ECG

Common Cases in Clinical Practice

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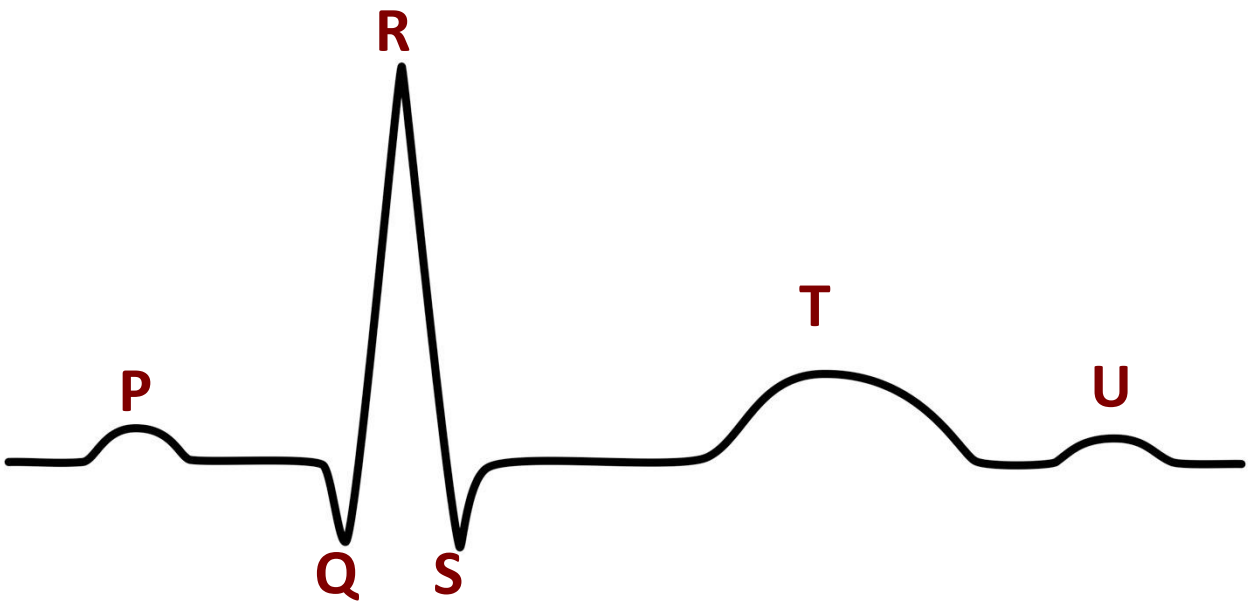
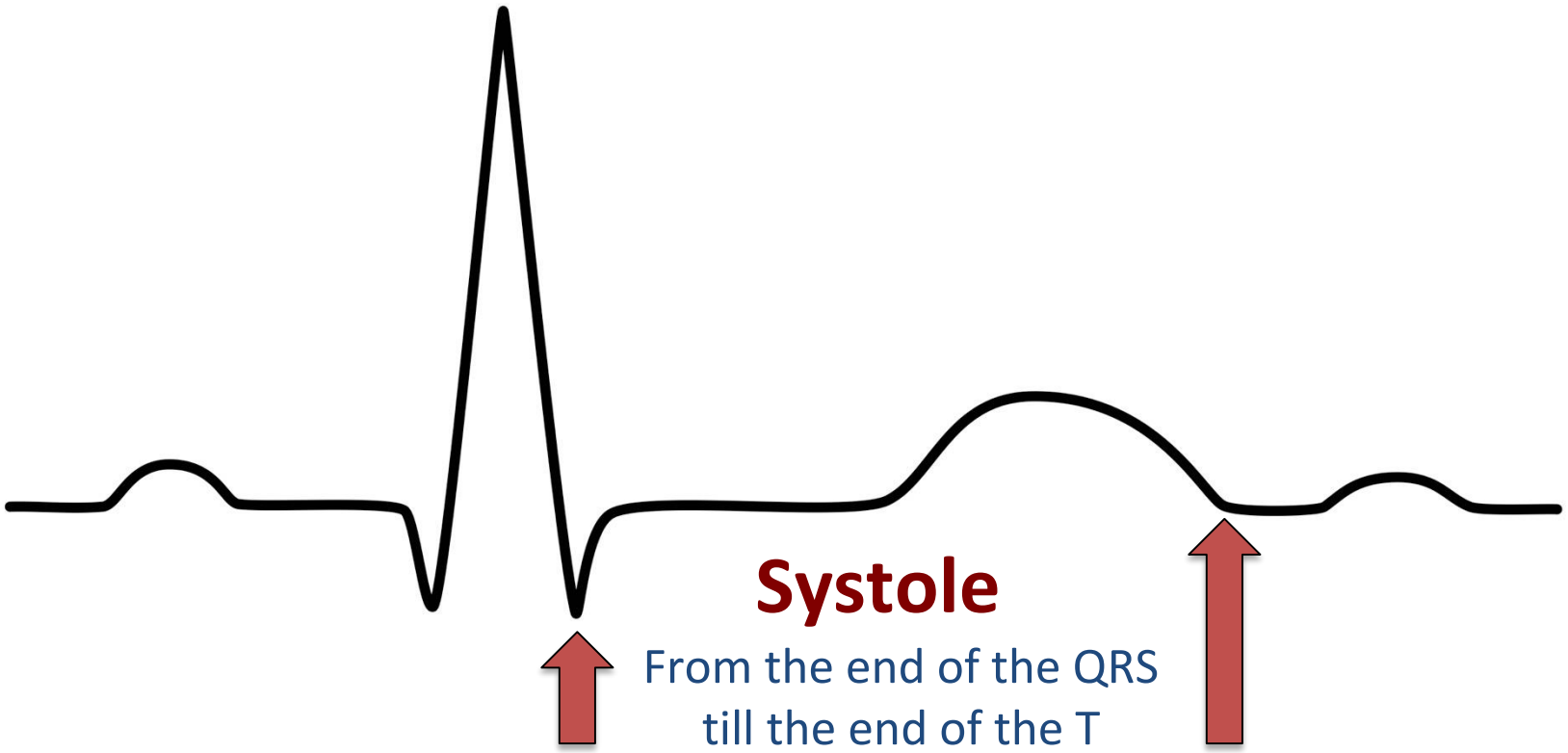
Mastering the Language

- PQRST is the letter sequence of the alphabets.
- They were given these letters to make them sound cool and prestigious!



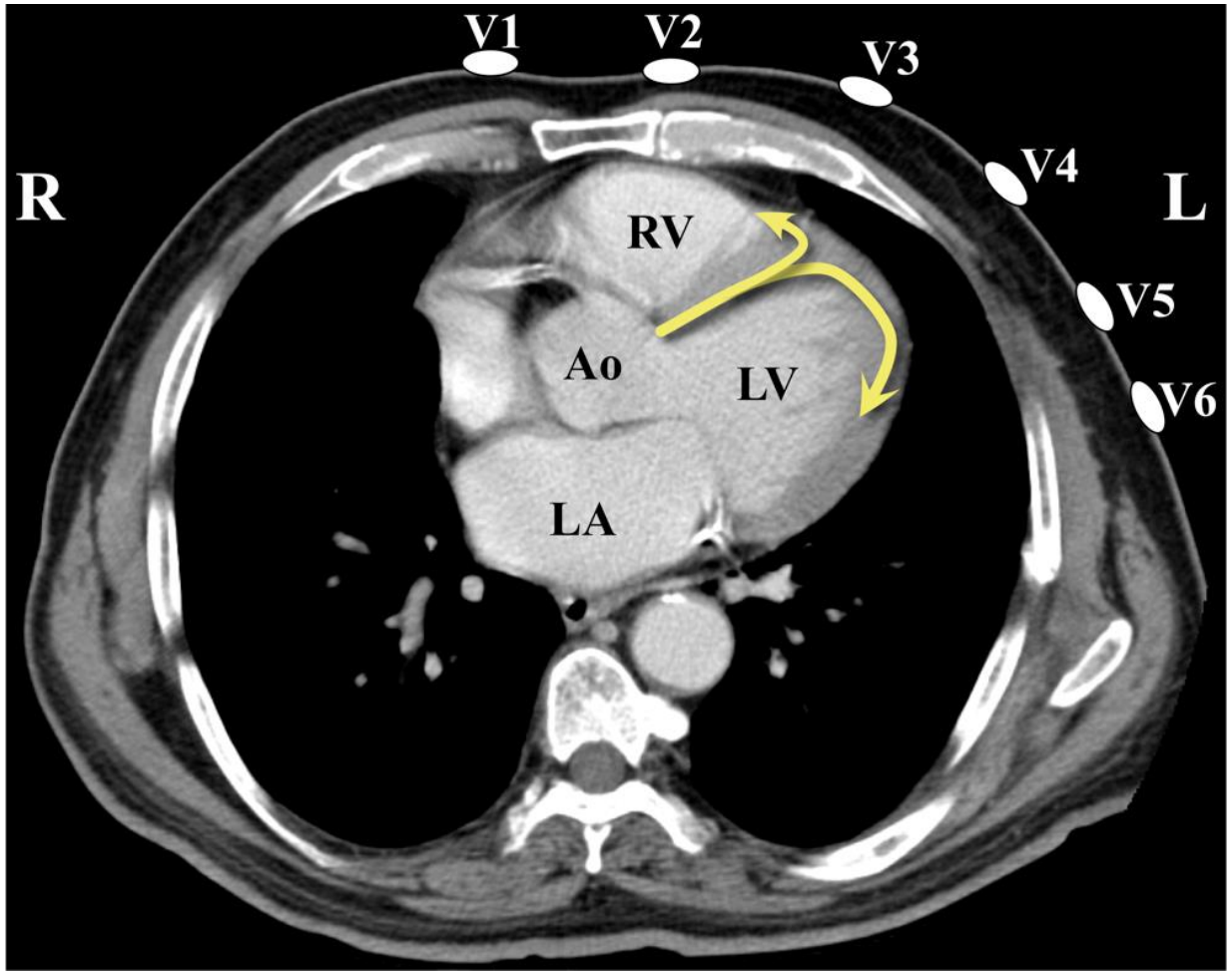
Orientation, Timing, and Events

Electrical activity first. Mechanical activity later.



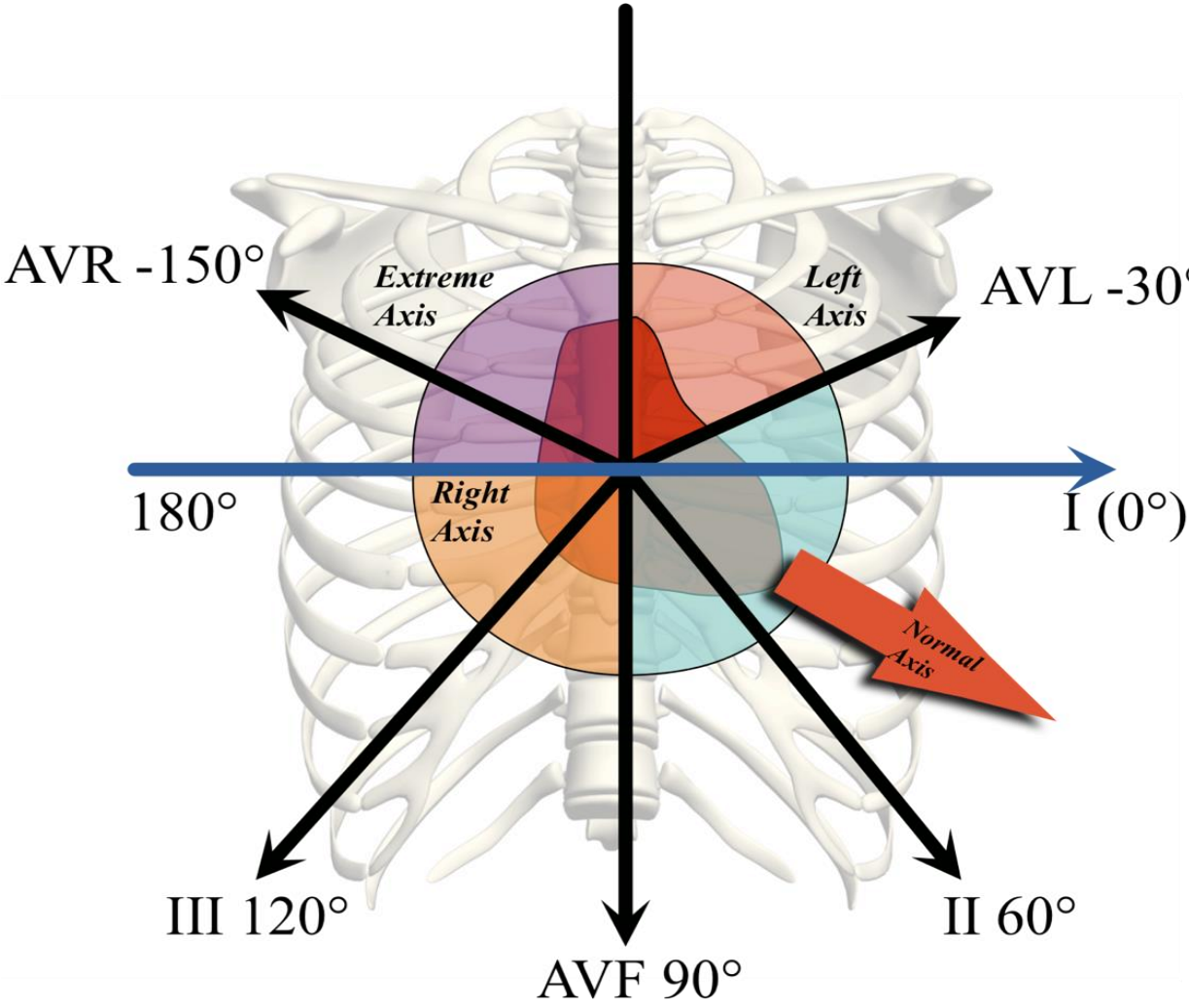
Orientation, Timing, and Events

Precordial Leads



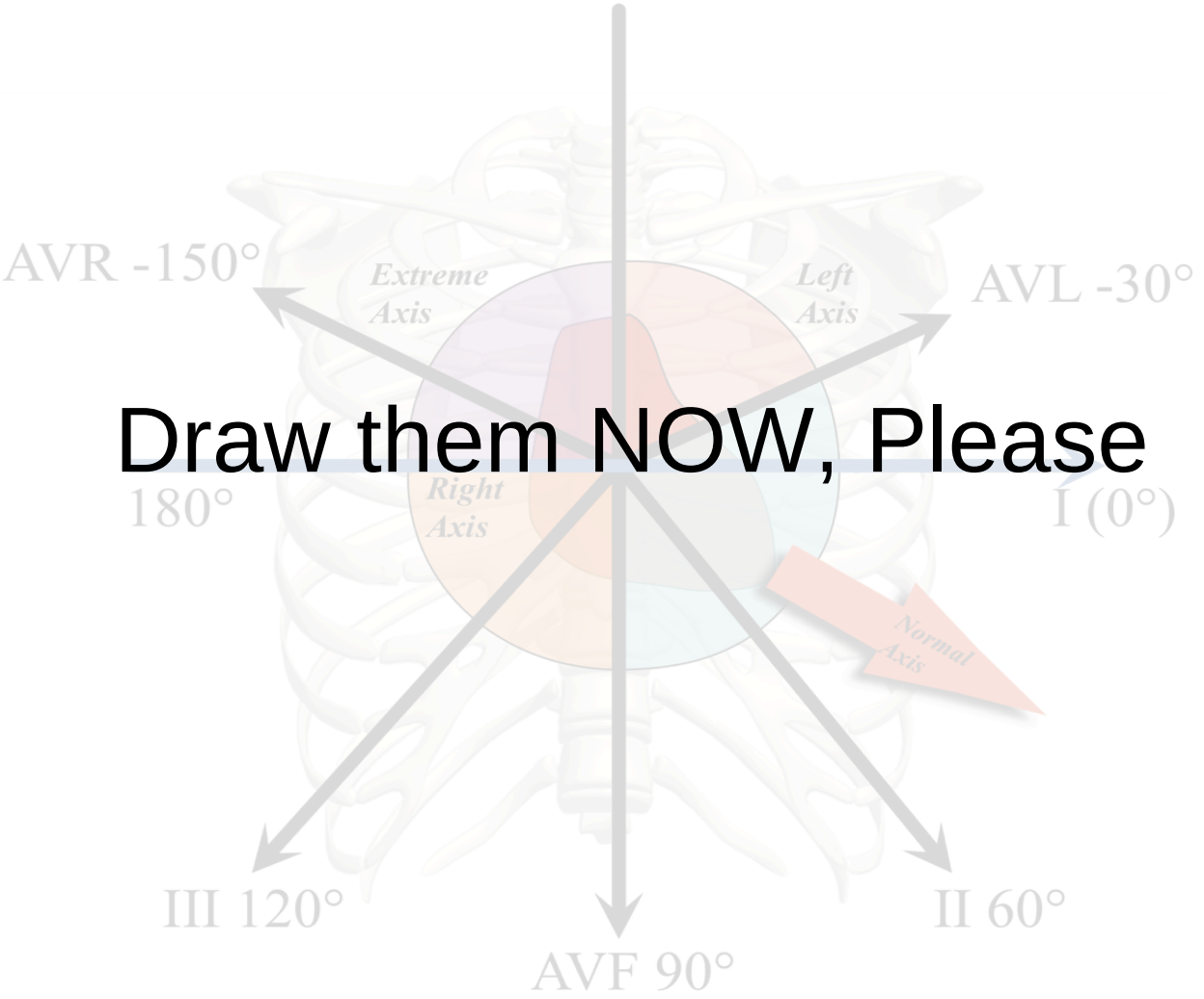
Orientation, Timing, and Events

Limb Leads



Orientation, Timing, and Events

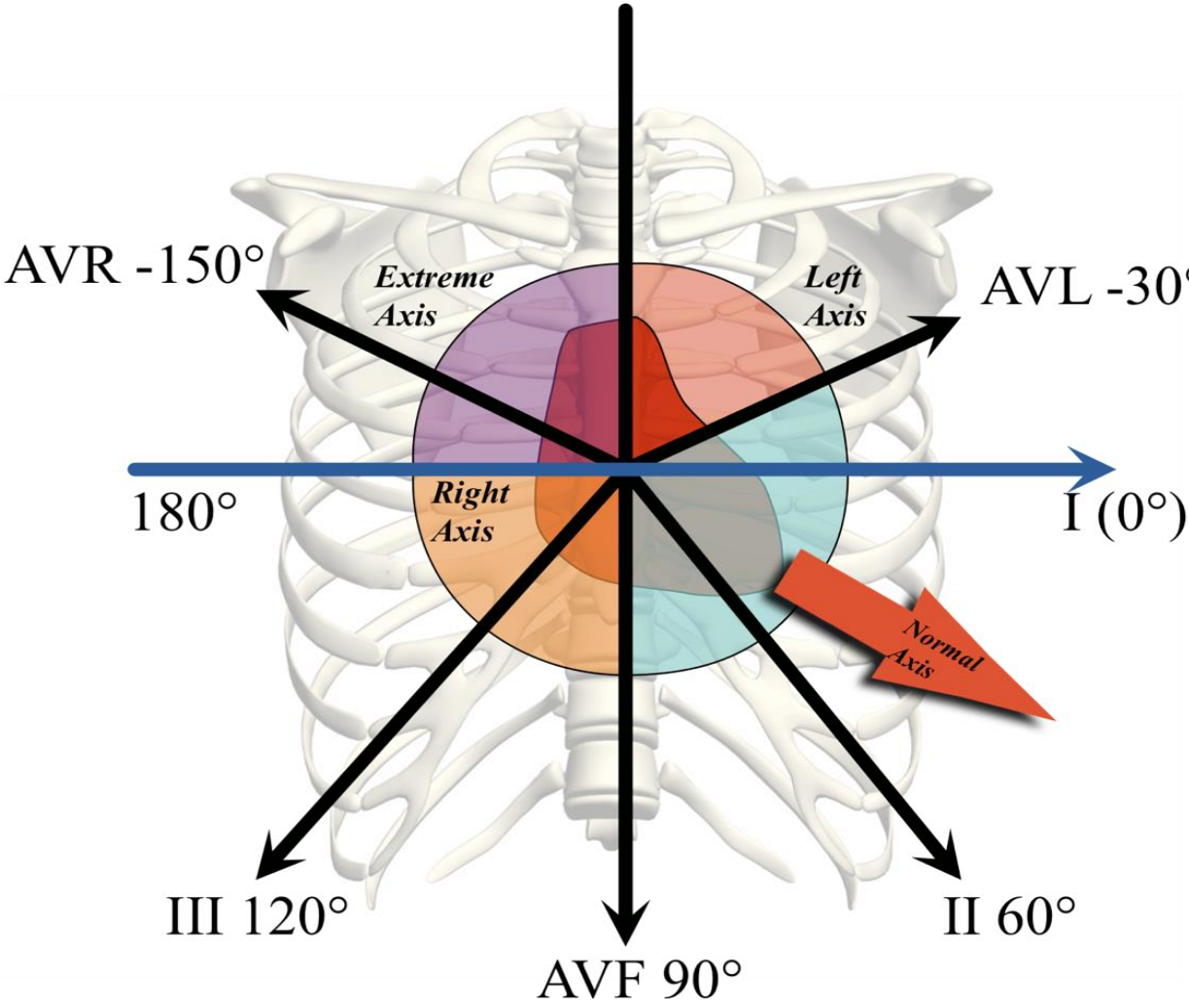
Limb Leads



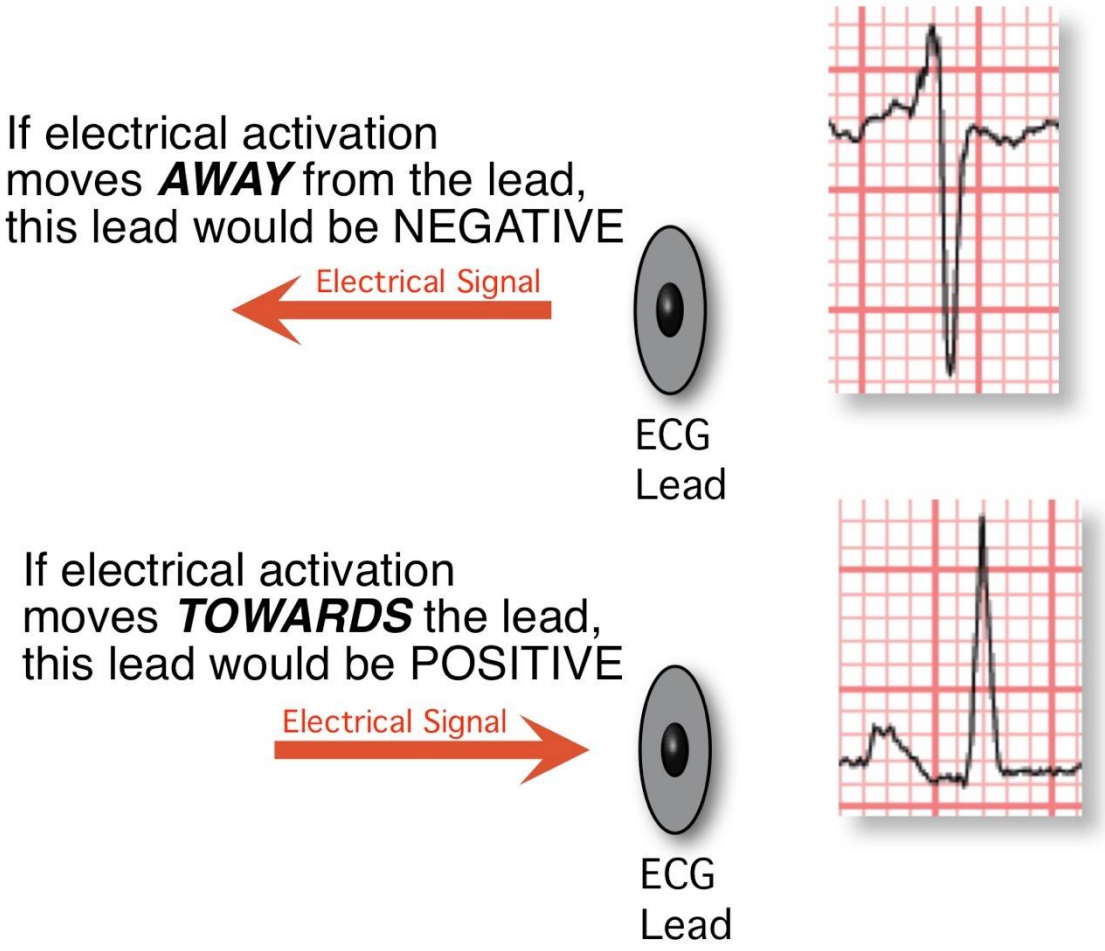
Draw them NOW, Please

Orientation, Timing, and Events

Limb Leads



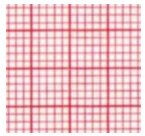
Lead Deflection



This rule applies to P wave as well as the QRS complex and T wave

Orientation, Timing, and Events

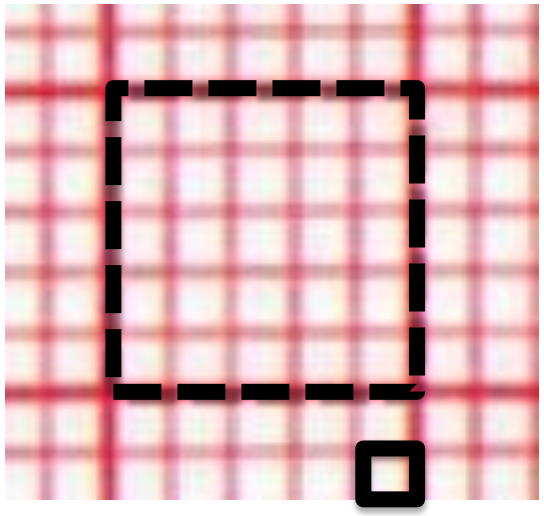
Squares



ECG
Thermal
Paper

One large square= 200 ms (0.2 sec)

One small square= 40 ms (0.04 sec)



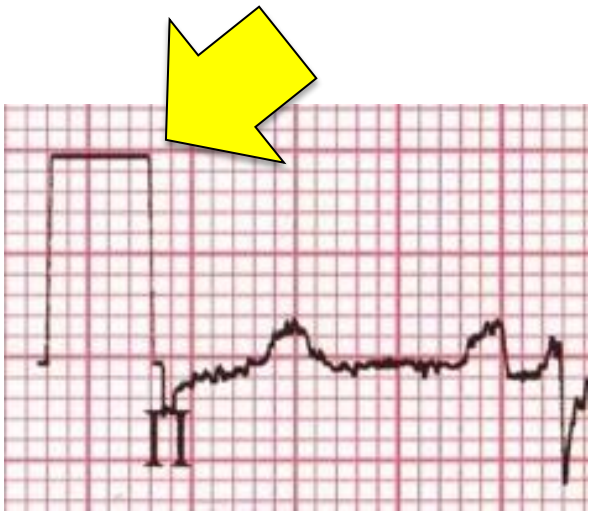
Orientation, Timing, and Events

The Standard

This rectangle at the margin.

