

Review began 03/19/2025

Review ended 03/25/2025

Published 03/26/2025

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DOI: 10.7759/cureus.81239

Femoro-Femoral Bypass for a Vascular Complication During Transfemoral Aortic Valve Implantation

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Abstract

A 94-year-old woman underwent transcatheter aortic valve implantation (TAVI) for treatment of severe aortic stenosis (AS). Final angiography showed the right external iliac artery occlusion due to vascular injury related to a large-diameter introducer sheath. Although we performed endovascular therapy, no guidewires could cross the culprit lesion because the intima had frapped and occluded the vessel lumen. Therefore, we performed femoro-femoral bypass for bailout of acute limb ischemia. Femoro-femoral bypass is a less invasive, shorter operation time and therefore a reasonable strategy as an urgent bailout for vascular complications during TAVI in super-aged or higher-risk surgical patients with severe AS.

Categories: Cardiology, Cardiac/Thoracic/Vascular Surgery

Keywords: aortic stenosis, endovascular therapy, femoro-femoral bypass, transcatheter aortic valve implantation, vascular complication

Introduction

The number of patients with heart failure (HF) is increasing due to the aging of the population, along with therapeutic innovations in the management of cardiovascular diseases [1]. Approximately one-third of patients with HF have some valvular heart disease [2]. Among them, aortic stenosis (AS) is the most common valvular heart disease, especially in the elderly. As its treatments, transcatheter aortic valve implantation (TAVI) is recognized as an established, less-invasive strategy for higher surgical risk patients with symptomatic severe AS.

While advances in technology have made it possible to lower the profile of the valve delivery system from the femoral artery, sheath-related vascular complications still increase morbidity and mortality in patients who undergo transfemoral TAVI [3, 4]. Thus, it is important for the heart team to evaluate the access site with reference to pre-procedural enhanced computed tomography (CT) findings and to manage vascular complications during the TAVI procedure.

This is a successful bailout case for acute limb ischemia due to a vascular complication during transfemoral TAVI by femoro-femoral bypass surgery in an elderly patient with severe AS.

Case Presentation

A 94-year-old woman with a medical history of hypertension and dyslipidemia was referred to our hospital for treatment of acute decompensated heart failure (ADHF) due to severe AS. After the treatment of ADHF, the heart team decided to perform TAVI for this patient. On the pre-procedural contrast CT, significant stenosis was not observed in any access sites (Figures 1A, 1B).

How to cite this article

Omote K, Kamada T, Furugen M, et al. (March 26, 2025) Femoro-Femoral Bypass for a Vascular Complication During Transfemoral Aortic Valve Implantation. Cureus 17(3): e81239. DOI 10.7759/cureus.81239

