CASE REPORT

Multidetector Computed Tomography Angiography Role in Diagnosing Superior Mesenteric Arteriovenous Fistula with Superior Mesenteric Vein Thrombosis: A Case Report

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Abstract

Introduction: Arteriovenous fistulas (AVF) of the superior mesenteric vasculature are rare vascular abnormalities. It often occurs due to iatrogenic injuries during bowel resection or abdominal traumas. As the patient exhibits a variety of signs and symptoms and can present late, diagnosis may be difficult.

Multidetector computed tomography (MDCT) is the most common modality for imaging the small bowel, vessels, and mesentery in patients with mesenteric ischemia.

Case presentation: We present the case of a 25-year-old man who presented with features of acute intestinal obstruction and was operated on in an emergency. Resection of gangrenous small bowel and bowel adhesiolysis with double barrel ileostomy was performed. During exploratory laparotomy, gangrenous bowels were found, but no cause of mesenteric ischemia could be delineated. Finally, on computed tomography angiography (CTA) superior mesenteric arteriovenous fistula (SMAVF) with superior mesenteric vein (SMV) thrombosis was diagnosed. The patient was advised of aggressive anticoagulant therapy.

Conclusion: Computed tomography angiography has become the most reliable diagnostic modality to confirm the diagnosis and guide the best treatment strategy.

Keywords: Computed tomography angiography, Superior artery mesenteric vein thrombosis, Superior mesenteric arteriovenous fistula.

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Background

Superior mesenteric arteriovenous fistula is a rare vascular disorder associated with gastrointestinal surgery or penetrating abdominal trauma.[1,2]

The diagnosis of SMAVF can be made by CTA. Computed tomography angiography yields reformatted images from volume datasets and various projections, showing tiny distal vascular segments and depicting various abnormalities. Moreover, MDCT is used to determine the full anatomical details of the SMAVF and its relationship with adjacent structures for preoperative planning and endovascular management.[3,4]

We present a case of a 25-year-old male who came to the emergency with features of acute intestinal obstruction due to acute mesenteric ischemia and was operated on for the same and the role of CTA in diagnosing SMAVF with SMV thrombosis.

Case Description

A 25-year-old male patient presented to the emergency with abdominal pain, multiple episodes of vomiting, non-passages of flatus and stool, and abdominal distension for 1 day.

The patient was conscious and well-oriented on clinical examination with a blood pressure of 78/60 mm Hg, and a pulse rate was 90 beats per minute.

The abdomen was distended with an inverted umbilicus during an abdominal examination. On palpation, guarding and diffuse tenderness was present. The provisional diagnosis of acute intestinal obstruction was made, and exploratory laparotomy was advised. All laboratory findings were within normal limits.

An exploratory laparotomy was done. Resection of gangrenous small bowel and bowel adhesiolysis with double barrel ileostomy was performed. At laparotomy, 30 cm of gangrenous bowel was found proximal to the ileocecal junction. There were multiple interbowel adhesions and straw-colored fluid in the abdomen with multiple mesenteric nodes. During surgery, even the adjacent healthy bowel segment started turning black, but no cause of mesenteric ischemia could be delineated.

Histologically, the small bowel segment showed diffuse mucosal ulceration and submucosal congestion.

Computed tomography angiography was advised in the postoperative period to see the cause of mesenteric ischemia. Computed tomography angiography showed prominent ileocolic arteries with multiple tortuous arteries and early filling of venous channels in the arterial phase in the right iliac fossa region. There was a prominent venous channel draining into the distal part of SMV (Fig. 1). There was nonvisualization of the proximal part of SMV even in the venous and delayed phase, suggesting SMV thrombosis. The

