History of Medicine, 2024, 10(2): 1899-1904
DOI: 10.48047/HM. V10.2.2024.1899-1904

Case Report: Moynihan's Hump: A Must Know Anatomical Variant for Every Laparoscopic Surgeon

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Abstract :

Among the numerous anatomical variations in the hepatobiliary-vascular anatomy, Moynihan's hump,although rare, is a dangerous one. Failure of a surgeon to recognize it while operating can lead to complications like bile duct injury, bleeding and conversion to open surgery. We report a case of cholelithiasis, in which Moynihan's hump was identified during laparoscopic cholecystectomy and tackled successfully. Further, we discuss the anatomy and surgical significance of this variation and conclude with the importance of adequate prior knowledge of hepato-biliary-vascular anatomy, achievement of critical view of safety to safely tackle this dangerous anomaly and prevent complications.

Keywords: Calot's triangle, Caterpillar hump, Laparoscopic cholecystectomy, Moynihan's hump, Right hepatic artery.

Introduction:

Rigorous research has shown us the high percentage of variations in the anatomy of the hepato-biliary-vascular region but even today despite the use of modern techniques and imaging, the complications of iatrogenic injuries have not reduced.[1]Moynihan's hump is a rare (incidence of

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3–13.3%) but disastrous variation, in which the right hepatic artery (RHA) has a tortuous course through the hepato-cystic triangle, lying very close to the gallbladder with a short cystic artery [7].Misidentification of RHA as cystic artery can lead to inappropriate clipping, bleeding, or duct injury. In the literature, till date, the worldwide proportion of Moynihan's hump in *in vivo* as well cadavers is only 7%.[1]

Case Description:

A 28-year-old female presented with intermittent right hypochondriac pain of mild intensity, since the past 3 months with no comorbidities. Ultrasonography of abdomen revealed cholelithiasis with acute on chronic cholecystitis. Patient underwent elective laparoscopic cholecystectomy for persistent biliary colic after preanesthetic fitness and consent. Pneumoperitoneum was created using Veress needle technique and subsequent trocars were inserted (epigastric,mid-clavicular, and anterior axillary,) under vision. Initial visualization revealed a non-inflamed gallbladder with no adhesions. With adequate lateral traction at the Hartmann's pouch, Calot's triangle was dissected carefully at the level of infundibulum, just in line with sulcus of Rouviere's. Medial and lateral peritoneum were dissected to reveal a large tortuous artery running toward gallbladder and then away from it toward the liver. The size and the turning away of the artery from the gallbladder created a suspicion as to it being a tortuous RHA rather than cystic artery. On further gentle dissection, a small short cystic artery was seen arising from the tortuous RHA. Both the cystic artery and the RHA hump were anterior to the common bile duct (Fig. 1). Critical view of safety was achieved demonstrating a tortuous RHA with a short cystic artery along with a cystic duct. The cystic artery was clipped carefully close to the gallbladderwithout excessive traction. Cystic duct was clipped and cut and retrograde cholecystectomy was carried out with adequate hemostasis. Postoperative stay was uneventful and patient was discharged on post-op day five.

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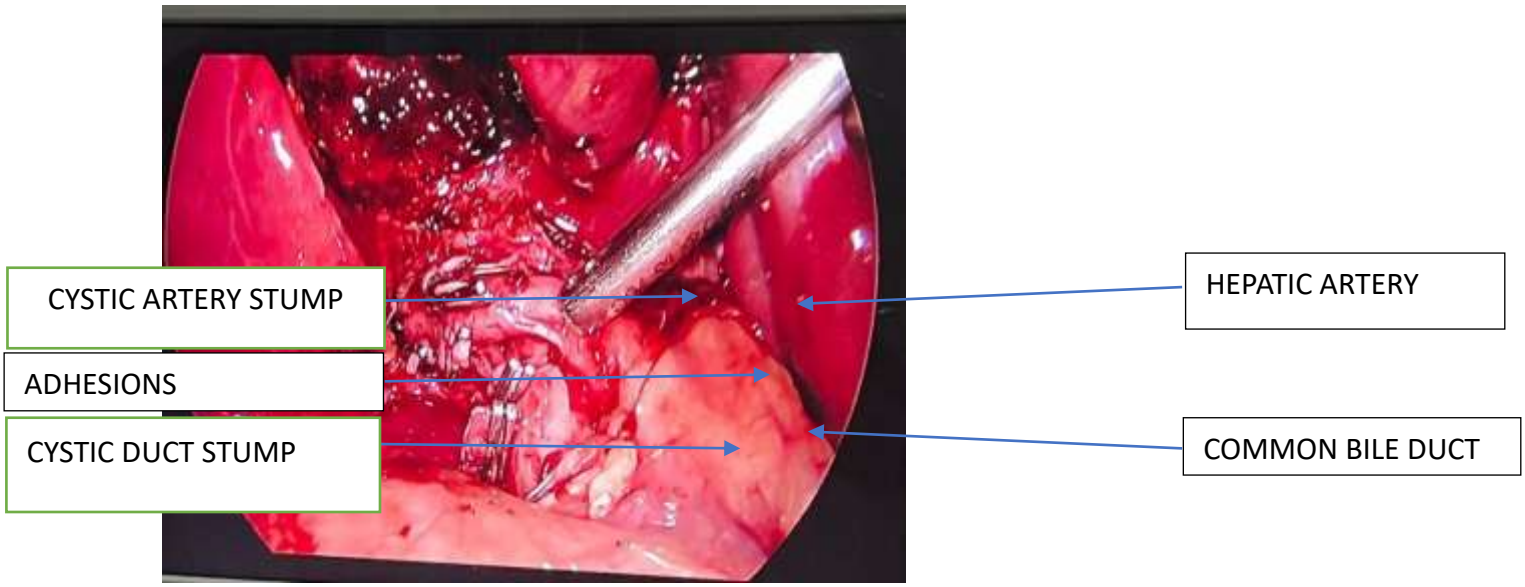
LEGEND



