

Pacemakers in the ED

Pearls and Pitfalls

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Disclosures

I get NOTHIN'
From Everybody!!!

This stuff is way more complicated...

I am not an ELECTROPHYSIOLOGIST

Objectives

Cooky Cases

Nuts and Bolts of Pacers

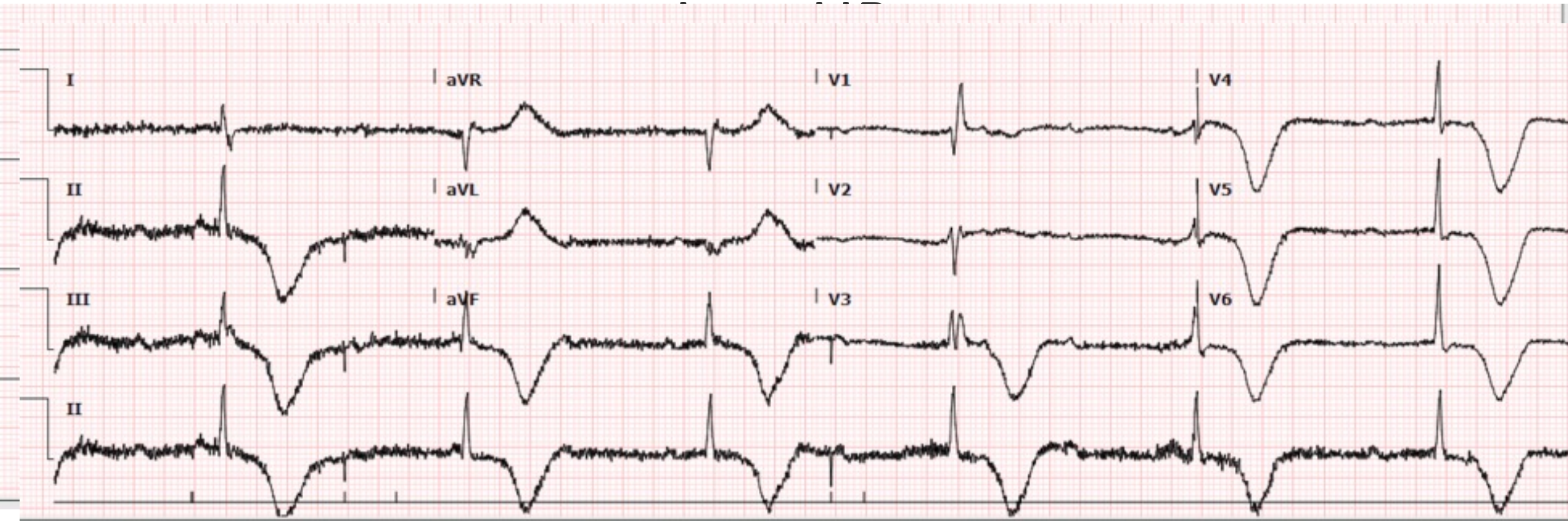
What Can Go Wrong? (Everything...)

Review of Cases

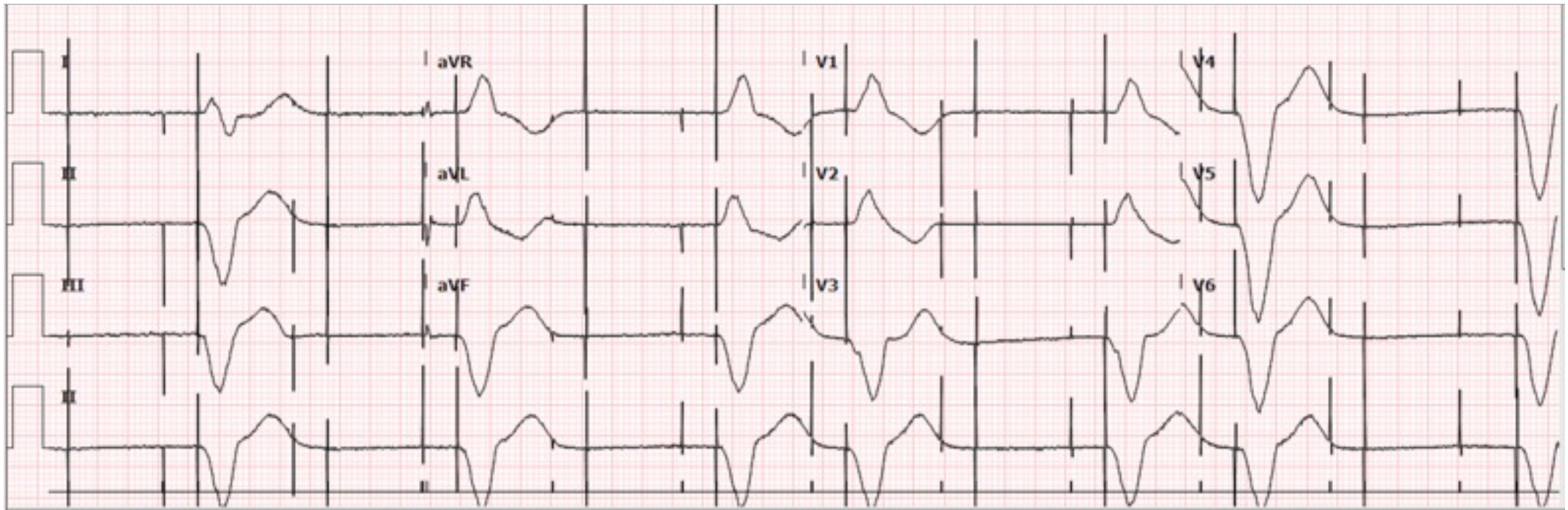
Let's Get GOING!!!

COOKY CASES!!

