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Original Research Article

A STUDY OF COMMON COELIOMESENTERIC TRUNK WITH VARIATIONS IN THE EXTRA HEPATIC ARTERIAL SYSTEM AND ITS CLINICAL SIGNIFICANCE

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ABSTRACT

Background: Variations in coeliac axis, superior mesenteric artery (SMA) and different mode of origin of hepatic arteries can be advantageous in some, while in some it can lead to life threatening complications. A replaced(in the absence of original artery) or an accessory (in addition to original artery) left hepatic artery provides a source of collateral arterial circulation in cases of occlusion of the vessels in the porta hepatis but may be injured during the mobilization of the stomach as it lies in the upper portion of the lesser omentum. The presence of replaced arteries can be lifesaving in patients with bile duct cancer, because they are further away from the bile duct. The study of various origin of replaced and the accessory hepatic artery is more important in right lobe donation for live donor liver transplantation. It is also important in planning whole and split liver transplantation.

Materials and Methods: The common coeliomesenteric trunk (CCMT) and its branches were studied during routine dissection for the undergraduate students in 55 formalin preserved cadavers over a period of 5 years.

Results: We found common origin of coeliac axis and superior mesenteric artery (CCMT) from the anterior surface of the abdominal aorta in three cadavers. In the first cadaver, the coeliac and superior mesenteric arteries had a common origin (CCMT). In the second cadaver along with the CCMT, there was an accessory left hepatic artery, which arose from the left gastric artery to enter the left lobe of the liver. In the third cadaver along with CCMT and an accessory left hepatic artery arising from the left gastric artery which entered the left lobe of the liver, common hepatic artery arose from the superior mesenteric artery.

Conclusion: The variant anatomy of the coeliac axis and superior mesenteric artery is of immense clinical significance. In case of CCMT, acute or chronic mesenteric ischemia may be observed without clinical symptoms. Accurate knowledge of all hepatic arterial system is of utmost importance in cases of recent techniques of liver transplantation like split liver or living donor transplantation and several other procedures like cholecystectomy, pancreatectomy and gastrectomy.

KEY WORDS: Coeliac axis, Superior Mesenteric artery, Common Coeliomesenteric trunk, Accessory left hepatic artery, Common hepatic artery, variations.

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INTRODUCTION

The coeliac axis is the first anterior branch of the abdominal aorta, and arises just below the aortic hiatus at the level of T12/L1 vertebral bodies. It divides into the left gastric, common hepatic and splenic arteries. The superior

mesenteric artery (SMA) arises from the aorta approximately 1cm below the coeliac trunk at the level of L1/L2 intervertebral disc. It may arise with the coeliac axis as a common origin [1]. Knowledge about this common origin of coeliac axis and superior mesenteric arteries and other anomalies like accessory hepatic artery and replaced origin of common hepatic artery is essential to successfully accomplish surgical, oncologic or interventional procedures.

MATERIALS AND METHODS

The specimens consisted of formalin fixed 55 cadavers irrespective of sex and age used for routine dissection by undergraduate medical students. Conventional method of dissection was done and examined for anatomical variations in coeliac axis, superior mesenteric artery and thier branches.

RESULTS

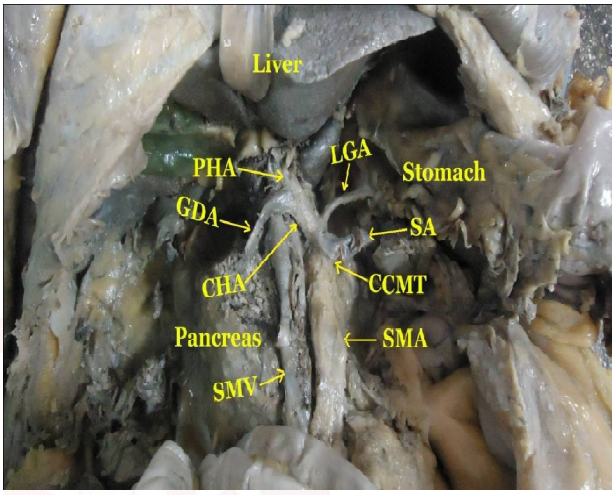
Out of the 55 cadavers dissected, 52 were having a normal course of coeliac axis and superior mesenteric artery. Variations were found in 3 cadavers.

In the first cadaver, the coeliac and superior mesenteric arteries had a common origin from the abdominal aorta about 2 cm below the aortic hiatus (CCMT). Shortly after branching from the CCMT 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 rise to inferior pancreatico duodenal, intestinal, middle colic, right colic and ileocolic arteries (Fig.1). The further course and distribution of these arteries were found to be normal.

