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Case Report

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MULTIPLE VARIATIONS IN BRANCHES OF COELIAC TRUNK – A CASE REPORT

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ABSTRACT

Coeliac trunk is the first ventral branch of abdominal aorta and is the artery of foregut. Apart from supplying the derivatives of foregut, it supplies liver, gall bladder, pancreas and spleen. It may give aberrant branches which supply diaphragm, suprarenal gland and even reach up to transverse colon. In this case report multiple variations in the branches of coeliac trunk are described. Inferior phrenic arteries took origin from the coeliac artery as a common trunk, common hepatic artery after giving origin to gastroduodenal artery immediately divided into right and left hepatic arteries without continuing as hepatic artery proper, right gastric artery originated from the left hepatic artery and cystic artery passed superficial to common hepatic duct. Embryological basis of these variations is discussed. Also, significance of coeliac trunk variations in various clinical conditions is described.

KEYWORDS: Celiac trunk, hepatic artery proper, inferior phrenic artery, cystic artery.

INTRODUCTION

Coeliac trunk (CT) is the first ventral branch of abdominal aorta arising at twelfth thoracic (T12) vertebral body level.[1] Classically it gives three branches namely left gastric artery (LGA), common hepatic artery (CHA) and splenic artery (SA).[2] LGA is the smallest branch, reaches the cardiac end of stomach where it gives esophageal branches, and run downwards along the lesser curvature of stomach to give gastric branches and anastomoses with RGA. CHA is an intermediate branch of CT, providing a right gastric artery (RHA) during its course, and later dividing into hepatic artery proper (HAP) and gastroduodenal artery (GDA). As the HAP passes through the free margin of lesser omentum, it divides into right (RHA) and left (LHA) hepatic arteries. GDA divides into superior pancreaticoduodenal artery (SPDA) and right gastroepiploic artery (RGEA). SPDA anastomoses with inferior pancreaticoduodenal artery (IPDA).These two supply the first and second parts of duodenum, and the head of the pancreas. RGEA anastomoses with left gastroepiploic artery (LGEA) along the greater curvature of stomach.[1]

Cystic artery invariably arises from RHA, lying posterior to common hepatic duct (CHD) and superior to cystic duct. CA divides into superficial and deep branches at the level of neck of gall bladder (GB).[1] SA is the largest branch of CT having a tortuous course along the superior border of pancreas. It gives pancreatic branches, short gastric branches, posterior gastric artery and runs in the leinorenal ligament where SA divides into 2-3 branches and these branches further divide into segmental arteries after entering the hilum of spleen.[1]

CT and its branches supply the foregut, and also spleen, liver, GB and pancreas.[1] Here, we are reporting a remarkable combination of variations in CT and its branches encountered in a female cadaver.

CASE REPORT

During routine abdominal dissection, in a 50-year-old female cadaver for undergraduate teaching, multiple variations in the pattern of branching and course of branches of CT were seen. CT took origin at T12 level and was 25mm in length. It showed quadrifurcation to give rise to LGA, CHA, SA and one common trunk. The common trunk divided into right inferior phrenic artery

(RIPA) and left inferior phrenic artery (LIPA). Both RIPA and LIPA were cut to expose the diaphragm and surrounding area [Figure 1]. LGA and SA had routine course and branching pattern without any variation. LGA gave branches to esophagus and gastric branches along the lesser curvature of stomach. CHA had trifurcated into GDA, RHA and LHA. GDA supplied the head of pancreas and duodenum. LHA supplied the left lobe of liver and gave RGA, which anastomosed with LGA along the lesser curvature of stomach. Further, GDA divided to give rise to SPDA, RGEA and a pancreatic branch [Figure 2]. SPDA anastomosed with IPDA. RGEA anastomosed with LGEA along the greater curvature of stomach. SA gave pancreatic branches to supply the pancreas and LGEA and short gastric artery for the supply of stomach along the greater curvature. RHA supplied right lobe of liver and gave origin to CA at 68 mm from the origin of CT and at 33mm from the origin of GDA from CHA. CA after taking origin from RHA outside the Calot's hepatobiliary triangle, divided into superficial and deep branches near the neck of GB. [3]Further, both the branches were seen in Calot's triangle and ran superficial to CHD [Figure 3]. There was no branch to GB from RHA, passing deep to CHD. Cystic duct was inferior to CA, joined CHD and formed common bile duct (CBD).The outer diameter of branches of CT was measured using a digital Vernier caliper (Table 1).

Table 1: Outer diameter of branches of coeliac trunk.

