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Transfemoral implantation of CoreValve Evolut-R aortic prosthesis in patient with prior ball-cage mechanical mitral valve prosthesis☆

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ABSTRACT

Transcatheter aortic valve replacement remains challenge in patients with ball-cage-type mechanical valve in mitral position. Potential under-expansion of the percutaneous valve and interaction between the mitral ball-cage mechanical valve tilted towards the left ventricular outflow tract and the percutaneous valve adds risk during and after implantation. We report a successful implantation of the novel CoreValve Evolut-R self-expanding in a patient with severe aortic stenosis and a mitral Starr-Edwards mechanical valve implanted 28 years ago.

1. Introduction

Transcatheter aortic valve replacement (TAVR) has emerged as an accepted alternative for high-risk patients with severe symptomatic aortic stenosis (AS) [1]. Pivotal clinical trials have excluded patients with mechanical prosthesis in mitral position because concerns for potential interference between the percutaneous aortic valve and the mechanical mitral prosthesis [2,3]. It is likely that several patients who underwent mitral valve replacement with old ball-cage mechanical prosthesis might need aortic valve replacement due to severe AS. We reported a challenging TAVR case of a high-risk woman with severe AS who underwent mitral valve replacement 28-years ago with a Starr-Edwards mechanical prosthesis.

2. Case Report

A 72 year-old lady with prior history of cardiac rheumatic disease, chronic atrial fibrillation under oral anticoagulation who underwent mitral valve replacement with a ball-caged mechanical prosthesis in 1987 (Starr-Edwards # 29) presented with progressive shortness of breath. Her general status appeared frail due to small body habitus (weight 56 Kg; height 155 cm) and chronic bilateral lower-limb venous insufficiency. Her laboratory was relevant for mild normocytic anemia (hematocrit 29%) and renal dysfunction (creatinine 1.4 mg/dL, GFR of 38 mL/min/1.73 m^2). Her predicted perioperative mortality risk was 6% based on the STS risk score and 26% based on Logistic Euroscore. Transthoracic echocardiogram demonstrated normal functioning of the mitral ball-caged prosthesis, severely dilated left atrium, severe stenotic tricuspid aortic valve with a mean gradient of 58 mmHg, peak gradient of 92 mmHg and estimated area of 0.5 cm2, moderately impaired left ventricular systolic function (ejection fraction of 45%) in addition to severe pulmonary hypertension (70 mmHg) and dilated right-ventricle. Angiogram showed normal coronary arteries and large non-tortuous bilateral ilio-femoral system. Comprehensive evaluation by ECG-gated computed tomography angiogram (CTA) confirmed a tricuspid severely calcified aortic valve with an aortic annulus of 19 × 27 mm, area of 456 mm^2 and a perimeter of 80 mm (Fig. 1). The aortic annulus appears deformed in the posterior aspect due to protrusion of the base of the ring of the mechanical mitral prosthesis (Fig. 1). The aortic-plane and horizontal angle was 56 degrees. A substantial part of the prosthesis cage showed to cross the left ventricular outflow tract (LVOT) on CTA multiplanar reconstruction (Fig. 2). Tomography confirmed wide, straight non-calcified ilio-femoral arteries. TAVR using a self-expandable aortic prosthesis was recommended by the 'heart team' due to her high-risk for standard AVR and repeated sternotomy.

The TAVR procedure was performed via right femoral artery under general anesthesia with trans-esophageal echocardiogram (TEE) and fluoroscopic/angiography guidance. Particular attention during wire crossing was given to avoid entreaping the wire across the prosthesis cage. Predilation with a 23 mm aortic balloon (Maxi, Cordis) was performed to ensure wire position outside the prosthesis cage (Fig. 3). In fact, no interaction between the balloon and the cage-ball function was observed.

A 29-mm CoreValve Evolut-R (Medtronic Inc., Minneapolis, MN) prosthesis was retrogradely positioned under angiographic and fluoroscopic guidance (Fig. 4). Slow deployment was successfully performed carefully watching for potential interaction with the mitral valve prosthesis cage. No deformation of the inferior nitinol frame of the CoreValve,

☆ Conflicts of interest: no conflicts to declare.

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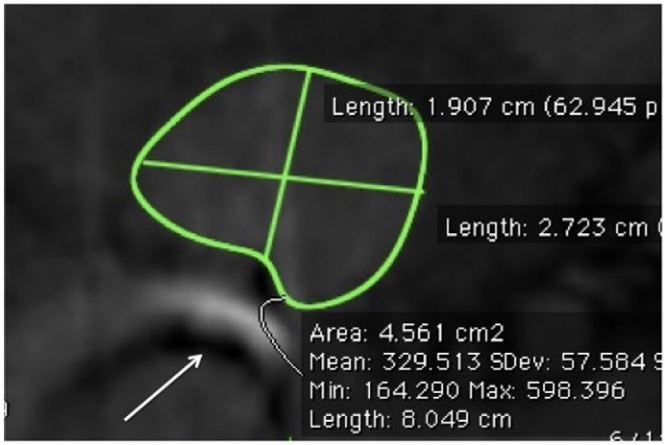

Fig. 1. 'Cardiac computed tomography based assessment of the aortic annulus'. Asymmetric aortic annulus of 19x27 mm of dimensions and area of 456 mm2. The arrow points an indentation in the aortic annulus caused by the ring of the mitral ballcage prosthesis.