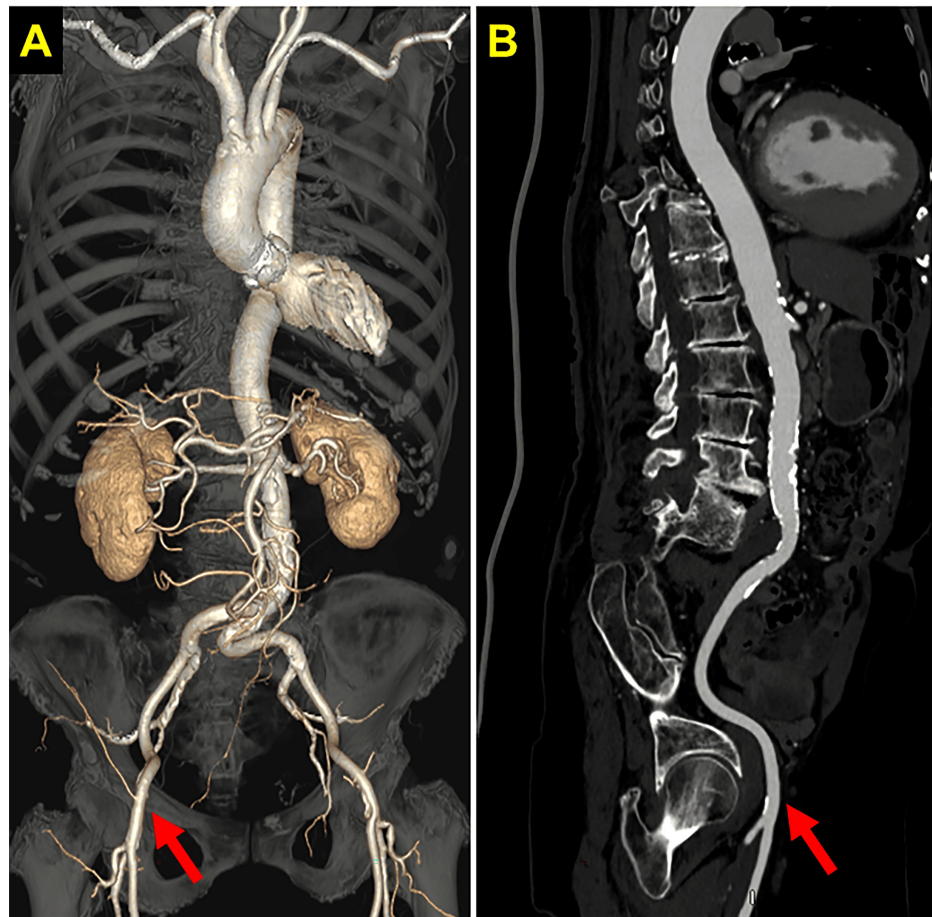


FIGURE 1: Findings of pre-procedural enhanced computed tomography

Red arrows indicate the access site.

Thus, transfemoral-TAVI was performed via the right side, and a dry seal introducer sheath (W.L. Gore & Associates, Inc., Flagstaff, AZ, USA) was inserted. A 26-mm Evolut FX valve (Medtronic, Minneapolis, MN, USA) was delivered and deployed successfully. However, final angiography at the access site showed the right external iliac artery occlusion (Figure 2).

