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Background

- Introduced in the 1980s, laparoscopic cholecystectomy became the standard of care for surgical management of gallbladder disease given its advantages of reduced pain, decreased hospital length of stay, and reduced wound complications compared to open cholecystectomy.¹ It has become one of the most frequently performed surgical procedures in the United States with more than 750,000 performed annually.²
- Bile duct injuries are a rare but serious complication of laparoscopic cholecystectomy, with incidence ranging from 0.15-0.5%.
- Bile duct injuries impact patient survival, impair quality of life, and are a major source of litigation cost to the modern health system.⁴ Injury to the common bile duct specifically has been shown to have a high rate of required reoperation, perioperative mortality, and deficits in long term quality of life and functional status.²
- In 2014, the Society of Gastrointestinal and Endoscopic Surgeons (SAGES) developed the SAGES Safe Cholecystectomy Program, a set of guidelines and didactic modules to aid surgeons in performing safer laparoscopic cholecystectomy. One key feature of these guidelines is the anatomic description of the Critical View of Safety.

Anatomy

- The original description of Calot’s Triangle was defined by the following boundaries: cystic duct (inferior), common hepatic duct (medially) and cystic artery (superiorly).
- Modern surgical textbooks describe what is known as the Hepatocystic Triangle with the following boundaries: cystic duct (inferior), common hepatic duct (medially), and undersurface of the liver (superiorly). This difference in the base of the triangle placed the right hepatic duct and right hepatic artery within the boundaries of dissection.
- The Critical View of Safety is a method of identification of the cystic duct and artery during laparoscopic cholecystectomy that is recommended by SAGES. It is achieved when the following conditions are met:
 - 1: The hepatocystic triangle is cleared of fat and fibrous tissue
 - 2: The cystic plate is exposed such that the lower third of the gallbladder is separated from the liver
 - 3: Two and only two structures (cystic artery and cystic duct) are seen entering the gallbladder

The Hepatocystic Quadrangle of Ozobia: A Novel Description

- The boundaries of the quadrangle
 - Laterally: a line from the neck of the gallbladder to the undersurface of the liver
 - Superiorly: the undersurface of the right lobe of the liver
 - Medially: border of the hepatoduodenal ligament
 - Inferiorly: a line from the neck of the gallbladder to the hepatoduodenal ligament
 - Bisecting the square vertically and horizontally gives rise to 4 quadrants
- Anatomy in each quadrant
 - Q1 = cystic duct, cystic artery, Node of Lund
 - Q2 = right hepatic artery, takeoff of the cystic artery, right hepatic duct, and right portal vein (deep to these structures)
 - Q3 = confluence of the right and left hepatic ducts forming the common bile duct, division of the proper hepatic artery into left and right hepatic arteries, and division of the portal vein into left and right branches (deep to these structures).
 - Q4 =common bile duct, proper hepatic artery, portal vein

