Cardiac transplantation remains the most effective therapy for end-stage heart failure in appropriate candidates, with a median posttransplant survival of 10 years. At any given point of time there are ≈3000 candidates on the heart transplant waiting list in the United States with annual mortality on the waiting list ≈15%. The number of heart transplants performed in the United States per year has been fairly constant at ≈2500. In spite of this, many donor hearts remain unused. Bench repair of mitral valves remains rarely practiced and significant mitral valve regurgitation (MR) remains a standard contraindication to use of a donor heart.

Case 1
A 53-year-old male donor who had a cerebral infarct became available for a 61-year-old man with blood group O who received left ventricular assist device, Heartmate II (Thoratec, Pleasanton, CA), for decompensated dilated cardiomyopathy. The donor coronary angiogram was normal. Donor transthoracic echocardiogram (TTE) showed inferior wall hypokinesis, interventricular septum 1.15 cm, left ventricular ejection fraction (LVEF) 55%, and moderate MR with a posteriorly directed jet (Figure 1).

Bench analysis of the mitral valve showed a dilated annulus. Saline test revealed a central leak caused by inadequate leaflet coaptation secondary to annular dilatation and leak through prominent indentations in the posterior leaflet. (Carpentier type I dysfunction). The heart was kept in ice, and continuous retrograde cold blood cardioplegia was perfused. The indentations in the posterior leaflet were closed. On saline test now there was no leak through the indentations; however, there was persistent central leak. A 27-mm ATS annuloplasty band (Medtronic, Minneapolis, MN) was placed. Saline test showed no residual leak across the mitral valve (Figure 2A and 2B). The donor heart was then implanted with bicalvarial technique (ischemic time 127 minutes). After weaning cardiopulmonary bypass, the heart was then implanted with bicaval technique (ischemic time 127 minutes). After weaning cardiopulmonary bypass, the heart was transplanted uneventfully. The predischarge echocardiogram 23 days after surgery showed LVEF 66%, minimal MR. At 18 months the patient remains well, in New York Heart Association class I with similar TTE.

Case 2
A 58-year-old woman with dilated cardiomyopathy had a body mass index of 38 kg/m². A 30-year-old donor who had intracranial hemorrhage was identified. TTE showed good function, mild mitral valve prolapse, and moderate central MR. Intraoperative mitral valve analysis showed annular dilatation and tethering of P2, P3 scallops of posterior leaflet (type I and IIIb dysfunction). Bench repair was performed with a true-sized 27-mm ATS annuloplasty band. The heart was transplanted uneventfully. The predischarge echocardiogram 23 days after surgery showed LVEF 69%, minimal MR. At 14 months he remained in New York Heart Association class I with similar TTE.

Case 3
A 29-year-old donor who had astrocytoma became available for a 58-year-old man with dilated cardiomyopathy, blood group O. Donor echocardiogram showed LVEF 53%, mild-to-moderate MR with slight bileaflet thickening with normal motion. Analysis of the donor mitral valve revealed annular dilatation. The heart was transplanted uneventfully after successful bench mitral valve repair with a 28-mm Carpentier-Edwards Physio ring (Edwards Lifesciences, Irvine, CA). The most recent TTE of this patient, 7 years after transplant, showed minimal MR with LVEF 75%.

Discussion
Risher et al in 1994 first described mitral commissurotomy of donor heart before transplantation. Since then, over the last 17 years there have been only few cases of bench mitral valve repairs.2

The surgeon should review the donor echocardiogram to determine the exact nature and pathology of MR in otherwise acceptable donor hearts. If the mechanism of MR is simple,
then bench repair can be performed adding only a few more minutes to warm ischemia time before transplantation.

We extended donor criteria for predicted long wait times (blood group O, high body mass index) or concerns about complications of left ventricular assist device support. A heart with a bench-repaired mitral valve may provide better odds of long-term survival compared with continued waiting on the list.

Disclosures
Dr Adams is co-inventor of the Tri-Ad Annuloplasty Ring (Medtronic Inc, Minneapolis, MN) and co-inventor of the Carpentier Edwards Physio II ring (Edwards Lifesciences, Irvin, CA). The remaining authors have no disclosures.

References

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Bench Mitral Valve Repair of Donor Hearts Before Orthotopic Heart Transplantation
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Supplemental Material

Supplemental Figure

Spectral Doppler tracing of mitral regurgitation in Case 1.

Video Legends

Movie 1. Transthoracic echo, long axis parasternal view of donor heart in Case 1.

Movie 2. Coronary angiogram of donor in Case 1; left main stem injection.

Movie 3. Coronary angiogram of donor in Case 1; right coronary artery injection.