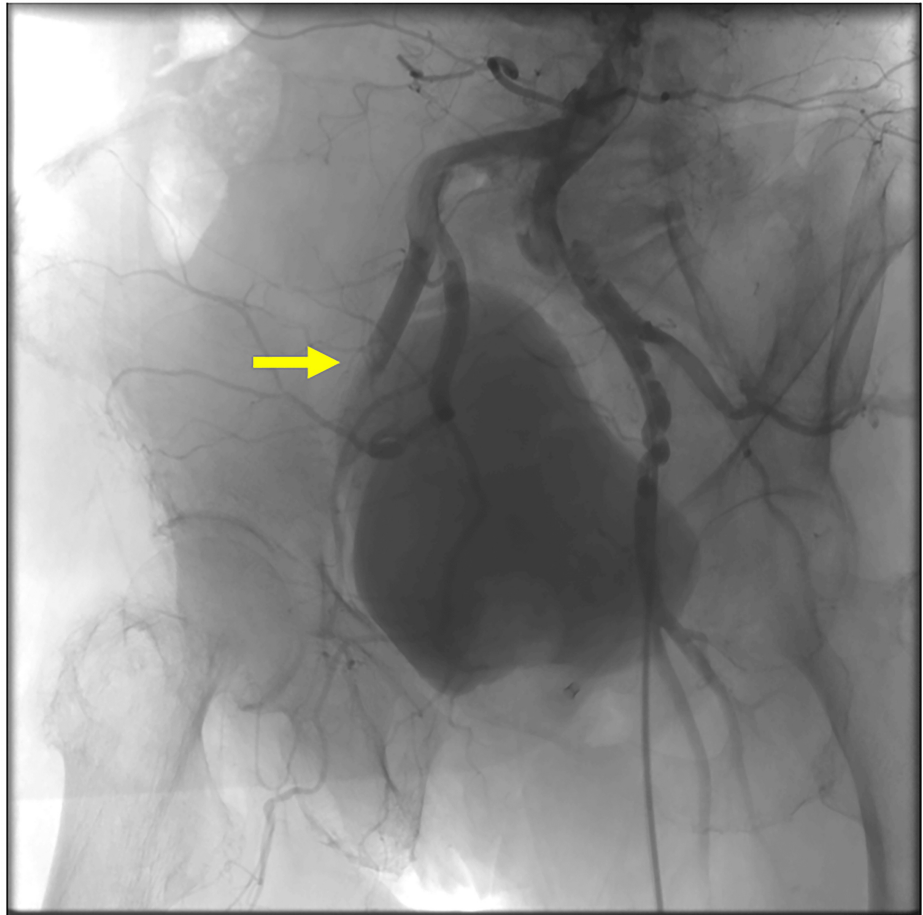


FIGURE 2: Final angiography at the access site

Yellow arrow indicates the occlusion site at right external-iliac artery.

Then, we performed endovascular therapy (EVT) by a bi-directional approach from an antegrade 6-Fr guiding system via the left brachial artery and a retrograde microcatheter via the right femoral artery. However, the guidewires from antegrade or retrograde could not cross the culprit lesion. Intravascular ultrasound (IVUS) showed that the intima had frapped and completely occluded the vessel lumen (Figures [3A](#), [3B](#)).

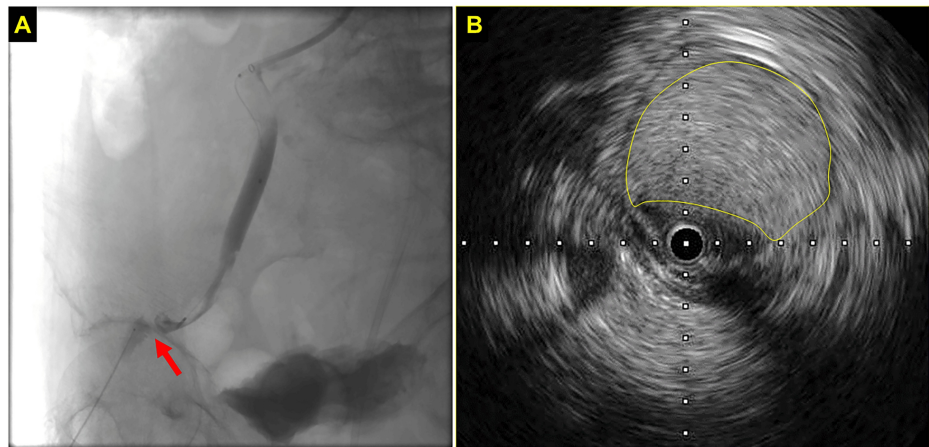


FIGURE 3: Endovascular therapy during TAVI (A) and the finding of intravascular ultrasound (B)

The red arrow indicates the occluded site of the vessel lumen. The yellow circle indicates the frapped intima revealed by intravascular ultrasound.

TAVI: transcatheter aortic valve implantation

Therefore, we had to change our plan to a surgical procedure. Since aorto-femoral bypass carries a higher risk of surgery for this super-aged patient, we selected femoro-femoral bypass for the bailout of acute limb ischemia. When the vessel was opened, a ruptured intima was observed in the culprit lesion (Figure 4A). The graft GORE PROPATEN (W. L. Gore & Associates, Inc.) 6 mm was tunneled from the left groin incision to the right and anastomosed to each vessel (Figure 4B).

