

# TRICUSPID VALVE REPLACEMENT IN INTRAVENOUS DRUG USERS

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## Abstract

Tricuspid valve replacement for infective endocarditis (TVE) in intravenous drug abusers (IVDAs) may pose special clinical challenges, since mechanical prostheses require lifelong anticoagulation therapy, and bioprostheses degenerate over time, especially in young patients. The Inspiris aortic bioprosthesis has been designed to reduce the rate of structural valve deterioration (SVD) and to improve durability. We describe three IVDAs with TVE undergoing tricuspid valve replacement with an inverted Inspiris valve, and discuss the potential advantages of this approach.

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## ABSTRACT

Tricuspid valve replacement for infective endocarditis (TVE) in intravenous drug abusers (IVDAs) may pose special clinical challenges, since mechanical prostheses require lifelong anticoagulation therapy, and bioprostheses degenerate over time, especially in young patients. The Inspiris aortic bioprosthesis has been designed to reduce the rate of structural valve deterioration (SVD) and to improve durability. We describe three IVDAs with TVE undergoing tricuspid valve replacement with an inverted Inspiris valve, and discuss the potential advantages of this approach.

## Background

The choice of valve prosthesis for tricuspid valve replacement in intravenous drug abusers (IVDAs) may pose special clinical challenges, since IVDAs are usually young, poorly adherent to therapy, and prone to continuing drug abuse. Mechanical prostheses are rarely preferred, since IVDAs with TVE are scarcely compliant to anticoagulation therapy. On the other hand, bioprostheses degenerate over time, especially in young patients (1, 2).

The Inspiris aortic bioprosthesis (Edwards Lifesciences, Irvine, Ca) is a bovine pericardial valve with a specific anticalcification treatment (RESILIA™) implemented to reduce the rate of structural valve deterioration (SVD) and to improve durability. Indeed, this prosthesis proved to be completely free from SVD at five-year follow-up (3). We describe three IVDA's undergoing tricuspid valve replacement (TVR) with an inverted Inspiris valve, and discuss the potential advantages of this approach. Informed consent was obtained. IRB approval was waived.

## Case 1

A 20-year-old patient with a history of IVDA and endocarditis underwent TVR with a Magna Ease (Edwards Lifesciences, Irvine, Ca) bioprosthesis. At the 4-year follow-up, the prosthesis showed signs of SVD. One year later, the patient developed dyspnea and fatigue. Echocardiography showed severe tricuspid stenosis and regurgitation. Cardiac CT excluded coronary artery disease (Figure 1). The patient refused oral anticoagulants. Considering his very young age (26 years at redo surgery) and the early failure of the previously implanted bioprosthesis, we offered him the off-label use of an Inspiris valve. Written informed consent was obtained.

The operation was performed through a right minithoracotomy on the beating heart, with femoro-femoral cardiopulmonary bypass. An inverted 29 mm Edwards Inspiris valve was implanted with pledgeted Ticon sutures. To avoid sutures' entrapment and facilitate the prosthesis housing, the tip of the three prosthesis struts was approximated with a 3/0 prolene suture, which was removed after tying the valve (Figure 2). The patient was easily weaned from bypass and the operation completed as usual.

The postoperative course was uneventful, and the patient was discharged on postoperative day 7. At the 3-years follow-up, the patient was alive and in good conditions. At the last echocardiogram there was no regurgitation and the mean transprosthetic gradient was 4 mmHg. Cardiac CT excluded the presence of subclinical thrombosis and/or calcific SVD (Figure 1).

## Case 2 and 3

Following the promising results obtained with the 1<sup>st</sup> case, we adopted the same strategy in two further patients. The first was a 35-year-old man undergoing his fifth operation for re-infection of the prosthetic valve with tricuspid stenosis. He had insulin-dependent diabetes and a history of lower limb ischemia with gangrene of the left toe. The second one was a 46-year-old woman with massive tricuspid regurgitation and pulmonary embolism. She had acute cardiogenic shock and was on high-dose inotropes on admission. The procedures were successful, and both patients were discharged to a rehabilitation facility on the 7<sup>th</sup> and 8<sup>th</sup> postoperative day, respectively. The control echocardiogram at follow-up (9 and 12 months, respectively) was satisfactory in both cases.

