

CADAVERIC STUDY OF VARIATIONS IN BRANCHING PATTERN OF SPLENIC ARTERY

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ABSTRACT

Introduction: Splenic artery was previously called as Lineal artery. Splenic artery is the largest branch of the celiac trunk and is the most tortuous artery in the body. Splenic artery mainly supplies spleen and gives off branches to the stomach and the pancreas. Splenic artery divides into terminal branches before entering into the hilum of the spleen which may be Magistral or Distributed type. Sometimes it may pass through the hilum without dividing and supplies the spleen.

Materials and methods: The study was done on 50 embalmed cadavers during routine dissection practices for undergraduates in the dissection hall of Gandhi Medical College, Secunderabad, and from the Department of Anatomy Osmania medical college, Hyderabad, during the period of 3years. The variations in the branching pattern of the splenic artery was observed and photographed. The prime objective of the study is to compare the prevalence of variations in the branching pattern of splenic artery.

Results and conclusion: The variations in the present study were almost correlated with the available literature. In some instances the left gastro epiploic artery, the posterior gastric artery and the accessory left gastric artery took origin from the interior of spleen. so care should be taken during splenectomy. Hence, the arterial blood supply of spleen is so varied that no two vascular patterns are ever the same.

KEY WORDS: Splenic artery (SA), Short gastric artery (SGA), Left gastro epiploic artery (LGEA), Posterior gastric artery (PGA), Superior terminal artery (STA), Middle terminal artery (MTA), Inferior terminal artery (ITA), Superior polar artery (SPA), Inferior polar artery (IPA).

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INTRODUCTION

Splenic artery is the largest branch of the celiac trunk. Its origin is at the level of T12/L1 vertebral bodies [1]. Branches of the splenic artery usually arise at right angles from the stem. The splenic artery divides into constant and inconstant branches [2].

The more constant branches of splenic artery are: Short gastric arteries (vasabrevia), Left gastro epiploic artery, Pancreatic branches, Superior terminal branch (ramus lienogastricus), Inferior terminal branch (ramus lienogastroepiploicus) and Inconstant branches are Posterior gastric artery, Superior polar artery,

Inferior polar artery, Middle terminal branch. Accessory left gastric artery can be distributed as Anterior cardio-esophageal or Posterior cardio-esophageal artery.

Short gastric arteries also known as arteria gastricae breves [2]. Short gastric arteries pass between the layers of gastro splenic ligament to supply the cardiac orifice and gastric fundus. These arteries anastomose with the branches of left gastro epiploic arteries. Left gastro epiploic artery runs forward and to the right. It sends several branches through the gastro splenic ligament and supplies the upper third of the greater curvature. The artery anastomose with right gastro epiploic artery. Posterior gastric artery ascends behind the peritoneum of omental bursa and supplies the posterior wall of the fundus through the gastro-phrenic fold of peritoneum [3]. Pancreatic branches arise from the splenic artery at varying intervals and vary in number (2-7). One of the branches is large, arteria pancreatica magna and one branch supplying the tail of the pancreas, arteria caudae pancreatis. The dorsal pancreatic artery if present, arises from the splenic artery, sometimes arises from the celiac trunk, superior mesenteric artery, common hepatic artery or from the aorta [2].

The terminal branches are superior and inferior often the third terminal branch is formed that is the middle terminal artery. These branches enter the hilum between the two layers of lieno-renal ligament, these terminals of the splenic trunk undergoes subdivision into penultimate and ultimate branches. The ultimate arteries sink directly into the spleen after origin from the two primary terminal divisions. The penultimate branches of the terminals that give off further branches (2-5) before entering the hilum of spleen [2].

The superior polar artery exhibits the characteristic tortuosity. It branches distally before entering the hilum of the spleen. Polar arteries to the inferior extremity of the spleen are much more numerous (1-5). The splenic artery before breaking up into its main terminal branches, may give rise to an accessory left gastric artery which is distributed anteriorly and posteriorly to the cardio esophageal region of the stomach [2].

