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ANATOMIC VARIATIONS

Celiacomesenteric trunk: a short report

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Abstract The authors describe the case of a 44-year-old male with chronic liver disease in whom celiacomesenteric trunk (CMT) was incidentally detected on routine multidetector row computed tomography of abdomen. The CMT (measuring approximately in diameter 12.3 mm) divided into celiac trunk and superior mesenteric artery (SMA) (measuring approximately 7.5 and 7.2 mm, respectively). The celiac trunk further divided into common hepatic, left gastric, and right inferior phrenic and splenic arteries. The common hepatic artery gave off gastroduodenal arteries before continuing as hepatic artery proper. The SMA was seen running down, deep to the neck of the pancreas to supply the midgut. The incidence and clinical implications of this vascular variation are discussed with a review of the relevant literature.

Keywords Celiacomesenteric trunk · Vascular variant · Celiac trunk · Superior mesenteric artery · Multidetector row CT

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Introduction

The celiac trunk (CT) and superior mesenteric artery (SMA) are the most important anterior branches of abdominal aorta as they supply almost the entire visceral territory of gastrointestinal tract. Common trunk for the celiac and superior mesenteric artery (celiacomesenteric trunk; CMT) from the aorta is one of the least frequently reported anatomical variations of all abdominal vascular anomalies [1, 3, 11, 12, 15]. Since, in such a case a single arterial trunk is responsible for the blood supply of a vast majority of gastrointestinal tract and abdominal viscera, any pathology involving this trunk can have catastrophic consequences. Moreover, the knowledge of this variant is of paramount importance to laparoscopic surgeons, interventional radiologists and clinicians alike for pre-procedural planning to prevent any inadvertent injury to the common arterial trunk.

Anatomical variations of CT were first classified by Lipshutz [6]. In his study on 83 subjects, he gave a detailed account of celiac trunk based on the mode of origin and distribution of gastric, splenic and hepatic arteries and classified his findings into four types [6]. In this study, he found two cases (2.4 % incidence) of CMT. Later, Adachi [1] proposed a more extensive classification system with six types (and 28 forms) of divisions of the CT and SMA based on dissections of 252 Japanese cadavers. Celiacomesenteric trunk (truncus celiacomesentericus) was classified into type IV as a rare but very well known anatomical variation. He described that it has been reported by European researchers (a total sample of 596 human cadavers analyzed) with a mean incidence of 1.3 %. In his own study, he found higher incidence (2.4 %) than the Europeans. Michels [11] reported 10 morphological types of anatomical variations of the CT according to their origin

and number of terminal branches. Celiacomesenteric trunk anomaly was classified into type VI in this report. The author commented that this variant occurs very rarely, as he found only two instances of this variant in his study on 500 bodies. Eaton [4] in his study on 206 subjects reported only one case (0.4 %) of CMT while Rossi and Cova [13] in their study on 102 subjects found two cases (1.9 %). We report a case of CMT discovered incidentally on imaging and discuss its clinical implications.

Case report

During the contrast-enhanced computed tomographic scan of a 44-year-old gentleman suffering from chronic liver disease, a striking variation in the upper abdominal arterial anatomy was noticed. The CT and SMA were seen to arise from a common trunk from aorta (Fig. 1). This vascular variant is referred to as a common celiacomesenteric trunk in the literature. Detailed evaluation revealed that the common trunk arose from the ventral aspect of the abdominal aorta at the level of lower border of twelfth thoracic vertebra and was about 12.3 mm in diameter with a length of 5.2 mm. It divided into a celiac trunk and SMA. The celiac trunk measured 7.5 mm in diameter and 18 mm in length. After traversing anteriorly for a distance of 6.3 mm, it gave off right inferior phrenic artery as its first branch from its right superolateral aspect which coursed cranially to supply the right dome of diaphragm. Left gastric artery (LGA) was seen arising almost immediately after this which coursed along the lesser curvature of stomach and then descended to the right towards the pylorus. The trunk then further divided into common hepatic and splenic arteries after a distance of 3 mm. The common hepatic artery (CHA) measuring 4.8 mm in diameter divided into gastroduodenal artery (GDA) and hepatic artery proper (HAP) after a distance of 26 mm. The GDA originated from the inferior aspect of the CHA and passed deep to the 1st part of the duodenum. The HAP was smaller than the GDA and divided after a short distance into its right and left branches. Right hepatic artery gave off cystic artery and then continued to supply the right lobe of liver. SA measured 5.9 mm and took its normal pathway along the upper border of the pancreas to the spleen giving multiple branches to dorsal pancreas along its route. SMA measured 7.2 mm and was seen running down, deep to the neck of the pancreas to supply the midgut.

