

When the Beat Drops: Pacemaker Emergencies in the Aging Heart

Geriatric Emergency Medicine Symposium 2026

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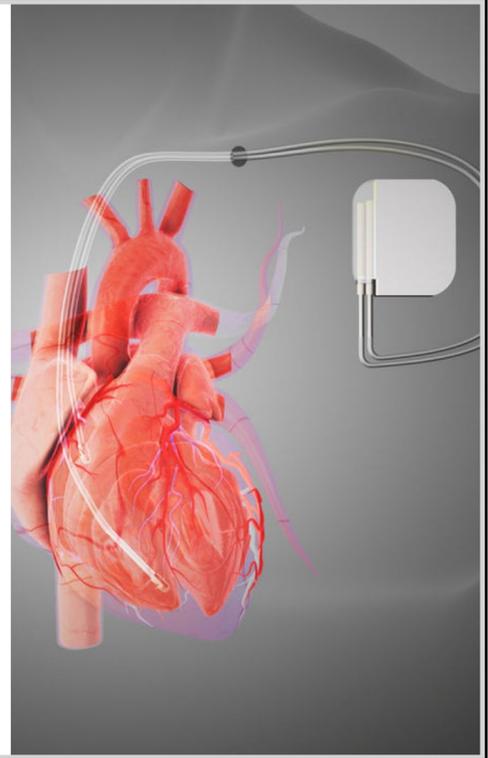
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No Financial Disclosures

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Objectives

- 1 | **Use the PACE framework to recognize life-threatening early complications after pacemaker or ICD placement.**
- 2 | **Develop an ED-focused approach to evaluating and managing pocket, access, cardiac, and electrical pacemaker complications.**



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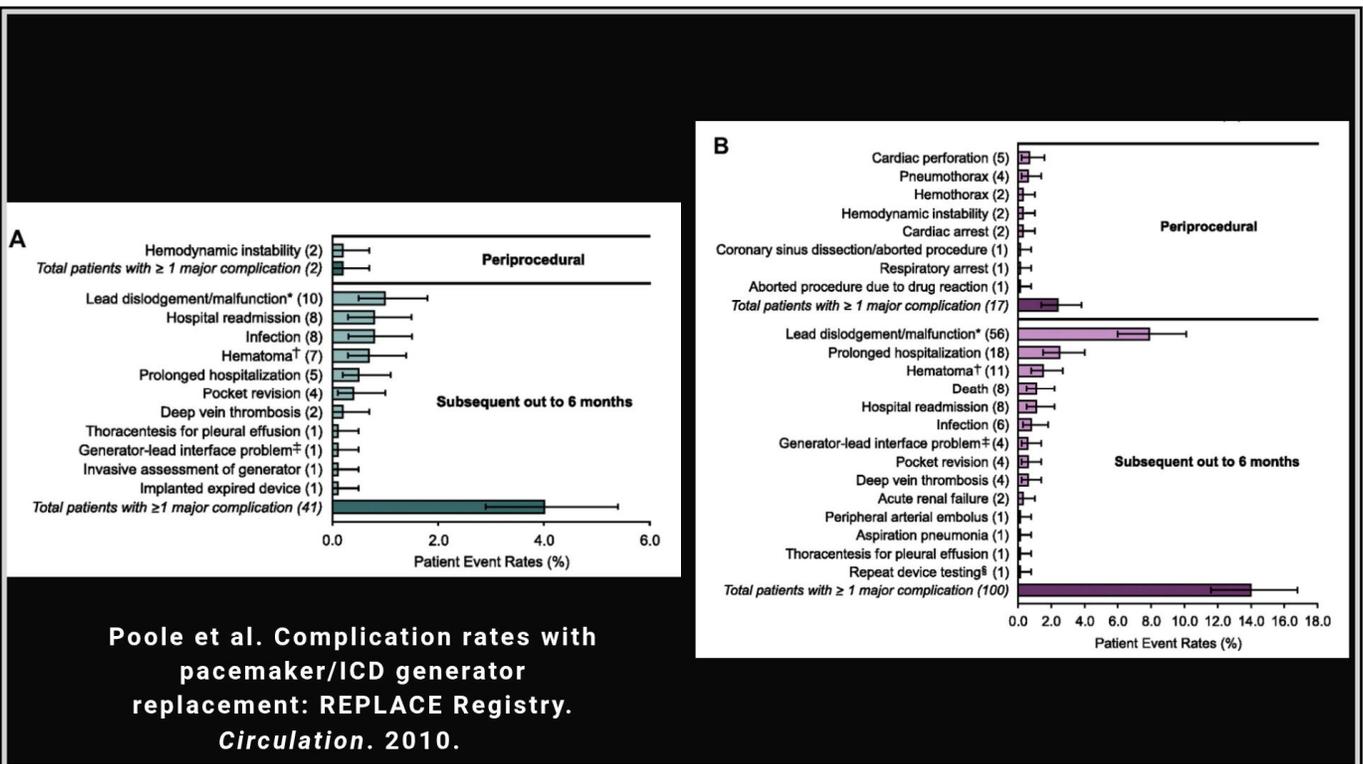
Our Crashing Patient

- **A 85 yo M arrives to your ED with chief complaint - chest pain, shortness of breath, presyncope**
- **Patient has a history of DM, HTN, SND s/p Pacemaker 5 days ago**

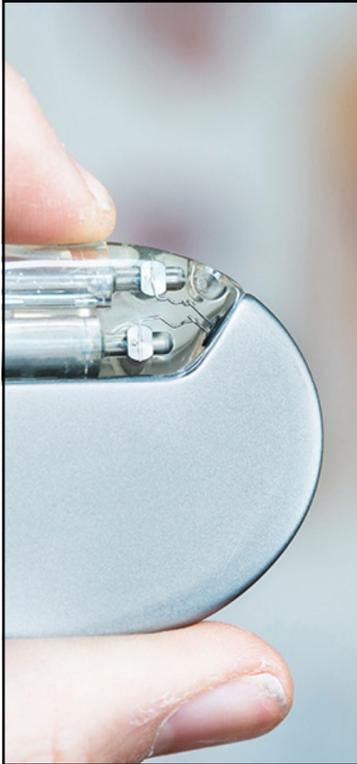
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What are most you worried about?

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PACE Mnemonic

- **A structured emergency department approach to evaluating common subacute pacemaker and ICD emergencies following recent device implantation**
- **Approximately Days 1 - 30 post procedure**

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PACE Mnemonic

- **Pocket**
- **A**
- **C**
- **E**

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PACE Mnemonic

- **Pocket**
- **Access**
- **C**
- **E**

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PACE Mnemonic

- **Pocket**
- **Access**
- **Cardiac**
- **E**

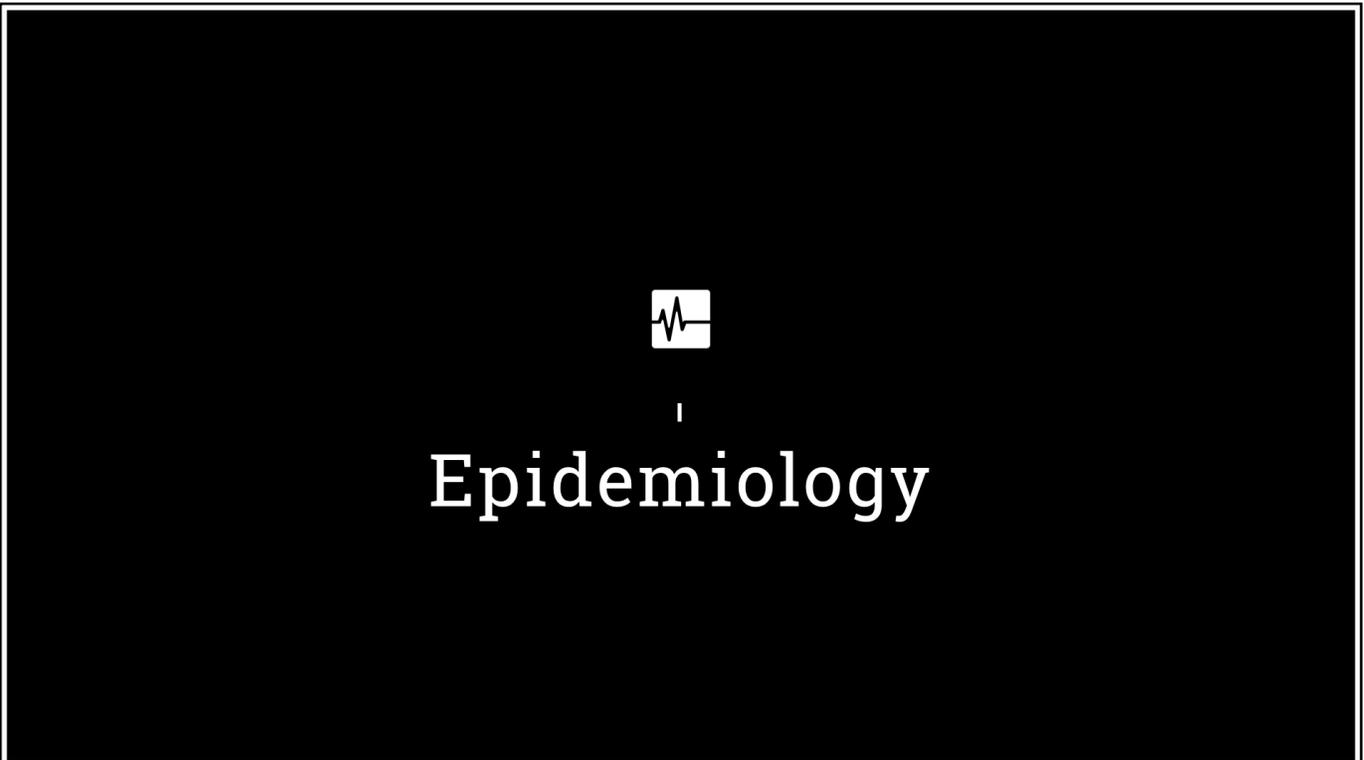
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PACE Mnemonic

- **Pocket**
- **Access**
- **Cardiac**
- **Electrical**

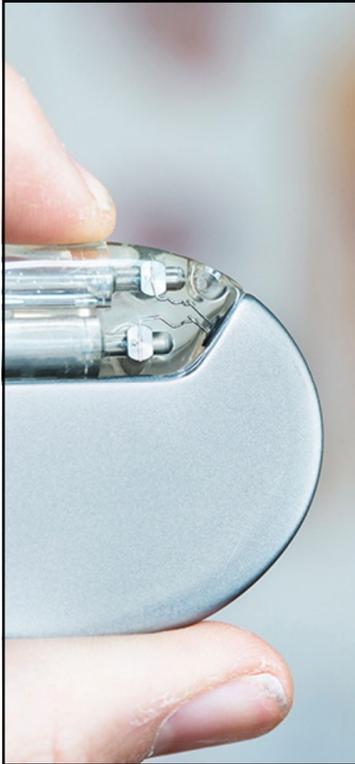
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Epidemiology

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Epidemiology - The Elderly Patient

- **Structural and electrical remodeling of cardiac tissue**
- **↑ Prevalence of cardiac disease**
- **Symptomatic Bradycardia**
 - **Sinus node dysfunction**
 - **AV Blockade**

