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CASE REPORT
Coronary heart disease

Case report: Buddy wire technique to facilitate atrial septal crossing during transcatheter transseptal mitral valve implantation

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Background Transcatheter mitral valve-in-valve implantation (MVIV) has emerged as a viable treatment option in patients at high risk for surgery. Occasionally, despite appropriate puncture location and adequate dilation, difficulty is encountered in advancing the transcatheter heart valve across interatrial septum.

Case summary We describe a case of a 79-year-old woman with severe chronic obstructive pulmonary disease (COPD), prior surgical bioprosthetic aortic and mitral valve replacement implanted in 2007, atrial fibrillation, and Group II pulmonary hypertension who presented with progressively worsening heart failure symptoms secondary to severe bioprosthetic mitral valve stenosis and moderate-severe mitral regurgitation. Her symptoms had worsened over several months, with multiple admissions at other institutions with treatment for both COPD exacerbation and heart failure. Transoesophageal echocardiogram demonstrated preserved ejection fraction, normal functioning aortic valve, and dysfunctional mitral prosthesis with severe stenosis (mean gradient 13 mmHg) and moderate-severe regurgitation. After a multi-disciplinary heart team discussion, the patient underwent a transcatheter MVIV implantation. During the case, inability in advancing the transcatheter heart valve (THV) across interatrial septum despite adequate septal balloon pre-dilation was successfully managed with the support of a stiff 'buddy wire' anchored in the left upper pulmonary vein using the same septal puncture. The patient tolerated the procedure well and was discharged home.

Discussion Operators should be aware of potential strategies to advance the THV when difficulty is encountered in crossing the atrial septum despite adequate septal preparation. One such strategy is the use of stiff 'buddy wire' for support which avoids the need for more aggressive septal dilatation.

Keywords Case report • Mitral valve disease • Percutaneous intervention • Percutaneous valve therapy • Structural heart disease intervention • Transcatheter valve intervention

Learning points

- Transcatheter transseptal mitral valve-in-valve interventions are gaining momentum as a treatment alternative to open surgical treatment in patients at high surgical risk.
- Procedural challenges include the inability to advance the transcatheter heart valve across the atrial septum despite adequate transseptal puncture location, as well as other technical challenges described in the case.
- Using a stiff 'buddy wire' for support can allow for avoidance of creation of a second transseptal puncture when the first puncture site is in the proper location.

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Introduction

Transcatheter mitral valve-in-valve (MVIV) implantation has emerged as a viable treatment option in patients at high risk for surgery.[1] Appropriate transseptal puncture location and balloon dilation of transseptal puncture are critical for advancing and positioning the percutaneous mitral valve. Transseptal puncture in the infero-posterior aspect of the fossa ovalis followed by balloon dilation of the transseptal puncture site provides a favourable trajectory for advancing the transcatheter heart valve (THV).[2] Sometimes, despite appropriate puncture location and adequate dilation, the difficulty is encountered in advancing the THV across the interatrial septum, especially in patients with prior transseptal approach for mitral valve surgery. We describe a case of transcatheter MVIV implantation, where inability in advancing the THV across interatrial septum despite adequate septal balloon pre-dilation was successfully managed with the support of a stiff 'buddy wire' anchored in the left upper pulmonary vein using the same septal puncture.

Timeline

Day 1	A 79-year-old female with a history of bioprosthetic mitral and aortic valve replacements is admitted for acute decompensated heart failure.
Day 2	Transthoracic and transoesophageal echocardiograms revealed severe bioprosthetic mitral valve stenosis and moderate to severe regurgitation.
Day 3	Multi-disciplinary heart team discussion regarding the best treatment option for the patient
Days 4–7	Medical optimization of heart failure prior to the planned intervention
Day 8	Successful transfemoral transcatheter mitral valve-in-valve replacement with a 23 mm Sapien S3 transcatheter heart valve
Day 12	Hospital discharge to home after an uncomplicated post-operative course

