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ANATOMIC VARIATIONS

Splenic artery arising from hepatic artery proper in a patient with celiacomesenteric trunk: a rare anatomical variant

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Abstract

We report an extremely rare case of splenic artery arising from hepatic artery proper in a patient with celiacomesenteric trunk variant. This anatomical variation was detected angiographically during hepatic mapping prior to transarterial radioembolization (TARE) for hepatocellular carcinoma in an 84-year-old man. TARE of hepatic tumors is one of the frequent procedures done by interventional radiologists. The identification of such rare vascular aberrations is of great importance not only in current interventional radiology procedures such as radioembolization but also in surgery and diagnostic radiology. To the best of our knowledge, this vascular variant is a novel discovery.

Keywords Aberrant splenic artery · Hepatic artery proper · Celiacomesenteric trunk · Variant · Hepatic mapping

Introduction

In conventional anatomy, the celiac artery (CA) originates anteriorly from the abdominal aorta at the level of T12 and terminates into three branches; left gastric artery (LGA), splenic artery (SA), and common hepatic artery (CHA). The CA supplies the liver, gallbladder, spleen, pancreas, and gut from distal esophagus to the ampulla of vater [6, 10]. Below this, the superior mesenteric artery (SMA) arises immediately superior to the origin of the renal arteries. The SMA passes behind the pancreatic body, where it enters the mesentery and supplies the distal duodenum, jejunum, ileum, and a large part of the colon [10]. Variant arterial anatomy is common and seen in about half of the population [11]. However, a common trunk of CA and SMA, which is known as celiacomesenteric trunk (CMT), is seen in less than 1% of patients [10, 11]. The SA arises from CA in 90.6% of cases [7].

We report an extremely rare case of SA arising from hepatic artery proper (HAP) in a patient with CMT variant detected angiographically during hepatic mapping prior to transarterial radioembolization (TARE) for hepatocellular carcinoma (HCC).

Case presentation

An 82-year-old male patient is known to have diabetes mellitus, hypertension, and liver cirrhosis. The patient was referred from another hospital as a case of multifocal HCC. Computed tomography (CT) scan (Fig. 1), which was done outside our hospital prior to admission, revealed cirrhotic liver with a large infiltrative mass measuring 14 × 8.8 × 8.7 cm, involving hepatic segment V and VI. The mass was hypo-attenuated on pre-contrast images with no

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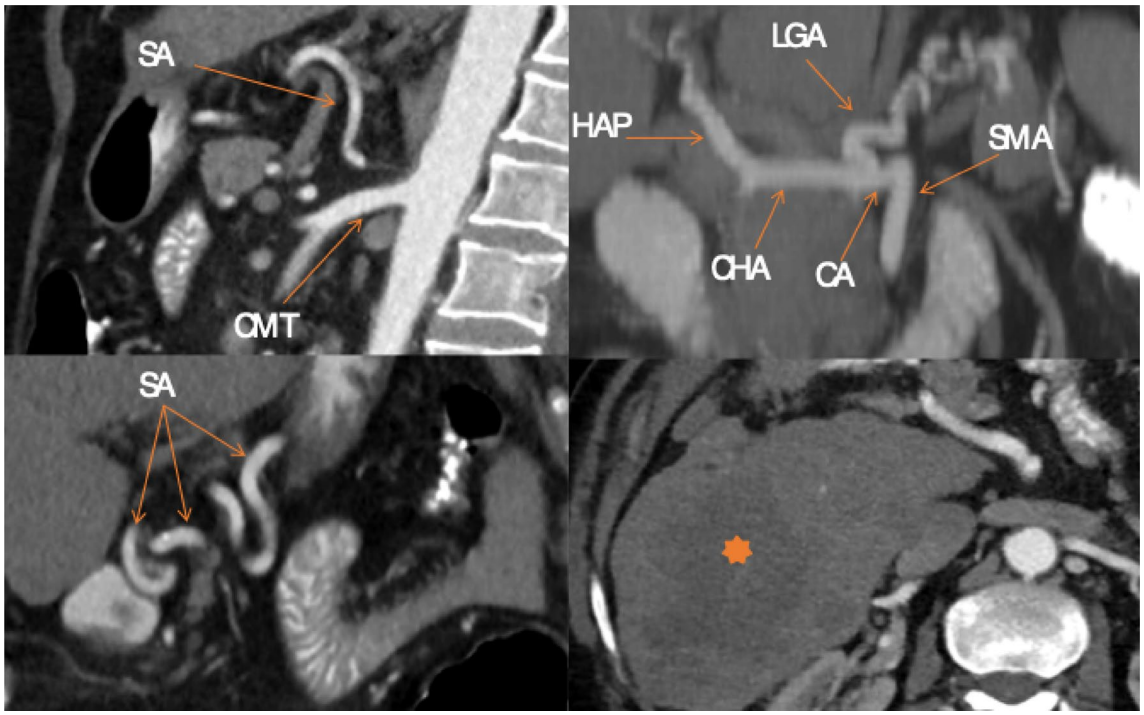

