

Anterolateral Thoracotomy and Rib Resection for LVAD Inflow Repositioning and Thrombectomy

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Introduction

- Over time, the position of left ventricular assist device (LVAD) components may shift due to ventricular remodeling and changes in body-mass index
- A malpositioned left ventricular assist device (LVAD) inflow cannula (IFC) can lead to thrombus formation in any of the components of the LVAD or the left ventricle itself due to unfavorable hemodynamics
- A small pump thrombosis (PT) can be treated with augmented anticoagulation, but a large PT causing low flow alarms and suction events usually requires complete device exchange, associated with numerous complications (stroke, hemorrhage, air embolism, death)
- A lateral thoracotomy hemisternotomy (LTHS) approach for implantation of LVADs has previously been associated with less malposition magnitude compared to conventional sternotomy. A novel derivation was used in this case to reposition the IFC and avoid full device exchange

Case Report

- A 63 year old female with a past medical history of dilated cardiomyopathy (left ventricular ejection fraction 10-15%), chronic obstructive pulmonary disease, hypertension, and hyperlipidemia was implanted with a HeartWare LVAD in 2018
- Due to inferolateral cannula malposition (Figure 1), she had frequent readmissions for suction events and symptomatic low flows accompanied by drops to nadir < 1.0 L/min
- During a routine clinic visit, she was found to have a peri-inflow cannula thrombus on a transthoracic echocardiogram despite a therapeutic international normalized ratio
- She was admitted for close monitoring and parenteral anticoagulation. Despite two weeks of heparin, the thrombus did not resolve
- She was not a candidate for heart transplantation due to allosensitization (100% panel reactive antibody)
- LVAD waveforms and power consumption trends did not suggest there was an intra-pump or outflow graft thrombus that would require a complete system exchange to the Heartmate-3 LVAD (Figure 2)

Procedure

- A left anterolateral thoracotomy with 7th rib resection was performed
- The rib resection allowed the surgeon to better maneuver the LVAD so that it could be repositioned approximately 20 degrees anteriorly, which corrected the IFC orientation (Figure 3)
- Intraoperative TEE confirmed the presence of a peri inflow cannula thrombus (Figure 4). The thrombus was removed from the inflow cannula
- Post-procedure, the LVAD function was excellent with flows consistently exceeding 3L/min and no suction events



Figure 1. Computed tomography (CT) scans demonstrating angular deviation from the ideal line in the coronal plane (17 degrees) and sagittal plane (13 degrees)

