CASE REPORT

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Facilitating Transfemoral Transcatheter Aortic Valve Implantation in Severe Peripheral Artery Disease Using Iliac Stenting and Radiopaque Contrast Lubrication: A Case Report

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Abstract

In this case report we aimed to explain how a severe aortic stenosis patient whom has severe stenosis in the peripherial artery was successfully treated after implanting greft stent to peripherial artery stenosis. After implanting greft stent, transcatheter aortic valve implantation (TAVI) valve can pass easily through the stent by lubricating valve with opaq material and propofol. During challenging anatomy and severe stenosis of iliac artery, predilatation and stenting is very important for successfull TAVI procedure.

Keywords: Aortic stenosis, cardiovascular disease, peripherial arterial disease, TAVI

INTRODUCTION

Transcatheter aortic valve implantation (TAVI) is an alternative to surgery for patients with severe symptomatic aortic stenosis and is increasingly being performed.[1]

When TAVI was first performed, it was limited to high-risk patients; however, recent studies indicate that it can be performed safely in low-risk patients.[2,3]

Current guidelines and studies indicate that 1-year mortality among patients with symptomatic advanced aortic stenosis is significantly increased and that valve replacement is recommended for these patients.[4]

The decision for transcatheter aortic valve replacement or TAVI is determined after the heart team meeting.[5]

At this point, Euroscore is an important parameter in determining the patient's surgical risk and is decisive for the TAVI indication.[5]

TAVI is generally preferred, especially in patients with a history of previous thoracotomy and coronary bypass graft operation, because of the high risk of reoperative heart surgery.[6,7]

However, TAVI can be difficult in patients with severe atherosclerosis and peripheral artery disease. TAVI valves are implanted through a 14-16 Fr. sheath; therefore, the procedure cannot be performed when the lumen gap is less than 5 mm.[8-10]

Severe peripheral arterial disease is a major limitation to transfemoral TAVI. An inadequate iliac artery lumen diameter may prevent the advancement of large-caliber delivery systems, often necessitating alternative access routes. We present a 76-year-old male with severe

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calcific aortic stenosis and bilateral aortoiliac stenosis (minimum lumen diameters: 4.1 mm right, 2.9 mm left), (Figures 1 and 2), who was successfully treated via transfemoral TAVI. Initial balloon predilatation of the right iliac artery was insufficient to allow passage of the valve (Figure 3). A peripheral stent was subsequently implanted (Figure 4). Despite this, device development remained challenging. Lubrication of the TAVI delivery system with radiopaque contrast material facilitated successful crossing of the stented segment. A 29-mm self-expandable valve was implanted without complications (Figure 5). In patients with complex vascular anatomy, stepwise peripheral artery optimization-including balloon dilatation, stenting, and, in selected cases, radiopaque lubrication-may enable successful transfemoral TAVI and avoid alternative access strategies.

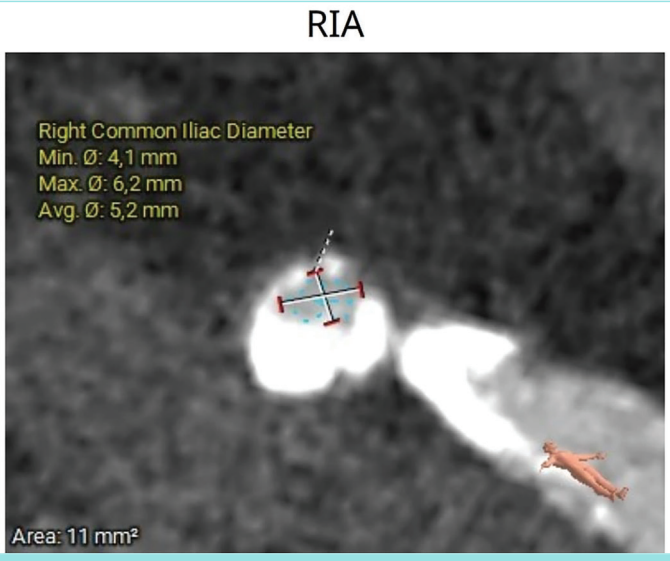

Figure 1. Right common iliac artery stenosis with mean lumen area 11 mm 2.

