasound of the abdomen which showed multiple gall bladder calculi with largest measuring 13mm. A diagnosis of symptomatic cholelithiasis was made and she was counselled for elective laparoscopic cholecystectomy. All routine preoperative investigations including liver function tests were normal.
During surgery, minimal adhesions were noted near the infundibulum of the gall bladder. Calots triangle dissection was performed and triangle of safety defined. However, the artery was found anterior to the duct and the caliber of the vessel was inappropriate for it to be cystic artery. This led to further dissection of the artery along the gall bladder wall. The artery was running along the infundibulum, branching to supply the gall bladder (Cystic artery). Rest of the vessel found coursing posteriorly to supply liver. Pictures and description are as follows.

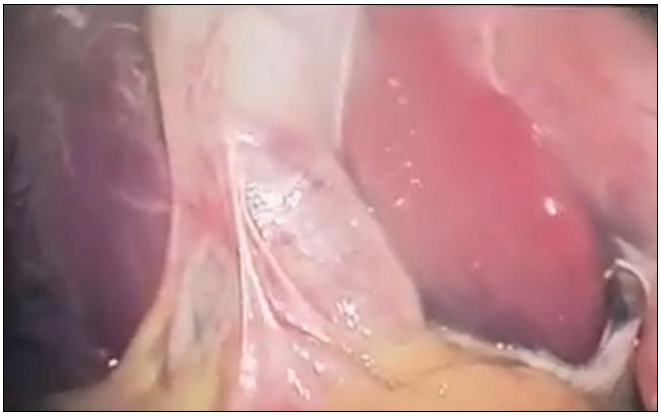

Fig 1: Minimal adhesions to the Gall bladder infundibulum

Fig 2: Calot dissection performed and demonstration of the triangle of safety

Fig 3: Cystic duct clipped, artery running in front of the duct and caliber is inappropriate for the cystic artery

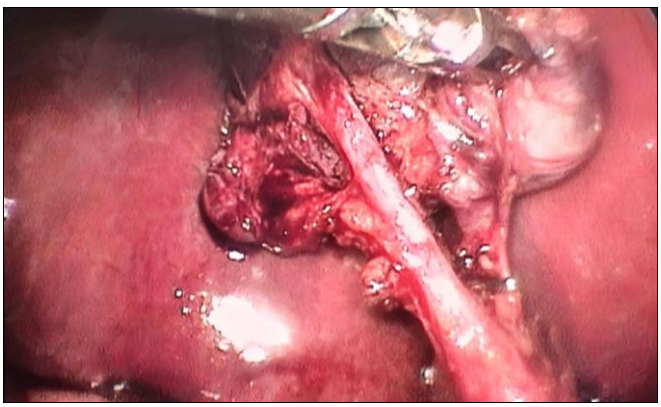

Fig 4: Artery skeletonized further to find it coursing posteriorly along the infundibulum to reach the liver

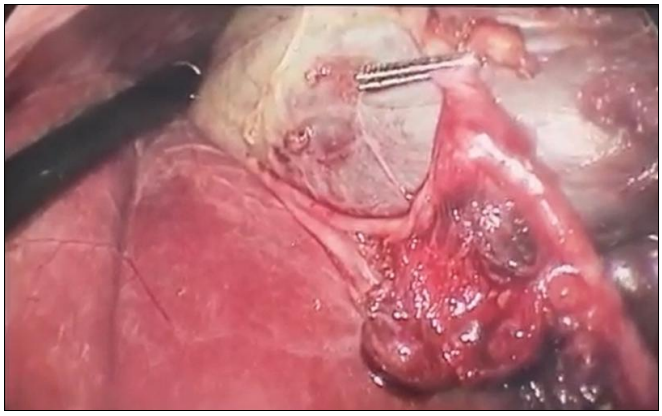

Fig 5: Cystic artery clipped close to gall bladder sparing the hepatic artery

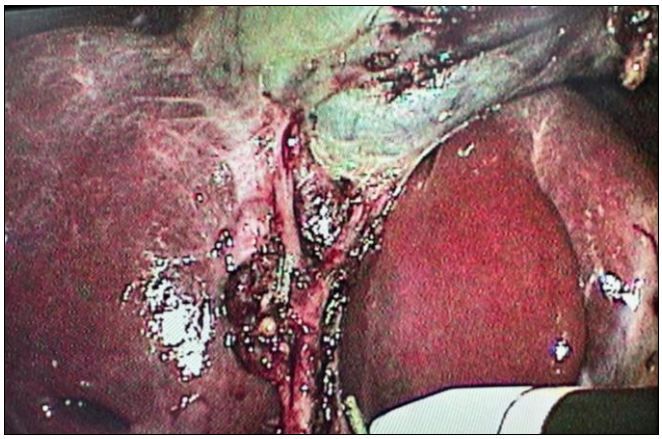

Fig 6: Half way through Gall bladder dissection from liver bed showing the branches of the hepatic artery in the Gall bladder fossa

