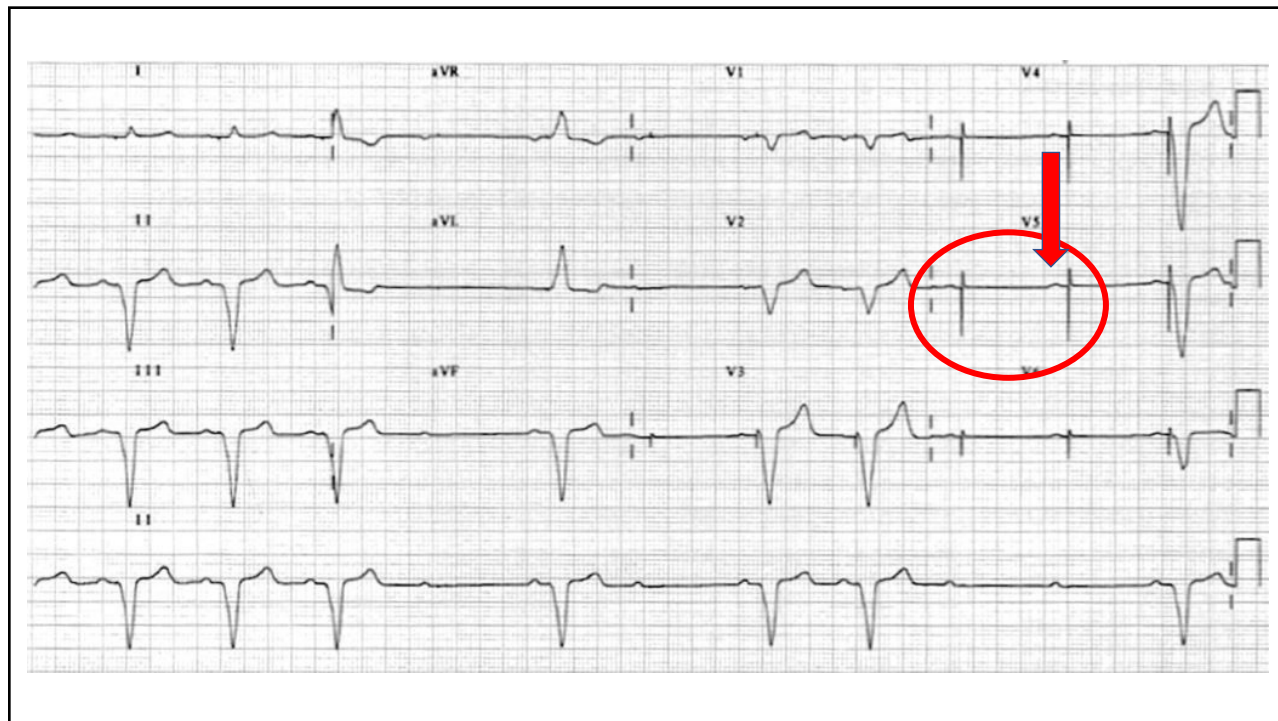




1

A screenshot of a medical software interface. The top navigation bar includes 'SLAY' and various menu items like 'ED Track Board', 'Patient Lists', and 'Patient Station'. The main content area is titled '9/12/2023 visit with Daniel Lawrence Lemkin, MD for Hospital Encounter'. On the left, a patient profile for 'Anita Goode-Rithm' is shown, including her photo, age (23), gender (Female), and medical history. The right side of the screen displays 'ED Provider Notes' and 'ED Resident Notes' sections, both with 'Create Note' buttons. Below the notes, an ECG (heart rate) is displayed on a grid, showing leads I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, and V6. The pulse rate is highlighted in red as 42!.

2



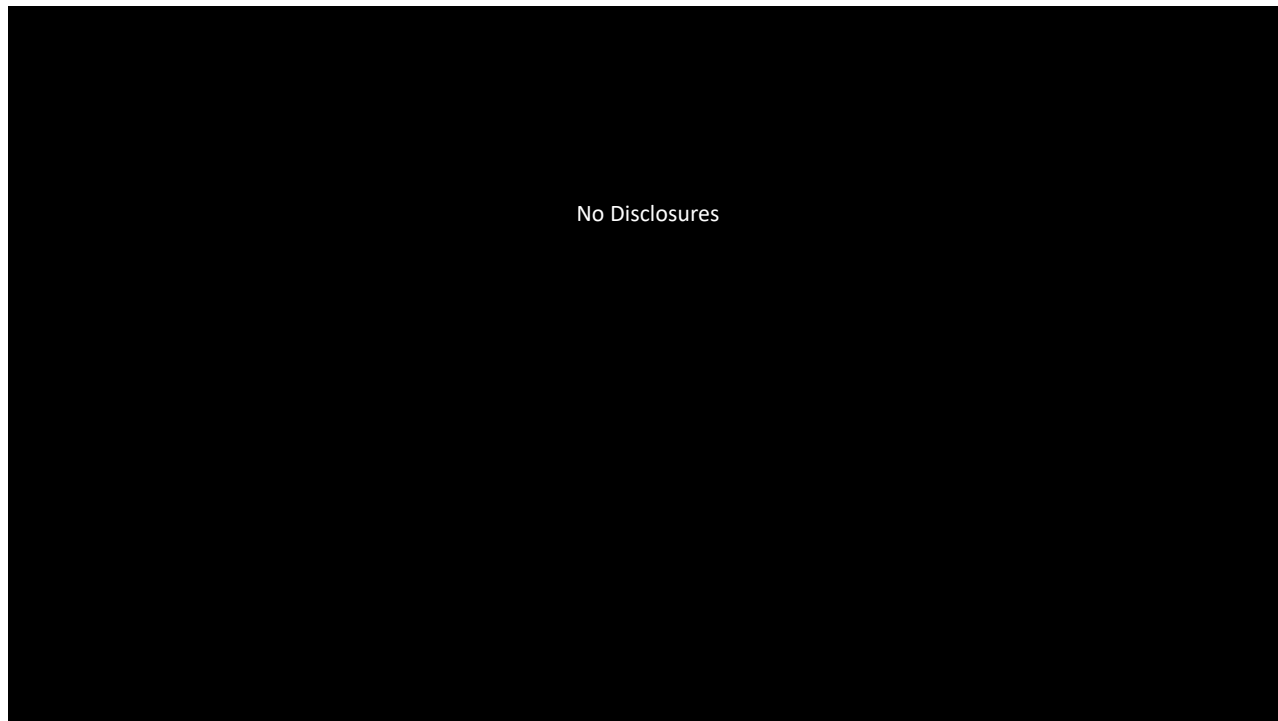
3

IN PACE OF EMERGENCY: WHEN PACERS GO HAYWIRE IN THE ED

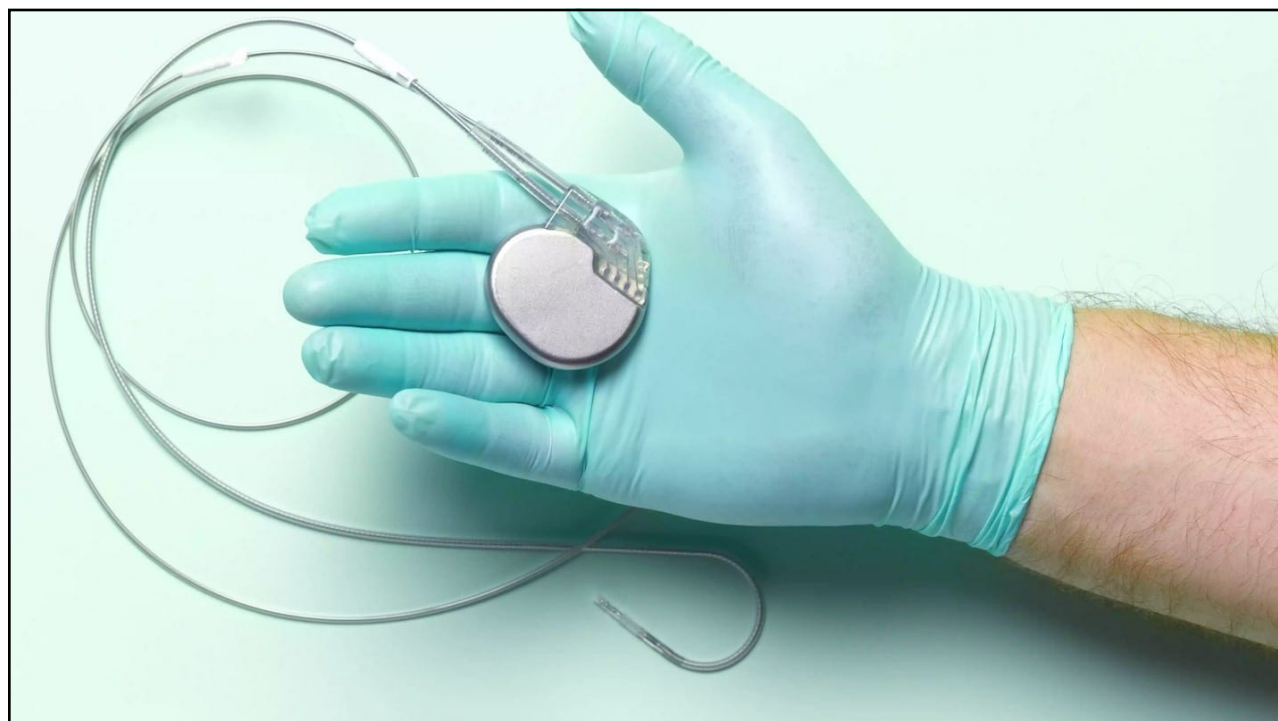
LEEN ALBLAIHED, MBBS, MHA, FAAEM, FACEP
UNIVERSITY of MARYLAND
SCHOOL OF MEDICINE

The image features a red emergency box mounted on a white brick wall. The box has 'EMERGENCY' written vertically on its side and 'BREAK IN EMERGENCY' on a small label at the top. The glass window of the box is shattered, with sharp fragments of glass and metal protruding. The background is dark with a lightning bolt effect. In the bottom left corner, there is a logo of the University of Maryland School of Medicine and the name of the author, Leen Alblaihed, MBBS, MHA, FAAEM, FACEP.

