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Case Report

# Transcatheter Aortic Valve Dislocation into the Left Ventricle Caused by the Watermelon Effect

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## Abstract

Transcatheter aortic valve implantation (TAVI) is a well-established method for treating severe aortic stenosis. Prosthetic valve dislocation immediately after deployment is a rare and feared complication. We present a case of a patient with severe, symptomatic aortic stenosis who was admitted for TAVI. During balloon inflation the valve (Edwards SAPIEN XT) dislocated into the left ventricle as a result of the watermelon effect caused by a narrow, severely calcified sino-tubular junction. A second valve of the same type and size was immediately implanted in a suboptimal position in order to reduce severe aortic regurgitation. This facilitated the use of veno-arterial extracorporeal membrane oxygenation support (V-A ECMO). The patient was thereafter stabilized and transferred for urgent surgery, where both prosthetic valves were removed. The aortic valve was replaced with an additional reconstruction of the ascending aorta.

**Keywords:** aortic stenosis, TAVI, ventricular device dislocation, VA-ECMO, surgery

**Abbreviations list:** TAVI - transcatheter aortic valve implantation, TTE - transthoracic echocardiography, TEE - transesophageal echocardiography, AVA - aortic valve area,CTA - Computed tomography angiography, LVOT- left ventricular outflow tract, AR - aortic regurgitation, VA-ECMO - venoarterial extracorporeal membrane oxygenation support

## Introduction

Transcatheter aortic valve implantation (TAVI) is a well-established method for treating severe aortic stenosis in high, intermediate and even low surgical risk patients [1, 2]. Prosthetic valve dislocation immediately after deployment is a rare and feared complication. It is usually the result of a prosthesis-annulus mismatch, too high or low implantation, ejection of the device by an effective ventricular contraction during deployment or lack of significant calcifications for prosthetic anchoring [3, 4]. Each prosthetic aortic valve has its own specific benefits and pitfalls. Even though there is still lack of data to claim superiority of one device over another, correct valve selection based on anatomical criteria is crucial for a safe and successful procedure [5]. In case of complications the valve most frequently dislocates upwards into the ascending aorta. Upwards snaring and positioning of a second valve is the usual strategy. The situation is much more demanding if the valve dislocates into the left ventricle. One of the possible bailout strategies includes a second valve implantation with simultanetous V-A ECMO support, followed by surgical extraction of the dislocated valve [6, 7].

Here we present a case of balloon expandable valve dislocation into left ventricle. Successful treatment with second valve implantation and V-A ECMO bridge to surgery is presented and discussed.

## Case report

A 70-year old female with history of nicotine addiction, type 2 diabetes mellitus, dyslipidemia, long standing arterial hypertension, extreme obesity and rheumatoid arthritis was admitted to our cardiology department for heart failure symptoms. Chest radiography showed pulmonary congestion. Transthoracic echocardiography (TTE) showed a normal ejection fraction of 65%, severe aortic stenosis (aortic valve area 0.65 cm2, maximal velocity 5 m/s, mean gradient 58 mmHg) and mild mitral and tricuspid regurgitation. Pulmonary pressure was estimated at 35 mmHg. Coronarography showed normal coronary arteries and severe calcifications of the ascending aorta. The initial medical strategy was to treat heart failure symptoms with intravenous diuretic agents. After improvement we proceeded with preparations for TAVI.

Computed tomography angiography (CTA) measurements revealed a severely calcified ascending aorta with an average annular diameter and perimeter of 21.4 mm and 67.2 mm respectively. Sinus of Valsava diameters were 26.1 mm, 27.4 mm and 25.8 mm. The sino-tubular junction had prominent ring calcifications and dimensions of 15.2 mm

and 19.5 mm (Figure 1). Coronary ostia height was 11.3 mm for left and 23,2 mm for right coronary artery. She was evaluated by the local heart team. Due to her low operative risk (STS 3.3%) she was first a candidate for surgical treatment. However, having in mind the porcelain aorta, severe obesity and comorbidities, the heart team decided for TAVI. Due to a severely calcified aortic apparatus and small Sinus Valsalva diameter, we decided for an implantation of a balloon-expendable valve Edwards SAPIEN XT 23 mm (Edwards Lifesciences, Irvine, CA, USA) via transfemoral access. The other option at that time, the CoreValve (Medtronic, Dublin, Ireland) prosthesis, was not suitable due to its higher frame and risk of coronary arteries obstruction.

