

Bench Replacement of Donor Aortic Valve Before Orthotopic Heart Transplantation

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Organic valve disease has been considered an absolute contraindication for acceptance as a donor heart. However, the severe shortage of donor hearts has prompted the use of marginally acceptable hearts to maximize the use of donor hearts. This report concerns a patient with repeated left ventricular assist system complications who underwent successful heart transplantation with a marginal donor heart requiring concomitant aortic valve replacement for mild aortic stenosis due to a calcified congenitally bicuspid valve. *J Heart Lung Transplant* 2009;28:981-3. Copyright © 2009 by the International Society for Heart and Lung Transplantation.

The severe shortage of donor hearts has prompted the use of marginally acceptable hearts to maximize the use of donor hearts.¹ We report a case of successful heart transplantation of a donor heart with bicuspid aortic valve and mild aortic stenosis that required bench replacement of the aortic valve.

CASE REPORT

A 21-year-old woman with dilated cardiomyopathy underwent Toyobo paracorporeal left ventricular assist system (LVAS; Nipro, Tokyo, Japan) implantation and was placed on the waiting list for heart transplantation. During the long-term support by the LVAS, she presented with repeated bacteremia caused by infection at the inflow cannula exit site, subarachnoid hemorrhage, and cerebral embolism after bacteremia. She recovered from the cerebrovascular events only with mild neurologic deficiencies.

A donor heart became available 853 days after LVAS implantation. The donor was a man in his late 30s who was pronounced brain dead after a subarachnoid hemorrhage. Initial cardiac evaluation with echocardiography revealed bicuspid aortic valve, mild aortic stenosis, and mild LV hypertrophy (LVH; [Figure 1A, B](#)). The peak pressure gradient across the aortic valve was 21 mm Hg. The thickness of LV wall was 11 mm at the interventricular septum and 13 mm at the posterior wall. Results

of an electrocardiogram did not meet standard criteria of LVH.

The retrieving team observed normal LV function and no palpable coronary artery disease. We discussed the details of the aortic valve disease with the recipient and her family. In view of the patient's deteriorating condition with repeated LVAS-related complications, they agreed to proceed with the heart transplantation and possible concurrent donor aortic valve replacement. They chose a mechanical valve rather than a bioprosthetic valve because of its durability.

The donor heart was retrieved in the standard fashion, and a congenital bicuspid aortic valve with severe calcification of 1 leaflet was identified ([Figure 2A, B](#)). The heart was transported to our hospital, and then the valve was excised and replaced with a 21-mm ON-X mechanical valve (On-X Life Technologies, Inc., Austin, TX) during a bench procedure ([Figure 2C](#)). Cardiac protection during the valve replacement was done by immersion in slush solution. Thereafter, implantation with a bicaval method was performed. The time for bench replacement of the aortic valve was 30 minutes, and the total ischemic time of the donor heart was 225 minutes.

The patient was weaned from cardiopulmonary bypass with a small amount of inotropic support. Her post-operative course was uneventful, and she left the intensive care unit 5 days after the transplantation. Warfarin was added to the standard post-transplant medication regimen. Because of the muscle atrophy caused by the long bed rest before transplantation, rehabilitation took long time and she was discharged home 89 days after heart transplantation.

The patient remains well more than 8 months after transplantation and is in New York Heart Association functional class I. Serial echocardiography showed good prosthetic valve and ventricular function. Ejection fraction was 57%, and LV wall thickness was 11 mm at both interventricular septum and posterior wall ([Figure 1C](#)).

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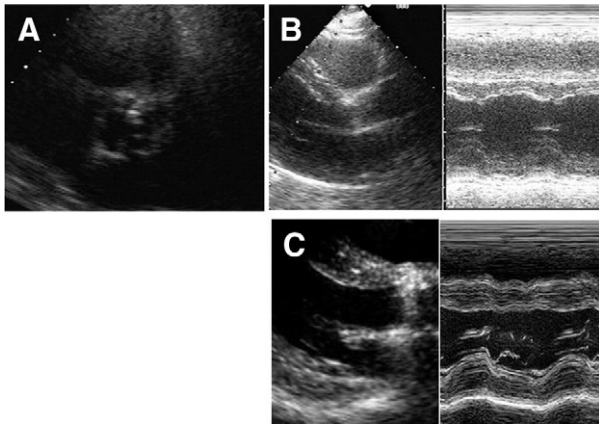


Figure 1. (A) The initial donor heart evaluation with echocardiography revealed calcification of the aortic valve and mild aortic stenosis, with a transaortic valve velocity of 2.3 m/sec. (B) Donor heart echocardiography also revealed mild left ventricular (LV) hypertrophy, with interventricular septum dimension of 11 mm and LV posterior wall dimension of 13 mm. The size and contraction of the heart was normal, with LV end-diastolic (LVED)/end-systolic (LVES) dimension of 50/33 mm and LV ejection fraction of 65%. (C) Postoperative echocardiography revealed good prosthetic valve function. LVED/LVES dimension was 43/30 mm and the LV ejection fraction was 57%. The interventricular septum dimension was 11 mm, and the LV posterior wall was 11 mm.