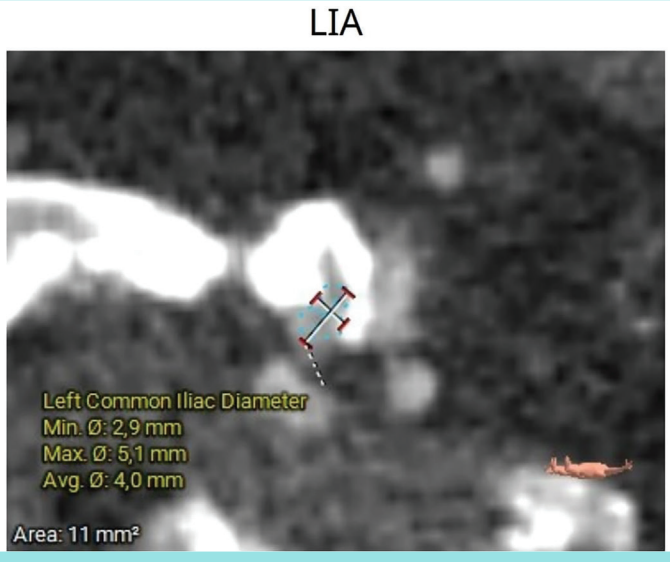

Figure 2. Left common iliac artery stenosis with mean lumen area 11 mm 2.

CASE REPORT

A 76-year-old male patient presented to the emergency department with chest pain and shortness of breath. On examination, the patient was diagnosed with severe calcific aortic stenosis and decompensated heart failure and was subsequently admitted to the cardiology department. The patient underwent coronary artery bypass graft surgery 10 years ago. Internal mammary artery-left anterior descending (IMA-LAD) artery, venous saphenous graft circumflex artery (CX), venous saphenous graft-diagonal and venous saphenous graft right coronary artery (RCA) bypass grafts. The patient has known hypertension and type II diabetes.

The patient was normotensive on Valsartan 160 mg 1x1, amlodipine 5 mg 1x1, and metoprolol 50 mg 1x1. Metformin was administered, and blood glucose was regulated. Renal functions were measured and found to be normal.

Echocardiography showed decreased left ventricular function, measured at 40% by the Simpson method. Hypokinetic areas were observed in the septal and anterolateral segments. The aortic valve was tricuspid and highly calcified. Vmax and Pmean were measured at 4.6 m/s and 48 mmHg, respectively. The valve area was 0.7 cm^2. The patient was clinically stabilized after IV furosemide and underwent coronary angiography. LAD, CX, and RCA were completely occluded. The IMA-LAD graft was open, the RCA saphenous vein graft was open, and the CX and Diagonal saphenous vein grafts were totally occluded. The patient had calcific stenoses of 70-80% in both aortoiliac arteries.

Following evaluation by the Heart team, it was decided that the patient, whose Euro score was 18%, should undergo TAVI. The left subclavian artery diameter was measured as 8.3-9.2 mm. Initially, the entry point was considered to be the left subclavian artery. However,