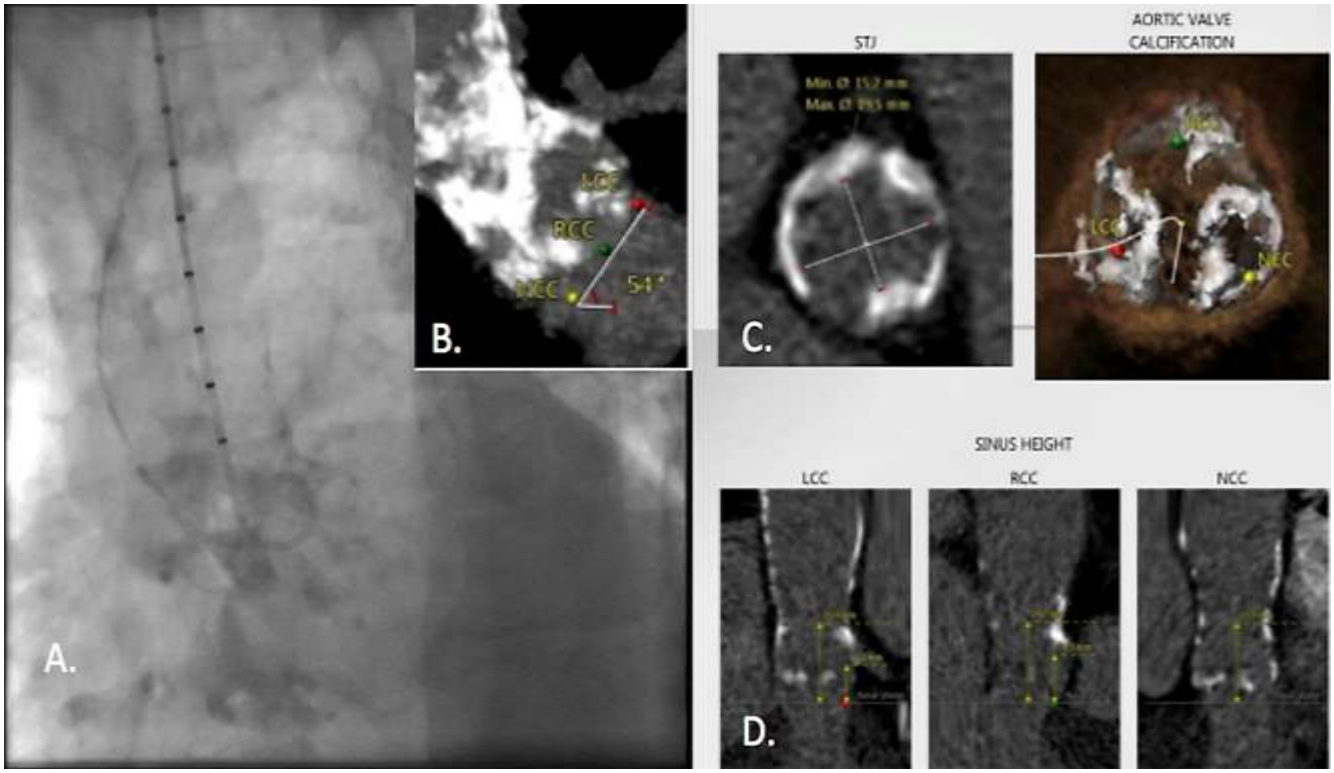


**Figure 1 -** *Porcelain aorta and anatomy of severely calcified sino-tubular junction: A) Porcelain aorta on angiography. B), D) and C) CTA showing severe calcifications of aortic valve and ascending aorta. C) Narrow sino-tubular junction dimensions 15.2 mm x 19.5 mm.*

