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## Study Of Variations In Origin And Course Of Splenic Artery In The 50 Adult Human Cadavers

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### Abstract

*Splenic artery is the largest branch of the Coeliac trunk and is the most tortuous artery in the body<sup>1</sup>. It mainly supplies the spleen, pancreas and stomach.*

*Splenic artery arises directly from the Coeliac trunk or from the abdominal aorta or from the superior mesenteric artery. Sometimes may arise as common trunk as hepato- splenic or gastro-splenic trunk<sup>2</sup>.*

*Typical course of splenic artery is supra-pancreatic. It may also be intra-pancreatic or retro-pancreatic in course<sup>3</sup>.*

*The study included total of 50 cadavers from the Department of Anatomy, Gandhi medical college, Secunderabad and from Osmania medical college, Hyderabad.*

*A thorough knowledge of variations in origin and course of splenic artery is important while performing different surgical interventions and radiological procedures of upper abdominal regions.*

*The ligation of splenic artery is important in surgical procedures like Haemolytic disorders, intra hepatic portal hyper tension and Bantis syndrome. The aim of ligation of the splenic artery, in most instances, is to effect a simple aseptic necrosis of the spleen that is to render the organ oligemic and not ischemic<sup>4</sup>.*

**key words:** Coeliac trunk (CT), Splenic artery (SA), Hepato-splenic trunk (HST), Spleno-gastric trunk (SGT).

### Introduction

The Splenic artery was previously called as Lineal artery<sup>4</sup>.

The splenic artery is the one off the branch of coeliac trunk which inturn arises from the abdominal aorta at the level of upper border of T12 vertebra<sup>1</sup>.

In rare instance artery may be doubled, the upper splenic artery being smaller, arises directly from the abdominal aorta and lower from the celiac trunk. Splenic artery is the most common artery to

undergo sudden haemodynamic alterations that tend to throw splenic artery tortuous and is the second most common site of intra abdominal aneurysms<sup>4</sup>.

Tortuous course of the splenic artery is considered so variable that no two arteries are alike and may be slightly curved, looped or straight<sup>2</sup>.

### 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

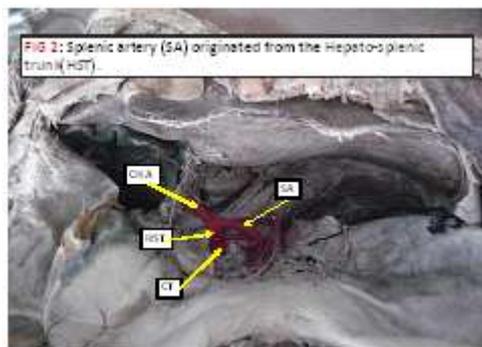
region was dissected. The splenic artery was identified, its origin and course were observed for variations.

**Observations and Results:**

**I. Variations in Origin:**

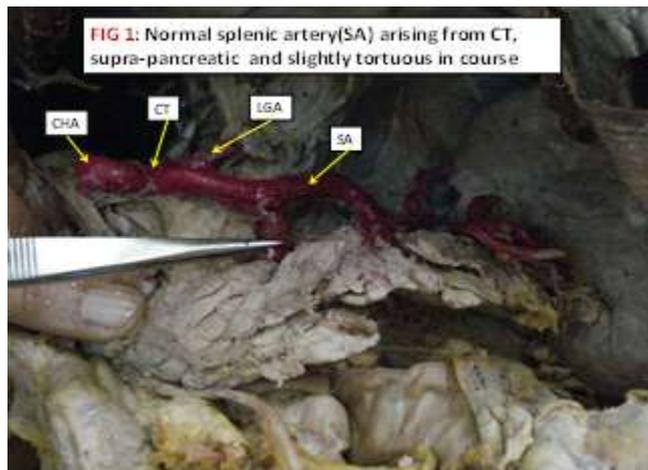
In the present study the splenic artery originated from the coeliac trunk in 49 cadavers (98%).