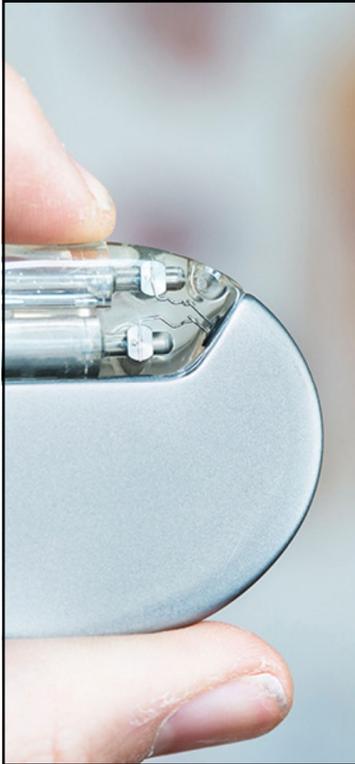
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Pacemaker Indications

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Pacemaker Indications

- **Advanced AV block**
- **Sinus Node Dysfunction**

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Pacemaker Indications

- **Carotid Sinus Syndrome**
- **Infiltrative disease**
- **Post-MI**
- **Atrial fibrillation with symptomatic bradycardia or pauses**
- **Neuromuscular Disease + ANY AVB**

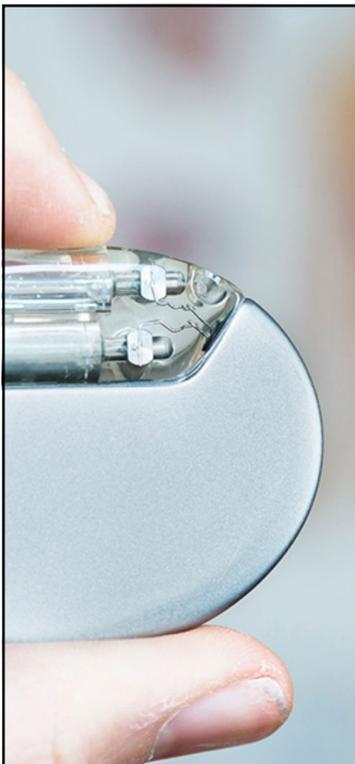
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Anatomy of the Pacemaker

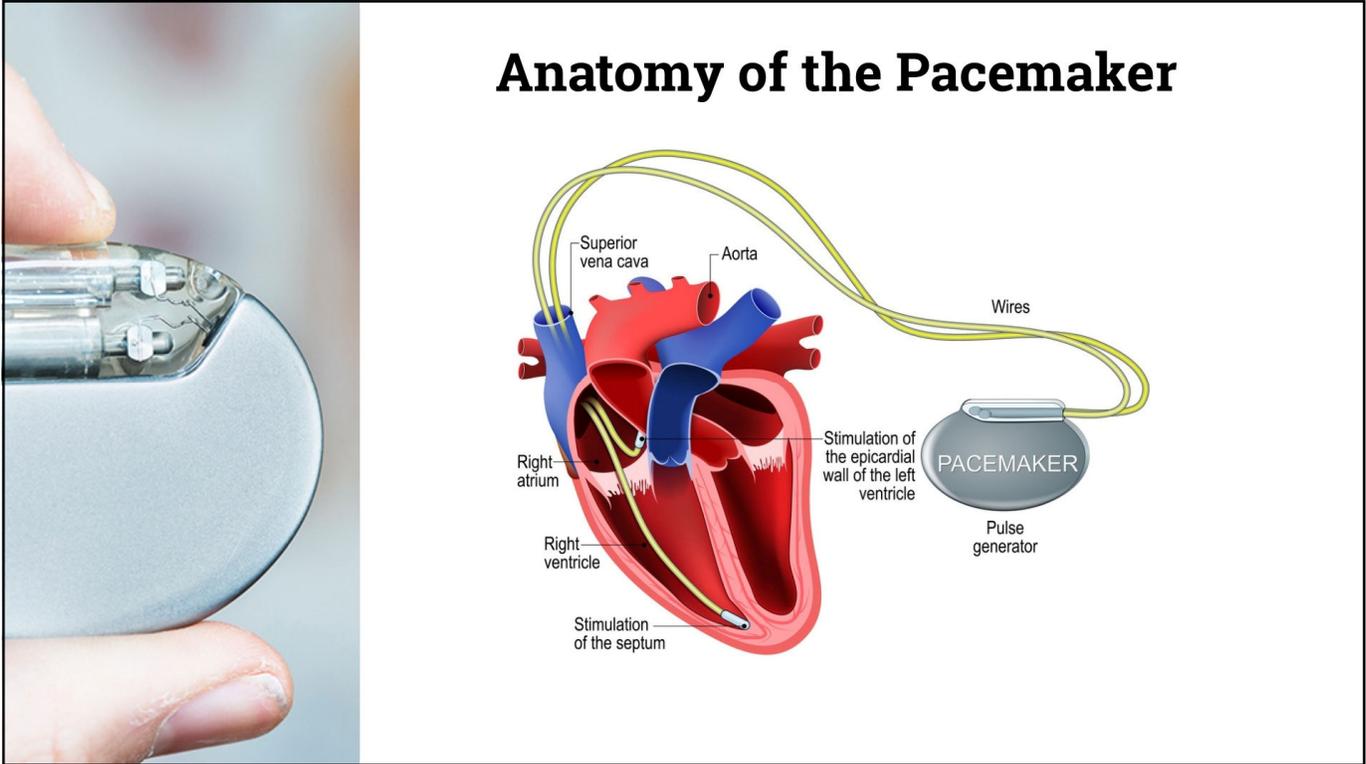
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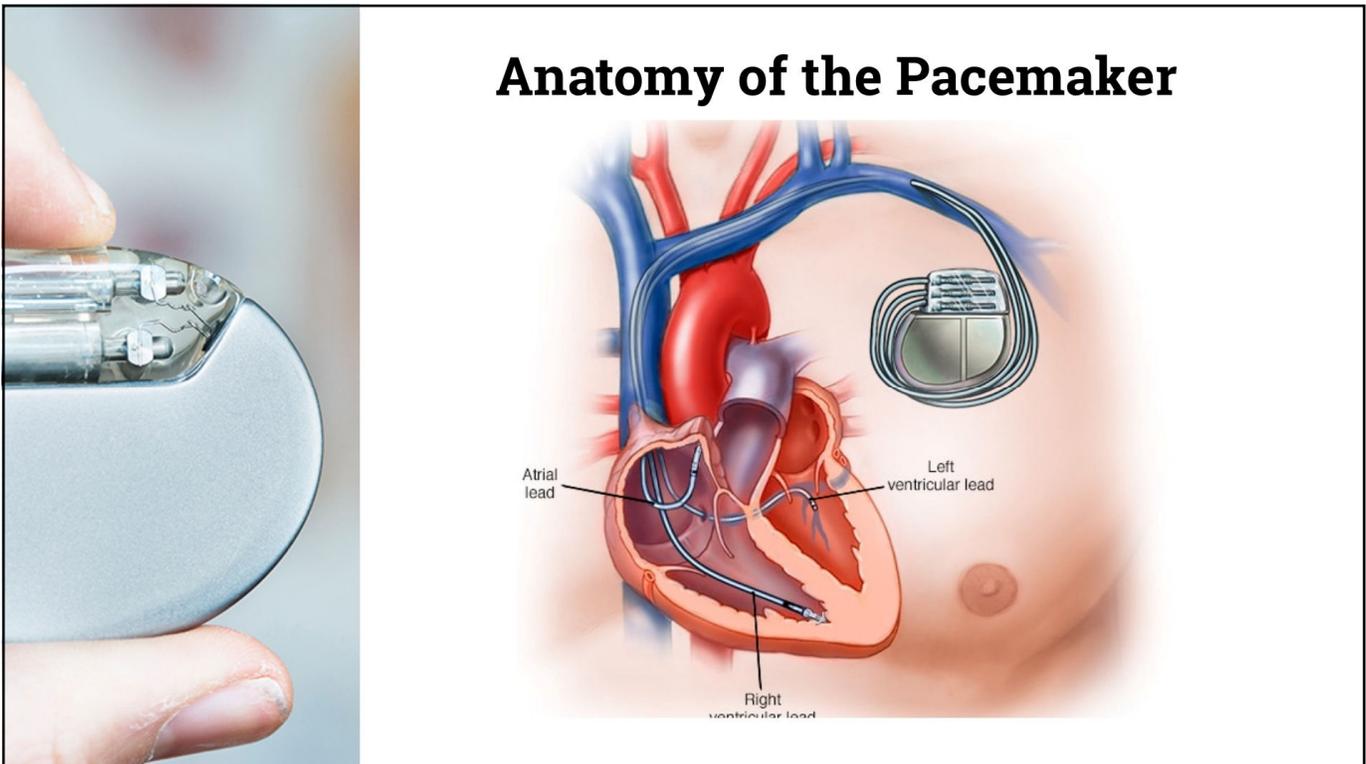
Anatomy of the Pacemaker

- **Pulse Generator**
- **Lead(s)**
- **Types of Pacemakers**
 - **Single-chamber pacemaker**
 - **Dual-chamber pacemaker**
 - **Biventricular pacemaker**

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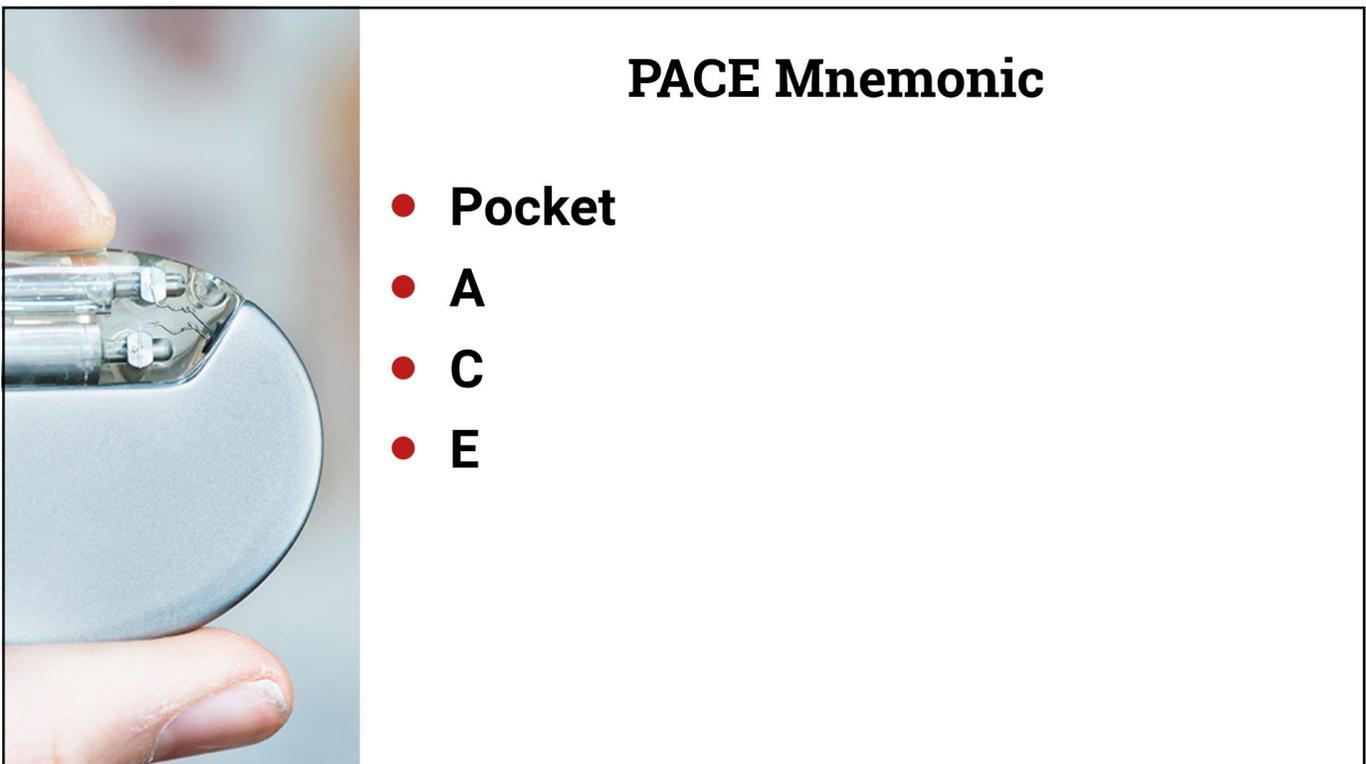
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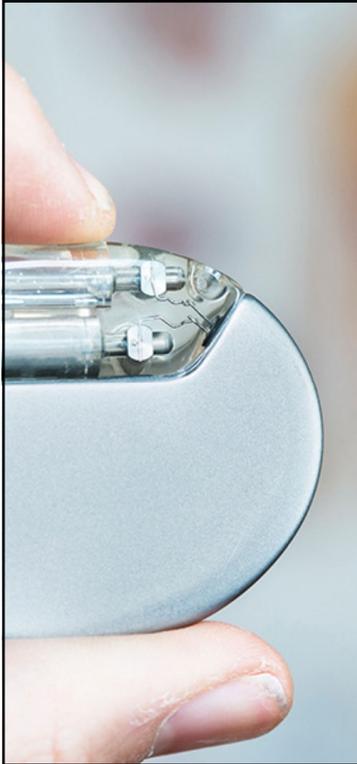
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Pocket Complications

