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Case Report

Replaced unclassified right hepatic artery arising from the celiac trunk: A case report [☆]

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ABSTRACT

Anatomical variations in hepatic arteries are both common and diverse. According to the classic classification systems, a replaced right hepatic artery typically originates from the superior mesenteric artery, supplying blood to the right liver lobe in the absence of the right branch of the proper hepatic artery. This article reports 2 cases of a rare variation, a replaced right hepatic artery arising directly from the celiac trunk. In these cases, the artery courses posterior to the common hepatic artery and then behind the portal vein within the hepatoduodenal ligament. The first case, involving a 62-year-old male with intraductal papillary mucinous neoplasm (IPMN) of the pancreas, was identified intraoperatively during a pancreaticoduodenectomy. The second case, involving a 58-year-old female with chronic sclerosing cholangitis, was detected through contrast-enhanced computed tomography angiography. Identification of such variations is critical in hepatobiliary and pancreatic surgeries to prevent serious postoperative complications. Injury to a replaced right hepatic artery can lead to biliary-enteric anastomosis dehiscence after pancreaticoduodenectomy or ischemic liver complications. While hepatic arteries display numerous anatomical variations, classic classification systems fail to encompass all these anomalies. A more comprehensive classification system, such as CRL and ex-CRL classification, is necessary to ensure safer surgical outcomes.

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Introduction

The celiac trunk typically branches into 3 main arteries: the left gastric artery, the splenic artery, and the common hepatic artery. The common hepatic artery further divides into the proper hepatic artery after giving off the gastro-duodenal and right gastric arteries. Subsequently, the proper hepatic artery typically splits into right and left branches, supplying the right and left hepatic lobes respectively, at the level of the porta hepatis within the hepatoduodenal ligament. This anatomical arrangement, classified as normal anatomy, is subject to multiple anatomical variations [1,2]. Michels' and Hiatt et al. [1,2] have classified the anatomical variations of the hepatic arteries into ten and 6 subtypes, respectively. According to these classifications, the right and left lobes of the liver can be supplied by, but not limited to, left and right hepatic arteries arising from the left gastric artery and the superior mesenteric artery, respectively, in addition to or in the absence of the corresponding proper hepatic artery branches [1,2]. The aberrant hepatic artery is considered accessory whenever the proper hepatic artery branch's blood supply to the corresponding lobe is present, and replaced whenever the latter is absent. Normal anatomy is present in 55% of cases according to Michels', and in approximately 75% of cases according to Hiatt et al [1,2]. In this article, we are going to present 2 cases of an unclassified replaced right hepatic artery arising directly from the celiac trunk. This article has been reported in line with the SCARE criteria [3].

First-case presentation

A 62-year-old male patient presented to the Digestive and Endocrine Surgery Department at Hôtel Dieu de France Hospital in Beirut with a 1-year history of diffuse abdominal pain associated with fatigue and unintentional weight loss of 25 kg during this period. On physical examination, his performance status was good, and he was non-icteric. Abdominal examination revealed no abnormalities. Blood tests showed non-significant results, with liver markers and bilirubin levels within the normal range.

Contrast-enhanced tomography conducted at another institution revealed an enlarged head of the pancreas measuring 50 mm with a non-enhancing hypodense lesion, diffusely dilated main pancreatic duct, and multiple cystic lesions in the head of the pancreas. Endoscopic ultrasound demonstrated cystic dilatation of the head of the pancreas, suggestive of intraductal papillary mucinous neoplasm of the pancreas (IPMN), with atrophy of the body and tail of the pancreas and severely dilated main pancreatic duct. A decision was made to proceed with a pancreaticoduodenectomy for IPMN. Upon revision of the contrast CT scan at our institution, a replaced right hepatic artery directly arising from the celiac trunk and coursing posterior to the portal vein was detected (Fig. 1).

Per-operative findings confirmed the CT scan findings, with a replaced right hepatic artery originating from the celiac trunk, running posteriorly to the portal vein, and supplying



Fig. 1 – Contrast-enhanced tomography showing a replaced right hepatic artery, marked by an asterisk, arising from the celiac trunk, and running posterior to the portal vein. PV: portal vein.

