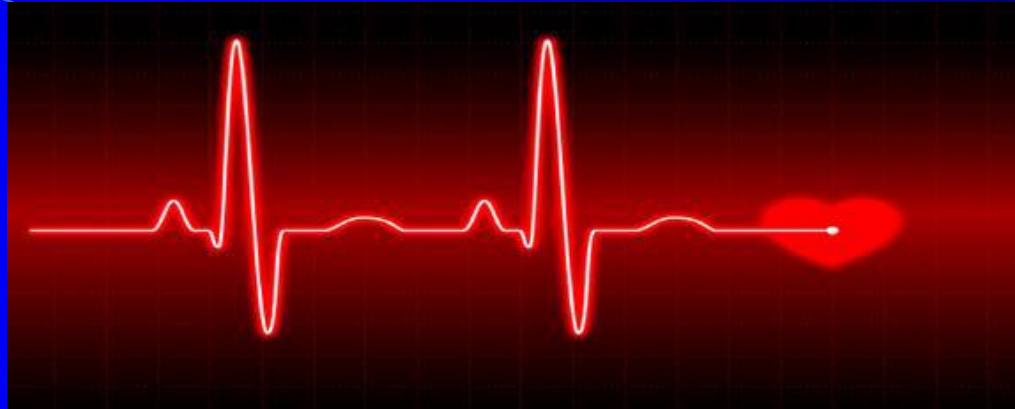


ABNORMALITY IN ECG

PART 2



Dr hedyeh mohagheh
Cardiologist
Assistant professor of DUMS

TITLES IN THIS SESEAN

- AV BLOCKES
- BUNDLE BLOCKES
- ECG IN STEMI
- ECG IN ISCHEMIA

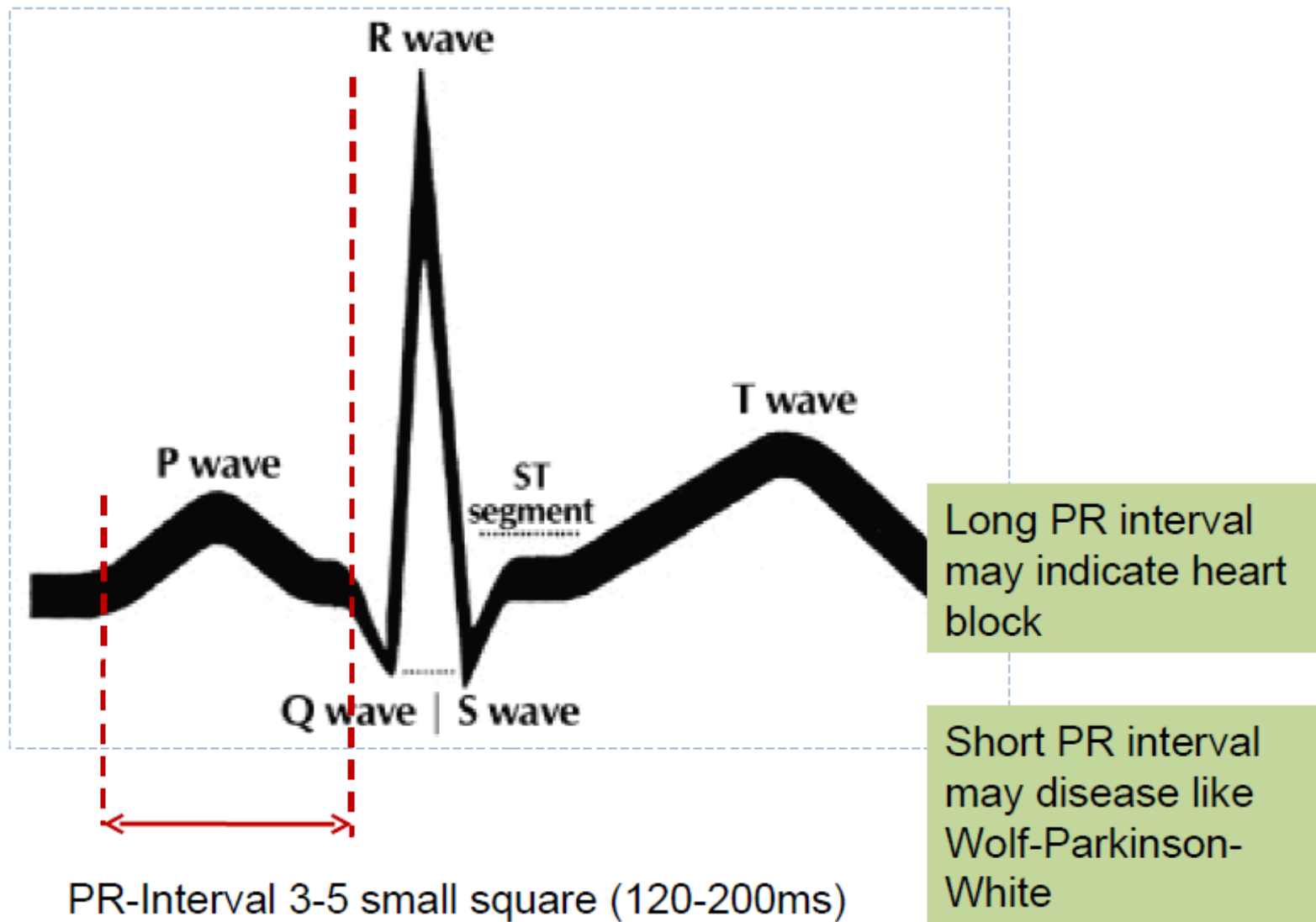
● AV BLOCKES

- Dr mohaghegh assistant professor of cardiology

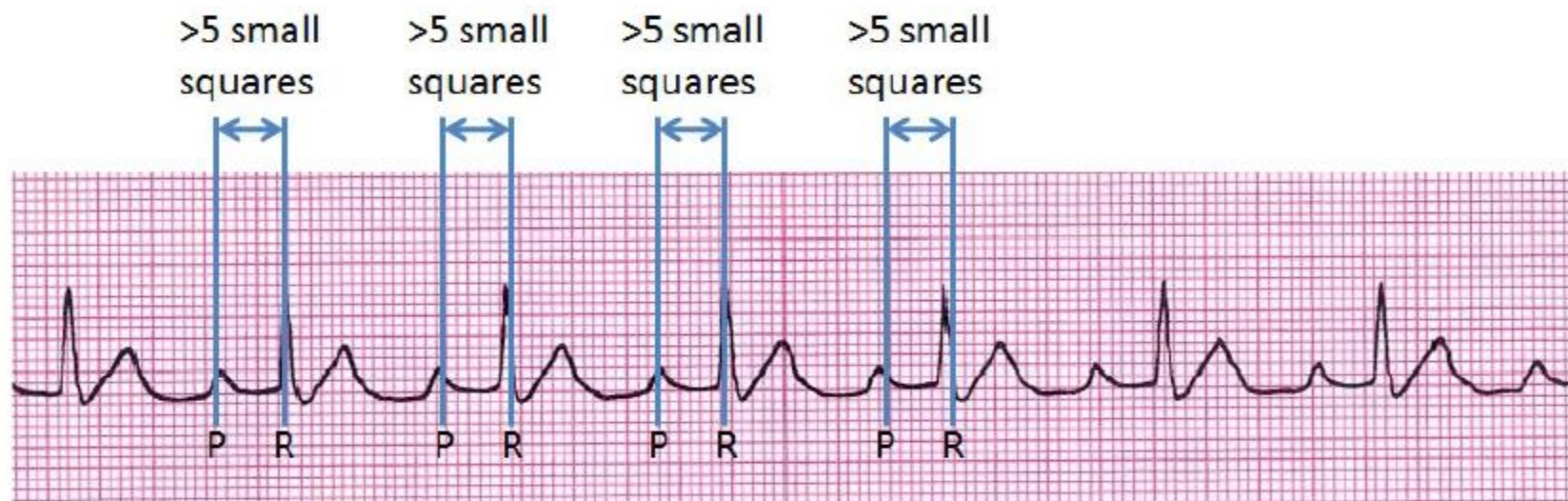
PR- INTERVAL

PR INTERVAL

NORMAL PR INTERVAL



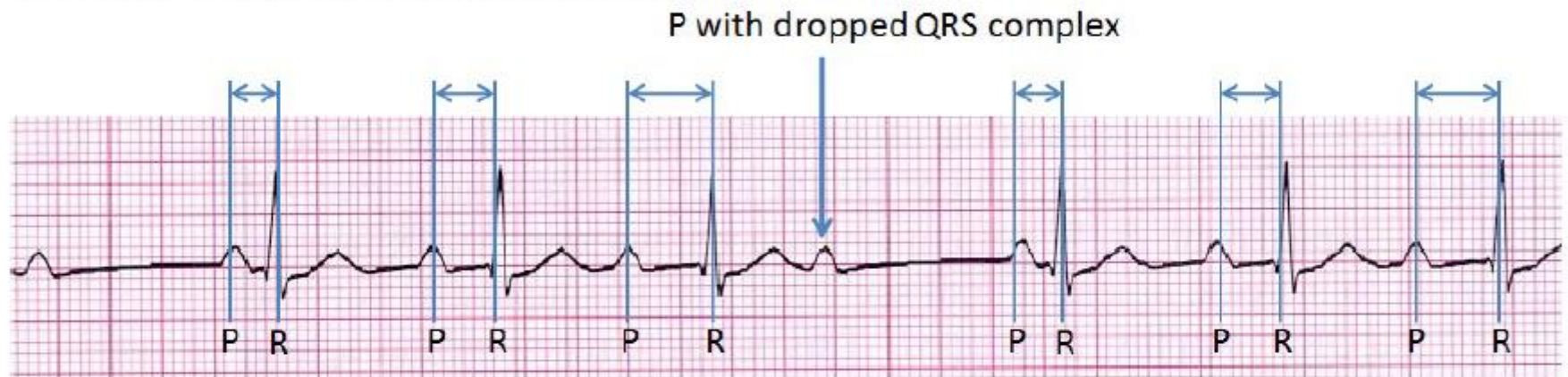
First degree heart block



P wave precedes QRS complex but P-R intervals prolong (>5 small squares) and remain constant from beat to beat