The prosthetic aortic valve was advanced through right transfemoral approach. After pre-positioning, the valve was directly implanted under rapid ventricular pacing with 180 bpm. During final balloon expansion the valve dislocated towards the left ventricular outflow tract (LVOT) and was caught, with its top of the frame, on the calcified annulus (Video 1 and 2). With stable hemodynamic status the heart team discussed further options. Meanwhile, the valve further migrated and got transversely stuck in the LVOT (Video 3). Furthermore, the supporting guidewire was accidentally pulled out. Transesophageal echocardiography (TEE) revealed severe aortic regurgitation (AR) (Video 4). Patient developed cardiogenic shock with a drop of blood pressure to 60/25 mmHg. V-A ECMO support was inserted for hemodynamic stabilization on left site, contralateral to TAVI device sheet introducer. Simultaneously with V-A ECMO insertion we proceeded with an implantation of a second Edwards SAPIEN XT 23 mm (with 1 ml smaller balloon volume) valve to reduce severe AR. The expansion was intentionally slower. At the end of inflation the valve dislocated towards the LVOT (Video 5). Although the position was low it was functional and stable enough with support of the aortic annulus (Video 6). AR reduced to a mild degree with stable hemodynamic status on VA-ECMO. The patient was immediately transferred to a surgical operating room where both valves were removed (Figure 2) and a new, biological valve (Sorin Mitroflow 19, USA) was successfully implanted. The porcelain ascending aorta was reconstructed with a horse pericardial patch. The operation lasted 9 hours and was deemed successful. The patient recovered well without any neurologic deficit. At five year follow up the patient was still asymptomatic, without any signs of heart failure. Control CTA scan revealed normal dimensions of ascending aorta (Figure 3). TTE showed a normal left ventricle ejection fraction with a normal function of the biological prosthetic valve (aortic valve area 1.4 cm2, maximal velocity 3.16 m/s, mean gradient 26.8 mmHg,) (Figure 3).

