Stent collapse during hybrid revascularization of extensive iliofemoral occlusive disease

Colapso de stent durante revascularización híbrida de enfermedad oclusiva iliofemoral extensa

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ABSTRACT

Combined revascularization with endovascular and open surgery is widely used. This hybrid strategy (HS) treats complex anatomies in high-risk patients. Guidelines recommend open surgery (OS) or hybrid approaches to treat iliofemoral occlusion (IO). While OS is associated with excellent long-term patency outcomes, it is also linked to high morbidity. HS is an alternative with lower morbidity and shorter hospital stay.
We report a case of self-expandable stent collapse during HS for IO in a high-risk patient, followed by expansion and realignment using a balloon-expandable stent.

Keywords: hybrid, endovascular procedure, multilevel revascularization, occlusive iliac disease, stent collapse.

RESUMEN

La revascularización combinando cirugía endovascular y abierta se utiliza ampliamente. La estrategia híbrida (EH) trata anatomías complejas en pacientes de alto riesgo. Las guías recomiendan la cirugía abierta (CA) o híbrida para tratar la oclusión iliofemoral (OI). Si bien la CA se asocia con excelentes resultados de permeabilidad a largo plazo, se asocia con elevada morbilidad. La EH es una alternativa con menor morbilidad y estancia hospitalaria más corta.
Reportamos un caso de colapso de stent autoexpandible durante la EH para OI en un paciente de alto riesgo, que fue expandido y realineado con un stent expandible por balón.

Palabras clave: híbrido, procedimiento endovascular, revascularización multinivel, enfermedad ilíaca oclusiva, colapso de stent.

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INTRODUCTION

Patients with multilevel occlusive vascular disease, especially those at high surgical risk, may benefit from a hybrid strategy (HS)[1]. Current treatment guidelines recommend both open surgery (OS) and HS combining iliac angioplasty with femoral endarterectomy to treat extensive iliofemoral occlusions[2]. While traditional OS with aorto or iliofemoral bypass is associated with excellent long-term patency outcomes, it is also associated with significant perioperative morbidity. HS is an attractive and minimally invasive alternative to OS; its potential advantages are reduced perioperative morbidity and shorter hospital stay[3]. We report a case of self-expandable stent collapse during HS for iliofemoral occlusion (IO) in a high-risk patient, followed by expansion and realignment with a balloon-expandable stent.

CLINICAL CASE

The patient was a 75-year-old man with cardiovascular risk factors including hypertension, former smoking, dyslipidemia, and obesity. He had a history of ischemic heart disease and chronic obstructive pulmonary disease (COPD). He had severe intermittent claudication (Rutherford 3) in the left lower limb (LLL), which prevented him from walking more than 50 meters (55 yards). A Doppler ultrasound (DU) revealed monophasic waveforms, which are characteristic of multilevel occlusive disease (**Figure 1A**). The ankle-brachial index (ABI) in the LLL is 0.6. An angiography (**Figure 1B**) showed moderate stenosis in the right common iliac artery (RCIA), severe stenosis in the right external iliac artery (REIA), severely calcified stenosis in the left common iliac artery (LCIA), chronic total occlusion of the left external iliac artery (LEIA), chronic total occlusion of the left common femoral artery (LCFA), patent bilateral hypogastric arteries and deep femoral arteries (both of them), chronic total occlusion of both superficial femoral arteries (SFA), and patent infrapopliteal vessels (all three).
OS was ruled out due to the patient's age and comorbidities. A hybrid approach was chosen for the left iliofemoral axis and an endovascular approach for the right iliac axis.

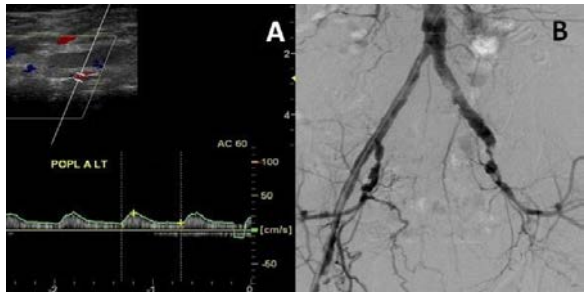

Figure 1. *Doppler ultrasound (DU) of the left popliteal artery and digital subtraction angiography (DSA) of the aortoiliac axis. A. DU of the left popliteal artery: monophasic waveform. B. DSA: extensive iliofemoral occlusion on the left side and severe stenosis in the right iliac axis.*

