Numerical variation of the celiac trunk and anatomical variation in origin and course of the dorsal pancreatic artery

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ABSTRACT

A numerical anomaly of the celiac trunk and anatomical variation in origin, and course of the dorsal pancreatic artery were encountered during a routine upper abdomen dissection of a 62-year-old male cadaver. The aim of this study was to describe a rare celiac trunk and dorsal pancreatic artery variation in detail, which can be a guide and precaution during operative procedures in this region. The abdominal aorta, its branches and the pancreas were cut and removed just above the celiac trunk and below the superior mesenteric artery to investigate the vascular distribution of the pancreas in detail. The celiac trunk divided into the left gastric, hepatic, splenic, and dorsal pancreatic arteries. The anatomical variation of the celiac trunk and splenic artery makes it vulnerable to iatrogenic surgery. Knowledge of the existing aberrations is important in planning and conducting surgical procedures.

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The celiac trunk arises just below the aortic hiatus at the level of thoracic 12-lumbar 1 (T12-L1), and is the first anterior branch of the abdominal aorta. It divides into the left gastric, common hepatic and splenic arteries.[1] The trifurcation of the celiac trunk was first described by Haller in 1756. This "tripus Halleri" was and is still considered to be the normal appearance of the celiac trunk.[2] The incidence of the 3 classical branches of the celiac trunk was reported as 86% in the literature, whereas only 2 of the classical branches as 12%, and absence of the celiac trunk as 2%.[2,3] An embryologic explanation for these variations was introduced by Tandler in 1904.[4] A "Lang anastomose" (longitudinal anastomosis) between 4 roots of the omphalomesenteric artery was reported in which the 2 central roots disappear and the "Lang anastomose" joins the first and the fourth roots.[4] The hepatic, splenic and left gastric arteries originate at this "Lang anastomose". Tandler did not explain the separate origin of the 3 celiac branches of the aorta, although it may be due to the persistence of the second and third root.[2,3,5] The dorsal pancreatic artery was first described by Haller who referred to it as "arteria pancreatica suprema". Subsequently, it has been called by many different names (superior pancreatic artery, middle pancreatic artery, isthmic pancreatic artery, a. pancreatica magna, and a. colli pancreatis), thus creating confusion.[3] The dorsal pancreatic artery supplies the neck and body, with or without the tail.[6] The dorsal pancreatic artery's origin from the first portion of the splenic artery, as its first or as one of its first pancreatic branches, is considered the

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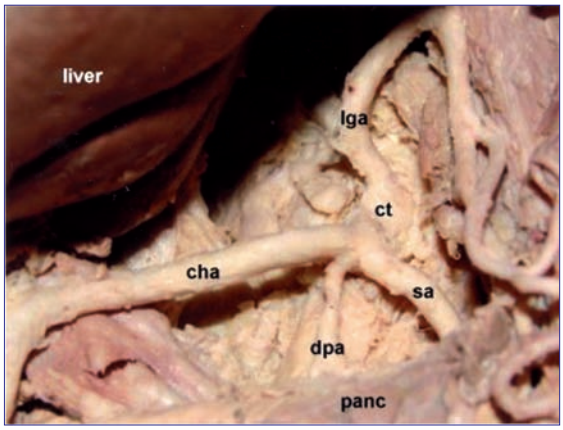


Figure 1 - Arterial branches of the celiac trunk. Note that the dorsal pancreatic artery arises from the celiac trunk. ct - celiac trunk; cha - common hepatic artery; lga - left gastric artery; sa - splenic artery; dpa - dorsal pancreatic artery; panc -pancreas.