It should be 10mm high.

It could be *doubled* using the machine settings if we want to see a “small” wave.



ECG Wave Morphology

QRS **RSR’** **QS** **qR** **rS**

Draw them. Label them.

Nomenclature According to Heart Rate

Tachycardia: Heart rate >100 bpm.

Bradycardia: Heart rate <60 bpm.

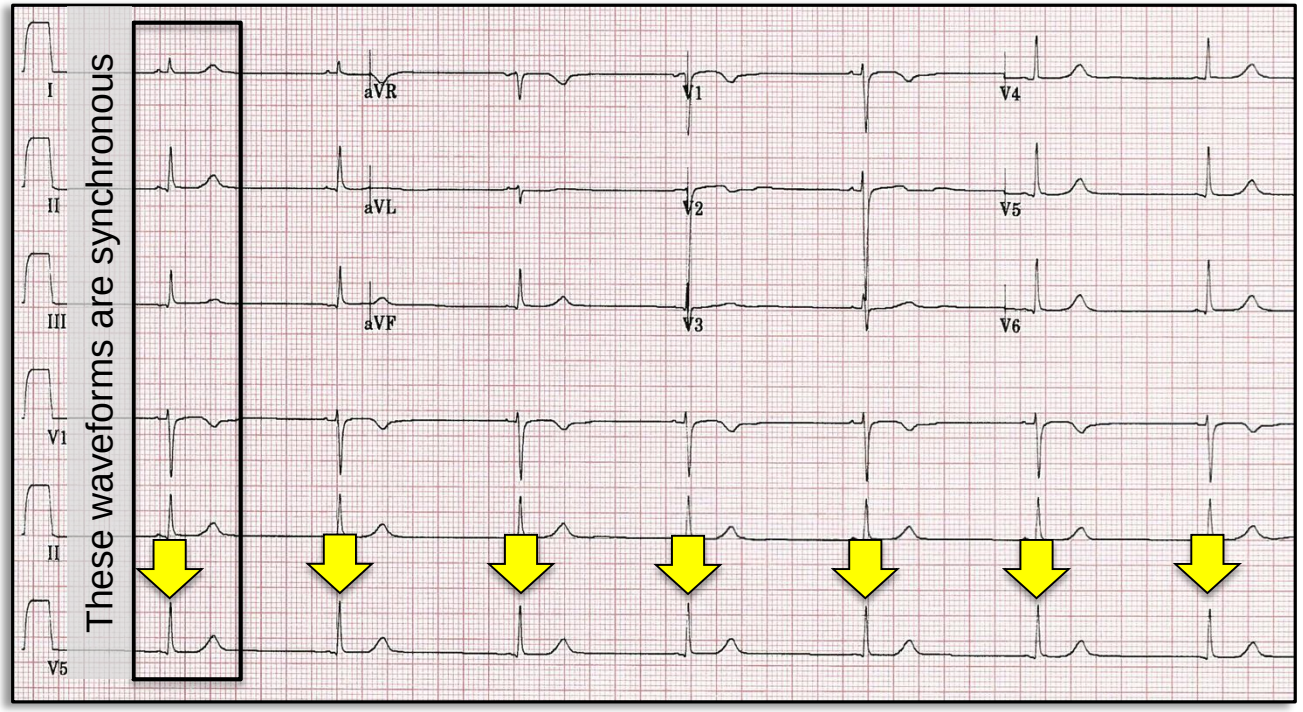
Sinus rhythm: P waves originate from the SA node.

Junctional (AV nodal) rhythm: Orchestrated by the AV node.

Escape: Cardiac activity “escaping” the control of a particular rhythm.

Heart Rate: Clues

How to calculate the heart rate?

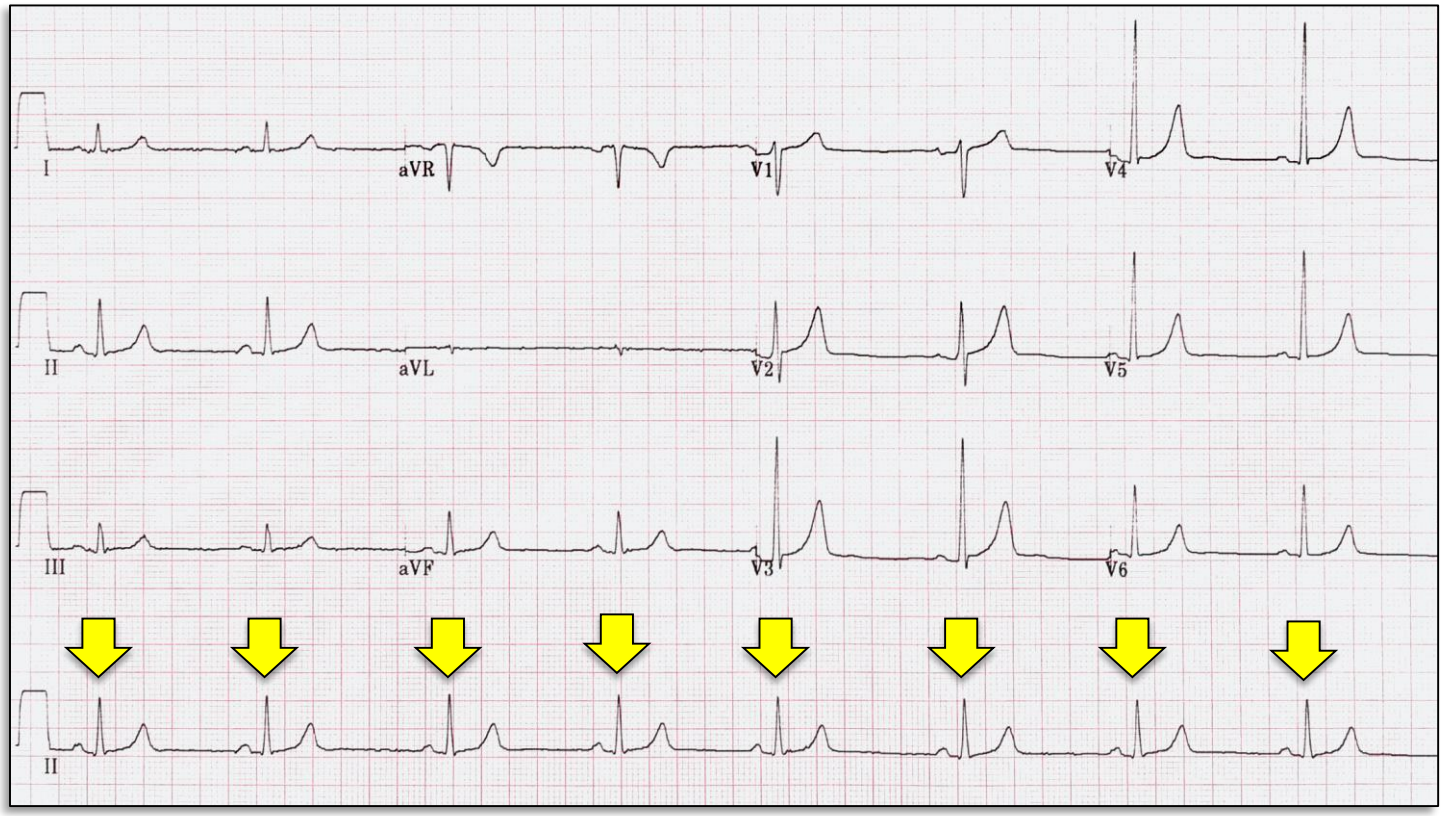


This 12-Lead ECG strip is recorded over 10 seconds

Count the R waves and multiply them by 6.

Heart Rate: Exercise

Calculate the heart rate in this asymptomatic 28 year old male.

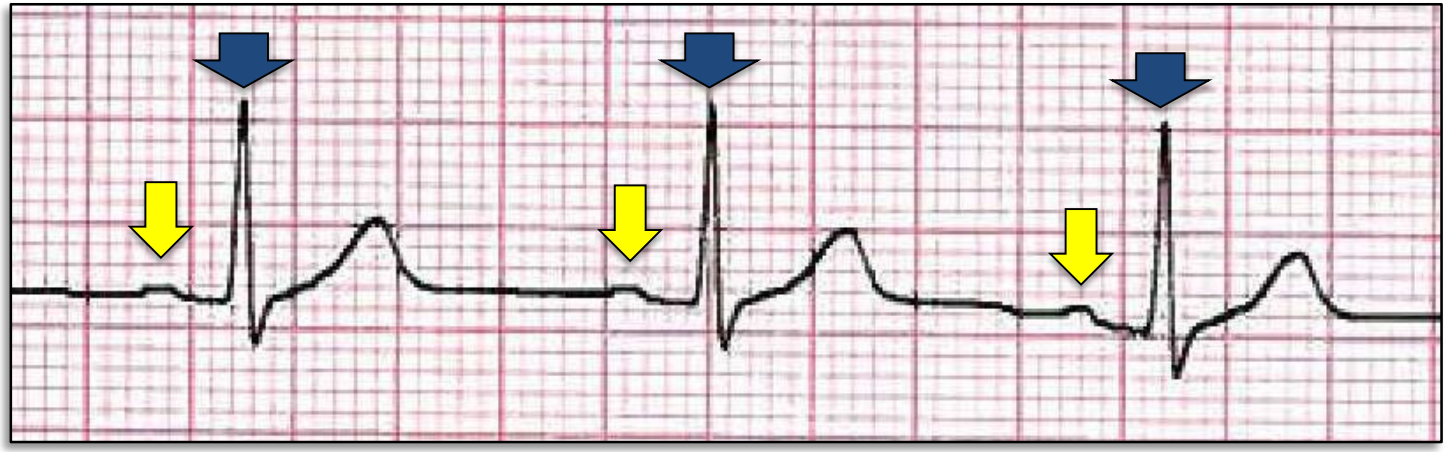


8 R waves X 6 = 48 bpm.
Variable R-R interval with no change in PR interval.
This is **sinus arrhythmia**. A sign of a good vagal tone. i.e. a healthy heart.

AV **association**

<u>Sinus rhythm</u>

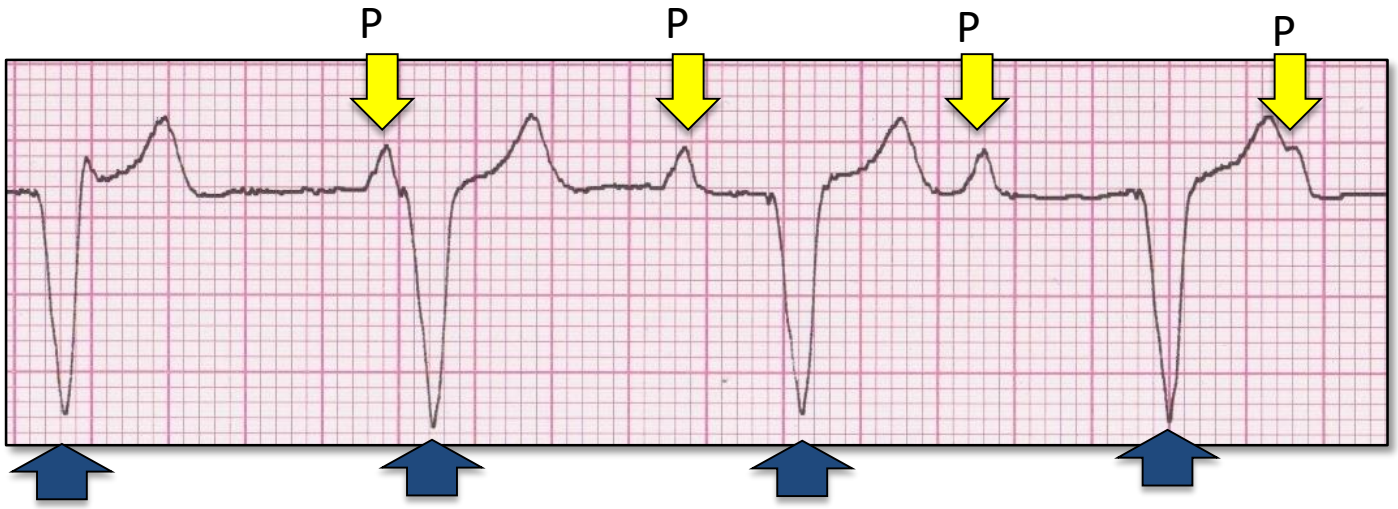
1. Upright P waves in the inferior leads.
2. P waves comes first. QRS complexes later.
3. AV association: every P is followed by a QRS.



AV **dissociation**

AV dissociation

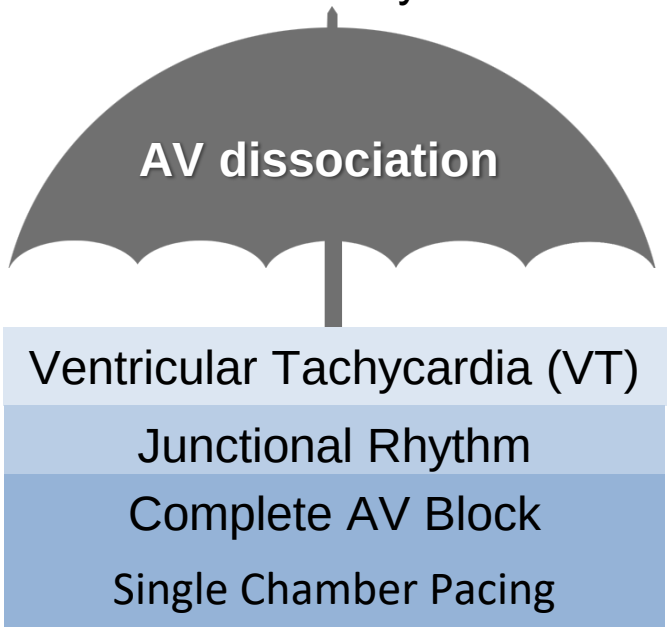
Atrial activity is *independent* from ventricular activity



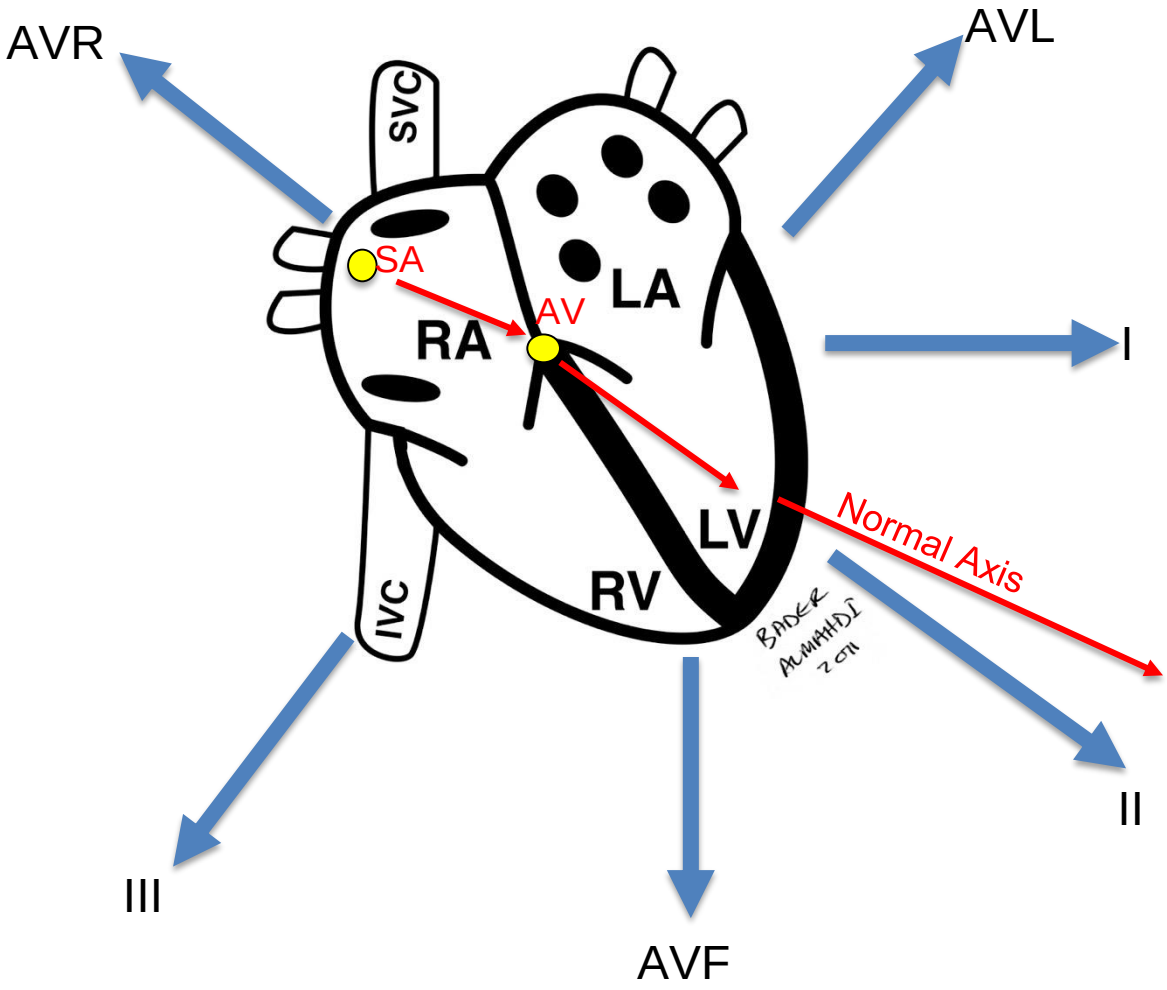
AV **dissociation**

AV dissociation is a broad term. A large umbrella.

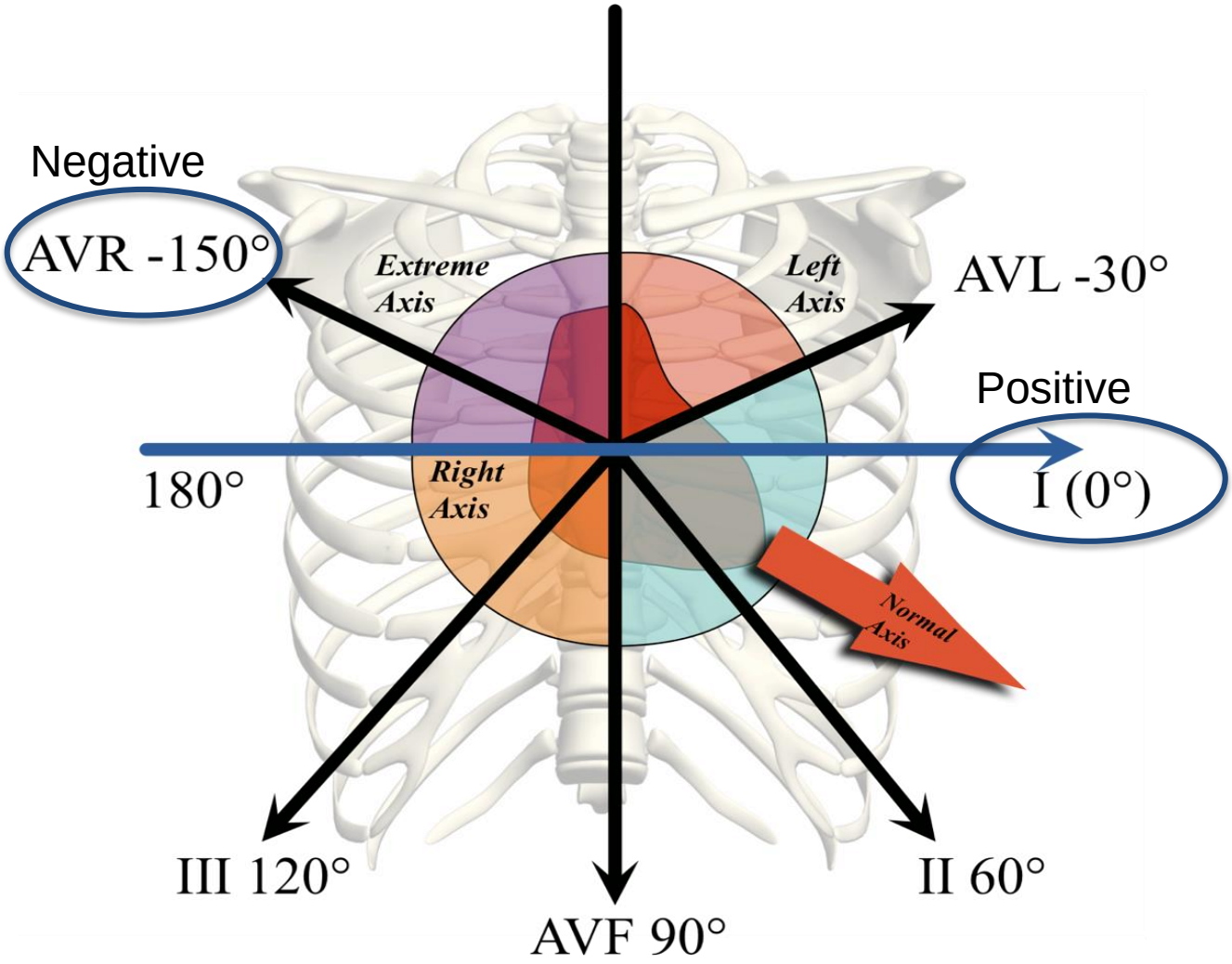
Examples of independent atrial activity from ventricular activity…



