Intravascular lithotripsy for the treatment of inferior mesenteric artery in-stent restenosis

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ABSTRACT

Endovascular revascularization with intraluminal stenting is the recommended first-line therapy for chronic mesenteric ischemia. However, early recurrence and in-stent thrombosis remain significant challenges. We present the case of a patient with recurrent chronic mesenteric ischemia secondary to in-stent restenosis that was successfully treated with intravascular lithotripsy, a novel, safe approach to stent salvage. (J Vasc Surg Cases Innov Tech 2023;9:101254.)

Keywords: Intravascular lithotripsy; In-stent restenosis; Chronic mesenteric ischemia

An endovascular-first approach for the treatment of chronic mesenteric ischemia (CMI) has been widely adopted, especially for elderly patients with multiple comorbidities that would preclude an open approach.[1] Endovascular intervention has been associated with lower perioperative morbidity, although long-term durability has come into question, with higher rates of symptom recurrence and restenosis compared with open revascularization.[2,3] Traditional endovascular strategies, such as balloon angioplasty with or without stenting, have been used to address in-stent stenosis and thrombosis.[4] In the present report, we discuss a case of mesenteric artery in-stent restenosis secondary to stent collapse in the setting of progressive atherosclerosis and orifical calcification, for which treatment with conventional balloon angioplasty failed. As such, intravascular lithotripsy (IVL) was successfully used to re-expand the stent. The patient provided written informed consent for the report of her case details and imaging studies.

HISTORY OF PRESENTATION AND MEDICAL HISTORY

The patient is a 91-year-old woman with history significant for type 2 diabetes mellitus, hypertension, hyperlipidemia, and mesenteric ischemia s/p placement of a 5-mm bare metal, balloon-expanding stent in the inferior mesenteric artery (IMA) 7 years before the current presentation. One year earlier, the patient had presented to multiple different hospitals, including our institution, complaining of postprandial epigastric pain, lasting 4 to 5 hours daily. During her admission, computed tomography angiography was obtained, which demonstrated chronically occluded celiac and superior mesenteric arteries with distal reconstitution via collateral vessels and a patent IMA stent. Duplex ultrasound confirmed a patent stent with velocities ranging from 99 to 130 cm/s. Further workup, including esophagogastroduodenoscopy and colonoscopy, was unremarkable.

One year later, the patient was readmitted to our institution for evaluation of 3 weeks of progressively worsening postprandial abdominal pain, PO intolerance, and weight loss. Repeat computed tomography angiography demonstrated unchanged proximal occlusion of the superior mesenteric and celiac arteries with distal reconstitution and a patent IMA stent. Given her persistent symptoms and otherwise negative workup, the decision was made to proceed with mesenteric angiography.

PROCEDURE PERFORMED

The right common femoral artery was accessed to place a 5F sheath, and an aortogram was performed, demonstrating significant calcification of the perivisceral segment of the aorta and sluggish flow through the IMA (Fig 1). Examination under fluoroscopy showed partial collapse of the mid-portion of the IMA stent due to circumferential calcifications at the ostia of the artery (Fig 2).

Using a steerable guiding sheath and an angled catheter, the IMA stent was traversed first with a 0.018-in. wire, followed by a 0.014-in. wire. Coaxial utilization of a CXI catheter (Cook Medical Inc) was used to check the in-stent position of the wire. Subsequent balloon angioplasty at the orifice with progressively larger balloons (2 mm and 4 mm) failed to re-expand the stent (Fig 3). At this point, IVL was performed using a 4-mm × 60-mm balloon (Shockwave Medical) for two cycles.

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Fig 1. Pretreatment aortogram demonstrating proximal inferior mesenteric artery (IMA) stenosis (*yellow arrow*) with sluggish flow.

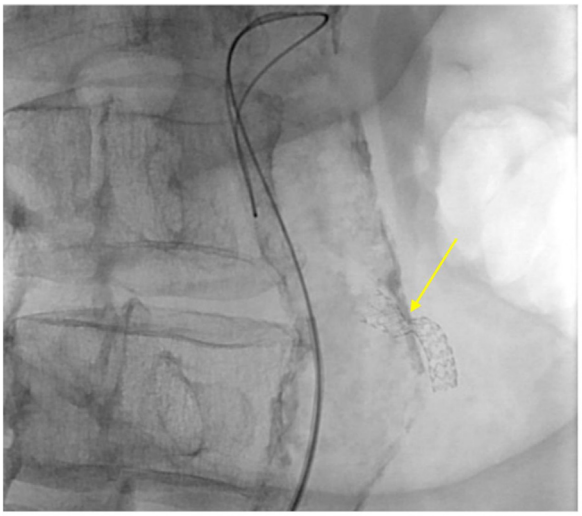

Fig 2. Partial collapse of the mid-portion of the inferior mesenteric artery (IMA) stent (*yellow arrow*) secondary to ostial calcifications seen on fluoroscopy.

Following treatment, balloon angioplasty with a 5-mm × 40-mm balloon was performed, resulting in full stent re-expansion (Fig 4). A completion angiogram demonstrated a patent IMA without stenosis (Fig 5) and inline flow via the IMA to the mesentery. No rupture or distal embolization was noted.

Fig 3. Angiogram after balloon angioplasty showing persistent inferior mesenteric artery (IMA) stenosis (*yellow arrow*) after failure to re-expand the stent.

