Turk Kardiyol Dern Ars 2021;49(3):237-241 doi: 10.5543/tkda.2021.51892

Case Report

Transcatheter aortic valve implantation through the brachial artery

Brakial arter yoluyla transkateter aort kapak implantasyonu

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Summary– Transcatheter aortic valve implantation (TAVI) has been increasingly used in patients with severe aortic stenosis. The femoral artery is the most commonly used entry site for TAVI; however, other entry sites were also reported as transapical, transaortic, transaxillary/subclavian, and transcarotid in patients with occlusive peripheral arterial disease. In this report, a case of TAVI procedure through the brachial artery is presented.

Özet– Transkateter aort kapak implantasyonu (TAVİ) ciddi aort darlığı olan hastalarda giderek daha yaygın uygulanmaktadır. TAVİ işlemi için en sık kullanılan girişim yeri femoral arterdir. Ancak tıkayıcı periferik arter hastalığı olanlarda trans-apikal, trans-aortik, trans-aksiller trans-karotid ve trans-subklavian yolla girişim de bildirilmiştir. Bu raporda ise brakial arter yoluyla TAVİ işlemi yapılan bir olgu sunulmaktadır.

Transcatheter aortic valve implantation (TAVI) has been increasingly used in patients with severe aortic stenosis throughout the world. Currently, the TAVI procedure is usually performed from the femoral artery, because it can be implemented under conscious sedation, and it is a minimally invasive method. However, when the femoral artery is not suitable for intervention, the transaxillary, transcarotid, direct aortic, and transcaval pathways can also be used as alternative pathways. The procedure from the brachial artery has been reported in a limited number of cases in the literature.[1] Herein, we present a case of TAVI performed through the left brachial artery.

Abbreviations:

CT	*Computed tomography*
TAVI	*Transcatheter aortic valve implantation*

CASE REPORT

A 79-year-old patient with a medical history of hypertension and chronic obstructive pulmonary disease presented to the hospital with a complaint of New York Heart Association class III dyspnea. Physical examination revealed 3/6 systolic murmur at the right upper sternal border, bilateral diffuse rhonchi, and lack of bilateral femoral artery pulses. Electrocardiography denoted sinus rhythm. Transthoracic echocardiography revealed degenerative severe aortic stenosis with a peak/mean gradient of 79/45 mm Hg and an aortic valve area of 0.85 cm^2. The left ventricular ejection fraction was 55%. Coronary angiography demonstrated noncritical coronary artery disease, whereas bilateral iliac artery occlusion was ascertained through peripheral angiography (Fig. 1). The angle between the aorta and left subclavian artery, which was determined by angiography of the aortic arch, was appropriate for TAVI. The aortic annulus was measured as 24 mm through transthoracic and transesophageal echocardiography. Computed tomography (CT) demonstrated that the aortic annulus was 23x28 mm in diameter, the aortic annulus area was 5.29 cm^2, whereas the diameter of the left subclavian artery was 7 mm, and the diameter of the left brachial artery was 5 mm (Fig. 2). The Society of Thoracic Surgeons score of mortality was 6.95%. A TAVI procedure through the subclavian artery was scheduled with a consensus of the heart team owing to bilateral total occlusion of the iliac arteries. The subclavian artery was explored after an

Received: October 11, 2021 *Accepted:* December 23, 2020
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incision of 4 to 5 cm in the left pectoral area under local anesthesia. Thereafter, a 6F vascular sheath was implanted in the left subclavian artery using the Seldinger method. However, neither 0.038-inch nor 0.035-inch guidewires were able to advance through the left subclavian artery. Subclavian artery dissection was demonstrated after contrast medium administration via 6F sheath, and the procedure was terminated after several attempts to cross the dissected area.

