Case Report:
Inverted Calot’s Triangle and Associated Vascular Variations

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Abstract: This report describes the concurrent vascular and ductal variations of the hepatobiliary system. The right hepatic artery arose directly from the common hepatic artery, passed through the Calot’s triangle and entered the right lobe of the liver through the gall bladder fossa. The left hepatic artery arose from a common gastrohepatic trunk and entered the left lobe of the liver through fissure for ligamentum venosum. It gave two esophageal branches before entering the liver. The cystic duct was broad, straight and opened on the left side of the common hepatic duct, thus giving a mirror image appearance to the Calot’s triangle. This report is likely to be the first on such combined variations at the vicinity of the liver.

Key Words: Cystic duct, hepatic artery, gallbladder, artery, celiac

Introduction:
Vascular variations are quite common at the vicinity of the liver, especially those of the branching pattern of the celiac trunk. A thorough knowledge of these possible variations can lead to successful radiologic diagnosis, therapeutic and surgical procedures. Usually, the hepatic artery arises from a common hepatic artery and divides into right and left hepatic arteries, which enter the respective lobes of the liver through the porta hepatitis. The origin of right hepatic artery, course, point of entry into the liver and its relations to the biliary duct system can show great deal of variations and these variations have been documented well in the literature (1-3). Presence of hepatogastric trunk has been reported in less than 2% of cases (4, 5). The cystic duct can also present congenital variations. It may be absent, duplicated or can have variant terminations (6, 7, 8). This case report presents a combined variation of hepatic arteries and cystic duct. Aim of this report is to alert the surgeons and radiologists about the possibility of this type of concurrent variations which may adversely affect the outcome of various surgical and diagnostic procedures.

Case Report:
During dissection classes for medical students, concurrent variations of cystic duct and branching pattern of celiac trunk were noted in an adult male cadaver aged approximately 65 years. The celiac trunk divided into three branches; common hepatic artery, splenic artery and a gastro-hepatic trunk. The common hepatic artery divided into gastroduodenal and right hepatic artery. Right hepatic artery gave a cystic branch and entered the liver by passing through the gall bladder fossa. The splenic artery had a normal course and distribution. The gastro-hepatic trunk ran upwards and to the left to reach the lesser curvature. Upon reaching lesser curvature, it divided into left hepatic artery and left gastric artery. Left hepatic artery gave two esophageal branches and then entered the liver by passing through the fissure for ligamentum venosum. Left gastric artery had a normal course and distribution. The gall bladder was situated in the gall bladder fossa, which was broader than usual. The neck of the gall bladder covered the common hepatic duct and the right hepatic artery from the front. The cystic duct was about 2cm long, straight, slightly broader than usual ran down on the left side of the common hepatic duct and opened into it obliquely. Hence the cysto-hepatic triangle formed was a mirror image of what is found usually. The cystic artery and right hepatic artery crossed the cysto-hepatic triangle before their termination. The common bile duct had a normal course and termination. The variations are shown in figures 1-3.
Figure 1. Dissection of the upper abdomen showing branching pattern of celiac trunk. (RLL – right lobe of liver; LLL – left lobe of liver; QL – quadrate lobe; CL – caudate lobe; GB – gall bladder; PH – porta hepatis; CT – celiac trunk; CHA – common hepatic artery; RHA – right hepatic artery; GDA – gastroduodenal artery; SA – splenic artery; GHT – gastro-hepatic trunk; LHA – left hepatic artery; LGA – left gastric artery; EB – esophageal branches; CBD – common bile duct)

Figure 2. Dissection of the upper abdomen showing left sided union of cystic duct with the hepatic duct. The neck of the gall bladder has been lifted to expose the Calot’s triangle. (RLL – right lobe of liver; LLL – left lobe of liver; CL – caudate lobe; GB – gall bladder; CD – cystic duct; CHD – common hepatic duct; CBD – common bile duct; RHA – right hepatic artery; LHA – left hepatic artery; LGA – left gastric artery)

Figure 3. Dissection of the upper abdomen showing relationship of cystic artery and right hepatic artery to cystic duct and common hepatic duct. Neck of the gall bladder has been pulled to the right. (RLL – right lobe of liver; LLL – left lobe of liver; QL – quadrate lobe; GB – gall bladder; CD – cystic duct; CBD – common bile duct; RHA – right hepatic artery; LHA – left hepatic artery; LGA – left gastric artery; CA – cystic artery)

Discussion:
Hepatobiliary surgeons, gastroenterologists, radiologists and surgeons in general have to be well versed with the possible variations of the celiac trunk to prevent the possible iatrogenic injuries. In the current case, the coeliac trunk did not give its classical branches; left gastric artery, common hepatic artery and splenic artery. The right hepatic artery arose from the common hepatic artery and passed through the Calot’s triangle and entered the right lobe through the fossa for the gall bladder. This artery might cause the serious bleeding during laparoscopic cholecystectomy because usually the artery enters the liver through the right end of the porta hepatis. The occurrence of hepatogastric trunk is seen in about less than 2% of cases. In such cases, the usually other branches of celiac trunk arise from the aorta directly. In the current case the left hepatic artery arose from the hepatogastric trunk and entered the liver through fissure for ligamentum venosum. It gave two esophageal branches. The knowledge of this variation is useful in surgery of the gastroesophageal junction and also in therapeutic embolization of the left gastric artery (9). Hepatogastric trunk may be mistaken for the left gastric trunk, resulting in avascular necrosis of the left lobe of the liver. The left hepatic artery ligation in the current case during resection of left lobe of liver might decrease the blood supply to the lower end of the esophagus as the esophageal branches arose from the left hepatic artery.

Inversion of the Calot’s triangle is an extremely rare anomaly. In the present case, gall bladder was enlarged and the neck of the gall bladder overlapped the Calot’s triangle. They cystic duct was broad and straight. Left sided opening of the cystic duct into the bile duct could cause difficulty in biliary drainage and probably the enlargement of the gall bladder in the current case was due to the same reason. Knowledge of this variation of the cystic duct could be useful in laparoscopic cholecystectomy.

References: