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Anomalous Bilateral Inferior Phrenic Artery from Celiac Trunk

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Abstract

Variations in the origin and branches of the celiac trunk are well established. We are reporting a rare case of celiac trunk with two main branches, hepato-splenic trunk and gastro-phrenic trunk in the place of the three classic branches. Hepato-splenic trunk divided into common hepatic artery and splenic artery. Gastro-phrenic trunk divided into left gastric artery, left inferior phrenic artery and right inferior phrenic artery. Anatomical variations in the branching pattern of the celiac trunk are of considerable importance in liver transplants, laparoscopic surgery, radiological abdominal interventions and penetrating injuries to the abdomen.

Introduction

The celiac trunk is the first ventral branch of abdominal aorta, arises just below the aortic hiatus at the level of T12/L1 vertebral body. It is 1.5-2 cm long and passes almost horizontally forwards and divides into the left gastric, common hepatic and splenic arteries which are considered as the ‘‘main classic branches’’ of the celiac trunk. The inferior phrenic arteries are two small arteries which supply the diaphragm. They usually arise from the aorta just above the coeliac trunk. They may arise by a common aortic stem or from the coeliac trunk.^[12] During the normal development, both dorsal aortas give rise to many ventral segmental (omphalomesenteric) arteries. Both dorsal aortas fuse together in about four weeks. The ventral segmental arteries regress shortly after fusion of dorsal aortas. The dorsal aorta gives off segmental branches to the gut (ventral splanchnic arteries), to the mesonephric ridge (lateral splanchnic arteries) and intersegmental branches to the body wall (somatic arteries). In the adult, ventral splanchnic arteries developed as celiac trunk, superior mesenteric and inferior mesenteric arteries. These vessels supply the derivatives of foregut, midgut, and hindgut, respectively.^[10]

Case report

During the routine dissection of middle aged male cadaver an anomalous celiac trunk was found. The celiac trunk arose from the ventral surface of the abdominal aorta at the level of the intervertebral disc between T12 and L1 vertebrae. 1 cm from the origin celiac trunk it divided into Gastro-phrenic trunk proximally and Hepato-splenic trunk distally. Hepato-splenic trunk gave common hepatic artery and splenic artery. The Gastro-phrenic trunk gave right inferior phrenic artery then terminates as left gastric artery and left inferior phrenic artery (Figure-1).

Discussion

Celiac trunk is the chief artery of the foregut. It supplies all derivatives of the foregut that lie in the abdominal cavity. It arises from the ventral portion of the abdominal aorta opposite the thoraco-lumbar junction, as a single trunk 3-4 cm in length and 6-8 mm in diameter. It gives rise to three main branches as left gastric, hepatic and splenic arteries. Studies on arterial variations of the abdomen showed that only 87.7% of the celiac trunk exhibited the classical trifurcation. An incomplete celiac trunk, namely bifurcation, accounted for 5.8–24.1%. Besides these variations, the celiac trunk itself may be absent; its branches may arise directly from the aorta^[8, 14].

Piao et al. stated that the right and left inferior phrenic arteries occasionally originated as a common trunk from the aorta, celiaco-mesenteric system or adrenorenal system ^[9]. They observed that inferior their origin was summarized as follows; a) the aorta itself (61.6%), b) ventro-visceral arteries (celiaco-mesenteric system of the aorta) including the celiac trunk (28.2%), and left gastric artery (2.9%), c) the laterovisceral arteries (adreno-renal system of the aorta) including the middle suprarenal artery (2.9%) and renal artery (4.3%). Cavdar et al. reported a case, in which the left inferior phrenic artery and the left gastric artery arose from the long celiac trunk (4.3 cm) via a common trunk ^[1]. Yuksel et al. stated multiple variations. In their study they found an extremely long coeliac trunk. They also found an inferior phrenic artery arose from celiac trunk and an aberrant right hepatic artery derived from the superior mesenteric artery. ^[15] Vandamme and Bonte observed the absence of coeliac trunk in 1.25% of cases of the series. ^[11] Cicekcibasi et al. reported that the inferior phrenic artery originated (8.1%) from the celiac trunk ^[3]. Jitendra P. Patel et al. studied 100 cadavers and found classic coeliac trunk with emission of the left gastric, splenic and hepatic arteries in 76 cadavers. Haller's tripod, in which the three arteries originated at the same level and in the terminal portion of the coeliac trunk, was observed in 18 cadavers. In 16 cadavers inferior phrenic arteries originated from coeliac trunk was observed. In 8 cadavers variations regarding disposition of the left gastric, splenic and hepatic arteries also regarding the number of emitted arteries observed. ^[4] The present variation of celiac trunk has not been reported so far.

The anatomical variations of the coeliac trunk are due to developmental changes in the ventral segmental (splanchnic) arteries. These ventral segmental arteries supply the yolk sac, allantois and chorion. Three ventral segmental arteries remain as coeliac trunk, superior mesenteric artery and inferior mesenteric artery. During embryological period, there are longitudinal anastomoses between roots of upper four ventral segmental arteries of abdominal region. The two central roots disappear and the longitudinal anastomosis joins first and fourth root. The hepatic, splenic and the left gastric arteries originate at this longitudinal anastomosis. These branches usually become separated from the fourth root (the future superior mesenteric artery) below their last end. If this separation takes place at the higher level, one of the branches is displaced to the superior mesenteric artery. If the first or fourth root disappears, a celiaco-mesenteric trunk will be formed. ^[2, 7] In our cases, the variations of the coeliac trunks are due to developmental changes in the longitudinal anastomosis between above mentioned ventral segmental arteries.