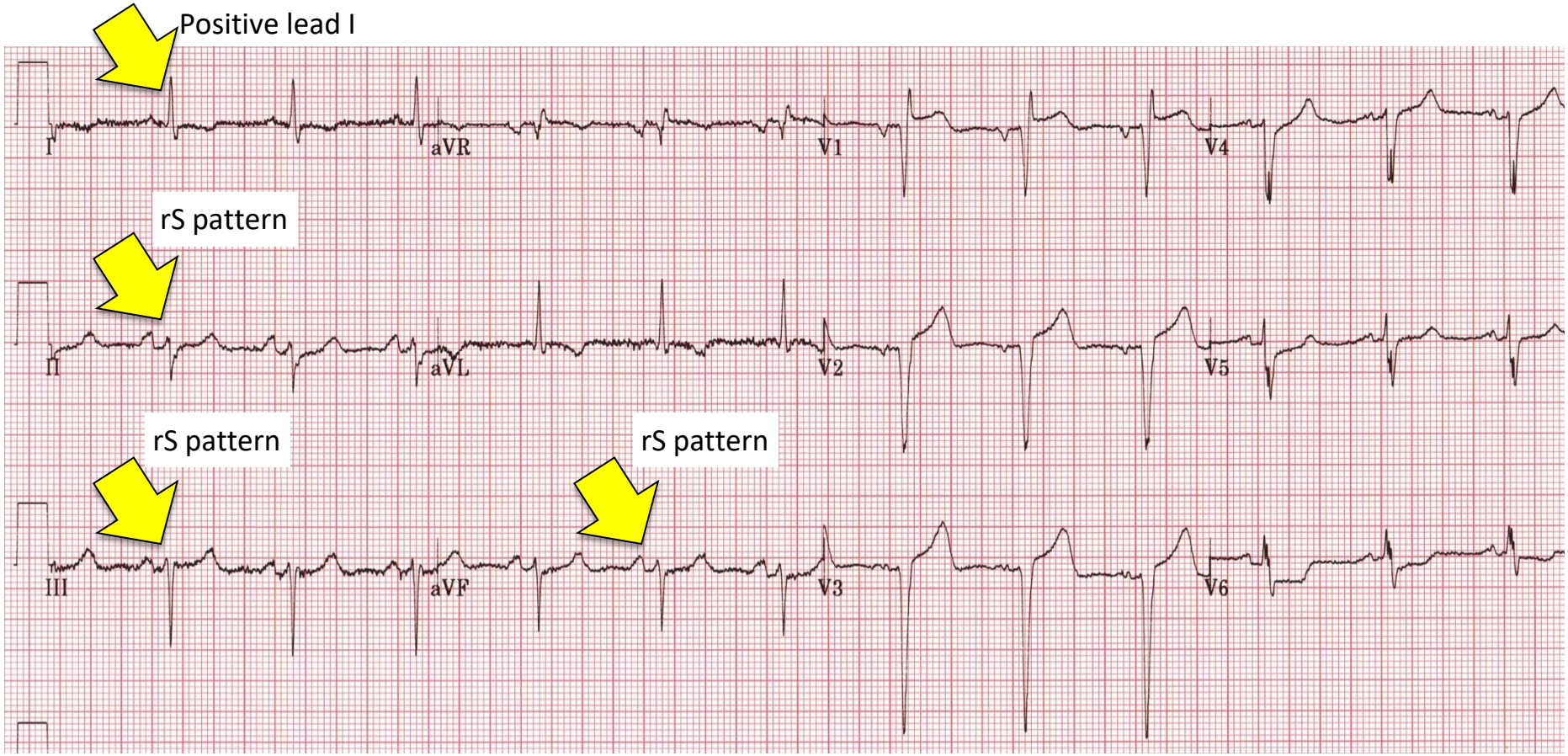
Determining the Axis



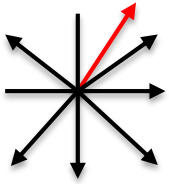
Putting Vectors into Perspective



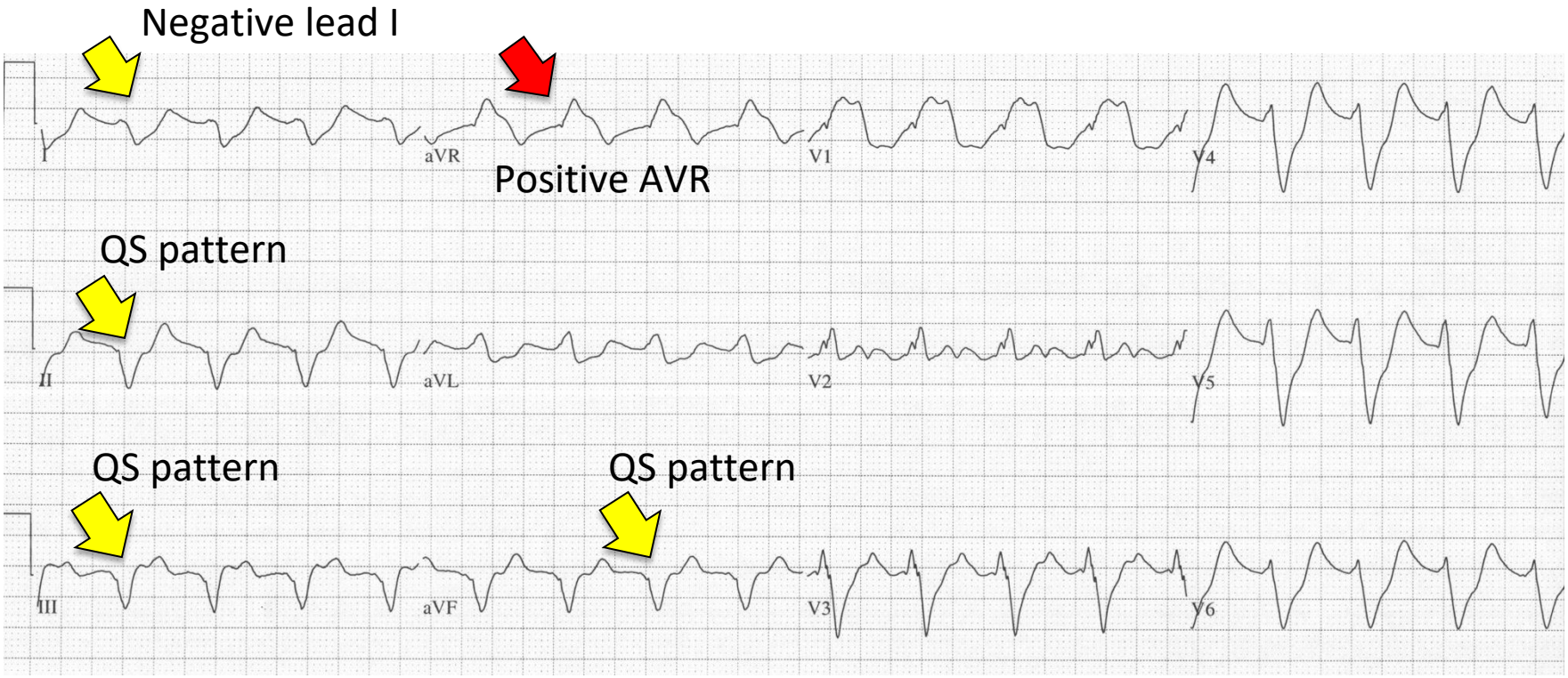
Let's determine the axis: Exercise 1



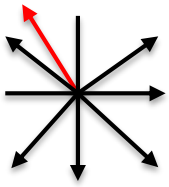
Left Axis Deviation



Let's determine the axis: Exercise 2

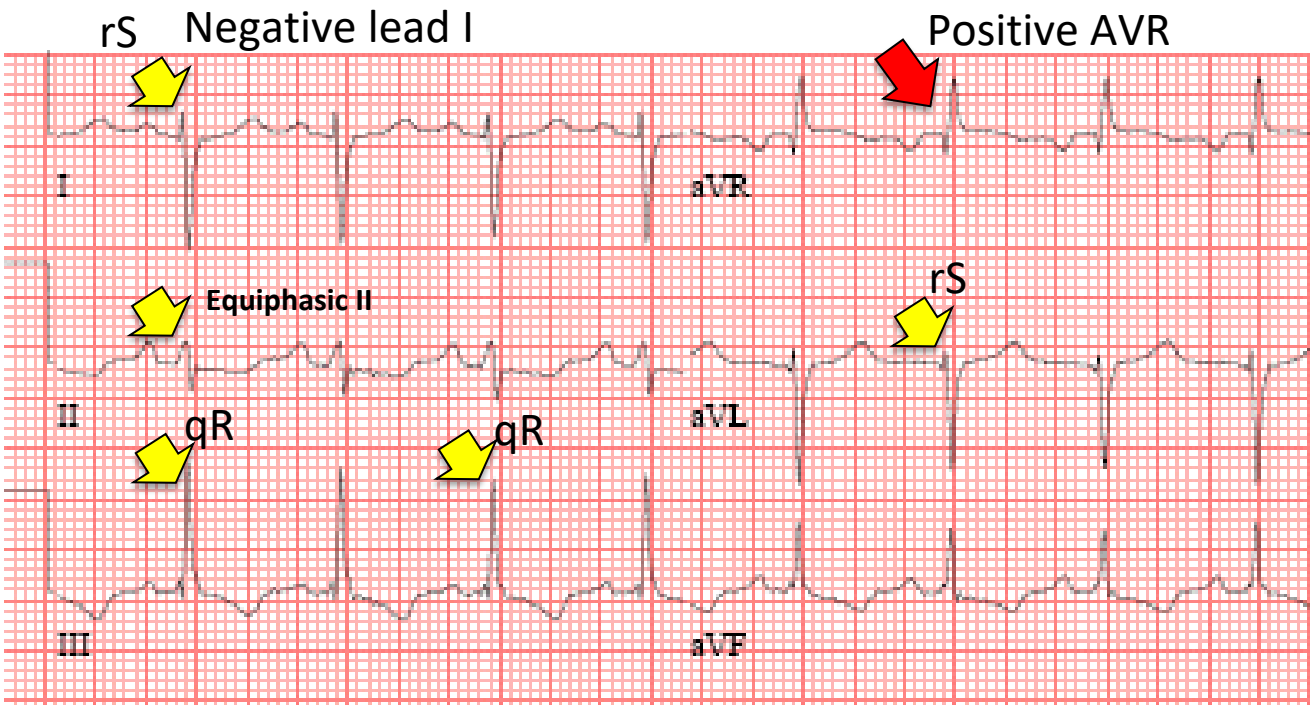


Superior Axis. Extreme Axis. North West. No mans land.

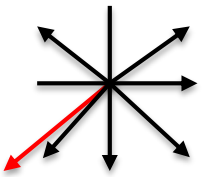


Ventricular Tachycardia

Let's determine the axis: Exercise 3



Right Axis Deviation. The equiphasic lead has the axis *perpendicular* to it.



The ischemic heart

Common terminology

V1-V2: septal leads.

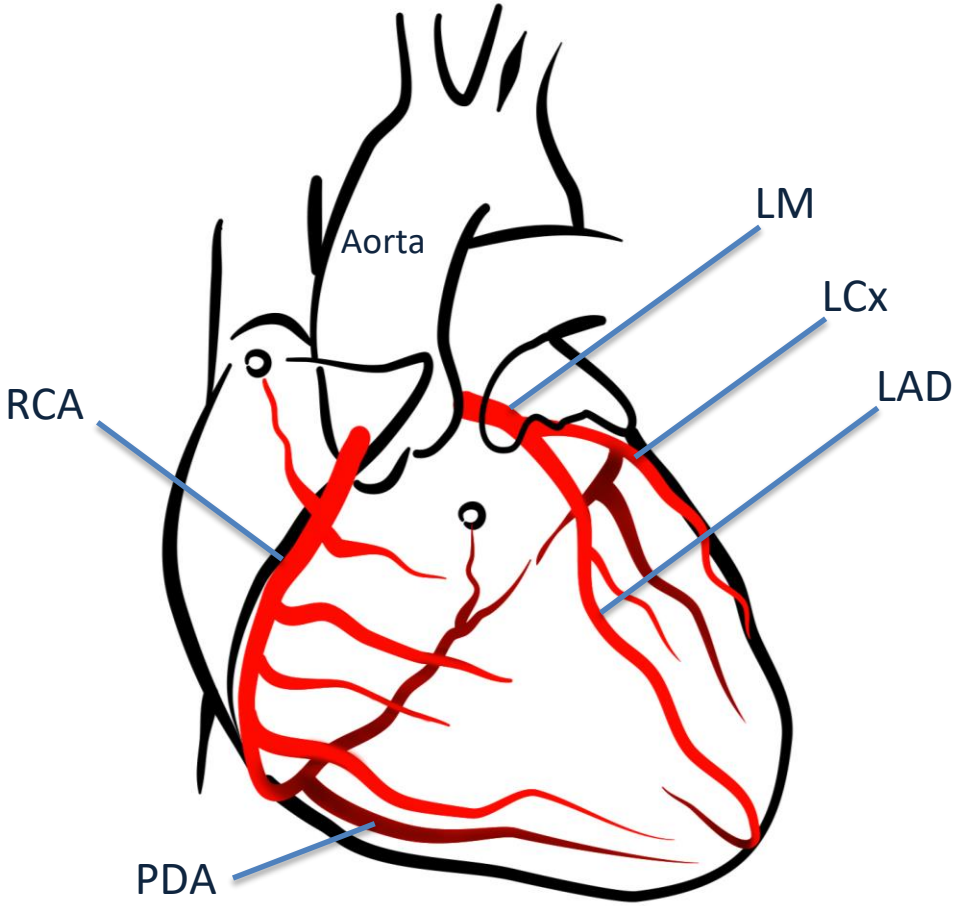
V3-V4: anterior leads.

I, AVL, V5-V6: lateral leads.

II, III, AVF: inferior leads.

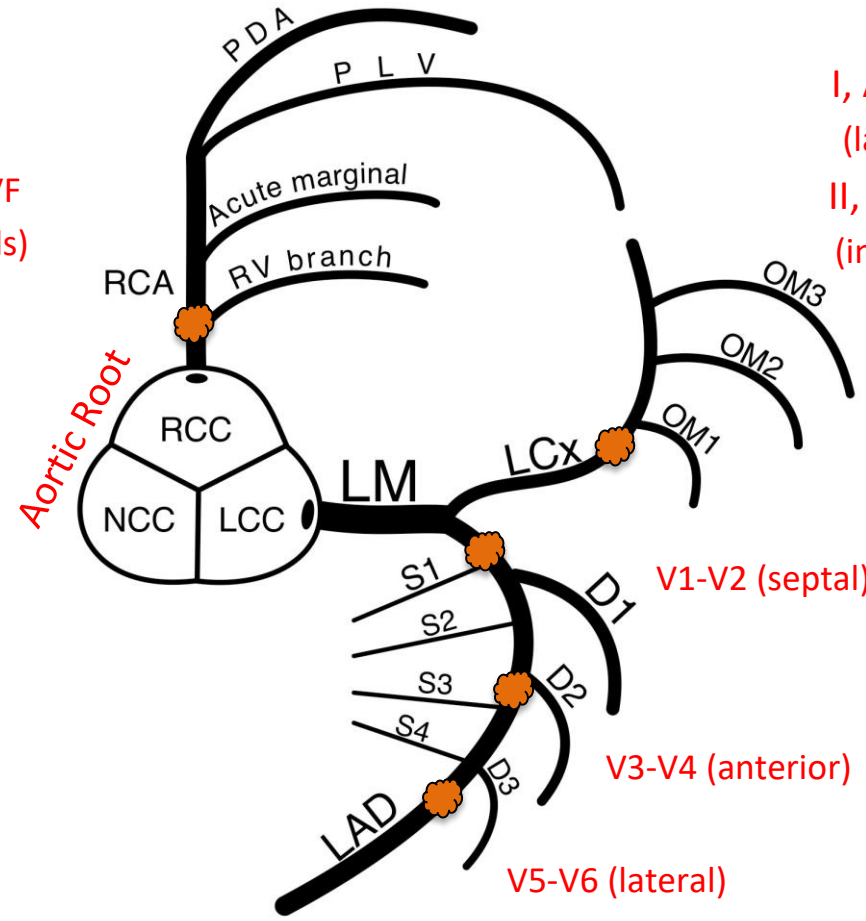
Dominance: the dominant vessel is the one which gives off the posterior descending artery (PDA). In 75% of the population, it is the RCA. Occlusion of the dominant vessel might cause complete AV block.

The ischemic heart



The Ischemic Heart

(Coronary Artery Layout , ST elevation MI)



II, III, and AVF
(inferior leads)

I, AVL, V5, V6
(lateral leads)

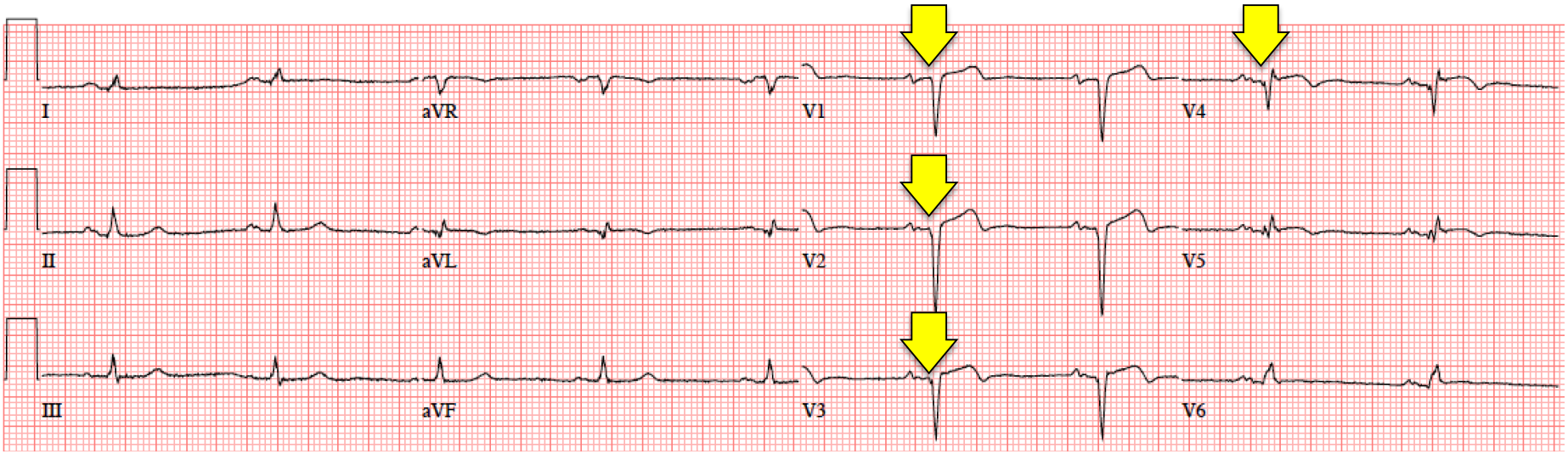
II, III, and AVF
(inferior leads)

V1-V2 (septal)

V3-V4 (anterior)

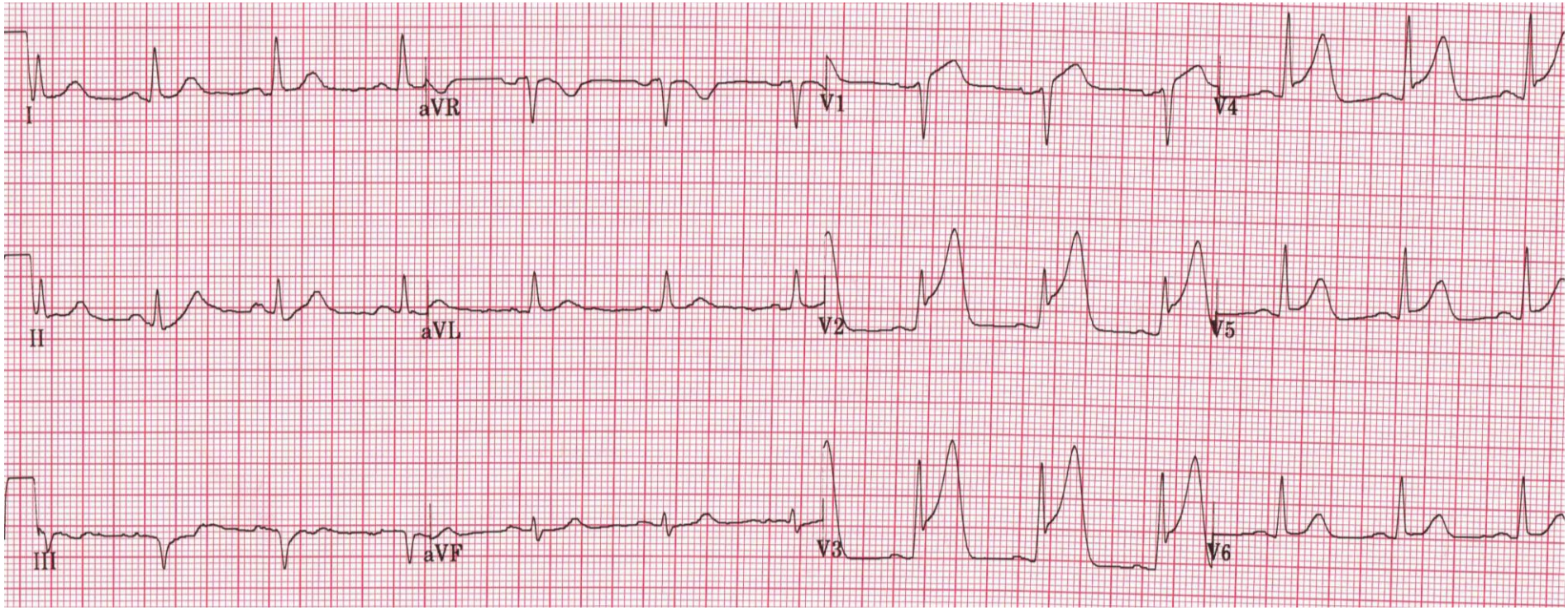
V5-V6 (lateral)

The ischemic heart



Q waves (QS pattern) in V1-4.
Evolved (Old) anterior wall MI.
R waves are lost. Damage has already been done.
Low voltage in limb and precordial leads.

The ischemic heart



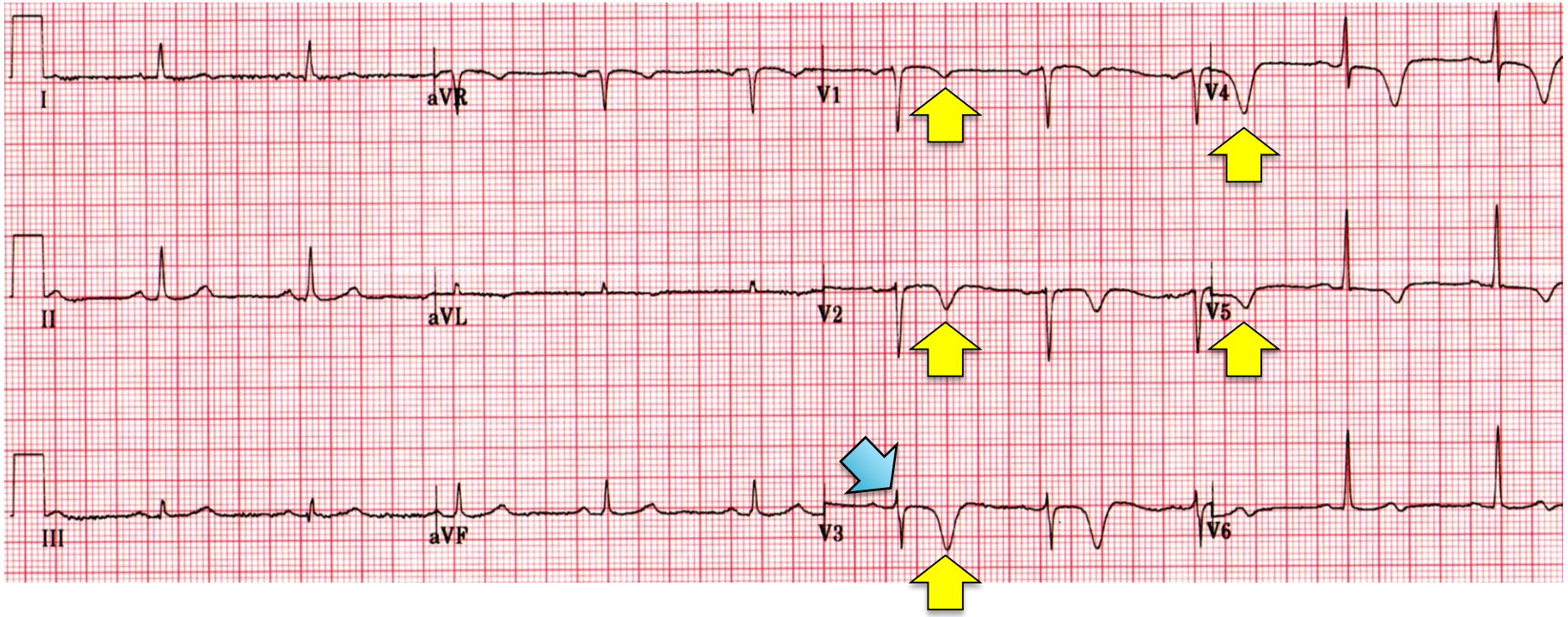
ST elevation in V1-V5.

