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A Study Of Anatomical Variations In The Origin And The Branching Pattern Of The Superior Mesenteric Artery.

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ABSTRACT

The aim is to study the anatomical variations in the origin of superior mesenteric artery and its branches. Variations in the arteries of abdomen frequently occur in the coeliac, renal and gonadal arteries. Thorough knowledge of normal and variant anatomy of major arteries originating from the abdominal aorta is necessary for successful abdominal surgeries and interventional radiological procedures to avoid complications. The origin of superior mesenteric artery was studied in 30 cadavers and 20 CT angiograms. The specimens were studied by routine dissection which was carried out in the Department of Anatomy Govt. Stanley Medical College, Chennai and CT angiogram pictures obtained from the Department of Radiology, Stanley Medical College after getting consent from the patient. Normal origin of superior mesenteric artery was seen in 30 dissected specimens and in 19 CT angiograms one CT angiogram shows common origin of superior mesenteric artery with coeliac trunk from abdominal aorta. Common coeliaco mesenteric trunk with the coeliac and superior mesenteric artery have a common origin from the aorta is least frequently reported variation in abdominal vascular anomalies. So a through knowledge of variations is important for both surgical approaches and angiographic examination to avoid complications.

Keywords: Superior Mesenteric Artery, Coeliac trunk, Common Coeliaco Mesenteric trunk

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INTRODUCTION

The arterial supply to gastrointestinal tract is derived from anterior midline visceral branches of aorta. There are usually 3 anterior branches, coeliac trunk, superior and inferior mesenteric arteries. The variations in the origins of arteries are very rare. The most common is the joint origin of the upper 2 branches either as a Coeliacomesenteric trunk or a Lienohepaticomesenteric trunk with a separate left gastric artery ⁽¹⁾.

Superior mesenteric artery arises from the abdominal aorta at a level between 1st lumbar and 2nd lumbar vertebrae, 1 cm below the origin of the Celiac trunk. It supplies the second part of the duodenum distal to the major duodenal papilla, the third and fourth part of the duodenum, a portion of the head and frequently an extreme area of the body of the pancreas, the jejunum, ileum and the large intestine up to the junction of right two third and left one third of transverse colon, because it is the artery of midgut. In the adult, inferior pancreaticoduodenal artery is the first branch of superior mesenteric artery, a remnant of the primitive condition, the artery staying on the right side of the primitive unrotated artery. From the concave right side of the artery the middle colic, the right colic and the ileocolic arteries arise. The terminal or ileal branch of ileocolic unites with the terminal end of the superior mesenteric artery. From the convex left side of the artery arise 12-15 jejunal and ileal branches. It has been explained that, in the embryo, the two vessels (coeliac-mesenteric trunk) have a common stem⁽²⁾.

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 embryonic process lead to the range of variations in vascular structures^(3,4).

Coeliac trunk usually arises from the aorta at the level of twelfth thoracic vertebra and after a short course, divides into left gastric common hepatic and splenic arteries. The common hepatic artery, after its origin from the coeliac trunk, runs downwards and to the right until it reaches the first part of duodenum. At the upper border or the first part of duodenum, it divides into hepatic artery proper and gastroduodenal arteries. Usually giving off a right gastric branch before its termination. The hepatic artery proper ascends in the right free margin of lesser omentum lying anterior to the portal vein and on the left side of the bile duct. It divides into right and left hepatic arteries at or near the porta hepatis. Coeliac trunk supplies the liver, stomach, pancreas and superior part of duodenum⁽⁵⁾.

Coeliac trunk initially originates from the dorsal aorta at the seventh cervical level which subsequently migrates caudally to the twelfth thoracic level by differential growth and due to descent of viscera supplied in the abdomen ⁽⁶⁾.

Vascular variations may occur due to persistence of some parts of the longitudinal channels between primitive vessels that normally disappear or due to disappearance of parts that normally persist. Others factors which may contribute to such vascular variations include the rotation of the midgut, physiological herniation, leftward migration of the spleen and haemodynamic changes in the abdominal viscera⁽⁷⁾.

MATERIALS AND METHODS

Superior mesenteric artery was dissected in 30 embalmed cadavers in the Department of Anatomy, Government Stanley Medical College. 20 Superior mesenteric artery pictures of CT angiogram from the Department of Radiology, Stanley Medical College.

Dissection Method

Abdomen was dissected according to the methodology prescribed in the Cunningham's practical manual. The origin of Superior mesenteric artery and its branches were traced, photographs were taken and studied.

