



Aberrant gastroduodenal and proper hepatic arteries

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Abstract

Purpose Anatomic variants of the celiac trunk and superior mesenteric artery are common, thus knowledge of these variants is important for preoperative planning of abdominal surgery and interventional procedures.

Methods We report a rare anatomic variant of replaced proper hepatic and gastroduodenal arteries discovered upon CT angiography and diagnostic angiogram.

Results Emergent angiogram performed on a 61-year-old male who presented with signs and symptoms of upper gastrointestinal hemorrhage revealed a rare variant of an absent common hepatic artery and its branches with aberrant origins. The replaced proper hepatic artery originated from the superior mesenteric artery and the replaced gastroduodenal artery originated from a gastrosplenic trunk.

Conclusion This case emphasizes the importance of evaluating preoperative imaging to identify vascular variants prior to undergoing abdominal surgery or interventional procedures.

Keywords Superior mesenteric artery · Celiac trunk · Gastrosplenic trunk · Hepatic artery variants · Replaced proper hepatic artery · Replaced gastroduodenal artery

Introduction

The celiac trunk is the first ventral branch of the abdominal aorta and provides arterial supply to most of the foregut. The normal branching pattern of the celiac trunk is a trifurcation of the splenic artery (SA), the left gastric artery (LGA), and the common hepatic artery (CHA). As the CHA courses towards the porta hepatis, it gives rise to the gastroduodenal artery (GDA) inferiorly, and becomes the proper hepatic artery (PHA) [4]. The PHA terminates by bifurcating into the right and left hepatic arteries to provide arterial blood supply to the liver.

Anatomical variants of the celiac trunk and hepatic arteries have been thoroughly described and classified in the literature and new classifications have been proposed and used to apply them in clinical scenarios [6, 7, 12]. Variation in hepatic arterial anatomy is common and is seen in approximately 50% of the population [3]. Understanding

these variants are of great importance to surgeons and interventional radiologists to prevent vascular injury during procedures. Thus, high quality imaging is necessary for preoperative planning to evaluate for aberrant anatomy.

Case report

We report a case of a 61-year-old male with no known past medical history and daily NSAID use who presents with hematemesis and hematochezia. Vitals signs on admission demonstrate tachycardia to 111 bpm, normotensive blood pressure of 148/71 mmHg, and respiratory rate of 20. Laboratory results reveal anemia with a hemoglobin level of 6.7 g/dL. The patient was subsequently transfused 2 units of packed red blood cells and underwent emergent endoscopy. During endoscopy, a giant duodenal ulcer with active bleeding was found and treated with epinephrine injection. Cessation of bleeding from the ulcer base was achieved after epinephrine injection. The patient remained hemodynamically stable without evidence of bleeding for 36 h before having melena and a drop in hematocrit.

MDCT (multidetector computed tomographic) angiography of the chest, abdomen and pelvis was done using a

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General Electric Revolution EVO scanner. The scanning parameters were as follows: 120 kVp; Auto mA; 0.5 s gantry rotation time; 1.375 mm pitch; 2.5 mm slice thickness. The scanning area included the chest, abdomen and pelvis. CT angiography demonstrated a replaced PHA with SMA origin and a replaced GDA arising from a gastrosplenic trunk (Fig. 1). Interventional radiology was consulted and upon multidisciplinary discussion with gastroenterology and general surgery, it was decided that empiric embolization of the replaced GDA is the appropriate next course of treatment.

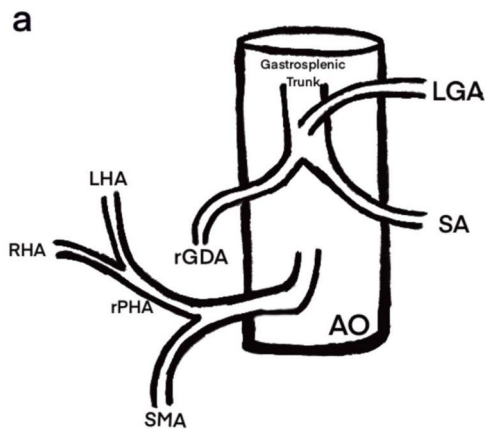
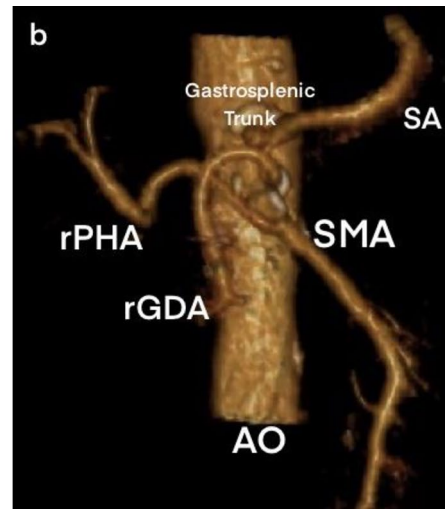


Fig. 1 Anatomical anomalies of the gastroduodenal and proper hepatic arteries discovered on CT angiography. **a** Schematic drawing of the abdominal aorta (AO), gastrosplenic trunk, splenic artery (SA), left gastric artery (LGA), replaced gastroduodenal artery (rGDA), superior mesenteric artery (SMA), replaced proper hepatic artery (rPHA), left hepatic artery (LHA), and right hepatic artery (RHA). **b**

Emergent angiography was performed and confirmed the absence of the CHA. Complete arterial supply to the liver via PHA originated from the SMA. The replaced GDA originated directly off the gastrosplenic trunk (Fig. 2).

