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LATE MIGRATION OF TRANSCATHETER AORTIC VALVE REPLACEMENT PROSTHESIS

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КЪСНА МИГРАЦИЯ НА ТРАНСКАТЕТЪРНА АОРТНА КЛАПНА ПРОТЕЗА

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Abstract.

Transcatheter aortic valve replacement (TAVR) is an established therapy for severe aortic stenosis, particularly in high-risk surgical candidates. While procedural success rates are high, valve migration remains a rare but serious complication, especially when occurring long after implantation. We report a case of late antegrade migration of a TAVR prosthesis presenting as new-onset heart failure nearly one year after successful implantation. A 77-year-old male with a history of hypertension and chronic lung disease underwent TAVR with a 27 mm NAVITOR (Abbott, USA) valve. Post-procedural recovery and early follow-up were uneventful. However, the patient later developed progressive heart failure symptoms. Transthoracic echocardiography revealed elevated transvalvular gradients, prompting further evaluation with computed tomography and fluoroscopy, which confirmed migration of the valve into the ascending aorta. Given the anatomic challenges and heavy native valve calcification, the Heart Team opted for surgical explantation and bioprosthetic aortic valve replacement. The patient recovered well postoperatively and remained asymptomatic at three-month follow-up with normal valve function. This case underscores the importance of long-term surveillance after TAVR and highlights the potential for late mechanical complications. Early recognition through advanced imaging and individualized Heart Team decision-making are essential for optimal outcomes in such rare scenarios.

Key words:

transcatheter aortic valve replacement, valve migration, late transcatheter aortic valve replacement complication, valve explantation

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Резюме:

Транскадетърната аортна клапна имплантация (TAVR) е утвърден метод за лечение на тежка аортна стеноза, особено при пациенти с висок оперативен риск. Въпреки високия процент на процедурен успех миграцията на клапата остава рядко, но сериозно усложнение, особено когато настъпи дълго след първоначалната имплантация. Представяме случай на късна антерградна миграция на TAVR протеза, проявила се, като новопоявила се сърдечна недостатъчност почти една година след успешна имплантация. Пациентът е 77-годишен мъж с артериална хипертония и хронично белодробно заболяване, на който е извършена TAVR с 27 mm NAVITOR (Abbott, USA) клапа. Следпроцедурното възстановяване и ранните контролни прегледи протичат без усложнения. По-късно пациентът развива прогресиращи симптоми на сърдечна недостатъчност. Трансторакалната ехокардиография показва повишени трансклапни градиенти, което налага допълнителна оценка с компютърна томография и флуороскопия, потвърждаващи миграция на клапата в асцендентната аорта. Предвид анатомичните особености и изразената калцификация

на нативната клапа, Heart Team екипът избира хирургично отстраняване на протезата и заместване с биологична аортна клапа. Постоперативното възстановяване протича добре, а на тримесечния контролен преглед пациентът е асимптомен с нормална клапа функция. Този случай подчертава значението на дългосрочното проследяване след TAVR и показва възможността за късни механични усложнения. Ранното разпознаване чрез съвременни образни методи и индивидуализираният подход на Heart Team са ключови за оптималния изход в подобни редки ситуации.

Ключови думи: транскатетърна аортна клапа имплантация, миграция на клапа, късно усложнение след транскатетърна аортна клапа имплантация, експлантация на клапа протеза

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INTRODUCTION

Transcatheter Aortic Valve Replacement (TAVR) has become a widely adopted treatment for patients with severe aortic stenosis particularly in patients at elevated surgical risk. Valve malposition, including ectopic deployment, valve migration and valve embolization is a rare but serious complication of TAVR [1, 2]. While valve malposition and ectopic deployment involve incorrect initial delivery of the device, valve migration refers to a correctly deployed valve that shifts from its original position but remains in contact with the annulus or within the aortic root. It usually occurs during or immediately after the procedure but cases of late migration albeit rare have also been reported [3]. Valve migration is often linked to inadequate valve size, suboptimal deployment, pacing issues during index procedure or complex native valve morphology such as excessive calcification, bicuspid native valve, aortic root dilation [1-4]. Treatment approaches depend on when the issue arises and how severe it is. In some cases interventional techniques such as interventional valve repositioning or a new TAVR implantation can be applied. Other instances call for prompt surgical intervention. Regardless, every patient should be viewed individually by the heart team taking into account both the risks of surgery versus intervention and the likelihood of procedural success as there is yet no standard protocol addressing the management of such patients. Consequently, rapid identification and timely management are key to achieving favourable outcomes [5].