Anteroseptal wall MI.

LAD territory. Thrombus most likely is at the proximal segment of the LAD.

R waves not lost yet.

The ischemic heart

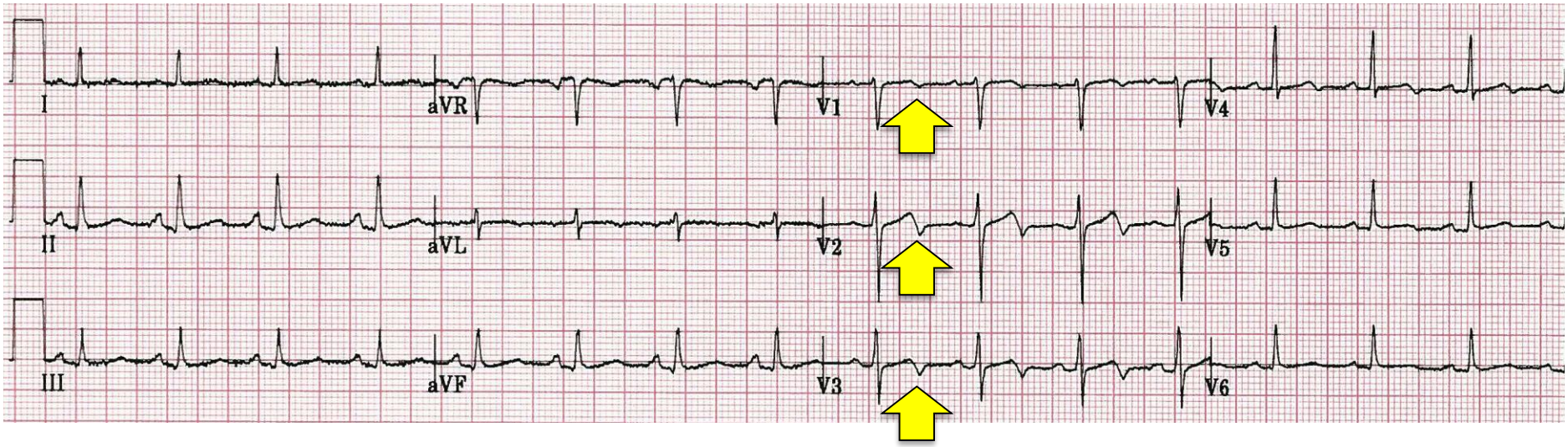


Deep, symmetrical T wave inversion in precordial leads.

Wellens' syndrome: proximal LAD disease

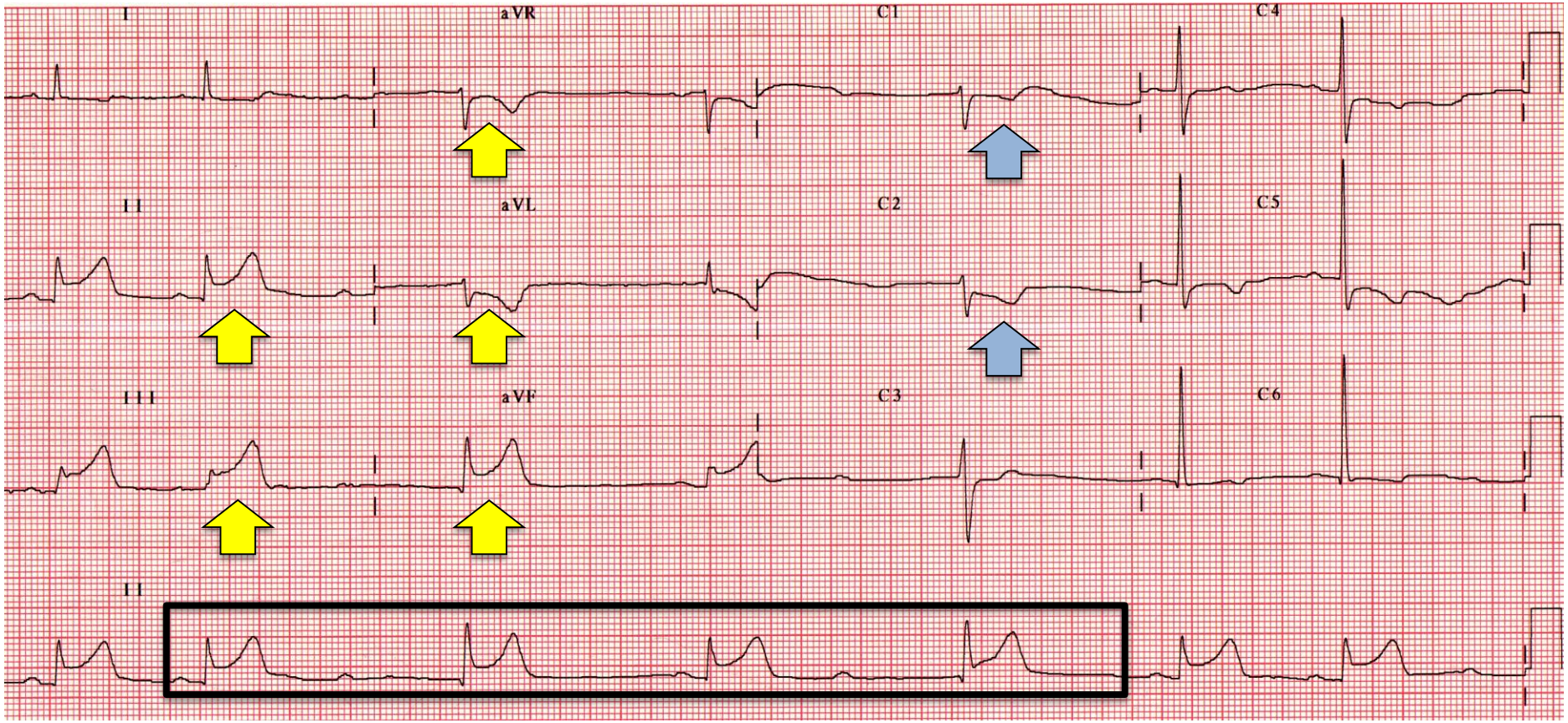
Poor R wave progression (R in **V3** is <**3mm**) is also a sign of LAD disease.

The ischemic heart



Biphasic T waves in precordial leads.
Another variant of Wellens syndrome
Proximal LAD disease

The ischemic heart



ST elevation in II, III, and AVF (inferior leads) with *reciprocal* changes in AVL and AVR.

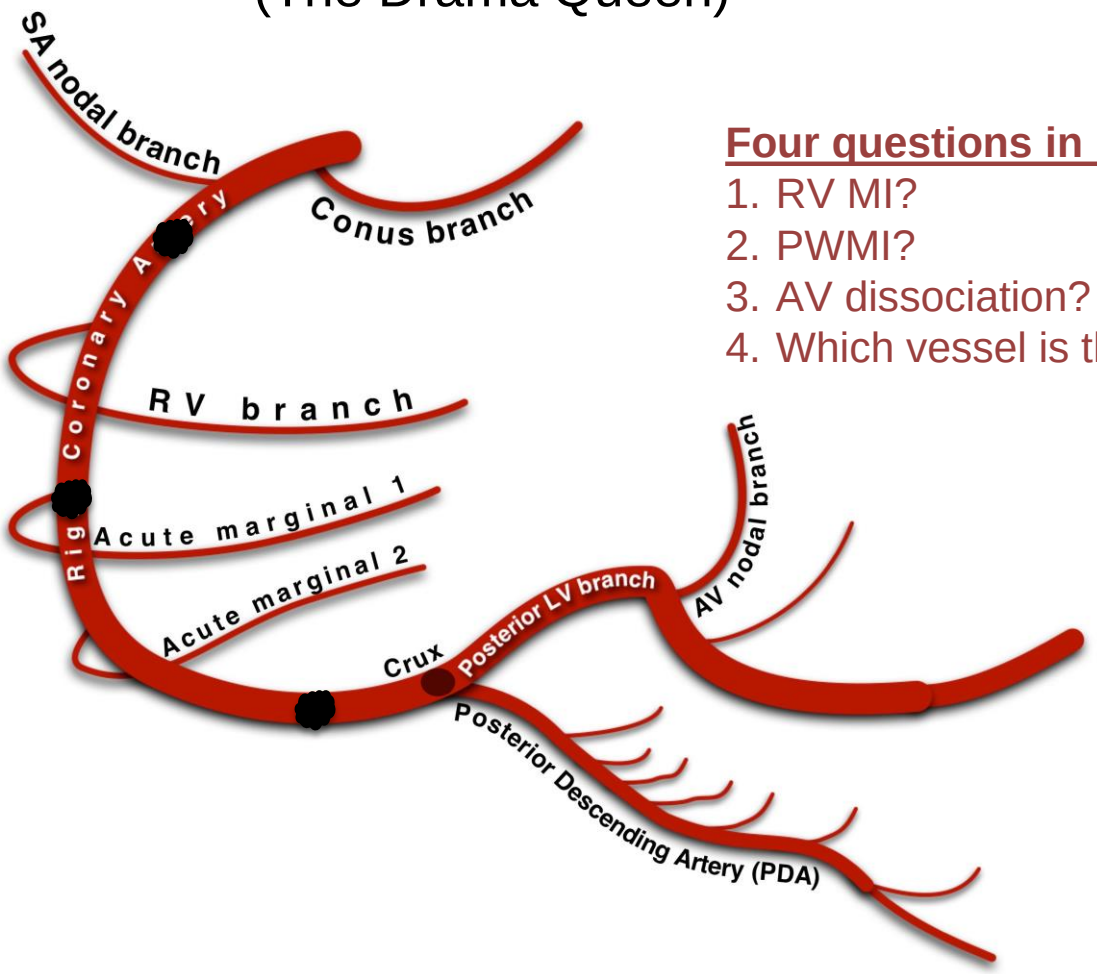
Posterior wall MI

AV dissociation

Which coronary artery is the culprit? RCA versus LCx.

The ischemic heart

(The Drama Queen)



Four questions in inferior wall MI

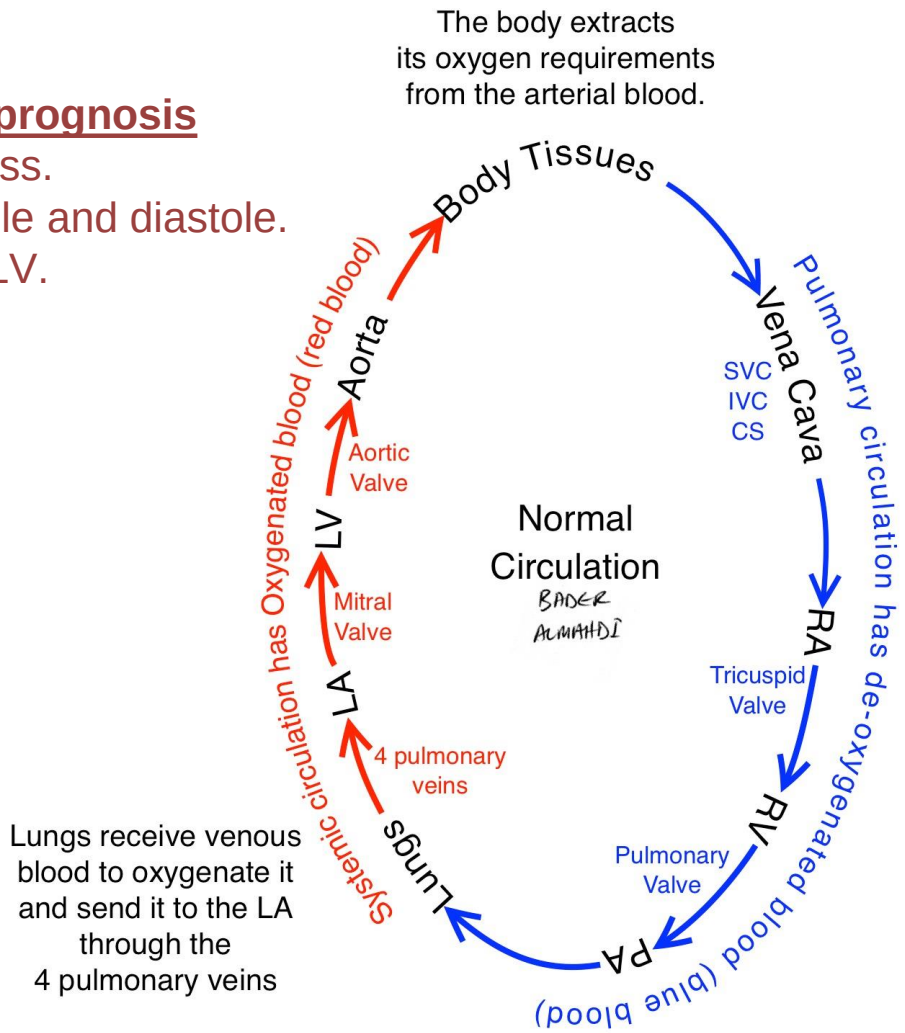
1. RV MI?
2. PWMI?
3. AV dissociation?
4. Which vessel is the culprit?

RV infarction

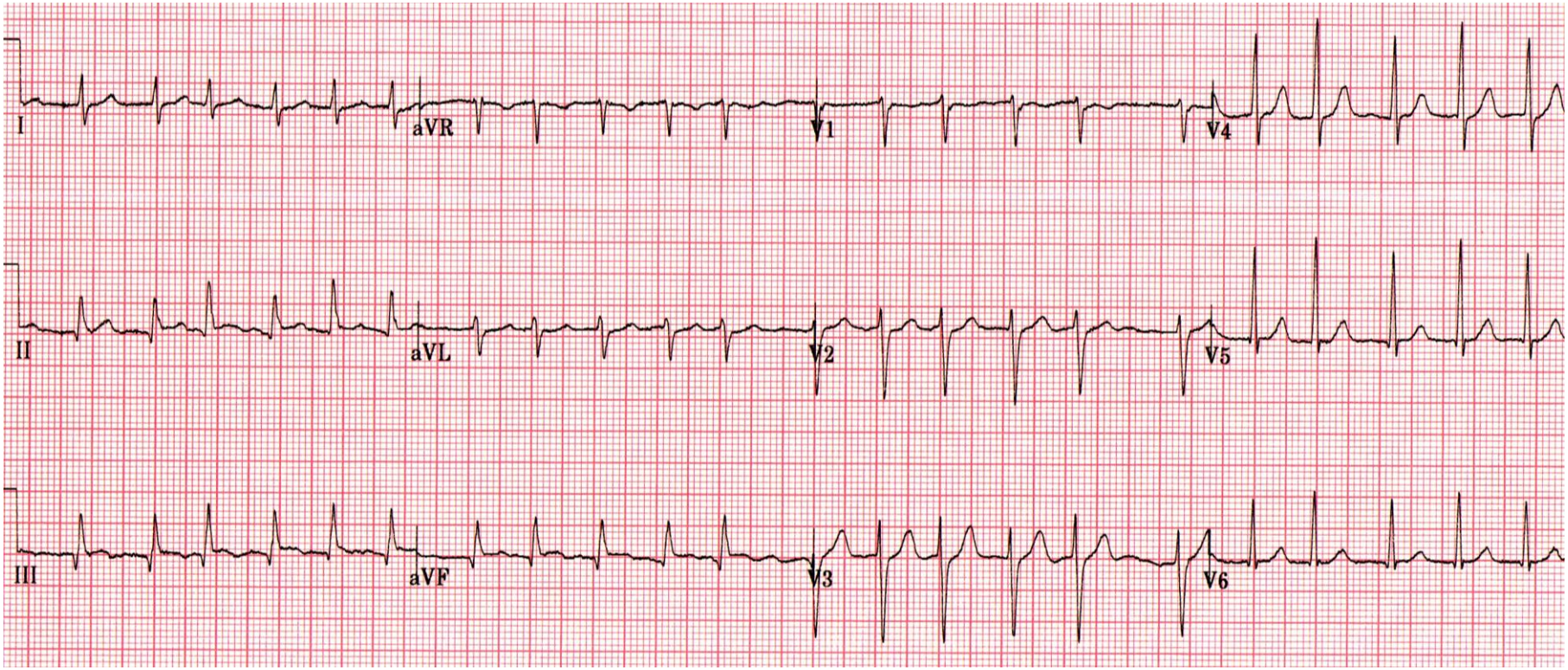
Explanation of signs and symptoms

RV MI has a good prognosis

1. Small muscle mass.
2. Perfused in systole and diastole.
3. Collaterals from LV.



The Fast Heart



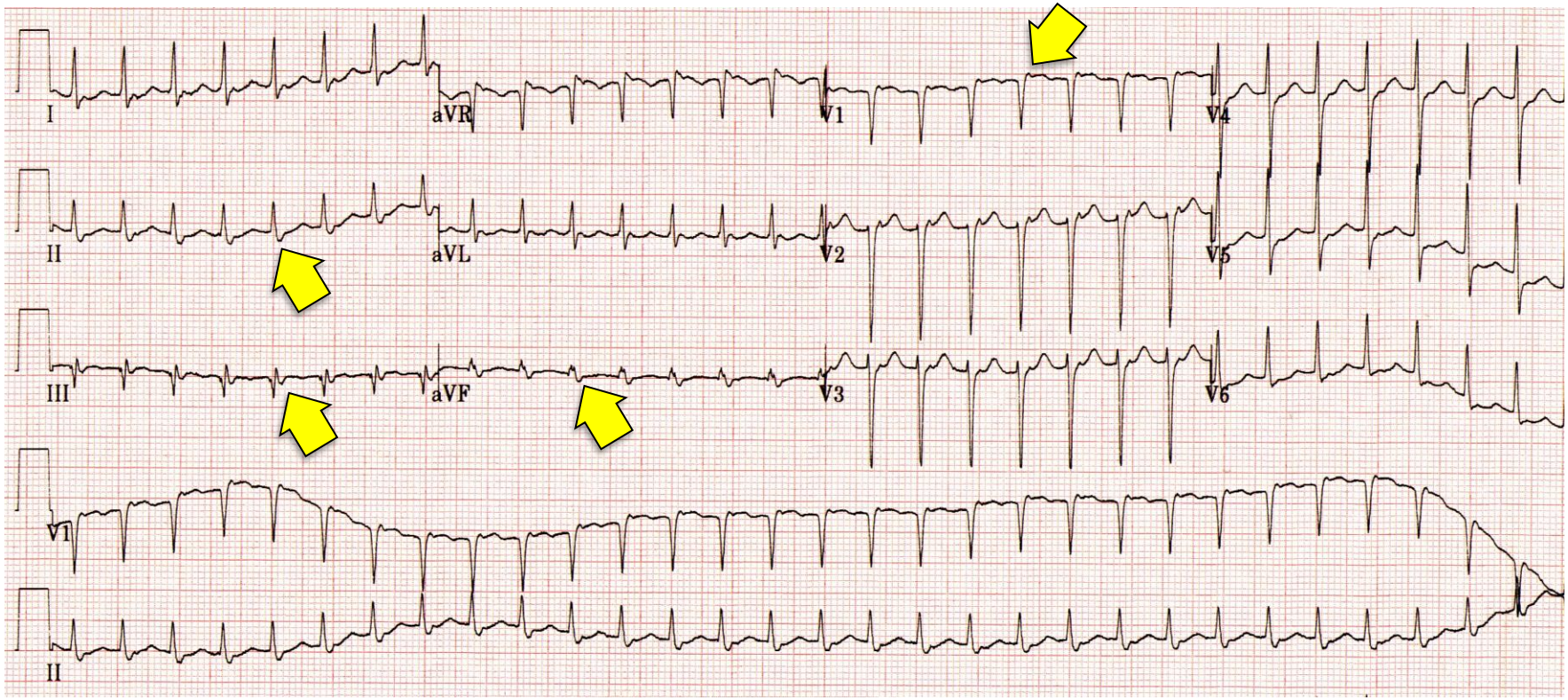
Tachycardia. Absent P waves. Irregular rhythm. Narrow QRS complexes.

Atrial fibrillation. The most common tachyarrhythmia.

The acute risk here is the formation of thrombus in the left atrium.

Chronically fast AF might lead to tachyarrhythmia-induced cardiomyopathy.

The Fast Heart



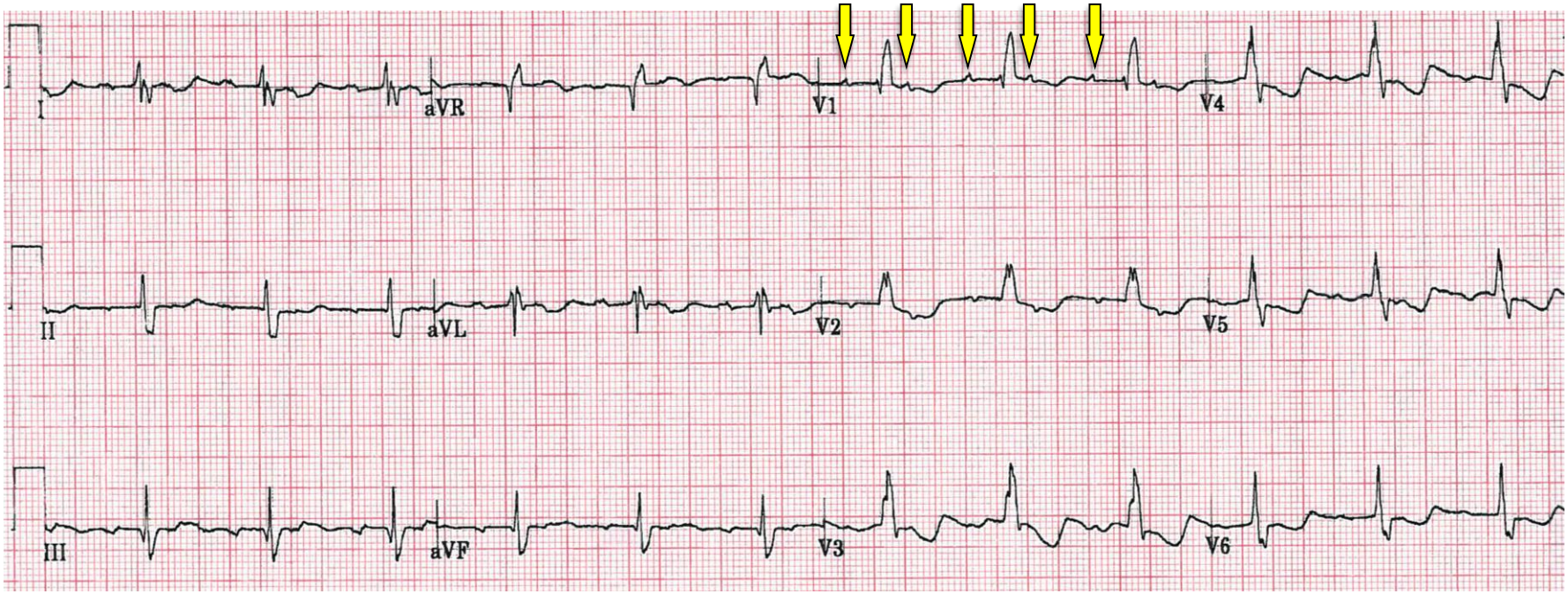
Tachycardia. Regular rhythm. Narrow complexes. No obvious P waves. Pseudo R in V1. Pseudo S in II, III, AVF.

AV nodal re-entry tachycardia (AVNRT)

Common arrhythmia in the young and healthy.

Aborted by Valsalva maneuver, IV adenosine/verapamil, or DC cardioversion.

