

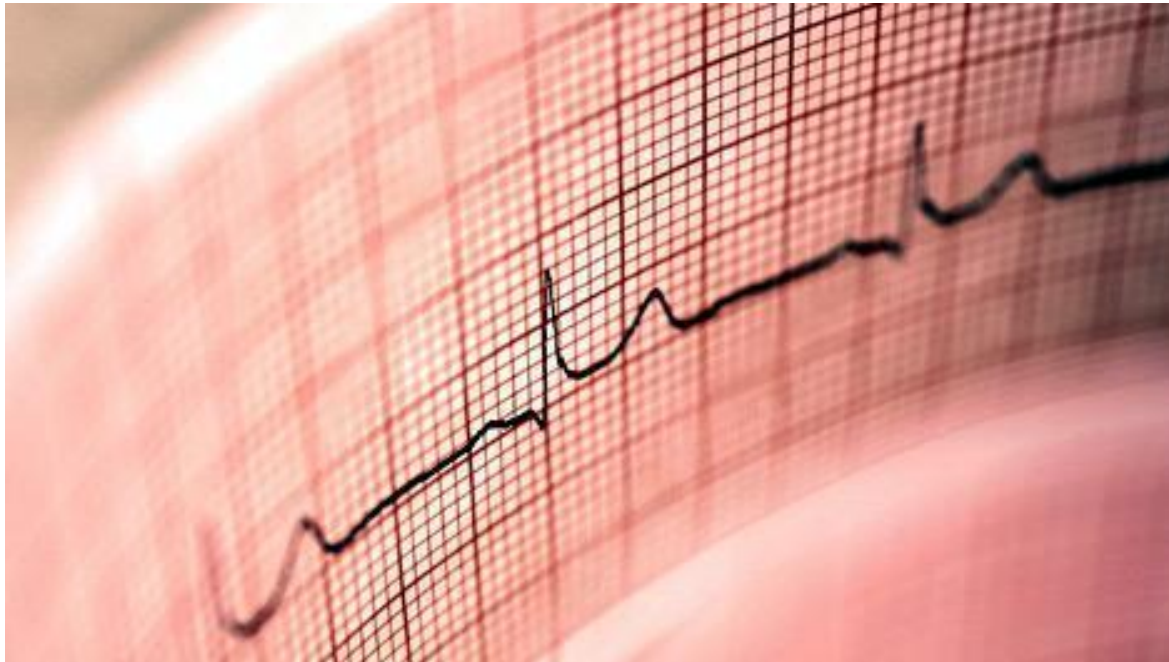
SIMPLY... ECGs

Dr William Dooley



Content

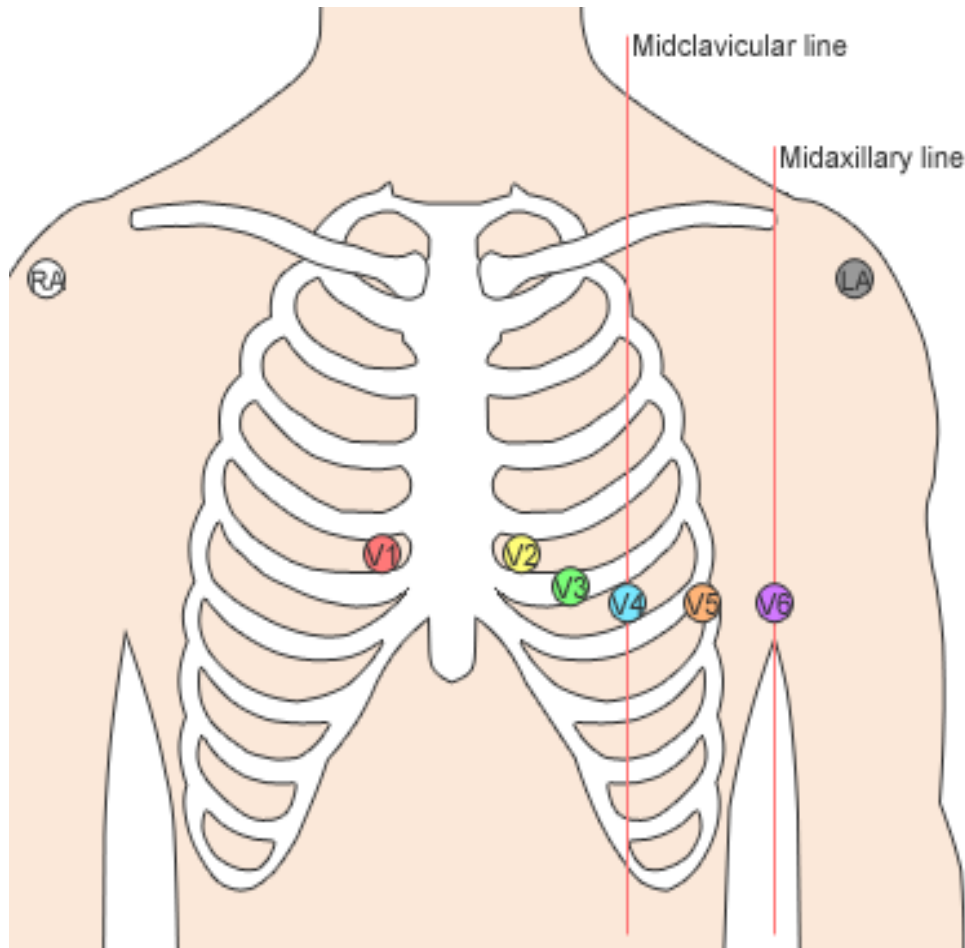
- Basic ECG interpretation pattern
- Some common (examined) abnormalities
- Presenting ECGs in context



Setting up an ECG



Setting up an ECG



- ① **V1**- 4th Right intercostal space at sternal border
- ② **V2**- 4th Left intercostal space at sternal border
- ③ **V4**- 5th Left intercostal space in mid-clavicular line
- ④ **V3**- Halfway between V2 and V4
- ⑤ **V6**- Mid-axillary line at same horizontal plane as V4
- ⑥ **V5**- Placed between V4 and V6

Basic Interpretation and Presentation

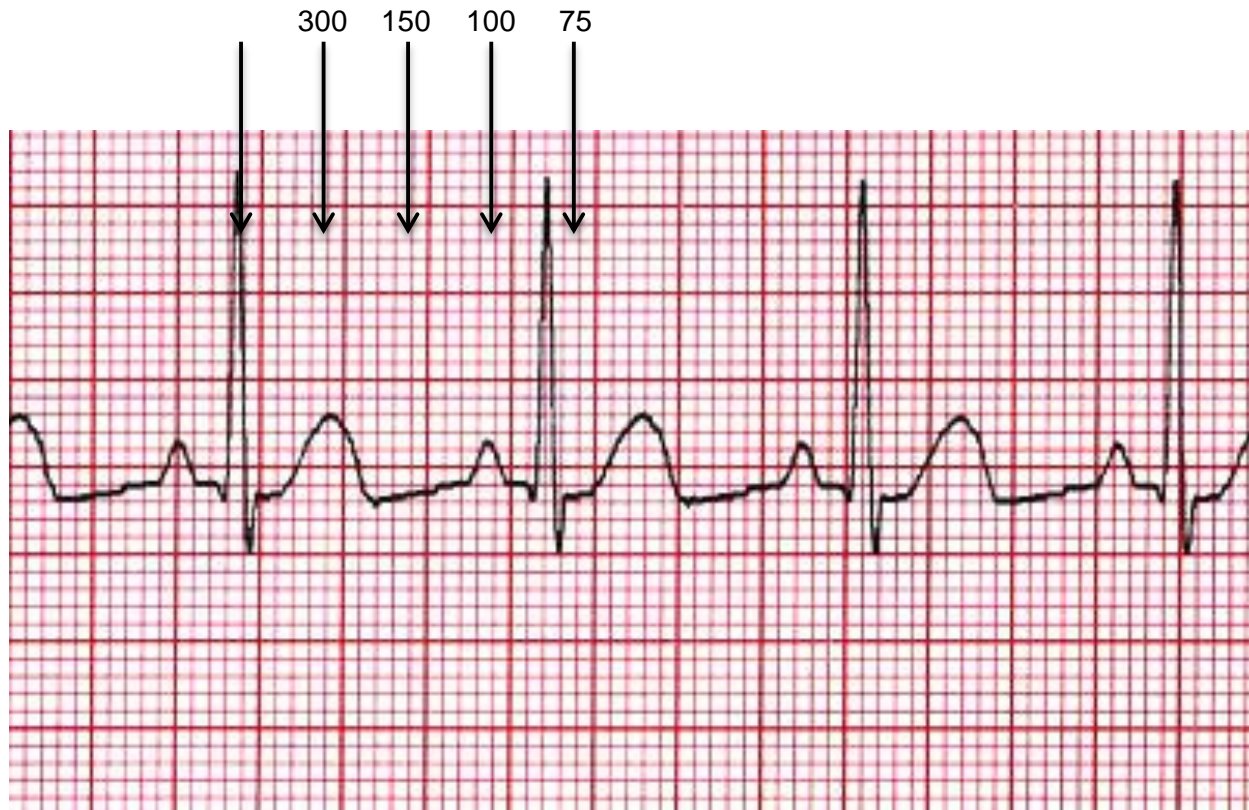
1. What/When: “Electrocardiogram” on Date and Time
2. Who/Why: Patient name with Age / Presenting Complaint
3. +/- Main abnormality
4. Structured approach:
 - Rate
 - Rhythm
 - Axis
 - P Waves/PR Interval
 - QRS Complex
 - ST segment
 - T Waves/QT Interval
5. Summary, then...

Investigation
Management



Rate

300 / R to R Interval (Big squares)



1 = 300

2 = 150

3 = 100

4 = 75

5 = 60

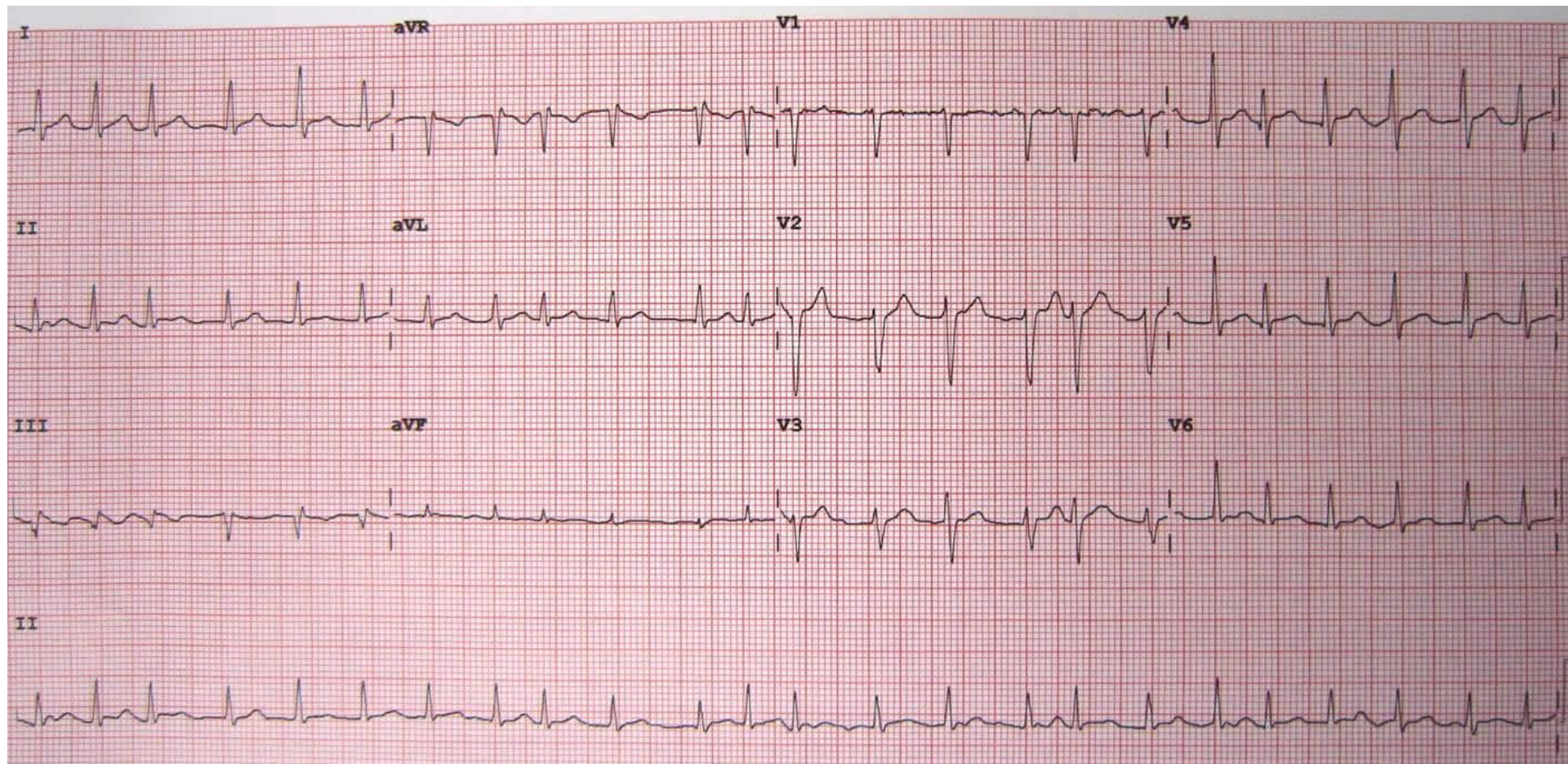
6 = 50

Normal rate is 60-99 bpm

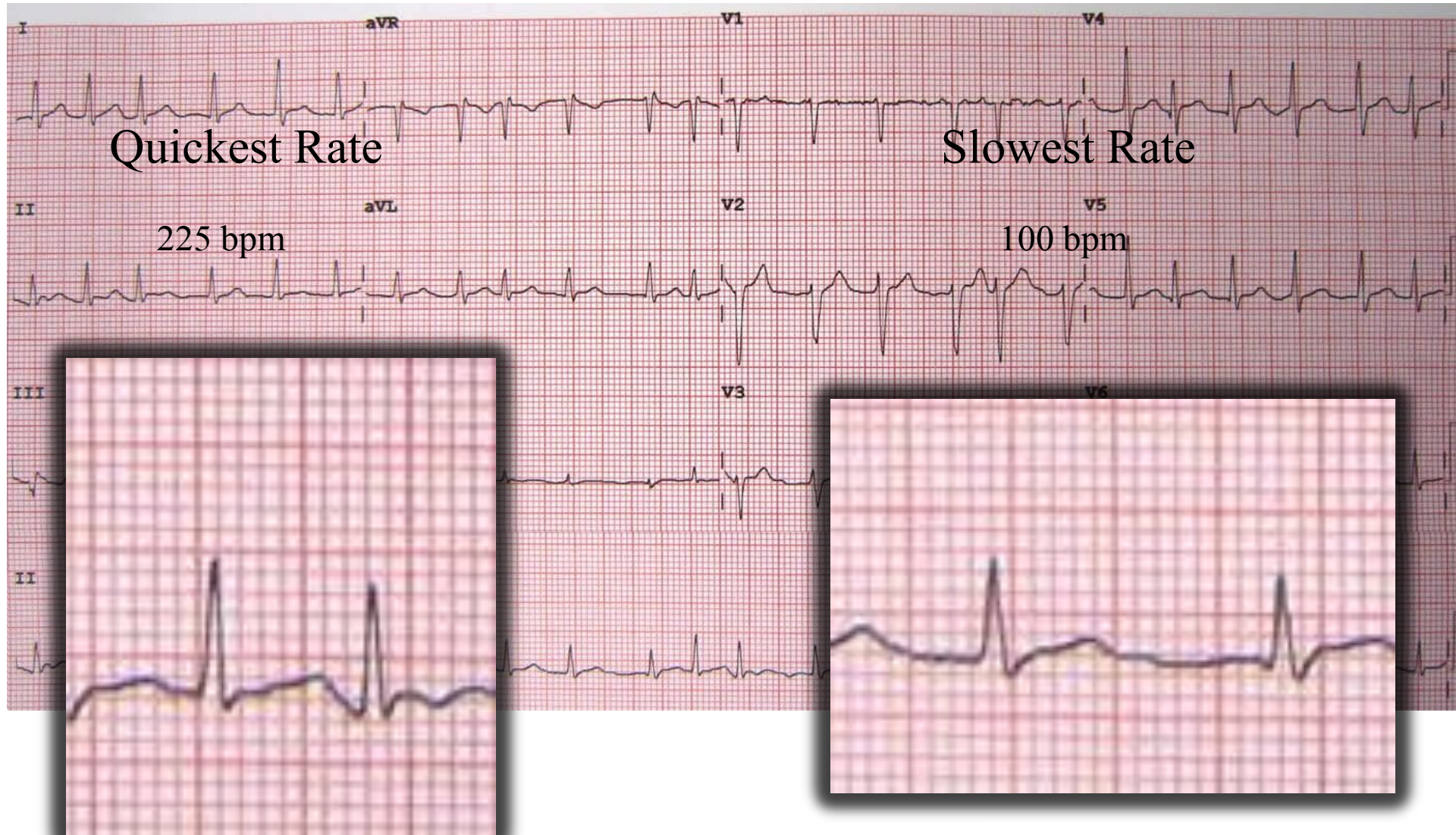
- Bradycardia: Rate is <60
- Tachycardia: Rate is >99 bpm

What is the rate?

80bpm



Regular/Irregular?
What is the rate?

