Coeliac trunk and its branches: anatomical variations and clinical implications

Prakash[1], MBBS, MD, T Rajini[1], MBBS, MD, V Mokhasi[1], MBBS, MD, BS Geethanjali[1], MBBS, MD, PV Sivacharan[1], MBBS, MD, M Shashirekha[1], MBBS, MD

INTRODUCTION Knowledge of anatomical variations of the great vessels of the abdomen, including the coeliac trunk, is important for clinicians planning surgical intervention and radiological imaging. The present study aimed to record the prevalence of variations in the vascular pattern of branches of the coeliac trunk in cadavers.

METHODS A total of 50 properly embalmed and formalin-fixed cadavers from the Indian population were selected for the study. Dissection included surgical incision, followed by mobilisation of the anatomical viscera, to observe and record the branching pattern of the coeliac trunk.

RESULTS The left gastric, common hepatic and splenic arteries were found to arise from the coeliac trunk in 86% of cadavers. In 76% of cadavers, the origin of the gastric artery was proximal to the bifurcation of the coeliac trunk into the common hepatic and splenic arteries. In one case, all three branches arose directly from the abdominal aorta, and the origin of the splenic artery was 1 cm distal to the origin of the left gastric and common hepatic arteries. In another case, the common hepatic and left gastric arteries arose from the coeliac trunk, and the origin of the splenic artery was 1.5 cm distal to the abdominal aorta.

CONCLUSION Vessel ligation and anastomosis are important in surgical procedures like liver transplantation, and background knowledge of the different vascular patterns of branches of the coeliac trunk is vital. The findings of our study could help to minimise complications related to abdominal surgery, including bleeding and necrosis, and facilitate better and more accurate radiological interpretations.

Keywords: anatomy, aorta, cadaver, coeliac trunk, dissection
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INTRODUCTION

The arterial supply for the foregut derivatives in the abdomen is provided by branches of the coeliac trunk. Variations in the vascular pattern of the coeliac trunk and its branches should be considered while planning surgical interventions on the abdominal part of the oesophagus, stomach, duodenum, liver, pancreas, gallbladder and spleen. Anatomical variations of the coeliac trunk are important for surgeons undertaking different surgeries on the abdominal region, including liver transplantation. Clinicians should also be aware of the variations in the vascular pattern of the coeliac trunk before performing angiographic examinations.

Coeliac trunk variations have been reported in the literature.[1-25] The prevalence of normal branching pattern of the coeliac trunk into common hepatic, splenic and left gastric arteries has been reported by Malnar et al (72%)[1], Song et al (89.1%),[5] Ugurel et al (89%)[24] and Bergman et al (86%).[25] Malnar et al reported the anatomical properties of the coeliac trunk on cadavers in their study on the Croatian population.[1] Song et al studied the prevalence of coeliac axis variations by using spiral computed tomography (CT) and digital subtraction angiography in their study on the Korean population.[5] In the present modern era of imaging techniques, the cadaver still stands as an important and reliable mode of anatomical study. Hence, the present cadaveric study aimed to examine the prevalence of variations in the vascular pattern of branches of the coeliac trunk in the hope that knowledge of these variations would help clinicians minimise the aforementioned complications related to abdominal surgery.

METHODS

A total of 50 formalin-fixed and properly embalmed cadavers were selected for this anatomical study. Of these, 34 cadavers were male and 16 were female (age range 20–70 years). The cadavers were dissected in the abdominal region. The dissection started with skin incision followed by opening of the peritoneal cavity. The viscera were then mobilised to trace the course of the branches of the coeliac trunk. All anatomical variations observed were photographed and recorded.

RESULTS

In 43 out of the 50 (86%) cadavers, the left gastric, common hepatic and splenic arteries were found to arise from the coeliac trunk. The most common vascular pattern observed was the division of the coeliac trunk into the common hepatic and splenic arteries, whereas the origin of the left gastric artery was located relatively proximal, between the abdominal aorta and the bifurcation of the coeliac trunk, in 38 out of the 50 (76%) cadavers.

[1]Department of Anatomy, Vydehi Institute of Medical Sciences and Research Centre, Bengaluru, India
Correspondence: Dr Prakash, Associate Professor, Department of Anatomy, Vydehi Institute of Medical Sciences and Research Centre, 82 EPIP Area, Whitefield, Bengaluru 560066, Karnataka, India. prakashrinku@rediffmail.com

