

“Valve in valve” percutaneous aortic valve implantation for severe mixed bioprosthetic aortic valve disease

Frederic De Vroey, Malcolm Legget, John Ormiston, Mark Webster, James Stewart

Abstract

Transcatheter aortic valve implantation (TAVI) is an effective treatment for patients with severe aortic stenosis at high risk for surgical valve replacement. We present a case of successful, off-label transfemoral valve-in-valve implantation of the self-expandable Medtronic-CoreValve prosthesis in an inoperable elderly patient with structural deterioration of an existing bioprosthesis in the aortic position. This case illustrates that TAVI for a deteriorated aortic bioprosthesis is feasible in a patient who was not suitable for reoperation.

Transcatheter aortic valve implantation (TAVI) is an effective treatment for patients with severe aortic stenosis at high risk for surgical valve replacement.

We present a case of successful, off-label transfemoral valve-in-valve implantation of the self-expandable Medtronic-CoreValve prosthesis in an inoperable elderly patient with structural deterioration of an existing bioprosthesis in the aortic position.

Case report:

A 76-year-old woman, with a past history of bicuspid aortic valve and rheumatic fever, had undergone aortic valve replacement, with a size 21 Carpentier Edwards Perimount porcine pericardial bioprosthesis, 8 years previously, for severe aortic stenosis. At operation, friability of the aorta had been noted. In addition, the patient had smoking-related severe chronic obstructive pulmonary disease (COPD), requiring intermittent systemic steroid therapy.

She had become progressively more breathless over the previous 12 months. Findings on clinical examination were consistent with severe mixed aortic valve disease, and left ventricular failure. There was elevation of N-terminal-brain natriuretic peptide (NT-ProBNP) at 145 pmol/L (normal <35), suggesting a significant cardiac contribution to her symptoms.

Serial echocardiography had demonstrated gradual degeneration of the porcine aortic valve prosthesis and, at presentation, there was severe prosthetic valve stenosis (mean gradient of 24 mmHg, peak velocity of 3.1 m/sec, peak to peak gradient 30 mmHg, calculated valve area of 0.8 cm²), and, by standard Doppler echocardiographic criteria, moderate aortic regurgitation due to prolapse of one cusp. Left ventricular function had deteriorated with a reduction in echocardiography-derived ejection fraction from 53% to 38% over the previous 6 months.

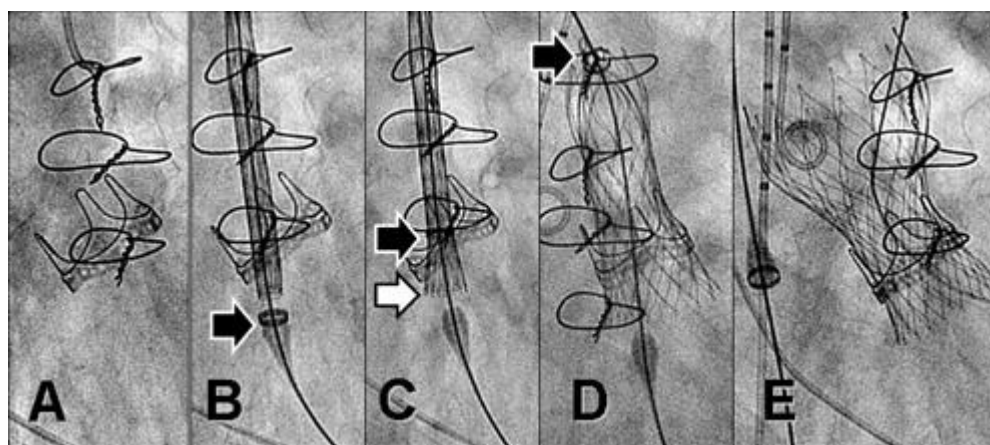
Given the patient's severe COPD, fragile aorta, and small aortic annulus, the risk of repeat aortic valve replacement was felt to be prohibitive. The logistic EuroSCORE (European System for Cardiac Operative Risk Evaluation) for perioperative mortality was 31% and STS (Society of Thoracic Surgeons mortality risk) score was 40%. A

multidisciplinary committee recommended TAVI. Coronary and peripheral angiography showed trivial coronary disease, an ascending aortic diameter of 42 mm and suitable iliac and femoral arteries for a transfemoral approach.

Percutaneous aortic valve replacement was performed under general anaesthesia, using a size 26 mm CoreValve ReValving system (Medtronic-CoreValve, Irvine CA). This prosthesis consists of a self-expanding nitinol frame with valve leaflets fashioned from porcine pericardial tissue, delivered through a 18 F deployment catheter.

Delivery and deployment of the CoreValve were uncomplicated (Figure 1) with an immediate reduction in the peak to peak gradient from 30 to 0 mmHg and trivial (Grade 1) aortic regurgitation. Echocardiography 3 days later showed normal function of the percutaneous aortic valve, with a calculated valve area of 1.3 cm² and an improvement in left ventricular ejection fraction to 53%. She remains well at 18 months with significantly reduced dyspnoea and no need for a permanent pacemaker.

Figure 1. Shown in A is a frame from a cine angiogram showing the Carpentier Edwards Perimount bovine pericardial aortic bioprosthesis, In B, the sheathed CoreValve percutaneous valve prosthesis lies across the degenerated surgical prosthesis with a black arrow indicating the marker on the distal end of the sheath. In C, the sheath (black arrow) has been partially withdrawn allowing the nitinol frame to expand partially (White arrow). In D the sheath has been largely withdrawn but is still attached to the CoreValve nitinol frame (black arrow). In E, the CoreValve is fully released and expanded.



Discussion:

The need for redo surgery due to structural valve deterioration is approximately 10% at 10 years,¹ depending on valve type and population studied. Given the large number of tissue valves that have been implanted over the last 20 years, there will be an increasing number of elderly patients with multiple co-morbidities and bioprosthetic aortic valve deterioration. Percutaneous aortic valve replacement will likely become an attractive therapeutic option in this population.^{2,3}

The ability to treat deteriorating prosthetic aortic tissue valves percutaneously, may alter valve selection, especially in patients between the ages of 60–70 years, in whom there is often a clinical dilemma as to the optimal prosthesis, balancing valve durability against the need for long-term anticoagulation.⁴

Percutaneous implantation of an aortic valve for degenerated bioprostheses may be safer than repeat surgical aortic valve replacement for native calcific aortic stenosis. First, precise percutaneous valve positioning is facilitated by the radio-opacity of the bioprosthetic frame.

Second, previous surgical removal of the native heavily calcified valve lessen the risk of underexpansion of the TAVI prosthesis and subsequent paravalvular aortic leak, and reduces the risk of valve material displacement covering a coronary ostium or inducing conduction disorder. Similarly, there may be a role for balloon expandable valve implantation from the transvenous or transapical routes for deteriorated mitral valve bioprostheses.⁵

This case illustrates that TAVI for a deteriorated aortic bioprosthesis is feasible in a patient who was not suitable for reoperation. Long term studies are required before firm recommendations can be made regarding the optimal treatment in this difficult patient group.

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