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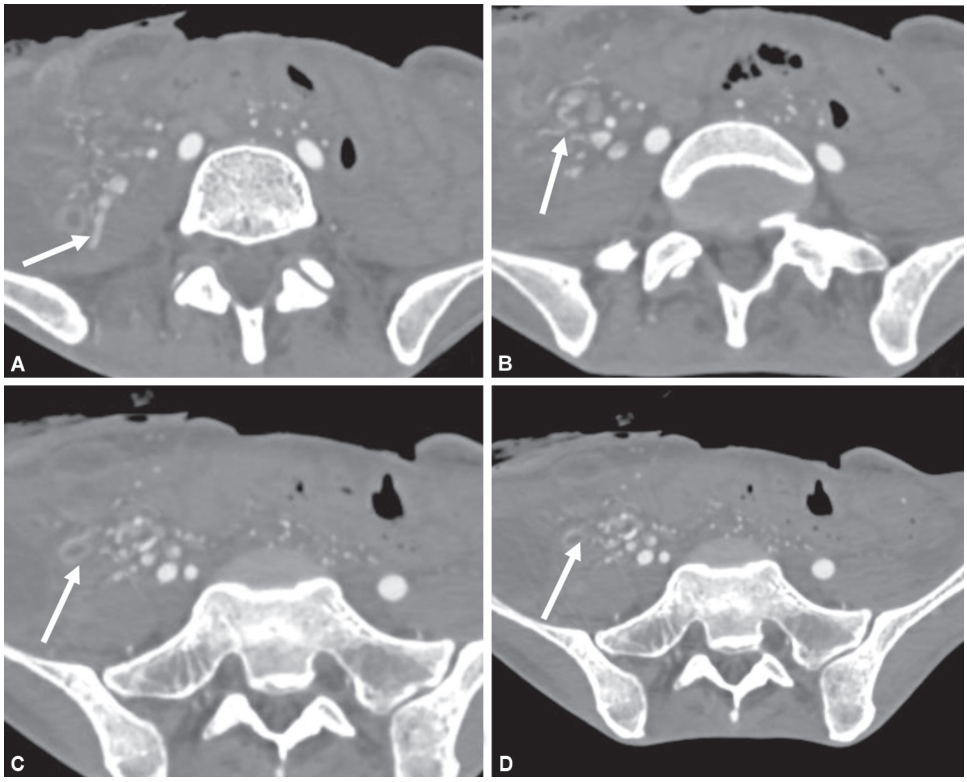
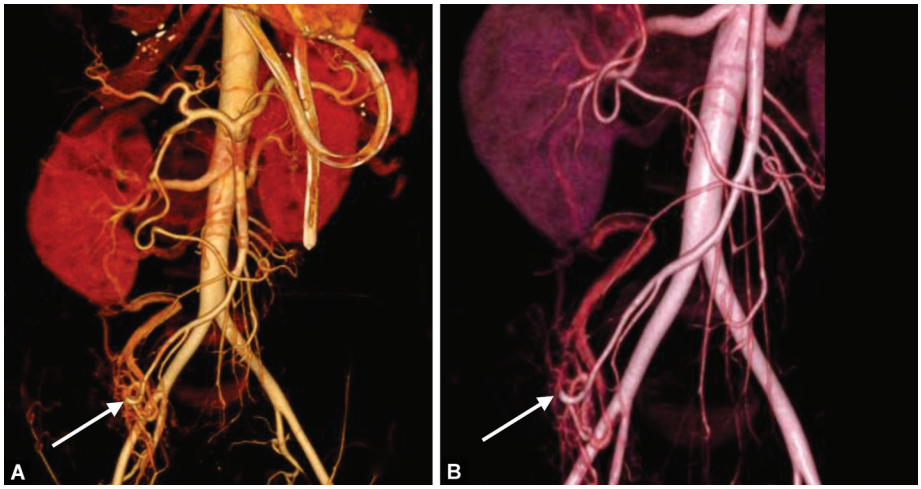
volume-rendered (VR) (Fig. 2) and maximum intensity projection (MIP) (Fig. 3) image showed communication between a prominent ileocolic artery and prominent venous channel draining into the distal part of SMV, leading to the formation of SMAVF. The other findings of bowel ischemia seen were: clumping of ileal loops in the right iliac fossa, circumferential bowel wall thickening with maintained stratification, and mucosal hyperenhancement. There were postoperative changes as well. Hence, the final diagnosis of SMV thrombosis with SMAVF was made.

The case was discussed at a multidisciplinary meeting, and no acute intervention such as DSA was advised for SMAVF. The reason for bowel and mesenteric ischemia was presumed to be due to SMV thrombosis, for which resection of the infarcted segment had already been done. Further aggressive anticoagulant therapy was advised. Formation of SMAVF may be sequelae to long-term SMV thrombosis rather than iatrogenic as there was the presence of multiple collaterals and prominent tortuous draining veins. The patient improved clinically.



