# **ORIGINAL ARTICLE**

## Assessment of diameter, length, tortuosity of splenic artery and its branches with its surgical implications

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## ABSTRACT:

**Aim:** Assessment of diameter, length, tortuosity of splenic artery and its branches with its surgical implications. **Materials & methods:** A total of 20 formalin preserved cadavers were enrolled. An incision was made in each cadaver in the midline from xiphoid process till the umbilicus and extended it till pubic symphysis encircling the umbilicus. Skin flaps and superficial fascia were reflected by blunt dissection. The course of splenic artery dissected along with pancreas. The diameter of splenic artery was measured 1cm before terminal branching. The diameters of superior and inferior were measured 5mm from the bifurcation. The length of the artery was measured by using measuring tape with tortuosity and after removing tortuosity by straitening the artery. Tortuosity was calculated by dividing length without tortuosity to length with tortuosity. Its variations about length, diameter was observed and noted down. **Results:** The splenic trunk divided into two primary branches in 80 percent and three primary branches 20 percent of the case. Superior polar artery was present in 32%, inferior polar artery was present in 38% and in 10% both superior and inferior polar arteries were seen. The mean distance of the point of division of splenic artery from the hilum was 4.80 cm, maximum 6.1 cm and minimum was 3.5 cm. The mean length of splenic artery with tortuosity was 9.71 cm. The mean length of splenic artery without tortuosity was 12.98 cm. **Conclusion:** During the surgical approach over the spleen andextrahepatic billiary apparatus it is imperative for thesurgeon to take the note of such anomalous origin ofsplenic artery.

Key words: Splenic artery, Surgical

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### **INTRODUCTION**

The splenic hilar lymph nodes are easily invaded in advanced upper- or middle-third gastric cancer. Due to the importance and permanent improvements as regards the treatment of different diseases involving abdominal organs such as the abdomen, pancreas and spleen. I was indined to investigate, both from the anatomic and surgical point of view, one of the collateral arterial branches of the celiac trunk, which is possibly considered to be one the least studied and, historically one of the most forgotten by the vessels irrigating the liver and stomach.<sup>1-3</sup>

Vascular anomalies of the spleen are usually asymptomatic. However, variant anatomy of splenic artery becomes clinically important, when the patients undergo diagnostic angiography for gastrointestinal bleeding or during transcatheter therapy. Padmalatha et al., reported a case of SA giving rise to two polar arteries. The author has mentioned in the report that, SA branching anywhere within 1-12cm can be regarded as polar artery. In the same report, author also mentioned about presence of an accessory SA, originating from left gastroepiploic artery.<sup>4, 5</sup>The splenic artery is remarkable for its tortuosity and because it is the largest branch of the coeliac trunk. It passes horizontally to the left, behind the stomach,

along the upper border of the pancreas. Near the tail of the pancreas, it enters in the lienorenal ligament and then divides into five or more terminal branches that enter the hilum of the spleen. The anatomical variation of the splenic artery makes it vulnerable to iatrogenic injury.<sup>6-8</sup> Hence; the present study was conducted for evaluating the diameter, length, tortuosity of splenic artery and its branches with its surgical implications.

#### **MATERIALS & METHODS**

The present study was conducted for evaluating the diameter, length, tortuosity of splenic artery and its branches with its surgical implications. A total of 20 formalin preserved cadavers were enrolled. An incision was made in each cadaver in the midline from xiphoid process till the umbilicus and extended it till pubic symphysis encircling the umbilicus. Skinflaps and superficial fascia were reflected by blunt dissection. The external oblique, internal oblique and transverous abdominis muscles were reflected. The rectus sheath, fasia transversils and peritoneum were divided. Celiac trunk exposed. The tail of pancreas and lineorenal ligament identified and terminal branches of the splenic artery dissected along with

pancreas. The diameter of splenic artery was measured 1cm before terminal branching. The diameters of superior and inferior were measured 5mm from the bifurcation. The length of the artery was measured by using measuring tape with tortuosity and after removing tortuosity by straitening the artery. Tortuosity was calculated by dividing length without tortuosity to length with tortuosity. Its variations about length, diameter was observed and noted down. All the results were recorded and analysed using SPSS software.

## RESULTS

The splenic trunk divided into two primary branches in 80 percent and three primary branches 20 percent of the case. Superior polar artery was present in 32%, inferior polar artery was present in 38% and in 10% both superior and inferior polar arteries were seen. The mean distance of the point of division of splenic artery from the hilum was 4.80 cm, maximum 6.1 cm and minimum was 3.5 cm. The mean length of splenic artery with tortuosity was 9.71 cm. The mean length of splenic artery without tortuosity was 12.98 cm. The mean diameter of splenic artery was 5.85 mm. The mean diameter of superior ramus was 4.84 mm. The mean diameter of inferior ramus was 4.86 mm.