The Fast Heart

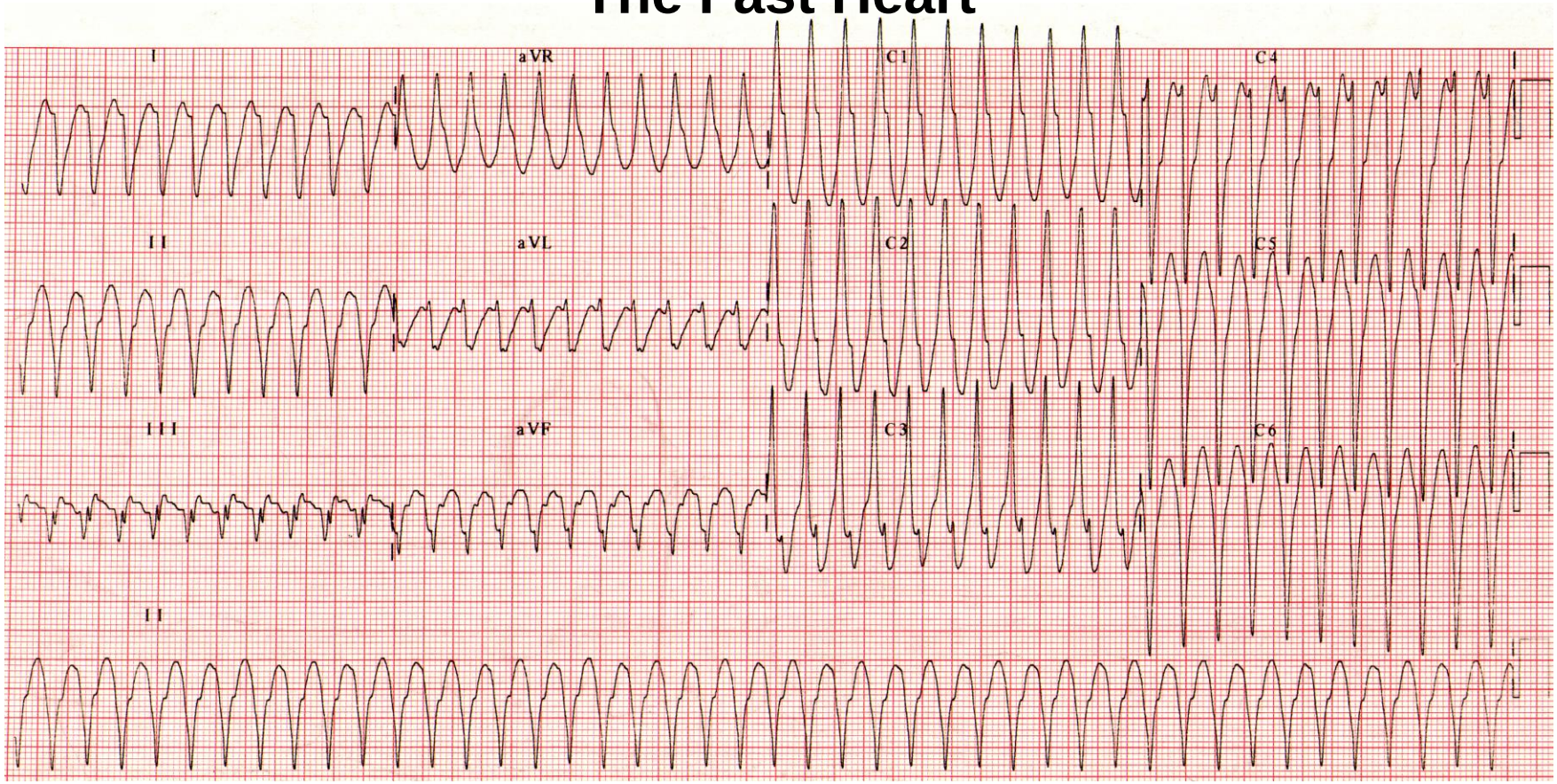


Regular rhythm. Two P waves per QRS complex. Atrial rate>100/min.

Atrial tachycardia with 2:1 block.

This is common with digoxin toxicity.

The Fast Heart



Wide complex tachycardia. No visible P waves. Superior axis.

Ventricular tachycardia.

A medical emergency. If hemodynamically compromised. Then DC shock.

The Slow Heart

Slow heart rates are called "Bradyarrhythmias" on the ECG.

<u>Classification of bradyarrhythmias depends on..</u>

Are they normal or not?

E.g. athlete's heart. Good vagal tone.

Do they cause symptoms?

E.g. Fatigue, palpitations, syncope, presyncope.

Is the problem temporary?

Should I treat the underlying cause and that's it?

Is the problem permanent?

In other words, will patient require permanent pacing?

The Slow Heart

Where does the rhythm come from?

Sinus node?

Sinus bradycardia.

Sino-atrial exit block / sinus arrest.

First / Second degree AV block.

AV node? (AV node lies at the AV junction)

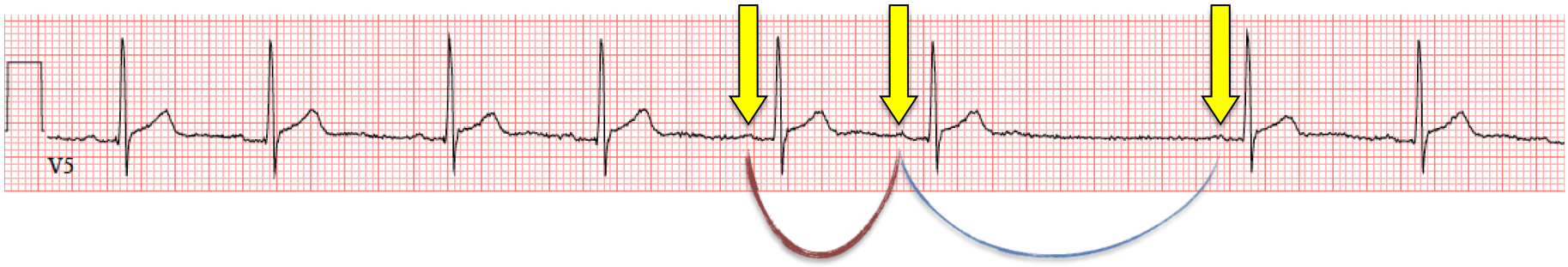
Junctional escape rhythm.

Accelerated junctional rhythm.

Ventricles?

Complete AV block.

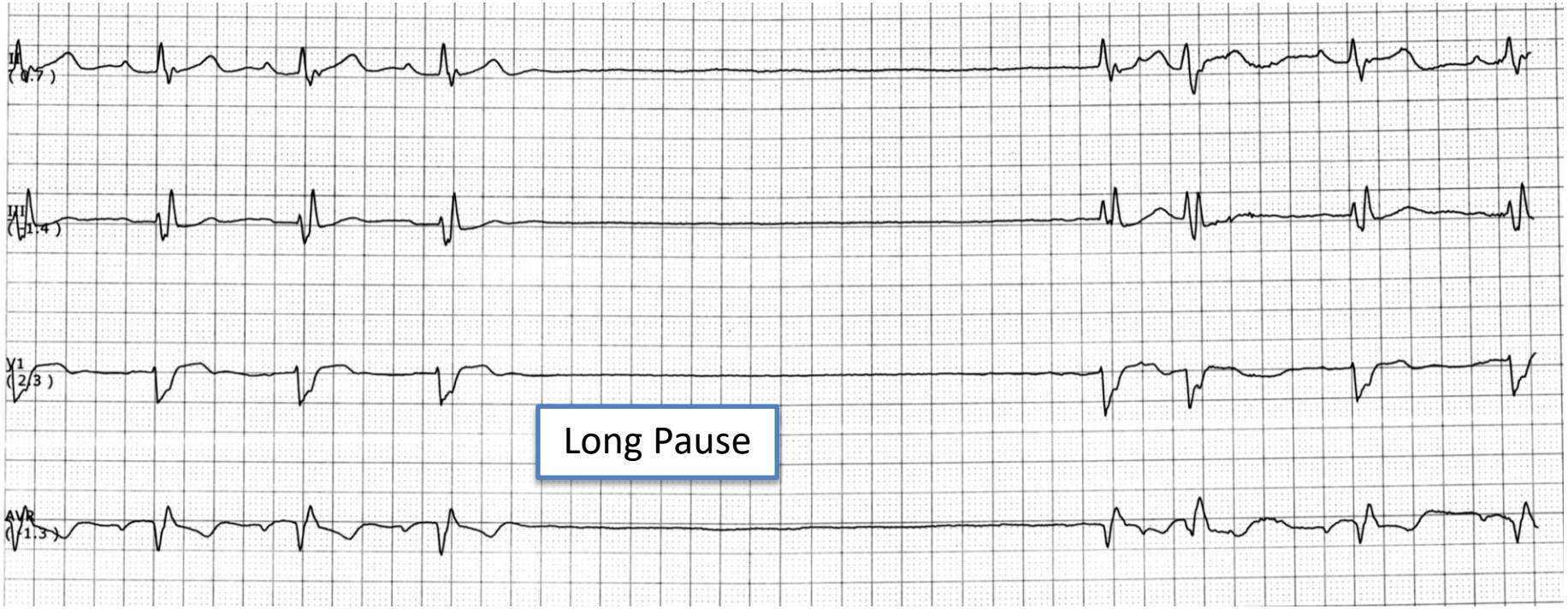
The Slow Heart



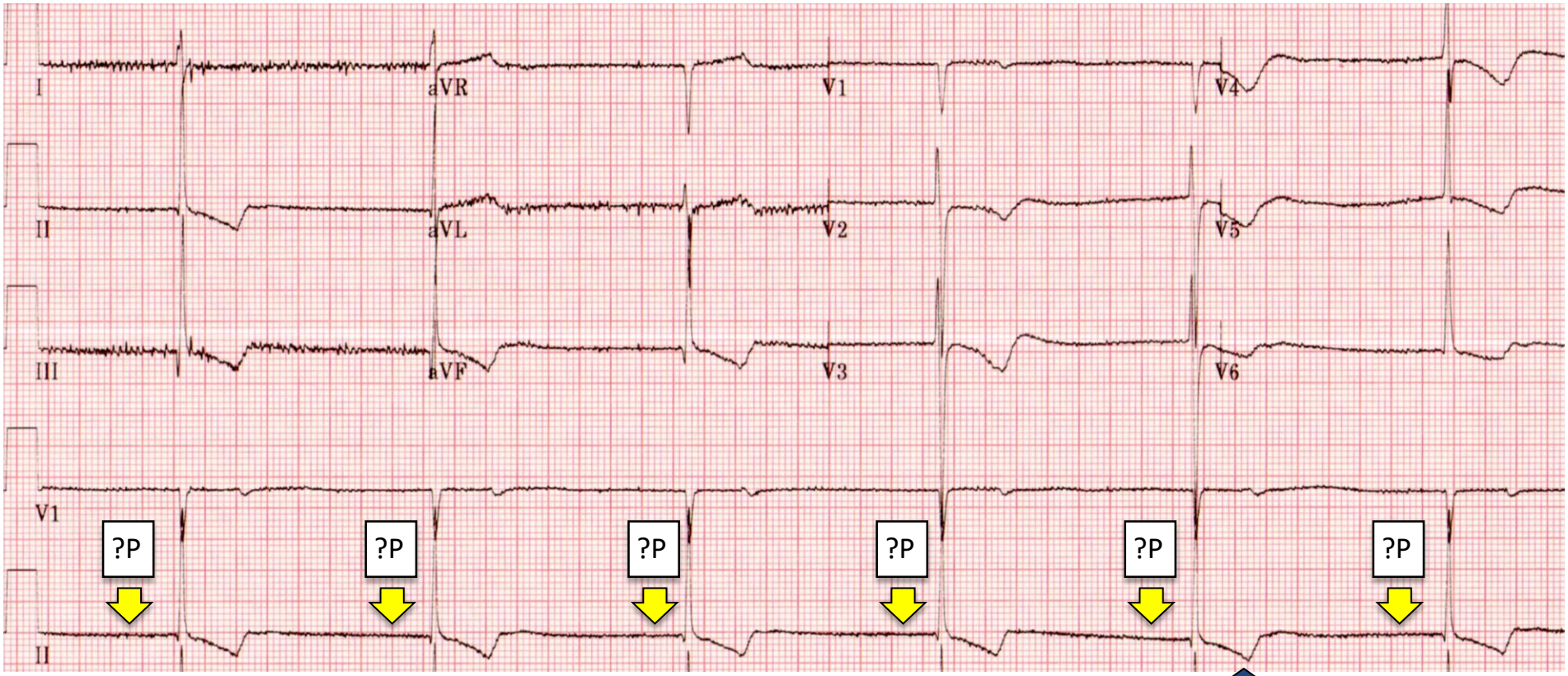
Double the distance between the two P waves

Sino-atrial exit block.

The Slow Heart



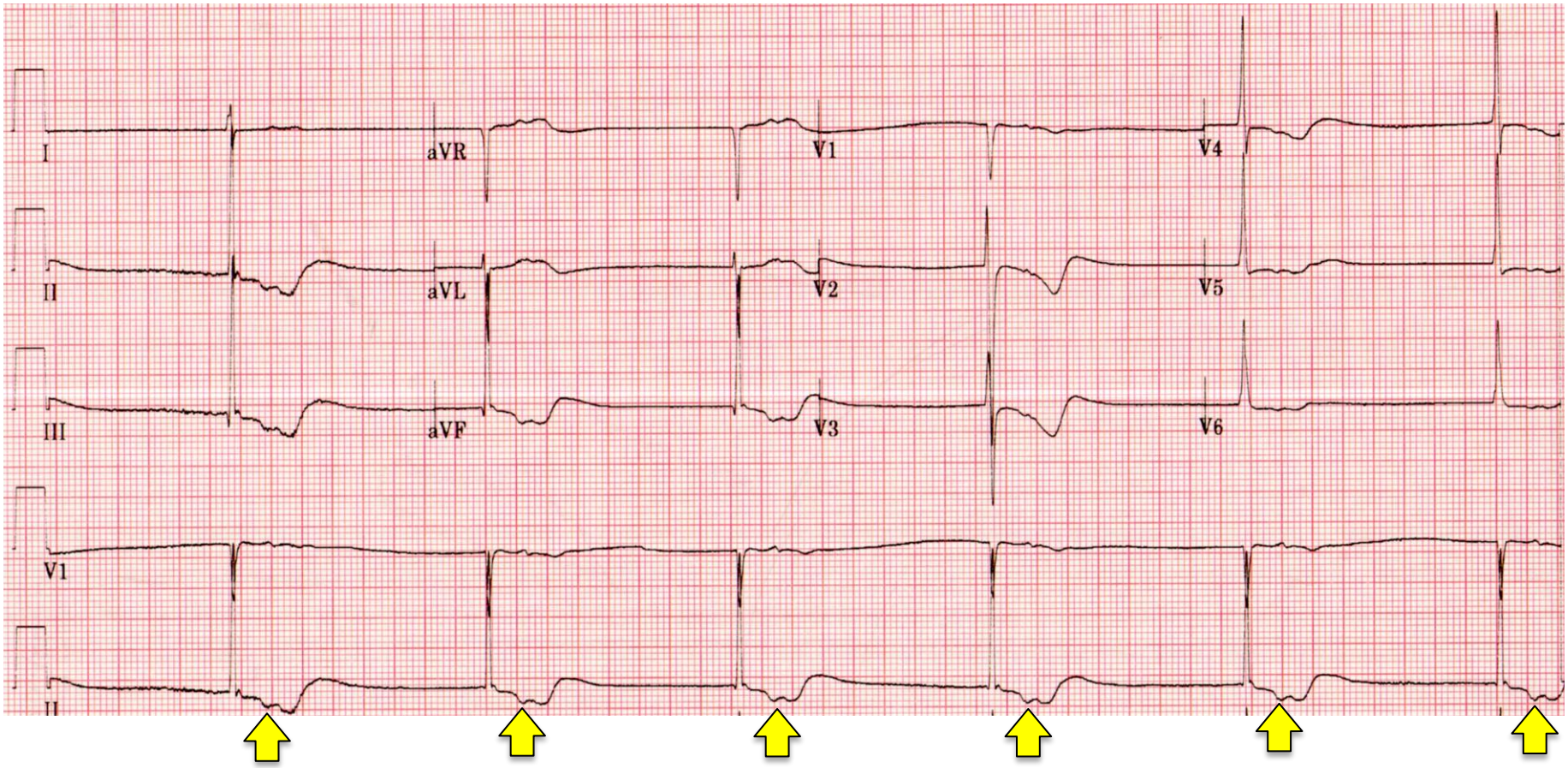
The Slow Heart



Regular rhythm. Narrow QRS complexes. P waves absent.
Junctional escape rhythm.

Reversed tick

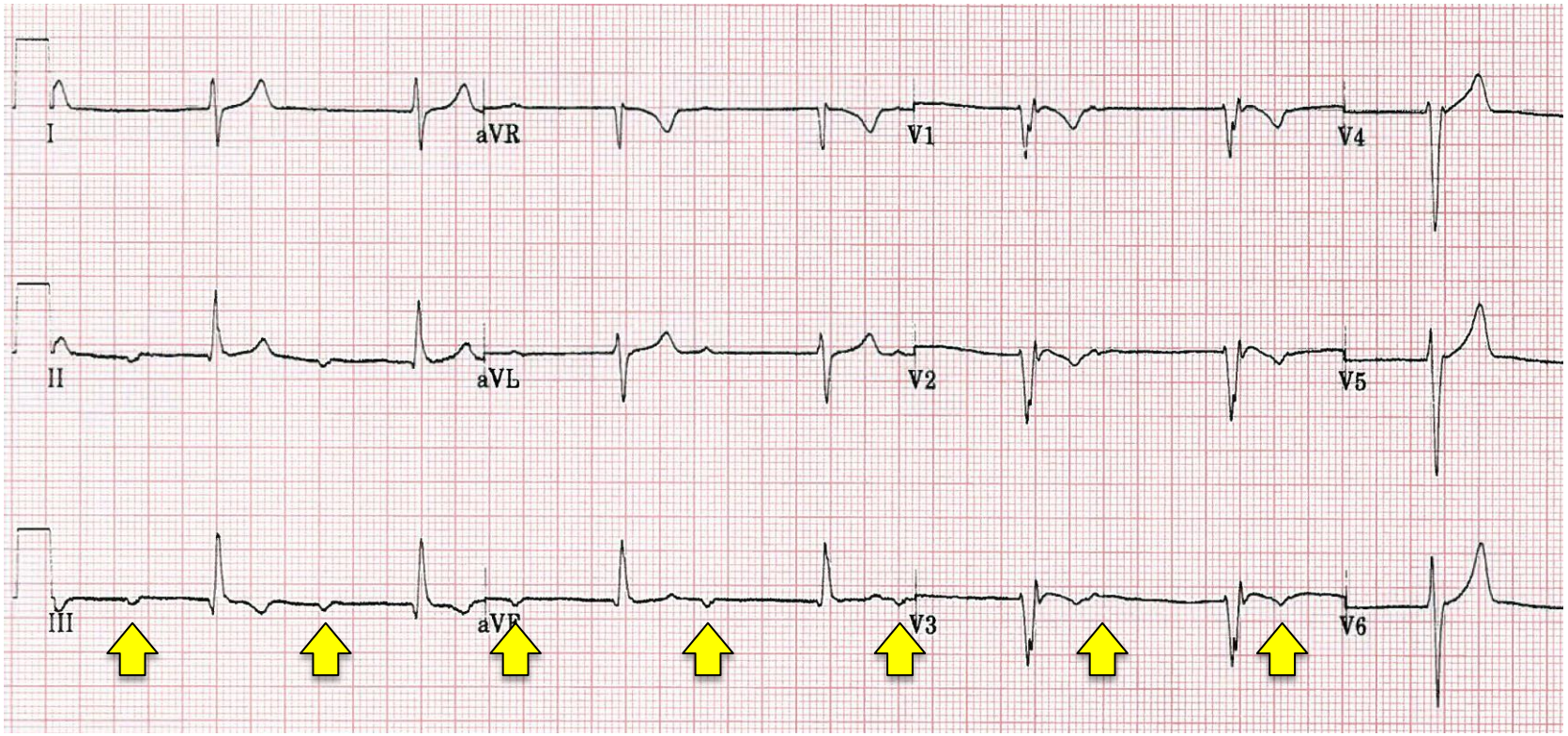
The Slow Heart



Retrograde inverted P waves. Narrow QRS complexes.

Junctional escape rhythm.

The Slow Heart

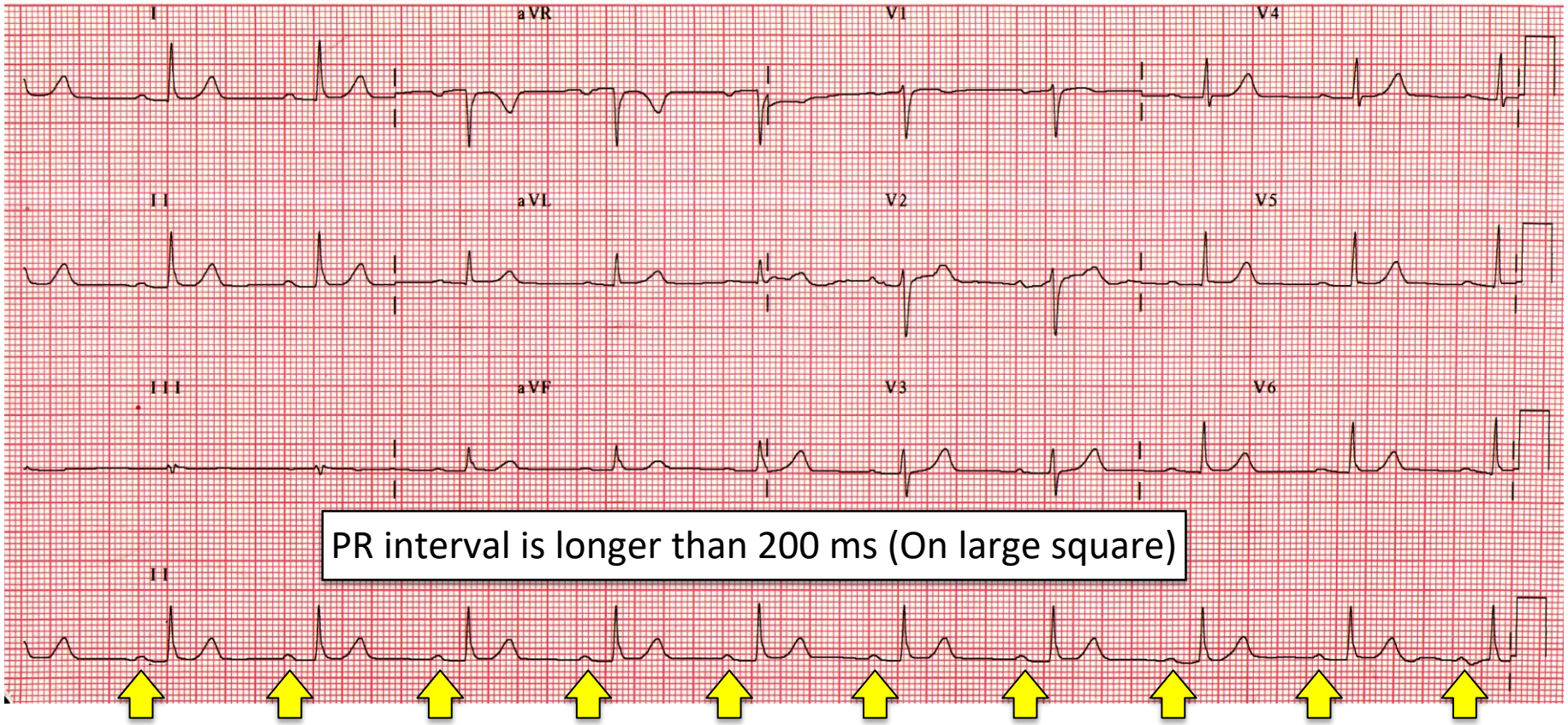


Inverted P waves. AV dissociation. Narrow QRS complexes.

Junctional escape rhythm.