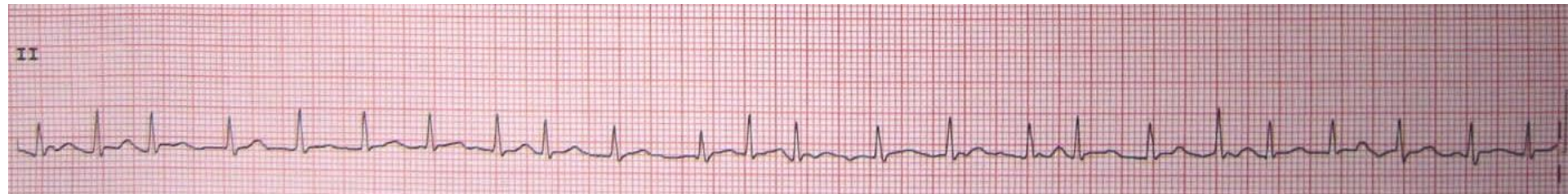


Regular/Irregular?
What is the rate?

Count up all the QRS complexes x 6 (*on standard ECG Paper*)

A standard ECG strip records 10 seconds

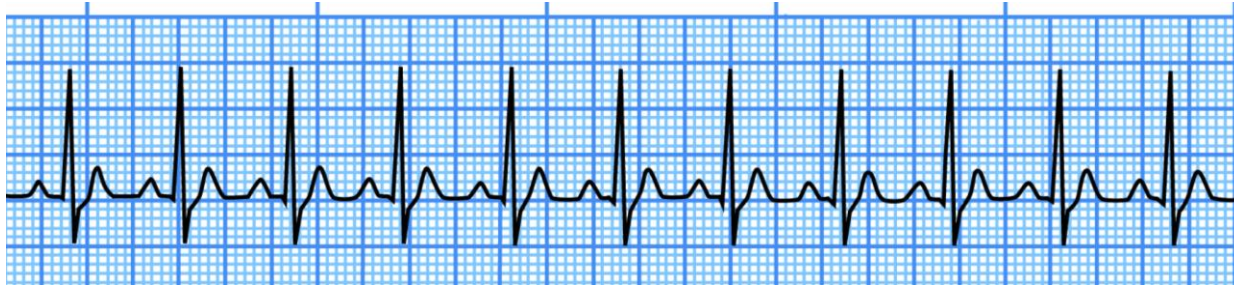
So this will give the rate over 1 minute



Count QRS = 25

$25 \times 6 = 150$ bpm

Step 2: Rhythm



Regular/Irregular?
What is the rhythm?

Step 2: Rhythm

Normal Sinus Rhythm



P wave is followed by QRS
P-R interval is 120-200ms
P-R interval is constant
Rate between 60-99bpm

P wave is followed by QRS
P-R interval is 120-200ms
P-R interval is constant
Rate 100bpm or more



Sinus tachycardia

Atrial Fibrillation



No P waves
Irregularly irregular
Variable R-R intervals

Narrow complex tachy
Regular P waves (300bpm)
Flutter waves (most in II/III/aVF)



Atrial Flutter

Regular/Irregular?
What is the rhythm?

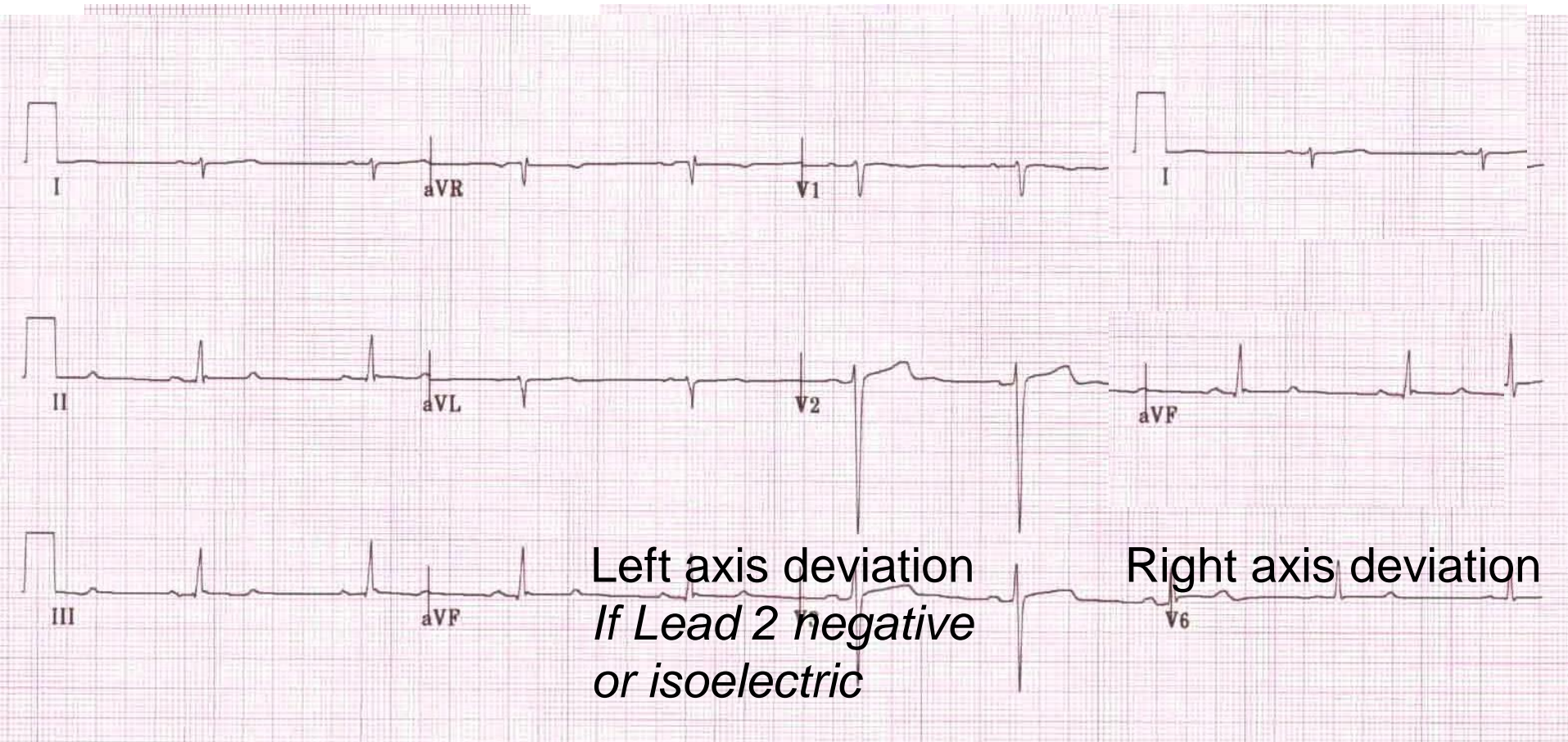
Step 3: Axis

Leads I and aVF

Normal

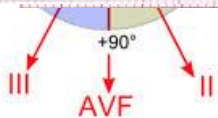
Leaving

Returning



Left axis deviation
*If Lead 2 negative
or isoelectric*

Right axis deviation



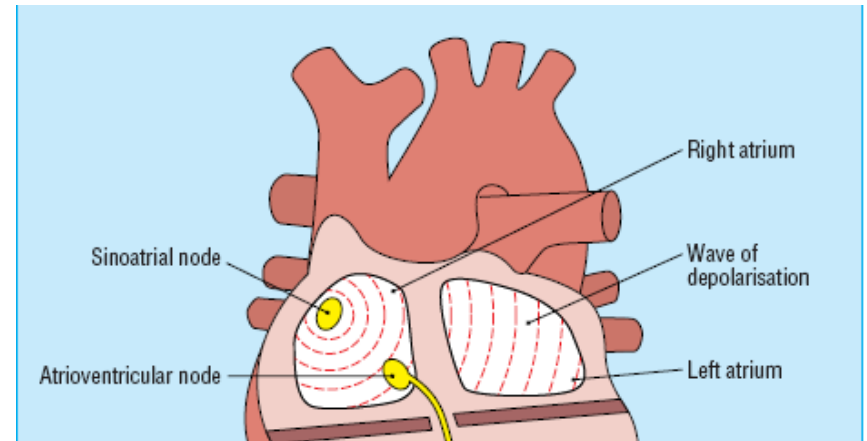
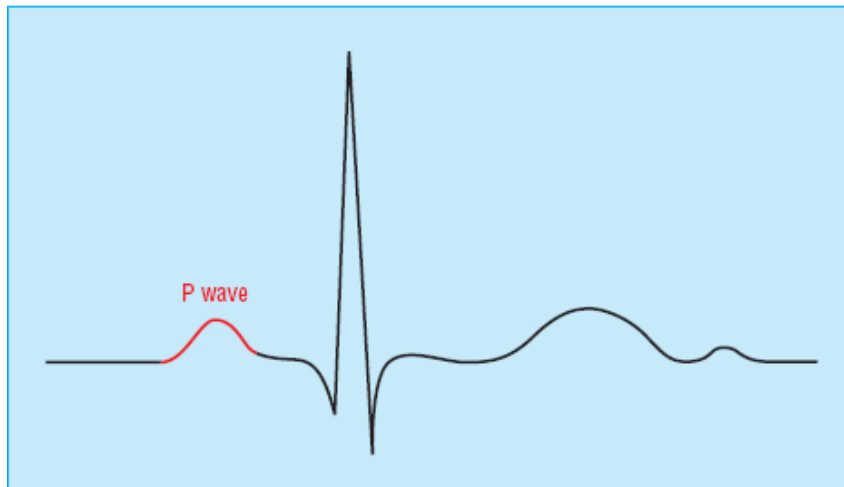
Step 4: P Waves and PR Interval

P wave: Atrial Depolarization.

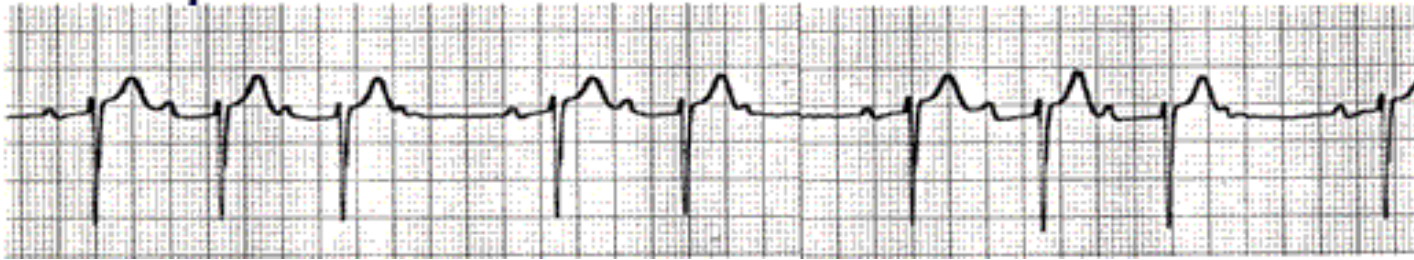
- <3 small squares in duration (120 ms)

PR Interval = Start of P to start of QRS

- <5 squares (200 ms)



What degree of heart block are these?



2nd Degree (Mobitz Type 1) AKA: Wenckebach

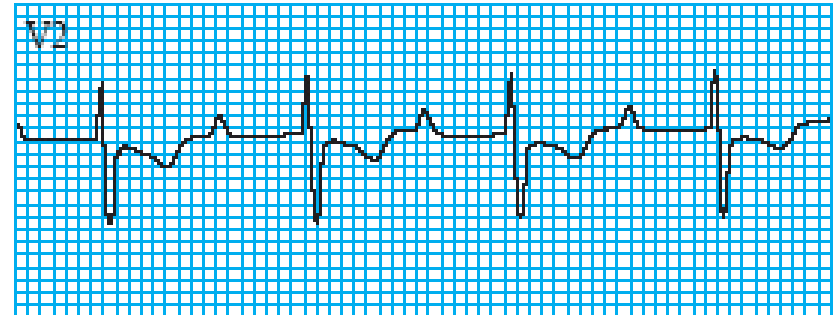


1st Degree



3rd Degree / complete

Heart Block

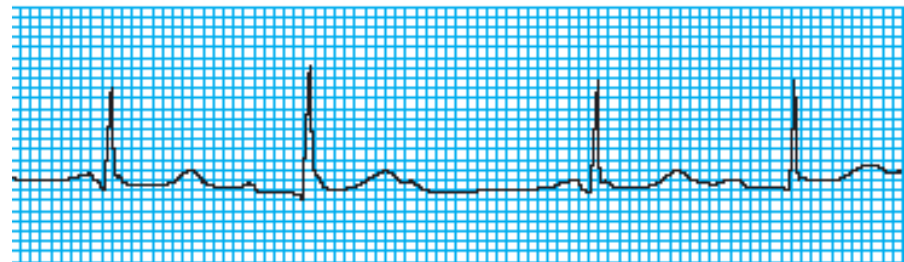


1st Degree

- PR Interval fixed and >5 small squares (200ms)

2nd Degree (Mobitz Type 1) aka: Wenckebach

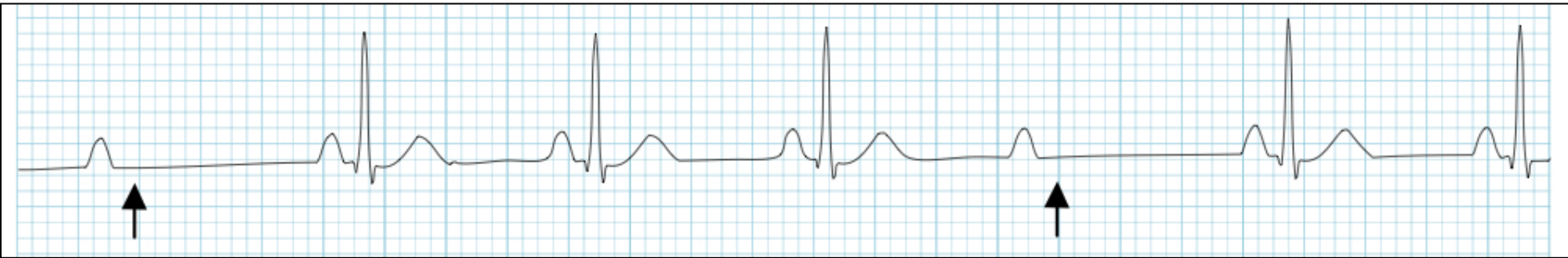
- Progressive lengthening of PR interval
- Then dropped QRS complex
- Cycle starts again



Heart Block

2nd Degree (Mobitz 2)

- PR Interval is constant
- QRS complex dropped

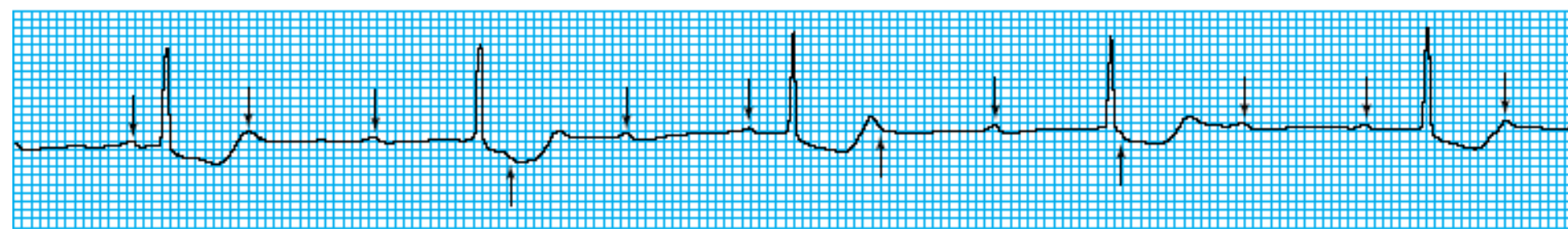


Need longer rhythm strip to see if there is a fixed order block e.g. 3:1 block

Heart Block

3rd Degree Block (or complete heart block)

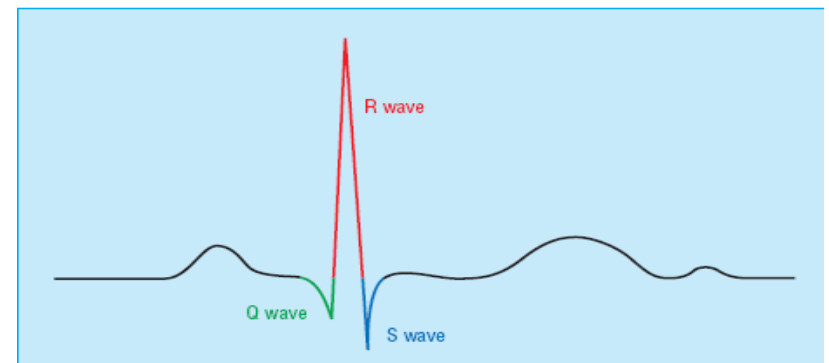
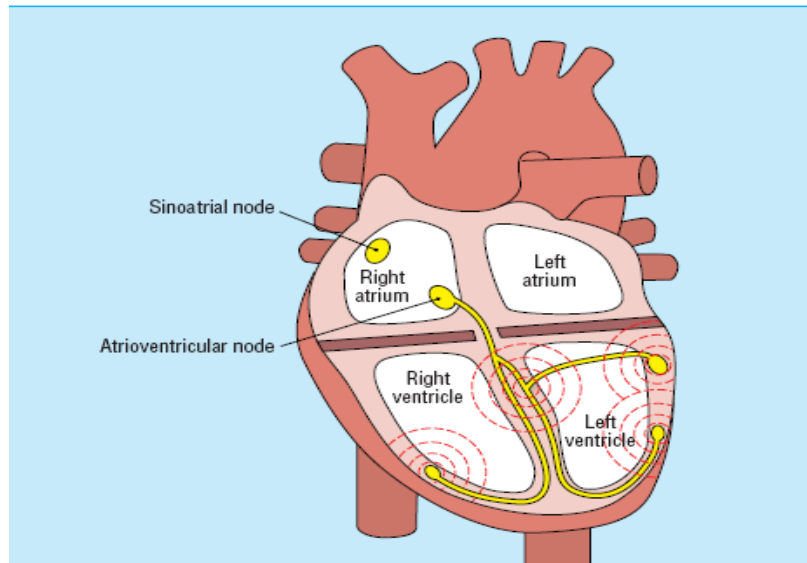
- No relation between P waves and QRS complexes
- QRS rate usually less than P rate