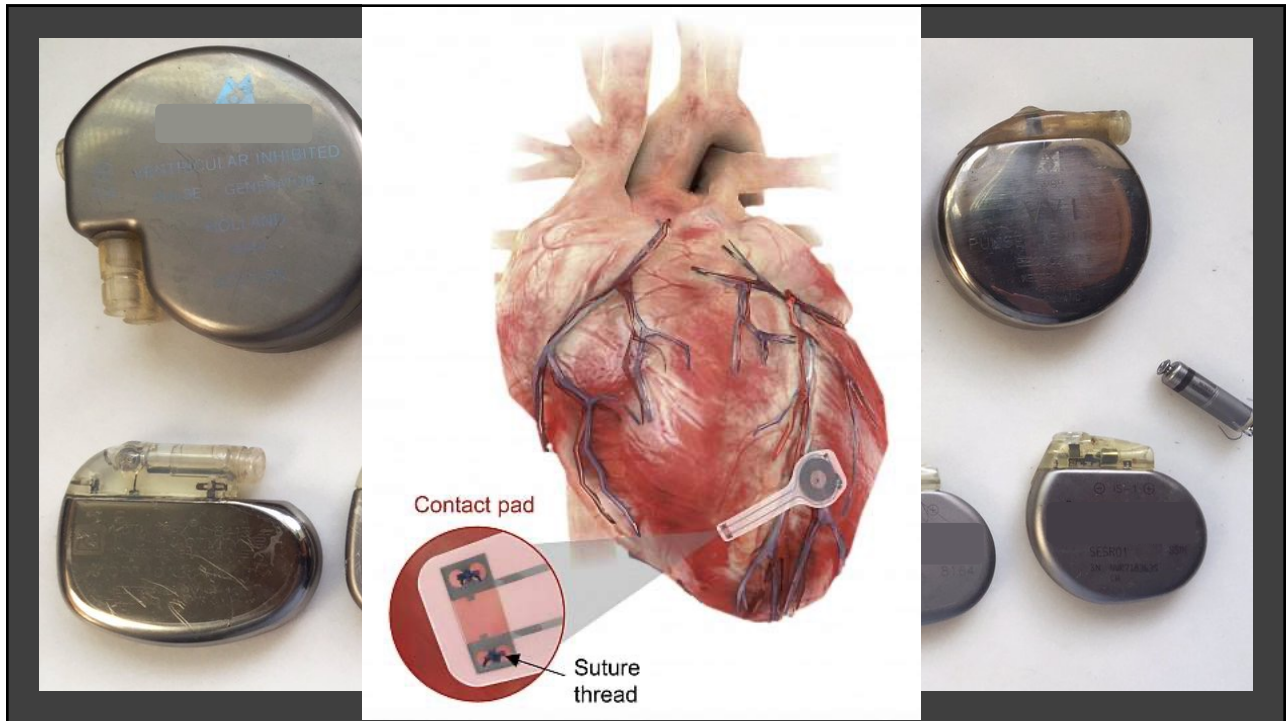
4



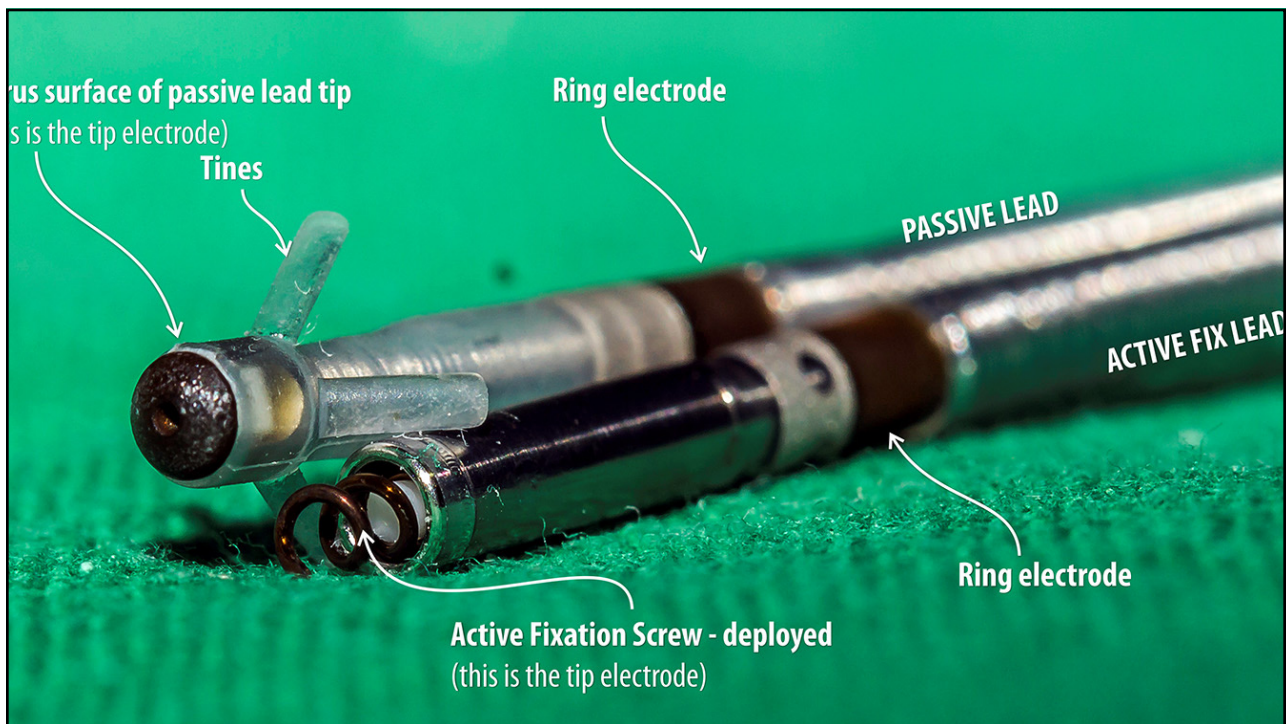
5



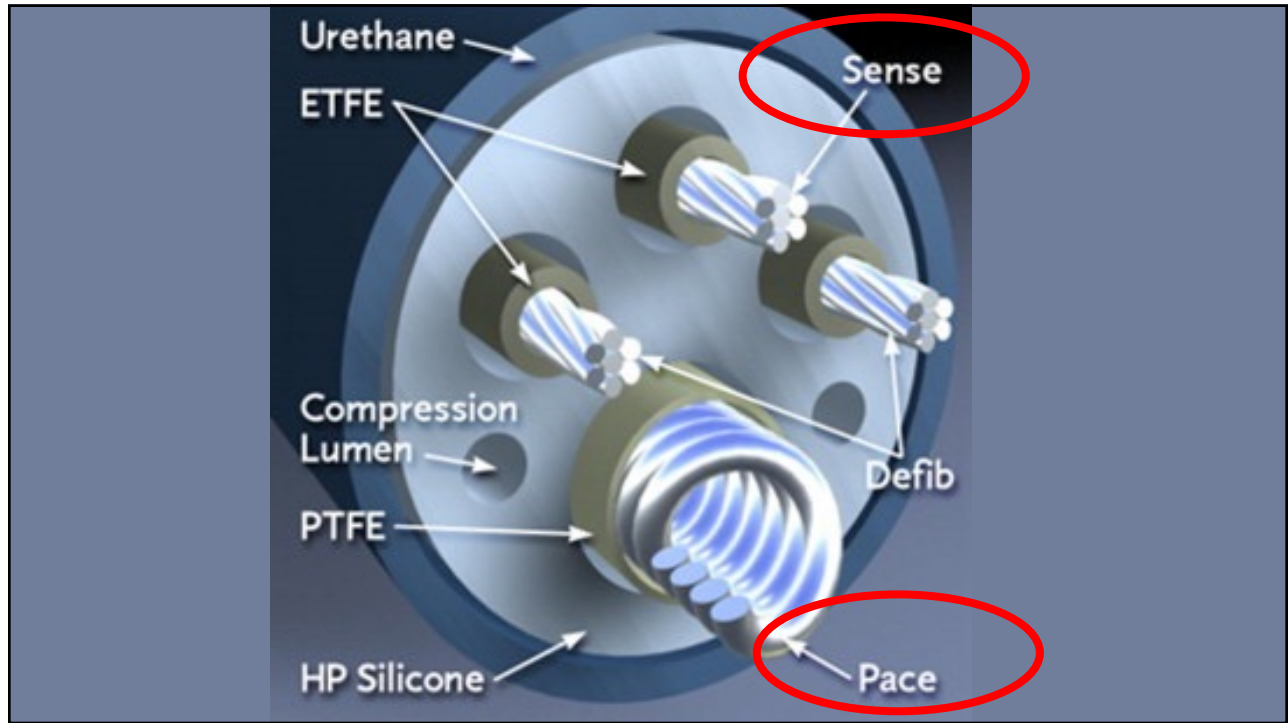
8



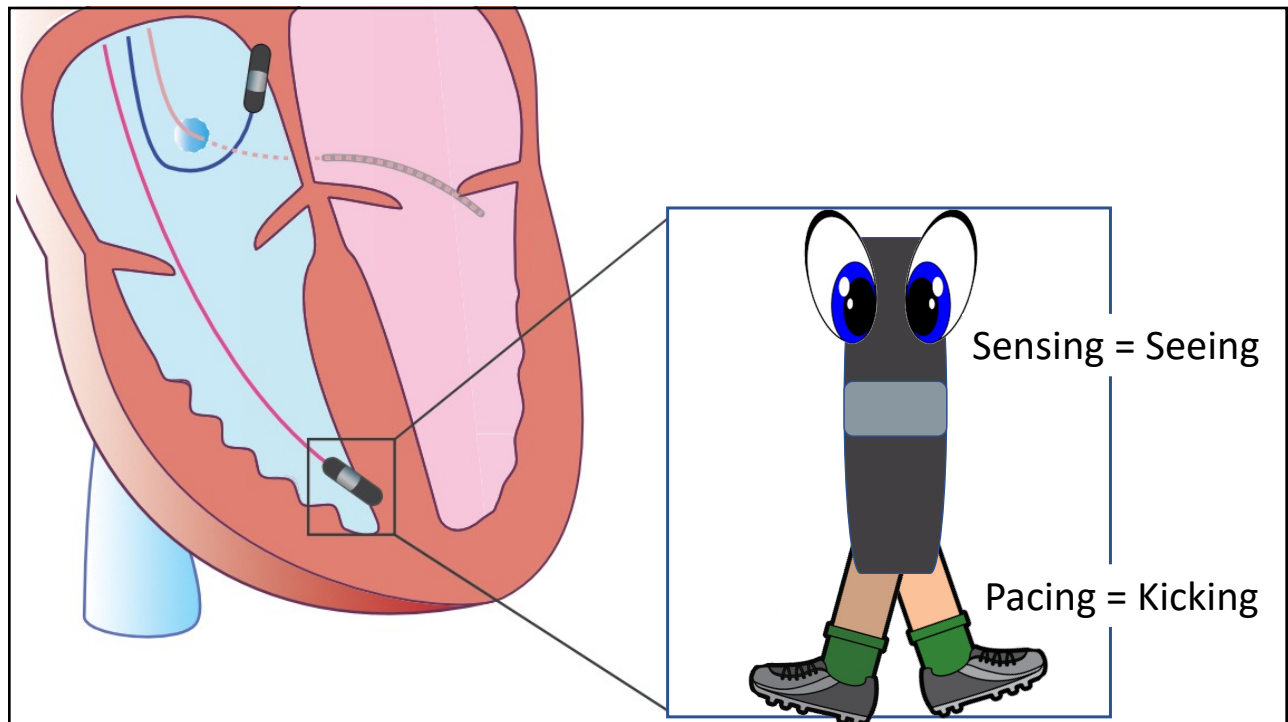
9



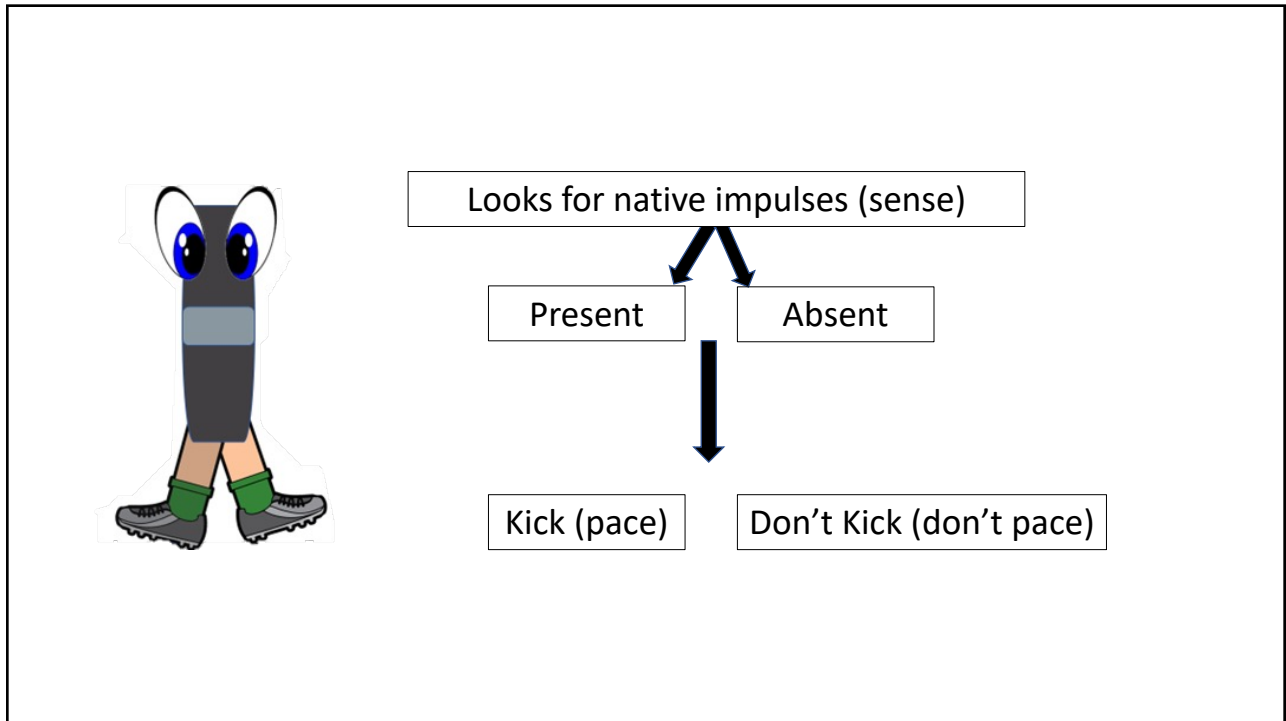
11



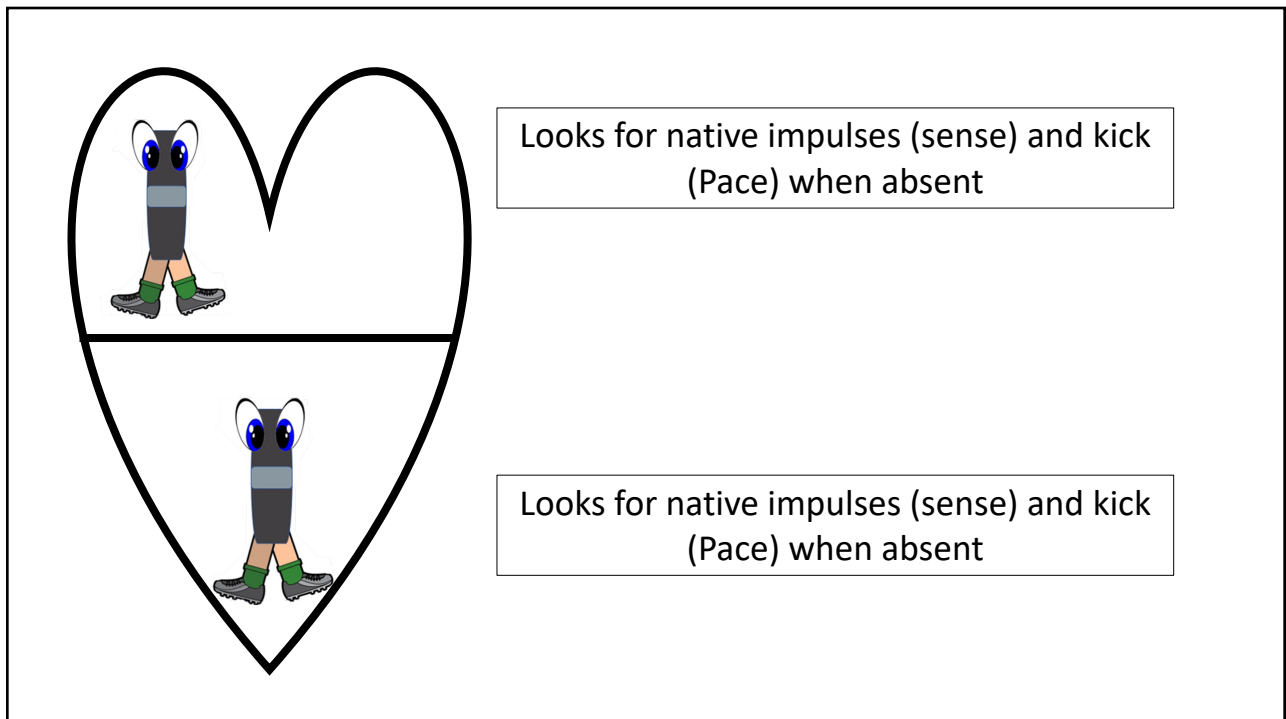
12



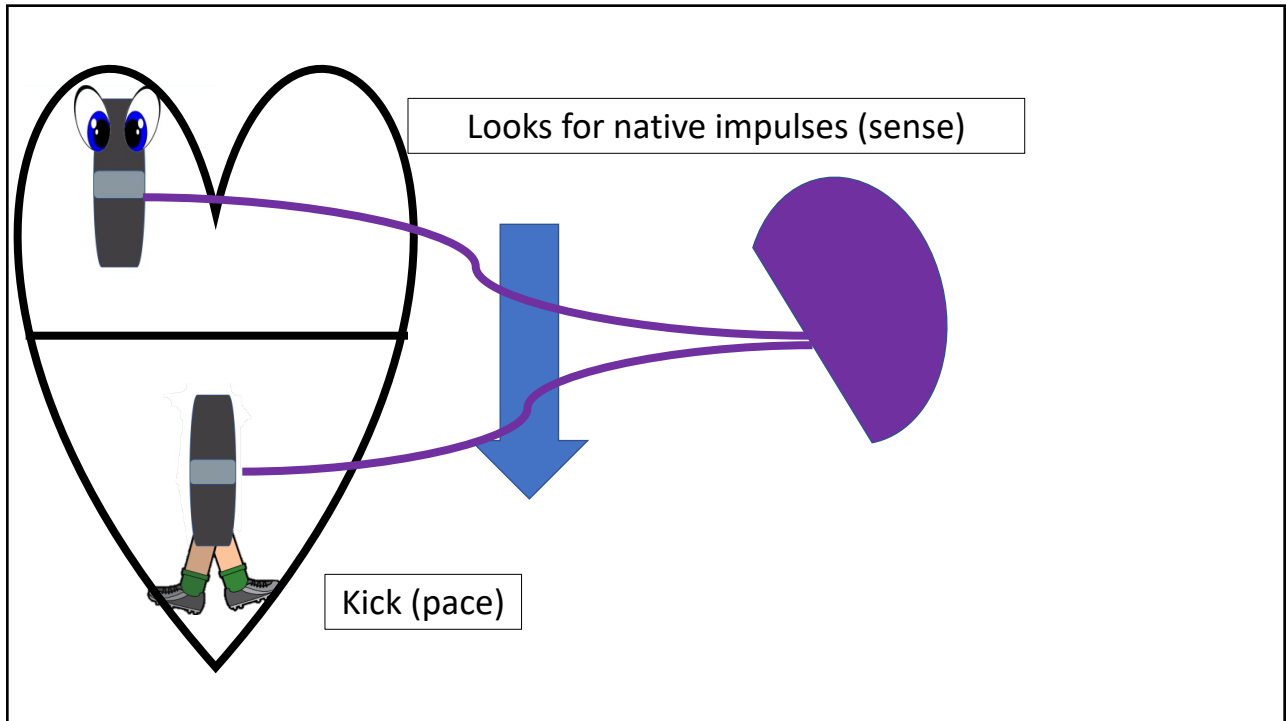
13



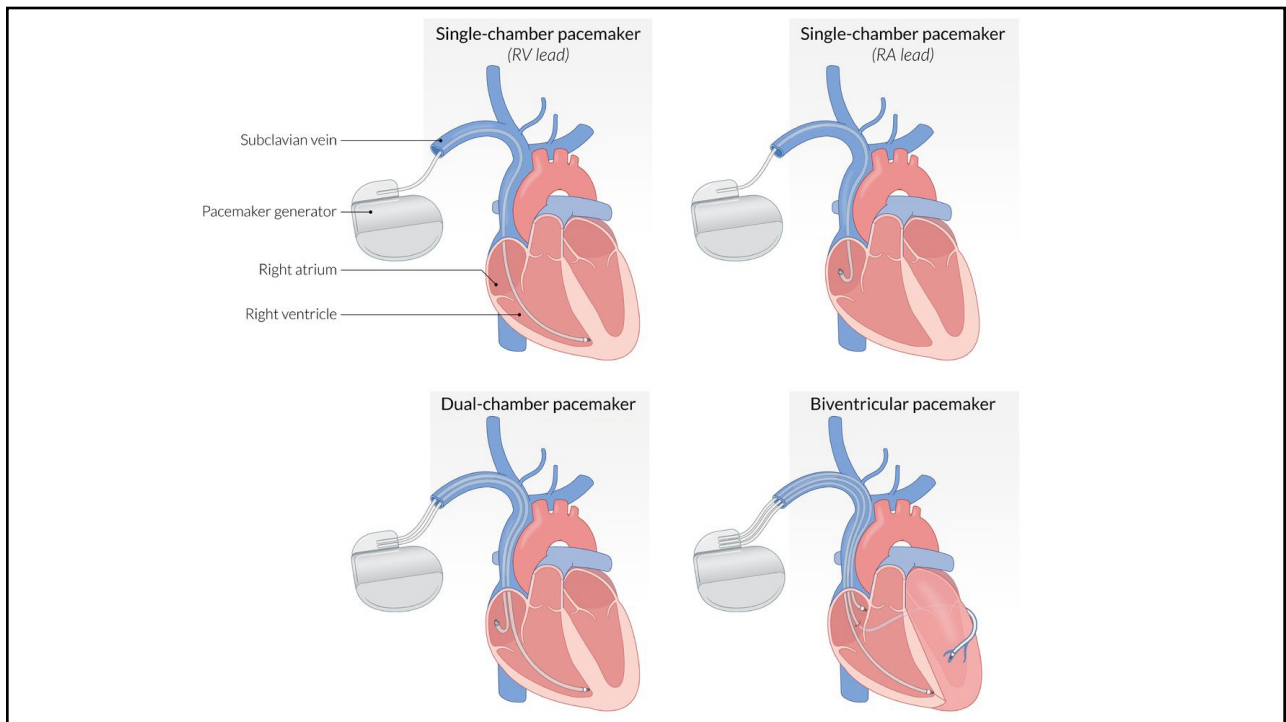
14



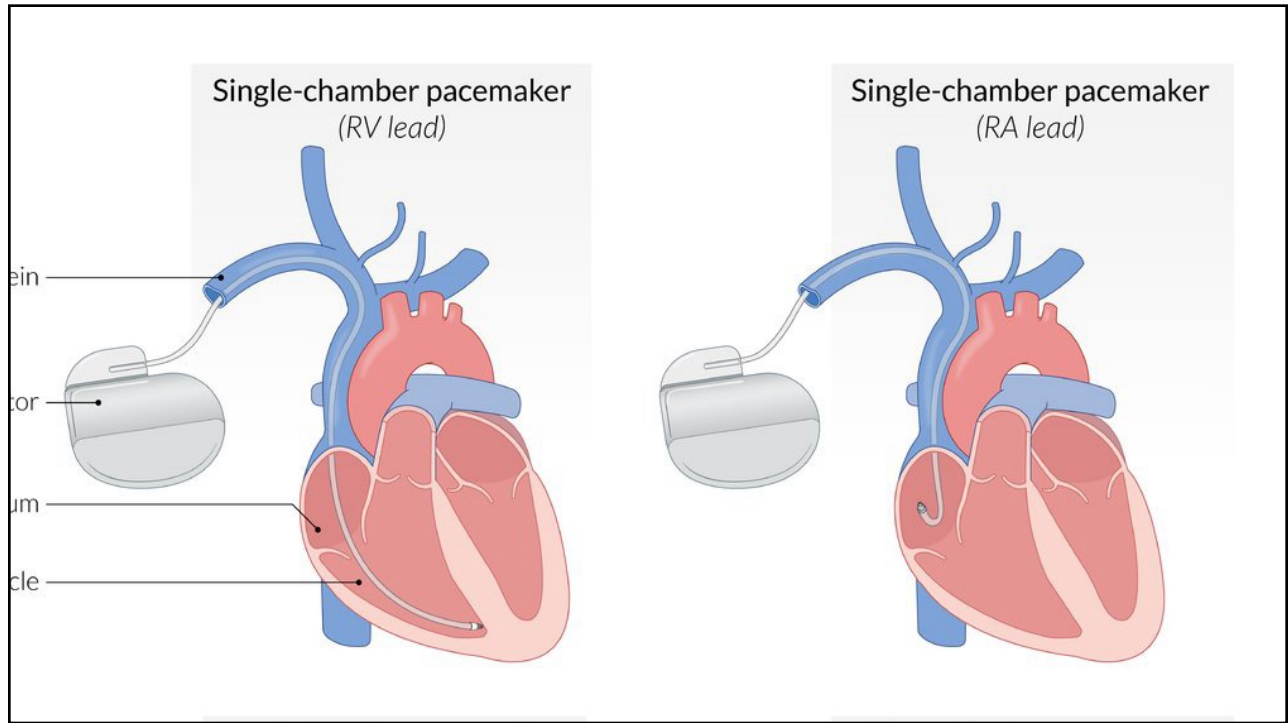
15



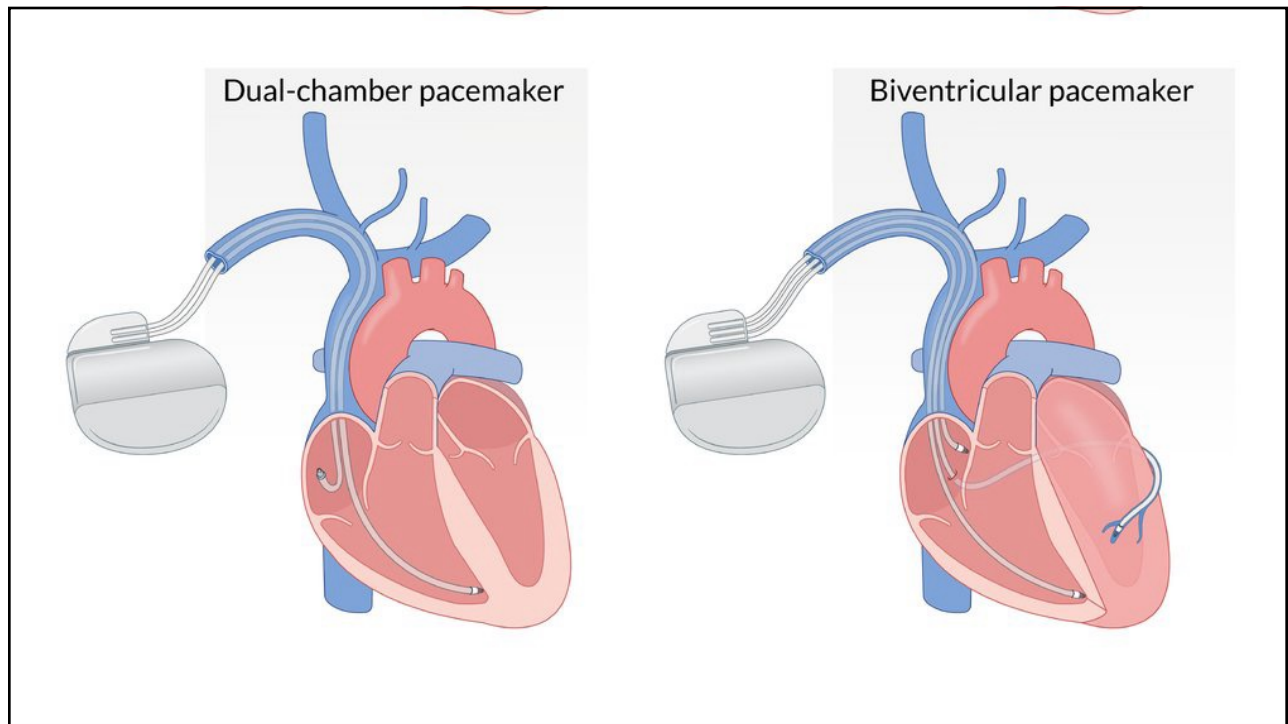
16



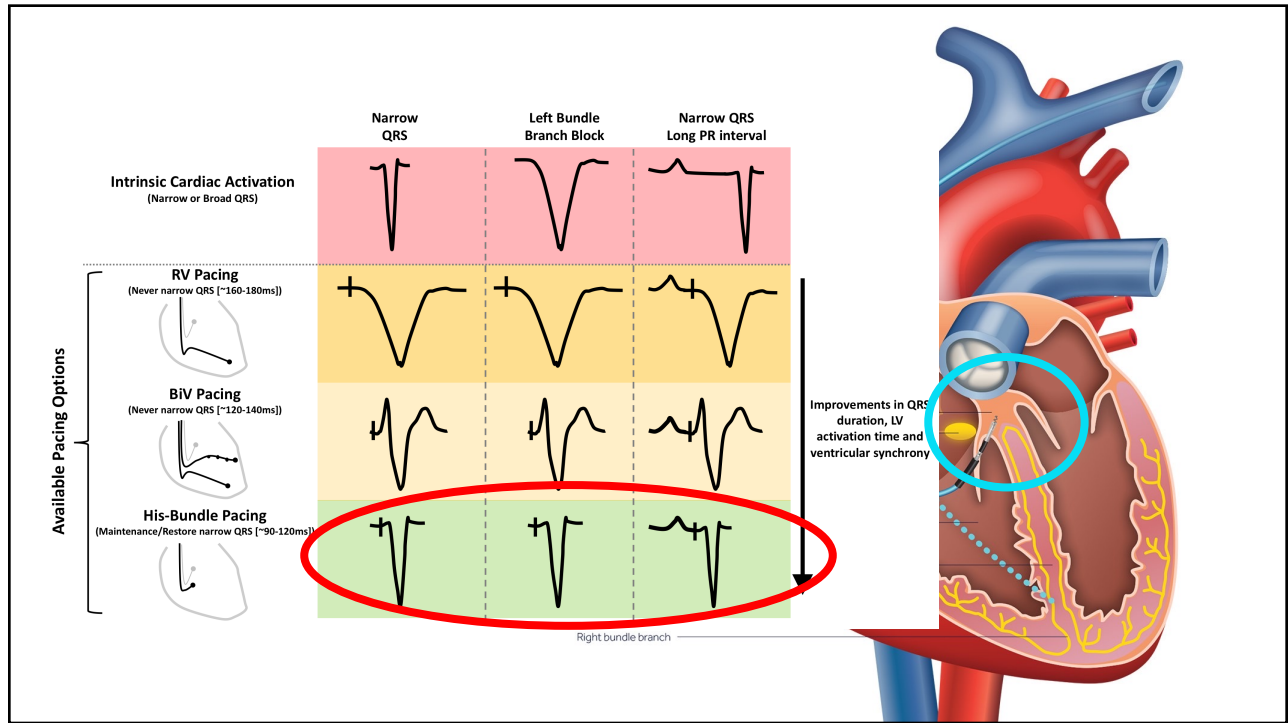
17



18



19

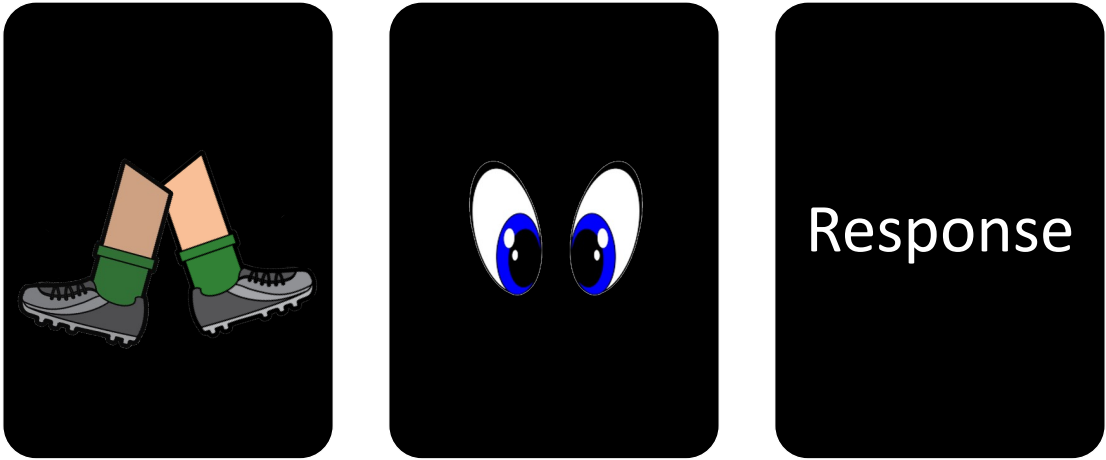


20

- Where did you put the feet?
- Where did you put the eyes?
- What's the response?

21

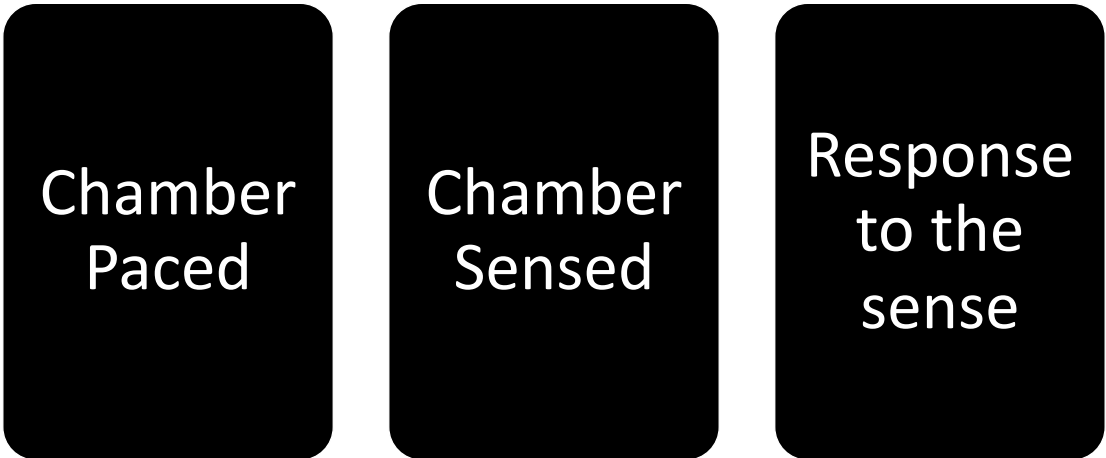
Pacemaker Terminology



The slide features three black rounded rectangles arranged horizontally. The first rectangle on the left contains a cartoon illustration of a pair of legs wearing tan socks and grey hiking boots with green gaiters. The middle rectangle contains a cartoon illustration of a pair of large, blue, wide-open eyes. The third rectangle on the right contains the word "Response" in white text.

22

Pacemaker Terminology



The slide features three black rounded rectangles arranged horizontally. The first rectangle on the left contains the text "Chamber Paced" in white. The middle rectangle contains the text "Chamber Sensed" in white. The third rectangle on the right contains the text "Response to the sense" in white, arranged in three lines.