Figs 1A to D: Axial contrast-enhanced CT images in arterial phase in a 25-year-old male with a history of bowel resection and anastomosis show bunch of vessels in the right iliac fossa with early opacification of venous channels in the arterial phase (thin white arrows)



Figs 2A and B: VRT images of the abdomen in coronal (A) and oblique sagittal plane (B) revealed serpentine vascular channels in the right iliac fossa supplied by superior mesenteric artery (white thin arrows) and early opacification of superior mesenteric venous branches in the arterial phase (arrowhead). Direct communication between branches of SMA and SMV is noted (white thick arrows)

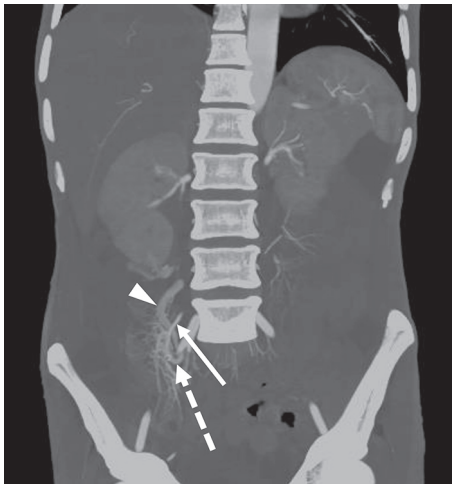


Fig. 3: Coronal MIP image of the abdomen reveals tangled mass of serpentine contrast-filled vascular channels in right iliac fossa supplied by the superior mesenteric artery (white arrow) with early opacification of mesenteric veins in the arterial phase (arrowhead) with a possible connection between branches of superior mesenteric artery and vein (dotted arrow)

Discussion

The arteriovenous fistula (AVF) is an abnormal connection between arteries and veins bypassing the capillary bed. It is highly uncommon in the splanchnic circulation. They occur more commonly in hepatic and splenic beds than in mesentery. Superior mesenteric arteriovenous fistulas are rare entities. Movitz and Finne first reported it in 1960 after bowel resection for gangrenous bowel.[5]

Etiology and Pathogenesis

It can be congenital, acquired (iatrogenic or traumatic), or of idiopathic etiology. Congenital SMAVFs occur from undifferentiated embryonic vessels or rupture of a congenital arterial aneurysm into an adjacent vein.[6] The most common causes of acquired SMAVF are abdominal surgery after bowel resection, gastrectomy, pancreatectomy, and abdominal trauma.[7] Iatrogenic SMAVF typically results from ligation of both artery and vein together during bowel surgery or ligature placement in the mesentery without localization of the bleeding point. The most common site is the ileocolic artery.[8]

An AVF results in decreased arterial flow and increased venous pressure in the tissue beyond the fistula, which usually results in bowel ischemia. There is hypoperfusion of mucosa as blood flow bypasses the capillary bed of the small bowel through AVF secondary to the steal phenomenon. Venous hypertension causes mucosal congestion and edema, which further increases bowel ischemia. Shunting blood from the SMV to the portal system leads to portal hypertension, seen in 50% of patients with splanchnic AVF.

Clinical and Imaging Features

The patient presents mainly with complaints of abdominal pain, nausea, vomiting, and diarrhea. Ascites, portal hypertension, mesenteric ischemia, bleeding, or right-sided heart failure are common symptoms.[8,9]

Mesenteric AVFs can be detected anytime from the initial injury. Diagnosis is initially made based on the patient's history and physical examination. The most common physical examination finding is abdominal bruit or thrill, which is easily missed.

Imaging plays an important role in diagnosing the cause of mesenteric ischemia and planning management. Superior mesenteric arteriovenous fistula is initially detected on abdominal ultrasound (USG) and MDCT.

Ultrasound of the abdomen shows a dilated SMV communicating with another vessel, a dilated portal vein, and sometimes massive ascites. Duplex ultrasound can be used to measure preprandial and postprandial blood flow, especially in proximal arteries.

Computed tomography angiography shows superior mesenteric artery (SMA)-SMV fistula, early opacification of the SMV and portal vein, poor and delayed enhancement of distal SMA branches, aneurysmal dilatation, edematous and hypoperfused small and large bowel walls and ascites. It also evaluates the position and the size of the fistula. Multidetector computed tomography is most widely used to diagnose because of its noninvasive nature and wide availability.