Case presentation

A 79-year-old female with severe COPD, prior surgical aortic (19 mm Carpentier-Edwards®) and mitral valve replacement (25 mm Hancock®), persistent atrial fibrillation, Group II pulmonary hypertension; presented with progressively worsening heart failure symptoms secondary to severe bioprosthetic mitral valve stenosis and moderate-severe mitral regurgitation. Physical examination revealed normal systemic blood pressure (116/62 mmHg), normal heart rate (85 b.p.m.). She was a thin, elderly female with moderate increased work of breathing, regular heart rate with 4/6 holosystolic murmur best heart over the apex. The patient had prominent jugular venous distention. Lung exam revealed diminished breath sounds at the bases of the lungs with crackles in the upper lung fields, and she had 2+ pitting oedema bilaterally in her lower extremities. Transthoracic and transoesophageal echocardiogram demonstrated preserved ejection fraction, normal functioning aortic valve, and dysfunctional mitral prosthesis with severe stenosis (mean gradient 13 mmHg) and moderate-severe regurgitation (*Figure 1A*). The interatrial septum was thickened and scarred due to prior surgical intervention. After evaluation by the multi-disciplinary heart team, she was deemed to be at elevated surgical risk (STS score-risk of mortality 10.5%, risk of morbidity or mortality 30%). Therefore, decision was made to proceed with transcatheter transseptal MVIV implantation using 23 mm Edwards SAPIEN S3 valve (Edwards, Irvine, CA, USA).

Under transoesophageal echocardiographic guidance; transseptal puncture was performed using 8-Fr SL-1 sheath (Swartz™ Braided transseptal introducer catheters, St. Jude Medical) and NRG® transseptal radiofrequency needle (Baylis Medical) in the inferior–posterior aspect of the fossa ovalis. Using an Agilis NxT Steerable sheath (Abbott, St Paul, MN, USA) positioned in the left atrium, a J wire was successfully advanced across the mitral prosthesis and then exchanged for Safari^{2TM} extra small curve wire (Boston Scientific) placed in the left ventricular apex. Balloon dilation of the interatrial septum was subsequently performed using 14 mm × 4 cm Z-Med II™ balloon (B BRAUN Interventional Systems) (*Figure 1B*). The right femoral venous sheath was then upsized to 14-Fr e-sheath® over the Safari wire. A 23 mm SAPIEN S3 THV was advanced into inferior vena cava (IVC) but despite multiple attempts, the THV could not be advanced across the atrial septum into the degenerated bioprosthetic mitral valve (*Video 1*). From the left femoral venous sheath, a Wholey wire (Medtronic Inc.) supported by multipurpose catheter was used to cross the same interatrial septal puncture and placed in the left upper pulmonary vein. The wire was then exchanged for an Amplatz Super Stiff™ Guidewire (Boston Scientific) and left in place to serve as a 'buddy wire' to stretch the interatrial septum and support the advancement of the THV across the septum (*Figure 1C*). The THV crossed the septum easily and was advanced across the mitral prosthesis (*Video 2*, *Figure 1D*). The buddy wire was then replaced by a temporary pacing wire which was placed in the right ventricle followed by successful MVIV implantation under rapid ventricular pacing with excellent results (*Video 3*, *Figure 1E, F*). Post-operative echocardiogram showed normal functioning of the mitral prosthetic valve with the mean gradient of 3 mmHg and no significant regurgitation. The patient was discharged home after 2 days and continues to do well with marked improvement in her symptoms at 6 months follow-up.

Discussion

Transcatheter transseptal MVIV interventions are gaining momentum as a treatment alternative to open surgical treatment in patients at high surgical risk. There are, however, several procedural challenges including the inability to advance the THV across the atrial septum. This can be encountered due to the presence of a thickened fibrotic septum due to previous catheter procedures, prior surgical intervention, improper transseptal puncture location, inadequate septal dilation, or lack of wire support.

Operators should be aware of potential strategies to advance the THV when difficulty is encountered in crossing the atrial septum despite adequate septal preparation. One such strategy is the use of stiff

