

Pre-Transplant Assessment of Hepatic Vascular Variations Using CT Angiography: A Case Study

F.S. Ondongo^{1*}, K. Outaghyame¹, N. Hammoune¹, A. Mouhcine¹¹Radiology Department, Avicenne Military Hospital, Mohamed VI University Hospital, Marrakech, MoroccoDOI: <https://doi.org/10.36347/sjmcr.2025.v13i06.020>

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*Corresponding author: F.S. Ondongo

Radiology Department, Avicenne Military Hospital, Mohamed VI University Hospital, Marrakech, Morocco

Abstract

Case Report

Anatomical variations of hepatic vasculature are frequent findings that require careful evaluation during the preoperative assessment for liver transplantation. We present the case of a 59-year-old patient with advanced hepatic cirrhosis complicated by portal hypertension, who was evaluated as a transplant candidate. Computed tomography angiography of the abdomen revealed an unusual vascular pattern characterized by the absence of the celiac trunk—classified as type V in Morita's system—with aberrant arteries arising directly from the aorta. Specifically, the left hepatic artery originated from the left gastric artery. The portal vein was noted to be patent, dilated, and exhibiting trifurcation. Additional imaging findings consistent with cirrhosis included hypertrophy of segment I, splenomegaly, and prominent esophageal collateral vessels. This report highlights the importance of identifying such complex vascular anomalies prior to transplantation, given their significant implications for surgical planning and postoperative outcomes. The coexistence of both arterial and portal vein variations in this patient underscores the need for thorough vascular mapping in transplant candidates.

Keywords: Hepatic Vascular Variations, Liver Transplantation, CT angiography, Celiac Trunk Anomaly, Morita Classification.

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INTRODUCTION

An accurate understanding of hepatic vascular anatomy is fundamental in the context of liver transplantation, where anatomical variations can significantly impact surgical planning and outcomes. Hepatic vascular anomalies, including variations of the celiac trunk and portal vein, are common and often asymptomatic but pose critical challenges during transplant procedures. Preoperative imaging, particularly computed tomography (CT) angiography, plays a crucial role in delineating these vascular structures to minimize intraoperative risks and postoperative complications.

We report a case illustrating a rare combination of arterial and portal venous variations detected by CT angiography in a patient undergoing evaluation for liver transplantation. This case underscores the importance of thorough vascular assessment in candidates for transplantation to ensure optimal surgical strategy and patient safety.

OBSERVATION

A 59-year-old male patient with a known history of hepatic cirrhosis complicated by portal hypertension was referred for pre-transplantation evaluation. The patient was clinically stable but required detailed vascular mapping to guide surgical planning.

An abdominal CT angiography was performed, revealing a complete absence of the celiac trunk, classified as type V according to Morita's classification. Instead, aberrant arterial branches originated directly from the abdominal aorta: notably, the left hepatic artery arose from the left gastric artery. The portal vein was patent and dilated, displaying a trifurcated branching pattern. Additional findings consistent with cirrhosis included hypertrophy of segment I, splenomegaly, and well-developed esophageal collateral vessels.

