A Novel Approach to Tricuspid Valve Replacement: The Upside Down Stentless Aortic Bioprosthesis

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Background. **Tricuspid valve replacement (TVR) is a rarely needed operation. Choices between mechanical and biological prosthesis still generate controversy. We present our initial clinical experience with a stentless aortic root placed inverted in the tricuspid annulus.**

Methods. **Between August 2000 and September 2003, TVR for severe tricuspid insufficiency was performed in 8 patients. Indications were infective endocarditis (7) and iatrogenic damage (1). Mean age was 42.2 years old (20 to 58 years old). Five patients were male and 3 patients had a concomitant procedure (mitral valvuloplasty, coronary bypass grafting, and aortic valve replacement). A stentless aortic root, size 27 mm (n = 5) or 29 mm (n = 3) was placed inverted in the tricuspid position after the valsalva sinuses were scalloped. Interrupted 4-0 polypropylene sutures were used between the tricuspid valve annulus and the sewing ring. The struts equivalent on the stentless valve were anchored to the septal, anterior and posteroinferior wall of the right ventricle using 5-0 PTFE pledgeted sutures.**

Results. **Hospital survival was 100% and mean hospital stay was 12.5 days (3 to 18 days). Intraoperative and follow-up echocardiograms revealed no stenosis or insufficiency. Mean follow-up was 17.2 months (1–38 months). There were 3 late deaths due to continued IV drug use (n = 2) and end-stage renal failure (n = 1).**

Conclusions. **This is a novel surgical alternative for a very high risk population. Potential advantages over current options include minimization of blood contact with nonbiological surfaces, preservation of annular motion, freedom from anticoagulation, and a theoretical lower rate of calcification.**

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Tricuspid valve insufficiency can usually be managed medically or with conservative surgery and tricuspid valve replacement (TVR) is seldom needed. When the need for valve replacement arises, optimal tricuspid valve substitutes are not available.

Stented biological valves risk early failure due to rapid degeneration and calcification while mechanical valves require anticoagulation. Both types of valves freeze the tricuspid annulus preventing normal systolic motion [1]. We present a simple technique for TVR with the use of a stentless aortic root placed inverted in the annular position.

Material and Methods

This is a retrospective review of our current clinical practice. Informed consent was obtained from all patients. Institutional Review Board approval was sought and an exemption granted providing patient identifiers were removed from the data collection.

Since August 2000, 8 consecutive patients (male:female = 5:3), ages 20 to 58 years old (mean 42.2 years old), underwent TVR with a stentless aortic root xenograft (Freestyle, Medtronic, Minneapolis, MN), 27 mm (n = 5) or 29 mm (n = 3) in diameter. Indications for surgery were endocarditis resistant to antibiotic management with symptomatic tricuspid insufficiency and pulmonary embolization in 7 patients. The remaining patient developed severe tricuspid insufficiency after iatrogenic damage to the tricuspid valve by catheter manipulation of a stent lost and trapped in the tricuspid apparatus. Concomitant procedures included mitral valvuloplasty (n = 1), coronary artery bypass grafting times three (n = 1), and aortic valve replacement (n = 1).

Technique

As umbilical tapes around the cavae are tourniqueted down, the right atrium is entered while the heart is beating to minimize cross-clamp time. The infected tricuspid valve and vegetations are excised and removed and the right ventricular cavity is flushed with cold saline to washout residual debris.

The largest fitting stentless aortic root xenograft is tailored appropriately (Fig 1). At this time the aorta is cross-clamped and antegrade blood cardioplegia is administered. Interrupted sutures with pledgets (4-0 polypropylene) are placed between the tricuspid annulus and the xenograft-sewing ring. Care is taken to position the graft in such a way that, once the valve is seated in the annulus, the right ventricular outflow tract will align with one of the valve sinuses.

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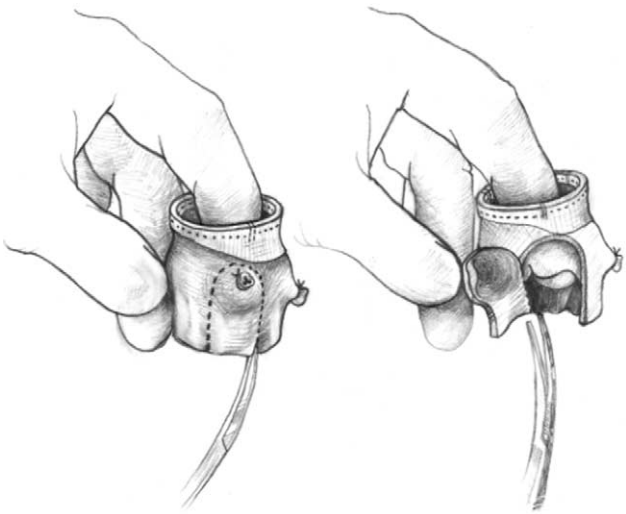

Fig 1. Excess aortic tissue and the wall component of all three sinuses of valsalva being removed.