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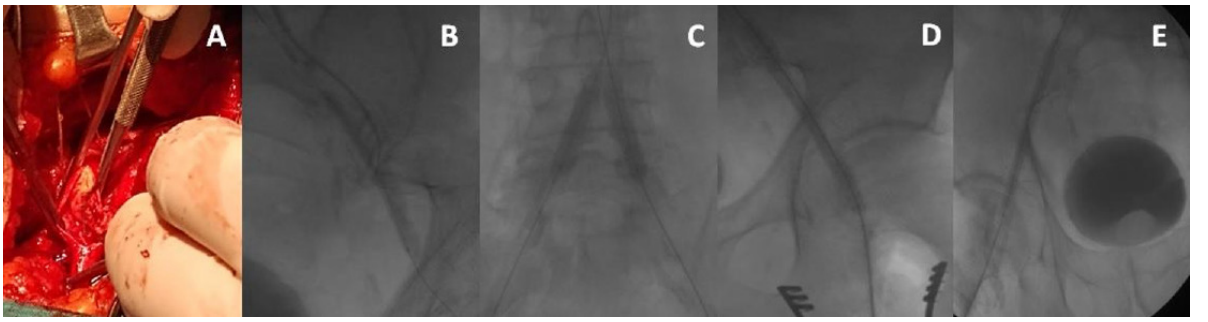

Figure 2. *Procedure. A. Femoral endarterectomy. B. Retrograde CART technique. C. Kissing stent technique. D and E. Post-dilation of self-expanding stents in both external iliac arteries.*

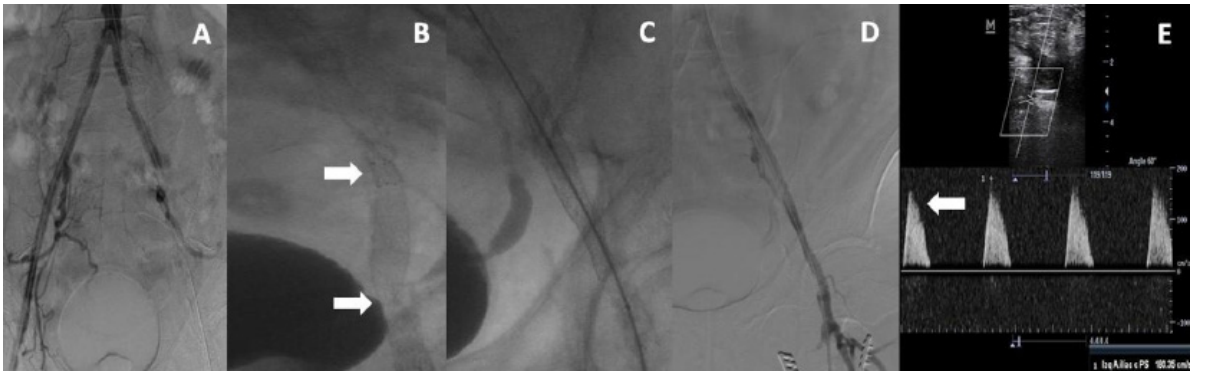

Figure 3. *Stent collapse, final outcome, and echocardiographic follow-up. A. Left external iliac artery occlusion. B. Stent collapse (arrows). C. Complete stent deployment after balloon-expandable stent implantation. D. Complete patency of the stented segment, the left common femoral artery, and the left deep femoral artery. E. DU of the distal left external iliac artery: PSV of 180 cm/s, low-volume high-resistance waveform, and a shoulder in the systolic downstroke curve, reflecting the pulse wave from distal disease.*