Second degree heart block

1. Mobitz Type I or Wenckenbach



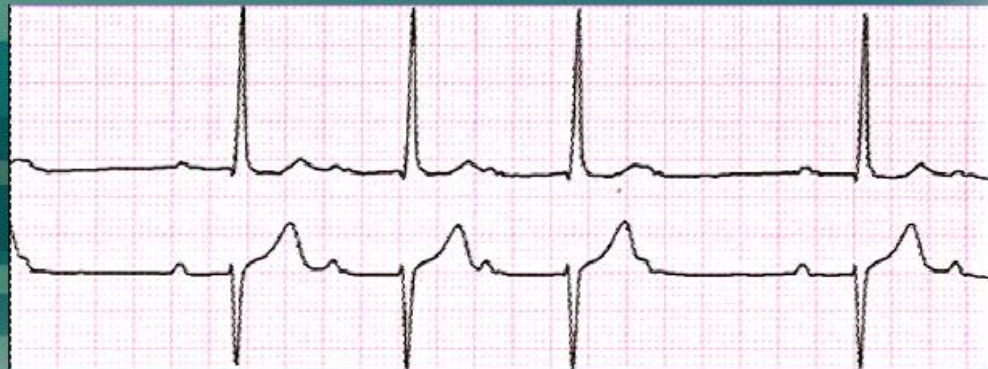
Runs in cycle, first P-R interval is often normal. With successive beat, P-R interval lengthens until there will be a P wave with no following QRS complex. The block is at AV node, often transient, maybe asymptomatic

Group beating

Mobitz type 1 (Wenckebach Phenomenon)



3:2 2nd Degree AV block (Type I)



Second degree heart block

2. Mobitz Type 2



P-R interval is constant, duration is normal/prolonged. Periodically, no conduction between atria and ventricles- producing a p wave with no associated QRS complex. (blocked p wave).

The block is most often below AV node, at bundle of His or BB,
May progress to third degree heart block



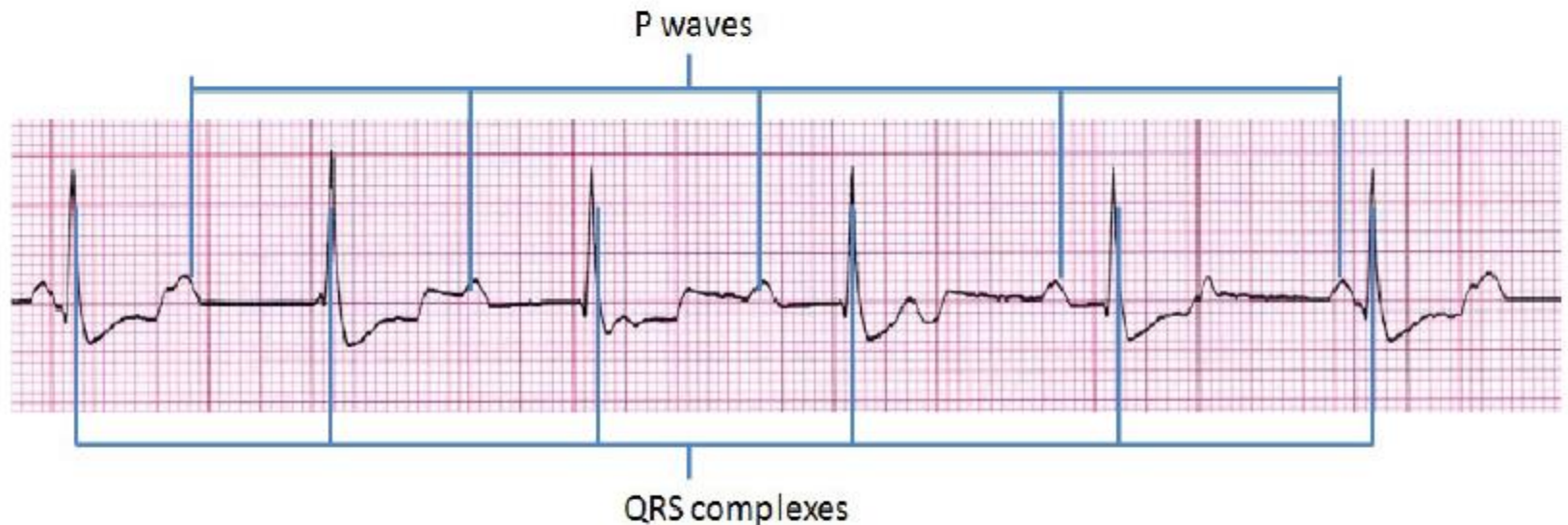
Heart Block

Second Degree Heart Block Mobitz Type II (Classical)



Heart Rate	Rhythm	P Wave	PR Interval (sec.)	QRS (Sec.)
Usually slow	Regular or irregular	2 3 or 4 before each QRS, Identical	.12 - .20	<.12 depends

Third degree heart block (Complete heart block)



No relationship between P waves and QRS complexes

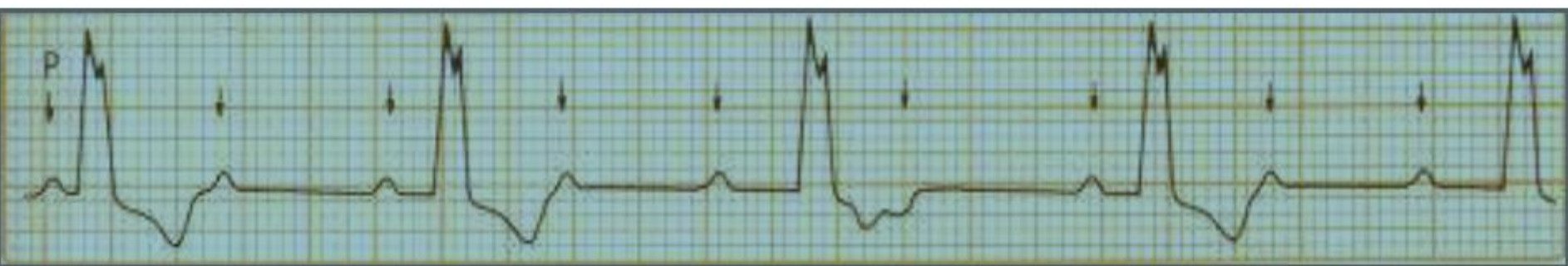
An accessory pacemaker in the lower chambers will typically activate the ventricles- escape rhythm.

Atrial rate= 60-100bpm. Ventricular rate based on site of escape pacemaker. Atrial and ventricular rhythm both are regular.



Heart Block

Third Degree Heart Block (Complete)

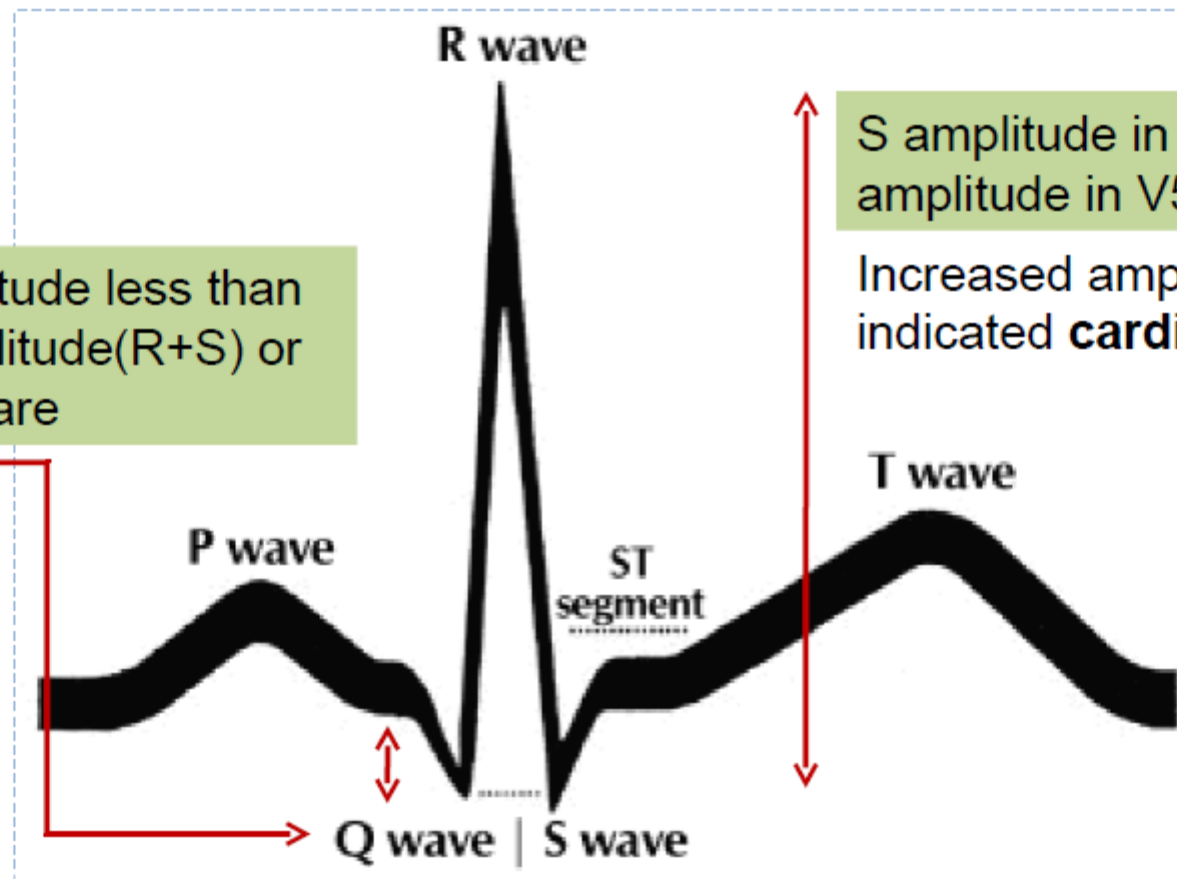


Heart Rate	Rhythm	P Wave	PR Interval (sec.)	QRS (Sec.)
30 – 60	Regular	Present but no correlation to QRS may be hidden	Varies	<.12 depends

