Use of HeartMate 3 ventricular assist device in second redo sternotomy for congenitally corrected transposition of the great arteries with dextrocardia and situs solitus

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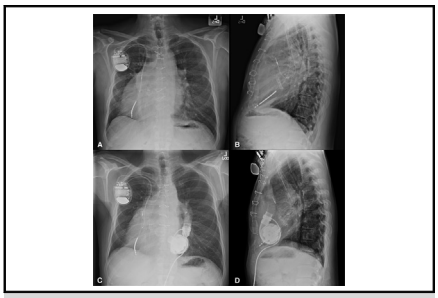

Pre- and postoperative radiographs of HM3 VAD implantation in ccTGA and redo sternotomy.

CENTRAL MESSAGE

We present the use of HeartMate 3 ventricular assist device in a patient with 2 previous sternotomies and ccTGA with dextrocardia and situs solitus as a bridge to transplant or destination therapy.

Congenitally corrected transposition of the great arteries (ccTGA) is a rare congenital cardiac defect featuring both atrioventricular and ventriculoarterial discordance: the right atrium is connected to the subpulmonary left ventricle and the left atrium to the systemic right ventricle (sRV). The aorta is located anterior and left-sided, whereas the pulmonary artery is posterior and right-sided. Dextrocardia occurs in approximately 20% of patients with ccTGA.[1] In current practice, a growing number of patients with ccTGA survive into adulthood and subsequently develop end-stage heart failure during their fourth or fifth decade of life. The unique anatomic abnormalities, such as sRV prominent trabeculation, present distinct challenges with respect to cannula insertion of a ventricular assist device (VAD). We report a case of HeartMate 3 (HM3) VAD implantation in a patient with a second redo sternotomy with ccTGA and dextrocardia with situs solitus. There are several published reports describing the use of a VAD in patients with ccTGA.[2,3] In regards to the specific use of HM3, there have been 2 reports in patients with ccTGA without dextrocardia[4,5] and 1 case with dextrocardia,[6] but none with redo sternotomy.

A 62-year-old male patient with ccTGA and dextrocardia with situs solitus was admitted with decompensated chronic heart failure, cardiogenic shock (Interagency Registry for Mechanically Assisted Circulatory Support profile 2), and renal failure. Two years previously, he had undergone tricuspid and pulmonary valve replacement for severe incompetence of both valves, associated with resection of subpulmonary stenosis and closure of the left atrial appendage; as a child, he had a pulmonary valvotomy. The patient had been previously evaluated for heart transplantation but was declined due to the presence of moderate-to-severe pulmonary hypertension (64/37, mean 46 mm Hg) and high pulmonary vascular resistance (3.7 Wood units). The VAD was implanted with both heart transplant and destination therapy as possible outcomes.

As the result of progressive multiorgan failure, he was taken to the operating room for urgent VAD implantation (Figure 1). There was severe biventricular dilatation, and the HM3 inflow cannula was inserted through the apex of the hypertrophic and dilated sRV. Extensive right ventricular trabeculae and fibrous muscle bundles resection inside the ventricle was performed to avoid inflow cannula obstruction. Severe bleeding was encountered while suturing the HM3 ring because of the thin nature of the ventricular wall, and additional reinforcement sutures were needed. There was concern for suction events because of the thin and flaccid nature of the sRV, so the HM3 was secured with heavy nonabsorbable pericostal sutures to the chest wall to prevent this. Of note, the outflow graft

