Lead Extractions
Indications, Procedural Aspects, and Outcomes

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KEYWORDS

• Lead extraction • Lead extraction indications • Lead recall • Lead extraction tools
• Device infections

KEY POINTS

- The number of implantable cardiac devices (cardiac implantable electronic devices [CIEDs]) is increasing.
- There is a trend toward increasing CIED infections.
- Lead malfunction and recalls require careful and potentially difficult lead management issues.
- There is an increased demand for lead extraction skills and comprehensive lead management programs.

INTRODUCTION

An estimated 10,000 to 15,000 pacemaker and implantable cardioverter defibrillator (ICD) leads are extracted annually worldwide.[1] New indications for device therapy and with that an increasing number of CIEDs placed contribute to the need for lead extractions. A higher lead prevalence due to an increased life expectancy as well as implantation of cardiac resynchronization therapy (CRT) devices requiring more leads per patient also play a role. CIED infections are a common indication for system extraction. Therefore, infection rates have increased as the number and complexity of devices increase.[2] Most recently, the complex question of lead recalls and lead malfunctions have added to the increasing number of lead extractions.

INDICATIONS FOR LEAD EXTRACTION

The Heart Rhythm consensus statement from 2009 contains the current recommendations for lead extraction.[3] The recommendations are summarized in **Table 1**. Overall, the most common indication for an extraction is infection, but the indications will vary somewhat depending on the referral base, volume, and expertise of the extraction center. **Fig. 1** shows the lead extraction indications at the University of California, San Diego.

CIED Infection

The indications for lead extraction as a result of CIED infection are outlined in **Table 2**. The patient vignette (**Box 1**) demonstrates a *Class I* indication for lead extraction. His ICD system was extracted, and a new ICD system was placed only after an appropriate antibiotic course as per Infectious Disease recommendations.

Device infection rates reportedly range from 1% to 7%. ICDs have a higher rate of infection compared with pacemakers. Factors that increase the risk of device infection include diabetes mellitus,

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Table 1
Indications overview

	Class I	Class IIa	Class IIb	Class III
Infection	X	X		X
Chronic pain		X		
Thrombosis or venous stenosis	X	X		
Functional leads	X		X	X
Nonfunctional leads	X	X	X	X

Adapted from Wilkoff BL, Love CJ, Byrd CL, et al. Transvenous lead extraction: heart rhythm society expert consensus on facilities, training, indications, and patient management. Heart Rhythm 2009;6(7):1085–104; with permission.

previous glucocorticoid therapy, underlying malignancy, operator inexperience, multiple lead placement, advanced patient age, oral anticoagulant use, frequent generator replacement, heart failure, fever before device implantation, use of temporary pacing catheters[4] nonpectoral (abdominal or thoracoscopic) implantations, and renal dysfunction.[3] CIED infections are associated with substantial morbidity and mortality, but it has also been shown that early and complete removal of CIED infected systems is associated with better outcomes.[5] Therefore, awareness of best management for infected CIED systems is imperative as is system-wide measurements to prevent infections.

Chronic Pain Indication

Severe chronic pain at the device or lead insertion site that failed medical management and had no alternative is a *Class IIa* indication. It would be appropriate to refer this patient for a discussion of the risks and benefits of an extraction procedure (**Box 2**).

Thrombosis or Venous Stenosis Indications

Ipsilateral venous occlusion if there is a contraindication for contralateral lead placement (arteriovenous [AV] fistula, mastectomy) is a *Class I* indication for extraction. This patient underwent a successful extraction of her left-sided right ventricular (RV) pacemaker lead and was upgraded to a biventricular ICD (CRT-D) device (**Box 3**). Other *Class I* indications include significant thromboembolic events originating from leads, bilateral subclavian or superior vena cava (SVC) occlusion precluding implantation of needed leads, SVC stenosis or occlusion with limiting symptoms, and also planned venous stent deployment to avoid lead entrapment. In the case of an ipsilateral occlusion at the time of placement of an additional lead, the current recommendation calls this a *Class IIa* indication.

Functional Lead Indications

There are several *Class I* indications for removal of functional leads, including when leads interfere

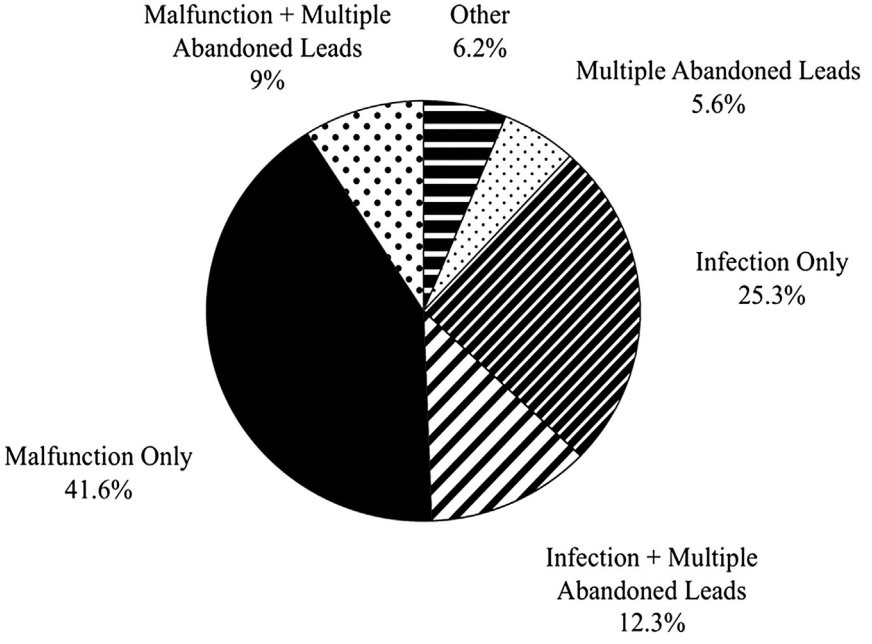

Fig. 1. University of California, San Diego, data from August 2010 to October 2013.