The graft is lowered into the tricuspid annulus and the sutures are tied. The proper location for anchoring the graft commisures in the right ventricular (RV) wall is identified and the fixation sutures are placed on the septal, anterior, and posteroinferior walls of the RV using CV-5 PTFE (W. L. Gore, Flagstaff, AR) pledgeted sutures (Figs 2 and 3).

Cardiopulmonary bypass was rapidly weaned without the use of inotropic support in all cases. Ischemic time and blood cardioplegic arrest, although a concern in any procedure, is minimized by resection of the infected valve and preparation of the new valve under a beating heart.

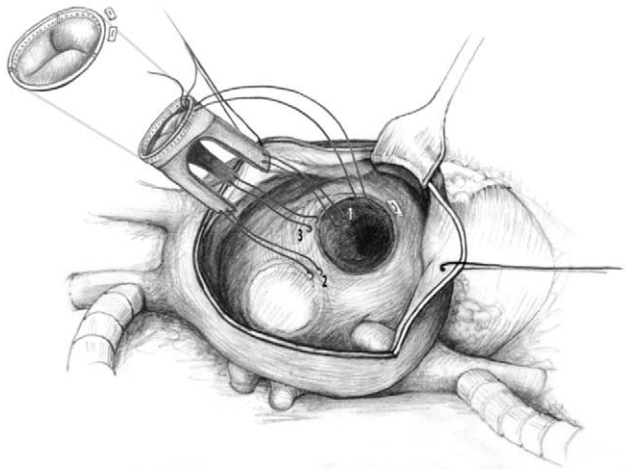

Fig 2. Interrupted 4-0 polypropylene sutures with pledgets placed between the tricuspid annulus and the xenograft-sewing ring. (For clarification purpose, 1-2-3 *indicates anchoring sutures for the valve commisures, although in reality those are placed after seating the valve.)*

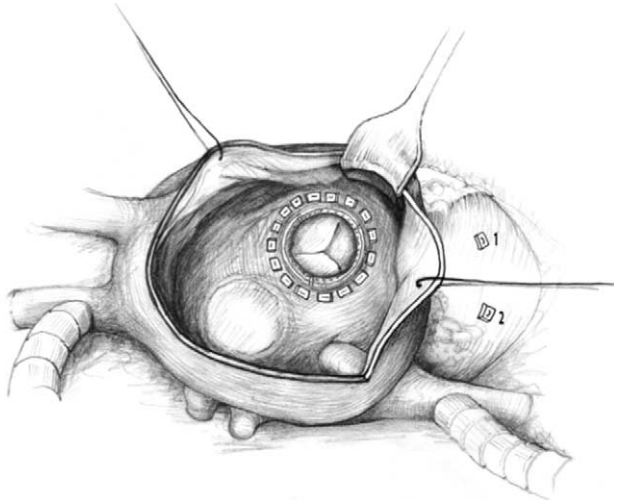

Fig 3. Valve is in position. Anchoring sutures for the commisures are placed on the anterior, posteroinferior, and septal walls of the right ventricle. Sutures 1 and 2 are exteriorized and tied off over pledgets.

Results

There were no hospital deaths. Transesophageal echocardiogram performed after discontinuation of bypass in all patients showed no evidence of tricuspid insufficiency or stenosis. Being a new technique the mean cross-clamp time was 81 minutes (range 65–94 minutes), and mean bypass time was 115 minutes (range 80–156 minutes).

Infected patients were discharged on long-term intravenous antibiotics or antifungal agents, either to home or to rehabilitation. No anticoagulation regimen was instituted.

Mean follow-up was 17.2 months (1 to 38 months). Transthoracic echocardiogram was performed at last visit in all surviving patients. In all cases there was no gradient across the valve, and no signs of insufficiency. Ventricular function was unchanged from the preoperative ultrasound. Long-term there were 3 deaths at 38, 24, and 2 months due to continued IV drug use (n = 2) and end-stage renal failure (n = 1).

Comment

Over 95% of diseased tricuspid valves are amenable to repair [2]. Surgical indications for TVR in the presence of endocarditis (bacterial or fungal) are antibiotic resistance, pulmonary embolization and severe tricuspid insufficiency [3]. Patients who may benefit from a TVR are commonly hardcore IV drug users, and in general belong to a group of the population with very low socioeconomical status and little social support. Medical compliance and rehabilitation are rare, and the type of prosthesis chosen should minimize the amount of nonbiological surfaces (likely to harbor future bacterial loads) while avoiding the cost and risk of anticoagulation.

At our institution TVR represents only 2.1% of all valve

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