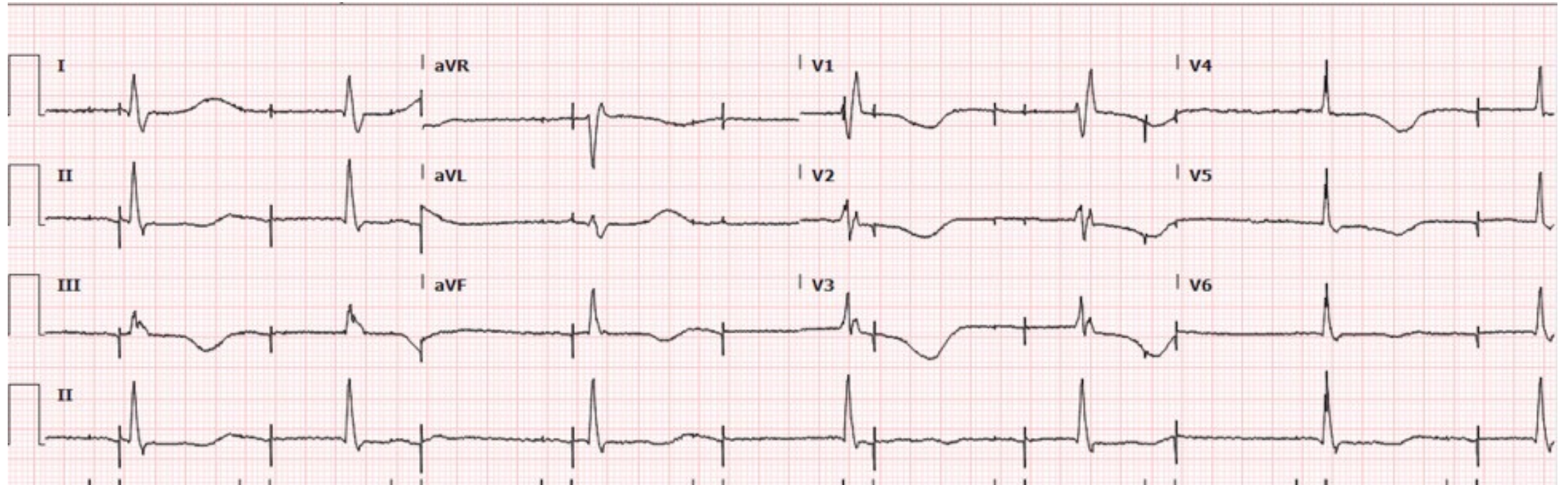
Near Syncope



Weakness



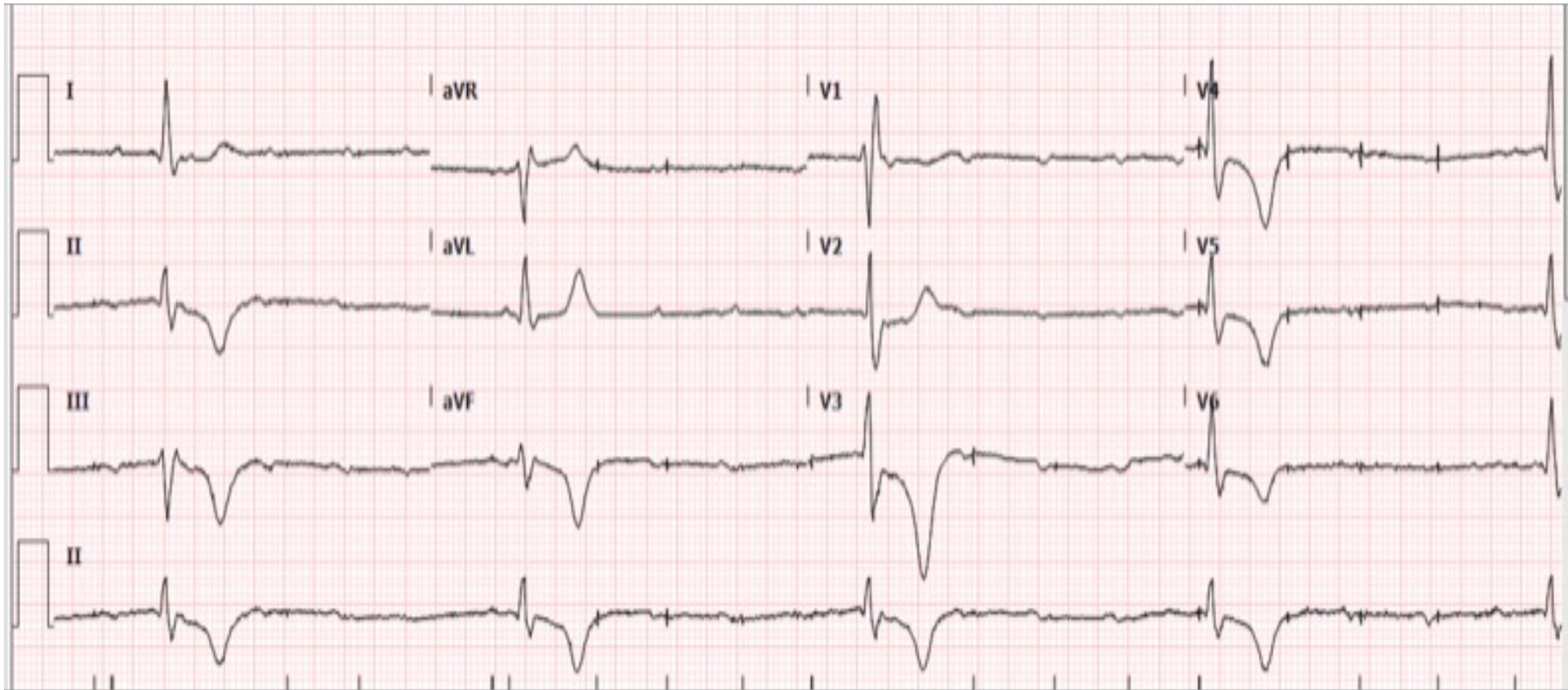
My Pacer isn't working



Weakness

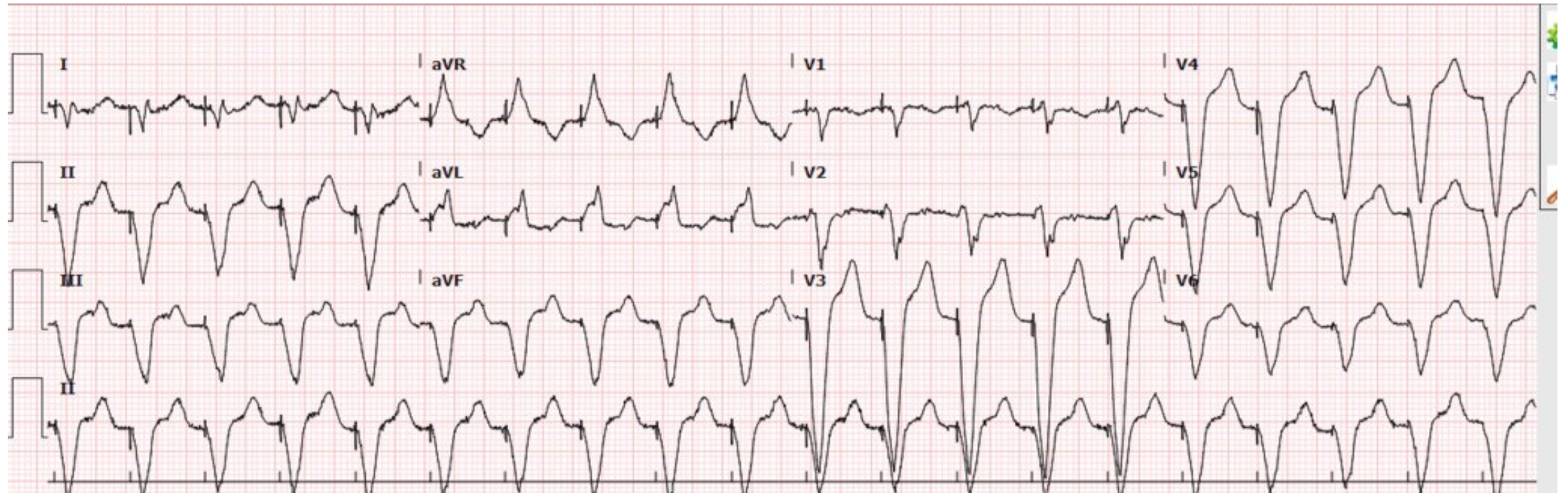


Getting Worse



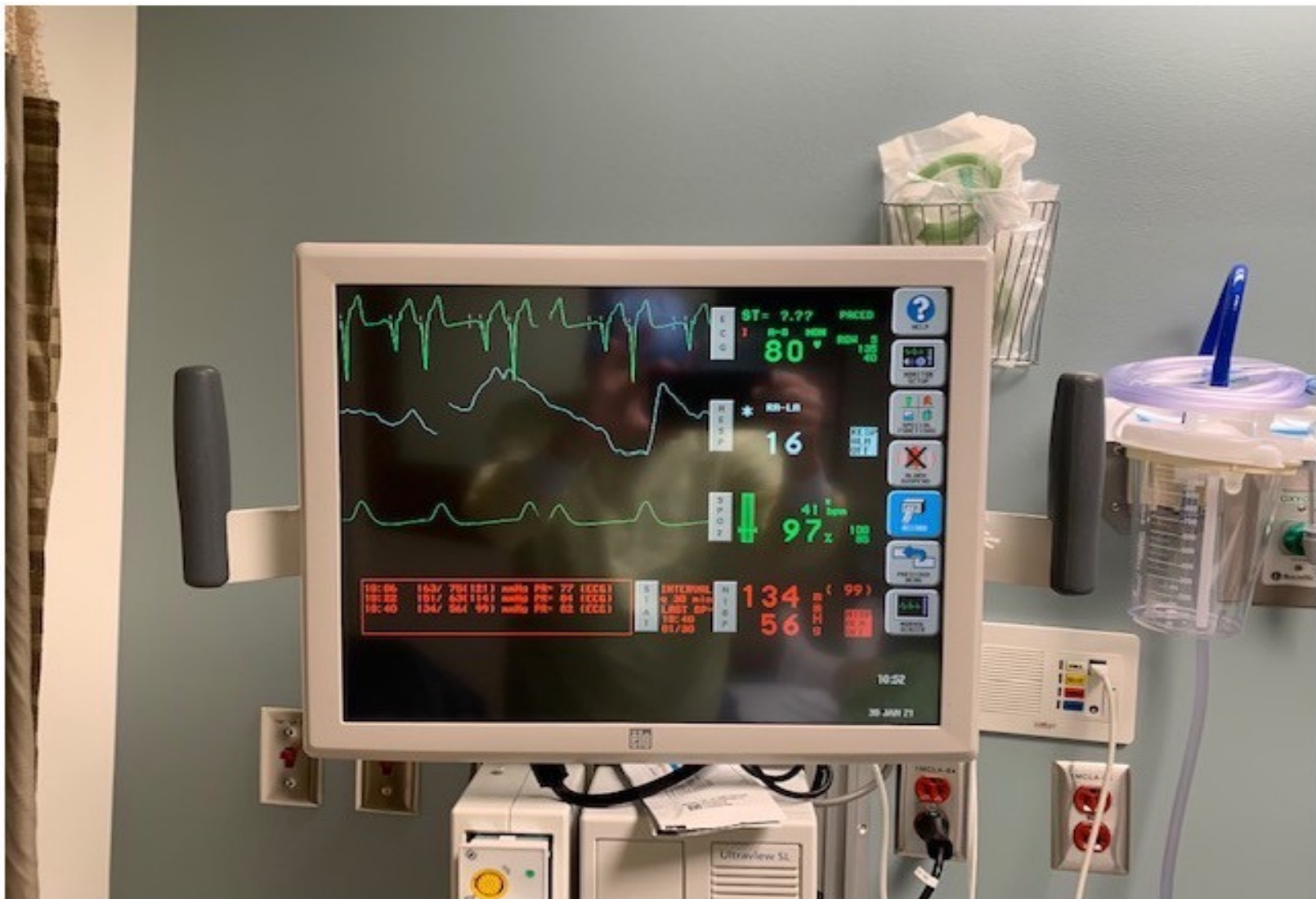
Rapid HR

BP 100

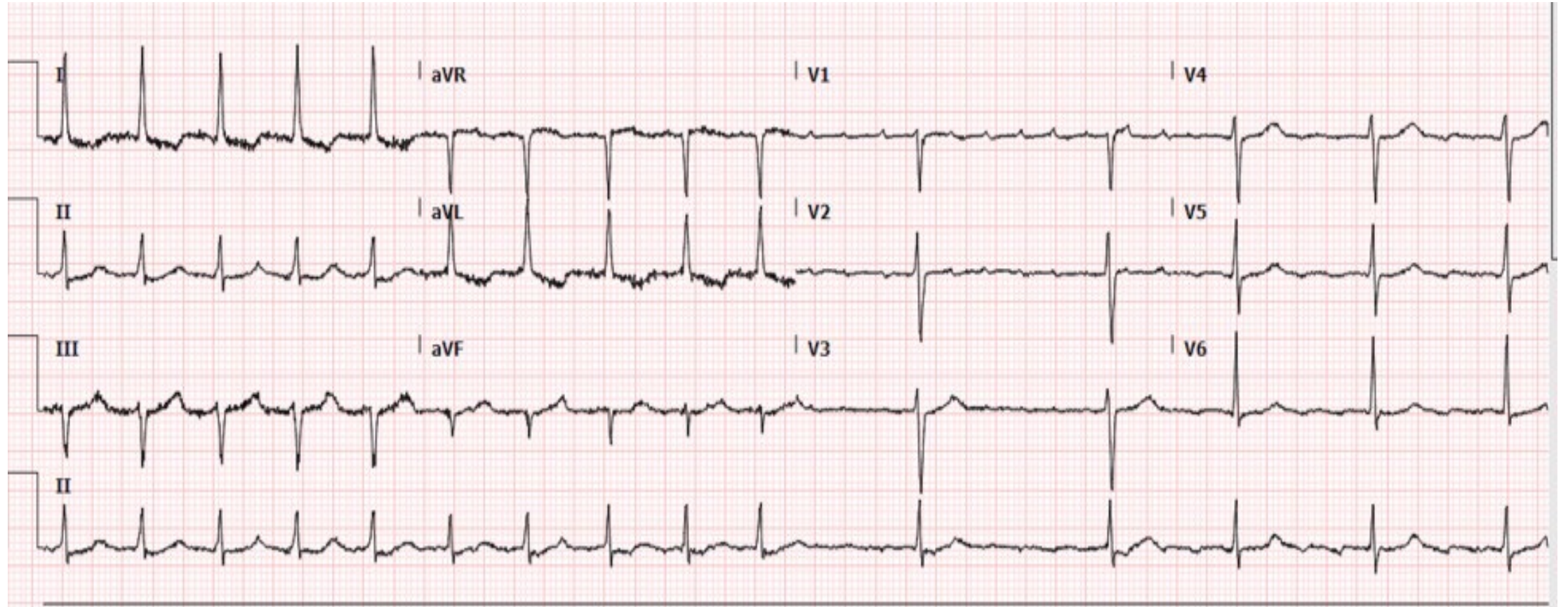


My Pulse is Slow

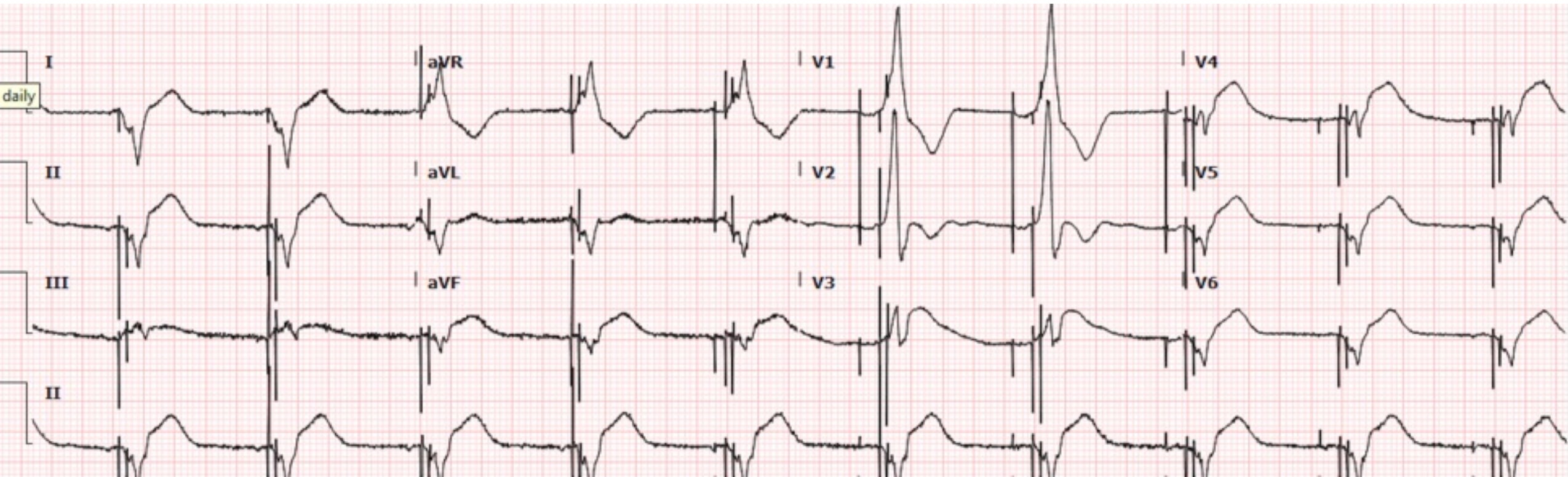




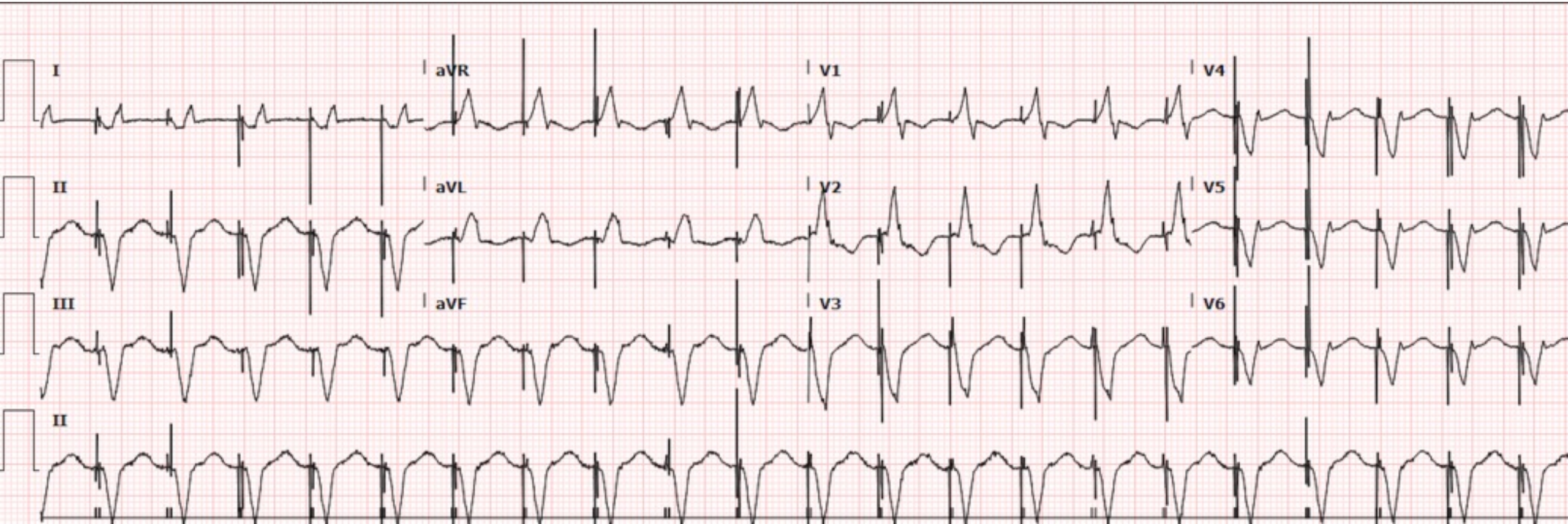
My Gizmo Keeps Firing!!!



