Transapical Mitral Valve Implant for the Treatment of Degenerated Bioprosthesis

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Introduction

Bioprosthetic heart valves are increasingly used in current clinical practice. Their major limitation, however, is the elevated risk of late reoperation due to structural degeneration, which increases progressively with time[1,2]. Considering that a larger number of young patients are treated with bioprosthetic valves, an increasing number of degenerated bioprostheses requiring replacement is expected[2,3]. However, valve reinterventions are considered to be highly risky because of the combination of adverse factors in that group of patients[4,5].

Despite being considered an 'off-label' indication and still not being part of guidelines, transcatheter valve-in-valve implantation emerges as a less invasive alternative. That experience, however, is still limited to a few cases and series published[6-9].

We report the case of a male patient with two previous surgical replacements of the mitral valve, who presented with new degeneration of the bioprosthesis, severe heart failure and high surgical risk, being submitted to transcatheter valve-in-valve implantation with the Inovare device (Braile Biomédica, São Paulo, Brazil).

Case report

The patient is a 74-year-old white male, who was admitted complaining of progressive dyspnea, fatigue and dry cough for three days. He denied chest pain, fever and shivering. His medical history included the diagnoses of mitral valve prolapse, benign prostate hyperplasia, and chronic kidney failure (CKF) not requiring dialysis. He reported mitral valve infectious endocarditis 13 years before, which was surgically treated with bioprosthetic replacement (St. Jude nº 31). After seven years, he had rupture of the posterolateral leaflet of the bioprosthesis, requiring new valve replacement with another bioprosthesis (St. Jude nº 31).

Keywords

Mitral Valve / surgery; Mitral Valve Annuloplasty; Bioprosthesis.

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On physical examination, the patient was in regular general condition, dyspneic and had no fever. His heart rate was 105 bpm and his respiratory rate, 24 bpm. His cardiac auscultation evidenced a holosystolic murmur of 5+/6+ on the mitral area, radiating to the left axillary region. His pulmonary auscultation showed crepitant rales on both lung bases. His abdomen had no changes. His extremities showed good peripheral perfusion. His electrocardiogram evidenced sinus tachycardia with left ventricular and atrial overload. His laboratory tests showed urinary tract infection and impaired renal function. His Doppler transthoracic and transesophageal echocardiograms showed: severe mitral regurgitation due to rupture of the posterolateral leaflet of the bioprosthesis; no vegetation; and ejection fraction (EF) of 65%.

The patient experienced severe sepsis from the urinary focus and aggravation of the heart failure (HF), requiring admission to the intensive care unit (ICU). He was discharged from the ICU after five days with improvement of the HF and sepsis, but experienced acute exacerbation of the CKF. Serum creatinine passed from 2.5 mg/dl (baseline) to 4.2 mg/dl, with endogenous creatinine clearance (ECC) calculated as 17 mL/min. The patient was assessed by a multidisciplinary team and was considered at high surgical risk for a new mitral valve replacement, with logistic EuroSCORE of 17.8% and STS score of 18.9% for mortality. The case was assessed by a multidisciplinary team that chose the transapical transcatheter balloon-expandable bioprosthesis implantation with the Inovare device (Braile Biomédica, São Paulo, Brazil), according to the valve-in-valve method.

The procedure was performed in a hybrid operating room, under general anesthesia, with no need for cardiopulmonary bypass. By use of left lateral minithoracotomy over the fifth intercostal space, the cardiac apex was exposed. Purse-string suture was performed with prolene 4.0 thread, bovine pericardial reinforcement was used to control hemorrhage, and an epicardial pacemaker lead was placed. The apex was punctured and a 0.35" guidewire was advanced with the aid of a JR catheter inside the right superior pulmonary vein. Heparin was administered and a 24-F sheath was introduced through the apex over the stiff guidewire. The internal diameter of the mitral bioprosthesis measured by use of intraoperative transesophageal echocardiography was 27 mm. Using the same size estimate for aortic stenosis (10%), an Inovare bovine balloon-expandable bioprosthesis nº 28 (Braile Biomédica, São Paulo, Brazil) was introduced through the 24-F sheath and placed over the mitral annulus.

