PERIOPERATIVE MANAGEMENT OF CARDIAC IMPLANTED ELECTRICAL DEVICES (CIED)

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MANAGEMENT OF CARDIAC IMPLANTED ELECTRICAL DEVICES

Objectives

- Describe different types of implanted cardiac devices
- Describe indications for placement of implanted devices
- Discuss the pre-operative evaluation/preparation of patients with implanted cardiac devices
- Discuss the intra-operative management of patients with implanted cardiac devices
- Discuss the post-operative management and evaluation of patients with implanted cardiac devices

MANAGEMENT OF CARDIAC IMPLANTED ELECTRICAL DEVICES

Question 1

- True/False: All pacemakers have defibrillation capabilities.
  - A. TRUE
  - B. FALSE
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**Question 2**

◊ True/False: All Implanted Cardioverter-Defibrillators (ICDs) have pacemaking capabilities.

• A. TRUE
• B. FALSE

**Question 3**

◊ The second letter in a pacemaker code (ex. DDD, VVI) refers to:

• A. Chamber paced
• B. Chamber sensed
• C. Response to sensing
• D. Defibrillation capabilities

**Question 4**

◊ The general response to placing a magnet over a pacemaker is:

• A. Deactivates pacemaker function
• B. Inhibits device sensing of electromagnetic interference
• C. Changes pacemaker to asynchronous mode
• D. Nothing
True/False: Placing a magnet over an ICD will place the pacemaker function (if activated) into asynchronous mode?

- A. TRUE
- B. FALSE

Types of Devices

- Pacemakers
- Implantable Cardioverter-Defibrillator
- Cardiac Resynchronization Therapy (CRT) - “Bi-V”

Indications for Pacemakers

- Symptomatic sinus node disease
- Symptomatic atrioventricular node disease (AV node)
- Long QT syndrome
- Hypertrophic Obstructive Cardiomyopathy
- Dilated Cardiomyopathy (CRT-P)
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Indications for ICD

- Ventricular Tachycardia
- Ventricular Fibrillation
- Brugada Syndrome
- Arrhythmogenic Right Ventricular Dysplasia
- Hypertrophic cardiomyopathy
- Cardiomyopathy with EF < 30-35%

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Pacemaker Code

- Table 1: The Revised NASPE/BPEG Generic Code for Arrhythmia Coding


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ICD Code

- Table 2: ICD-10CM Coding (V32.60)

Goals:
- Establish whether a patient has a CIED
- Define type of device
- Determine if patient is CIED-dependent for anti-bradycardia pacing function
- Determine device function

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Pre-operative Evaluation

1. Determine if a patient has a CIED
   - HISTORY
     - patient interview
     - review medical records
     - review CXR, EKGs, monitor, rhythm strip
   - PHYSICAL EXAMINATION
     - palpate device
     - look for surgical scar

2. Define the type of device
   - Obtain manufacturer’s ID card from patient
   - Review operative/implantation record
   - Call device manufacturer (if known)
   - Review CXR
2. Define type of device
- CXR review:
- Most devices have an X-ray code to identify manufacturer
- Look for lead characteristics

Pre-operative Evaluation - Chest X-Ray

3. Determine whether a patient is dependent on device for antibradycardia pacing function ("pacer dependent")
- Verbal history/medical record
- History of successful AV Node ablation
- CIED evaluation that shows no evidence of spontaneous ventricular activity when pacemaker programmed to VVI at lowest programmable rate
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Pre-operative Evaluation

4. Determining device function
   ◦ Comprehensive device evaluation

Pre-operative Preparation

1. Obtain a pre-procedure evaluation and prescription from the CIED “team”
   ◦ Advise CIED team about planned procedure:
     ○ Type, anatomic location, patient position for procedure
     ○ Potential for electromagnetic interference (EMI)
     ○ Surgical venue, post-op disposition, unusual circumstances
   ◦ CIED team to provide prescription to the procedure team:
     ○ Device type/make/model/indication for placement/last interrogation
     ○ Interrogation: Within 12 months for pacemaker, 6 months for ICD
     ○ Plan for pre-/intra-/post-op management
     ○ Device response to magnet
     ○ Is patient pacemaker dependent

Pre-op Preparation

1. Determine if EMI is likely to occur
2. Determine if reprogramming of pacemaker function to asynchronous mode or disabling special algorithms is needed.
3. Suspend antitachyarrhythmia function if present
4. Discuss case with surgeon - minimize EMI
5. Assure availability of temporary pacing and defibrillation equipment
6. Evaluate possible effects of anesthetic techniques on CIED function
**Table 1**

