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Foregut Artery Meets Hindgut Territory: A Unique Case of Splenic Artery Supplying Left Colic Flexure with Presence of Pga and Dpa

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KEYWORDS

Coeliac trunk, Splenic artery, Superior polar artery, Inferior polar artery, Dorsal pancreatic artery, Posterior gastric artery, Common hepatic artery

ABSTRACT:

Background: Coeliac trunk is the artery of foregut. The present case report is a unique constellation of vascular variations where intrapancreatic splenic artery with its branch supplying to the left colic flexure, presence of dorsal pancreatic artery arising from the common hepatic artery and the presence of posterior gastric artery originating from the splenic artery. This finding is unique as the splenic branch of coeliac trunk which is the artery of foregut is supplying the left colic flexure which is derivative of hindgut. Combination of such different vascular branching patterns in a single case is very rare. The knowledge of such variations are clinically significant to surgeons and radiologists for gastric cancer surgeries like total or subtotal gastrectomy, bariatric surgeries, pancreatic transplantations, gastric artery aneurysms, pancreatico-duodenectomy and surgery for insulinoma.

INTRODUCTION

The celiac trunk is a branch of the abdominal aorta which arises at the level of 12th thoracic vertebrae.[1,2] It gives rise to three branches that is common hepatic artery, left gastric artery and splenic artery.[1,2] This classical branching pattern of celiac trunk is known as "Tripus Halleri" as put forward by Von Halleri. [1]

Splenic artery is the largest branch of the celiac trunk (90.6%)[3]. Apart from its terminal branches in the hilum of spleen, it also gives off numerous branches to the pancreas, 5 to 7 short gastric branches and the left gastroepiploic artery.[2] Variations in relation to origin, course and branching pattern of splenic artery are not uncommon.[3,4]

In our case¸ we encountered a different branching pattern of splenic artery with the presence of posterior gastric artery and branch to left colic flexure from inferior polar artery. We also found dorsal pancreatic artery arising from the common hepatic artery.

The reported prevalence of the posterior gastric artery ranges from 4%-100% in literature.[5] Nevertheless, this artery may be an important source of blood to the remnant of stomach after gastric resection. Its accidental injury may cause gastric ischemia or bleeding.[5]

The branching pattern of splenic artery supplying left colic flexure is rare and very few reports of the same have been found in the review of literature [6,7]. Knowledge of anatomical variations in the splenic artery system is crucial in the context of liver and pancreatic transplantation surgeries.[8]

Variation in the vasculature of pancreas is reported from time to time and many studies have demonstrated the dorsal pancreatic artery as one of the major arterial supply of pancreas [9] The incidence of dorsal pancreatic artery has been reported to range from 64-100% in anatomical and radiological studies.[10] Knowledge of dorsal pancreatic artery is important to surgeons who perform pancreatic transplants since damage to this artery can cause ischemia and necrosis with serious complications.[11]

The present case report describes a distinctive blend of variations of splenic artery supplying the left colic flexure, dorsal pancreatic artery taking origin from common hepatic artery and presence of posterior gastric

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artery. Combination of such variations in a single case is very unique and clinically significant.

CASE -REPORT

During routine cadaveric dissection, in a 60-year-old male cadaver, variations in the vascular pattern of branches arising from the coeliac trunk were encountered. Coeliac trunk was dividing into three cardinal branches which are Left gastric, Splenic and Common hepatic artery[Fig 1]. To our surprise, the course of splenic artery was intra-pancreatic and initial half of the artery was found to be embedded in pancreas [Fig 1]. The splenic artery gave rise to the posterior gastric artery which passed behind the posterior surface of the body of stomach and supplied it [Fig 2,3]. Splenic artery in addition to PGA also had two terminal branches- superior and inferior polar arteries [Fig 4]. Superior polar artery travelled upwards and entered the spleen near upper pole. It had not given any branches in its course. Inferior polar artery passed downwards towards the lower pole of spleen and gave two branches before entering the spleen, Left Gastroepiploic Artery (LGEA) and Branch to Left Colic Flexure (BLCF)[Fig 4]. LGEA had the normal course. BLCF passed vertically downwards after its origin from inferior polar artery and terminated by supplying the left colic flexure. This branch was additional supply to left colic flexure as it was also supplied by branch from the left colic artery.