 Table 1: Division of splenic trunk

| Splenic trunk branches | Number | Percentage |
|------------------------|--------|------------|
| Two primary branches   | 16     | 80         |
| Three primary branches | 4      | 20         |
| Total                  | 20     | 100        |

| Splenic artery     | Mean  | SD  |
|--------------------|-------|-----|
| With tuberosity    | 9.71  | 2.1 |
| Without tuberosity | 12.98 | 3.1 |

## DISCUSSION

Anatomical variations of the hepatic arteries and coeliac trunk are of considerable importance in liver laparoscopic surgery, radiological transplants, abdominal interventions and penetrating injuries to the abdomen. The frequency of inadvertent or iatrogenic hepatic vascular injury rises in the event of anatomy and aberrant variations. Arterial vascularisation of the gastrointestinal system is provided by anterior branches at three different levels of the abdominal aorta (the coeliac trunk and the superior and inferior mesenteric arteries). Differences arising during several developmental stages in the embryonal process led to a range of variations in these vascular structures.6- 9Hence; the present study was conducted for evaluating the diameter, length, tortuosity of splenic artery and its branches with its surgical implications.

The splenic trunk divided into two primary branches in 80 percent and three primary branches 20 percent of the case. Superior polar artery was present in 32%, inferior polar artery was present in 38% and in 10% both superior and inferior polar arteries were seen. The mean distance of the point of division of splenic artery from the hilum was 4.80 cm, maximum 6.1 cm and minimum was 3.5 cm. Zheng CH et al investigated the splenic hilar vascular anatomy and the influence of splenic artery (SpA) type in laparoscopic total gastrectomy with spleen-preserving splenic lymphadenectomy (LTGSPL). There were 205 patients with a concentrated type (64.7%) and 112 patients with a distributed type (35.3%) SpA. There were 22 patients (6.9%) with a single branch of the splenic lobar vessels, 250 (78.9%) with 2 branches, 43 (13.6%) with 3 branches, and 2 patients (0.6%) with multiple branches. The mean splenic hilar lymphadenectomy time (23.15  $\pm$  8.02 vs 26.21  $\pm$  8.84 min: P = 0.002), mean blood loss resulting from splenic hilar lymphadenectomy (14.78  $\pm$  11.09 vs  $17.37 \pm 10.62$  mL; P = 0.044), and number of vascular clamps used at the splenic hilum  $(9.64 \pm 2.88 \text{ vs} 10.40 \text{ splenic})$  $\pm$  3.57; P = 0.040) were significantly lower in the concentrated group than in the distributed group. However, the mean total surgical time, mean total blood loss, and the mean number of harvested splenic hilar lymph nodes were similar in both groups (P >0.05 for each comparison). There were also no significant differences in clinicopathological and postoperative characteristics between the groups (P >0.05). It is of value for surgeons to know the splenic hilar vascular anatomy when performing LTGSPL.<sup>10</sup> In the present study, the mean length of splenic artery with tortuosity was 9.71 cm. The mean length of splenic artery without tortuosity was 12.98 cm. The mean diameter of splenic artery was 5.85 mm. The mean diameter of superior ramus was 4.84 mm. The mean diameter of inferior ramus was 4.86 mm.Pandey SK et al. in another study assessed variation in splenic artery. The artery originated from the coeliac trunk in the majority of cadavers (90.6%), followed by abdominal aorta (8.1%), and other sights (1.3%). A suprapancreatic course of the artery was commonly observed (74.1%) followed by enteropancreatic (18.5%), intrapancreatic (4.6%), and retropancreatic (2.8%) courses. In two cases (0.63%) the proximal part of the splenic artery made a loop that was embedded in the substance of the pancreas, which is an interesting and rare finding. In five cases (1.5%) the proximal part of the artery divided into two or more branches that had suprapancreatic and enteropancreatic courses. The splenic artery divided into terminal branches in 311 (97%) cadavers. In nine (2.8%) cadavers it passed through the hilum of spleen without dividing. Two terminal branches were the most common (63.1%) followed by four (18.8%), six (9.7%), and more than six (5.6%) branches. Their study clearly indicates that there is variation in origin, course, and terminal distribution pattern of the splenic artery.<sup>11</sup>Waizer A et al observed an aberrant course of the proximal splenic artery in nine of 26 adult cadavers dissected for mapping of the lesser omentum. Such an aberrant course makes the artery vulnerable to iatrogenic injury. In view of this relatively high prevalence of splenic artery aberration, it is suggested that surgeons operating in the area of the lesser omentum should keep in mind the possibility of its occurrence and the dangers that it may present.<sup>12</sup>Karakose M et al described 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.<sup>13</sup>

## CONCLUSION

During the surgical approach over the spleen andextrahepatic billiary apparatus it is imperative for thesurgeon to take the note of such anomalous origin ofsplenic artery.

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