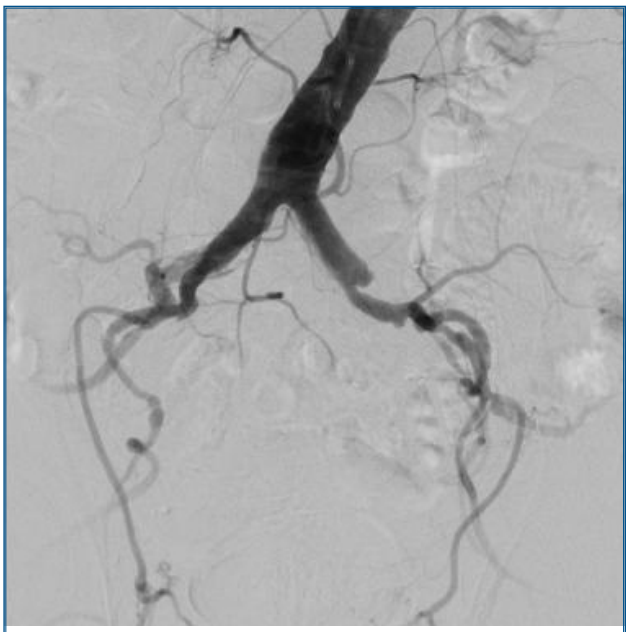

Figure 1. Bilateral iliac artery occlusion was ascertained through peripheral angiography.

After 1.5 months, a second CT showed the recovery of the dissected segment of the left subclavian artery. However, a second attempt via the left subclavian artery could not be scheduled owing to the possibility of similar complications. We decided to perform surgery on the left brachial artery, considering that the management of complications might be easier if they arose.

The mid portion of the left brachial artery was explored under local anesthesia, and 6F vascular sheath was implanted via the Seldinger method (Fig. 3). After intravenous administration of heparin, a pigtail catheter was advanced through the aortic root via the right radial artery not only to perform aortography to determine the level of the prosthetic valve inside the native aortic valve but also for blood pressure monitorization. Temporary pacing was done by means of the right femoral vein entry. Then, a 0.035-inch flat-tipped guidewire was advanced through stenotic aortic valve via Amplatz 1 catheter. A pigtail catheter was advanced over the guidewire, and a 0.035-inch Safari II guidewire was delivered forward to the left ventricle via the pigtail catheter. Subsequently, 14F sheath was passed to the ascending aorta via the Safari guidewire. Then, an Edwards SAPIEN 3 prosthetic valve with a size of 26 mm was inserted into the ascending aorta through the 14F sheath (Fig. 4). The prosthetic valve was loaded to balloon in the ascending aorta. After confirmation of the position of the prosthetic valve, it was implanted with a pacing

