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CASE REPORT
Structural intervention

A valve embolized twice: a case report of Sapien 3 embolization in left ventricle and left atrium during transcatheter transapical mitral valve-in-valve implantations for a failed bioprosthesis

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Background Transcatheter mitral valve-in-valve (TMVIV) using the Sapien 3 (Edwards Lifesciences, Irvine, CA, USA) transcatheter heart valve is associated with high technical success and sustained valve performance. However, complications may occur or be detected during or after the procedure.

Case summary We herein describe a rare case of a 59-year-old female who underwent TMVIV for a failed surgical mitral bioprosthesis. During the procedure, the device was embolized twice into the left ventricle and left atrium, respectively, resulting from the crimped transcatheter valve partially detaching from the balloon of the Certitude delivery system during passage through a tight transapical sheath. Fortunately, we were able to catch the dislodged valve and anchor it by the partially inflated device balloon, followed by successful repositioning and deployment.

Discussion In cases where the valve has already detached, as in the present case, the sheath may be advanced against the proximal end of the valve as a pusher, providing good support to push the entire system to cross the bioprosthesis. Then, the delivery catheter should be withdrawn with the counteraction of the sheath in order to correct the interrelated positions of the valve and the balloon. Finally, the valve can be positioned and deployed after the sheath is withdrawn.

Keywords Transcatheter mitral valve replacement • Mitral regurgitation • Valve-in-valve • Transapical • Mitral bioprosthesis • Device embolization • Case report

ESC curriculum 2.2 Echocardiography • 2.4 Cardiac computed tomography • 4.3 Mitral regurgitation • 4.10 Prosthetic valves

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Learning points

(1) The majority of device embolization can be avoided with meticulous planning, sound techniques, and adequate knowledge of the factors, in this case, it is the crimped valve detaching from the balloon of the Certitude delivery system during passage through a tight transapical sheath, and proceeding with balloon inflation even though deviation of the central marker was noticed.

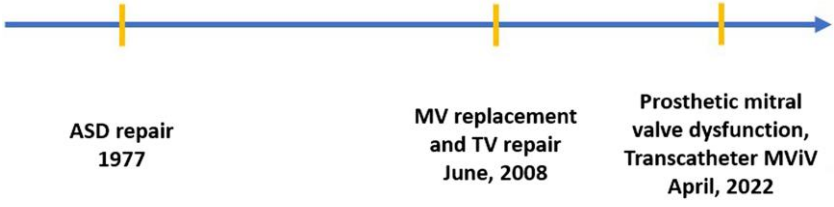
(2) Being familiar with percutaneous rescue techniques in device embolization may become a silver lining before converting to sternotomy.

Introduction

Reoperation of failed bioprosthetic mitral valves can lead to significant morbidity and mortality.[1] A transcatheter mitral valve-in-valve approach using the balloon-expandable Sapien 3 transcatheter heart valve (Edwards Lifesciences, Irvine, CA, USA) is a vital option that has demonstrated high technical success and sustained valve performance.[2]

In this case report, we describe a rare complication of Sapien 3 embolization that occurred twice in the left ventricle and the left atrium, respectively, during the same procedure. This complication resulted from detachment of the crimped valve from the balloon of the delivery catheter and inflation of the mal-positioned balloon. Ultimately, the embolized valve was successfully caught, repositioned, and deployed.

Summary figure



Case presentation

A 59-year-old woman with a medical history of atrial fibrillation and prior cardiac surgery presented to our hospital with severe heart failure. Upon admission, she suffered from New York Heart Association functional class IV heart failure symptoms, and a grade 4/6 systolic murmur over the apex was noted. The patient had been diagnosed with a congenital atrial septal defect (ASD) 45 years ago and underwent surgical repair. Thirteen years prior to admission, she received mitral valve replacement using a Perimount Magna Mitral 29 mm valve (Edwards Lifescience, Irvine, CA, USA), tricuspid valve repair, and permanent pacemaker implantation due to severe mitral regurgitation, tricuspid regurgitation, and tachy-brady syndrome.

Transthoracic and transoesophageal echocardiography revealed that the patient had preserved biventricular function and a well-functioning repaired tricuspid valve. However, the mitral bioprosthesis had degenerated, resulting in severe regurgitation (*Figure 1A* and *B*).