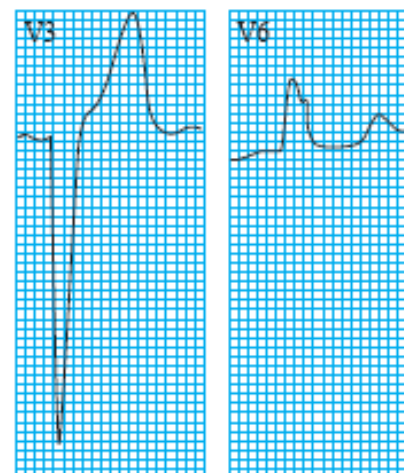
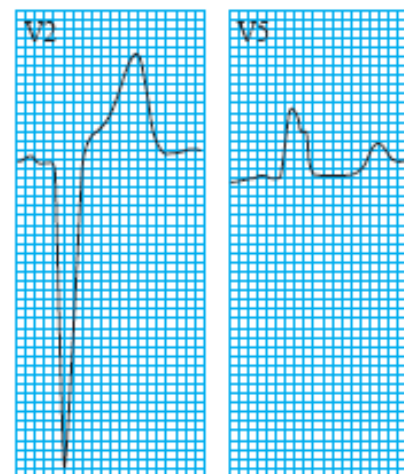
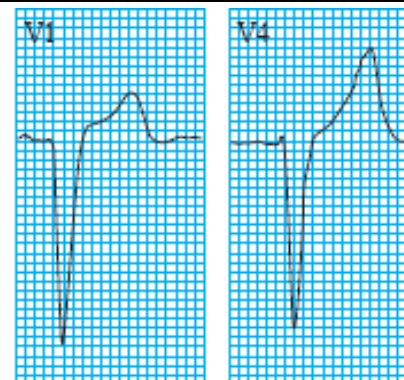
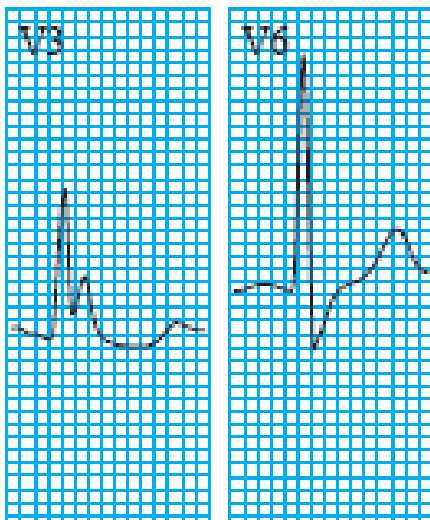
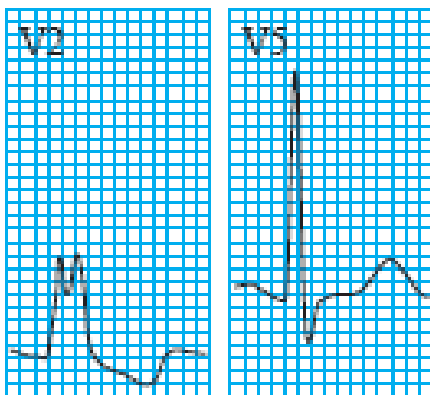
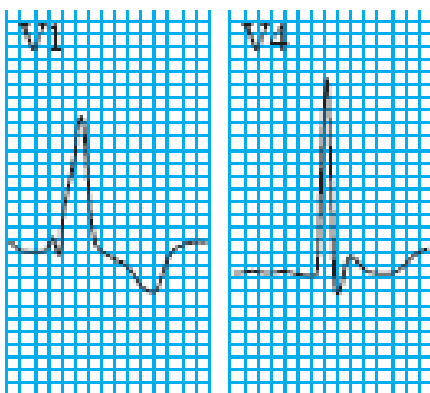
Step 5: QRS Complex

Ventricular Depolarization

- <3 small squares (120ms)



Which type of bundle branch block are these?





vs.



 **SIMPLY**
FINALS

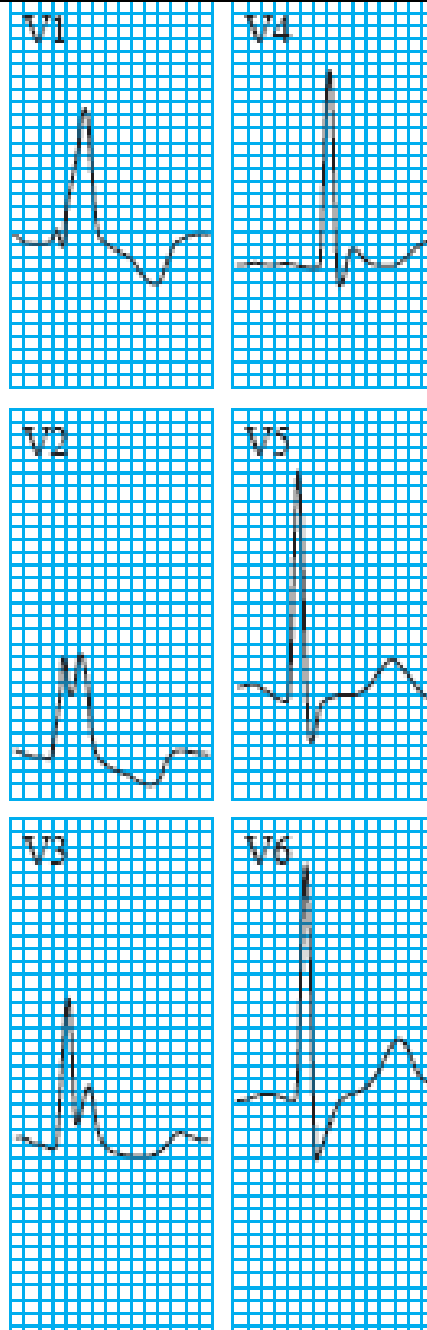
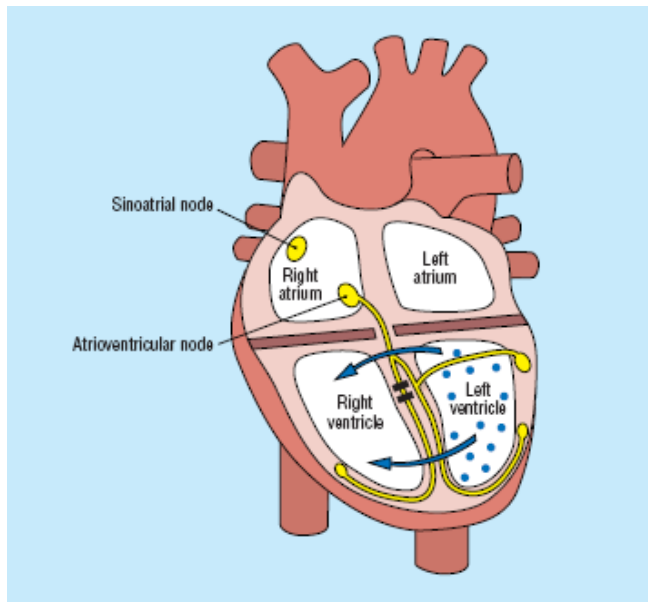
RBBB....

Broad QRS Complex

V1/V2 → V5/V6

Normal axis deviation

M_aRRoW



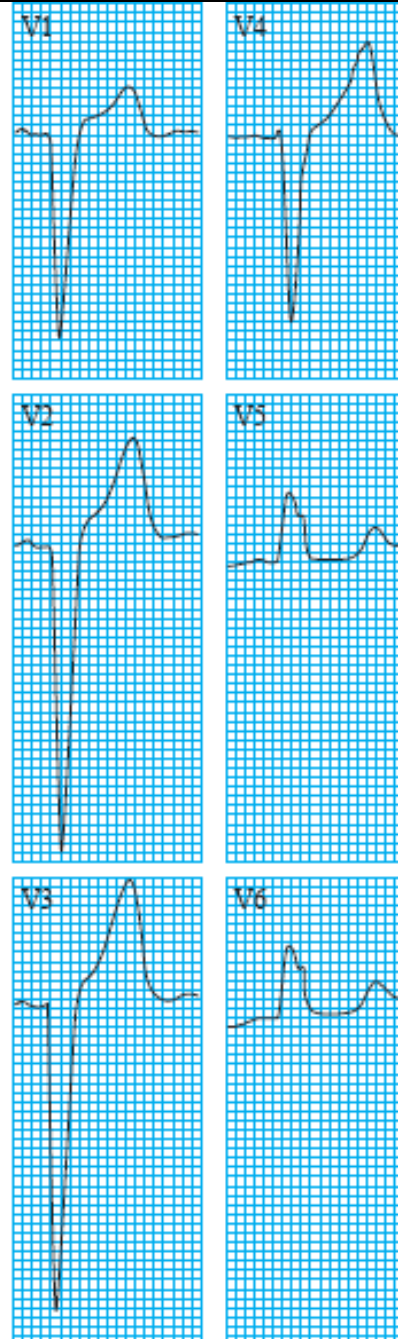
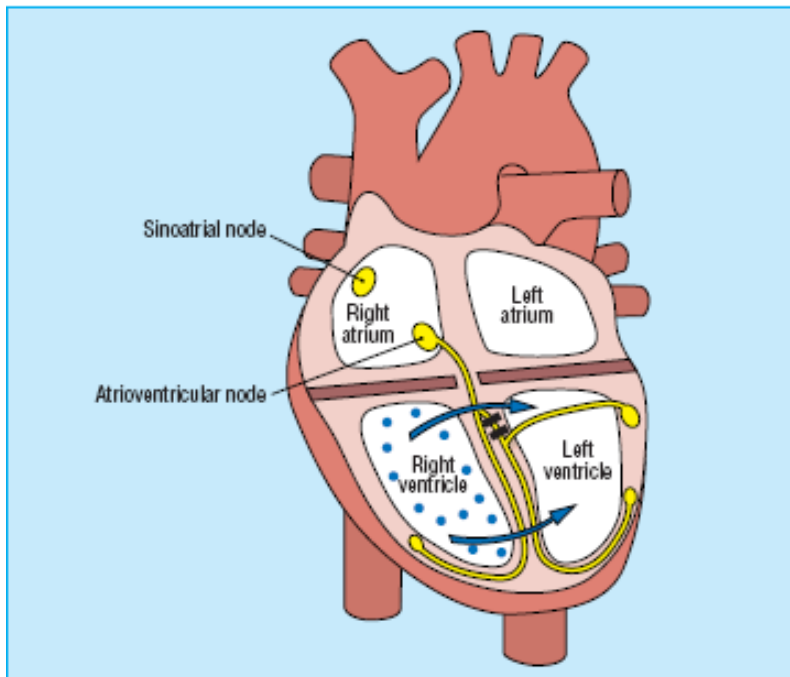
LBBB...

Broad QRS Complex

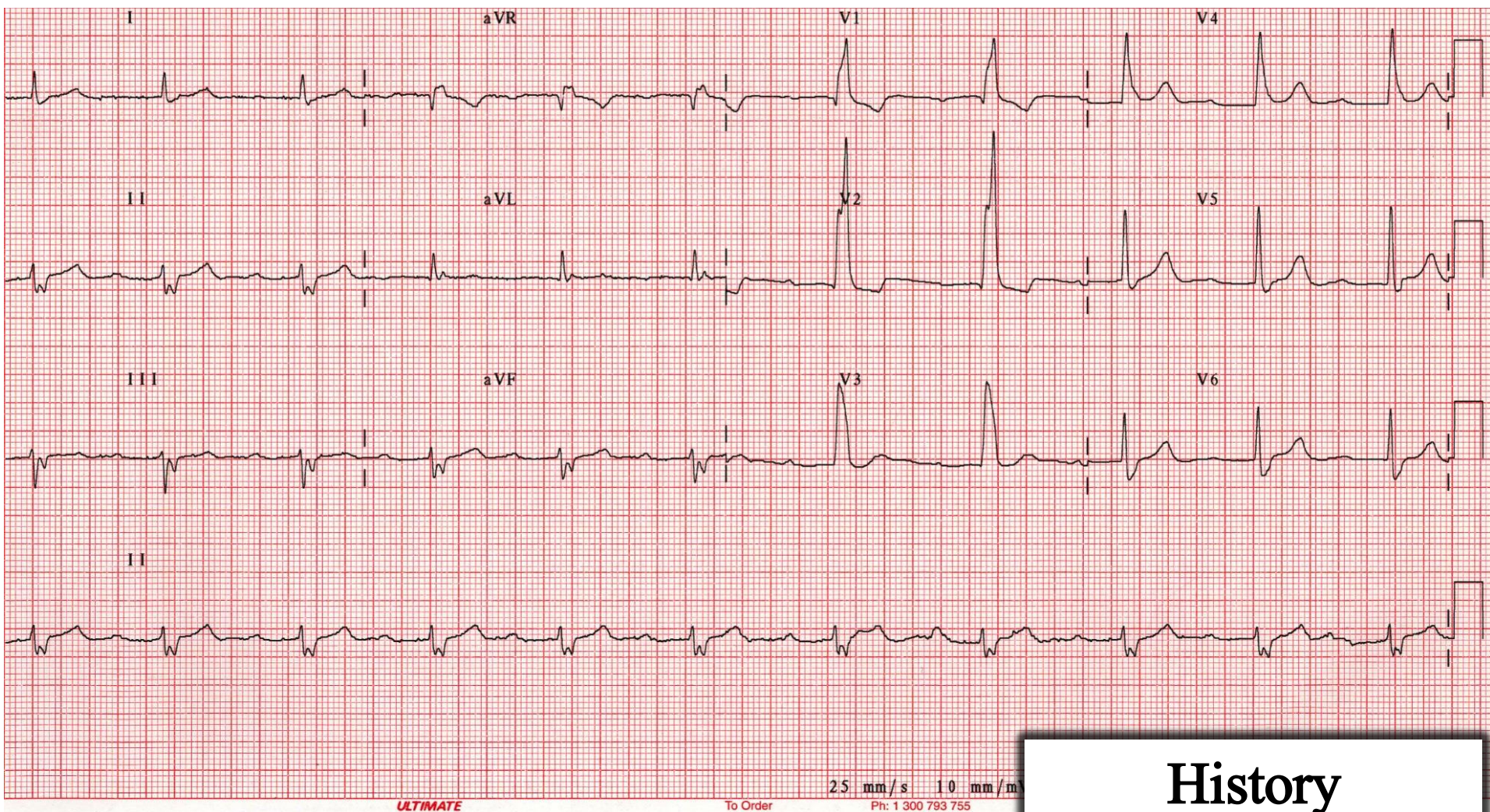
V1/V2 → V5/V6

WiLLia**M**

Normally Left axis deviation



Nb. Not possible to interpret ST segment in LBBB



Present this ECG.

72 yo woman in ED.
Syncope episode.
PMH- CCF

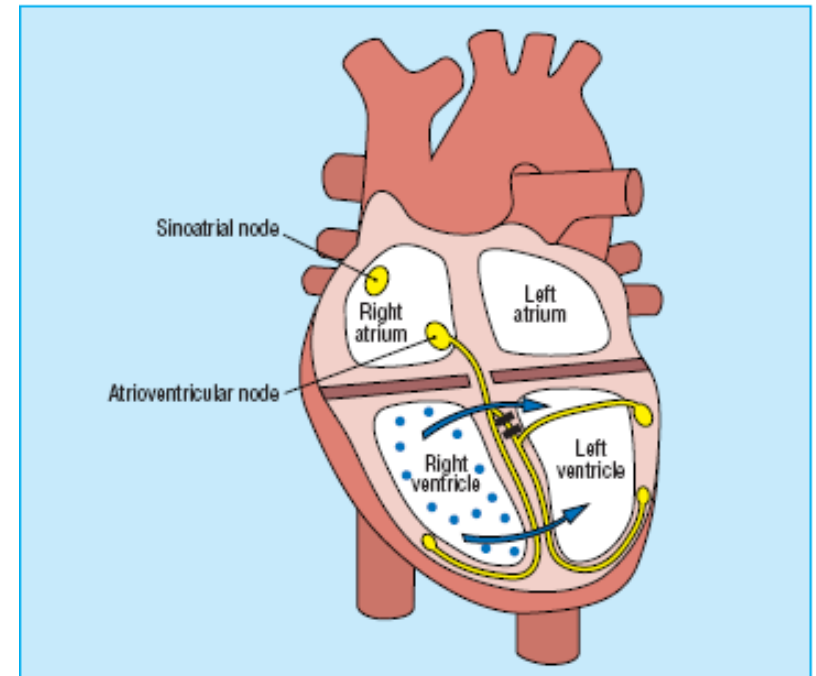
**History
Examination
Investigation
Management**

Bifasicular block

1. Right bundle branch block, and:
2. either left anterior fascicular block
→ Left axis deviation
or left posterior fascicular block
→ Right axis deviation