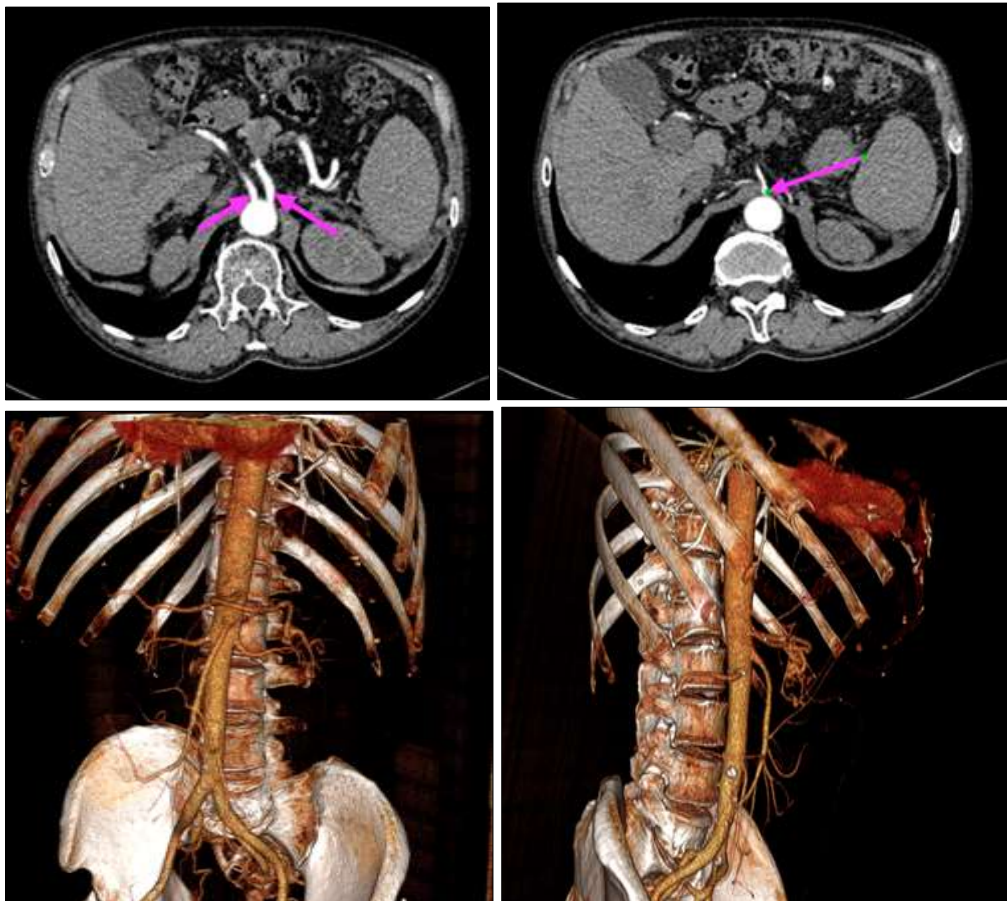
These vascular anomalies were carefully documented to inform the transplant surgical team, highlighting the importance of precise preoperative imaging in identifying anatomical variations that could influence the surgical approach and reduce intraoperative risks.

Arterial Supply of the Liver:

- The celiac trunk is absent, consistent with a type V variant per Morita's classification.
- The splenic artery and left gastric artery originate directly from the anterior wall of the abdominal aorta at the L1 vertebral level. Both vessels demonstrate normal caliber, regular course, and homogeneous contrast enhancement throughout their length.
- The common hepatic artery arises independently from the anterior aortic surface at L1 and bifurcates into the right hepatic artery and the gastroduodenal artery, both vessels maintaining normal caliber, regular trajectory, and adequate opacification.
- The left hepatic artery emerges from the left gastric artery (coronary artery of the stomach).

Portal Vein Anatomy:

- The portal vein is patent and dilated, measuring 19 mm in diameter, terminating in a trifurcation pattern: a left portal branch, an anterosuperior right portal branch, and a posteroinferior right portal branch.
- Presence of a tortuous vein draining esophageal varices, which communicates with the splenic vein.
- The splenic vein is dilated, measuring 9 mm in diameter.
- The superior and inferior mesenteric arteries and veins are visualized, patent, and without evidence of significant stenosis or obstruction.





DISCUSSION

Hepatic vascular anatomical variations are a well-documented phenomenon, with significant prevalence in the general population. These variations hold particular clinical importance in liver transplantation, where unrecognized anomalies can complicate surgical dissection, graft procurement, and vascular anastomoses, potentially compromising graft viability and patient outcomes.

The absence of the celiac trunk, as observed in our patient, is an exceptionally rare variant classified as type V in Morita's system. This anomaly results in direct aortic origins of the hepatic and gastric arteries, which necessitates careful surgical consideration due to the atypical arterial course and potential for vascular injury. Furthermore, the trifurcation of the portal vein, although less frequent, adds complexity to portal inflow management during transplantation.

Preoperative CT angiography serves as the gold standard for non-invasive vascular mapping, offering high-resolution images that accurately depict both arterial and venous anatomy. This imaging modality enables surgeons to anticipate anatomical challenges, tailor their operative technique, and minimize intraoperative complications such as hemorrhage or ischemia.

The concomitant presence of both arterial and portal vein variations, as in this case, highlights the need for comprehensive vascular assessment in transplant candidates. Recognizing these anomalies preoperatively allows for meticulous planning, potentially including modifications in surgical approach or vascular reconstruction techniques, thereby improving transplant safety and outcomes.

In addition to surgical implications, awareness of these variants is crucial for interventional radiologists and hepatologists involved in pre- and post-transplant

care, as vascular anatomy influences procedures such as embolization, stenting, or biopsy.

Our case reinforces the indispensable role of detailed vascular imaging in the multidisciplinary management of liver transplant candidates and contributes to the growing body of literature emphasizing individualized surgical strategies based on patient-specific anatomy.

CONCLUSION

Preoperative identification of hepatic vascular variations is crucial for safe liver transplantation. This case highlights the importance of CT angiography in detecting rare anomalies like absence of the celiac trunk and portal vein trifurcation, allowing for tailored surgical planning and improved outcomes.

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