

Coeliac Trunk Variations - Case Report

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Abstract- We report two variations of coeliac trunk which we found during the routine dissections of cadavers in Anatomy Department, Government Medical College, Thrissur, Kerala. Even though enormous number of variations of coeliac trunk are reported, quadrifurcation of coeliac trunk into splenic, hepatic, left gastric and gastroduodenal is a very rare variation. Awareness of the arterial variations in the upper gastrointestinal region, such as shown in our case, is very important during surgical and radiological procedures pertaining to the liver and adjacent viscera.

Index Terms- coeliac trunk, hepatic artery, gastroduodenal artery

I. CASE REPORTS

We present two variations that we have found during our routine dissections in cadavers.

Case Report one:-It was a very rare case where the Gastroduodenal artery (GDA) is directly arising from the Coeliac trunk. So the coeliac trunk, instead of trifurcating to three branches, it is dividing into 4 branches (figure 1). An unusual embryologic development of the ventral splanchnic arteries may lead to this variation. In this case, the coeliac trunk is quadrifurcating into splenic artery (SA), Left Gastric artery (LGA), Common Hepatic artery (CHA) and Gastroduodenal artery.

Case report two:- It is case of Hepatic artery variation. The Coeliac trunk in this case gives off splenic artery, Left Gastric artery, Common Hepatic artery. The Common Hepatic artery bifurcates into Gastroduodenal artery and Proper Hepatic artery. But the Proper Hepatic artery instead of dividing into right and left Hepatic arteries simply continues as the right Hepatic artery (RHA) alone. The left hepatic artery (LHA) is arising directly from left Gastric artery (figure 2).

II. DISCUSSION

Hepatic artery variation was first described by Michels *et al.* in the 1960s, and since then more and more variation types have been reported. Generally, the incidence of anatomical variations in the HA is 20-50%, with diversity in different series¹. Gruttadauria *et al*² reported normal anatomy of the HA and variations of the HA in 57.8% and 42.2% of 701 cases, respectively. It was infrequent for a CHA to originate from the Superior Mesenteric artery - SMA (0.86%) or be directed from the aorta (0.43%). Being the rarest type of HA variations, a right HA might originate from the gastroduodenal artery or the aorta.

Stable blood supply is necessary for every organ to function normally. Knowledge of topography, morphology, and

anatomical variations of vascularization of the liver is necessary in clinical procedures, especially in hepatic surgery (mainly in liver transplantations) or radiological trans-arterial chemo-embolization procedures for hepatic tumors³. The "normal" arterial supply of the liver comes from the common hepatic artery (CHA) arising from the coeliac trunk (CT) and dividing into the gastroduodenal artery (GDA) and the proper hepatic artery (PHA). PHA divides into two main branches: the left hepatic branch (LbPHA) and the right hepatic branch (RbPHA). It is consistent with International Anatomical Terminology⁴. One of the study showed that the left gastric artery was directly originating from the abdominal aorta³.

Anatomic anomalies of the hepatic artery can be found in 25.5–46.5% of the cases. After studying 200 cadavers, Michels classified the variations into ten types, according to the clinical and modern concepts of accessory and replaced hepatic arteries: (1) the normal right, left, and middle hepatic artery (textbook type); (2) replaced left hepatic from left gastric artery; (3) replaced right hepatic from superior mesenteric artery; (4) replaced right hepatic from superior mesenteric artery and replaced left hepatic replaced from the left gastric artery; (5) accessory left hepatic from the left gastric artery; (6) accessory right hepatic from the superior mesenteric artery; (7) accessory right hepatic from the superior mesenteric and accessory left hepatic from the left gastric artery; (8) combination patterns of replaced right hepatic and accessory left hepatic or accessory right hepatic with replaced left hepatic artery; (9) common hepatic derived from the superior mesenteric artery; (10) common hepatic derived from the left gastric artery. This classification was completed by Hiatt *et al.* in 1994.⁵

Hepatic artery variations can usually be explained by embryonic development. The liver is supplied during the fetal life by three arteries: the CHA, the right HA from the SMA, and the left HA from the LGA. Anatomical variations correspond to the results of partial or complete persistence of the fetal pattern^{1,6}.