Trifasicular block

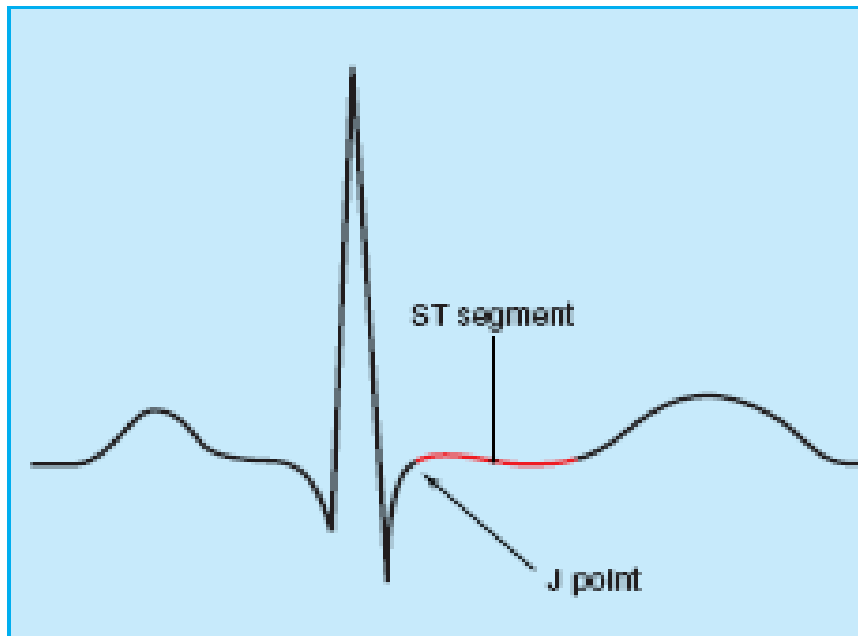
1. Bifasicular block, and
2. Heart block
(most commonly 1st degree)

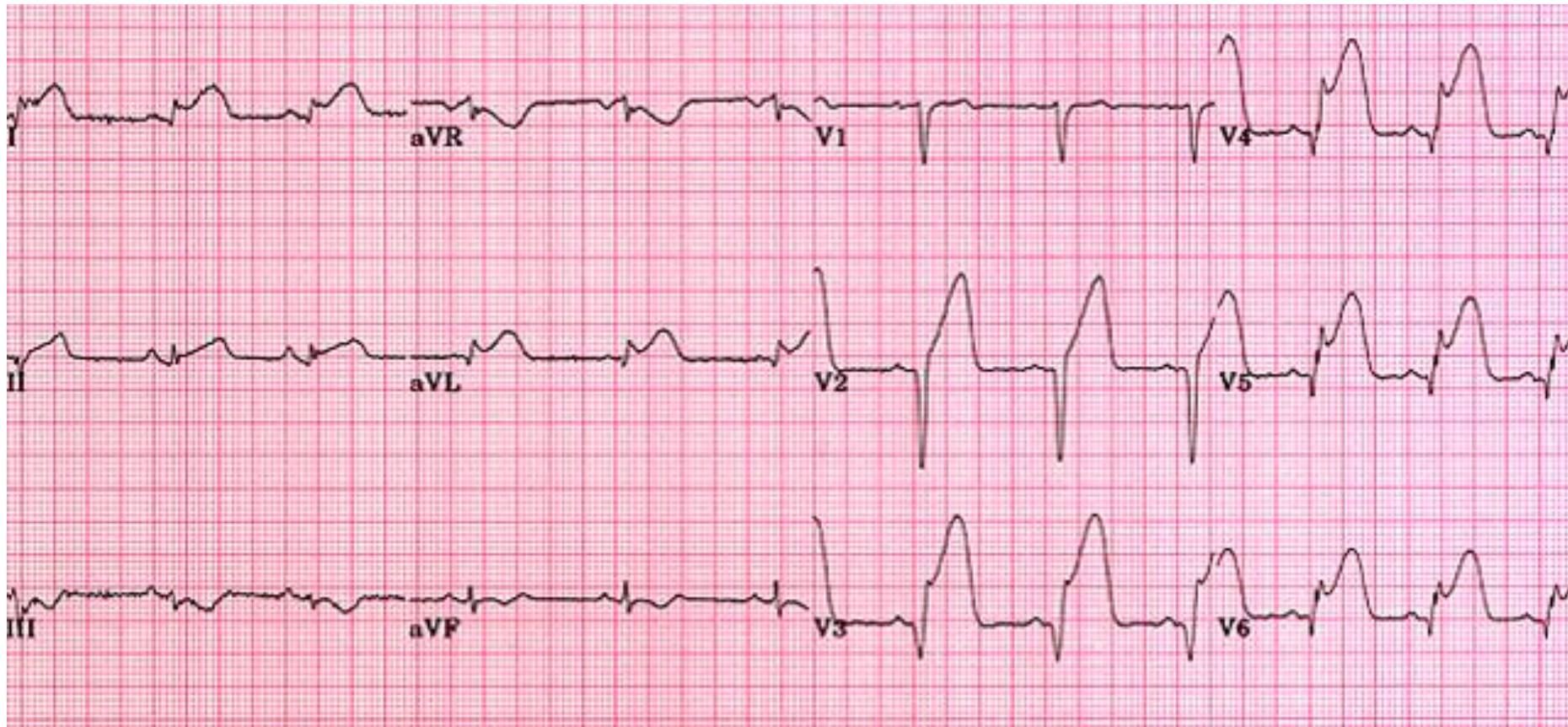


Step 6: ST Segments

From end of QRS to end of T Wave

- Normally isoelectric





75 yo. SOB/central chest pain worse on exertion.

PMH- HTN/CCF

DH- Frusemide/amlodipine

SH- Smoker

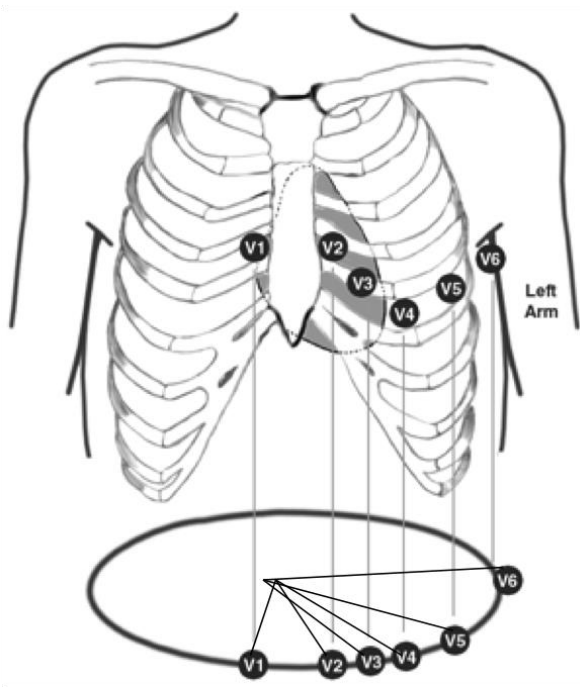
What is the main abnormality?
How would you present this case?

History
Examination
Investigation
Management

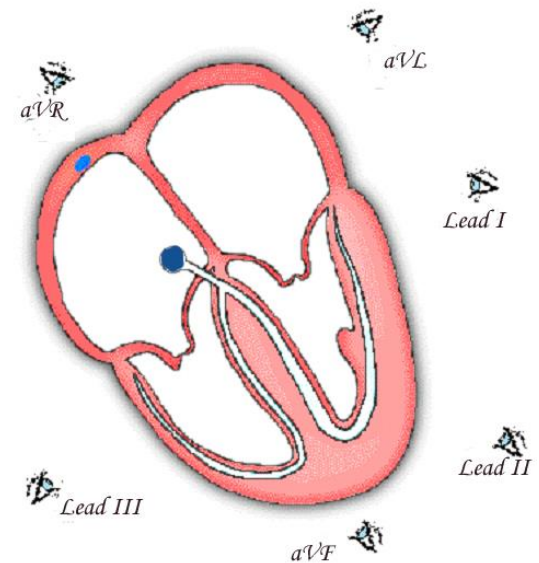
12 lead ECG

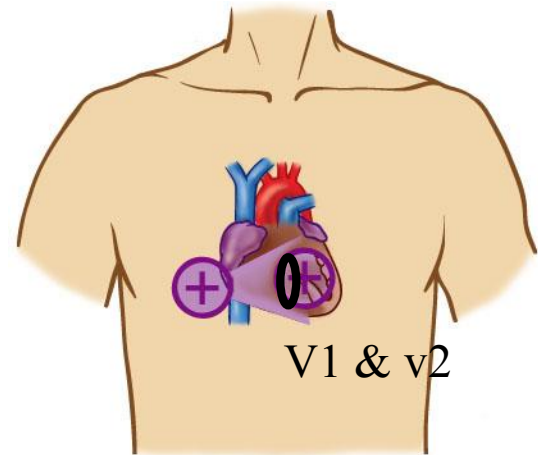
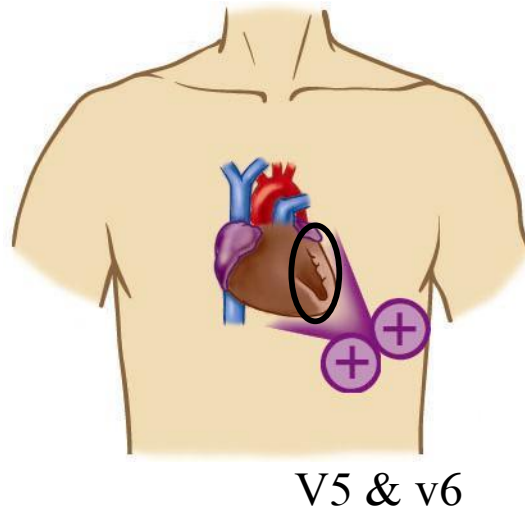
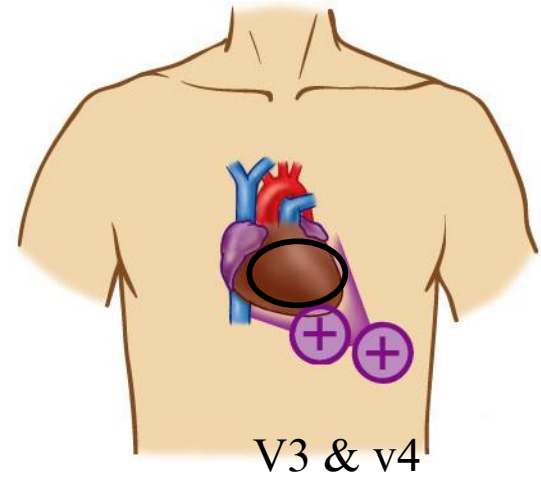
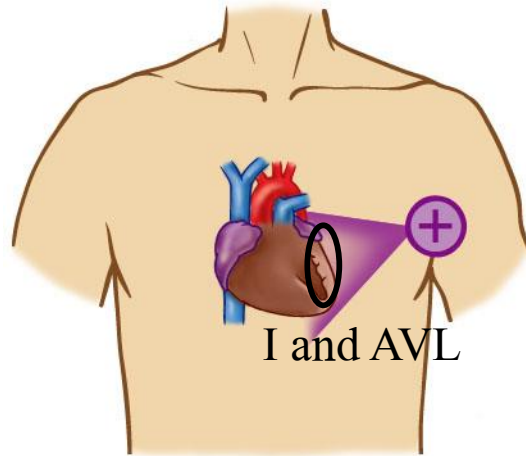
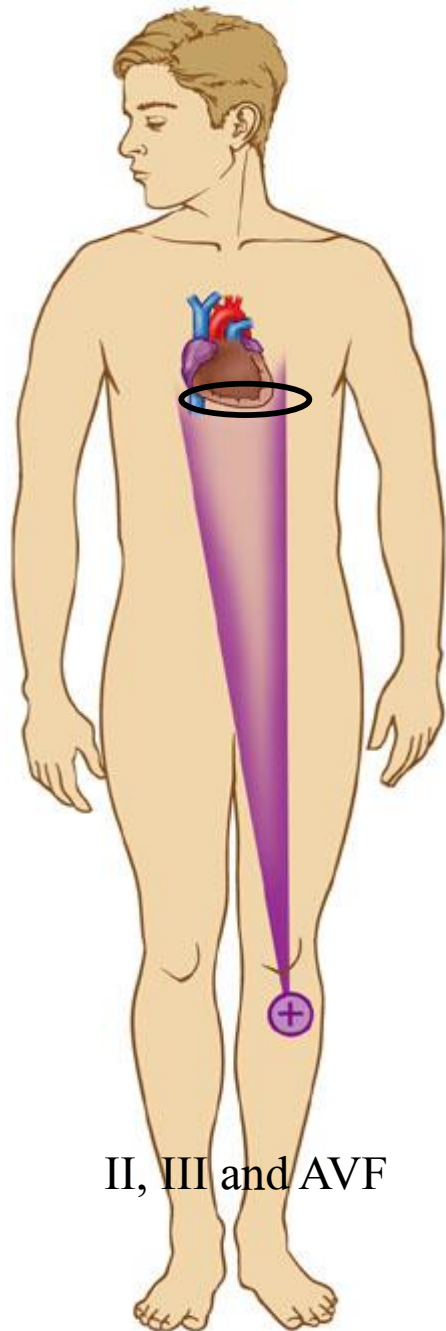
Panoramic view of heart from 12 angles