		Diameter(mm)
Inferior phrenicartery	Right	1.34
	Left	1.30
Common Hepatic Artery		3.72
Hepatic artery	Right	2.91
	Left	1.45
Cystic Artery		1.74
	Superficial Branch	0.90
	Deep Branch	1.70

Figure 1: Showing quadrifurcation of coeliac trunk.

1- Right inferior phrenic artery; 2- Left inferior phrenic artery; 3-Left gastric artery; 4- Coeliac trunk; 5-Common hepatic artery; 6- Splenic artery; 7- Abdominal aorta; 8-Common trunk giving origin to right and left inferior phrenic artery.

Figure 2: Showing various branches of coeliac trunk.

1-Right inferior phrenic artery ; 2- Left inferior phrenic artery; 3-Left gastric artery ; 4-Coeliac trunk ; 5-Common hepatic artery ; 6-Splenic artery; 7-Gastroduodenal artery; 8-Right hepatic artery; 9-Left hepatic artery; 10-Right gastric artery; 11-Superior pancreaticoduodenal artery ; 12-Pancreatic branches from gastroduodenal artery;13-Pancreas ; 14-Right gastroepiploic artery ; 15 – Left gastroepiploic artery; 16-Spleen;17-Stomach; 18- Liver

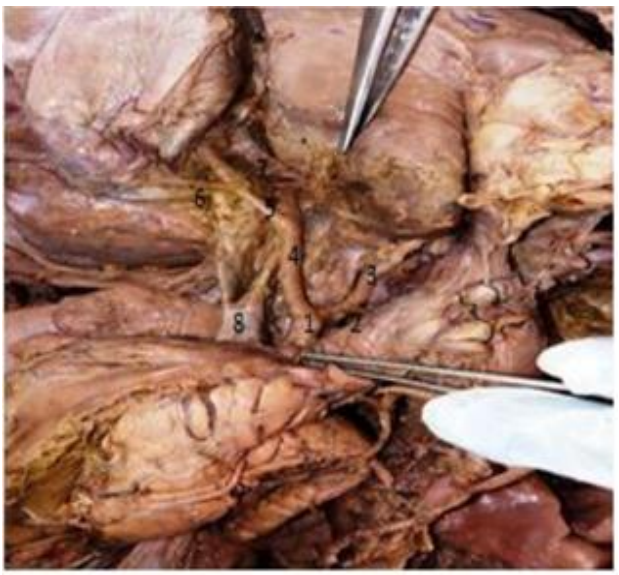

Figure 3: Showing origin and branching of cystic artery.

1- Common hepatic artery; 2- Right gastric artery; 3-Left hepatic artery; 4- Right hepatic artery; 5- Cystic artery and its superficial and deep branches; 6- Cystic duct; 7 – Common hepatic duct; 8- Common bile duct.

