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Case Series

Persistence of Ventrolateral Splanchnic Longitudinal Channels

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ABSTRACT

The coeliac trunk is the branch of the abdominal aorta at the level of the twelfth thoracic vertebra. Its branches namely left gastric, common hepatic and splenic arteries supply the primary organs of the supracolic abdominal compartment namely the stomach, pancreas, spleen and liver. In this article, we report case series of three cases in male cadavers aged 65yrs, 60yrs and 70yrs respectively in the Department of Anatomy, Pondicherry Institute of Medical Sciences and MVJ Medical College and Research Institute wherein we discovered that the branching pattern of the coeliac trunk varied from the usual pattern, thus the specimens were photographed to understand further. The observation of first case, common trunk from abdominal aorta showed common hepatic and superior mesenteric artery and left gastric and splenic artery aroused as another common trunk from abdominal aorta. The second case showed the superior mesenteric artery arising from coeliac trunk and the third case was observed the inferior phrenic arteries were arising from coeliac trunk. Knowledge of this variable anatomy may be useful in planning and executing surgical or radiological interventions.

KEY WORDS: Ventral splanchnic vessels, coeliac trunk, Superior mesenteric Artery, Inferior Phrenic artery, vascular variations.

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INTRODUCTION

The coeliac trunk is the first largest ventral branch of abdominal aorta and arises at the level of twelfth thoracic vertebra [1]. Haller is the one described the three branches of coeliac trunk in 1756 and become the normal branching pattern of coeliac trunk [2]. Its branches namely left gastric, common hepatic and splenic arteries supply the primary organs of the supracolic abdominal compartment which include stomach, pancreas, spleen and liver [1]. The coeliac trunks commonly have variations in the branching patterns [3].

Many literatures are describing the gastrosplenic trunk and hepatosplenic trunk can be the commonest variations of coeliac trunk [4, 5]. Also the bifurcating braches, splenic and heaptic arteries from coeliac trunk and the left gastric artery will attach on the area of coeliac trunk on the abdominal aorta [6]. Various studies are mentioned about the aneurysms of the branches of abdominal aorta and leads into complicate the different procedures [7-9]. The knowledge of the arterial branches and the variations of coeliac trunk is considered as very important for the surgical procedures of oesophagus, duodenum, pancreas, liver, gall baldder, stomach and spleen [2, 10].

In 2010, Ugurel M S et al used non-invasive multidetector computed tomography (MDCT) to investigate the branching and variability of the coeliac trunk [3]. Torres K et al. published anatomical variations of the celiac trunk in a homogeneous Polish population in 2015 [11]. In 2010, Song et al used spiral computed tomography (CT) and digital subtraction angiography to evaluate the coeliac trunk variance in the Korean population [12].

This present case series was observed the changes in the branching pattern of coeliac trunk in three cadaveric cases, even though the availability of imaging techniques, the cadaver still stands as an important and reliable mode of anatomical study. Hence, the present cadaveric case series aimed to document the variations in the vascular pattern of branches of the coeliac trunk in the hope that knowledge of these variations would help clinicians minimize the aforementioned complications related to abdominal surgery.

CASE SERIES

During routine dissection of abdomen in male cadavers of aged 65yrs, 60yrs and 70yrs respectively, we observed the variations in the branching pattern of coeliac trunk in the Department of Anatomy, Pondicherry institute of medical sciences and MVJ Medical College and Research Institute. The coeliac trunk and its branches were thoroughly dissected using standard Cunningham's manual after reflecting the anterior abdominal wall. Variant specimens were precisely documented and photographed as best as possible. The three variations that were explored are listed below.

Case 1: In the 65 year old male cadaver, he common hepatic and superior mesenteric artery The common hepatic and superior mesenteric artery aroused as common trunk from abdominal aorta and left gastric and splenic artery aroused as another common trunk from abdominal aorta (Fig. 1).

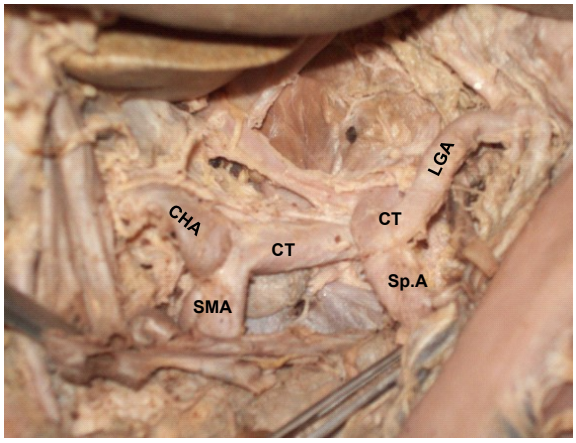

Fig. 1: Shows the two common trunk arising from abdominal aorta.
CHA-Common Hepatic Artery, **SMA**-Superior Mesenteric Artery, **CT**-Common Trunk, **LGA**-Left Gastric Artery, **Sp.A**-Splenic Artery.