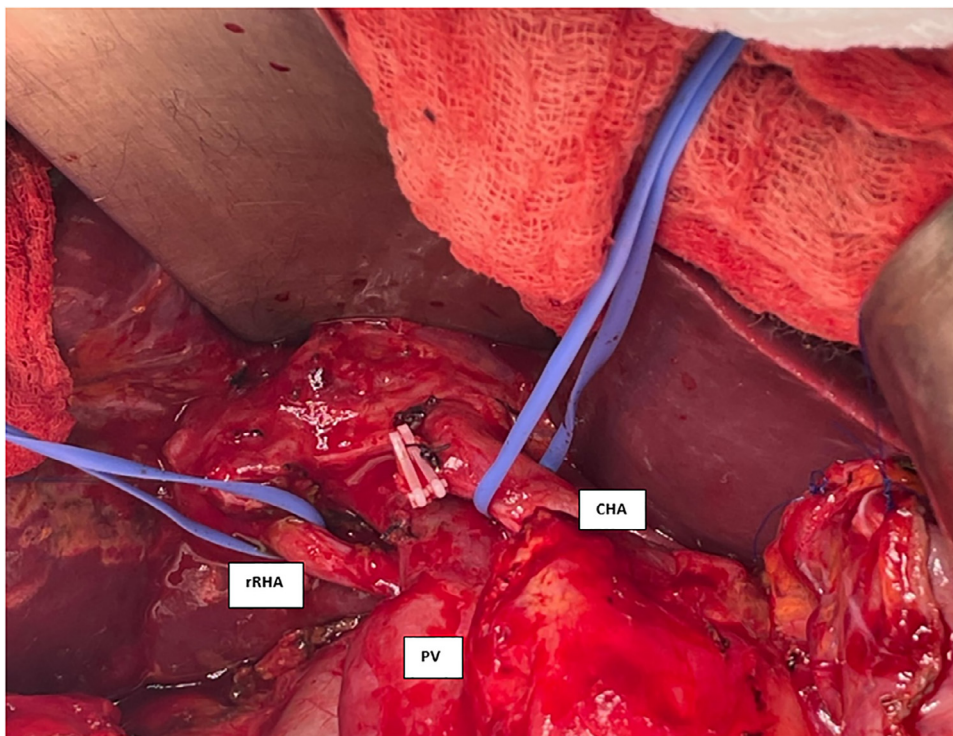


Fig. 2 – Per operative image showing a replaced right hepatic artery looped in blue sling, originating from the celiac trunk and coursing posterior and lateral to the portal vein during a pancreaticoduodenectomy. rRHA: replaced right hepatic artery, CHA: common hepatic artery, PV: portal vein.

branches to the right hepatic lobe. The artery was identified and preserved (Fig. 2). The postoperative course was uneventful, and the patient was discharged home on the fifth postoperative day in good condition. Histopathologic examination revealed a high-grade, intestinal-type IPMN of the pancreas originating from the main pancreatic duct. Pathological staging: pTis pN0 R0.

Second-case presentation

A 58-year-old female patient presented to Hôtel Dieu de France Hospital in Beirut with repetitive cholangitis due to sclerosing cholangitis. She had undergone abdominal surgery 6 years ago, cholecystectomy and choledochoduodenostomy for impacted choledocholithiasis at another institution. Since then, she has experienced repeated episodes of cholangitis. During a contrast-enhanced computed tomography with colored 3-dimensional angiography scan performed to investigate her primary disease, an anatomical arterial variation is detected: the celiac trunk gives off 4 branches instead of 3. The first branch is the left gastric artery, from which an accessory left hepatic artery, supplying the left hepatic lobe, arises. The second branch is a replaced right hepatic artery. The third branch is the common hepatic artery, which gives rise to the gastroduodenal artery and then the left hep-

atic artery. Finally, the fourth branch is the splenic artery (Fig. 3).

The patient's acute condition was treated with percutaneous transhepatic external biliary drainage. During this procedure, a percutaneous cholangiography revealed multiple zones of intrahepatic and extrahepatic bile duct stenosis and dilatations. Liver transplantation is being proposed as a treatment for her chronic sclerosing cholangitis.

Discussion

Identification of all anatomical variations of the hepatic arteries preoperatively by hepatobiliary pancreatic surgeons using imaging is of utmost importance before performing surgical interventions to prevent iatrogenic injuries to blood vessels and, therefore, postoperative complications [2,4,5]. When it comes to Pancreaticoduodenectomy, recognizing and preserving replaced hepatic arteries is critical to prevent ischemia to the biliary-enteric anastomosis and subsequent dehiscence [6,7]. Moreover, accidentally injuring a replaced hepatic artery could also result in liver ischemia, ischemic cholangitis, and liver abscess [6,7]. Additionally, to enhance safety, intraoperative liver Doppler ultrasonography confirming bilateral intrahepatic arterial flow during pancreaticoduodenectomy is suggested [8]. Thus, recognizing arterial anatomical variations is a



Fig. 3 – Three Dimensional colored CT scan showing an anatomical variation: the celiac trunk gives rise to 4 branches: left gastric artery, replaced right hepatic artery, common hepatic artery, and splenic artery. CT: celiac trunk, SA: splenic artery, rRHA: replaced right hepatic artery, LHA: left hepatic artery, aLHA: accessory left hepatic artery arising from the left gastric artery.

crucial necessity for performing safe hepatobiliary-pancreatic interventions.

According to a systematic review analyzing the anatomical variation of the celiac trunk, quadrifurcation, defined as a fourth terminal branch besides the 3 principal branches, is present in approximately 8.33% of cases [9]. The fourth terminal branch is the gastroduodenal artery in 1 study [10], or the middle colonic artery in another [11]. On the other hand, according to Michels' and Hiatt et al. classifications, the replaced right hepatic artery originates from the superior mesenteric artery [1,2]. Interestingly, our article describes a new finding of a replaced right hepatic artery, arising as the fourth branch of the celiac trunk in addition to the splenic, left gastric, and common hepatic artery. In the second-case presentation, an additional anatomical variation is also present: an accessory left hepatic artery originating from the left gastric artery. Similarly, Behara et al. reported a comparable anatomical variation, where a replaced right hepatic artery arising directly from the celiac trunk and coursing posterior to the portal vein is identified, in addition to an accessory left hepatic artery arising from the left gastric artery, in a patient undergoing a pancreaticoduodenectomy for a periampullary adenocarcinoma [12]. The replaced right hepatic artery described in our cases has a course like that Behara et al. describes.

Recently, 2 classification systems have emerged, the CRL and ex-CRL classifications, which encompass nearly all anatomical variations of the common, right, and left hepatic arteries [13,14]. The anatomical variations described in this article, previously unclassified by traditional systems, can be

easily categorized using the CRL classification [13]. The first case can be classified as CRrCL (Type 2c), and the second as CRrCLaL (Type 7a) [13].

Conclusion

Hepatic arteries display a wide range of anatomical variations, making their preoperative identification crucial for ensuring safe hepatobiliary and pancreatic surgeries. Given that traditional classification systems do not account for all these anomalies, the development of a more comprehensive system, such as the CRL and ex-CRL classifications, has become essential for improving surgical outcomes.

Ethical approval

Obtained.

Patient consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request. Ethical approval also has been obtained and available on request.

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