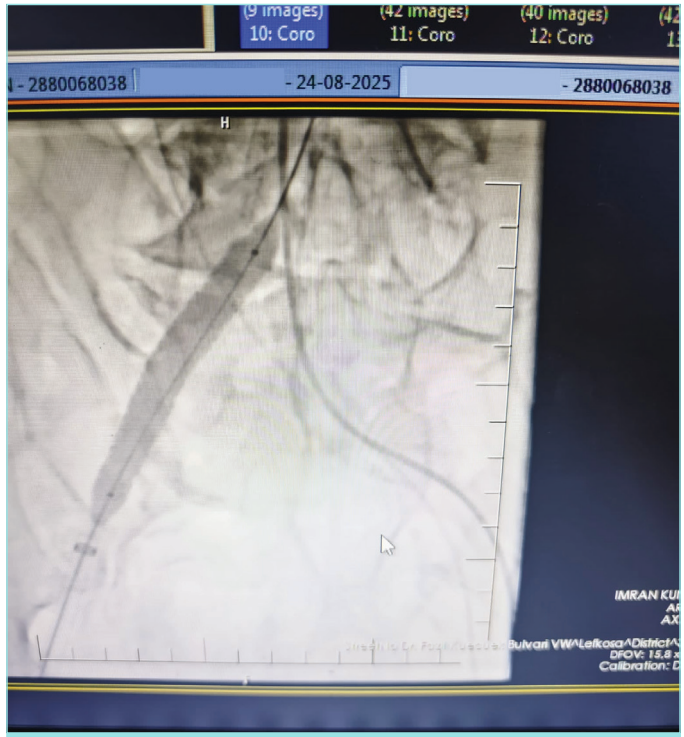

Figure 3. Left iliac artery balloon dilatation.

Figure 4. After stent implantationin the left iliac artery.

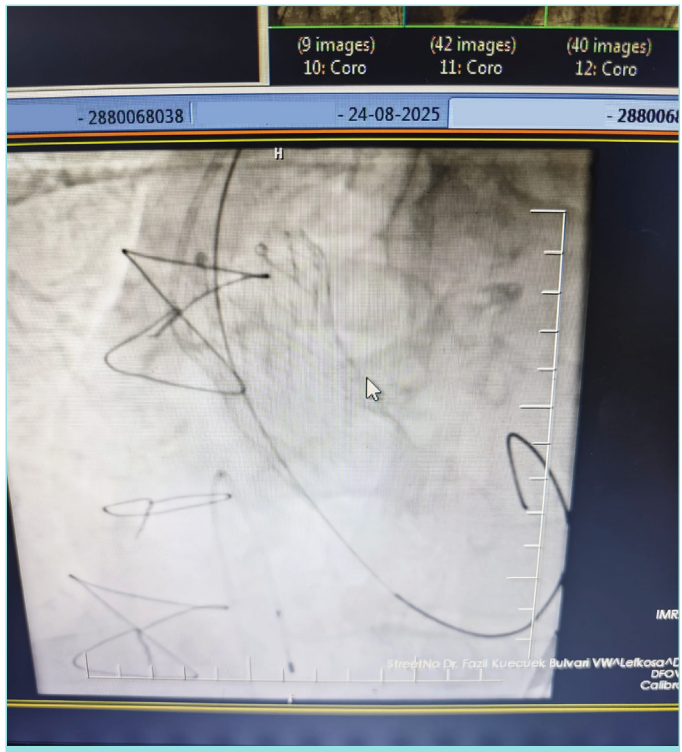

Figure 5. After self expandable aortic valve implantation.

because of severe tortuosity of the left subclavian artery and the risk of decreased left IMA (LIMA) flow from an accordion effect caused by flattening the artery with a stiff wire, the procedure was performed via the transfemoral route. Tomographic measurements were performed, and implantation of a 29 mm Evolute TM self-expandable valve was planned.

In tomographic examinations, the narrowest part of the left aortoiliac region measured 2.9 mm, and that of the right aortoiliac region measured 4.1 mm. The right femoral artery was opened via a surgical cut-down, and the procedure was then started.

A temporary balloon PM was placed via the left femoral vein into the right ventricular apex. A pigtail catheter was placed via the left femoral artery into the noncoronary cusp.

First, an 8-mm x 40-mm peripheral balloon was placed across the stenosis in the right aortoiliac region and dilated to 12 atm. The valve could not be advanced. Subsequently, a 10x60 mm peripheral stent was implanted in that region. An attempt to advance the valve was made again, but the attempt was not successful. The delivery system was flushed with radiopaque contrast material to increase lubrication and this time it could be advanced from the aortoiliac region. The valve was positioned and implanted using the cusp overlapping technique. After the procedure, the peripheral stent was inspected, and no problems were identified. The procedure was completed successfully. After the procedure, the temporary pacemaker was removed because no AV or branch block had developed. The patient was discharged home in good condition after 1 day of monitoring in the coronary intensive care unit and 3 days in the ward.

On echocardiography performed after the procedure, Vmax was 1.4 m/s and pmean was 8 mmHg. No valvular or paravalvular leakage was observed. Written informed consent was obtained from the patient.

