

# Anatomical Variation of Celiac Axis Artery in Karaikal Population: MDCT Angiographic Findings

SIDDARTH RAGUPATHI<sup>1</sup>, KANISHKA SUNIL PATIL<sup>2</sup>

## ABSTRACT

**Introduction:** The first branch of the abdominal aorta, the celiac axis is the main arterial supply to the foregut structures. Anatomical variations in such important arteries are very important for the surgeons and interventional radiologists. Conventional angiography has been replaced nowadays by the CT angiography to guide the surgeons and prevent complications such as injury to these arterial branches.

**Aim:** To find the prevalence of variations in the anatomy of the celiac trunk in the population of Karaikal, Pondicherry using Multidetector CT (MDCT).

**Materials and Methods:** A prospective study was conducted in which total of 300 consecutive patients from 20-60 years of age referred for a contrast enhanced CT study of the abdomen were included in the study. The arterial phase sequence is used for the evaluation of the celiac trunk and its branching pattern. The images were reported by two separate radiologists who were blinded to the report of the other. Kappa correlation test was used to analyse the data obtained.

**Results:** The classic celiac axis anatomy was noted in 222 (74%) patients. The most common variant identified was the origin of left hepatic artery from left gastric artery which was seen in 26 patients. The second most common variant which is the direct origin of left gastric artery from abdominal aorta was seen in 20 patients. Other variants identified were Accessory splenic artery from the left gastric artery, Common trunk of celiac artery and superior mesenteric artery, Left hepatic artery originating from the celiac artery and the left gastric artery from the splenic artery and direct origin of left hepatic artery off the celiac axis. A rare variant of left gastric artery from the splenic artery was identified in one patient. The agreement between the two radiologists who separately reported the images was found to be 0.84.

**Conclusion:** Out of the 300 patients, 78 patients (26%) had variant anatomy of the celiac axis which is one-fourth of the total number of patients in the study. Most common variant identified is the origin of left hepatic artery from left gastric artery in 26 patients while direct origin of left gastric artery from abdominal aorta being the second commonest variant identified in this study in 20 out of the 78 patients with variant anatomy.

**Keywords:** Celiac trunk, Gastric artery, Hepatic artery, Splenic artery

## INTRODUCTION

Celiac axis is the first branch of the abdominal aorta and arterial supply for the entire foregut. Coeliac trunk anatomical variation has significant importance in liver transplants, hepatobiliary manipulations, laparoscopic abdominal surgery, radiological abdominal interventions and penetrating injuries to the abdomen [1].

Conventional angiography was used in the past to evaluate the arterial anatomy. With the advent of Computed Tomography (CT), invasive angiography is no longer the sole method for evaluation of arterial pathologic conditions [2]. CT angiography is now preferred because of its speed, high spatial resolution, and ability to depict associated extra-arterial structures. Moreover, the complex anatomy can be evaluated in detail with 3-dimensional reconstruction giving a better view of the abdominal vasculature for both diagnostic and interventional radiologists and surgeons [3]. An exhaustive acquaintance of variation of celiac trunk is important for proper preoperative diagnosis and arrangement of surgical and radiological interventions. Therefore, this study was done with an aim to find out the prevalence of variations in the anatomy of the celiac trunk in the population of Karaikal, Pondicherry using multidetector CT.

## MATERIALS AND METHODS

This prospective study was conducted in Vinayaka Mission Medical College, Karaikal from January 2018 to July 2018 after obtaining approval from the Institutional Ethical Committee. A total of 300 consecutive patients from 20-60 years of age without previous history of abdominal surgery who were referred for a contrast