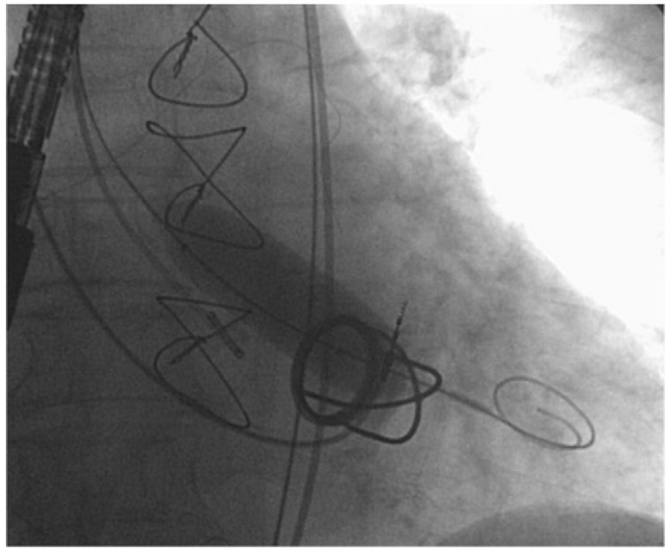

Fig. 3. 'Balloon aortic valvuloplasty predilation'. Fluoroscopic capture of a fully inflated 23 mm aortic balloon showed absence of interaction of the mitral cage-ball prosthesis and the aortic balloon.

neither distortion nor malfunction of the mechanical valve in mitral position occurred, as assessed by TEE and fluoroscopy (Figs. 5 and 6). Mean post-TAVR aortic gradient was 9 mmHg, with mild aortic regurgitation on TEE and angiography (Figs. 5 and 6). The patient underwent VVI pacemaker implantation the 3rd day after TAVR due to slow atrial fibrillation and prolonged pauses. Patient was discharged the 5th day after the index procedure. Two months after the procedure the patient remains in NYHA class 1. Transthoracic echocardiogram confirmed normal function of the aortic prosthesis with minimal paravalvular regurgitation.

3. Discussion

The reported case demonstrates that TAVR using self-expandable prosthesis is feasible and safe in patients with ball-cage-type mechanical valve in mitral position. The presence of a mechanical valve in mitral position challenges TAVR procedure due to reduced mitro-aortic space to accommodate the transcatheter valve. In addition, mitral metallic/rigid ring might limit the expansion of the percutaneous prosthesis. Ball-cage-type mechanical valve in mitral position also occupies the LVOT adding potential risk for interaction between the aortic prosthesis and the mechanical valve during and after implantation.

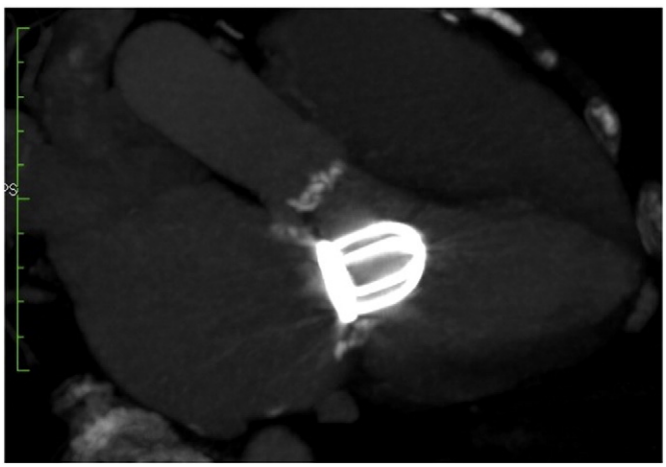

Fig. 2. 'Cage-ball mitral valve relationships by cardiac tomography'. A long axis view with increased thick-slab showing the cage-ball mitral prosthesis crossing part of the left-ventricular outflow tract and its ring in close relationship with the aortic annulus.

The Evolut-R CoreValve has a novel delivery recapture system, the EnVeo R Capsule (Medtronic Inc). This new feature allows capsule flare expanding to enable controlled valve deployment with resheathing capability. The nitinol capsule provides structural support necessary to resheath partially deployed valve.

The feasibility of TAVR with self-expanding CoreValve was previously reported in a series of 4 patients with mechanical valve in mitral position [4]. The successful implant of a self-expanding CoreValve in patients with AS and a ball-cage mechanical prosthesis in mitral position was previously reported by Gedikli et al. [5] and Rehman et al. [6] In our knowledge our reported case is the first case performed with the novel Evolut-R CoreValve in a patient with severe AS and concomitant ball-cage mechanical prosthesis type in mitral position.