Clinical importance - The anatomy of the HA is of great importance in general surgery and hepatic surgery, especially in liver transplantation, as well as vascular radiology. Recently, the arterial vascular anatomy of the liver has played a significant clinical role, especially after the considerable development of hepato-pancreatobiliary surgery, the introduction of laparoscopic surgery, and the constant development of liver transplantation. Knowledge of the potential HA anatomical variations is essential for a transplant surgeon in order to prevent vascular damage, and also in many radiological procedures such as transarterial chemo-embolization for hepatic tumours^{7,8}. A study showed that the entire hepatic artery, namely CHA or the proper hepatic artery, was arising from the left gastric artery, as the only arterial supply

to the liver⁹. Inferior phrenic arteries also arise as variant branches from celiac axis¹⁰.

According to standard anatomical textbook descriptions¹¹, the coeliac trunk and its branches supplies the gastrointestinal tract from the distal third of the oesophagus to the mid part of the duodenum and all derived adenexae (liver, biliary tree, spleen, dorsal pancreas, greater omentum and lesser omentum). The coeliac trunk is the first anterior branch and arises just below the aortic hiatus at the level of T12/L1 vertebral bodies. It is 1.5–2 cm long and passes almost horizontally forwards and slightly right above the pancreas and splenic vein. It divides into the left gastric, common hepatic and splenic arteries. The coeliac trunk may also give off one or both of the inferior phrenic arteries. The superior mesenteric artery may arise with the coeliac trunk as a common origin. One or more of the superior mesenteric branches may arise from the coeliac trunk.

The left gastric artery is the smallest branch of the coeliac axis. The left gastric artery rarely arises from the common hepatic artery or its branches. A replaced/accessory left hepatic artery origin from the left gastric artery is more common than a replaced/accessory left gastric origin. The right gastric artery arises from the hepatic artery. The origin of the right gastric artery often varies: the most common alternative origins are from the common hepatic, left hepatic, gastroduodenal or supraduodenal arteries. The gastroduodenal artery usually arises from the common hepatic artery behind, or sometimes above, the first part of the duodenum. Although the gastroduodenal artery usually branches from the common hepatic artery, it may also arise as a trifurcation with the right and left hepatic arteries, or from the superior mesenteric artery or the left hepatic artery (occasionally), or from the coeliac axis or right hepatic artery (rarely). In our case it's a direct branch from the Coeliac Axis.

In adults the hepatic artery is intermediate in size between the left gastric and splenic arteries. In fetal and early postnatal life it is the largest branch of the coeliac axis. It may be subdivided into the common hepatic artery, from the coeliac trunk to the origin of the gastroduodenal artery, and the hepatic artery 'proper', from that point to its bifurcation. A small number of normal variants are important to demonstrate angiographically because they may influence surgical and interventional radiological procedures. Rarely a replaced common hepatic artery arises from the superior mesenteric artery and is identified at surgery by a relatively superficial portal vein. Occasionally, a replaced left hepatic artery or an accessory branch arises from the left gastric artery: these vessels provides a source of collateral arterial circulation in cases of occlusion of the vessels in the porta hepatis but may also be injured during mobilization of the stomach as it lies in the upper portion of the lesser omentum. Rarely, accessory left or right hepatic arteries may arise from the gastroduodenal artery or aorta. The presence of replaced arteries can be lifesaving in patients with bile duct cancer: because they are further away from the bile duct they tend to be spared from the cancer, making excision of the tumour feasible. Knowledge of these variations is also important in planning whole and split liver transplantation. Splenic artery - The spleen is supplied exclusively from the splenic artery. This is the largest branch of the coeliac axis and its course is among the most tortuous in the body. Gastroduodenal variations reported are as branches arising from right hepatic artery, quadrifurcation of common hepatic

artery as right and left hepatic arteries, gastroduodenal and right gastric artery¹².

III. CONCLUSION

Even though enormous number of variations of celiac trunk are reported, quadrifurcation of celiac trunk into splenic, hepatic, left gastric and gastroduodenal is a very rare variation.