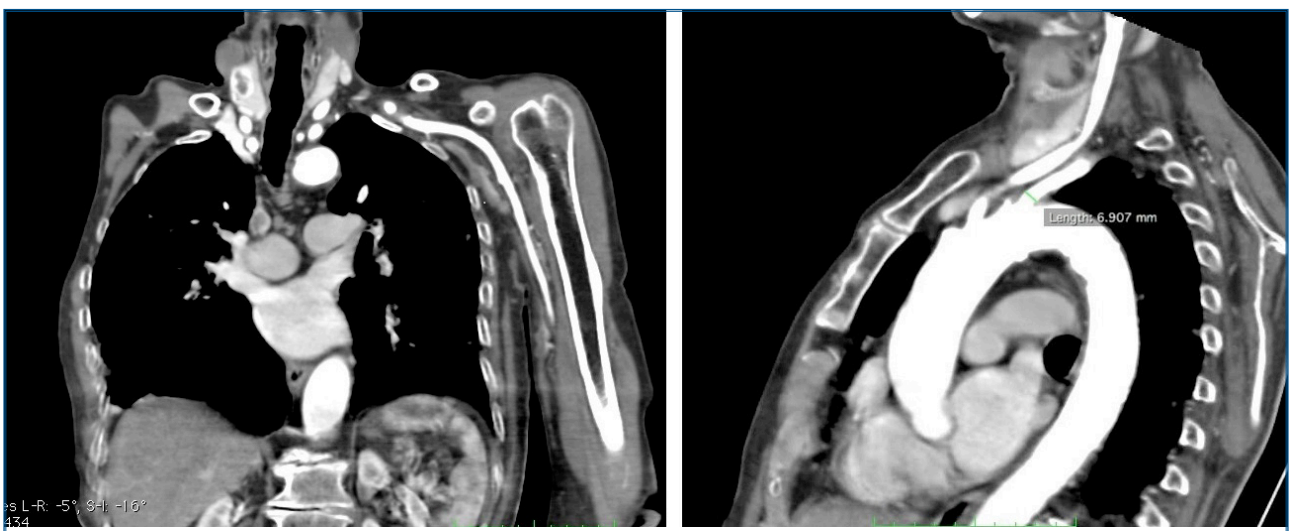

Figure 2. Computed tomography of the patient's upper extremity.

Figure 3. The transcatheter aortic valve implantation procedure site was surgically prepared in the brachial artery.

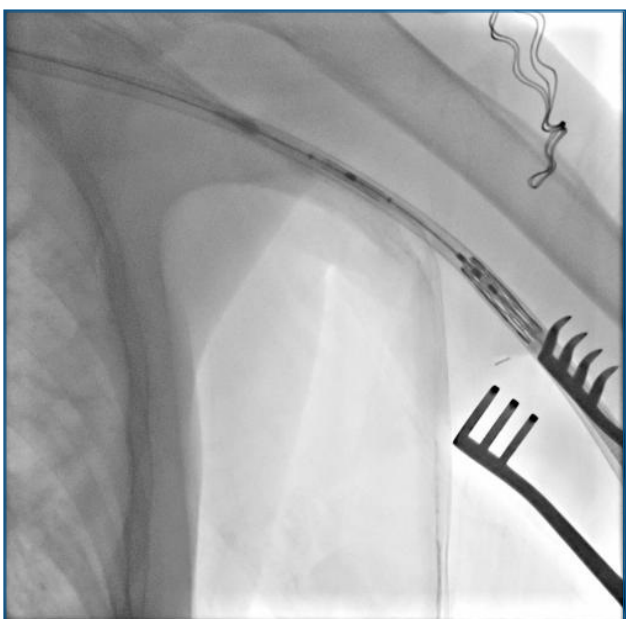

Figure 4. Edwards SAPIEN 3 prosthetic valve was advanced to the ascending aorta through the 14F sheath.

rate of 210/min. There was no paravalvular or valvular regurgitation on the control aortography (Fig. 5). The brachial artery was sealed surgically with some

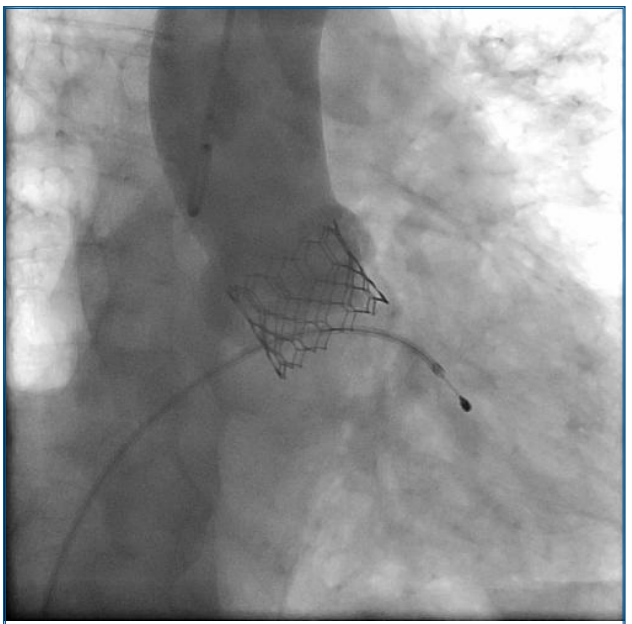

Figure 5. There was no paravalvular or valvular regurgitation on the control aortography.

repair. The blood flow was clear, and there was no ischemic finding of the left arm.

