HETEROTOPIC HEART TRANSPLANTATION

A Life-Saving Procedure with a Size-mismatched Donor

SHU-HSUN CHU, M.D., CHANG-HER TSAI, M.D., SHOEI-SHEN WANG, M.D.
HANG CHANG, M.D., YUAN-TEN LEE, M.D., CHIAU-SUONG LIAU, M.D.
MING-FONG CHEN, M.D., WEN-JONE CHEN, M.D., CHII-MING LEE, M.D.
CHI-LONG CHEN, M.D., AND SHU-WEN HOW, M.D.

A 32-year-old B-type male weighing 60 kg suffered from end-stage dilated cardiomyopathy. Although aggressive medical treatment with dobutamine 21 μ g/kg/min, dopamine 17 μ g/kg/min, digoxin 0.25 mg iv once daily, furosemide 40 mg iv every 6 h, and bumetanide 0.5 mg iv every 6 h were given, he was finally ventilator dependent for the last 3 weeks until a B-type donor weighing 42.5 kg was found. Because of the 29.2% weight mismatch, a heterotopic heart transplantation was performed. Posterior plication mitral annuloplasty was also performed to correct the severe mitral regurgitation of the recipient heart. Postoperatively the patient remained respirator dependent for 17 days and was finally discharged in good condition on the 46th postoperative day.

THE first clinical heterotopic heart transplantation was performed in 1974 by Barnard^{1,2} who also reported the largest series of this procedure³. Barnard preferred heterotopic to orthotopic heart transplantation because in heterotopic transplant the recipient's heart acted as a built in cardiac assist and would maintain life during severe acute rejection of the donor heart^{4,5}. Although orthotopic heart transplantation is widely accepted as a routine procedure, heterotopic heart transplantation remains a reliable option for special indications^{6,7}. This paper presents a case of heterotopic heart transplantation for end-stage dilated cardiomyopathy from a size-mismatched donor. The recipient heart also underwent post-

erior plication mitral annuloplasty to correct mitral regurgitation.

CASE REPORT

Under the impression of dilated cardiomyopathy, a 32-year-old B-type male patient weighing 60 kg was transferred to our hospital. Chest X-ray showed cardiomegaly with a cardiothoracic ratio of 0.7 (Fig. 1). Echocardiogram showed dilation of all chambers and severe mitral and tricuspid regurgitation. Left ventriculogram revealed a remarkably dilated left ventricle with diffuse hypokinesia (left ventricular score being 15). Endomyocardial biopsy from the right ventricle showed myocardial degeneration. Abdominal echogram revealed hepatomegaly with dilatation of the inferior vena cava (2.6 cm in diameter) and hepatic veins. No abnormal renal echo was noted. Cytomega-

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Department of Surgery, Internal Medicine, and Pathology, National Taiwan University Hospital, Taiwan, Republic of China

Mailing address: Shu-Hsun Chu, M.D., Department of Surgery, National Taiwan University Hospital, 1, Chang-Te St. Taipei, Taiwan, Republic of China

Fig.1. Preoperative chest film showed marked cardiomegaly.

Fig.2. Postoperative chest film revealed that the donor heart (DH) was in the right chest cavity, while the recipient heart (RH) in original position.

lovirus titer was 1 : 64 (+), Herpes simplex virus titer was also 1 : 64 (+), Varicella-zoster virus titer was 1 : 32 (+), EB virus IgG antibody was 1 : 80 (+). No neurologic problems were detected. He was accepted by the Heart Transplantation Review Board and waited for transplantation at home.

Because of progressive heart failure he was admitted once again. Despite aggressive treatment with digoxin 0.25 mg iv once daily, furosemide 40 mg iv every 6 h, bumetanide 0.5 mg iv every 6 h, dobutamine 21 mcg/kg/min, and dopamine 17 mcg/kg/min, he was finally intubated and put on a volume-control ventilator for 3 weeks until the size-mismatched donor appeared on June 26, 1989.

The donor was a 28-year-old B-type male patient weighing 42.5 kg. His bilateral legs showed atrophic changes due to sequelae from previous poliomyelitis. Brain death was diagnosed on the 7th day after a traffic accident. After all legal procedures for

organ donation had been completed, the heart procurement was performed at a distant hospital. The donor heart was arrested with St. Thomas cardioplegia and was placed in a plastic bag filled with cold saline. The first bag was placed in a second bag containing cold saline, which was placed in a cooler filled with ice.