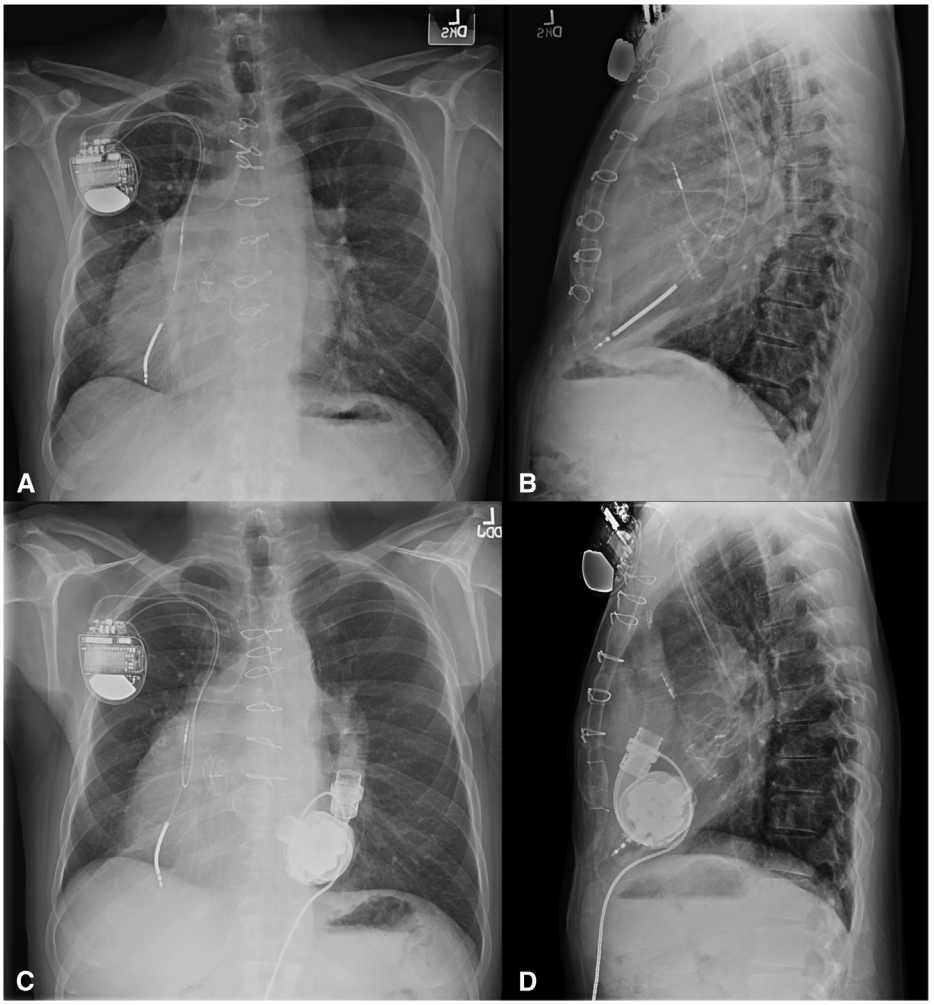

FIGURE 1. Pre- and postoperative radiographs of HeartMate 3 VAD implantation. A and B, Radiograph of the chest 2 months before VAD implantation. C and D, Radiograph of the chest 3 months post-VAD implantation. Inflow cannula is inserted through the apex of the hypertrophic and dilated systemic right ventricle. The outflow graft was placed intrapericardially to the left side of the heart (in a mirror direction of the usual technique) and anastomosed to the left-side aorta.

was placed intrapericardially to the left side of the heart (in a mirror direction of the usual technique) and anastomosed to the left-side aorta. The speed of the VAD was adjusted accordingly to avoid shift of the interventricular septum from the midline and cause opposite ventricular failure, and to allow the sRV to eject through the native valve and to avoid leaflet fusion and valvular regurgitation. At the first chest closure attempt, the HM3 flow and the cardiac output dropped precipitously, prompting chest opening. The HM3 was suspended to the chest wall further to the left (Figure 2). This allowed the HM3 to sit in the left chest.

The intraoperative course was complicated with severe vasoplegia, coagulopathy, bleeding requiring massive blood transfusion, and pulmonary ventricle failure. The chest was left open because of ongoing coagulopathy. Peripheral venoarterial extracorporeal membrane oxygenation was temporarily required but successfully weaned off 3 days after, followed by chest closure. A GoreTex patch (W. L. Gore & Associates, Inc) was not applied with closure because of the infection risk after having left the chest open for 3 days in an uncertain transplant candidate. His postoperative course was complicated by dialysis, requiring acute on chronic renal failure. He was discharged 45 days after surgery. His kidney function normalized, with significant improvement in functional capacity (class II). After discharge, the patient received long-term antibiotic treatment and surgical debridement for a driveline infection that has recently improved. He may be reconsidered for transplantation if the pulmonary hypertension and pulmonary vascular resistance have decreased to normal range as expected.

The use of HM3 VAD in a patient with second redo sternotomy for ccTGA and dextrocardia with situs solitus

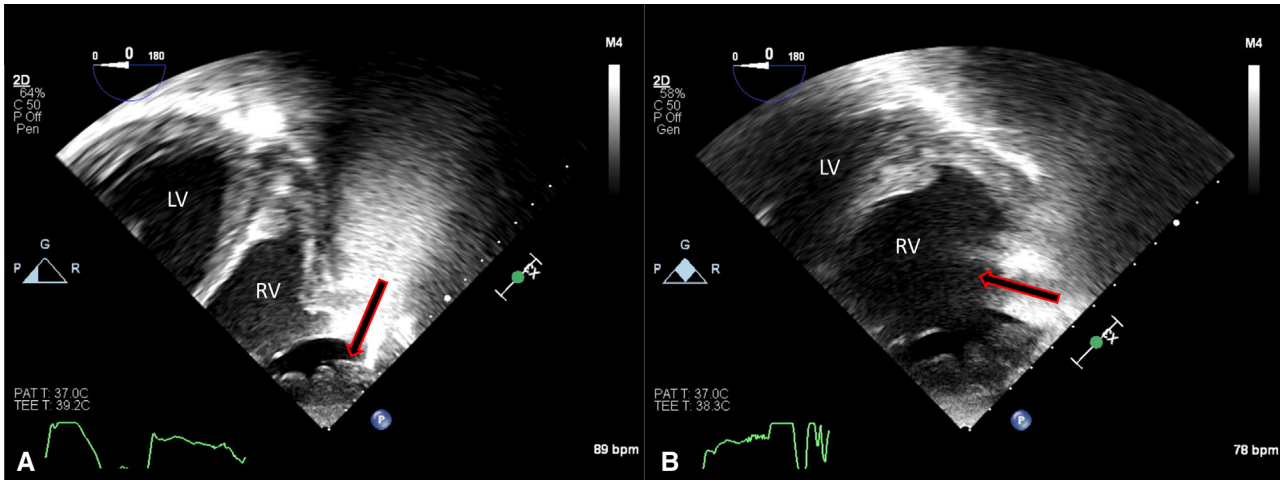

FIGURE 2. A, *Arrow* illustrates the initial orientation of the inflow cannula, which was directed inferiorly in close contact with the right ventricular (*RV*) wall. B, *Arrow* illustrates the orientation of the inflow cannula after repositioning, which lied horizontally toward the ventricular septum/left ventricle (*LV*).

proved feasible and can serve as a bridge to heart transplant or destination therapy. The role of durable VDs in patients with failing sRV (particularly in those with ccTGA) warrants further investigation.

Review by institutional review board was not required. Informed consent was obtained.

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