Fig. 1 Arterial phase of abdominal CT scan in sagittal plane (top left), coronal reformatted (top right), coronal (bottom left), and axial (bottom right). *CMT* Celiacomesenteric trunk, *CA* celiac axis, *LGA* left gastric artery, *SMA* superior mesenteric artery, *CHA* common hepatic artery, *HAP*, hepatic artery proper, *SA* splenic artery. * Non-enhancing large liver mass during arterial phase

enhancement in arterial phase? hypodense at portal venous, and delayed phases were associated with invasion of the right portal vein. Signs of portal hypertension were noted which was predominantly manifested as multiple portosystemic shunts at the gastroesophageal junction as well as splenomegaly. There was no ascites, regional lymph nodes, or extrahepatic metastasis. Due to the non-typical appearance of the lesion, liver mass biopsy was done which revealed moderately differentiated HCC. The patient's Child–Pugh score was A and the performance status was 1. The case was discussed at the hospital's tumor board, and as the patient is a non-surgical candidate, it was decided that the best alternative treatment option would be TARE.

The patient underwent hepatic mapping prior to TARE (Fig. 2). The procedure was done via right common femoral artery access followed by catheterization of a common trunk of CA and SMA. Selective catheterization of SMA showed no contribution to the tumor supply. The catheter was pulled back into CA which bifurcated into LGA and CHA. Selective catheterization of CHA and angiogram were performed which showed gastroduodenal artery (GDA) and HAP with SA arising aberrantly from it. Then, selective catheterization of SA and angiogram were obtained, which showed a very tortuous redundant artery going towards the left hypochondrium; however, no evidence of tumor supply was seen. Afterwards, using a microcatheter, left hepatic artery (LHA) was selected, and again, angiogram showed no evidence of tumor supply. Finally, the microcatheter was placed in right hepatic artery (RHA), which gives the main blood supply to the large tumor in the right lobe of the liver. At this stage, technetium-99m macroaggregared albumin (Tc-99m MAA) was injected into RHA.

The patient was brought back after 1 week for TARE. After obtaining access, a catheter was hooked to CMT and selection of RHA was done coaxially using a microcatheter. Angiogram was obtained followed by cone-beam CT confirming a large tumor blush in the right hepatic lobe. After confirming a good position of the catheter, a total dose of 2.97 gigabecquerel (Gbq) of SIR-Sphere Y-90 particles was injected into RHA. The patient tolerated the procedure well with no complications.

Discussion

Anatomical variations detected by angiography are not uncommon, especially during variety of interventional procedures. Numerous variations in regard to CA and hepatic arteries have been described in the literature; however, almost none reported a variant of SA arising from HAP [7, 9].

