

Anatomical Variations of Celiac Trunk Anatomy and their Clinical Importance

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Abstract: Purpose of this study was to identify and evaluate the spectrum and prevalence of celiac axis (CA) variations and its branches. To study accurately the celiac trunk (CT) morphometry: its diameter, length, distance from superior mesenteric artery (SMA) and its topography, as well as the diameter of SMA. Evaluation of the importance of these findings in patients' (pts) management. **Methods and Materials:** This prospective-single-center-study included: 133 consecutive pts referred to our clinic for abdominal-CT-scans over a 9-month period. They underwent MDCT and MDCT angiography with 120 ml i/v contrast medium at an injection speed of 3.5 and 4ml/s, with 3D-reconstructions. **Results:** In our series, we identified normal trifurcation of CT (type-1-Michels) – 84 pts(64%); type-2-Michels-3%; type -3-Mischel-1.3%;type 5-Mischel-1%;type6-Mischel-2%,the other anatomical variations of the celiac trunk no included in Michel's classification where found in 39 of patients (29% of cases). Regarding topography, CT origin was found opposite T12-L1 junction (37%), opposite T12 (31.9%) or L1 vertebra (31.1%). The length range of CT was: 1.17 to 4,5cm, its diameter: 0.4 to 1.13cm; its distance from SMA: 0.4 to 2.15cm; while the diameter ranges of SMA: 0.51 to 1.05cm. **Conclusion:** Our findings were similar to a certain range to previous studies. Recognition of CA variants requires a detailed description, and as previously noted a hypothetical anatomic model for summarizing the observed CA anatomical variations is needed. Recognition in detail of variations of CA anatomy and its morphometry is important in the accurate interpretation of disease, in diagnostic imaging, while it is indispensable in preventing complications during surgery/interventional radiology procedure.

Keywords: celiac trunk, morphometry, CA anatomical variations

1. Introduction

The celiac trunk is the first anterior branch of abdominal aorta and is the most important artery of the foregut. It arises from abdominal aorta at the level of T12–L1 vertebrae [1]. After a short horizontal trajectory forwards it divides into left gastric artery, common hepatic artery and splenic artery [2] (Figure 1). The celiac trunk also known as hepatolienogastric trunk or "Tripus Hallery" was first described by Haller in 1756 [3]. This trifurcation was considered as the normal appearance of the celiac trunk. Anatomical variation of the celiac trunk is due to the persistence or abnormal development of the ventral splanchnic arteries. According to the branching pattern of celiac trunk many variations have been reported [4]-[5]. These anatomical variations are common and usually asymptomatic. Awareness of the celiac trunk anatomic variations becomes specifically important in patients undergoing interventional radiology procedures or prior to an operative procedure [6].

2. Materials and Methods

This prospective single center study included 133 consecutive patients referred to our clinic for abdominal CT-scan during a 2-yers period. They underwent MDCT and MDCT angiography with 120ml/i/v contrast medium at an injection speed of 3.5and 4 ml/s with 3D-reconstrations.

3. Results

In our study, the trifurcation of the celiac trunk "Tripus Hallery" was observed in 84 patients (63.1%). Anatomical variation of the celiac trunk where found in 39 of patients (36% of cases). In four patients (3%) the celiac trunk gave

rise to the common hepatic and splenic artery-the hepatosplenic trunk (Type II –according to Mischel classification) and the left gastric artery had direct origin from the aorta. The hepatosplenomesenteric trunk (Type III-according to Mischel classification where the common hepatic artery, splenic artery and superior mesenteric artery where noted to have a common origin and the left gastric artery had direct anatomic origin from the aorta) was found in only one patient (0.75%).

In two patients (1.5%) it was found that the celiac trunk was the origin of the splenic and left gastric artery (splenogastric trunk) whiles the common hepatic artery derived as a separate branch from the aorta.

