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Case Report

Recanalization of Visceral Complex Chronic Total Occlusions: An Innovative Triaxial Endovascular Technique

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Abstract

Chronic mesenteric ischemia is an uncommon disease and its management remains a challenge, especially in patients with severely calcified occlusions of both celiac and superior mesenteric arteries. Endovascular therapy has been increasingly performed to treat this entity due to its favorable outcomes when compared with open surgery. As so, we report three cases of severe chronic mesenteric ischemia with highly calcified occlusion of both celiac and superior mesenteric artery treated by endovascular approach using an innovative triaxial technique.

ABBREVIATIONS

CMI: Chronic Mesenteric Ischemia; CTO: Chronic Total Occlusion; SMA: Superior Mesenteric Artery; CA: Celiac Artery; IMA: Inferior Mesenteric Artery CTA: Computed Tomography Angiography; MRA: Magnetic Resonance Angiography.

INTRODUCTION

Occlusive disease of the splanchnic arteries is a common finding in elderly patients. However, because of the presence of an extensive collateral network, clinical manifestations are rare and usually only develop when there is progression to multilevel disease [1]. Atherosclerotic disease is the most common cause and characteristically occurs in elderly smokers [2,3].

The management of symptomatic chronic mesenteric ischemia (CMI) is challenging. Although the available evidence on the natural history of chronic mesenteric ischemia points to a significant mortality up to 70% without revascularization, there is lack of data concerning comparison between open and endovascular surgery [4]. Endovascular revascularization is the preferred treatment modality in elderly patients with multiple comorbidities. Due to the poor general condition of these patients, open surgicalrevascularization for CMI is associated with in-hospital mortality rates of up to 15% [5]. On the other hand, endovascular revascularization in low-risk patients is not well defined [6].

At presentation, patients with CMI typically have high-grade stenosis or chronic total occlusion (CTO) involving one or more mesenteric arteries [7]. Even if visceral CTOs represent an unique endovascular challenge, there are several observational studies reporting technical success of endovascular revascularization of CTO [2]. Meanwhile, even if the presence of an angiographic stump is a predictor of technical success, its absence should not preclude attempted recanalization, as the majority of these cases, although more difficult, can also be successfully treated [2,8].

Accordingly, we report three cases of CMI with highly calcified CTOs, two of the superior mesenteric artery (SMA) and another of the celiac artery (CA) which have been successfully recanalized by endovascular techniques.

CASES PRESENTATION

Case 1

An 82 year-old male with a prior medical history of diabetes, hypertension, dyslipidemia and cutaneous systemic sclerosis presented with worsening abdominal pain, vomiting for several months, and a 20 kg weight loss in the previous year. A computed tomography angiography (CTA) scan performed in the setting of an acute cholecystitis, showed an occlusion of both CA and SMA origin (Figure 1). The inferior mesenteric artery was patent, with no other relevant findings apart of the biliary tree.

Subsequently, an endovascular approach was scheduled after recovering from the biliary condition. A 6Fr 90 cm long sheath (Terumo Medical, Somerset, NJ) was placed in the left brachial artery. An initial abdominal aortogram was performed using a 5-Fr pigtail catheter (Tempo, Cordis Endovascular, Johnson & Johnson Corporation, Miami, FL) confirming the previous CTA findings: CA and SMA occlusions and patency of inferior mesenteric artery (IMA) with several supplying collaterals. The SMA was selectively catheterized and recanalized using a triaxial system composed by: 1) the 6Fr sheath to overcome the aortic arch; 2) a 5Fr multipurpose diagnostic catheter placed against what we believed to be the SMA ostium (Tempo aqua, Cordis Endovascular, Johnson & Johnson Corporation, Miami, FL) (Figure 2); 3) a 2.7Fr microcatheter to give additional support to the 0,018" guidewire (V18, Boston Scientific, Fremont, CA) used to cross the occlusion. The ostium was predilated using a 3,5 × 60 mm balloon (Savvy, Cordis Endovascular, Johnson & Johnson Corporation, Miami, FL). A balloon-expandable stent 6 × 18 mm (Palmaz Genesis, Cordis Endovascular, Johnson & Johnson Corporation, Miami, FL) was placed at the ostium of the SMA. The final angiogram showed no relevant residual stenosis or evidence of embolization. During the procedure, intravenous bolus doses of 100 U/kg heparin was given and activated clotting times were monitored.

The postoperative course was uneventful and the patient was discharged one day after the procedure being placed on dual antiplatelet therapy for 6 months and single antiplatelet therapy thereafter.

After 2 months of follow-up, the patient was asymptomatic and had recovered 9 Kg. At that time the CTA performed revealed patency of the stent and the SMA (Figure 3). After a 2.5 years follow-up, the patient remained asymptomatic with an overall gain of 21 kg.

