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Subcostal to rib-cross incision for HeartMate II explantation: A case report

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The role of left ventricular assist devices (LVADs) is expected to become more important because of an increasing number of patients experiencing heart failure and a shortage heart transplant donors.¹ LVAD explantation following myocardial recovery is well documented² and most of the patients requiring the procedure have multiple medical problems, making minimally invasive methods more attractive. Several surgical approaches have been reported.^{3,4} We report 2 cases of LVAD explantation using a subcostal to rib-cross incision combined with a separate anteriolateral minithoracotomy.

CLINICAL SUMMARY

The first patient was 57 years old and had a HeartMate II (Thoratec, Pleasanton, Calif) LVAD implant for cardiogenic shock after redo aortic valve replacement. The patient's ejection fraction (EF) improved from 15% to 45% over 2 months and the LVAD was explanted 64 days after LVAD implantation. The second patient was 47 years old and had an HeartMate II LVAD implant for cardiogenic shock after coronary artery bypass grafting and mitral valve repair. The EF in this patient improved from 10% to 60% over 5 months and the LVAD was explanted 149 days after it had been implanted.

A subcostal incision was made over the device and extended laterally toward the rib cage to match placement of

the device. The apex of the heart and the device inflow was exposed by excising the seventh rib. The upper side of the costal incision was retracted for exposure (Figure 1, A). Simultaneously, a small right thoracotomy through the third intercostal space was performed and the outflow graft was exposed (Figure 1, B). Cardiopulmonary bypass (CPB) was established from the right femoral artery (BioMedicus 17Fr cannula, Medtronic, Minneapolis, Minn) and vein (Biomedicus 21Fr cannula, Medtronic) (Figure 2). The left ventricular vent was not placed. The LVAD flow was discontinued and the outflow graft was clamped as soon as CPB was started. While in Trendelenburg position, the apical inflow cannula was removed. A left ventricular plug made from rolled felt was inserted into the left ventricular apical cuff and secured using no. 5 TiCron sutures (Covidien, Mansfield, Mass) and reinforced with Biogluce (CryoLife, Kennesaw, Ga) on its end. The outflow graft, which had been clamped since CPB started, was used as a root vent to deair by periodically opening the clamp. The CPB was weaned and came off followed by protamine reverse (CPB time 17 minutes and 49 minutes, respectively). The outflow graft was stapled and transected using a white vascular EndoGIA (Covidien) through the minithoracotomy. The bend relief was removed through the subcostal incision. Blake silicone drains (19Fr; Ethicon, Somerville, NJ) were placed in right pleural space, the outflow graft tunnel, and the device pocket. The incisions were closed in the standard fashion. Postoperative bleeding was minimal and the postoperative course was uneventful for both patients.

DISCUSSION

There are about 5 million patients with heart failure in the United States. Heart transplantation has been limited by the number of donors and has reached a plateau at about 4500

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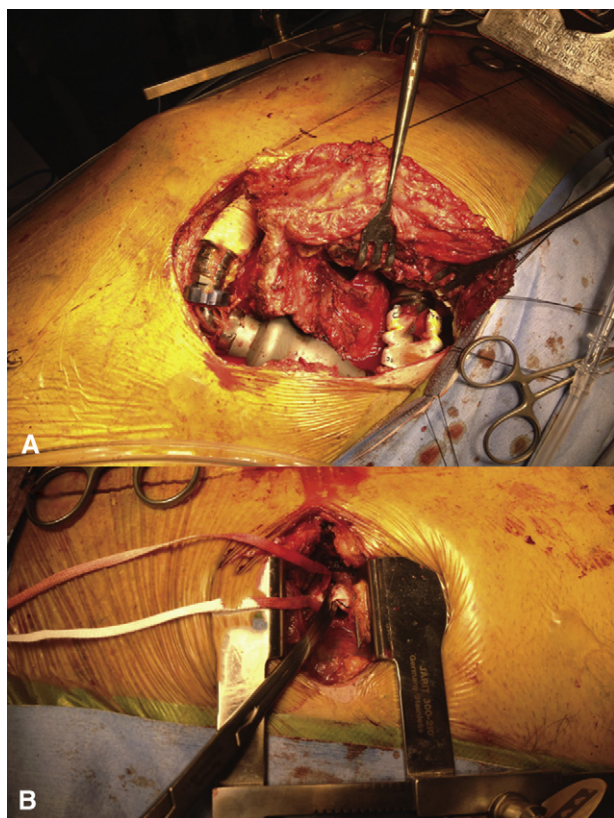


FIGURE 1. A, HeartMate II left ventricular assist device pump exposure with the subcostal incision. B, Outflow graft exposure through the third intercostal incision.

patients a year.¹ Therefore, LVAD placement has emerged as an important strategy. It has been well documented that patients with LVAD support remodel their myocardium and heart function recovers enough to explant the LVAD.⁶ The recovery rate is higher for patients with nonischemic etiology and it has been reported from 3.4% to 11%.² Many investigators previously reported that redo cardiac surgery with full sternotomy significantly increased postoperative mortality and morbidity.⁵ It is generally accepted that resternotomy in patients with an LVAD carries high risk due to the dense adhesion. Therefore, full sternotomy should be avoided, as reported previously.^{3,4}

Haj and colleagues³ reported LVAD explantation with 3 small incisions, including an incision through the second intercostal space. However, the subcostal incision is sometimes not good enough to expose the apical inflow site, which is critical to perform this operation safely. We do not hesitate to extend the incision to the ribs. In these cases, we divide the rib cartilage and remove the lateral margin of the costal cartilage and a part of seventh rib for optimal

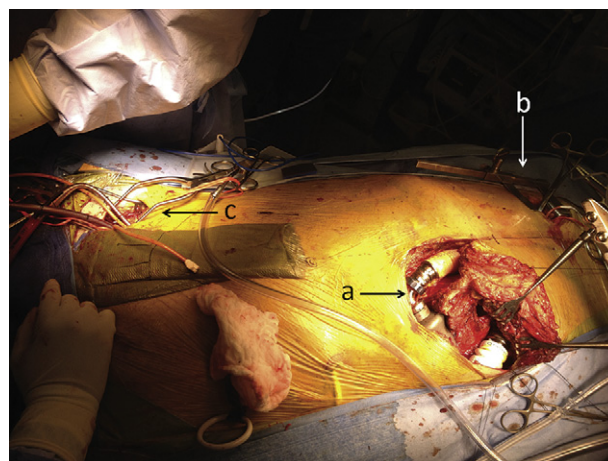


FIGURE 2. An operative picture. *a*, The subcostal to rib cross incision. *b*, The third intercostal incision. *c*, Cannulation in the right femoral artery and vein.

exposure. As a result, we were able to perform the explant with good visualization of the apex inflow cannula during the procedure performed on each of these patients. Our CPB time was 17 minutes and 49 minutes, respectively, short enough to prevent the severe systemic inflammatory response caused by extended CPB. Although Anson and colleagues⁴ reported a feasibility of off-pump LVAD explantation, we believe that it was more important to complete this procedure safely than to risk compromising patient outcome by not using CPB. Patients who would require a left ventricular vent due to conditions such as significant aortic insufficiency should be excluded from this surgical approach.

In summary, we report 2 cases of LVAD explantation using a subcostal approach extended to a rib-cross incision. This approach could be a better option for explantation of a HeartMate II LVAD.

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