Chest Pain



My leg hurts...



Extra Credit



Nuts and Bolts

How the Gizmo Works

What does a Pacemaker do?

Pace

Sense

Synchrony

Tachycardic Therapy

Who needs Pacer?

Can't generate an impulse
Chronotropic incompetence

Can't conduct an impulse

Requires Synchrony

Low EF/Wide Complex QRS

Tachycardia therapy-
Defibrillator

Components of Pacemaker

Pulse generator

Can

Battery

Computer

Leads

Types of Gizmo's

Single Chamber

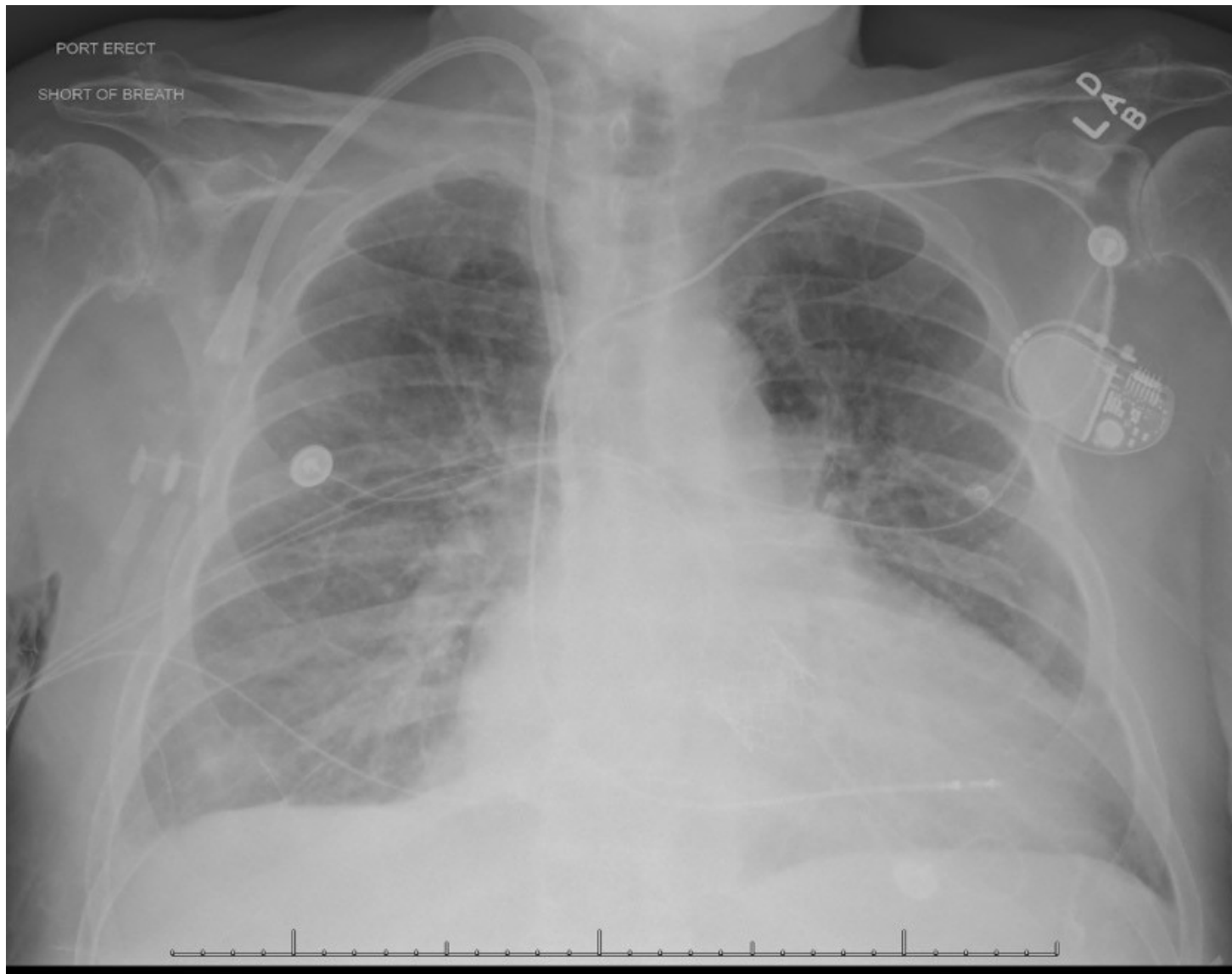
Dual Chamber RA/RV

BiV RV/LV

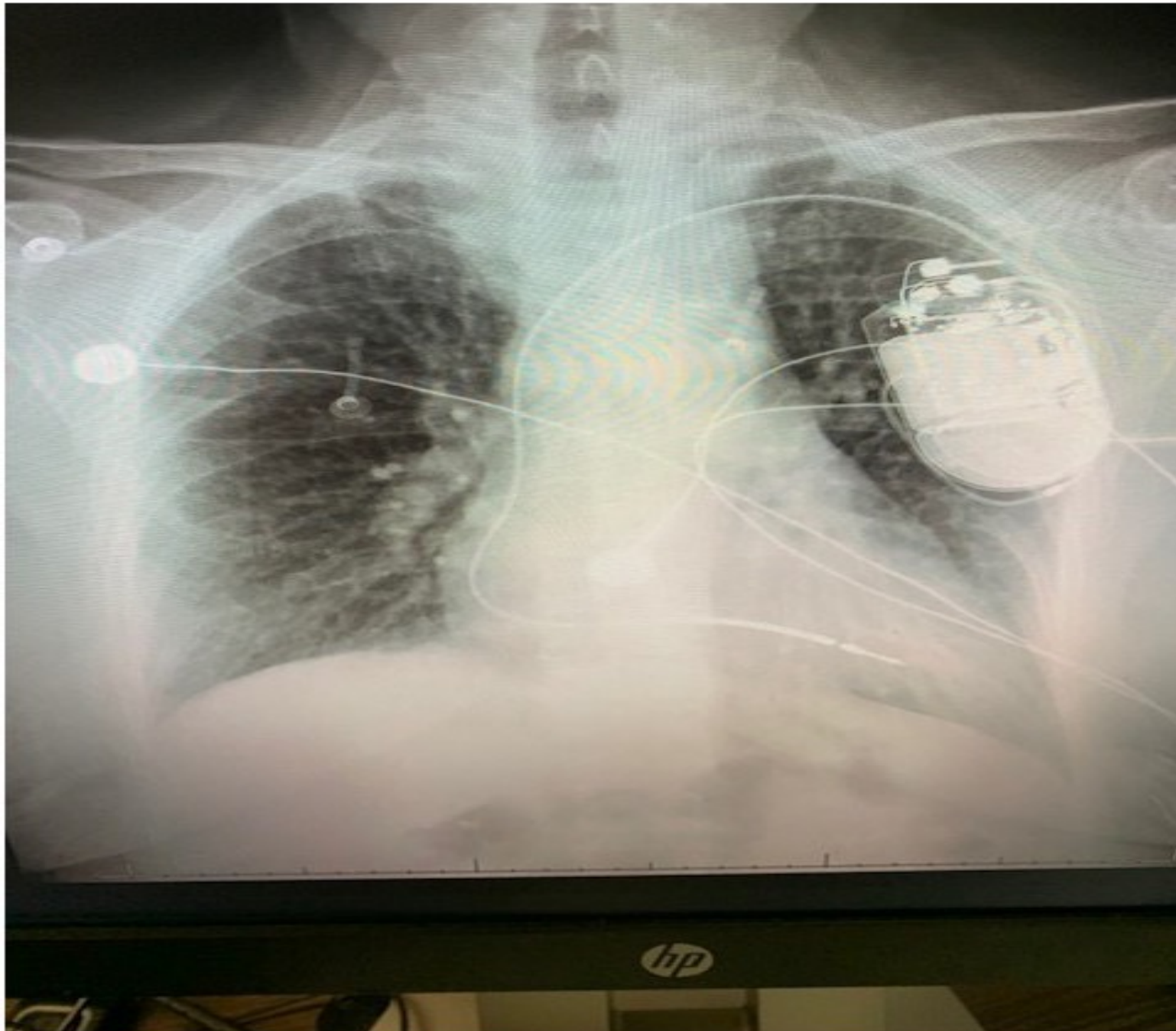
AICD's

Combinations

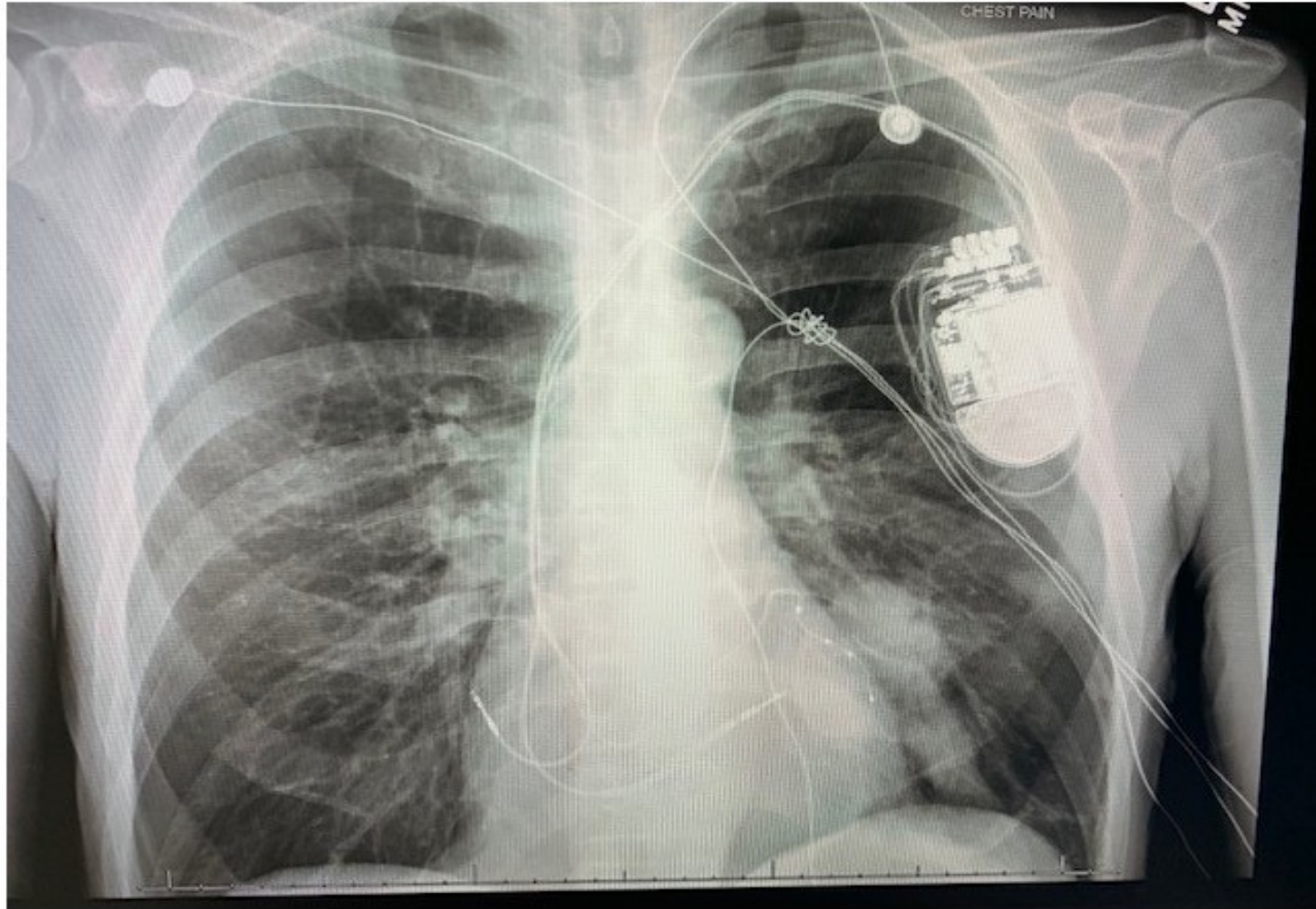
Single RV Pacer



RV pacer/AICD



Bi V pacer



How it Works!!!

