

# Ex vivo aortic valve replacement before orthotopic heart transplantation



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Disclosures: The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

Received for publication Aug 13, 2021; accepted for publication Jan 12, 2022; available ahead of print Jan 26, 2022.

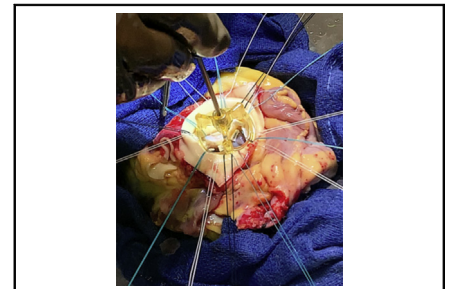
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JTCVS Techniques 2022;12:118-20

2666-2507

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<https://doi.org/10.1016/j.jtc.2022.01.008>



Backbench ex vivo donor aortic valve replacement before orthotopic heart transplantation.

## CENTRAL MESSAGE

Backbench ex vivo aortic valve replacement is an effective and easily implemented strategy to increase the utilization of donor hearts that would otherwise be declined because of aortic valve pathology.

▶ Video clip is available online.

A 54-year-old blood type O man with nonischemic cardiomyopathy complicated by ventricular tachycardia underwent cardiac resynchronization therapy and left ventricular assist device implantation 8 months before being listed for heart transplantation. After 14 days on the waitlist, a suitable donor organ became available from a 36-year-old blood type O man whose cause of death was anoxic brain injury. Donor transthoracic echocardiography showed a bicuspid aortic valve with grade III insufficiency and ejection fraction of 55%. Because the recipient was a status 3 blood type O candidate, a population with long wait times and frequent waitlist adverse events, the donor heart was considered to be a suitable match.

## SURGICAL TECHNIQUE

The femoral vessels were accessed percutaneously for safety during mediastinal reentry. When cardiopulmonary bypass (CPB) was established, the native heart and ventricular assist device were explanted in the standard fashion.

Upon inspection of the donor heart on the backbench while on saline slush, the aortic valve was in fact bicuspid and heavily calcified along the leading edges (Figure 1). A longitudinal aortic incision was made to 2 mm above the annulus, directed toward the noncoronary cusp (Video 1). The calcified leaflets were excised and a 27-mm bioprosthetic valve

was implanted. The longitudinal aortic incision was closed with horizontal mattress sutures using pledgeted 4-0 prolene, followed by running 4-0 prolene (Figure 2). After completing the aortic valve replacement (AVR), the donor heart was removed from the slush and implanted in the typical bicaval fashion. Total allograft ischemic time was 279 minutes, warm ischemic time 39 minutes, and total CPB time 204 minutes. Post-CPB transesophageal echocardiography revealed a 4 mm Hg mean gradient across the bioprosthetic valve. The patient had an uneventful postoperative course and was discharged on postoperative day 18. The patient has returned to normal activity as an outpatient and remains healthy 12 months post-transplant. The patient provided written consent for the reproduction of his health information related to this case. Following is the clause included on our institution's procedural consent form: "I consent to the taking of pictures, videotapes, or other electronic reproductions of my medical or surgical condition or treatment, and the use of the pictures or videotapes for treatment or internal or external activities consistent with Stanford Healthcare's mission, such as education and research, conducted in accordance with Hospital policies."



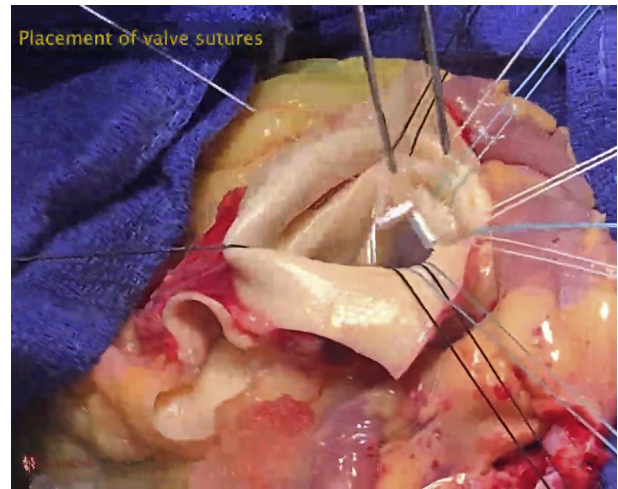
**FIGURE 1.** Excised donor bicuspid aortic valve cusps, severely calcified.

