Case Report

Asymptomatic stenosis of a celiacomesenteric trunk

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A B S T R A C T

Celiacomesenteric trunk is a rare variant of celiac artery anatomical variations. Stenosis of celiacomesenteric trunk is a severe usually symptomatic condition which might jeopardize the arterial supply of both supramesocolic organs and the midgut. It was diagnosed in a 79-year-old male during the preoperative workup for a pancreatic adenocarcinoma. Highly developed arterial anastomotic arcades, and mainly Riolan arcade, allowed to bypass this stenosis and to avoid digestive ischemia. Arterial anastomotic arcades are of paramount interest to ensure sufficient supply to the corresponding organs and must be thoroughly evaluated before planned surgery to avoid postoperative ischemia.

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Introduction

Abdominal surgery, and especially hepatobilary, pancreatic, and gastric oncological surgery, require a perfect knowledge of vascular anatomy. In these settings, preoperative imaging is especially important in order to identify “risky” variants that might be misidentified intraoperatively, causing serious postoperative complications.

One of the main abdominal arteries is the celiac trunk or artery (CA), the first branch that originates from the abdominal aorta. Along with the superior mesenteric artery (SMA), they ensure arterial supply of supramesocolic organs. Haller described for the first time the modal distribution of the CA, the so-called “Tripus Halleri” [1]. The CA trifurcates in three branches: common hepatic artery (CHA), splenic artery (SA), and left gastric artery (LGA).

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Many variants have been reported in the literature. Among them, the celiacomesenteric trunk (CMT) has been reported by several authors. In this case, a stenosis at the origin might compromise the vascularization of the mid gut and the supramesocolic organs unless the development of several collateral pathways bypasses the stenosis. This anatomical situation could be challenging especially in the setting of hepatobiliary, pancreatic surgery.

Herein, we report a case of CMT with significant stenosis at its origin bypassed by a highly developed Arc of Riolan.

**Case report**

A 79-year-old male, with a past medical history of hypertension, was diagnosed with a pancreatic head adenocarcinoma.

He presented to our emergency center for mild abdominal pain, jaundice, and a weight loss of 10 kg in 1 month. A blood workup showed total bilirubin level at 165 μmol/L (N < 17 μmol/L), conjugated bilirubin at 103 μmol/L (N < 5 μmol/L), AST of 72 UI/L (10-50 UI/L), ALT of 286 UI/L (10-50 UI/L), GGT of 1527 UI/L (8-61 UI/L), PAL of 569 UI/L (4-130 UI/L), and CA 19-9 level of 2332 UI/mL (N < 37 UI/mL).

In that patient, computed tomography (CT) scan of the abdomen and pelvis was performed: an iodine radiocontrast agent was injected in the right brachial vein (90 mL, with 3 mL/s flow), followed by 20 mL saline. A 64-slice scanner was used: 1.25-mm thickness for the primary diagnosis; and 2-mm thickness reconstruction for multiplanar reconstruction, maximum intensity projection (MIP), and 3-dimensional volume rendering technique (3D-VRT). The arterial variant was documented using the Synapse software and its 3D VRT.

Imaging identified a tumor in the head of the pancreas measuring 26 × 18 mm. The common bile duct was dilated up to 20 mm with an associated dilation of the pancreatic duct up to 7 mm.

The tumor appeared to be confined to the pancreatic head with neither enlarged lymph node nor metastatic lesions. There was no involvement of the mesentericopetal vein or SMA, CA, and CHA. Thus, the tumor was classified as upfront resectable according to the NCCN classification. Moreover, the CT-scan showed no replaced right hepatic artery.

The anatomic variation was suggested on multiplanar reconstruction but was more obvious after 3D reconstruction.

Close observation confirmed the absence of modal CA (Figs. 1 and 2). Both the CA and the SMA have a common origin from the abdominal aorta as a single trunk: A CMT.

CT scan showed ostial slight stenosis of the CMT with an internal diameter of 5.8 mm (Fig. 1). On the other side, the inferior mesenteric artery (IMA) was large and prominent. At the origin, the diameter of the IMA was 13.5 mm. A unique, large, and tortuous arterial branch arises from the IMA and ascends above the transverse mesocolon until the CMT, distal to the previously described stenosis. This highly developed arterial anastomosis between the SMA and IMA is an authentic arc of Riolan (Figs. 1 and 2).

The diagnosis of pancreatic adenocarcinoma was confirmed after endoscopic ultrasound with biopsy. A metallic biliary stent was placed to relieve jaundice.

The patient was presented at our multidisciplinary tumor board. Risks of postoperative mortality and complications after pancreaticoduodenectomy (PD) were considered very high and may outweigh the oncological benefits from surgery.

For all these reasons, surgery was not considered safe, and patient was referred to chemotherapy.

