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MINI-FOCUS ISSUE: COMPLICATIONS

ADVANCED

CASE REPORT: CLINICAL CASE

Common Calcified Femoral Artery Rupture After Intravascular Lithotripsy for TAVR Implantation

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ABSTRACT

We describe a case with unfavorable calcified femoral access in which the implantation of a 34-mm self-expandable transcatheter aortic valve was possible after intravascular lithotripsy. Although the aortic valve was successfully implanted, we observed a severe vascular complication requiring the implantation of a covered stent of the femoral artery. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2020;2:882–5) © 2020 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

HISTORY OF PRESENTATION

An 82-year-old man was admitted with acute heart failure symptoms.

LEARNING OBJECTIVES

- To understand the available options for the treatment of aortic stenosis. TAVR is now ubiquitously used in elderly patients with high-risk severe aortic stenosis and deemed at intermediate-low risk. Of note, the superiority of TAVR over surgical aortic valve replacement is only achieved when transfemoral access is preferred, and severe tortuosity or heavy calcification of iliac-femoral axes may limit its use.
- To understand the potential role of the new generation of "plaque modifier" devices in facilitating transfemoral access TAVR procedures and its possible complications.

PAST MEDICAL HISTORY

The patient had a history of right hip arthroplasty, severe chronic obstructive pulmonary disease, hypertension, former smoker, carotid artery disease, type 2 diabetes mellitus, and permanent atrial fibrillation.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis was acute coronary syndrome, severe mitral regurgitation, myocarditis, or endocarditis.

INVESTIGATIONS

The echocardiogram showed severe aortic stenosis (mean gradient, 48 mm Hg; aortic valve area, 0.7 cm^2) with dilation of the left atrium, moderate mitral regurgitation, severe pulmonary hypertension (systolic pulmonary pressure, 75 mm Hg), and slight

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reduction of left ventricular ejection fraction (52%). Figure 1 shows the computed axial tomography performed before the procedure. Looking at the access sites, the computed tomography scan showed diffuse calcific atheromas of right common femoral artery with circumferential thick calcium plates restricting the lumen diameter (minimal lumen diameters, 4.1 mm) and the evidence of a penetrating atherosclerotic ulcer (Figure 1C). Conversely, the left iliac axis had diffuse calcium atheromas but without significant tortuosity and with an acceptable minimal lumen diameter (minimal lumen diameters, 5.5 mm) (Figure 1B). Finally, because the annulus was 92 mm, we opted for an Evolut R 34-mm valve (Medtronic, Minneapolis, Minnesota).

MANAGEMENT

Accordingly, the left common femoral artery was selected by the heart team, whereas the right access was exclusively used to place a safety wire for the contralateral axis (Hi-Torque Connect 0.018-inch, Abbott, Santa Clara, California). Of note, during this step we checked the correct position of the wire into the superficial femoral artery and did not notice any vascular dissection or wall rupture. However, the valve failed to cross the common femoral artery, with and without the sheath. Therefore, we decided to use intravascular lithotripsy (IVL) (Shockwave Medical, Fremont, California). Four cycles of 30-inch with shockwave balloon catheter 7.0 × 60 mm inflated to 6 atm were performed, allowing successful implantation of the 34-mm Evolute R Medtronic valve through a 20-F introducer (Figure 2). However, after the failure of the two Proglides, we performed an angiogram that showed a long dissection starting into the distal segment of the external iliac artery (Figure 3A) extending to the access site, with clear evidence of a wall rupture (Figure 3B).

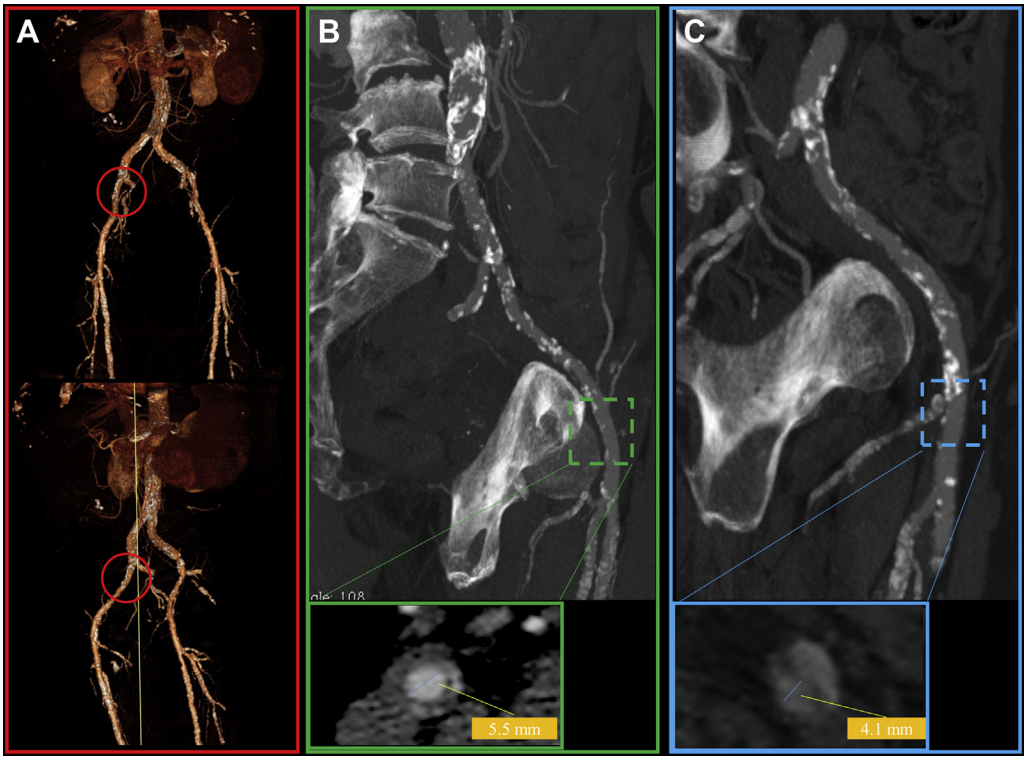
Therefore, a self-expanding Viabahn-coated 7.0 × 50 mm stent was implanted in the left common femoral artery followed by multiple dilatations with an 8.0 × 20 mm balloon catheter. At the end of the procedure, an acceptable result was obtained, with complete recanalization of superficial and without