Case 2: In a 60-year-old male cadaver, the superior mesenteric artery and coeliac trunk emerged as a common trunk from the abdominal aorta. There were no other variations in the branching pattern of the coeliac trunk (Fig. 2).

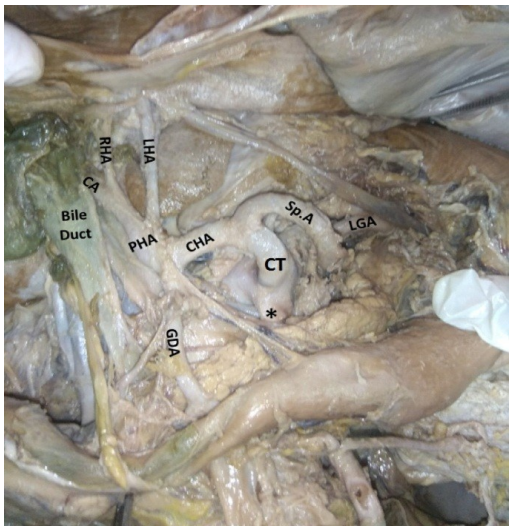

Fig. 2: Shows the superior mesenteric artery and coeliac trunk as arising common trunk (asterisk).
CHA-Common hepatic artery, CT-Coeliac trunk, LGA-Left gastric artery, PHA-Proper hepatic artery, Sp.A–Splenic artery, RHA-Right hepatic artery, LHA-Left hepatic artery, CA-Cystic artery.

Case 3: In this case, we discovered that the inferior phrenic artery (IPA) in a 70-year-old male cadaver originates from the coeliac trunk rather than the abdominal aorta (Fig. 3).

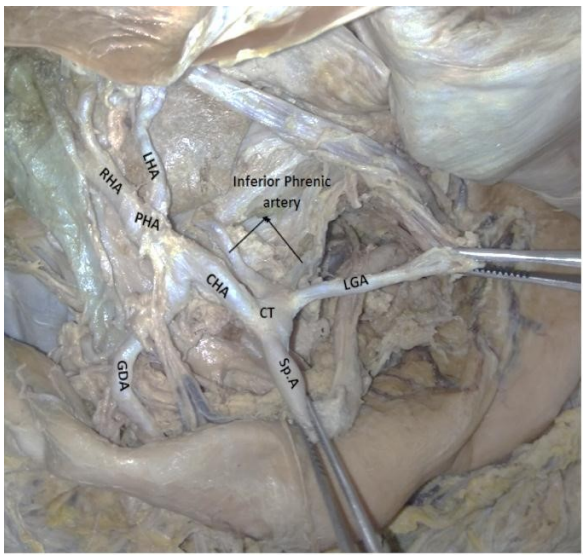

Fig. 3: Shows the Inferior phrenic artery arising from coeliac trunk.

CHA-Common hepatic artery, **CT**-Coeliac trunk, **LGA**-Left gastric artery, **PHA**-Proper hepatic artery, **Sp.A** – Splenic artery, **RHA**-Right hepatic artery, **LHA**-Left hepatic artery

DISCUSSION

Adachi in 1928 classified the 6 types of anatomic variations of coeliac trunk [14]. The common hepatic, left gastric and splenic artery aroused as a common origin as a hepatogastrosplenic trunk [15].

In the first specimen, we observed two common trunks emerging from the abdominal aorta: one as the hepatomesenteric trunk, which further divides into the common hepatic and superior mesenteric arteries, and the other as the gastrosplenic trunk, which divides into the left gastric and splenic arteries (Figure 1). The vascular variation in the first case confirms to Type V and Type VI of Adachi Classification (Figure 4) of coeliac trunk. In an American study, Hiatt et al. (1994) reported a mesenteric origin of the common hepatic artery in just 1.5% of patients [13]; 1.5% in the study conducted by Juszczak A et al [16].

The superior mesenteric and coeliac trunk were shown originating as a single trunk from the abdominal aorta in case 2. Variation of Coeliac trunk observed in the case 2 falls under Type IV of Adachi classification (Fig. 4). Juszczak A et al conducted the study on coeliac trunk using MDCT angiography reported the incidence of Type IV in 1.1% [16].