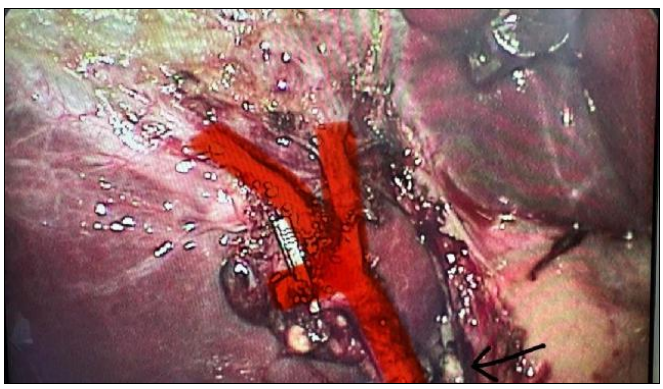

Fig. 7: After completion of cholecystectomy, showing the artery anatomy marked red in the picture on the right side and cystic duct stump marked by an arrow

Discussion

Variations in the anatomy of the hepatic artery has been identified way back in 1966 and classified by Michels A as follows [2]:

Type 1: Standard anatomy ~60% (range 55-61%)
Type 2: Replaced LHA from LGA ~7.5% (range 3-10%)
Type 3: Replaced RHA from SMA ~10% (range 8-11%)
Type 4: Replaced RHA from SMA and LHA from LGA ~1%
Type 5: Accessory LHA from LGA ~10% (range 8-11%)
Type 6: Accessory RHA from SMA ~5% (range 1.5-7%)
Type 7: Accessory RHA and LHA ~1%
Type 8: Accessory RHA and LHA and replaced LHA or RHA ~2.5%
Type 9: CHA replaced to SMA ~3% (range 2-4.5%)
Type 10: CHA replaced to LGA ~0.5%
Unclassified

- CHA separate origin from aorta ~2%
- double hepatic artery ~4%
- PHA replaced to SMA; GDA origin from aorta <0.5%

Anatomic variations of cystic artery are not uncommon, they have been seen in around 16.8% of the patients [1]. You-Ming Ding *et al*. have investigated variations in cystic artery anatomy in patients undergoing laparoscopic cholecystectomy and details are as follows. They divided patients into groups and subgroups based on the cystic artery variations [3].

Group 1: Calot's triangle type- cystic artery passes through the calot's triangle. Most common type- seen in 85.5% of the patients. Subdivided into single cystic artery or double cystic artery.

Group 2: Cystic artery approaches the gall bladder outside the Calot's triangle. Seen in 13% of the patients, further divided into four subgroups- cystic artery from Gastroduodenal artery (7.5%); cystic artery from variant right hepatic artery (3%); cystic artery directly from liver parenchyma (2.5%); cystic artery from left hepatic artery (1%).

Group 3: Compound artery type- more than one blood supply in addition to classic cystic artery seen in 1.5% of the patients.

Here we would like to elaborate on cystic artery arising from variant right hepatic artery (Group 2) where it has been described as variation in the right hepatic artery course usually from superior mesenteric artery, runs parallel to cystic duct to reach liver in the gall bladder fossa. This variant described in this study is similar to the variation seen in our patient.

The clinical significance of this variation is of utmost importance. Inadvertent clipping of the right hepatic artery would be catastrophic. Most of the patients continue to have normal post operative course due to presence of portal flow and dense collateral network at the hilum. Some patients may present with massive hepatic necrosis requiring lobectomy, recurrent liver abscess and liver atrophy [4].

Identification and preserving hepatic artery in the presence of variant anatomy is key for a successful laparoscopic cholecystectomy. In most of the patients undergoing cholecystectomy, cross sectional imaging will not be performed preoperatively to identify such variations. Hence, intra operative identification of the variant anatomy plays a vital role.

Conclusion

Laparoscopic cholecystectomy is most commonly performed procedure worldwide. It is the treatment of choice for patients with symptomatic cholelithiasis. Presence of variant anatomy is one of the common causes for bleeding, bile leaks and conversion to an open procedure. Knowledge of the common variants in the arterial anatomy will avoid unnecessary hemorrhage and conversion to open procedure. Identification of aberrant course of right hepatic artery as in our patient will avoid inadvertent clipping of the hepatic artery.

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How to Cite This Article
Muddasetty R, Jayaramaiah D. Aberrant course of right hepatic artery - A case report. International Journal of Case Reports in Surgery. 2025;7(2):83-85