Annals of Case Reports
Almohamdi W, et al. Ann Case Rep: 8: 1199
www.doi.org/10.29011/2574-7754.101199
www.gavinpublishers.com

Case Report

Multiple Rare Anatomical Variation of Celiac Trunk, Splenic and Hepatic Arteries in a Complicating Pancreaticoduodenectomy: A Case Report and Literature Review

Wadha Almohamdi[1*], Saad Alharthi[2], Ahmad T Alharbi[3], Saga Ali[1], Meshal Saleh Aldosri[4], Jameel Miro[1]

[1]Department of General Surgery, King Faisal Specialist Hospital and Research Centre, Jeddah, Kingdom of Saudi Arabia

[2]Department of General Surgery, Alhada Armed Forces Hospital, Taif, Kingdom of Saudi Arabia

[3]Department of Radiology, King Faisal Specialist Hospital and Research Centre, Jeddah, Kingdom of Saudi Arabia

[4]Department of General Surgery, King Fahad Armed Forces Hospital, Jeddah, Kingdom of Saudi Arabia

***Corresponding author**: Wadha Almohamdi, Department of General Surgery, King Faisal Specialist Hospital and Research Centre, Jeddah, Kingdom of Saudi Arabia

Citation: Almohamdi W, Alharthi S, Alharbi AT, Ali S, Miro J (2023) Multiple Rare Anatomical Variation of Celiac Trunk, Splenic and Hepatic Arteries in a Complicating Pancreaticoduodenectomy: A Case Report and Literature Review. Ann Case Report. 8: 1199. DOI:10.29011/2574-7754.101199

Received: 28 February 2023, **Accepted:** 03 March 2023, **Published:** 06 March 2023

Abstract

In hepatopancreatobiliary surgery, liver transplants and radiological abdominal interventions surgical anatomy and knowledge of vascular variations plays an important role in the accurate interpretation of disease in diagnostic imaging as well as in deciding the optimum elective procedure in surgical or interventional radiological management and to avoid any vascular injury during the procedure. In this article, we reported a rare anatomical variation of celiac trunk, splenic and hepatic artery as incidental findings intraoperative of pancreaticoduodenectomy (Whipple Procedure) for periampullary mass with an occurrence rate of less than 1.0%, although this incidence was based on fewer reported cases worldwide.

Keywords: Celiac Trunk; Splenic Artery; Hepatic Artery; Multidetector Computed Tomography Angiography; Normal Variation; Case Report

Case Presentation

This is a 52 years old male patient, not known to have any medically illness, referred to our facility as case of periampullary mass with high tumour marker CA 19-9, biopsy showed atypical cells, contrasted tomography showed double duct sign and dilatation of the common bile duct, no distant metastasis and single kidney anomaly, diagnosed as case of periampullary tumour. Underwent pancreaticoduodenectomy (Whipple procedure), intraoperative finding showed ampulalry tumour with soft pancreas and dilated CBD. The right hepatic artery is replaced rising from the superior mesenteric artery (SMA) and runs almost intrapnacreatic supirolateral to the portal vein, the gastroduodenal artery (GDA) takes off very shortly suprapancreatic from right hepatic artery (RHA). MDCT angiography of the abdomen demonstrated several vascular variations including absence of classic trifurcating celiac trunk, direct origination of the left gastric artery from the abdominal aorta, replaced left hepatic artery originating from the left gastric artery, splenomesenteric trunk which bifurcates into splenic artery and superior mesenteric artery (SMA) as well as replaced right hepatic artery arising from the SMA (Figure 1).

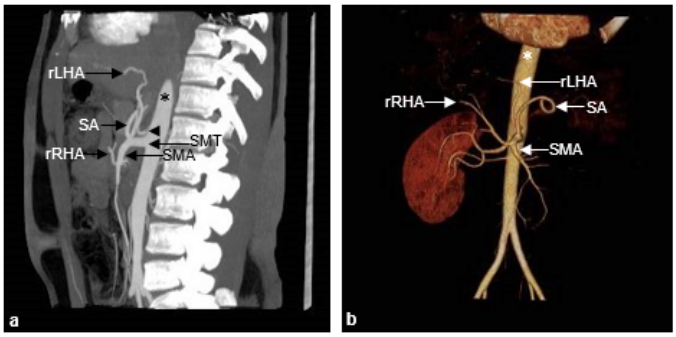

Figure 1: (a) Sagittal Maximum Intensity Projection (MIP) image and (b) Coronal Volume Rendering 3D image of CT abdomen angiogram. Left Gastric Artery (arrow head) is originating directly from the Abdominal Aorta (asterisk). Replaced Left Hepatic Artery (rLHA) originating from the Left Gastric Artery. Splenomesentric trunk (SMT) bifurcates to Spleninc Artery (SA) and Superior Mesenteric Artery (SMA). Replaced Right Hepatic Artery (rRHA) originating from SMA.