## Comment

The choice of the prosthetic valve in IVDA requiring TVR is challenging, since both mechanical and biologic prostheses have major limitations in this population. We have observed excellent early haemodynamics in three IVDA patients receiving an inverted Edwards Inspiris bioprosthesis in the tricuspid position. More importantly, promising results, including normal valve kinetics at transoesophageal echocardiogram in the absence of calcification / thrombosis at CT, were observed in the first patient at 3 years. Interestingly, in this same patient the previously implanted conventional pericardial bioprosthesis had shown evidence of severe calcific SVD as early as 4 years postoperatively.

IVDA patients with TVE are often young and scarcely adherent to the medical therapy. As a result, the re-infection rate with the consequent need for reoperation can be as high as 20-30%, and many of these patients finally require valve replacement (1). In a recent report on 6815 patients undergoing valve replacement for infective endocarditis, a history of IVDA was associated with reduced long-term survival and higher reoperation rate, irrespective of the prosthesis type (2).

Mechanical prostheses are rarely preferred in this population, since the management of anticoagulation therapy may be problematic. Moreover, the reduced pressure regimen of the right heart may increase *per*

sethe risk of valve thrombosis (4).

In recent years, several factors have promoted a wider adoption of stented bioprostheses at younger ages. Anti-mineralization treatments have improved durability; transcatheter valve-in-valve implantation has reduced the number of anticipated redo procedures; and, last but not least, young patients are well informed, and often ask for a biologic substitutes to avoid anticoagulation and maintain an active lifestyle. However, bioprostheses are rarely recommended in patients younger than 50, since younger age at the time of surgery is one of the main risk factors for SVD (5).

SVD is a multifactorial process, promoted by the aldehyde moieties and phospholipids that remain after fixation, leading to the deposition of calcium salts in the prosthetic leaflets' tissue (5). The RESILIA<sup>TM</sup> pericardium undergoes a phospholipids removal process and stable capping that permanently blocks calcium binding sites. The RESILIA<sup>TM</sup> tissue was highly effective in reducing leaflets calcification in animal models and showed excellent performance and safety in two clinical trials, and is currently investigated in a registry of patients younger than 60 years (6).

In the lack of dedicated tricuspid valve substitutes, mitral bioprostheses are implanted in the tricuspid position, since aortic bioprostheses have a higher profile. However, the implantation of the Inspiris valve did not require any special attention in our patients, demonstrating the feasibility and safety of this approach. The prosthesis was implanted as usual, with pledgetted mattress sutures on the atrial side. At the level of the atrioventricular node, the sutures were passed through the base of the septal leaflet to minimize the risk of conduction disturbances.

Even if very encouraging, our results should be interpreted with caution, since they are derived from only 3 patients (with only one of them with a follow-up longer than 1 year). However, the very good haemodynamics and the absolute absence of calcium deposition at 2-year CT imaging, along with the history of rapid-onset calcific SVD of the previously implanted bioprosthesis in the same patient, in our opinion support a wider adoption of the Inspiris valve in IVDAs needing TVR. Further studies with longer follow-up are needed to validate this strategy.

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## Figure legends.

Figure 1. a: pre-operative cardiac CT demonstrating severe calcific SVD (c). b: 2-years follo-up cardiac CT (inspiris bioprosthesis). There are no signs of leaflets' calcification or thrombosis and the valve is normofunctioning (d).

Figure 2. a. The tricuspid valve is approached through a right minithoracotomy. After removal of the degenerated bioprosthesis, 2/0 tycron pledgetted mattress sutures have been passed through the annulus. b. The sutures are passed upside-down in the inverted bioprosthesis. (c) A prolene suture is passed through the tip of the prosthesis struts and exteriorized through the prosthesis, to be cut and removed after tying the valve (d).





