

Unusual Collateral Pathways in Triple Vessel Occlusion-Nature's Way of Survival in Mesenteric Ischemia

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Abstract: This case report describes a unique case of chronic pancreatitis who presented to us with pancreatic cancer. The patient also had a rare presentation of three-vessel occlusion involving origins of the celiac trunk, superior mesenteric artery, and inferior mesenteric artery. However multiple unusual and rare collaterals were seen taking over the abdominal circulation with no ischemic changes in concerned organs. Such a phenomenon is rare and only one case with triple vessel occlusion has been described in the literature. However triple vessel involvement in the setting of pancreatic disease has not been reported to our best knowledge. Information about these rare collaterals is important for the management of hepatic tumors, pancreaticobiliary surgery, and liver transplantation.

Keywords: Collaterals, Mesenteric, Ischemia, Pancreatitis.

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I. INTRODUCTION

Chronic mesenteric ischemia is a slow progressive disease. Over time, collaterals develop to maintain intestinal perfusion. These patients are rarely symptomatic and present with recurrent post-prandial pain. The occurrence of mesenteric ischemia depends on the number of vessels involved, and the ability of the patient to develop collaterals. (7)

II. CASE PRESENTATION

➤ Clinical Presentation

A 60-year-old male diabetic patient with a history of alcohol abuse and chronic pancreatitis presented to the Emergency room with diffuse abdominal pain predominantly in the epigastric region for 2 weeks. Pain was non-radiating, which used to aggravate 1-2 hours post meals. The patient had been experiencing similar episodes of pain in the past 2 years associated with significant weight loss. On clinical examination, he had epigastric tenderness on light palpation.

➤ Investigations

The patient had a WBC count of 10,800, serum amylase value of 230, and CA 19.9 value of 534U/ml. Alkaline phosphatase measured 154 IU/L. Given the raised CA 19.9, and concern for pancreatic neoplasm, an ultrasound study was done, which showed a bulky pancreatic head with

calcifications. The Celiac artery showed no flow on color Doppler. Because of this finding, an Abdominal computed tomography angiogram was done.

➤ Imaging Findings

CT abdominal angiography was performed. The images were reconstructed to get MIP, 3D volume rendered images to study the vascular anatomy in detail. The study showed complete occlusion of origins of the celiac trunk, superior mesenteric artery, and inferior mesenteric artery. However, all solid organs showed normal enhancement patterns ruling out organ ischemia. There was also no radiological evidence of bowel ischemia.

The branches of the celiac trunk, namely the splenic artery, hepatic artery, and left gastric artery showed normal contrast opacification through collaterals. The superior mesenteric artery was reformed through tortuous collateral from the right common iliac artery.

The left hepatic artery appeared to receive collateral from the right internal mammary artery. The left gastric artery was seen arising from the left hepatic artery.

The splenic artery was reformed through multiple collaterals, from the left inferior phrenic artery, and an enlarged left inferior adrenal artery, which was seen arising from the left renal artery.

The celiac artery showed reformation through a direct anastomotic channel with the reformatting superior mesenteric artery. This channel is termed an arc of Buhler in literature. It is a persistent anastomotic branch between the 10th and 13th ventral segmental arteries, connecting the celiac trunk and the superior mesenteric artery. It is a rare anastomotic channel seen only in 1 to 4 percent of individuals. (6)

The inferior mesenteric artery appeared dilated and received supply through an enlarged arc of riolan. The inferior mesenteric artery continued inferiorly as the superior rectal artery.

In addition to vascular findings, the patient also had an ill-defined heterogeneously enhancing mass at the head of the pancreas with multiple calcifications. The main pancreatic duct and common bile duct both appeared dilated.



Fig1 (a) CT Abdominal Angiography Showing Dilated Inferior Adrenal Artery (White Arrow) Arising from Left Renal Artery (Black Arrow). Fig (b) Illustration Showing Collateral Supply of Splenic Artery from Left Adrenal Artery.