- **Pocket Hematoma**
- **Cellulitis**
- **Pocket Infection**
- **Pocket Erosion (more chronic)**

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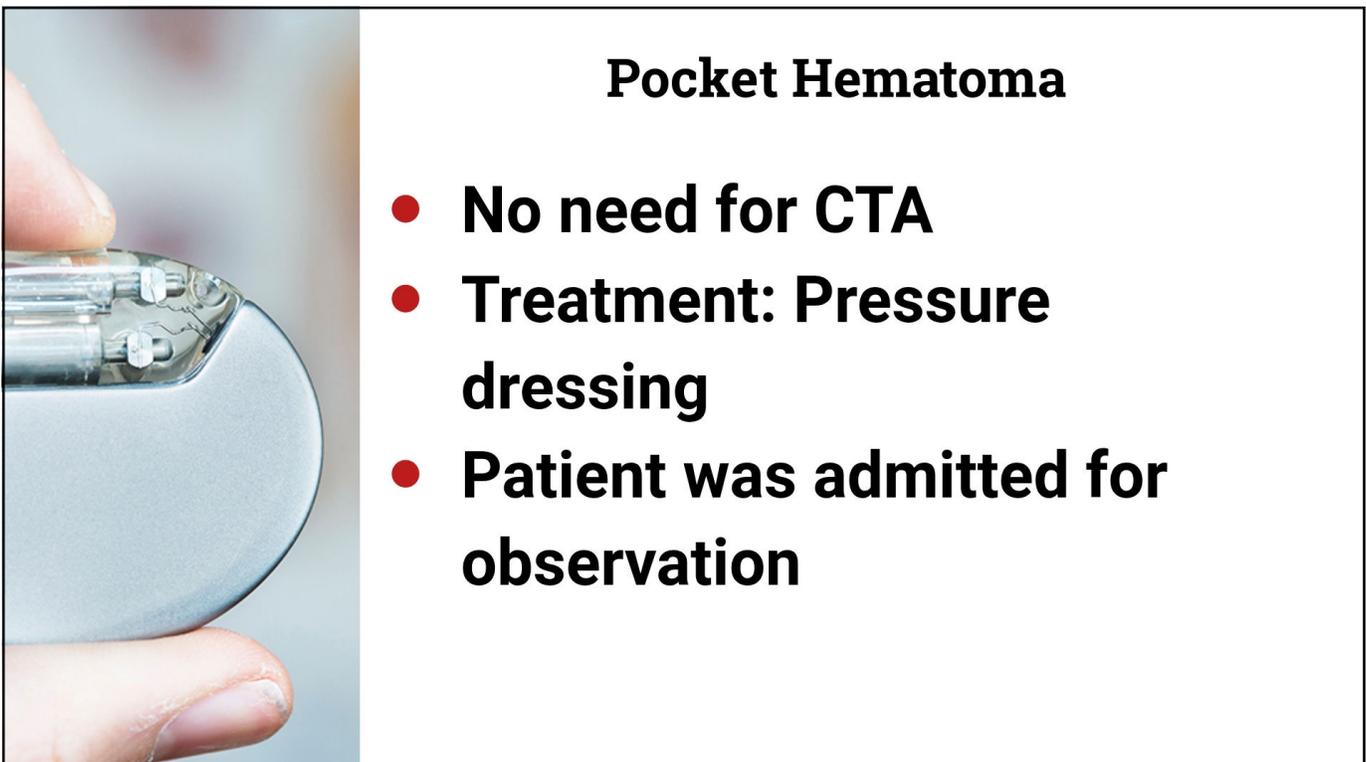
Pocket Complications

- **65+ yo M s/p AICD 2 weeks ago**
- **2 days of chest swelling and bleeding from site**

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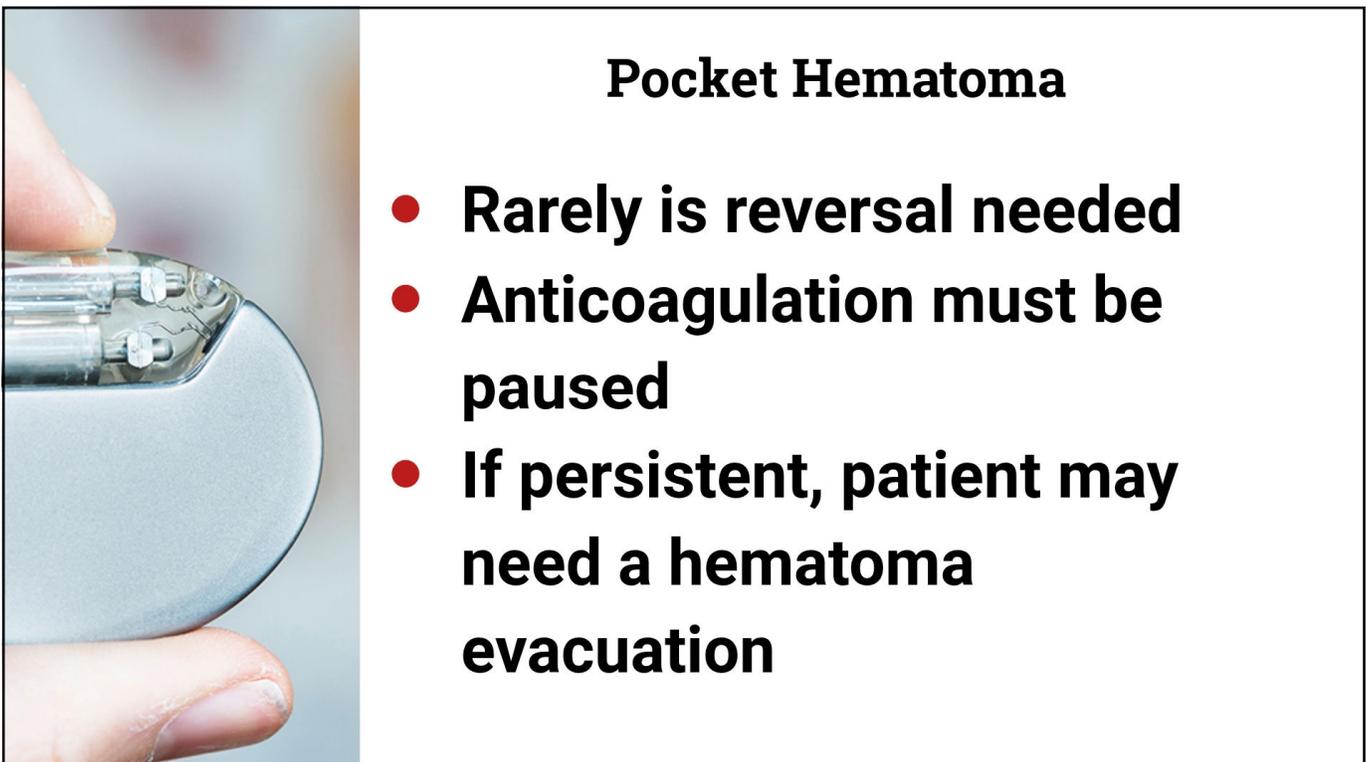
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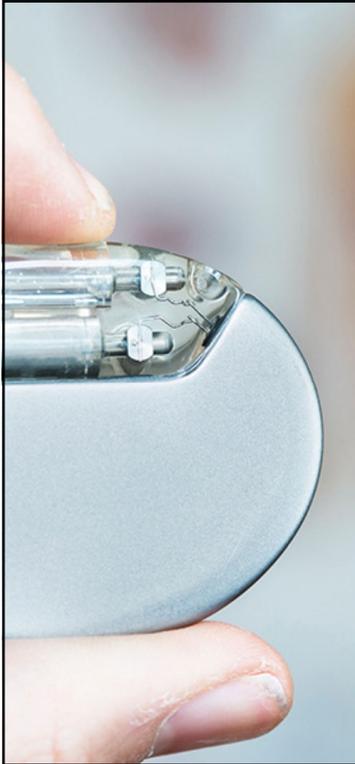
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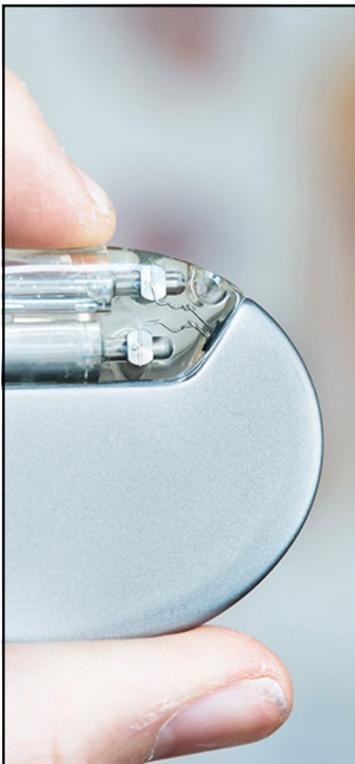
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Pocket Hematoma

- **If not addressed:**
 - **Skin breakdown**
 - **Local infection**
 - **Bacteremia / Endocarditis**

