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CASE REPORT

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Pericardial release for early LVAD malalignment a less invasive approach

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Abstract

In a previously well-functioning LVAD, pericardial release via thoracotomy may improve inflow angle and correct malpositioning to ultimately restore LVAD function and patient hemodynamics. To prevent this, we recommend that implantations include a longitudinal pericardiotomy and anchoring sutures.

KEYWORDS

heart failure, heart transplant, heartmate, heartware, left ventricular assist device, LVAD, pericardial release, pump thrombosis

1 | INTRODUCTION

Cardiogenic shock is a state of low cardiac output resulting in life-threatening end-organ hypoperfusion and hypoxia.[1] Mechanical circulatory support is often a necessary therapy for those who fail medical management.[2,3] While durable left ventricular assist device (LVAD) is a sustainable option for many patients,[4,5] the pitfalls of these therapies should be described to offer solutions to potentially recurring problems. Only through optimizing medical and surgical management options, can we continue to improve the lives of the patients on the continuum of cardiogenic shock and end-stage heart failure.

2 | METHODS

Pericardial release through a left mini anterior thoracotomy.

3 | RESULTS

A 39-year-old woman with a medical history significant for systolic heart failure secondary to viral myocarditis was transferred to our facility for evaluation. She was medically managed by the heart failure team for over a year, and her heart function stabilized with left ventricular ejection fraction (LVEF) > 40%. When she became pregnant in 2018, her LVEF declined to 10%-15%. Six months after an uneventful cesarean section, she presented in ambulatory cardiogenic shock, with a 40 lb weight gain, jugular venous distention to the level of the mandible, and acute renal injury. She was started on inotropes, underwent aggressive diuresis, and had an axillary intraaortic balloon pump (IABP) placed. She was discussed at the Medical Review Board and listed for orthotropic heart transplant (OHTx). Despite 2 weeks of ambulatory IABP support, she progressively deteriorated, and so we transitioned our strategy to LVAD (Heartware HVAD, Medtronic) via sternotomy as a bridge to transplant. During, and prior to the completion of the procedure, we ensured the inflow cannula was parallel to the interventricular septum and the outflow tract did not obstruct the right ventricle.

She did well in her initial postoperative course with flows averaging 4-5 L/min. However, over the next 4 weeks, her LVAD intermittently experienced low flow alarms to 2.5 L/min with MAPs > 90 mm Hg. Transthoracic echocardiogram demonstrated a midline septum and the aortic valve opening with every beat, so the revolutions per minute were increased