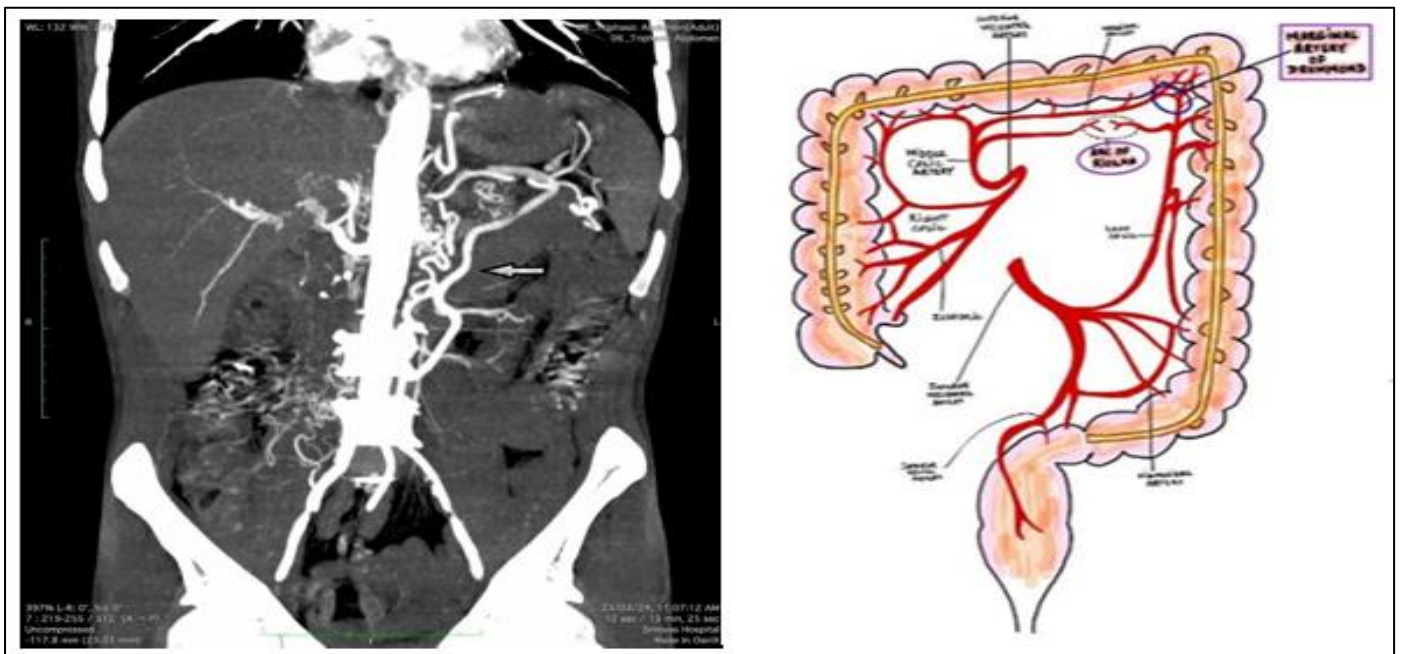


Fig 2 (a) CT Abdominal Angiography (MIP) Shows Prominent Arc of Riolan – Anastomosis Between the Superior Mesenteric Artery and Celiac Trunk (white Arrow). b) An Illustration Shows Collaterals Between the Superior Mesenteric and Inferior Mesenteric Artery.