**Fig 2:** The splenic artery arose along with common hepatic artery as hepato-splenic trunk from celiac trunk (2%).

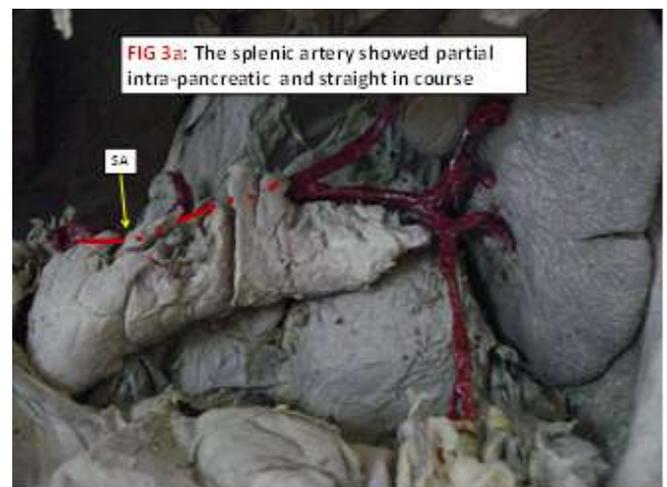
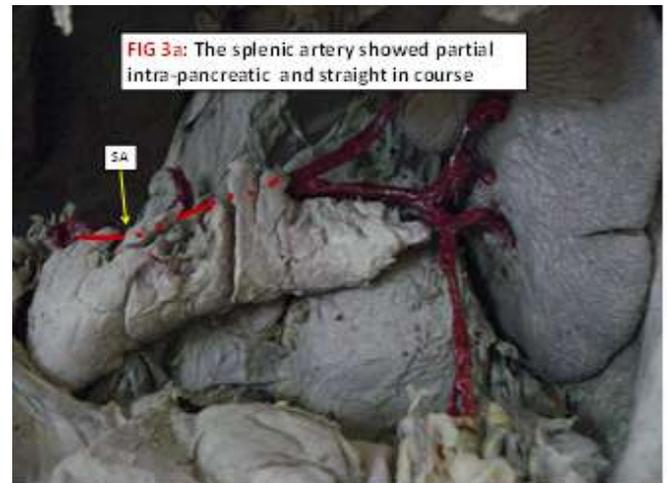


**II. Variation in Course:**

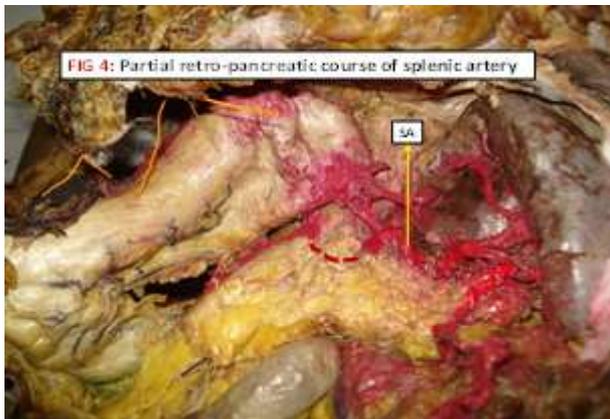
**Fig 1:** The suprapancreatic course of splenic artery was observed in 48 cadavers (96%-Normal course).



**Fig 3a&b:** The splenic artery was partial intrapancreatic (2%) and straight in course.



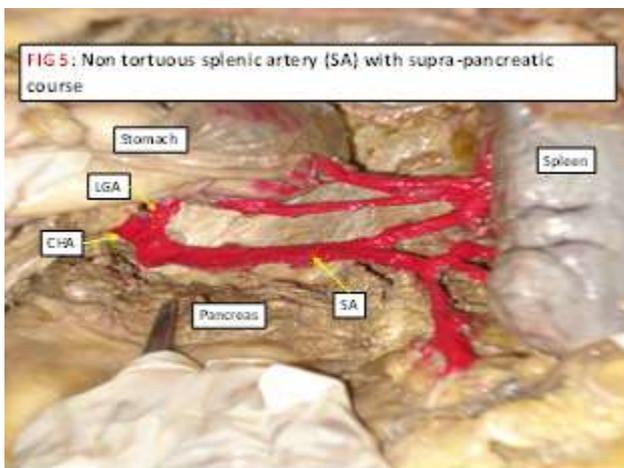
**Fig 4:** The splenic artery was slightly tortuous (slightly curved normal) and retro-pancreatic (2%) at the proximal part and supra pancreatic in the distal part (normal).



