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ADVANCES IN ANESTHESIA

The Perioperative Management of Implantable Pacemakers and Cardioverter-Defibrillators

Peter M. Schulman, MD[a,*], Marc A. Rozner, PhD, MD[b,c]

[a]Department of Anesthesiology and Perioperative Medicine, Oregon Health & Science University, Mail Code KPV 5A, 3181 Southwest Sam Jackson Park Road, Portland, OR 97239, USA; [b]Department of Anesthesiology and Perioperative Medicine, The University of Texas MD Anderson Cancer Center, 1400 Holcombe Boulevard, Unit Number: 0409, Houston, TX 77030, USA; [c]Department of Cardiology, The University of Texas MD Anderson Cancer Center, Houston, TX, USA

Keywords

- Pacemaker • Implantable cardioverter-defibrillator
- Cardiovascular implantable electronic device (CIED)
- Electromagnetic interference

Key points

- In addition to delivering high-voltage therapy, all modern transvenous implantable cardioverter-defibrillators (ICDs) can also perform all the sophisticated, advanced functions of a pacemaker (PM) (ie, all ICDs also have antibradyarrhythmia capability).
- Before elective surgery, ensuring that the patient's cardiovascular implantable electronic device (CIED) is functioning properly remains paramount, especially for surgery that is likely to result in hemodynamic embarrassment or whenever electromagnetic interference (ie, the use of monopolar electrosurgery) is likely. In any situation wherein a preoperative device evaluation cannot take place (ie, emergency surgery), practitioners must be prepared for perioperative device malfunction or outright failure. This preparation often includes the placement of transcutaneous pacing/defibrillation pads.

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*Corresponding author. *E-mail address*: schulman@ohsu.edu

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- Electrical instruments, principally monopolar electrosurgery, but also those used by anesthesiologists (eg, nerve stimulators, radiofrequency scanning devices), can create electromagnetic interference and adversely affect the function of a CIED. If intraoperative electromagnetic interference is anticipated, ICD high-voltage therapy (antitachycardia pacing and shock) should be disabled and external defibrillation pads applied. Reprogramming to an asynchronous pacing mode should also be considered for any pacing-dependent patient.
- Except under exigent circumstances, magnet behavior should be confirmed whenever magnet use is planned. A magnet never alters the pacing mode of an ICD. It is sometimes possible to disable a CIED's magnet response through programming. Especially for an ICD, it might be difficult to determine that a CIED's magnet mode is disabled.
- Perioperative practitioners must be alert to incorrectly displayed electrocardiographic signals and rates resulting from electromagnetic interference.

INTRODUCTION: NATURE OF THE PROBLEM

In the United States, more than 3 million people have an implantable pacemaker (PM) or cardioverter-defibrillator (ICD) [1], and more than 500,000 PMs and ICDs are now implanted each year [2–5]. Initially developed to manage symptomatic bradyarrhythmias and sustained ventricular tachyarrhythmias, these cardiovascular implantable electronic devices (CIEDs) and their indications for use have evolved considerably, including treatment for heart failure [6]. Moreover, patients receiving these devices are older and have increasing medical comorbidities [3]. Although the incidence of patients with a CIED undergoing surgery is currently unknown, this number is likely substantial because these devices are so prevalent and more than 80 million surgical procedures are performed annually in the United States [7,8]. Also, some published reports suggest that the number of potentially eligible patients not receiving ICD therapy is sizable, but that a higher proportion of eligible patients might receive devices going forward [9,10]. Consequently, clinicians involved in perioperative care should expect to encounter and manage these patients with increasing frequency. Thus, anesthesiologists, just like general cardiologists, must become proficient in certain basic aspects of CIED therapy [6].

Unfortunately, the broad functionality of modern CIEDs has increased their complexity. As a result, safe, efficient, and cost-effective perioperative care of patients with CIED has become confounded by economic, personnel, and procedural challenges. The sophistication of these devices, the abundance of complex issues surrounding effective perioperative management of the patient with CIED, and changing patient conditions has increased the difficulty of providing this care. At least 2 reports suggest an association between these devices and increased perioperative morbidity and mortality [11,12]. Particular challenges include manufacturer-specific proprietary features, lack of standardization among device manufacturers, and an array of published literature that is often outdated and sometimes incorrect. Furthermore, in the operating or procedure