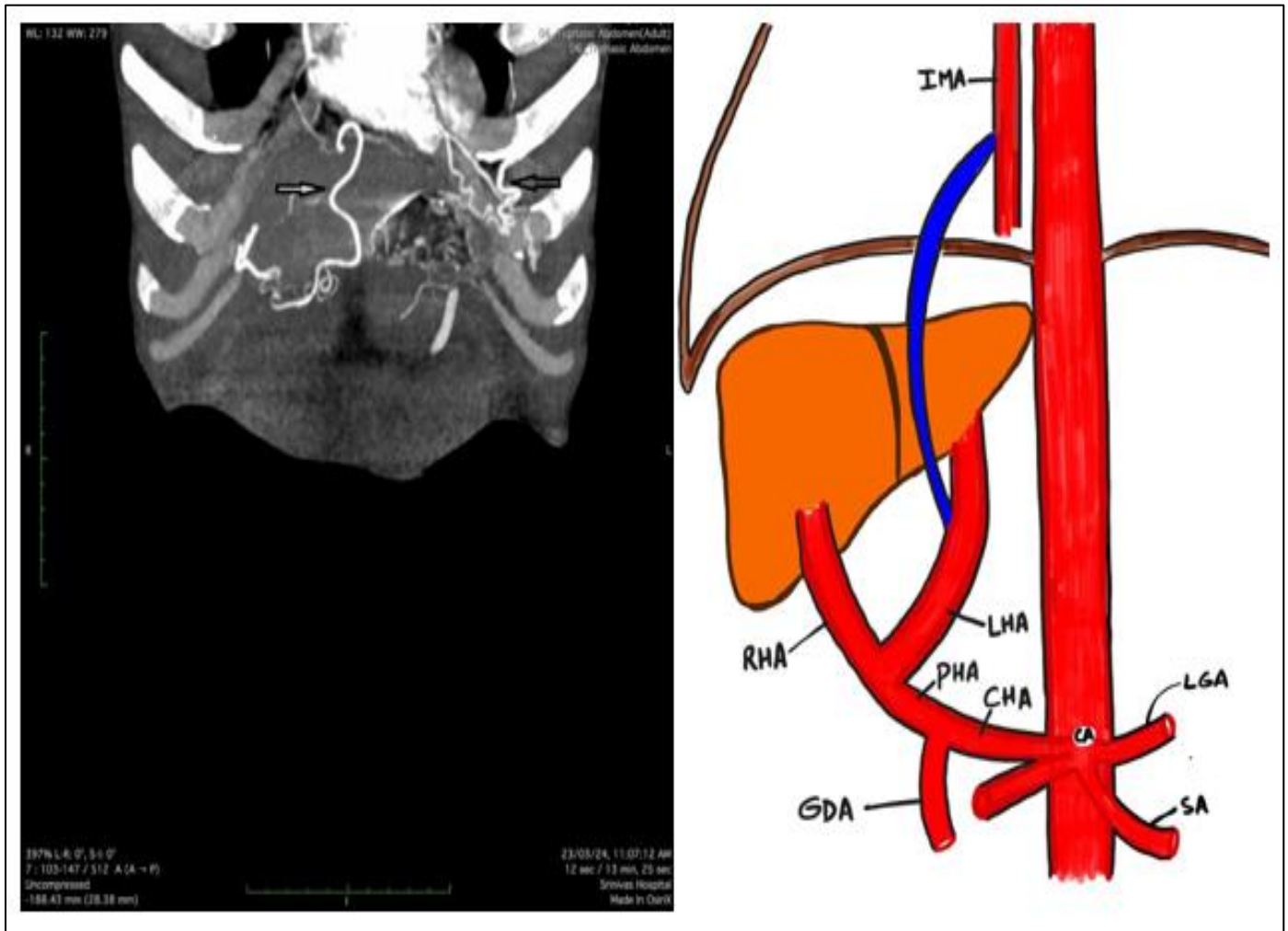


Fig3 a) CT Abdominal Angiography Showing Tortuous Internal Thoracic Artery Coursing Inferiorly Towards the Liver on the Right Side. (White Arrow) The Tortuous Inferior Phrenic Artery is Seen on the Left Side. (Black Arrow). b) Illustration Shows the Collateral Supply of Left Hepatic Artery from Internal Mammary Artery.