We present a case of bio-prosthetic aortic valve migration, manifesting as new-onset heart failure one year after successful TAVR, that was managed surgically with favourable outcomes.

CASE PRESENTATION

A 77-year old male with hypertension presented with symptoms of heart failure (HF) and exertional angina at the end of 2023. Transthoracic echocardiography was diagnostic of severe aortic stenosis and the

patient was referred for TAVR due to high surgical risk defined by history of chronic obstructive pulmonary disease (GOLD stage IIB) and chronic respiratory failure.

Pre-TAVR Assessments

Echocardiography revealed dilated LA, mild left ventricular dilation and left ventricular hypertrophy. Aortic valve was tricuspid with calcified leaflets; peak transvalvular gradient (PGmax) was 65 mm Hg, mean transvalvular gradient (PGmean) – 41 mm Hg and maximum velocity (Vmax) – 3.6 m/s. Coronary angiogram pre-TAVR showed no evidence of coronary artery disease, invasive peak-to-peak gradient was 70 mm Hg. Computed tomography (CT) angiography of aortic root and ascending aorta was positive for aortic leaflet calcifications with no abnormalities in aortic root anatomy (Fig. 1).



Fig. 1. CT angiography of aortic root demonstrating leaflet calcifications in a tricuspid aortic valve

Index procedure

In January 2024 the patient underwent TAVR with a TAVI NAVITOR No 27 valve (Fig. 2). No significant

technical difficulties were experienced during valve implantation. The intervention was performed via right femoral access. Pre-dilation and post-dilation were performed as per protocol. The invasive aortic transvalvular gradients at the end of the procedure were 14/8 mm/Hg and aortography showed only trace of regurgitation. The peri- and post-procedural period was uneventful. There was no evidence of TAVR-related complications. The patient was asymptomatic and physical examination was unremarkable. Transthoracic echocardiography at discharge showed aortic valve peak gradient of 15.6mmHg with first degree of aortic regurgitation. The patient was discharged on the fifth day after the procedure on clopidogrel monotherapy, low dose loop diuretic, angiotensin receptor bloker, dapagliflosin, spironolactone and betablocker.

