Asia's First Successful Minimally Invasive Transapical Transcatheter Mitral Valve-in-Valve Implantation

Dear Editor,

Reoperation for mitral valve re-replacement in patients with patent coronary bypass grafts can be a formidable task in the elderly. We report a patient that was successfully treated using a novel minimally invasive approach via the apex of the left ventricle.

Case Report

A 72-year-old man with hypertension, hyperlipidaemia, diabetes and renal impairment presented with recurrent heart failure from a severely leaking mitral bioprosthesis. He had undergone 2 previous coronary bypass operations, 25 years and 7 years ago respectively. His porcine mitral valve implanted during his most recent bypass surgery was severely regurgitant from a flail leaflet (Figs. 1A and 1B). The peak and mean transmitral gradients were 16 mmHg and 5 mmHg respectively, with an effective orifice area of 1.71 cm^2. There was moderate tricuspid regurgitation and elevated systolic pulmonary artery pressures (79 mmHg). His left ventricular ejection fraction was 55% to 60%. His mammary artery graft to the anterior descending coronary artery and vein graft to the obtuse marginal were patent, whilst the vein graft to the ramus intermedius was diseased (Fig. 1C). The graft to the diffusely diseased right posterior descending artery was occluded but deemed not clinically significant.

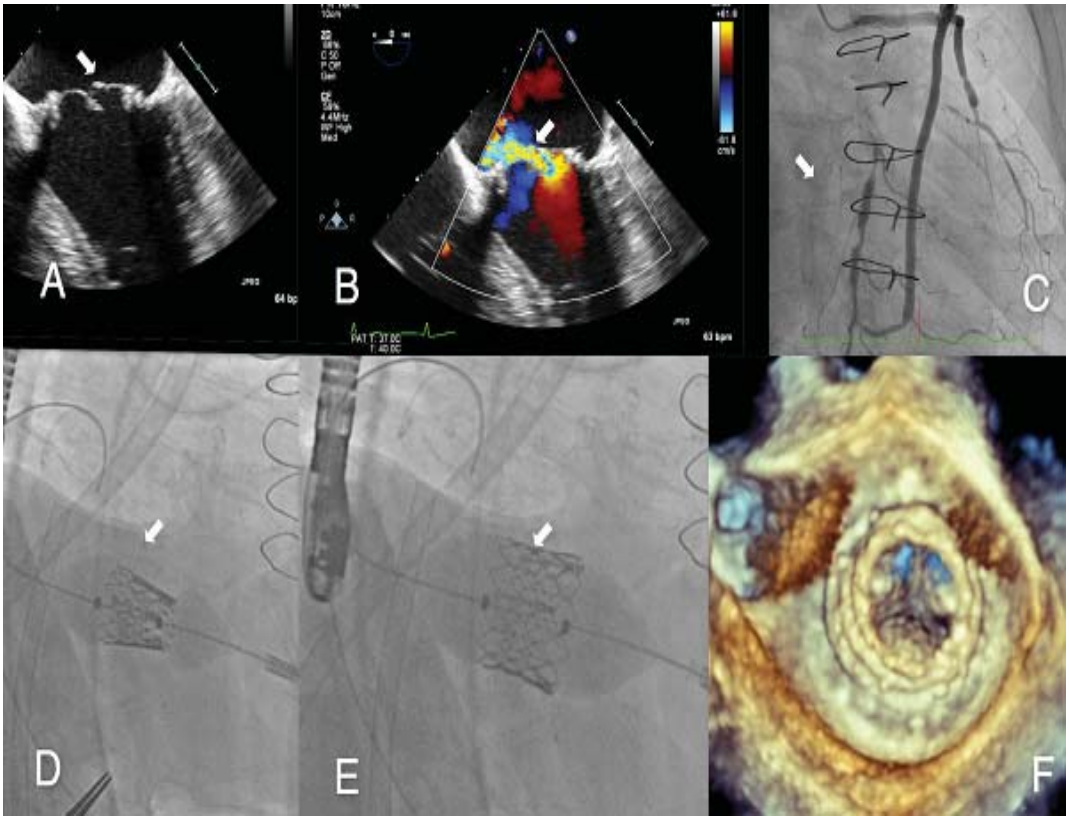

Fig. 1. Echocardiographic (A, B, F) and fluoroscopic (C, D, E) images: Arrows point to flail leaflet in (A), regurgitant jet in (B), and faint radio-opaque mitral sewing ring in (C, D, E). Arrow in E also shows the mandatory "waisting" of the oversized Sapien valve. (F) 3D echo image of the Sapien valve within the failed porcine valve stent.

The predicted 30-day surgical mortality of mitral re-replacement was high and estimated to be 28% (logistic EuroScore) or 13.4% (American Society of Thoracic Surgeon score), with a 27.8% predicted risk of long hospital length of stay. The manufacturer-specified internal diameter of the 33 mm mitral bioprosthesis was 31 mm. The computer tomography (CT)-assessed diameter at the level of the radio-opaque sewing ring was 28.5 mm, and deemed suitable for the 29 mm Edwards Sapien valve. The Health Sciences Authority's approval was obtained and the patient consented for the procedure.