Postoperatively, the patient experienced no adverse events and was discharged from the hospital shortly thereafter. At her 8-month follow-up visit, she remained asymptomatic and reported a 5-lb weight gain. Mesenteric duplex ultrasound confirmed a patent IMA stent with good flow and no recurrent stenosis.

DISCUSSION

IVL has shown utility in the treatment of CMI secondary to severe calcific stenosis of the superior mesenteric artery in limited case reports.[5,6] Although, there is a paucity of data on treating in-stent restenosis of the mesenteric arteries with lithotripsy,[7] within the cardiology literature, IVL has been used in select cases to treat coronary artery stent underexpansion[8] and, more recently, in-stent restenosis.[9]

IVL can potentially serve as an important adjunct in the treatment of recurrent CMI, as demonstrated in our case of successful treatment of a partially collapsed IMA stent

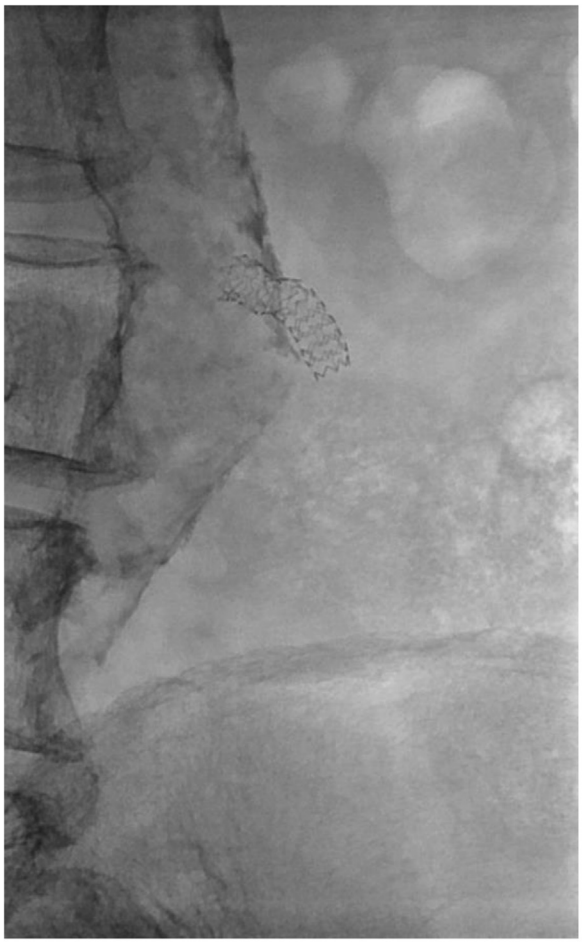

Fig 4. Stent re-expansion after intravascular lithotripsy (IVL) demonstrated on fluoroscopy.

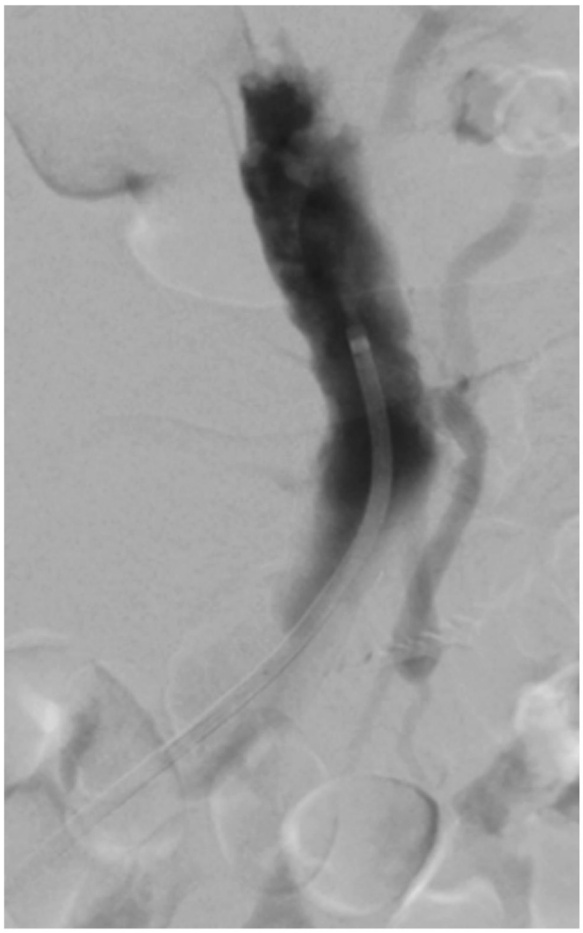

Fig 5. Completion angiogram demonstrating a patent inferior mesenteric artery (IMA) without stenosis.

secondary to ostial calcification. IVL, a technique that uses sonic pressure waves to fracture intimal and medial calcifications, offers unique advantages, especially in the high-risk territory of the aorta and visceral vessels. Modifying the calcium before balloon dilatation allows for treatment of the lesion at a lower pressure, decreasing the risk of aortic rupture. Moreover, treatment of calcium within the vessel wall, at least theoretically, obviates the risk of distal embolization, which can lead to bowel ischemia, however; further studies are needed to confirm this assumption.

Although the use of IVL to treat CMI, due to either de novo or in-stent thrombosis, requires further investigation, IVL should be considered for patients in whom conventional therapies have failed and who are poor candidates for open revascularization of the mesenteric vessels.

CONCLUSIONS

IVL proved to be a safe and effective treatment of calcific in-stent restenosis causing CMI, although further studies are needed to evaluate the use of this technology in patients for whom more traditional treatments have failed.

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