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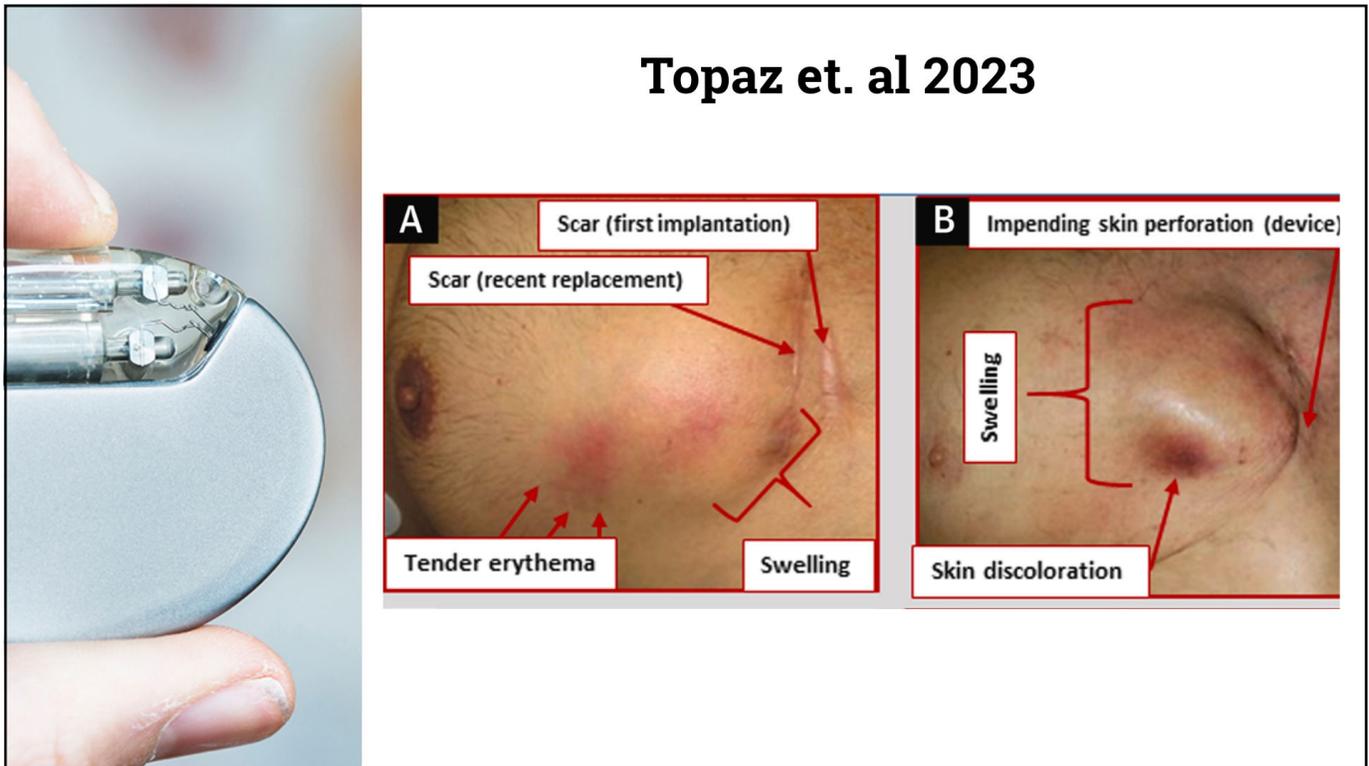
Pacemaker Infections

- **Incidence: < 2-3%**
- **Can occur within 6 months**
- **Can be subacute <30 days**
- **AICD leads carry higher risk than pacer leads**

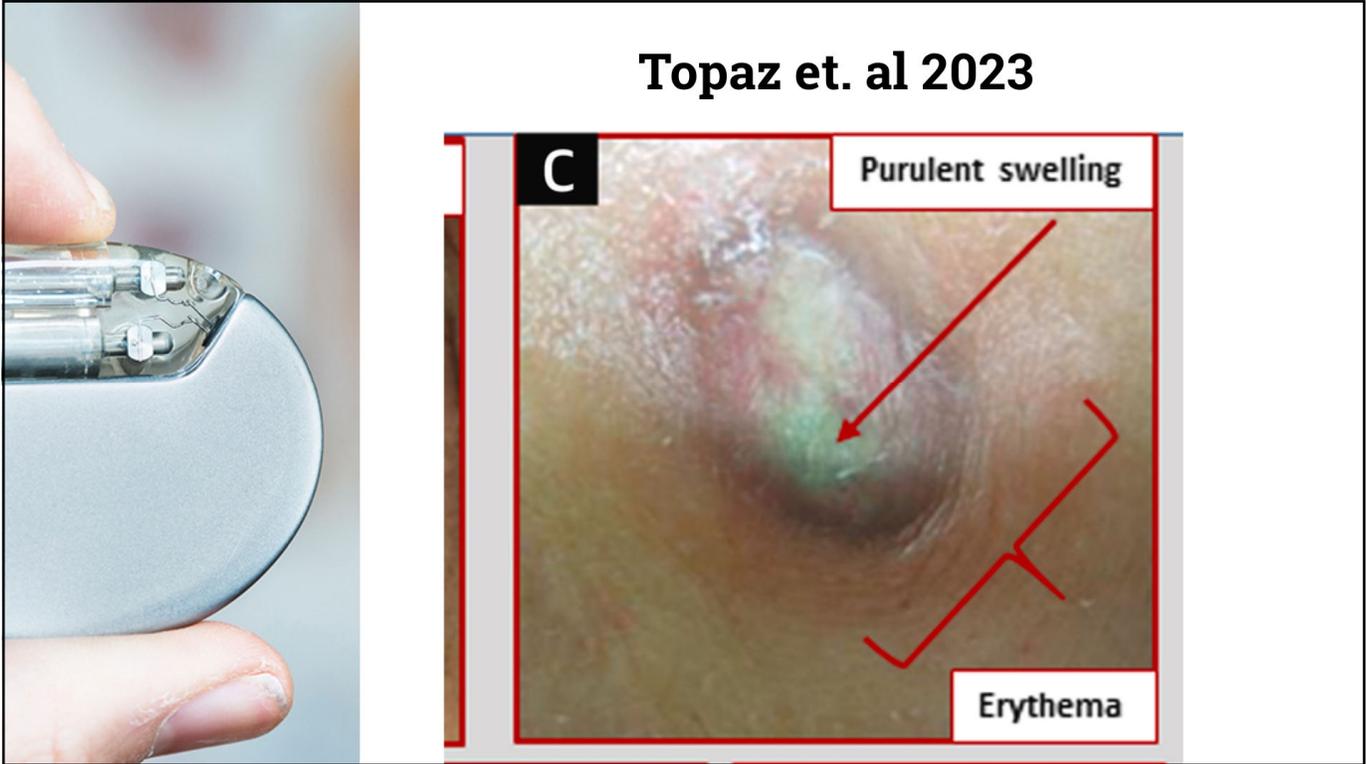
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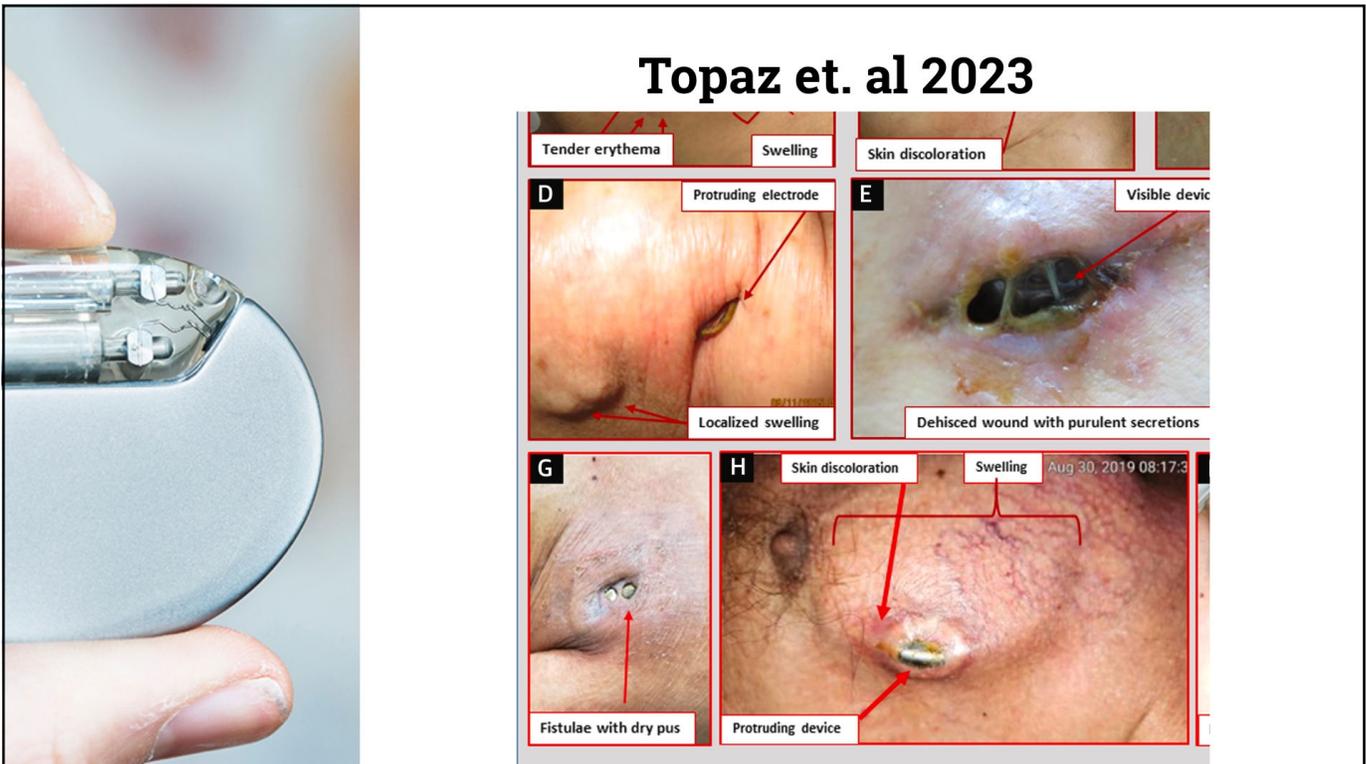
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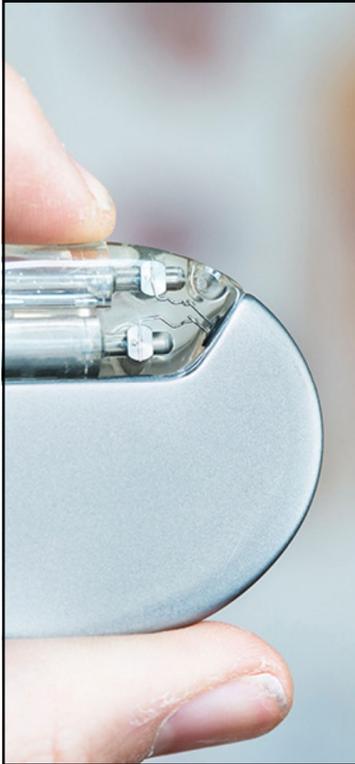
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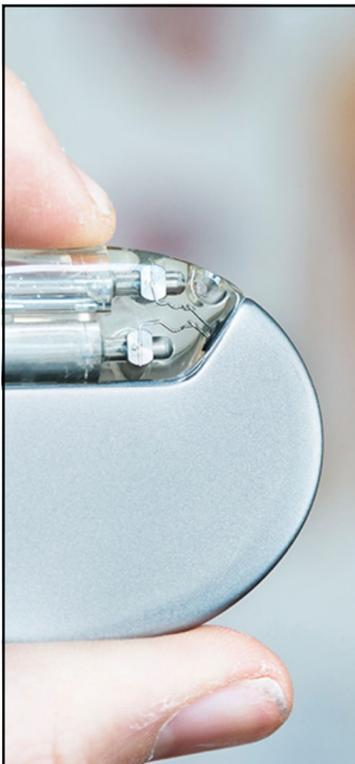
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Pacemaker Infections