23

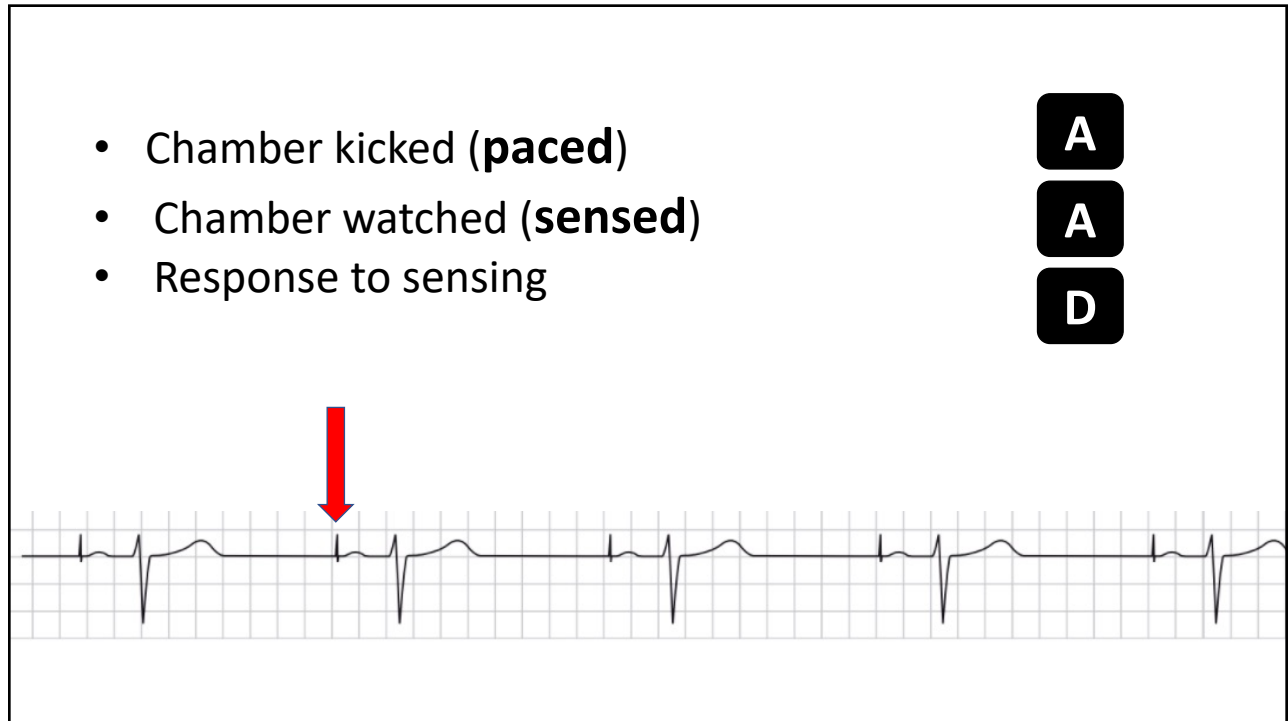
Chamber Paced	Chamber Sensed	Response to the sense
A Atria	A Atria	T Triggered
V Ventricle	V Ventricle	I Inhibited
D Dual	D Dual	D Dual
O None	O None	O None

24

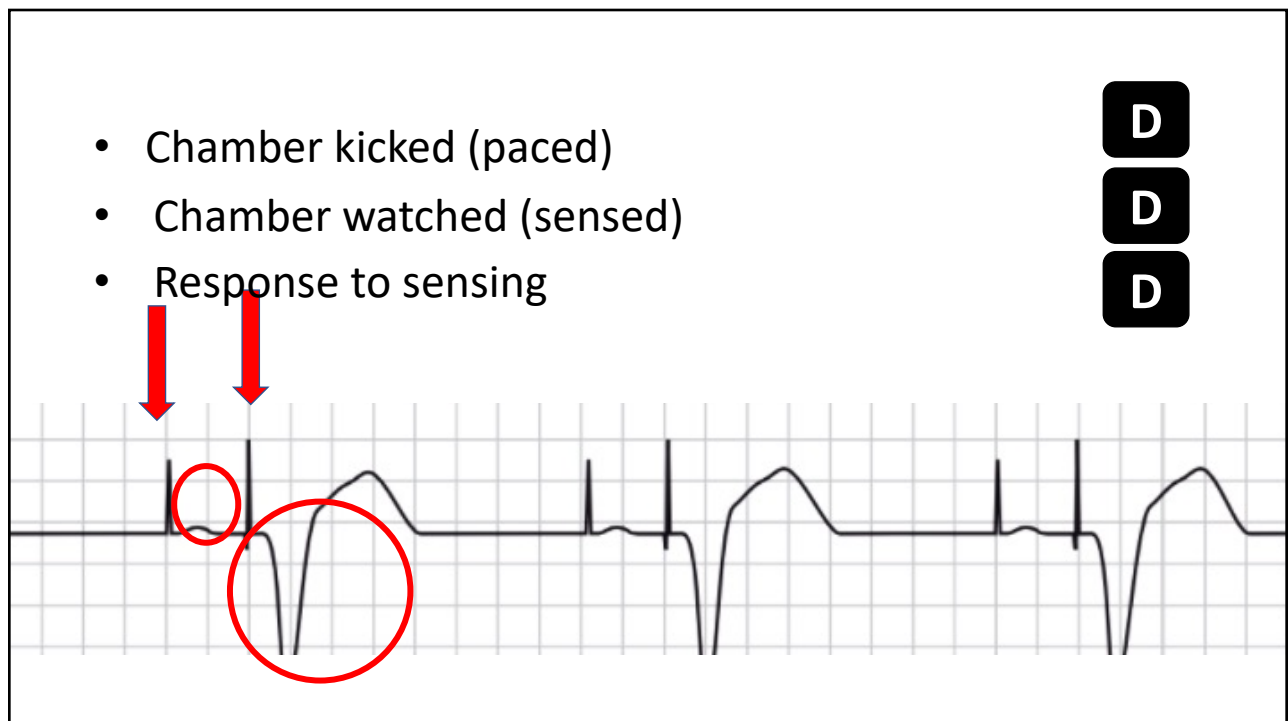
- Chamber kicked (paced)
- Chamber watched (sensed)
- Response to sensing

The diagram shows a heart with two pacemaker leads. The top lead is in the atrium and the bottom lead is in the ventricle. To the right of the heart are three stacked buttons labeled V, A, and T. Below the heart is an ECG trace on a grid. A red arrow points to a sensed ventricular event (a sharp spike) which is circled in red.

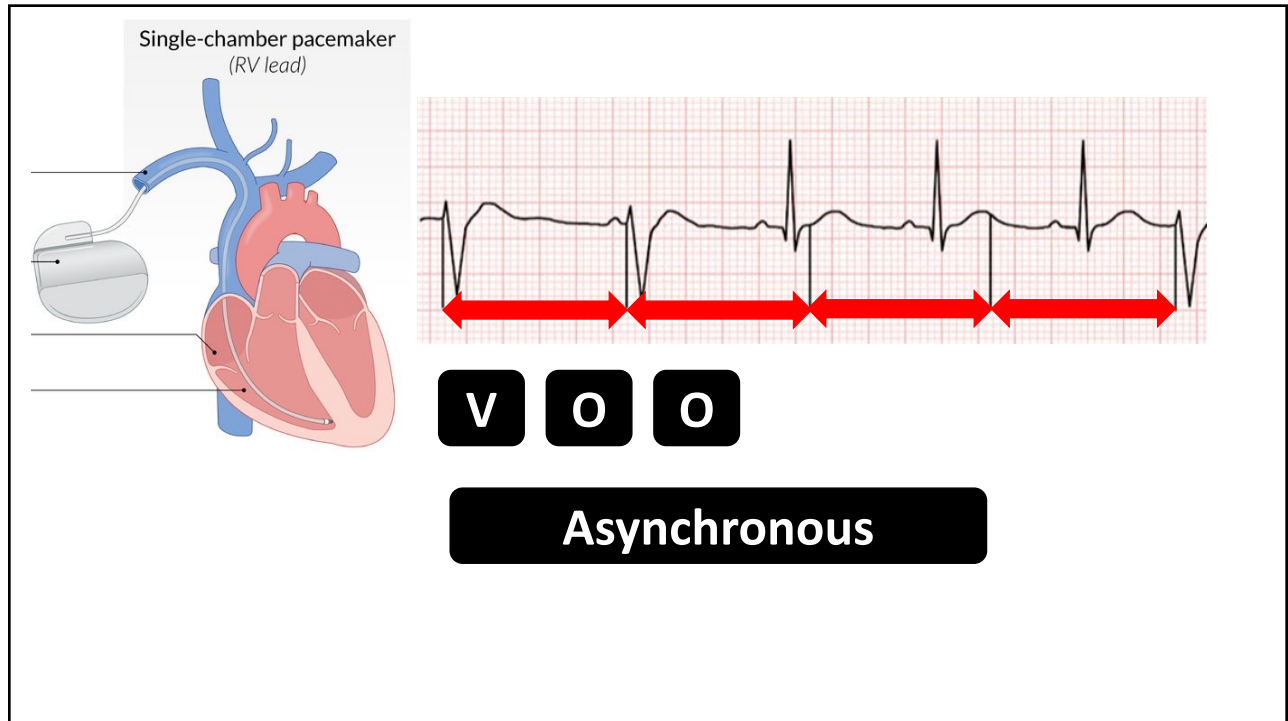
25



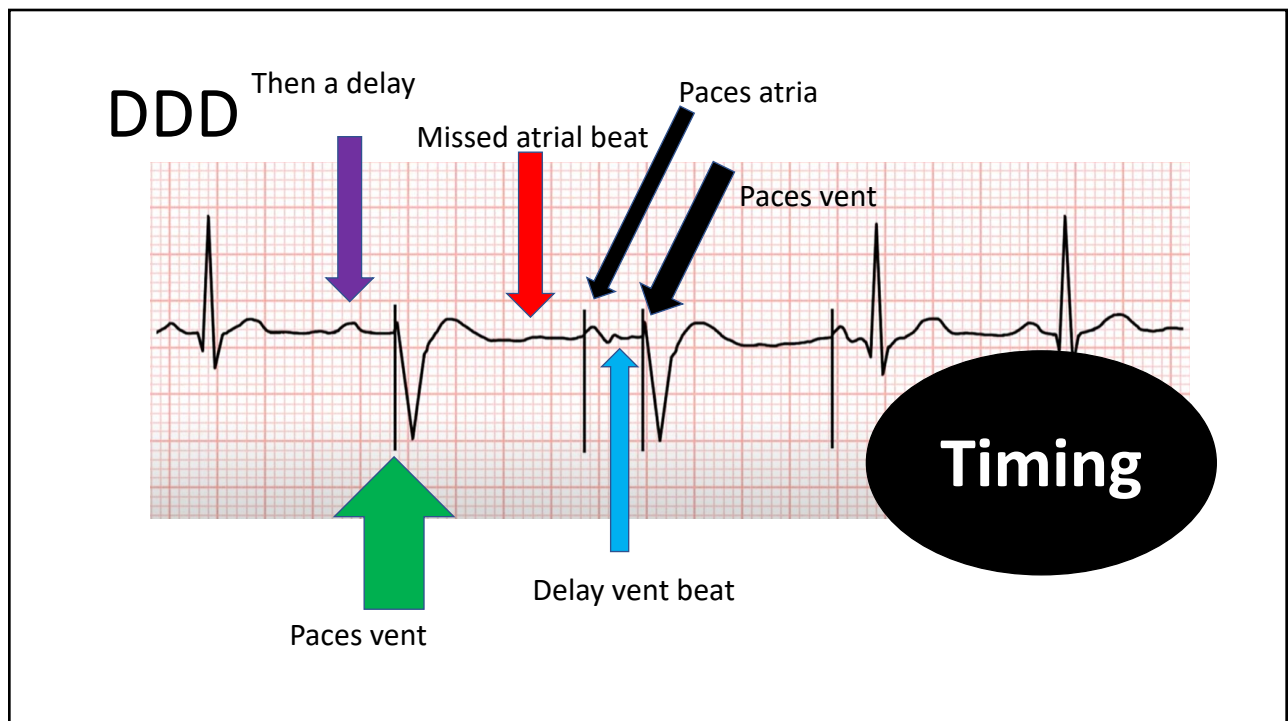
26



27



28



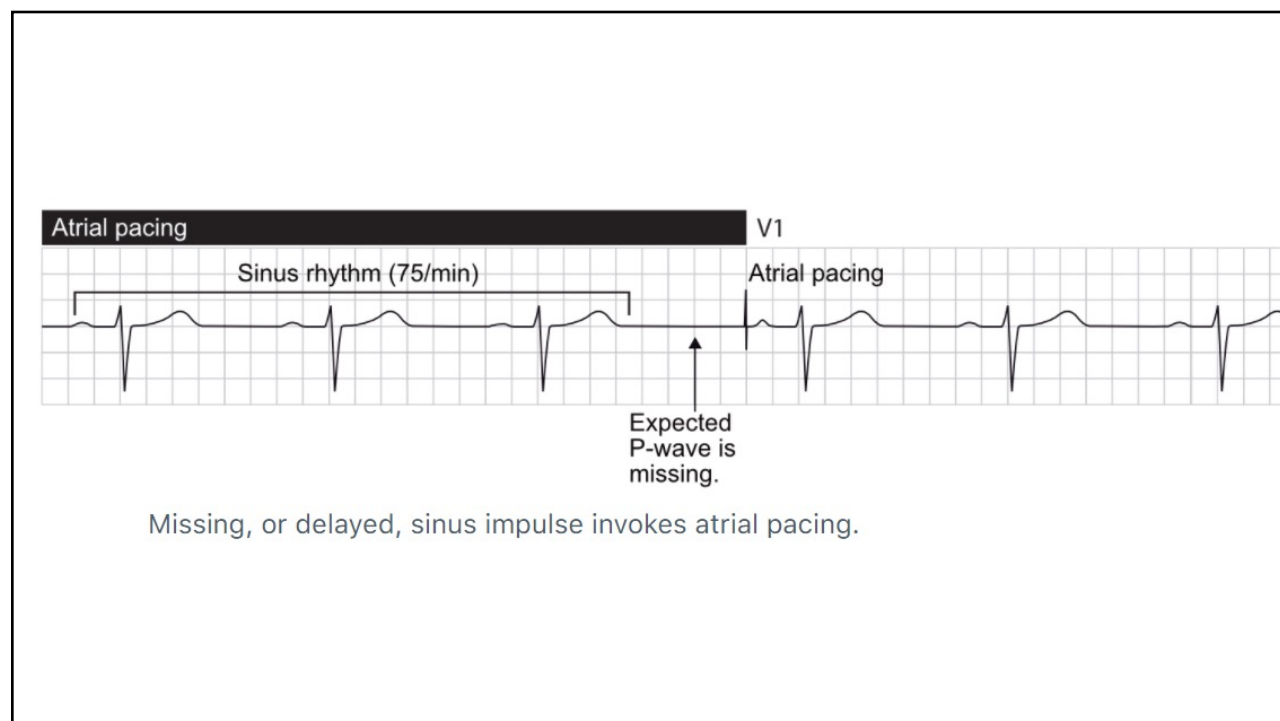
30

A good pacemaker

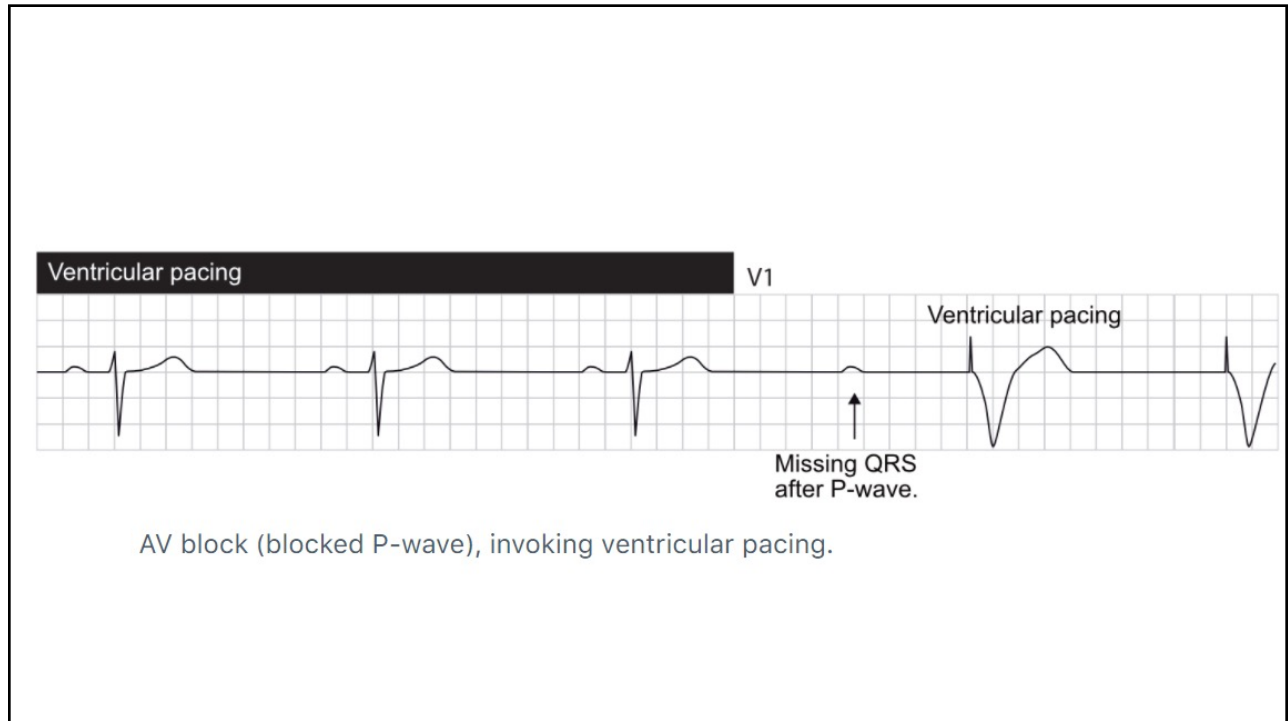
- If pacer senses intrinsic cardiac activity P-QRS → Should not pace the heart (**Inhibit**)
- If pacer senses atrial (P) w/o subsequent QRS → Should pace the ventricle (**Trigger**)
- If pacer sees no intrinsic activity → pace



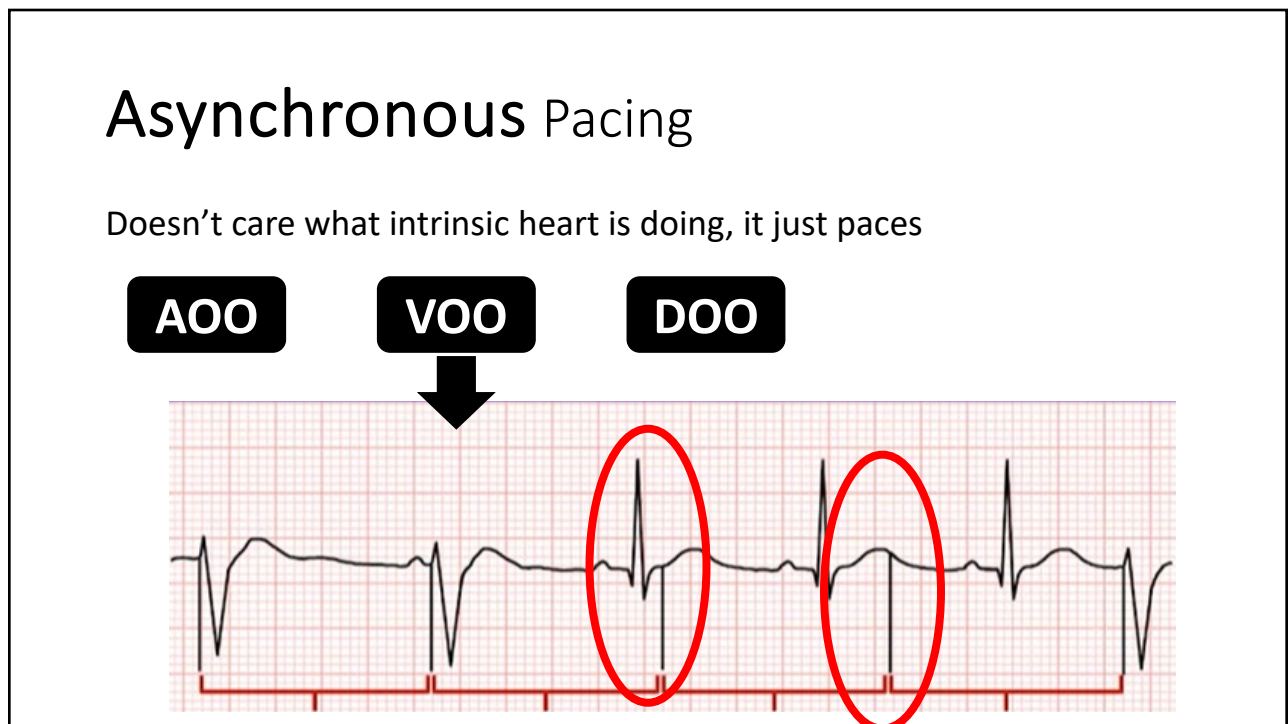
31



32



33

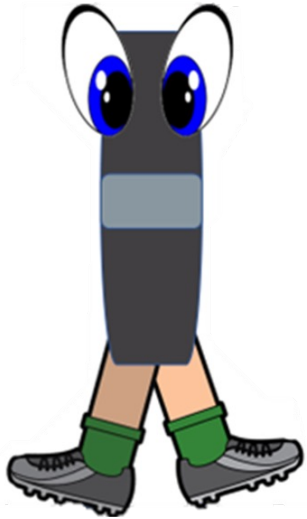


34



35

Problems with Pacemakers

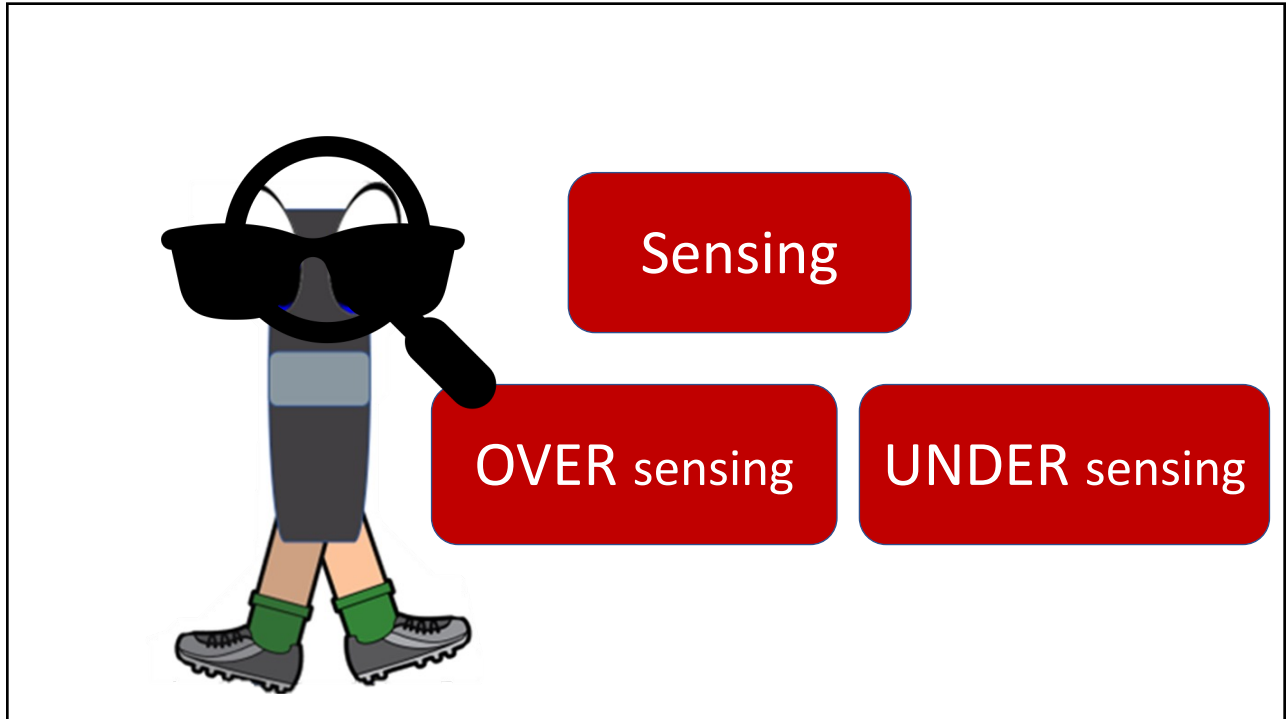


Sensing

Pacing

A cartoon illustration of a pacemaker character. The character has a grey, cylindrical body with a white band around the middle. It has large, blue, circular eyes with white highlights, and thin, white, stick-like arms. Its legs are thin and orange, wearing green socks and grey sneakers with white laces. To the right of the character are two rounded rectangular buttons: a red one at the top with the word "Sensing" in white, and a blue one at the bottom with the word "Pacing" in white.






36



37

OVERsensing

- Super sensitive to any signal
- Thinks there's intrinsic beats (when there isn't!)



Attention | Les porteurs de stimulateurs cardiaques ne doivent pas traverser ce portique.
Warning! Bearers of pacemakers must not go through the metal detector.
(Celle-ci) Si vous est porteur, ne devez passer par cette détecteur de métal.