In three patients (2.2%) the celiac trunk had a common origin with the superior mesenteric artery and formed the celiacomesenteric trunk (type VI-according to Mischel classification-Figure 2).

Quadrifurcation of celiac trunk was found in 7 patients (5.2%) (figure 3). In these patients the fourth branch of the celiac trunk was: the pancreatic-duodenal artery (3pts); right inferior phrenic artery (1pts); middle colic artery (1pts); accessory pancreatic artery (1pts). Whereas in a case the celiac trunk divided into: middle colic artery, left hepatic artery, splenic artery and the accessory pancreatic artery. The left gastric artery of this patient had direct origin from the aorta while the right hepatic artery has a common origin with superior mesenteric artery.

In eight other patients (6%) the right hepatic artery was found to have a common anatomic origin with superior mesenteric artery. Another anatomic variation found in 11

patients (8.2%) was the left hepatic artery having a common origin with left gastric artery.

Accessory left hepatic artery having a common origin with left gastric artery where found in three patients (2.2%).

Coexistence of the collaterals between celiac trunk and superior mesenteric artery was found in one patient (0.75%).

Regarding topography, the celiac trunk origin was found opposite to T12-L1 junction in 37% of patients; opposite to T12 in 31% and opposite to L1 vertebra in 31.1% of patients. The length range of celiac trunk varied between 1.17 to 4.5cm; its diameter range was estimated to be between 0.4 to 1.13cm; its distance from the superior mesenteric artery 0.4 to 2.15cm while the diameter range of superior mesenteric artery varied from 0.51 to 1.05 cm.

Anomaly during embryological development of the vitelline arteries (fusion or malfusion) may be responsible for the variations of the celiac trunk.

Anatomical variations involving celiac trunk are common and usually asymptomatic [7]. The celiac trunk has been classified by many authors according to its branching pattern. Lipchutz was first in 1917 who classified the celiac trunk in four types: 1-Normal trifurcation; 2-Hepatosplenic trunk; 3-Hepato gastric trunk; 4-Gastrosplenic trunk [8].

Later Adachi in 1928 added two more variants in this classification: the Celiacomesenteric and hepatomesenteric trunk classifying in this way the celiac trunk in six types [9]. In 1951 Michel's classified the celiac trunk in six different types: 1-Normal trifurcation; 2-Hepatosplenic trunk; 3-Hepatospleno mesenteric trunk; 4-Hepato gastric trunk; 5-Splenogastric trunk; 6-Celiacomesenteric trunk [10]. Uflacker in 1997 added two more variants to the previously reported classification types by Michels and Adachi [11]. He added the celiacocolic trunk and the absence of the celiac trunk classifying it in eight different types.

In our study we have analyzed 133 patients. Female were 43.6% and male 56.4%. According to Mischels's classification in our study type 1 was found in 64% of patients; type 2 was found in 3% of patients; type 3 was found in 1.3%; type 5 was in 1.% and type 6 was found in 2% of patients. The other anatomical variations of the celiac trunk no included in Michel's classification where found in 39 of patients (29% of cases) (table 1).

Knowledge of the anatomical variations of the celiac trunk is of extreme clinical importance during surgery/interventional radiology procedures. Recognition in detail of arterial dimension and branch anomaly of celiac trunk are mandatory before liver surgery including liver transplantation, tumor resection or chemoembolisation of liver malignancy. During abdominal surgery such open or laparoscopic gastrectomy (where gastric vessels are legated and divided) or splenectomy (where splenic and short gastric artery should be legated-previous knowledge of these arterial variation are indispensable to avoid catastrophic complications due to ligation or division of the wrong vessel which may lead to ischemia or bleeding of the respective

organ, so detailed informations for celiac trunk anomaly become important. Also, information about right hepatic artery is of great value in pancreatic surgery for malignancies of head/uncinate process and preservation of this artery is important to prevent liver necrosis.