The knowledge of Anatomical variations of Coeliac trunk is important for proper pre-operative diagnosis and planning of surgical and radiological procedures. Presence of arterial variations may result in erroneous interpretation of angiograms. The topographical anatomy of such variations is also important for interventional radiologists performing arteriography.

Conflict of Interest – The authors declare no competing interests.

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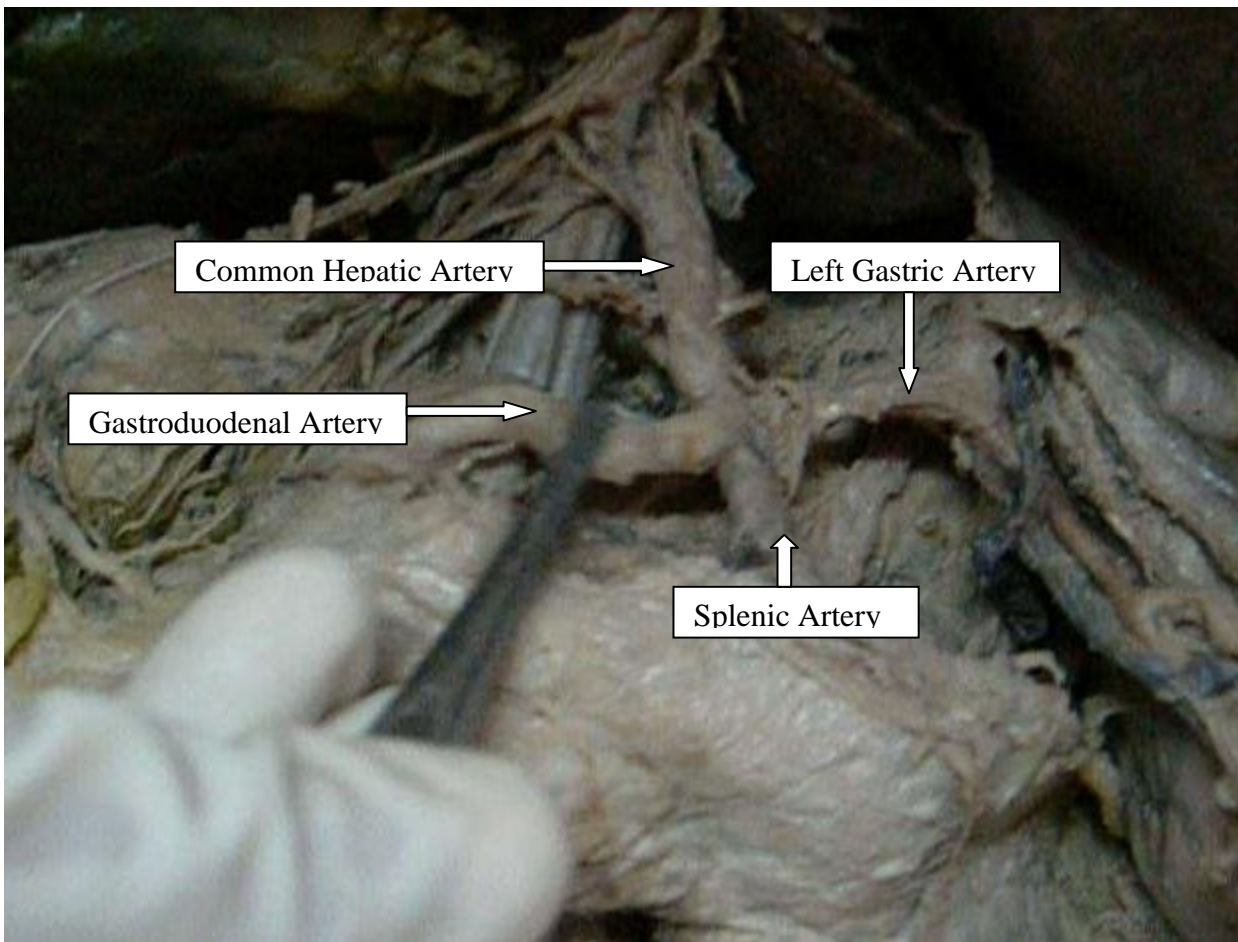