QRS-COMPLEX

QRS COMPLEX

NORMAL QRS COMPLEX



Q wave amplitude less than $\frac{1}{3}$ QRS amplitude (R+S) or < 1 small square

S amplitude in V1 + R amplitude in V5 < 3.5

Increased amplitude indicated **cardiac hypertrophy**

QRS complex < 3 small square (0.06 - 0.10 sec)

Prolonged indicates **hyperkalemia** or **bundle branch block**

Bundle branch blocks

Normal Impulse Conduction

Sinoatrial node



AV node



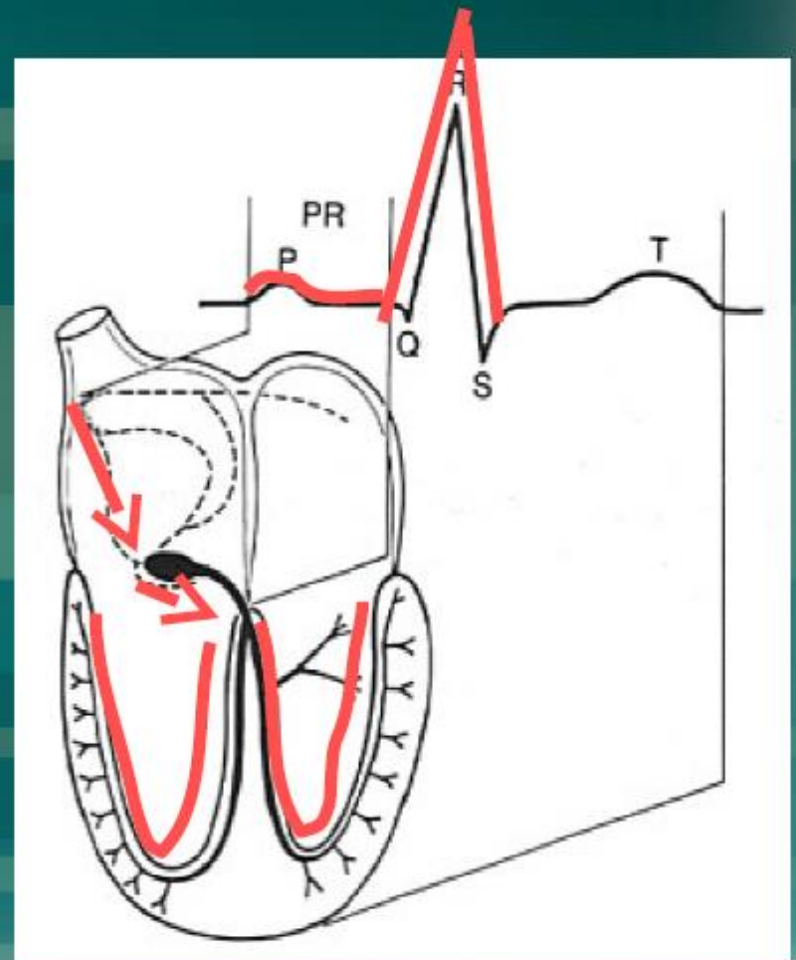
Bundle of His



Bundle Branches



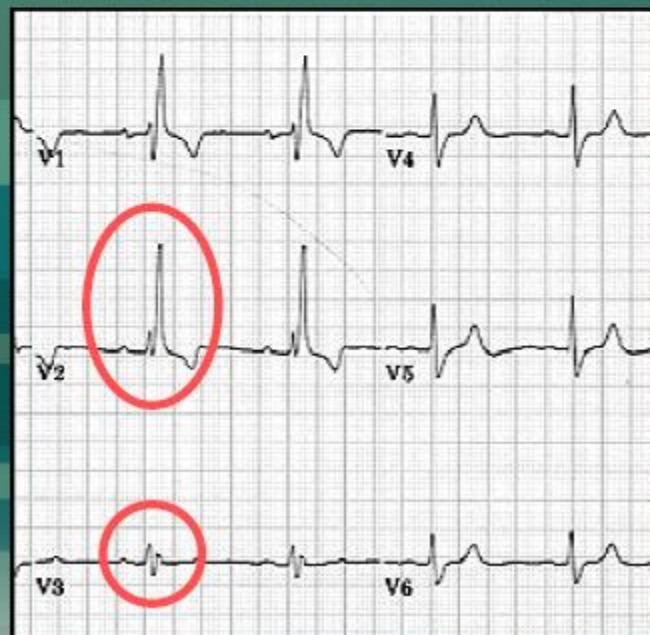
Purkinje fibers



Bundle Branch Blocks

With Bundle Branch Blocks you will see two changes on the ECG.

- QRS complex widens (> 0.12 sec).
- QRS morphology changes (varies depending on ECG lead, and if it is a right vs. left bundle branch block).



Right Bundle Branch Blocks

What QRS morphology is characteristic?

For RBBB the wide QRS complex assumes a unique, virtually diagnostic shape in those leads overlying the right ventricle (V_1 and V_2).

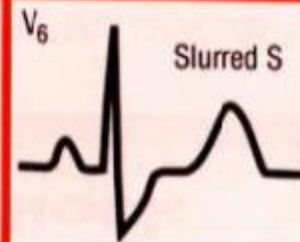
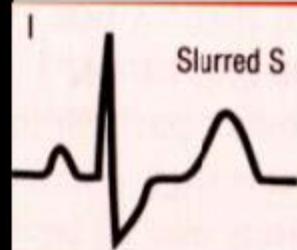


“Rabbit Ears”