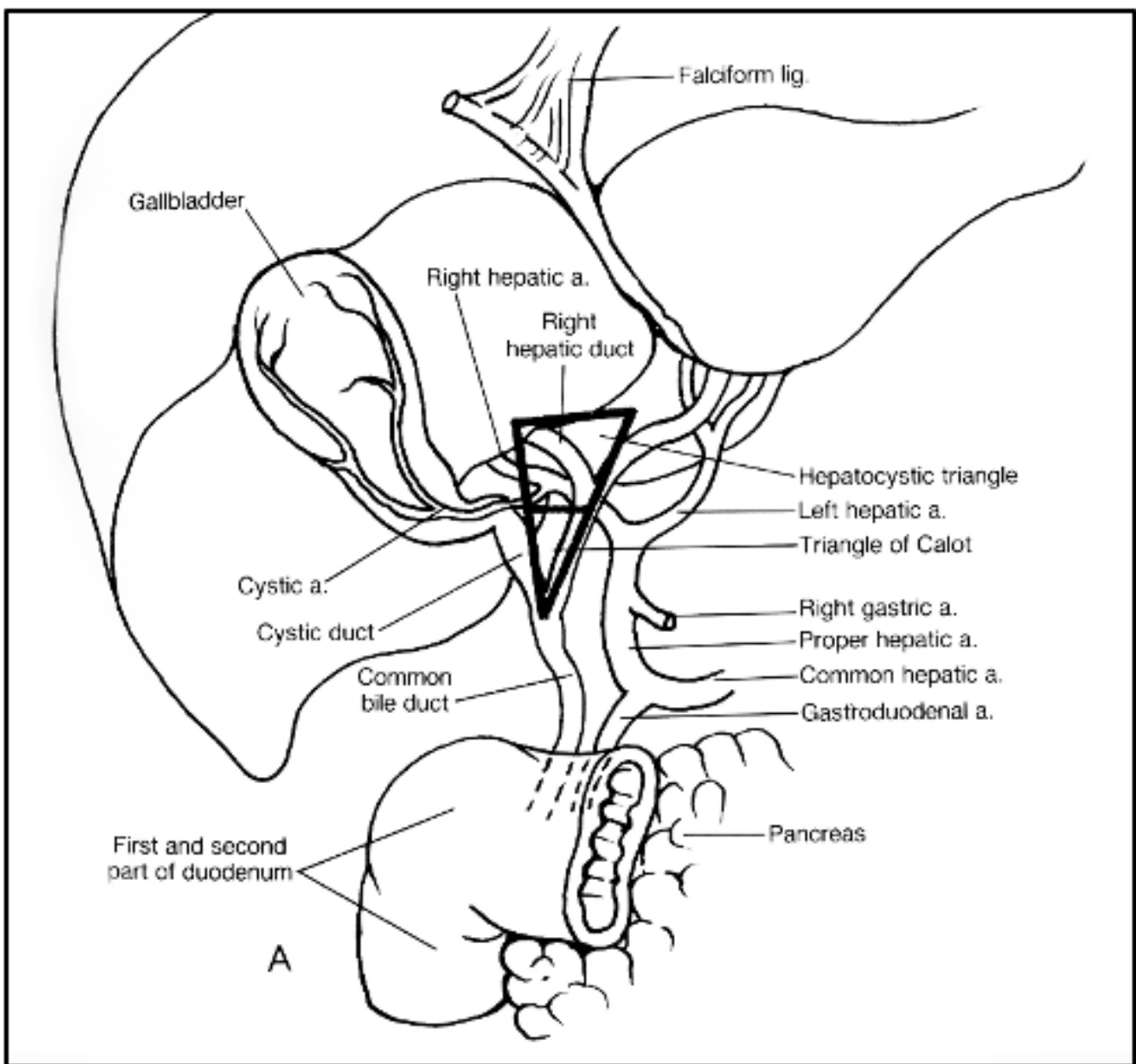
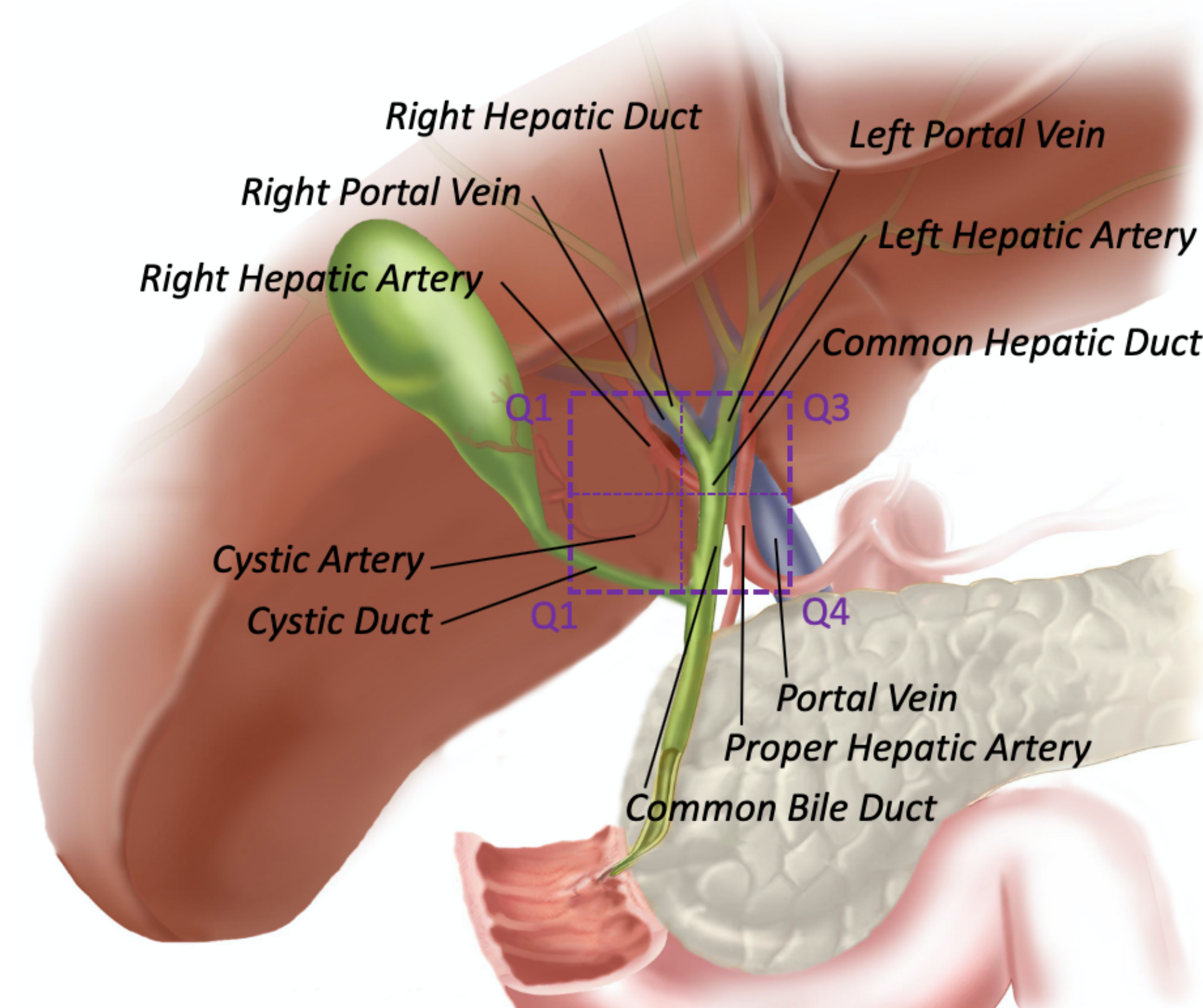


