VARIATION IN THE ORIGIN AND COURSE OF CYSTIC ARTERY

Sundip H. Charmode

Assistant Professor, Department of Anatomy, ESIC Medical College and Hospital, Paripally, Kerala.

ABSTRACT

BACKGROUND
The variation in the origin, course and number of cystic arteries is commonly encountered during routine dissections in cadavers and also during surgeries. Hence, it becomes mandatory to have information about these variations before conducting surgeries related to hepatobiliary region. Cystic artery is usually a branch of right hepatic artery which arises within the Calot's triangle. The development of hepatic and biliary apparatus and its vasculature is quite complex resulting in many variations. Lack of knowledge of the variations in origin and course of cystic artery, cystic duct, common hepatic duct and related structures within Calot's triangle can create difficult situations for surgeons conducting both laparoscopic and open cholecystectomy surgeries. Uncontrolled bleeding from the cystic artery and its branches is a serious problem that may increase the risk of intraoperative lesions to vital vascular and biliary structures during these surgeries.

KEYWORDS
Cystic Artery, Hepatic Artery Proper, Calot's Triangle, Anatomical Variation, Gastroduodenal Artery.


BACKGROUND
Calot's triangle is a space bordered by the cystic duct inferiorly, common hepatic duct medially and the inferior (Visceral) surface of the liver superiorly. Cystic artery normally arises from right hepatic artery within Calot's triangle and passes posterior to the common hepatic duct and cystic duct. Anatomical variations of the cystic artery are very commonly encountered during cholecystectomy. Currently, laparoscopic cholecystectomy is widely accepted as the gold standard in the treatment of cholecystitis.1-4 This new technique was initially associated with a significant increase in morbidity, and in particular, iatrogenic biliary injury and arterial haemorrhage, perhaps due to lack of knowledge of the laparoscopic anatomy of the gallbladder pedicle.5-8 Therefore, the laparoscopic surgeon has to deal with the new anatomical views and must be aware of the possible arterial and biliary variants. Very often surgeons face problems in laparoscopic cholecystectomy when cystic artery arises outside the Calot's triangle (to the left) and crosses anterior to the common hepatic duct.9-10 The other origins are left hepatic artery, the proper hepatic artery, the common hepatic artery, the gastroduodenal artery, the superior pancreaticoduodenal artery and the superior mesenteric artery. In addition to the variation in origin of the cystic artery, its course also follows different pathways, often in close proximity to the common bile duct.11 Cystic artery bleeding is a common complication during laparoscopic cholecystectomy due to these variations.

CASE REPORT
During routine dissection of formalin fixed cadaver of a 65-year-old male, it was observed that the cystic artery is taking origin from gastroduodenal artery instead of its normal origin from right hepatic artery. After arising from gastroduodenal artery it was passing anterior to common hepatic duct and also anterior to cystic duct and eventually reaching neck of gall bladder. The further course and branching pattern of cystic artery was normal as seen in Fig 1 and 2. Celiac trunk was very clearly seen giving origin to splenic, left gastric and common hepatic artery. Common hepatic artery continues towards right and gives origin to gastroduodenal artery and further continues as hepatic artery proper. Further course and branching of hepatic artery proper was as usual. The cystic artery clearly arises outside the limits of Calot's triangle.

Figure 1. 1. Undersurface of liver. 2. Common hepatic duct. 3. Cystic artery. 4. Hepatic artery proper. 5. Gastroduodenal artery. 6. Gall bladder (Inferior surface).

DISCUSSION

The cystic artery originates from right hepatic artery (63.9%), hepatic trunk (26.9%), left hepatic (5.5%), gastroduodenal artery (2.6%), superior pancreaticoduodenal artery (0.3%), right gastric (0.1%), celiac trunk (0.3%) and superior mesenteric artery (0.8%). Harris and Pellegrini in 1994 showed that cystic artery was originating from right hepatic artery (75%). Other sources found were left hepatic artery (6.2%), hepatic artery proper (2.2%), common hepatic artery (0.6%), superior pancreaticoduodenal artery (0.2%) and superior mesenteric artery. Double cystic artery in Calot's triangle existed in 5.55%. Cystic artery which arises from gastroduodenal artery is called low lying cystic artery which passes outside Calot's triangle. In conventional open cholecystectomy, in a laparoscopic view, cystic artery is seen passing inferior to celiac duct, while it usually appears superficially and anterior to the cystic duct. Terminal segment of cystic artery is of importance as it has to be manipulated first and is also susceptible to injury and haemorrhage during dissection of the peritoneal folds connecting the hepatoduodenal ligament to Hartmann's pouch of the gallbladder.16

Embryological Basis

The reason behind these variations in the cystic artery can be attributed to the developmental pattern of the biliary system. Embryologically, the simple branching pattern of the gastroduodenal and hepatobiliary vasculature is profoundly altered by the growth of the liver and pancreas and by the assumption of a curved form in the stomach and duodenum. These factors operate to complicate the branching of the celiac axis and proximal segment of the superior mesenteric artery. Considering that the liver is derived from a portion of the foregut endodermal hepatic diverticulum, which usually carries a rich supply of vessels from the abdominal aorta and its initial branches. Most of the vessels picked up from the abdominal aorta during development degenerate leaving in place the mature vascular system. Because the pattern of degeneration is highly variable, the origin and branching pattern of the vessels to these organs also vary considerably (Hiatt et al., 1994). Considering the complexity of this developmental scheme, it is easy to understand the large degree of arterial variation within this vascular system as described by Daseler et al. Knowledge of the different anatomical variations of the arterial supply of the gallbladder, liver and stomach is of great importance in hepatobiliary and gastric surgical procedures. Variations in the cystic artery are many, and precautions should be taken during the performance of surgeries involving hepatic and biliary apparatus.

REFERENCES