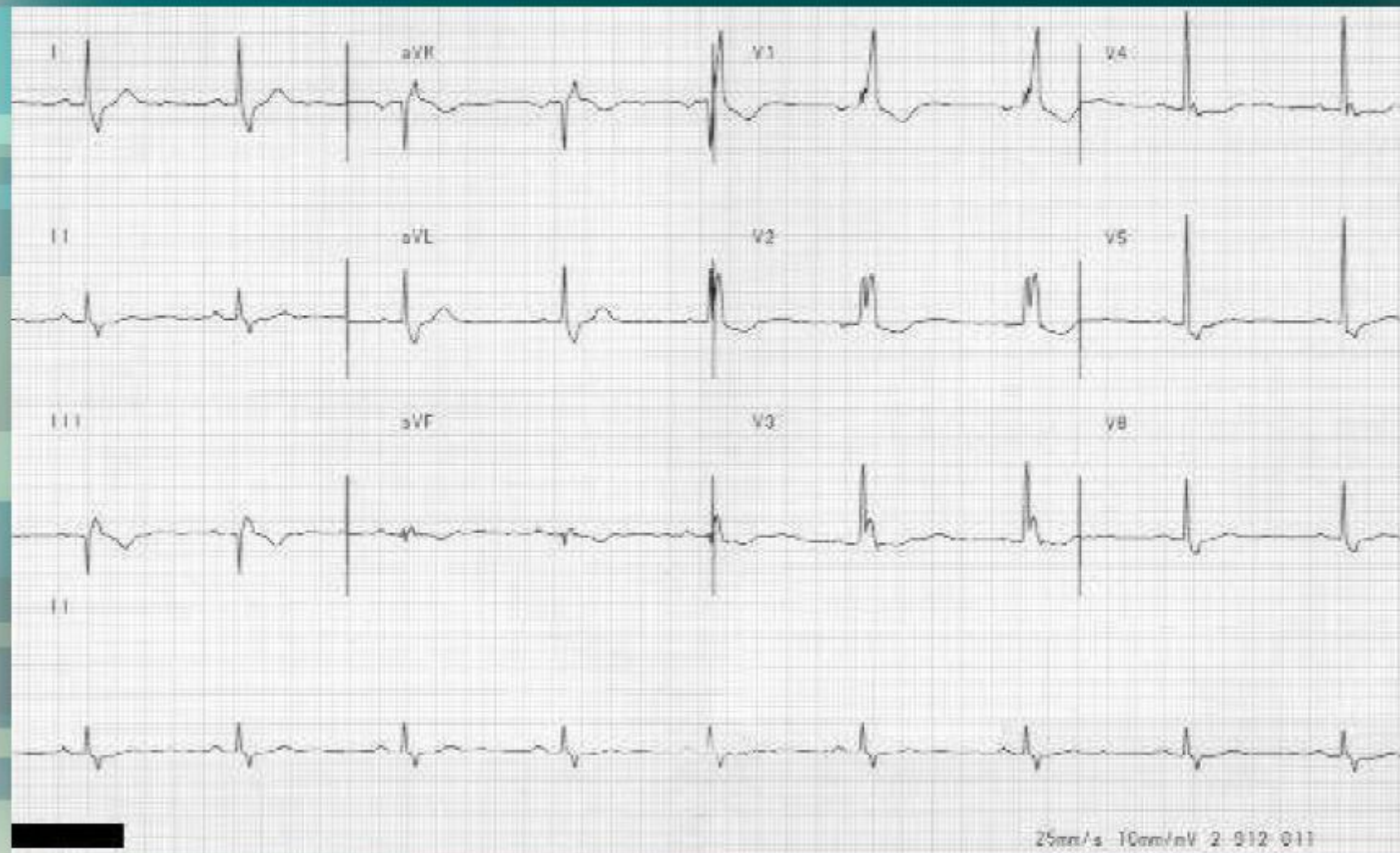
Right Bundle Branch Block

- QRS ≥ 0.12
- Slurred S wave in leads I and V6
- RSR' pattern in V1 or V2



QRS Morphology

RBBB

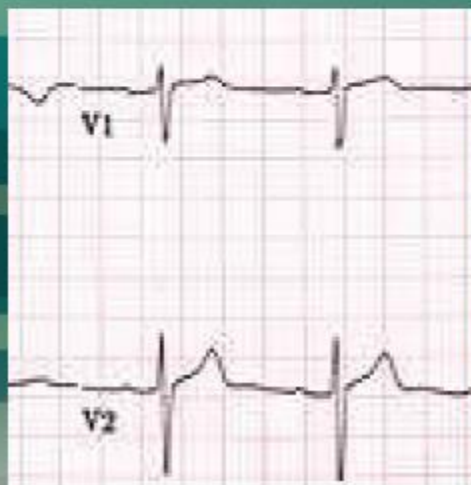


Left Bundle Branch Blocks

What QRS morphology is characteristic?

For LBBB the wide QRS complex assumes a characteristic change in shape in those leads opposite the left ventricle (right ventricular leads - V_1 and V_2).

Normal

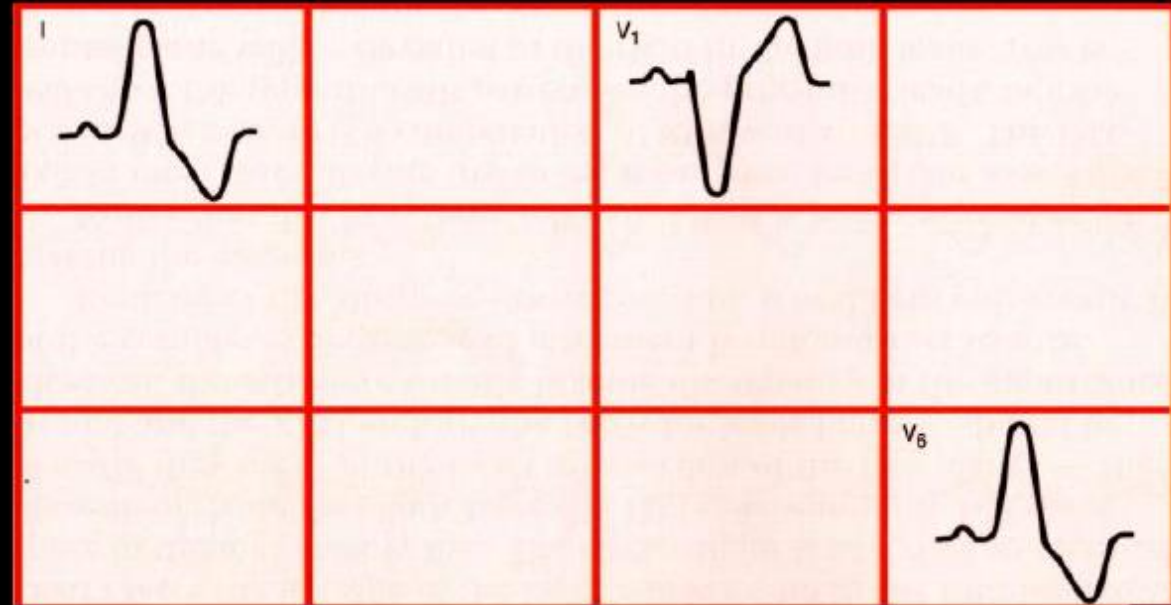


**Broad,
deep S
waves**

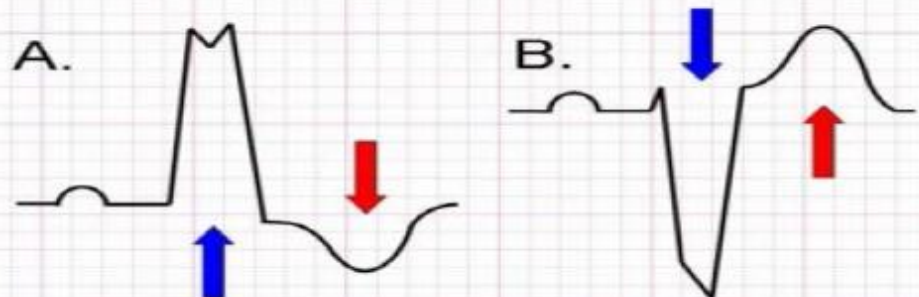
Left Bundle Branch Block

- $QRS \geq 0.12$
- Broad, monomorphic R waves in I and V6
- Broad monomorphic S waves in V1

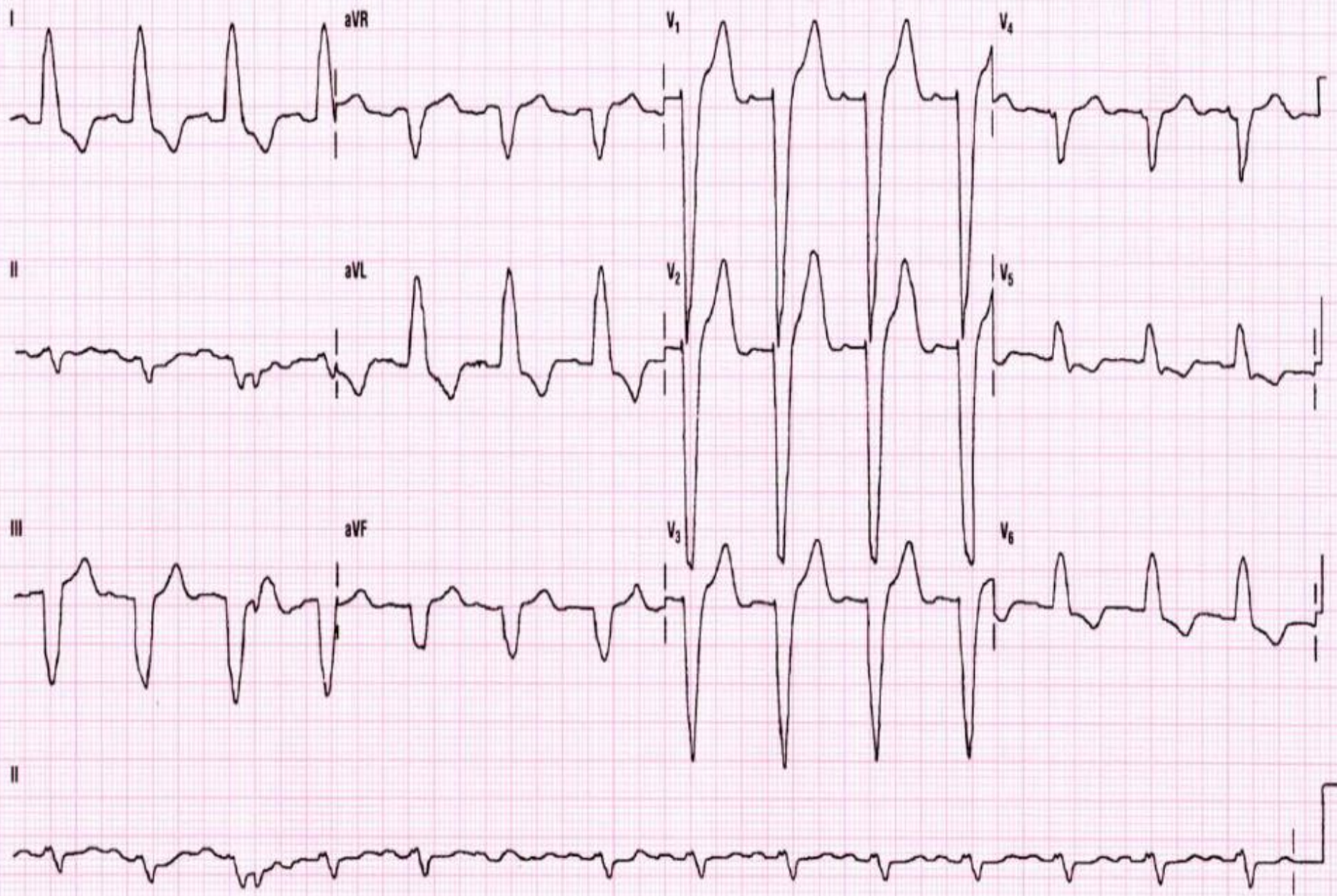
QRS Morphology



Discordant ST-Segments and T-Waves



Normal for LBBB and paced rhythm



Bundle Branch Block

- V1



ECG in coronary artery disease

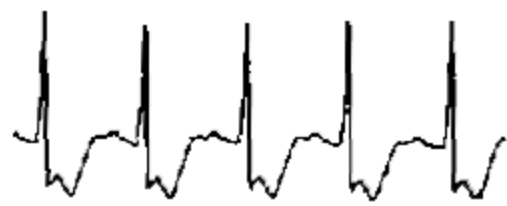
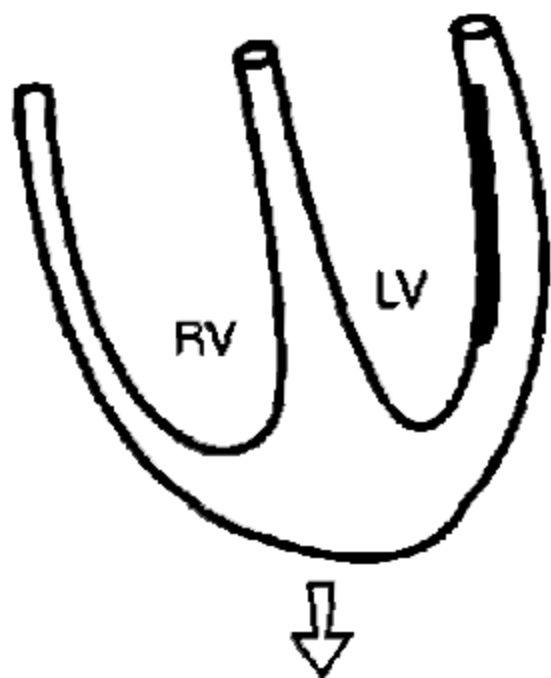