Inhibition-single chamber

Programmed to Pace at intervals

A-A

V-V

Unless inhibited by sensed events

Triggered-dual chamber

A-V/ V-A

Sensed A Beat can trigger V Paced
beat

Intervals

A-A V-V intervals

Programmed

1000msec-60 BPM rate

Chamber will fire every 1000 msec unless inhibited by sensed event

If intrinsic rate > chamber rate pacer inhibited

A-V / V-A

After A event if no V event after interval

V is triggered

After V event if no A event after interval

A is triggered

Other Intervals

URL-Upper Rate Limit

Shortest interval between Paced beats

Maximum Rate of Pacer

PVARP/V REF

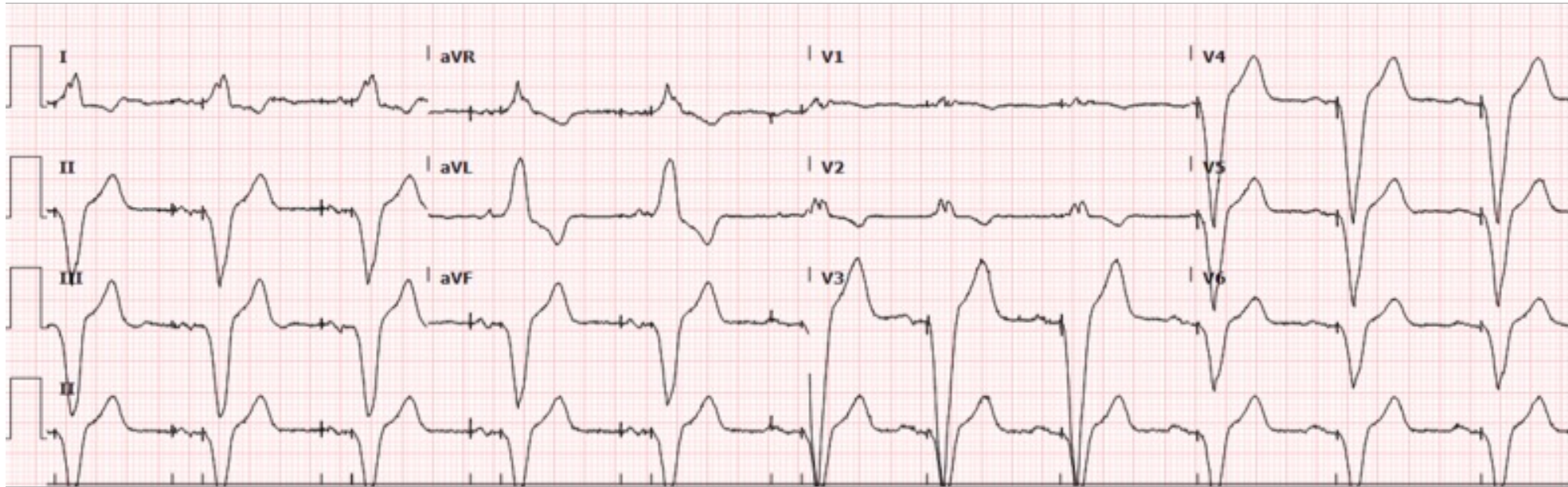
A lead and V lead ignore events

Pacer Classification

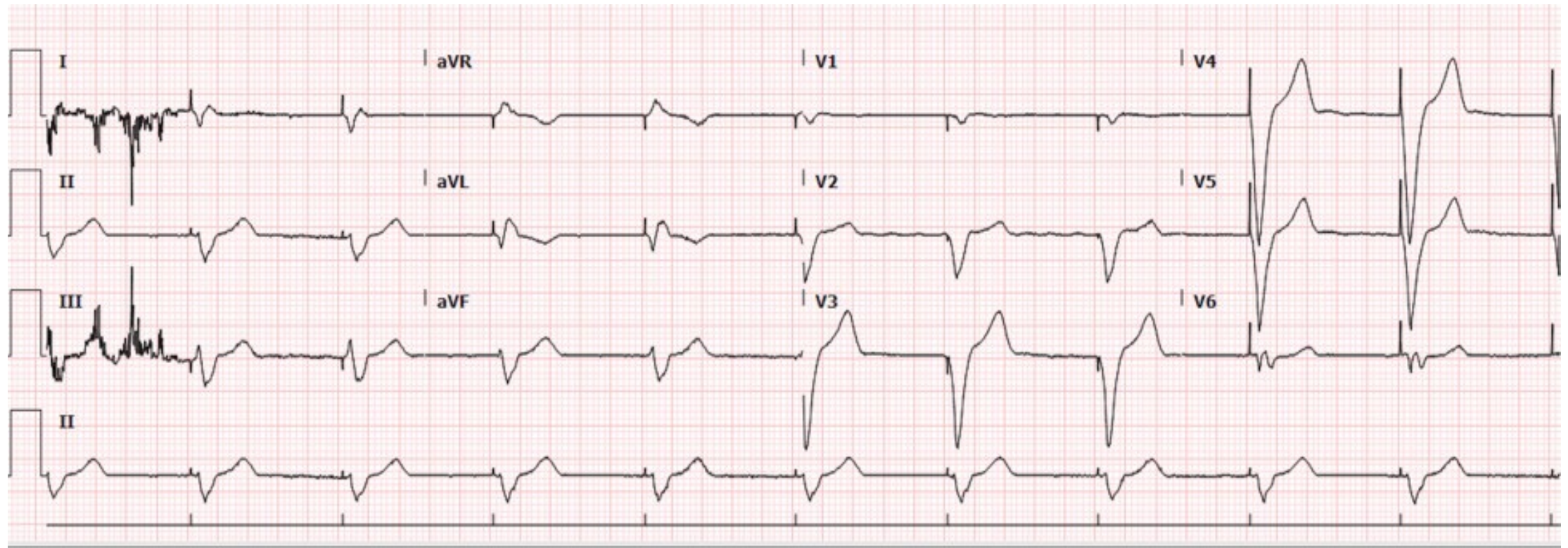
NBG Code Review

I Chamber Paced	II Chamber Sensed	III Response to Sensing	IV Programmable Functions/Rate Modulation	V Antitachy Function(s)
V: Ventricle	V: Ventricle	T: Triggered	P: Simple programmable	P: Pace
A: Atrium	A: Atrium	I: Inhibited	M: Multi-programmable	S: Shock
D: Dual (A+V)	D: Dual (A+V)	D: Dual (T+I)	C: Communicating	D: Dual (P+S)
O: None	O: None	O: None	R: Rate modulating	O: None
S: Single (A or V)	S: Single (A or V)		O: None	

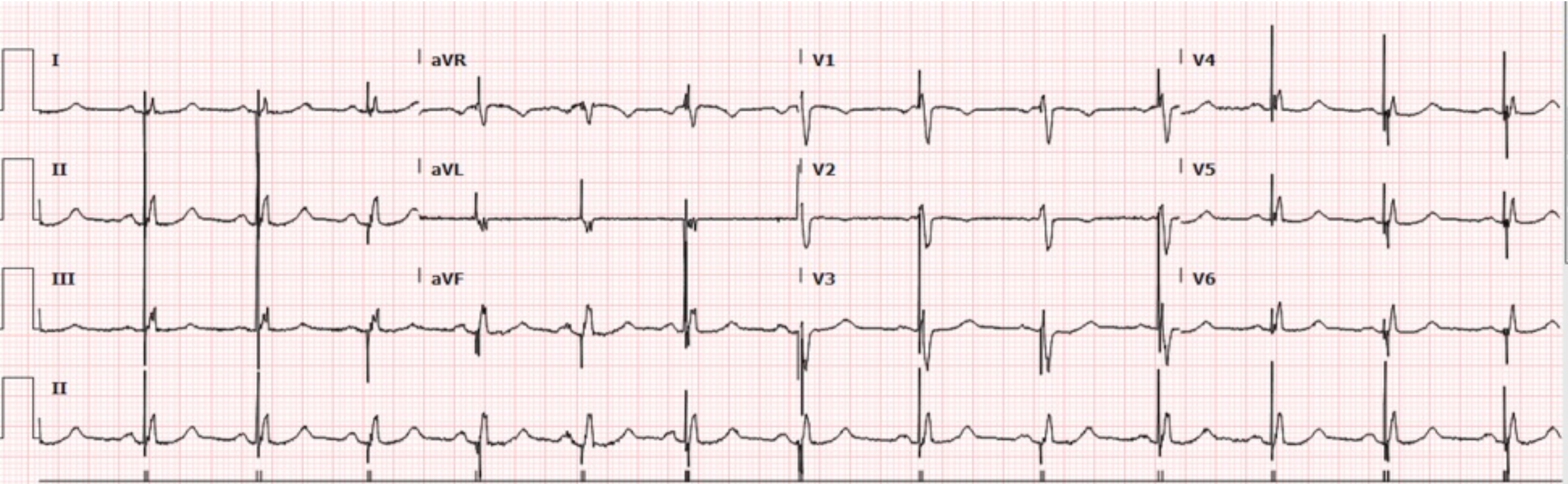
Dual Chamber A / V Pacer



Single Chamber V lead



Bi-V pacer



The Magnet

What does it do ?