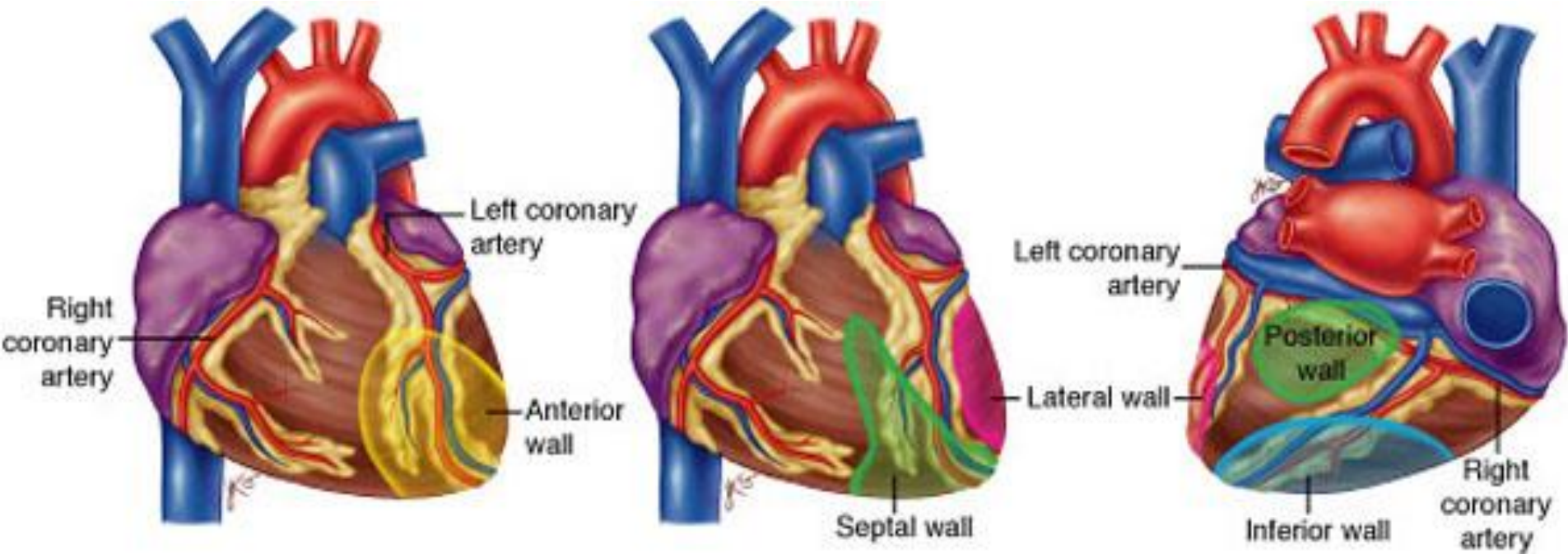
Limb/augmented leads → frontal plane



6 chest leads → horizontal plane







I	AVR	V1	V4
II	AVL	V2	V5
III	AVF	V3	V6

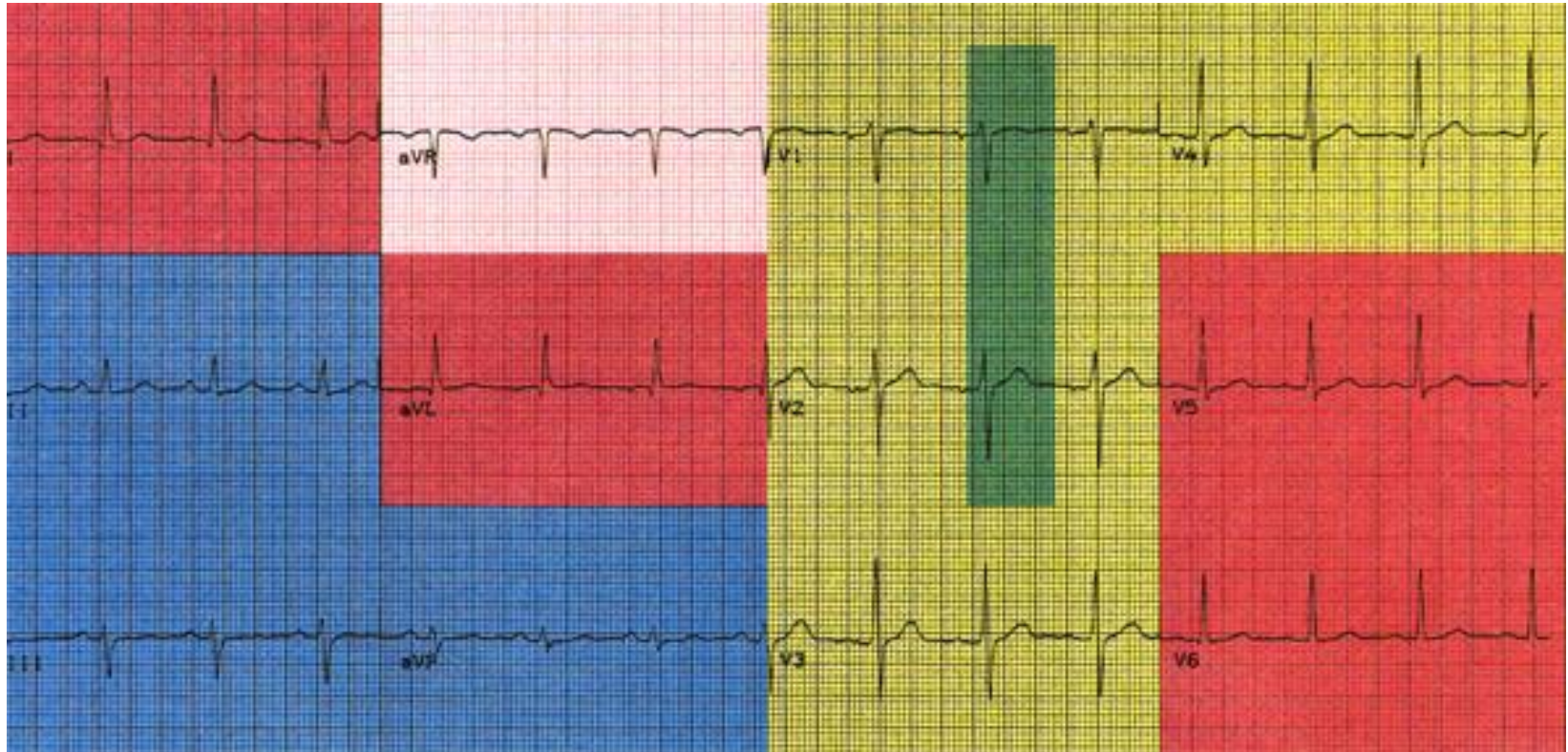
Anterior: V3, V4

Septal: V1, V2

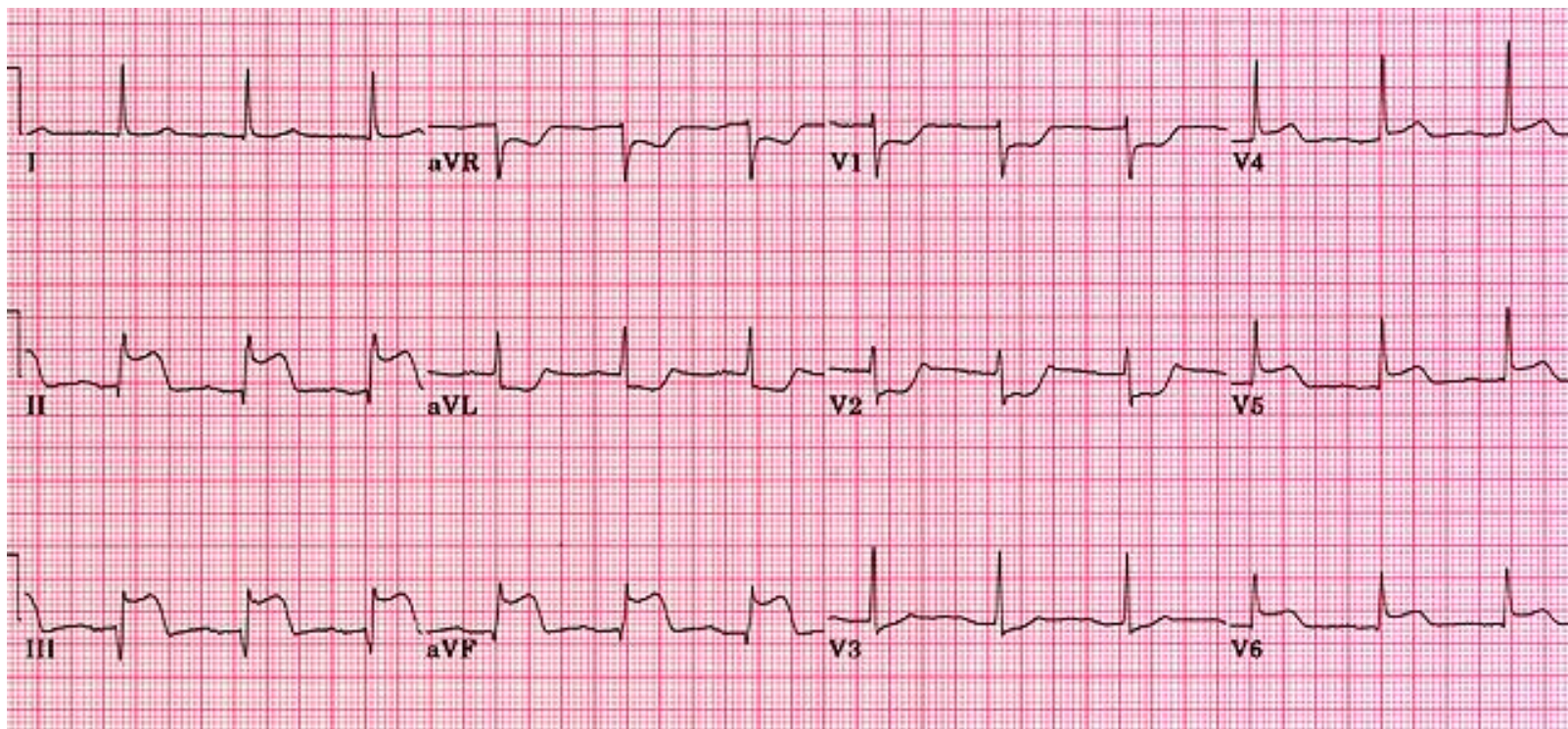
Inferior: II, III, AVF

Lateral: I, AVL, V5, V6

Cardiac Territories



Inferior	Right Coronary Artery
Lateral	Left Circumflex Artery
Anterior	Left Anterior Descending Artery
Posterior (ST Depression)	RCA/LCX



What territory?

Inferior / posterior

What vessel?

Right Coronary Artery
Left Circumflex Artery

Inferior	RCA
Posterior	RCA/LCX

Evolving MI and Hallmarks of AMI



Preadmission



Admission



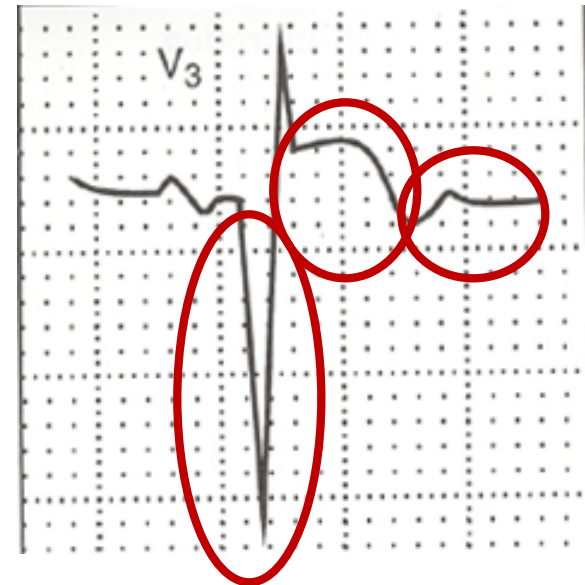
1 Hour



24 Hours



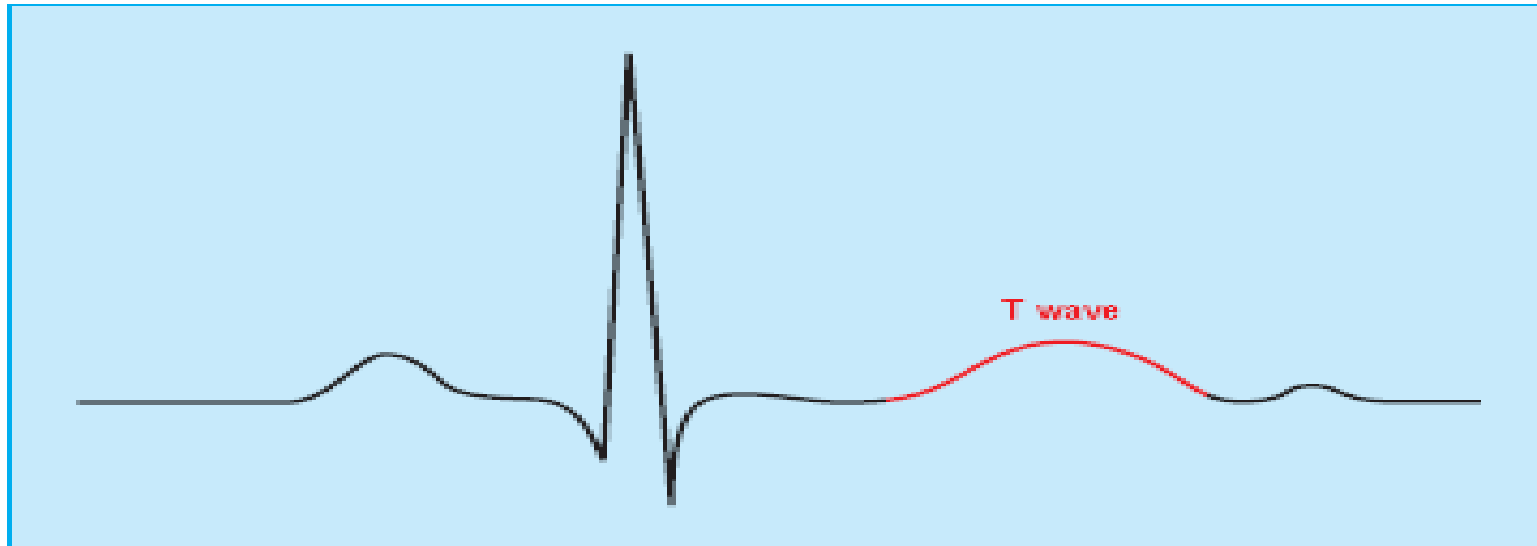
1 year



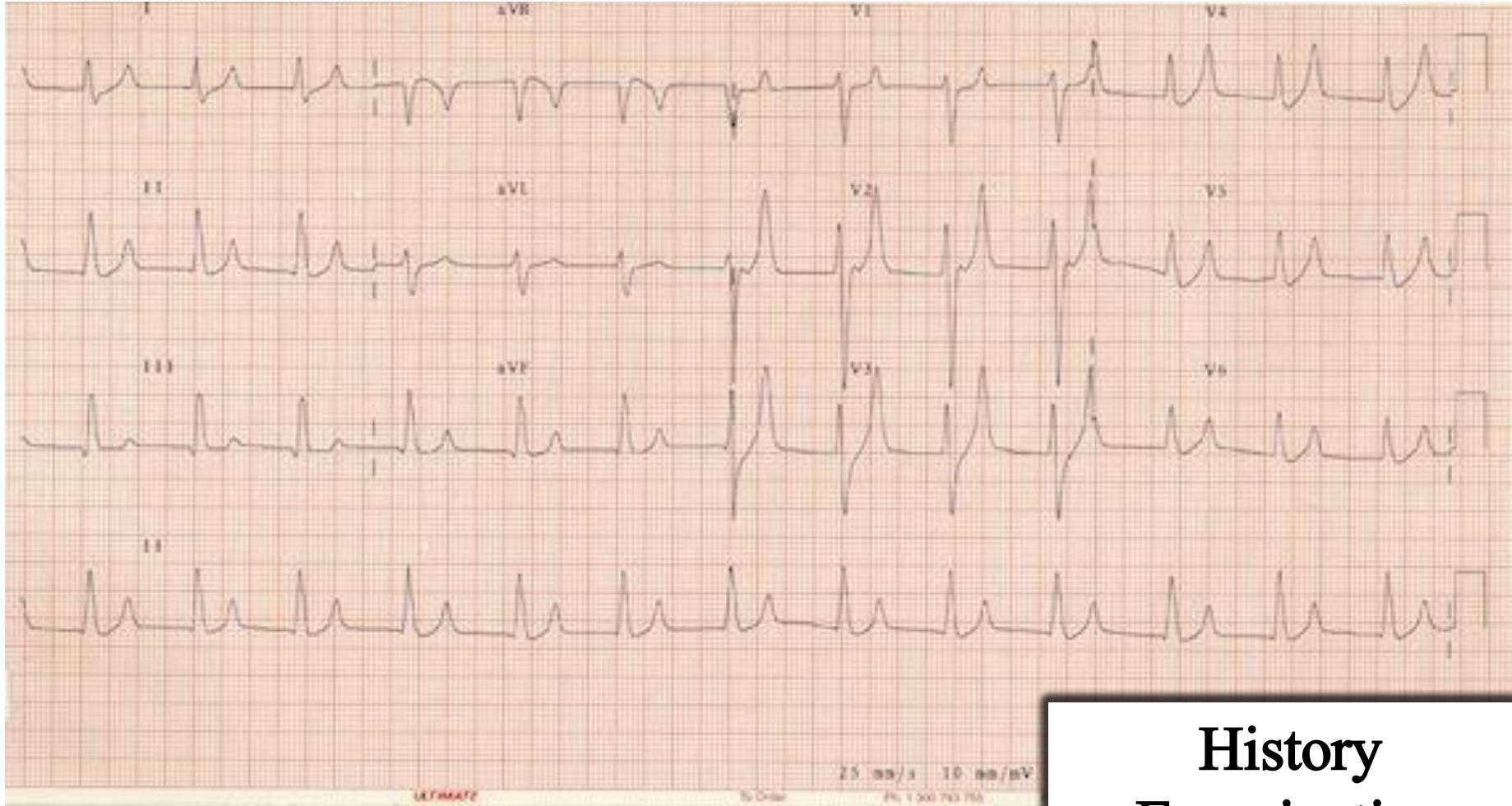
T Waves

Ventricular Repolarization

- Normal = same direction as QRS complex

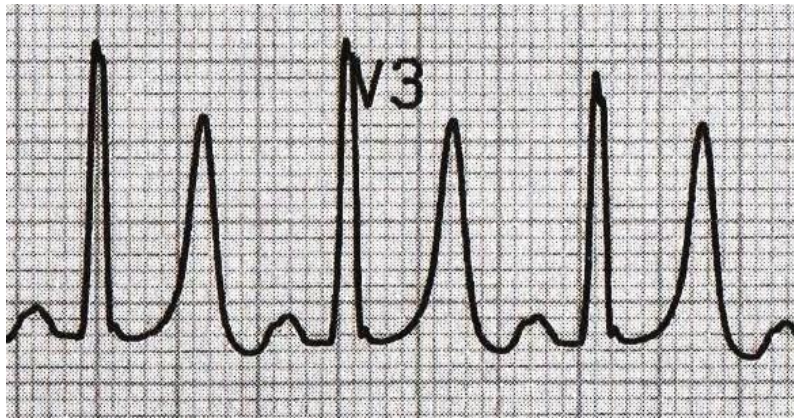


What's the T wave abnormality?

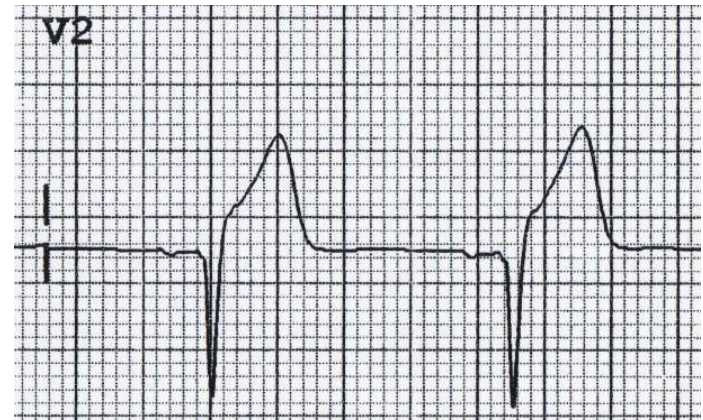


81 yo. Male. Palpitations.
PMH- HTN/CCF/T2DM
DHx- Enalapril/Spironolactone

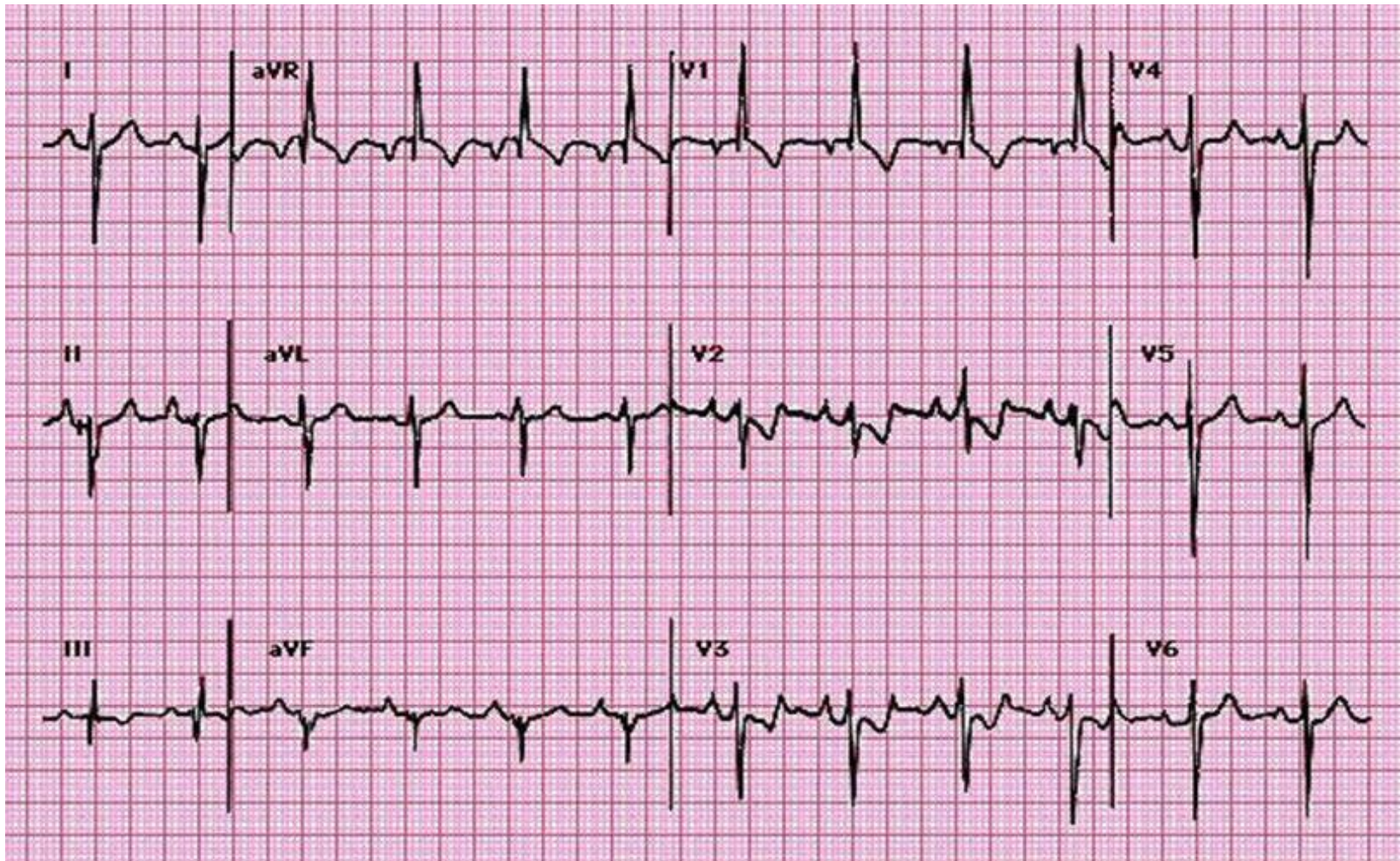
History
Examination
Investigation
Management



Tall tented narrow T waves
Hyperkalaemia



Wide based, asymmetrical T waves
Hyperacute ischaemia



39yo female. SOB.
PMH- Nil
DHx- COCP

What are the abnormalities on this ECG?
What is the diagnosis?
How would you present it?