Type of coronary artery diseases

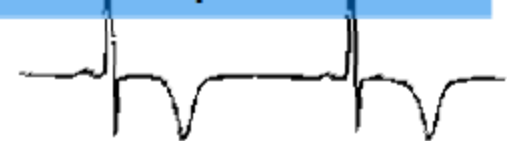
- Unstable angina
- Non-ST elevation myocardial infarction
- ST elevation myocardial infarction
- Other cardiac diseases ; e.g. coronary emboli , coronary dissection

Sub – endocardial ischemia

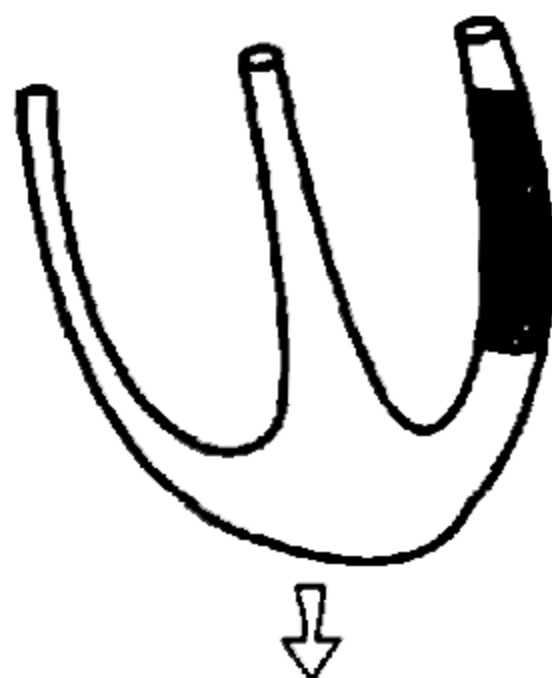
Transmural ischemia



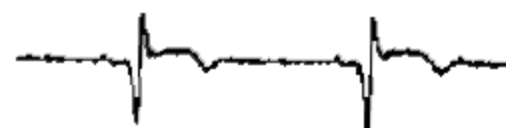
ST depression



early



ST elevation



later

STEMI – “trans-mural ischemia”

- Life – threatening condition
 - Plaque rupture
 - Acute obstruction of infarct artery (s)
 - Immediate management is essential
-
- Mortality is higher if a greater number of ECG leads show ST elevation

Management

Early diagnosis

Early treatment

Time = myocardium



ECG evaluation

12-lead ECG recording and interpretation is indicated as soon as possible at the point of FMC, with a maximum target delay of 10 min.^{36,38}

I

- ECG recording as soon as possible

If the ECG is equivocal, repeat ECGs and compared with previous recording

ECG monitoring with defibrillator capacity is indicated as soon as possible in all patients with suspected STEMI.^{44,45}

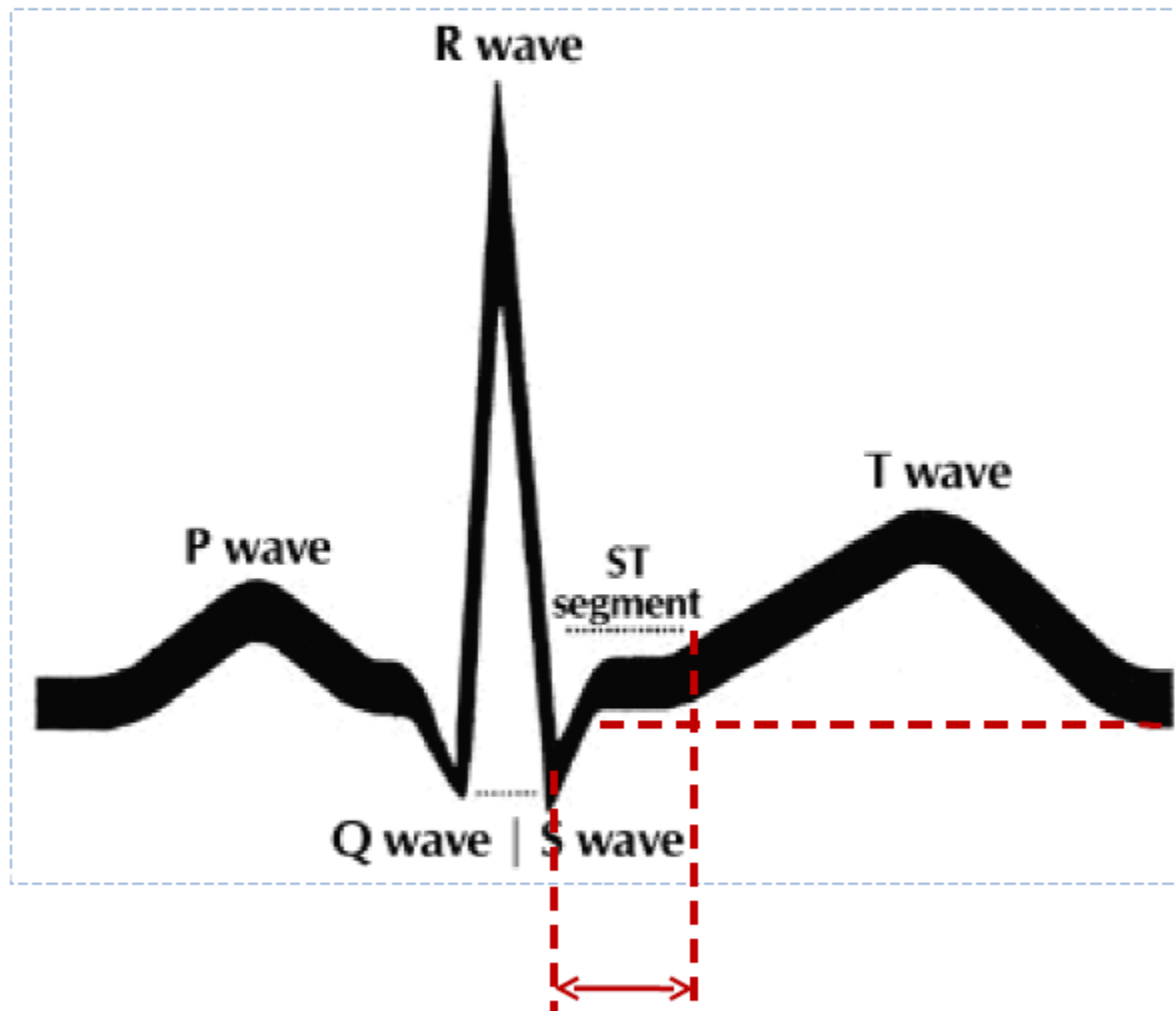
I

- Monitor ECG with defibrillator capacity

FMC = First medical contract

ST SEGMENT

NORMAL ST SEGMENT



ST segment is isoelectric and at the same level as subsequent PR-interval

ST segment < 2-3 small square (80 to 120 ms)

ST SEGMENT

OK, WE GONNA TALK ABOUT
MYOCARDIAL INFARCTION (MI)

THERE ARE 2 TYPES OF MI

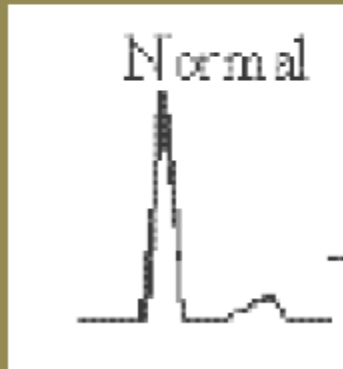
ST-ELEVATION MI (STEMI)

AND

NON ST-ELEVATION MI (NSTEMI)

WE DECIDE THIS BY LOOKING AT THE ST SEGMENT IN ALL LEADS

**NORMAL
ST SEGMENT**



Flat (isoelectric) $\pm$ Same level with subsequent PR segment

Elevation or depression of ST segment by 1 mm or more, measured at J point is abnormal.
J point is the point between QRS and ST segment

ST SEGMENT

ST-ELEVATION MI (STEMI)

0 HOUR



Pronounced T Wave initially
ST elevation (convex type)

1-24H



Depressed R Wave, and Pronounced T Wave. Pathological Q waves may appear within hours or may take greater than 24 hr.- indicating full-thickness MI. Q wave is pathological if it is wider than 40 ms or deeper than a third of the height of the entire QRS complex

Day 1-2



Exaggeration of T Wave continues for 24h.

Days later



T Wave inverts as the ST elevation begins to resolve. Persistent ST elevation is rare except in the presence of a ventricular aneurysm.