Splenic artery divides into terminal branches before entering into the hilum of the spleen which may be Magistral or Distributed type [4]. Sometimes it may pass through the hilum without dividing and supplies the spleen [5].

Vascular system makes its appearance in the middle of third week of intra uterine life [6]. Initially the ventral splanchnic branches are paired, with the fusion of dorsal aortae, the ventral branches also fuse and form a series of unpaired segmental vessels which run forward through the dorsal mesentry of the primitive gut and divide into ascending and descending branches along the dorsal aspect of the gut. These vessels eventually form the dorsal and ventral longitudinal anastomotic channels. The dorsal splanchnic anastomosis persists in the later life as the gastro-epiploic, pancreaticoduodenal and the marginal arteries of the large gut where as the ventral anastomosis form the right and left gastric arteries [7].

The ventral longitudinal anastomosis between the roots of the primitive vitelline arteries is the common source of origin of all the branches of the celiac artery. Persistence of interrupted sections accounts for aberrancy in origin of the regional arteries [2].

MATERIALS AND METHODS

The present study was done on 50 embalmed cadavers of both sexes, during routine dissections for undergraduates from the Department of Anatomy for a period of 2010-2013. The abdomen region was dissected. The branches of splenic artery were identified, and variations in branching pattern were observed and photographed.

OBSERVATIONS

Variation in Short gastric arteries (SGA):

Fig. 1: The short gastric arteries in 46 of 50 cadavers were seen to be arising from the superior terminal artery contributes 92% of splenic artery.

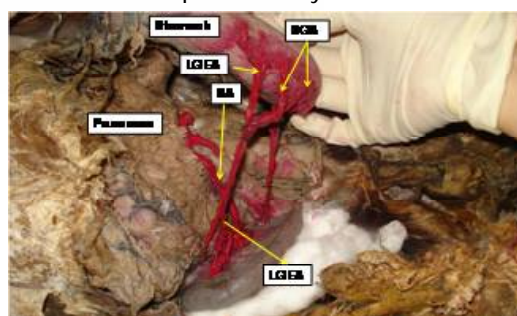


Fig. 2: The short gastric arteries originated from the left gastro epiploic artery (LGEA) (2%).

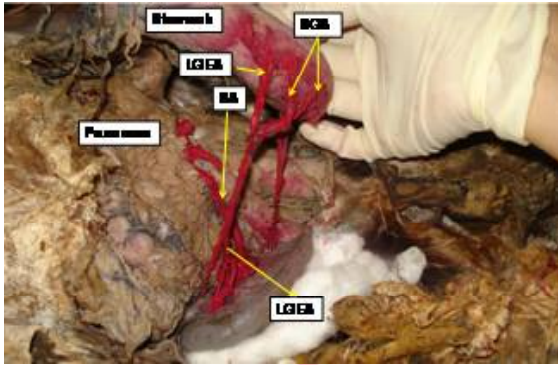


Fig. 3: The short gastric arteries arose from the inferior terminal arteria (2%).

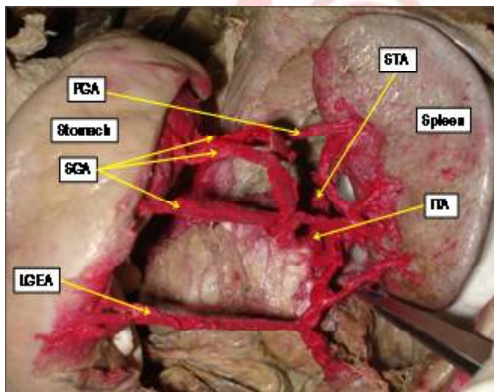
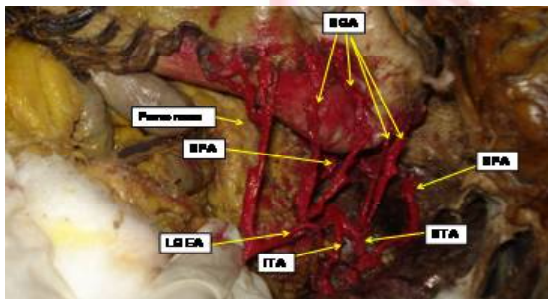


Fig. 4: The short gastric arteries were seen to be arising from the superior terminal and from the left gastro-epiploic artery (2%).



