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Case Report

THE HEPATIC VASCULATURE- A CLINICAL AND ANATOMICAL CORRELATION

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ABSTRACT

Knowledge regarding the hepatic vasculature is important for the planning of hepatic surgeries, liver transplant surgeries and also the gall bladder surgeries. The presence of variation in the hepatic vasculature sometimes may result in the postoperative complications such as bleeding. In the present case report, there was a coexistence of left accessory hepatic artery arising from the left gastric artery and the cystic artery arising from the hepatic artery proper. This vascular variation in coexistence is rare to find and is of foremost important for clinicians, surgeons, radiologist, and anatomists.

KEY WORDS: hepatic artery, accessory, liver, cystic artery.

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INTRODUCTION

The liver is the largest abdominal viscera with dual blood supply. The blood supply is derived from the portal as well as hepatic circulation. The portal vein conveys 80% of the blood, which is deoxygenated but carries most of the nutrients absorbed from the intestines. The hepatic arteries are the branches of the common hepatic artery, which in turn is a branch of the coeliac trunk in 52-76% of population along with left gastric and splenic artery [1]. The hepatic artery reaches the porta hepatis via the right free margins of the lesser omentum. In the lesser omentum, hepatic artery lies to the left and portal vein comes posterior to the bile duct. Variations in the hepatic arteries are found in 32-48% of patients [2].

Proper identification of the vasculature in the porta hepatis, as well as the presence of any accessory arteries, is necessary for surgical as well as some of the interventional studies and percutaneous procedures. Sometimes, it becomes essential to perform the pre-operative vascular studies to plan open and endovascular surgeries [3]. The marked anatomical variation of the hepatic artery in the liver transplanted recipients increased the risk of hepatic artery complications [4]. Few of the studies have reported, that injury to the hepatic vasculature is more likely to be involved in pancreaticoduod enectomy, mainly in the region of the porta hepatis. According to previous literatures, cystic artery originates from the various sources such as right hepatic artery (63.9%), hepatic trunk (26.9%), Left hepatic artery (5.5%), gastroduodenal artery (2.6%), superior pancreaticoduodenal artery (0.3%), celiac trunk (0.3%) and superior mesenteric artery (0.8%) [5].

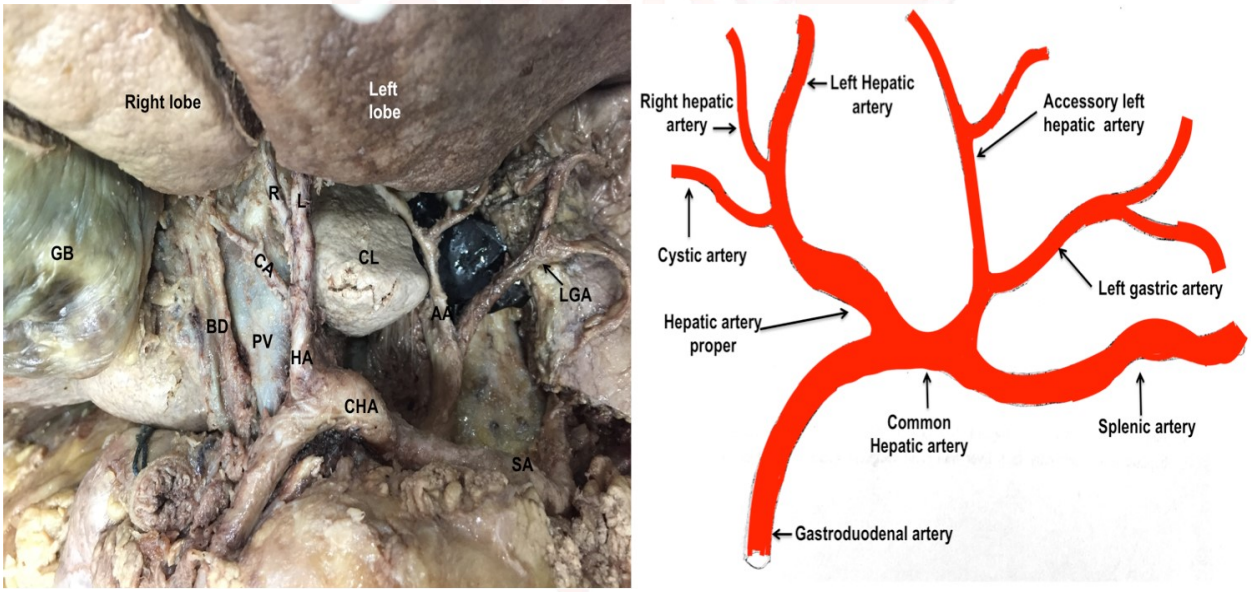
In the present case report, the coexistence of the accessory left hepatic artery originating from

the left gastric artery and the cystic artery arising from the hepatic artery proper was observed. According to Ostroverkhov et al., the left accessory hepatic artery, a variant branch of the left gastric artery is encountered in 20% of all autopsies [6].