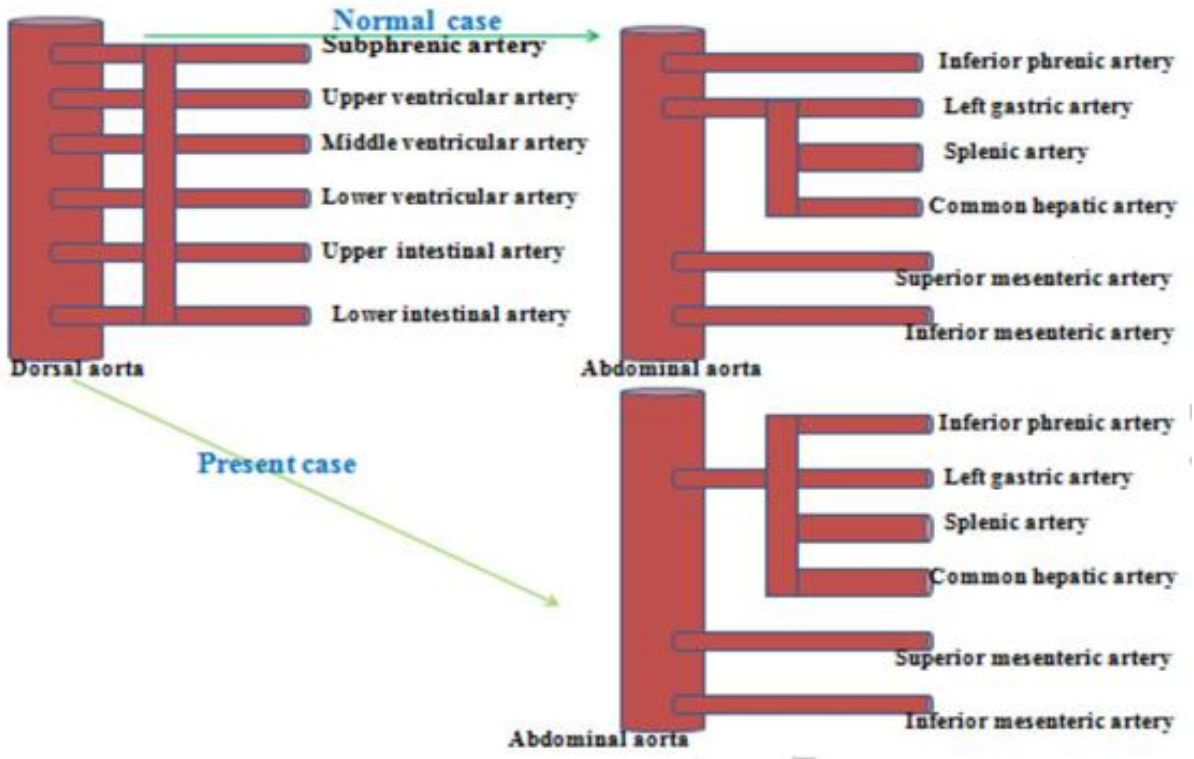

Figure 4: Schematic diagram to show development of arteries of gut.

DISCUSSION

Variations at various levels during the course of branches of CT have been reported in the past but multiple variations in the branches of CT in single cadaver have not been reported. Chitra R observed branching pattern of coeliac trunk in 50 cadavers. The classical trifurcation was noted only in 20 cases, remaining had different variations in branching pattern of coeliac trunk.[4]

Mburu et al., have described branches other than 3 classical branches of CT as collaterals. Collaterals can be inferior phrenic artery (IPA), GDA, middle colic artery, superior mesenteric artery, and left superior and middle suprarenal arteries.[5] Unilateral and bilateral origin of IPA from CT and various other sources have been reported in past by Gurses et al.,[6] Nayak et al., observed trifurcation of CHA, absence of HAP and origin of RGA from LHA.[7] Gorantla et al., observed multiple variations in a male cadaver, CT gave origin to a pair of inferior phrenic artery in addition to three classical branches, CHA gave LHA and then after a short course it terminated by dividing into GDA and RHA. CA was given by LHA.[8]

It is clear from the above discussion that CT may quadrifurcate or even more branches can be given by it but multiple variations in the course of CT and its subsequent branches have rarely been found in the literature. These multiple variations are clinically and surgically very significant. Hence these variations are reported in this case report.

At the end of 4th week of intrauterine life yolk sac is supplied by six pairs of ventral segmental (splanchnic) arteries known as vitelline arteries.[9] These six pairs of vitelline arteries are subphrenic, upper ventricular, middle ventricular, lower ventricular, upper intestinal and lower intestinal artery. These vitelline arteries are connected by a longitudinal anterior anastomotic artery. Afterwards, the central two roots are absorbed and branches of abdominal aorta i.e. IPA, LGA, SA, CHA, SMA and inferior mesenteric artery (IMA) form to supply the gut [Figure 4]. During further development, left hepatic, middle hepatic and right hepatic arteries arise from LGA, CT and SMA respectively. Later, the embryonic left and right hepatic arteries regress and middle hepatic artery persist as HAP which eventually divides near hilum of liver to give RHA and LHA. Any disturbance in this developmental process may give rise to variation in vascular supply of liver and also absence of HAP.[10]

During development, extra hepatic biliary system arises from an intestinal diverticulum which carries rich blood supply from abdominal aorta, CT and SMA. Subsequently, these branches are absorbed leaving behind the mature vascular supply. Depending upon absorption of the vessels and relation to CHD, various variations are encountered.[3]

Variation in the course of CT or any of its branches is clinically significant in liver transplantation, biliary surgery, adiological investigation and transcatheter embolization of hepatic tumors. IPA is the most frequent source of extra hepatic blood supply in case of

hepatocellular carcinoma. Any trauma to IPA can cause hemoperitonium, hemoptysis, gastro esophageal, diaphragmatic, or hepatic bleeding. [11] Also, variations in the hepatic vasculature may jeopardize the patient's life in case of pancreaticohepatobiliary surgery (open or laparoscopic). Thorough knowledge of arterial supply and variation of extra hepatic biliary system is important to prevent uncontrolled bleeding and biliary leakage during GB surgery. [12]

CONCLUSION

The knowledge of possible variations of arteries of foregut and that of extra hepatic biliary system is important for radiological intervention, to avoid injury and hemorrhage during hepatobiliary and gastric surgery, to find the source of bleeding in hepatocellular carcinoma and for transarterial chemo embolization in case of hepatocellular carcinoma. Hence the multiple variations found in this case report have clinical relevance and significance.

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