The mitral valve was positioned over the degenerated bioprosthesis by simultaneous use of fluoroscopy and echocardiography. By using rapid pacing, the balloon was expanded and the valve deployed (Figure 1). No iodine contrast medium was necessary. Guidewires, catheters and introducer were removed, and the apex closed. A chest drain was placed into the left pleural space.

The patient was sent to the postoperative care unit, awakened and extubated. The patient neither had neurological deficit nor required blood transfusion. The transesophageal echocardiogram performed immediately after implantation showed the following: a normal functioning bioprosthesis with neither paravalvular nor valvular leak; peak and mean diastolic gradients of 16.4 and 8 mm Hg, respectively (Figure 2); and effective valvular area of 2.6 cm^2.

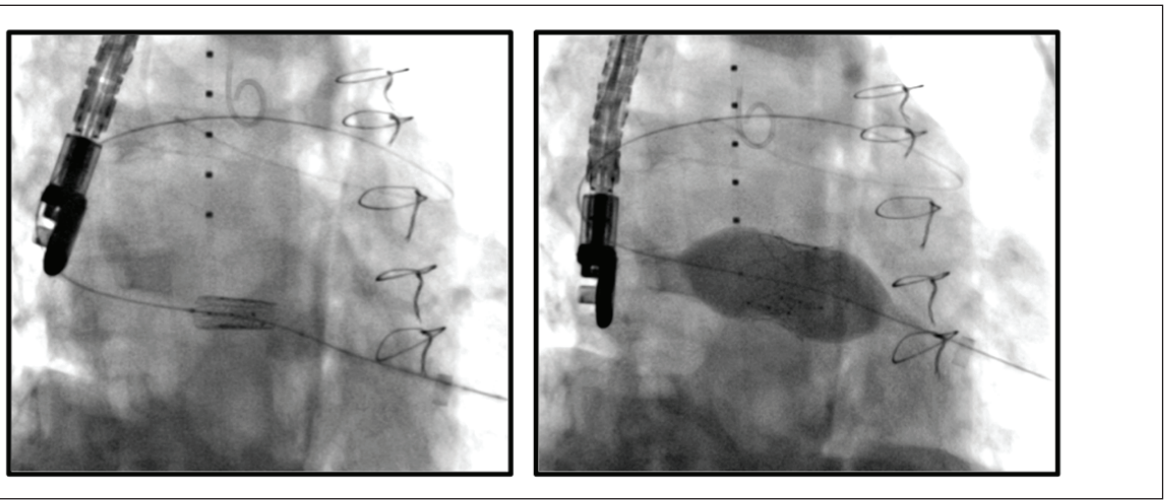

Figure 1- *Valve positioning and deployment.*

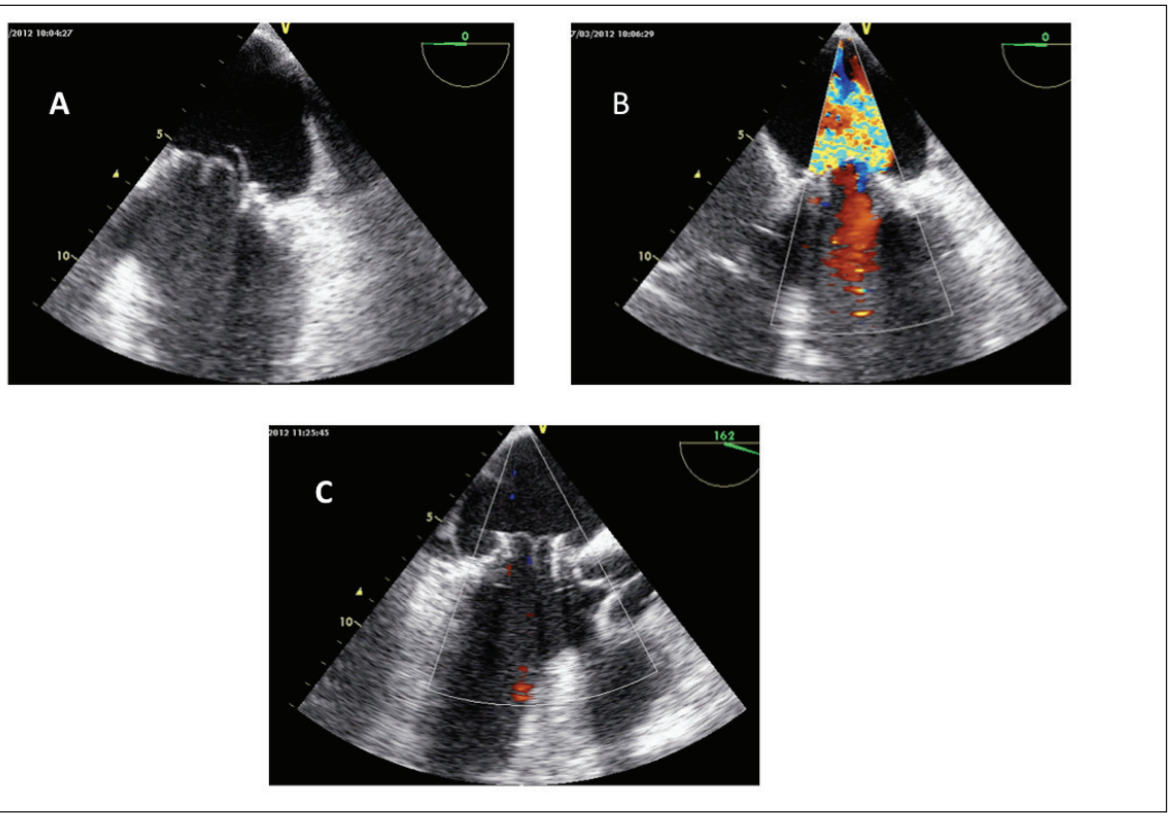

Figure 2- *Transesophageal echocardiogram: mitral bioprosthesis with rupture of the posterolateral leaflet (A); Doppler showing severe mitral regurgitation (B); Doppler after endoprosthesis implantation showing no mitral regurgitation.*

The patient had an uneventful postoperative course, being transferred to a room on the third postoperative day. He had aspiration pneumonia, which was treated with large spectrum antibiotics. The patient was discharged 13 days after the procedure with no signs of HF and partial improvement of his renal function.

Discussion

Reoperation and mitral valve replacement might be associated with higher mortality in elderly patients with comorbidities[5]. A recent guideline recommends mitral valve replacement in symptomatic patients with severe regurgitation even with preserved left ventricular EF[10]. However, it is worth emphasizing that, in mitral regurgitation, because the ejection occurs to a low pressure chamber, such as the left atrium, the ventricular function can be overestimated.

