

Case Report

MULTIPLE AND RARE VARIANT BRANCHES OF THE CELIAC TRUNK COMBINED WITH RETROPORTAL HEPATIC PROPER ARTERY: A CASE REPORT

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ABSTRACT

Background: Understanding the variation patterns of the celiac trunk and its branches is necessary for the upper abdominal operations to prevent an unintentional injury to the variant structures.

Purpose of the study: To point out the clinical importance of the variations in the vascular anatomical locations, especially when they coexisted with the variation in origin.

Results: The common hepatic artery was not presented, as a result, the celiac trunk abnormally quadrifurcated into the left gastric, splenic, gastroduodenal and hepatic proper arteries. Variant arteries were further identified from these branches: the left gastric artery gave the accessory left hepatic artery, the replaced right gastric artery came off the gastroduodenal artery and the replaced posterior superior pancreaticoduodenal artery was originated from the hepatic proper artery. The hepatic proper artery was located posterior to the portal vein. The right and left terminal branches of the hepatic proper artery also ran behind their corresponding portal veins and hepatic ducts.

Conclusion: This article demonstrates a cadaver having complexed multiple and rare variations of the celiac trunk and retroportal hepatic artery.

KEY WORDS: Celiac Trunk, Hepatic Artery, Variation, Liver Anatomy, Hepatic Proper Artery.

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INTRODUCTION

The variations of the hepatic arterial system have been extensively studied worldwide, the incidence of variants were reported as 21.9-45%. The widely accepted classification used to describe the patterns of hepatic artery was Michels' and Hiatt's classification[1,2]. Though there were six variation patterns described by Hiatt et al., there were still frequent reports of other unknown pattern and called unclassified

aberrant hepatic arteries (0.5-13.42%)[1-6].

Although the incidence is not high, it may cause serious surgical or interventional complications from unintentional injury to the variant vessels. This article describes an unclassified case with multiple and rare variations.

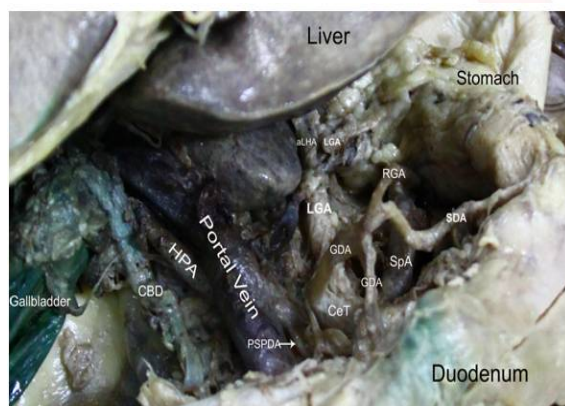
CASE REPORT

During a routine educational dissection of a 44-year-old male cadaver, multiple variations of

the hepatic artery at both the origin and location were identified (Fig. 1, 2 and 3). The left gastric artery (LGA) and the splenic artery branched from the celiac trunk as usual. The common hepatic artery (CHA) was absent, while the replaced gastroduodenal artery (GDA) and the replaced hepatic proper artery (HPA) arose directly from the celiac trunk. The LGA was the first branch from celiac trunk, it crossed the abdominal aorta and then gave off the accessory left hepatic artery (LHA) which propagated superiorly and entered the left lobe of the liver. The splenic artery, branched next to the LGA, coursed and branched normally.

