

Liver Transplantation in a Patient With an Intraabdominally Located Left Ventricular Assist Device: Surgical Aspects—Case Report

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ABSTRACT

The presence of a cardiac assist device in a liver transplantation candidate should not be considered to be an absolute contraindication to transplantation. In this first case report of liver transplantation in a patient with an intraabdominally located left ventricular assist device, we have described the surgical aspects and discussed the timing of the liver transplantation and the removal of the left ventricular assist device.

LIVER procurement from a donor whose cardiac function is supported by a mechanical device has been described.^{1,2} We recently reported a case of orthotopic liver transplantation (OLT) in a patient with propionic acidemia whose cardiac function was supported by a left ventricular assist device (LVAD).³ Herein, we have focused on the surgical aspects of the procedure and the timing for removal of the LVAD and the OLT.

CASE REPORT

The patient was a 16-year-old boy diagnosed at the age of 8 months with propionic acidemia, an autosomal recessive disorder caused by a deficiency in propionyl-CoA carboxylase.^{4–6} Despite standard treatment, and as frequently described in this syndrome, the patient developed dilated cardiomyopathy. He was admitted with refractory cardiogenic shock that necessitated the placement of an LVAD (Heartmate2; Fig 1) and a temporary right VAD (Jostra) because of transient associated right ventricular failure. This treatment normalized the patient's hemodynamic status. Given the absence of irreversible damage on myocardial biopsy specimens and the probable amelioration of cardiac function by better metabolic control, the patient was considered for isolated OLT. His model end-stage liver disease score was 7. He had no other medical comorbidities.

Two months after placement of the LVAD, a graft was available from a 14-year-old girl (weight 52 kg). Aspirin (80 mg) and low molecular weight heparin (clexane, 1 mg/kg) were stopped immediately before surgery. To optimize exposure for the OLT, the first phase of the operation involved dissection and mobilization of the tunnelled electric cable of the LVAD and its retraction upwards and to the left. A classical "Mercedes" approach with right and left subcostal incisions and a midline extension toward the xyphoid was impossible due to the central position of the LVAD and the electric cable. Therefore, the incision was limited to a short right subcostal muscular incision (~15 cm) approaching, but not reaching, the midline, where the LVAD and its connected electric cable were

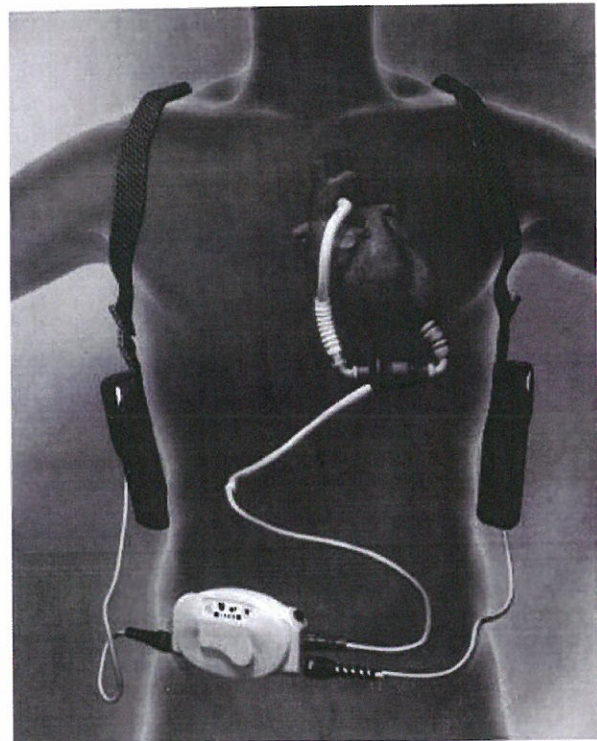


Fig 1. Position of the left ventricular assist device (type Heartmate2) showing the interference with the operative field needed for liver transplantation (Source: Thoratec).

