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Case Reports

How should we manage thrombosis of Viabahn stent-graft? A case report focused on catheter-directed thrombolysis☆

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ABSTRACT

Purpose: To report a case of a thrombosed GORE® VIABAHN® endoprosthesis stent-graft in the femoral artery (SFA) and popliteal artery managed using the pulse-spray technique and complicated by compartment syndrome of the lower leg of the affected limb.
Case Report: A 61-year-old woman with three Viabahn stent grafts relining seven bare-metal stents in her right SFA and popliteal artery visited our hospital with complaint of recurrent lifestyle-limiting claudication of right leg. Angiography and intravascular ultrasound showed complete intra-stent obstruction by thrombus from the proximal right SFA to the proximal popliteal artery. Catheter-directed thrombolysis using pulse-spray technique followed by mechanical thrombectomy was performed. Despite successful recanalization, unfortunately, compartment syndrome developed on her right leg on the following day and fasciotomy was performed.
Conclusion: The larger thrombus burden in Viabahn stent-grafts and its unique physicochemical properties increases the risk for distal embolic complications and potential poor clinical outcomes.

1. Introduction

The GORE® VIABAHN® Endoprosthesis (W.L. Gore & Associates, Flagstaff, AZ) is a flexible, self-expanding stent-graft made of an expanded polytetrafluoroethylene lining coupled with an external nitinol support extending along its entire length. It is the only stent-graft approved for implantation in the superficial femoral artery (SFA) to treat de novo, restenotic, and in-stent restenotic lesions. The use of Viabahn stent-graft in SFA disease is increasing because of its relative good patency rates in both native vessel disease and in-stent restenotic lesions [1,2]. These good results have been marred by the considerably high rates of Viabahn thrombosis (16.7 ~ 34%) that have been reported [3–5]. In patients presenting with acute limb ischemia (ALI), Viabahn thrombosis should be treated promptly either percutaneously or with open surgical revascularization.

Several trials have shown that in patients with ALI percutaneous catheter-directed thrombolysis (CDT) is not inferior to open surgical revascularization in terms of limb salvage [6,7]. Furthermore, CDT is more effective in occluded grafts than in native vessels for limb salvage [6]. Based on this evidence, CDT is widely used in the treatment of thrombosis of both stent-grafts and native vessels. However, the use of CDT is associated with complications such as bleeding (2.9–13.3%) or distal embolization of clots (3.8–24%) [8]. Whether complications of CDT in patients with Viabahn thrombosis may be affected by specific thrombus features or by the technique employed for CDT remains unanswered. We report a case of compartment syndrome complicating CDT of a femoropopliteal Viabahn thrombosis.

2. Case Report

A 61-year-old woman was admitted to our hospital with complaint of recurrent lifestyle-limiting claudication of right leg (Rutherford class 3). She had a history of hypertension, hyperlipidemia, coronary artery disease, and peripheral artery disease with multiple revascularization procedures. She had undergone ilio-femoral bypass surgery with placement of a polytetrafluoroethylene (PTFE) graft in her left leg 6 years prior to admission, and multiple percutaneous endovascular interventions (PEI), with placement of seven bare-metal nitinol self-expanding stents (BMS) in right SFA and popliteal artery several years before prior to admission, followed by placement of 2 Viabahn stent-grafts (6 × 150 and 7 × 100 mm) in 2012 and one 7 × 50 mm Viabahn stent-graft in 2013 for diffuse in-stent restenosis (ISR). The ankle brachial index was 0.5 on her right leg and 0.7 on her left leg. She was considered a candidate for endovascular revascularization of the right leg and was brought to the cath lab for intervention. A long stented segment (28 cm of total stent length) was present from the ostium of the

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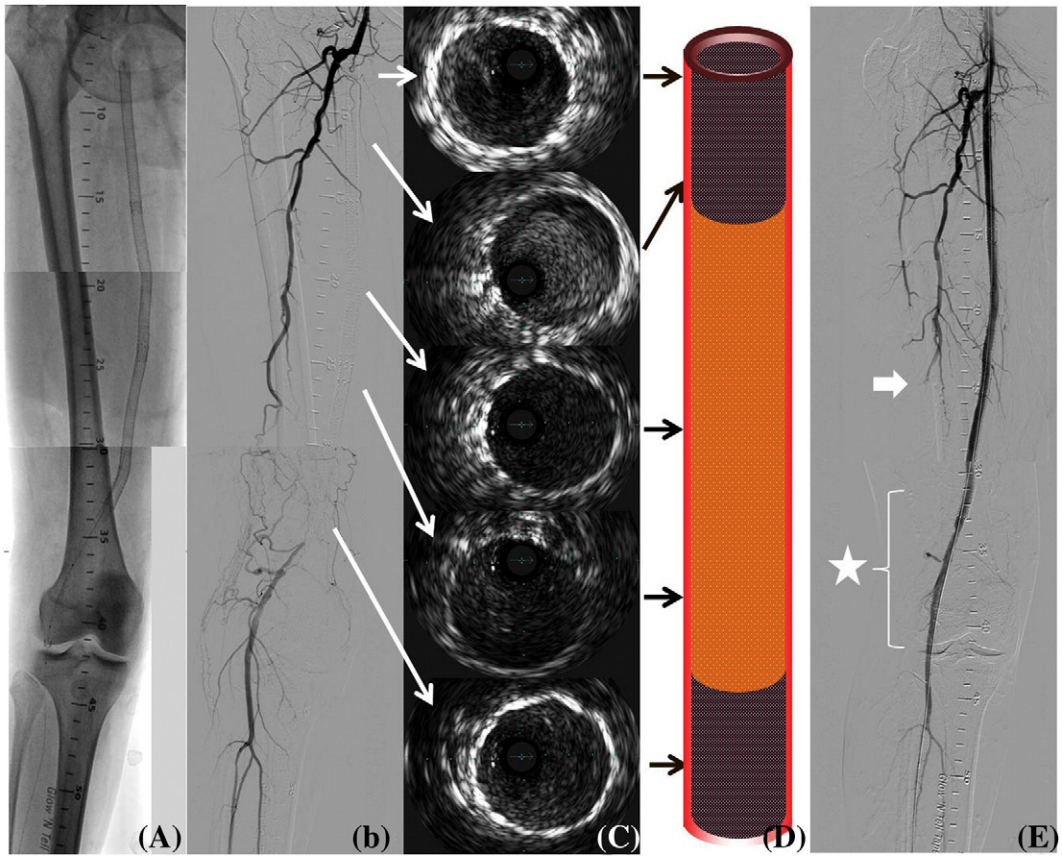