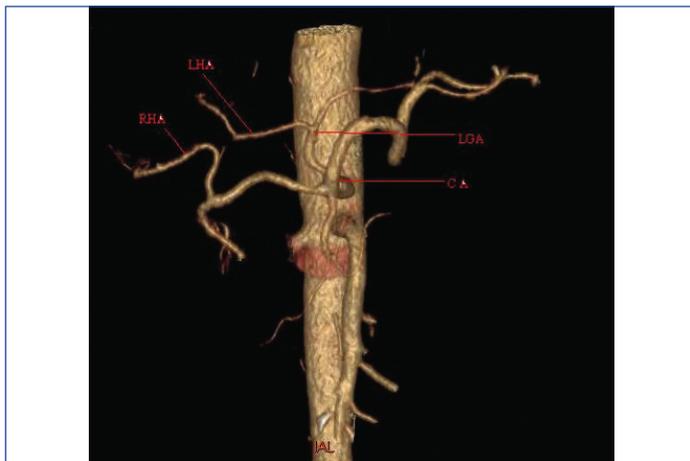
enhanced CT study of the abdomen for indications such as abdominal pain, abdominal fullness were randomly selected and included in the study. Those patients with suspected chronic liver disease, upper abdominal mass lesions were excluded from the study. All CT examinations were performed using a 16-slice MDCT scanner (Medical Health Care GE Work Station RDW 4.3, GE, USA). Technical features of MDCT were as follows: 16 mm × 1 mm collimation, minimum slice thickness of 0.625, gantry rotation time of 320 ms, kV of 120 and mAs of 320. A bolus of 80-100 mL of non-ionic iodinated contrast agent (ultravist-300) followed by 50-60 mL of normal saline was injected by means of an 18-gauge intravenous catheter through an antecubital vein or a vein in the forearm at a flow rate of 4-6 mL/secods. The arterial phase sequence was used for the evaluation of the celiac trunk anatomy and its variants using both the axial images as well as the multiplanar reformation, maximum intensity projection and volume rendering images using the Uflacker classification of celiac axis variants [4]. The images were analysed independently by two separate experienced radiologists. Kappa statistics test was used to analyse the data obtained.

## RESULTS

A total of 300 patients underwent contrast enhanced CT of the abdomen out of whom 144 (48%) were women. The age range was between 20 and 60 years.

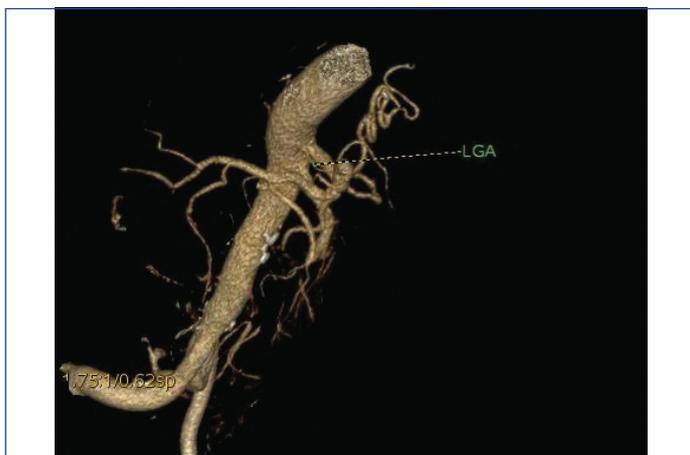
It was observed that 222 (74%) of the patients had classical arterial anatomy in whom celiac artery divided into common hepatic, left gastric and splenic arteries. Out of the 78 (26%) patients who had anatomical variants, 24 patients (30%) were women. The most

frequent variation was left hepatic artery originating from left gastric artery seen in 26 patients [Table/Fig-1]. The second most common variation was left gastric artery directly originating from the abdominal aorta seen in 20 patients [Table/Fig-2,3]. Accessory splenic artery was seen to arise from the left gastric artery in 12 patients [Table/Fig-4]. Common trunk of celiac artery and superior mesenteric artery was seen in 9 patients [Table/Fig-5]. The right hepatic artery was found to be originating directly off the superior mesenteric artery in five patients [Table/Fig-6]. In 5 patients, left hepatic artery arose from the celiac artery [Table/Fig-7]. One of the patients had a rare variant in which left gastric artery was seen to arise from the splenic artery [Table/Fig-7]. The agreement between the two radiologists who separately reported the images was found to be 0.84.

