DEVICE THERAPY

COMPLEX CASE STUDY

Vacuum-assisted Debunking of a Prohibitively Large Tricuspid Valve Vegetation Prior to Percutaneous Laser Lead Extraction

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ABSTRACT. We present a case of a 62-year-old man with non-ischemic cardiomyopathy related to sarcoidosis status after previous biventricular implantable cardioverter-defibrillator (BIVICD) implantation, found to have evidence of a large (4.7 x 2.1 cm) mass on his tricuspid valve in the setting of immune-compromise from treatment of sarcoidosis. Given the size of the mass the patient did not meet consensus guidelines for percutaneous extraction due to risk of embolization. The patient was felt to be high risk for open surgical extraction and therefore elected to undergo a staged hybrid approach with vacuum-assisted debunking of the vegetation followed by percutaneous removal of the BIVICD system.

KEYWORDS. cardiac implantable electronic device, debunking, lead extraction, vegetation.

Introduction

Percutaneous lead extraction of infected or dysfunctional cardiac implantable electronic devices (CIEDs), including pacemaker or implantable cardioverter-defibrillator (ICD) leads, has been shown to be a safe and effective management strategy1,2 that avoids the potential need for open cardiac surgery and the associated potential morbidity and mortality risks.

The risk of open cardiac surgery is increased in a patient population that requires ICDs or biventricular ICDs (BIVICDs), given the underlying substrate predominantly involves patients with an ejection fraction (EF) ≤35%. Therefore, when possible, a percutaneous approach is preferred in centers with experience and expertise in percutaneous laser or mechanical extraction techniques. However, in some instances of endocarditis/thrombus with pacemaker/defibrillator lead involvement, the vegetation size is considered prohibitive for percutaneous extraction.3

We present a case of a patient with tricuspid valve endocarditis in the setting of a BIVICD with a vegetation size that would be considered prohibitive for percutaneous extraction and the use of an innovative technique to minimize the risk of embolization of the vegetation with stand-alone laser lead extraction technology.

Case presentation

A 62-year-old man with a history of cardiac sarcoidosis, and associated cardiomyopathy, status after BIVICD implantation in 2010 (Figure 1) was admitted to our institution with generalized fatigue and weakness. The patient denied fevers or chills but on echocardiogram was found to have a large tricuspid valve vegetation measuring 4.7 x 2.1 cm (Figure 2) and a left ventricular ejection fraction (LVEF) of 20%. Blood cultures were positive for Enterococcus faecalis and his minimal systemic symptoms were felt to be related to outpatient treatment with systemic immune suppressants for the treatment of his sarcoidosis. Despite his
sarcoidosis, the patient was determined to be a candidate for orthotopic heart transplant and had been undergoing work-up prior to his admission for endocarditis. The patient was seen by the electrophysiology service. The BIVICD system was only 3 years old and therefore it was felt that the extraction itself was highly likely to be successful from a percutaneous approach. However, given the size of the tricuspid valve vegetation and associated risk of massive pulmonary embolism it was recommended that a surgical consultation be obtained to discuss the open surgical extraction option. The patient was discussed during the multidisciplinary heart transplant rounds. Given his LVEF of 20% there was significant concern regarding the mortality risk of an open surgical approach. The patient also voiced significant concern and resistance to an open surgical approach. Therefore, the option of a combined approach in collaboration with interventional radiology was discussed, with a goal of endovascular debulking or removal of the vegetation prior to the attempted lead extraction. Endovascular debulking was performed using the Angiovac (Angiovac, Angiodynamics, Latham, NY) thrombectomy system. This system comprises a large caliber, 26F, venous drainage catheter placed under fluoroscopic and echocardiographic guidance adjacent to the vegetation, with an extracorporeal cardiopulmonary bypass circuit that is used to aspirate the target mass. Intraprocedure transesophageal echocardiogram images were obtained at the time of attempted vegetation extraction, demonstrating the large, mobile mass adherent to the posterior leaflet of the tricuspid valve, with the aspiration catheter in close contact. (Figure 3). This imaging allowed real-time monitoring of potential complications.
such as pericardial effusion or entrapment of the right atrial wall or tricuspid leaflet in the aspiration catheter suction tip. The aspiration circuit was deployed, with aspiration of the most mobile elements of the vegetation in several pieces without distal embolization. (Figure 4). The more adherent elements of the vegetation remained on the valve leaflet. However, in order to minimize the risk of leaflet trauma and severe tricuspid regurgitation, the procedure was terminated. Overall, the mass was debulked from $4.2 \times 2.1$ cm to $1.4 \times 2.1$ cm, with minimal residual mobile components left in situ.