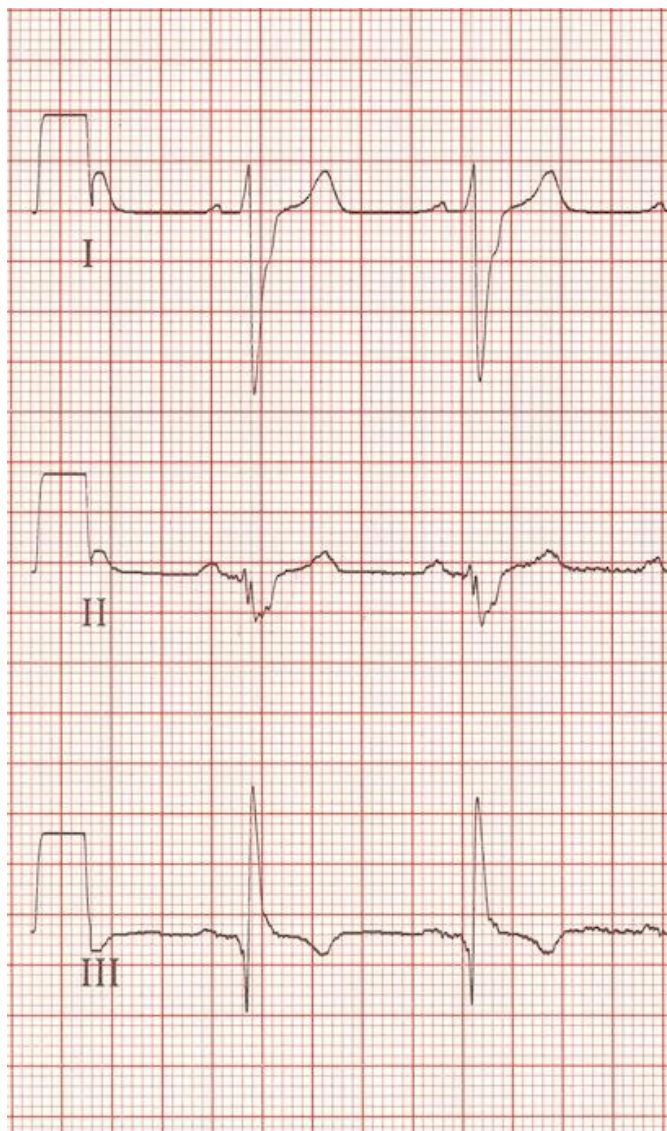
ECG changes in pulmonary embolism

"Classical" S1Q3T3

Occurs in only 20% of PE.

S1

Deep S wave in lead 1

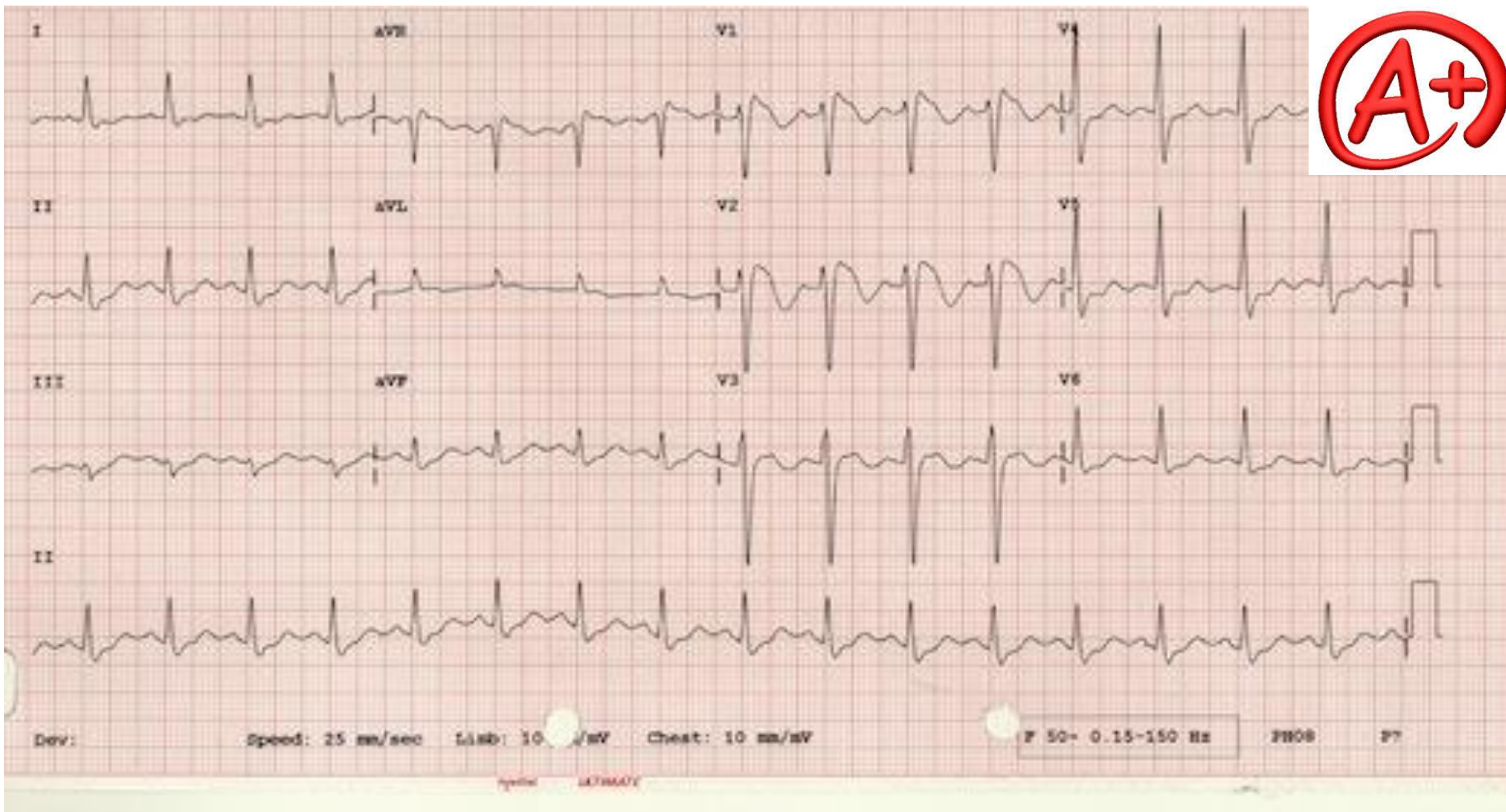


Q3 T3

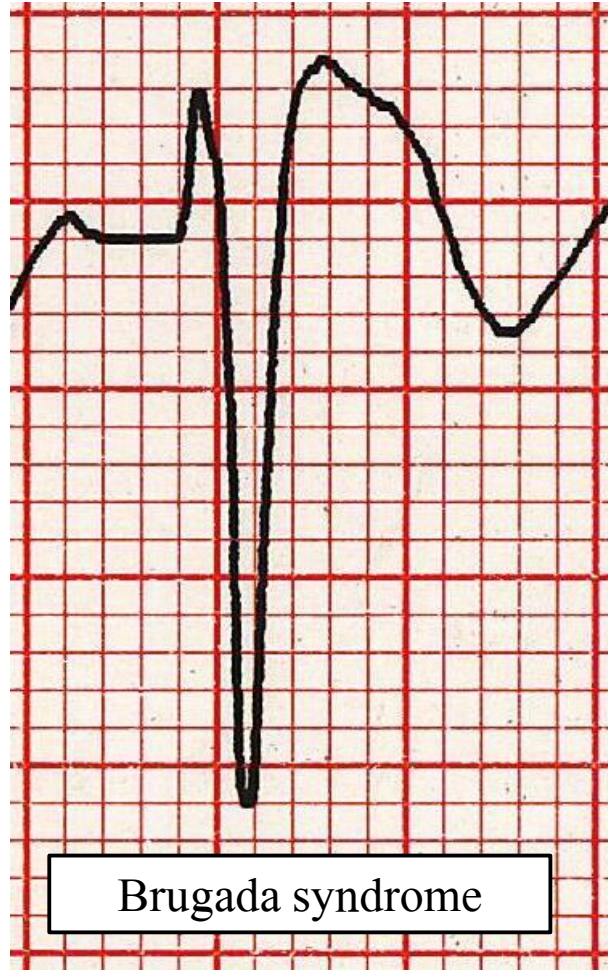
Q wave in lead 3

Inverted T wave in lead 3

More common is sinus tachycardia, RBBB or RAD



21yo Somali male. Syncopal episode.
Now asymptomatic
PMH- Nil. Has had similar episodes previously



Coved ST segment
elevation $>2\text{mm}$ in >1
of V1-V3 followed by a
inverted T wave

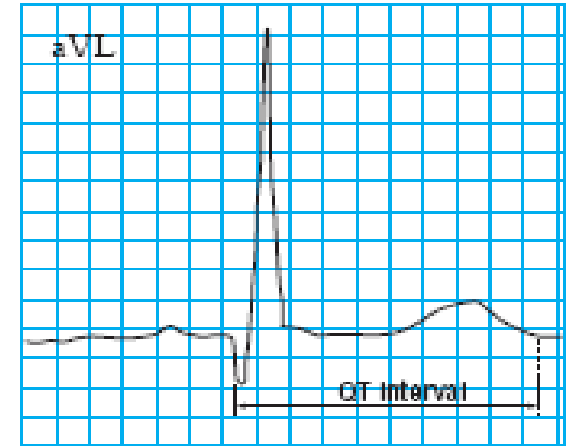
Signs and symptoms include:

- Blackout
- Seizures
- Cardiac arrest



55 year old alcoholic
Presented unwell with dizziness and fainting.