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Fig 2. Abdominal x-ray showing the intraabdominal location of the left ventricular assist device.

located. It was believed that this short right subcostal incision would provide sufficient exposure if adequate retraction could be applied upwards. Standard upwards retraction provided by a

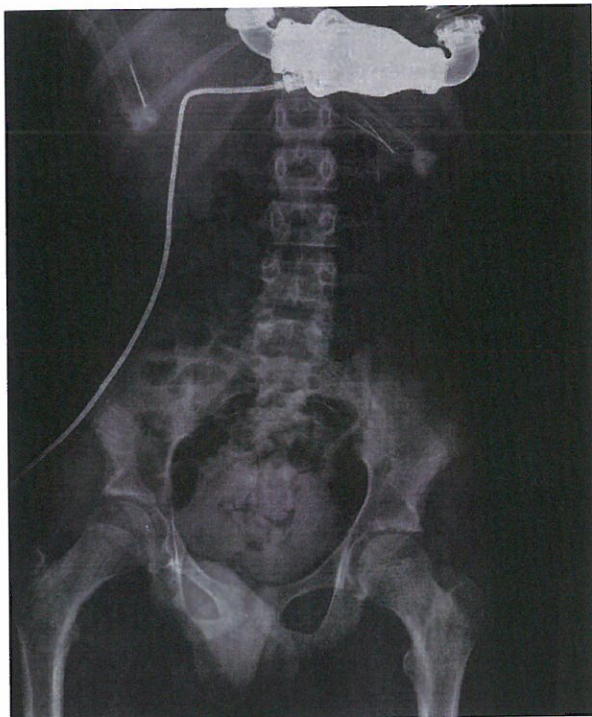


Fig 3. Perioperative view. The liver has been successfully transplanted.

Rochard valve could not be maintained because it caused repeated runs of ventricular tachycardia probably due to mechanical trauma to the ventricular wall by the device. Therefore, and in addition to the standard upwards retraction, a vascular omnitract provided retraction to the left. In adjusting the position of the two retractors (upwards and to the left), direct contact between them and the LVAD was minimized allowing the cardiac rhythm to remain stable. In part because the exposure provided by this unusual retraction was suboptimal and the access to the retrohepatic vena cava limited, we elected to use the piggy-back technique to implant the new liver.

Indeed, it was believed that preservation of the recipient vena cava and the performance of only one caval anastomosis would ease the hepatectomy and implantation phases in this particular case. The liver was successfully transplanted (Fig 2). Under protection of the LVAD, no hemodynamic changes were noticed during the procedure. No vasopressors were required. In particular at reperfusion, the patient remained hemodynamically stable and free of pulmonary hypertension. Cold and warm ischemia times were 10 hours 23 minutes and 48 minutes, respectively. He received 2 units of packed cells. He suffered mild ischemic reperfusion injury as assessed by a posttransplantation peak transaminase of 1129 U/l. The patient experienced an uneventful postoperative course. Only low-dose clexane (20 mg) was administered posttransplantation. As planned, the LVAD was removed 3 days after the OLT. The patient was discharged at postoperative day 24 with normal liver and cardiac functions. He is doing well for more than 1 year posttransplantation with normal liver and cardiac functions.

DISCUSSION

It was necessary to determine the best time to remove the LVAD: before versus after OLT. The argument in favor of first removing the LVAD was the presence of the cumber-

some device in the epigastrium and the large tunnelled electric cable in the right hypochondrium that would prevent a normal approach for OLT (Figs 1 and 3). Arguments in favor of first transplanting the liver were: (1) it seemed physiologically more appropriate to correct the underlying metabolic disorder that had caused cardiac failure before removing assistance to this dysfunctioning heart; (2) the OLT procedure on its own may induce substantial heart dysfunction, particularly at reperfusion, when the hemodynamic support would be crucial; (3) removal of the LVAD first would inevitably create an apical infarct that would favor heart arrhythmias and/or dysfunction during OLT; and finally (4) a sternotomy and removal of the device would necessarily entail a longer cold ischemia time to the liver graft. After multidisciplinary deliberation between intensivists, metabolic specialists, cardiac and transplant surgeons, it was believed that, despite the anticipated technical difficulty, the OLT should first be attempted. A "back-up" OLT candidate was called in case the OLT was not possible. Given the urgency of the transplantation and the exceptional indication, an hyperurgent status was accepted by the auditing committee of Eurotransplant.

In conclusion, the presence of a cardiac assist device in an OLT candidate should not be considered to be an absolute

contraindication to transplantation, but one must (1) adjust the surgical approach and the implantation technique because of the limited access caused by the device, and (2) take the risks of arrhythmias, potentially caused by retraction on the device, into account.

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