Because of the increased surgical risk and the growing evolution of transcatheter aortic valve implantation, valve-in-valve procedures are used in such high-risk patients. However, because of the lack of data on the durability of transcatheter devices and the excellent long-term results with conventional valve surgery, that new approach still requires special considerations on the criteria for selecting patients. Elderly patients at high surgical risk and with indication for reoperation would benefit from that technique. Our patient had impaired renal function after an episode of urinary sepsis and had indication for mitral valve reintervention. The transapical access was easily obtained, allowing a short and straight route until the mitral plane. No hemorrhagic complications occurred. Careful echocardiographic measurement of the internal diameter of the bioprosthesis is required to define the size of the device to be implanted. It is also fundamental to make sure that the regurgitation through the degenerated valve is either central or transvalvular, because that technique is not suitable for perivalvular leaks. Positioning and deployment should always be guided by transesophageal echocardiography. In the present case, because of the renal injury, no radiological contrast medium, which is recommended whenever possible, was used.

Although our findings are limited because they correspond to the experience with one single patient, they are corroborated by similar descriptions in the literature. According to the current European guideline, that is an exception technique, emerging as an alternative for the treatment of mitral bioprosthesis dysfunction in patients considered inoperable or at very high risk[11]. It is worth emphasizing that such technique should always be indicated via the careful assessment of a multidisciplinary team, strengthening the concept and necessity of the Heart Team. Further studies, with greater power and hard clinical outcomes, are required to establish the actual role of that approach.

Author contributions

Conception and design of the research: Bernardi GLM, Prates PRL, Sarmento-Leite R; Acquisition of data: Prates PRL, Quadros AS, Salgado Filho PA, Kruse JCL, Sarmento-Leite R; Writing of the manuscript: Bernardi GLM, Prates PRL, Sarmento-Leite R; Critical revision of the manuscript for intellectual content: Prates PRL, Quadros AS, Sarmento-Leite R.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

This study is not associated with any post-graduation program.

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