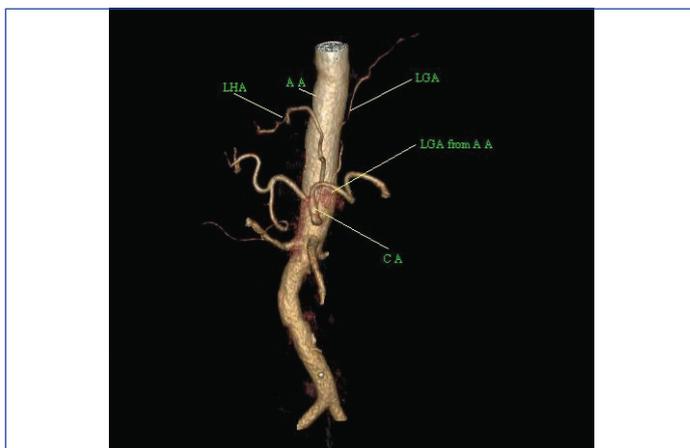


**[Table/Fig-1]:** Shows the origin of Left Hepatic Artery (LHA) from Left Gastric Artery (LGA).

RHA: Right Hepatic Artery; CA: Celiac Axis



**[Table/Fig-2]:** Shows the Left Gastric Artery (LGA) originating directly from the abdominal aorta.

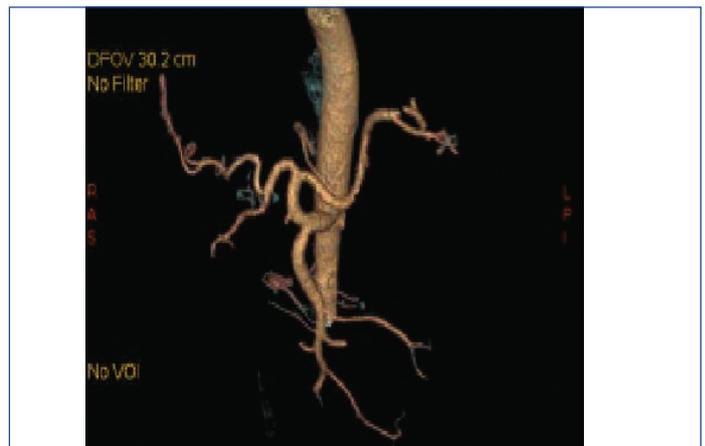


**[Table/Fig-3]:** Shows the origin of Left Gastric Artery (LGA) from the Abdominal Aorta directly (AA) and also the Left Hepatic Artery (LHA) originating directly from the Celiac Axis (CA).