Knowledge of variations concerning the celiac trunk is of extreme clinical importance in the areas of the Appleby procedure ^[5], laparoscopic surgery, and radiological procedures in the upper abdomen, and should be kept in mind by clinicians to avoid complications. Anatomic variants of the celiac trunk is essential to successfully accomplish surgical, oncologic, or interventional procedures including lymphadenectomy around hepato-spleno-mesenteric trunk, aortic replacement with reimplantation of the trunk, or chemoembolization of liver malignancies, all of which can potentially create significant morbidity because of the large visceral territory supplied by a single vessel ^[6].

Arterial variations should be taken care during the abdominal operative procedures. Vascular anomalies are usually asymptomatic; they may become important in patients undergoing diagnostic angiography for gastrointestinal bleeding, celiac axis compression syndrome, or prior to an operative procedure or transcatheter therapy ^[13].

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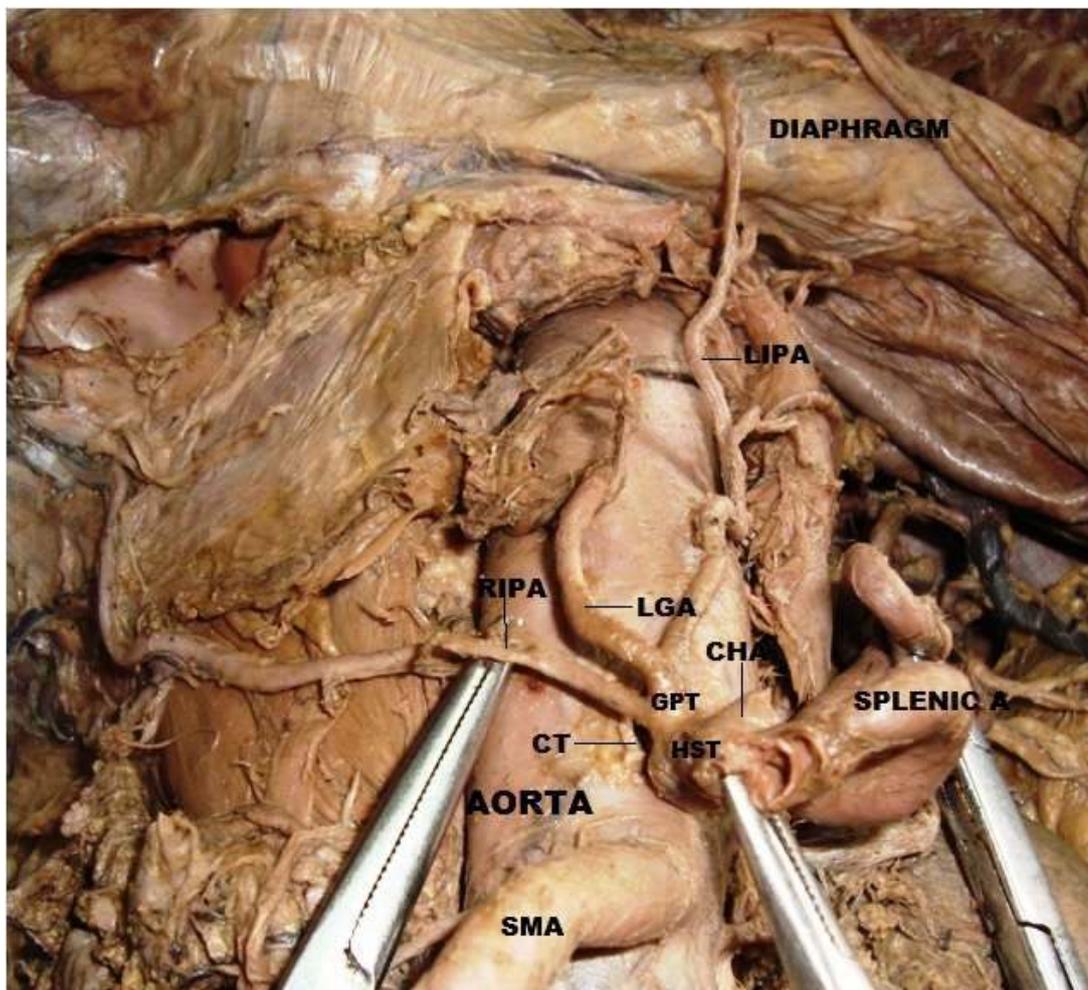


FIGURE-1:CT-Celiac Trunk, GPT- Gastro-Phrenic Trunk, HST- Hepato-Splenic Trunk, CHA- Common Hepatic Artery, LGA- Left Gastric Artery, SMA- Superior Mesenteric Artery, RIPA- Right Inferior Phrenic Artery ,LIPA-Left Inferior Phrenic Artery