

Study of variations in the origin of superior mesenteric artery

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Abstract

The best way to avoid injury to blood vessels is to know them and to know how, when and where to ligate them properly. Responsibility of teaching arterial variations lies with the anatomist. Anatomical variations of the Superior Mesenteric Artery (SMA) are not infrequent. The Superior Mesenteric Artery supplies the midgut. This is the portion of digestive tract extending from the second part of duodenum at the opening of the bile duct to the junction between the right two third and left one third of the transverse colon. SMA arises from the front of Abdominal Aorta (AA) about 1cm below the Coeliac Trunk (CT). In the present study we observed the source of origin, mode of origin, distance between CT&SMA and mode of termination of SM in 50 adult embalmed cadavers from the Institute of Anatomy, Madras Medical College. We found in all 50 specimens source of SMA was Abdominal Aorta, the SMA arise as a single trunk in all 50 specimens, distance between the Coeliac Trunk and SMA from Abdominal Aorta was found to be ranged from 3mm to 15mm with the mean of 7.72mm and terminates either with inferior division of ileocolic artery or with a branch from trunk of ileocolic artery.


Key Words: superior mesenteric artery.

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INTRODUCTION

Knowledge of the branching pattern of the Abdominal Aorta is clinically important for Surgeons operating on parts of gut and neighbouring structures like the spleen, liver and kidney. The SMA is by far the most important of all arteries to the alimentary tract, as it supplies the whole of the small intestine from the second part of the duodenum to the major portion of transverse colon, and is functionally an end artery. The Coeliac Trunk is a first ventral branch of Abdominal Aorta. The SMA arises as a single trunk from the AA 1cm below the CT. The SMA leaves the front of AA at the level of the L1-L2 vertebral disc and is crossed anteriorly at its origin by the splenic

vein and body of pancreas. It then descends obliquely in the mesentery, near its root to the right iliac fossa, accompanied by the Superior Mesenteric Vein to its right and surrounded by a plexus of nerves. The SMA gives Inferior Pancreaticoduodenal Artery, Middle Colic Artery, Right Colic Artery, Ileocolic Artery, Jejunal and Ileal branches. The present study is mainly aimed at the source of origin of SMA, modes of origin of SMA, distance between CT & SMA, modes of termination of SMA²⁴.

MATERIALS AND METHODS

Fifty adult embalmed human cadavers (31 Female and 19 Male) were selected from the cadavers allotted to the first MBBS and BDS students at the Institute of Anatomy, Madras Medical College Chennai 03.

Conventional Dissection Method

A midline skin incision is made from xiphisternum to pubic symphysis. Skin, superficial fascia and anterior abdominal wall muscles were reflected and the peritoneum was opened. After mobilizing the stomach and liver, the Coeliac Trunk and Superior Mesenteric Artery were identified. The mesentery of small intestine in the infra colic compartment was exposed and the attachment of root of mesentery was traced. Fat from the

mesentery of small intestine was removed; Superior Mesenteric Artery and its branches were exposed⁷.

OBSERVATION

The Superior Mesenteric Artery along with Coeliac Trunk was dissected in fifty cadavers. The dissected cadavers were preserved in formalin and studied by conventional

dissection method. The findings of the dissection were summarized as follows

Source of origin of the Superior Mesenteric Artery

In the present study, the Superior Mesenteric Artery was found to arise from the Abdominal Aorta in all the fifty specimens (PIC-1).



Figure 1



Figure 2

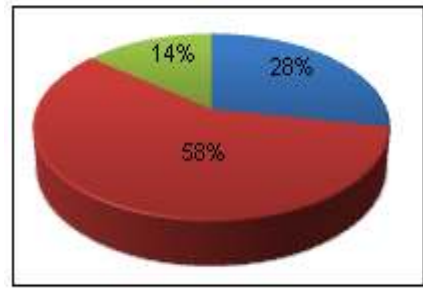


Figure 3



Figure 4

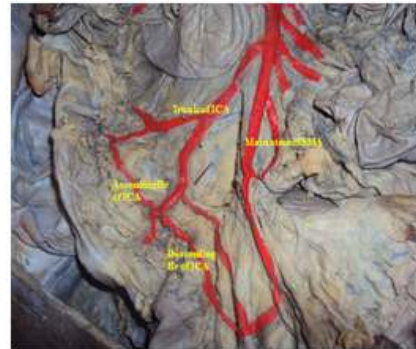


Figure 5

Legend

Figure 1: Source of origin of sma from abdominal aorta; **Figure 2:** Distance between the origin of sma and coeliac trunk; **Figure 3:** Distance between the origin of Coeliac Trunk and Superior Mesenteric Artery; **Figure 4:** The stem of SMA terminates with the inferior division of ICA; **Figure 5:** The stem of sma terminates with the branches from trunk of ica and with descending branch of ica

Modes of origin of the Superior Mesenteric Artery

In the present study, the Superior Mesenteric Artery was found to arise as a single trunk from the abdominal aorta in all 50 adult cadavers. (PIC-1)

Distance between the origin of the Coeliac Trunk and the Superior Mesenteric Artery

In the present study the distance between the origin of Coeliac Trunk and the Superior Mesenteric Artery from

the Abdominal Aorta ranged from 3mm to 15mm in 50 adult cadavers in the present study (PIC-2) (Table No-1) (Chart-1). The distance between the Coeliac Trunk and Superior Mesenteric Artery from the Abdominal Aorta was 3-6mm in 14 (28%) specimens, 7-10mm in 29(58%) specimens, and 11-15mm in 7 (14%) specimens. It was observed that the prevalent distance was 7-10mm in 29(58%) specimens.