The procedure was performed in the hybrid operating theatre under general anaesthesia. A 6-cm left antero-lateral thoracotomy exposed the left ventricular apex. Orthogonal pledgetted Prolene sutures and epicardial pacing wires were placed in the muscular apex. Transesophageal Echocardiography (TEE) and fluoroscopic imaging guided the crossing of the mitral prosthesis using a short 0.035 inch J-tip wire through a 18G needle apical puncture. The wire was exchanged for a 0.035 inch curved J-tip Amplatz Super-stiff wire and the 26F Ascendra 1 sheath introduced. The heart is then rapidly paced (ventricular) during valve deployment (Figs. 1D to F). No ionic contrast medium was required and the total fluoroscopic duration was 10 minutes.

The patient received one unit of blood and spent a day in the intensive care unit. He was ambulant and fit for discharge from hospital on the 4th postoperative day. His heart function continued to improve with trivial tricuspid regurgitation, normal pulmonary artery pressures (27 mmHg systolic) and improved mitral valve hemodynamics 1-month post-implant. The mean and peak transmitral gradients were 4 mmHg and 14.4 mmHg respectively, and the effective orifice area was 1.68 cm^2. Three months post-implant, he was in sinus rhythm, New York Heart Association (NYHA) functional class 1, and walking 1 km regularly.

Discussion

Despite improving outcomes in revisional mitral replacement surgery, age continues to predict mortality.[1] The morbidities associated with revisional valve surgery also remain. Alternative surgical approaches aim to expedite surgery in relatively "virgin" territory, avoiding repeat sternotomy and potential injury to patent bypass grafts. These techniques include the (i) right thoracotomy,[2,3] (ii) left antero-lateral thoracotomy,[4] and (iii) left postero-lateral thoracotomy approaches.[5] These operations, however, invariably require cardiopulmonary bypass.

Since the first transapical transcatheter mitral valve-in-valve implant performed in July 2007 at St Paul's Hospital Vancouver, the worldwide clinical experience has been limited.[6,7] This case report is Asia's first successful procedure using the new 29 mm Edwards Sapien balloon expandable valve. Oversizing of the Sapien valve is mandatory because it is secured within the dysfunctional prosthetic sewing ring by radial force alone (Fig. 1E). This approach however does not allow us to treat concomitant significant coronary disease and tricuspid regurgitation. Interestingly, despite having some residual coronary disease, this patient's pulmonary hypertension and tricuspid regurgitation resolved with successful treatment of his mitral regurgitation.

The transapical approach allows easy wire access across the mitral valve and coaxial implanting angles. This approach expands our capabilities to deal with the older high risk patients needing revisional mitral replacement. It offers these patients an opportunity for an expedited recovery, and improved quality of life.

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