In one cadaver there were no short gastric arteries (2%) and the splenic artery gave rise to accessory left gastric artery which was supplying the anterior part of anterior cardio esophageal region of stomach (Fig. 17).

Variations in Left gastro-epiploic artery (LGEA):

Fig. 5: In 42 of 50 cadavers (84%) the left gastro epiploic artery was seen to be originated from the splenic artery.

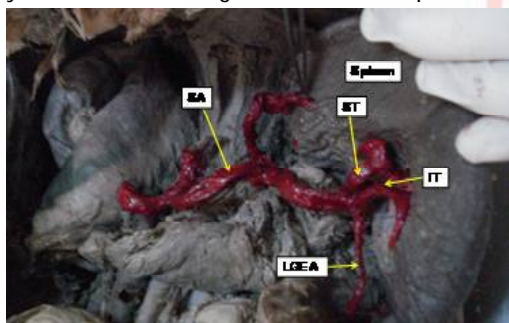
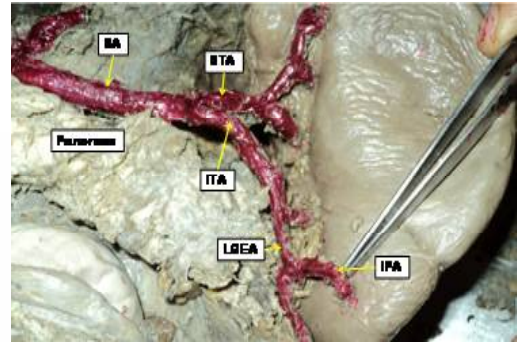


Fig. 6: In 7 cadavers (14%), the artery arose from the inferior terminal arteria of splenic artery.



In 1 cadaver (2%), the left gastro epiploic arteries were two, of which one LGEA originated from the segmental artery coming from the interior of the spleen which was very rare and other LGEA was originated from the inferior terminal artery (Fig. 17).

Variations in posterior gastric artery (PGA):

Fig. 7: The posterior gastric artery originated from the splenic artery in 18 out of 50 cadavers (36%).

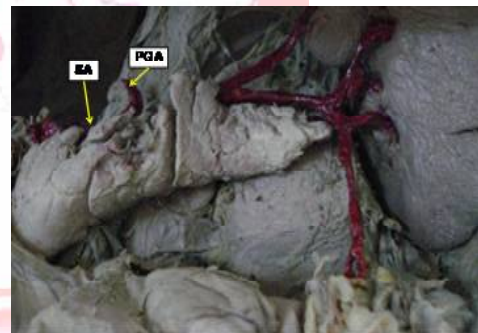


Fig. 8: The posterior gastric artery arose directly from the interior of the spleen from the segmental branch in two cadavers.

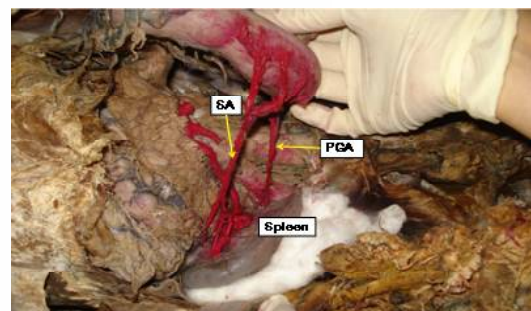
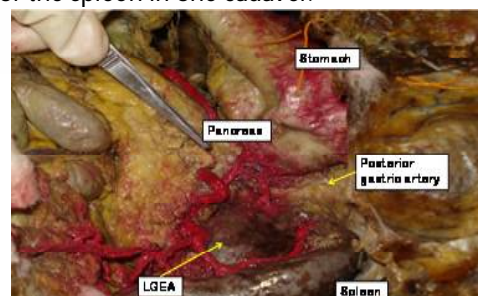


Fig. 9: The posterior gastric artery arose from the middle of the splenic artery and inturn gave branches to the posterior surface of the fundus of stomach and upper pole of the spleen in one cadaver.