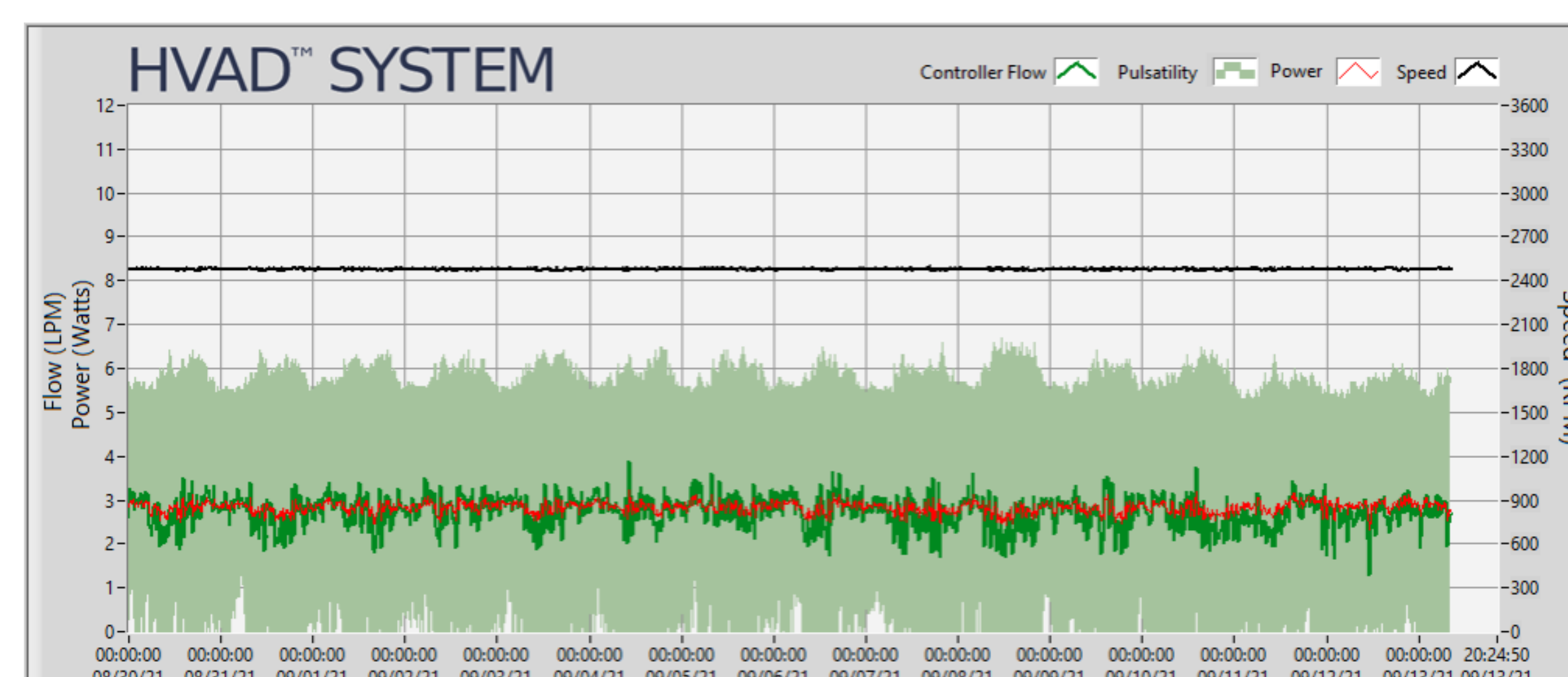


Figure 2. LVAD power consumption trends remained stable throughout the admission

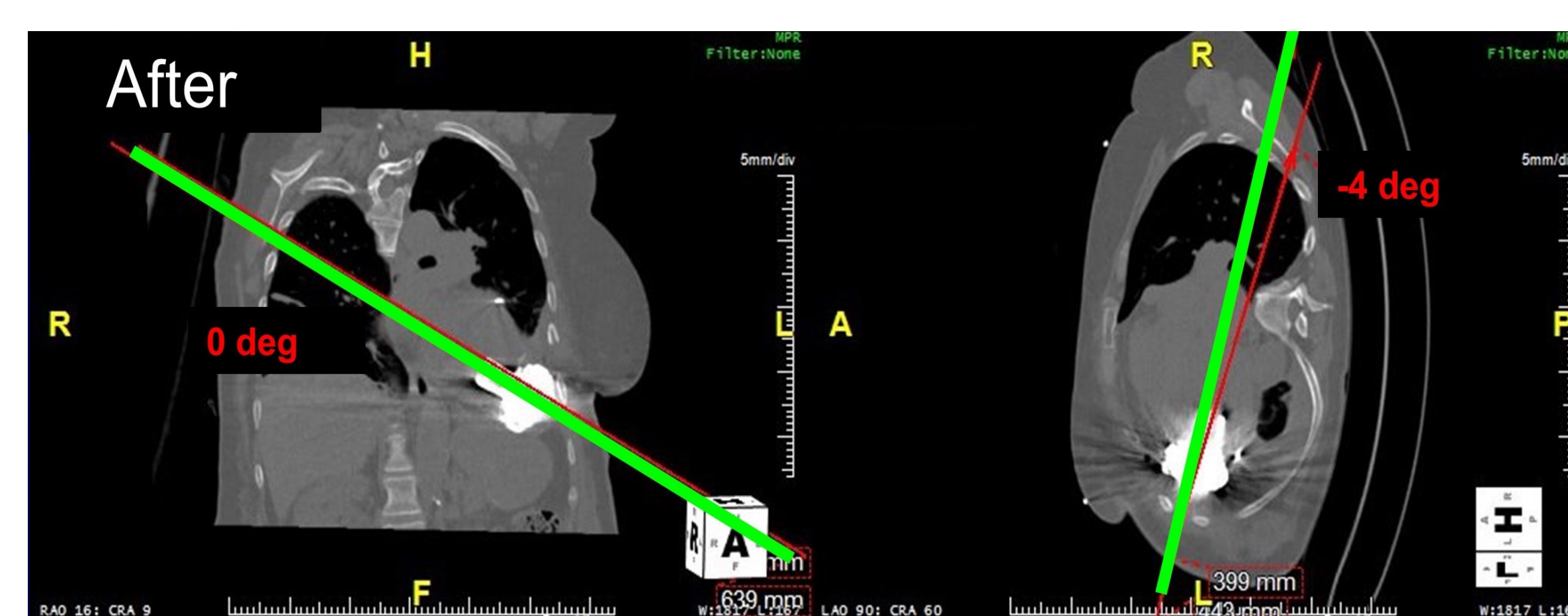


Figure 3. CT scans demonstrating correction of the angular deviation, with perfect alignment with the ideal line in the coronal plane (0 degrees deviation) and only mild deviation in the sagittal plane (4 degrees)

