

Asia's first combined liver transplant and aortic valve replacement

To the Editor:

Orthotopic liver transplantation is the only cure for patients with end-stage liver disease. It is however an ultra-major surgery which is physiologically challenging to the cardiopulmonary function of the patient. Hence, in patients who also have valvular heart disease or coronary artery disease, liver transplantation would be considered a contraindication unless their cardiac problems could be corrected. On the other hand, coagulopathy and the risk of postoperative liver decompensation associated with end-stage liver disease would render the patients unsuitable for corrective valve repair or coronary artery bypass graft surgery. In the literature, there are only a small number of cases of combined orthotopic liver transplantation and cardiac surgery.

Our hospital has performed Asia's first combined orthotopic liver transplantation and aortic valve replacement. A patient with end-stage hepatitis B cirrhosis and severe aortic stenosis was saved by a successful operation of combined deceased-donor liver transplantation and aortic valve replacement.

The patient was a 67-year-old man with a medical history of renal stone, old pulmonary tuberculosis and bronchiectasis. He presented with jaundice. Initial workup showed acute flare of hepatitis B with background cirrhosis. His model for end-stage liver disease (MELD) score was 26 at admission. He was given entecavir as antiviral treatment. During workup for liver transplantation, he was incidentally found to have severe aortic stenosis. On echocardiography, he had concentric left ventricular hypertrophy and diastolic dysfunction, with an ejection fraction of 61%. His aortic valve was calcified with severe stenosis. The pressure gradient was 65/42 mmHg. The aortic valve area was about 1 cm² by continuity equation. Coronary angiography showed a very tortuous ascending aorta and markedly dilated aortic root. He had minor coronary artery disease. Computed tomography of the abdomen showed a cirrhotic liver with splenomegaly.

Except for the presence of severe aortic stenosis, the patient was otherwise considered fit for liver transplantation. Given his poor liver function and coagulopathy, an aortic valve replacement was considered too risky. Minimally invasive cardiac intervention was not possible in view of his tortuous aorta. The case was discussed in our joint meeting of liver transplant and cardiothoracic surgeons. The decision was that when a deceased-donor liver graft became available for him, he would undergo a liver transplantation preceded immediately by an open aortic valve replacement. Living-donor liver transplanta-

tion would be a better alternative but unfortunately there was no living-donor available. He was put up on our liver transplant waiting list.

Five months later, a deceased-donor of his blood group was available for him when he became the top on the waiting list. The donor was a 41-year-old man (weighing 75 kg, 165 cm tall) who suffered traumatic head injury. He was healthy with normal liver function. The organ harvest surgery was uneventful and finished in 471 minutes. The liver was flushed with Custodial Bretschneider's histidine-tryptophan-ketoglutarate solution via the inferior mesenteric vein (4 L) and the infrarenal aorta (12 L). The liver graft weighed 1195 g.

Surgery was started by the cardiothoracic surgeons. Sternotomy was performed and a cardiopulmonary bypass was set up. After cardioplegia and ascending aortotomy, the aortic valve was resected and replaced with a bioprosthesis. The aortotomy was closed with anointer positional synthetic graft. The total cardiopulmonary bypass time was 129 minutes. After temporary closure of the skin, the surgery was taken over by the liver transplant surgeons. Liver transplantation was performed with the use of modified piggyback side-to-side cavocavostomy reconstruction to avoid cross-clamping of the inferior vena cava so as to minimize intraoperative cardiovascular instability. During implantation, the chest was reopened due to cardiac tamponade. The total operation time was 15 hours. Cold ischemic time of the liver graft was 244 minutes and recipient warm ischemic time was 44 minutes. Pathology of the excised liver showed cirrhosis.

Postoperatively the liver graft and the heart functioned well. The patient was nursed in the intensive care unit with regular Doppler ultrasonographic assessment of the liver graft vasculature as usual. He was extubated on day 1 but was re-intubated on the same day due to sputum retention. Bronchoscopy and chest physiotherapy were done and he was extubated 4 days later. Aspirin was started on day 10. He was discharged from the intensive care unit on postoperative day 12 and discharged from hospital on postoperative day 25. On follow-up, his liver graft function was normal. Echocardiography showed nothing remarkable. No wound infection nor any other postoperative complication was noted.

In the past, the presence of valvular heart disease,^[1] coronary artery disease^[2] or heart failure^[3] would be a contraindication to liver transplantation. With technical advances and modifications in surgery, these cardiac conditions no longer preclude liver transplantation at most high-volume centers if the conditions can be optimized. In patients with end-stage liver disease, a cardiac problem can be a result of the underlying pathophysiology of end-stage liver disease (such as amyloidosis or

cardiac cirrhosis^[4]) or just an incidental finding. Liver transplant candidates should go through rigorous cardiovascular risk assessment to ensure they can tolerate the stress during transplantation and in the immediate post-operative period.^[5] Those with considerable cardiovascular risk should be denied liver transplantation if a reasonable chance of survival is slim. In patients with end-stage liver disease, optimization of cardiovascular risk factors is difficult and outcomes of treatment for cardiovascular problems are often poor. In a couple of studies, cardiac operations in patients with Child's C cirrhosis led to 100% mortality.^[6,7]

In the literature, there are only a small number of cases of combined liver transplantation and aortic valve replacement.^[8-12] The first case was reported by Parker et al.^[8] It was a 56-year-old man with end-stage alcoholic cirrhosis and moderate-to-severe aortic stenosis. He received a combined aortic valve replacement and liver transplantation. The patient survival was 30 days at the time of publication and a reversible brachial plexus injury was reported. A total of 14 cases have been reported, and the operative mortality was up to 25%. All of the operations were performed in the United States.

Our patient underwent Asia's first combined liver transplant and aortic valve replacement. A modified technique was used in the deceased-donor liver transplantation. At our center, the usual practice is resection of the whole liver together with the native inferior vena cava, followed by caval reconstruction with the donor vena cava by suprahepatic and infrahepatic end-to-end caval anastomosis. In this patient, however, cross-clamping of the inferior vena cava might compromise the heart as it was already stressed by cardioplegia. Therefore, we deliberately preserved the recipient inferior vena cava by transecting the right, middle and left hepatic veins separately. The recipient inferior vena cava was then side-clamped and anastomosed to the donor vena cava with the modified piggyback side-to-side cavocavostomy technique.

In future cases, the chest should be covered rather than closed. In this patient, coagulopathy led to cardiac tamponade. Patients should be evaluated aggressively and given the best chance of having a life-saving liver transplantation. This case illustrates the importance of multidisciplinary management, with which treatment outcomes can be optimized.

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