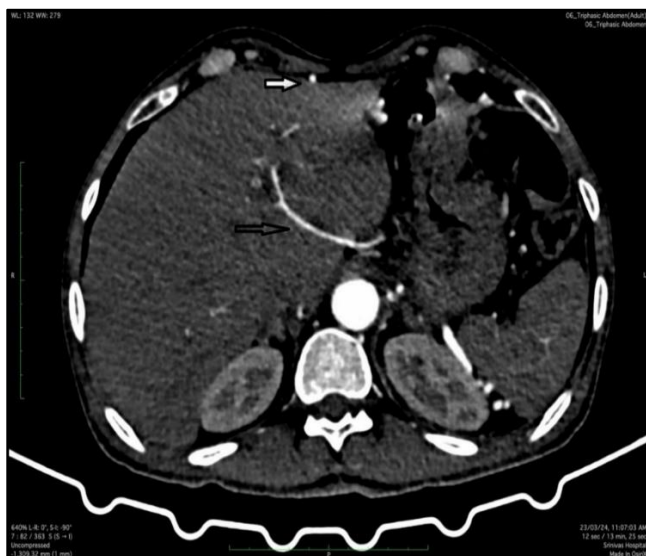


Fig 4 CT Abdominal Angiogram Shows the Collateral Supply (Black Arrow) of the Left Hepatic Lobe from a Prominent Right Internal Thoracic Artery (White Arrow)



Fig 5 CT abdominal Angiogram Sagittal Section Shows Tortuous Internal Thoracic Artery Coursing Inferiorly. (White Arrow)

