VOL. 16|NO. 4|ISSUE 64|OCT.-DEC. 2018

Concurrent Variations of Celiac and Superior Mesenteric Arteries

Satheesha Nayak B,[1] Surekha D Shetty,[1] Sirasanagandla SR,[2] Naveen Kumar,[1] Swamy Ravindra S,[1] Abhinitha P[1]

[1]Department of Anatomy
Melaka Manipal Medical College (Manipal Campus),
Manipal Academy of Higher Education, Madhav Nagar,
Manipal, Karnataka State, India.

[2]Department of Human and Clinical Anatomy,
College of Medicine and Health Sciences,
Sultan Qaboos University,
Al Khoudh 123, Muscat, Oman.

Corresponding Author

Satheesha Nayak Badagabettu

Department of Anatomy

Melaka Manipal Medical College (Manipal Campus),

Manipal Academy of Higher Education, Madhav Nagar,

Manipal, Karnataka State, India.

E-mail: nayaksathish@gmail.com

Citation

Satheesha Nayak B, Surekha D Shetty, Srinivasa Rao Sirasanagandla, Naveen Kumar, Swamy Ravindra S, Abhinitha P. Concurrent Variations of Celiac and Superior Mesenteric Arteries. *Kathmandu Univ Med J.* 2018;64(4):345-7.

ABSTRACT

Celiac trunk is the first ventral branch of the abdominal aorta. It usually terminates by giving three branches; the common hepatic artery, the left gastric artery and the splenic artery. We report a rare variation of the branching pattern of the celiac trunk. The Celiac trunk divided into two branches; left gastric artery and splenico-gastroduodenal trunk. The splenico-gastroduodenal trunk divided into splenic and gastroduodenal arteries. The superior mesenteric artery and hepatic artery took origin from a common hepato-mesenteric trunk. The hepatic artery had a winding course around the portal vein and hepatic duct. The knowledge of these variations is important while doing radiological investigations and liver transplant and pancreatic surgeries.

KEY WORDS

Celiac artery, Gastroduodenal artery, Hepatic artery, Superior mesenteric artery, Splenic artery

INTRODUCTION

The Celiac trunk (CT) is the first anterior branch of the abdominal aorta and it originates just below the aortic hiatus of the diaphragm, at the level of intervertebral disc between the T12 and L1 vertebrae. It is 1.5 to 2 cm long and it passes almost horizontally forwards and terminates by dividing into left gastric artery (LGA), common hepatic artery (CHA) and splenic artery (SA).[1] Its trifurcation was first reported by Haller in 1756. This "Tripus Halleri" is still being considered to be the normal appearance of the CT.[2] The branching pattern and distribution of the CT is known to show variations. In rare cases it may be totally absent; may join SMA at its origin to form a celiaco-mesenteric trunk; may join superior mesenteric artery (SMA) and inferior phrenic artery to form celiaco-mesenterico-phrenic trunk or may show bifurcation instead of a trifurcation.[3-6] Other reported variations of the CT include origin of hepato-gastric trunk and splenic artery or hepato-splenic trunk and left gastric artery directly from the abdominal aorta instead of CT.[7] Knowledge of possible variations of the CT and SMA is very useful for surgeons during supracolic surgeries like cholecystectomy, liver transplant and gastrectomy. It is also useful in planning and performing the radiological procedures and therapeutic embolization procedures. We report here a very rare variation of branching pattern of CT and SMA.

CASE REPORT

During routine dissections for medical undergraduates, abnormal branching pattern of the CT and SMA was noted in an adult male cadaver aged approximately 70 years. The CT divided into two branches; a left gastric artery and a splenico-gastroduodenal trunk (fig. 1). The left gastric artery had a normal course and distribution. The splenico-gastroduodenal trunk was 2 inches long and divided close to the pyloric end of the stomach into a splenic artery and a gastroduodenal artery (fig. 1). The splenic artery had a course along the upper border of the pancreas and its further branching and distribution was normal. The gastroduodenal artery also had a normal course and distribution. The HA and SMA took origin from a common hepatomesenteric trunk. The hepatomesenteric trunk arose from the abdominal aorta, immediately below the origin of the celiac artery (fig. 2). The SMA descended behind the body of the pancreas, passed anterior to the uncinate process of pancreas and entered the mesentery of the small intestine (fig. 2). The hepatic artery coursed to the right, behind the portal vein and appeared between the portal vein and the bile duct. It then ascended upward in the free margin of the lesser omentum and divided into right and left hepatic arteries just below the porta hepatis. The left hepatic artery (LHA) entered the left lobe of the liver through the left edge of the porta hepatis. The right hepatic artery (RHA) coursed to the right, behind the common hepatic duct and appeared in the Calot's triangle, where it gave the cystic artery. Thereafter, it entered the right lobe of the liver by passing through the right edge of the porta hepatis. The right hepatic artery gave another (additional) branch before crossing the bile duct and this branch entered the liver through the porta hepatis between the common hepatic duct and the left hepatic artery (fig. 1). The lower part of the portal vein was sandwiched between the hepatic and gastroduodenal arteries.