Turns off Sensing

Converts DDD to DOO
VVI to VOO

Pacer fires at its Programmed Rate

Turns off "shock" in AICD

Troubleshooting The 4 Problems

Failure to Pace

Failure to Capture

Failure to Sense

Tachycardia-Premature triggering

Troubleshooting

Stable/Unstable

Unstable

Slow

Fast

ACLS

Atropine/chronotropic

Rate Control

External Pacer

Rhythm Control

Consider Hyper K

Meds/Electricity

Transvenous

Stable

Focused History and Physical

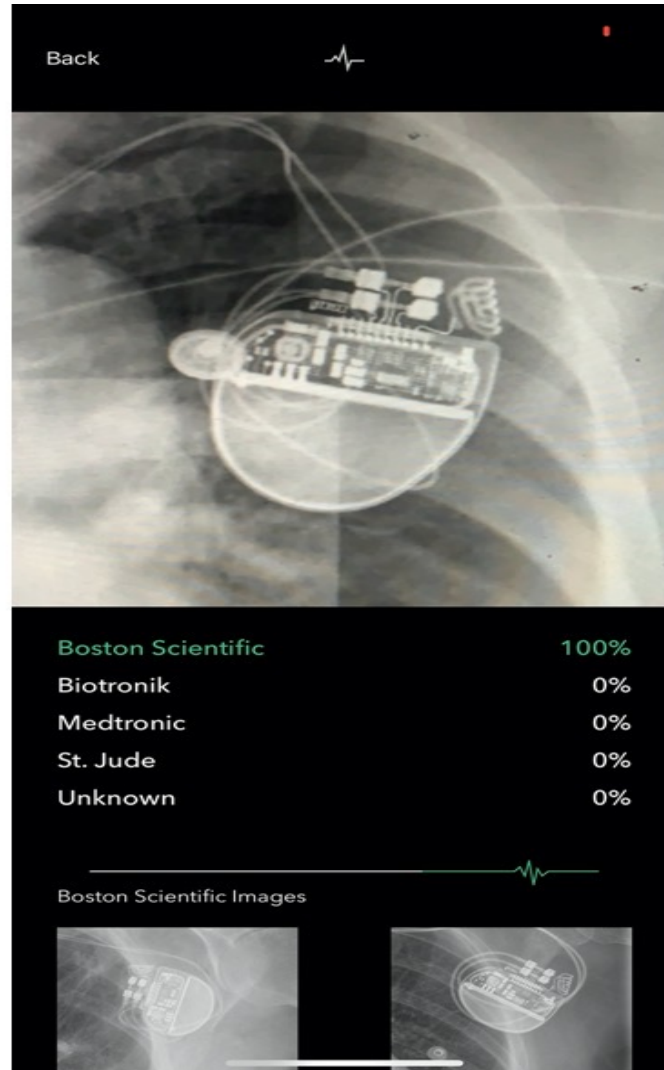
Identify Pacer (Why? What? When?)

Evaluate ECG

Look at CXR

Interrogate Pacer

Pacemaker-ID



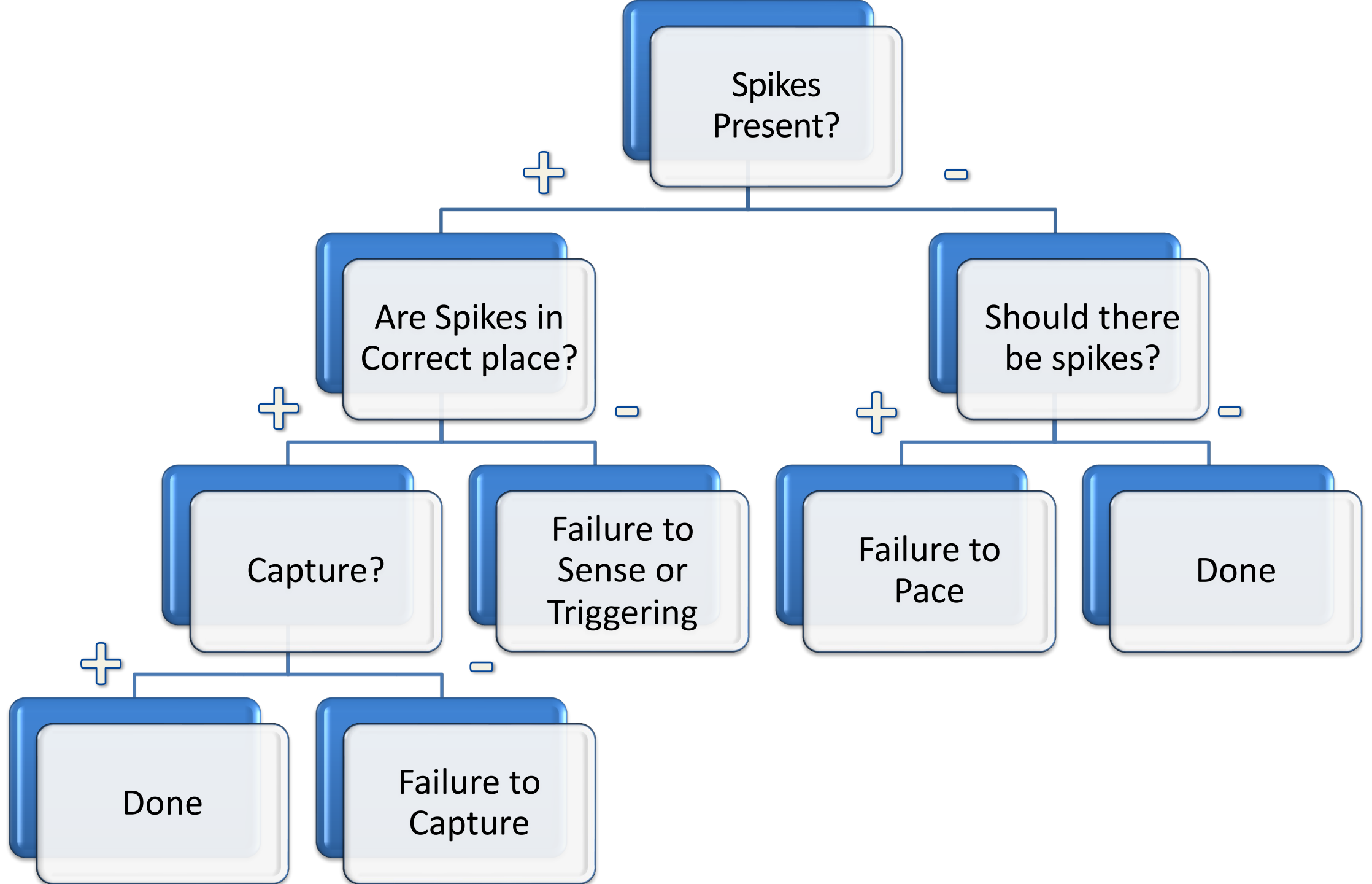
ECG Interpretation

Underlying Rhythm?

Are there Spikes?

Are Spikes in Correct place?

Are Spikes followed by Capture ?



Failure to Pace (No Spikes)

Oversensing

Apply Magnet

Pacer Failure

Battery

Leads

INTERROGATE GIZMO

Failure to Capture No complex after Spike

Physiologic

Spike in refractory period

Pacer

Battery/Leads/Output

Host

Threshold/Ischemia/HyperK

Failure to Sense

Asynchronous Pacing

Programmed Rate

Early Triggering

Spikes earlier than Programmed Rate

APC's

Trigger early V pacer spike

Cross talk

T wave sensed by A lead

Trigger V pacer spike

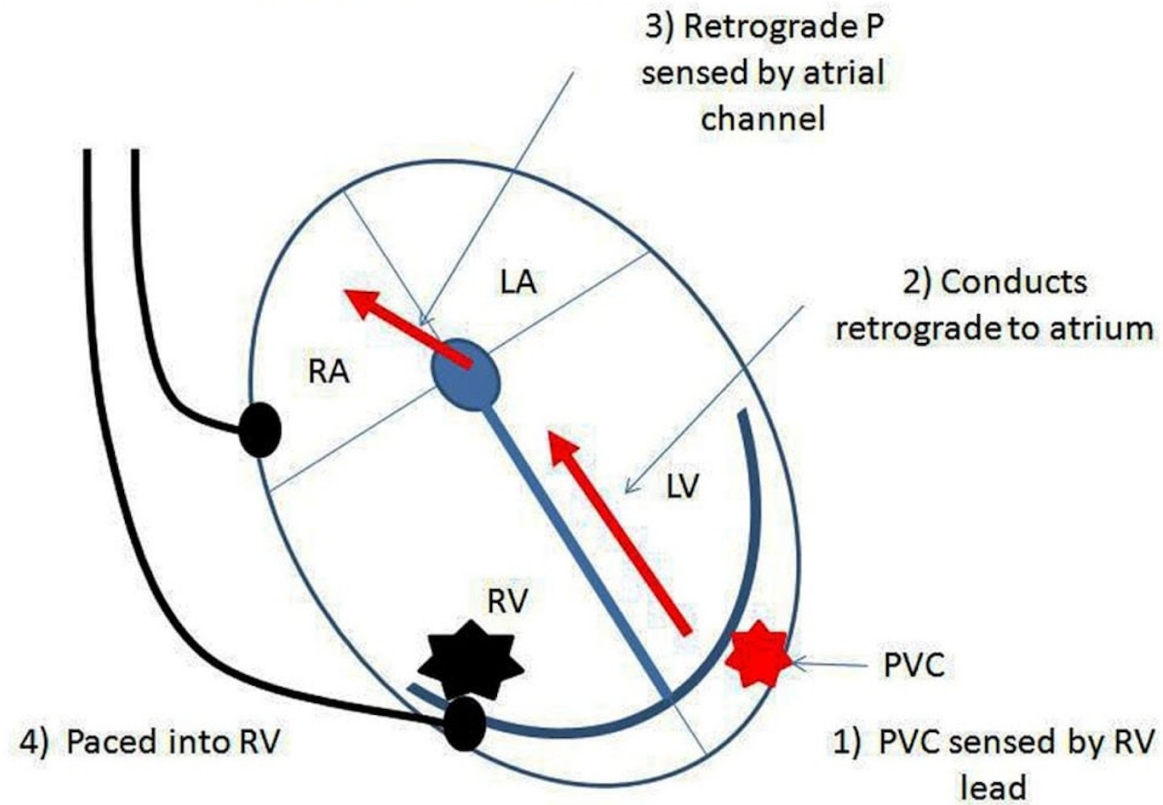
PMT

Pacer Mediated

Tachycardia

Pacemaker Mediated Tachycardia

Initiation of Endless Loop Tachycardia by a PVC



Courtesy rebel em

Treatment

Break the cycle

AV nodal blocking agents

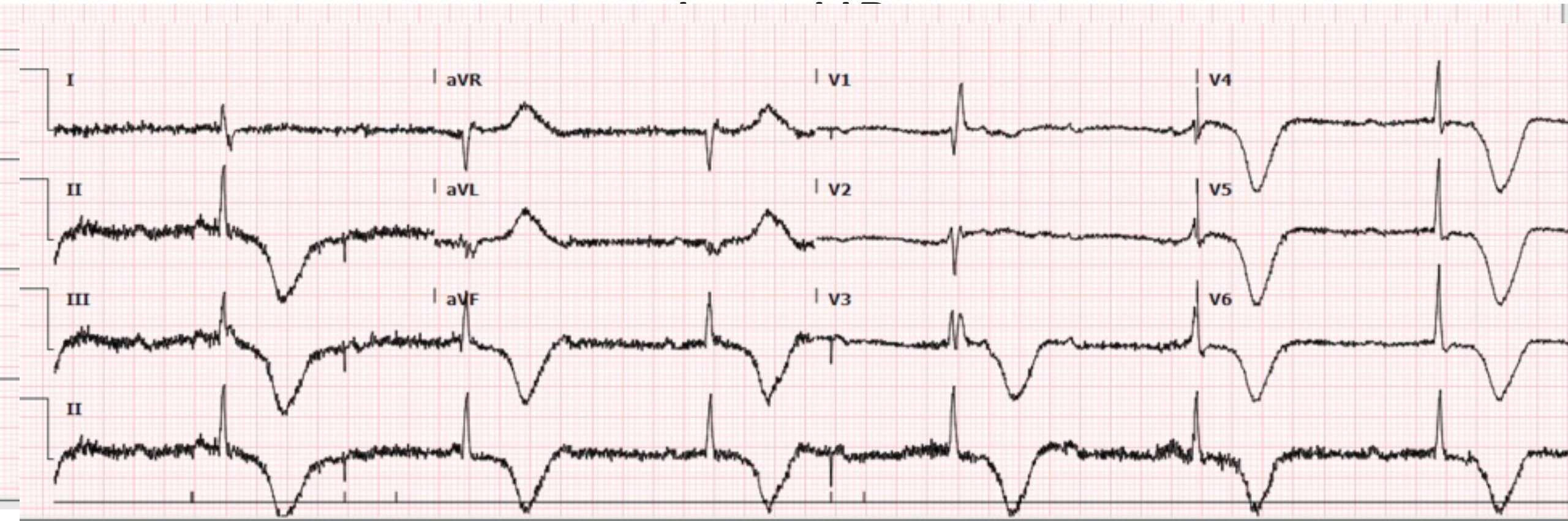
Magnet

(Turns off Atrial sensing and V triggering)

Let's Solve the Cases

- What's the Problem?
 - What's the Fix?

