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Management of Prosthesis Embolization into Left Ventricle after Transcatheter Aortic Valve Implantation: A Case Report

Transkateter Aort Kapak İmplantasyonu Sonrası Sol Ventriküle Protez Embolizasyonunun Yönetimi: Bir Olgu Sunumu

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ABSTRACT

Transcatheter aortic valve implantation is recommended in advanced aortic stenosis, in elderly patients who are not suitable for surgery. Valve embolization is one of the most important complications that is life-threatening. A 61-year-old male patient was being followed up with a complaint of shortness of breath. He had a history of coronary artery bypass graft operation. Transthoracic echocardiography revealed severe aortic stenosis. Transfemoral transcatheter aortic valve implantation was performed, but while the balloon passed through the valve, the valve embolized the ventricle. The patient was then taken into operation. The native aortic valve was resected, the valve embolized into the ventricle was cut and removed, and surgical aortic valve replacement was performed. Endovascular methods can be preferred in suitable patients, but in cases where they fail, urgent open-heart surgery is required. One of the most important points is that the guidewire should not be removed when embolization.
Keywords: Transcatheter aortic valve implantation; aortic stenosis; prosthesis embolization.

ÖZ

İleri aort darlığında, cerrahiye uygun olmayan yaşlı hastalarda transkateter aort kapak implantasyonu önerilmektedir. Kapak embolizasyonu hayatı tehdit eden en önemli komplikasyonlardan biridir. 61 yaşında erkek hasta nefes darlığı şikayetiyle takip ediliyordu. Koroner arter baypas greft operasyonu öyküsü vardı. Transtorasik ekokardiyografide ciddi aort darlığı saptandı. Hastaya transfemoral transkateter aort kapak implantasyonu yapıldı, ancak balon kapaktan geçerken kapak ventrikülü embolize oldu. Hasta daha sonra operasyona alındı. Doğal aort kapağı rezeke edildi, ventriküle embolize olan kapak kesilerek çıkarıldı ve cerrahi aort kapak replasmanı yapıldı. Uygun hastalarda endovasküler yöntemler tercih edilebilir ancak başarısız olunduğu durumlarda acil açık kalp ameliyatı gerekir. En önemli noktalardan biri embolizasyon sırasında kılavuz telin çıkarılmamasıdır.
Anahtar kelimeler: Transkateter aort kapak implantasyonu; aort stenozu; protez embolizasyonu.

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INTRODUCTION

According to the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS) guidelines, transcatheter aortic valve implantation (TAVI) is recommended in advanced aortic stenosis (AS), elderly patients, in patients with high-risk (Society of Thoracic Surgeons-Predicted Risk of Mortality (STS-PROM)/European System for Cardiac Operative Risk Evaluation (EuroSCORE) II >8%) or who are not suitable for surgery (Class I) (1). Successful results have been reported in suitable patients, but many serious complications may occur, such as vascular problems, aortic root, valve, heart rhythm

problems, paravalvular leak, ischemic complications, and valve embolization (2). Although many of the complications can be managed with interventions, when endovascular interventions are insufficient, especially in cases such as valve embolization, these patients, who are already in the high-risk group for surgical aortic valve replacement (SAVR), may need to undergo urgent surgery.

In this case, a patient who underwent TAVI due to symptomatic severe AS, who was operated on under emergency conditions after ventricular embolization of the valve was presented, and the points that should be taken into consideration during the operation management.

CASE REPORT

A 61-year-old (81 kg) male patient was being followed up with a complaint of shortness of breath for 3 months. He had a history of hypertension, and diabetes mellitus (DM), a coronary artery bypass graft (CABG) operation performed 20 years ago, and a history of percutaneous coronary intervention (PCI) 2 years ago. Transthoracic echocardiography (TTE) revealed severe AS (max/mean gradient: 75/43 mmHg, aortic valve area: 0.89 cm^2), moderate aortic regurgitation (AR) and ejection fraction (EF) was 55%. The aortic annulus measured was 22 mm. Coronary computed tomographic angiography (CTA) revealed that the bypass grafts and the stent placed in the left circumflex artery were patent. Due to CABG history, DM, and comorbidities, the STS score, expected operative mortality was 1.7%, and estimated morbidity and mortality was 11.2%. The patient was evaluated multidisciplinary by the heart team, in terms of surgery, TAVI, and sutureless valve options, and it was decided to perform TAVI because the surgery was high risk due to the patient's comorbidities, previous heart surgery, poor general condition, and the high STS score.