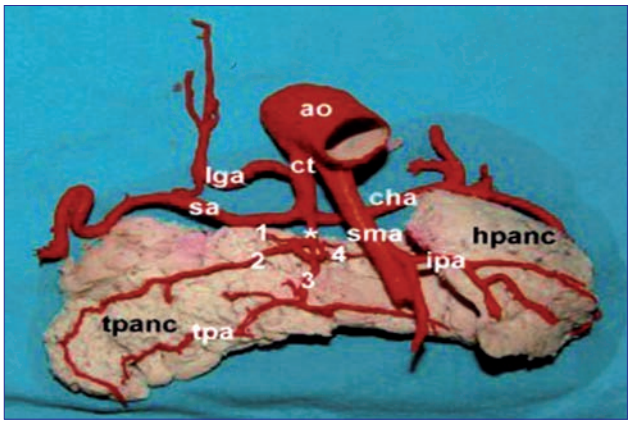


Figure 2 - Arterial supply of the pancreas from the dorsal aspect. ao - abdominal aorta; ct - celiac trunk; cha - common hepatic artery; lga - left gastric artery; sa - splenic artery; sma - superior mesenteric artery; *dorsal pancreatic artery; 1 - first branch of the dorsal pancreatic artery (dpa); 2 - second branch of the dpa; 3 - third branch of the dpa; 4 - fourth branch of the dpa; tpa - transverse pancreatic artery; ipa - inferior pancreaticoduodenal artery; hpanc - head of the pancreas; tpanc - tail of the pancreas.

most common occurrence.[5] The course of the dorsal pancreatic artery is rather constant, since the origin is almost always situated close to the division of the celiac trunk.[3] The celiac trunk, aorta, and the inferior vena cava are all close enough to the esophageal hiatus to be at risk during operations on the hiatus.[3] The anatomical variation of the celiac trunk and splenic artery makes it vulnerable to iatrogenic surgery.[7] Knowledge of the existing aberrations is important in planning and conducting surgical procedures.[8] The aim of this study is to describe the rare occurring celiac trunk and the dorsal pancreatic artery variation in detail, which can be a guide and precaution during operative procedures in this region.

Case Report. Numerical anomaly of the celiac trunk and anatomical variation in origin and course of the dorsal pancreatic artery were encountered during a routine upper abdomen dissection of a 62-year-old male cadaver. The abdominal aorta, its branches and the pancreas were cut and removed just above the celiac trunk and below the superior mesenteric artery to investigate the vascular distribution of the pancreas in detail. All arteries supplying the pancreas, especially the dorsal pancreatic artery, were dissected and visualized under a surgical microscope (Zeiss Opmi Pico, Oberkochen, Germany) with X5-X12.5 magnification. Afterwards, measurements of the variations were taken with a sliding caliper. Detailed anatomic descriptions of this rare case are shown in **Figure 1**. The celiac trunk arose from the left third of the ventral aspect of the aorta at the level of T12-L1. The trunk was 22 mm long, and its diameter was 7.5 mm. The celiac trunk trifurcated into the hepatic, splenic, and dorsal pancreatic arteries. The left gastric artery arose directly from the celiac trunk. In this respect, the celiac trunk gives off 4 branches (**Figure 1**). The common hepatic artery was the most voluminous (4.6 mm in diameter), and the left gastric artery the smallest branch (3.7 mm in diameter) of the 4 celiac arteries. No abnormalities were found in the hepatic artery and its branches. The splenic artery showed a tortuous course; its diameter was 4.1 mm and its length was 109 mm. The splenic artery gives off the first branch to the pancreas 45 mm after its origin from the celiac trunk. A fourth branch arising between the common hepatic and splenic arteries was detected; this branch entered the dorsal aspect of the body of the pancreas in its upper border (**Figure 2**). Regarding this finding, the above mentioned branch was classified as the dorsal pancreatic artery. The dorsal pancreatic artery ramified into 4 branches on the dorsal aspect of the body of the pancreas. The diameter of the dorsal pancreatic artery was 2.7 mm; its length from its origin to the ramifying point was 11.3 mm. The first branch of the dorsal pancreatic artery was 0.4 mm in diameter and 13 mm in length; this branch supplied the body of the pancreas. The second branch was 1.2 mm in diameter and 66 mm in length. It extended to the tail of the pancreas. The third branch (1.5 mm in diameter and 17 mm in length) reached the lower border of the body of the pancreas and divided as a reversed "T" into 2 terminal branches, which run transversely in opposite directions. The left terminal branch supplied the tail of the pancreas; its diameter was 0.93 mm and its length was 51 mm. This branch was named the

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transverse pancreatic artery in the literature. The right terminal branch was 0.8 mm in diameter and 42 mm in length and supplied the head of the pancreas. The fourth branch of the dorsal pancreatic artery (0.8 mm in diameter and 33 mm in length) ran to the neck of the pancreas.