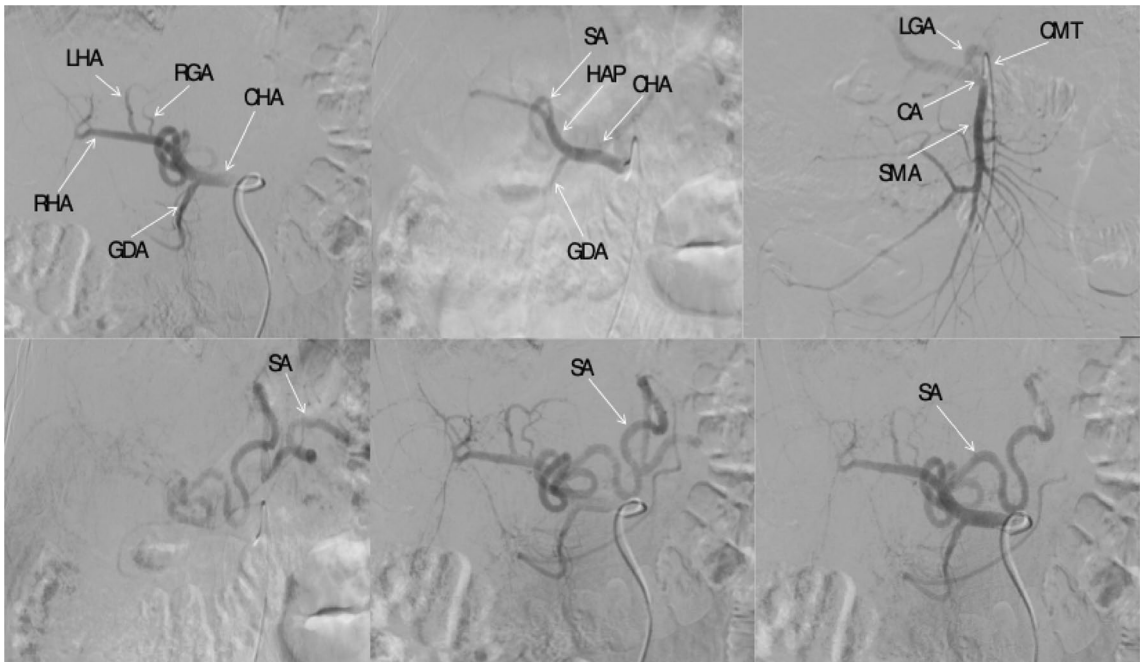

Fig. 2 Digital subtraction images. Catheter tip was placed at CMT that gives CA and SMA. The CA is very short and bifurcates into LGA and CHA. The CHA gives GDA and continues as HPA. Then HAP gives SA and RGA, and terminates as it bifurcates into right and left hepatic arteries. The SA has very tortuous redundant loops going towards the left hypochondrium. *CMT* Celiacomesenteric trunk, *CA* celiac axis, *LGA* left gastric artery, *SMA* superior mesenteric artery, *CHA* common hepatic artery, *HAP* hepatic artery proper, *SA* splenic artery, *GDA* gastroduodenal artery, *RGA* right gastric artery, *LHA* left hepatic artery, *RHA* right hepatic artery

Embryologically, the abdominal aorta in its primitive form gives rise to ventral splanchnic arteries connected via longitudinal anastomosis, most of which disappear normally. Either the persistence or fusion of such arteries could explain the several arterial variants of the course of SA [4, 8].

CMT is one of the described rare anatomical variants where CA and SMA arise from a common trunk. According to a large systematic review by Panagouli et al., 36 cadaveric and radiological studies with a total of 12196 cases were reviewed, the variant of CMT was only seen in 0.76%. Such classification was proposed by Michel (type VI) and Adachi (type IV) [7]. In addition, Marco-Clement et al. performed a study on 43 adults with no report whatsoever of CMT variant [2].