Weeks later



ECG returns to normal T wave, but retains pronounced Q wave. An old infarct may look like this

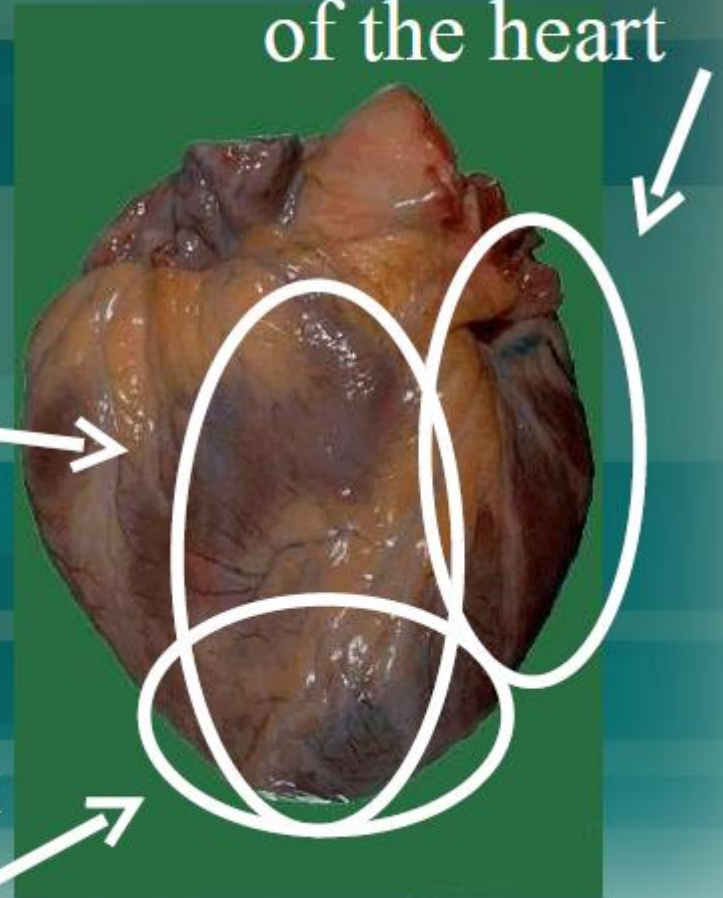
Other MI Locations

First, take a look
again at this picture
of the heart.

Anterior portion
of the heart

Inferior portion
of the heart

Lateral portion
of the heart

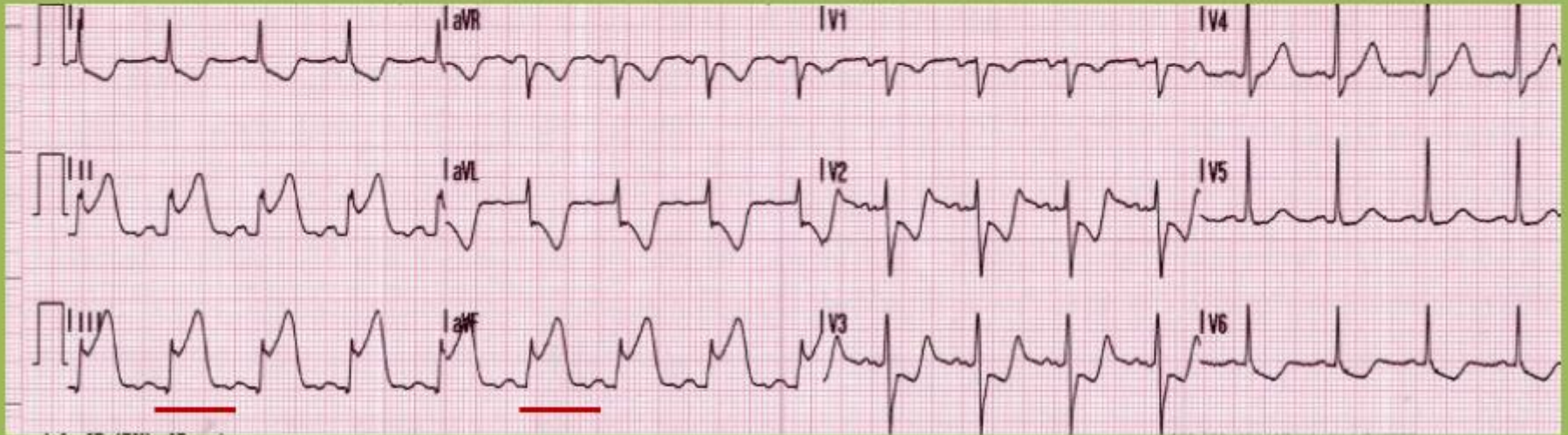


Anatomic Groups (Summary)

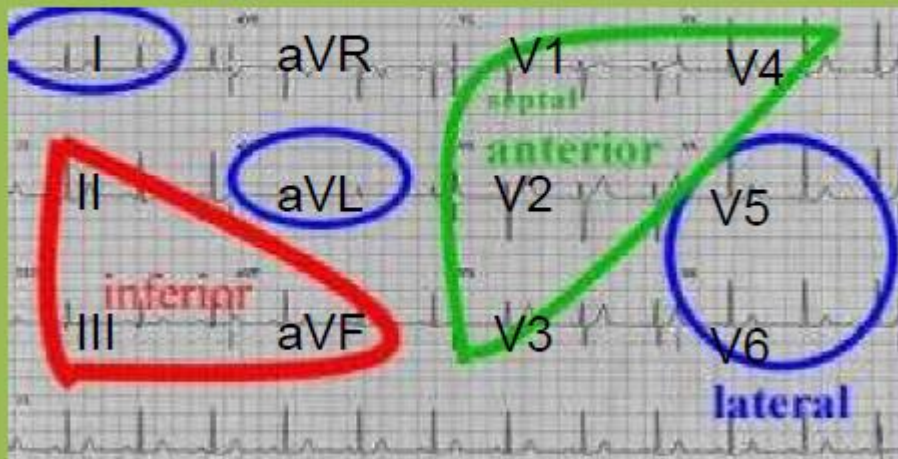
I Lateral	aVR None	V ₁ Septal	V ₄ Anterior
II Inferior	aVL Lateral	V ₂ Septal	V ₅ Lateral
III Inferior	aVF Inferior	V ₃ Anterior	V ₆ Lateral

ST SEGMENT

How about this one?



Check again!



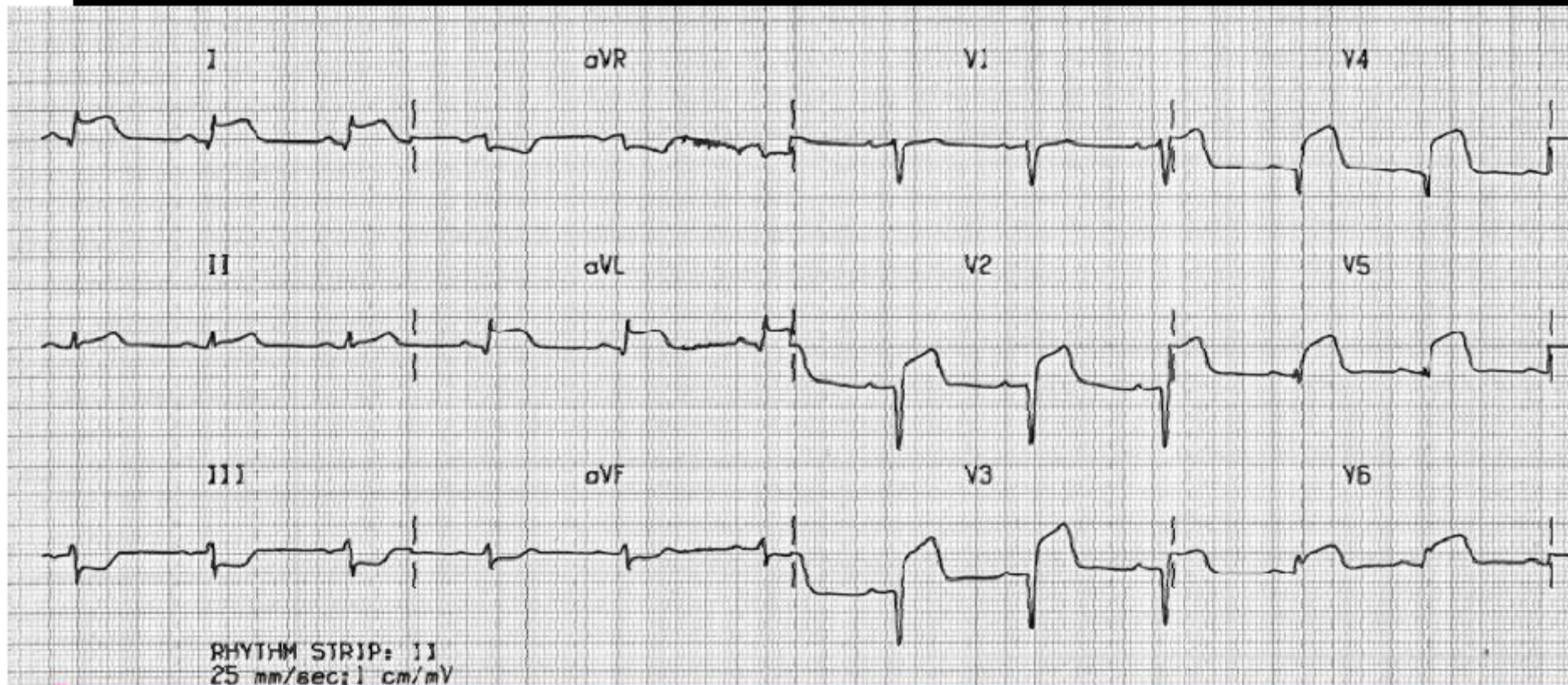
Inferior MI!