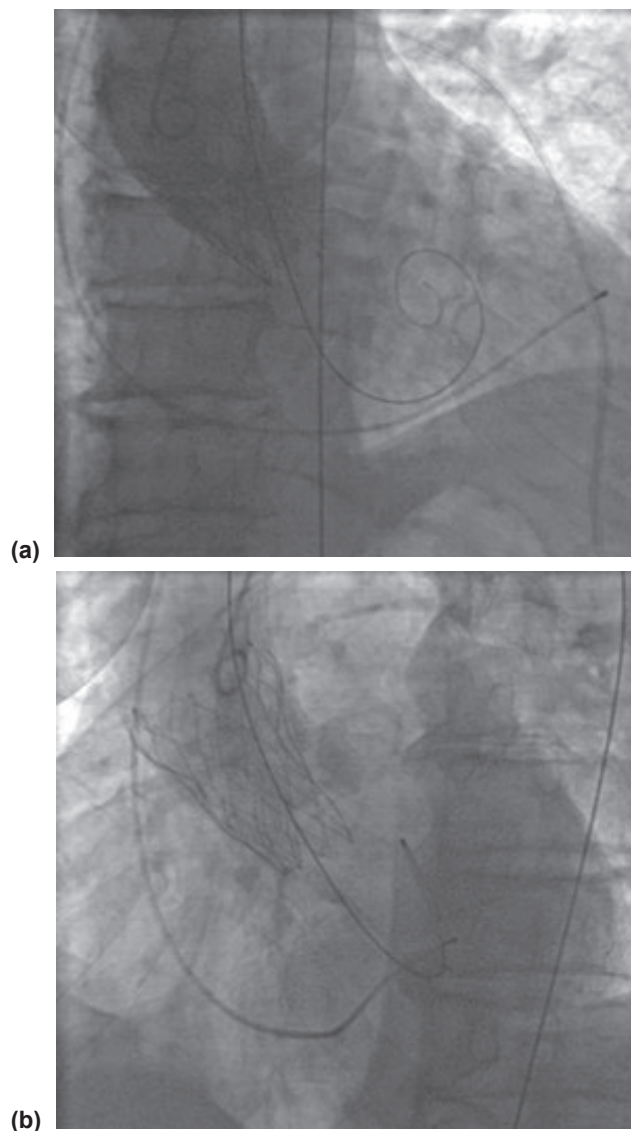


Fig. 2. TAVR position at implantation. The images show fluoroscopy of the valve prosthesis in relation to the aortic root during contrast agent injection in (a) right anterior oblique position, pigtail catheter in the left ventricle and (b) left anterior oblique position, pigtail catheter in the ascending aorta

On transthoracic echocardiography during follow-up at 1 and 3 months the transvalvular gradient remained unchanged, minimal aortic regurgitation (AR) persisted and left-ventricular ejection fraction was preserved. There were no signs or symptoms of heart failure and the patient was overall asymptomatic. Consequently no significant changes to medication were made.

Presentation

About one year post-implantation the patient presented to our institution with progressive symptoms of heart failure that started roughly 3 weeks prior to admission. His vital signs were normal, but physical examination was remarkable for pulmonary congestion and a systolic murmur at the 2nd right intercostal space with carotid propagation. Electrocardiogram showed sinus rhythm with evidence of left ventricular hypertrophy as per previous electrocardiograms. Laboratory test results came negative for acute myocardial ischemia, there was no laboratory evidence of anemia, infection or other conditions that would result in heart failure deterioration in an otherwise stable patient. Kidney and liver functional tests came back normal.

Echocardiogram demonstrated significant deterioration in valve function in comparison to previous examinations. Left ventricular ejection fraction (LVEF) was preserved with no wall-motion abnormalities but aortic valve mean gradient was 54mm Hg, with transvalvular velocity of 5.33m/s and mild aortic regurgitation. TAVR position could not be assessed due to abundance of calcifications on the native valve and yet there was clear evidence of bioprosthetic valve dysfunction and need for further evaluation.

As a part of patient assessment the index procedure was reviewed. Fluoroscopy showed trace of paravalvular regurgitation (PVL), with adequate valve deployment and post-dilation as per procedural plan and protocol thus ruling out malpositioning at implantation.

Structural valve deterioration, valve thrombosis, hypo-attenuated leaflet thickening and patient-prosthesis mismatch were all considered as potential causes of the deterioration in valve function. A CT angiography of ascending aorta was ordered to obtain more detailed imaging. As a result structural valve deterioration, thrombosis and hypoattenuated leaflet thickening were ruled out. Computed tomography demonstrated complete antegrade migration of the prosthetic valve in the aortic root with the prosthesis inflow located at 12 to 14 mm cranially from the native aortic ring (Fig. 3a).

The image was compared with fluoroscopy images from the index procedure confirming the dynamics

in valve position. Valve prosthesis showed no signs of thrombosis and prosthetic leaflets were of preserved configuration. The native valve presented with massive calcification with no dynamics compared to pre-procedure CT which was likely the reason for elevated transvalvular gradients on echocardiography (Fig. 3b). No significant changes in aortic root morphology were noted.