Although the concern existing regarding the use of percutaneous aortic valve in patients with ball-cage mechanical prosthesis in mitral position because of the self-expanding support frame of the valve and

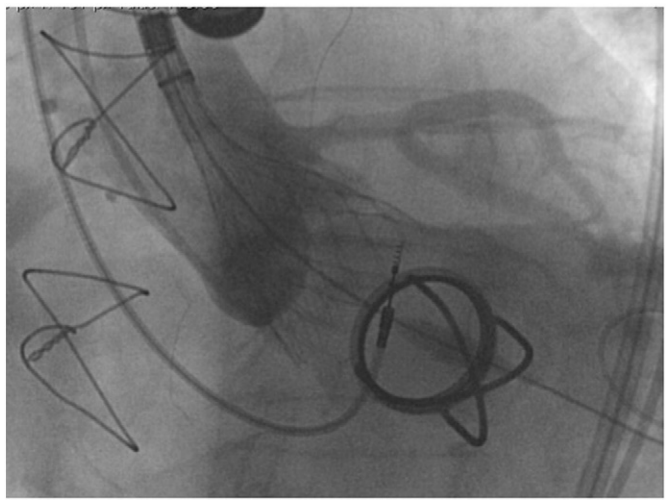

Fig. 4. 'Aortic root angiography during valve deployment'. Angiogram showed initial third deployment of the Evolut-R prosthesis, with a pigtail standing in the non-coronary cusp for angiographic guidance. No interaction with the mitral cage-ball prosthesis was observed.

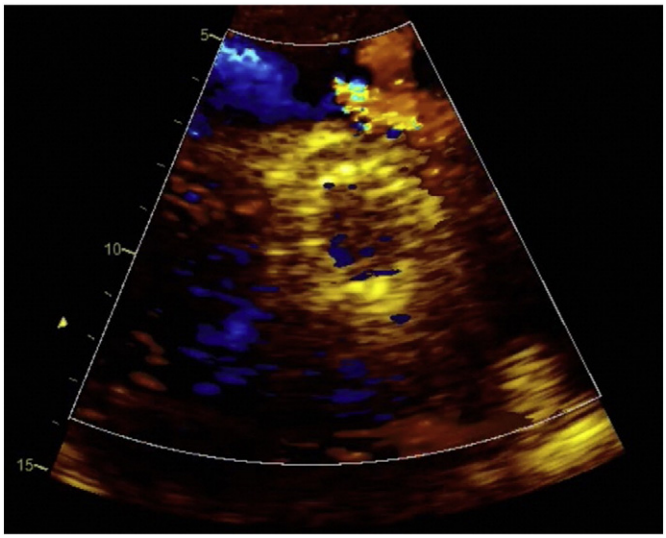

Fig. 5. 'Transesophageal echocardiogram after valve deployment'. Sagital view of deployed 29-mm CoreValve Evolut-R showed complete expansion of the stent frame and mild paravalvular leak at 12 o'clock

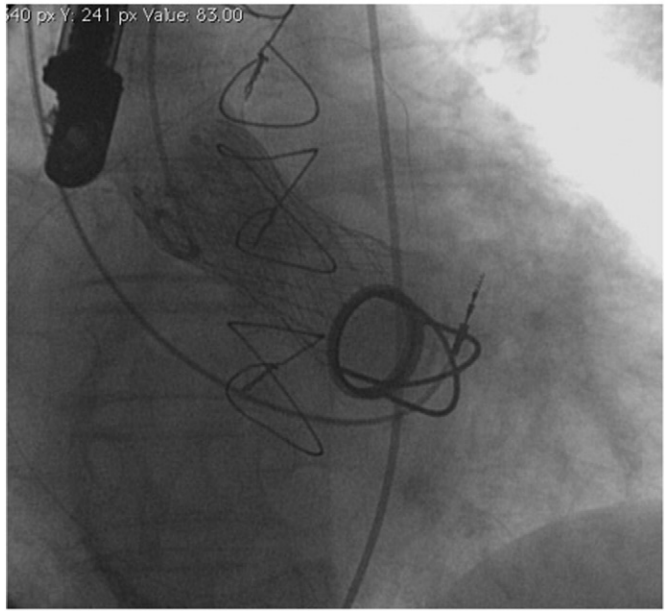

Fig. 6. 'Aortic root angiography after valve deployment'. Aortic root angiogram showed adequate position of the delivered prosthesis with mild aortic regurgitation and normal functioning of the mitral cage-ball prosthesis.

possible under-expansion/deformation of the prosthesis and mechanical interaction during and after deployment, we did not observe deformation of the nitinol tubing of the Evolut-R design without interference with the mechanical mitral ball-cage valve. It is our opinion that the new Evolut-R CoreValve prosthesis offers optimal features to allow a safe control deployment in presence of a ball-cage mechanical mitral prosthesis with the capability of recapturing and repositioning if needed.

4. Conclusion

The reported case support that TAVR using the novel CoreValve Evolut-R self-expandable prosthesis is feasible and safe in patients with ball-cage-type mechanical valve in mitral position following careful procedural planning.

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