A micro-catheter was used to selectively catheterize the replaced GDA and an arteriogram demonstrated no active extravasation. Empiric coil embolization of the replaced GDA was subsequently performed. Post embolization angiography of the gastrosplenic trunk showed no antegrade flow into the replaced GDA.



3D reconstruction of a MDCT angiogram of the abdomen and pelvis with IV contrast demonstrates an oblique view of the abdominal aorta (AO) demonstrating aberrant origins of the replaced proper hepatic artery (rPHA) arising from the superior mesenteric artery (SMA) and replaced gastroduodenal artery (rGDA) arising directly from the gastrosplenic trunk

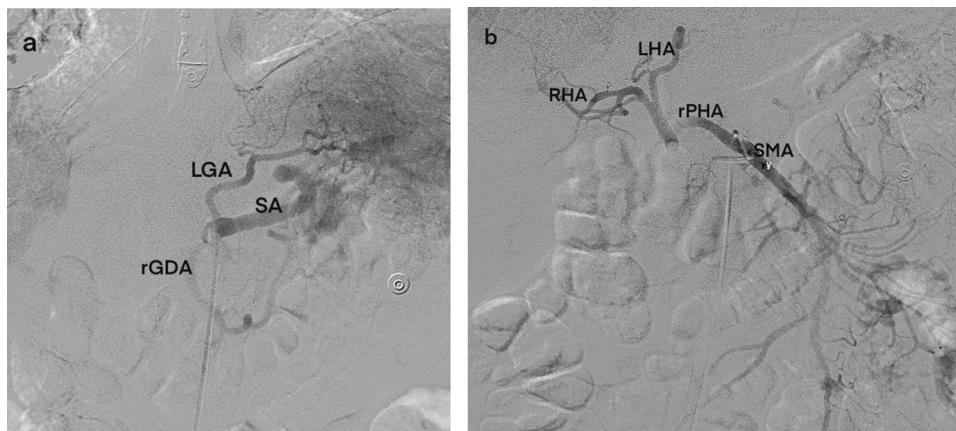


Fig. 2 Anatomic anomalies of the gastroduodenal and proper hepatic arteries visualized on angiography. **a** Digital subtraction angiogram of the gastrosplenic trunk demonstrates trifurcation of the replaced gastroduodenal artery (rGDA), splenic artery (SA), and left gastric

artery (LGA). **b** Digital subtraction angiogram of the superior mesenteric artery (SMA) demonstrates a replaced proper hepatic artery (rPHA) giving rise the right hepatic artery (RHA) and left hepatic artery (LHA)

Discussion

Anatomic variants of the celiac trunk and SMA occur due to anomalous embryogenesis of the primitive ventral blood vessels from the abdominal aorta [1, 4, 5, 9, 10, 15]. Michels set the benchmark for classifications of hepatic artery variants in 1966 [12]. Since his work there has been further investigation and modifications on the classification of these variants [7, 16, 18, 19].

Various origins of the CHA have been reported in approximately 4% of individuals [8, 17]. These include a replaced CHA arising from the SMA in 0.86–3% of cases (Michels type IX, 4.5%) [12]. The GDA, however, is found as a constant branch of CHA in 92–95% of patients [9, 12]. A replaced GDA with a celiac origin has been described in the meta-analysis as the hepatosplenic trunk by Macro-Clement [11].

To emphasize the rarity of this variation, we reference only two studies on cadaveric dissections that demonstrate CHA absence and coexistence of a replaced PHA and replaced GDA [2, 13]. The absence of the CHA and coexistence of a replaced PHA and GDA was not included in Michels classification, however it has particular relevance for patients who are having their hepatic arteries interrogated or, as in the presented case, being evaluated for bleeding duodenal ulcer.

Documenting new and rare variants of the visceral arteries is important to maximize the database available to provide optimal care for patients during invasive procedures [14, 16]. It is important that interventional radiologists and surgeons are familiar with both common and rare celiac trunk and SMA branch variants, because failure to recognize aberrant vasculature can result in incomplete therapy or severe vascular and surgical complications.

Conclusion

The precise knowledge of the celiac trunk and arterial variants is very important for preoperative and interventional planning. It is essential to identify and understand variant anatomy prior to any intervention to avoid vascular complications and decrease morbidity of patients.

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Declarations

Conflict of interest None.

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