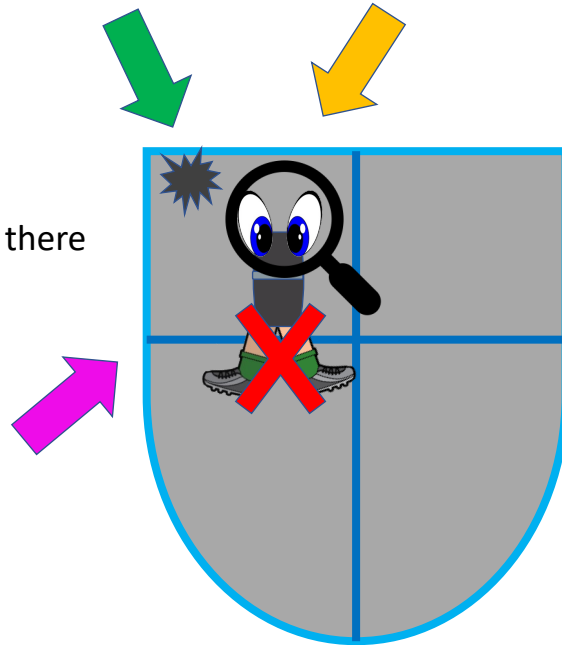
NDC 63323-043-21
Succinylcholine Chloride
Injection, USP
200 mg per 10 mL (20 mg/mL)
WARNING: Paralyzing Agent
For Intravenous or Intramuscular use
10 mL, Multiple-Dose Vial For only

39

OVERsensing

- Super sensitive to any signal
- Thinks there's intrinsic beats (when there are not)

→ Inhibited pacing
→ brady



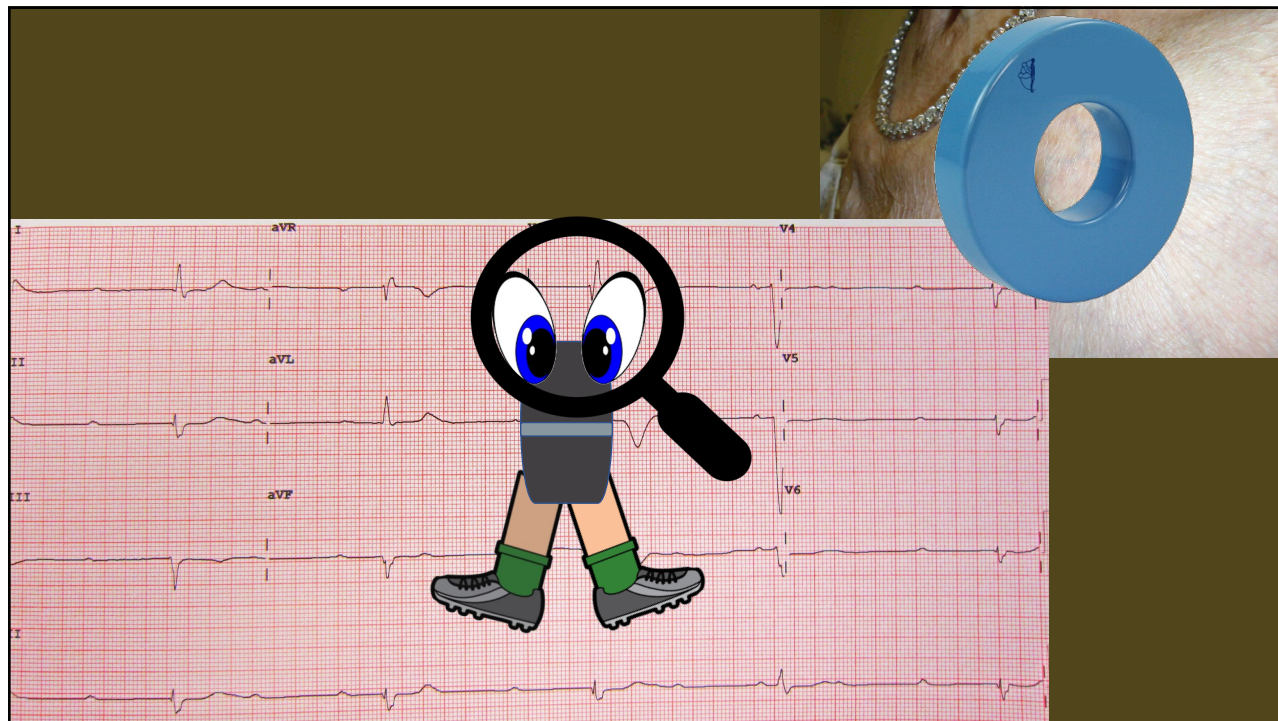
40

OVERsensing

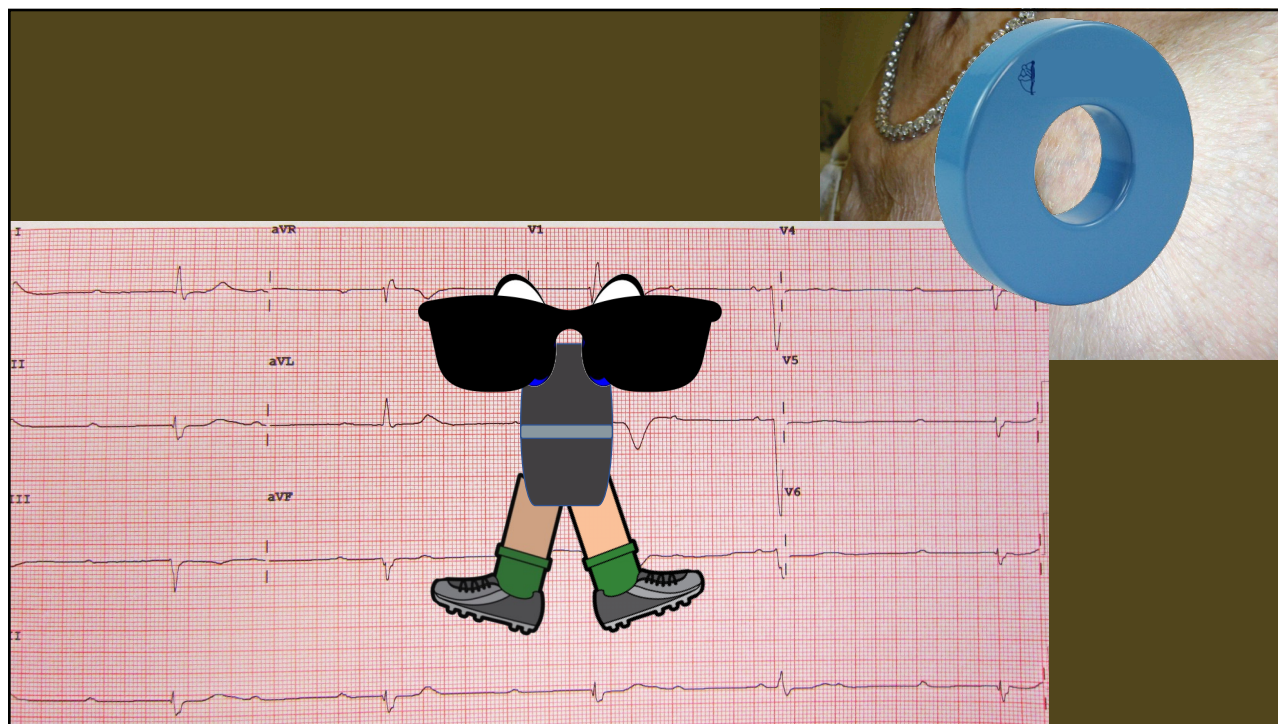
The oversensing pacemaker mistakes these random fluctuations for P wave activity, and fails to pace this bradycardic patient



41



43



44

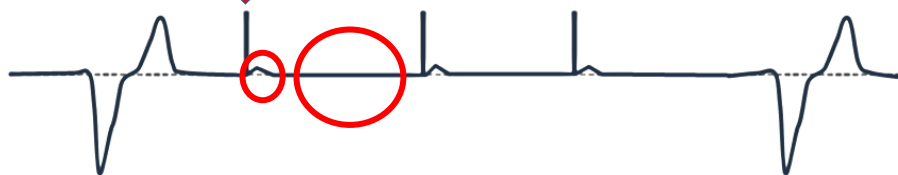
What does it do?



- Asynchronous mode
- Constant paced rate (doesn't care what native rhythm/ rate is)
- AOO, VOO, DOO

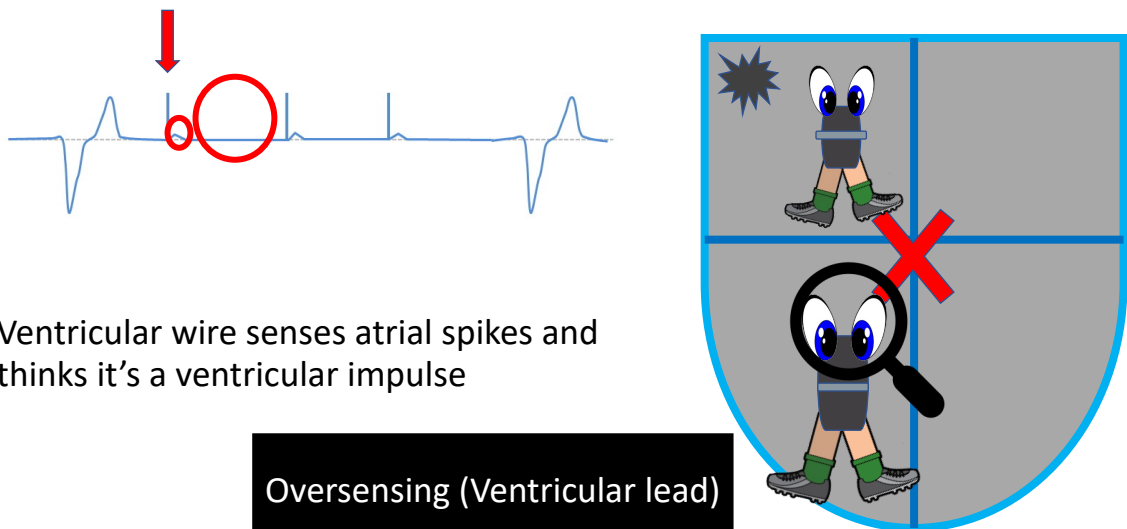
45

What is happening?

D D D

46

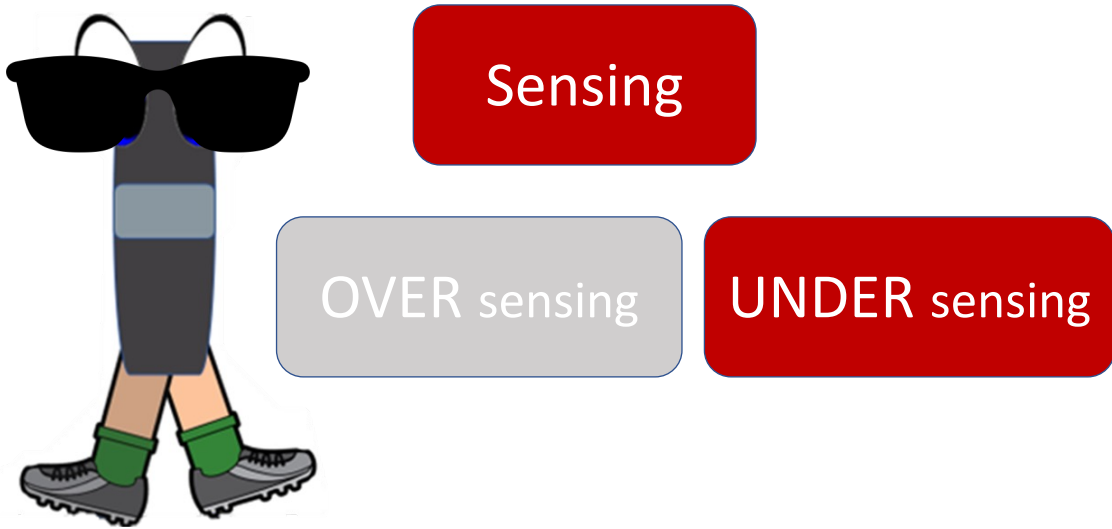
Cross-Talk



Ventricular wire senses atrial spikes and thinks it's a ventricular impulse

Oversensing (Ventricular lead)

47



Sensing

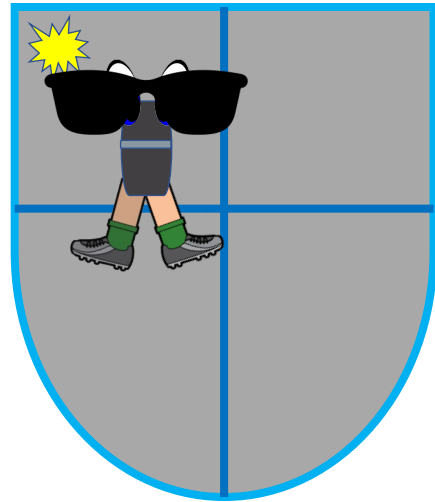
OVER sensing

UNDER sensing

48

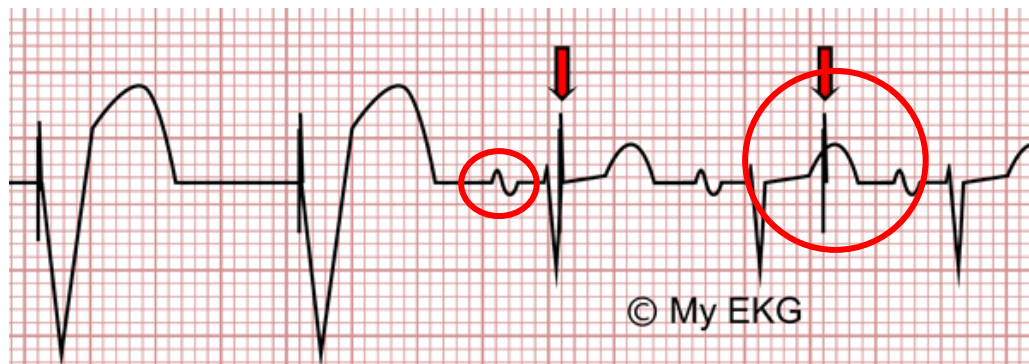
Failure to Sense (Undersensing)

- Can't see intrinsic depolarization
- Can't sense true P waves or R waves
- Paces as if there was no underlying rhythm
- **Asynchronous pacing**



49

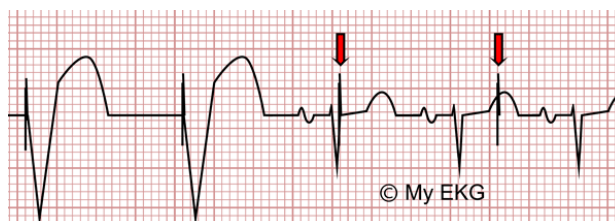
Failure to Sense (Undersensing)



50

Failure to Sense (Undersensing)

Pacer spikes despite normal P or QRS

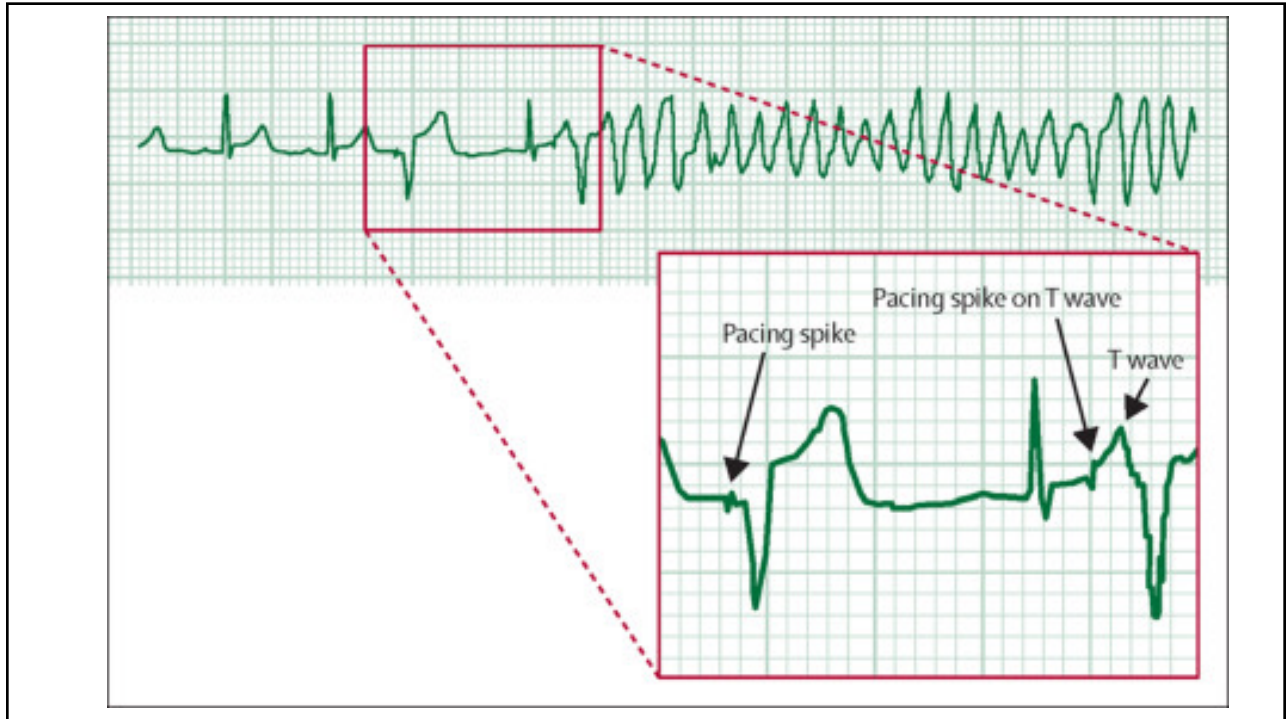


51

Failure to Sense (Undersensing)

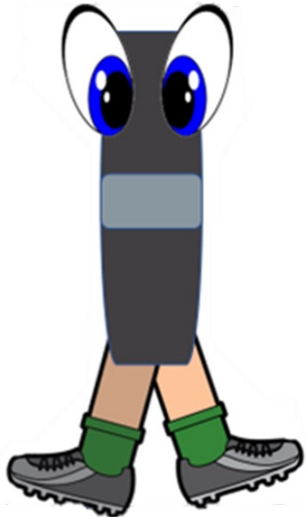


52



53

Problems with Pacemakers



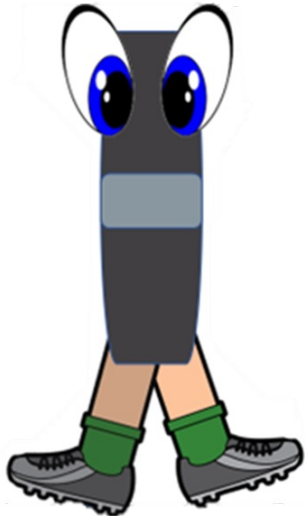
A cartoon character of a pacemaker, depicted as a grey vertical cylinder with large blue eyes, wearing tan pants, green socks, and grey sneakers.

Sensing

Pacing

54

Problems with Pacemakers



Failure to Capture

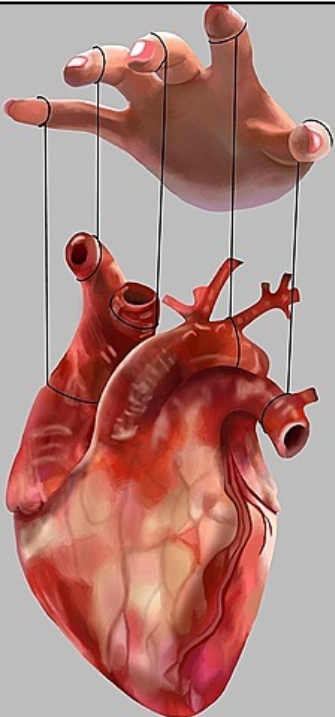
Output Failure

Pacing

55

Capture

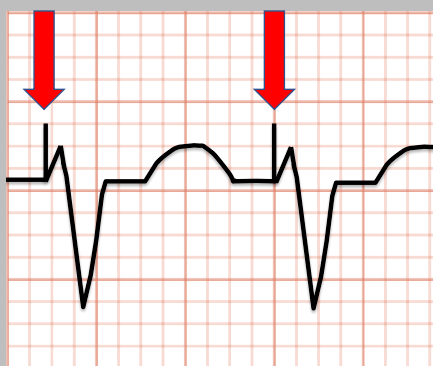
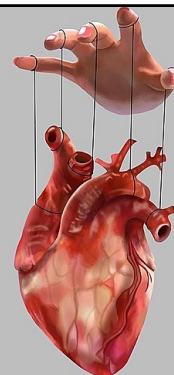
Gaining control by force



57

Capture

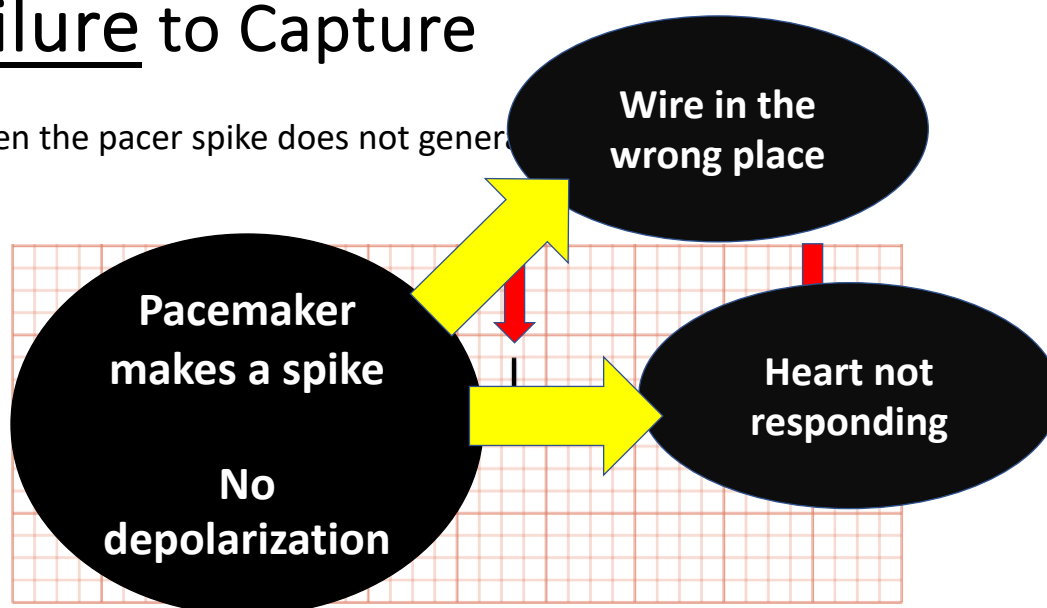
When the pacer spike gains control of impulse (P or QRS)



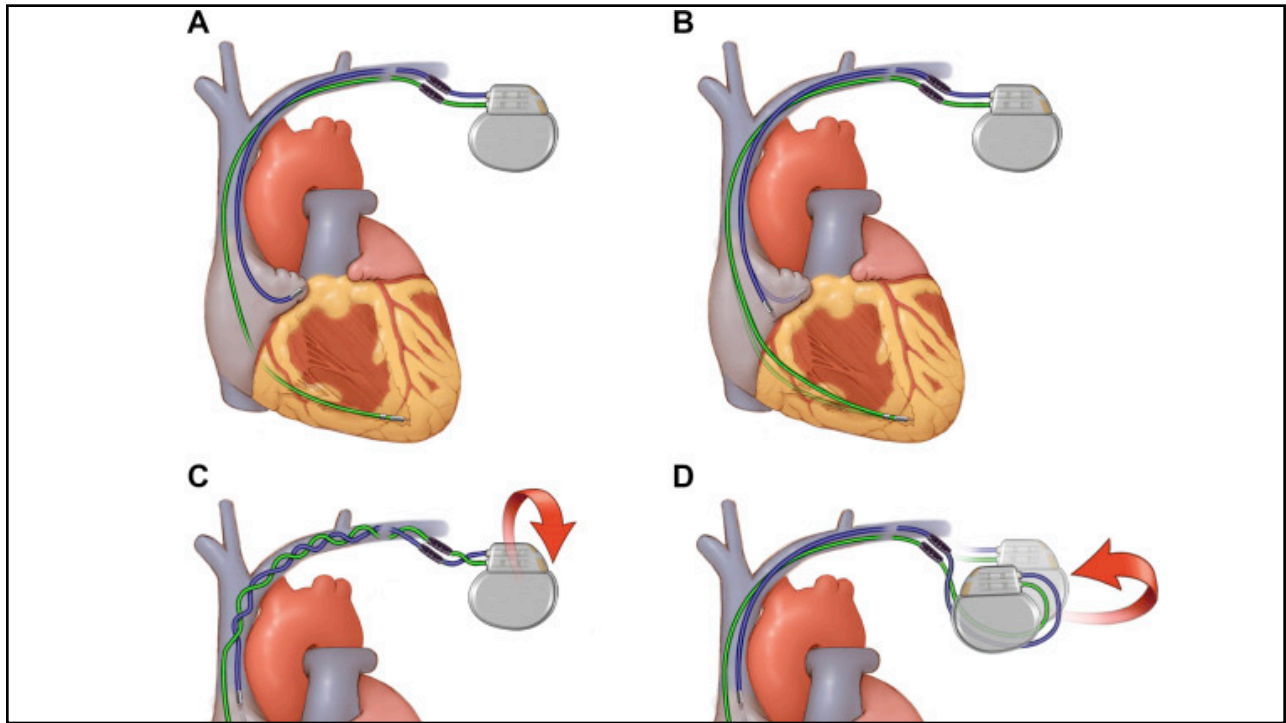
58

Failure to Capture

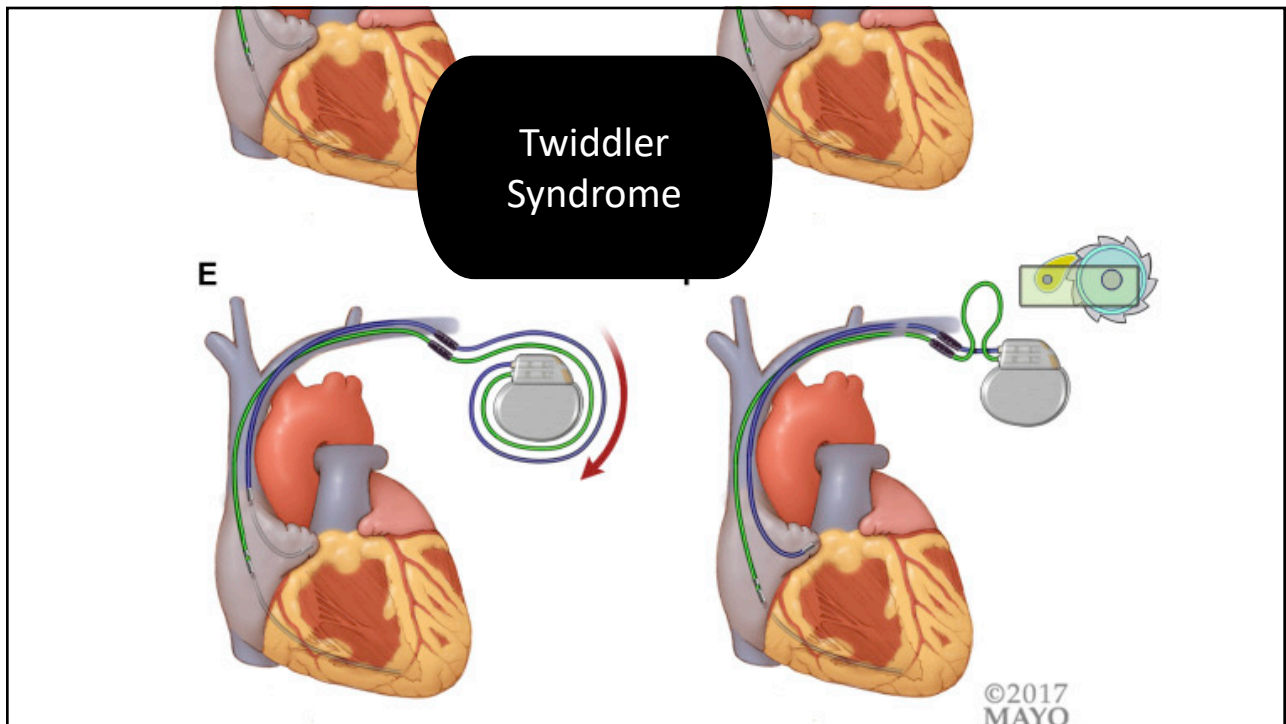
- When the pacer spike does not generate