Near Syncope

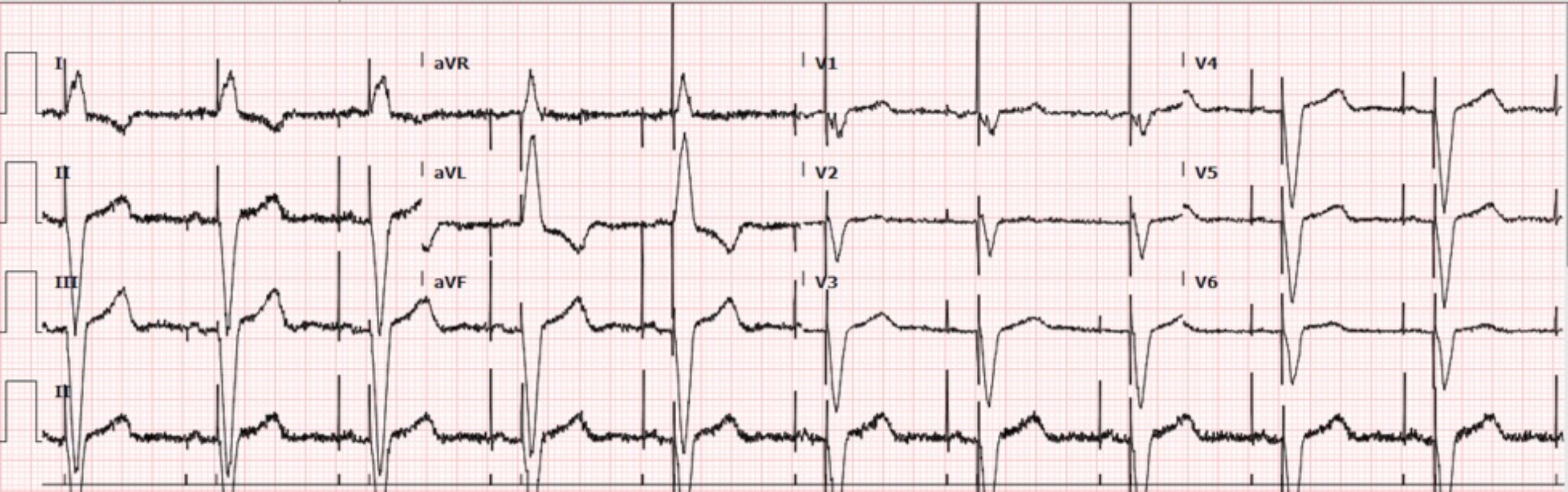


Failure to Pace

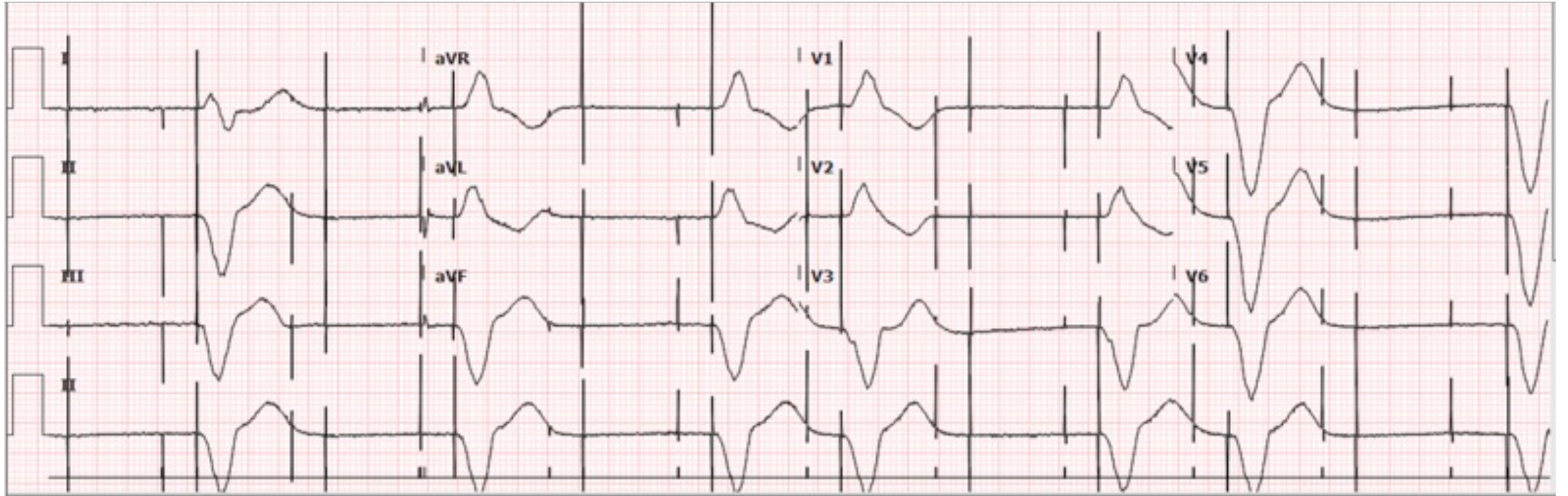
Lead Malposition
1st rib-syndrome
“noise” causes over-sensing

Fix
Magnet
Reprogram to DOO mode

The Fix



Weakness



Failure to Capture

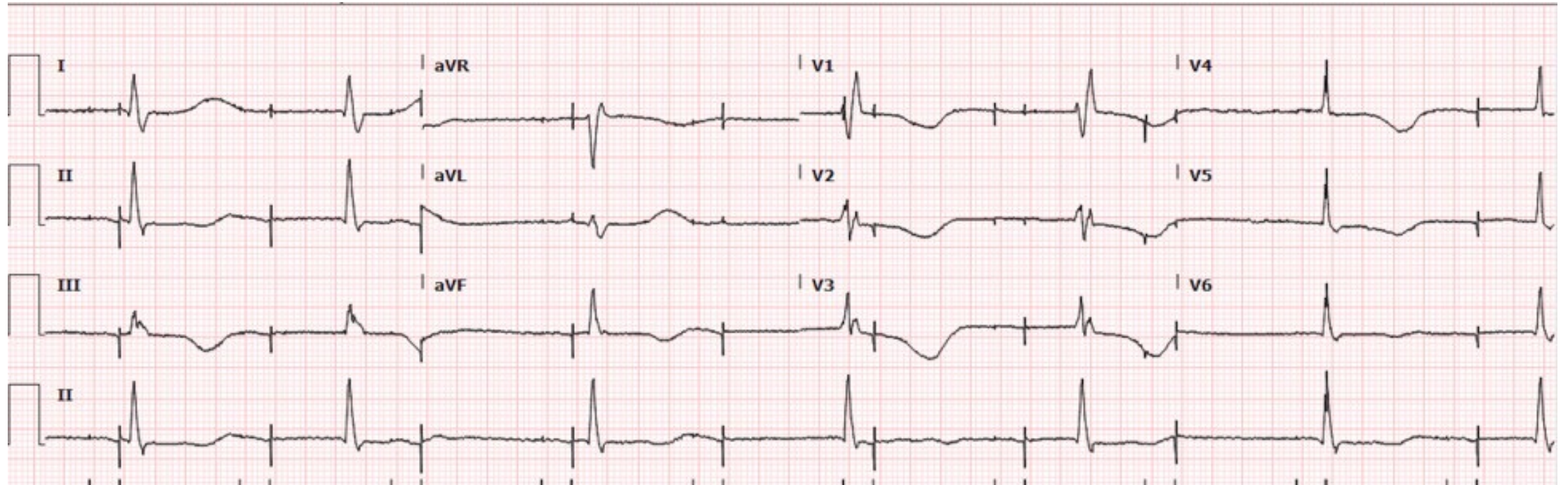
Failure to Capture
Increased Capture threshold
Flecainide toxicity/sepsis