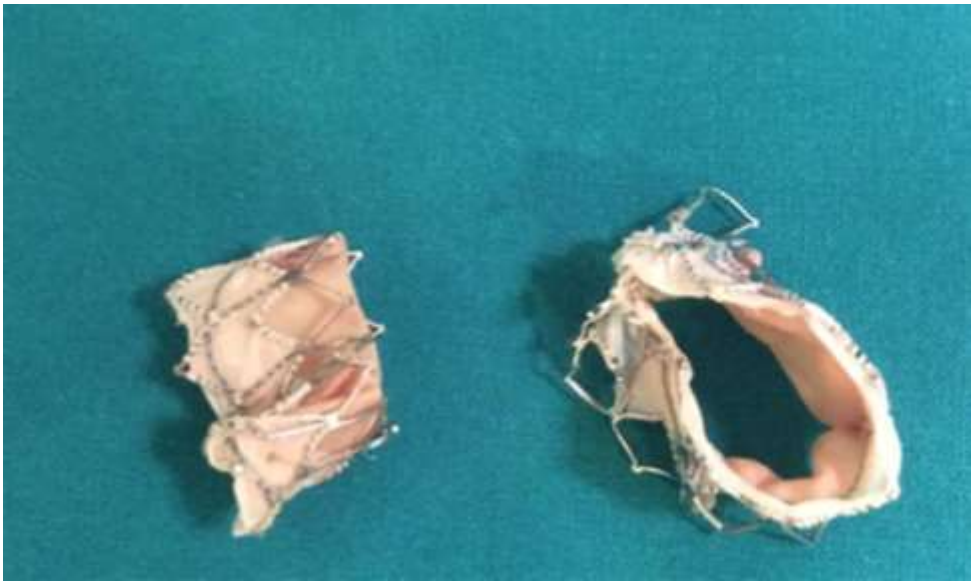

**Figure 2:** *Both TAVI valves after surgical extraction.*

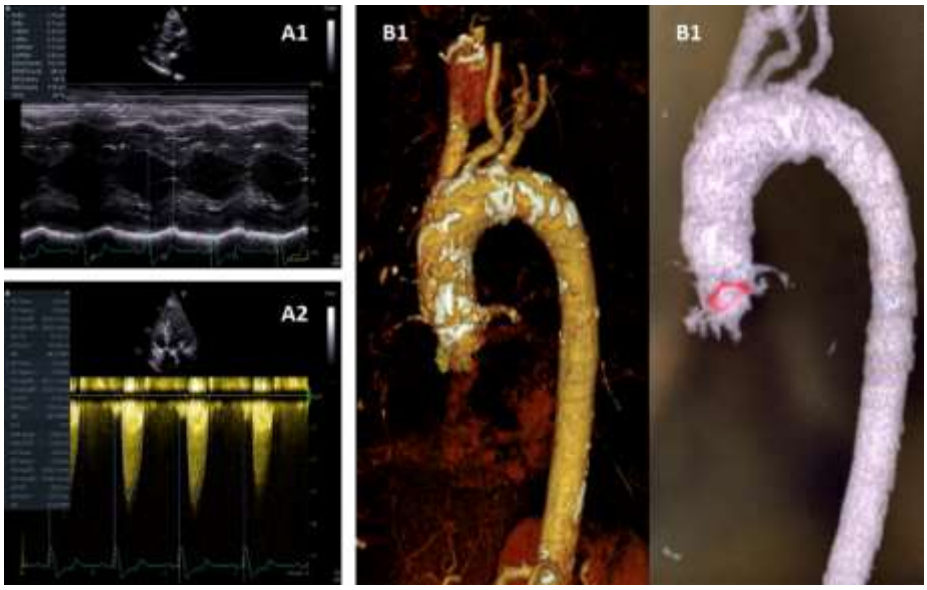


**Figure 3 -** *follow-up TTE and CTA: A1) and A2) TTE 5 years after implantation of surgical aortic valve. B1) and B2) CTA 1 year after surgery showing proper anatomical position of biologic surgical valve.*

Video 1.mp4

**Video 1 - *inflation***: *Inflation of the first Edwards SAPIEN XT valve during rapid pacing.*

Video 2.mp4

**Video 2 –** *final position of first valve: Low position of the Edwards SAPIEN XT valve.*

Video 3.mp4

**Video 3 –** *first dislocation: Dislocated Edwards SAPIEN XT valve in the LVOT.*

Video 4.mp4

**Video 4** *–severe aortic regurgitation on TEE: Severe aortic regurgitation after migration of the first valve into LV.*

Video 5.mp4

**Video 5 -** *second valve implantation: Edwards SAPIEN XT valve implantation and watermelon effect.*

Video 6.mp4

**Video 6 –** *final position of valves and visible ECMO cannula: Final position of Edwards SAPIEN XT valves and visible V-A ECMO cannula.*

## Discussion

This case report shows a downward dislocation of a prosthetic aortic valve due to the watermelon effect. This means that the valve slipped in the LVOT most probably because of a narrow, severely calcified sino-tubular junction that squeezed the inflation balloon. (Video 5) In case of downward dislocation it is crucial that the valve remains on the supporting guidewire in order to maintain correct orientation [2-4, 8]. Prosthesis can then be successfully pulled out using a gooseneck snare and an inflated balloon, separately or in combination [8, 9]. Tiroch K. et. al. [9] reported a successful repositioning of a dislocated SAPIEN prosthesis with a partially inflated valvuloplasty balloon that was used for dragging an undersized prosthesis proximally in a sub-annular position under rapid ventricular pacing. Anchoring of the valve and prevention of distal migration was thereafter achieved with a second valve implantation. Surgical trans-apical approach with placement of a large sheath from the apex was proposed as an alternative strategy. The guidewires could then be snared and externalized via the sheath. Finally, the expanded valve would be crushed and withdrawn with forceps [9]. Unfortunately our procedure was further complicated with an accidental removal of the supporting wire. In combination with a rotated valve this prevented rewiring and correct valve orientation. After a successful implantation of a second valve with a smaller balloon volume, reduction of AR, V-A ECMO insertion and consequent patient hemodynamic stabilization, the only further possible solution was surgery. We may speculate that the use of a smaller volume balloon during expansion and post-dilatation with a lower position could prevent the watermelon effect and downward dislocation of the valve. Furthermore, balloon valvuloplasty with a 22 mm diameter balloon might improve our strategy in both, valve sizing and valve positioning.

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