

Lead Management and Lead Extraction



Charles J. Love, MD, FHRS, CCDS

KEYWORDS

- Cardiac implantable electronic devices • Lead extraction • Pacing complications

KEY POINTS

- Management of patients with cardiac implantable electronic devices (CIEDs) has become complex given the complications that can occur with implanted lead systems.
- Clinical problems such as infection, lead failure, and occluded vessels create situations that demand intervention to remove leads.
- Due to adhesions that occur in the venous system and at the endomyocardial attachment site, simple traction to remove a lead is often not sufficient, and is in many cases dangerous.
- Infection is, with few exceptions, a mandatory reason to remove the entire CIED system.
- Tools and techniques are now available that enable a skilled operator with a well trained team to extract leads with a great deal of efficacy and safety.

Lead extraction has become an indispensable procedure to manage patients with cardiac implantable electronic devices (CIED). Since the first implanted pacemaker in 1958 resulted in a lead fracture (2 hours after the implant), the weak link in any CIED system remains the lead. Although lead failure is not uncommon, it does not in itself represent an urgent cause for removal. The most compelling cause is infection. This article will provide an overview of lead extraction and what is now called lead management.

INDICATIONS FOR EXTRACTION

The current indications for lead extraction are listed in **Box 1**. Infection of any part of the CIED system is recognized as being the most noncontroversial reason to extract leads. This is true whether the infection is in the device pocket (other than a superficial cellulitis), or if it is intravascular with endocarditis. Failure to extract leads in an infected system almost always results in a failure to cure (at best), or severe sepsis and death. Delay in complete system removal is associated with worse patient outcomes and increased mortality.¹⁻⁴ Beyond

infection, Class I indications are somewhat less common or compelling. Occlusions of the vasculature preventing placement of new leads, or a need to perform a vasculature intervention that would require placing a stent that would cover and incarcerate existing leads has become a more common reason for need to extract leads.

With the advent of MRI conditionally safe CIED systems, there are several conditions that must be present in order to proceed with an MRI in keeping with the labeling requirements. Having leads that are not attached to the pacemaker or defibrillator, leads that are fractured, or leads that are not themselves labeled as MRI conditionally safe would result in a non-MRI conditionally safe system. Although some medical centers are willing to do scans on patients with these noncompliant systems, most do not do so. By extracting superfluous leads rather than abandoning them, patients have the option of getting a needed MRI scan at most imaging centers.

Accumulation of leads in the vasculature can create future problems for a patient. Factors that have been shown to increase the difficulty and risk of extraction include longer dwell time and

Johns Hopkins Hospital, 600 North Wolfe Street/Carnegie 592B, Baltimore, MD 21287, USA

E-mail address: clove14@jhmi.edu

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Box 1**Lead management recommendations**

- **Class I indications (strong)**
 - Careful consideration with the patient on the decision on whether to abandon or remove a lead is recommended before starting the procedure. The risks and benefits of each course of action should be discussed, and any decision should take the patient's preference, comorbidities, future vascular access, and available programming options into account.
 - If antibiotics are going to be prescribed, drawing at least 2 sets of blood cultures before starting antibiotic therapy is recommended for all patients with suspected CIED infection to improve the precision and minimize the duration of antibiotic therapy.
 - Gram stain and culture of generator pocket tissue and the explanted lead(s) are recommended at the time of CIED removal to improve the precision and minimize the duration of antibiotic therapy.
 - Preprocedural transesophageal echocardiography is recommended for patients with suspected systemic CIED infection to evaluate the absence or size, character, and potential embolic risk of identified vegetations.
 - Evaluation by physicians with specific expertise in CIED infection and lead extraction is recommended for patients with documented CIED infection.
 - A complete course of antibiotics based on identification and in vitro susceptibility testing results after CIED removal is recommended for all patients with definite CIED system infection.
 - Complete device and lead removal is recommended for all patients with definite CIED system infection.
 - Complete removal of epicardial leads and patches is recommended for all patients with confirmed infected fluid (purulence) surrounding the intrathoracic portion of the lead.
 - Complete device and lead removal is recommended for all patients with valvular endocarditis without definite involvement of the lead(s) and/or device.
 - Complete device and lead removal is recommended for patients with persistent or recurrent bacteremia or fungemia, despite appropriate antibiotic therapy and no other identifiable source for relapse or continued infection.
 - Careful consideration of the implications of other implanted devices and hardware is recommended when deciding on the appropriateness of CIED removal and for planning treatment strategy and goals.
 - Lead removal is recommended for patients with clinically significant thromboembolic events attributable to thrombus on a lead or a lead fragment that cannot be treated by other means.
 - Lead removal is recommended for patients with superior vena cava stenosis or occlusion that prevents implantation of a necessary lead.
 - Lead removal is recommended for patients with planned stent deployment in a vein already containing a transvenous lead, to avoid entrapment of the lead.
 - Lead removal as part of a comprehensive plan for maintaining patency is recommended for patients with superior vena cava stenosis or occlusion with limiting symptoms.
 - Lead removal is recommended for patients with life-threatening arrhythmias secondary to retained leads.
 - Extraction programs and operator-specific information on volume, clinical success rates, and complication rates for lead removal and extraction should be available and discussed with the patient prior to any lead removal procedure.
- **Class IIa Indications (moderate)**
 - Lead abandonment or removal can be a useful treatment strategy if a lead becomes clinically unnecessary or nonfunctional.
 - Transesophageal echocardiography can be useful for patients with CIED pocket infection with and without positive blood cultures to evaluate the absence or size, character, and potential embolic risk of identified vegetations.
 - Evaluation by physicians with specific expertise in CIED infection and lead extraction can be useful for patients with suspected CIED infection.

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