CASE REPORT

During the routine dissection classes for the first year undergraduates, an uncommon variation of the accessory left hepatic artery and the cystic artery was studied in female cadaver aged 56 years in the Department of Anatomy, All India Institute of Medical Sciences, New Delhi, India. The cadaver was donated to the hospital and there were no signs of trauma, pathological lesions or surgery in the related abdominal quadrants. The abdomen was opened according to dissector manual. The supracolic compartment was dissected very carefully after reflecting the greater omentum and transverse colon. Efforts were made to identify the location and branches of coeliac trunk. Splenic artery was identified and was running above the pancreas to enter in the spleen. The left gastric artery arose from the coeliac trunk, supplied the lesser curvature of the stomach and gives oesophageal branch to supply the lower part of the esophagus. In its course, accessory left hepatic artery appears to arise from the trunk of the left gastric artery and entering through the porta hepatis of the liver (Figure.1). After tracing the common hepatic artery, it divides into the gastroduodenal artery and hepatic artery proper (Hap). Hap enters the porta hepatis by dividing into the thick left hepatic artery and small right hepatic artery. In the same cadaver, the cystic artery arose from the hepatic artery proper. The diameter of the accessory hepatic artery is smaller than the left hepatic artery. The relations of the portal vein, bile duct, and the hepatic artery were maintained at the porta hepatis. No other neurovascular variations were observed in the cadaver.

Fig. 1: Photograph showing the presence of accessory left hepatic and cystic arteries (CA) artery arising from the left gastric artery (LGA) and hepatic artery proper (HA) respectively.



CL: Caudate lobe, BD: bile duct, CA: Cystic artery, HA: Hepatic artery proper, PV: Portal Vein, CHA: Common hepatic artery, GB: Gall Bladder, LGA: Left gastric artery, SA: Splenic artery, CA: Cystic artery, R: Right hepatic artery, L: Left hepatic artery.

DISCUSSION

Knowledge regarding the hepatic vasculature is important in surgeries related to hepatobiliary region and liver transplantation. The hepatic arteries chiefly supply the right and left anatomical lobes of the liver. Generally, these hepatic arteries are the branches of the common hepatic artery, which in turn is a branch from coeliac trunk. Sometimes, due to differential arterial anatomy, these vessels may arise from the different source. The most common variation related to the right hepatic artery in the form of replaced or accessory hepatic artery, which arises from the superior mesenteric artery (6.67%) and a replaced left hepatic artery originates from the left gastric artery (6.41%) [7]. The accessory hepatic artery is referred to

as an arterial vessel that supplies hepatic lobe in addition to the normal blood vasculature pattern [7]. Variations in the origin of the hepatic artery are the common type of hepatic arterial variation. Abdullah et al. conducted one study on 932 patients in which 48 had common hepatic artery variations, 236 right and left hepatic arteries variations, and 13 rare variations including one case of right hepatic artery arising from the inferior mesenteric artery. Sometimes, the common hepatic artery may arise from the left gastric artery [8]. The origin of the right hepatic artery from the superior mesenteric artery is very rare but forms an important clinical relation with the surrounding structures such as the head of the pancreas, first part of duodenum and portal vein, making it vulnerable during the surgeries. According to the study done by Chanasong et al, an additional accessory hepatic artery originated from the left aspect of the celiac trunk entering the porta hepatis of the liver in the Thai patient [9].

The cystic artery plays an important role in supplying the cystic duct and the gall bladder. Normally, cystic artery arises from the right hepatic artery but due to developmental abnormalities, it may arise from the hepatic trunk (26.9%) or from the left hepatic artery (5.5%) or sometimes from the gastroduodenal artery (2.6%) or celiac trunk (0.3%) [5]. Knowing the proper anatomy of the cystic artery is necessary during laparoscopic cholecystectomy and also to avoid uncontrolled bleeding that may increase the risk of intraoperative problems or sometimes the postoperative complications [10].

In the present study, an accessory hepatic artery arising from the left gastric artery and entering in the porta hepatis. Along with this accessory left hepatic artery, cystic artery instead of arising from the right hepatic artery was arising from the hepatic artery proper. If the vascular variation is observed in one of the vessels, then there may be more chances of having other vascular anomalies in the same system.

The embryological explanation of such vascular anomalies may be due to patency of different embryonic channels. During development, embryonic left hepatic artery, the middle hepatic artery and right hepatic artery originate respectively from the left gastric artery, the celiac trunk, and superior mesenteric artery. In later stages of development, the embryonic right and left hepatic arteries regress but middle hepatic artery remains patent as a proper hepatic artery supplying the whole liver. Sometimes, failure of regression may result in the formation of the accessory artery [11].

Another suggested hypothesis was the role of hypoxia causing angiogenesis in the formation of an accessory artery or the different sites of origin of the arteries [12]. Low oxygen saturation leads to the stabilization of hypoxia inducible factor-1 alpha which upregulates vascular endothelial growth factor A and nitric oxide synthase expression. As a consequence, the production of nitric oxide causes dilatation of the existing vessels and also the extravasation of plasma proteins, leading to the protease and matrix metalloproteinase expression. These formed substances result in the proliferation and angiogenesis of the endothelial cells which leads to the formation of the abnormal vasculature [13].

CONCLUSION

The coexistence of these vascular anomalies with embryological and clinical significance is discussed in the present case. The knowledge of the vascular variation regarding the origin of accessory left hepatic and cystic arteries is important to a surgeon during the hepatic surgeries and also helps to decrease the postoperative morbidity of the patients

Conflicts of Interests: **None**

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