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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**.

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

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 (suspicion for venous thrombosis)**

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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:

	ICD	Permanent Pacemaker
Tachyarrhythmia Therapy	Suspend	n/a

Effect on pacing	N/a	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, pace-maker is programmed to ignore the magnet for safety
Magnet Removal	Function Restored	Sensing function restored

References // Further Reading:
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