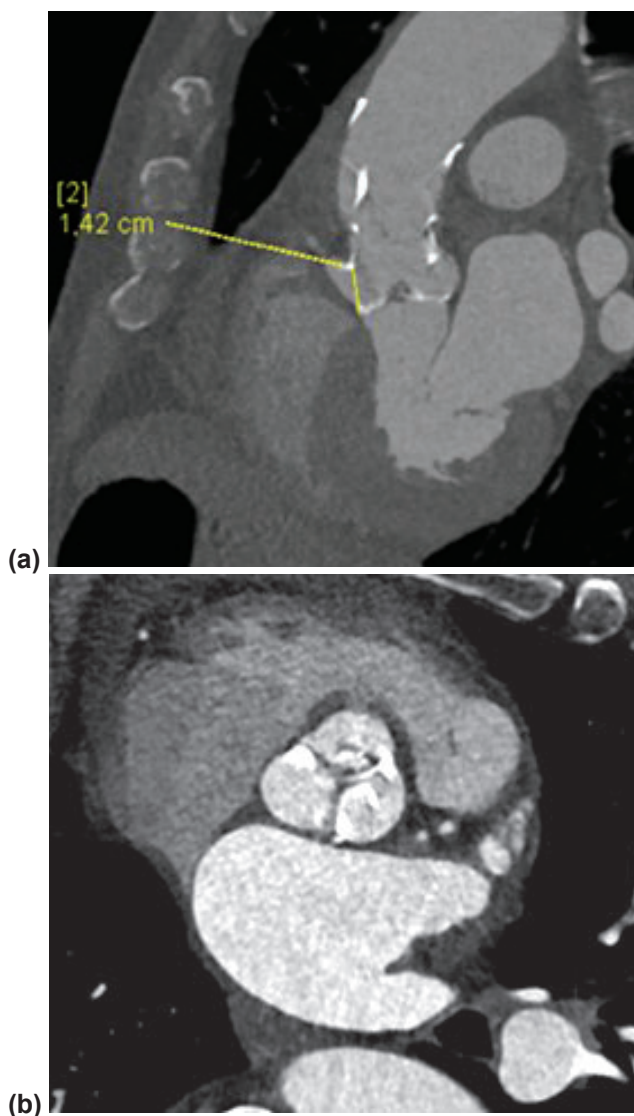


Fig. 3. CT angiography of the ascending aorta one year post-implant (a) parasagittal plane demonstrating complete migration of the bioprosthetic valve at 1.42 cm from the native aortic ring. (b) transverse section at the level of the aortic cusps demonstrating massive calcifications

To provide better comparison and in order to assess coronary artery anatomy and position in relation to the now displaced bioprosthetic valve repeat coronary angiography with valve cine-fluoroscopy and aortic root angiography were ordered. CT findings were confirmed with fluoroscopy and there was no evidence of coronary artery obstruction (Fig. 4).

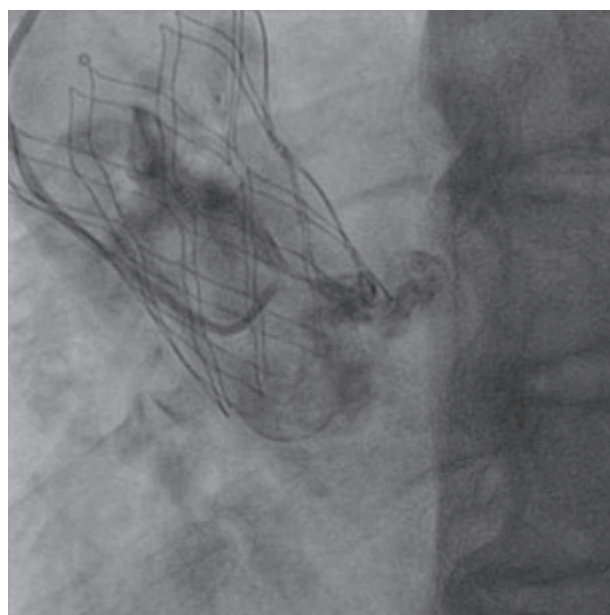


Fig. 4. Fluoroscopy of TAVR during contrast agent injection in the ascending aorta one year post-implant demonstrating cranial migration of the prosthetic valve

PATIENT MANAGEMENT

Intravenous administration of loop diuretics and non-invasive ventilation were promptly initiated but heart failure symptoms persisted despite optimal medical treatment. The patient became hypotensive and low-dose catecholamine infusion was started with little effect.