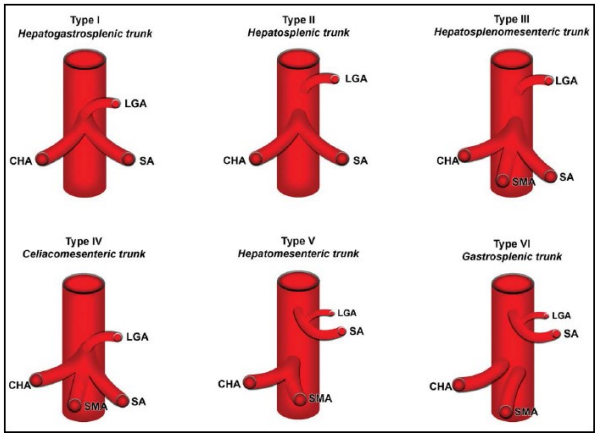

Fig. 4: Adachi classifications of coeliac trunk variations [14].

Kulkarni et al in 2020 found the variations in the origins of inferior phrenic artery incidence as 9.6% using slice Multidetector Computed Tomography (MDCT) among 256 cases [17]. In our third case, we noticed a difference in the inferior phrenic artery, which demonstrated the right and left phrenic arteries arose from the celiac trunk. (Fig. 3).

EMBRYOLOGICAL EXPLANATION:

Tandler (1904) suggested, the ventral segmental arteries are connected with the longitudinal anastomoses running parallel to the abdominal aorta forming ventral and dorsal segmental anastomosis and connect the four roots of the ventral splanchnic vessels and when the central two disappear, the first and fourth roots remain connected via these anastomoses.

Common hepatic, left gastric and splenic arteries usually originate from the first root and superior mesenteric from the fourth root. Ventral longitudinal anastomosis usually separates between these two roots. If this separation occurs at a higher level than usual, any one of the coeliac branches can be displaced to the superior mesenteric artery.

In the case 1, it is possible that the first ventral splanchnic branch formed the gastrosplenic by the fusion of the splenic and left gastric arteries via the longitudinal anastomosis. The fourth ventral splanchnic branches formed the common hepatic and superior mesenteric arteries [18].

In case 2, the superior mesenteric artery was

derived from the coeliac trunk, and the embryological reasons could be attributable to fetal developmental abnormalities in the ventral segmental arteries supplying the digestive tube. The roots from 10th to 13th give origin for the left gastric artery, common hepatic artery, splenic artery and superior mesenteric artery. The second and third roots combine to form coeliac trunk whereas single fourth root gives origin as superior mesenteric artery. So the persistence of the connections through the ventral longitudinal anastomosis forms the superior mesenteric artery from coeliac trunk.

Ventral, dorsal, and dorsolateral groups of branches develop from the original dorsal aorta, which the embryological explanation for the inferior phrenic arteries (IPAs) was originating from the coeliac trunk as in the third case of our study. During fetal development, most primitive arteries from the ventral, lateral, and dorsal group disappear. The lateral splanchnic arteries persist as renal, suprarenal, phrenic, and gonadal arteries and supply the structures from intermediate mesoderm.

The "Felix's ladder theory," suggesting the inferior phrenic arteries are forming from the cranial group of lateral splanchnic arteries [19]. So the persistence of longitudinal channels between these ventral, lateral and dorsal primitive vessels may be the reason for the inferior phrenic arteries are originating from the celiac artery as common trunk.

According to another theory proposed by Isogai et al, the adrenal primordium (cranial half of paraaortic ridge) is supplied by few branches from the gonadal artery and/or abdominal aorta, during day 14 of embryonic life. The most cranial part of these adrenal arteries, which are the prospective IPAs, establishes their definitive branching pattern of the adult by day 15, 16. This theory provides an explanation for the coeliac origin of IPA as well as its origin as a common trunk from the aorta [20].

CONCLUSION

The variations of coeliac trunk are very important for gastrointestinal surgeries and also for interventional radiologists. So, the prior knowledge of variations of coeliac trunk branches may help to reduce the incidence of operative complications.

ABBREVIATION

CHA- Common hepatic artery,
CT- Coeliac trunk,
LGA- Left gastric artery,
PHA- Proper hepatic artery,
IPA- Inferior phrenic artery
Sp.A – Splenic artery,
RHA- Right hepatic artery,
LHA- Left hepatic artery
MDCT- Multidetector Computed Tomography

Conflicts of Interests: None

Author Contributions

The authors in this article have made the following contribution: Sakkarai Jayagandhi: Conceptualization, Data Collection, Literature research, Writing original draft; Khizer Hussain Afroze M: Dissection of specimen, Manuscript and Figure editing. All authors have read and approved of the final version of the article.

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