Int J Clin Exp Med 2019;12(8):10991-10993
www.ijcem.com /ISSN:1940-5901/IJCEM0093690

Case Report

A unique arterial loop formed from a variant hepato-spleno-mesenteric trunk supplying the liver and spleen: a case report

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Received March 11, 2019; Accepted July 11, 2019; Epub August 15, 2019; Published August 30, 2019

Abstract: Variations of celiac trunk anatomy are of crucial importance in interventional radiology and hepatopancreatobiliary surgery. Here a rare case with a celiac trunk variation is presented. The 63-year-old man was found to have a pancreas head mass as identified on ultrasonography. Preoperative computed tomography angiography demonstrated an absent celiac trunk. His splenic artery (SA), common hepatic artery (CHA) and superior mesenteric artery (SMA) originate from a hepatosplenomesenteric trunk. A shunt was also identified existing between the CHA and SA, while the left gastric artery arose directly from the abdominal aorta. Thus the SMA, CHA, SA and shunt formed a loop. The patient underwent pancreaticoduodenectomy with CHA resection, while the shunt was spared, preserving arterial supply to the liver. The resected specimen confirmed pancreatic adenocarcinoma by pathology and the patient recovered uneventfully with normal liver function and was free of tumor recurrence after 7 months follow-up. Knowledge of rare variant arterial anatomy is critical for surgical approaches in pancreaticoduodenectomy to avoid vascular injuries and reduce complications.

Keywords: Celiac trunk, arterial variation, hepatosplenicmesenteric trunk, pancreaticoduodenectomy, superior mesenteric artery, computed tomography angiography

Introduction

Pancreaticoduodenectomy (PD) with the achievement of an R0 resection leads to superior outcomes for patients with head of pancreas adenocarcinoma [1]. Variations of celiac artery anatomy are reported to occur in 10.6%-27.9% cases [2-4]. This has the potential to complicate surgery and also radiological interventions. Therefore accurate preoperative identification of arterial anomalies help to prevent arterial injury and its potential sequelae, such as hemorrhage, biliary fistula, hepatic ischemia, and liver abscess [5, 6]. There are several well-known variations of celiac trunk anatomy. Here a rare case is presented in which the celiac trunk was absent and arterial supply to the liver and spleen arose from a hepatosplenicmesenteric trunk (HPMT), with the left gastric artery (LGA) directly originating from the anterior wall of the abdominal aorta (AA). To the best of our knowledge, this is the first case of such unique variation of celiac trunk reported in the literature.

The study was approved by the Ethical Committee of Yiwu Central Hospital, Zhejiang Province (Yiwu, China), and written informed consent was obtained from the patient.

Case presentation

A 63-year-old man who exhibited a pancreatic head mass on ultrasonography, presented to the Yiwu Central Hospital, Zhejiang Province (Yiwu, China). The patient had no significant prior medical or surgical history. He was a nonsmoker and did not drink alcohol. Physical examination was unremarkable. Full blood count, serum amylase and electrolytes were within normal range. Liver function tests were as follows: albumin 38.2 g/L, alanine transami-

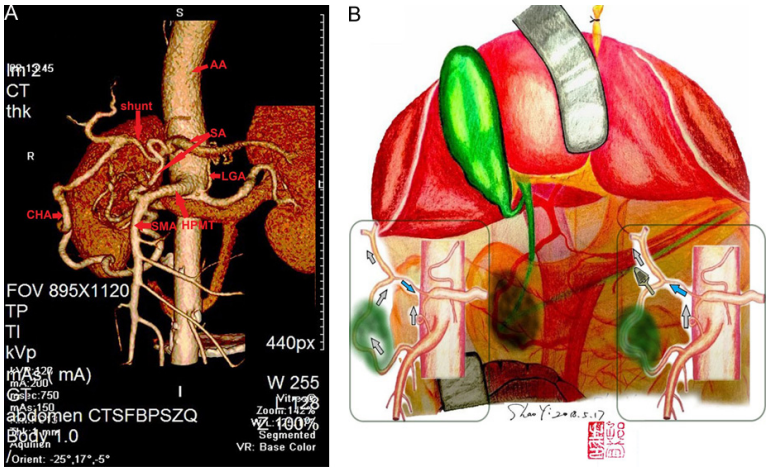

Figure 1. A. Computed tomography angiography (CTA) 3D-reconstructed image. The celiac trunk was aberrant, with the left gastric artery (LGA) directly emerging from the anterior wall of the abdominal aorta (AA). The caliber of splenic artery (SA) was very small. The SA arose from the proximal hepatosplenicmesenteric trunk (HPMT), the common hepatic artery (CHA) originated from the superior mesenteric artery (SMA), with a shunt existing between the variant CHA and SA trunk. The SMA, CHA, SA and shunt formed an arterial loop. B. Illustration of the intraoperative appearance during pancreaticoduodenectomy (PD). The variant common hepatic artery (CHA) coursed through the lesion. The hemodynamics of the arterial loop was confirmed by intraoperative ultrasonography. After occlusion of the CHA flow, the shunt flow reversed.