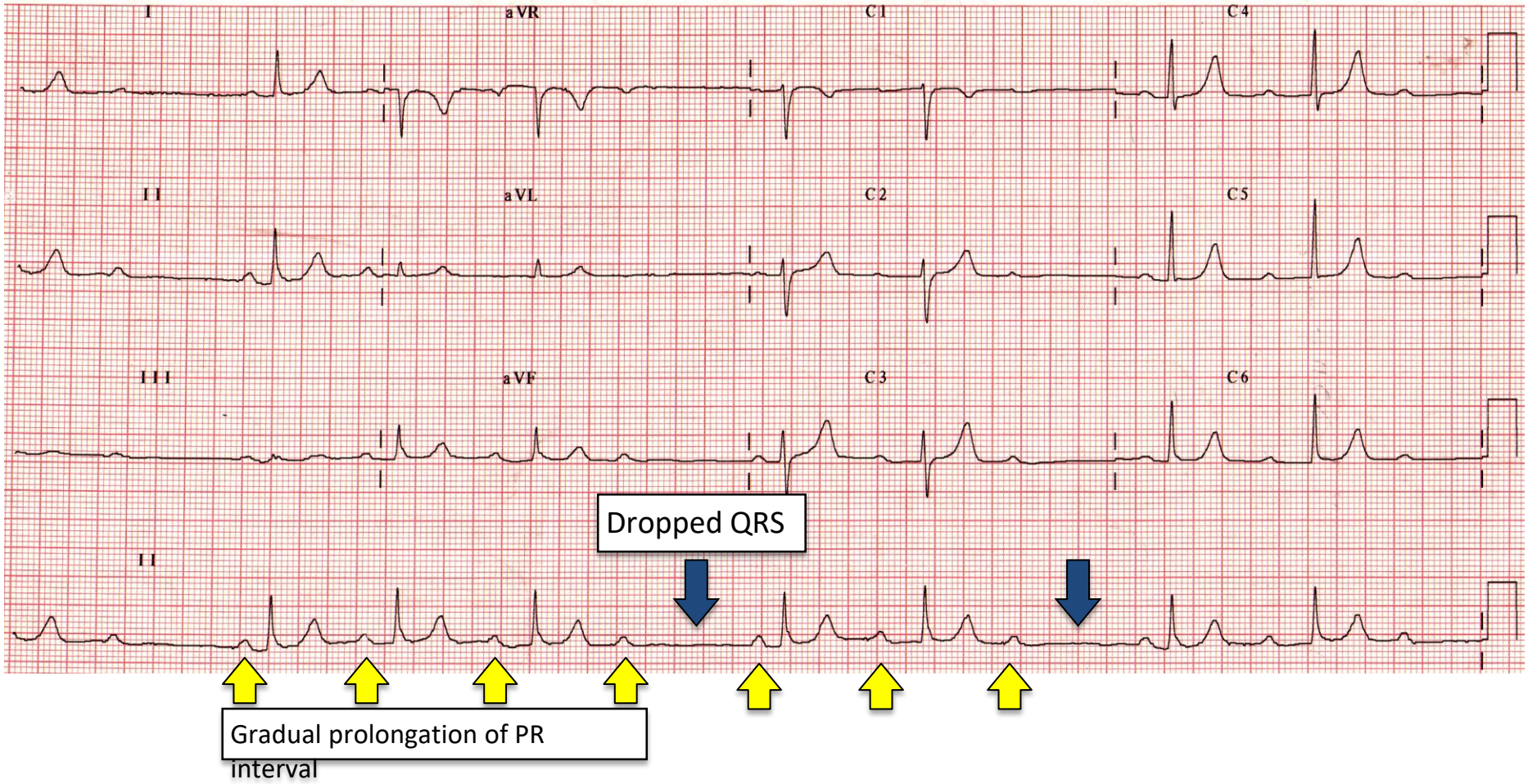
P waves in II, III, AVF are negative. Activation from down to up.

The Slow Heart



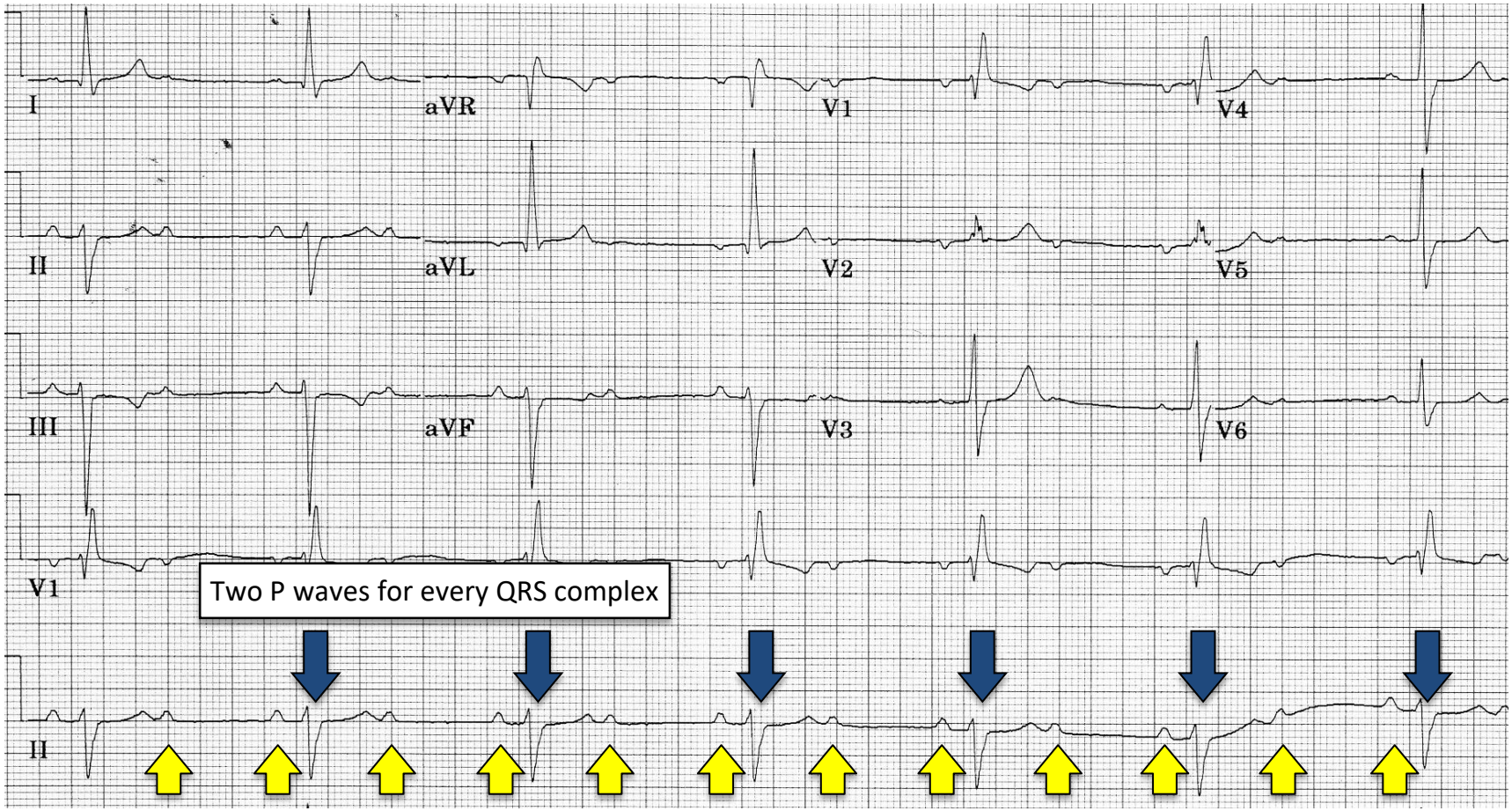
1st degree AV block

The Slow Heart



2nd degree AV block (Mobitz type I)

The Slow Heart

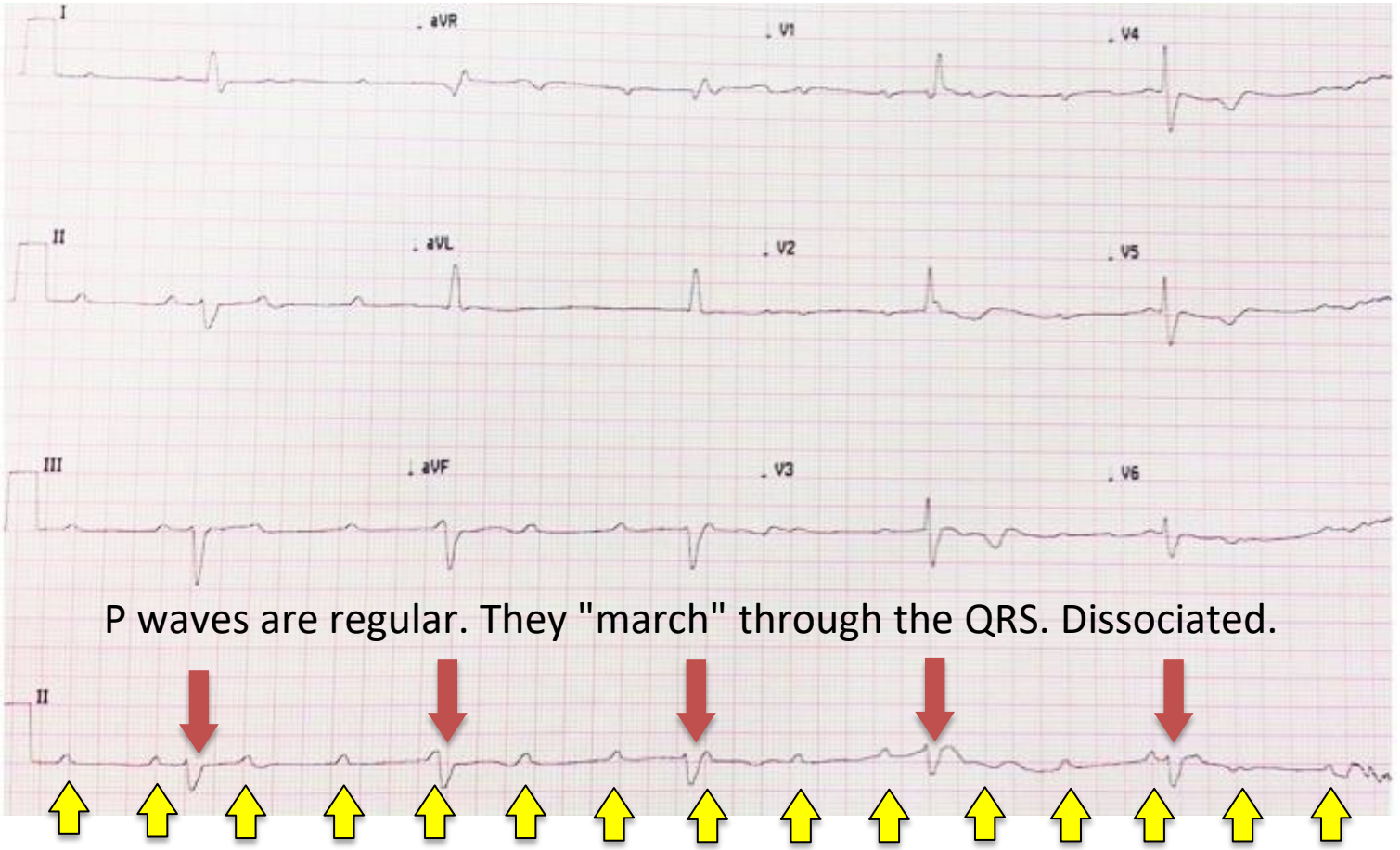


2nd degree AV block (Mobitz type II)

A serious arrhythmia. Might progress to complete AV block.

Pacing required.

The Slow Heart



3rd degree (complete) AV block.

This requires urgent temporary pacing.

The Accessory Pathway

Accessory pathway in this context is ***not*** exclusive to WPW.

Activation starts at atrial level, then propagates through to activate both ventricles through the AV node.

Bundle branch blocks

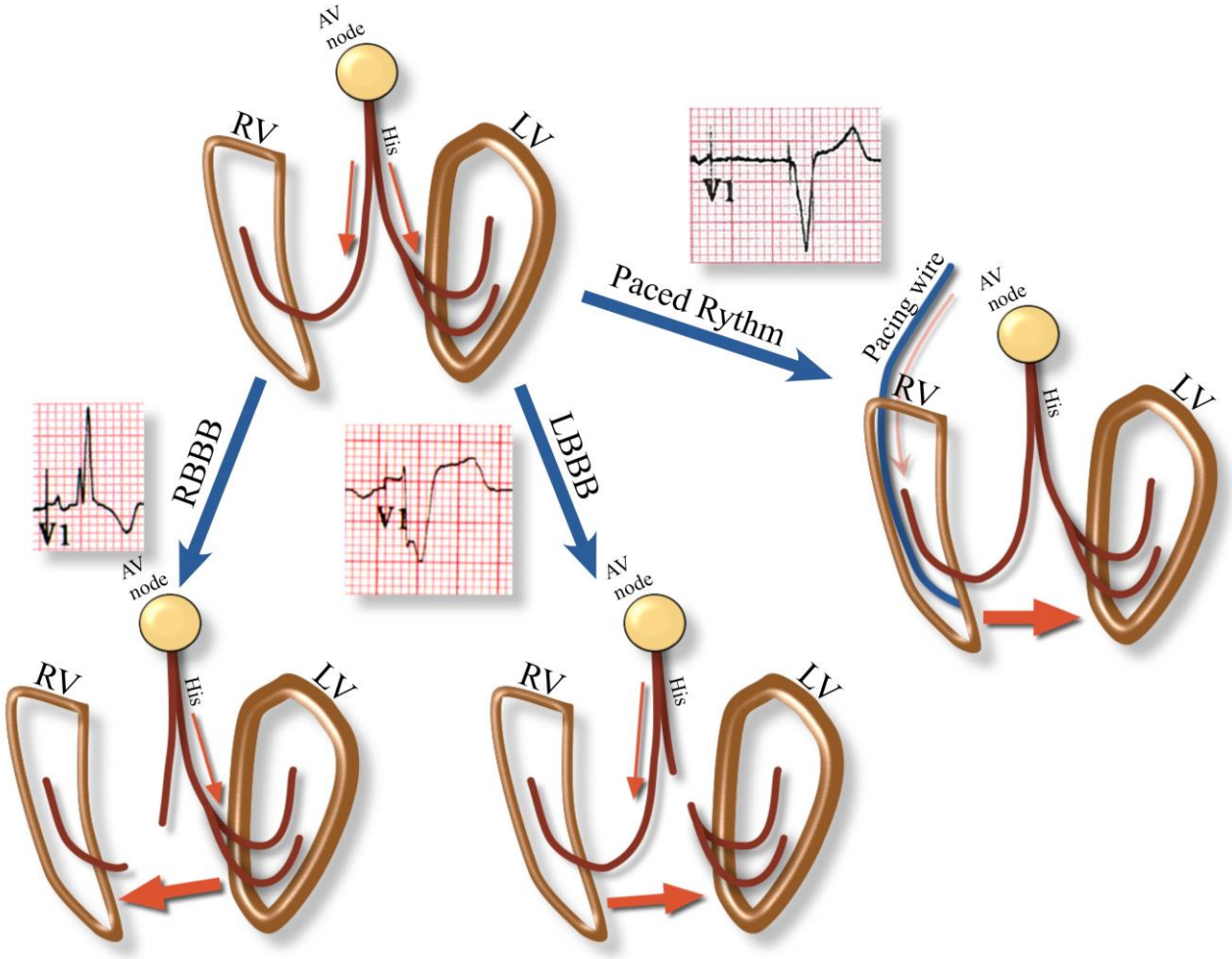
Ventricular pacing

Pre-excitation (e.g. WPW)

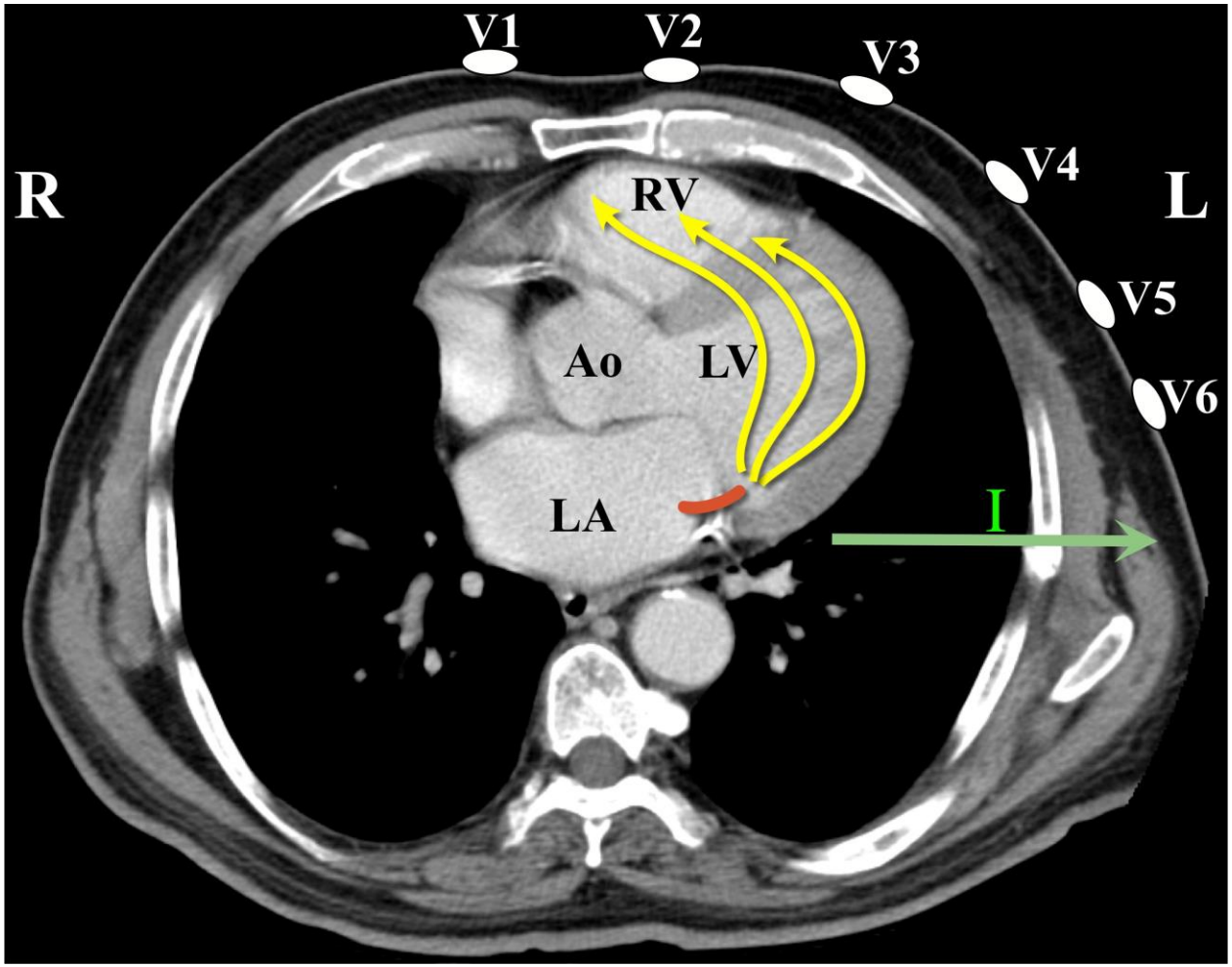
All share one mechanism...

One chamber activates the other.

The Accessory Pathway

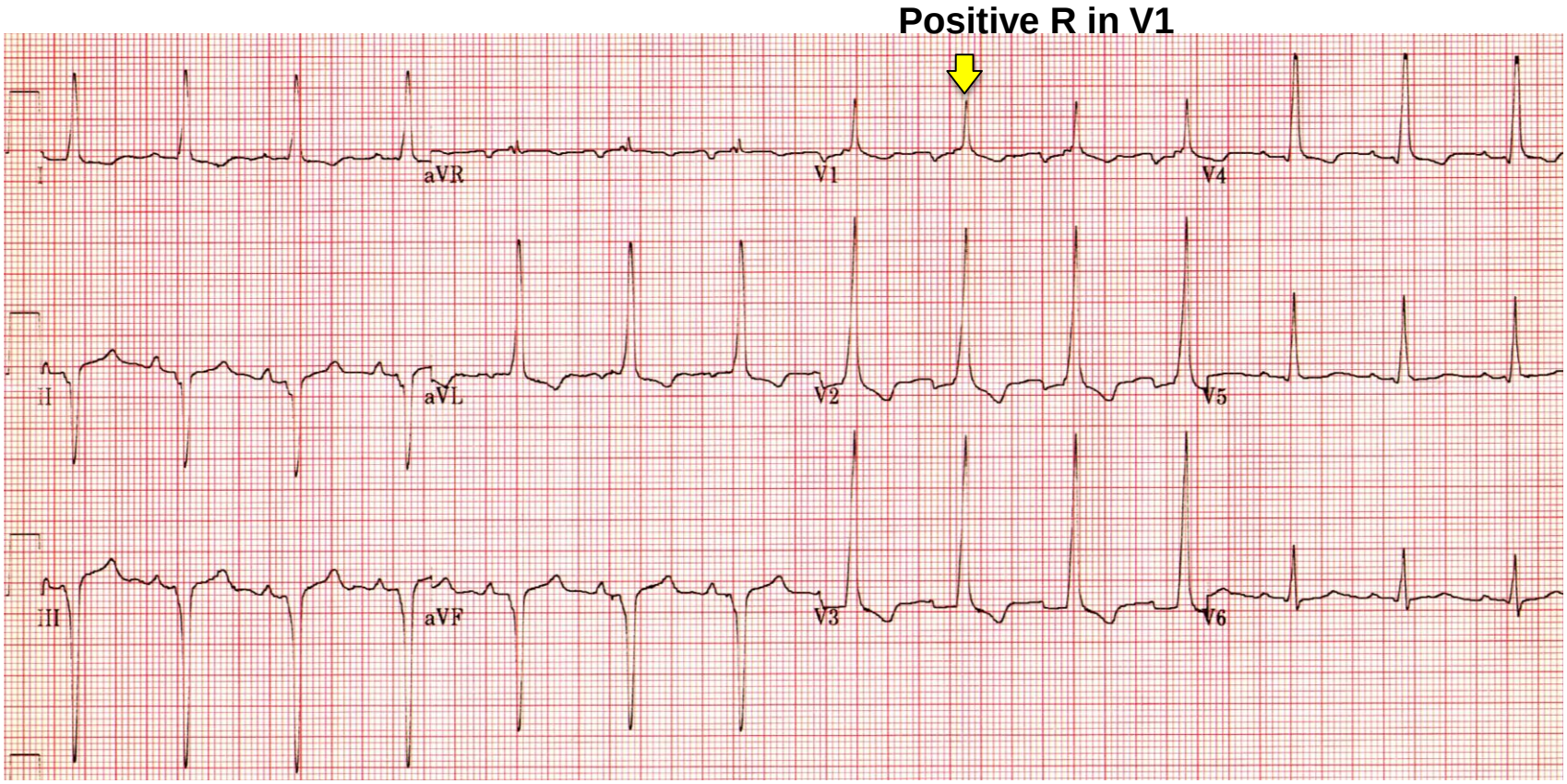


The Accessory Pathway



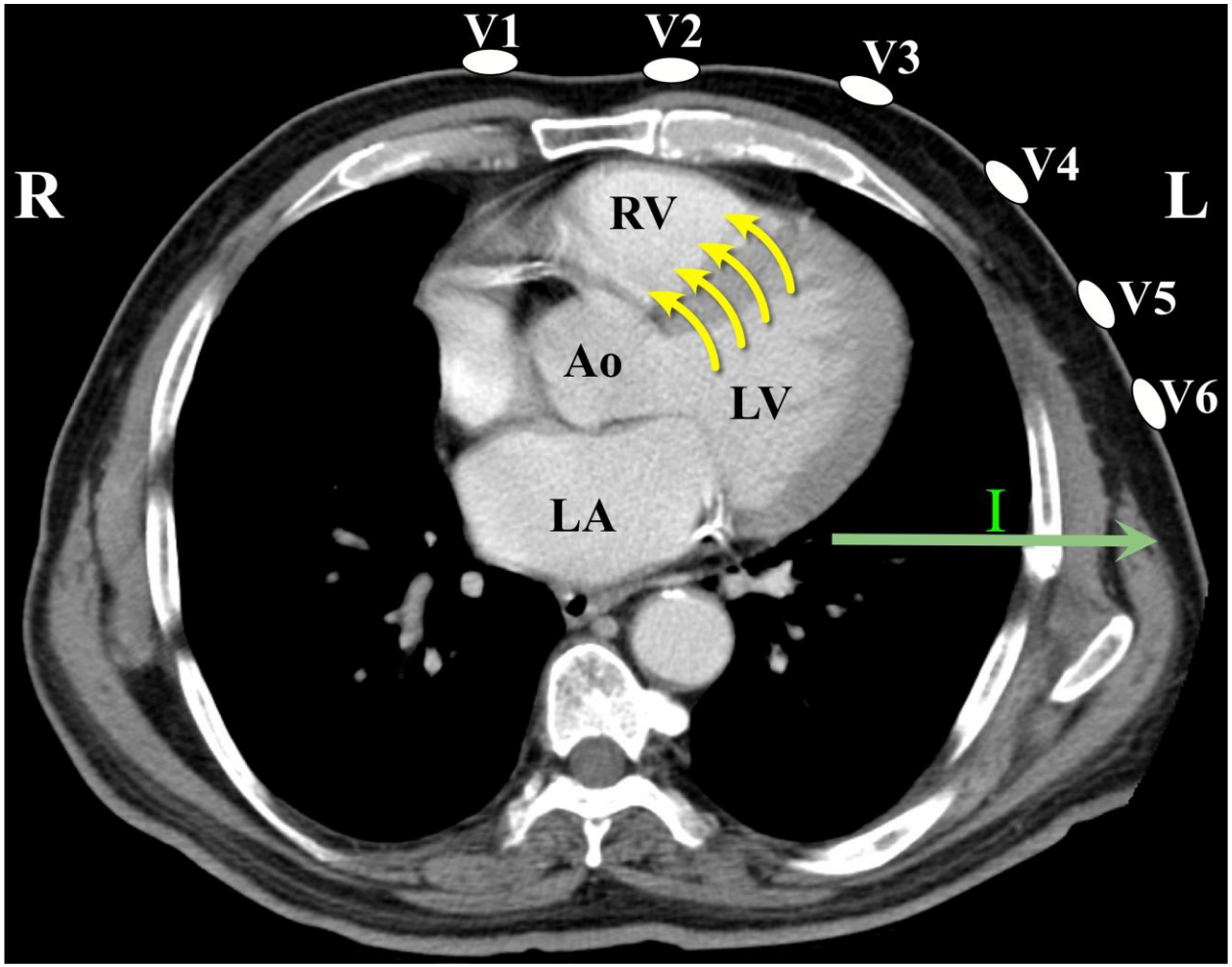
Left Accessory Pathway (WPW)