The patient underwent endarterectomy of the LCFA with a bovine pericardium patch and profundaplasty (**Figure 2A**).A 0.035" hydrophilic-coated guidewire was inserted through puncture in the distal portion of the patch, and a 7-Fr introducer sheath was placed. Retrograde crossing of the LEIA was attempted with support from a 4-Fr vertebral catheter and a 0.035" hydrophilic-coated guidewire, without success. The right common femoral artery was punctured retrogradely, and a 6-Fr, 45-cm introducer sheath was placed in the LCIA using the crossover technique. This maneuver was challenging due to severely calcified stenosis in the LCIA, requiring predilation with 4-mm and 6-mm balloons to facilitate introducer sheath advancement. The first attempt at LEIA antegrade rechanneling with 0.018" and 0.035" guidewires and support from various catheters failed Subsequently, operators attempted a retrograde CART technique (**Figure 2B**) with a 6-mm × 100-mm balloon at 4 atmospheres, achieving antegrade subintimal crossing and externalization of the 0.035" hydrophilic-coated guidewire through the left femoral introducer sheath.

Predilation with a 7-mm ×100-mm balloon at 16 atmospheres

The kissing stent technique was used to implant two 9-mm × 37-mm balloon-expandable coated stents (BeGraft, Bentley) in both common iliac arteries (**Figure 2C**). Two self-expanding (SE) stents (EPIC, Boston Scientific), 8 mm × 120 mm and 8 mm × 80 mm, were implanted in the distal LCIA and LEIA, respectively. An 8-mm × 100-mm SE stent (EPIC, Boston Scientific) was implanted in the REIA. On the left side, the stent was deployed at the upper edge of the endarterectomy patch (**Figures 2D and 2E**).

A control angiography revealed occlusion in the LEIA (**Figure 3A**) due to incomplete stent expansion in the most heavily calcified area (**Figure 3B, arrows**), despite post-dilation with a non-compliant 7-mm × 40-mm balloon at 20 atmospheres. To solve the stent collapse, a 7-mm × 57-mm balloon-expandable stent (BES) (Express LD Vascular, Boston Scientific) was implanted, resulting in complete stent expansion (**Figure 3C**) and complete patency of the stented segment, the LCFA, and left deep femoral artery (**Figure 3D**).

RESULTS

The patient progressed without complications and was discharged on the second day after the procedure. Dual antiplatelet therapy (aspirin 100 mg/day plus clopidogrel 75 mg/day) was prescribed for 1 year. Currently, 5 months after the procedure, the patient experiences Rutherford class 1 claudication, and his LLL ABI is 0.85. A Doppler ultrasound recorded a peak systolic velocity (PSV) of 180 cm/s, and a low-volume high-resistance waveform and a characteristic shoulder in the systolic downstroke curve, in the distal LEIA, reflecting the pulse wave of distal disease (**Figure 3E**).

DISCUSSION

Traditionally, OS is considered the most durable intervention for the treatment of IO, with excellent long-term patency. However, advanced age and patient comorbidities are associated with poor outcomes, which has spurred interest in the HS in recent decades[3]. The HS has been associated with shorter hospital stays and lower perioperative morbidity, while maintaining medium-term patency rates comparable to OS in patients with IO (TASC C/D)[4].

During the HS performed in our patient with extensive IO, an EPIC SE stent collapsed in the area of greatest calcification. Because the LEIA rechanneling was completely subintimal, no intravascular atherectomy or lithotripsy devices were used for plaque preparation.

The decision to use coated stents in both common iliac arteries (CIA) was due to their high radial force and precise implantation[5]. In the external iliac arteries (EIA), we implanted bare self-expandable (SE) stents to keep both hypogastric arteries patent, considering their greater flexibility, better adaptation to the vascular wall, and lower neointimal hyperplasia[6]. The EPIC stent has shown good results in studies on primary patency and efficacy, and it can be recommended for most iliac artery lesions[7, 8]. Cases of collapse of BES in the iliac artery have been very infrequent. Ichihashi *et al.*[9] described BES fracture and collapse in both CIA due to *shiatsu* massage, and Park *et al.*[10] reported a case of BES collapse in CIA due to minor external compression in a thin patient.

CONCLUSION

A HS for extensive IO treatment allows for multilevel revascularization in high-risk surgical patients, maintaining favorable patency and a low complication rate. Stent collapse in the iliac arteries is extremely rare. There are reports of BES collapse in the iliac arteries. We did not find any cases of SE collapse in the iliac arteries in the literature. However, this rare event should be considered before implanting an SE in a severely calcified chronic total iliac occlusion.

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