Variations in pancreatic branches

Fig. 10: Arteria pancreatica magna was seen in 88% and Arteria caudae pancreatis was seen in 82% of cases.

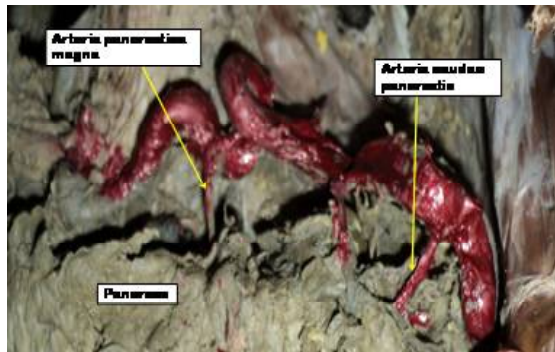
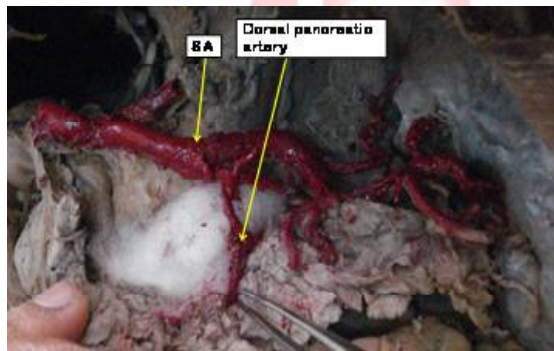
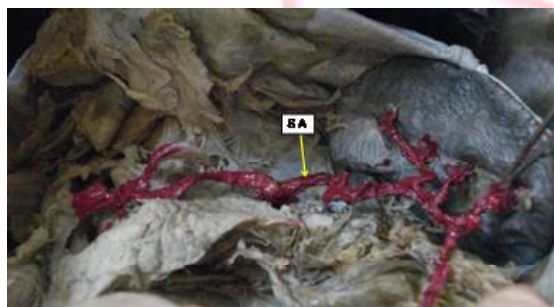


Fig. 11: The dorsal pancreatic artery (inconstant branch) was seen to be arising from the splenic artery 2%.



Variations in Terminal branching pattern of splenic artery

Fig. 12: Branching pattern of splenic artery was found to be Magistral type in 8 of 50 cadavers (16%).



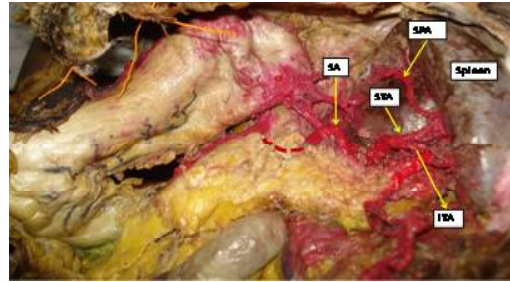
In 42 cadavers, the splenic artery was found to be of Distributed type (84%) (Fig. 11).

Variations in Superior polar artery (SPA)

Fig. 13: The superior polar artery originated from the splenic artery in 42 of 50 cadavers (84%).



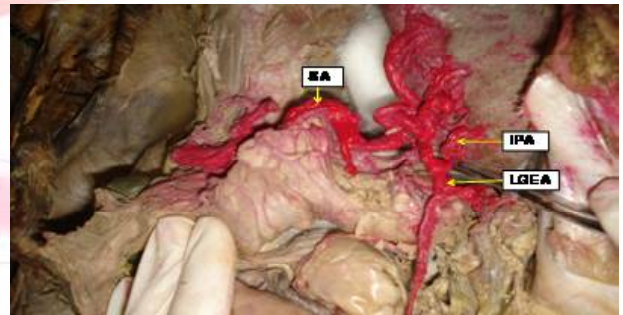
Fig. 14: In 1 cadaver (2%) the superior polar artery was arising from the arteria terminalis superior.