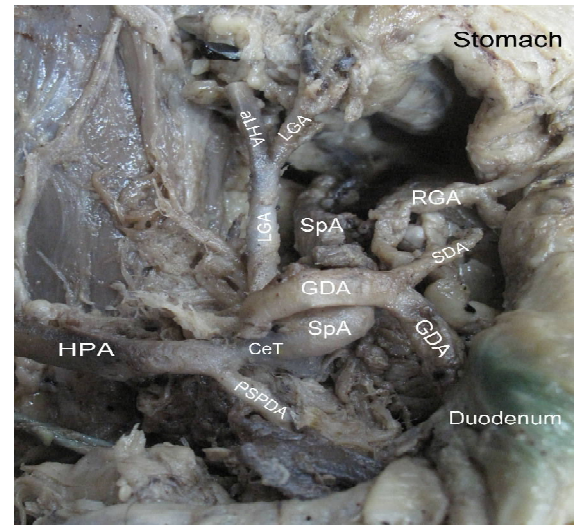
The CHA was not found. Instead, its two terminal branches, the GDA and the HPA, ramified laterally from the celiac trunk. The GDA curved anteriorly, then turned downward and branched as the replaced right gastric artery (RGA). Just distal to the branching site, the replaced RGA gave the supraduodenal artery. The GDA continued caudally, crossing behind the duodenum, then stemmed the right gastroepiploic artery (RGEA) which ran horizontally in the greater omentum. The terminal branch of the GDA was the anterior superior pancreaticoduodenal artery (ASPD) which anastomosed with the replaced posterior superior pancreaticoduodenal artery (PSPDA) from the HPA and the inferior pancreaticoduodenal artery from the superior mesenteric artery.

Fig. 1: Anterior view of the celiac trunk and its branches with related to nearby structures: the portal vein is retracted to the right, reveals the hepatic proper artery lying behind.



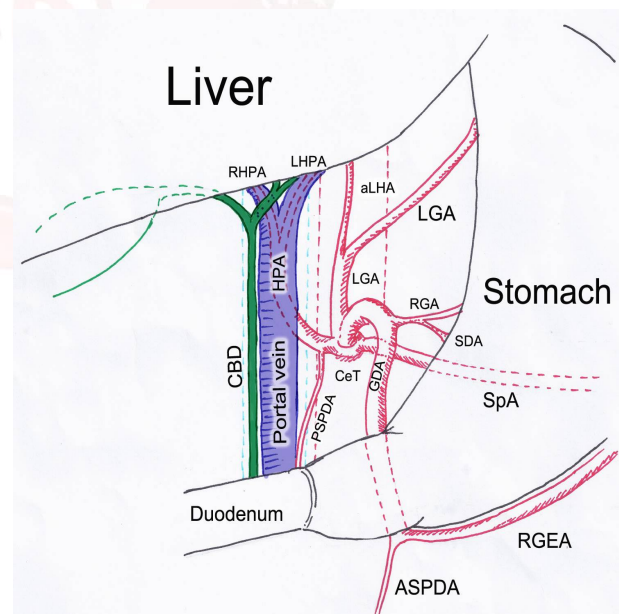
CeT, celiac trunk; GDA, gastroduodenal artery; LGA, left gastric artery; aLHA, accessory left hepatic artery; RGA, right gastric artery; SDA, supraduodenal artery; SpA, splenic artery; HPA, hepatic proper artery; PSPDA, posterior superior pancreaticoduodenal artery; CBD, common bile duct.

Fig. 2: Anterolateral view of the celiac trunk and its branches. Liver and the portal vein are removed.



HPA, hepatic proper artery (cut); CeT, celiac trunk; SpA, splenic artery; GDA, gastroduodenal artery; LGA, left gastric artery; RGA, right gastric artery; aLHA, accessory left hepatic artery (cut); PSPDA, posterior superior pancreaticoduodenal artery; SDA, supraduodenal artery (cut).

Fig. 3: Schematic drawing of the celiac trunk and its branches.



GDA, gastroduodenal artery; LGA, left gastric artery; aLHA, accessory left hepatic artery; RGA, right gastric artery; SDA, supraduodenal artery; SpA, splenic artery; HPA, hepatic proper artery; ASPDA, anterior superior pancreaticoduodenal artery; PSPDA, posterior superior pancreaticoduodenal artery; CBD, common bile duct; RGEA, right gastro-epiploic artery; RHPA, right branch of the hepatic proper artery; LHPA, left branch of the hepatic proper artery.