Digital subtraction angiography (DSA) shows the AVF, rapid filling of a dilated SMV and portal vein, and retrograde filling of the splenic vein, dilated jejunal or ileal veins, and poorly perfused SMA branches distal to the AVF. It remains the gold standard for treatment. It defines the exact anatomic site and extent of mesenteric vessel involvement.

In our case, CTA showed a prominent and tortuous ileocolic branch of SMA with multiple early filling tortuous venous structures in small bowel mesentery and ascending mesocolon in the arterial phase and a prominent venous channel draining into the distal part of SMV, which suggested an AVF. The communication between prominent tortuous ileocolic branches of SMA and prominent venous channel draining into the distal part of SMV indicates AVF formation on the VR imaging. The proximal part of SMV was not visualized, suggestive of thrombosis. The other findings were clumping of ileal loops in the right iliac fossa with circumferential mural thickening with maintained stratification and mural enhancement, suggesting bowel ischemia. The final diagnosis of SMAVF with SMV thrombosis was made. Digital subtraction angiography was not advised in our case as the patient just had major surgery and was in the recovering phase. Moreover, it is mainly done to locate the site of the vascular defect. However, it is sometimes difficult to delineate vascular anatomy due to venous congestion and postoperative changes.

Multidetector computed tomography has nowadays toppled conventional angiography for evaluation of the mesenteric vasculature. With technological advancement in CT scanners and 3D computer workstations, CTA enables the visualization of the mesenteric vessel in detail, including distal segments. After rapid intravenous contrast injection, the dual-phase imaging protocol ensures excellent visualization of both mesenteric arteries and mesenteric veins. The axial images evaluate the proximal artery patency, whereas the origin and proximal portion of mesenteric arteries and their anatomic variations are better evaluated in the sagittal image. The VR image can display the vessel in the best orientation. The minor branches are better appreciated on MIPs. It offers a more complete examination than conventional angiography. Moreover, it is minimally invasive and less expensive. It can be completed in a few minutes, thus improving its diagnostic efficiency.[10] It can be beneficial in a very sick patient who cannot tolerate invasive procedures or post-emergency surgery period to delineate the cause of bowel ischemia.

The definitive diagnosis is made based on bowel ischemia's clinical signs and symptoms, identification of AVFs by imaging studies such as MDCT angiography or angiography of the SMA, and intraoperative finding of a congested small bowel. Computed tomography angiography with both arterial and venous phases should be considered as a confirmatory diagnostic modality for SMAVF cases.

There are few cases reported of mesenteric thrombosis associated with mesenteric fistula. The cause for bowel and mesenteric ischemia was thought to be venous thrombosis, so resection of the infarcted segment was done. Aggressive anticoagulant therapy was advised. Formation of SMAVF may be sequelae to long-term SMV thrombosis rather than iatrogenic as there was the presence of multiple collaterals and prominent tortuous draining veins. The patient improved clinically.

Treatment

The primary treatment of mesenteric AVFs is the surgical correction of the AVFs with or without bowel resection. Percutaneous endovascular therapy, such as embolization of the feeding artery or a covered stent, is another treatment mode.

Differential Diagnosis

The other vascular causes which are mostly seen in mesenteric ischemia need to be differentiated based on CTA findings. The most common cause is superior mesenteric artery (SMA) or SMV thrombosis or embolus. The thrombosis of SMA occurs in atherosclerotic disease and usually develops at the origin of the SMA. However, emboli in SMA typically lodge 3–10 cm from the artery's origin, and blood flow is preserved in the proximal branch of SMA.

Superior mesenteric artery dissection typically extends from aortic dissection into mesenteric vessels, but isolated SMA dissection is extremely rare.

Splanchnic artery aneurysm, both true and pseudoaneurysm, represents a rare cause of mesenteric ischemia, the splenic artery being the commonest site.

The CT findings in the case of mesenteric ischemia due to venous thrombosis include a thrombus in the SMV with diffuse wall thickening of the small bowel and right colon.

However, in the case of AVF, CTA usually shows the communication between prominent arterial branches and prominent draining veins.

Conclusion

Superior mesenteric arteriovenous fistula formation associated with superior mesenteric thrombosis and mesenteric ischemia is sporadic but treatable. Multidetector computed tomography has become an excellent noninvasive imaging technique. It has replaced conventional catheter angiography to evaluate mesenteric vasculature.

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