59



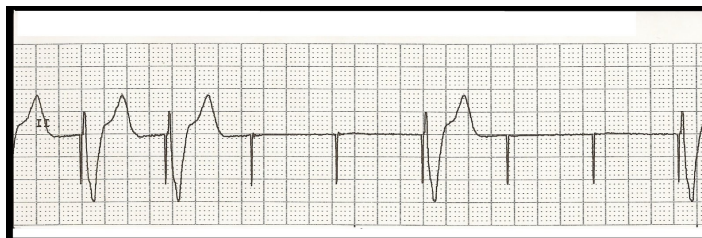
60



61

Failure to Capture

- Wire fracture
- Exit block
- Displacement
- Electrolyte disturbance
- MI



62

Problems with Pacemakers



Failure to
Capture

Output
Failure

Pacing

63

Failure to Pace (Output Failure)

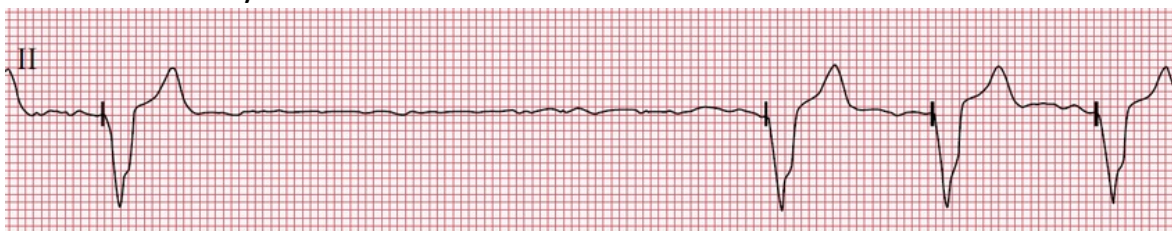


No Pacing spike

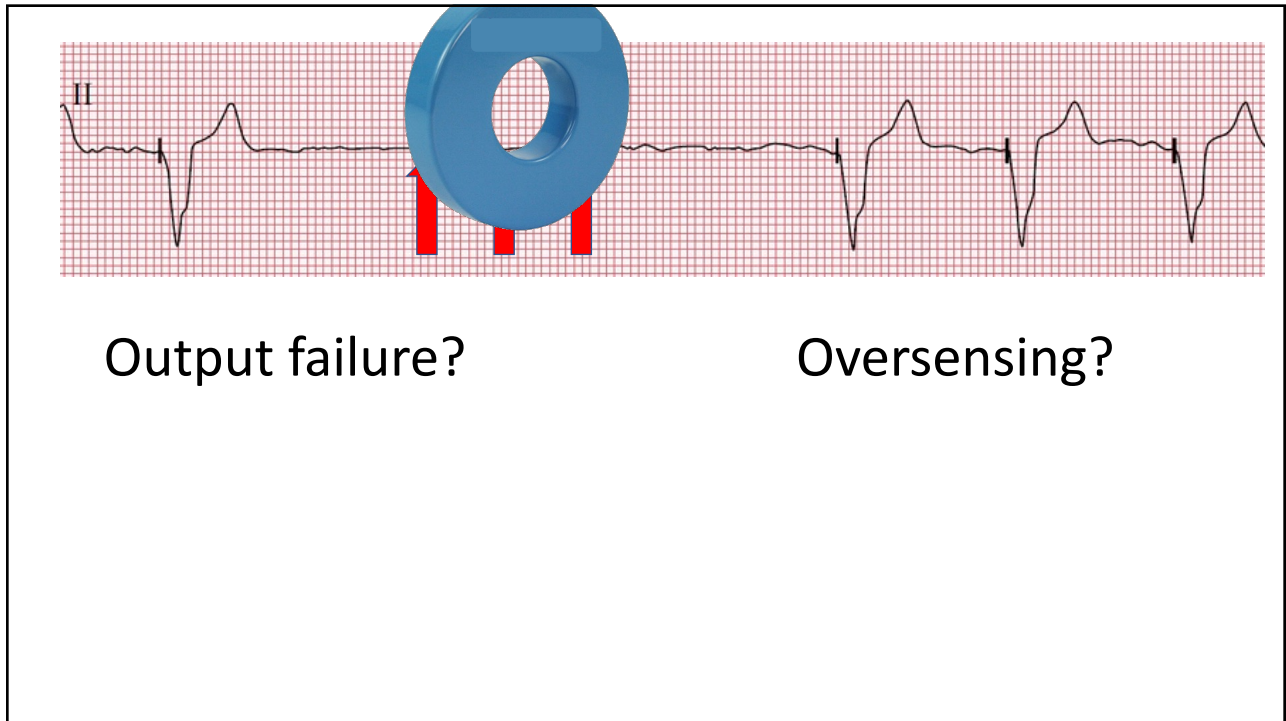
64

Failure to Pace (Output Failure)

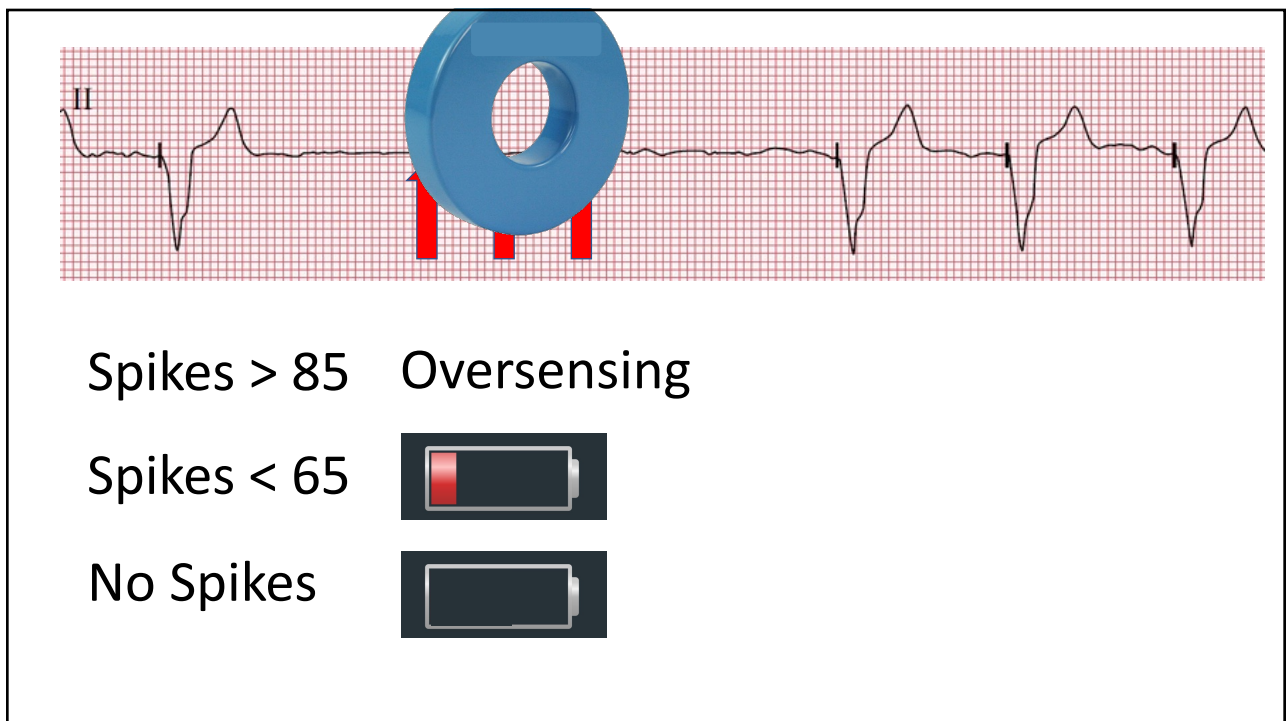
- Oversensing
- Lead fracture
- Lead displacement
- Low Battery