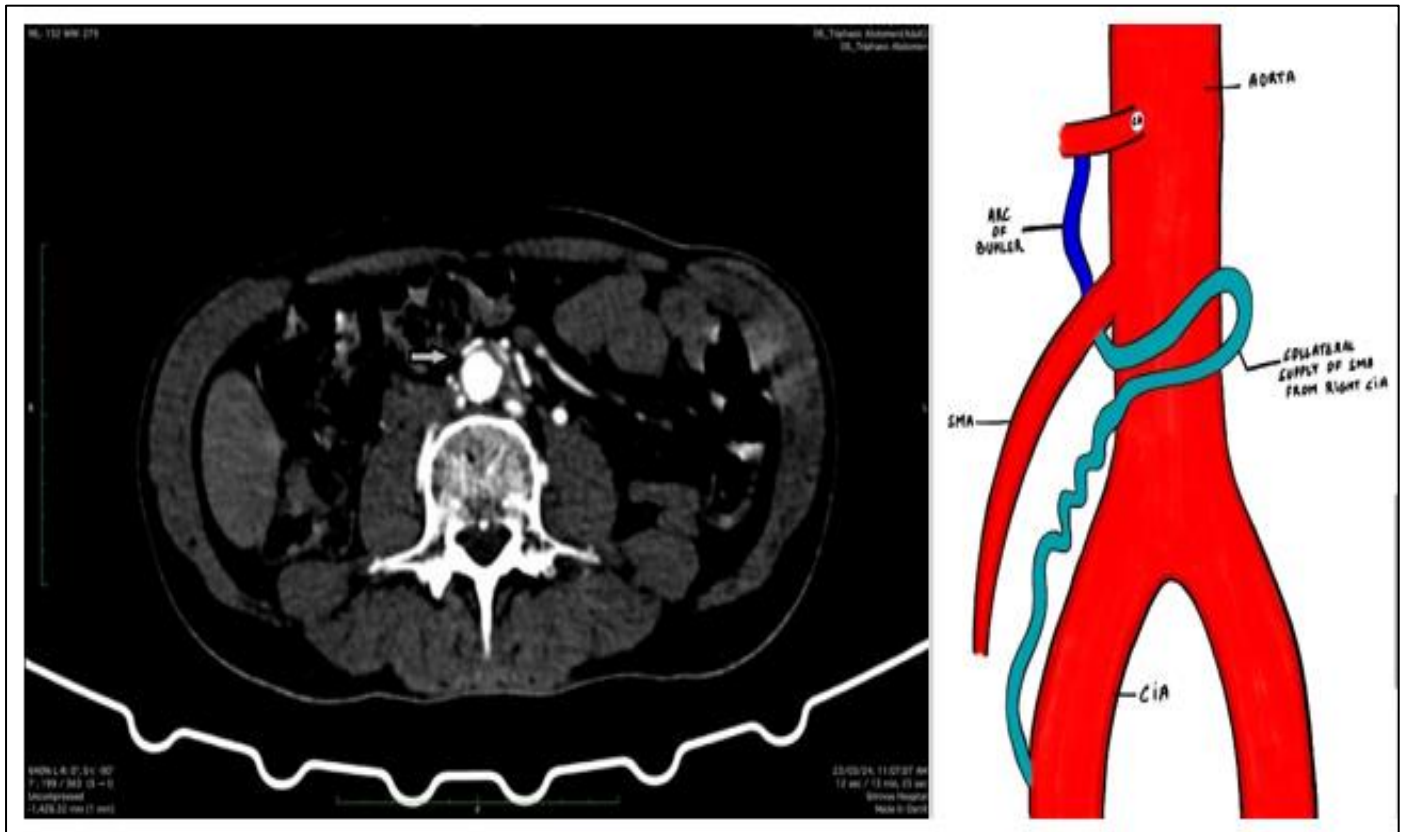


Fig 6 a) Multiple Tortuous Collaterals (White Arrow) from the Right Common Iliac Artery Coursing Around the Abdominal Aorta Could be Traced to the Superior Mesenteric artery (Not Shown here) b) Illustration Showing Collateral Supply of Superior Mesenteric Artery from Right Common Iliac Artery.

