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# COMPUTED TOMOGRAPHIC ANGIOGRAPHY STUDY OF VARIATIONS OF THE CELIAC TRUNK

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**Abstract**

**Background:** The celiac trunk, approximately 1.25 cm in length, is the primary branch originating from the abdominal aorta. In humans, it arises from the aorta at thoracic vertebra 12 (T12). The celiac artery is the initial significant branch derived from the descending abdominal aorta, branching at a 90° angle, just below the diaphragm's crus, approximately at the level of the first lumbar vertebra.
The celiac artery has three main divisions, each with its own named branches. It supplies oxygenated blood to the liver, stomach, abdominal esophagus, spleen, and the superior half of both the duodenum and the pancreas.

**Material and Method :** The study was performed on 100 CT Scan images, 50 males and 50 females with the help of Radiant Dicom viewer software.

**Observation and result:-**We observed that the most common landmark for the origin of the celiac trunk is at the T12 level, some artery direct origin from aorta such as 5 subjects showing origin of left gastric artery, 2 subjects shows splenic artery, 3, some celiac trunk branches arise from the superior mesenteric artery, the left gastric artery in 1 case, a splenic artery in 4, and a common hepatic artery in 8,

**Conclusion:** Proficiency in vessel ligation and anastomosis plays a critical role in surgical procedures such as liver transplantation. A comprehensive understanding of the various vascular patterns of coeliac trunk branches is essential to minimize complications associated with abdominal surgery, including bleeding and necrosis.

**Keywords:-**coeliac trunk, coeliac trunk anomalies, variations, vascular anatomy.

## Introduction

The celiac trunk, approximately 1.25 cm in length, is the primary branch originating from the abdominal aorta. In humans, it arises from the aorta at thoracic vertebra 12 (T12).The celiac artery is the initial significant branch derived from the descending abdominal aorta, branching at a 90° angle, just below the diaphragm's crus, approximately at the level of the first lumbar vertebra.[1]
The celiac artery has three main divisions, each with its own named branches. It supplies oxygenated blood to the liver, stomach, abdominal esophagus, spleen, and the superior half of both the duodenum and the pancreas. These structures correspond to the embryonic foregut.[2]

The celiac artery is crucial for providing blood to the structures it supplies. It cannot be safely cut off from the blood supply in a living person because the other major arteries in the gut cannot compensate for its loss, leading to necrosis of the affected structures.[3]

Celiac artery compression syndrome, also known as celiac axis syndrome, celiac trunk compression syndrome, or Dunbar syndrome, is an uncommon condition characterized by abdominal pain caused by compression of the celiac artery and celiac ganglia by the median arcuate ligament. The pain may be meal-related, accompanied by weight loss, and associated with an abdominal bruit discernible by a clinician.[4]

The diagnosis of median arcuate ligament syndrome (MALS) relies on excluding other conditions, as it's common for even healthy individuals to have some level of compression in the celiac artery without experiencing any symptoms. Therefore, a diagnosis of MALS is typically considered only after ruling out more common conditions. When MALS is suspected, screening can be conducted using ultrasonography and confirmation can be obtained through computed tomography (CT) or magnetic resonance (MR) angiography.[5]

## MATERIALS AND METHODS

Our study was performed on 100 CT Scans images in which 50 males and 50 females were taken .CT scan images were procured from the Department of Radiology, Rama Medical College, Hospital & Research Centre, Kanpur Whole study was performed with the help of Radiant Dicom viewer software.

### Inclusion criteria

**No abdominal** surgery.
No history of abdominal aorta variation.

### Exclusion criteria

Past history of abdominal surgery.
With a history of abdominal aorta variation.

### Radiological interpretation

CT Angiography was performed on 64-slice multidetector spiral CT scanner (BRILLIANCE CT, Philips medical system, Nederland, B.V.5684 PC Best, The Nederlands). This machine is installed in 64-slice CT scan centre of Department of Radiodiagnosis, CT Angiography of all patients was done after overnight fasting. Before angiography the patients were trained for breath holding which was required during examination.

