Evaluation of Pacemakers in the ED

**Pacemaker Code**

- Pacemakers are identified by a 5 letter code. The first letter is lead location, second letter is for the chamber(s) sensed by the pacemaker, the third letter is the response of the pacemaker to sensed impulse, the fourth letter indicates the ability to program and ability to perform rate modulation, the fifth letter indicates if multisite pacing is present in atrium, ventricle, or both.

<table>
<thead>
<tr>
<th>First Letter</th>
<th>Second Letter</th>
<th>Third Letter</th>
<th>Fourth Letter</th>
<th>Fifth Letter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chambers Paced</td>
<td>Chambers sensed</td>
<td>Action Upon Sensing</td>
<td>Programmability, rate modulation</td>
<td>Multisite pacing</td>
</tr>
<tr>
<td>A= Atrium</td>
<td>A= Atrium</td>
<td>T= Triggered</td>
<td>P= Simple Programmable</td>
<td>A= Atrium</td>
</tr>
<tr>
<td>V= Ventricle</td>
<td>V= Ventricle</td>
<td>I= Inhibited</td>
<td>M= Multiprogrammable</td>
<td>V= Ventricle</td>
</tr>
<tr>
<td>D= Dual (A+V)</td>
<td>D= Dual (A+V)</td>
<td>D= Dual (triggered + inhibited)</td>
<td>C= Communicating</td>
<td>D= Dual</td>
</tr>
<tr>
<td>O= None</td>
<td>O= None</td>
<td>O= None</td>
<td>R= Rate Modulation</td>
<td>O= None</td>
</tr>
</tbody>
</table>

Most Common Pacemakers seen in the ED:
- AAIR (Atrium Paced, Atrium Sensing, Inhibited, Rate Modulation)
- DDDR (Dual Paced, Dual Sensing, Triggered and Inhibited, Rate Modulation)
- VVIR (Ventricle Paced, Ventricle Sensed, Inhibited, Rate Modulation)
- DDD (Dual paced, Dual sensed, Triggered and Inhibited)

**Evaluating in ED**

**Pertinent History and Physical Exam**

- 1. The original indication for pacemaker placement
- 2. Cardiac History
- 3. Dates of implantation or revision
- 4. Recent Programming Changes
- 5. History of electromagnetic exposure and traumas
- 6. Recent episodes of syncope, palpitations, light headedness, sense of bradycardia or tachycardia, muscle twitching
- 7. Examine implantation site => swelling, bruising, erythema, tenderness, neck swelling or arm swelling (suspicions for venous thrombosis)
**EKG**
- The absence of a pacer artifact before P waves or the QRS complexes indicates intrinsic depolarization
- **Typically see a LBBB with appropriate discordance** in the ST segments and T-waves w/ leads placed in the Right Ventricular Apex. A **new RBBB may indicate lead dislodgment**.
- **Discordant ST-segment elevation to >5mm is most specific (99%)** for acute MI in ventricular-paced patients

**CXR**
- **1. Obtain PA/Lateral films**
- **2. Lead Locations:** Atrial leads are usually in the right atrial appendage. Right ventricular leads are usually in the right ventricular apex. Left ventricular leads of a biventricular pacemaker are located in the epicardial location along the posterior and lateral free wall of the left ventricle.
- **3. Compare pulse generator w/ previous CXRs.**
- **4. ID the Manufacturer**
- **5. Identify leads and lead locations.** A common site for lead fractures occurs between the **first rib and the clavicle** (subclavian crush syndrome).
- **6. Confirm integrity of each lead**
- **7. Distinguish an ICD from a permanent pacemaker by the presence of shock coils** with the appearance of thick bands on the leads.
- How to identify the Device: Ask the patient for their **pocket card**, place a **magnet** over the pulse generator, Call the **manufacturer hotline**, get a **CXR**

**Pacemaker Malfunction**
- Failure to **Capture** (the pacemaker delivers a stimulus but fails to depolarize the chamber)
- Failure to **Sense** (inability of the pacemaker to recognize intrinsic cardiac activity)
- Failure to **Pace** (pacemaker fails to deliver a stimulus to the heart. You usually see a HR lower than the pacemaker’s intrinsic rate)
- Don’t be afraid to use the magnet if you note any of the above or you don’t know what’s really going on with the pacemaker/ICD

**Use of the Magnet**
- Place over Pulse Generator
  - Indications:
    - Pacemaker: **break pacemaker-induced tachycardia, prevent pacing inhibition, demonstrate ability to pace, put pacemaker into fixed asynchronous pacing (no sensing)**
    - ICD: **cessation of shocks, inhibit tachyarrhythmia therapy during procedures**
  - Evaluate from Table Below:

<table>
<thead>
<tr>
<th>Tachyarrhythmia Therapy</th>
<th>ICD</th>
<th>Permanent Pacemaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspend</td>
<td></td>
<td>n/a</td>
</tr>
</tbody>
</table>
Effect on pacing | N/a |
<table>
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<tbody>
<tr>
<td>The pacer fires at a specific rate known as Asynchronous pacing (DOO, AOO, VOO) 85 beats/min: Battery @ beginning of life 65 beats/min: Elective battery replacement indicated No pacing: battery @ end of life, obese patient, poorly positioned magnet, pacemaker is programmed to ignore the magnet for safety</td>
<td></td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Magnet Removal</th>
<th>Function Restored</th>
<th>Sensing function restored</th>
</tr>
</thead>
</table>

References // Further Reading: