Outpatient Management of Patient Devices

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Disclosures

• None

Objectives

• Understand safe perioperative care for patients with cardiac implantable electronic devices (CIEDs)
• Familiarize yourself with management of insulin pumps
• Recognize anesthetic concerns and develop a safe approach to patients with deep brain stimulators and spinal cord stimulators
Pacemakers

- Impulse generator – usually implanted inferior to clavicle on left.
- Lead(s) – transvenous to the respective chamber(s) where electrodes implant.
- Indications: Sinus node dysfunction, symptomatic bradycardia, AV conduction abnormalities, long Q-T syndrome

ICDs

- Implantable Cardiac Defibrillators (ICDs)
  - Similar device composition to pacemakers
  - Electrodes deliver shock to myocardium in the setting of VT/VF
  - Most ICDs have pacing capabilities
  - Indications: arrhythmias with risk of sudden cardiac arrest (recurrent VT/VF)

Magnets

- Placing a magnet without knowing about device is inappropriate care.
  - Response to magnet placement can vary:
    - Asynchronous pacing (AOO, VOO, DOO) at pre-determined rate
    - No change
    - Asynchronous pacing for 10-64 beats, then return to programmed setting
  - For ICDs, a magnet will inhibit anti-tachycardia detection/therapy (unless programmed not to do so):
    - If arrhythmia is encountered intraoperatively, magnet can be removed and normal detection/therapy may occur.
    - Magnet does not affect pacemaker function of ICD.

In 2009, over 230,000 new pacemakers (130,000 ICDs) placed in the U.S.*

*The 11th world survey of cardiac pacing and implantable cardioverter-defibrillators: calendar year 2009, a joint survey of the World Society of Arrhythmia's projects.
### Pre-operative Approach

- Does patient have a CIED?
  - H&P, chart review, ECG
- Determine type of device
  - Identification card, CXR, CIED clinic, database
- Dependence on pacing
  - Documentation of dependence, verbal history
- Functional CIED
  - Pre-op evaluation by CIED clinic, pacer spikes, battery, sensing/capturing
- Attempt to determine underlying rhythm

### Pre-operative Preparation

- Things to consider:
  - Electromagnetic interference (EMI) can alter/reprogram device
    - Monopolar vs bipolar cautery
    - Distance to generator
    - Placement of grounding pad
  - Need to reprogram CIED?
  - Should disable anti-tachycardia function of ICD
  - Have external defibrillation equipment readily available
  - Anesthesia does not affect CIED, but physiologic changes may

### Intraoperative Considerations

- Monitor CIED function during surgery
  - Continuous ECG
    - If switched to asynchronous mode, watch for R on T phenomenon
  - Peripheral pulse monitoring
- Minimize EMI (may oversense and thus inhibit pacing)
  - Avoid direct contact of cautery to device
  - Maximize the distance between the device and the current (grounding pad and cautery)
  - Recommend:
    - Bipolar cautery, or
    - Short bursts of monopolar cautery
    - Use lowest effective setting for electrocautery
**Emergency Defibrillation**

- Be prepared for external defibrillation
  - Remove all EMI
  - Remove magnet (if applied)
    - Reenable anti-tachycardia capabilities.

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**To defibrillate…**

- If not, externally defibrillate.
  - Pads should be placed as far from generator as possible
  - Pads should be placed in an anterior-posterior orientation with current perpendicular to the device.

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**Post-operative Management**

- Continue cardiac monitoring in recovery room
- If magnet was applied, remove magnet.
  - Never leave patient in asynchronous mode unattended.
- Make sure anti-tachycardia capabilities are restored
- May or may not need reprogramming of CIED
  - Perioperative reprogramming?
  - Presence of EMI?
  - Uneventful surgical course?
Non-OR Procedures

- MRI - may cause EMI as well
  - Generally contraindicated in CIED patients.
  - Medtronic has an MRI-safe pacemaker.
- Lithotripsy (conflicting studies)
  - Keep beam as far from generator as possible.
- ECT (no EMI created)
  - Generally safe; should disable ICD prior to treatment
- GI procedures – usually no cautery utilized
- Radiation therapy
  - Ensure pulse generator is outside field of radiation


Other Recommendations

- CIED clinic gathers information about patient and device PRIOR to surgery
  - CIED nurse may need to interrogate device on day of surgery.
  - Will contact anesthesiologist regarding device.
- No magnet/reprogramming needed for surgery below umbilicus (pacemaker) and in LE (ICDs), or if bipolar used.
  - Do not use electrocautery within 6 inches of pulse generator.
- Call pacemaker nurse post-op for reprogramming.

