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MINI-FOCUS ISSUE: VASCULAR MEDICINE

ADVANCED

CASE REPORT: CLINICAL CASE

Sole Obstruction of the Inferior Mesenteric Artery With Acute Aortic Dissection Causing Critical Mesenteric Ischemia

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ABSTRACT

Inferior mesenteric artery obstruction rarely causes critical mesenteric ischemia, because of the good collateral blood supply. We report a rare case of critical mesenteric ischemia due to sole inferior mesenteric artery obstruction accompanied by acute aortic dissection. Early diagnosis and treatment of mesenteric ischemia are important. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2020;2:2465–9) © 2020 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

A 79-year-old man presented with severe back pain and elevated blood pressure (247/88 mm Hg) without a significant difference between arms. Oxygen saturation was 95% on room air, heart rate was 55 beats/min, and respiratory rate was 19 breaths/min. The patient had no abnormal heart murmurs, abdominal tenderness, or paralysis and had a normal peripheral pulse.

LEARNING OBJECTIVES

- Mesenteric ischemia is a life-threatening complication of AD. Early diagnosis is necessary to save the patient.
- Sole IMA obstruction can cause mesenteric ischemia.

MEDICAL HISTORY

The patient had no specific medical history other than smoking and untreated hypertension.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis for the patient's acute severe back pain included acute aortic dissection (AD), aortic rupture, urolithiasis, and musculoskeletal diseases.

INVESTIGATIONS

Urgent contrast-enhanced computed tomography (CT) was performed for suspected acute AD, and an acute type B AD extending from the distal aortic arch to the end of the descending aorta was noted (**Figure 1**). A primary tear was located in the aortic

