Case Report

Successful endovascular treatment of severe chronic mesenteric ischemia by concurrent triple-vessel mesenteric artery revascularization

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\begin{abstract}
A 52-year-old man presenting with severely symptomatic chronic mesenteric ischemia had proximal occlusion of the celiac and superior mesenteric arteries and critical stenosis of the inferior mesenteric artery ostium. Concurrent percutaneous revascularization with stenting of all three mesenteric arteries was successfully achieved using techniques tailored to each lesion. Complete clinical recovery was observed at the six-month post-procedure follow-up.

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1. Introduction

Endovascular therapy is now considered the first treatment option in most patients with chronic mesenteric ischemia (CMI) secondary to atherosclerotic occlusive disease of the mesenteric arteries.\textsuperscript{1,2} In comparison to open surgery, endovascular therapy for CMI has less morbidity, lower or comparable mortality, and shorter in-hospital stay; however it is associated with a more frequent need for re-intervention,\textsuperscript{1,3-5} which could be partly related to incomplete revascularization.\textsuperscript{1,4} Obstruction of two or all three mesenteric arteries is usually required to cause CMI, and in keeping with the surgical principle of revascularizing more than one obstructed mesenteric artery,\textsuperscript{6} endovascular treatment of multiple mesenteric vessels improves clinical outcomes.\textsuperscript{1,4} However, revascularization of multiple mesenteric arteries frequently entails recanalization of totally occluded arteries, which can be technically challenging. Until now endovascular procedures involving revascularization of mesenteric arteries in CMI have largely been restricted to one or two arteries.\textsuperscript{7,8} We report a severely symptomatic case of CMI in which all three mesenteric arteries, two of which were total occlusions, were concurrently and successfully revascularized by endovascular technique.
2. Case report

A 52-year-old man presented with a history of abdominal pain and occasional vomiting after food intake, associated with progressive loss of weight, for the last two years. He had diabetes mellitus, systemic hypertension, and dyslipidemia, and was a chronic smoker. Physical examination was unremarkable except for significant emaciation (body mass index 16.9 kg/m²) and left below-knee amputation from a past accident. Blood tests, abdominal ultrasonography and upper gastro-intestinal endoscopy were non-contributory. CT angiography revealed proximal occlusion of the celiac and superior mesenteric arteries and critical ostial narrowing of the inferior mesenteric artery, with distal patency of all three vessels. Conventional angiography (Figs. 1A and 2A,C) confirmed these findings and also detected non-critical (asymptomatic) coronary artery disease. A percutaneous approach to revascularizing the obstructed mesenteric vessels was preferred in view of the multiple medical co-morbidities.

3. Intervention

After obtaining written informed consent, percutaneous 7F right femoral artery access was obtained. 5000 units of heparin was administered. After baseline angiography, the celiac artery ostium was engaged with a 7F Judkins Right guiding catheter and the proximal occlusion was traversed using a 0.014″ Conquest wire (Asahi Intecc, Aichi, Japan), after softer wires failed to penetrate the proximal cap. Serial balloon dilatation was followed by implantation of two overlapping 6 mm diameter balloon-expandable stents (Dynamic Renal, Biotronik AG, Bulach, Switzerland) of lengths 19 and 12 mm extending distally into the hepatic artery; the second stent was necessary since the first did not cover the celiac artery ostium adequately; the origin of the splenic artery was jailed by the stents, but normal flow into this branch was preserved. Next, using the same guiding catheter, the superior mesenteric artery occlusion was probed and successfully crossed with an angled-tip 0.035″ hydrophilic guidewire (Terumo Medical, Somerset, NJ, USA); this wire was changed to a 0.035″ Amplatz Superstiff guidewire (Boston Scientific, Marlborough, MA, USA) through a 4F hydrophilic catheter (Terumo); the lesion was dilated and stented using a 8 × 37 mm balloon-expandable stent (Express LD, Boston Scientific) delivered through a 7F long sheath (Ansel, Cook Medical, Bloomington, IN, USA). Lastly, the ostial stenosis of the inferior mesenteric artery was crossed using a soft hydrophilic 0.014″ wire (Fielder, Asahi) and stented with a 6 × 18 mm balloon-expandable stent (Express SD). In all the arteries treated, stent diameters were matched with the normal vessel beyond the lesion and stent length was chosen to ensure coverage from the aortic lumen to the normal vessel just distal to the lesion. Final angiography (Figs. 1B and 2B,D) showed a good result in all three mesenteric vessels, with no residual stenosis or dissection and rapid flow into the distal branches. The sheath was removed immediately and hemostasis was obtained by manual compression. The total fluoroscopy time was 46 mins and 250 ml of iodinated contrast was used. The hospital stay was uneventful and the patient was discharged after two days without any complication. The patient’s symptoms were completely relieved by the procedure. There was rapid