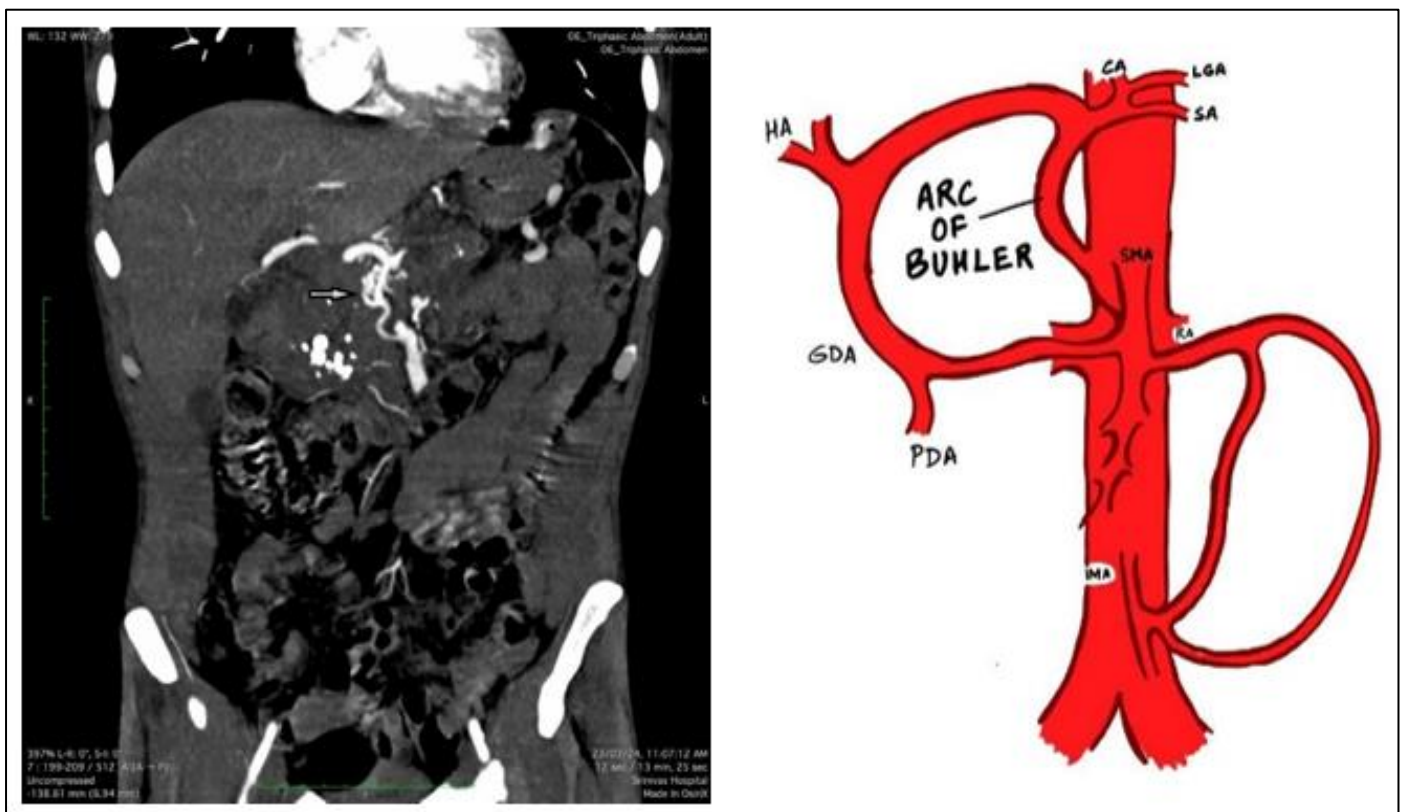


Fig 7a) CT Abdominal Angiogram Shows Arc of Buhler – a Direct Anastomotic Channel Between Celiac Trunk and Superior Mesenteric Artery.(4) (White Arrow).b)Illustration Shows Arc of Buhler and Pancreatico Duodenal Arcades as Anastomotic Pathways Between Celiac Trunk and Superior Mesenteric Artery. (4)

III. DISCUSSION

Chronic mesenteric ischemia presents with a benign or indolent course. The most common cause is atherosclerotic plaque, which is slowly formed and as it is a slow process, the affected patients develop collateral vessels in an attempt to maintain an appropriate intestinal perfusion.(3) Although atherosclerosis of mesenteric vessels is common, CMI is relatively uncommon owing to its extensive multiple redundant intercommunicating branches that protect the bowel from potential ischemia or infarction. Nonatherosclerotic causes are uncommon and include connective tissue disorder, idiopathic fibrosis, post-radiation vasculitis, and abdominal coarctation. Chronic pancreatitis and pancreatic neoplasm are prothrombotic conditions. A common manifestation is venous thrombosis. Arterial thrombosis is uncommon. As far as we know, arterial thrombosis in chronic pancreatitis has been reported only in 2 cases. But no case has been reported with all 3 primary vessels occlusion. The mesenteric collaterals, embryonic remnants of vessels connecting the celiac artery (CA), superior mesenteric artery (SMA), and inferior mesenteric artery (IMA), can develop within one mesenteric artery outflow, between two mesenteric arteries, or between mesenteric and parietal or body wall vessels.(2) The primary collateral pathways are relatively constant ones that connect the main mesenteric arteries.(5)

The most common collateral pathways found between the Celiac trunk and the SMA are the pancreaticoduodenal arcades formed by the superior and inferior pancreaticoduodenal arteries and occasionally the gastroduodenal arteries. Additionally, there are inconstant collateral pathways of persistent embryologic origin that connect celiac and SMA such as the arc of Buhler (communication between embryonal ventral segmental arteries) and arc of barkow (anastomoses between left and right gastric epiploic arteries) .(1) The SMA and IMA are linked through the marginal artery of Drummond and may also be connected through the centrally located arc of Rioloan. The marginal artery of Drummond is situated along the mesenteric border of the colon and it runs the entire length of the colon and is formed by anastomotic continuation among right, middle, and left colic arteries. The arc of rioloan is situated medial to the mesenteric border of the colon, where it courses radially through the mid portion to the mesenteric arcade and the inferior mesenteric vein.(1) It is a principal pathway between proximal branches of SMA and IMA and is an inconstant anastomosis between the middle and left colic arteries. (6) The IMA and the internal iliac artery collateral arcades involve the superior and middle rectal arteries.(1)

ABBREVIATIONS

- CT- Computed tomography
- MIP- Maximum intensity projection
- CMI- Chronic mesenteric ischemia
- CA- Celiac artery
- SMA- Superior mesenteric artery
- IMA – Inferior mesenteric artery

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