<table>
<thead>
<tr>
<th>Action</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMI Unlikely</td>
<td>no special precautions</td>
</tr>
<tr>
<td>EMI Likely - PM</td>
<td>Reprogram to asynchronous mode when indicated</td>
</tr>
<tr>
<td>EMI Likely - ICD</td>
<td>Suspend anti-tachyarrhythm mode</td>
</tr>
<tr>
<td>EMI Likely - All</td>
<td>Suspend antitachyarrhythm mode</td>
</tr>
<tr>
<td></td>
<td>Use Bipolar electrocautery or ultrasonic scalpel</td>
</tr>
</tbody>
</table>

**Intra-operative Management**

- Manage potential sources of EMI
  - Electrocautery
    - Position cautery tool and current return pad so current pathway does not pass through or near the CIED: >6 inches
    - Avoid proximity of cautery’s electric field to the pulse generator and leads
    - Use short, intermittent burst of electrocautery and lowest feasible energy levels
    - Use bipolar electrocautery or ultrasound (harmonic) scalpels

- Monitoring:
  - Continuous electrocardiography
  - Continuous monitoring of peripheral pulse
    - Palpation of pulse
    - Arterial line tracing
    - Pulse plethysmography
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Intra-operative Management

- Electromagnetic Interference:
  - Radiofrequency Ablation:
    - Avoid direct contact of ablation catheter to generator and leads.
    - Keep current pathway as far away as possible.
  - Cardiotomy:
    - Place pads as far away from generator as possible.
    - Place pads perpendicular to major axis of generator and leads. A/P.
  - Lithotripsy:
    - Possible inappropriate sensing and suppression of pacing.
    - Focus lithotripsy beams away from generator.
    - Terminate lithotripsy for arrhythmias.
    - Disable atrial pacing if the lithotripsy machine triggers via the R-wave.

- Therapeutic Radiation:
  - Device must be out of target area for radiation.

- ECT:
  - Pacemaker: If unipolar sensing - reprogram to asynchronous.
  - ICD: Disable tachytherapy.

- MRI:
  - Generally contraindicated - if must be performed, consult with cardiologist, radiologist, and device manufacturer.

- Special circumstances - EMI:
  - Colonoscopy / gastroscopy:
    - No problem unless electrocautery used.
  - Tissue Expanders:
    - May have magnets used to direct needle to fill expanders - may activate magnetic switch in device - DO NOT USE.
  - TENS/Spinal Cord Stimulators:
    - Generally not recommended.
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**Intro-operative Management**

- **DISABLING THERAPY:**
  - Device reprogramming
  - Magnet

**Magnet Response:**

- **Pacemaker:**
  - Generally cause ASYNCHRONOUS PACING

- **ICD:**
  - Generally inhibits antitachycardia (SHOCK) therapy
    - Not always -
  - *****NO effect on pacemaker function!!!
  - Asynchronous pacemaker function needs to be programmed.

**Reprogramming:**

- **Advantage:**
  - Predictable
  - Does not rely on proper placement of magnet

- **Disadvantage:**
  - Changes not always readily reversible (Vtach, sinus tach, competing heart rhythm)
  - Human error: programming and failure to re-enable tachytherapy
  - Need for continuous ECG monitoring and defibrillation equipment continuously available
  - Need for patient “tagging”
Intra-operative Management

- Magnet
  - Advantage:
    - readily available
    - quickly reversible
  - Disadvantage:
    - Not always possible to maintain magnet position
    - Unpredictable magnet response

Post-operative Management

- Goals:
  - interrogation of device
  - restoration of CIED function

ASA Practice Advisory:

- Cardiac rate and rhythm should be monitored continuously throughout immediate post-op period
- Interrogation of device
- Restoration of antitachytherapy
- Consider consultation with cardiologist or pacemaker/ICD service
Table 9: Indications for interrogation of CIEDs prior to patient discharge or transfer from a cardiac telemetry environment

- Patients with CIEDs reprogrammed prior to the procedure that left the device nonfunctional such as disabling tachycardia detection in an ICD.
- Patients with CIEDs who underwent hemodynamically challenging surgery such as cardiac surgery or significant valvular surgery (e.g., AAA repair).
- Patients with CIEDs who experienced significant intraoperative events including cardiac arrest requiring temporary pacing or CPR and those who required external electrical cardioversion.
- Patients with CIEDs who underwent certain types of procedures (Table 8 - previous slide) that emit EMI with a greater probability of affecting device function.
- Patients with CIEDs who have logistical limitations that would prevent reliable device evaluation within one month from their procedure.
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Management of Cardiac Implanted Electrical Devices

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Questions?

References:

- “Practice Advisory for the Preoperative Management of Patients with Cardiac Implantable Electronic Devices: Pacemakers and Implantable Cardioverter Defibrillators - An Updated Report by the American Society of Anesthesiologists Task Force on Preoperative Management of Patients with Cardiac Implantable Electronic Devices.” Anesthesiology 2011; 114:2-61
- Rozner, MA “Cardiac Pacing and Defibrillation.”