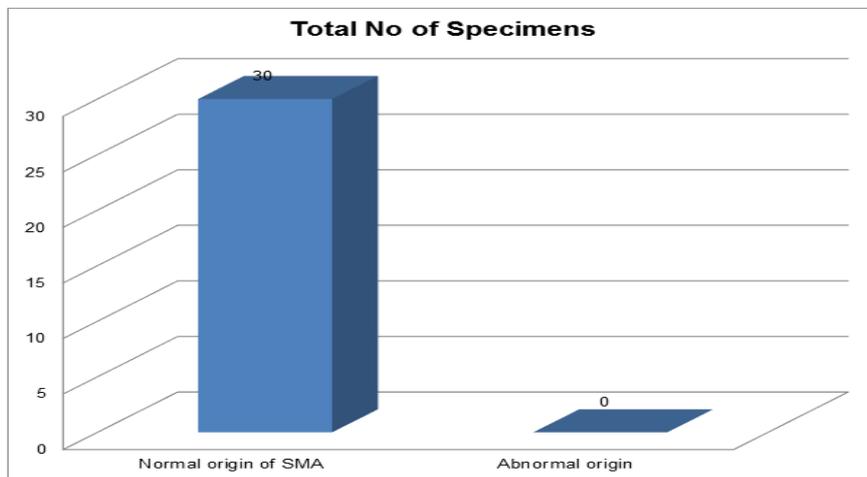
CT Angiogram

The patient positioned in supine position, after giving the test dose of 150ml of omnipaque which is an iodinated contrast is injected at a rate of 3ml per second by pressure injection. The scan was taken.

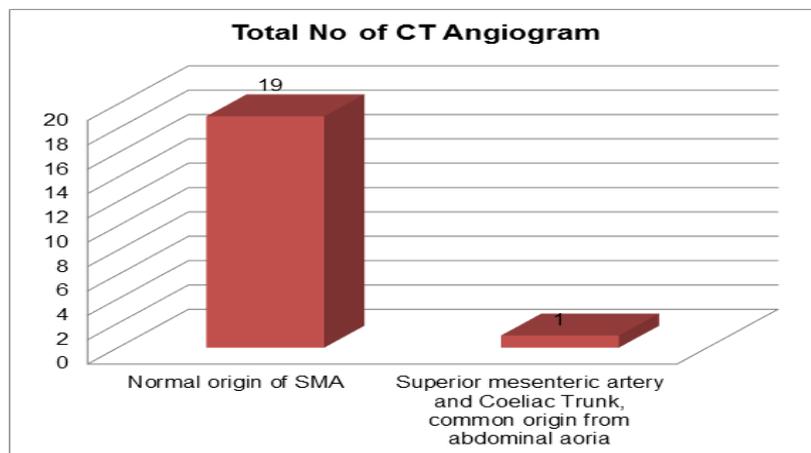
RESULTS

Out of 50 superior mesenteric arteries studied, in 98% of cases, it arises from anterior aspect of the abdominal aorta behind the body of pancreas at the level of first lumbar vertebra. 1 picture(2%) of CT angiogram shows the common origin of coeliac trunk with superior mesenteric artery from the abdominal aorta.

Sl. No.	Origin	Total Specimens
1.	Normal origin of SMA	30
2.	Abnormal origin	Nil

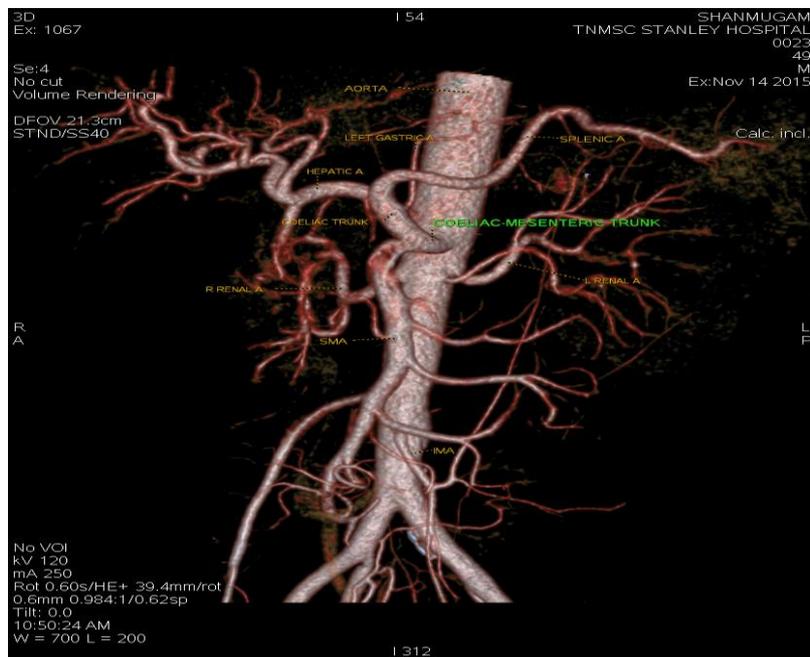


Sl. No.	Origin	Total No of CT Angiogram
1.	Normal origin of SMA	19
2.	Superior mesenteric artery and Coeliac Trunk, common origin from abdominal aorta	1