Reciprocal change

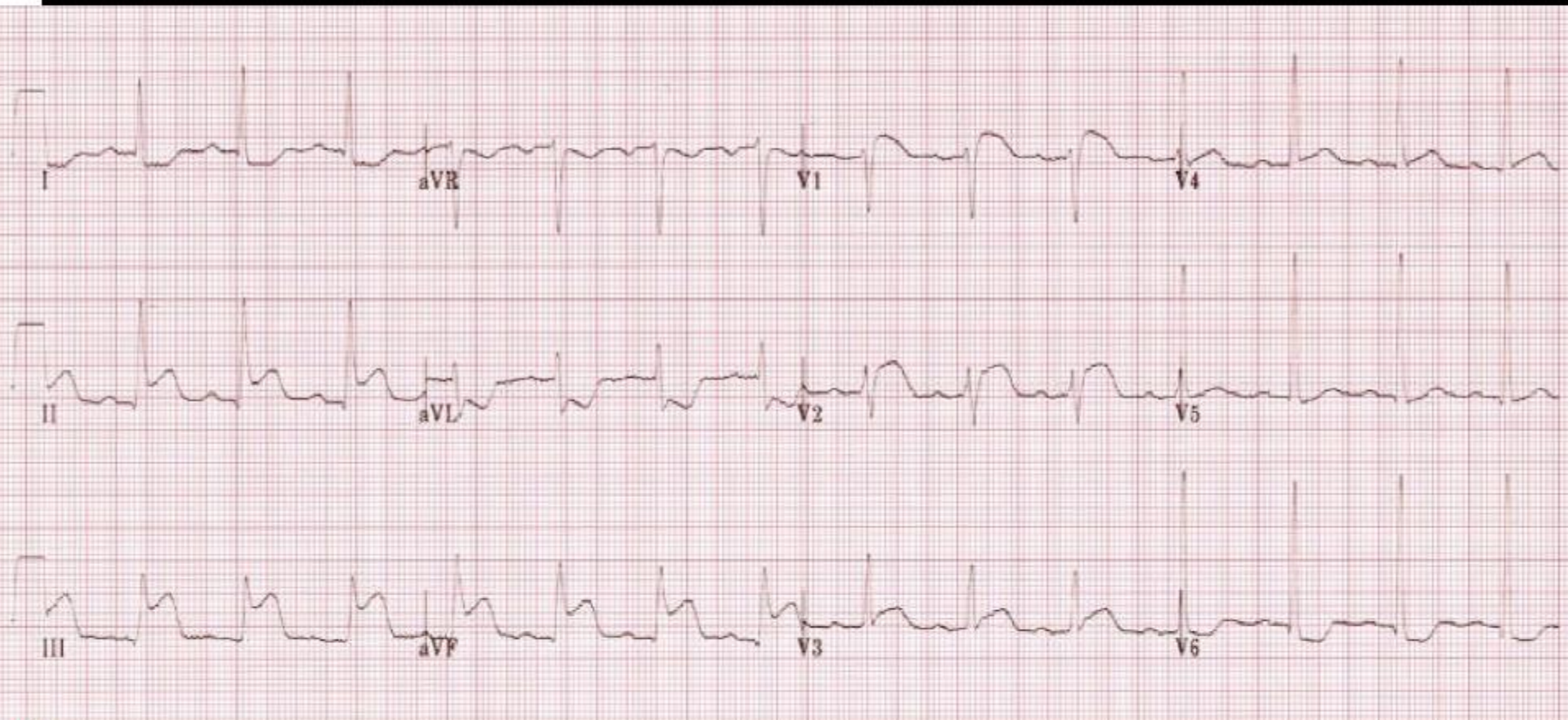
- Reciprocal change is a very important ECG finding, not only supporting the diagnosis of STEMI but also indicating a high-risk patient.
- Reciprocal change is defined as ST-segment depression occurring on an ECG which also has ST-segment elevation in at least 2 leads in a single anatomic segment.
- The concept of reciprocal change cannot be used in patients who have the following patterns on ECG: left bundle-branch block, right bundle-branch block, right ventricular paced rhythm from an implanted pacemaker, and left ventricular hypertrophy via voltage criteria with strain.