## DISCUSSION

Various attempts at expanding the heart transplantation donor pool have only modestly improved utilization rates.<sup>1,2</sup> Without sweeping policy changes, the simultaneous implementation of multiple strategies is needed to substantially improve utilization. To that point, echocardiographic findings other than ejection fraction remain poorly reported in United Network for Organ Sharing donor data, and therefore, an unknown number of hearts are declined by transplant centers because of correctable valvular abnormalities. Although several previous reports have described repair of donor mitral<sup>3,4</sup> and aortic<sup>5</sup> valves and AVR, there are few reports on the technical considerations of valve replacement at the time of orthotopic heart transplantation.<sup>6-8</sup>

As in elective cardiac procedures, in general, every attempt should be made to repair the valve to avoid the risk of structural valve degeneration or lifelong anticoagulation. Equally important in the appropriate application of this technique is an honest assessment of the additional time required to perform a backbench AVR in the context of the expected allograft cold ischemic time. In contrast to previous reports,<sup>6</sup> in which the AVR is performed after the left atrial, bicaval, and pulmonary arterial anastomoses, we believe that our technique of performing the AVR on the backbench while the heart remains on ice minimizes the warm ischemic time and might reduce crossclamp time. At our center, we have found that the backbench AVR minimally increases the cold ischemic time by no more than 20 minutes.

The surgeon must remain cognizant of the potential for patient prosthesis mismatch and should size the valve according to the recipient, while ensuring the valve can be seated properly within the donor's annulus. Quantitative



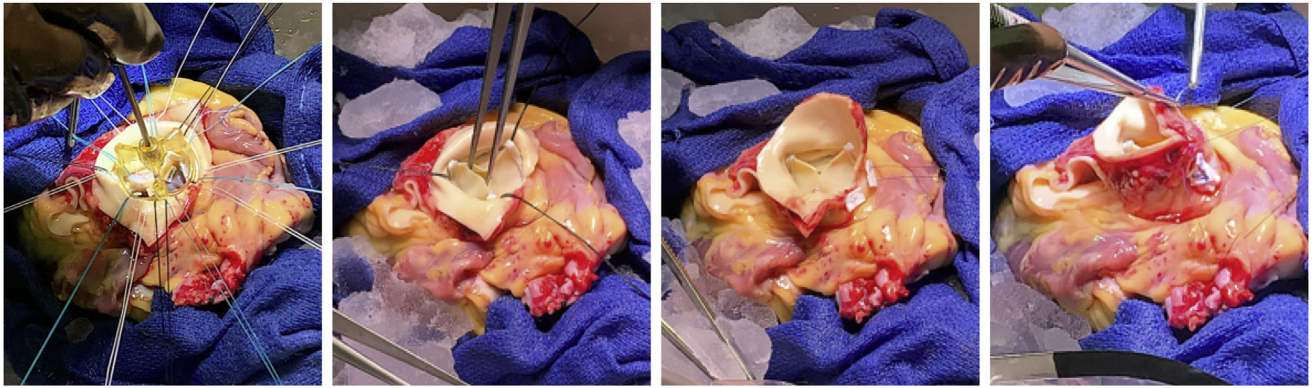
**VIDEO 1.** Description of surgical technique of backbench aortic valve replacement before orthotopic heart transplantation. Video available at: [https://www.jtcvs.org/article/S2666-2507\(22\)00036-0/fulltext](https://www.jtcvs.org/article/S2666-2507(22)00036-0/fulltext).

assessment of the donor's echocardiogram before an offer of acceptance is essential to avoid patient prosthesis mismatch or be faced with a decision between root enlargement versus replacement on an ischemic heart. Additionally, the accepting center must consider the caliber of the donor and recipient ascending aorta, because the diameter of the distal donor aorta will be slightly narrower after closure of the longitudinal aortic incision, which has the potential to create an aortic size mismatch between donor and recipient.

In this report we attempt to clarify the procedural decision-making and surgical technique of concomitant backbench AVR and orthotopic heart transplantation. Caution should be exercised when applying this strategy to young recipients who might require multiple subsequent valvular interventions, patients with significant mismatches in the caliber of the ascending aorta, and donor organs with long cold ischemic times. With proper donor and recipient selection, ex vivo valve replacement at the time of transplantation can be performed expeditiously and could enable utilization of high-quality donor allografts that would have otherwise been declined because of valvular heart disease.

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**FIGURE 2.** From left to right, after a longitudinal aortic incision above the donor's noncoronary cusp, annular sutures were placed in the typical fashion, followed by implantation of the valve. The valve is inspected to ensure that it is well seated and secure without left ventricular outflow tract obstruction. Using pledgeted 4-0 prolene, horizontal mattress sutures are placed across the longitudinal aortic incision followed by a running 4-0 prolene oversew.

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