In 7 cadavers (14%) the superior polar artery was absent.

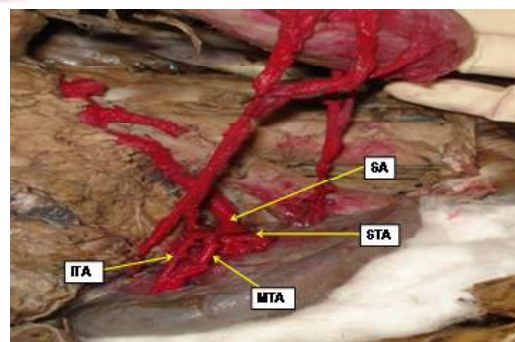
Variations in Inferior polar artery (IPA):

Fig. 15: In 3 out of 50 cadavers (6%), the inferior polar artery was found to be originated from the left gastro-epiploic artery and was absent in 47 of 50 cadavers (94%).



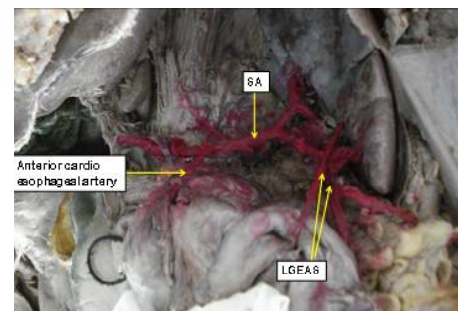
Variations in Terminal branches of splenic artery

Fig. 16: The middle terminal artery (MTA) was seen in only 10% of cases and the superior and inferior terminal arteries were seen in 100% of cases.



Accessory Left Gastric Artery

Fig. 17: In one cadaver (2%), the accessory left gastric artery supplying the anterior part of cardio esophageal region of the stomach.



DISCUSSION

The vascular architecture of the spleen was presented in detail by Assolent in 1802. Variation of arterial anatomy is very common and occurs in nearly half of the population [2].

Short gastric arteries: frequently arise from the superior terminal, sometimes from the inferior terminal, splenic artery, superior polar artery, inferior polar artery or from the left gastro epiploic artery [2].

Left gastro-epiploic artery: arise commonly from the splenic artery, sometimes arise from the superior terminal or inferior terminal artery, occasionally originates from the segmental artery in the interior of the spleen [2].

Seok Kil Zeon et al [8] (1998), found the left gastro epiploic artery in 46% of cases and absent in 64% of cases. Ndoeye JM et al [9](2008) classified the origin of left gastric artery into 3 types

Truncular origin (type I) in 20.5% of cases, from the inferior polar branch (type II) in 68.35% of cases and from the common spleno-gastroepiploic trunk (type III) in 11.4% of cases.

Posterior gastric artery is a branch of splenic artery (48-67.8%) or from the left gastric artery or celiac trunk or segmental branches of splenic artery [2]. Its high incidence, hidden origin, deep course and distribution make this artery very important for surgical procedures related to stomach, pancreas, spleen and celiac region. It may be crucial, if partial gastric resection or splenectomy have obliterated other gastric vessels. Walther in 1729, was first to observe the ramus gastricus and was termed by Haller in 1745 as the posterior gastric artery [10].

Adachi [2](1928), found a ramus gastricus in 21.6% of cases, arising from the splenic artery, ascends to the left behind the stomach and gives branches to the fundus of the stomach and upper pole of the spleen. Kuniko Suzuki et al [10](1978), reported that the posterior gastric artery originated from the splenic artery in 38 of 61 individuals (62.3%). According to him, the origin of the posterior gastric artery was from the proximal third of the splenic artery in 7/38 individuals (18.4%), from mid third in 18 (47.8%) and from distal third in 13 (34.2%).