On further dissection, we also noticed the presence of Dorsal Pancreatic Artery (DPA) which

was originating from the common hepatic artery [Fig 2,3]. DPA was intrapancreatic and originated in the neck of pancreas and gave the two branches during its course right and left. The right branch ran towards the second part of duodenum and the left branch continued within the substance of pancreas [Fig 2,3]. The main artery descended vertically downwards and divided into two terminal branches before entering the pancreas. No abnormalities were found in the other branches of common hepatic artery.

DISCUSSION

Terminal branching pattern of splenic artery can be classified as concentrated type and distributed type depending upon distance of the terminal branching from the hilum. Present case report comes under distributed type as the distance is more than 2cm from the hilum. The author, Chao-Hui Zheng,in his study found more cases of the concentrated type pattern (64.7%) than distributed type (35.3%).[12] The Author also labelled terminal branching pattern as single branched type, 2 branched type, 3 branched type and multiple branched type depending upon the number of branches entering spleen. Present case report comes under 2- branched type as two branches (SPA and IPA) are entering the spleen.[12]

When we see the course of splenic artery in relation to pancreas in the present case, the initial half of the splenic artery was embedded in the pancreas and was having retropancreatic course. This relationship doesn't fit into any of the classification types explained by author, Chao-Hui Zheng in Table 1. The classification is as follows-

Table 1: Classification of Splenic artery in relation to pancreas

Types	Description
Type I	Splenic trunk follows the suprapancreatic course to the splenic hilum after arising from the celiac artery
Type II	the middle half of the splenic trunk has either a retro- or intra-pancreatic course
Type III	the distal half of the splenic follows either a retro- or intra-pancreatic course
Type IV	the distal three-quarters of the splenic is entirely embedded in the substance of the pancreas or follows a retro-pancreatic course

Type I category as per author gives better exposure of artery to surgeon and hence prevent haemorrhage which might occur. In other types where splenic artery is embedded in pancreas –intrapancreatic or retropancreatic chances of injury and pancreatic fistula is more. [12]

Author Serghei Covantsev found maximum cases of splenic aretery having suprapancreatic course followed by intrapancreatic and retropancreatic and very few being anteropancreatic in his study.[13]

In present case, one branch ranch to left colic flexure (BLCF) was from the SA. Left colic flexure is the derivative of hindgut while SA is the branch of CT which normally supplies foregut. Similar embryological variation was reported by only three authors, in the literature Shao-Tung Liu in 2002 [6], R Pakhiddey in year 2013 [14] and Belgin Bamac [7] in 2006. In third case of author Belgin Bamac, the branch from SA was supplying distal one third of transverse colon and not the the left colic flexure. [7] Normally left colic flexure is supplied by left colic artery, branch of Inferior mesenteric artery (IMA). BLCF was an additional blood supply to the left colic flexure in the present case report. Such accessory arteries are significant in procedures like left

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colectomies, resection of segment of colic flexure and nephrectomies. [14]

The CT, superior mesenteric artery(SMA) and inferior mesenteric artery(IMA) supplying foregut, midgut and hindgut derivatives embryologically derived by the fusion of numerous primitive arteries supplying the yolk sac in the dorsal mesentery of gut. [7,14] In the present case, SA, branch of CT supplying left colic flexure which is derivative of hindgut. This variation can be due to abnormal migration of primitive arteries of yolk sac. The rest of the blood supply of hindgut derivatives by IMA was found to be normal.[7,14]

The posterior gastric artery (PGA) is variably present with a total pooled prevalence of 57.4%. [5] In the present case, PGA was taking origin from the middle one third of splenic artery and the origin was intrapancreatic Author, Andrej Nikov mentioned in this article prevalence of variant origin of PGA. It arose from the proximal third 48.9%); from the middle third (37.0%), and from the distal third (15.1%).[5]

The PGA is clinically significant in gastric cancer surgeries like total or subtotal gastrectomy, bariatric surgeries, pancreatic transplantations and gastric artery aneurysms. [5,15 -18]