After a thorough discussion with the patient and her family, they declined the option of trido surgery. Consequently, our multidisciplinary Heart-Team decided to perform a transcatheter mitral valve-in-valve implantation to replace the failed bioprosthesis. Before the procedure, a computed tomography (CT) scan revealed a thickened atrial septum, possibly owing to the patient's previous ASD repair. Based on the CT scan finding, a transapical approach was chosen. The CT sizing provided important parameters, including as follows: aorto-mitral angle of 128°; neo-left ventricular outflow tract (LVOT) area of 203 mm^2; and inner diameter of the mitral bioprosthesis of 27 mm (*Figure 1C, D,* and *E*), therefore, a 29 mm Sapien 3 valve was selected for the procedure.

A temporary endocardial pacing lead was inserted into the right ventricle through right femoral vein. The optimal apex position for transapical approach was determined by echocardiographic and CT guidance, and then a left anterolateral thoracotomy was performed to access the pericardium. After a transapical puncture, a 21F Edwards Certitude introducer sheath was inserted and a 0.035 guide wire was introduced through the ventricle towards the mitral prosthesis, eventually reaching the right upper pulmonary vein. Subsequently, the wire was replaced with a Safari wire. Under the guidance of fluoroscopy and transoesophageal echocardiography, the Sapien 3 valve was successfully crossed and positioned in the surgical bioprosthesis.

Valve deployment was performed under rapid ventricular pacing, although we noticed that the central marker of the balloon had shifted to the distal part of the Sapien 3 valve (*Figure 2A*). Unfortunately, the partially inflated distal part of the balloon caused the valve to embolize into the left ventricle (*Figure 2B* and *C*).

To reposition the embolized valve back to the mitral position, we attempted to recapture it using the Lasso method,[3] snaring the valve frame of the embolized valve with a 6 F EN Snare® (Merit Medical System, South Jordan, UT, USA) via parallel access, but unfortunately, this approach was unsuccessful (*Figure 2D*). Instead, by positioning the snare at the nosecone of the delivery system, the Sapien 3 valve was able to be re-directed and crossed the bioprosthetic annulus (*Figure 2E* and *F*). However, during the second valve deployment, only the proximal portion of the balloon was inflated (*Figure 2G*), which pushed the valve upwards and caused it to embolize into the left atrium (*Figure 2H*).

As the patient was haemodynamically stable, we utilized the Safari wire to secure the embolized valve against the atrial wall to prevent its rotation. Next, we advanced the deflated deployment balloon into the partially opened frame of the embolized valve and inflated the balloon at a low volume, which fortunately anchored the valve in place. We then retracted the entire system into the bioprosthetic mitral valve (*Figure 2I*), and the Sapien 3 valve was able to cross the bioprosthetic annulus again and reposition correctly (*Figure 2J*). Finally, the valve