Superior Mesenteric Artery (CT Angiogram)



Common origin of sup mesenteric artery and coeliac artery (CT Angiogram)

DISCUSSION

Common coeliac-mesenteric trunk was 1.1 cm length present at the level of L1 vertebra. The coeliac axis divided into splenic artery, left gastric artery and common hepatic artery. Apart from its unusual origin, the superior mesenteric artery took its normal course and it gave off inferior pancreaticoduodenal, intestinal,

middle colic, right colic and ileocolic arteries. The further course and distribution of these arteries were found to be normal.

The findings of the present study correlate with most of the previous studies, which were conducted in various parts of India and other parts of the World. ⁽⁸⁾ Sridhar Varna (2009), ⁽⁹⁾ Mahomet Tugrik Wilma et al (2013), ⁽¹⁰⁾ Mange Manama (2013) and ⁽¹¹⁾ Arun S Carmaker (2014) have reported cases of coeliomesenteric trunk. Compression of celiac trunk alone by median arcuate ligament does not produce symptoms earlier because of collaterals between the celiac and superior mesenteric arteries. But in case of CCMT, the compression by median arcuate ligament (Dunbar Syndrome) and lack of collateral circulation leads to ischemia, causing recurrent abdominal pain.

Celiac trunk had a common origin with superior mesenteric artery. The anatomical variations of these vessels are due to developmental changes in the ventral splanchnic arteries.⁽¹²⁾

⁽¹³⁾ Adachi and ⁽¹⁴⁾ Michele have classified the Coeliac trunk into 6 different types. Type 1: Normal branching pattern of coeliac trunk. Type 2: Hepatosplenic trunk and left gastric artery from abdominal aorta. Type 3: Hepato splenomesenteric trunk and left gastric artery from abdominal aorta. Type 4: Hepatogastric trunk and splenic artery from superior mesenteric artery. Type 5: Splenogastric. Type 6: Coeliaco mesenteric trunk.

Splanchnic arteries arise in the 4th week of fetal development, coexisting with paired ventral segmental arteries from the 2 dorsal aorta.

Ailawadi mentioned variation in coeliac and mesenteric arteries are supposed to result from variation in the involution from the 10th to 12th ventral segmental arteries, resulting in the persistence of the 13th ventral segmental artery and the common origin of both the celiac and superior mesenteric arteries.⁽¹⁵⁾

Von holer reported that the celiac trunk may arise from superior mesenteric artery.⁽¹⁶⁾

Coeliacomesenteric trunk was reports by Munger and Mangaushi(1941)⁽¹⁷⁾

Miches 1955 in his study of 200 dissection described the occurrence to be 1%.⁽¹⁸⁾

Dr.Kalavathi carries out a detailed study in 75 cases(1980) and she observed that the superior mesenteric artery with celiac artery arising as a common trunk in 3.3% of cases⁽¹⁹⁾,

Dr.Anbusudar (2013) reported the celiac trunk and the superior mesenteric artery arose together as a common coelicaomesenteric trunk from the abdominal aorta at the level of L1 vertebra in 1 cadaver.⁽²⁰⁾

Dr.Chitra observed out of 55 cadavers dissected, in 1 cadaver, celiac trunk and the superior mesenteric arteries had a common origin from the abdominal aorta 2cm below the aortic hiatus⁽²¹⁾

CONCLUSION

A through knowledge of variations in origin and branching pattern of superior mesenteric artery are helpful for correct interpretation of any invasive procedures, resection of colon for carcinoma, resection of small & large intestine, embolectomy and radiological interventional procedures, vascular surgeries. Knowledge about the variations of vessels help the surgeons to take precautions against the bleeding vessels in operating field. superior mesenteric artery embolism is a common clinical problem in common coelico mesenteric trunk. Approximately 4% of all arterial emboli lodge in the SMA⁽²²⁾. The cause may be varied such as atrial fibrillation, mitral stenosis, myocardial infarction, atheromatosis and aneurysm. Anatomical variations in the branching pattern of the coelico trunk with superior mesenteric artery are of considerable importance in liver transplantation, laparoscopic surgery in penetrating injuries of the abdomen. Common coelico mesenteric trunk should be kept in mind as a differential diagnosis for cases of recurrent non-specific abdominal pain, as it is associated with the risk of mesenteric ischaemia due to the lack of SMA-coeliac axis collaterals.

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