Intraoperative image showing the single loop U-shaped Moynihan's hump of RHA

Discussion and conclusion:

The anatomy of hepatobiliary triangle, that is, the biliary tree and cystic artery is complex due to three important reasons: (1) multiple vital structures (bile duct, hepatic artery, portal vein) lying in close approximation with each other, (2) multiple anatomical variations in biliary tree, cystic artery, and RHA, and (3) high incidence of these anatomical variations. The variations in this are as common as 20–50%.[1–5] Knowledge about these variations is a must for surgeons before operating in this critical area as the course of cystic artery cannot be determined preoperatively and can only be established by careful dissection during operative procedure. Lack of knowledge is one of the major causes of avoidable complications like bile duct injury and vascular injury. The incidenceof conversion of laparoscopic approach to open in case of vascular injuries is 0–1.9% with a mortality of 0.2%.[3,6]Moynihan's hump defined as the tortuous course of the RHA forming a U-shaped loop giving it a "caterpillar hump" appearance with an incidence of 3–13.3%.[1,7,8] As far as the etiology is concerned, there have been multiple theories but none have been proven to be the exact cause. As per Taylor CR,[9] architectural distortion due to cirrhosis of liver causes corkscrewing of intrahepatic arteries leading to a tortuous hepatic artery. As of now,

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no clinical evidence has been demonstrated to prove this hypothesis. According to Benson and Page,[4] this is not an anomaly but artifact created due to traction giving during cholecystectomy. Similar incidence of this anomaly in operated individuals and in cadavers disproves this hypothesis. Miyaki[10] suggested that the origin of hump is embryological. The embryonic liver is supplied by three segmental arteries arising from the aorta. The middle hepatic artery forms the future hepatic artery. The left and right fetal hepatic arteries become the accessory hepatic arteries from left gastric and superior mesenteric arteries in 25 and 18% of the cases. It is postulated that complete or partial persistence of the fetal arterial supply can lead to caterpillar hump.Anatomically, the tortuous part of the RHA can either lie anterior to the common hepatic duct or posterior to it. The posterior location of RHA is more common (60%).[11] In our case, the artery lied anterior to duct. Depending on its tortuosity, the artery can course with a single loop (55% cases) when it is less tortuous and in double loop when it is more tortuous. The cystic artery is usually short whether it arises from single loop or double loop course, except when it arises from the proximal loop of the RHA.[12,13] Such characteristics of this anatomical variation can easily lead to complications due to (1) misinterpretation of RHA as cystic artery, (2) mechanical/tractional injury to RHA/cystic artery during dissection. These factors can cause:

- Misinterpretation of RHA as cystic artery and its complete ligation can cause right lobar ischemic necrosis of liver.
- Misinterpretation of RHA as cystic artery with its partial ligation can cause hepatic artery pseudoaneurysm leading to uncontrolled bleeding.
- Vascular injury to RHA/cystic artery leading to bleeding which obscures the surgeon's vision and prompts blind coagulation leading to injury or complete transection of bile duct.
- Conversion to open cholecystectomy due to uncontrolled bleeding from vascular injury.

Such iatrogenic complications can be prevented by simple preventive measures which include:

- Acquirement of thorough knowledge of hepatobiliary anatomical variations by the surgeon.
- Achieving the critical view of safety before ligating any structures and ensuring only two structures are attached to gallbladder.
- When in doubt about the anatomy, or difficulty in dissection of calot's triangle, a second opinion should be taken from senior surgeon and priority to be given to patient safety and outcome.

- IV bolus of indocyanine green dye is used to delineate cystic artery – hepatic artery anatomy during cholecystectomy.[14]

All this discussion makes it necessary to understand that each cholecystectomy must be approached as a new case and the surgeon should be thoroughly vigilant about the vascular and bile duct anomalies.

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