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ABBREVIATIONS AND ACRONYMS

AD = aortic dissection

CT = computed tomography

FL = false lumen

IMA = inferior mesenteric artery

ROSC = return of spontaneous circulation

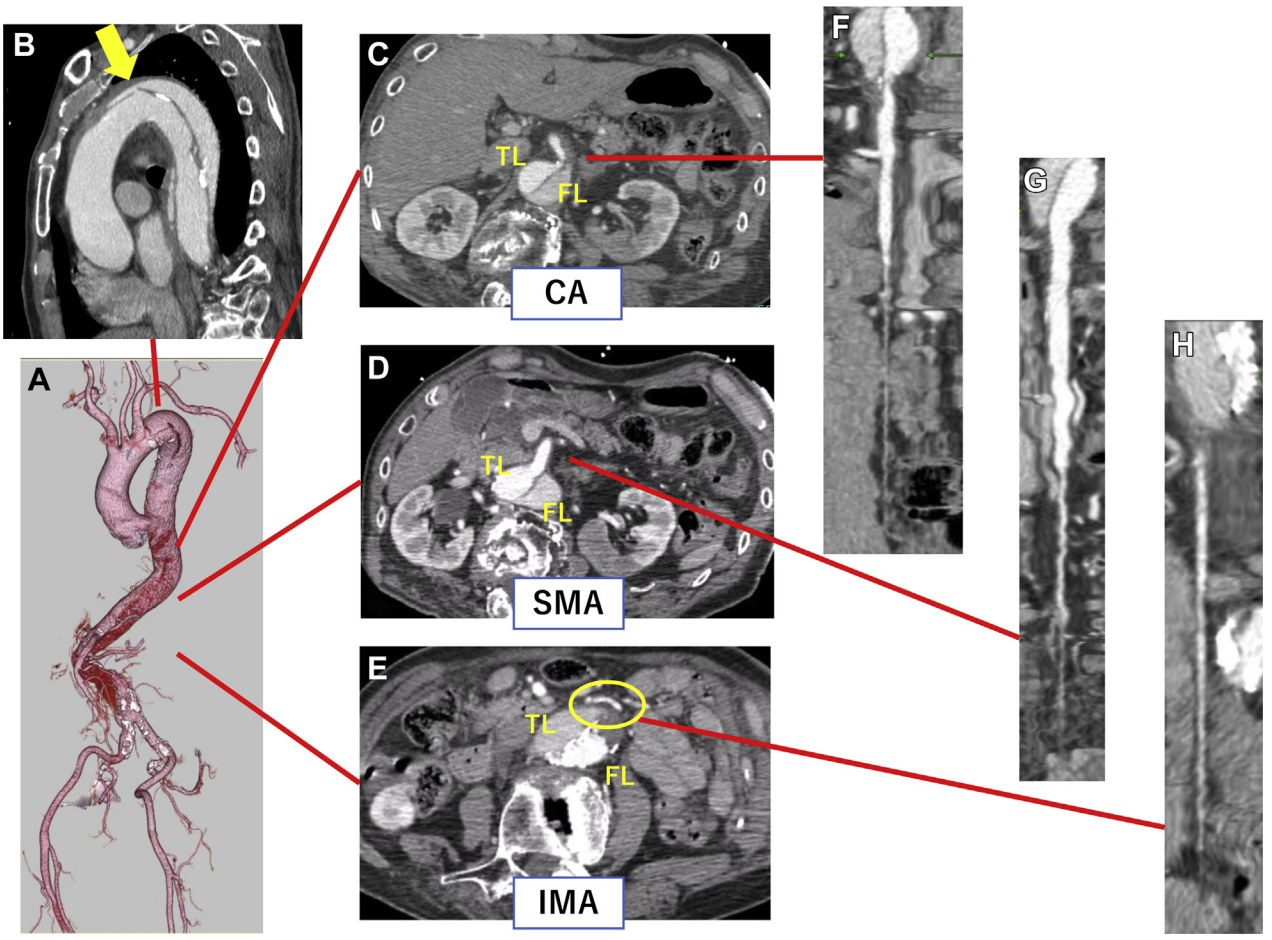
SMA = superior mesenteric artery

TL = true lumen

arch. Blood supply of the celiac artery originated from both the true lumen (TL) and false lumen (FL). The superior mesenteric artery (SMA) was perfused through the TL. Although the inferior mesenteric artery (IMA) origin was unclear, the distal IMA and its branches were adequately enhanced. The bowel wall was well enhanced. The patient had no abdominal tenderness or laboratory abnormalities indicative of mesenteric ischemia, such as metabolic acidosis or increasing lactate levels. He was admitted to the intensive care unit, and antihypertensive drugs were administered.

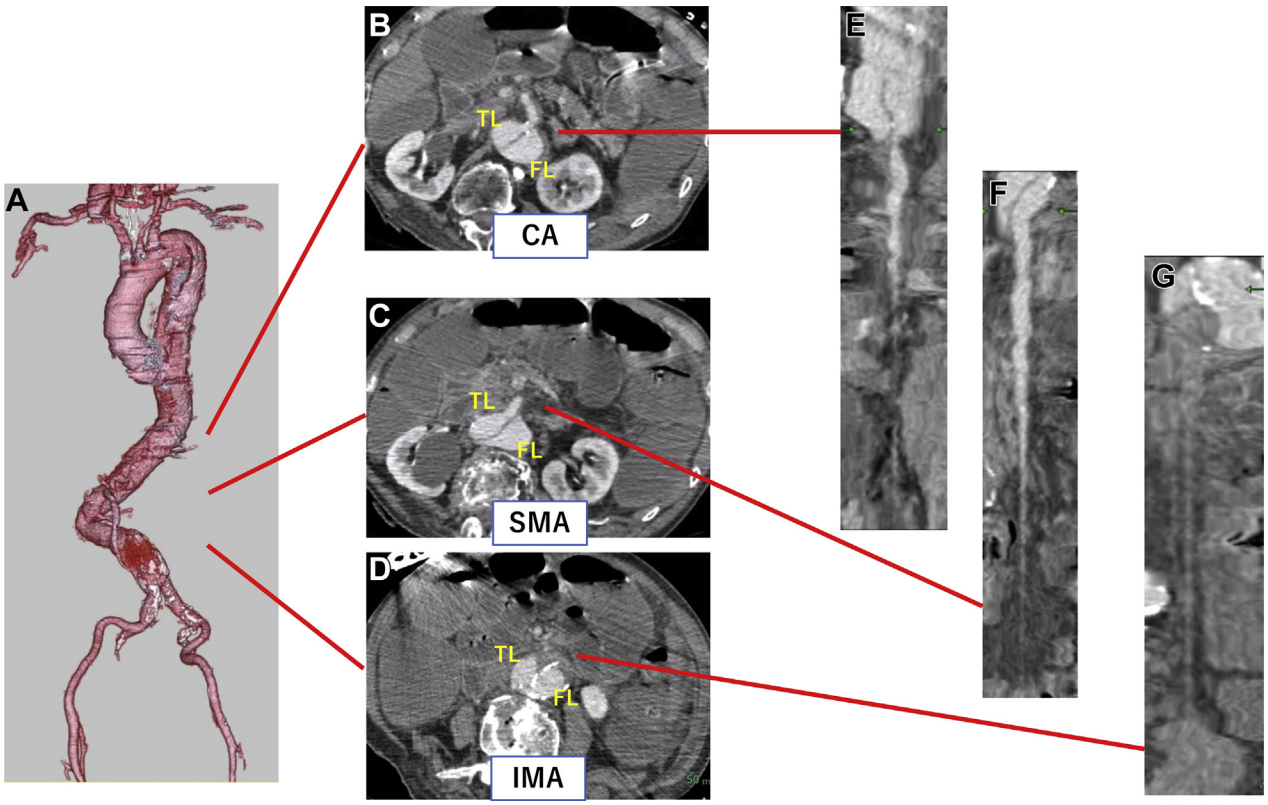
On hospital day 2, systolic blood pressure was well controlled at <120 mm Hg, and the patient had good bowel movement. On hospital day 8, he experienced nausea and vomited after breakfast. He had no abdominal pain. Although nausea improved spontaneously, poor appetite persisted. The following day, he vomited again but had no abdominal pain. Vital signs and physical examination results showed no significant abnormalities, and the serum creatinine level was not elevated (0.77 mg/dl) even after contrast-enhanced CT. However, we performed contrast-enhanced CT to exclude the possibility of mesenteric ischemia. Compared with computed tomographic findings on