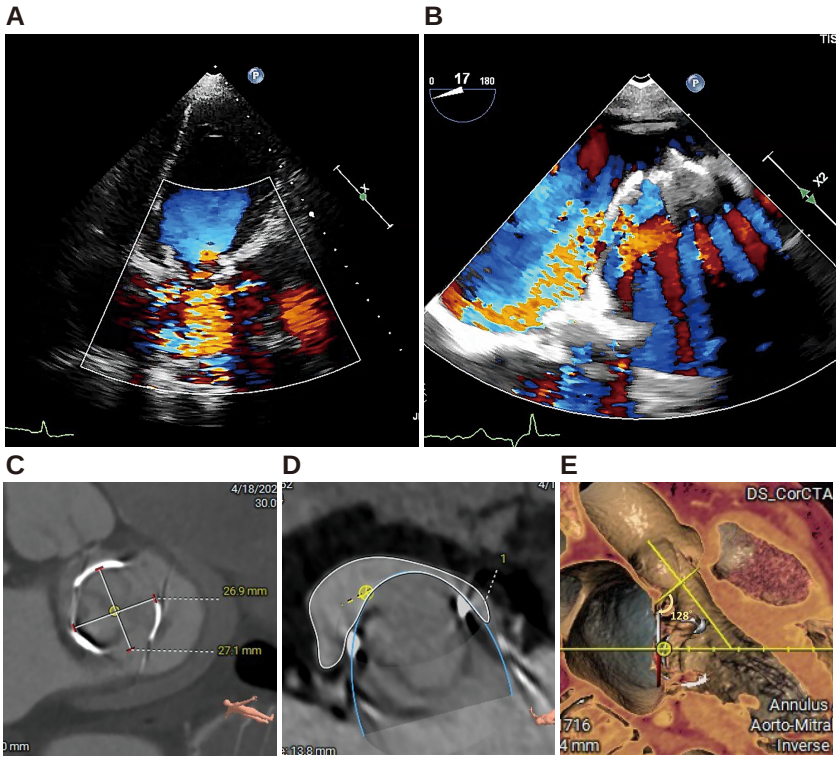


Figure 1 Pre-procedural echocardiography and computed tomography. *(A)* Transthoracic echocardiography showed severe bioprosthetic mitral regurgitation. *(B)* Transoesophageal echocardiography demonstrated the severity of mitral regurgitation. *(C)* Pre-intervention computed tomography analysis revealed inner diameter ID) of mitral bioprosthesis was 27 mm. *(D)* Cross-sectional image with simulating virtual valve showing minimal area of neo-left ventricular outflow tract (LVOT) area was 203 mm^2. *(E)* Aorto-mitral angle was 128°.

was successfully deployed (*Figure 2K* and *L*). The final result was satisfactory, the new valve functioned well with no paravalvular leakage. The patient was discharged after an uneventful hospital course, and her heart failure symptoms improved to function class I status.

Discussion

Device embolization has been reported in transcatheter mitral valve-in-valve and valve-in-ring implantation procedures.[4–6] In the mitral valve-in-valve procedure, anatomic and procedural factors contributed to device embolization the most, including undersized prosthesis, poor coplanar angle, device mal-positioning, incomplete balloon inflation, and failure to retract the transcatheter heart valve pusher.[7] In this case, detachment of the Sapien 3 valve from the balloon of the Certitude delivery system occurred during passage through a tight transapical sheath, which caused the device embolization. To the best of our knowledge, this has never been reported in the literature.

To avoid this complication, the valve should be crimped tightly before being introduced into the sheath. Next, the large-bore sheath should be advanced with the transcatheter valve inside, up to the level just beneath the degenerative surgical bioprosthesis, or even across it. Then, the valve can be advanced to cross the bioprosthesis, followed by the withdrawal of the sheath. Finally, the valve can be positioned and deployed properly.

If the valve has already detached, as in the present case, the sheath could be advanced against the proximal end of the valve, acting as a pusher and providing good support to push the entire system to cross the bioprosthesis. Next, the delivery catheter may be withdrawn with the counteraction of the sheath to adjust the positioning of the valve and the balloon. Finally, the valve can be deployed after the sheath is withdrawn.

In the majority of cases, surgical removal is required once bioprosthesis embolization has occurred during the mitral valve-in-valve procedure.[5,6] However, in this case, we were able to solve left ventricle embolization by snaring the nosecone of the delivery system to reorient the Sapien 3 valve. Left atrium embolization was tackled with the partially inflated device balloon, which fortunately anchored and repositioned the embolized valve. The transcatheter rescue technique we present herein may serve as a last resort before converting to sternotomy.