The case was discussed by the Heart Team with redo TAVR and surgery being the only two treatment options. Redo TAVR would involve transcatheter valve implantation under the same conditions of excessive native valve calcification as per the failed initial implant. Furthermore there would be the requirement for the new prosthesis to anchor the migrated one in the aortic root which would make the procedure even more complex and would dwindle the likelihood of success. Given the fact that the patient was quickly deteriorating redo TAVR did not seem as a reliable solution. A surgical approach was selected as the more appropriate in this case due to anatomic considerations related to prosthetic valve malposition and excessive native valve calcification.

A surgical explant of the TAVR prosthesis with surgical aortic valve replacement with bio-prosthetic valve (surgical aortic valve replacement – SAVR) was performed. Hospital stay was prolonged due to need for rehabilitation and respiratory issues probably the result of chronic respiratory failure. The patient was discharged 17 days after surgery. At discharge there were no signs or symptoms of heart failure. Echocardiogram showed a functional aortic valve prosthesis with transvalvular aortic gradient of 11.2 mm Hg, no trace of aortic regur-

gitation and preserved LVEF. Medical treatment was continued with clopidogrel monotherapy, angiotensin receptor blocker, beta blocker, dapagliflosine, spironolactone and loop diuretic.

So far the patient has been followed up for 3 months after surgery. He remains asymptomatic, with no evidence of heart failure. Echocardiograms demonstrate normal valve function, preserved left ventricular ejection fraction and no paravalvular regurgitation.

DISCUSSION

Late migration of transcatheter aortic valve prosthesis is an uncommon but clinically significant complication, with reported incidence rates ranging between 0.3% and 1.2% depending on device type and patient anatomy [6, 7]. Valve migration is typically classified as antegrade (toward the aorta) or retrograde (into the left ventricular outflow tract), and it can occur intra-procedurally or, more rarely, as a delayed event weeks to months after successful implantation. Symptoms at presentation may vary from heart failure decompensation to acute hemodynamic compromise and cardiogenic shock with high mortality rates [8].

In our case, the patient presented approximately one year after TAVR with signs of heart failure and elevated transvalvular gradients, prompting further imaging. Computed tomography revealed antegrade migration of the valve, a rare finding so late after implantation. The absence of thrombus or leaflet thickening, along with preserved valve morphology, supported migration rather than structural valve deterioration as the underlying cause. Furthermore comparison to analogous imaging modalities i.e. fluroscopy of the valve prosthesis confirmed the diagnosis of late migration and ruled out initial valve maldeployment and malposition.

Contributing factors to late valve migration may include undersizing or underexpansion of the valve, excessive annular or leaflet calcification, insufficient anchoring due to suboptimal radial force, progressive remodelling of the aortic root or native annulus over time [9, 10]. In this patient, severe native valve calcification and borderline anchoring may have predisposed to eventual prosthesis displacement approximately one year after the index procedure as no changes in aortic root and native valve anatomy were identified. Another argument in favor of the latter was the fact that the patient remained asymptomatic after implantation and during follow-up with no evidence of prosthetic valve dysfunction. Heart failure developed only when elevated transvalvular gradients were registered leading to the speculation that valve migration likely took place late after index procedure at the time of patient deterioration. The inclusion of CT angiography in the follow-up protocol for early assessment of suspected patients may be beneficial, especially in centers with less experience.

While early migration may allow for percutaneous repositioning or valve-in-valve TAVR, late migration with elevated gradients and anatomic challenges – such as heavy calcification – often presents a procedural challenge with unacceptably high procedural risk and low likelihood of succes. Hemodynamic instability makes intervention even more complex and demanding and such patients often require surgery [11].

In this case the decision to proceed with surgical explantation and bioprosthetic valve replacement was guided by Heart Team evaluation, taking into account the malpositioned valve, the degree of calcification, and the patient's overall surgical risk. Although surgical explant of TAVR prostheses can be technically demanding, particularly when endothelialized or embedded in calcific tissue, the procedure was successful in this case, with an excellent post-operative outcome.

CONCLUSION

This case highlights the importance of ongoing surveillance following TAVR, particularly in patients with complex anatomy. It also underscores the need for high clinical suspicion and advanced imaging in evaluating post-TAVR heart failure symptoms, as well as the value of Heart Team-based individualized decision-making.

No conflict of interest was declared

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