Pre-emptive Pericardial Access in Anticipation of Perforated Lead Extraction

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ABSTRACT. Acute lead perforation is an infrequent complication of permanent atrial or ventricular lead placement, and is recognized most commonly in the first 24 h following implant. Extraction of the offending lead can lead to rapid hemodynamic compromise due to hemorrhage from the perforation and subsequent tamponade. Consequently, emergency pericardiocentesis or open pericardial draining of the hemorrhage is required to address this situation. We describe a case in which a patient presented with clinically evident perforation without a significant effusion, and in whom prophylactic pericardial access was obtained prior to removing the perforated lead to maintain control of the pericardium.

KEYWORDS. pacemaker lead perforation, pericardiocentesis.

Case report

The patient was a 42-year-old woman (height 1.65 m, weight 98 kg, body mass index 37.8) with a background of ischemic cardiomyopathy and a large area of scar involving the anterior, anteroseptal, and inferior walls. Despite optimal medical therapy her left ventricular ejection fraction remained below 35%, and she was referred for implantation of a dual-chamber implantable cardioverter-defibrillator (ICD).

The device implantation was guided by peripheral vein contrast injection, utilizing the axillary vein. The defibrillator electrode was advanced and screwed into the right ventricular apex, where the following thresholds were obtained: bipolar tip negative-pulse width, 0.5 ms; 0.6 mA, 0.8 volts, 21.7 R wave, 1486 ohms. The relatively high impedance was cause for concern and the lead manufacturer was contacted. It was confirmed that this impedance was within range for the particular lead. Given the satisfactory pacing and sensing threshold and appropriate lead position, the lead was secured. Defibrillation threshold testing was satisfactory at ≤14 joules.

The following morning the patient complained of pleuritic chest pain. Device interrogation revealed markedly elevated right ventricular pacing impedance (2451 ohms) and increased right ventricular pacing thresholds (5 V at 0.4 ms). The chest radiograph identified that the ICD lead had prolapsed forward, suggesting some advancement either within the right ventricular cavity or through the right ventricular free wall. Owing to these findings, incipient cardiac perforation was considered and a transthoracic echocardiogram was performed (Figure 1). The lead tip/helix could be visualized within the pericardial space, and lead extraction was planned.

Following cross-matching for potential blood transfusion, an intracardiac echocardiography probe was advanced via the right femoral vein. No frank effusion was seen using this modality. Utilizing a subxiphoid approach pericardial access was obtained using a Tuohy needle under fluoroscopic guidance and contrast to define the pericardial borders. An 0.32 Amplatz extra-stiff wire was advanced into the pericardial space to facilitate placement of an 8-French input sheath and a pigtail catheter into the pericardial space. Examination of the right ventricular lead following the contrast injection confirmed that the helix had exited the myocardial wall by at least 2–3 mm (Figure 2).
Following pocket dissection and suture sleeve removal, the helix was retracted and a stylet placed into the right ventricular lead. In addition, a further extrathoracic puncture of the left axillary vein was performed and a guidewire placed into the vasculature to maintain access. The ICD lead was withdrawn from the vasculature without the accumulation of an effusion or any hemodynamics change. Intracardiac echocardiography confirmed the absence of an effusion accumulation. A different ICD lead was advanced to the apical septum and fixed in a more proximal and septal position to the previous lead placement. Electrical properties, defibrillation and threshold testing was found to be acceptable.

**Discussion**

Although, the incidence of lead perforation remains around 1%,2–4 this event can be lethal. Optimal management of the suspected lead perforation involves multiple diagnostic modalities, involving the clinical scenario, device interrogation, chest radiographs, and transthoracic echocardiograms. Acute tamponade can develop in the early (<24 h) period after implantation or can be precipitated by extraction of the offending lead5—both scenarios requiring urgent pericardial drainage. We present a case illustrating a potential strategy following identification of such a perforation, and although evacuation of pericardial bleeding was ultimately not required obtaining access to the pericardium in an emergency with hemodynamic deterioration does entail more risk. In the controlled and elective environment, however, this procedure is now considered a routine intervention by electrophysiologists.5 This permits control of the pericardium in the event of abrupt hemorrhage.

Risk factors for development of tamponade with removal of a clearly perforated lead remain undefined. In the present case, the dramatic radiographic and echo findings prompted clinical concern, which proved unfounded. Determining when a patient is at high risk for this event is important, but challenging. Each diagnostic modality is unfortunately quite limited in their respective efficacy. The chest radiograph is likely the least sensitive, and usually only able to identify gross positional changes of the lead tip, whereas echocardiography and cardiac/chest computed tomography is hampered predominantly by artifact. Clinically, in the absence of clear-cut perforation a trial of non-steroidal anti-inflammatory drugs is reasonable. We reserve surgical intervention with lead repositioning for refractory pain, changing and/or unacceptable thresholds, or the presence of a significant.

**Conclusion**

Cardiac lead perforation is a potentially lethal complication of lead implantation, and extraction of the lead can lead to rapid hemodynamic compromise. Anticipatory pericardial access can be considered in these cases to preempt cardiac tamponade and manage the situation in a more controlled manner.

**References**