Figure 1
Above: The hepatocystic triangle as seen with traditional laparoscopic forces in place
Left: The triangle of Calot defined by the inferior, smaller triangle. The triangle of Strasberg used as part of the critical view of safety defined by the larger, broader based triangle.
Right: Intra-operative view of the triangle of safety with full exposure of all three parts (liver base, cystic artery, cystic duct)

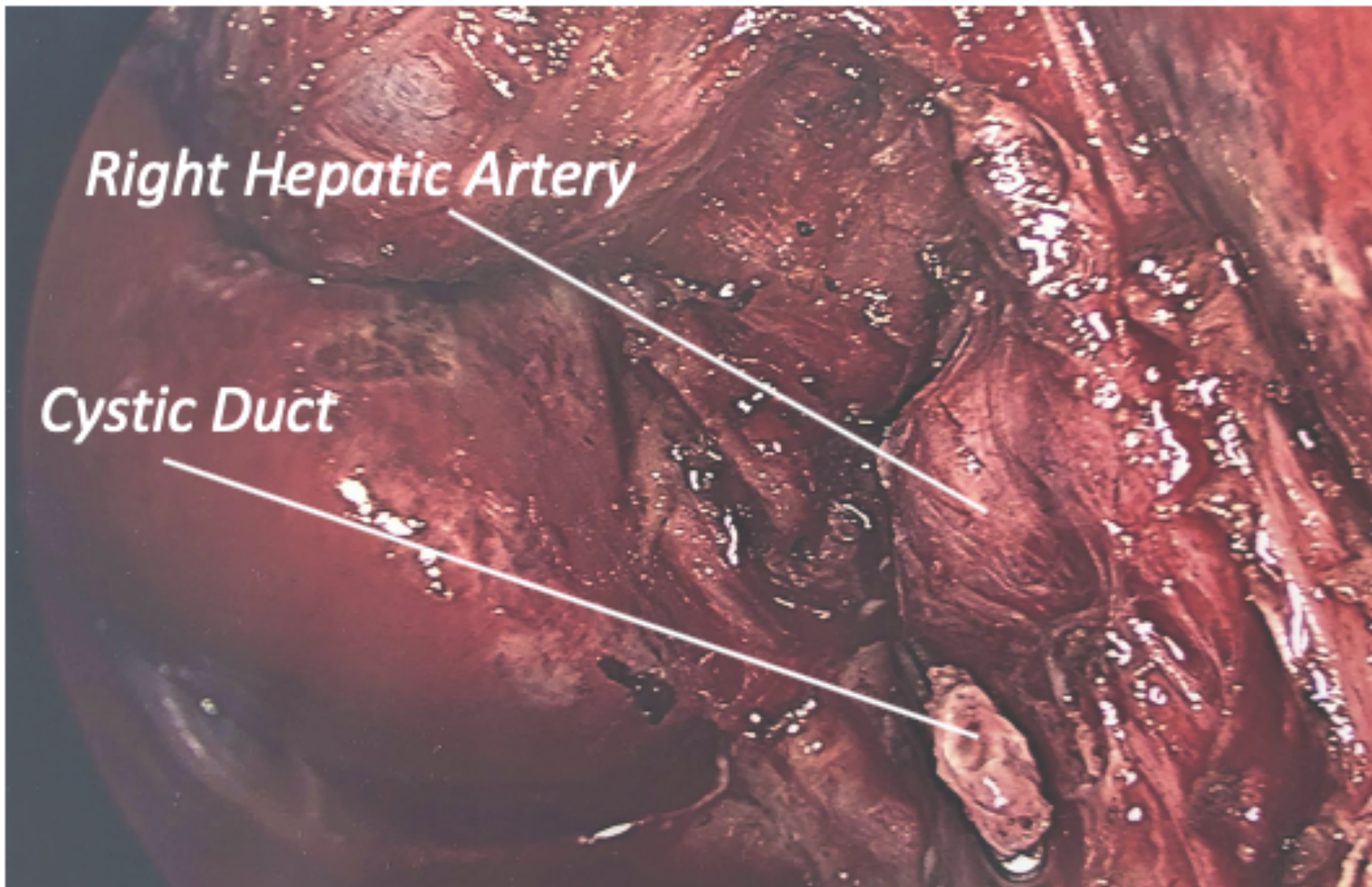
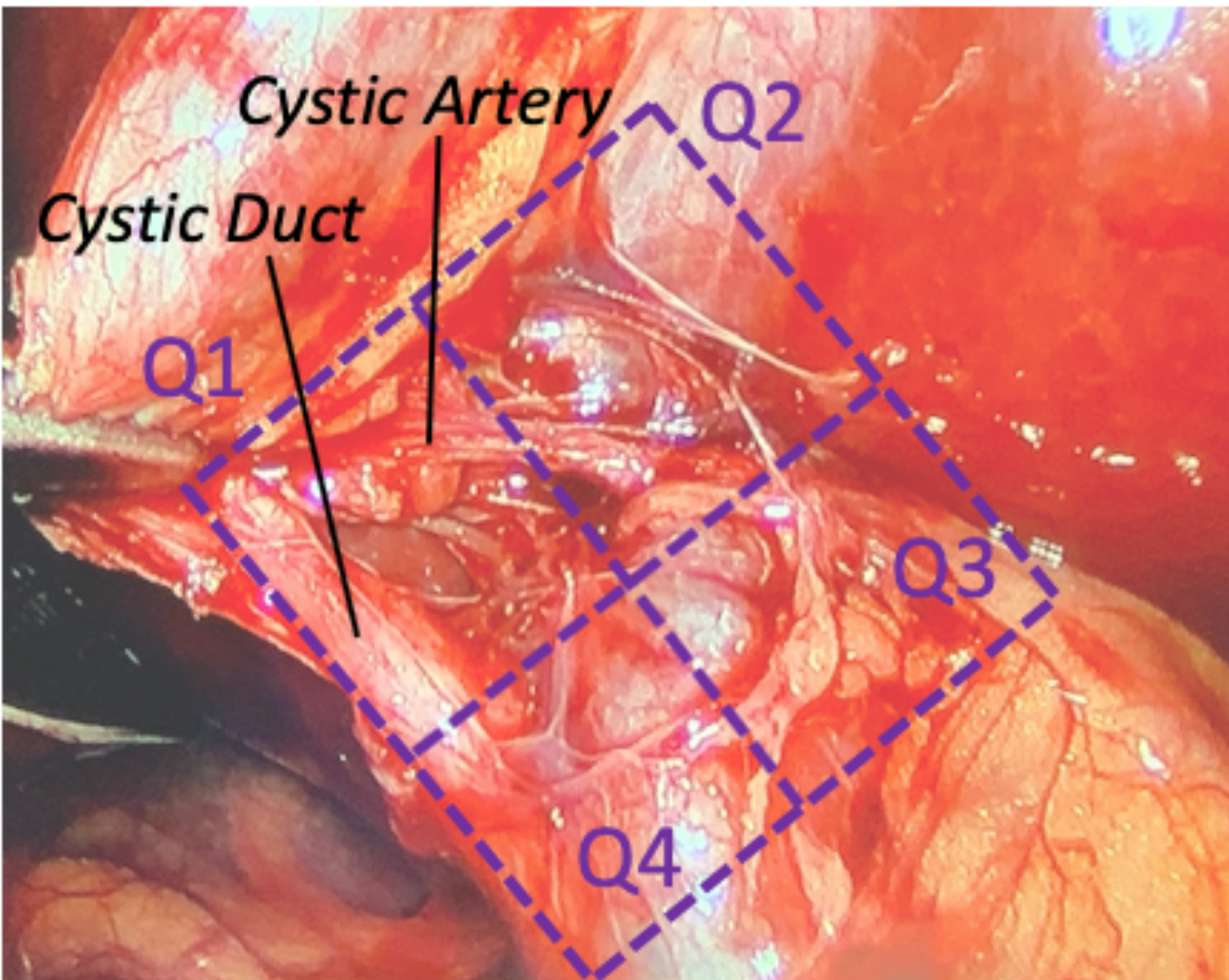