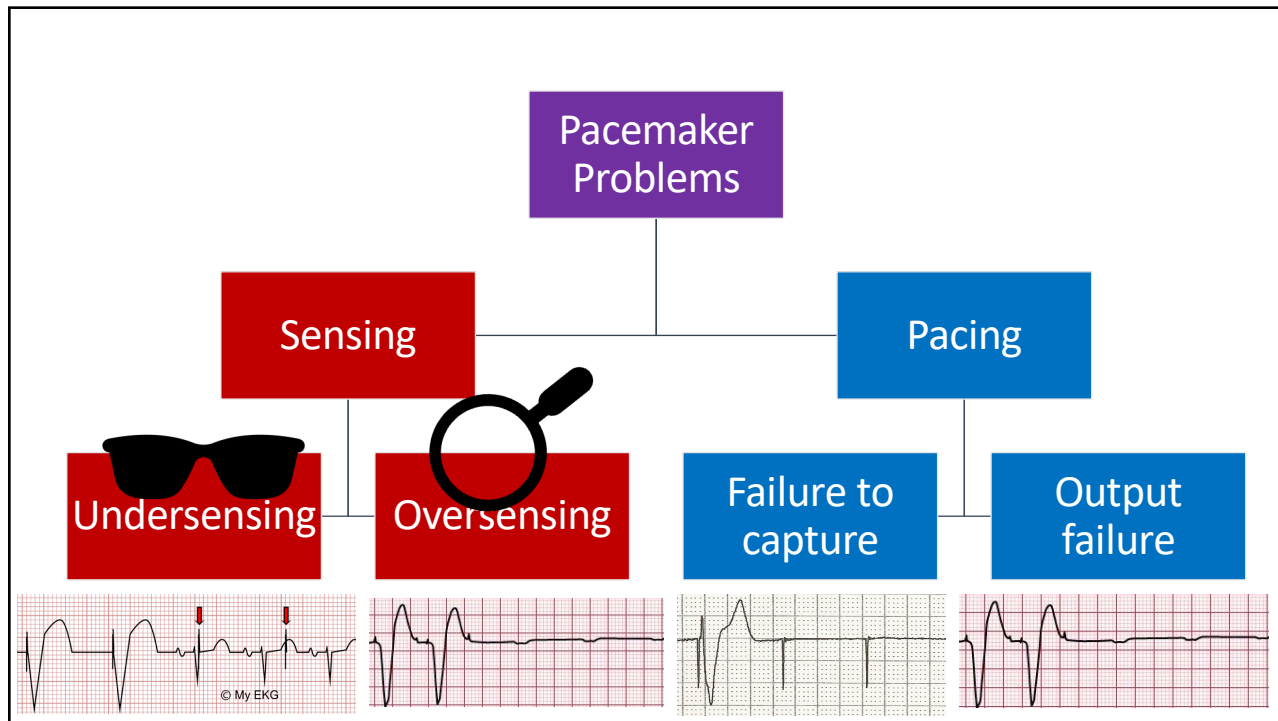
65



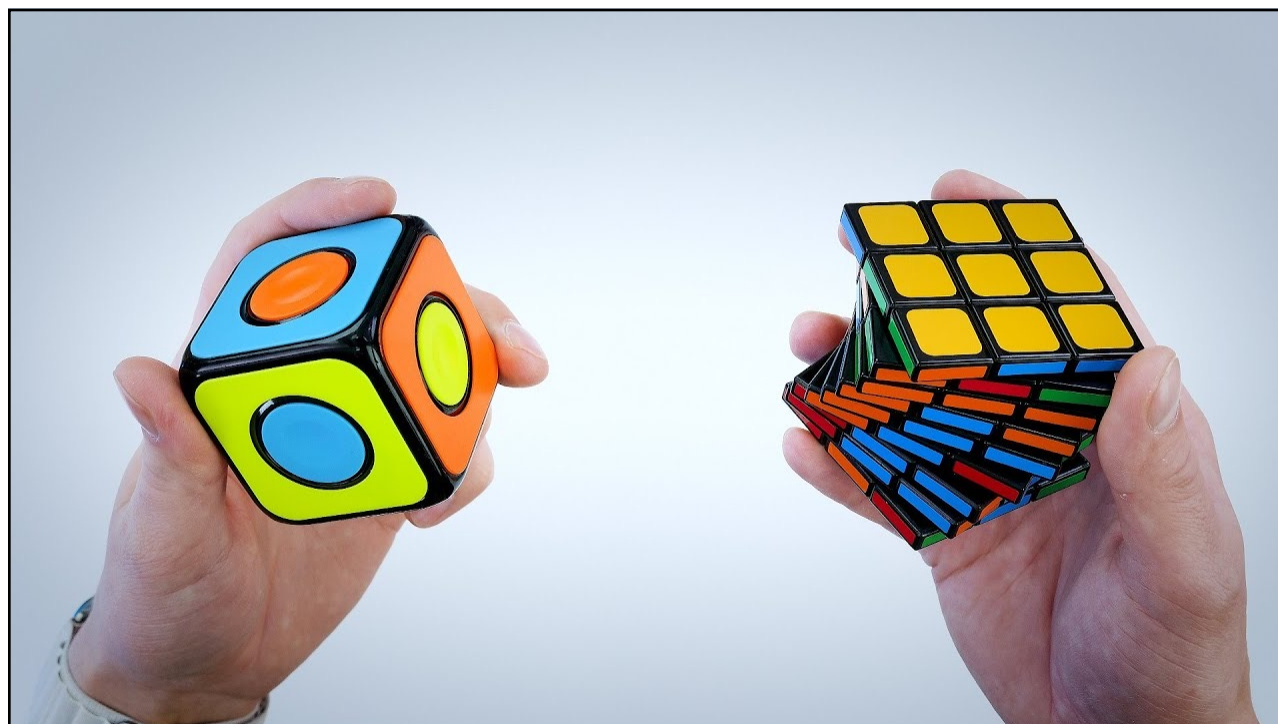
66



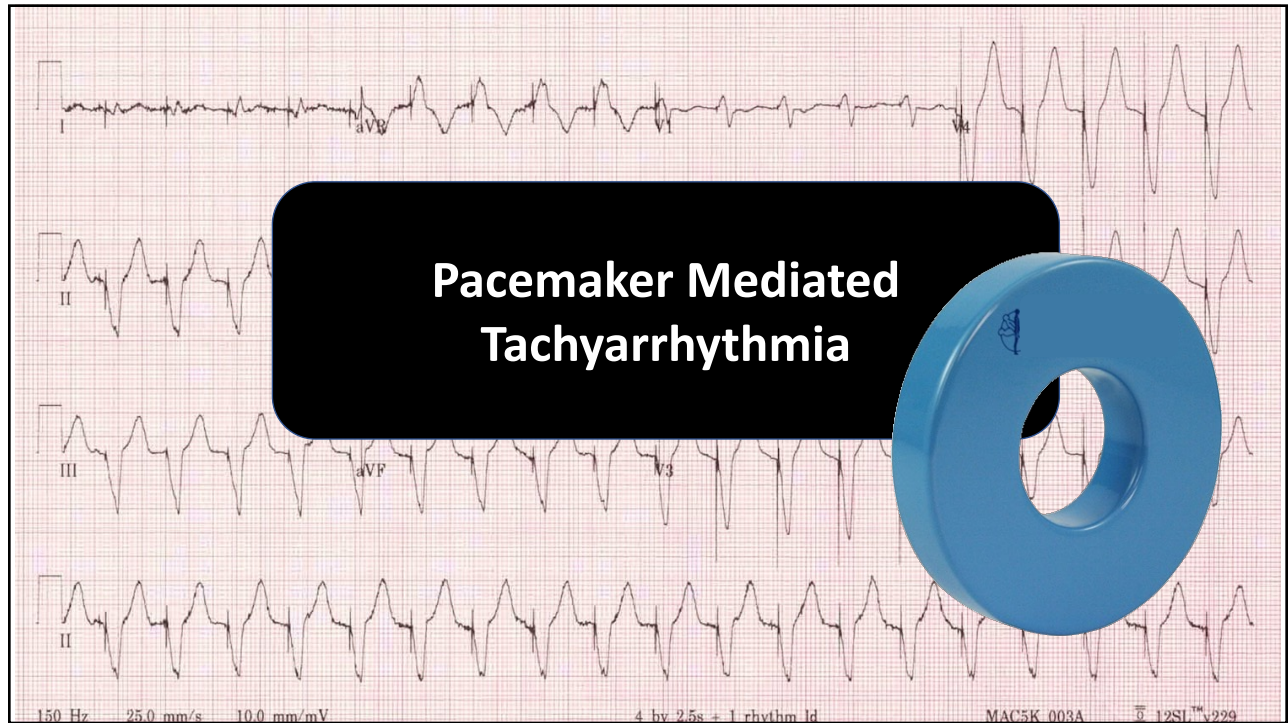
67



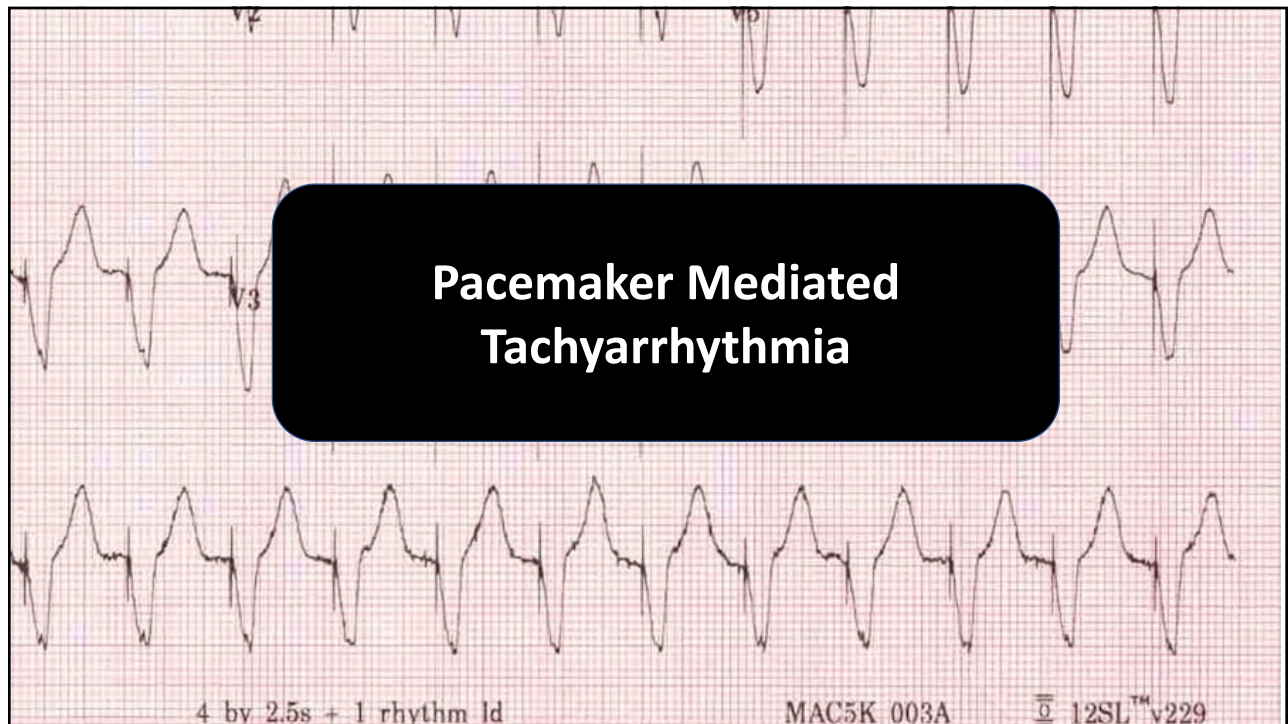
68



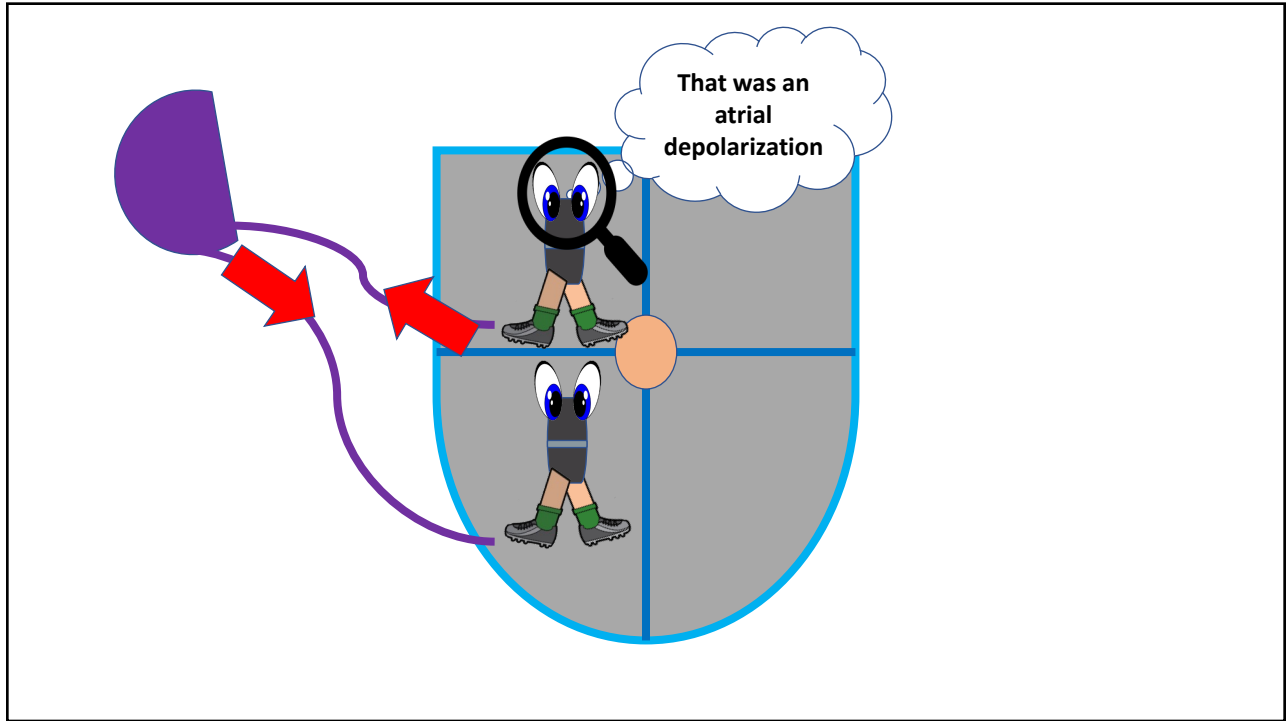
69



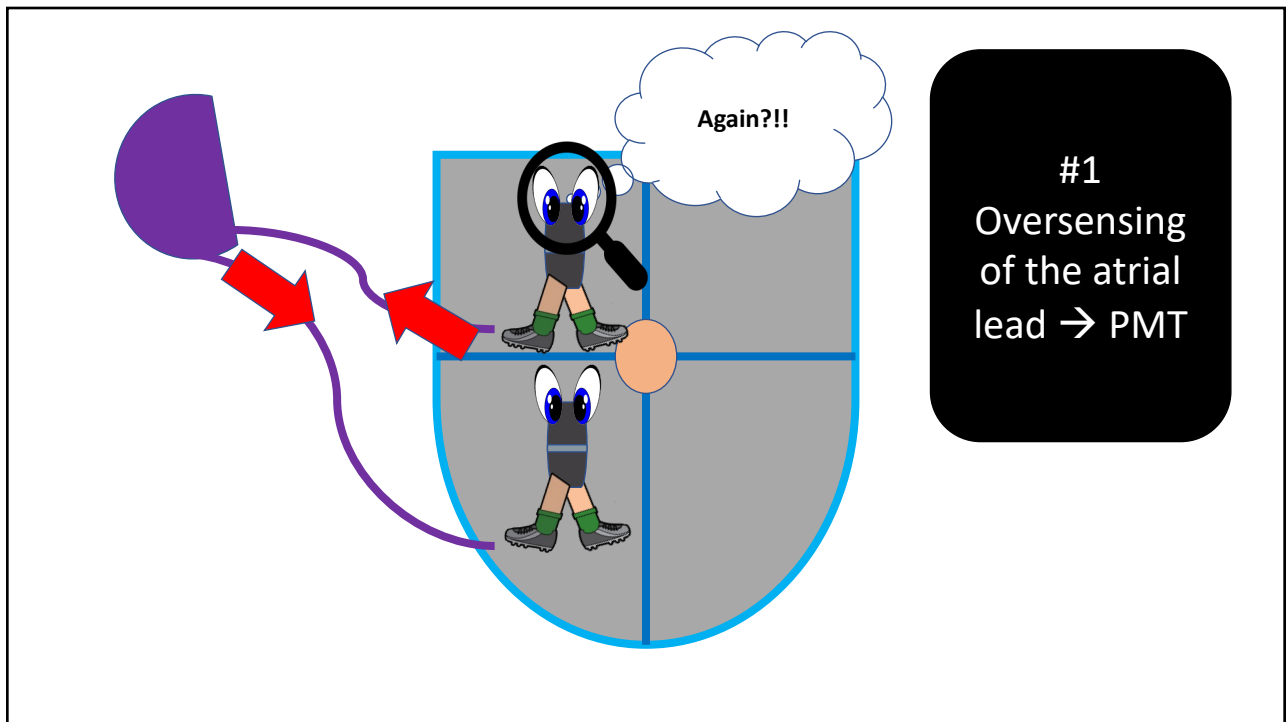
70



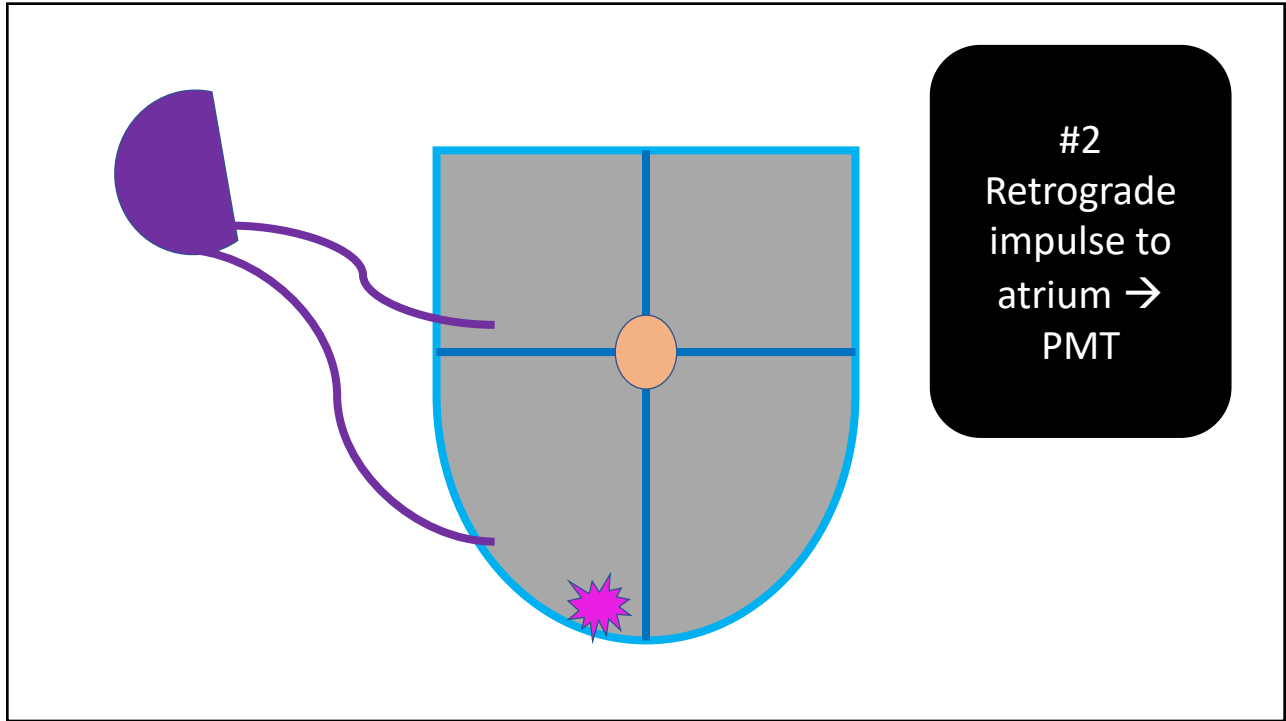
71



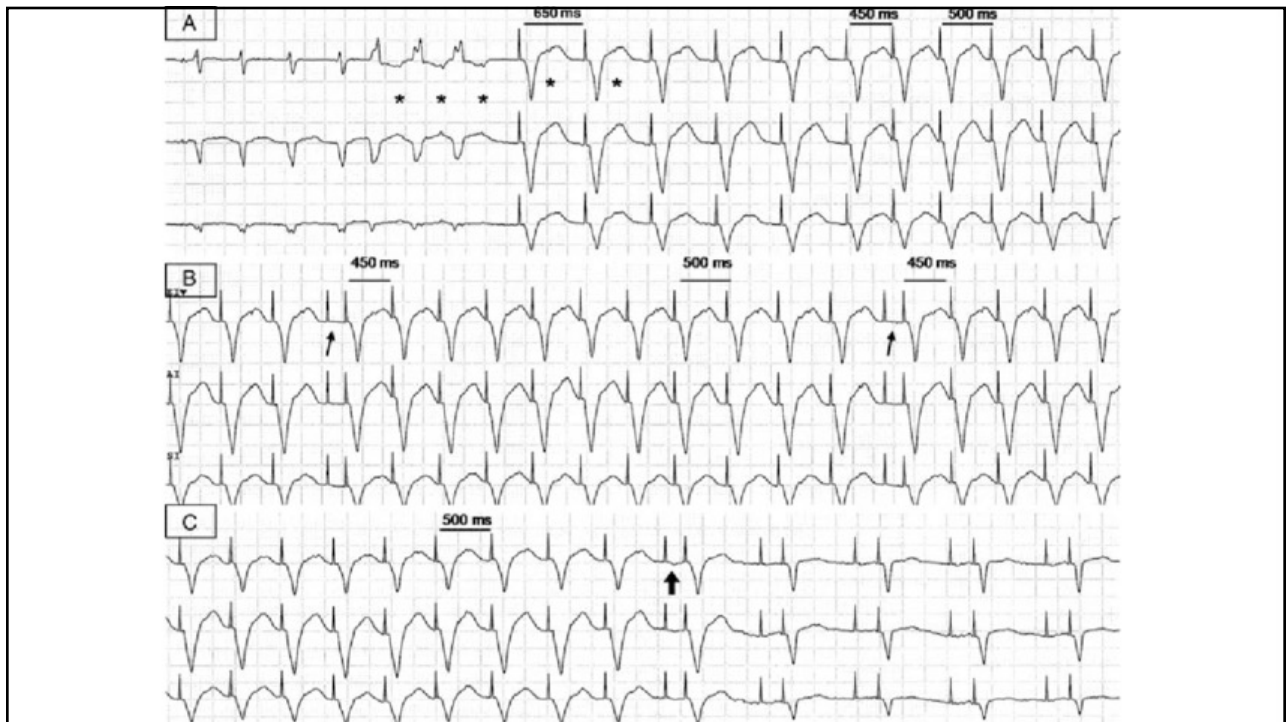
72



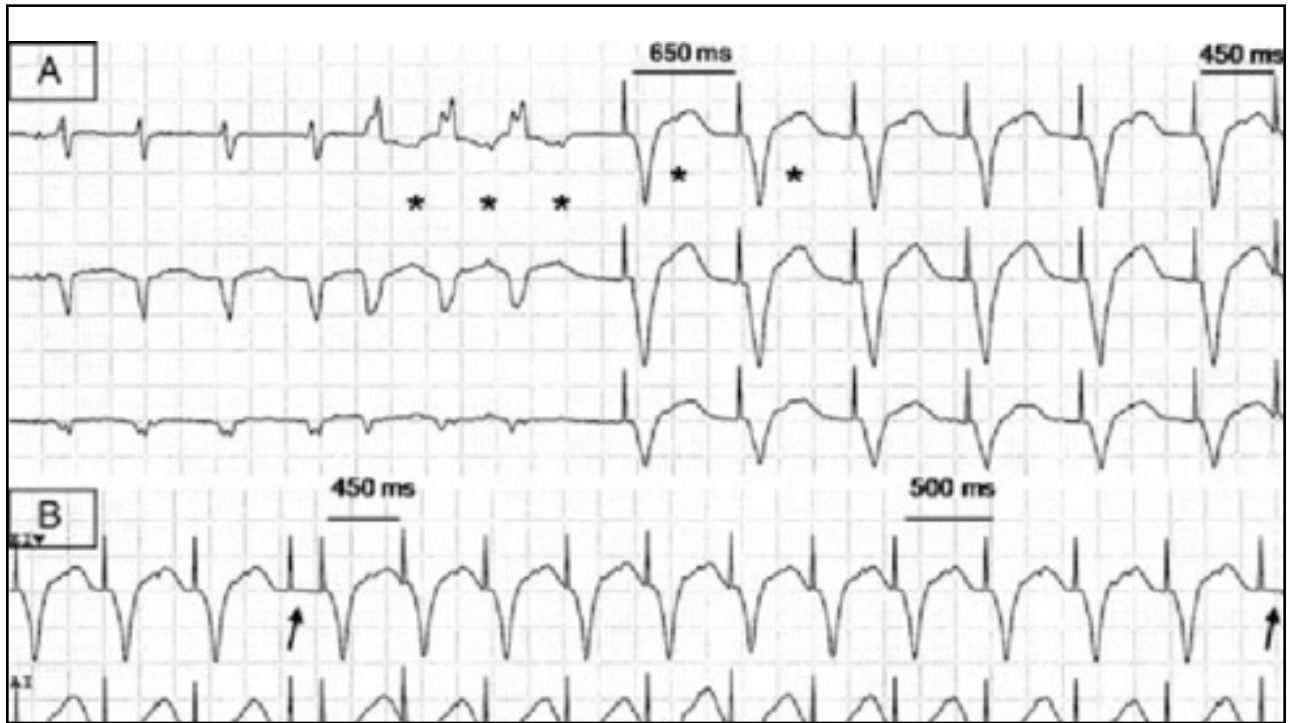
73



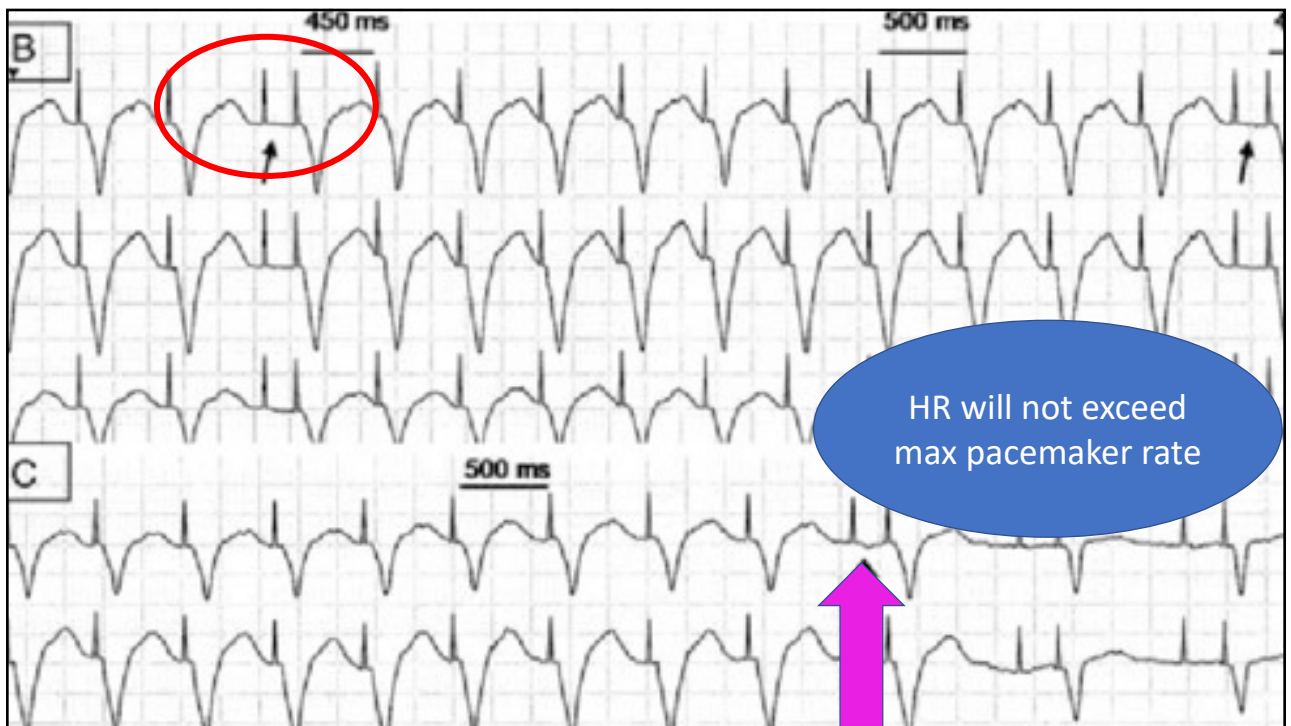
74



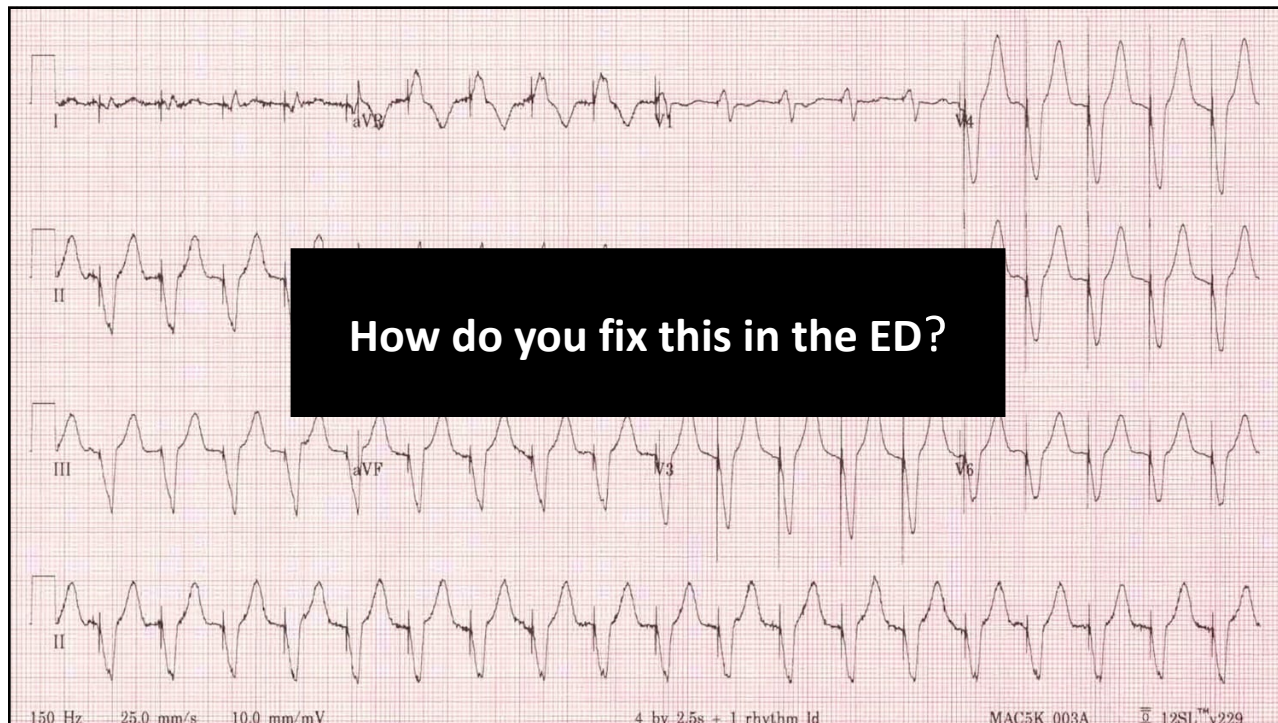
75



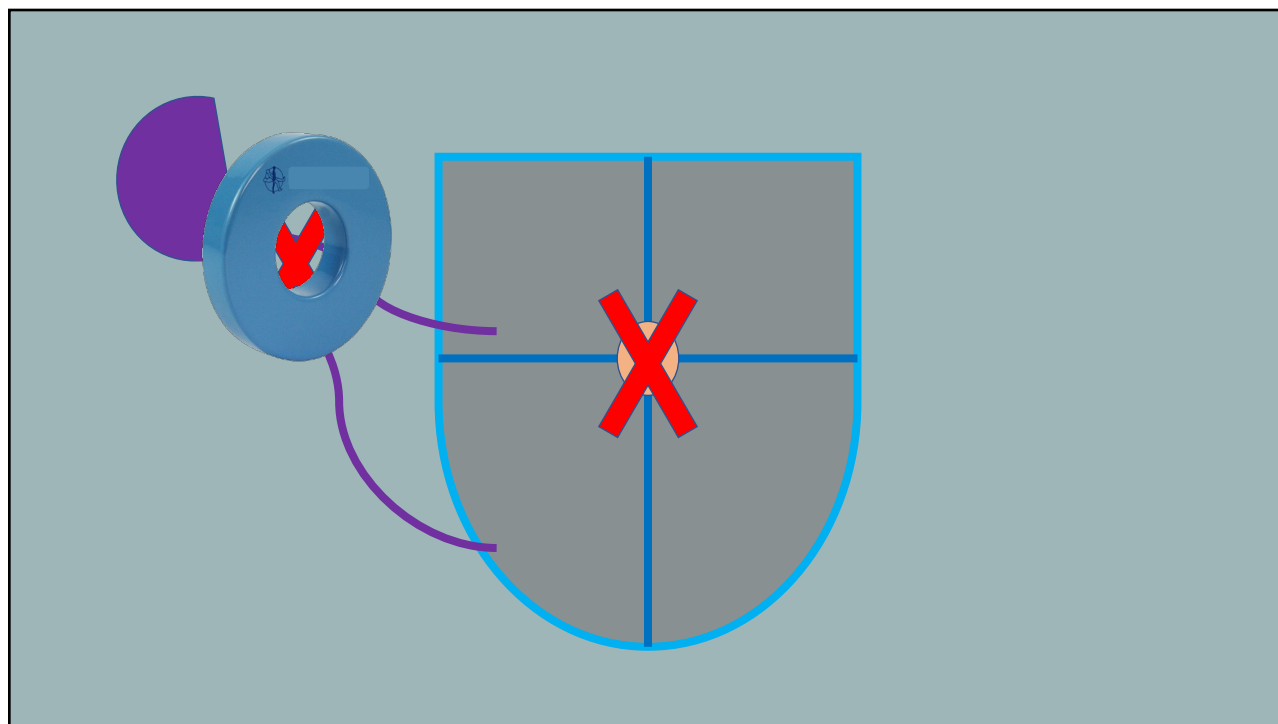
76



77



78




79



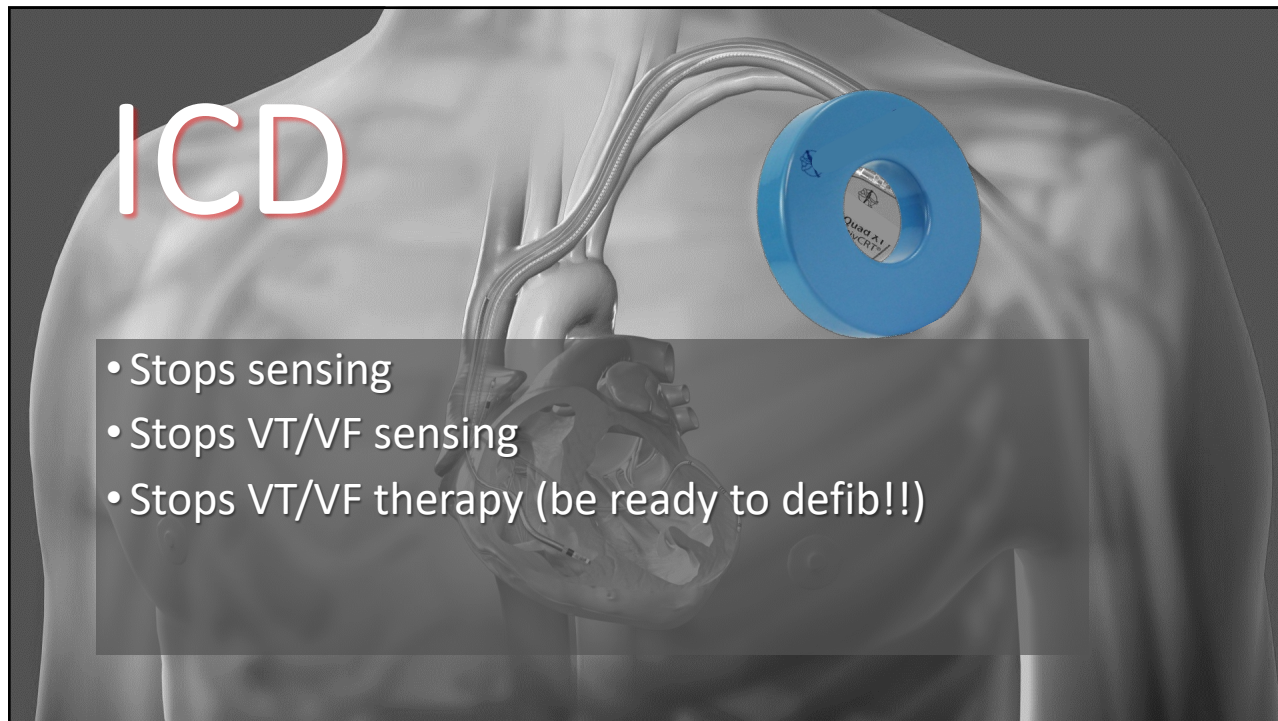
80

When to use magnet in ED?

- PMT
- Bradycardia w/ failure to pace

A blue circular magnet with a central hole is shown on the right side of the slide.