- **Can progress to lead endocarditis**
- **Difficult to tell from systemic infection**
- **May only present with fever**
- **Requires device removal and IV antibiotics**

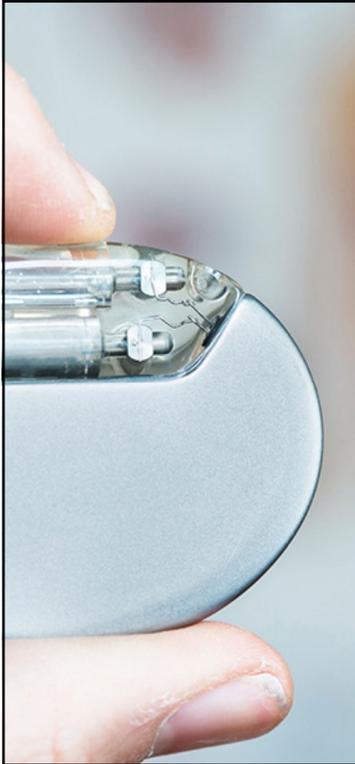
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PACE Mnemonic

- **Pocket**
- **Access**
- **C**
- **E**

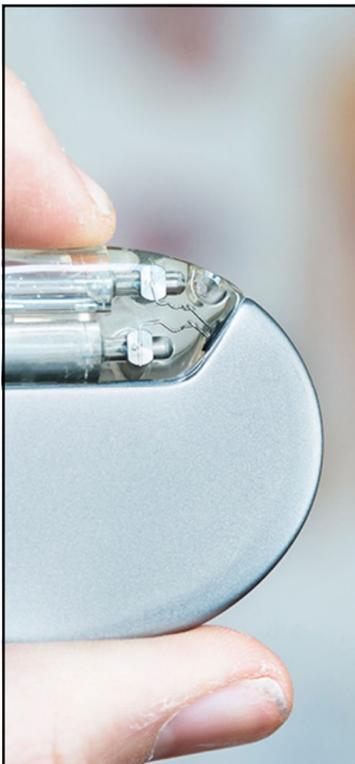
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Access-related Complications

- **Pneumothorax**
- **Hemothorax**
- **AV Fistula (rare)**
- **SVC Syndrome (rare)**

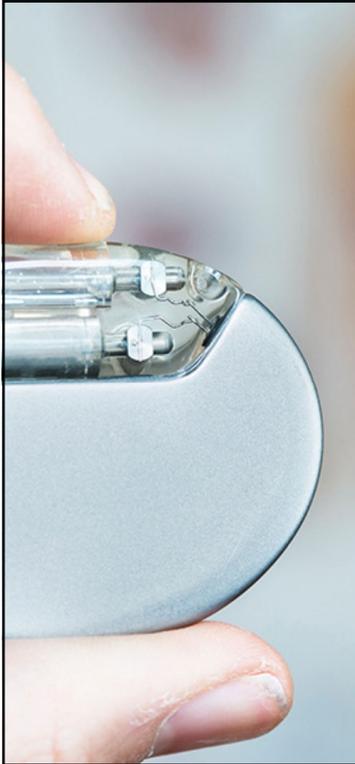
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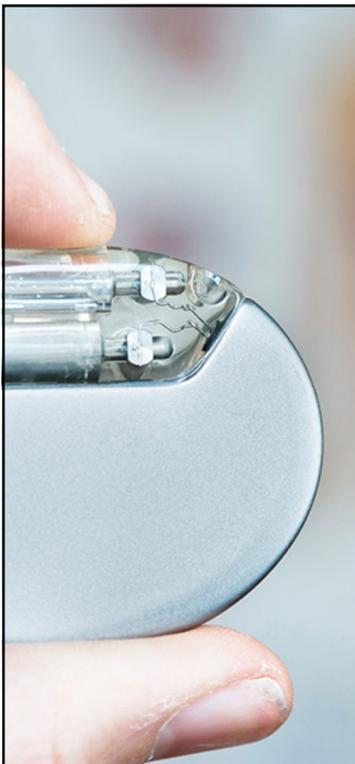
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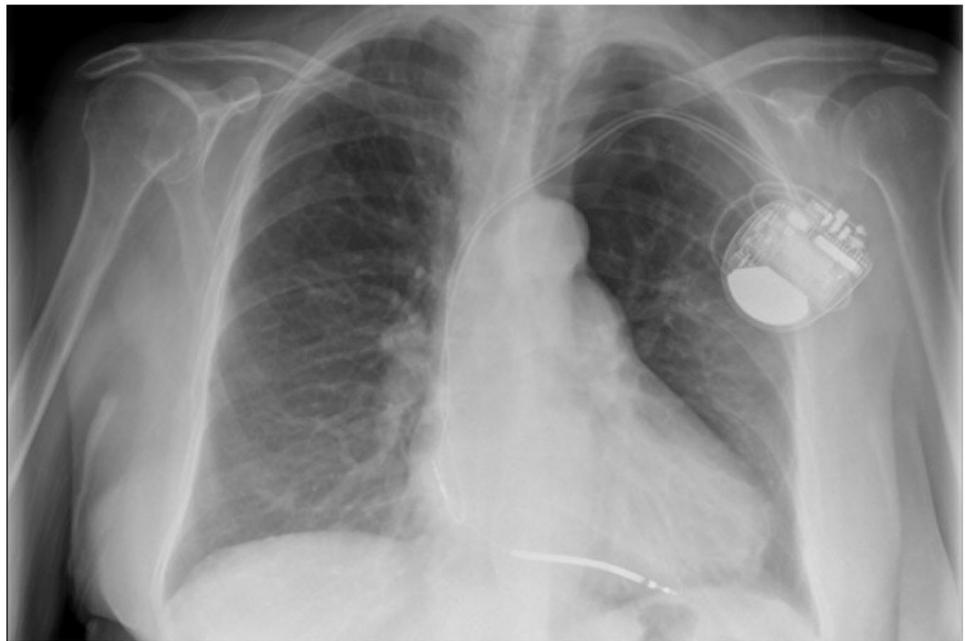
Access-related Complication

- **75+ yo F who was discharged 8 hours ago after AICD placement**
- **Mild hypoxia, chest pressure and trouble swallowing**

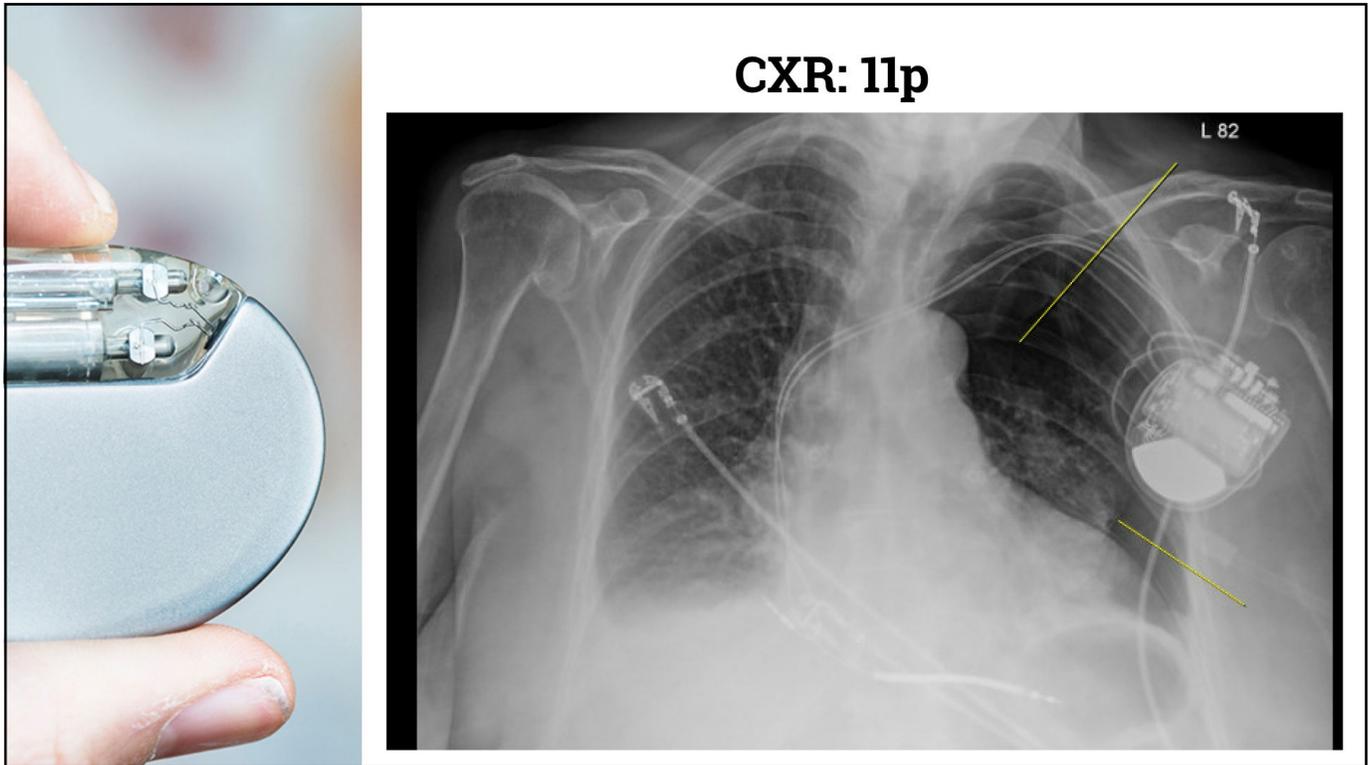
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CXR: 12p earlier in the day



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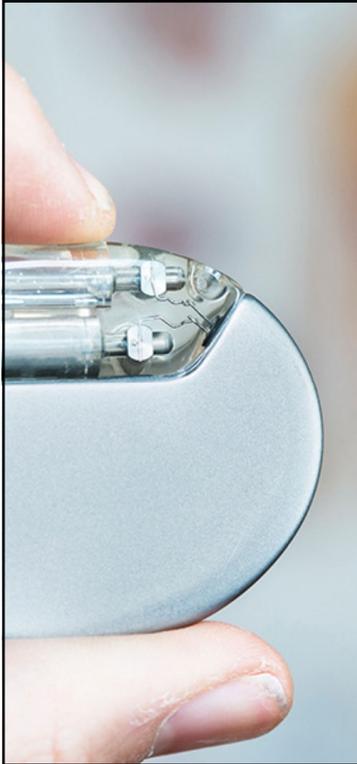
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Access-related Complication

- **Pneumothorax**
complication rate: 0.6-1.6%
- **Patient symptoms resolved with chest tube**
- **CXR earlier in the day does not rule out pneumothorax!**