Case 2

A 77-year-old female with a prior medical history of hypertension, atrial fibrillation (treated with vitamin K antagonist) and dyslipidemia had complained of unspecific postprandial abdominal pain and anorexia for several months. She had a history of an average weight loss of 4 Kg in 3 months. Laboratory test results, upper digestive endoscopy and colonoscopy evidenced no definite organic cause for the chronic abdominal pain. Finally, an abdominal CTA revealed a highly calcified short occlusion of the CA and a calcified occlusion of the first 7 cm of the SMA, with a patent IMA. The clinical history and imagiological findings were consistent with chronic mesenteric ischemia.

The procedure was performed similarly to the first case, with the placement of a 6 x 18 mm balloon-expandable stent (Palmaz Genesis, Cordis Endovascular, Johnson & Johnson Corporation, Miami, FL) in the ostium of the CA. The final angiogram showed good patency of the stent and reconstitution of the CA (Figure 4).

The postoperative course was uneventful and the patient was discharged one day after the procedure and was placed on double antiplatelet therapy for 6 months.

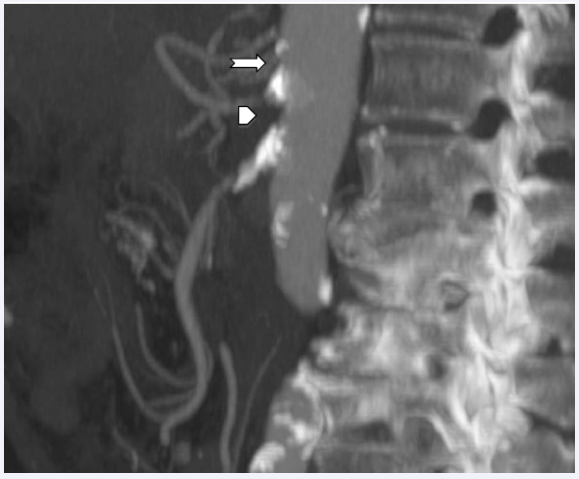

Figure 1 Case 1. PreoperativeCTA demonstrates severely calcified occlusion of CA (arrow) and SMA (arrow head) – Sagittal plane.

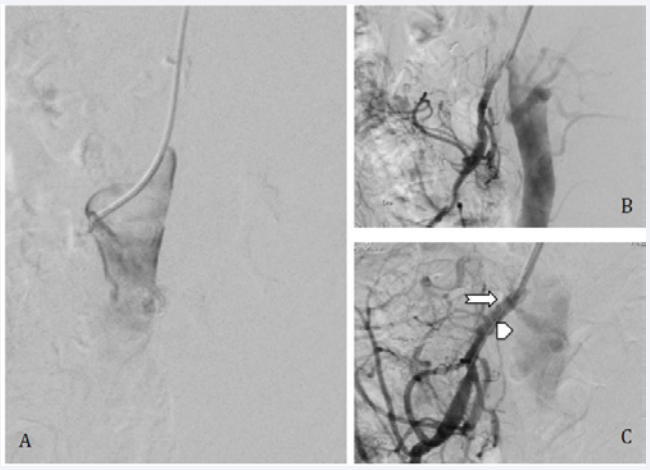

Figure 2 Case 1. A: Angiogram confirming preoperative CTA findings.B: Angiogram after SMA balloon angioplasty. C: Angiogram after the placement of a balloon expandable stent. Note the shadow of the aorta (arrow head) and the position of the stent (arrow).

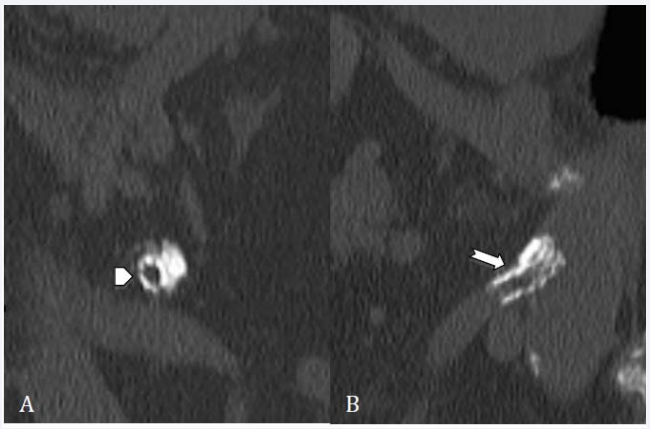

Figure 3 Case 1. Postoperative CTA showing patent stent in the SMA with no relevant stenosis and dense eccentric calcification. A: coronal plane (arrow head). B: sagittal plane (arrow).

