A survivor of late prosthesis migration and rotation following percutaneous transcatheter aortic valve implantation

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INTRODUCTION

Transcatheter aortic valve implantation (TAVI) is now recommended as the standard of care for inoperable patients with severe aortic stenosis (AS) [1] and is also an alternative to surgical replacement in patients at high risk for open surgery [2]. Valve migration is a known complication of TAVI and occurs most frequently during implantation. We report a case of late displacement of an aortic bioprosthesis into the left ventricular outflow tract (LVOT), 43 days after transfemoral arterial implantation, and discuss some possible factors that may have contributed to the valve migration.

CASE REPORT

A 75-year old man with hypertension, diabetes mellitus and previous coronary artery bypass grafting surgery was found to have symptomatic severe AS during the follow-up. Transthoracic echocardiography (TTE) revealed severe degenerative aortic valve stenosis with an area of 0.4 cm² and a mean pressure gradient (MPG) of 63 mmHg. Left ventricular ejection fraction (LVEF) was 51%. His aortic annulus measured 18 mm in diameter. Coronary angiogram showed that all three bypass grafts, including the left internal mammary artery to the left anterior descending artery, were patent. The operative mortality risk based on the logistic European System for Cardiac Operative Risk Evaluation (EuroSCORE) and Society of Thoracic Surgeons (STS) scores were 23.0 and 12.8%, respectively.

Management options were discussed and the patient declined redo surgery and opted for TAVI, which was performed retrograde via the right common femoral artery. A 23-mm Sapien XT transcatheter heart valve (THV) (Edwards Lifesciences Inc., Irvine, CA, USA) was advanced to the annulus and deployed under rapid pacing. Post-deployment transoesophageal echocardiography and aortogram (Fig. 1A) showed the prosthesis in the correct position, with preserved LVEF of 60%.

TTE on the 5th post-procedure day (Fig. 1C) showed a stable THV with leaflets opening well, a MPG of 24 mmHg and mild aortic regurgitation (AR). LVEF was 51%. He was discharged well on the 5th post-procedure day.

He was re-admitted to hospital 43 days after TAVI, complaining of acute shortness of breath due to left ventricular failure. Echocardiography (Fig. 1D) showed that the valve had migrated into the LVOT, partially obstructing the mitral valve inflow. It appeared stable with no rocking motion and leaflet excursion was normal. There was moderate transvalvular AR, mild paravalvular AR and LVEF was 25%. Cardiac computed tomography angiography and conventional aortography (Fig. 1B) confirmed the migration of the valve into the LVOT, with suggestion of rotation.

His left ventricular failure resolved after medical treatment. Due to the risk of further valve migration into the left ventricle, management options were discussed and subsequently open heart surgery to retrieve the THV and the standard aortic valve replacement were performed.

Surgical findings confirmed the echocardiographic and aortogram findings. The valve, which had migrated caudally and rotated upside down, was extracted successfully without difficulty. There were severe calcifications affecting the native aortic valve leaflets and minimal calcification of the annulus. A 21-mm tissue valve was implanted after removing the aortic valve cusps.

TTE on the 3rd post-operative day showed a stable bioprosthetic valve with normal leaflet excursion and pressure gradients. MPG was 2 mmHg and AR was trivial. LVEF was 35%. He was discharged well on the 7th post-operative day.
DISCUSSION

Valve migration is a rare but severe life-threatening complication of TAVI. Most cases occur during the procedure or immediately after implantation [3]. The incidence of delayed migration is unknown, with few published reports [4, 5].

This patient is the first reported case of delayed migration and rotation of a THV who survived open heart surgery for device retrieval. Previous reports have described two patients who died from surgery to retrieve migrated THVs [4, 5].

Valve migration results when forces acting on the THV overcome the strength of attachment of the valve to the aortic wall. Stent valves are subjected to antegrade ejection forces during systole and retrograde forces during diastole. The retrograde force on a closed valve has been shown to be 10 times the antegrade force [6]. Leaflet calcification plays an important role in anchoring the prosthesis. THVs should be used with caution in patients with less-than-severe and non-uniformly distributed calcifications. Selecting an appropriate bioprosthesis size is another key decision, and in this case, the size 23 mm Sapien XT THV was chosen as his annulus diameter was 18 mm.

A non-uniformly calcified annulus with residual leaflet pliability may have prevented optimal anchoring of the THV. The residual overhanging leaflets could have exerted force downwards during diastole, causing migration of the THV towards the left ventricle, following which it rotated ~180° within the left ventricle before being pushed upwards and lodged within the LVOT during systole. The patient survived these events due to a paravalvular leak which prevented complete LVOT obstruction. Valve-in-valve deployment was considered but precluded by the position of the THV being too ventricular and the suspected malrotation of the THV.

Despite promising results from the PARTNER trial, the long-term outcomes and durability of balloon-expandable valves are still unknown. Although minimally invasive, TAVI is still associated with potential life-threatening complications which may require conventional open heart surgery for rectification. This case illustrates that valve rotation must be considered in the event of valve migration as it implicates management options. Evolving device technology and implantation techniques will improve procedural success rates and minimize such complications in the future [7].

Conflict of interest: None declared.

REFERENCES