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PACE Mnemonic

- **Pocket**
- **Access**
- **Cardiac**
- **E**

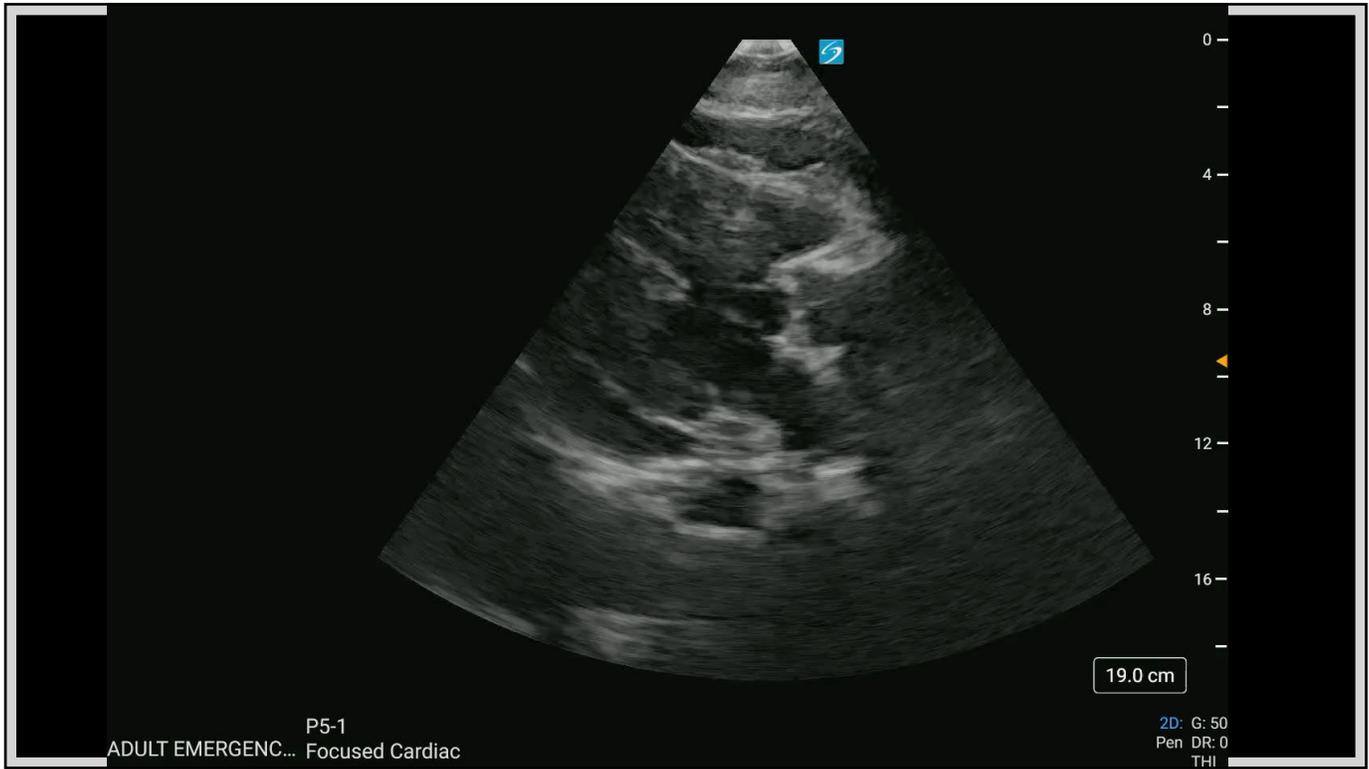
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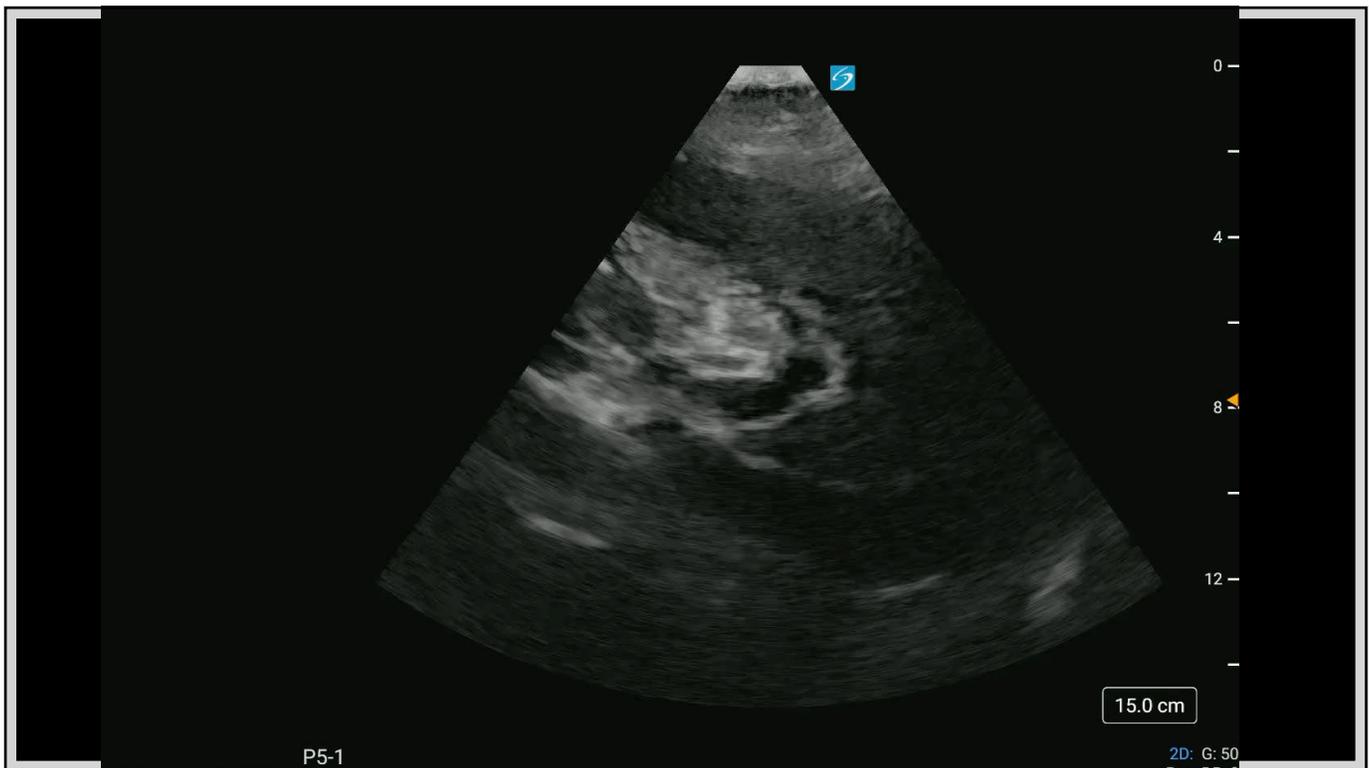
Cardiac Tamponade

- **80+ yo M**
- **Recent PPM 3 days ago**
- **2 days of shortness of breath**
- **BP 72/42, HR 111, RR 22, SpO2% 87%**

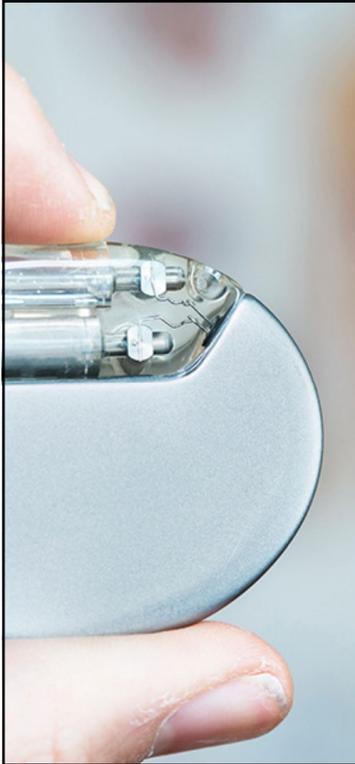
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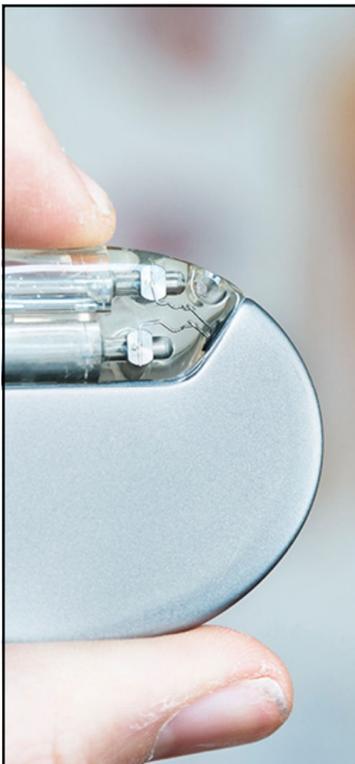
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Cardiac Tamponade

- **Tamponade ~ 0.5% incidence**
- **s/p pericardiocentesis**
- **400 cc out + drain**
- **Resolution of symptoms**

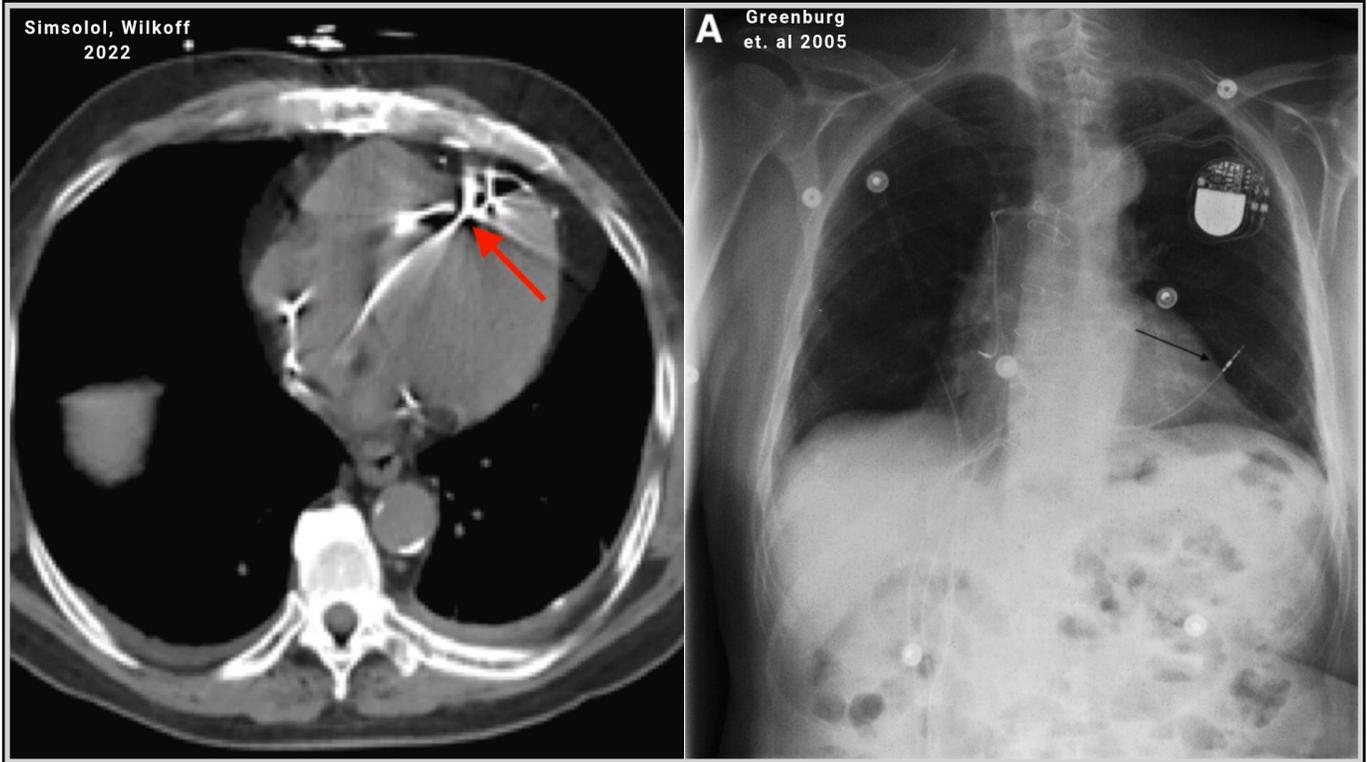
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Lead Perforation