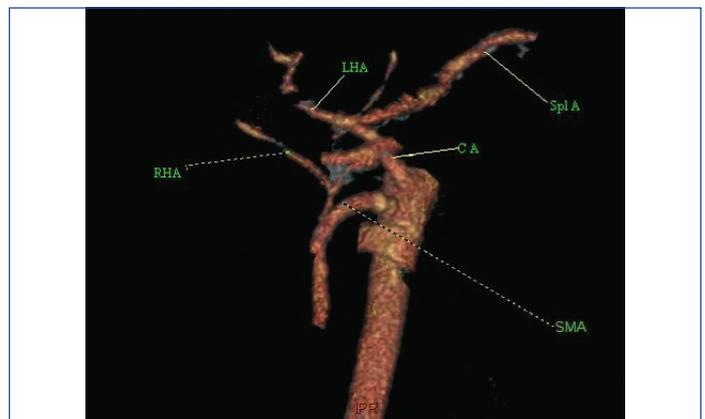


**[Table/Fig-4]:** Shows the presence of accessory splenic artery (Acc Spl A) from the Left Gastric Artery (LGA).

Spl A: Splenic Artery; CA: Celiac Axis

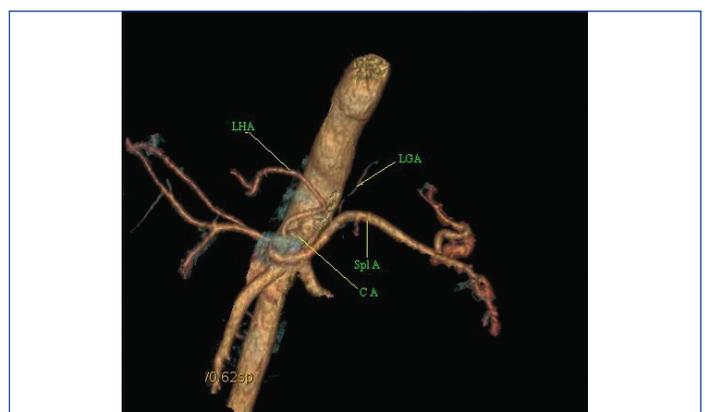


**[Table/Fig-5]:** Shows the presence of a common trunk for both Celiac Axis (CA) and the Superior Mesenteric Artery (SMA).



**[Table/Fig-6]:** Shows the abnormal origin of Right Hepatic Artery (RHA) from Superior Mesenteric Artery (SMA).

CA: Celiac Axis; Spl A: Splenic Artery; LHA: Left Hepatic Artery



**[Table/Fig-7]:** Shows the abnormal origins of Left Hepatic Artery (LHA) from Celiac Artery (CA) and Left Gastric Artery (LGA) from Splenic Artery (Spl A).

## DISCUSSION

The prevalence of anatomical variants in celiac axis had been determined by several studies which were done all over the world. The Uflacker's and Michel's classifications of celiac trunk and hepatic artery variants were used in the study done by Ahmed M. Osman MD et al., which showed the classic celiac trunk trifurcation pattern (Uflacker type I) in about 90.5% of the patients with the commonest variant being the gastro-splenic trunk (Uflacker type V) with 4.3% incidence and the bifurcation pattern representing 7.7% of cases [5]. Studies by Mburu KS et al., and Lipschutz B found that Uflacker type II was the commonest celiac trunk variants while type V being the second commonest [6,7]. In the present study, 74% of the patients showed the normal trifurcation pattern. Anatomical variations involving celiac trunk were common and usually asymptomatic [8]. Many authors had classified the celiac trunk according to its branching pattern. In 1917, Lipschutz B was the first to classify the celiac trunk in four types: Normal trifurcation; Hepatosplenic trunk; Hepatogastric trunk; Gastrosplenic trunk. Apart from the normal trifurcation, the other variants were not seen in the present study population.

Later two more variants such as the Celiacomesenteric and hepatomesenteric trunk were added by Adachi in 1928 in this classification, thus classifying the celiac trunk in six types [9,10]. The celiacomesenteric trunk variant anatomy was seen in nine of the present patients.

A cadaveric study by Sankar KD et al., showed a variant of the hepato-gastric trunk getting divided into LGA and ALHA and the large hepato-splenic trunk into SA and CHA. The study also found out variants such as hepato-gastric trunk, which consists of the common origin of LGA with the ALHA and origin of left gastric artery directly from abdominal aorta, which were not found in the any of the classification mentioned in literature in contrast to the study by Hiatt JR et al., and Michel's (1966) classification [11-13]. No such variants were seen in the present study population.

## LIMITATION

Many other anatomical variants which were mentioned in the literature could be found out, if the sample size would have been

increased, still more in addition to those identified in this study and also any new variant which were not yet identified.

## CONCLUSION

There is a wide variation in the anatomy of the celiac axis. Hence, knowledge of the vascular patterns of the celiac axis in the local population becomes fundamental in surgical management of patients undergoing upper abdominal surgeries. It is imperative for surgeons and interventional radiologists to perform CT angiography prior to the procedure in order to prevent vascular complications.

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FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Aug 25, 2018**

Date of Peer Review: **Oct 20, 2018**

Date of Acceptance: **Nov 12, 2018**

Date of Publishing: **Jan 01, 2019**