Figure 1 – Gastroduodenal Artery arising directly from Coeliac Trunk (within the tip of forceps)

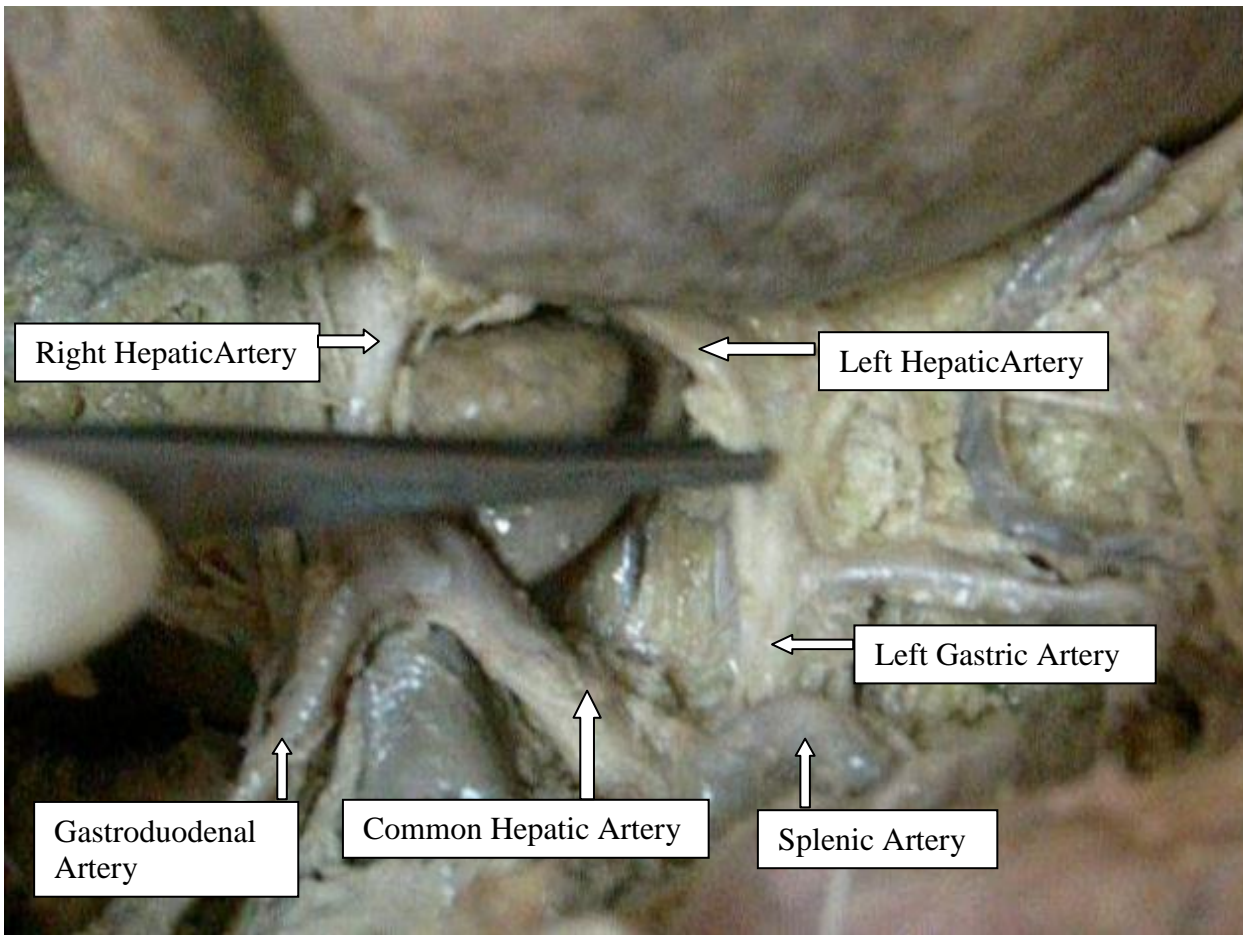


Figure 2 – Replaced Left Hepatic Artery from Left Gastric Artery as hold by forceps