Figure 2
Left: The hepatocystic triangle in an operative setting during dissection
Right: Cystic duct after being clipped and transected. An aberrant right hepatic artery (Moynihan’s hump) seen in the center of Calot’s triangle

Case Summary: Encountering Moynihan’s Hump

74 year-old male with a history of biliary colic who presented with acute onset of right upper quadrant abdominal pain. Initial laboratory workup was significant for total bilirubin 2.5, lipase 47, AST 78, ALT 68, leukocytosis of 14.3. An MRCP was obtained demonstrating tapering of the distal common bile duct consistent with choledocholithiasis. The patient underwent ERCP with stones removal and stent placement, followed by laparoscopic cholecystectomy during the same admission. Intraoperatively, a prominent and tortuous artery was identified in Calot’s triangle. Utilizing the anatomic knowledge built into the hepatocystic quadrangle, careful dissection was performed and revealed this to be an anatomic variation known as Moynihan’s hump. All relevant clips were placed with transection of the cystic duct and artery while avoiding injury to this anatomic aberrancy.

Conclusions

- Laparoscopic cholecystectomy is a common surgical procedure that requires a keen understanding of anatomy to avoid devastating consequences
- The Hepatocystic Quadrangle is a novel description of the hepatobiliary anatomy that may assist surgeons who encounter anatomic variations during surgery
- This proposed model builds upon the method of the Critical View of Safety with new dissection landmarks, providing an additional tool to the surgeon navigating a difficult cholecystectomy

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