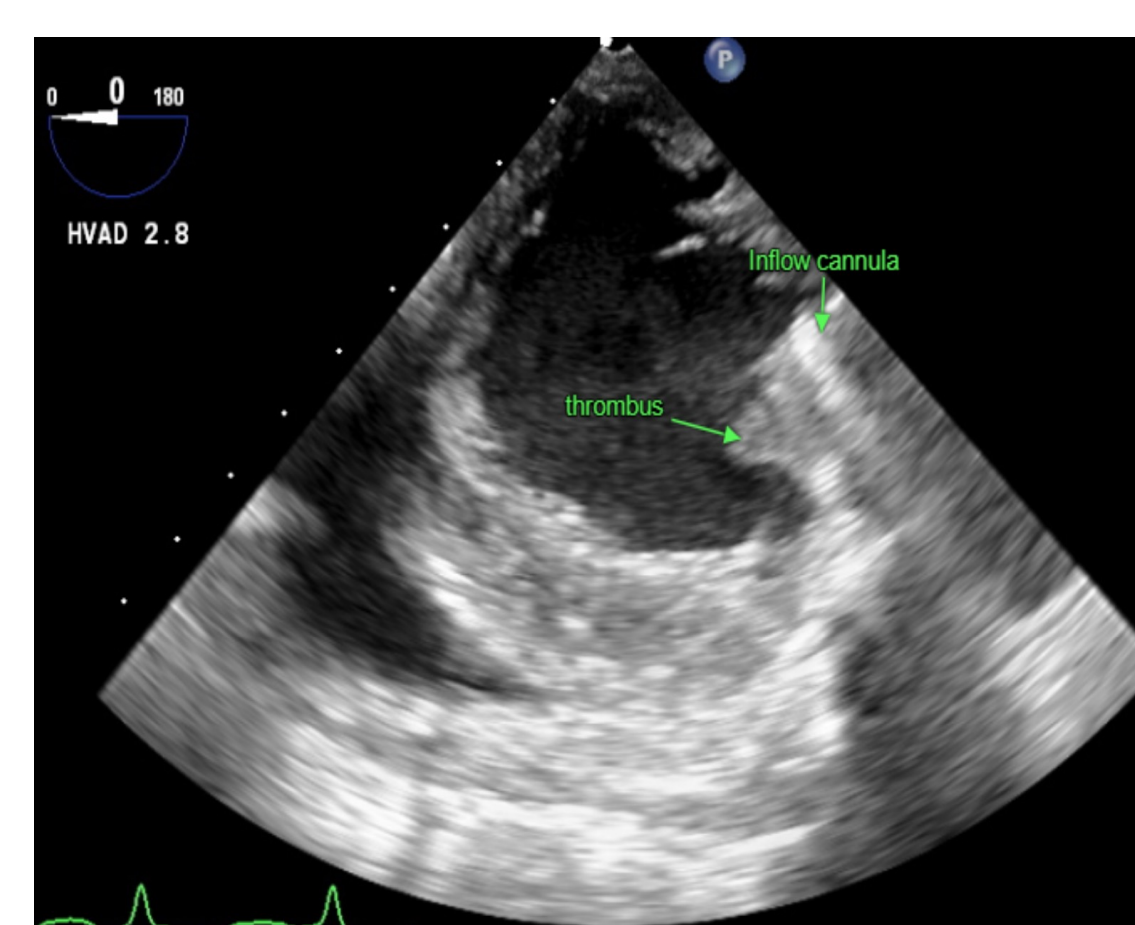


Figure 4. Transgastric short axis view of thrombus adjacent to inflow cannula inside the left ventricle