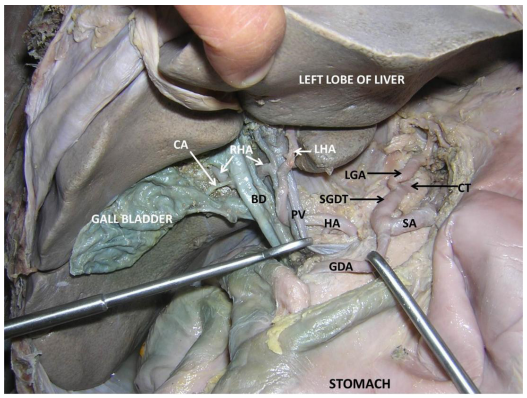

Figure 1. Dissection of the upper abdomen showing the abnormal branches of the celiac trunk.

(BD, bile duct; CA, cystic artery; CT, celiac trunk; GDA, gastroduodenal artery; HA, hepatic artery; LGA, left gastric artery; LHA, left hepatic artery; PV, portal vein; RHA, right hepatic artery; SA, splenic artery; SGDT, splenico-gastroduodenal trunk)

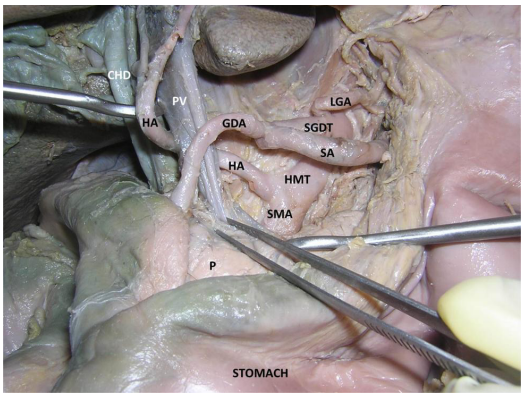

Figure 2. Closer view of the abnormal branches of the celiac trunk and the superior mesenteric artery.

(CHD, common hepatic duct; GDA, gastroduodenal artery; HA, hepatic artery; HMT, hepatomesenteric trunk; LGA, left gastric artery; P, pancreas; PV, portal vein; SA, splenic artery; SGDT – splenico-gastroduodenal trunk; SMA, superior mesenteric artery)

DISCUSSION

The variation in the number and branching pattern of the arteries of the gut may be correlated with their embryologic development. During the fetal life, each of the dorsal aortae, even before the stage of their fusion, give ventral splanchnic branches which supply the gut and its derivatives. In the early stage, the ventral branches are paired. When the dorsal aortae fuse, the ventral branches fuse and form a series of unpaired segmental arteries. These arteries run in the dorsal mesentery of the gut and divide into ascending and descending branches. These arteries eventually form dorsal and ventral longitudinal anastomotic channels. With the formation of longitudinal anastomotic channels, numerous ventral splanchnic branches disappear and only three trunks persist as the CT, the superior mesenteric artery and the inferior mesenteric artery.[8] Abnormal fusion of the ventral branches of the dorsal aorta may lead to the formation of celiaco-mesenteric, celiaco-mesenterico-phrenic or hepatomesenteric trunks. Adachi and Michels et al. have classified the CT into six different types.[9-10] The types of CT according to Michels's classification are as follows:

Type 1: Normal branching - Trifurcation.

Type 2: Hepatosplenic trunk and left gastric artery from aorta.

Type 3: Hepatosplenomesentric trunk and left gastric from aorta.

Type 4: Hepatogastric trunk and splenic artery from SMA.

Type 5: Splenogastric type; splenic and left gastric from the CT and common hepatic artery from SMA.

Type 6: Celiacomesentric trunk; splenic, left gastric, common hepatic and SMA arise from a common trunk.

The current case does not match with any one of the above

types. It is unique to have a splenico-gastroduodenal trunk and left gastric artery arising from the CT. However the origin of HA from hepatomesenteric trunk has been reported earlier.[11] Variations in the branching pattern of the CT are common and many of them have been reported. In a study conducted by Mburu et al. the CT trifurcated in 76 (61.7%), bifurcated in 22 (17.9%) and gave collaterals in 25 (20.3%) cadavers.[12] In the same study, the dorsal pancreatic artery was the most common collateral of CT and it occurred in 14.8% of the cadavers. Cicekcibasi et al. have reported the origin of the LGA, the CHA, the SA, the left gastro-epiploic, right and the left phrenic arteries from a celiacomesenteric trunk.[13]

The gastroduodenal artery may arise directly from CT. In a cadaveric study by Mburu et al. gastroduodenal artery originated directly from the CT, in 3.61% of cases.[13] Origin of the gastroduodenal artery from the SMA and right or left hepatic artery has also been reported.[14-15] In the current case, the gastroduodenal artery arose from splenico-gastroduodenal trunk. This is a unique case and to the best of our knowledge, has not been reported yet. In the procedure of hepatic arterial infusion pumps in hepatic arterial chemotherapy and also for liver and/or colon resection, the gastroduodenal artery is usually cannulated. Therefore, the knowledge of its varied origin from splenico-gastroduodenal trunk, as in our case, is important for radiologists and surgeons for successful cannulation. A case of gastroduodenal artery steal syndrome during liver transplantation has been reported by Nishida et al.[16] This syndrome is characterized by low arterial flow towards the graft caused by a shift of flow into gastroduodenal artery. This happens commonly in variations of the gastroduodenal artery.