Posterior plication mitral annuloplasty for mitral regurgitation was performed in the recipient heart.⁸ Then heterotopic heart transplantation was performed: the left atrial orifice of the donor was anastomosed to the recipient left atriotomy wound. After right atrial anastomosis and aortic anastomosis, a 26 mm woven Dacron vascular graft was then interposed between the donor and recipient hearts. The recipient heart resumed spontaneous beating after reperfusion while the donor heart required several instances of counter-shock.

The patient's postoperative hemodynamic condition improved greatly although he suf-

Fig.3. The donor heart was dominant in contributing cardiac output. From top: first pannel is ECG of the donor heart; second one is ECG of the recipient heart; the third one is arterial pressure which is dominated by donor heart (D).
R: recipient

ferred from right lower lobe atelectasis. Dobutamine was discontinued 10 h after transplantation. Dopamine was soon tapered to 3.5 mcg/kg/min to maintain good renal blood flow during cyclosporine infusion. He was finally taken off the respirator on the 17th postoperative day. Follow-up chest X-ray showed clear lung fields with the donor heart in the right pleural cavity and a reduced recipient heart size (Fig. 2) in the native position.

Triple immunosuppression was given. Azathioprine was given to keep the white blood cell count around 5,000/mm³. Cyclosporin A was given by continous intravenous infusion and kept at whole blood levels between 300–500 ng/ml (by high performance liquid chromatography). Methylprednisolone 1 gm was given just before release of the aortic clamp, and then 125 mg was given every 8 hours for 3 doses. Oral prednisolone 50 mg per day was then given and tapered off on the 17th postoperative day. Because of grade 5/10 rejection⁹ oral prednisolone was resumed at 10 mg per day on the 31th postoperative day.

Although echocardiographic examination

and monitoring of changes in lymphocyte subpopulations,^{10,11} prelymphoblasts and lymphoblasts,¹² and transferin receptors¹³ of the peripheral blood were performed frequently to detect rejection, endomyocardial biopsy was performed weekly. The severity of acute rejection was scored according to the 10 grade system of the Texas Heart Institute.⁹ The first biopsy revealed grade 4 and the 5th biopsy grade 5 rejection. Both were treated with one dose methylprednisolone 500 mg intravenously. He was then discharged on the 46th postoperative day in good condition. Now, at the time of this report 7 months after transplantation he is still doing very well.

DISCUSSION

The weight difference in orthotopic transplantation should be within 20%.⁶ However, a shortage of donor organs is a common problem around the world,¹⁴ and heterotopic heart transplantation offers a chance for those with a body weight mismatch of more than 20%. This desperate recipient received a large dose of catecholamines and relied on

the ventilator during the last 3 weeks. Because the weight difference was 29.2%, heterotopic heart transplantation was performed. Posterior mitral plication annuloplasty was also performed to correct mitral regurgitation.

One of the advantages of heterotopic heart transplantation is that by sharing the circulatory load with a second heart (Fig. 3), the working load of the recipient heart can be reduced, and may improve cardiac function. In our case, the patient showed a significant reduction of heart size after transplantation (Fig. 1, 2).

One of the disadvantages of heterotopic heart transplantation is thromboembolization. In our case we controlled the donor heart blood pressure with captopril to around 100–120 mmHg systolically so the recipient heart might have a chance to open the aortic valve and improve cardiac output to prevent blood stasis in the left heart and thus prevent thromboembolization. Our patient is now under warfarin 5 mg once per day to keep prothrombin time 1.5 times the control value. No thromboembolic complication or hemorrhagic events have happened so far. If the recipient heart becomes non-functioning and produces toxic systemic symptoms such as thromboembolism or endocarditis, it should be removed; or, an orthotopic transplantation of the donor heart might be indicated, if the heterotopically placed donor heart does not function well.

In conclusion, heterotopic heart transplantation can be safely performed in which an available donor heart appears unable to support recipient circulation, such as in the case of a weight mismatch over 20%. It extends the donor and recipient criteria, and thus offers a chance for survival to some desperate end-stage heart patients who otherwise would shortly die.

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