Fig. 1. Fluoroscopy, digital subtraction angiogram (DSA), and intra-vascular ultrasound. (A) Fluoroscopy shows long stents from proximal superficial artery (SFA) to proximal popliteal artery. (B) DSA before intervention shows total occlusion from ostium of SFA to proximal popliteal artery with rich collateral flow from deep femoral artery with distal constitution in popliteal artery and well developed genicular/sural arteries. (C) IVUS shows iso-echoic density of thrombus in the both ends of Viabahn with ruptured thrombus of proximal intra-graft area and hypo-echoic density in the mid portion of Viabahn. (D) Schematic diagram shows relatively firm thrombus in both end of Viabahn and relatively soft and floating thrombus in the mid portion of Viabahn. (E) Final angiogram shows good distal flow without filling defect or dissection in the SFA or popliteal artery, but a distal branch of deep femoral artery (arrow) and genicular and sural arteries (star) disappeared by embolism.

right SFA to the proximal portion of the right popliteal artery (Fig. 1-A). There was complete intra-stent obstruction from the proximal right SFA to the proximal right popliteal artery, with a patent deep femoral artery that provided extensive bridging collaterals reconstituting the mid segment of the right popliteal artery (Fig. 1-B). Intravascular ultrasound (IVUS) imaging study using the Volcano Eagle Eye® IVUS catheter (Volcano Corporation, San Diego, CA) showed organized thrombus in both ends of the overlapping Viabahn stent-grafts, with dissected thrombus or plaque on the proximal portion of the graft and relatively less organized thrombus in the mid portion of the stents (Fig. 1-C). It was decided to proceed with the infusion of thrombolytic agent using the "pulse-spray" technique followed by mechanical rheolytic thrombectomy. After positioning of a 0.014-in. Emboshield NAV6 7.2-mm filter (Abbott Vascular, Santa Clara, CA) in the distal right popliteal artery segment for distal embolic protection, a total of 4.5 mg of tenecteplase (TNK-tPA) was delivered directly into the thrombus through a 6F AngioJet thrombectomy catheter (MEDRAD Interventional/Possis, Indianola, PA). After an indwelling time of 45 min, mechanical rheolytic thrombectomy was performed along the entire length of the occluded right SFA/popliteal artery. The follow-up angiogram, however, showed no-flow in the right popliteal artery segment where the filter was located. After filter removal and intra-arterial administration of vasodilator agents (nitroglycerin and sodium nitroprusside) into the right below-the-knee arterial system, brisk flow to the distal vessels was successfully restored. Balloon angioplasty of both edges of the Viabahn stent-grafts with paclitaxel-drug coated balloons (Medtronic DCB 5.0 × 80 mm for distal edge and a 6.0 × 80 mm for proximal edge) was then performed, with excellent angiographic results. The follow-up angiogram showed no residual stenosis or filling defects in the SFA and popliteal artery with good flow to the three (3)-vessel run-off. However, it also showed occlusion of the distal segments of the right deep femoral, genicular, and sural arteries with 'no flow' (Fig. 1-E). At that time, not much emphasis was placed on the embolization with total occlusion of the right deep femoral and genicular/sural arteries, as the patient was relatively asymptomatic.

The following day, the patient complained of pain and swelling of her right lower extremity, particularly in the calf area. On examination, tense edema and tenderness to palpation from her right distal thigh to the lower leg were present. Creatine kinase (CK) was elevated at 2103 units/L at 10 h and 17,690 units/L at 34 h after the procedure (reference values: 26–192 units/L). Based on the clinical presentation, a diagnosis of compartment syndrome was made. The patient was taken urgently to the operating room and underwent 4-compartment fasciotomy. Intraoperatively, all muscles were swollen with the most severe bulging noted at the superficial posterior compartment. The deep posterior compartment showed darkened muscle but had a positive response to electrocautery stimulation. The postoperative course was regular and total CK values gradually dropped. Subsequently, the patient underwent right lower leg debridement, split thickness skin grafting, and adjunctive wound management, and she was discharged home improved.

3. Discussion

In the current case, the 'pulse-spray' technique with rheolytic thrombectomy using AngioJet catheter (MEDRAD Interventional/Possis, Indianola, PA) was selected among several CDT methodologies available