Discussion. The celiac trunk generally composes of the 3 classical branches. In this configuration, the celiac trunk divides into the hepatic and splenic arteries, whereas the left gastric artery usually arises as a tributary anywhere on this trunk. The normal celiac trunk usually leaves the aorta on its left third, sometimes in the middle, but seldom on the right. It runs from the upper left to the lower right, and from the back towards the front.[2] The celiac trunk arose from the left third of the ventral aspect of the aorta in our case. The left gastric artery arose from the celiac trunk itself, 12 mm after its origin. Thereafter the common hepatic, splenic and dorsal pancreatic arteries ramified as a branch from the celiac trunk. Regarding the branches of the celiac trunk, 2-5 divisions are reported in the literature. The incidence of occurrence has been reported as: bifurcations to be 25%, trifurcations to be 10%, and tetra furcations to be 1.8-5%. Even a division into 5 branches was published by Serebrov in 1958.[2] In the present case, the celiac trunk appeared as 4 branches. Leriche and Villemin[2] reported that the splenic artery always arises from the celiac trunk with the same diameter as the hepatic artery. In contrast to adults, the diameter of the hepatic artery in young children is larger than that of the splenic artery.[2] In the present study, the diameter of the hepatic artery was larger than that of the splenic artery. When compared, our finding disagree with the previous studies. It was thought that the variation in origin of the dorsal pancreatic artery might cause this conflict because its origin from the splenic artery, as its first or as one of its first pancreatic branches, is considered the most common occurrence.[3,5] Toni et al[9] reported that the dorsal pancreatic artery originated from the gastrohepatic artery instead of the splenic artery. However in our case, the dorsal pancreatic artery originated directly from the celiac trunk between the common hepatic artery and the splenic artery. The dorsal pancreatic artery is the most important branch of the splenic artery. It supplies the neck and body of the pancreas.[9] The dorsal pancreatic artery may arise from 4 main sources. These are: 1) first portion of the splenic artery (22-80%); 2) celiac trunk (3-33%); 3) first portion of the common hepatic artery (12-25%); and 4) superior mesenteric artery (6-25%).[3] In our case, the origin of the dorsal pancreatic artery was from the celiac trunk and it was supplying the neck, body and the tail of the pancreas. The incidence of occurrence of the dorsal pancreatic artery has been reported with values ranging from 13.5 to 100% according to authors in anatomic or angiographic research.[5] Toni et al[9] investigated the pancreatic arteries with selective celiac angiography. They reported that the dorsal pancreatic artery has been visualized in 75% of the cases. They have also found that the dorsal pancreatic artery originated from the gastrohepatic artery in 39%, the celiac trunk in 37%, the splenic artery in 18%, and the common hepatic artery in 6% of the cases.[9] For angiographers, the main problem is probably to overcome the overlapping views of the many vessels occurring in the celiaca-mesenteric area, which in standard angiographic examinations, can conceal the exact site of origin of the pancreatic arteries.[5] Anatomical variations of the dorsal pancreatic artery should inform the radiologist of the types of vascularization that he might encounter.[6] The dorsal pancreatic artery has been reported by most investigators to divide as a reversed "T" into 2 terminal branches, which run transversely in opposite directions. The right terminal branch forms the prepancreatic arcade; less frequently, it may resolve into minute branches for the ventral surface of the pancreatic head. The left terminal branch of the dorsal pancreatic artery is the transverse pancreatic artery.[5] However, the dorsal pancreatic artery divided into 4 branches in our case. The thickest branch was the third branch. This branch divided as an inverted "T" into 2 terminal branches, which run in opposite directions as, described in the literature. The second branch of the dorsal pancreatic artery showed a parallel course to the transverse pancreatic artery and supplied the head of the pancreas whereas the first branch of the dorsal pancreatic artery supplied the body and the fourth branch the neck. The constant progress in surgery of the pancreas requires detailed recognition of its arterial vascularization since the pancreas is a low-flow organ without its own hilus, but encircled by arteries originating from the celiac trunk and superior mesenteric artery. It must be remarked that the dorsal pancreatic artery supplies a critical neck area which is considered hypovascular and that this area may, in a significant number of patients, be supplied by the transverse pancreatic artery; therefore, special attention should be given to the anatomic features of these vessels if pancreatic head-body transection is contemplated.[10] Even though leading to a reduction of complications and mortality, the preoperative definition of the pancreatic arterial distribution before major pancreatic surgery is an advantage that many surgeons seem to underestimate.[9] Anatomical variations of the celiac trunk and vessels

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of pancreas are, to our knowledge, still lacking and would represent a useful tool for the clinical approach to pancreatic vasculature.

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