**Discussion**

Digestive arteries are formed from the 10th, 13th, and 21st vitelline segments. Persistence of these segments give respectively the CA, SMA, and IMA. Usual anatomical distribution requires the regression of all other segments. Initially, through all these vitelline arteries, aorta is connected to ventral anastomotic channel which tend to regress completely before birth [2]. The failure of either a vitelline artery or a ventral anastomosis to regress will result in anatomical variations [2]. In our case, the 10th to 12th vitelline arteries regressed completely while there was an abnormal persistence of a ventral anastomosis between the 13th vitelline artery and the branches of the 10th vitelline artery. However, this theory does not explain the arterial collateral network. The latter may have developed later alongside with the stenosis to ensure a sufficient blood supply and prevent ischemia of both foregut and midgut.

Normal anatomy of the CA was first described by Haller in 1756 with typical division into 3 branches: the LGA, CHA, and SA, the so called “tripus Halleri” [1]. Several reports have described anatomical variations of the CA with subsequent various classifications [3–5]. Among them, CMT is a rare variant of the CA anatomy reported in approximately 0.5%–1% of cases [3–6]. Song et al [6] in the largest radiological anatomical study about the variation of the CA and HA in 5002 CT-scans, reported 53 patients (1.06%) with a CMT. In this rare modality, the CA has a common origin with the SMA. Panagouli et al [4] performed the latest review of the previously published data about variation of the CA. The authors took into consideration cadaveric, radiological, and surgical studies and developed a comprehensive new classification. Nearly the same rate (0.76%) was reported in this systematic review of the literature that analyzed more than 12,000 patients.

To our knowledge, atheromatous stenosis of CMT was reported in the literature in only 6 cases [7]. Patients were symptomatic with mesenteric angina, weight loss, and dyspepsia. There were treated by endovascular stenting or/open surgery.

Herein, we report an asymptomatic stenosis of CMT by dint of retrograde blood flow mainly from the Arc of Riolan. A significant stenosis at the origin of the CMT might jeopardize the vascularization of both mid gut and supramesocolic organs. The arterial backflow from the IMA to the branches of the CMT through several developed collateral pathways ensured higher arterial supply and thus our patient was strictly asymptomatic.

In this setting, digestive arterial trunk anastomoses are crucial [8]. Riolan arc between the SMA and the IMA (supramarginal arcade) is the most frequently reported.

The main arterial anastomoses between the CA and the SMA are Rio Branco duodenopancreatic arcs and Buhler
arcade. Usually, they are overdeveloped in case of CA trunk stenosis. Villemin arcade is an inter mesenteric arcade between SMA and Arc of Riolan which is only present in 12%-18% cases [8]. In our case, with a CMT stenosis, all these arcades, but mainly the Riolan arcade, were highly developed which might explain the absence of severe symptoms with such CMT stenosis.

Knowledge of such extremely rare anatomical variation might be relevant especially in the clinical fields of malignancies, hepatobiliary surgery, and interventional radiology.
For our patient, unfortunately, diagnosis of such anatomical variation was made during the pre-therapeutic workup for a pancreatic ductal adenocarcinoma. Endovascular stenting was deemed not feasible because of the length of the stenosis and a high risk of complications in case of stent thrombosis.

Surgical resection in this setting must be guided by oncological recommendations with adequate lymphadenectomy and total excision of the retroportal lamina.

For this patient, usual dissection plans could not be used without a high risk of vascular injury. The potential risk of post PD hemorrhagic complications related to CHA/gastroduodenal artery stump pseudoaneurysms could not be treated by interventional radiology.

The other issue was the major role of pancreaticoduodenal arcades (Rio Branco arcades) in the arterial supply of the liver. Resection of the pancreatic head with the retroportal lamina excision (that comprises the ligation of pancreaticoduodenal arcades) may compromise the hepatic arterial flow.

Among the discussed surgical options, dissection and reimplantation of CHA into the aorta was relevant. However, the risk of complications was considered extremely high. Intraoperative injury/ligation of collateral shunts with the SMA may compromise not only the arterial supply of the midgut, but also the gastric arterial supply. In fact, after ligation of the right gastric and right gastroepiploic arteries, the arterial blood supply of the stomach will remain dependent on the LGA and branches of the SA (left gastroepiploic artery and short vessels). In case of surgical injury of Riolan arc branches, the CMT stenosis would be symptomatic, and a subsequent gastric ischemia might occur.

Finally, thrombosis of the arterial anastomosis between CHA and the aorta would result in a dreadful hepatic arterial ischemia.

This case report is another example to support that triple phase abdominal CT scan with 3D reconstruction is of paramount importance in the preoperative assessment before PD to identify “risky” variants that may be misidentified intraoperatively, thus leading to serious complications. Arterial anastomotic arcades are also of extreme importance in case of CA and/or SMA stenosis and might be taken into account during preoperative planning to avoid serious postoperative arterial complications.

**Author’s contribution**

R Rhaiem: Project development, Data collection, Manuscript writing and editing; C Hammoutene: Project development, Data collection, Manuscript writing and editing; C Durto: Data collection, Manuscript writing; O Bouche: Project development, Manuscript writing; R Kianmanesh: Project development, Manuscript editing.

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**Patient consent statement**

The patient gives his consent for the writing and the publication of this case.