nase 14 U/L, aspartate transaminase 16 U/L, total bilirubin 58.2 μmol/L, direct bilirubin 45.1 μmol/L, and γ-glutamyltranspeptidase 211 U/L. Carbohydrate antigen (CA) 19-9 was elevated at 173.64 U/ml. Other tumor markers, including α-fetoprotein, carcinoembryonic antigen, CA-153 and CA125 were normal. Abdominal computed tomography and magnetic resonance cholangiopancreatography demonstrated intra- and extra-hepatic bile duct dilation down to the distal common bile duct due to the presence of a head of pancreas mass. Preoperative computed tomography angiography (CTA) demonstrated a rare variation of celiac artery anatomy. The celiac trunk was absent and a loop formed from the HPMT supplied the liver and spleen, with the LGA directly emerging from the anterior wall of the AA. The caliber of the splenic artery (SA) arising from the proximal HPMT was very small. The common hepatic artery (CHA) originated from the superior mesenteric artery (SMA), with a shunt existing between the variant CHA and SA trunk. Thus the SMA, CHA, SA and shunt formed an arterial loop (**Figure 1A**).

Indeed the unique arterial variation presented a challenge during surgery. After adequate exposure of the pancreatic head, the variant CHA was identified. However the CHA was involved in the tumor necessitating CHA resection en bloc with the pancreaticoduodenectomy specimen (**Figure 1B**). Before division of the CHA, intraoperative ultrasonography was used to characterize flow within the variant arteries. This demonstrated the direction of shunt flow was from liver to the spleen (**Figure 1B**). The CHA was then clamped, resulting in reversal of the shunt flow and continuation of the hepatic arterial blood supply (**Figure 1B**). Therefore the patient proceeded to PD with CHA resection (without reconstruction), while the shunt was protected to maintain the hepatic arterial blood supply. A definitive diagnosis of head of pancreas adenocarcinoma was made following histological analysis of the specimen. The patient recovered well without any complications. Following discharge he remains well with normal liver function tests and free of tumor recurrence after 7 months of follow-up.

Discussion

Hepatic, left gastric and splenic arteries are the "classical branches" of the conventional celiac trunk, and are present in 72.1-89.4% of the population [2-4]. Appreciation and study of celiac trunk anatomical variations are essential to the performance of a PD to prevent surgical complications such as hepatic ischemia/failure, postoperative hemorrhage, and anastomotic leak/stricture [5, 6]. Awareness of the variations allows the surgeon to adapt intraoperatively to appropriate surgical strategies to prevent the consequences of arterial disruption [5, 6].

The celiac trunk variation reported in this case is termed type VI according to the Panagouli Classification of celiac trunk patterns [4] and named HSMT with a reported incidence of 0.4% [2, 4]. The HSMT divides into SA, CHA, and SMA. The uniqueness of this case is that the

caliber of the SA was very small with a shunt from CHA to reinforce the blood supply of spleen. Therefore the SMA, CHA, SA and shunt formed a circular arrangement (**Figure 1A**). To the best of our current knowledge this is the first case of such a variation of the celiac trunk reported. The hemodynamics of the arterial loop was confirmed by intraoperative ultrasonography. Unfortunately, the variant CHA coursed through the lesion and therefore it was concluded that it would require resection en bloc. The CHA flow was intentionally occluded before division in order to test for arterial blood supply of the liver. Fortunately hepatic arterial flow was revealed to be preserved due to reversal of the shunt flow. Consequently, the CHA was resected without reconstruction, and the patient was in good health after 7 months follow-up. Postoperative surveillance CT identified dilatation of the previously narrow-caliber SA.

Every effort should be made to preserve aberrant arteries unless resection is oncologically indicated. In such cases arterial reconstruction is usually mandated. The existence of the shunt in this patient is crucial and fortunate. Protection of the shunt avoided vascular reconstruction, otherwise the resected CHA would require reconstruction to prevent potentially fatal postoperative complications. Hence, detailed knowledge of the types/subtypes of variations is of critical importance for effective preoperative vascular planning. Furthermore, prior knowledge of anatomical variants is fundamental to successfully accomplish interventional or oncologic procedures such as chemoembolization of liver malignancies or lymphadenectomy.

Good knowledge of arterial variations is important for surgical approaches to avoid vascular injuries and reduce complications. It is therefore recommended that CTA or magnetic resonance angiography be used as a non-invasive assessment of celiac trunk anatomy. Furthermore, these modalities may provide 3D-image reconstruction and if available should be used routinely for PD patients [2, 3].

Acknowledgements

The authors would like to thank Jiaojiao Feng for her kindly mental and psychological support. This project was supported by grants from Basic Public Interest Research Project of Zhejiang Province (LGF18H030006) and National S&T Major Project (NO. 2018ZX103-01201). Xiangyu Zhu and Yi Shao contributed equally to this work. Local Ethics Committee at Yiwu Central Hospital approved this study. Written informed consent was acquired from the patient.

Disclosure of conflict of interest

None.

Abbreviations

AA, abdominal aorta; CA, carbohydrate antigen; CHA, common hepatic artery; CTA, computed tomography angiography; HPMT, hepatosplenicmesenteric trunk; LGA, left gastric artery; SA, splenic artery; SMA, superior mesenteric artery; PD, pancreaticoduodenectomy.

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