SA most commonly originates from CA, as reported by Pandey et al. This large study dissected 320 cadavers to look into their splenic origin concluding that CA accounted for 96.6%, abdominal aorta 8.1%, and CHA or SMA 1.3% [8]. In addition, an aberrant origin of SA as spleno-gastric trunk was observed by Lipshutz [1]. Most notably, splenic artery arising from HAP is a novel discovery; none of the authors scarcely ever mentioned it.

HAP is typically a continuation of CHA after giving off GDA, which terminates as right and left hepatic arteries. Mehta et al. reported double right gastric arteries emanating from HAP in a very rare and remarkable course [4]. Conversely, several studies reported an absent HAP [3, 5, 9]. In regard to the origin, Natsis et al. reported a very rare variant of HAP and GDA arising from SMA, with absent CHA [5].

In our present case, the patient has CMT that gives CA and SMA. The CA is very short and bifurcates into LGA and CHA. The CHA gives GDA and continues as HAP. Then, HAP gives SA and RGA, and terminates as it bifurcates into right and left hepatic arteries.

Thorough knowledge of the different vascular variants, which have been explained over years by numerous studies, case series, and reports, is of great importance for interventional radiologists especially with the modern development of different varieties of transarterial therapy. TARE of hepatic tumors is one of the frequent procedures done by interventional radiologists. Prior to this procedure, hepatic mapping is performed to identify areas of target and non-target embolization. In case of anticipated risk for the latter during the injection into hepatic artery, either a new site of infusion may be selected or selective coil embolization of extrahepatic artery at risk is performed prior to radioembolization.

To the best of our knowledge, this angiographically detected splenic artery arising from hepatic artery proper is an extremely unique variant. The identification of such rare vascular aberrations is of great importance not only in

current interventional radiology procedures such as radioembolization, but also in surgery and diagnostic radiology.

Author contributions JA: manuscript writing/editing. AA: manuscript editing and figure selection. WA: manuscript writing/editing. HA: case selection. YAZ: case selection, data collection, and manuscript revision.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

References

1. Lipshutz B (1917) A composite study of the coeliac axis artery. Ann Surg 65:159–169
2. Marco-Clement I et al (2015) Anatomical variations of the celiac trunk: cadaveric and radiological study. Surg Radiol Anat 38:501–510
3. McNulty J (2000) Total anomalous arterial supply to the liver and gallbladder from gastroduodenal artery: a case report. Surg Radiol Anat 22:123–124
4. Mehta V, Dave V, Suri RK, Rath G (2012) Quadrifurcation of the hepatic artery proper in conjunction with double right gastric arteries. Singap Med J 53:e211–e213
5. Natsis K et al (2017) Anastomotic loop between common hepatic artery and gastroduodenal artery in coexistence with an aberrant right hepatic artery. Folia Morphol. https://doi.org/10.5603/FM.a2017.0023
6. Nonent M, Larroche P, Forlodou P, Senecail B (2001) Celiac-bimesenteric trunk: anatomic and radiologic description—case report. Radiology 220(2):489–491
7. Panagouli E, Venieratos D, Lolis E, Skandalakis P (2013) Variations in the anatomy of the celiac trunk: a systematic review and clinical implications. Ann Anat 195:501–511
8. Pandey K, Bhattacharya S, Mishra N, Shukla K (2004) Anatomical variations of the splenic artery and its clinical implications. Clin Anat 17(6):497–502
9. Skórzewska A et al (2014) Rare variations of hepatic arteries in association with variable origin of gastroduodenal artery found in multidetector computed tomography angiography. Folia Morphol (Warsz) 73:531–535
10. Walker G (2009) Mesenteric vasculature and collateral pathways. Semin Intervent Radiol 1(212):167–174
11. Wayne MG, Narang R, Verzosa S, Cooperman A (2011) Superior mesenteric artery originating from the celiac axis: a rare vascular anomaly. World J Surg Oncol 9(1):71