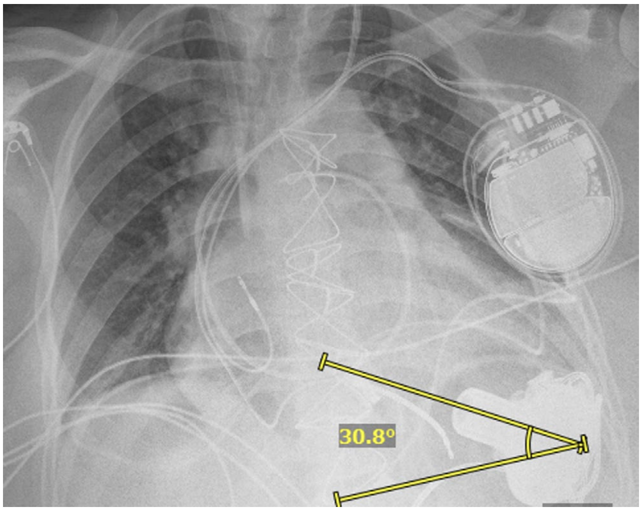

FIGURE 1 Chest X-ray image of LVAD during low flow alarms

in addition to continued afterload reduction. Despite these interventions, she had progressively worsening low flow alarms and was now flowing consistently at 1.5 L/min. Real-time and log file waveform analysis showed trends of gradual dampening with both decreased flow and pulsitility.[6] Review of her daily chest x-rays demonstrated initial optimal LVAD inflow positioning in the immediate postoperative period; however, by postoperative day 33 the device had gradually migrated creating a suboptimal inflow angle (Figure 1). Given concern for inadequate support, we elected for surgical reintervention. We proceeded with a left mini anterior thoracotomy for pericardial release. With the pericardium exposed, an incision in the pericardium was made superior and parallel to the phrenic nerve 3 cm cranial and caudal to the LVAD. It was clear that the LVAD had been displaced in the pericardium superiorly and anteriorly with the inflow cannula now directed at the septum. By reangling the LVAD inflow, pump flows immediately improved to >4.5 L/min. Two 0 prolenes were used to anchor the pump to the chest wall (Figure 2). The subsequent postoperative course was significant for normalization of her right atrial, pulmonary artery, and wedge pressures. She recovered well following the pericardial release. Nine months later, she underwent an uneventful OHTx and has been discharged home. She is now 9 months from transplant and doing well and is without evidence of rejection. We have yet to experience similar issues with the Heartmate 3 (HVAD) (Abbott Laboratories), and this may be related to the inherent differences in the LVAD specifications. Specifically, with HVAD implantations approached via sternotomy, we have modified our implant strategy to include a longitudinal pericardiotomy 2 cm superior to the phrenic nerve and anchoring sutures to prevent inflow malalignment and pump migration.

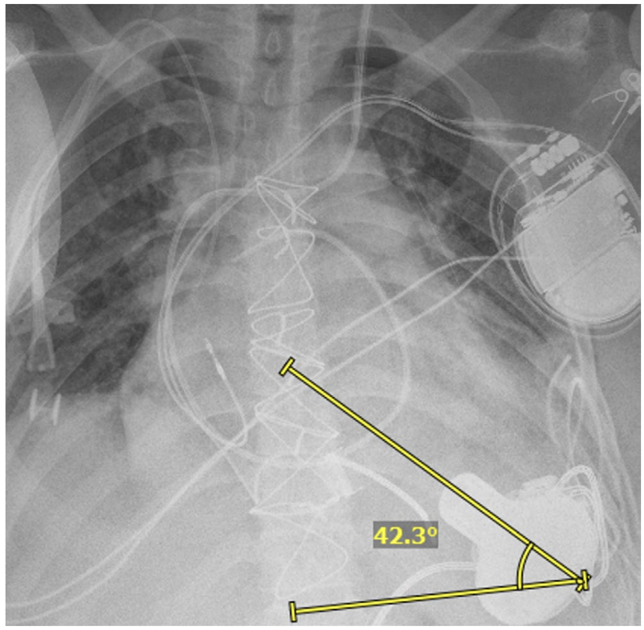

FIGURE 2 Chest X-ray image of LVAD after pericardial release

4 | CONCLUSION

The LVAD device pocket can undergo contraction in the postoperative period changing the angle of the inflow or outflow cannula.[7] This has been described previously in preperitoneal placed LVADs but is not well known in pericardial placed LVADs. In our patient, we noticed dampening of LVAD waveforms and decline in LVAD pulsity and flows over a 5-week interval.[6] In order to optimize end-organ support and to prevent pump thrombosis, we employed a thoracotomy approach pericardial release and device anchor along the chest wall. We were able to utilize this as a durable solution for LVAD malalignment and successfully bridge this patient to OHTx.

ACKNOWLEDGMENTS

We would like to acknowledge the team of physicians and nurses that collaborated to help this patient survive to ultimately receive transplant.

CONFLICT OF INTEREST

None of the authors have any financial conflicts of interest to disclose.

AUTHOR CONTRIBUTIONS

EIJ: provided the oversight of the project and critical revision of article. ADG: drafted the article. MMA: revised and approved the article.

ETHICAL APPROVAL

For the purposes of drafting this manuscript, all activities were performed in accordance with the ethical standards of the institutional and/or national research committee.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

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