Device Manufacturers

- Phone numbers:
  - Biotronic: (800) 547-0394
  - Medtronic: (800) 633-8766
  - Guidant/Boston Scientific: (800) 227-3422
  - ELA/Sorin Medical: (800) 352-6466
  - St. Jude Medical: (800) 722-3423
Insulin pumps

- ~500,000 patients in the U.S. with insulin pumps
  - Demonstrated better HbA1c and preferable quality of life over daily injection regimen
- No standardization of CSII perioperative management
- A collaborative management plan between facility, physicians, and patient is ideal


Use It or Lose It?

- Consider continuing CSII if:
  - Minor-moderate surgery
  - Case length less than 2 hrs (in case of pump failure)
  - Insulin pump is away from surgical field
- Consider d/c of CSII when:
  - Moderate-major surgery
  - Abdominal procedure
  - Emergent/trauma cases


Perioperative Glucose Management

- Administer subcutaneous fast-acting insulin if hyperglycemic
  - More effective than IV intermediate-acting insulin*
  - Ask patient usual bolus dose for hyperglycemia
  - "Rule of 1800"


*Note: Intraoperative insulin therapy with intermediate-acting insulin can be used when necessary.
**Radiation Exposure**

- What if there is radiation or electromagnetic fields?

  According to manufacturers’ recommendations, pumps should not be exposed to radiologic procedures.

  


**Approach to CSII**

- No standardization of perioperative management of insulin pumps
  - Lack of evidence regarding safety and efficacy of insulin pump use intraoperatively

- General consensus advocates institution-specific guidelines and protocols involving facility, physicians, nurses, and patients
  - Site/functionality of pump
  - Surgical time limit
  - Plan if pump fails


**Deep Brain Simulators (DBS)**

- Indications include:
  - Movement disorders
  - Epilepsy
  - Tourette’s Syndrome
  - Neuropsychiatric disorders (ie. OCD)

- Patients usually elderly with multiple comorbidities
  - Thorough chart review, especially pulmonary function
  - Preop CXR to check for leads

Perioperative Concerns with DBS

- May interfere with other devices (ie. Pacemaker)
- May cause ECG artifact
- Cautery can damage leads, reprogram device, or even injure brain tissue
  - Consider same precautions with EMI (grounding pad)

DBS

- Electroconvulsive therapy
  - Recommend:
    - Disable DBS prior to treatment
    - Careful ECT lead placement
    - Limit number of treatments in regimen
- Disable DBS if necessary!
  - Patients may require time to regain function once DBS is restarted.

Spinal Cord Stimulators (SCS)

- Utilized for refractory non-malignant pain
- Indications:
  - Failed back surgery, neuropathic pain, CRPS type I, refractory angina, peripheral vascular disease
- Modulates neurotransmitters and conduction of pain signals


SCSs

- System includes:
  - Generator (gluteal placement)
  - Conducting wires
  - Electrodes (in epidural space)
  - Remote control

Preoperative Considerations in Patients with SCSs

- Verify SCS placement/location
  - Medical record
  - Imaging
  - History and physical exam
- Multidisciplinary discussion of concerns
  - Surgical: Site, EMI
  - Pain management: adjuncts, turn off generator?

Anesthetic Plan and Goals

• General anesthesia
  – Minimize damage to SCS
  – Maintain proper function perioperatively
• Neuraxial Technique
  – May damage SCS or cause infection
    • Needle tip below/away from leads
    • Local anesthetics should not affect SCS
  – Discuss management with pain specialist

Summary

• Variety of patient devices are utilized
  – Be vigilant in learning about your patients!
• Understand potential risk factors that may threaten patient safety
• Develop a systematic approach in preparing and treating these patients
• Never be afraid to ask for assistance!

References

• ASA Practice Advisory for the Perioperative Management of Patients with Cardiac Implantable Electronic Devices: Pacemakers and Implantable Cardioverter-Defibrillators, 2011
• Germano, Joseph J. Commonly Implanted Cardiac Devices from Various Manufacturers, 2016, photograph.
References (cont.)