DISCUSSION

TAVI is generally performed via the femoral artery as the first choice. However, 19% to 42% of patients who are scheduled to underwent TAVI have peripheral arterial disease.[2] Therefore, other entry sites are needed to perform TAVI. Transapical, transaortic, transaxillary/subclavian, and transcarotid are the other preferred entry sites.[3-6] Subclavian or axillary entry is the most commonly preferred entry site among aforementioned entry sites by virtue of better clinical results and being less invasive.[7, 8] We scheduled the procedure on the brachial route in our patient because it is less invasive and easier to manage if complications occur.

Transaxillary/subclavian entry can be achieved percutaneously or by surgical incision. The left side is generally preferred over the right side owing to difficulties in achieving coaxial alignment of the aorta and the prosthetic valve owing to increased angulation. The subclavian artery ends at the lateral border of the first rib, and the axillary artery starts from this point toward the lower border of the teres major muscle, and after this point, it is named the brachial ar-

tery. The average diameter of the brachial artery is 4 to 5 mm, but it can vary according to age, sex, and flow rate.[9-11] The diameter of the left brachial artery of our patient was 5 mm. Because the subclavian artery approach was unsuccessful, the left brachial artery was used as the entry site. Although radiological dissection was not observed in the subclavian artery in control CT angiography, we did not choose to make the second attempt from the subclavian artery to avoid complications. It is obvious that there is a risk of opening the upper pleura and developing pneumothorax in the patient when accessing the subclavian artery, which will be tried to be reached as a "redo." To minimize these risks, we chose the brachial intervention.

In subclavian artery interventions, we can perform graft anastomosis on the subclavian artery with surgical technique and work through this anastomosis. In this method, the graft is applied with arteriotomy, and after the procedure, the graft must be cut from the vein, and the arteriotomy must be repaired. Because this method is a more invasive method, in our case, the left subclavian artery was rotated and hung with loop tapes from proximal and distal, brought to the point where the operator could reach it, and cannulation was attempted by the Seldinger technique.

Self-expandable and balloon-expandable prosthetic valves are used during TAVI performed via the axillary/subclavian artery. In addition, 14F to 20F sheaths may be used according to the diameter and type of the prosthetic valve. As the diameter of the left brachial artery is relatively small, we preferred Edward SAPIENS 3 with a size of 26 mm, which can be advanced through the 14F sheath. At the end of the TAVI procedure, the injury of the left brachial artery was primarily repaired surgically. It should be taken into consideration that if the injury is more extensive and cannot be primarily repaired, a saphenous graft may be needed to bypass the injured segment.

In conclusion, with reduction in the size of the apparatus used in TAVI and improved flexibility of this material owing to the advancement of medical technology, the application has become easier and the risk of complications has reduced considerably. However, despite the aforementioned advancements in the TAVI technology, different solutions should be identified for patients with extraordinary challenges. We hereby emphasize that the brachial artery may be used as an alternative entry site in patients who are not suitable for TAVI through other entry sites.

Informed Consent: Informed consent was obtained from the patient for the publication of the case report and the accompanying images.

Peer-review: Externally peer-reviewed.

Authorship contributions: Concept - N.B., G.C..; Supervision - Ş.A., E.K.; Data - Ç.M.Ü., N,B.; Literature search - Ç.M.Ü..; Writing - N.B. E.K., ; Critical revision - G.Ç., Ş.A.

Conflict-of-interest: None

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Keywords: Aortic valve stenosis; brachial artery; transcatheter aortic valve replacement

Anahtar Kelimeler: Aort kapağı darlığı; brakial arter; transkateter aort kapak değişimi