The Fix-
Hold Flecainide
NaHco₃
Increase Pacer output
Change modes

Rep Fixes



My Pacer isn't working





Failure to Sense/Capture Both A/V Leads

Lead Reversal
RA/RV leads switched places

A and V lead Pace
asynchronously

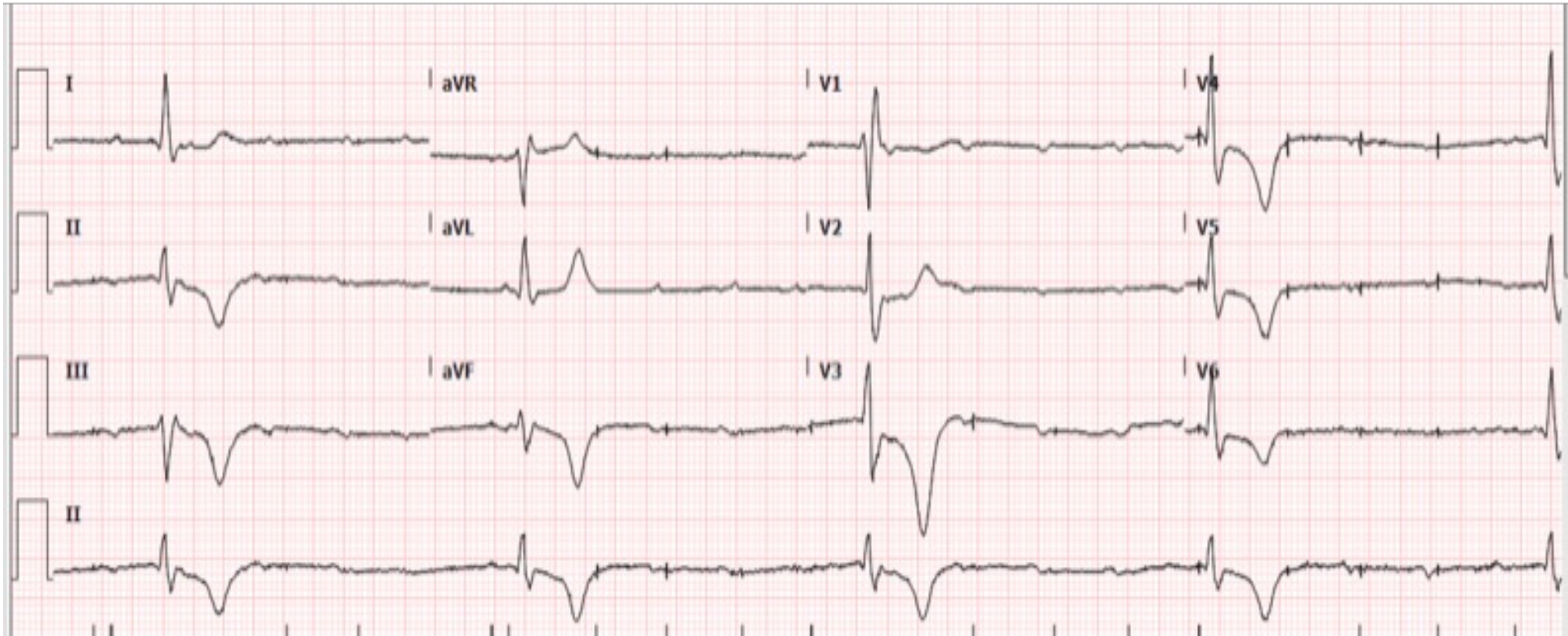
But no Sense/Capture
Either Lead

Fix— To Lab for Redo of Pacer

Weakness



Getting Worse



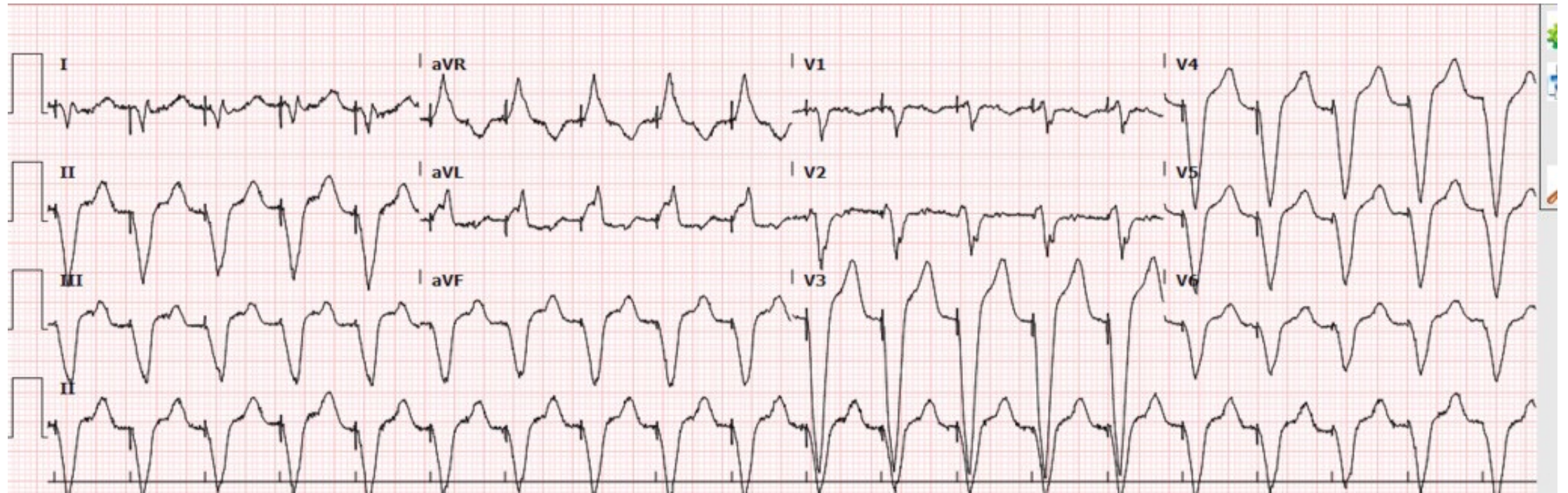
Failure to Capture

Increased Pacing Threshold
Hyperkalemia

Fix- Increase Pacing output
Rx K+

Rapid HR

BP 100



Pacemaker Mediated Tachycardia

Retrograde P Triggers Ventricular Pacing

Fix-Apply Magnet

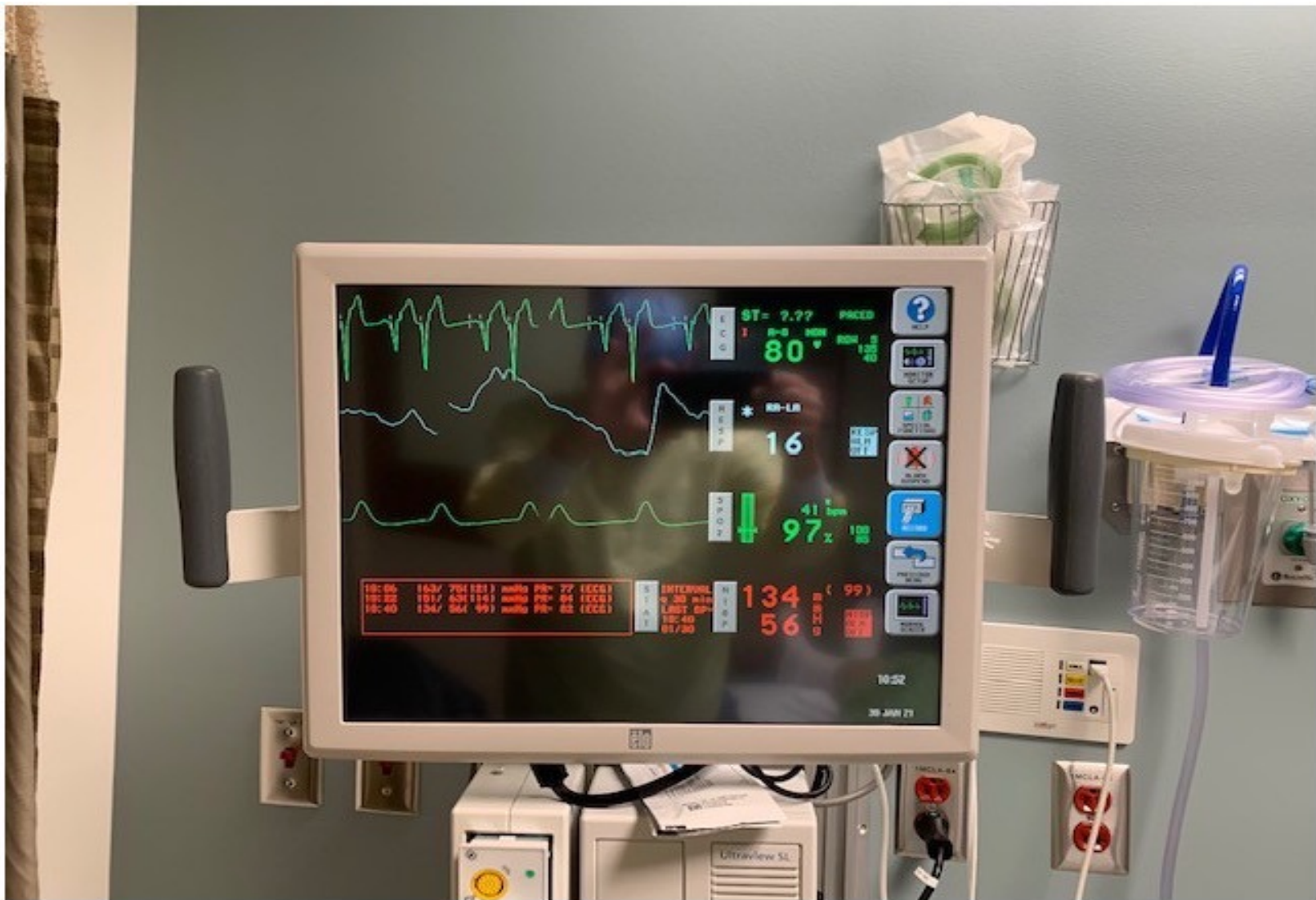
P wave not sensed

Cycle broken

Remove Magnet

My Pulse is Slow





Hidden P (APC)

PAC P hidden in T

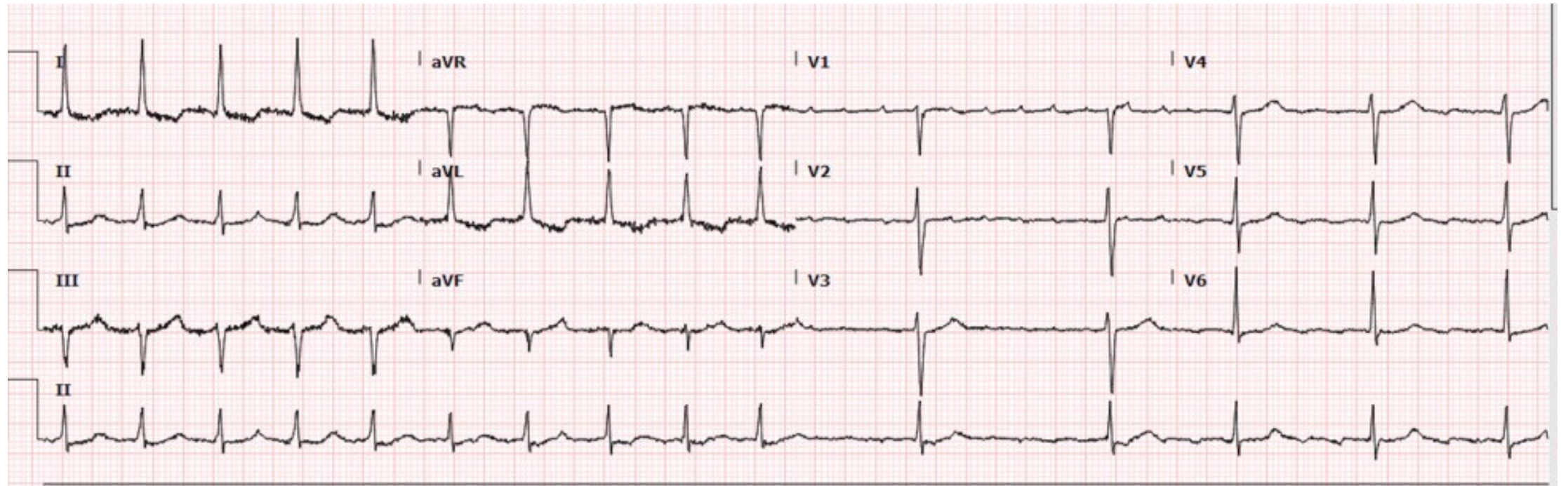
Triggers early V Paced

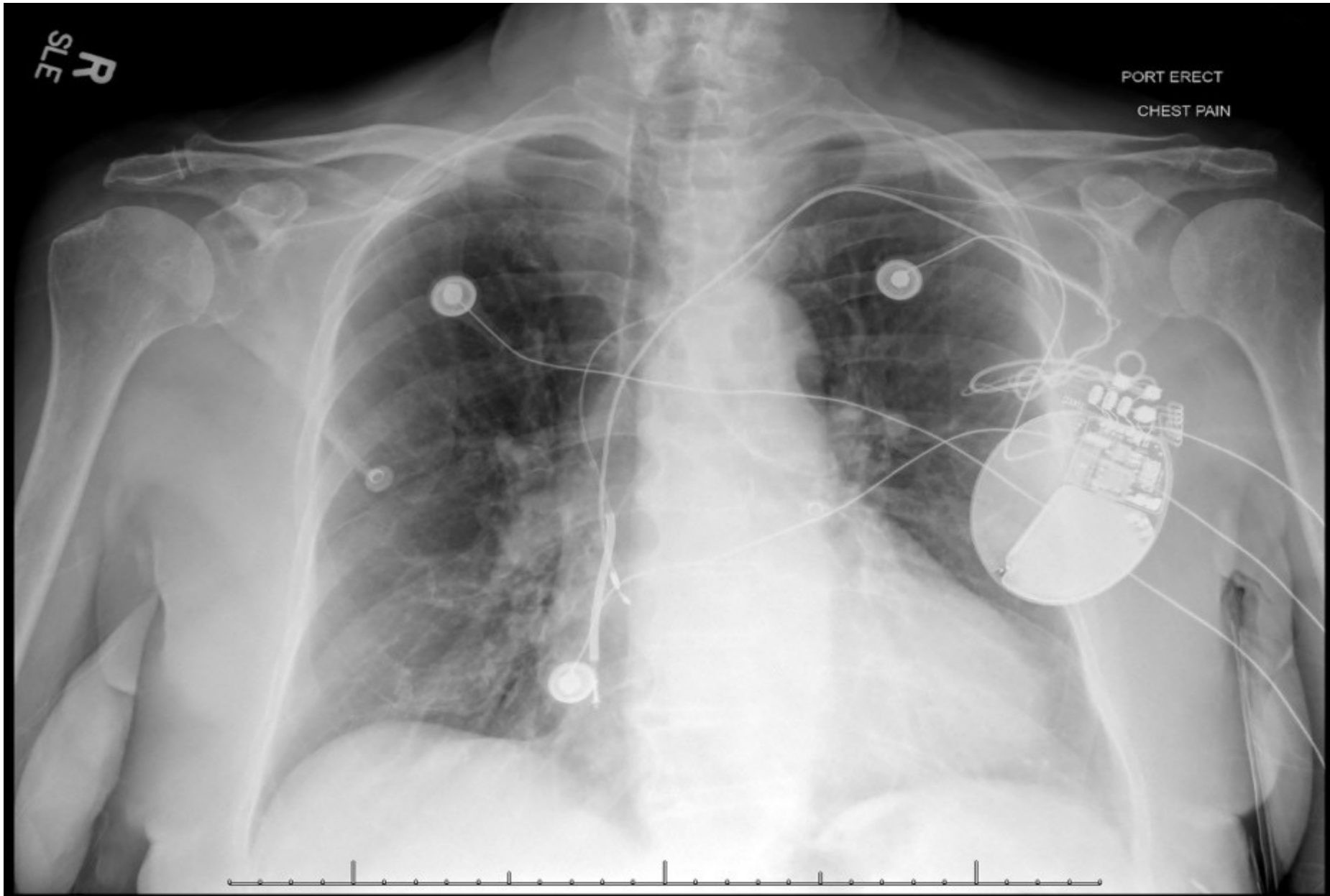
Pacer Bigeminy Pattern

Fix-Increase PVARP

PAC isn't sensed

My Gizmo Keeps Firing!!!