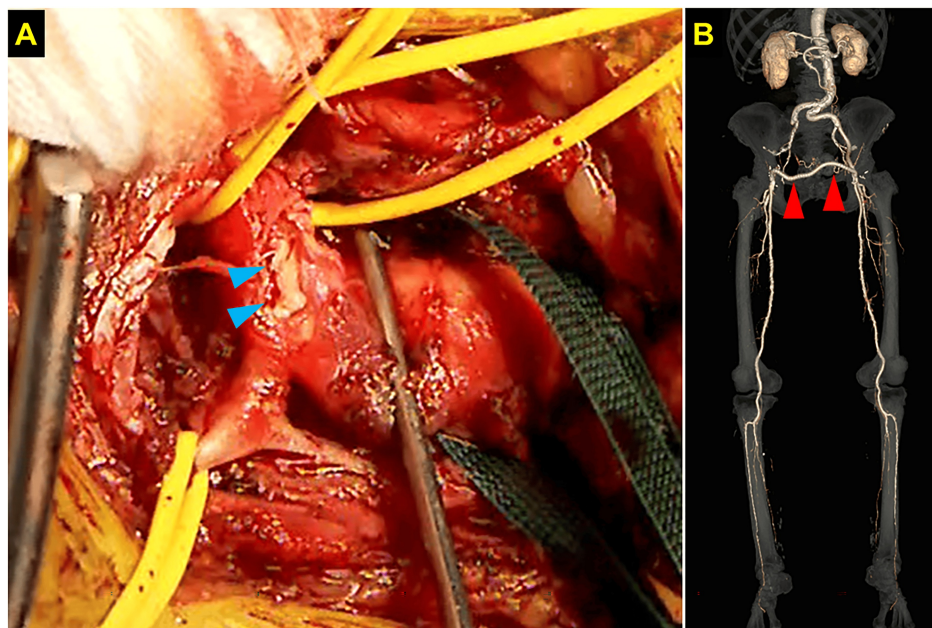


FIGURE 4: Macroscopic findings (A) and post-procedural enhanced computed tomography (B)

Blue arrows indicate the ruptured intima in the culprit lesion. Red arrows indicate the femoro-femoral bypass graft.

We successfully treated acute lower extremity ischemia via femoro-femoral bypass. This patient was discharged home after surgery without lower limb amputation.

Discussion

Many elderly patients with symptomatic severe AS cannot undergo surgical aortic valve replacement (SAVR) because of the high surgical risk [5]. Transcatheter aortic valve implantation is a less invasive alternative to SAVR and is recognized as a well-established therapeutic strategy for treating symptomatic severe AS, regardless of intermediate or even high operative risk [6]. However, there are specific complications related to TAVI. Among them, sheath-related vascular complications are associated with worse clinical outcomes in patients who underwent TAVI [3,4].

In case of vascular complications during the TAVI procedure, patients are usually treated by EVT with balloon angioplasty, stents, or covered stents, but some cases require surgical vessel repair [7]. In this case, we first selected to perform EVT. But any guidewires could not cross the culprit lesion because the flapped intima completely covered the vessel lumen. And thus, we decided to perform surgical repair as a secondary option.

Because long-term graft patency is superior after aorto-femoral bypass as compared with femoro-femoral bypass, open aorto-femoral bypass surgery is still the gold standard for aortoiliac reconstruction [8]. According to a previous comparative study, three-year graft patency was inferior after femoro-femoral bypass as compared with aorto-femoral bypass (60% versus 85%), although both surgeries achieved limb salvage in more than 85% of patients at three years [8]. But femoro-femoral bypass is a less invasive, shorter operation time (within one hour in this case), and therefore a reasonable strategy as an 'urgent bailout' for vascular complications during the TAVI procedure in super-aged or higher operative risk patients with severe AS.

Conclusions

We experienced a successful bailout case of acute limb ischemia due to sheath-related vascular injury during transfemoral TAVI via femoro-femoral bypass. Endovascular therapy is the first choice for a bailout of this complication. But femoro-femoral bypass is another acceptable option as an urgent bailout for vascular complications during the TAVI procedure in super-aged or high surgical risk patients.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Kazunori Omote, Takeshi Kamada, Makoto Furugen, Shunsuke Otori, Azusa Furugen, Daisuke Sunaga, Naohiro Funayama

Drafting of the manuscript: Kazunori Omote, Takeshi Kamada, Makoto Furugen, Shunsuke Otori, Daisuke Sunaga

Supervision: Makoto Furugen, Naohiro Funayama

Critical review of the manuscript for important intellectual content: Azusa Furugen, Naohiro Funayama

Disclosures

Human subjects: Consent for treatment and open access publication was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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