One month after the procedure, the abdominal pain has resolved completely and the patient has already gained 3 kg. The CTA at that time, revealed patency of the stent and of the CA (Figure 5).

She remained symptom-free until one year after the procedure, when she presented new complains of abdominal pain; the CTA scan performed at that time demonstrated intra-stent occlusion. There was a favorable evolution of the symptoms with conservative treatment (vasodilators and analgesics), therefore no intervention was carried out. After a 2.5-year follow-up period, the patient is alive, remains asymptomatic and with no weight loss.

Case 3

A 67 year-old male patient with a previous medical history of smoking, arterial hypertension and peripheral artery disease, developed symptoms of weight loss and post-prandial epigastric pain for several months. After having performed several diagnostic tests, CTA was completed revealing diffuse atherosclerotic lesions with highly calcified long CTO of the SMA as well as a CTO of the CA (Figure 6).

The procedure was performed similarly to the previous two cases, with the placement of a 6 x 39 mm and a 6 x 58 mm balloon-expandable stents (Omnilink Elite, Abbott Vascular, Abbott Park, Il) in the ostium and the first segment of the SMA. The final angiogram showed a reopened SMA without significant residual stenosis or dissection and adequate outflow.

After the procedure, the patient was also been placed on double antiplatelet therapy.

After 1 month of follow-up, the patient was asymptomatic and had recovered 4 Kg. The CT performed at that time revealed patency of the stents (Figure 7).

Meanwhile, during the recovery from an anal surgery performed in another institution several months later, the patient died suddenly. No information regarding the cause of death was available.

DISCUSSION

Chronic mesenteric ischemia is a debilitating and potentially life-threatening disease. Left unrecognized or untreated, patients face severe malnutrition or death from complications of acute mesenteric ischemia on CMI. Regrettably, the diagnosis is frequently delayed as a result of an initial poorly specific presentation. The mesenteric circulation is richly collateralized and arises from the CA, the SMA, and the IMA. Although CMI is thought to be primarily a disease of the CA and SMA, the presence of an occlusion of both arteries as in these three cases, leaving all the visceral circulation only depending on IMA, represents a fairly rare condition. Though all patients with CMI should undergo revascularization to minimize pain, prevent bowel infarction, allow weight regain, and restore nutritional reserves, the optimal means to achieve it is still been actively debated [9]. In fact, the elaboration of CMI treatment standards is particularly difficult due to the differences in comorbidities, the limitations in comparing outcomes in patients treated with endovascular revascularization versus open repair, and the relative rarity of the disease [6]. Actually, the currently available literature consists

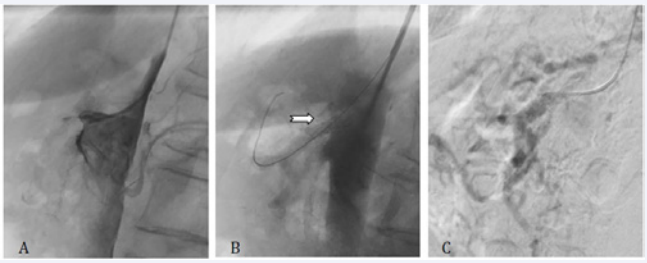

Figure 4 Case 2. A: Angiogram confirming occlusion of both CA and SMA. B: Angiogram after the placement of a balloon expandable stent at the ostium of CA (arrow). C: Final angiogram with patency of the stent and CA branchs.

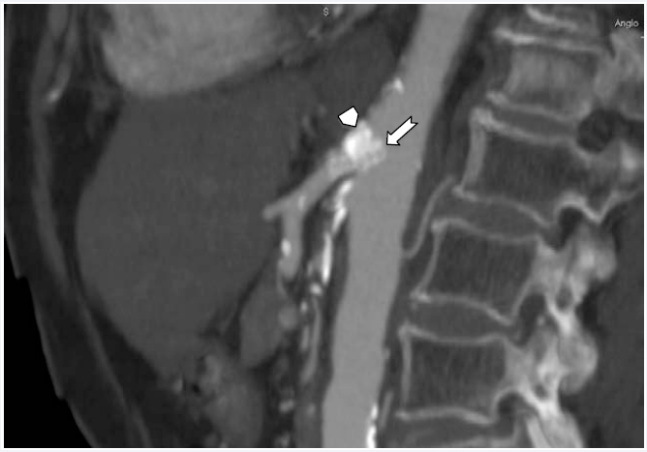

Figure 5 Case 2. Two months follow-up postoperative CTA showing patent stent (arrow) in the CA (note the severe calcification of the CA origin – arrow head).

Figure 6 Case 3. PreoperativeCTA with extremely calcified occlusion of CA (arrow) and SMA (arrow head) and densely calcified abdominal aorta – Sagittal plane.