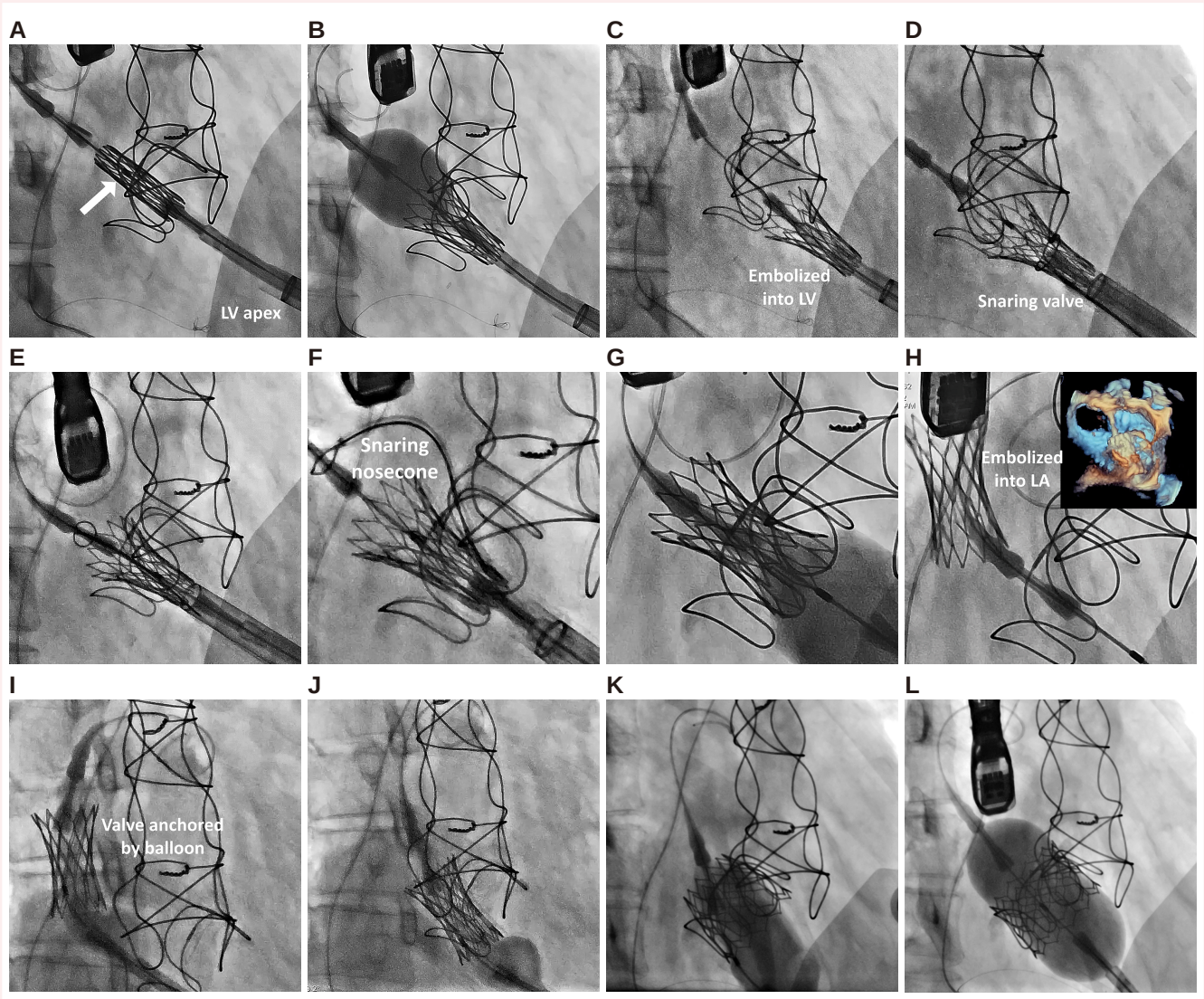


Figure 2 Mitral valve-in-valve implantation of an Edwards SAPIEN valve into a degenerated Carpentier–Edwards valve. *(A)* Sapien 3 valve being positioned, but the central balloon marker (white arrow) has deviated to Sapien 3 valve distal portion. *(B)* The first time of valve deployment, only the distal portion of the balloon was inflated. *(C)* Sapien 3 valve embolized into the left ventricle. *(D)* Lasso method by snaring the valve frame of the embolized valve with a 6 F Snare via parallel access failed to reposition the valve. *(E* and *F)* Snaring the nosecone of the delivery system, Sapien 3 valve could be reoriented and re-advanced to cross the bioprosthetic annulus. *(G)* Second time of valve deployment, only the proximal portion of the balloon was inflated. *(H)* Sapien 3 valve embolized into the left atrium. *(I)* Deployment balloon was inflated, which fortunately anchored the embolized valve. *(J)* Sapien 3 valve was retracted and could cross the bioprosthetic annulus again. *(K)* Positioning and anchoring the valve successfully. *(L)* Optimization of Sapien 3 valve was achieved with full volume inflation.

Lead author biography

Huan Chiu Lin is a doctor of the Heart Center, Cheng Hsin General Hospital, Taipei, Taiwan. His work focuses specifically on the echocardiography, and image analysis in the field of structural heart diseases.

Supplementary material

Supplementary material is available at *European Heart Journal – Case Reports*.

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Data availability

The data underlying this article are available in the article and in its online supplementary material.

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