### Procedure

Optimum patient preparation, positioning and injection of contrast were taken care of. A single unenhanced low-dose scan was first obtained. After that an automatic power injector (Medrad, USA) and 18-20 gauge intravascular cannula in the antecubital vein was used to administer a 80-100ml bolus of 350mg/ml non-ionic contrast medium (Omnipaque, GE Healthcare, Cork, Ireland) at the rate of 5.5 ml/sec. Bolus tracking programme was used to determine the starting time for arterial phase scanning. A region of interest was drawn on the aorta at the level of the diaphragm and the trigger level was set. After an appropriate delay to allow passage of the contrast agent into the renal arterial circulation, a series of thin cuts were obtained throughout the aorta. Rapid acquisition of data afforded by spiral CT allows multiple images to be made precisely at the moment when the contrast medium passes through the renal vessels.

**Result**

**In our study, we observed that the most common landmark for the origin of the celiac trunk is at the T12 level, as shown in Table 1.**

**Table1: Origin of the celiac trunk at different vertebral levels**

| SN | Level of Origin | Overall (n=100) | Gender | |
|---|---|---|---|---|
| | | | Male (n=50) | Female (n=50) |
| | | No. | No. | No. |
| 1 | T11 | 14 | 5 | 9 |
| 2 | T11-T12 | 5 | 1 | 4 |
| 3 | T12 | 66 | 36 | 30 |
| 4 | T12-L1 | 5 | 3 | 2 |
| 5 | L1 | 10 | 5 | 5 |

**Our current study observed a mean diameter of 7.68 mm and 6.48 mm in males and females, as shown in Table 2.**

**Table No. 2 Shows the mean diameter of the celiac truck**

| SN | Variable | n | Mean (mm) | SD | Min | Max | Significance of difference ("p" value) |
|---|---|---|---|---|---|---|---|
| 1. | Male | 50 | 7.68 | 1.68 | 4.8 | 10.6 | 0.540 |
| 2. | Female | 50 | 6.48 | 1.44 | 3.9 | 9.9 | |

**In our study we found some artery direct origin from aorta such as 5 subject showing origin of left gastric artery, 2 subjects shows splenic artery, 3 show origin of common hepatic artery as show in table no. 3**

**Table No. 3 Showing origin of the artery directly from abdominal aorta**

| S. No | From aorta | Number of Subjects | Percentage |
|---|---|---|---|
| 1 | left gastric artery | 5 | 5% |
| 2 | splenic artery | 2 | 2% |
| 3 | common hepatic artery | 3 | 3% |