FIGURE 1 Urgent Computed Tomography on Admission



(A) Three-dimensional reconstruction showing severe abdominal aortic tortuosity. **(B)** Primary tear located in the aortic arch **(arrow)**. **(C)** The celiac artery (CA) is perfused from both the true lumen (TL) and false lumen (FL). **(D)** The superior mesenteric artery (SMA) is perfused from the TL. **(E)** Despite unclear enhancement of the inferior mesenteric artery (IMA) origin, the distal IMA is adequately enhanced **(circle)**. **(F to H)** Stretched multiplanar reconstructions of the CA, SMA, and IMA show adequate enhancement.

FIGURE 2 Computed Tomography After Return of Spontaneous Circulation



(A) Three-dimensional reconstruction showing no changes in the range of aortic dissection. **(B,C,E,F)** Luminal properties of the CA and SMA are not significantly changed. **(D)** Thrombosis near the origin of the IMA progressed compared with computed tomographic findings on admission. **(G)** Minimal IMA enhancement on multiplanar reconstruction. Abbreviations as in Figure 1.

admission, no changes were observed in the range of the AD and luminal properties of the celiac artery, SMA, and IMA. Although intestinal swelling was observed, the bowel wall was well enhanced. Laboratory tests revealed no abnormalities. The patient's nausea and vomiting diminished spontaneously, and he had no abdominal pain. Therefore, we opted for watchful observation and started saline hydration for poor appetite. However, the following day, he developed malaise and nausea with abdominal pain for the first time since admission. Urgent laboratory testing showed profound metabolic acidosis and increased lactate level (venous blood pH 7.216, serum HCO_3^- 13.5 mmol/l, venous lactate 9.1 mmol/l). Immediately after evaluation of the laboratory data, the patient vomited and developed sudden cardiac arrest. His initial waveform was pulseless electric activity.

MANAGEMENT

The patient received immediate cardiopulmonary resuscitation, and return of spontaneous circulation (ROSC) was achieved. Promptly after ROSC, contrast-enhanced CT was performed again (Figure 2). Compared with computed tomographic findings on admission, thrombosis in the lower segment of the abdominal aorta had progressed, and the IMA was less enhanced. The SMA was well perfused from the TL. The bowel wall was also enhanced; thus, there were no signs of mesenteric ischemia on CT. The direct cause of cardiac arrest was considered to be suffocation due to aspiration of the vomit. During cardiopulmonary resuscitation, the patient was intubated, and his blood oxygen saturation was sufficient. However, his blood lactate level was consistently high, and a large dose of an intravenous vasopressor

TABLE 1 Characteristics of Patients Reported to Develop Mesenteric Ischemia Complicated by Type B AD