Occurrence of hepato-mesenteric trunk is not uncommon. There are a few reported cases of occurrence of hepatomesenteric trunk.[6,11,17] In the current case the hepatomesenteric trunk had a high origin, above the level of pancreas and the HA took origin from the trunk above the level of the pancreas. We could not get a report of a similar case in our literature survey. What makes the current case unique is the presence of a splenico-gastroduodenal trunk, a hepatomesenteric trunk with a very high origin and a winding course of the hepatic artery around the portal vein and the hepatic duct. The portal vein was sandwiched between the gastroduodenal and HA and it is liable to get compressed by these two large arteries. Knowledge of these concurrent variations might minimize the iatrogenic injuries of these vessels during liver transplant, cholecystectomy and pancreatectomy. The awareness of these variations is of paramount importance to radiologists, while planning and executing various radiological procedures and diagnosis.

REFERENCES

1. Standring S. Gray's Anatomy, Anatomical basis of Clinical practice, 40th ed. Elsevier Churchill Livingstone, New York. 2008;1073.
2. Hemanth K, Garg S, Yadav TD, Sahni D. The hepato-gastro-phrenic trunk and the hepato-spleno-mesentric trunk: A rare anatomic variation. *Tropical Gastroenterology.* 2008; 32: 56-9.
3. Yamaki K, Tanaka N, Matsushima T, Miyazaki K, Yoshizuka M. A rare case of absence of the celiac trunk: The left gastric, the splenic, the common hepatic and the superior mesenteric arteries arising independently from the abdominal aorta. *Ann. Anat.* 1995;177:97-100.
4. Bhatnagar S, Rajesh S, Jain VK, Patidar Y, Mukund A, Arora A. Celiacomesenteric trunk: a short report. *Surg Radiol Anat.* 2013;35(10):979-81.
5. Nayak S. Common celiaco-mesenterico-phrenic trunk and renal vascular variations. *Saudi Med J.* 2006; 27:1894-6.
6. Kardile PB, Ughade JM, Ughade MN, Dhende A, Ali SS. Anomalous origin of the hepatic artery from the hepatomesenteric trunk. *J Clin Diagn Res.* 2013; 7:386-8.
7. Vandamme JP, Bonte J. The branches of the celiac trunk. *Acta Anat.* 1985;122:110-4.
8. Datta AK. Essentials of Human Embryology, 5th ed. Current Books International: Kolkata 2005;192-3.
9. Adachi B. Das Arteriensystem der Japaner. Vol. 2. Verlag der Kaiserlich-Japanischen Universitat zu Kyoto, Japan. 1928.
10. Michels NA. Blood supply and anatomy of the upper abdominal organs with descriptive atlas. Philadelphia: Lippincott, USA. 1995.
11. Kahraman G, Marur T, Tanyeli E, Yildirim M. Hepatomesenteric trunk. *Surg Radiol Anat.* 2001; 23:433-5.
12. Mburu KS, Alexander OJ, Hassan S, Bernard N. Variations in the branching pattern of the celiac trunk in a Kenyan population. *Int J Morphol.* 2010;28:199-204.
13. Cicekcibasi AE, Uysal I, Seker M, Tuncer I, Buyukmcu M, Salbacak A. A rare variation of the coeliac trunk. *Annnals of Anattomy.* 2005;187: 387-91.
14. Huu N, Tam NT, Minh NK. Gastro-duodenal artery arising from the superior mesenteric artery. *Bull Assoc Anat (Nancy).* 1976; 60:779-86.
15. Rawat K. CT angiography in evaluation of vascular anatomy and prevalence of vascular variants in upper abdomen in cancer patients. *Indian J Radiol Imaging.* 2005; 16:457-61.
16. Nishida S, Kadono J, DeFaria W, Levi DM, Moon JI, Tzakis AG et al. Gastroduodenal artery steal syndrome during liver transplantation: Intraoperative diagnosis with Doppler ultrasound and management. *Transpl Int.* 2005;18:350-53.
17. Nakamura Y, Miyaki T, Hayashi S, Iimura A, Itoh M. Three cases of the gastrosplenic and the hepatomesenteric trunks. *Okajimas Folia Anat Jpn.* 2003;80:71-76.