The Accessory Pathway



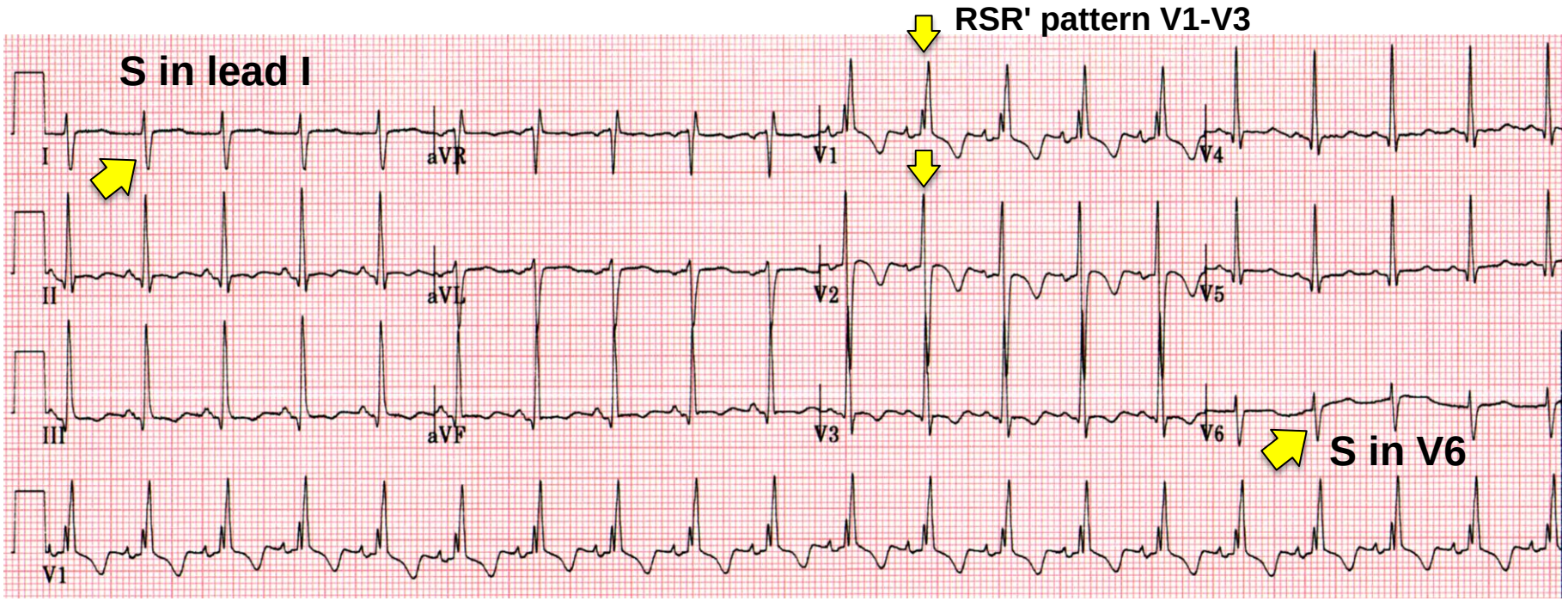
Left Accessory Pathway (WPW)

The Accessory Pathway



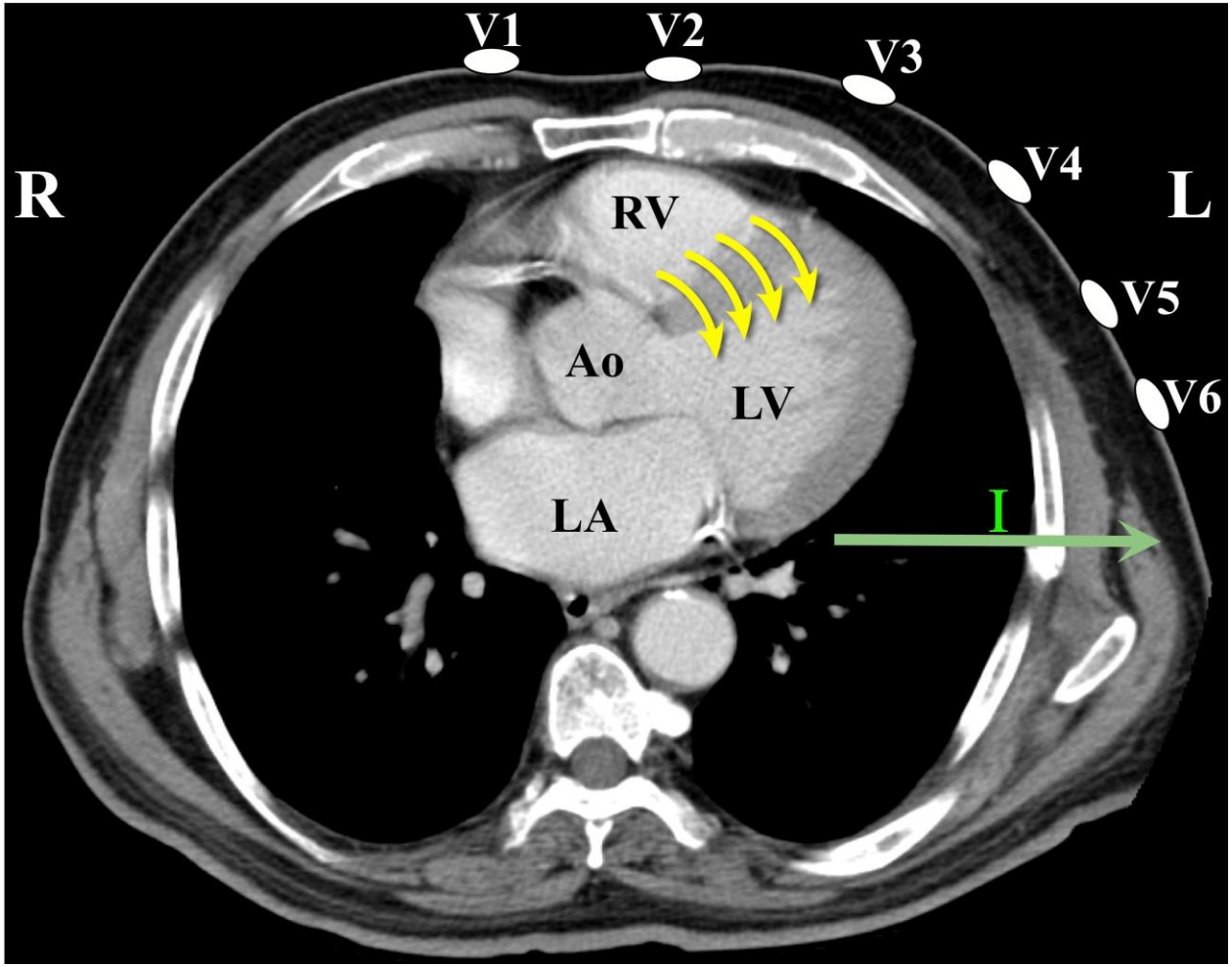
RBBB (LV activates RV)

The Accessory Pathway



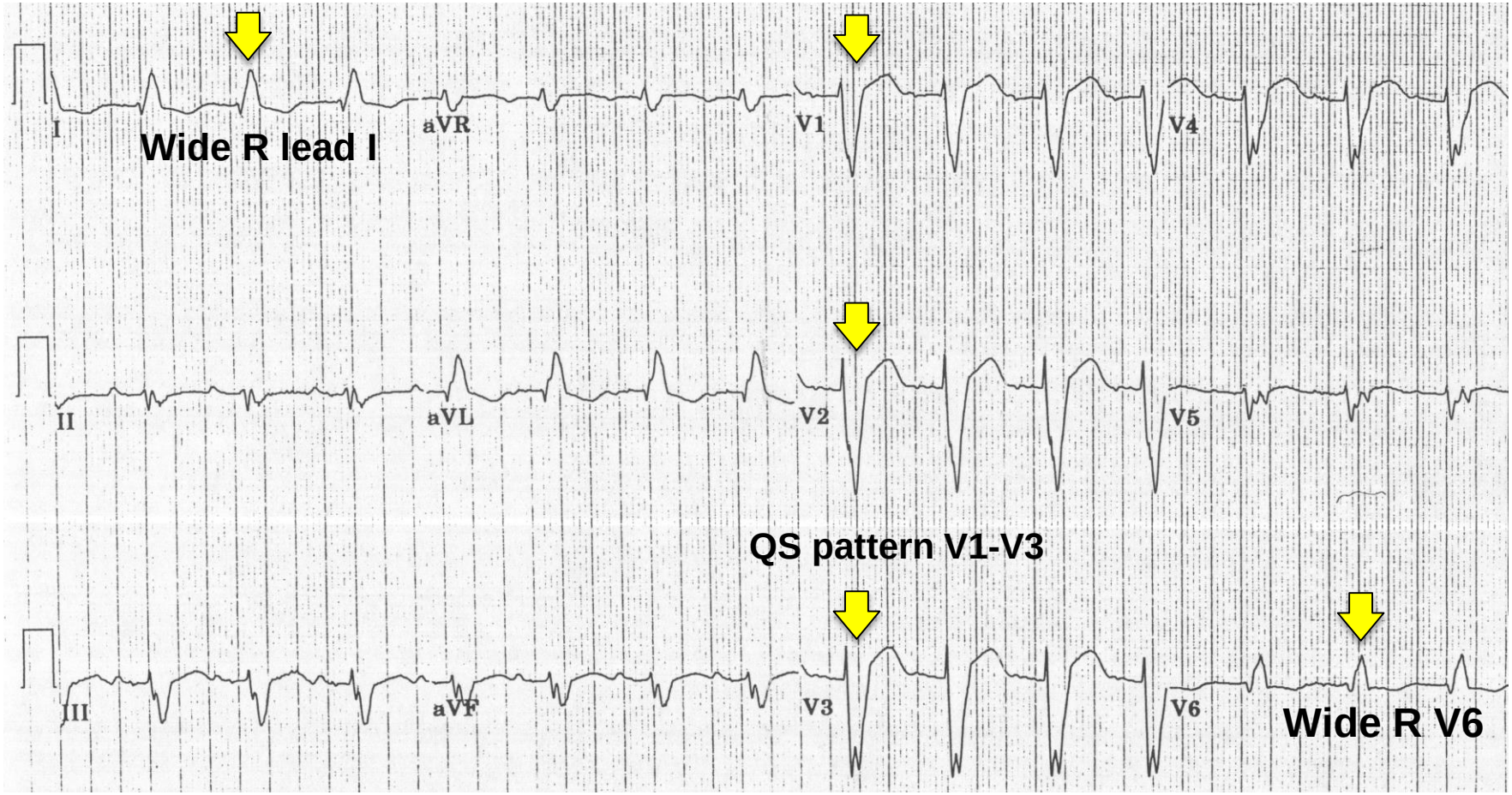
RBBB (LV activates RV)

The Accessory Pathway



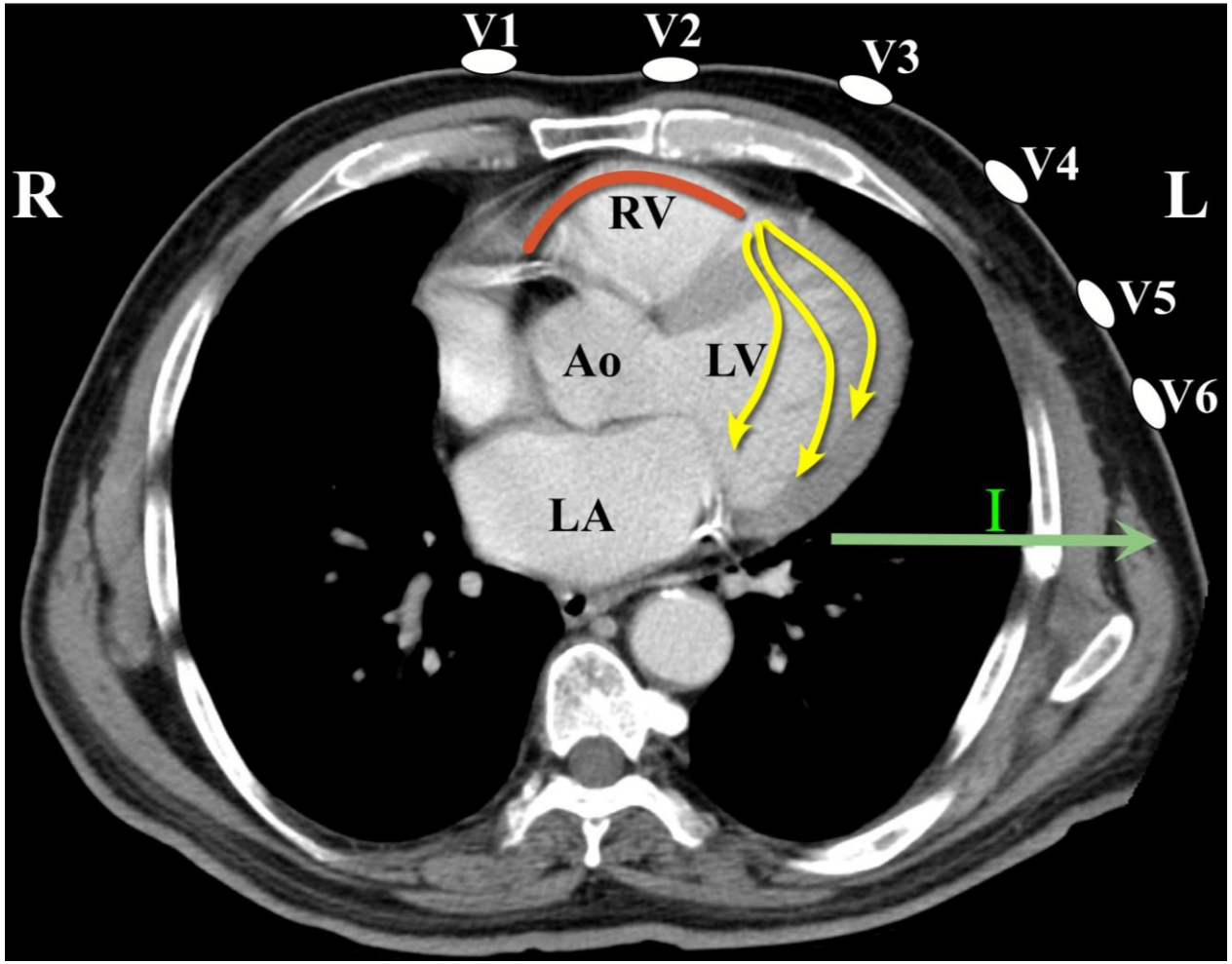
LBBB (RV activates LV)

The Accessory Pathway



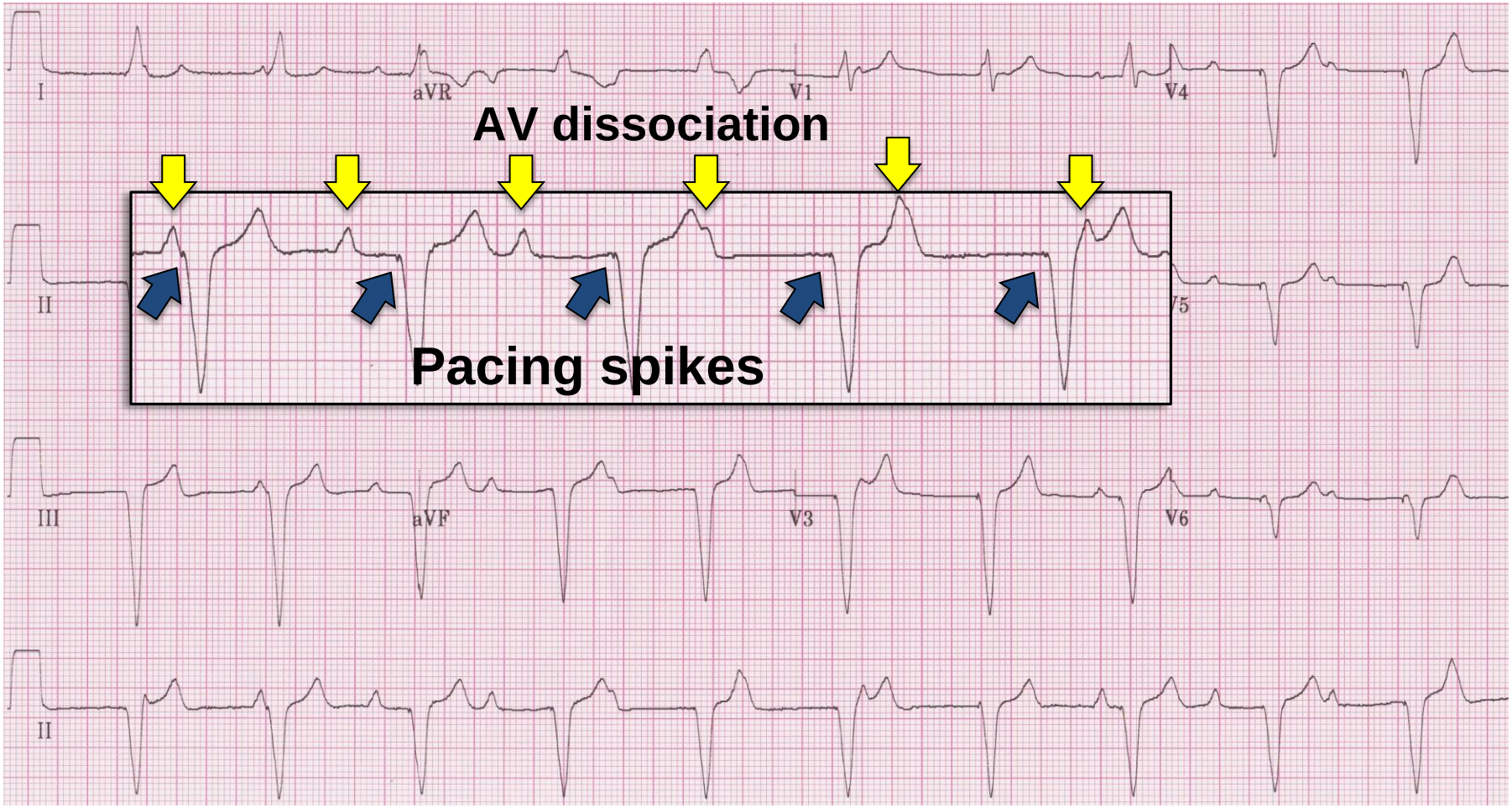
LBBB (RV activates LV)

The Accessory Pathway



RV pacing (RV activates LV)

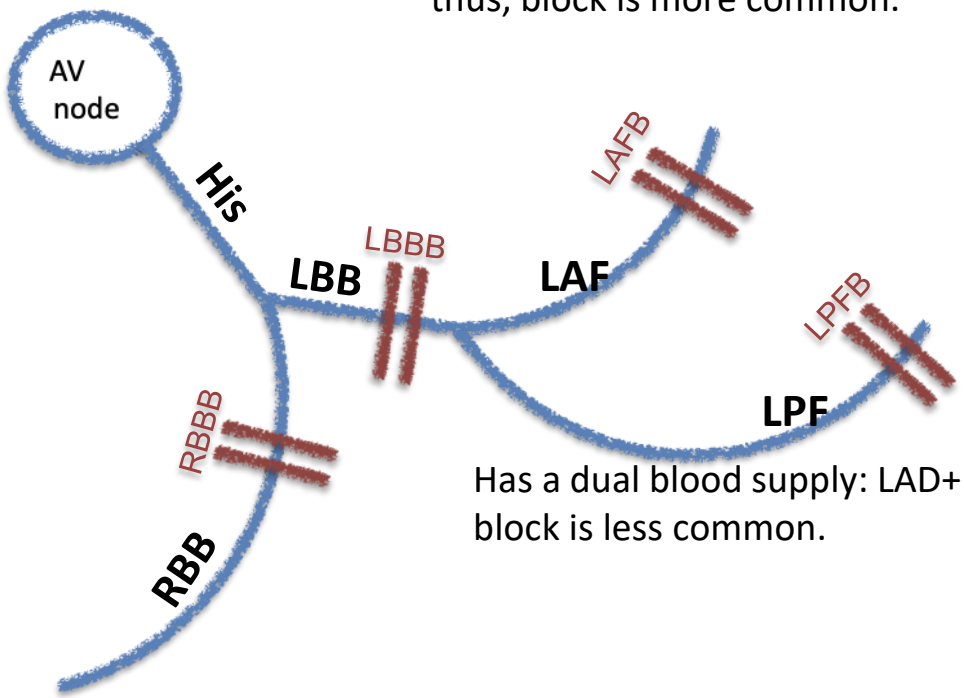
The Accessory Pathway



RV pacing (RV activates LV)

Fascicular Blocks

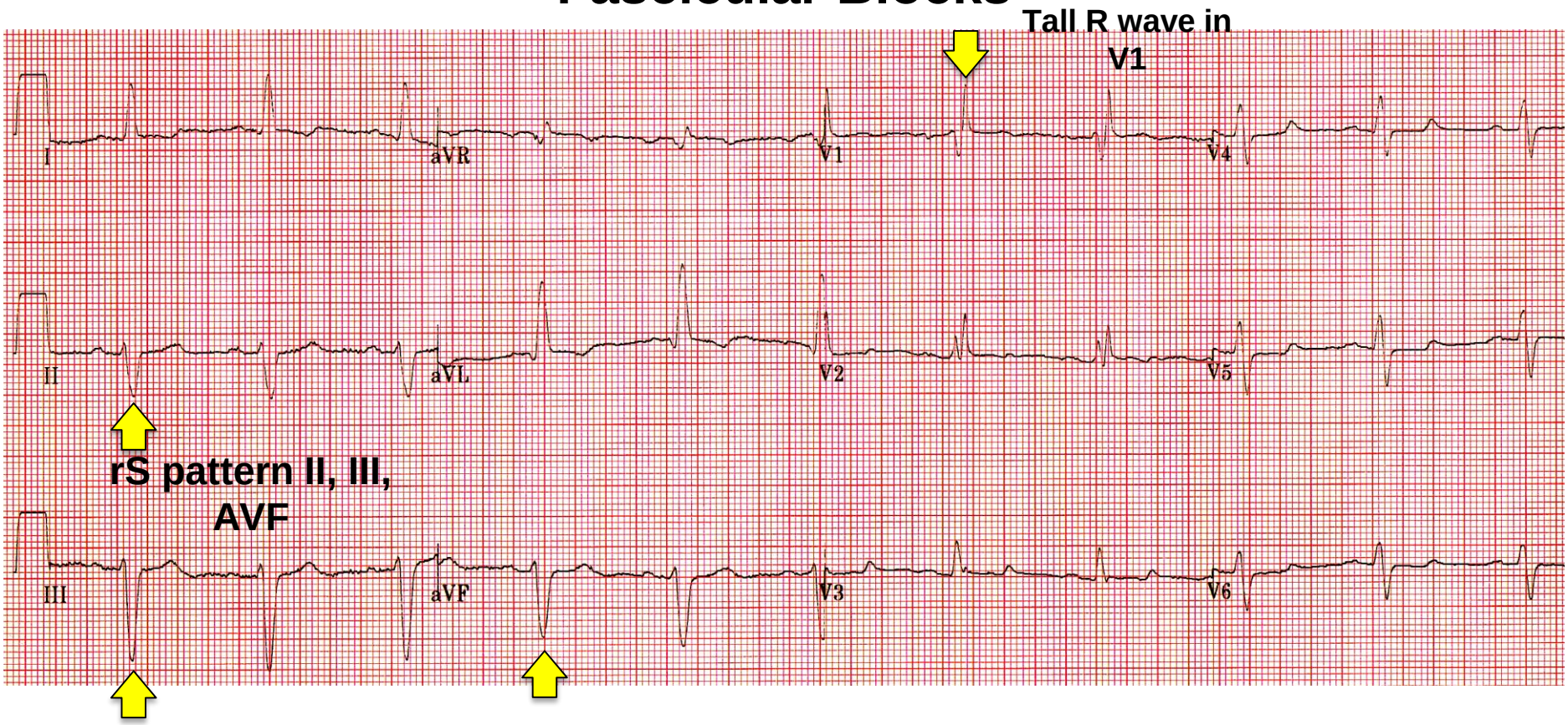
Has a single blood supply: LAD
thus, block is more common.