In gastrectomy surgeries the presence of PGA determines the choice of total or subtotal gastrectomy as PGA can become sole supply to the gastric stump and its absence in subtotal gastrectomy can lead to post-operative necrosis.[5]. The knowledge of presence and course of PGA can also help in its preservation in pancreatic transplantations and lymphadenectomy in gastric malignancies to avoid potential haemorrhage. [16,17] It is essential to identify the PGA in bariatric surgeries like laparoscopic sleeve gastrectomy and laparoscopic Roux-en-Y gastric bypass for mobilizing fundus and managing proper functioning of gastric stapler.[5]

The PGA aneurysm is also reported in the literature.[5] The incidence of gastric artery aneurysm is 4% with most commonly affected are right and left gastric arteries. Gastric artery aneurysm is a clinical emergency and has higher probability of bleeding.[5]

On review of literature, the reported incidence of DPA is 64% to 100%. [10]. The varied origin of DPA is reported in different studies, it is mainly from the SA (37%), followed by the CT (33%), then from the SMA (21%), and very few cases from the CHA (8%)[19].

Normally DPA divides into inverted T shaped pattern and supplies pancreas. In our case, we found four branches of DPA. The knowledge of vascularization of pancreas is essential for planning surgeries like pancreatico-duodenectomy or surgery for insulinoma to have successful outcome without hemorrhage. [20] In pancreaticoduodectomy, identification and ligation of DPA is important as it will cut off the blood supply from the head of pancreas and prevents intraoperative haemorrhage and decrease chances of post-operative pancreatic fistula.[9,21]

In pancreatic transplantation surgery, DPA should be taken into account as sometimes it is the main source of supply along with SA to the body and tail of pancreas. If neglected can lead to the post-transplant ischemia and necrosis.[11]

For the treatment of diabetes mellitus, sometimes stem cells are infused into pancreas from the DPA through its right branch supplying head and uncinate process and left branch supplying body and tail of pancreas for homogenous distribution. Variations in the branching pattern of DPA may affect such infusion. [22]

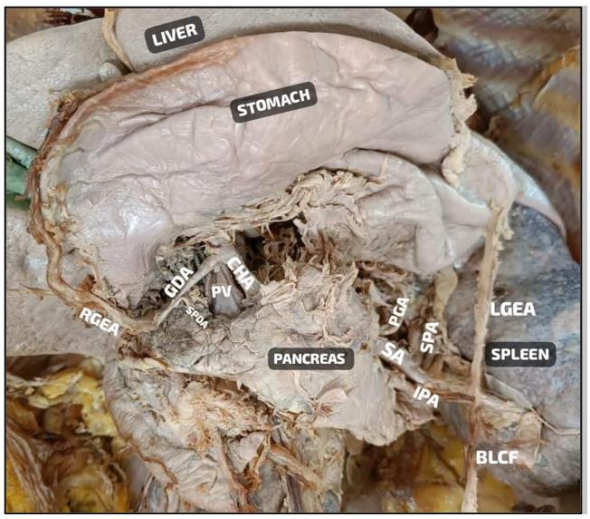

Figure 1: dissection 1 image – [stomach is reflected] – Image showing CHA (Common Hepatic artery), GDA (Gastroduodenal Artery), SPDA (Superior Pancreaticoduodenal Artery), RGEA (Right Gastroepiploic Artery), SA (Splenic Artery), PGA (Posterior Gastric Artery), SPA(Superior Polar Artery), IPA (Inferior Polar Artery), LGEA (Left Gastroepiploic Artery), BLCF (Branch to Left Colic Flexure) and PV (Portal Vein)

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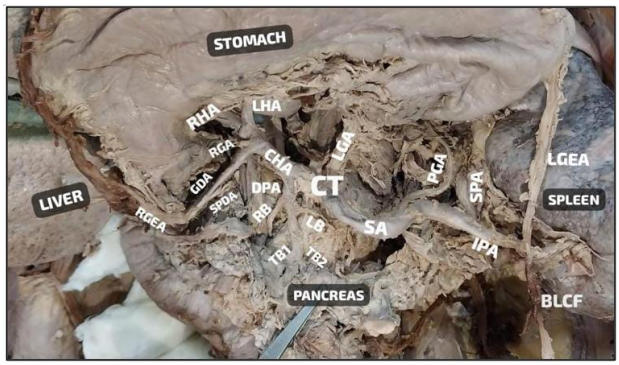