Discussion

According to conventional visceral anatomy, the CT originates from the abdominal aorta and gives origin to the LGA, SA, and CHA. The CHA extends anteriorly and

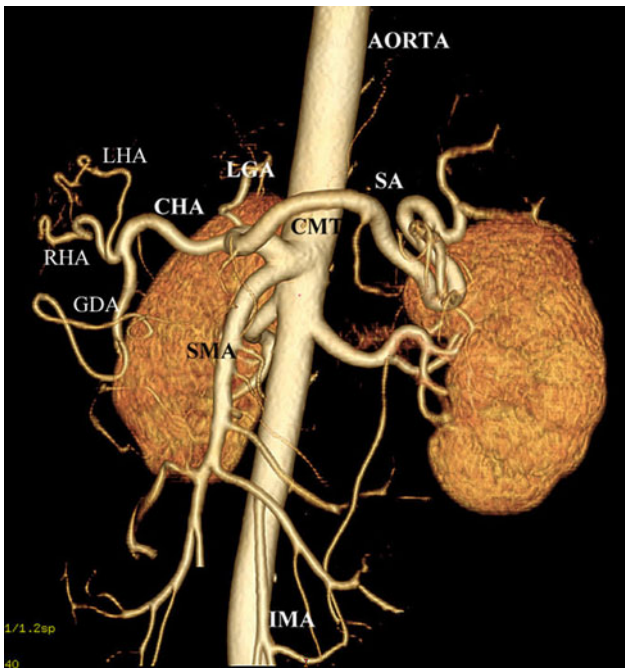

Fig. 1 Three-dimensional volume rendered CT image showing the celiacomesenteric trunk (CMT). CMT divides into celiac artery and superior mesenteric artery (SMA). Common hepatic artery (CHA), splenic artery (SA) and left gastric artery (LGA) are seen arising from celiac artery. Inferior mesenteric artery (IMA) is also seen. *RHA* right hepatic artery, *LHA* left hepatic artery, *GDA* gastroduodenal artery

bifurcates into the GDA and the HAP. The HAP extends cephalad, runs to the left side of the common hepatic duct and then bifurcates into the right and left hepatic arteries typically immediately below the bifurcation of the common hepatic duct. Variations in arterial anatomy is not only of anatomical and embryological interest, but also carries immense clinical implications during surgery and radiological interventions when their prior knowledge can prevent inadvertent injury and result in a more planned and accurate treatment.

Celiacomesenteric trunk is a rare variation in which the CT and SMA originate as a common trunk. Lippert and Pabst [5] reviewed most of the classical studies on arterial variations and wrote that the classical complete celiac trunk pattern has been reported in 84 % of cases, the celiac incomplete trunk in 9 % of cases and celiac trunk cases with common origin of main branches (splenic, hepatic or left gastric) in 7 % of cases. Celiacomesenteric trunk was found in 2 % of cases according to this report. More recently, Matusz et al. [10] reported the incidence of variations in the branching pattern of CT after reviewing a large series of cases (10,750 cases from 19 studies). The typical branching pattern of CT was seen in 90.70 % (9,751 cases), the incomplete CT in 6.09 % (655 cases), and the absent CT in 0.19 % (20 cases) of subjects. The incidence of CMT in this series was 0.68 % (73 cases).

Tandler [14] provided an embryological explanation for the variations of CT and SMA in 1904. During development, three groups of collateral anastomotic arteries arise from the abdominal aorta as dorsal, lateral and ventral branches. The latter develop initially as paired vessels, which then coalesce in the midline to form the four roots for the gut, the four roots being connected by ventral longitudinal anastomosis. The two central roots disappear and the longitudinal anastomosis joins the first and the fourth roots. The hepatic, splenic, and left gastric arteries originate at this longitudinal anastomosis. The anastomosis usually becomes separated from the fourth root (the future superior mesenteric artery) below the last of these three celiac branches. If this separation occurs at a more cranial level, one of the branches is displaced to the SMA. Retention of the ventral longitudinal anastomosis higher than the fourth root with disappearance of the first or fourth root causes a common celiacomesenteric trunk.

A celiacomesenteric trunk is often discovered incidentally during radiological imaging [15] or cadaveric dissections by anatomists [3]. This variant has important wide-ranging clinical implications because, if injured or thrombosed, it jeopardizes the blood supply of a large portion of the gastrointestinal tract and it may put at severe risk most of the abdominal viscera.

It can be involved in a variety of pathological conditions like aneurysm [9, 12], chronic occlusive disease [2], compression by abdominal aorta aneurysm or aortic dissection [2], celiac trunk compression syndrome [7], or thrombosis resulting in massive gastrointestinal infarction [8].

Ailawadi et al. [2] reported that four patients (out of 18 patients who had a CMT) had aneurysmal or occlusive disease that led to operative treatment. Pertinent arteriographic findings in those four patients included a CMT aneurysm ($n = 2$), an occluded proximal CMT ($n = 1$) and a type III aortic dissection that was compressing the CMT. Close relation of short celiacomesenteric trunk with median arcuate ligament and the tight tendinous ring around the aortic opening can cause compression of the trunk which may lead to postprandial periumbilical pain known as celiac trunk compression syndrome. Cavdar et al. [3] pointed out that during the evaluation of celiac trunk compression syndrome, the existence of a CMT should be kept in mind to avoid the risk of ligating the wrong vessel. Thus, recognition of this unique and rare vascular pattern can minimize complications related to abdominal surgeries and transcatheter therapies including bleeding and necrosis, as well as facilitate better and more accurate radiological interpretation.

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Conflict of interest The authors declare that they have no conflict of interest.

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