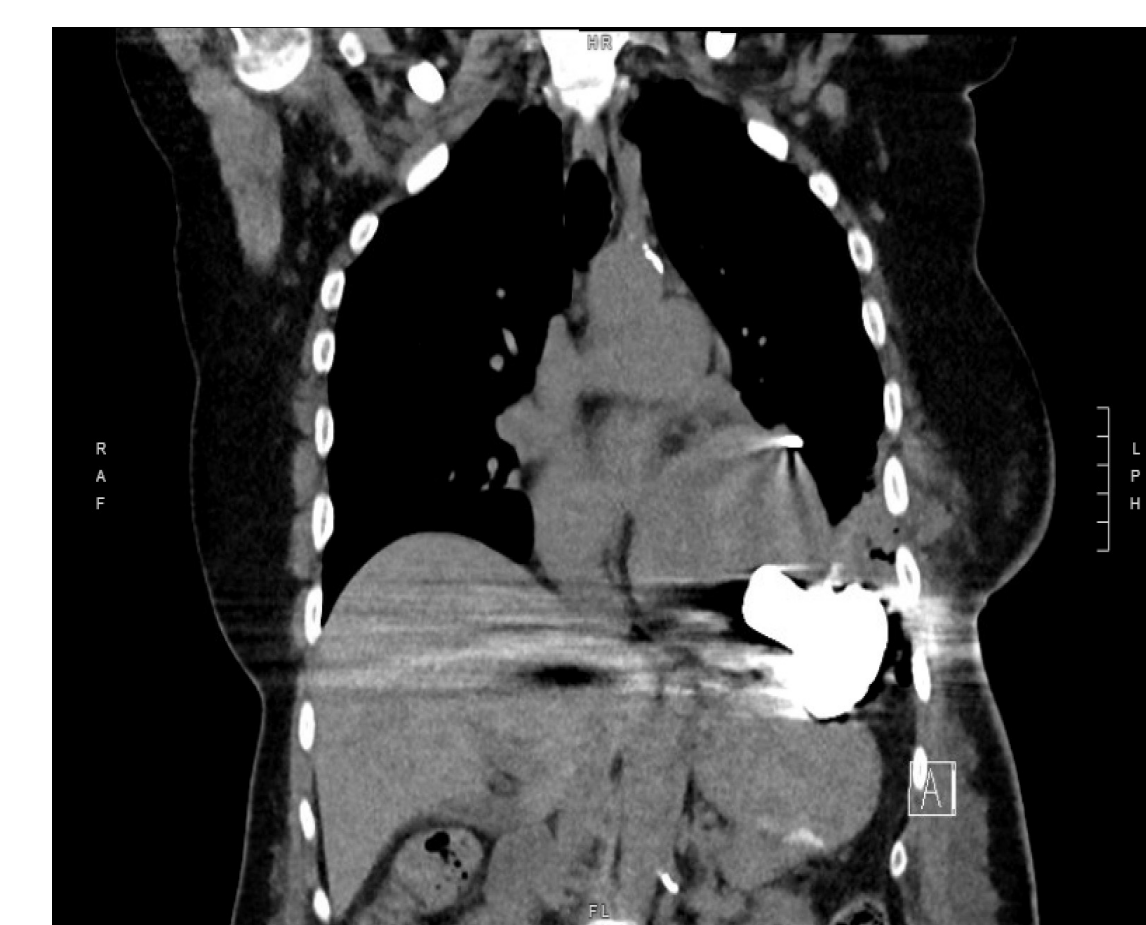


Figure 5. CT one month post-surgery with stable position of the LVAD

Conclusion

- Post-operative length of stay was 9 days
- After discharge, she did not have recurrence of low flow alarms or readmissions. Her LVAD position was stable on a CT angiogram of the chest one month (Figure 5) and one year later
- LVAD repositioning and thrombectomy in an otherwise well-functioning device mitigated risk of stroke without requiring a complete system replacement

References

1. Sen A, Larson JS, Kashani KB, et al. Mechanical circulatory assist devices: a primer for critical care and emergency physicians. *Critical Care*. 2016;20(1):153. doi:10.1186/s13054-016-1328-z
2. Bhamra JK, Bansal A. Left ventricular assist device inflow cannula position may contribute to the development of Heartmate II left ventricular assist device pump thrombosis. *Ochsner J*. 2018;18(2):131-135. doi:10.31486/toj.17.0070
3. Schmitto JD, Mariani S, Abicht TO, et al. Expert consensus paper: lateral thoracotomy for centrifugal ventricular assist device implant. *The Annals of Thoracic Surgery*. 2021;112(5):1687-1697. doi:10.1016/j.athoracsur.2020.09.063
4. Sorensen EN, Hivvala NJ, Jeady J, Rajagopal K, Griffith BP. Computed tomography correlates of inflow cannula malposition in a continuous-flow ventricular-assist device. *The Journal of Heart and Lung Transplantation*. 2013;32(6):654-657. doi:10.1016/j.healun.2013.03.010