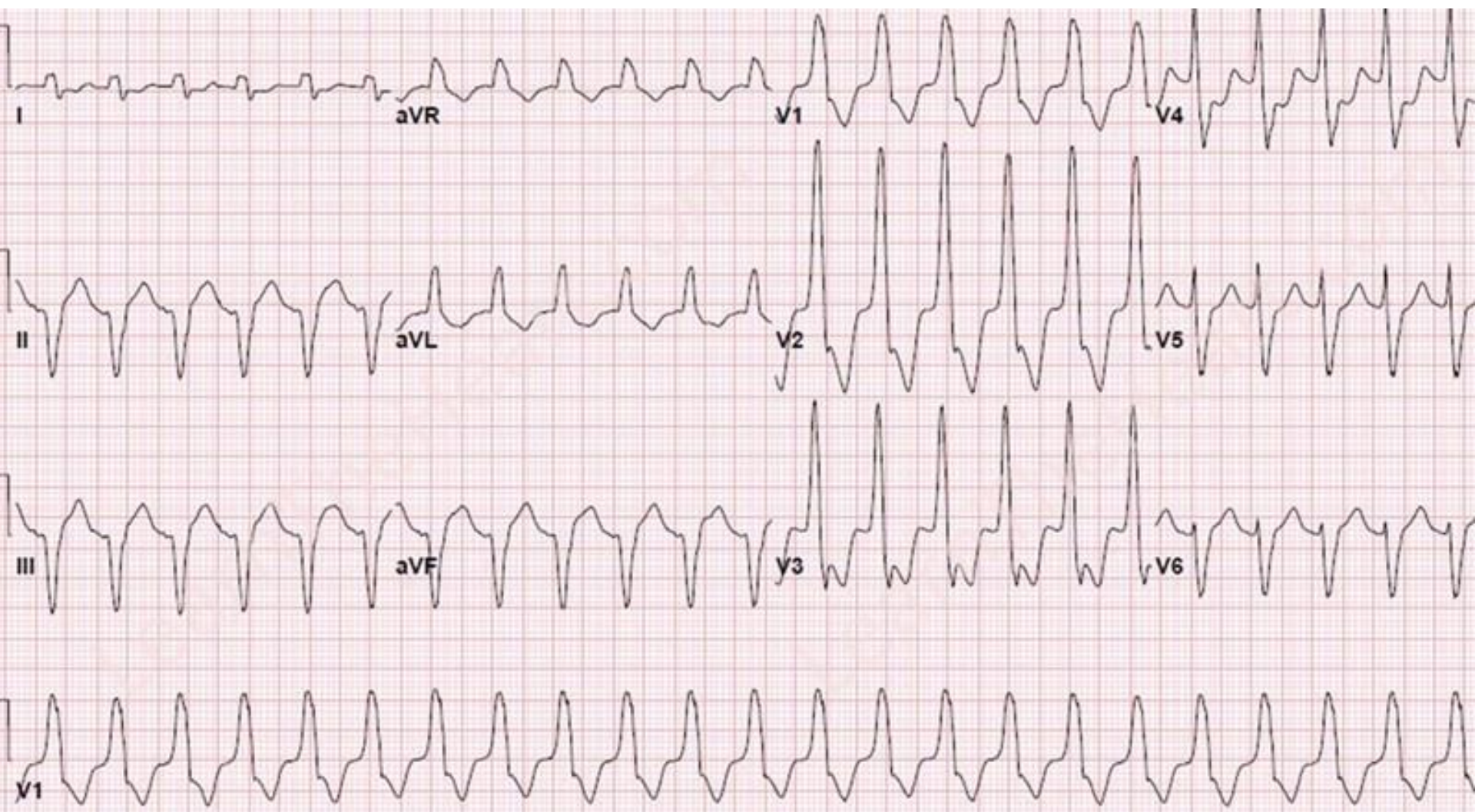
QT Interval



- QT Interval: Start of QRS to end of T wave
- $QTC = QT / \sqrt{(R-R)}$



Ventricular Fibrillation



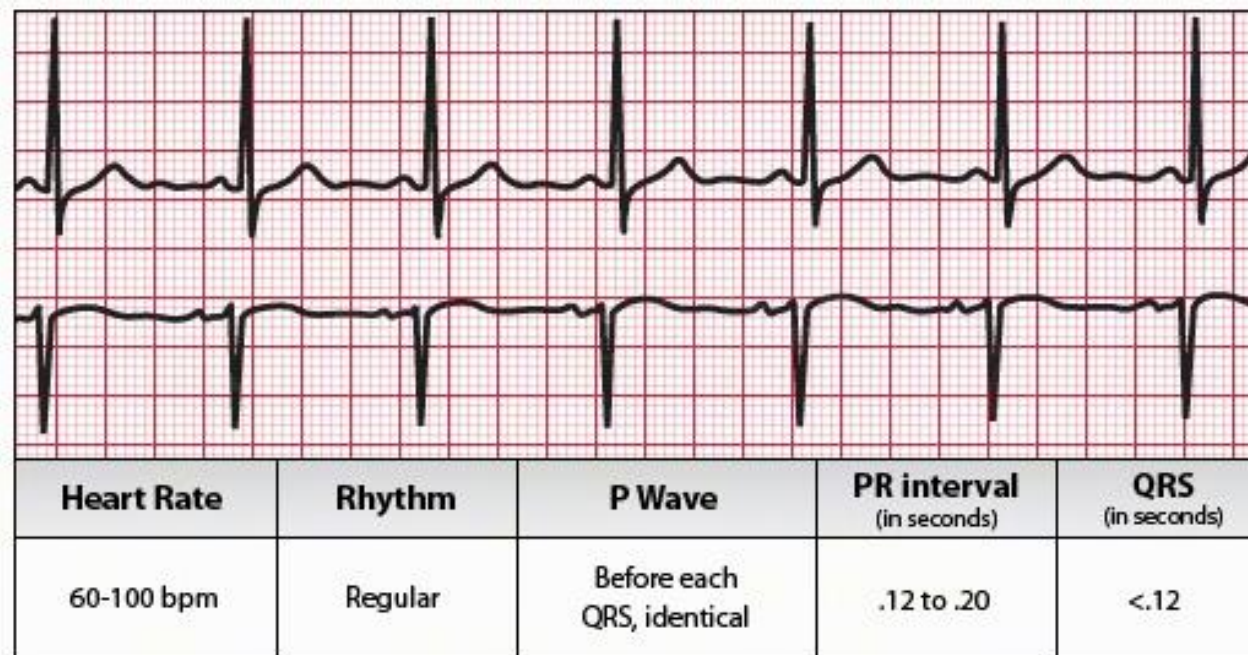
Ventricular Tachycardia



Asystole

Basic ECG Interpretation

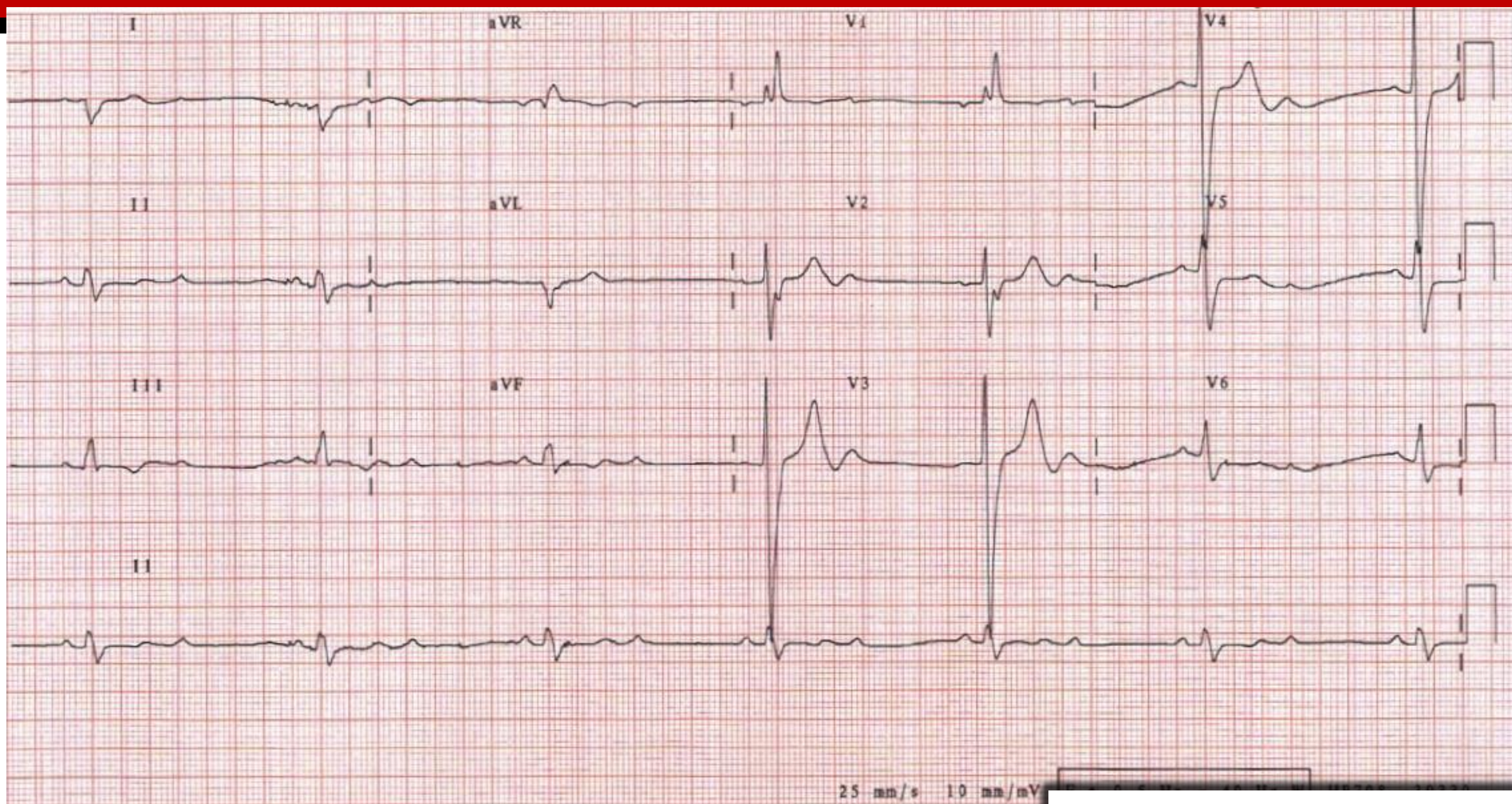
- Rate
- Rhythm
- Axis
- P Waves/PR Interval
- QRS Complex
- ST segment
- T Waves/QT Interval
- Summary



- ✓ Basic ECG interpretation pattern
- ✓ Some common (examined) abnormalities
- ✓ Presenting ECGs in context

Any Questions?

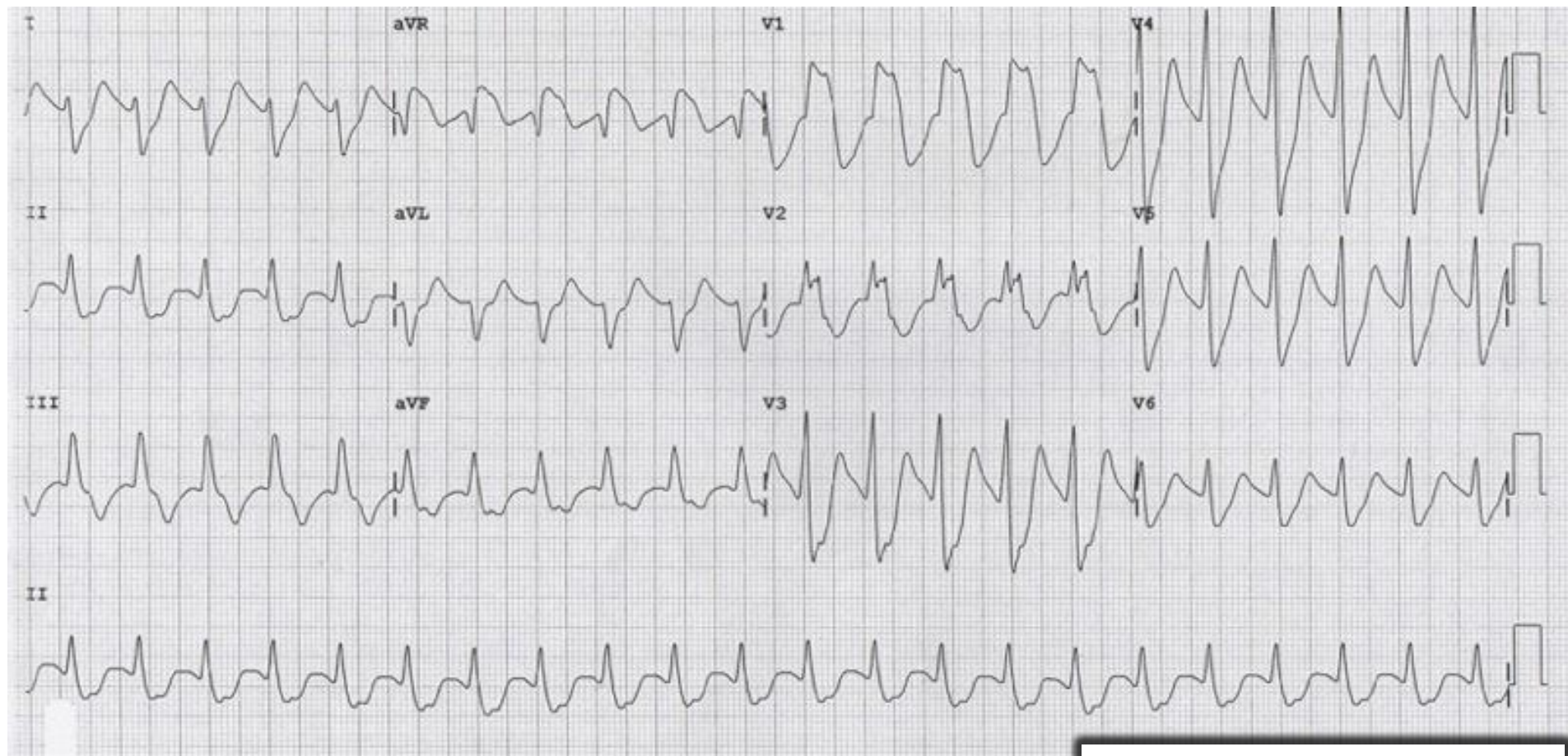




78yo in ED. Collapsed
 PMH- CCF
 DH ??

Rate: 300/8- 37
 Rhythm Regular
 Axis RAD
 PR- 2:1 p waves : QRS
 QRS – RBBB
 Mobitz type 2 AV block

History
Examination
Investigation
Management



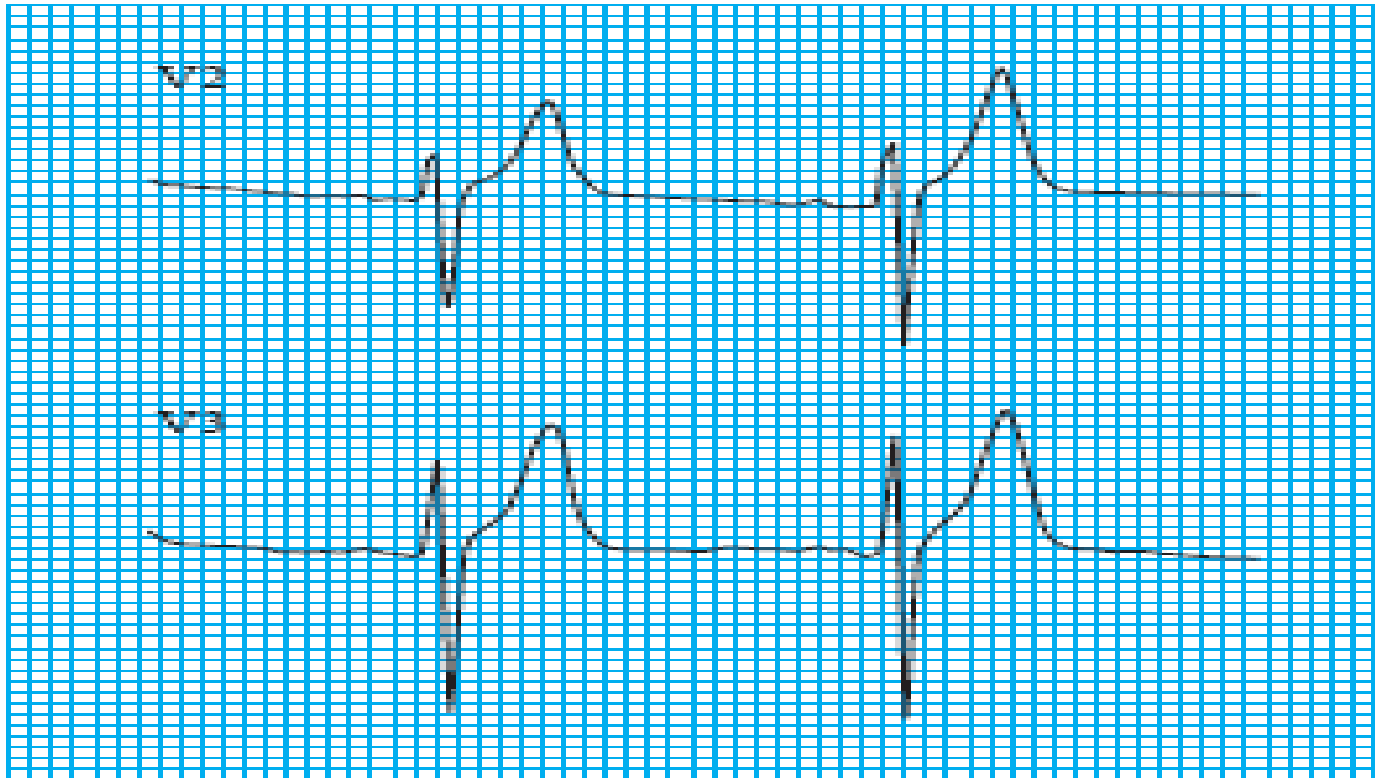
18yo male. BIBA. GCS 3. Seizures
PMH/DH- Nil

Rate- 150
Rhythm- Regular
Axis- RAD
RBBB
Long QTc
Dx- TCA Overdose

History
Examination
Investigation
Management

'High Take Off'

Normal variant... in correct context

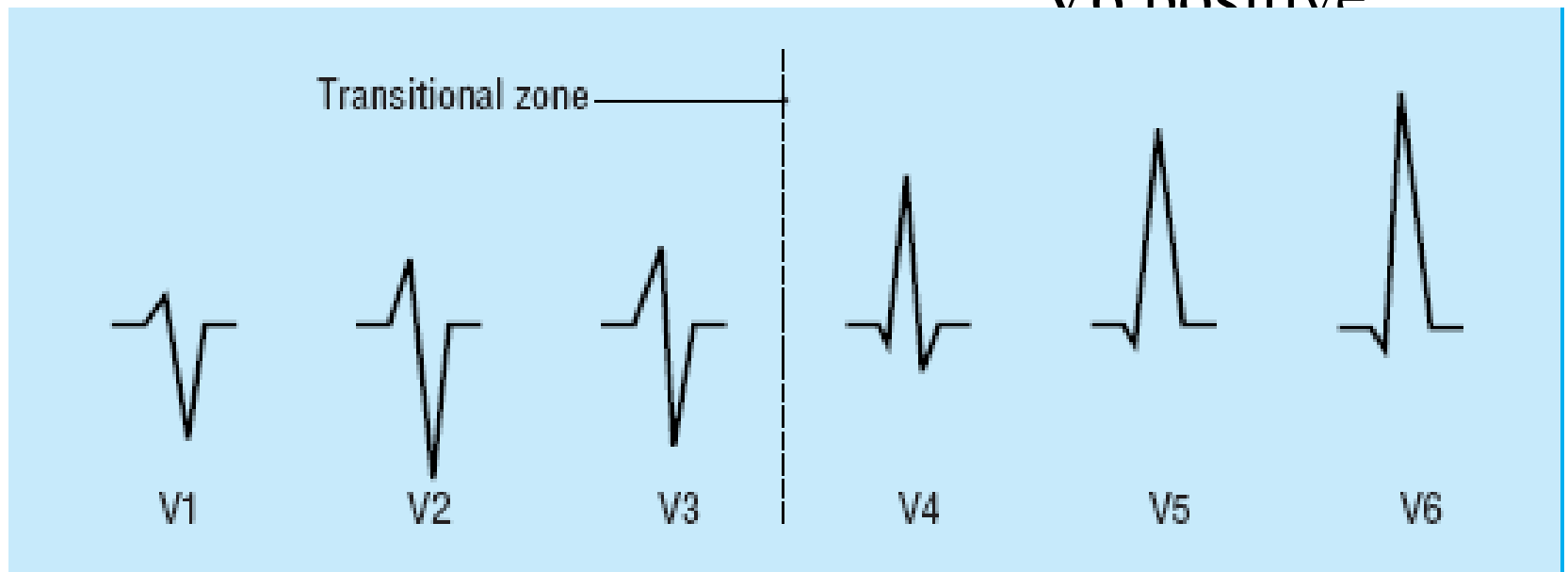


R wave progression

V1 negative

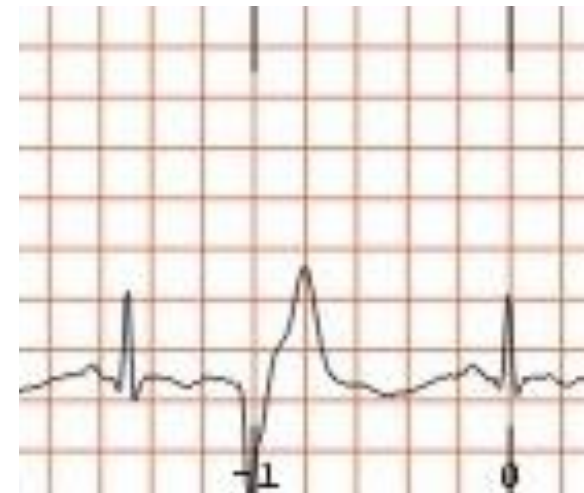


V6 positive

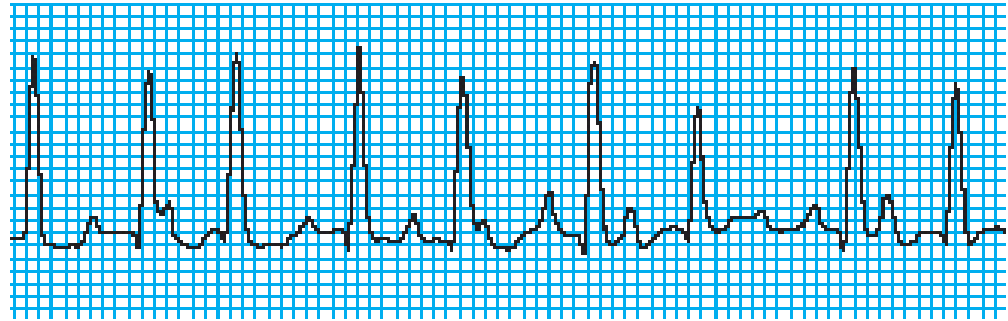


Ectopics

- Supraventricular
 - Narrow Complex
 - Abnormal P Wave
 - Normally get compensatory pause
- Ventricular
 - Abnormal Broad Complex
 - Then goes back to normal beat