In the second cadaver, we found CCMT which gave rise to coeliac axis and superior mesenteric artery. All the branches of coeliac axis and superior mesenteric artery took their normal course. In addition, there was an accessory left hepatic artery (ALHA) which arose from the left gastric artery and entered the left lobe of the liver. (Fig.2)

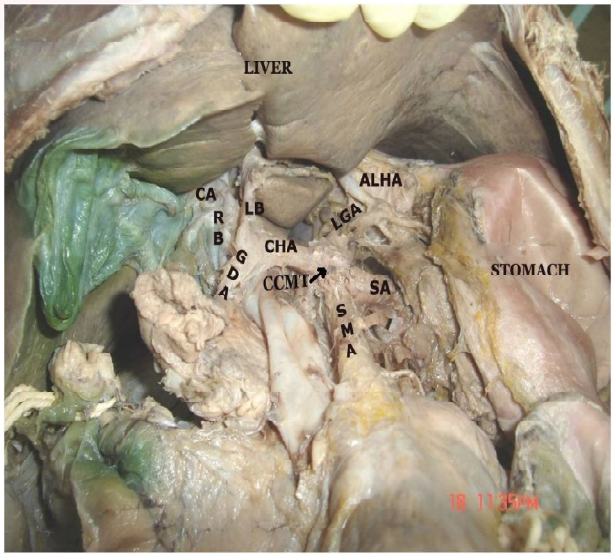
In the third cadaver, the CCMT gave origin to coeliac axis and SMA. The left gastric artery and splenic artery arose from the coeliac axis. There was also an accessory left hepatic artery which arose from the left gastric artery and entered the left lobe of the liver. But the common hepatic artery instead of arising from the coeliac axis, originated from the superior mesenteric artery and divided into right and left hepatic arteries at the porta hepatis. (Fig.3)

Fig. 1: Showing the Common Coelio Mesenteric Trunk.



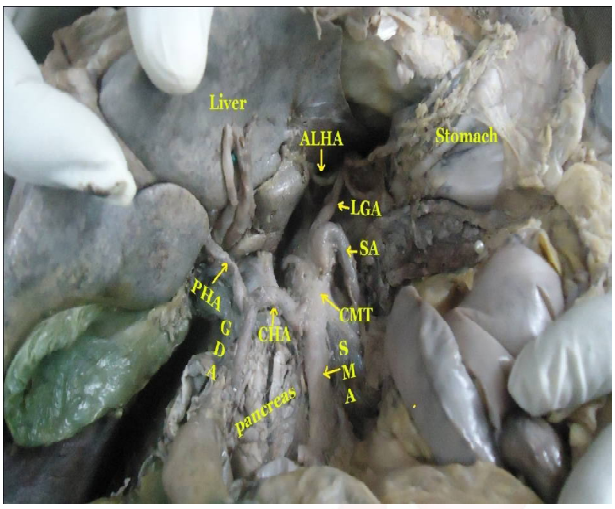
CCMT-Common Coelio mesenteric trunk; CHA-Common hepatic artery; PHA-Proper hepatic artery; LGA – Left gastric artery; SA- Splenic artery; GDA-Gasteroduodenal artery; SMA-Superior mesenteric artery,SMV-Superior Mesenteric Vein

Fig. 2: Showing the Common Coeliomesenteric Trunk with Accessory left heparic artery from Left Gastric artery.



CCMT-Coeliomesenteric trunk;CHA-Common Hepatic Artery; LB-Left branch; RB-Right branch; CA-Cystic artery; GDA- Gastroduodenal Artery; SA-Splenic Artery;SMA-Superior Mesenteric Artery;LGA-Left Gastric Artery;ALHA-Accessory Left Hepatic Artery.

Fig. 3: Common coelio mesenteric trunk with accessory left hepatic artery from left gastric artery along with common hepatic artery arising from superior mesenteric artery.



CCMT-Common Coeliomesenteric Trunk; CHA-Common Hepatic Artery;GDA-Gastroduodenal Artery;PHA-Proper Hepatic Artery; SA-Splenic Artery;SMA-Superior Mesenteric Artery;LGA-Left Gastric Artery; ALHA-Accessory Left Hepatic Artery.

DISCUSSION

Table 1: Michel et al classification of types of Hepatic artery.

Hepatic artery variation	Michels classification		
	Types	%	Range
Normal anatomy	Type I	60%	55-61%
Replaced left hepatic artery originating from the left gastric artery	Type II	7.50%	3-10%
Replaced right hepatic artery originating from the superior mesenteric artery	Type III	10%	8-11 %
Co-existence of Type II and III	Type IV	1%	--
Accessory left hepatic artery originating from the left gastric artery	Type V	10%	8-11%
Accessory right hepatic artery originating from the superior mesenteric artery	Type VI	5%	1.5-7%
Accessory left hepatic artery originating from the left gastric artery and accessory right hepatic artery originating from the superior mesenteric artery	Type VII	1%	--
Accessory left hepatic artery originating from the left gastric artery and replaced right hepatic artery originating from the superior mesenteric artery	TypeVIII	2.50%	---
Common hepatic artery originating from the superior mesenteric artery	Type IX	3%	2-4.5%
Right and left hepatic arteries originating from the left gastric artery	Type X	3%	

