Tricuspid transcatheter valve-in-valve: an alternative for high-risk patients

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Abstract

Tricuspid valve disease is not uncommon. Some patients with tricuspid valve disease require tricuspid replacement with bioprosthesis and, over time, may require re-interventions. Transcatheter tricuspid valve-in-valve approach has emerged as an alternative to treat dysfunctional bioprosthesis. In this article, we report a case of a patient with four previous cardiac interventions presenting with tricuspid bioprosthesis dysfunction. The patient was treated with the transcatheter transatrial tricuspid valve-in-valve procedure. The procedure was successful with no residual leakage and a non-significant mean gradient. The patient recovered well and was discharged in 1 week. The procedure is a feasible alternative for high-risk patients. Selection and postoperative care are crucial for the outcome.

Keywords: Tricuspid valve • Surgery • Cardiac catheterization

INTRODUCTION

Tricuspid valve disease is not an uncommon disease. Most of the time, it is caused by annular dilatation and right ventricular enlargement, secondary to pulmonary hypertension that often accompanies mitral disease [1]. Besides the origin, the presence of significant tricuspid regurgitation often carries a major impact in survival and life quality, including severe right dysfunction symptoms.

Surgical approaches to tricuspid regurgitation include valve repair and replacement. Unfortunately, not all times are possible to perform an adequate repair: sometimes replacement is mandatory [2]. Re-intervention over the tricuspid valve carries considerable risk, especially because multiple co-morbidities often play a major role [2]. Transcatheter valve treatment has emerged as an alternative procedure for high-risk groups with consistent results [3].

The possibility of using a transcatheter valve inside a dysfunctional bioprosthesis is described as an alternative for re-operations [4, 5]. This technique has just a few descriptions in tricuspid position and consistent results are not available [6].

This report describes the use of a transcatheter transatrial valve-in-valve implantation into a dysfunctional bioprosthesis in the tricuspid position.

MATERIALS AND METHODS

A 65-year-old female patient was admitted at the emergency unit with exertional dyspnoea, peripheral oedema and ascites. Functional class had worsened over the past 3 months, despite multiple hospitalizations and intensive medical treatment. Chronic renal insufficiency, hypertension, chronic obstructive lung disease, atrial fibrillation, rheumatic fever and four previous cardiac interventions were present (1971, mitral comissurotomy; 1981, mitral valve comissurotomy (mitral restenosis) and tricuspid replacement; 1985, mitral valve (mitral restenosis) and tricuspid valve replacement (leaflet calcification); 1997, mitral valve replacement (mechanical St. Jude 25 mm, SJM, Inc., St Paul, MN, USA) (leaflet calcification) and tricuspid valve replacement (Biological porcine 29 mm, Braile Biomedical, Brazil) (leaflet calcification)).

Initial clinical and echocardiographic examination revealed a normal functional mitral prosthesis. Failed tricuspid bioprosthesis with leaflet rupture causing severe tricuspid insufficiency (transvalvular gradient of 15/8 mmHg). Pulmonary artery pressure was 35 mmHg and left ventricle ejection fraction was 0.43.

Clinical compensation attempts failed and surgical intervention was mandatory. Logistic EuroSCORE predicted 29.24% mortality. Based on previous experiences with the aortic valve and after informed consent, transatrial transcatheter tricuspid valve-in-valve implantation was performed. The procedure was approved by Institutional Review Board.

The procedure was performed in hybrid operation room under fluoroscopic and transoesophageal echocardiogram. The patient underwent general anaesthesia with single lumen ventilation. Right anterior minithoracotomy through the forth intercostal space was performed exposing right atrium. Purse string suture with Teflon pledges was placed to control bleeding.

Full-dose heparin was administered followed by clotting time control. Right atrium was punctured and a 6F vascular sheath was advanced into the right atrium. A hydrophilic guidewire was easily positioned inside the pulmonary trunk. The guidewire was replaced by a Super Stiff one and sheaths removed.
Figure 1: Braile Innovare transcatheter prosthesis. A stainless steel frame with bovine pericardium (20–28 mm).

Figure 2: (a) Transoesophageal echocardiogram. Prosthesis aligned to annulus. Full expansion. No regurgitant flow. (b) Computed tomography. Valve-in-valve prosthesis in position.
A 22F introducer was positioned in the right atrium. A 28-mm, bovine, stainless steel, balloon expandable Innovare Transcatheter Endoprosthesis (Braile Biomedical, Brazil) was crimped over a balloon and advanced inside the introducer sheath (Fig. 1).

Axial positioning of the prosthesis was achieved using fluoroscopic and echocardiography guidance. Without using rapid ventricular pacing, balloon was inflated and prosthesis deployed (Fig. 2). Prosthesis fixation was accomplished using the rigid annulus of the dysfunctional bioprosthesis.

The patient awoke and the orotracheal tube was removed in operation theatre. The patient was transferred to intensive care unit without inotropic support. No blood products were used.

RESULTS

Immediate post implant transoesophageal echocardiogram demonstrated a functional bioprosthesis, without any perivalvular or valvular leak, peak diastolic gradient 10 mmHg and mean diastolic gradient 5 mmHg. Follow-up (2 month) echocardiogram showed no perivalvular leak and diastolic gradients of 10 mmHg (peak) and 5 mmHg (mean) with a left ventricle ejection fraction of 0.57.

The patient recovered well and was transferred to ward after 1 day. After 1 week in the ward, the patient was discharged home. At 2-month follow-up, the patient is recovering well with New York Heart Association II and a significant decrease in right heart failure symptoms. Computed tomography confirmed the valve position (Fig. 2).

DISCUSSION

Re-operative procedures are a known risk factor increasing mortality and morbidity [7]. The possibility to treat valvular diseases less invasive is recently in focus after transcatheter techniques spreading. Treatment of dysfunctional bioprosthesis has been reported to be feasible with the valve-in-valve approach [4, 8].

Initial results using this approach are encouraging and until now reserved for older high-risk individuals [4]. Reports in young patients are dismal. Treatment of young patient suggests that the transcatheter valve-in-valve approach may be a safe alternative for patients with multiple re-operations or other medical conditions that increase the risk. Rheumatic fever patients are one of these since many present with multiple re-operations, pulmonary hypertension and other co-morbidities.

The transfemoral and transapical valve approaches have been used for aortic and mitral valve implantations. Unfortunately, due to alignment difficulty, these approaches are unsuitable for tricuspid intervention. Transatrial insertion of the catheter seems to be comfortable, with easy tricuspid valve crossing and perfect alignment.

Adequate valve sizing was easier compared with native aortic valve, since the dysfunctional radius is known. A major limitation is that tricuspid bioprosthesis is often of large diameter limiting the use of the currently available devices.

Results of transcatheter techniques are encouraging. The minimally invasive strategy offered benefits with a reduced blood product use and an intensive care unit stay, besides reducing mortality and morbidity.

The possibility of using valve-in-valve procedures to avoid conventional redo valves may in future increase the use of bioprosthesis. Transcateter valves may even be used inside a previous transcatheter valve.

Tricuspid valve-in-valve implantation is as feasible as mitral and aortic valve-in-valve implantations. The technique possibly provides a less-invasive approach especially in high-risk and multiple re-operative patients.

Conflict of interest: none declared.

REFERENCES