ABBREVIATIONS AND ACRONYMS

IVL = intravascular lithotripsy

TAVR = transcatheter aortic valve replacement

FIGURE 1 Computed Tomography Scan



(A) 3-dimensional reconstruction of left and right iliac and femoral arteries **(red circles)**. Ulcerated plaque with an intimal flap shown in **C**. **(B)** Left femoral artery: long and short axis. **(C)** Right femoral artery: long and short axis.

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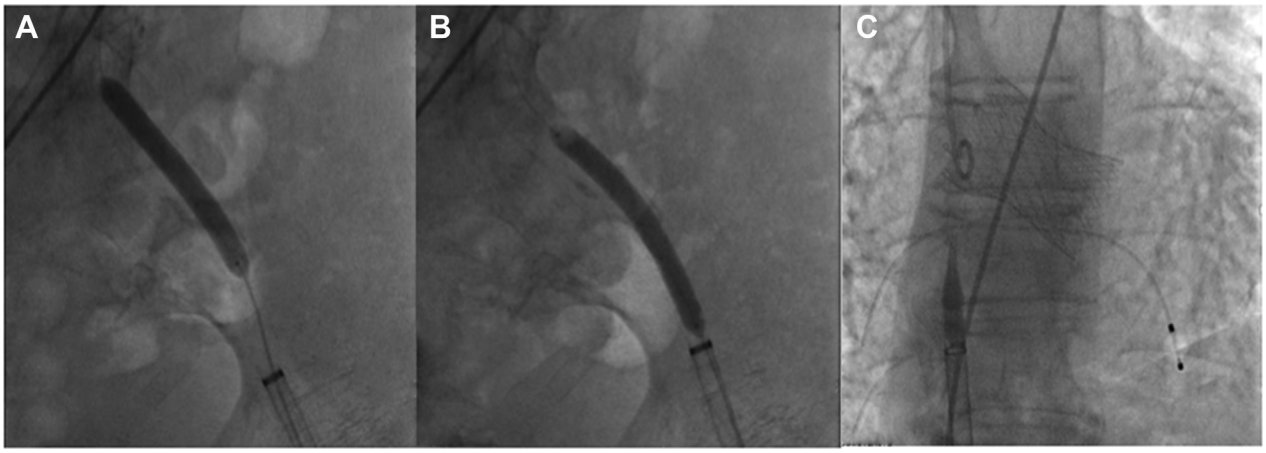
FIGURE 2 The Inflated Lithotripsy Balloon in the Iliac and Femoral Arteries and the 20-F Introducer