The HPA was the last branch of the celiac trunk in this cadaver. Just distal to its origin, the HPA ramified the replaced PSPDA, which travelled

downward to meet the other pancreaticoduodenal vessels. After branching, the HPA passed behind the portal vein and then ascended posteriorly alongside the portal vein, enveloped by the hepatoduodenal ligament.

The portal vein bifurcated into the right and left portal pedicles which located behind the right and left hepatic ducts, respectively. The HPA subsequently gave two terminal branches: the right and left hepatic proper artery (RHPA, LHPA). The cystic artery came off the RHPA as usual. The RHPA and LHPA ran posteriorly to the right and left portal pedicles and ducts, respectively, before entering the liver.

DISCUSSION

Variations of the hepatic artery and the celiac axis are commonly found, the incidence ranges from 21.9 to 45.0%. Factors contributed to the different prevalence may be ethnics, methods of study, and number of subjects. According to the Hiatt's classification, the unclassified or rare type ranged from 0.5 to 13.42%[1-6]. Most of these rare cases had only a single anomaly, while the case in this report had multiple rare variations. The vascular variations in this article will be discussed in two ways: branching patterns and location related to nearby structures. Most literatures only pay attention to the branching pattern, whereas the abnormal courses of the vessels remain out of focus.

Normally, the celiac trunk had three branches (60.0–94.2%) while four branching as found in this case was extremely rare[7]. The quadrifurcation might be due to the absence of the CHA, which was rare because the prevalence less than 1%[8-10], led to its branches (the GDA and the HPA) directly originated from the celiac trunk instead. The GDA and its branches supposed to be displaced to the left due to an absence of CHA but these vessels were still lying in the normal location which might be explained by the long segment of the proximal curving part of the GDA. The GDA branched into the replaced RGA, the RGEA and the ASPDA as found in general population.

The accessory LHA originated from the LGA is considered as Hiatt class II. Though the incidence varied (0.5-15%) [1-6], this variant is relatively common. For this reason, being

familiar with the variant LHA is essential, especially in the esophagogastric surgery. Injury to the LGA may cause some degree of liver damage, evaluation of postoperative liver function is suggested. Luckily, most observed cases have transient mild liver dysfunction, except those with gastric cancer who had undergone curative gastrectomy and the aberrant LHA was sacrificed, many surgeons reported liver necrosis which was the lethal complication[11].

The PSPDA stemmed from the HPA instead of the GDA was also uncommon. It was reported by few literatures with varying incidence; 1.82-8.0%[1-6,12,13]. Although the prevalence were not high but if there was a coexisting retroduodenal artery, which was not rare, surgeon might be confused with the PSPDA, especially when the PSPDA that comes from the sources other than the GDA.

In general, the HPA runs anteriorly to the portal vein, and locates on the right side of the common bile duct in contrast to the current HPA that coursed posteriorly to the portal vein. This variation was remarkably rare. To the best of my knowledge, the retroportal HPA was reported by only three literatures, every cases coincided with other unusual variations[12,14,15]. The RHPA and LHPA also aberrantly ran posterior to their corresponding lobar portal veins. This means the two terminal branches of the HPA lie in the deepest part of the liver hilum. During dissection, the retroportal HPA was totally hidden by the portal vein, complicated by the complex variations of the branching of the celiac trunk, as a result the author could not find the HPA during the first attempt. In the operative field, the portal vein might be diagnosed by mistake as the HPA or vice versa. For the same reason, the retroductal branches of the HPA might also be misdiagnosed as the portal branches.

This article demonstrates a complex case that has multiple and rare variations in its origin and its course. Clinicians should be familiar with the various types of hepatic arterial branching patterns, moreover, abnormal vascular location should always be in mind. An accurate preoperative diagnostic investigation is an effective option to prevent complications.

CONCLUSION

Variation of the celiac trunk is commonly found and may cause many surgical and interventional complications. Being familiar with various branching patterns of the celiac trunk and preoperative investigations are essential, especially when the variation in the anatomical location coexisted with the variation in origin.

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Conflicts of Interests: None

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