Owing to the need for systemic heparinization during the AngioVac procedure, the lead extraction component of the procedure had to be staged to occur 1 day after the vegetation evacuation. As is the procedure at our institution, laser lead extraction tools (Spectronetics, Colorado Springs, CO) were available for the procedure and a cardiothoracic surgeon was present throughout the procedure. All three leads were easily removed without the use of the laser system, utilizing only mild manual traction. There was no clinical evidence of pulmonary embolism, and the residual vegetation remained stable in size (Figure 5) and location throughout the extraction procedure.

The patient had no complications from either procedure. He continued antibiotic therapy per the infectious disease team and was relisted for heart transplant without having to take on the risk of sternotomy and open surgical lead extraction of a system that could be easily removed with a percutaneous approach.

Discussion

Implantable cardiac device infections, although occurring relatively infrequently, remain a recurrent issue. The ACC/AHA/HRS guidelines\(^4\) give a class I recommendation for lead extraction for devices present with any evidence of lead or valvular infection. Complete device removal is typically required for pocket infection without clear endocarditis as well. Further, there is evidence that delay in definitive removal can impact mortality.\(^5\) Le and colleagues\(^5\) demonstrated that the risk of delay in removal far outweighed the immediate procedural risk, and that delay led to a threefold increase in 1-year mortality.

The HRS guidelines on transvenous lead extraction\(^3\) suggest that vegetations $>3$ cm should commonly be extracted via a surgical approach. In patients with chronic leads of prolonged duration (>10 years) and/or ICD leads with superior vena cava coils that add to the percutaneous extraction complexity, surgical extraction may be the safest option. However, given that many patients with ICDs have a depressed EF, the surgical risk needs consideration, especially in cases where the leads may be easily removed with a percutaneous technique. Vacuum-assisted vegetation removal has been described but reports are limited. Removal of thrombotic masses has been described as primary treatments.\(^6\)-\(^9\) In addition, the system has also been used as a bridge to surgical intervention for an infected bioprosthetic pulmonic valve.\(^10\) Patel and colleagues\(^11\) reported the only case series of three patients with pacemakers or defibrillators

Figure 2: Pre-procedure transesophageal echocardiogram showing a large ($4.7 \times 2.1$ cm) mass/vegetation on the tricuspid valve.
undergoing vegetation removal prior to attempted lead extraction. We provide further evidence of the potential utility of this combined technique, which allows percutaneous extraction for a patient that in most centers might be required to have an open surgical intervention. A multidisciplinary approach with collaboration between the cardiomyopathy, cardiac electrophysiology, cardiac surgery, cardiac anesthesia, and interventional radiology teams allowed for a safe and effective intervention with limited risk for this patient. Further data are needed to further understand the clinical utility of this hybrid technique.

Conclusion

Percutaneous CIED lead extraction is a safe and effective tool for removal of infected or dysfunctional leads. Techniques such as endovascular (Angiovac) removal of large vegetations/clots prior to lead extraction have the potential to be an important advancement in the field as they may prevent patients that could otherwise easily be treated with a percutaneous approach, from having to undergo open cardiac surgery.

References

Figure 4: Angiovac system with extracted vegetation visible.


Figure 5: Transesophageal echocardiogram of the residual vegetation after debulking that was decreased in size sufficiently (2.1 × 1.4 cm) to allow safe percutaneous laser lead extraction.