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# SURGICAL TECHNIQUE

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# Surgical antegrade transcatheter mitral valve implantation for symptomatic mitral valve disease and heavily calcified annulus

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#### Abstract

Surgical techniques for the treatment of mitral valve disease (MVD) have continuously evolved; however, anatomical details like severe annular calcification remain challenging and require sophisticated surgical strategies. Among patients with symptomatic MVD referred for surgical valve repair or replacement, four presented with circumferential calcification of the mitral annulus precluding conventional surgical techniques. Successful treatment by implanting a balloon-expandable transcatheter aortic heart valve using an antegrade surgical access was performed. The perioperative course and follow-up assessment ( $19.3 \pm 21$  months) were uneventful. Echocardiographic assessment confirmed a well-seated valve with normal function (mean  $4.5 \pm 0.6$  mmHg). Surgical mitral valve replacement using a balloon-expandable transcatheter aortic bioprosthesis can be a valuable and attractive bailout strategy in patients with a heavily calcified mitral annulus.

Keywords: Mitral valve • Replacement • Valve disease • Bailout technique

#### INTRODUCTION

Surgical treatment of mitral valve disease (MVD) is tailored and performed according to individual patho-anatomical changes. Although mitral valve repair is the treatment of choice [1], the management of extensive mitral calcification represents a surgical challenge and can be associated with calcium fragmentation, annulus dehiscence, paravalvular leakage and atrioventricular rupture.

After the first-in-man report of the surgical implantation of a transcatheter heart valve in mitral position [2], we present a small series of antegrade transcatheter valve implantation in native, heavily calcified MVD.

### **METHODS AND RESULTS**

Between January 2012 and July 2014, four patients (73  $\pm$  9 years) with symptomatic MVD were referred for surgery and had severe calcification of the mitral annulus infiltrating the myocardium. Surgery was performed via median sternotomy and cardiopulmonary bypass was conducted in moderate hypothermia. The mitral valve was approached through the left atrium or a transseptal access. All patients had severe calcification of the mitral leaflets and the mitral annulus extending into the left ventricle (Video 1), and a hybrid approach with the implantation of a balloon-expandable transcatheter aortic bioprosthesis under direct visualization was considered. Parts

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of the mitral leaflets and major calcifications were resected. The SapienXT prosthesis was used in three patients, whereas the fourth patient received the Sapien3 (Edwards Lifesciences, Irvine, CA, USA). The device size was based on the measurements from preoperative CT, TEE and intraoperative balloon sizing. Using the transapical delivery system, antegrade insertion and placement of the prosthesis were performed. The bioprosthesis was secured with additional sutures in two patients and an additional xeno-pericardial patch was required to minimize the risk for paravalvular regurgitation in two patients (Fig. 1). The immediate perioperative result was assessed using transoesophageal echocardiography (Video 2). During echocardiographic assessment, significant obstruction of the left ventricular outflow by a prolapse of the anterior mitral leaflet was noticed in one patient requiring partial transaortic resection of the leaflet.

Peri- and post-procedural course was uneventful in all patients. No adverse cardiac events were reported during  $19.3 \pm 21$  months of follow-up (range 4–50 months). Information on baseline and procedural characteristics as well as follow-up assessment are presented in Table 1.

## DISCUSSION

Mitral valve surgery offers multiple techniques for the reconstruction of the mitral valve leaflets, the subvalvular apparatus and the mitral annulus. However, when massive mitral annular calcifications come to challenge the surgical situs, the surgical risk for repair or

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Video 1: Preoperative echocardiography.



Figure 1: Intraoperative images: (A) balloon catheter from the left atrium, (B) placement of the transcatheter heart valve, (C) expanded SapienXT, (D) sutures for additional anchoring. Parts of the figure reprinted with permission (Citation 2).

replacement increases. Demanding techniques with complete decalcification and reconstruction of the mitral annulus are required with the risk of myocardial tissue injury, calcium fragmentation, annulus dehiscence, paravalvular leakage and atrioventricular rupture. Although valve-in-valve, valve-in-ring and the implantation of transcatheter aortic valves in native mitral position using the transapical or a percutaneous transseptal approach have been described, the use of a surgical antegrade access might offer a valuable bailout strategy in patients with surgically demanding anatomy and heavily calcified mitral valve pathology.

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Video 2: SapienXT in mitral position without signs of paravalvular regurgitation.

#### Table 1: Patient characteristics and clinical outcomes

	Patient 1	Patient 2	Patient 3	Patient 4
Baseline characteristics				
Age	80	60	79	74
Gender	Female	Male	Female	Female
STS PROM (%)	5.0	1.7	3.4	4.7
Dyspnoea	NYHA IV	NYHA II	NYHA IV	NYHA III
Previous Hx of Cardiac Surgery	-	St/p AVR 1987 (SJM 27 mm) St/p Mitral Annuloplasty 1978		
Mitral valve pathology	Severe regurgitation Moderate stenosis	Severe stenosis	Severe regurgitation Moderate stenosis	Severe regurgitation Moderate stenosis
Mean gradient (mmHg)	9	17	8	6
Procedure				
Туре	Edwards	Edwards	Edwards	Edwards
Model	SapienXT	SapienXT	SapienXT	Sapien3
Size (mm)	26	29	29	29
Concomitant procedure	Maze procedure		CABG (LIMA-LAD) Septal myectomy	
Cardiopulmonary bypass (min)	149	140	195	102
Outcomes				
Follow-up (months)	50	17	6	4
Dyspnoea	NYHA II	NYHA I	NYHA II	NYHA II
Echocardiographic follow-up (months)	18	17	6	4
Mitral regurgitation	Mild (paravalvular)	None	None	Mild (transvalvular)
Mean gradient (mmHg)	5	5	4	4

STS-PROM: Society of Thoracic Surgeons - Predicted Risk of Mortality; Hx: History; NYHA: New York Heart Association; St/p: Status post; SJM: St. Jude Medical; AVR: Aortic Valve Replacement; CABG: Coronary Artery Bypass Graft Surgery; LIMA-LAD: Left Internal Mammary Graft - Left Anterior Descending Coronary Artery.

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