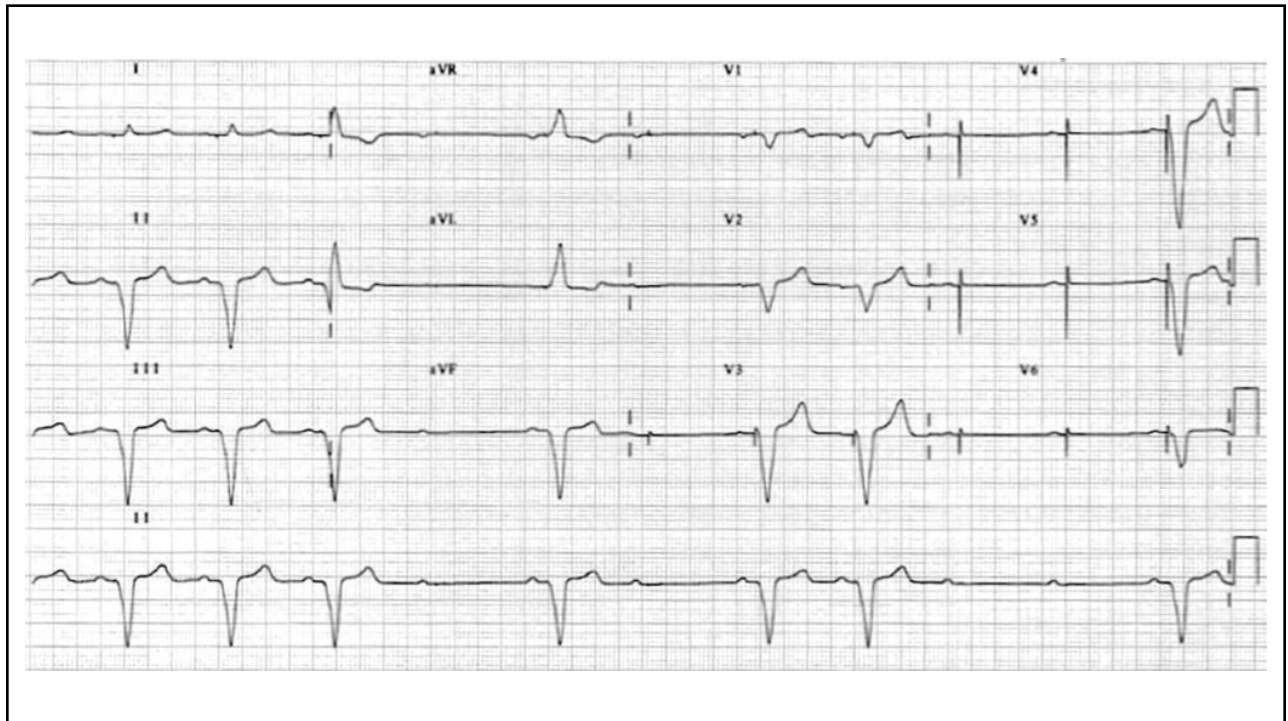
82



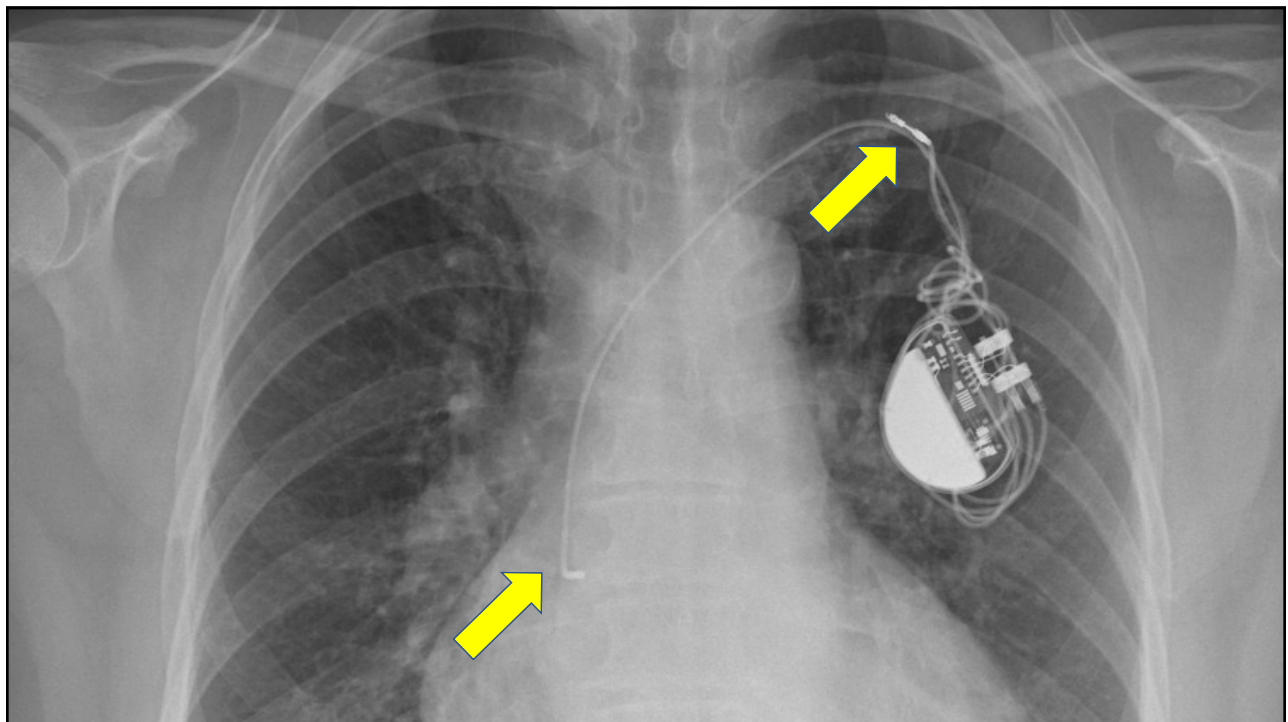
83



84



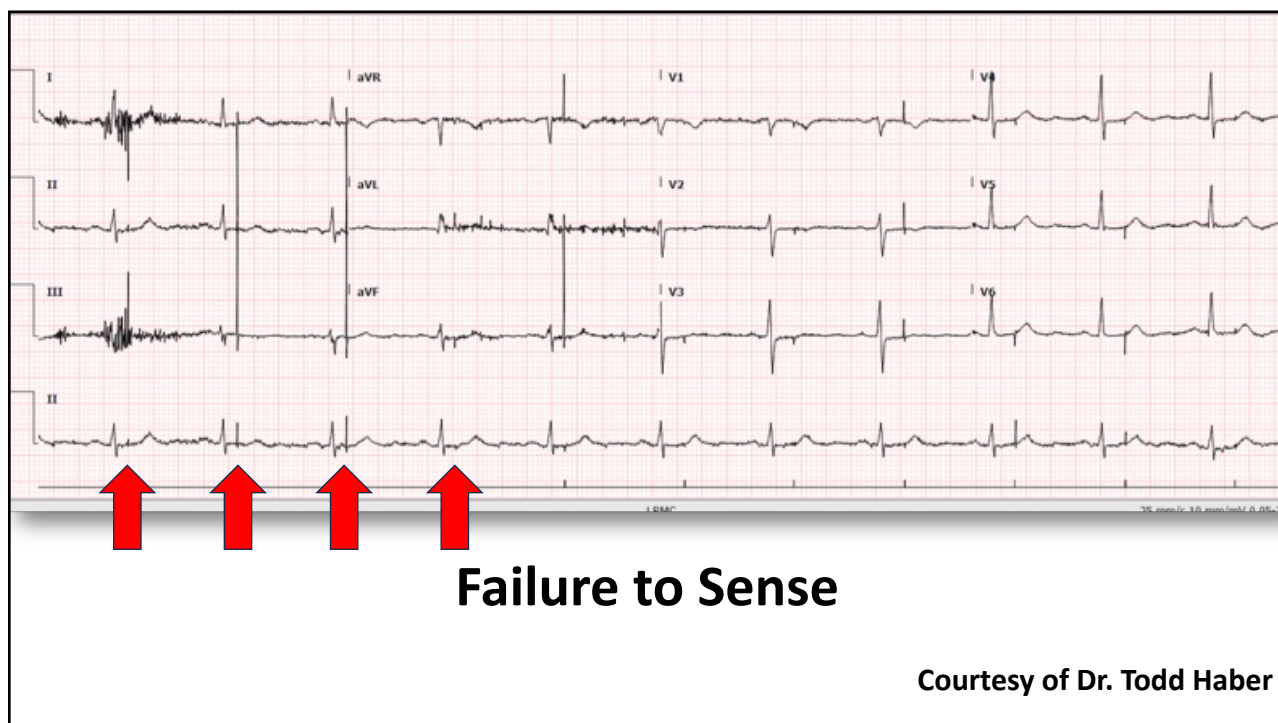
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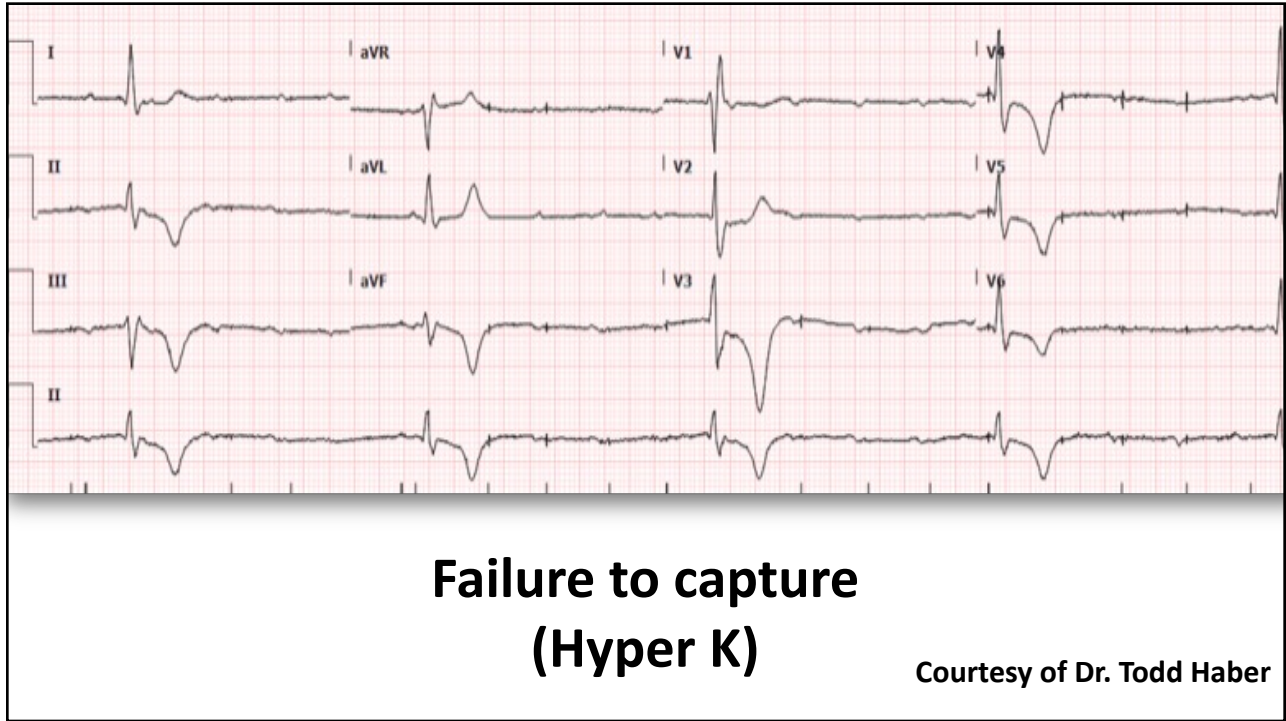
86