Table 1: Distance between the origin of coeliac trunk and superior mesenteric artery

Distance	No. of specimens	Percentage
3-6mm	14	28%
7-10mm	29	58%
11-15mm	7	14%

Modes of termination of Superior Mesenteric Artery

In this present study out of fifty specimens dissected the Superior Mesenteric Artery ends by anastomosing with the inferior branch of Ileo Colic Artery in 42(84%) cases. (PIC-3) The Superior Mesenteric Artery ends by

anastomosing with a branch from the trunk of Ileo Colic Artery in 8(16%) cases. (PIC-4).

DISCUSSION

Source of origin of Superior Mesenteric Artery

In this present study all the fifty cadavers, Superior Mesenteric Arteries arose from the Abdominal Aorta which coincided with Anatomy Textbooks by George A. Piersol (1930)⁹, Romanes. C. J. (1972)⁶, Hamilton. W. J (1977)²⁹, Jhon. V. Basmajian and Charles. E. Slonecker (1989)¹¹, Chummy.S.Sinnatamby (1999)⁵, Moore, Arthur. F. Dalley (1999)¹⁴. Textbook of colon and rectal surgery by Marvin.L.Carman¹⁵ had reported that the SMA arises from the Abdominal Aorta.

Modes of origins of Superior Mesenteric Artery

In the present study the Superior Mesenteric Artery arose as a single trunk from the Abdominal Aorta in all the 50 specimens which coincided with Anatomy Textbooks by Romanes C.J (1972)⁶, Hamilton.W.J (1977)²⁹, Jhon.V. Basmajian and Charles. E. Slonecker (1989)¹¹, Chummy.S.Sinnatamby (1999)⁵.

Distance between Coeliac Trunk and Superior Mesenteric Artery

In the present study, the distance between the site of origin of the Superior Mesenteric Artery and Coeliac Trunk in 50 adult specimens ranged from 3mm to 15 mm. The mean distance was 8.14mm and the SD was 2.96mm. Burnet et al (1993) in his study of 140 specimens stated that the distance between CT and SMA ranged from 1 to 11 mm with a mean of 3.88 mm. George(1934)⁸ in his study of 38 specimens found that the distance between CT and SMA was ranging from 0.5 to 3.1 cm with a mean of 1.6 cm. Anson and Mcvay (1936)³ reported in their study that 71% of the cases the distance between CT and SMA was ranging from 1 to 2 cm with a mean of 1.3 cm. Michel’s (1955)¹⁶ observed in his study of 200 specimens, the distance ranged from 1 to 22 mm. Selma Petrella et al (2007)²¹ reported the distance ranged from 0.102 to 1.80 cm with a mean of 0.73 cm. When compared with the study of the above mentioned authors the distance between CT and SMA of the present study (ranged 0.3 to 1.5 cm with a mean of 0.77 cm) was almost similar to the findings of Selma Petrella²¹, but lower than stated by the George, Anson and Mcvay and higher than stated by Burnet et al. (Table-2)

Table 2: Distance between coeliac trunk and superior mesenteric artery

Authors	Sellma et al	Burnet et al	George	Anson &Mcvay	Present Study
No. of Cadavers Studied	76	140	38	70	50
Range	1.0 - 18 mm	1-11 mm	5 - 31 mm	10 -20 mm	3 -15 mm
Mean	7.3 mm	3.88 mm	16 mm	13 mm	7.7 mm

Modes of termination of Superior Mesenteric Artery

Hollinshead. Henry. W (1966)²⁷ said that the main stem of SMA ends by anastomose with the ileocolic artery. In the **present study** the main stem of SMA anastomosed with the branch from the trunk of ICA in 8 (16%). Susan Standring (2008)²⁴ said that the inferior branch of the ICA anastomose with the end of the SMA. In the **present Study** the main stem of SMA anastomosed with the inferior division of ICA in 42(84%). The relation between the CT and SMA is often mandatory during the radiation therapy of upper GI malignancies and treatment of lymph nodes in that region.

Result

In the present study

- The origin of Superior Mesenteric Artery is from the Abdominal Aorta.
- The Superior Mesenteric Artery arises as a single trunk from the abdominal aorta in all the 50cadavers.
- The distance between the origin of Coeliac Trunk and Superior Mesenteric Artery from the Abdominal Aorta is found to be ranged from 3mm to 15mm with a mean of 7.7mm.

- The Superior Mesenteric Artery was found to terminate with the inferior division of Ileocolic Artery in 84%.
- The Superior Mesenteric Artery was found to terminate with the branch from trunk of Ileocolic Artery in 16%.

The comprehensive study of the pattern of origin, the distance between the origin of Coeliac Trunk and Superior Mesenteric Artery under a common umbrella will prove to be useful to the surgeons while performing surgeries of the gut like oesophagojejunostomies, resection of intestine, liver and pancreatic transplant. This study is also useful to the Radiologists while evaluating radiographs and the Oncologists while giving selective chemotherapy and arterial embolisation.

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