Discussion

The main proximal branches of the abdominal aorta (AA) are three ventral branches the celiac artery (CA), the superior mesenteric artery (SMA) and the inferior mesenteric artery (IMA) respectively supply the derivatives of embryonic foregut, midget and hindgut. During embryological development, right and left dorsal aortas spread out into the segments of embryo by giving dorsal, lateral end ventral branches around the fourth week of development. Each segmental artery of the dorsal intersegmental arteries of the body wall, lateral splanchnic arteries of the mesonephric ridge and ventral splanchnic arteries of the digestive tube become permanent after forming a single aorta by the fusion of the two dorsal aortas under the fourth thoracal vertebra. Although many of the ventral splanchnic arteries evanesce, three roots (CT, SMA, and IMA) in the mesenteries become permanent [1]. The celiac trunk is the first ventral branch of the abdominal aorta, which arises at the level of T12. Haller first observed the classical trifurcation of the coeliac trunk into the left gastric, the common hepatic and the splenic arteries in 1756. It is thus known as Tripus Halleri, since then it is considered as a normal anatomical form [2]. Anatomical variations of the CT and its branching pattern are frequently detected during cadaveric dissections and diagnostic radiological imaging. Although these variations are usually asymptomatic, the importance of knowledge of these variations lies in preplanning of invasive surgical techniques, organ transplantation, diagnosis, prevention, and management of some metastatic tumours and to overcome the catastrophic consequences like organs ischemia if any vascular injuries was happened. Hence a better understanding of these anatomical variations is considered vital for surgeons or radiologists for appropriate planning and conduction of surgical procedures or interventions [3,4]. Adachi [5] has studied the anatomical variations of CT in detailed and classified into six types for the first time in 1928. However, not all variations of CT branching have been described in Adachi's classification. Studies have shown that the CT can divide into from two to five or even six different branches in very rare cases; furthermore, all three components branch from the AA independently, so the trunk itself may be absent, described as 'agenesis of celiac trunk' [6,7]. In a case report and literature review published by Matusz et al., the absence of the CT was reported as varying from 0% to 1.96% in cadaveric dissections, from 0% to 1.11% in surgical findings and from 0.1% to 1% in radio diagnostic analyses [8]. Splenic artery is the largest branch of celiac trunk in adults and is the second largest next to common hepatic artery in fatal life. It is tortuous in its course. It gives branches that supplies to the stomach, pancreas, and greater momentum and ends by supplying the spleen via its terminal branches [9]. Pandey S K studied the variations in origin, course and terminal branching pattern of splenic artery in 320 cadavers. The splenic artery originated from celiac trunk in 90.6%, from abdominal aorta in 8.1% and either from common hepatic artery or superior mesenteric artery in 1.3% [10]. Selma Petrella studied anatomy of the celiac trunk through its diameter, length and variations of its branches in 89 cadavers. Classic celiac trunk with 3 branches was found in 73 cases. Variations were noted in rest 16 cadavers. In 3 cases gastro splenic trunk was noted and common hepatic artery arose from superior mesenteric artery. In 2 cases hepatosplenic trunk was observed and the left gastric artery originated from abdominal aorta. In 2 all the 3 branches arose directly from abdominal aorta. In remaining 9 cases additional branches were observed [11]. Bergman mentioned that splenic artery may arose from the aorta in combination with the hepatic artery to form a hepatosplenic trunk (3.5%), or combination with the left gastric artery to form a splenogastric trunk (5.5%) [12].

Conclusion

The majority of the vascular variations are incidental findings. Unidentified major vascular anatomic variants can lead to complications in abdominal surgeries and radiological intervention procedures as they can significantly reduce morbidity and mortality of patients. MDCT along with 3D reconstruction plays an important role in identifying such variants. Reporting of such rare variations is important in current clinical practice. In the end, surgeons and interventional radiologist should understand and know the anatomical vascular variation that could be seen in the preoperative imaging or incidentally discovered intraoperatively. Although the preoperative identification of arterial variation and its relationship with the tumour is necessary to avoid intraoperative vascular injury and complications after surgery.

Declaration of interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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