Pancreatic branches arose from the splenic artery at varying intervals and vary in number. Seok Kil Zeon et al [8] (1998), reported that in 80% of cases the dorsal pancreatic artery was seen. The arteria pancreatica magna was seen in 98% of cases, followed by arteria caudae pancreatis in 84% of cases.

Morphologically terminal pattern of splenic artery are of two types, the Magistral and Distributed. In the Magistral type, lineal branching of the main splenic trunk takes place near the spleen (1-2cm from the hilus). In the Distributed type of splenic artery branching takes place at a distance of 2-12cm from the hilum of spleen. Piquand [2] (1910), reported that in 66% of cases, the splenic artery divided as Distributed type and in 34% of cases, divided as Magistral type. Lipshutz [2] (1917), observed that in 75% of cases, the splenic artery divided as Distributed type, showing the three terminal branches, the arteria polaris superior, the arteria terminalis superior, and the arteria terminalis inferior.

Superior polar and inferior polar arteries both may arise from the splenic trunk or Less frequently from the superior terminal or from inferior terminal branches [1]. Prashanth Nashiket Cheware et al (2012), found the superior polar artery in 28.8% of cases and inferior polar artery in 42.34% of cases [11]. The terminal branches of the splenic artery have been named as arteria terminalis superior and inferior by Sobotto.

Lipshutz [2] and Seok kil Zeon et al [8] (1998), noticed the superior and inferior terminal arteries in 100% of cases. Seok kil Zeon et al [8] (1998) also, reported middle terminal arteries and accessory left gastric artery in 28% of cases.

In the present study we observed numerous variations in the branching pattern of splenic artery.

The short gastric arteries arose from the inferior terminal artery in 2% of cases, superior polar in 2% of cases, LGEA in 2% of cases, in 2% of cases short gastric arteries were absent and in 92% of cases from superior terminal branch of splenic artery.

The left gastro epiploic artery (LGEA) was arising from the inferior terminal artery in 14%, in 84%

from splenic artery and in 2% of cases the left gastro epiploic arteries were two, of which one LGEA originated from the segmental artery coming from the interior of the spleen which was very rare and other LGEA was originated from the inferior terminal artery.

The posterior gastric artery was absent in 64% and in 36% was seen to be arising from the splenic artery, among these in one cadaver the posterior gastric artery was seen to be arising from the middle third of the splenic artery supplying the posterior part of the fundus of the stomach and then enters the upper pole of the spleen and in another cadaver the posterior gastric artery originated from the segmental artery coming from the interior of the spleen.

The Arteria pancreatica magna and arteria caudae pancreatis was seen in 88% and 82% of cases respectively and dorsal pancreatic artery seen only in 2% of cases. The splenic artery should be ligated distal to the pancreatic branches, otherwise involvement of pancreatic branches lead to pancreatitis during splenectomy and laproscopic assisted distal gastrectomy.

In 84% of cases the Distributed type was seen and in 16% of cases the Magistral pattern of terminal branches of splenic artery was found.

The superior polar artery arose from the superior terminal artery in 2%, in 84% of cases the artery originated from the splenic trunk and absent in 14%. The inferior polar artery was seen only in 6% of cases. Ligation of splenic branches should be started from the inferior pole of the spleen as most of the splenic artery branches were very slender and can readily be missed. The middle terminal artery was seen in only 10% of cases and the superior and inferior terminal arteries were seen in 100% of cases.

A rare branch, the anterior cardio esophageal artery or left accessory gastric artery was seen only in one cadaver (2%) originating from the splenic artery.

CONCLUSION

Anatomists, Surgeons and radiologists must have a thorough knowledge regarding branching pattern of splenic artery. Most of the vascular variations had been identified during the clinical diagnostic evaluations or cadaveric studies. The

findings of our study could help to minimize complications related to abdominal surgeries like splenectomy and splenic pedicle, gastric esophagoplasty and resection of tumors or it may lead to ischemic necrosis of the pancreas, spleen and stomach. In some instances the left gastro epiploic artery, the posterior gastric artery and the accessory left gastric artery took origin from the interior of spleen, so care should be taken during splenectomy.

Conflicts of Interests: None

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