

Episode 83: AICDs and Pacemakers

On this episode: Dr. Jed Wolpaw and Dr. Jared Miller

In this episode, episode 83, I welcome Dr. Jared Miller to the show. Dr. Miller is finishing his electrophysiology fellowship and we discuss the preoperative management of pacemakers and AICDs.

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What is a pacemaker?

- Solution for bradyarrhythmias, mainly sinus node dysfunction and AV block.
- Majority are subcutaneous devices with 1-3 transvenous wires through subclavian →→ ventricle. The wires depend on the number of chambers paced/sensed.
- Single chamber – Right Ventricle or Right Atrium
- Dual chamber – RV + RA
- Biventricular (CRT) – 3rd wire into coronary sinus for LV

What is an AICD?

- Automated Implantable Cardioverter Defibrillator. All ICDs can pace, but not all pacemakers are ICDs. Similar device to pacemaker, but also has a capacitor to build up charge. This extra feature deals with tachyarrhythmias, basically watching for possible ventricular tachycardia/fibrillation.
- Two responses to a rapid pacing heart. **Anti-tachycardic pacing (ATP) or deliver shock.** Essentially a 'fire sprinkler system at home' that sits there not doing anything unless vfib/tach.
- Starts with ATP first to try and terminate, then shock. Dependent on heart rate.

How to tell the difference on chest x-ray?

- The generator/can for ICD is **larger** due to battery and capacitor.
- Look for leads into heart. Pacemaker is thinner, while the ICD is likely **coiled** to deliver shock.

What is a CIED?

- Cardiovascular Implantable Electronic Device. An umbrella term for pacemakers and defibrillators.

Why one vs other?

- Pacemaker if sinus node dysfunction or complete heart block, which can lead to symptomatic bradycardia.
- AICD for 2^o prevention if already had vtach/vfib, and for 1^o **prevention generally with heart failure with high risk of vtach/vfib.**
- Why so selective? AICD is expensive. Morbidity and mortality risks of surgery. Risk of inappropriate shocks (eg, rapid afib misinterpreted).

Terminology for device modes:

- Pacemaker code generally have 5 letters
 - 1) chamber paced (A, V, D for Atrium, Ventricle, Dual)
 - 2) chamber sensed (A, V, D)
 - 3) response to sensed event (I, T, D for Inhibit, Trigger Pacing, Dual)
 - VVI (Common outside in US): Pace ventricle at a defined rate, and if R wave detected within set timer, it will inhibit pacing and reset timer. Generally saved for
 - DDD (Most common in US)
 - **If sinus node dysfunction with normal AV node, would want atrial pacing, ventricular sensing**
 - **If sinus node fine with AV block, want ventricular pacing, atrial sensing.**
 - Pacemaker-mediated tachycardia is a phenomenon due to retrograde P waves.
 - DDD 60-120 means won't pace any higher than 120 bpm.
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- Mode switching: if it senses atrium going too fast, and not likely to be sinus rhythm, device will automatically switch to a lower #.
- 4) left off or 'R' for **rate responsiveness**
- Sinus node dysfunction with DDD 60. Will always keep at minimum 60 bpm, so device will bring up heart rate based on sensor (based on manufacturer). One manufacturer senses for activity/motion..
- 5) biventricular pacing – about position of leads

Why biventricular pacing?

- Cardiac resynchronization therapy (CRT), a **solution for heart failure**, not rhythm.
- Can be CRT p(acemaker), or CRT d(efibrillator)

Why dual chamber vs just one?

- Maintain AV synchrony for best cardiac output.
- Single chamber + sinus rhythm → **pacemaker syndrome**, with signs/symptoms of decreased cardiac output.

Other implantable devices?

- ICD is entirely subcutaneous, vs generally device is subcutaneous while leads are transvenous. Can shock but not pace. Good for high risk of infection, such as dialysis patients, or for younger patients whose leads would otherwise be inside the vasculature for many years.
- Leadless devices
- Entire device in heart. Shaped like bullet in right ventricle (jokes on radiologist?)

What should we think about as anesthesia providers?

- Why have device in first place?
 - o If AICD, why? Low v-fib and heart failure? History?
- What's impact on surgery?
 - o Electrocautery, especially monopolar (typical bovie) → electromagnetic interference where device might OVERsense heart activity so it inhibits pacing.
 - o ICD → sense as really fast rate so deliver shock.
- How do we decide when to worry?
 - o No electrocautery/electromagnetic interference → nonissue
 - o Check device if it hasn't been looked at in over a year.
 - o When pacemaker dependent, needs reprogramming.
- What are some ways to avoid disrupting the device?
 - o **Use bipolar if possible, or short bursts of cautery if unavoidable**
 - o **Current path more than 6 inches away from device.**
 - o **Below umbilicus.**
- Have magnet, pads, external defibrillator ready in the room
- Calling about device, have open communication and clear protocols.
 - o Say 'reprogramming' rather than turning 'on'/'off' the device

How are magnets used with CIEDs?

- On pacemaker, magnets generally change pacing mode to asynchronous
 - o If DDD → then DOO
- On ICD, magnets generally turn off tachyarrhythmia feature, but not brady arrhythmias.
- If ICD and pacemaker-dependent, magnet will stop shock but not sensing.

Most ICD wires are transvenous. What to keep in mind if placing central lines?

- Common to have venous occlusion on ICD wire side, so avoid venous access on that side.
- If using the same side, prepare that you might run into venous occlusion.
- Communicate with electrophysiologist if trying to use same side first.

What to do in emergency of patient with CIED?

- Magnet is friend. Call EP for help.
- Not an issue if procedure is below umbilicus.
- Check for dependence by examining whether the EKG is paced or not.
- If pacemaker-dependent, put on magnet. With AICD, same concept: have defib ready.
- Keep patient on telemetry postoperatively until reprogrammed!

Are the CIEDs safe for scans?

- CT scans are almost universally YES.
- MRI – most people who received device in last 15-20 years can get MRI. Confirm first!
- Most devices have FDA conditionally safe mode.

Other considerations?

- If patient undergoing EP or ablation, confirm management with EP.
- If radiation ablation over device, the rad-onc / nuclear physicist will manage.
- Cautery may be used for colonoscopy/endoscopy.
- TENs units may cause electromagnetic interference!

How do you manage AICDs and pacemakers?

Review Questions

Link jumps to appropriate section

[What are the two ways that AICD respond to a rapid pacing heart?](#)

[How can you tell the difference between AICD and pacemaker on chest x-ray?](#)

[If a patient has heart failure or a history of vfib, which device would you use?](#)

[If a patient has sinus node dysfunction with normal AV node, where would you pace and sense?](#)

[What does the 4th letter of the code indicate?](#)

[What is the pacemaker syndrome?](#)

[What are a some ways to avoid disrupting the device if using a monopolar bovie?](#)

References

<https://www.ncbi.nlm.nih.gov/pubmed/24182719>

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