

## Electrosurgery Safety Update - Pacemakers and Implantable Cardiac Defibrillators

Patients with cardiac pacemakers or internal cardiac defibrillators (ICDs) may be scheduled for various surgical procedures that require the use of radiofrequency (RF) equipment. The Valleylab Clinical Hotline often receives calls from perioperative nurses concerned about the safe use of RF equipment, such as electrosurgery (ES) and RF ablation units, on patients with pacing systems.

In order to provide good perioperative intervention and patient control, it is helpful to understand the basic functions of a pacemaker, why the pacemaker patient is at risk, and how to reduce some of those risks.

### How do pacing systems function?

Pacemakers use batteries as an energy source while wires and leads deliver **low-energy** therapy during bradycardia. There are two types of cardiac pacemakers, fixed rate and demand.

- Fixed-rate pacemakers stimulate the heart at a regular rate independent of the intrinsic heart rate.<sup>1</sup>
- Demand pacemakers sense the heart's spontaneous rhythm and are programmed to activate only as needed. They are more commonly used because they do not compete with normal heart function.

ICDs also use batteries as an energy source and use wires and leads to deliver therapy. There are generally two types of ICDs; both monitor heart activity and deliver therapy when appropriate, activating on demand:

- ICDs deliver a high-energy shock in the advent of tachycardia. This shock may produce some discomfort for the patient, similar to receiving a blow to the chest.

- Some ICDs also feature pacing capabilities. They provide antitachycardia pacing for ventricular tachycardia and antibradycardia pacing.<sup>2</sup>

### Electromagnetic Interference

RF equipment produces a high frequency electrical field, creating an electric voltage that might cause electromagnetic interference (EMI). If the electric voltage is detected within a pacing system, it could disrupt normal function. EMI might also affect electrical instruments and, in some instances, may cause stimulation of excitable tissues, resulting in ventricular fibrillation.

EMI has been reported to cause skipped beats, pacemaker reprogramming, ICD activation, asystole, bradycardia, depleted battery, and unspecified tachyarrhythmia.<sup>3</sup>

### Manufacturer Safety Recommendations

Pacemaker manufacturers provide general safety guidelines when medical devices are in use. Guidelines vary according to the type and model of pacing system. The following list is for information only and is not a comprehensive set of guidelines.

Pacemakers are generally safe from interference when the following medical devices are in use:

- Dental equipment: dental drills, ultrasonic probes to clean teeth, and dental x-rays
- Diagnostic x-rays, CT (or CAT) scans, and mammograms
- Fluoroscopy



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**Do not place the following medical devices directly over the pacemaker implant site:**

- Ultrasound
- Electrolysis
- Transcutaneous Electrical Nerve Stimulation (TENS)

**Guidelines must be followed when using these medical devices:**

- External defibrillation: If defibrillation is necessary, the medical worker should not place the paddles directly over the pacing system.
- Electrosurgery
- Radiofrequency ablation, including RF pain equipment
- Diathermy (heart treatment using electricity)
- Lithotripsy
- Radiation therapy

**Magnetic Resonance Imaging (MRI) is not recommended for a person with implantable pacer systems. Even when the MRI scanner is turned off, a strong magnetic field surrounds it. Consult a doctor and pacer system manufacturer when MRI is to be used.**<sup>4</sup>

**Device Manufacturers and Safety Organizations Guidelines**

- Hospitals should consult the pacemaker manufacturer.
- If pacemaker type is unknown, assume the patient is pacemaker dependent and have an external defibrillator and pacemaker available.
- Use bipolar ES (including vessel sealing) rather than monopolar.
- Continuously monitor patient. Have crash cart available.
- Use alternate surgical methods (knives, ultrasonics, vessel sealing).
- If monopolar ES must be used, place patient return electrode so the current will not pass through pacemaker, heart, or leads.
  - Use cut, blend, or desiccate mode to decrease voltage.
  - Use short activations.
- Proper pacemaker programming can help prevent pacing malfunctions due to ES, ablation, and other RF equipment. Consult a cardiologist and manufacturer representative.

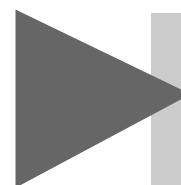
**Additional ICD Guidelines:**

- Doctors, dentists, and other healthcare personnel need to be aware of a patient's ICD. Certain medical procedures may interfere with ICD operation.<sup>5</sup> ICD manufacturers recommend keeping patients with activated ICDs away from EMI sources, such as electro-surgical units (ESUs).
- **ES can be safely performed in ICD patients as long as the device is deactivated before the procedure, then reactivated and reassessed immediately afterward.**<sup>6</sup>
- Consult the ICD manufacturer if varying from these general warnings.

Although recent improvements in electrical shielding and filtering systems have made pacemakers more resistant to outside electrical influence, it is very important to consult the pacemaker manufacturer whenever possible.<sup>7</sup> If the manufacturer cannot be contacted, such as in an emergency, use the strictest guidelines.

Patient safety begins when the patient and doctor notify medical personnel of a patient with an implantable pacer system. According to US federal law, medical device manufacturers must maintain a current database of patients in the US who have implantable medical devices, such as pacemaker(s). Patients should have an ID card with them at all times that includes model and serial numbers of pacemaker and lead(s), date of implant, doctor, and hospital.<sup>8</sup> It is the combined responsibility of the patient, doctor, and all hospital staff to provide a safe environment.

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