DISCUSSION

The presence of organic valve disease has been considered an absolute contraindication for acceptance as a donor heart.² However, as the heart transplant waiting list continues to expand, the shortage of cardiac donors has forced the organ donor criteria to be expanded. Although several recommendations have been made to expand the donor pool effectively without increasing the risk of adverse outcomes,¹ the use of donor hearts with valvular dysfunction has been rarely discussed. Only several institutions have reported successful experiences with bench repair of the mitral valve³ or tricuspid valve⁴ before heart transplantation and mitral or tricuspid valve replacement after heart transplantation.⁵

The report of aortic valve disease is more scant. Navia et al⁶ reported aortic valve repair during heart transplantation for moderate central aortic regurgitation from a donor with normal LV function. Aortic valve replacement during transplantation has been reported for new-onset aortic regurgitation diagnosed at the conclusion of the implant.⁷ The aortic valve was a congenital bicuspid valve, and the regurgitation was due to torsion of the aortic root during the heart transplantation procedure. The other group reported “unintended” concomitant aortic valve replacement for severe aortic stenosis and LVH that was not recognized at the time of organ procurement.⁸ Significant reduction in LV mass was documented in an 18-month follow-up period. However, the authors commented that the offered allograft would have been

rejected for transplantation if the valvular disease had been recognized at the time of organ procurement. In our patient, a marginal donor heart with congenital bicuspid aortic valve with stenosis, which was recognized at the time of organ procurement, was successfully used concomitantly with aortic valve replacement.

The use of the mechanical valve in a patient who needs regular endomyocardial biopsies after transplantation may be controversial because the therapeutic warfarin required for a mechanical valve can expose the patient to increased risk of bleeding. The risk of structural valve deterioration of aortic bioprosthesis is known to be higher in younger patients. A rate of reoperation as high as 50% in 15 years is reported in 25-year-old patients.⁹ On the other hand, 10-year survival rate of heart transplant recipients in their 20s is more than 50% and improving over the years.¹⁰ The longevity of the heart graft could be longer than that of an aortic bioprosthesis. The drawbacks of warfarin use were carefully discussed with the patient and her family, who chose a mechanical valve rather than a bioprosthetic valve. A bioprosthesis could also be used in such circumstances if its longevity were expected to exceed that of the expected survival of the heart recipient, thus avoiding the added risk of anti-coagulation with warfarin.

LVH has been analyzed as a risk factor for short-term and long-term graft survival.¹ Peri-operative risks are significantly increased if echocardiographic evaluations show a wall thickness > 13 mm and standard electrocardiogram criteria are present.¹ Although the donor heart had mild LVH, the heart did not meet the standard electrocardiogram criteria and the wall thickness was 11 to 13 mm. Moreover, expected ischemic time was shorter than 4 hours even with the added time of bench replace-

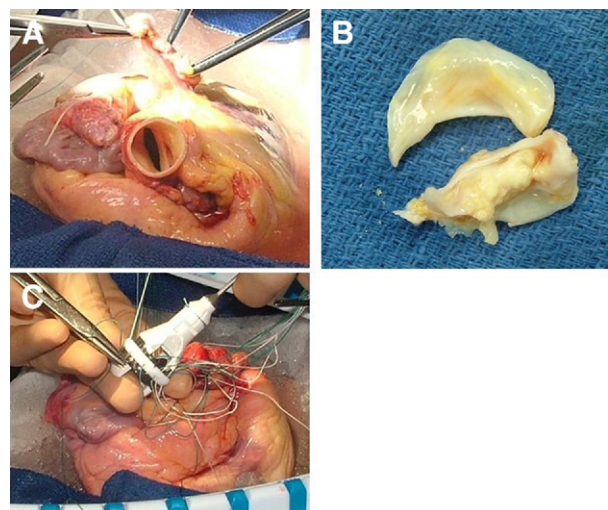


Figure 2. (A) Inspection of the donor aortic valve revealed congenital bicuspid valve. (B) Severe calcification of one leaflet was observed. (C) Bench replacement of the aortic valve with mechanical valve was performed before the heart transplantation.

ment of the aortic valve. We considered the heart acceptable for these reasons.

The use of a donor heart with aortic stenosis and LVH may still be controversial, especially in a young recipient as in the present report. The shortage of donor hearts is much more severe in Japan than in other countries. All who undergo heart transplantation are critically ill, and the average waiting time is more than 2 years. Considering the deteriorating condition of our patient, with repeated bacteremia and cerebrovascular complications related to the LVAS support and the expected additional waiting time when declining the donor heart, we thought acceptance of the marginal donor heart was more beneficial for the patient. However, we still consider this practice could only be justified in situations where there is urgent need for a donor, such as a deteriorating recipient condition, and only be considered acceptable to those who accepted and consented to the possible added risk with full informed consent.

DISCLOSURE STATEMENT

There were no significant disclosures provided by the authors.

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