

# Complications and Errors Made in Lead Extraction

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## KEYWORDS

- Lead extraction • Implantable cardioverter-defibrillator • Complications • Pericardiocentesis
- Lead management • Pacemaker

## KEY POINTS

- Evaluate the patient carefully and make sure you have reviewed every facet of the patient's medical and device history.
- Have a low threshold to look for and diagnose a complication.
- Have a low threshold to treat a complication.
- Remember the Boy Scout motto, "be prepared"; when doing this procedure it is important that proper planning has taken place. Have the appropriate people and the proper tools present.

## PERFORMING A PROCEDURE THAT IS NOT NECESSARY

Each lead extraction must be performed by evaluating the risk to the individual patient given the total circumstances present, and includes evaluation of the number of leads implanted, duration of implant of the targeted lead(s), age of the patient, comorbidities present, indication for the extraction, and the degree of skill and experience of the operator and personnel. There is broad consensus that leads falling into the Class I indications for extraction should be removed in nearly all patients.<sup>1</sup> However, leads falling into Class II indications require somewhat more consideration. For example, extracting a normally functioning lead in an elderly patient because of a lead "recall" may expose the patient to a significantly higher risk from the extraction procedure relative to the risk of continuing to use the lead, or that of simply placing another lead while abandoning the targeted lead. It would be difficult to justify the addition of any surgical risk in such a patient.

Unfortunately, many of these decisions are not simple, requiring consideration of several issues specific to the individual patient. One of the main axioms of performing this procedure safely is to carefully review all aspects of the device history, all dictated implant notes, and the patient's medical history.

## PERFORMING A PROCEDURE WITHOUT ENOUGH EXPERIENCE

Lead extraction is not the same procedure with regard to success and risk for every patient. Many issues such as the duration of implant will have an effect on the risk to the patient. Whereas a physician with minimal experience would be capable of removing a lead that had been implanted a few years previously, a lead that is 20 years old with calcification present would pose an entirely different risk. It is important that physicians undertaking lead extraction start with leads that potentially are easier to remove. As experience is gained, more challenging leads may be attempted. This aspect is

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Disclosures: **Dr Love:** Medical Advisory Board or Consultant: Medtronic, Spectranetics, WL Gore, Leadexx, Eximo, St Jude Medical. **Dr Kennergren:** Performed studies in cooperation with, advised, and/or presented on behalf of: Biotronic, Boston Scientific, Ela/Sorin, Medtronic/Vitatron, Mentice, Spectranetics, St Jude, TYRX.

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Card Electrophysiol Clin 6 (2014) 355–360

<http://dx.doi.org/10.1016/j.ccep.2014.03.003>

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especially important when considering the risks and benefits of removing leads considered for Class II indications. Until such experience is gained, additional mentoring or referral of the patient to a physician with more experience is appropriate.

### **PERFORMING A PROCEDURE WITHOUT THE CORRECT TOOLS**

One of the more common issues that can result in failure to extract a lead or in a complication resulting from working too hard with a certain tool is the failure to recognize that all leads cannot be extracted with a single type of extraction system. The highly successful physician, who is able to change techniques as needed given the circumstances present during the extraction process, has access to and training with multiple types of extraction tools. This armamentarium includes different types of locking stylets, lead stabilization devices, nonpowered sheaths, LASER sheaths, rotationally powered sheaths, femoral access systems, and multiple types of snares. Knowing when to use which tool, and when to change from one tool or technique to another, requires knowledge and experience. Failure to change technique, pushing and/or pulling harder, or continuing to apply energy at the same site without advancing can lead to complications.

### **PERFORMING A PROCEDURE WITHOUT THE APPROPRIATE TEAM(S)**

Lead extraction obviously requires a trained operator. However, failure to have a trained and experienced team can result in complications, failure to recognize a complication, or failure to rescue a patient when a complication occurs. The staff must be familiar with all of the equipment being used, including the theory of traction/countertraction, and calibration and safety regarding the laser. Staff must be knowledgeable about the types of complications that can occur, at which points during the procedure they are likely to occur, and the anatomic sites that are vulnerable to damage. Staff must be fully focused on the procedure at all times, but especially during sheath application. Emergency procedures need to be known and practiced, with specific roles assigned to individual members of the team. If the primary extractor is not a cardiac surgeon, the surgeon and his or her team must be fully aware of the types of injuries that can occur, and must be prepared to provide the procedures required to rescue the patient. It is strongly advised that a checklist be developed and reviewed before each procedure, with the extraction team present, to assure that all personnel, equipment, and supplies are readily available and prepared.

### **NOT RECOGNIZING THAT A COMPLICATION HAS OCCURRED**

It is not uncommon for the blood pressure to drop during the performance of a lead extraction. This event can be due to vasodilation from anesthetic agents, vagal responses to traction on the lead, vagal response to pain, or inversion of the right ventricle. These causes are usually quickly reversible. However, it is imperative that the first consideration regarding the cause of a drop in blood pressure be the possibility of a tear in the myocardium or venous system. Likewise, failure of a finger pulse oximeter to register is often due to the probe falling off the patient's finger. However, this can also be attributable to the lack of blood pressure from an intravascular complication. Failure to consider one of the serious complications as the cause of loss of blood pressure or oximeter readings may delay the diagnosis of a major complication and, thus, the efforts to begin the needed rescue procedure. Delays of even several minutes to diagnose a complication requiring surgical rescue can lead to a poor outcome for the patient. Having transesophageal echo or portable transthoracic echo available in the operating room is very helpful in assisting in the differential diagnosis relating to hypotension. Most operators consider this essential equipment in the room. In some laboratories, intracardiac echo is placed to allow on-line simultaneous monitoring of the right and left ventricle for an effusion. The bottom line is that ideally some form of echo should be in the room, or at least immediately available.

### **NOT RESPONDING IMMEDIATELY TO A POSSIBLE COMPLICATION**

Just as failure to recognize that a complication has occurred delays the surgical rescue required, it is not uncommon for the extraction team to believe that they can manage the situation with conservative measures, and thus delay the involvement of the surgical rescue team. In the case of a small venous or myocardial tear within the pericardium, it is not uncommon that pericardiocentesis is effective in relieving tamponade. In many of these cases the small leak is sealed by a thrombus, and the chest does not need to be opened. However, it would be a mistake to believe that all cases can be managed in this manner, or that all patients will respond well to pericardiocentesis. When a complication has occurred, the extraction attempt should be halted (if the lead is not removed already), and all attention and resources should be focused on resuscitation and management of the patient. If the cardiac surgery team is not

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