Implantable Devices

Assessment and Perioperative Management

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KEYWORDS

- Cardiovascular implantable electronic device (CIED)
- Automatic implantable cardioverter defibrillator • Pacemaker
- Electromagnetic interference (EMI) • Preoperative assessment
- Perioperative management • Ventricular assist devices (VAD)

KEY POINTS

Preoperative assessment of patients with implanted devices for unrelated surgeries includes

- The underlying disease and its associated comorbidities and presence of complications
- Treatment modalities and side effects
- Effect of surgery and anesthesia on the disease
- Effect of surgery and anesthesia on the implanted device
- Perioperative management plans to prevent
  - Patient injury
  - Device damage
  - Device malfunction.

INTRODUCTION

The twenty-first century has seen incredible progress in technology and this has affected the medical field as well. For years, instruments have been used for patient care; however, with advancement in knowledge, electronic device sophistication, and nanotechnology increasing numbers and types of implantable devices are being used. Much progress has been made since the first pacemaker that was partially implanted in a Bolivian priest in 1957, powered by a 9 V car battery with a total device

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weight of 80 lb. He probably did not have the cardiac reserve to carry that extra weight. Modern devices weigh a few grams and have remotely rechargeable batteries.

Patients with these devices are presenting for unrelated surgeries and their perioperative management requires understanding of these devices, the associated risks, the underlying comorbidity for which the device is implanted, and the medications the patient is taking. This article focuses on cardiac devices and neurostimulators. Other devices will be listed and briefly described.

Principles of assessment, risk, and management are similar with all devices.

CARDIOVASCULAR IMPLANTABLE ELECTRONIC DEVICES

There has been a paramount increase in the number of implantable cardiovascular devices. As the population lives longer and develops a multitude of cardiac conditions, medical science has developed a variety of devices that assist in the daily functioning and, possibly, life extension of individuals with cardiac problems. Cardiovascular implantable electronic device (CIED) is a broad term that includes permanent pacemaker (PPM), implantable cardioverter-defibrillator (ICD), cardiac resynchronization therapy device, and implantable loop recorder. In an analysis of CIED implantation in the United States between 1997 and 2004, implantation rates for PPMs and ICDs increased by 19% and 60%, respectively.[1]

The perioperative management of patients with CIEDs has changed dramatically as the types and functions of these devices have evolved in recent years. Ensuring patients' safety during surgical procedures is challenging when using CIEDs. Reviews and guidelines are required regarding the rapidly changing CIED technology, wide use of electromagnetic interference (EMI) sources, and obscure recommendations. The American College of Cardiology/American Heart Association/Heart Rhythm Society (HRS) provide guidelines and specific recommendations for CIED implantation.[2] The 2011 HRS/American Society of Anesthesiologists (ASA) Expert Consensus Statement created by the American Heart Association, the American College of Cardiology, and the Society of Thoracic Surgeons provides guidelines for the preoperative management of patients with CIEDs.[3] This article focuses on the actual preoperative assessment and management of patients with pre-existing CIEDs presenting for surgeries or any procedure requiring the care of an anesthesiologist.

The preoperative evaluation is extremely important in the assessment of a patient's past and present medical conditions, including the presence of and management plan for implantable devices. In patients presenting with CIEDs, the specific indication for implantation, type, function, and management of the device needs to be elicited directly from the patient's CIED team (electrophysiologist, cardiologist, primary care physician, and, possibly, the device manufacturer). The perioperative team, including the anesthesiologist and surgical group, need to communicate the exact nature of the procedure to the CIED team, including possible sources of EMI, fluid and electrolyte management, availability of telemetry perioperatively, and expected postoperative management. If the patient's own CIED team is unavailable, the institutional CIED team needs to be consulted to evaluate the patient, possibly interrogate the device, and provide specific recommendations. The CIED's manufacturer and an industry-employed allied professional (IEAP) may make expert suggestions about to the perioperative care. However, an IEAP may not determine the perioperative management of patients with CIEDs.[4]

Many physical and chemical factors affect the functioning of CIEDs. These include

- EMI, which is ubiquitous in the modern world and the operating room environment