- **Rare (<1%) but serious**
- **Usually caught intraop**
- **Symptoms within 24h**
- **Can be subacute <30 days**
- **Cardiac Surgery**

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PACE Mnemonic

- **Pocket**
- **Access**
- **Cardiac**
- **Electrical**

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Pacer Malfunction

- **Output Failure**
- **Failure to Capture**
- **Pacemaker Associated Dysrhythmias**

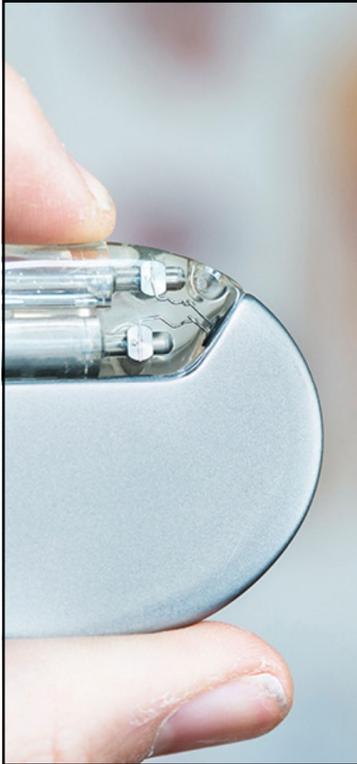
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Pacer Malfunction

- **ECG**
- **CXR**
- **Pacemaker Interrogation**
- **Electrolytes**
- **Cardiology Consult**

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ECG

- **Inappropriate pacing**
- **Unusual bradycardia**
- **Inappropriate tachycardia**

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Output Failure

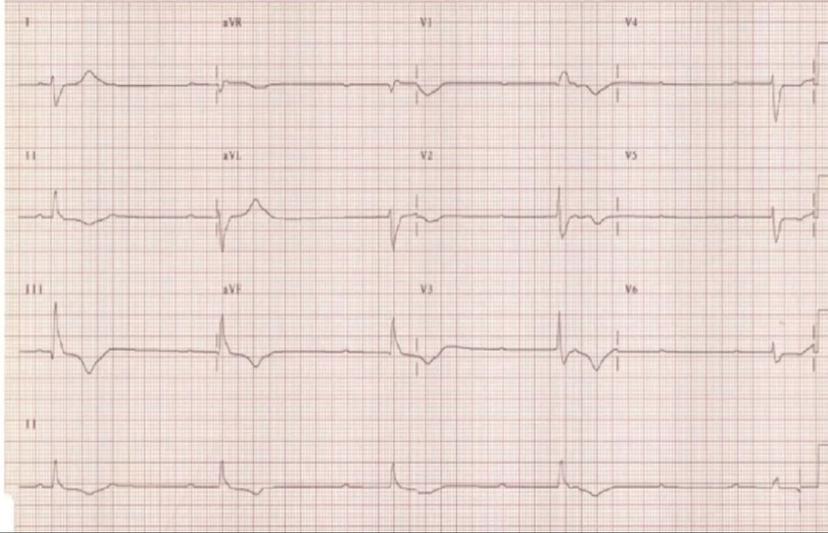
- **The Pacemaker is NOT Pacing**
- **No pacer spikes where pacer spikes should be**
- **May present as pauses or bradycardia**

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Output Failure

- Downeast Emergency Medicine



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Output Failure

- EMDocs

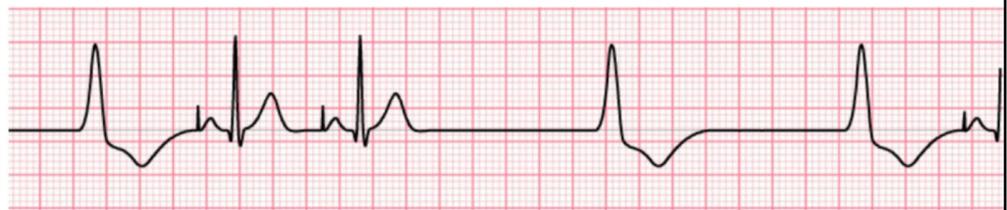
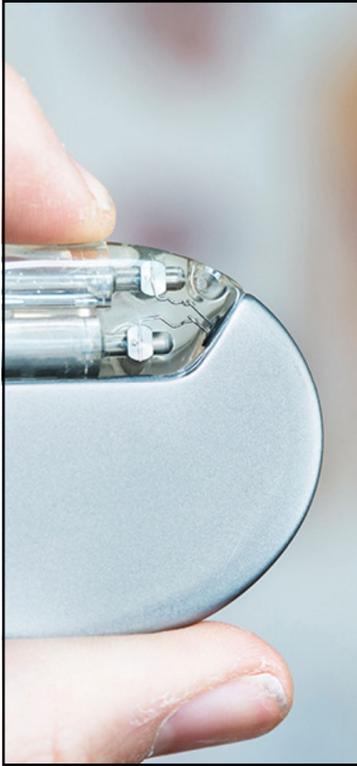


Fig 4) Atrial spikes are initially present then fail to deliver a stimulus [5].

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Failure to Capture

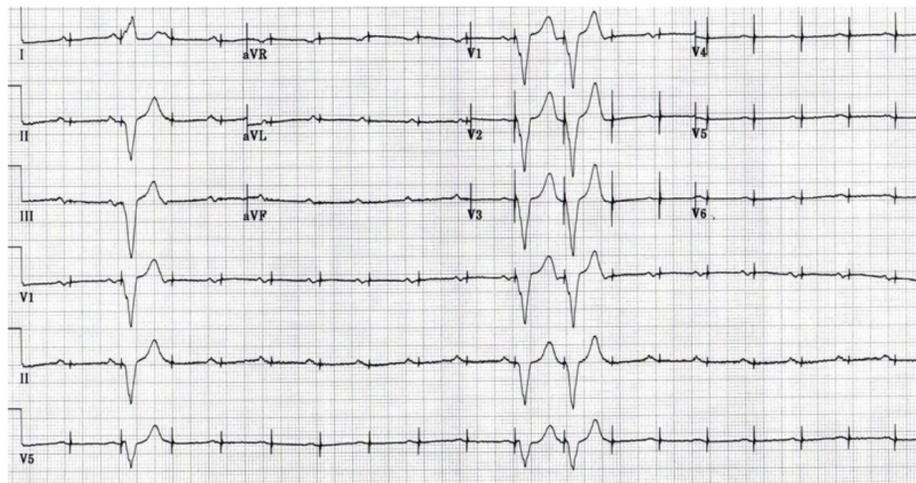
- The Pacemaker spike is present without the appropriate response
- A spike without a QRS after it

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Failure to Capture

- Courtesy of Dr. Mackenzie Brown



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Pacemaker Failures

- Sabbagh et al 2020

Causes Within Hours to Weeks of Device Implant	Long-term Causes	
	Cardiac	Noncardiac
Lead dislodgment or malposition	Lead fracture	Electrolyte imbalances
Premature lead failure	Fibrosis/inflammation	Acidemia
Premature battery depletion	Cardiomyopathy	Hypoxemia
Programming errors with suboptimal output	Exit block	Medication-induced alterations of the capture threshold
	Breach of insulation	External electrical stimulus
	Battery voltage being at the end of life	

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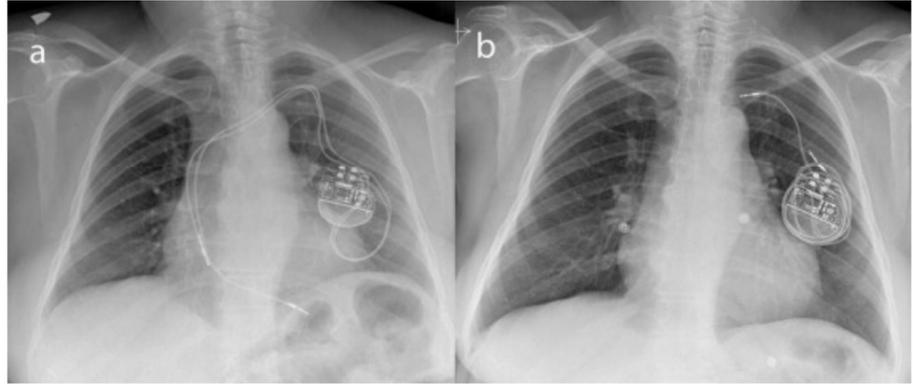
Pacemaker Failures

- Sabbagh et al 2020

Causes Within Hours to Weeks of Device Implant
Lead dislodgment or malposition
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Premature battery depletion
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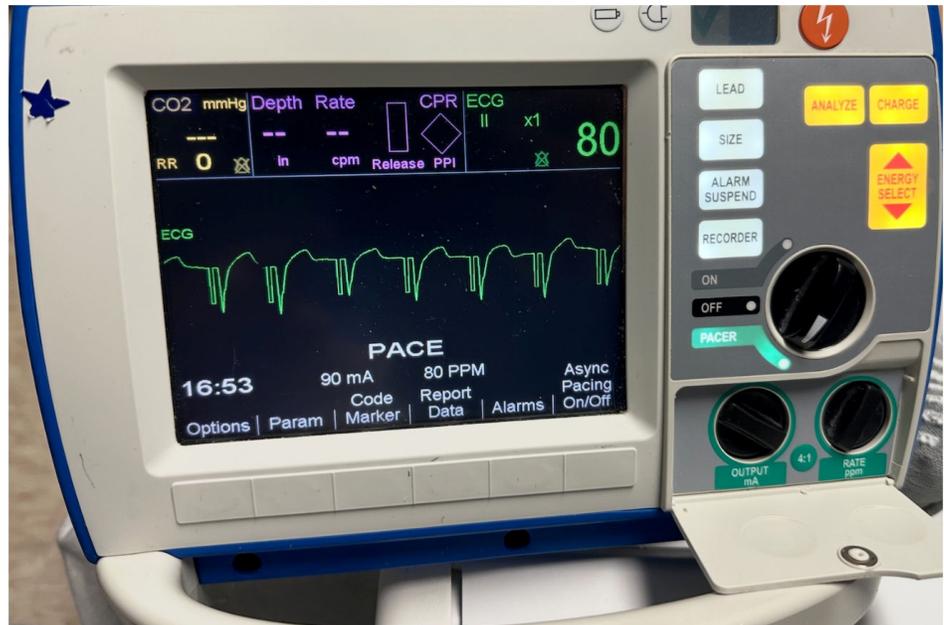
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Pacemaker Failures