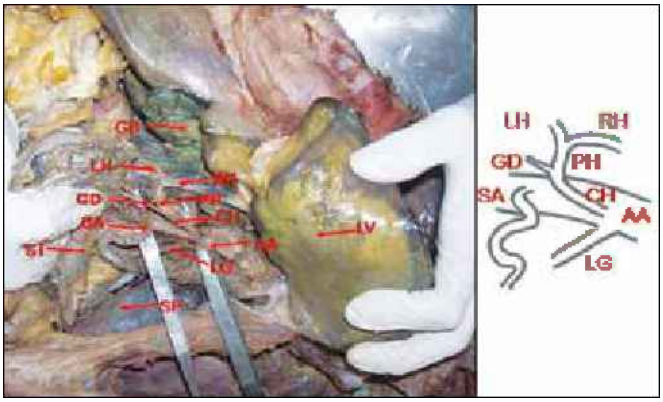

Fig. 1 Photograph shows the branches of the coeliac trunk, namely the left gastric and common hepatic arteries arising directly from the abdominal aorta, whereas the origin of the splenic artery was arising directly from the abdominal aorta, 1 cm distal to the origin of the left gastric and common hepatic arteries.
GB: gallbladder; CH: common hepatic artery; SA: splenic artery; LV: liver; AA: abdominal aorta; ST: stomach; LG: left gastric artery; SP: spleen; PH: proper hepatic artery; RH: right hepatic artery; LH: left hepatic artery; GD: gastroduodenal artery

Fig. 2 Photograph shows the left gastric and common hepatic arteries as terminal branches arising from the coeliac trunk; on the other hand, the splenic artery was seen to arise directly from the abdominal aorta, 1.5 cm distal to the origin of the coeliac trunk.
GB: gallbladder; CH: common hepatic artery; SA: splenic artery; LV: liver; AA: abdominal aorta; ST: stomach; LG: left gastric artery; CA: coeliac trunk

Anatomical variations were observed in 14% of cases, and these could be broadly classified into three categories: (1) The left gastric, common hepatic and splenic arteries were arising separately and directly from the abdominal aorta (Fig. 1) (n = 2, 4%); (2) There was direct proximal origin of the left gastric artery from the aorta, along with the coeliac trunk dividing terminally into the common hepatic and splenic artery (n = 4, 8%); (3) The coeliac trunk divided into the common hepatic and left gastric arteries, whereas the splenic artery was arising directly from the abdominal aorta (Fig. 2) (n = 1, 2%). Fig. 1 shows the branches of the coeliac trunk, namely, the left gastric artery and the common hepatic artery arising directly from the abdominal aorta, whereas the origin of the splenic artery was arising directly from the abdominal aorta, 1 cm distal to the origin of the left gastric artery and the common hepatic artery. Fig. 2 shows the left gastric artery and the common hepatic artery as terminal branches arising from the coeliac trunk; on the other hand, the splenic artery was arising directly from the abdominal aorta 1.5 cm distal to the origin of the coeliac trunk.

DISCUSSION

The embryological significance of the abovementioned variations has been described. At the end of the fourth week of intrauterine life, a number of paired vessels in the form of vitelline arteries supply the yolk sac.[23] Later, they gradually fuse and form arteries in the dorsal mesentery of the gut, which are represented in adult life as coeliac, superior mesenteric and inferior mesenteric arteries.[23] Incomplete fusion or malfusion of the vitelline arteries during the developmental stage may be responsible for the variations observed in the present study.

During splenectomy, short gastric and splenic vessels are ligated and divided. Laparoscopic-assisted distal gastrectomy and open total or subtotal gastectomy involve ligation and division of the gastric vessels. In laparoscopic surgery, where the operative field is relatively limited, there is a chance of ligation or division of the wrong vessel due to a lack of awareness of the anatomical variations, which may lead to bleeding and ischaemia or necrosis of the organ being irrigated.

Malnar et al reported that the coeliac trunk divides into the common hepatic artery and splenic artery, whereas the left gastric artery originates separately, proximal to the bifurcation of the coeliac trunk in 72% of cases in their study on Croatian cadavers.[1] In our study, the aforementioned vascular pattern was prevalent in 76% of cadavers. Song et al reported the prevalence of a normal coeliac axis in 89.1% of their patients and identified anatomical variations in 9.64% of patients by studying spiral CT images and digital subtraction angiography in the Korean population.[5] We observed the origin of the left gastric, common hepatic and splenic arteries from the coeliac trunk in 86% of the cadavers in our study.

Knowledge of the aforementioned anatomical variations is useful in laparoscopic surgeries, coeliac axis compression syndrome and aortic replacement with re-implantation of the coeliac trunk,[3] and could help surgeons to successfully accomplish abdominal interventions and avoid catastrophic complications. Knowledge of coeliac trunk variations would enable interventional radiologists to protect important vessels prior to transcatheter therapy, and recognition of the vascular pattern would also prevent inadvertent injury. We hope that the present study would help to minimise complications related to abdominal surgeries, including bleeding and necrosis, as well as facilitate better and more accurate radiological interpretation.

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