### III. Variations in Tortuosity:

**Fig 3a&3b:** In one cadaver the splenic artery was straight (2%) and partial intra-pancreatic.

**Fig 5:** In four cadavers the splenic artery was straight (8%) and supra-pancreatic.



**Fig 6:** In two cadavers the splenic artery was highly tortuous (looped 4%) and supra-pancreatic.

**Fig 1:** The splenic artery was slightly curved and supra-pancreatic in 43 cadavers (normal 86%).

### Discussion:

Splenic artery was first discovered by Julius Ceasar Arantius from Venice (1751), who was regarded as discoverer of splenic artery. He was the first anatomist to emphasize tortuous course of splenic artery. Leonard da vinci mentioned that in old people the splenic artery increases in thickness, grows longer, then becomes twisted like snake<sup>4</sup>.

An arteria splenica secunda was described by Haller in 1764. The upper splenic artery being smaller, arises from the abdominal aorta and lower from the celiac trunk<sup>4</sup>.

Anatomical variations involving the splenic artery are common and the knowledge becomes important in patients undergoing diagnostic laproscopic procedures, upper abdominal surgeries and radiological investigations which can lead to vulnerable iatrogenic surgery.

Data derived from past research on cadavers and living persons has shown a plethora of variations in splenic artery. About 10-20% of the individuals display significant variations in the form of origin,

pattern of course and branching system (Ssonsoj-Jaroscewitsch).

This present study showed 14% of variations in origin and course of the splenic artery.

The Lipshutz<sup>4</sup> gave a detailed account on splenic artery based on origin and classified into 4 types.

**Type 1:** (75% cases) The splenic artery, left gastric artery and common hepatic artery originated from the celiac trunk.

**Type 2:** (15% cases) The splenic artery arose from hepato-splenic trunk.

**Type 3:** (6% cases) The splenic artery took origin from abdominal aorta.

**Type 4:** (4% cases) The splenic artery was originating from the spleno-gastric trunk.

Pamidi N et al<sup>5</sup> (2008), found a rare case of celiac trunk with two main branches, hepato-splenic trunk and left gastric artery in place of the three classic branches.

Prakash et al<sup>6</sup>(2012), observed that in 86% Of cases, the left gastric, common hepatic and splenic arteries were found to arise from the celiac trunk. In 4% of cases, the splenic artery were arising from the hepato- splenic trunk, in the rest 2% of cases the common hepatic and left gastric arteries arose from the celiac trunk, and the splenic artery was arising directly from the abdominal aorta.

In the current study (Fig 2), the celiac trunk gave off two branches, left gastric artery and hepato splenic trunk which is Type2 of Lipschutz classification.

Similar observation of hepato splenic trunk (Fig 2) was found with the studies done by Pamidi N et al and Prakash et al work.

### Origin of Splenic Artery

AUTHOR	C.T	HST	SGT
Lipschutz	75%	15%	4%
Pamidi N	-	Case report	-
Prakash	86%	8%	-
Present study	98%	2%	-

The injury of the hepato-splenic trunk can involve ischemia of spleen, liver and pancreas. The ultra sound knowledge of the arterial architecture of the patient in this critical area can lead to surgical risk of error and lethal complications.

Ssonson-Jaroscewitsch<sup>4</sup> (1927), found supra-pancreatic course of splenic artery in 90% of cases, retro-pancreatic in 7% of cases and in 3% of cases course of splenic artery being pre-pancreatic.

H.Ozan et al<sup>7</sup>(1997), observed the partial intra pancreatic course in 2% of cases.