Patient	Age (yrs)	Sex	Type of AD	Suspicion of Mesenteric Ischemia	Imaging for Diagnosis		Treatment	First Author (Year) (Ref. #)
					CT	Angiography		
#1	50	M	Acute type B	At admission	Dynamic SMA obstruction	Occlusion of the SMA; poor enhancement of the small intestine	Stent placement in the SMA	Suzuki et al. (2015) (4)
#2	44	M	Acute type B	12 h after the onset	Dynamic CA and SMA obstruction	Occlusion of the CA and SMA	Stent placement in the SMA	Sato et al. (2016) (5)
#3	56	M	Acute type B	13 days after the onset	Dynamic CA and SMA obstruction	Not performed	Resection of the intimal flap	Kurumisawa et al. (2015) (6)
#4	55	F	Acute type B	5 weeks after the onset	Static SMA obstruction	Stenosis of the SMA	Stent placement in the SMA	Sasaki et al. (2019) (7)
#5	41	M	Acute type B	At admission	Dynamic SMA obstruction	Stenosis of the SMA	TEVAR	Tshomba et al. (2012) (8)
#6	22	F	Acute type B	At admission	Dynamic SMA obstruction	Stenosis of the SMA	TEVAR	Tshomba et al. (2012) (8)
#7	33	M	Acute type B	At admission	Static SMA obstruction	Not performed	Medical	Tshomba et al. (2012) (8)
#8	70	M	Acute type B	At admission	Dynamic SMA obstruction	Stenosis of the SMA	TEVAR	Tshomba et al. (2012) (8)
#9	69	M	Acute type B	At admission	Static SMA obstruction, edema of the jejunal loops	Stenosis of the SMA	TEVAR	Tshomba et al. (2012) (8)

AD = aortic dissection; CA = celiac artery; CT = computed tomography; SMA = superior mesenteric artery; TEVAR = thoracic endovascular aortic repair.

was needed. Although bowel wall enhancement was observed on CT, we performed exploratory laparotomy to rule out mesenteric ischemia. The bowel wall seemed ischemic from the distal transverse colon to the proximal descending colon. Intraoperative indocyanine green fluorescence angiography indicated hypoperfusion of the same area of the necrotic colon. Hence, at least, subtotal colectomy was needed to save the patient. However, we carefully discussed his poor prognosis with his family and decided to withdraw active treatment.

DISCUSSION

Mesenteric ischemia is an uncommon complication of AD; however, it accounts for 15.4% of the mortality associated with type B AD (1). The clinical manifestation of mesenteric ischemia is frequently insidious. The abdominal pain is often nonspecific, and patients may be pain free in up to 40% of cases (2). Thus, diagnosis is frequently made too late to save the bowel and/or patient.

In AD, visceral malperfusion causes may be of 2 types (3): dynamic obstruction due to blood flow reduction in the TL compressed by high pressure in the FL and static obstruction due to blood flow reduction in the TL compressed by the thrombosed FL. In this case, CT after ROSC showed IMA stenosis due to thrombosis (i.e., partial static obstruction). The necrotic bowel was splenic flexure of the colon, called Griffiths' point. This is the watershed area between the SMA and IMA that is vulnerable to ischemia. However, unlike the small intestine, which is supplied primarily by the SMA, the colon generally has good collateral blood supply from each anastomotic network between the SMA and IMA. Therefore, even if the IMA is solely obstructed, most patients remain asymptomatic. No current guidelines for endovascular aortic repair specially mention the risk for IMA obstruction. To our knowledge, this is the first case report of sole IMA obstruction-induced mesenteric ischemia as a complication of type B AD (**Table 1**) (4–8).

A possible reason for mesenteric ischemia caused by sole IMA obstruction was that the patient innately had poor or absent collateral vessels at Griffiths' point. Another possibility was that dynamic SMA obstruction occurred simultaneously with static IMA obstruction. Mesenteric blood flow may have decreased hemodynamically without obvious stenosis of the TL of the SMA on CT.

FOLLOW-UP

After abdominal closure, the patient returned to his hospital room. Twelve hours after ROSC, he died. In this case, closure of the primary tear in the aortic arch using thoracic endovascular aortic repair in the early period may have been the best treatment. However, it was difficult to make the decision to perform thoracic endovascular aortic repair solely on the basis of computed tomographic findings. More frequent

laboratory tests and physical examinations might have saved the patient. Exploratory laparotomy is also important when mesenteric ischemia cannot be excluded.

CONCLUSIONS

Mesenteric ischemia is a life-threatening complication of AD that is difficult to diagnose. It is noteworthy that mesenteric ischemia can be caused by sole IMA obstruction.

AUTHOR DISCLOSURES

The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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KEY WORDS acute aortic dissection, inferior mesenteric artery, mesenteric ischemia