Has a dual blood supply: LAD+LCx
block is less common.

RBB has no branches

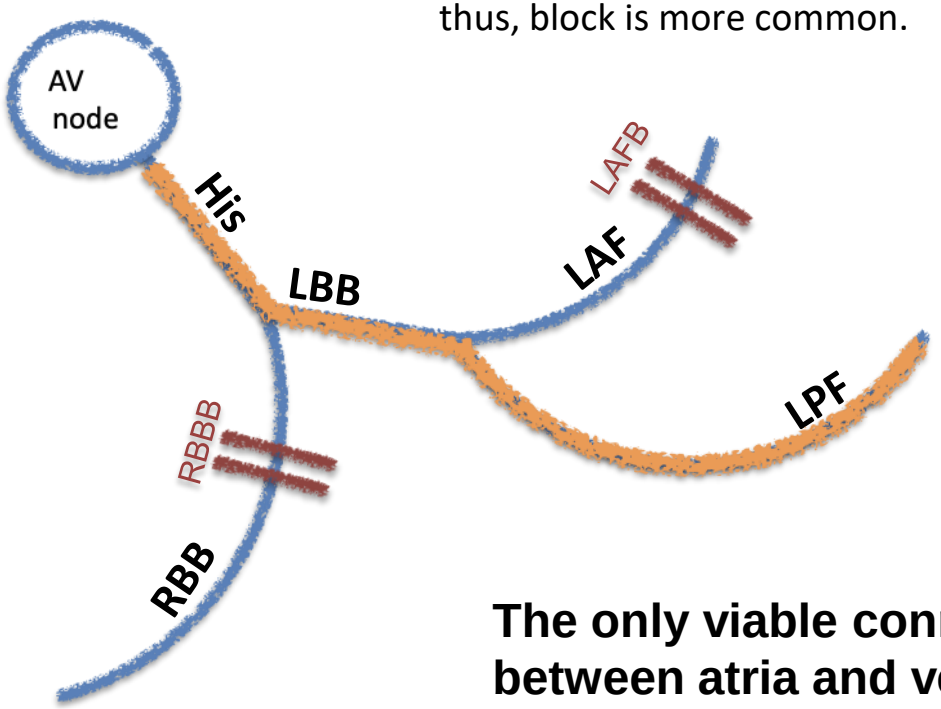
Fascicular Blocks



RBBB+LAFB = Bifascicular Block

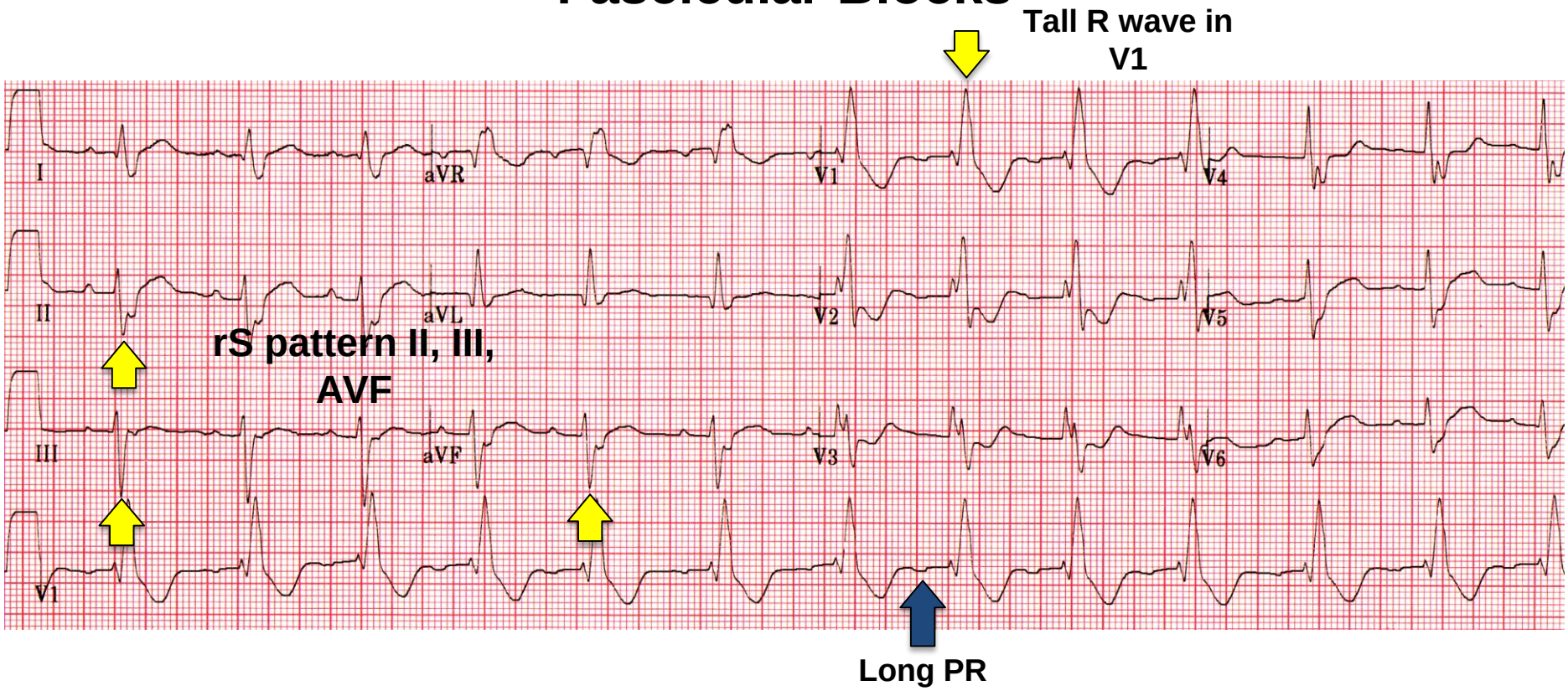
Bifascicular Block

Has a single blood supply: LAD
thus, block is more common.



The only viable connection between atria and ventricles is the LPF

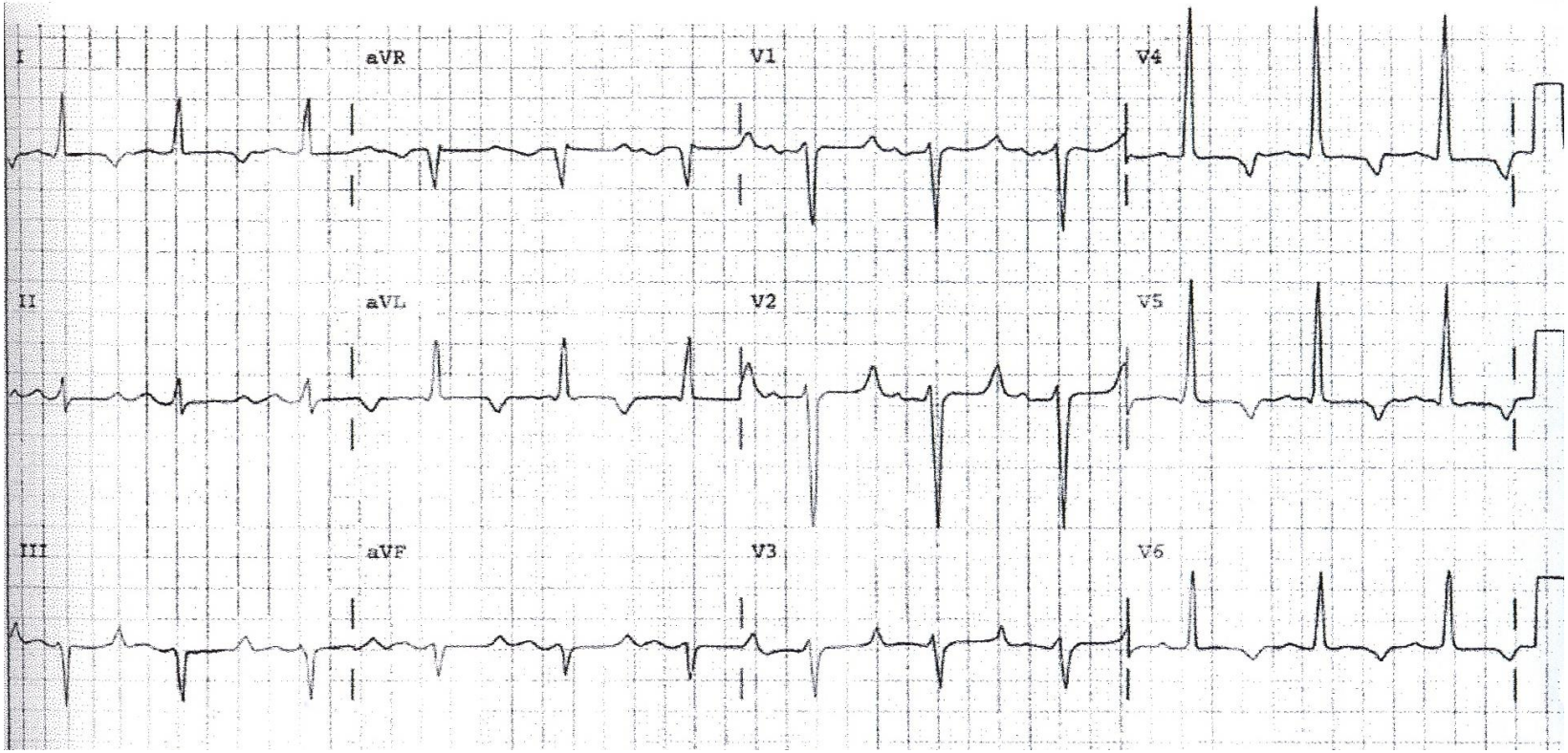
Fascicular Blocks



Long PR+RBBB+LAFB = Trifascicular Block

If newly discovered with history of syncope, then permanent pacing is essential.

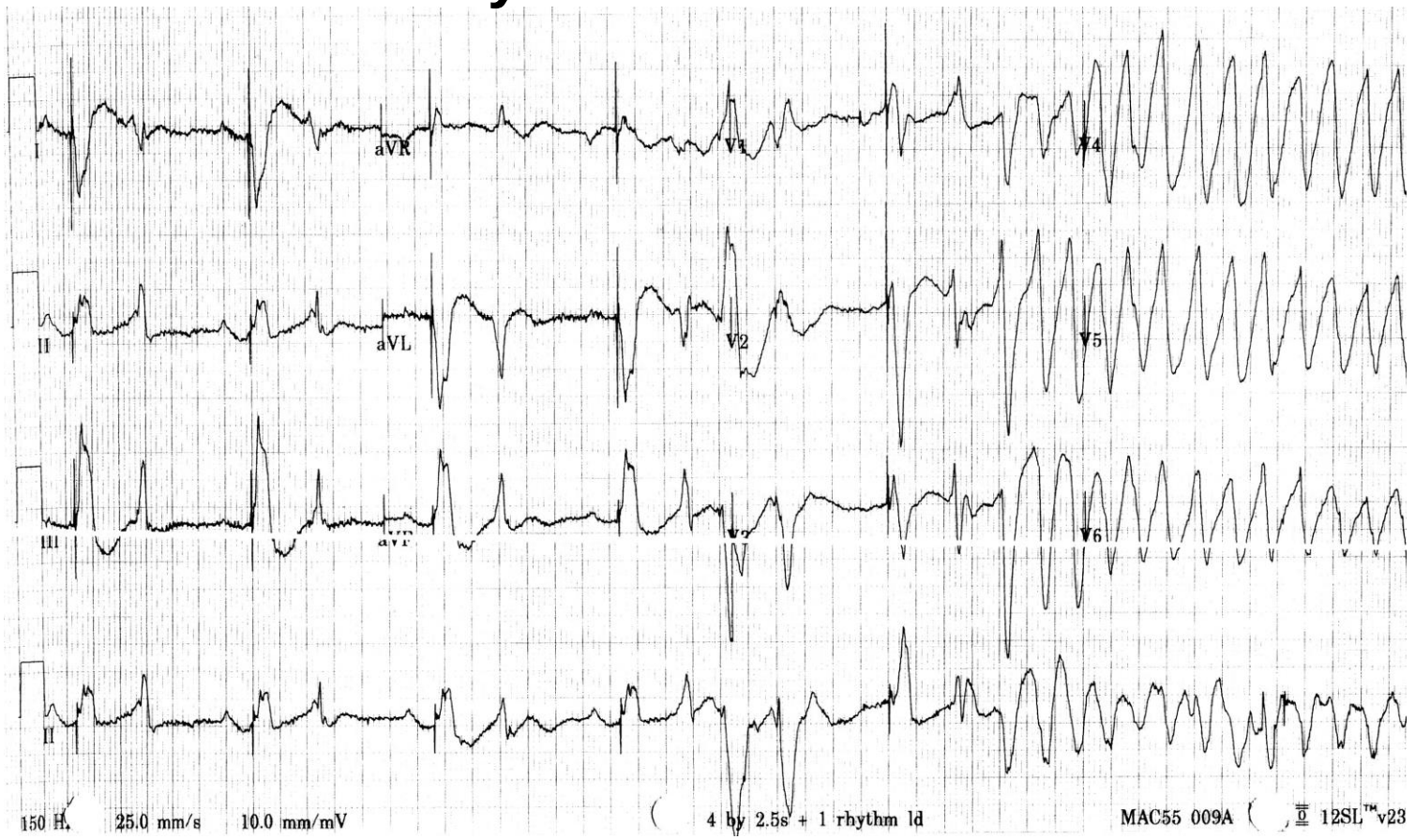
Electrolytes and Miscellaneous



Prolonged QT interval.

Know the 5 hypo sisters.

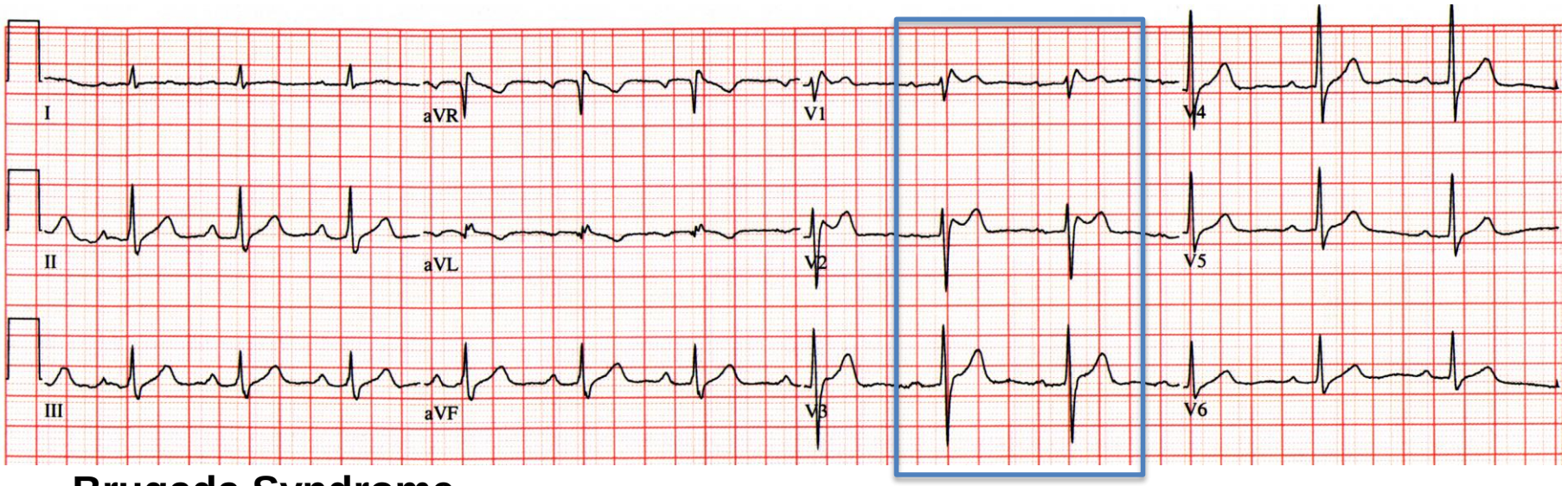
Electrolytes and Miscellaneous



Torsade de Pointes

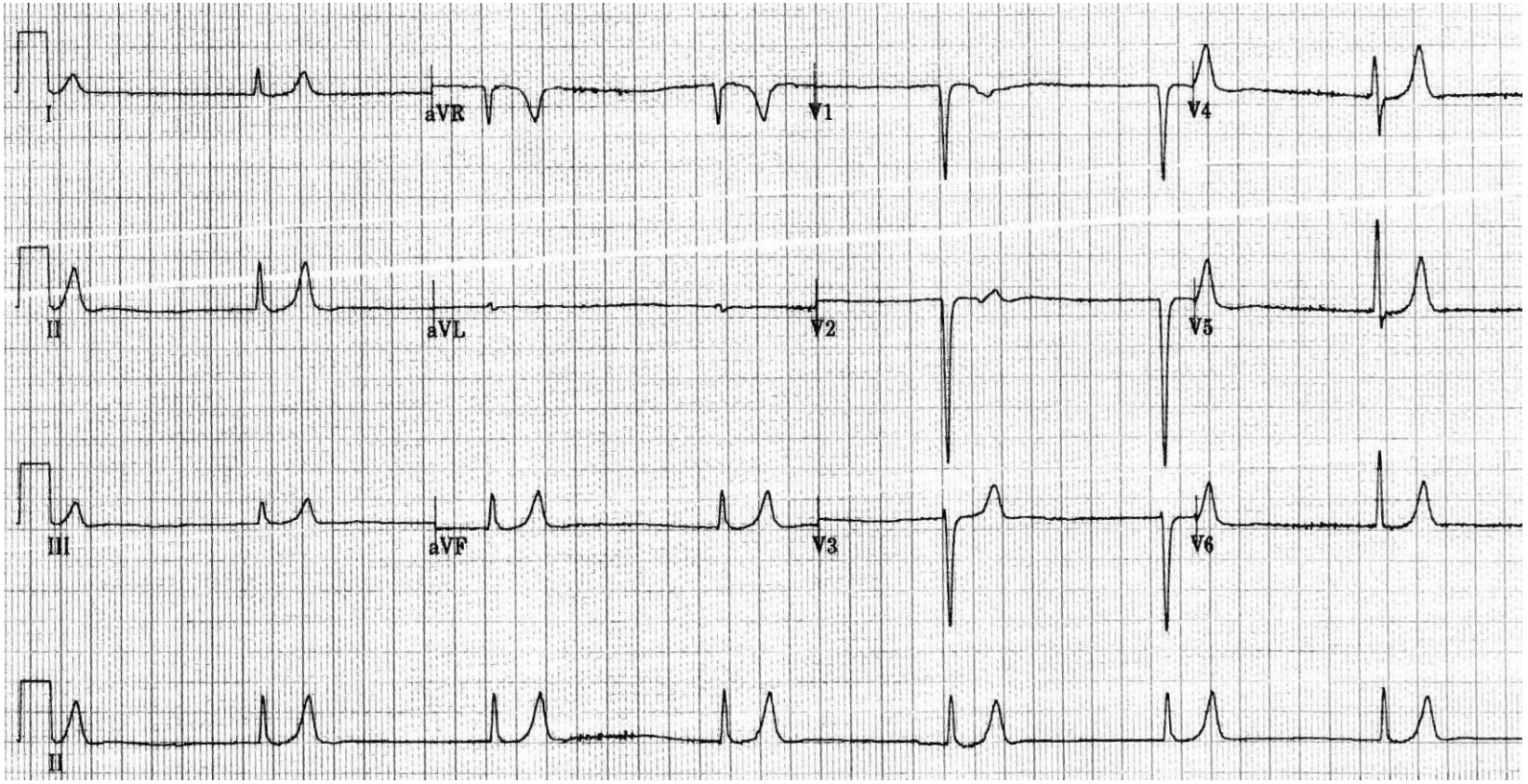
Polymorphic VT secondary to long QT interval

Electrolytes and Miscellaneous



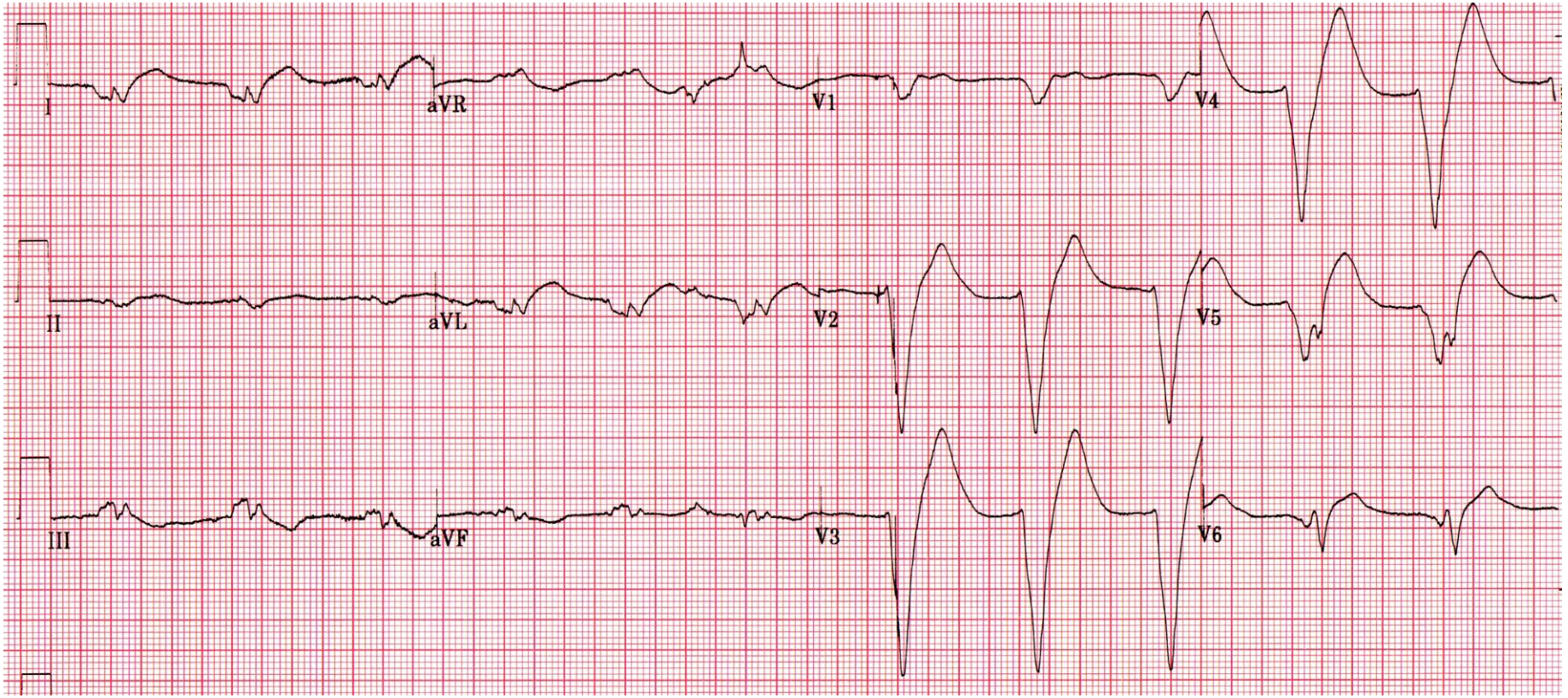
Brugada Syndrome

Electrolytes and Miscellaneous



Hyperkalemia

Electrolytes and Miscellaneous



Accelerated idioventricular rhythm

Well. That's it!

I wish you all the best. If you have any queries...

Please contact me.

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