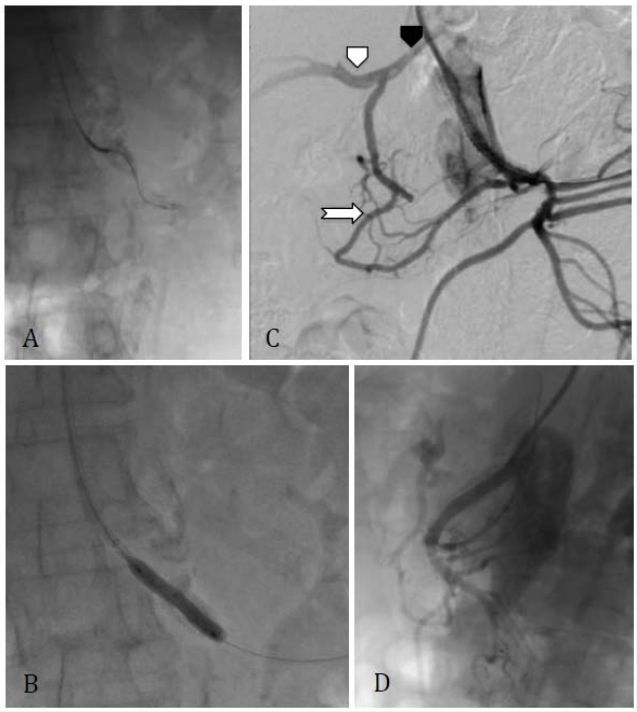

Figure 7 Case 3. A: 0,018" guidewire crossing long heavily calcified occlusion of SMA, supported by the 2,7F microcatheter and the 5Fr MP catheter.B: Occlusion pre-dilatation. C: Final angiogram after the placement of two balloon expandable stents (coronal plane). Note the reconstitution of the common hepatic artery (black arrow head) and proper hepatic artery (white arrow head) through pancreaticoduodenal arteries (arrow). D: Final angiogram (sagittal plane).

mainly of observational cohort studies reporting isolated data on endovascular revascularization or surgical repair and a few comparative studies. No randomized controlled trials were ever performed [4]. Nevertheless, There is an excessive morbidity and mortality described in open surgery performed in CMI patients which seem to be associated with the presence of significant weight loss, malnutrition, and low albumin levels, all predictors of increased morbidity and mortality after any major surgery [9]. Therefore, the endovascular approach is now the first option for many authors.

Although heavily calcified visceral aortas with involvement of the mesenteric vessel takeoff, long lesions(>2 cm) and chronic total occlusions are technically more demanding and have a higher chance of endovascular revascularization failure, it was possible to achieve technical success in the presented three cases [6]. The described triaxial technique may have significantly contributed to the final result. In fact, the 6Fr sheath allowed stability across the left subclavian artery and the aortic arch, while the 5F multipurpose catheter adequately supported and guided the 2.7Fr microcatheter and the 0,018" guide wire to the ostia of the targeted vessels, allowing increased pushability throughout the occlusion. The adequate diameter of the stents is perhaps still an issue in these challenging cases. In fact, if on one hand there is a need in keeping the artery ostium widely opened choosing a larger diameter stent, on the other hand, such severely calcified arteries may easily rupture if overdilated, which can lead to a disaster considering its location. Therefore, covered balloon-expandable stents may represent the optimal option in those specific lesions allowing a more controlled wider opening of the calcified artery. Additionally, it is noteworthy that the successful endovascular treatment of the described occlusions are seldom described in the literature and only in high volume dedicated centers [2].

The imaging follow-up of these patients is also another concern. Duplex scan is of little help in those cases due to the arteries location and to its severe calcification. In fact accurate imaging can only be achieved by CTA or magnetic resonance angiography (MRA). CTA is invasive and MRA is less available and perhaps visceral arteries can be more difficult to be evaluated. Besides, there is a low incidence of acute thrombosis in mesenteric vessels with a reduced need of reintervention [10,11]. In fact, in the described case 2, even after the occlusion of the stent, the patient did relatively well and was still alive 1,5 years after the event. Perhaps we can hypothesize that the endovascular procedure has allowed more time for improvement on collateral circulation and metabolic adaptation that permitted to keep the patient mostly asymptomatic after the occlusion of the stent. Considering these aspects, we perform one control CTA one to two months after the procedure, and then only if new or worsening symptoms occur.

In conclusion, these cases of recanalization and stenting of SMA/CA for CMI support existing evidence that an endovascular-first approach is warranted in these frail and often malnourished patients. The described technique may further increase the success of endovascular therapy even in long, heavily calcified total occlusions.

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