Pandey sk et al<sup>3</sup>(2004), reported the supra-pancreatic course of splenic artery in 74.1% of cases, followed by entero-pancreatic course in 18.5% of cases, intra-pancreatic course in 4.6% of cases and retro-pancreatic course in 2.8% of cases. In 1.5% of cases, the proximal part of splenic artery divided into two or m branches that had supra-pancreatic and entero-pancreatic co urses.

In the present study 2% of cases, the splenic artery showed partial intra-pancreatic course (Fig 3a&b) and in 2% of cases the proximal splenic artery was retro-pancreatic in course (Fig4).

In 96% of cases the course was normal supra-pancreatic.

These observations agree with studies of splenic artery done by Ssonson-Jaroscewitsch, H.Ozan et al and Pandey et al.

**Course of Splenic Artery**

<b>AUTHOR</b>	<b>SUPRA PANCREATIC</b>	<b>INTRA PANCREATIC</b>	<b>RETRO PANCREATIC</b>
<b>Ssonson – Jaroscewitsch</b>	90%	3%	7%
<b>H.Ozan</b>	98%	2%	-
<b>Present Study</b>	96%	2%	2%

The knowledge about the course of splenic artery is important to surgeons while performing surgeries related to pancreas. It is helpful for interventional radiologists for embolisation of the splenic artery to avoid the risk of pancreatitis<sup>8</sup>.

Arantius (1571) was the first to describe tortuosity of the splenic artery, is the most striking feature of splenic artery<sup>9</sup>.

Tortuosity protects the interior of the spleen from the sudden, strong rush of blood and thus maintains pressure. It allows movement of the spleen and permits distention of the stomach without obstruction to the splenic blood flow, as the artery passes along the stomach bed<sup>4</sup>.

Lipshutz <sup>4</sup>(1917), found that the tortuosity being marked and frequent in 67% of cases. In 33% of cases the tortuosity was found to be slight.

Caramel<sup>4</sup> (1925), found the splenic artery to be notably tortuous in 20% of cases.

**Tortuosity of Splenic Artery**

<b>Author</b>	<b>Highly Coiled</b>	<b>Slightly Coiled (Normal)</b>	<b>With Out Tortuosity</b>
<b>Lipshutz</b>	67%	33%	-
<b>Carmel</b>	20%	80%	-
<b>Present Study</b>	4%	86%	10%

The present study conducted on 50 cadavers showed in 4% of cases the splenic artery was notably tortuous or highly coiled, in 10% cases the artery was straight and in 86% of cases the splenic artery was slightly tortuous.

Tortuosity increases with age. Tortuosity is being maximal in aged individuals (70-90), minimal in young individuals (below 40) and absent in infants and children i.e. Splenic artery runs straight course in infants and children. The splenic artery can withstand a pressure of 41 pounds<sup>4</sup>.

The straight course of splenic artery which was observed in 5 adult cadavers in the current study which were very rare. Such straight course of splenic artery was not reported in literature and I would like to highlight this important findings.

### Embryology:

The anatomical variations of splenic artery are due to unusual embryological development of ventral splanchnic arteries. The coeliac trunk derived from persistent embryonic ventral splanchnic artery. Coeliac trunk intum divides into Left gastric, Common hepatic and Splenic arteries.

Tandler<sup>10</sup> in 1904 suggested, that the ventral longitudinal anastomosis connect the four roots of the ventral splanchnic vessels and the central two vessels disappear. The 1<sup>st</sup> and 4<sup>th</sup> roots remain connected via anastomosis. The CHA, LGA, SA usually originate from the 1<sup>st</sup> root and the SMA from 4<sup>th</sup> root. The ventral longitudinal anastomosis usually separates between these two roots. If this separation occurs at a higher level, any one of the celiac branches can be displaced to the SMA or one of the branches of celiac trunk.

### Conclusion

Vascular anomalies usually asymptomatic; they may become important in patients undergoing diagnostic angiography for gastro-intestinal

bleeding, splenic neoplasm and total pancreatectomy.

A cadaveric study on variations in origin and course of splenic artery was undertaken in the department of Anatomy is humble effort to throw light on already existing knowledge.

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**Conflict of Interest:** Nil.

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