Fig. 1 – Abdominal aortograms in antero-posterior projection. A. Baseline angiogram showing atherosclerotic abdominal aorta, severe ostial stenosis of the inferior mesenteric artery (arrow) and non-visualizatin of the celiac and superior mesenteric arteries. B. Post-stenting angiogram showing recanalized celiac and superior mesenteric arteries (upper and lower white arrows respectively) and stented inferior mesenteric artery (black arrow).
weight gain of 9 kg over the next one month, followed by slower additional weight gain of 14 kg to attain a body mass index of 24.1 kg/m² (body weight 72 kg) by six-months post-procedure, at which time the patient continued to remain asymptomatic.

4. Discussion

All patients with symptomatic CMI need to undergo revascularization of the mesenteric vessels to achieve relief from post-prandial abdominal pain, restoration of nutritional status and prevention of bowel infarction. As CMI is most often caused by obstruction of more than one mesenteric artery, it stands to reason that as many mesenteric vessels be revascularized as is feasible and safe in order to maximize the treatment effect. Surgical results have shown that although single-vessel revascularization may relieve symptoms, complete revascularization of all obstructed vessels is required to obtain optimal long-term results. Similar findings have been seen with endovascular therapy of CMI, where two-vessel treatment was more protective against symptom recurrence and need for re-intervention than single-vessel treatment. Kougias et al attributed the fact that surgically treated CMI patients were more likely to experience long-term symptomatic relief than patients treated by endovascular therapy to the...
higher incidence of two-vessel revascularization in the surgical group.

Endovascular therapy for CMI is associated with shorter in-hospital stay, lower morbidity and lower or comparable short- and long-term mortality when compared to open surgery; however, early restenosis and the need for further intervention is more common in the endovascular group.1–5 Oderich9 found 47% restenosis after endovascular therapy for CMI with bare metal stents. Given this trend towards more frequent restenosis in the endovascular group, revascularization of multiple obstructed vessels becomes all the more important so that alternative channels of mesenteric blood supply are present in case restenosis occurs in some of the revascularized vessels.

Endovascular treatment of CMI often involves recanalization of occluded arteries, especially when multiple obstructed mesenteric vessels have to be revascularized; in a study by Sarac7 28% of 87 lesions treated for CMI were occlusions. Percutaneous recanalization of occluded mesenteric vessels can be technically challenging, and may be one reason why the proportion of patients receiving two-vessel revascularization in endovascular series is lower than that in surgical series.4 Difficulty in revascularization of chronic mesenteric artery occlusions has necessitated modifications in the antegrade technique11 and the use of retrograde transcollateral approaches.11,12 A recent study of endovascular therapy for chronic mesenteric artery occlusions has reported high technical success rate (87%) with no major complications8; another encouraging finding is that endovascular therapy for chronic mesenteric artery occlusions produces outcomes similar to that in stenotic arteries.7

There is only one previous case report of concurrent revascularization of all three mesenteric arteries in CMI10; in that case, which was done emergently in combination with bowel resection, only one vessel, the superior mesenteric artery, was occluded, and it was recanalized by retrograde technique through a collateral channel. Our patient, who underwent elective concurrent revascularization of all three mesenteric arteries, had total occlusions in two of the arteries; both these were recanalized antegrade, but with different techniques, as the characteristics of the occlusions were dissimilar: in the celiac artery a fine, stiff non-hydrophilic wire was required as no soft path could be found within the occlusion and sharp penetration was required, whereas in the superior mesenteric artery a thicker, soft hydrophilic wire could be manipulated through the occlusion into the vessel lumen distally. Enthusiasm for multi-vessel endovascular therapy for CMI should be tempered against the risk of complications occurring during the procedure, the most significant of which are bowel necrosis due to distal embolization and arterial dissection14, mesenteric artery complications during endovascular therapy for CMI result in greater mortality, morbidity, and length of hospital stay.15

5. Conclusion

This case demonstrates that concurrent percutaneous triple-vessel mesenteric artery revascularization for CMI using contemporary technique can be safely accomplished even with two vessels occluded and the third critically stenosed; its use in appropriate cases could help to make mesenteric revascularization more complete and provide durable relief from symptoms to patients presenting with CMI.

Conflicts of interest

All authors have none to declare.

REFERENCES