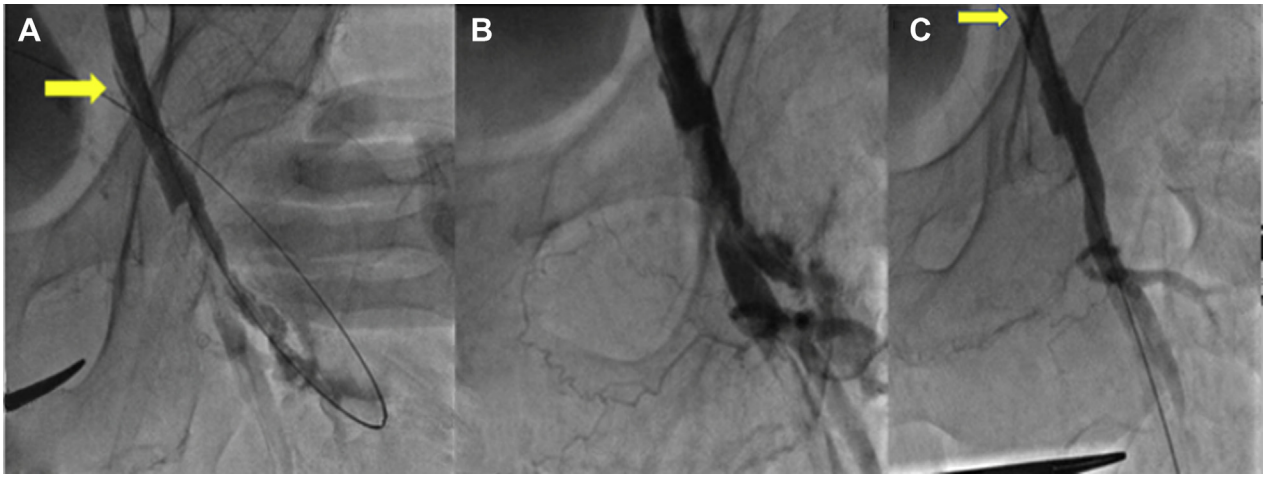
Intravascular lithotripsy angioplasty of the left common iliac **(A)** and femoral **(B)** arteries. The 20-F introducer and Evolut R 34-mm aortic valve implanted **(C)**.

contrast media extravasation (Figure 3C), whereas the angiography demonstrated the dissection of the distal iliac artery far away to the puncture site (Video 1). After transcatheter aortic valve replacement (TAVR) implantation clinical and hemodynamic status was stable, with New York Heart Association functional class I. No further complications were observed including the access site. The post-procedure echocardiogram showed an optimal valve position with a transvalvular mean pressure gradient of 7 mm Hg, and the in-hospital length of stay was 10 days.

DISCUSSION

TAVR is an effective strategy in patients with severe aortic stenosis and it is superior to surgery when transfemoral arterial is the access of choice (1-4). As for the coronary interventions (5), the reduced dimension of the TAVR devices decreases the vascular complications. However, a significant number of patients remain ineligible for transfemoral TAVR because of peripheral arterial disease and/or severe artery calcifications. The use of IVL to

FIGURE 3 Angiograms Showing a Long Dissection and a Rupture of the Arterial Wall



(A) Dissection starting into the distal segment of the external iliac artery extending to the access site **(arrow)**. **(B)** Contrast medium extravasation after femoral artery rupture. **(C)** Covered stent implanted with a good final angiographic result and angiographic image of residual iliac dissection **(arrow)**.

facilitate transfemoral arterial by disrupting intimal and medial calcification and increasing vascular compliance may extend the number of patients suitable to this access (6-8).

Of note, the safety and efficacy of such an approach have been explored in a prospective registry including 42 patients undergoing IVL of the iliac or femoral arteries to facilitate transfemoral passage of the delivery system. Of note, TAVR through transfemoral arterial was possible for the 90% of these patients, with 1 (2.4%) patient developing pseudoaneurysm and 1 (2.4%) requiring endarterectomy (9). Furthermore, some complications related to IVL have been recently reported, including femoral artery dissection during peripheral interventions. In particular, this last complication has been documented in about 14.6% of the cases, of which 0.9% were flow-limiting (10). In our case, we observed a long dissection of the iliac-femoral axis and the rupture of the femoral artery near the puncture site. The IVL was performed with a 7 mm balloon to modify the severe atherosclerotic burden of the iliac-femoral axis. The TAVR in severe small calcified femoral arteries remains challenging even in the era of new "plaque modifier" devices and might require vascular repair. In the case presented, the angioplasty with lithotripsy allowed the implantation of the valve with the support of a large-sized device (20-F sheath) that was necessary because the delivery system was not able to cross the femoral axis alone. Accordingly, the use of IVL is not exempt from vascular complications and may require additional costs. The use of a covered stent leads to adjunctive problems, including stent thrombosis, closure of the collateral vessel, unfavorable vessel anatomy, and potential fracture. Furthermore, its use is more likely to be complicated by the covering of the deep femoral artery, which may significantly impact leg perfusion, and by a significant restenosis rate. However, in emergency situations, the use of the endovascular approach is an easy, quick, and effective option to repair the vessel rupture for rapid leg reperfusion, in particular in high-risk patients, as described in this case. Of note, our routine approach for patients undergoing TAVR includes, first of all, the contralateral insertion of safety wire to be used in emergency situations, allowing easy management of vascular complications.

FOLLOW-UP

The clinical and ultrasound evaluation of the femoral axis at 6-month follow-up demonstrated patency of common femoral artery, good leg perfusion, and no symptoms.

CONCLUSIONS

IVL was an effective device for peripheral angioplasty allowing TAVR implantation in unfavorable calcified femoral access. However, this case demonstrated that severe vascular complications might occur in calcified arteries even after intravascular lithotripsy.

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KEY WORDS aortic stenosis, shockwave, transcatheter aortic valve replacement, vascular complications

APPENDIX For a supplemental video, please see the online version of this paper.