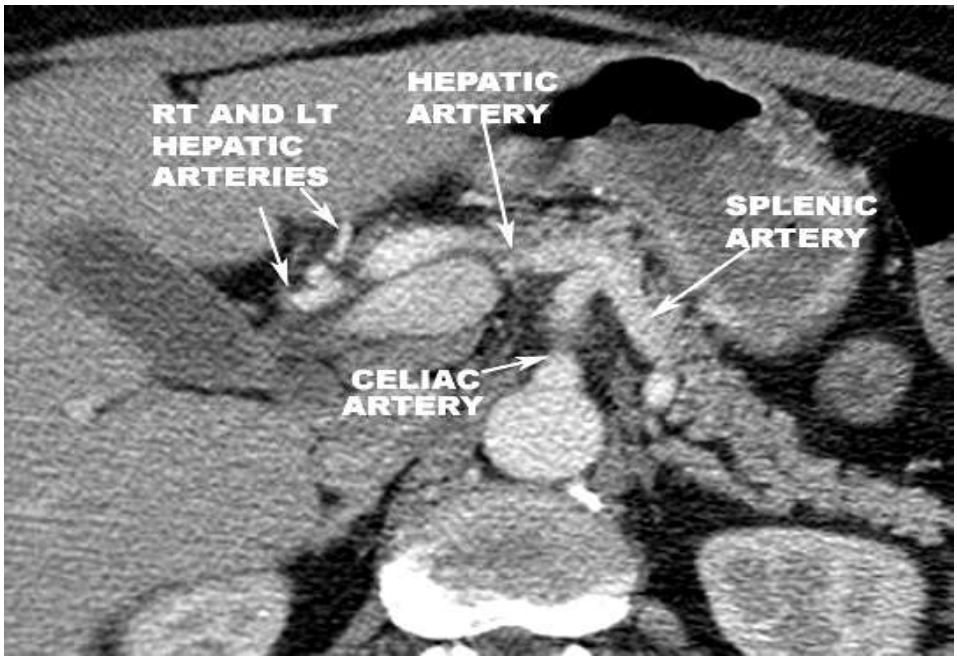


**Fig No. 1 Shows a CT scan image of the celiac artery**

Our study found that some celiac trunk branches arise from the superior mesenteric artery, the left gastric artery in 1 case, a splenic artery in 4, and a common hepatic artery in 8.As shown in table number 4

**Table No. 4 Shows the origin of the Superior Mesenteric artery**

| S. No | From the Superior Mesenteric artery | Number of Subjects | Percentage |
|---|---|---|---|
| 1 | left gastric artery | 1 | 1% |
| 2 | splenic artery | 4 | 4% |
| 3 | common hepatic artery | 8 | 8% |

## Discussion

In our study, we observed that the most common landmark for the origin of the celiac trunk is at the T-12 level while comparing our study of David F. Pinal-Garcia[6], observed that the most common celiac trunk originated at the level of T 12 which is shows in 90% of subjects, another study of A Juszczak[7] also, observed that the most common celiac trunk originated at the level of T 12 which is shown in 90% of subjects which was similar with our finding. In our study, we found some arteries with direct origin from the aorta, such as five subjects showing the origin of the left gastric artery, two subjects showing splenic artery, three show the origin of the common hepatic artery while comparing our data with Ivelise Regina Canito Brasil[8] observed that celiac trunk branches arising from the superior mesenteric artery, the left gastric artery in 1 case, a splenic artery in 4, and a common hepatic artery in 8 while comparing our study with identified four types of variations of the celiac trunk. A normal anatomical pattern was seen in 82 patients regarding the hepatic artery. Another finding of Angelos Gkaragkounis[9]A single arterial variation was found in 22.89% of the cases and multiple arterial variations were found in 4.21% of the cases. We examined first the aorta for supernumerary branches and then checked the fissure between right and left liver lobe, following porta hepatis, and finally the CTr and superior mesenteric artery. Hepatic arteries and CTr variations are relatively common (27.11%) and should be identified by the radiologists when studying CTs as their recognition provides better surgical planning, preventing iatrogenic complications. Imaging in coronal plane was helpful for end branches, same study of David F. Pinal-Garcia[10]The celiac trunk derived in a common hepatic artery, a left gastric artery and a splenic artery (type I) in 43.6% of dissections. A true tripod was found in 7.1% and a false tripod in 36.4%. Celiac trunk bifurcation (type II) was found in 7.1%. Additional branches (type III) were observed in 47.9%. One or both phrenic arteries originated from the celiac trunk in 41.4% of dissections. Celiac trunk tetrafurcation was observed in 12.9%, pentafurcation in 12.9%, hexafurcation in 1.4%, and heptafurcation in 0.7%. The mean diameter of the celiac trunk ranged from 6 to 12 mm, Prakash[11] the left gastric, common hepatic and splenic arteries were found to arise from the coeliac trunk in 86% of cadavers. In 76% of cadavers, the origin of the gastric artery was proximal to the bifurcation of the coeliac trunk into the common hepatic and splenic arteries. In one case, all three branches arose directly from the abdominal aorta, and the origin of the splenic artery was 1 cm distal to the origin of the left gastric and common hepatic arteries. In another case, the common hepatic and left gastric arteries arose from the coeliac trunk, and the origin of the splenic artery was 1.5 cm distal to the abdominal aorta similar with our finding.

## Conclusion

The proficiency in vessel ligation and anastomosis plays a critical role in surgical procedures such as liver transplantation. A comprehensive understanding of the various vascular patterns of coeliac trunk branches is essential to minimize complications associated with abdominal surgery, including bleeding and necrosis. Additionally, this knowledge facilitates improved and precise radiological interpretations. Consequently, there is a pressing need for studies aimed at reducing the complexities of abdominal surgery.

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