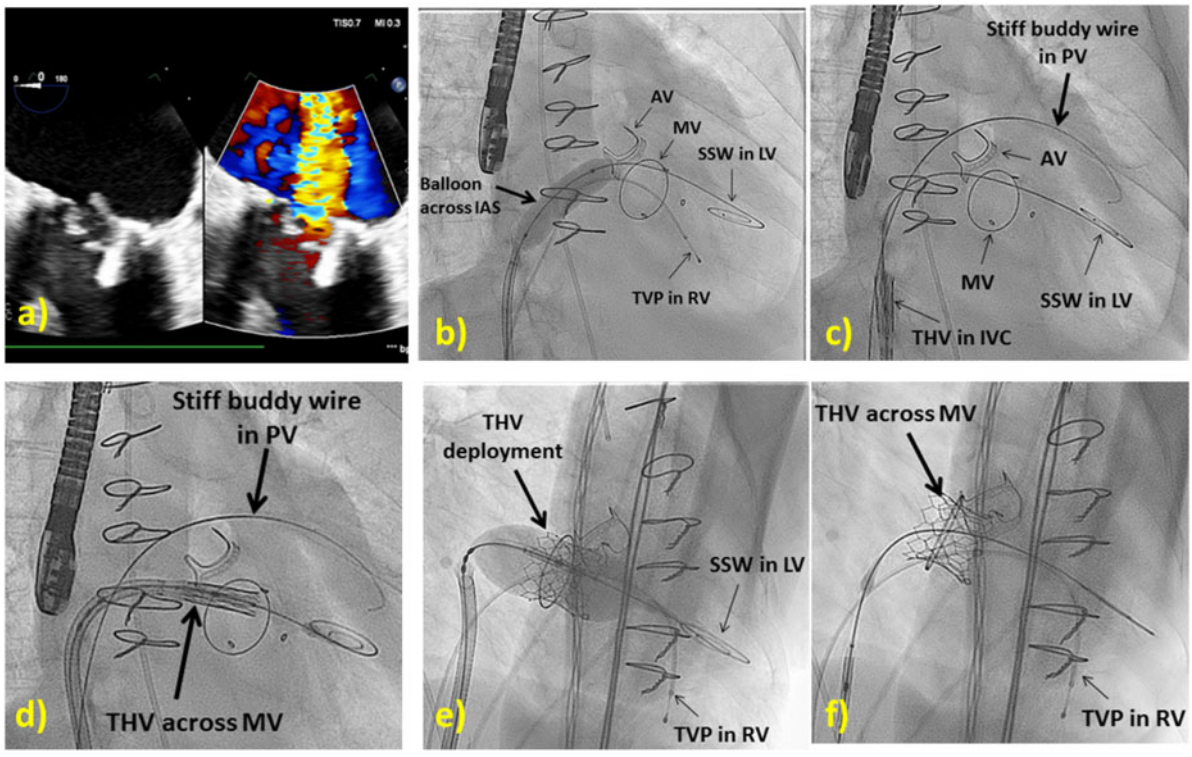

Figure 1 Figure showing degenerated mitral valve and procedural details. (*A*) degenerated mitral bioprosthesis with leaflet malcoaptation and moderate-severe mitral regurgitation on colour Doppler; (*B*) balloon dilation of interatrial septal puncture; (*C*) Amplatz super stiff 'buddy wire' in left upper pulmonary vein; (*D*) SAPIEN S3 transcatheter heart valve successfully positioned across degenerated mitral bioprosthesis after successfully crossing interatrial septum with 'buddy wire' support; (*E*) successful deployment of transcatheter heart valve; (*F*) final position of transcatheter heart valve, post deployment. AV, aortic valve; IVC, inferior vena cava; IAS, interatrial septum; LV, left ventricle; MV, mitral valve, PV, pulmonary vein, RV, right ventricle; SSW, extra small curve safari wire; TVP, transvenous pacemaker; THV, transcatheter heart valve.

'buddy wire' for support. The stiff buddy wire can be placed from the contralateral femoral vein into the left upper pulmonary vein, across the same septal puncture site as the THV. Others have previously described using buddy wires to advance THVs across the interatrial septum, involving the creation of separate transseptal puncture.[3] Our approach is simpler and avoids the need for a separate transseptal puncture. We used a wholey wire supported by multipurpose catheter to re-cross the previously dilated interatrial septum. The wholey wire was then placed in the left upper pulmonary vein and exchanged for a stiff wire such as an Amplatz super-stiff wire. The buddy wire stretches open the interatrial septal puncture and allows for easier advancement of the THV. Once the valve is across the interatrial septum and positioned across the mitral valve; the stiff wire is removed and replaced with a temporary pacing wire for rapid pacing to complete deployment of THV in the mitral position. At our institution, this strategy is becoming our default approach to facilitate THV septal crossing rather than deferring to a more aggressive balloon septal dilatation.

With the expansion of transcatheter transseptal MVIV interventions, operators should be aware of potential techniques to advance the THV across difficult to cross interatrial septum. Stiff 'buddy wire' support is one such technique, which can facilitate advancement of THV, without risking the removal of the valve from the body.

Lead author biography

Dr Hussam Suradi is an interventional cardiologist at Rush University Medical Center in Chicago, USA. He is the Director of Structural Hybrid Lab and Co-Director of Cardiac Catheterization Labs. Dr Suradi's clinical practice specializes in interventional cardiology, with a focus on catheter-based therapy of valvular and structural heart disease.

Supplementary material

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

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The author/s confirm that written consent for submission and publication of this case report including image(s) and

associated text has been obtained from the patient in line with COPE guidelines.

Conflict of interest: none declared.

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