He was operated on by the cardiology clinic for this purpose. Firstly, two Perclose ProGlide™ systems (Abbott Vascular, CA, USA) were placed in the right femoral artery, a sheath was placed in the left femoral artery and jugular vein, and a temporary pace was placed over the right jugular vein. Subsequently, Myval transcatheter heart valve 27 mm (Meril Life Sciences Pvt. Ltd., Vapi, India) was implanted. As moderate paravalvular AR was detected after the procedure, a balloon was planned. However, while the balloon was being passed through the valve, it was observed that the valve embolized the ventricle (Figure 1). The patient was hemodynamically stable but was referred to us for emergency surgery. Due to the position of the valve in the ventricle, in order to prevent it from moving and closing the left ventricular outflow tract (LVOT) and causing sudden hemodynamic deterioration, the guidewire holding the valve was not removed and was left in place. The patient was taken into operation under emergency conditions. An incision was made in the right axillary region, an 8 mm Dacron graft was placed in the axillary artery and arterial cannulation was performed. A venous cannula was placed percutaneously into the left femoral vein. Then re-sternotomy was performed. After the adhesions were removed, a second venous cannula was placed in the superior vena cava and selective venous cannulation was performed. The left internal mammary artery (LIMA) and other saphenous vein grafts were carefully located and confirmed to be patent. After LIMA flow was stopped, the heart was arrested by giving intermittent antegrade and continuous retrograde cardioplegia, and then aortotomy was performed. Native aortic valve leaflets were observed to be calcified. The valve falling into the ventricle and the support wire holding this valve were seen (Figure 2). Native aortic valve leaflets were resected and the supporting wire was cut and separated from the valve. The valve, which fell into the left ventricle and was over the LVOT, could not be removed in one piece because it was stuck in the surrounding tissues due to the cobalt alloy frame. The valve stuck in the left ventricle was removed in 3 pieces with wire cutters and scissors (Figure 3). Then, a 23 mm Dafodil™ pericardial bioprosthesis (Meril Life Sciences Pvt. Ltd., India) valve was implanted. Cross

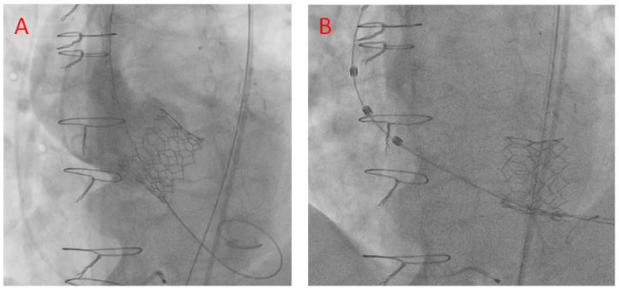

Figure 1. A) Fluoroscopic image of the transcatheter aortic valve implantation valve after placement, **B)** fluoroscopic image of the valve after it is embolized into the ventricle while the balloon is passed through the valve

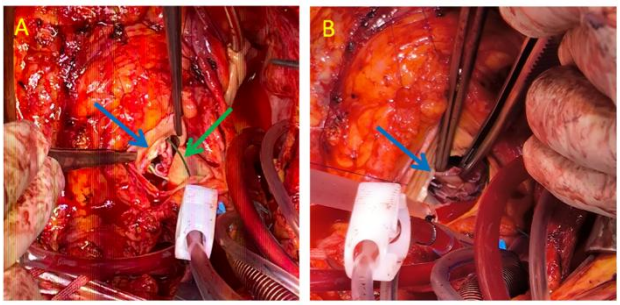

Figure 2. A) After aortotomy, the guidewire holding the valve in place (green arrow), and the calcified native aortic valve (blue arrow), **B)** the transcatheter aortic valve implantation valve embolized into the ventricle after the native aortic valve was resected (blue arrow)

Figure 3. Image of the transcatheter aortic valve implantation valve, which was not removed in one piece and had to be cut off

clamp time (XCL) was 123 min and cardiopulmonary bypass (CPB) time was 230 min. After the operation, a total of 700 ml was drained and a total of 2 U of erythrocyte suspension was given. In the TTE performed in the first postoperative week, EF was 55% and no pathology was detected in the aortic valve. The patient was taken to the service on the 3rd postoperative day and discharged with Asa + Warfarin on the 8th postoperative day without any complications.

DISCUSSION

With the development of technology, TAVI is an extremely important treatment option for severe AS patients, especially in patients with a high risk of surgery, and has found its place in the guidelines with a Class I recommendation (1). However, this procedure has its own important complications. Valve embolization is one of the most important complications that is life-threatening and requires urgent intervention. In the study conducted by Thomas et al. (3) with SAPIEN Aortic Bioprosthesis, the embolization rate was reported as 0.3%. In a cohort study by Frumkin et al. (4) with 3757 patients, valve embolization and migration were seen in 1.44%. The transfemoral approach has been associated with a higher ventricular embolization rate compared to the transapical approach (5). Reasons such as suboptimal positioning, incorrect measurement of the annulus, inadequate aortic valve calcifications, insufficient support in subvalvular structures, ventricular pacing error, complex annulus or aortic valve structure, septal hypertrophy, incomplete or late inflation of the balloon may lead to embolization (5-7).