Atrial Tachycardias



- Appearance
 - Narrow Complex
 - Abnormal P wave morphology

Supraventricular = Narrow Complex

Sinus Tachycardia

Atrial Tachycardia

Atrial Flutter

Atrial Fibrillation

Junctional Tachycardias inc. Wolff Parkinson White

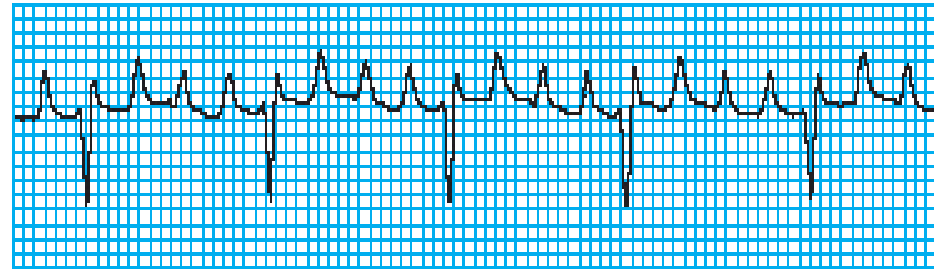
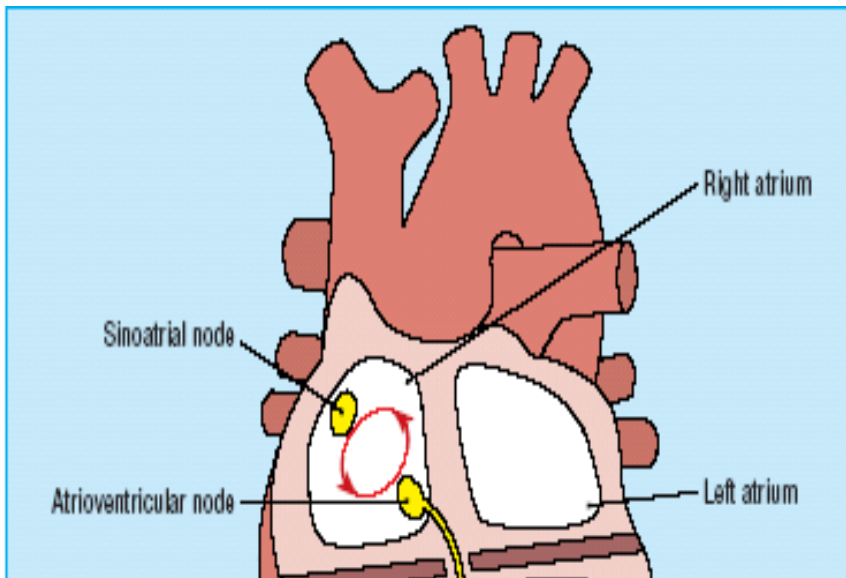
Ventricular = Broad Complex

Ventricular Tachycardia

Ventricular Fibrillation

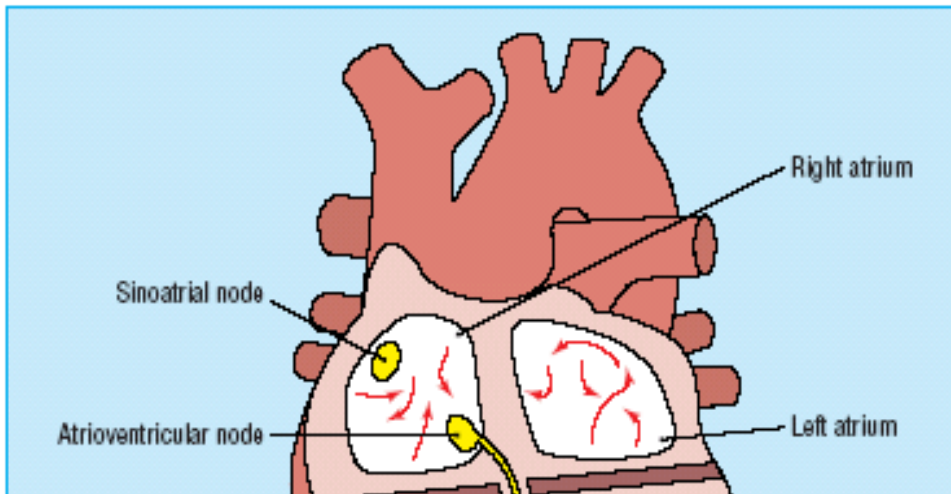
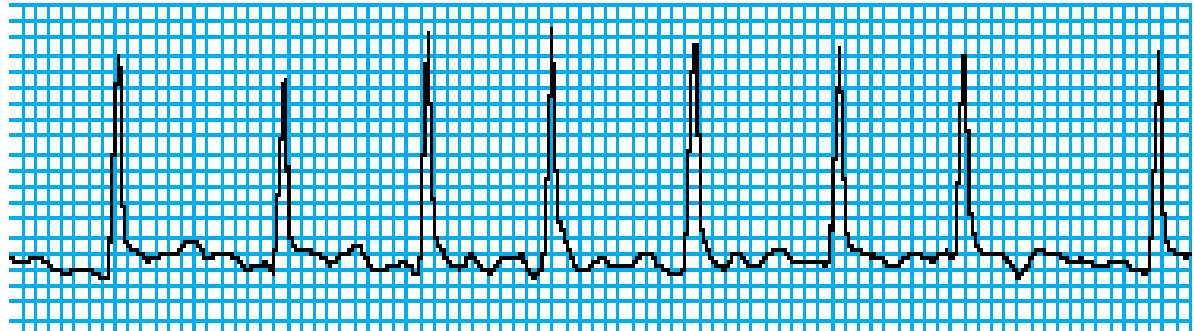
Atrial Flutter

- Atria contractions of 300bpm
- **Saw-tooth** flutter waves
- Normally also see AV block



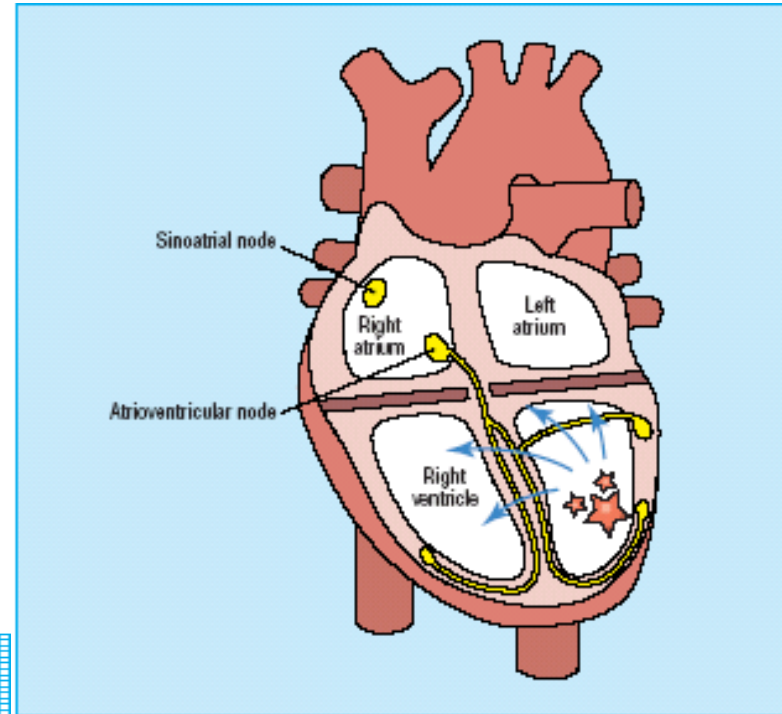
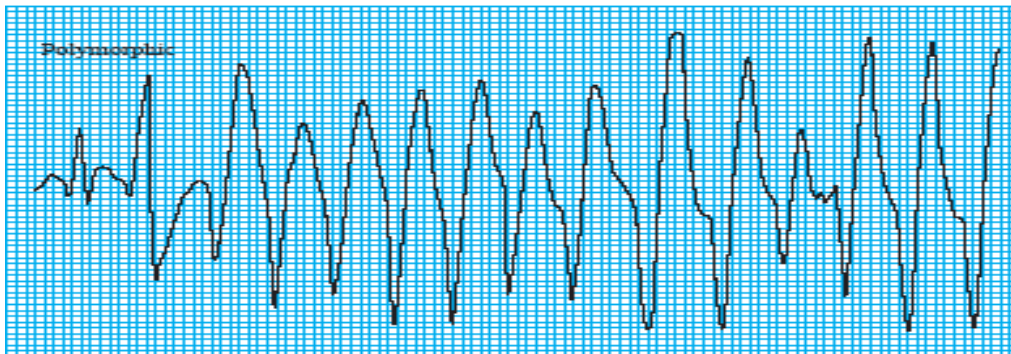
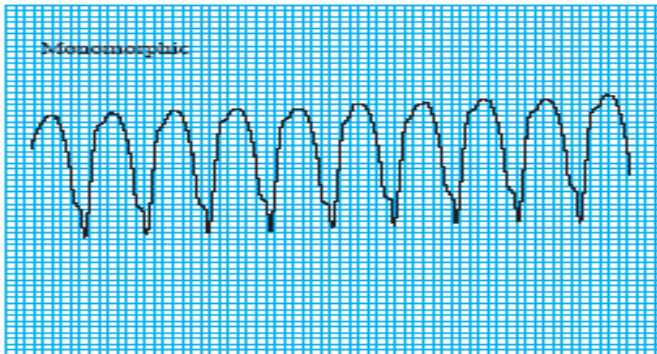
Atrial Fibrillation

- Uncoordinated atrial depolarization
- No P waves + Irregular baseline



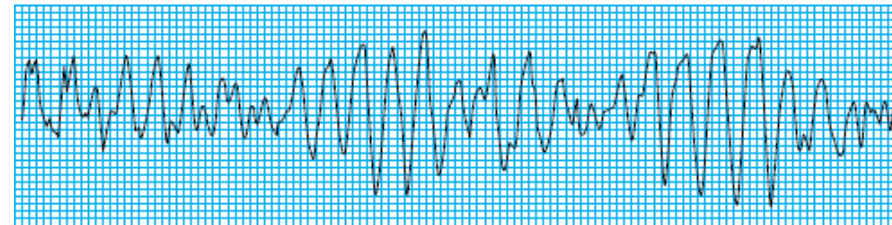
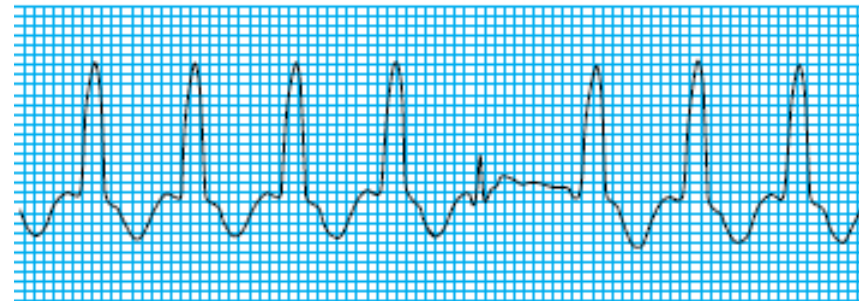
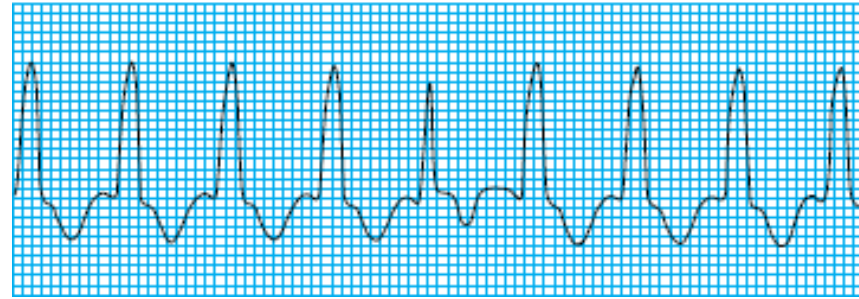
Ventricular Tachycardia

- Aberrant focus of excitation in ventricles
- Wide QRS Complex
- Monomorphic or polymorphic



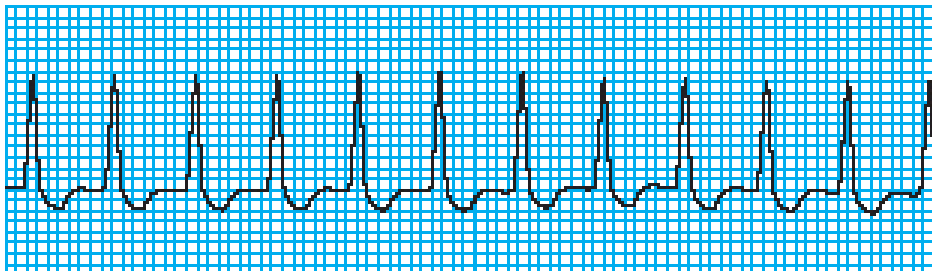
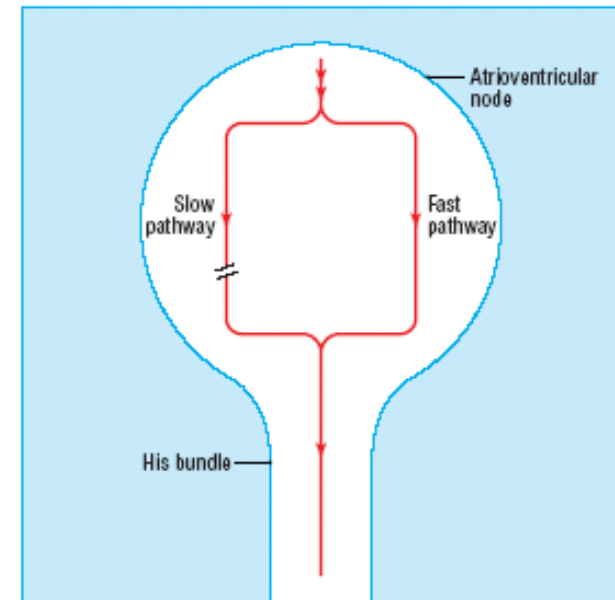
Ventricular Tachy

- Capture Beats
 - Atrial depolarization ‘capture’
- Fusion Beat
 - Mix of A & V beats
 - Looks halfway between normal and VT
- Torsades
 - Type of polymorphic VT
 - Fluctuates



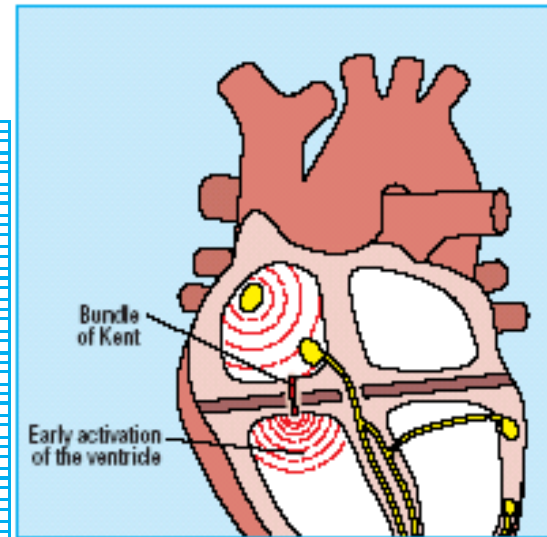
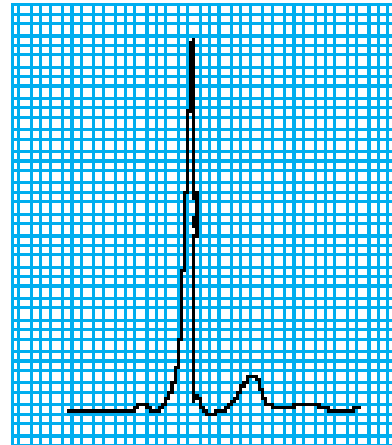
Junctional Tachycardias

- AVN Re-entry Tachycardia
 - 2 pathways through AVN & common final pathway
 - One fast - long refractory period
 - One slow- short refractory period
- Atrial beat...
 - Down slow as fast refractory
 - Back up fast pathway
 - Circuit gets set-up
- Narrow QRS/Regular/No P Waves



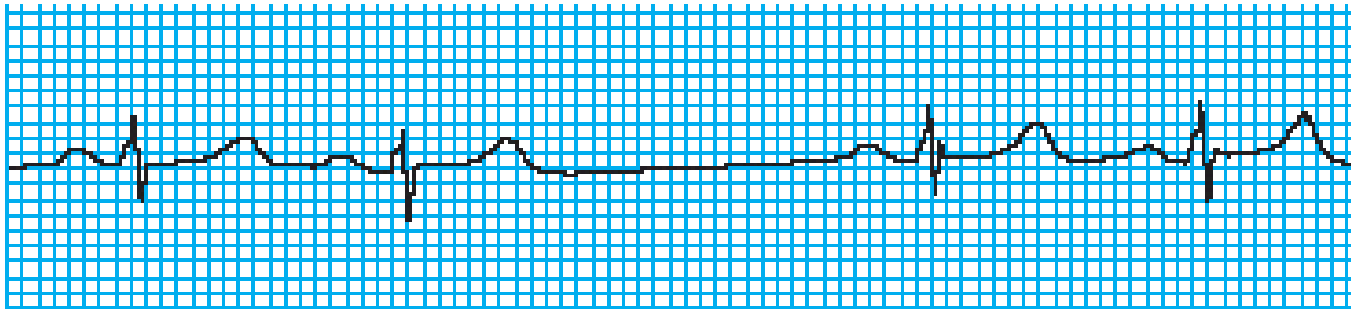
Atrioventricular Re-entry Tachycardia: WPW

- Aberrant connection between Atria and Ventricle with non-specialist conduction tissue
- Rapid conduction into ventricles
 - Short PR / Long upstroke to QRS: Delta Wave
- Extra circuit -> re-entry tachycardia
- 2 types
 - 1: Dominant R in V1
 - 2: No dominant R in V1



Sick Sinus Syndrome

- Get Brady, Tachy and Tachy-bradycardias
 - Age
 - Idiopathic fibrosis
 - Ischaemia, including myocardial infarction
 - High vagal tone
 - Myocarditis
 - Digoxin toxicity



- ECG RBBB R wave progression rather than Marrow
- Do W and M then give a lots R positive
- L ventr hyp