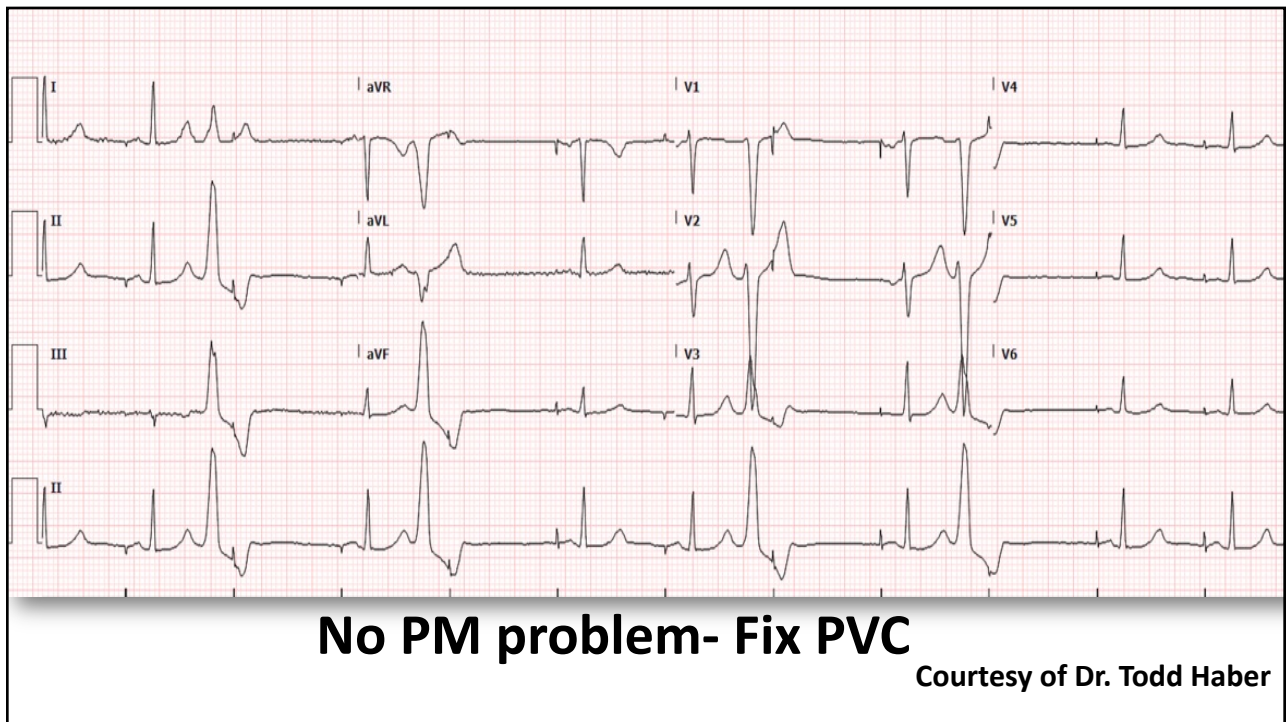
87



88



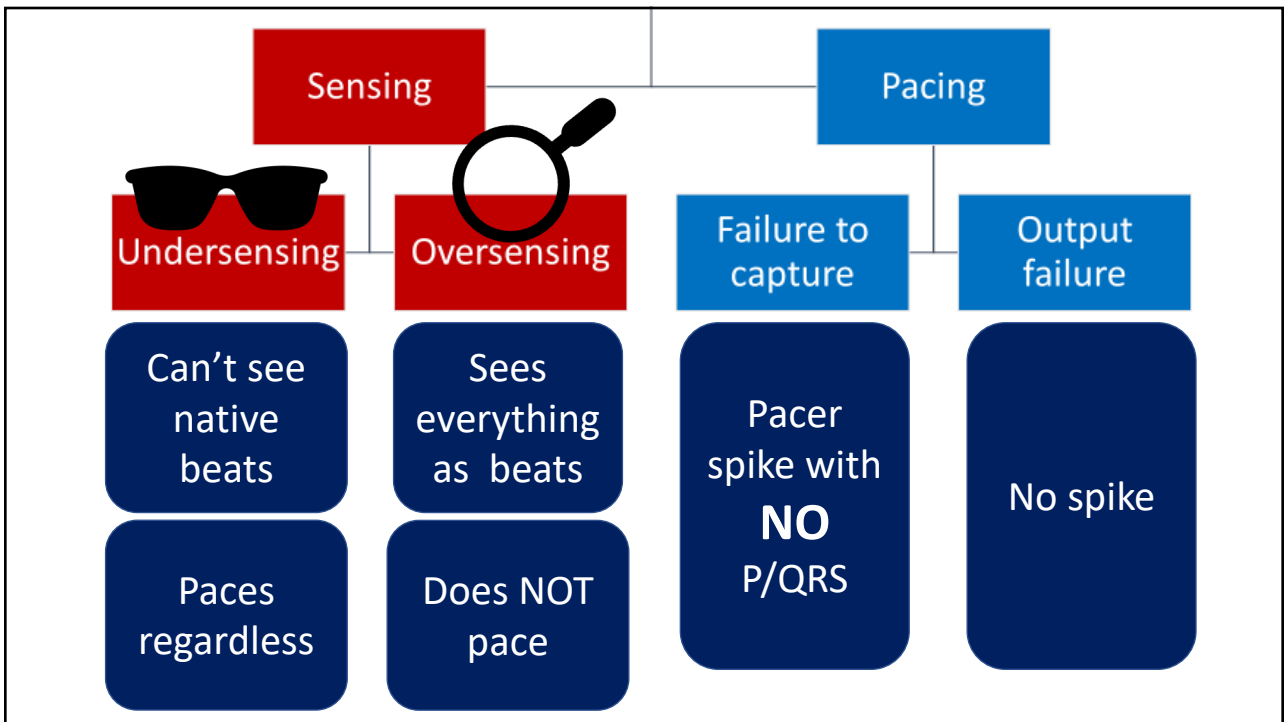
89



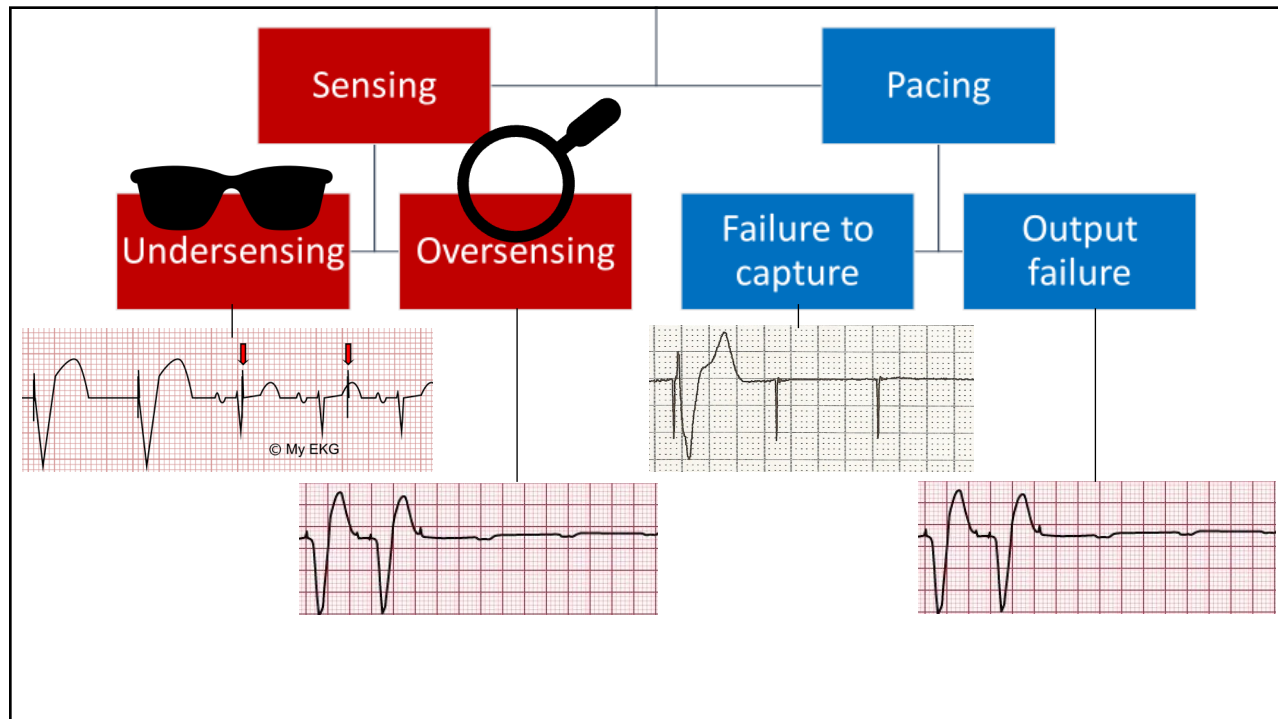
90



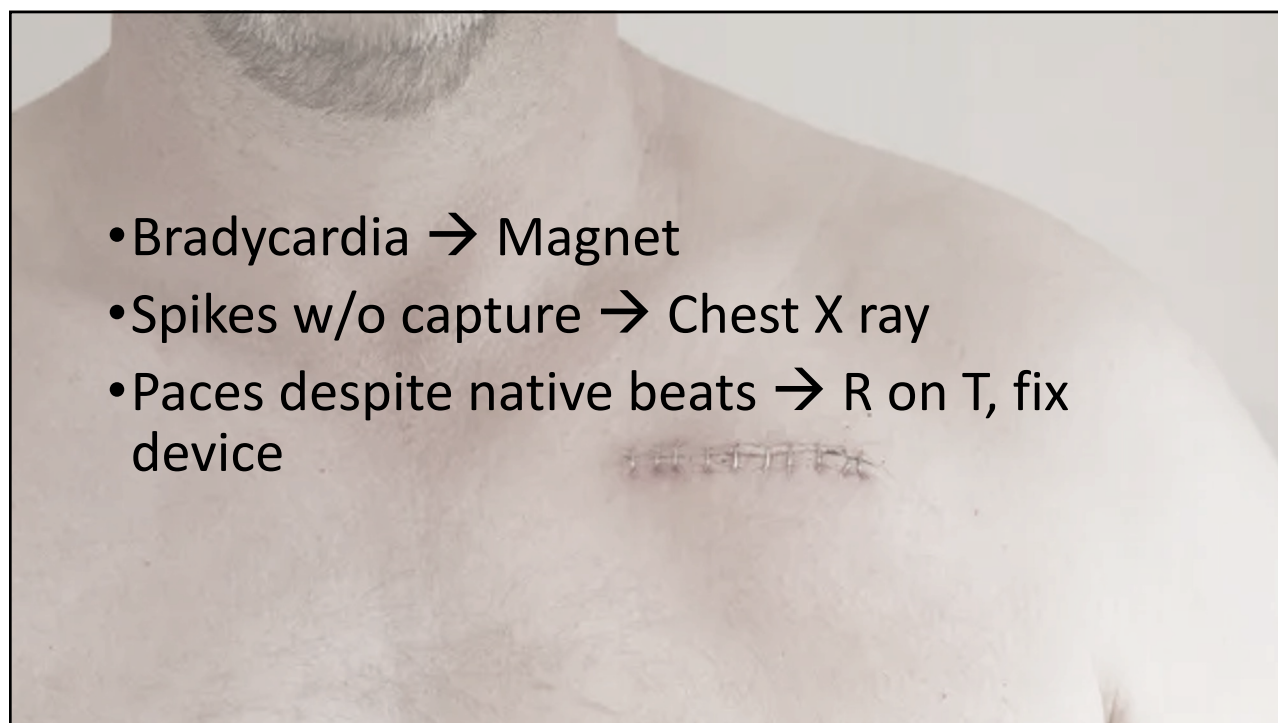
91



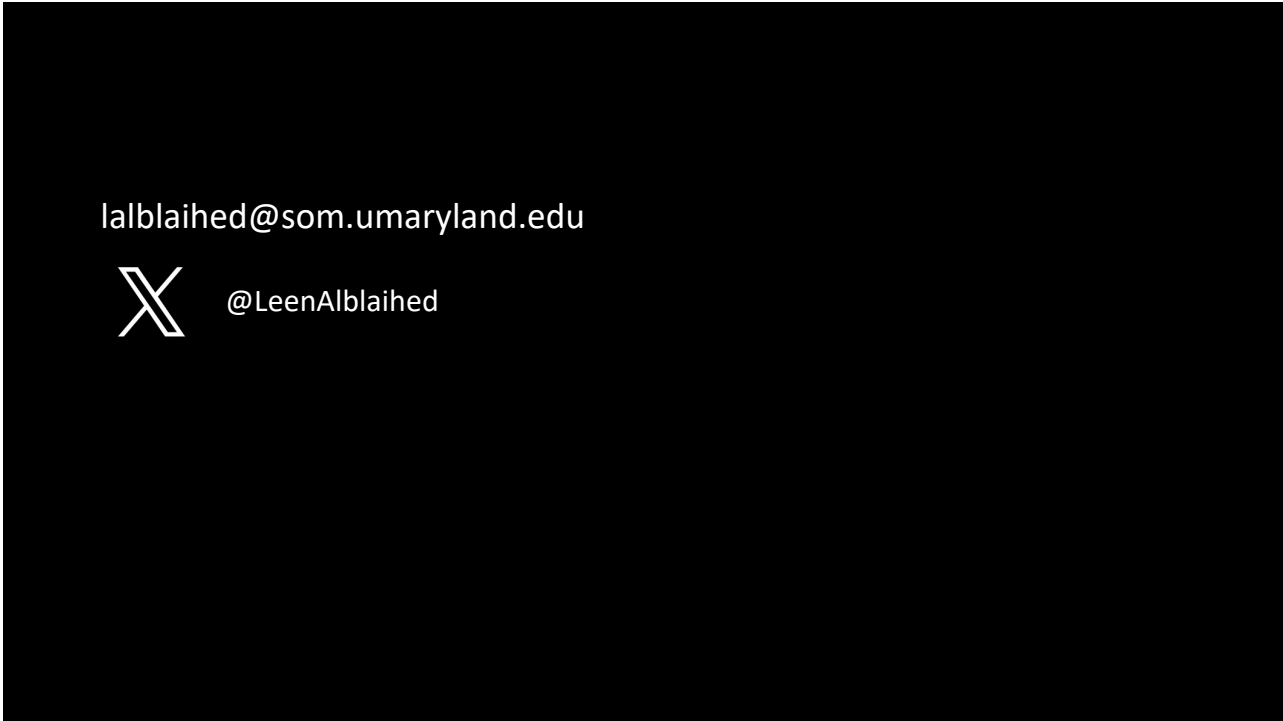
92



93



94

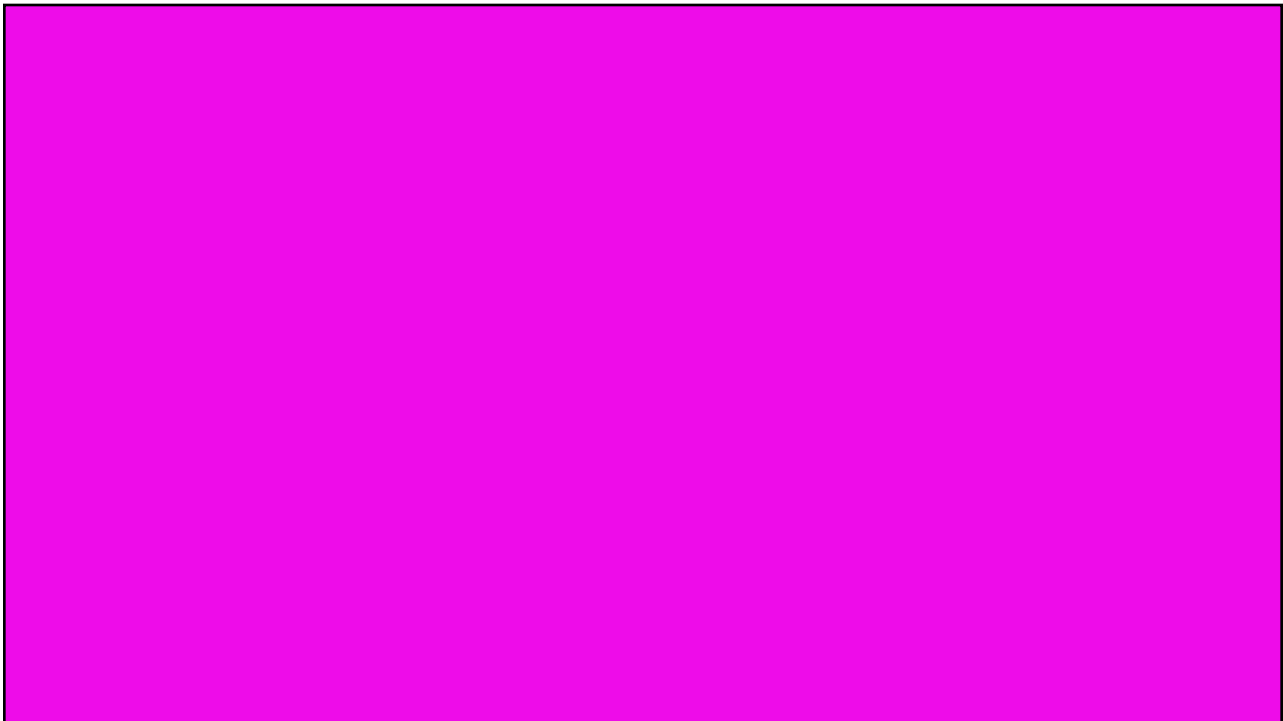


lalblaihed@som.umaryland.edu

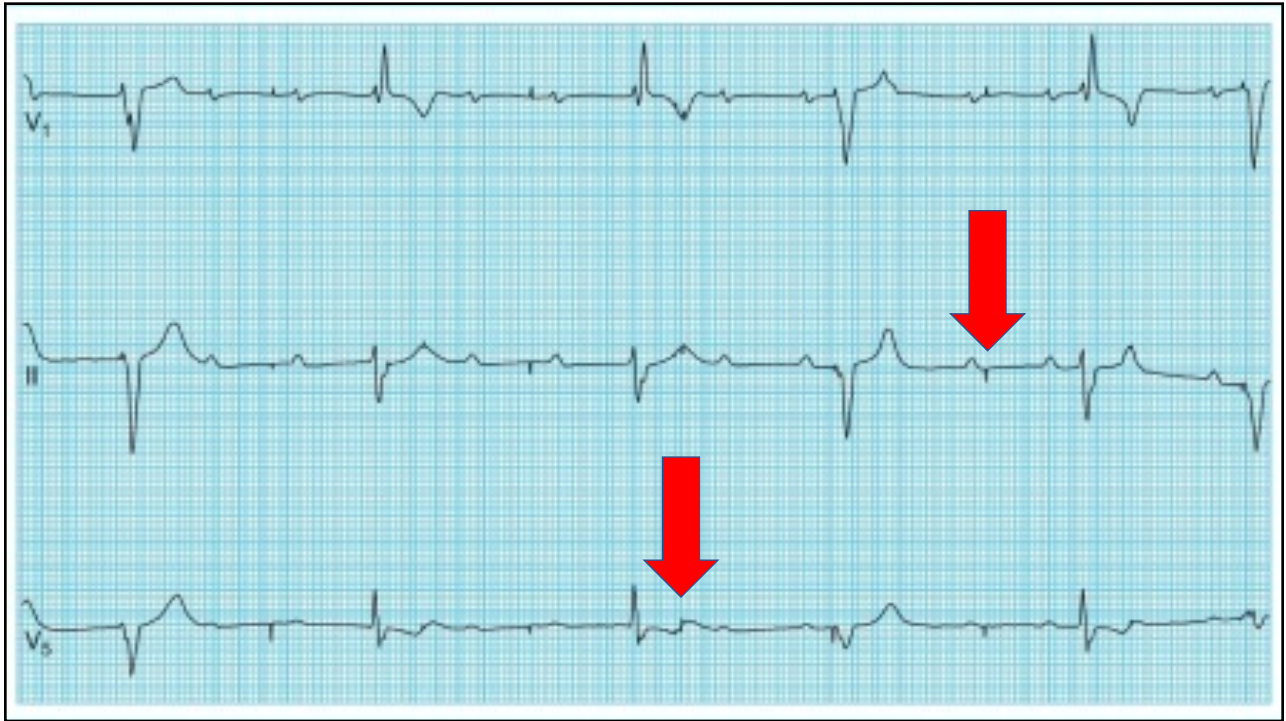


@LeenAlblaihed

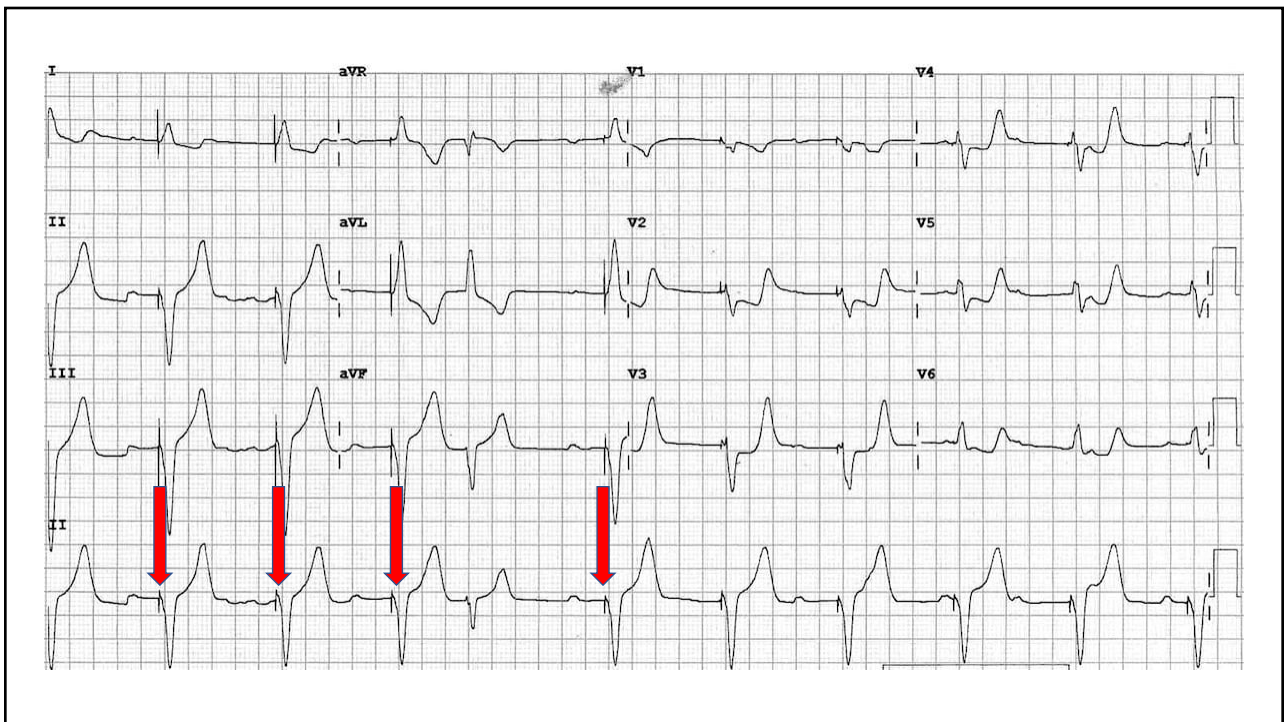
95



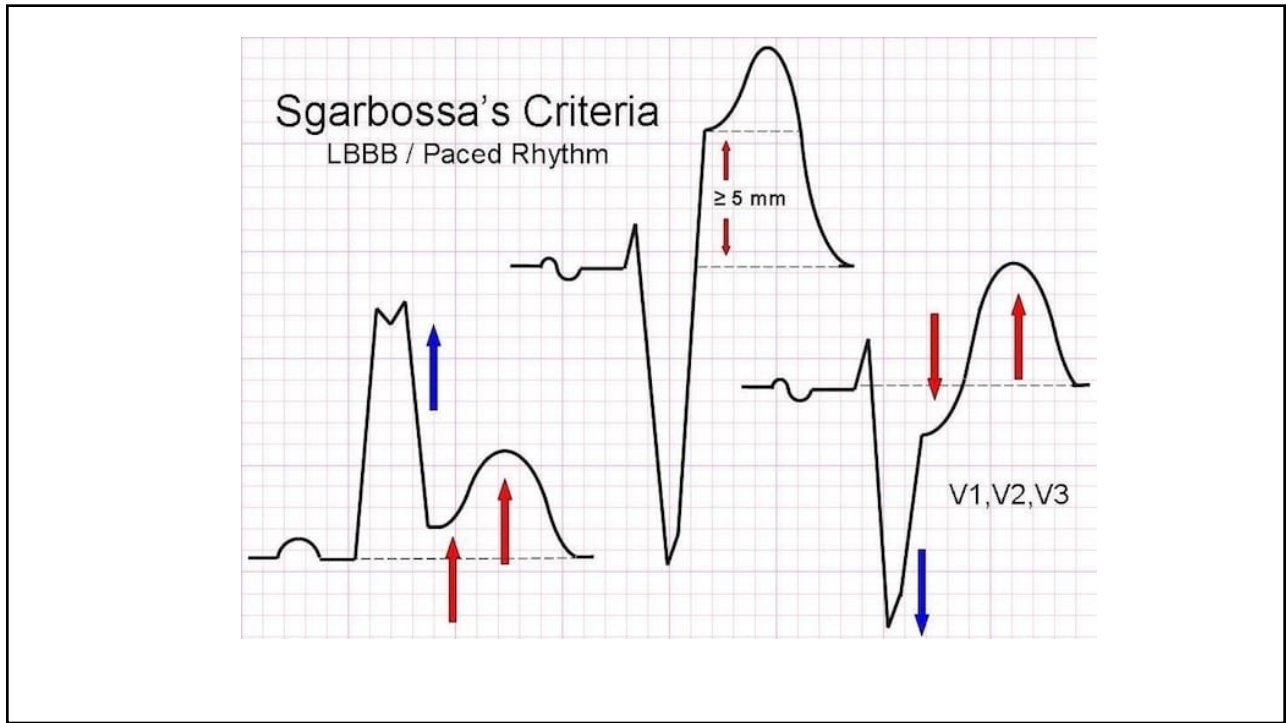
96



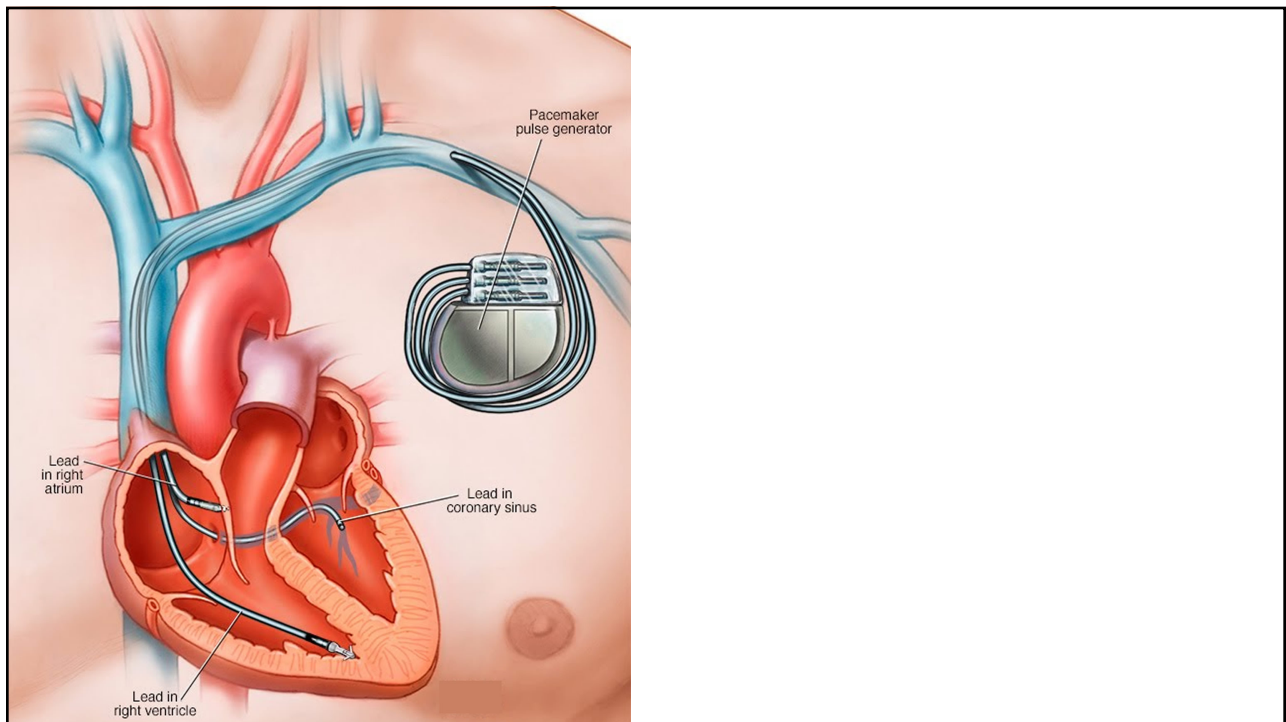
97



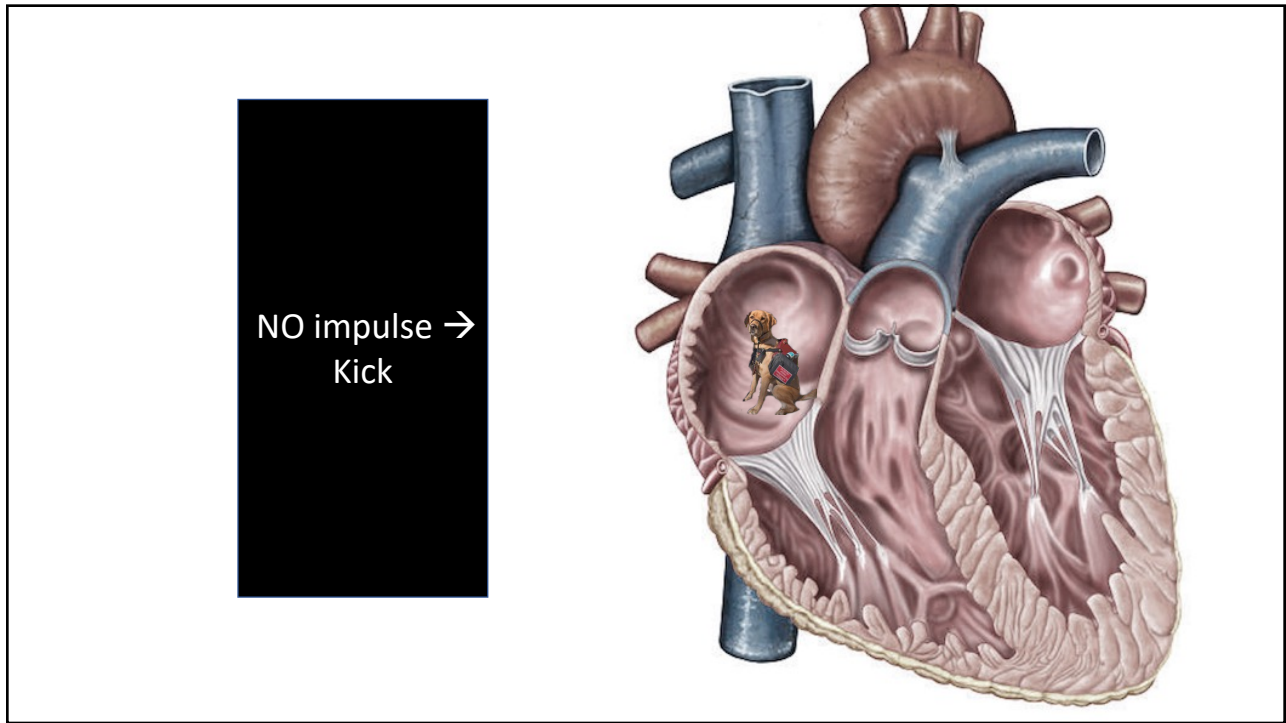
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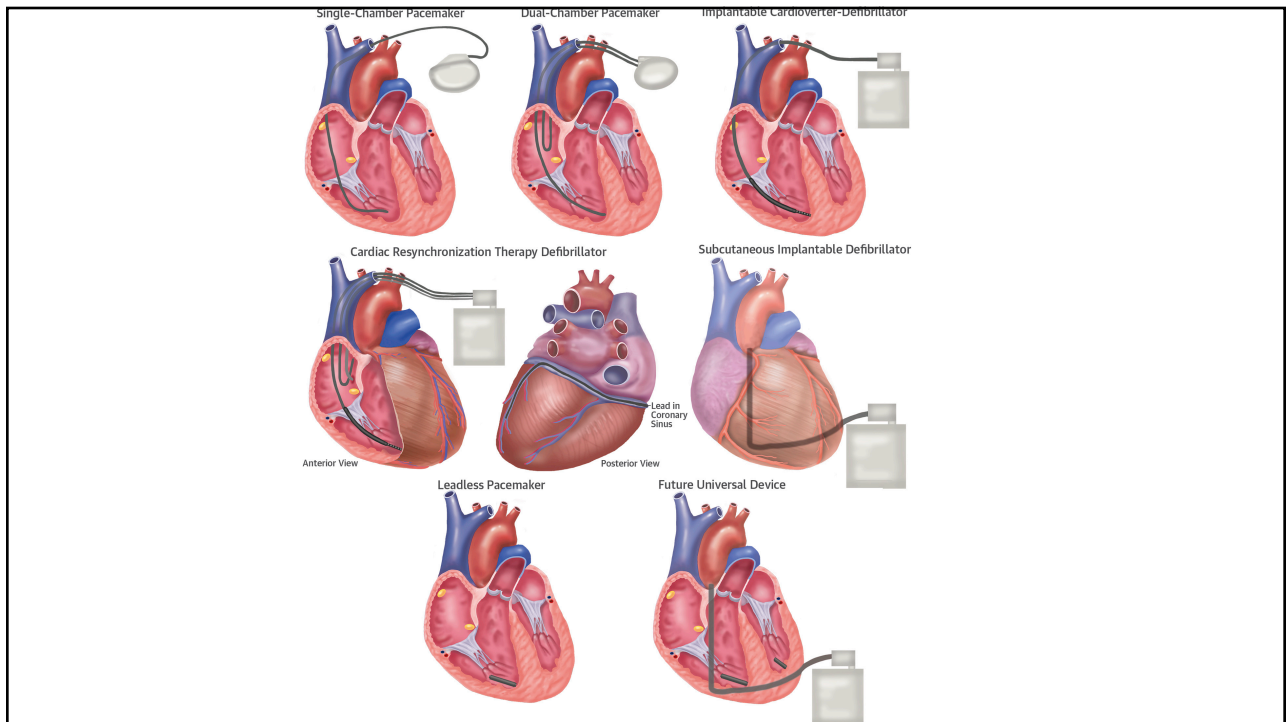
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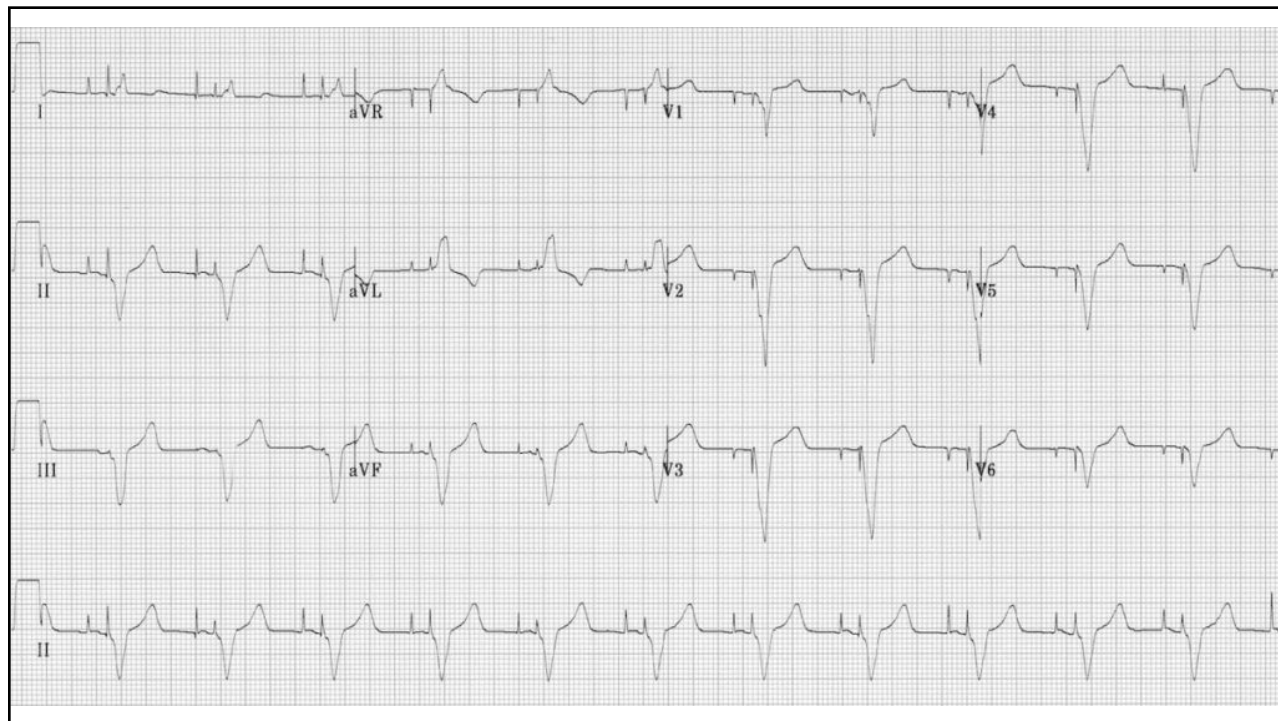
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101



102



103



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