Embolization may be towards the aorta or, more rarely, into the ventricle. During valve placement, aortic embolization is attempted to be prevented by reducing contractility with rapid ventricular pacing. However, embolization of the valve into the aorta may be better tolerated than embolization into the ventricle. The issue that needs to be taken into consideration is maintaining the wire position. With this, the rotation of the valve can be prevented and blood flow is not blocked. The most important point to pay attention to is maintaining the guidewire position. With this, the rotation of the valve can be prevented and blood flow is not blocked. The valve can be snared or repositioned with a partially inflated balloon into a stable position in the more distal aorta (8). However, if valve stability cannot be achieved, surgery is required.

Left ventricular embolization is less common and in many cases, the valve requires surgical removal. In this case, one of the most important points is to keep the guidewire on the valve. A released valve may obstruct the LVOT and cause sudden hemodynamic compromise, leading to an arrest. We also applied this in our case. After the valve was embolized into the ventricle, we took the patient to the operating table and started the operation, without changing the position of the existing guide wire and femoral catheter. After undergoing CPB and placing the XCL, we performed an aortotomy and saw the guidewire inside the aorta. After perfusion was achieved by CPB, we cut and separated the guidewire and then removed the cover.

Another option after ventricular embolization is the placement of a second valve. In the report of Tiroch et al. (9), a second prosthesis was implanted and fixed the first prosthesis within the annulus. In the case series of Otalvaro et al. (10) with left ventricle embolization, a second transcatheter prosthesis was implanted and then the first embolizing valve was removed and the operation was completed without the need to use SAVR and XCL. Astarci et al. (11), in a patient who developed left ventricle embolization after transapical TAVI, removed the valve using the same access route and then implanted a second transcatheter valve. For this, femoral CPB and induced ventricular fibrillation may be helpful (10). In addition, after the second valve implantation, the anatomical location of this valve is also important. It should be kept in mind that a thrombus may develop in this valve in addition to the first valve. Care should be taken to ensure that this second valve does not cover the branches of the aorta. In addition, care should be taken in terms of possible aortic dissection after these repeated interventions. The valve can also be removed via the left atrium, but it should not be forgotten that mitral valve damage may occur. In the case report of Seecherran et al. (12), after LVOT embolization, balloon-assisted recapture and subsequent successful implantation of the valve across the aortic annulus without significant hemodynamic compromise or surgical intervention have been reported.

In our case, it was not possible to move the valve using the endovascular method. Since the valve could not be guided back to its original position, we decided to remove it. However, we decided to perform a re-sternotomy because he had a previous CABG history, and his grafts were patent. Even after the native aortic valve was resected, we could not remove the TAVI valve from where it was embolized into the ventricle. Therefore, we had to cut the valve off. In patients with a high risk of sternotomy, the valve can be removed with thoracotomy and femoral CPB and a second TAVI valve can be re-implanted. However, in difficult cases like this, removing the valve may not be easy. If the valve cannot be removed after thoracotomy, it may be necessary to return to sternotomy again. Therefore, in addition to deciding on the operation, it is also important to decide how the operation will be performed. In particular, mobilization of the embolized valve should be evaluated fluoroscopically. If it is thought that it will be easy to remove, thoracotomy can be performed in appropriate anatomical localization. However, in complex cases, sternotomy, which is the gold standard, will be life-saving in these patients. SAVR can also be performed after sternotomy.

Although embolization after TAVI can be managed effectively, each repeated intervention increases mortality and morbidity for these patients who are already in the high-risk group. More important than dealing with this complication is preventing it. We think that these complications can be reduced with appropriate measurement, appropriate positioning, appropriate ventricular pacing, and correct patient selection. However, when it occurs, we think that this case report will guide physicians in the management of this complication, which is rare in the literature.

CONCLUSION

Valve embolization to the ventricle after TAVI is a rare but life-threatening complication that requires urgent intervention. Endovascular methods can be preferred in suitable patients with a rapid strategy, but in cases where

they fail, urgent open heart surgery is required. In patients with a history of cardiac surgery, the first valve can be removed by thoracotomy and a second valve can be placed, but it may also be necessary to remove the valve by sternotomy. Appropriate patient selection is important in this regard. One of the most important points is that the guidewire should not be removed when embolization occurs.

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