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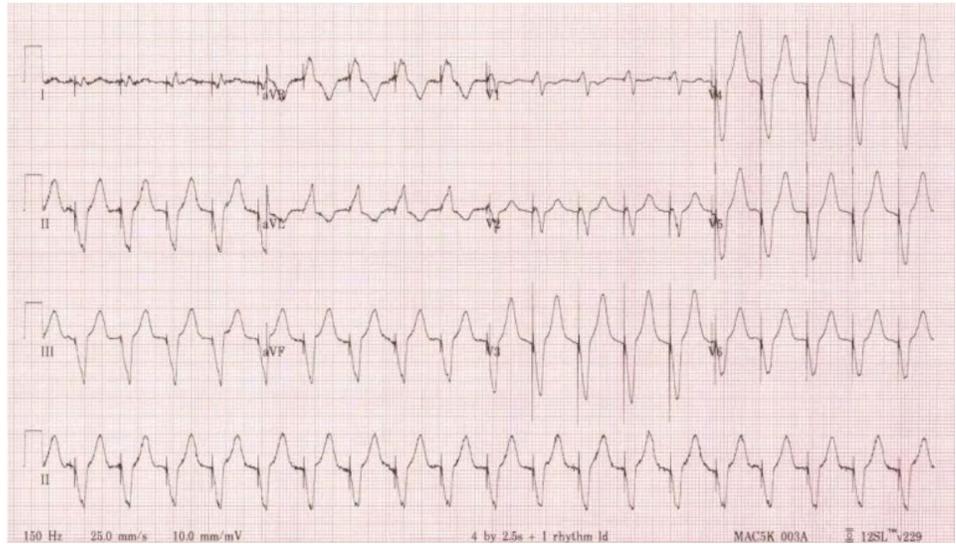
The Fix: Transcutaneous Pacing



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Pacemaker Failures: Pacemaker Mediated Tachycardia



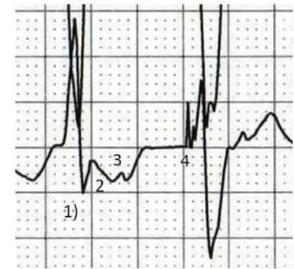
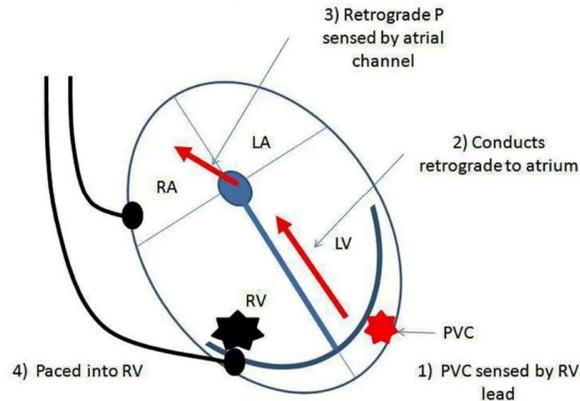
Rush Emergency Medicine

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Pacemaker Failures: PMT Mechanism

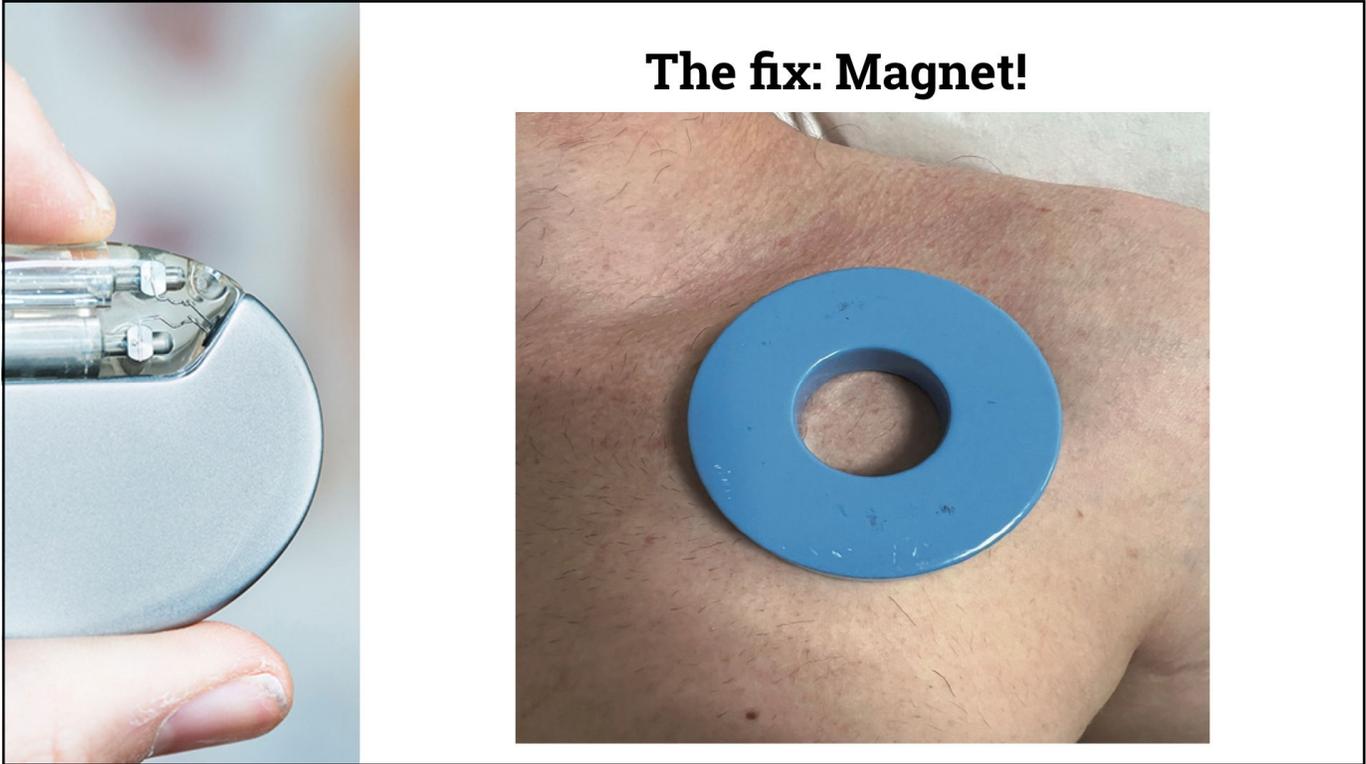
Initiation of Endless Loop Tachycardia by a PVC



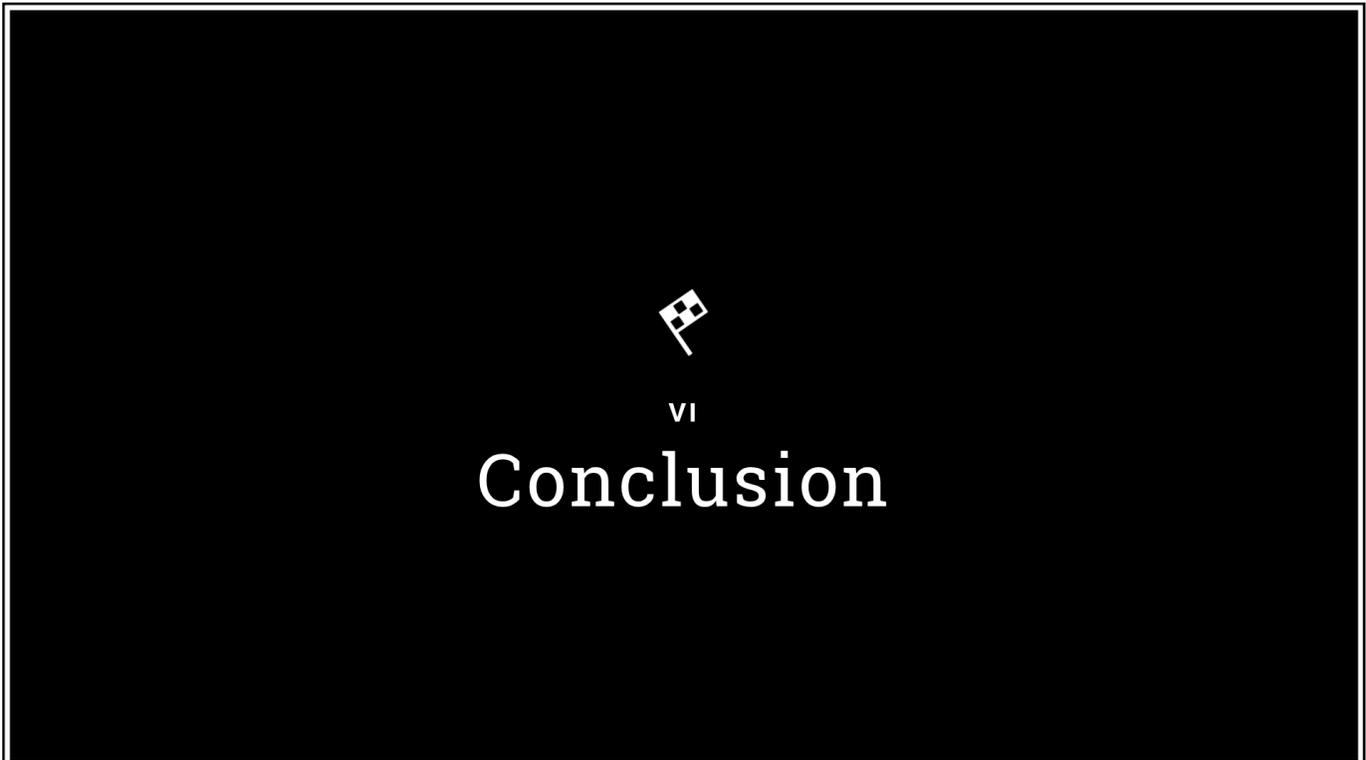
Adapted from:
Ellenbogen KA, et al. 2011. Clinical Cardiac Pacing, Defibrillation and Resynchronization Therapy 4th ed. PA Elsevier

RebelEM

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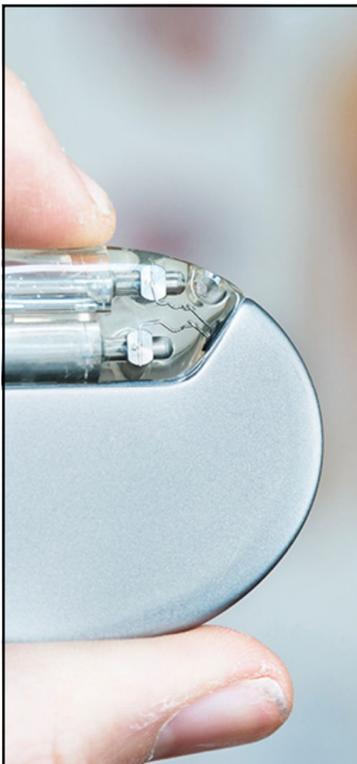
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Conclusion

- **Pocket - bleeding or infection**

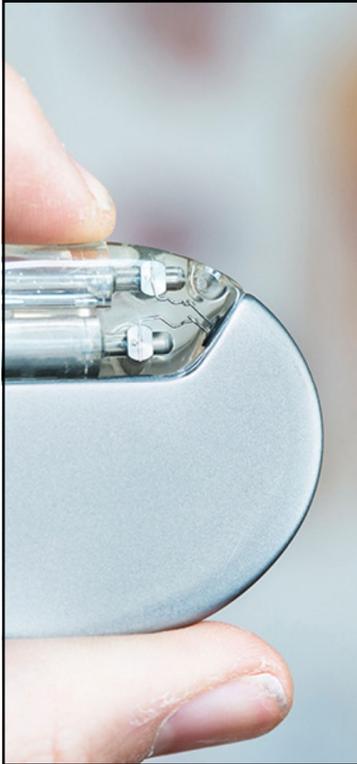
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Conclusion

- **Pocket - bleeding or infection**
- **Access - pneumothorax**

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Conclusion

- **Pocket - bleeding or infection**
- **Access - pneumothorax**
- **Cardiac - tamponade**

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Conclusion

- **Pocket - bleeding or infection**
- **Access - pneumothorax**
- **Cardiac - tamponade**
- **Electrical**
 - **lead displacement**
 - **pacemaker failure**
 - **pacemaker mediated tachycardia**

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Thank you!

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