4. Conclusion

Our findings were similar to a certain range to previous studies published [12]. Recognition in detail of variations of celiac trunk anatomy and its morphometry is important in the accurate interpretation of disease, in diagnostic imaging, while it is indispensable to avoid complications during surgery/interventional radiology procedures.

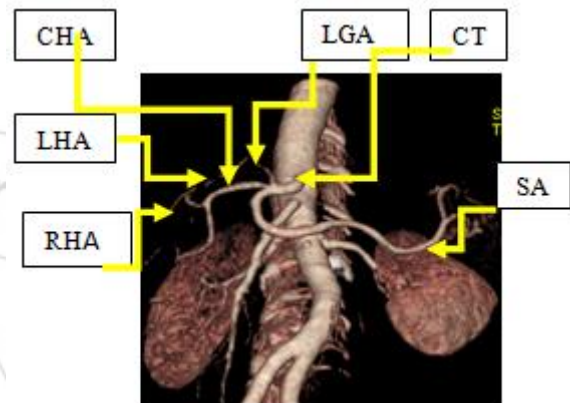


Figure 1: Normal appearance of the celiac trunk. CT-ceeliac trunk; SA-splenic artery; LGA-left gastric artery; CHA-common hepatic artery; RHA-right hepatic artery; LHA-left hepatic artery

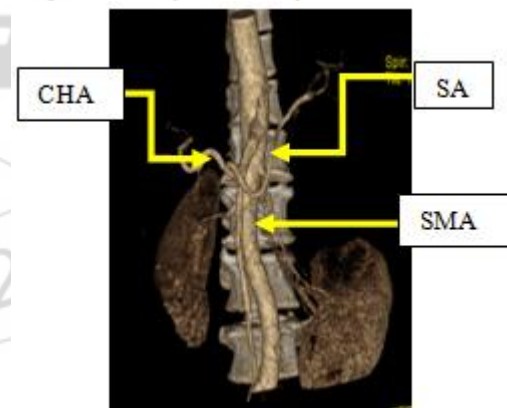


Figure 2: The celiac mesenteric trunk; SA-splenic artery; CHA-common hepatic artery; SMA-superior mesenteric artery

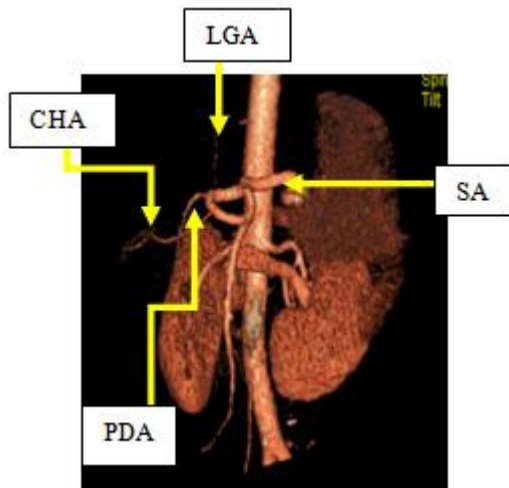
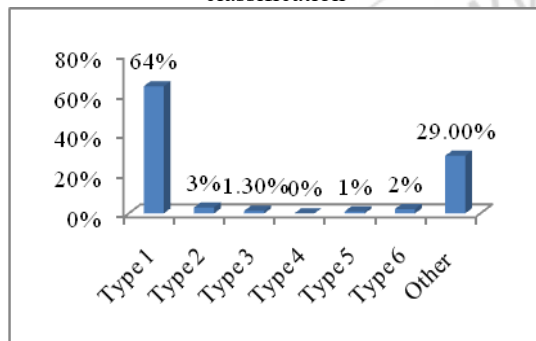


Figure 3: Quadrifurcation of the celiac trunk. SA-splenic artery; CHA-common hepatic artery; LGA-left gastric artery; PDA-pancreatico-duodenal artery

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Table 1: Type of variation according to Mischels's classification



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