R
SLE

PORT ERECT
CHEST PAIN

Twiddler Syndrome

RV lead in RA

Senses atrial Tach as V Tach

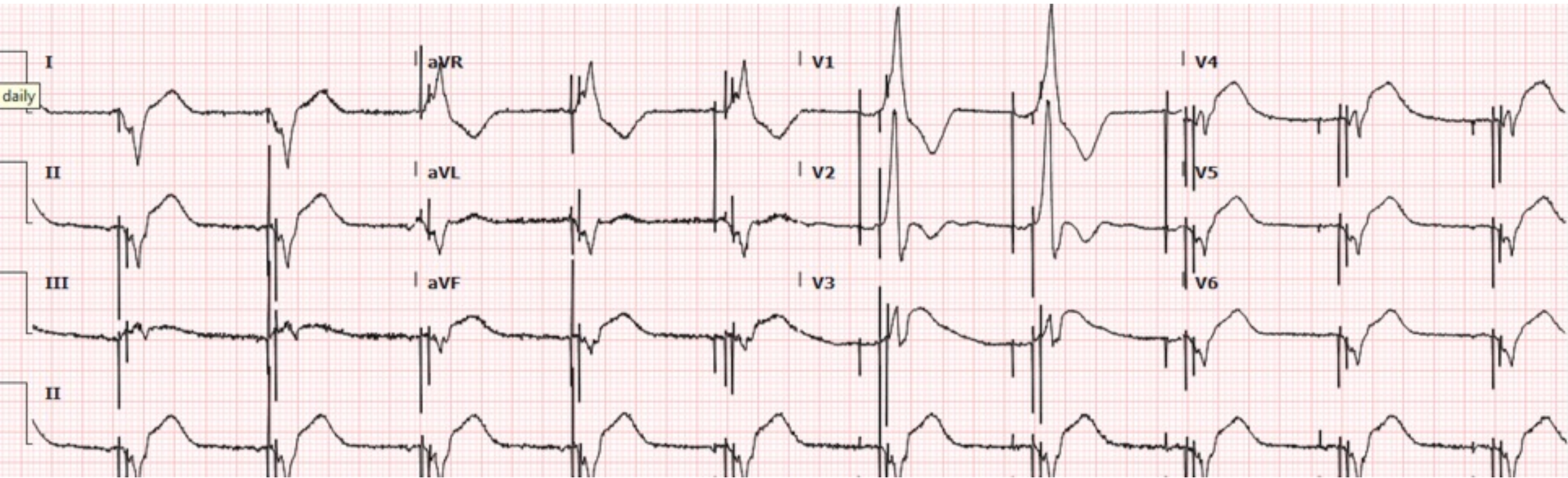
Shock delivered

Fix-Apply magnet

Stops Shocks

Redo Pacer/AICD

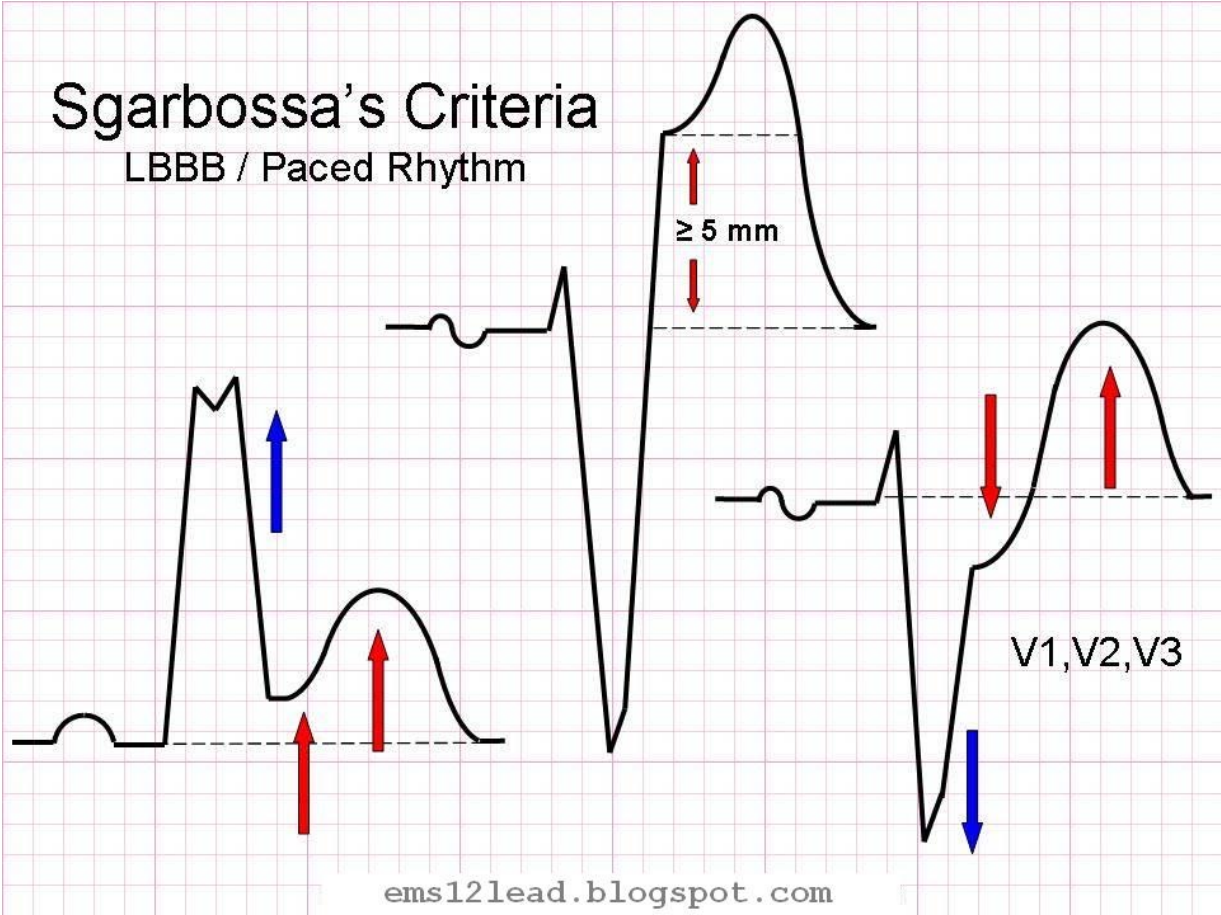
Chest Pain



Baseline EKG



Sgarbossa



Pacer STEMI

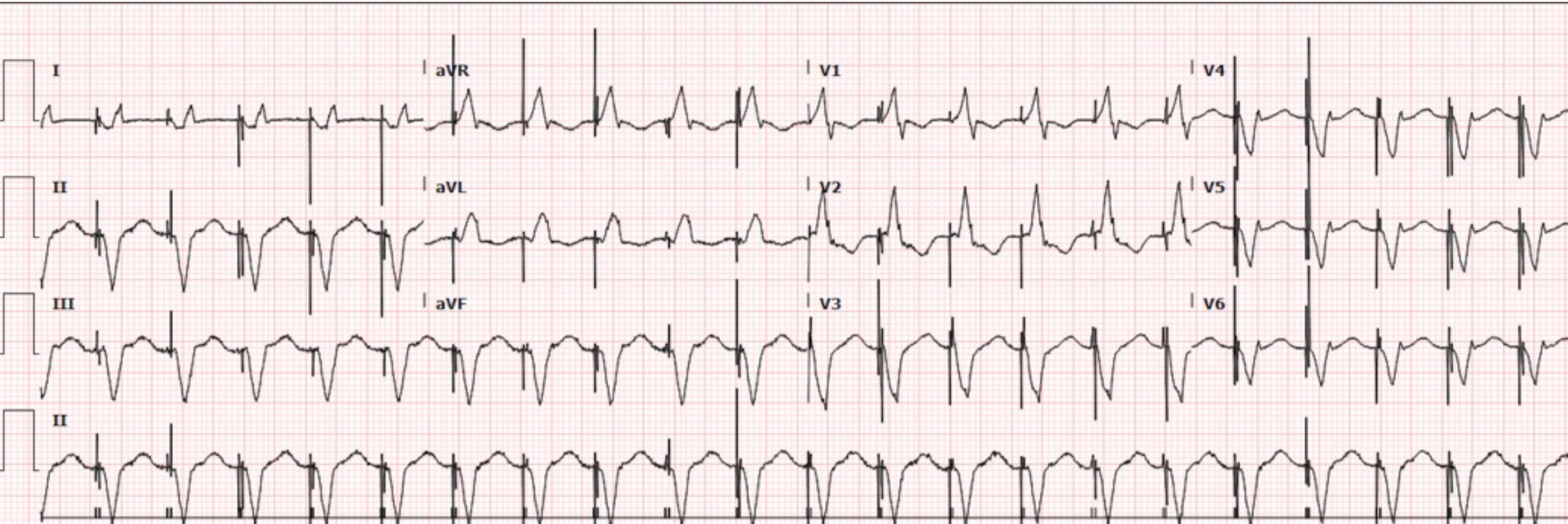
Sgarbossa Criteria

Excessive Disconcordant STE

Useful in LBBB and Pacers

Specificity >> Sensitivity

My leg hurts...

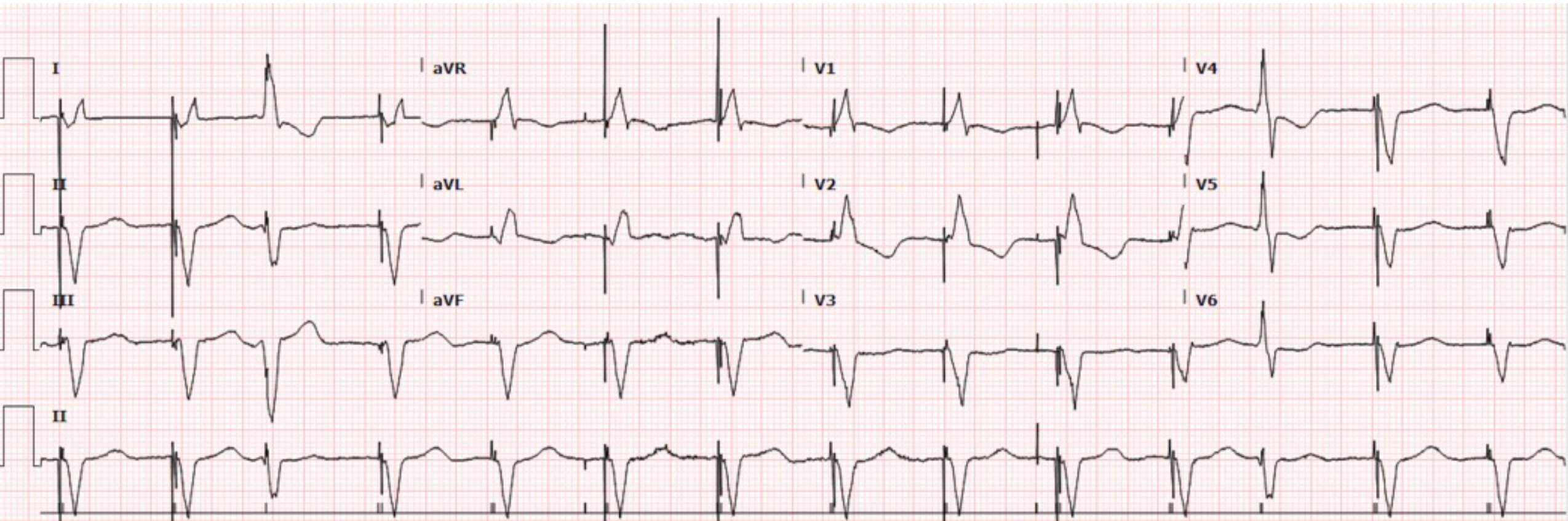


Atrial triggering at URL

FIX

Reprogram Pacer to DDI
Turns off Atrial triggering

My leg hurts



Extra Credit



AV Search Hysteresis

Pacer increases A-V interval

To search for intrinsic V beat

To decrease % paced to preserve
Battery life

Take Home Points

Unstable-Apply Standard Care

Stable- EKG/Xray/Interrogate

No Spikes-Failure to Pace
Apply Magnet

Spikes w/out QRS
Failure to Capture

Premature or Random Spikes
Failure to Sense-Premature Triggering