DISCUSSION

In patients undergoing TAVI with severe peripheral arterial stenosis, transfemoral access should not be abandoned prematurely. Careful preprocedural planning, balloon predilatation, and peripheral stent implantation can facilitate valve delivery. In selected cases where device advancement remains difficult, radiopaque contrast lubrication may serve as an adjunctive strategy. This approach may help avoid alternative access routes and reduce procedural complexity.

The TAVI procedure can be difficult, and the complication rate can be high in patients with severe peripheral artery disease. Before TAVI, the patient's tomographic and angiographic images should be examined thoroughly, and the access site should be determined according to a clearly defined strategy.[5,10]

Stenosis of the femoral/iliac arteries and insufficient lumen area prevent passage of the valve, and alternative entry sites are preferred. The most commonly used artery other than the iliac artery is the left subclavian or left axillary artery. A lumen diameter of 7 mm and above allows the procedure to be performed, but the patient's LIMA-LAD and saphenous grafts and the native left system were occluded. In addition, this patient has an extremely tortuous subclavian artery, and the stiff wire will flatten the tortuosity, causing an accordion effect that will reduce LIMA flow. The right subclavian artery is not suitable for some patients because of unfavorable angulation. Therefore, transfemoral TAVI should also be considered in patients with peripheral artery

disease. Detailed tomographic examinations should be performed first, and a management strategy for peripheral arterial disease should then be determined. Narrowed areas should be predilated with a peripheral balloon to facilitate valve passage. In some cases, shock wave lithotripsy can modify dense calcific plaques and widen the lumen. However, shock waves are not widely used due to their high cost. If passage is still not achieved after balloon dilatation, the procedure can be continued by implanting a peripheral stent suitable for the vessel diameter.[11]

If passage does not occur despite this, opaque material can be used to increase lubrication, as was applied in this case. Radiopaque contrast agents are viscous liquids that, when applied between the surfaces of the TAVI delivery system, can act as lubricants by reducing friction. These agents create a thin fluid layer that separates the metal or polymer surface of the device from the rough, calcified arterial wall, thereby minimizing direct mechanical contact and abrasive forces. This fluid layer decreases surface-to-surface friction through a mechanism called hydrodynamic lubrication, where the viscous fluid supports part of the load and allows smoother sliding motion.[12] Additionally, the contrast material may fill microscopic irregularities in the vessel wall and device surface, preventing "snagging" on calcific plaques or rough edges.

On the otherhand, previous reports have demonstrated that propofol and radiopaque material have been used to increase lubrication in cases where stents cannot pass in calcific coronary lesions.[13,14] In addition to this, propofol use has been reported in the literature in challenging TAVI cases.[15] No cases of lubrication of the TAVI valve using a radiopaque lubrication method have been reported. A limitation of this study is that it is a single-case experience; the safety and reproducibility of radiopaque lubrication require further validation in larger studies.

CONCLUSION

In such difficult lesions, lubricating the valve with a radiopaque material may be recommended. Finally if there is peripheral artery stenosis during the TAVI procedure, the facilitating mechanism of this procedure is to place a stent in the stenosis of the peripheral artery and to ensure that the TAVI valve is lubricated with radiopaque liquid material so that the TAVI valve can pass through the severe peripherial artery stenosis.

MAIN POINTS

- Severe iliac artery stenosis may preclude transfemoral access during transcatheter aortic valve implantation.
- Stepwise vascular optimization with balloon dilatation and iliac stenting can restore transfemoral feasibility.
- Radiopaque contrast and pofol lubrication of the delivery system may facilitate device passage in selected, difficult cases.

ETHICS

Informed Consent: Written informed consent was obtained from the patient.

Footnotes

Authorship Contributions

Surgical and Medical Practices: A.Ö., C.C., Concept: A.Ö., C.C., Design: A.Ö., C.C., Data Collection and/or Processing: A.Ö., C.C., Analysis and/or Interpretation: A.Ö., C.C., Literature Search: A.Ö., C.C., Writing: A.Ö., C.C.

DISCLOSURES

Conflict of Interest: One author of this article, Cenk Conkbayır, is a member of the Editorial Board of the Cyprus Journal of Medical Sciences. However, he did not involved in any stage of the editorial decision of the manuscript. The editors who evaluated this manuscript are from different institutions. The other author declared no conflict of interest.

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