Common coeliomesenteric trunk is a rare occurrence of all abdominal vascular anomalies. It can be explained on embryological basis. Each dorsal aorta gives paired ventral splanchnic branches to supply the derivatives of the primitive gut.. With the fusion of dorsal aortae, the ventral branches fuse and form several unpaired vessels and are connected by ventral longitudinal anastomoses. Many of the ventral splanchnic arteries are withdrawn and ultimately only three trunks persist. Coeliac axis, superior mesenteric artery and inferior mesenteric artery develop from 10th, 13th and 21st or 22nd ventral segmental arteries respectively. Occurrence of common coeliomesenteric trunk can be explained by the persistence of 10th and 13th root and anterior longitudinal anastomoses [2]. The arcade of Buhler that connects coeliac axis and SMA is explained by persistence of 10th and 13th primitive arteries associated with persistence of ventral anastomoses between the two arteries [3].

Sridhar Varna (2009) [4], Mahomet Tugrik Wilma et al (2013) [5], Mange Manama (2013)[6] and Arun S Carmaker (2014)[7] have reported cases of coeliomesenteric trunk. Compression of coeliac trunk alone by median arcuate ligament does not produce symptoms earlier because of collaterals between the coeliac 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 [8, 9].

Mammano E et al (2009) [10] reported a case of coeliomesenteric trunk aneurysm. It accounts for 4% of all abdominal arterial aneurysms and rupture of the aneurysm is the major complication [7].

SMA embolism is a common clinical problem in CCMT. Approximately 4 % of all arterial emboli lodge in the SMA [4]. The causes may be varied such as atrial fibrillation, mitral stenosis, myocardial infarction, atheromatosis and aneurysm. CCMT accounts for less than 1% of all abdominal vascular anomalies with prevalence ranging between 0.1% - 3.5% as reported in previous literature. The prevalence in the present study is 5.4% which is higher in comparison to the prevalence found in the

previous studies on Asian subjects.

In the second cadaver, along with CCMT there was an accessory left hepatic artery arising from the left gastric artery. In embryonic and early fetal life, the hepatic artery arises from the left gastric artery. This condition rarely persists. (67% of 56 individuals)[11]. Michels NA et al[12] classified the hepatic artery variations into many types in his cadaveric study (Table 1).

Our second variation comes under type V of Michels classification. An accessory left hepatic artery arising from the left gastric artery provides collateral arterial circulation in cases of occlusion of vessels in the porta hepatis but may also be injured during mobilization of stomach as it lies in the upper portion of lesser omentum [13].

R.M.Jones & K.J.Hardy et al [14] reported that the occurrence of left hepatic artery from left gastric artery is about 15%.

Okano.S.Sawai K et al [15] reported that severing of left hepatic artery from left gastric artery in 15 patients out of 141 during gastrectomy reported changes in liver function and wider the area fed by left hepatic artery from left gastric artery, the greater the change in liver function.

The hepatic artery and its branches after variable courses enter the liver divide and subdivide. There are no or very few anastomoses between their territories; each is an end artery. [16] Lurie [17] reported a case of left lobe hepatic necrosis after severing the left accessory hepatic artery. An aberrant left hepatic artery that feeds a wide area within the liver may cause postoperative liver dysfunction when that artery is severed during surgery.

Rafael Lopez-Andujar et al [18] classified the variation in which the common hepatic artery arose from superior mesenteric artery along with an accessory left hepatic artery from left gastric artery as type 11which was not included in Michel's classification.

We found a new type of variation in which the common hepatic artery arose from the superior mesenteric artery and an accessory left hepatic artery from left gastric artery, along with CCMT which does not conform to any type of classification.

Dasler et al [19] found 4.4% of common hepatic artery arising from the superior mesenteric artery by a study that observed five hundred specimens of hepatic arterial system. In our study the accessory left hepatic artery from left gastric artery was found in two cadavers (3.6%).The common hepatic artery from superior mesenteric artery was found in one cadaver (1.8%).

In liver transplant patients, as all routes of collateral circulation are interrupted during the graft collection, not having the mechanism to compensate for an injury to the main arterial trunk causes tissue necrosis with serious consequences [20]. Hence extra hepatic arteries must be accurately identified at the time of organ collection, preventing injuries that may hinder complete arterialization of the graft.

CONCLUSION

CCMT 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. Awareness of hepatic arterial variations are important for successful surgical procedures like liver transplantation, radiological procedure or interventional procedures including lymphadenectomy around a hepato-spleno mesenteric trunk, aortic replacement with reimplantation of trunk and chemo-embolization of liver malignancies all of which can potentially create significant morbidity because of the large visceral territory supplied by a single vessel.

Conflicts of Interests: **None**

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