

Uncommon hepatic arterial variation: replaced right hepatic artery originating from dorsal pancreatic artery

Emre Emekli, Elif Gündoğdu, Hilal Kırmızıgül

Eskişehir Osmangazi University, Faculty of Medicine, Department of Radiology, Eskişehir, Türkiye

SUMMARY

This case report describes a rare anatomical variation where the right hepatic artery (RHA) originates from the dorsal pancreatic artery in a healthy 51-year-old liver donor. Although previously reported in isolated cases, this variation remains extremely rare and is not widely covered in existing classification systems. Detailed imaging revealed that the celiac trunk trifurcated into the left gastric artery, common hepatic artery, and splenic artery, with the dorsal pancreatic artery giving rise to the right hepatic artery. Hepatic artery variations underscore the importance of detailed preoperative imaging. Recognizing these rare variants is critical in liver transplantation and other hepatobiliary surgical procedures to prevent surgical complications. This case contributes to existing knowledge of hepatic artery anatomy and highlights the need to include rare variants identified through advanced imaging techniques in classification systems. In conclusion, hepatic artery variations are common, and due to complex embryological development, it may not be possible to classify all variations. However, even if they cannot be classified, these anomalies should be clearly described.

Key words: Hepatic artery variation – Dorsal pancreatic artery – Replaced right hepatic artery

– Liver transplantation – Vascular imaging

INTRODUCTION

The liver receives blood via the portal vein and hepatic arteries, with hepatic arterial vascularity crucial for hepatobiliary perfusion. In classical anatomy, the common hepatic artery (CHA) originates from the celiac trunk (CeT), bifurcating into the proper hepatic artery (PHA) and the gastroduodenal artery (GDA). The PHA divides into the left hepatic artery (LHA) and right hepatic artery (RHA). Throughout its course, the hepatic artery lies adjacent to the pancreas, peritoneum, and posterior abdominal wall (Sinnatamby and Last, 2011).

Computed tomography (CT) and magnetic resonance imaging (MRI) are modalities for evaluating hepatic artery courses and variations (Swami et al., 2021).

Hepatic artery variations frequently occur and are significant in liver transplants, advanced hepatobiliary surgeries, imaging-guided interventions, and trauma. Unawareness of these variations can lead to intraoperative vascular injuries, which increase with abnormal anatomy (Swami et al., 2021). The gastrointestinal arterial supply is primarily from the anterior branches of the

Corresponding author:

Emre Emekli. Eskişehir Osmangazi University, Faculty of Medicine, Department of Radiology, Eskişehir, Türkiye. E-mail: emreemekli90@gmail.com - Orcid: 0000-0001-5989-1897

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abdominal aorta at three levels: the CeT, superior mesenteric artery (SMA), and inferior mesenteric artery (IMA). Variations in these structures can arise from different embryonic development stages. Adachi (1928) described six celiac trunk variants, and Lipshutz (1917) provided a composite analysis of celiac anatomy. Uflacker (1997) later proposed an eight-type classification based on angiographic studies. Subsequently, cadaveric and imaging-based classification systems were introduced to better integrate embryological knowledge into anatomical taxonomy (Marco-Clement et al., 2016).

Due to the importance of anatomical variations, several classification systems have been proposed for hepatic artery variations. The Michels classification is widely accepted; Michels (1966) found 55% of 200 cadavers had classical anatomy. Hiatt et al. (1994) and Abdullah et al. (2006) later expanded upon Michels' classification. Kobayashi et al. (2014) proposed a detailed classification and reported 77.2% of 1,200 patients had normal vascular anatomy. This case presents a rare hepatic artery variation found in a healthy liver donor.

CASE REPORT

A 51-year-old living liver donor candidate underwent a triphasic IV contrast-enhanced abdominal CT scan for transplant planning. A radiology specialist with seven years of experience in abdominal and transplantation radiology reviewed axial, sagittal, and coronal images, followed by three-dimensional volume rendering (3D VR).