Figure 2: dissection 2 image - [stomach is reflected, some portion of pancreas removed] image showing CT (Coeliac Trunk), CHA (Common Hepatic artery), RHA (Right Hepatic Artery), LHA (Left Hepatic Artery), RGA (Right Gastric Artery), GDA (Gastroduodenal Artery), SPDA (Superior Pancreaticoduodenal Artery), RGEA (Right Gastroepiploic Artery), DPA (Dorsal pancreatic artery), RB (Right Branch), LB (Left Branch), TB1 (Terminal Branch 1), TB2 (Terminal Branch 2), LGA (Left Gastric Artery), SA (Splenic Artery), PGA (Posterior Gastric Artery), SPA (Superior Polar Artery), IPA (Inferior Polar Artery), LGEA (Left Gastroepiploic Artery), BLCF (Branch to Left Colic Flexure)

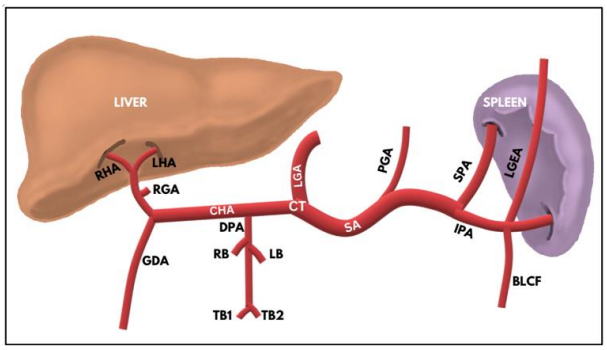

Figure 3: Schematic diagram of dissection image 2 depicting CT (Coeliac Trunk), CHA (Common Hepatic artery), RHA(Right Hepatic Artery), LHA (Left Hepatic Artery), RGA(Right Gastric Artery), GDA (Gastroduodenal Artery), SPDA (Superior Pancreaticoduodenal Artery), RGEA (Right Gastroepiploic Artery), DPA (Dorsal pancreatic artery), RB (Right Branch), LB (Left Branch), TB1 (Terminal Branch 1), TB2 (Terminal Branch 2), LGA (Left Gastric Artery), SA (Splenic Artery), PGA (Posterior Gastric Artery), SPA(Superior Polar Artery), IPA (Inferior Polar Artery), LGEA (Left Gastroepiploic Artery), BLCF (Branch to Left Colic Flexure)

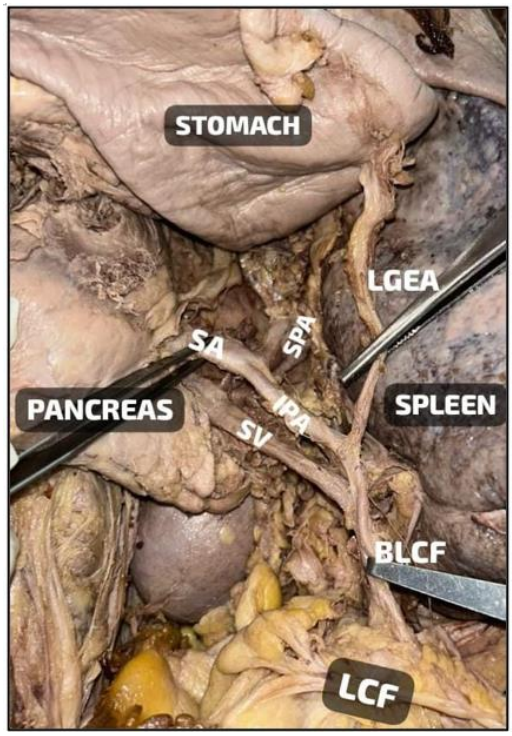

Figure 4: shows a closer view of SA (Splenic Artery) with its terminal branching pattern – SPA (Superior Polar Artery), IPA (Inferior Polar Artery), LGEA (Left Gastroepiploic Artery), BLCF (Branch to Left Colic Flexure) and SV (Splenic Vein)

CONCLUSIONS

This rare case highlights an intrapancreatic splenic artery, supplying the left colic flexure, derivative of hindgut along with presence of the dorsal pancreatic and posterior gastric arteries. The knowledge of such variations is significant for anatomists, surgeons, radiologist, gastroenterologists and transplantation surgeons to avoid vascular complications and haemorrhage.

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