CT showed the CeT trifurcating into the left gastric artery, CHA, and splenic artery. The CHA first gave off the dorsal pancreatic artery, then the GDA and LHA. The LHA supplied the left hepatic lobe and segment 4. The RHA originated from a replaced dorsal pancreatic artery.

The 3D VR image depicted the branches of the CeT (Fig. 1). Oblique coronal MIP images showed the replaced RHA originating from the dorsal pancreatic artery (Fig. 2).

Written and informed consent for publishing this case report was obtained from the patient.

DISCUSSION

Embryologically, the CeT originates from six pairs of ventral splanchnic arteries. During fetal development, these arteries develop and regress. Persistence of channels between them can result in vascular anomalies and variations. Tandler (1908) first described how the vitelline arteries transform into the adult splanchnic branches through selective regression and persistence. If atypical segments remain, unusual arterial pathways can develop—including rare cases, like an RHA originating from the dorsal pancreatic artery. Such anomalies reflect the complex, non-linear remodeling of the embryonic arterial plexus.

The prevalence of replaced RHA ranges between 5% and 21% in the literature (Sinnatamby and Last, 2011; Swami et al., 2021). Variations in these percentages are attributed to factors like ethnic characteristics, cadaveric or imaging-based studies, and modalities used. Reported origins of re

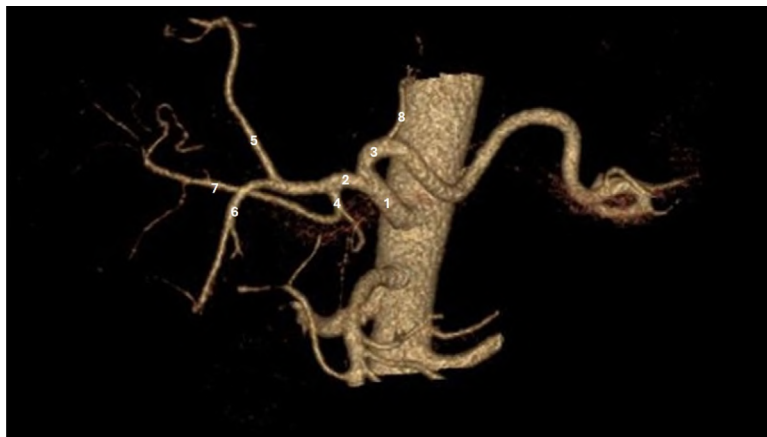


Fig. 1.- Three-dimensional volume rendering (3D VR) of the celiac trunk and branches. 1 celiac trunk, 2 common hepatic artery, 3 splenic artery, 4 dorsal pancreatic artery, 5 left hepatic artery, 6 gastroduodenal artery, 7 replaced right hepatic artery, 8 left gastric artery.



Fig. 2.- Coronal oblique maximum intensity projection (MIP) image a right hepatic artery (black arrow) arising from dorsal pancreatic artery and left hepatic artery (white arrow) originating from common hepatic artery.

placed RHA include the SMA (Michels Type III), GDA, aorta, IMA, inferior phrenic artery, and middle colic artery (Covey et al., 2002; Ugurel et al., 2010; Abdullah et al., 2006; Noussios, 2017). The dorsal pancreatic artery, as described in this case and previously reported by Kishi et al. (2010), represents a very rare site of origin.

Advancements in invasive angiographic techniques and non-invasive vascular imaging, such as volume rendering and curved planar reformation, enable detailed visualization of vascular structures. Despite identifying numerous vascular variations, rare variants are not included in current classification systems. New classification proposals exist but are not widely used due to their complexity and lack of practicality.

Hepatic arterial variations are common, and unrecognized variants may exist due to complex embryological development. Not all anomalies can be classified or known, but they should be clearly described, even if they cannot be classified. In this context, CT stands out due to its non-invasive nature.

AUTHOR CONTRIBUTIONS

EE: manuscript drafting and submission, figure editing. EG: critical revision of the manuscript.

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