Anterior wall STEMI

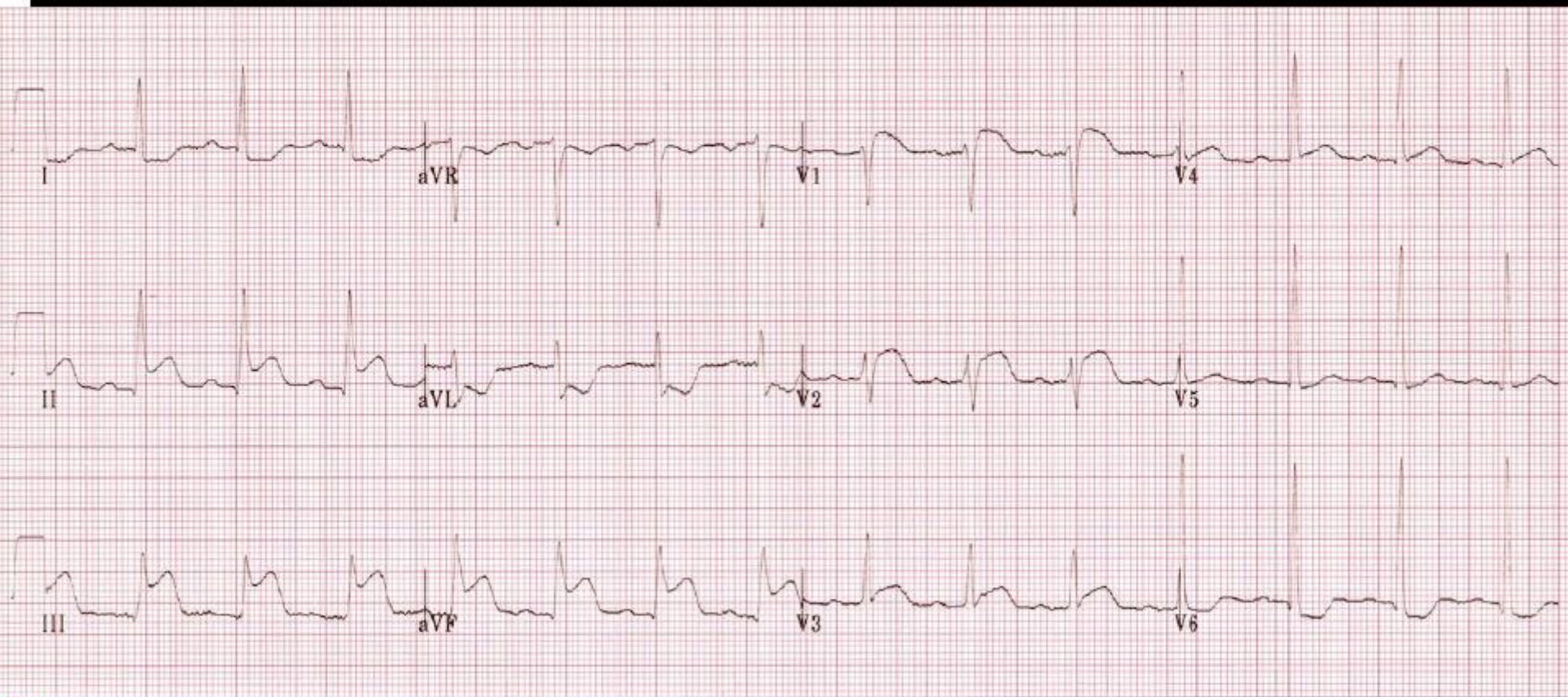


Inferior wall STEMI



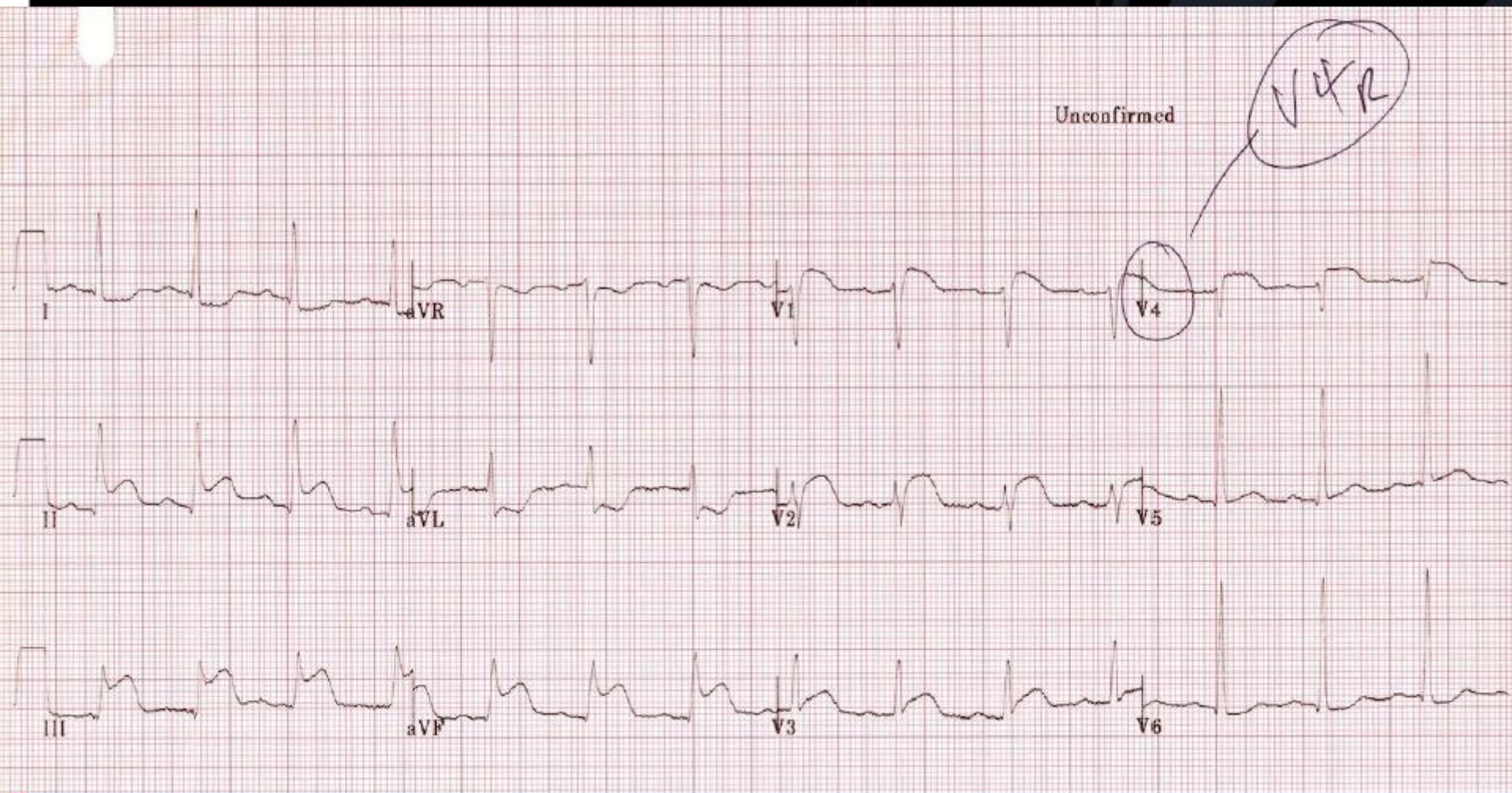
ST elevation in II , III and aVF

Right ventricular infarction (concomitant with inferior wall MI)

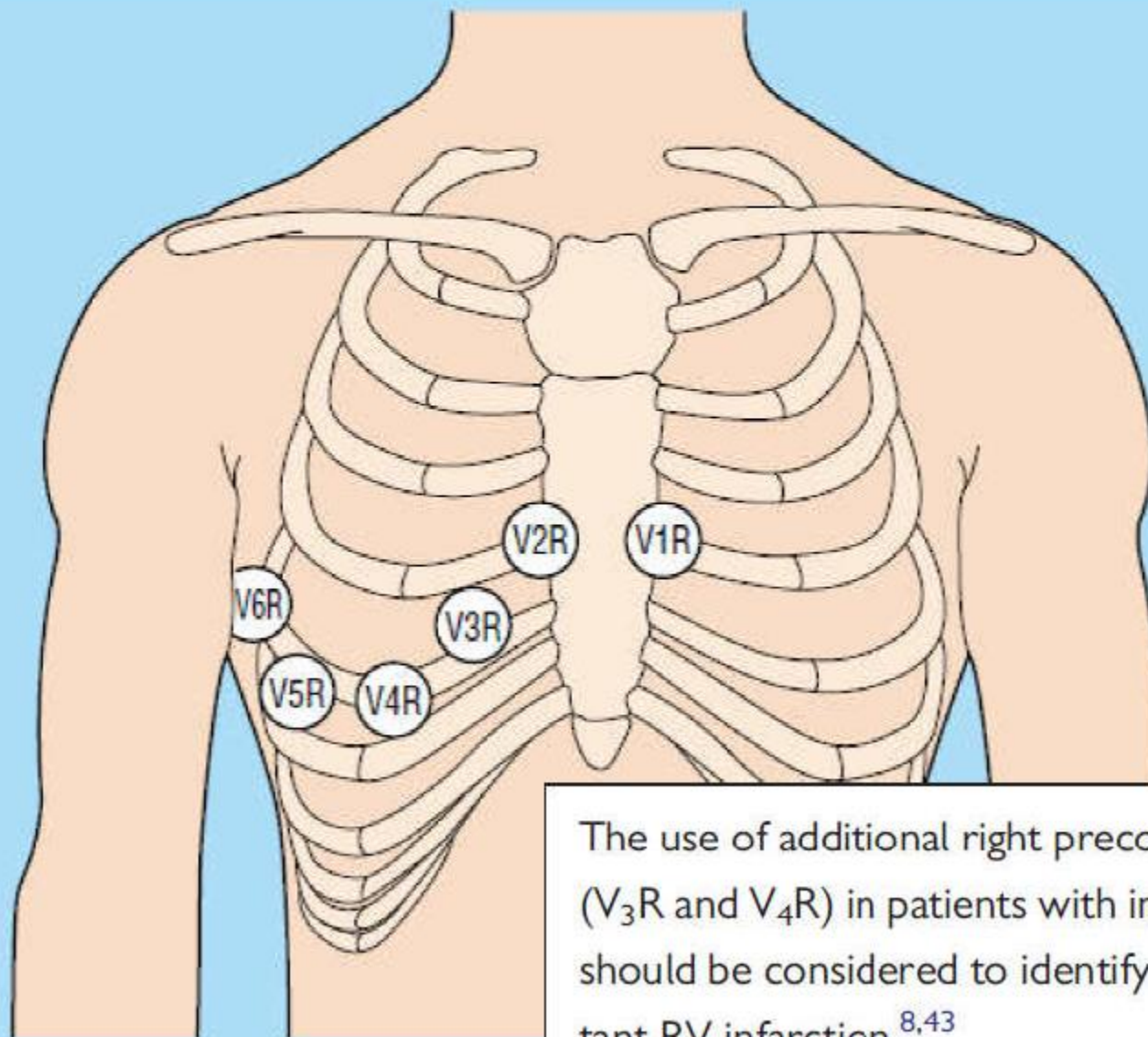


ST elevation in II , III and aVF and V1

V₃R , V₄R lead



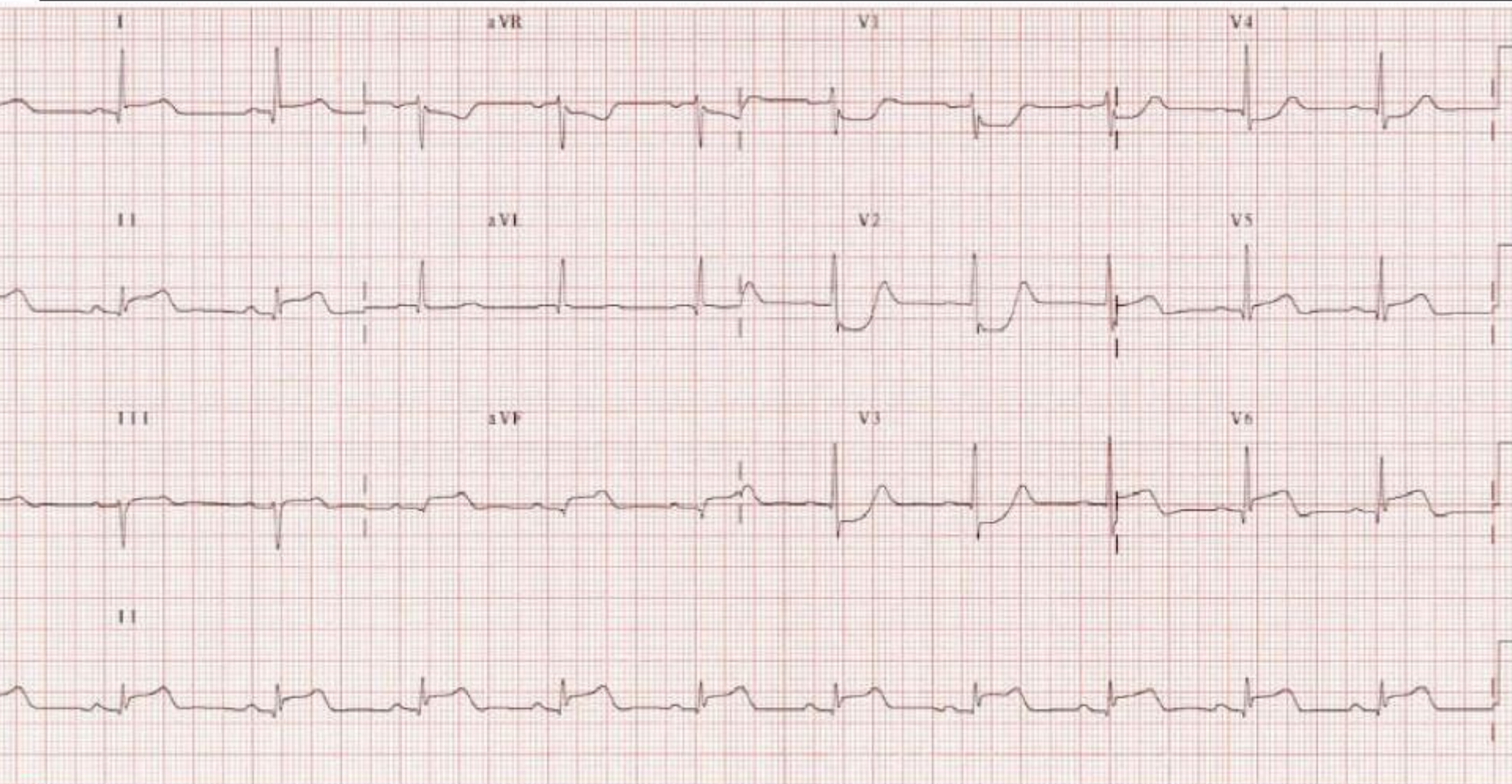
V₃R , V₄R lead



The use of additional right precordial leads (V₃R and V₄R) in patients with inferior MI should be considered to identify concomitant RV infarction.^{8,43}

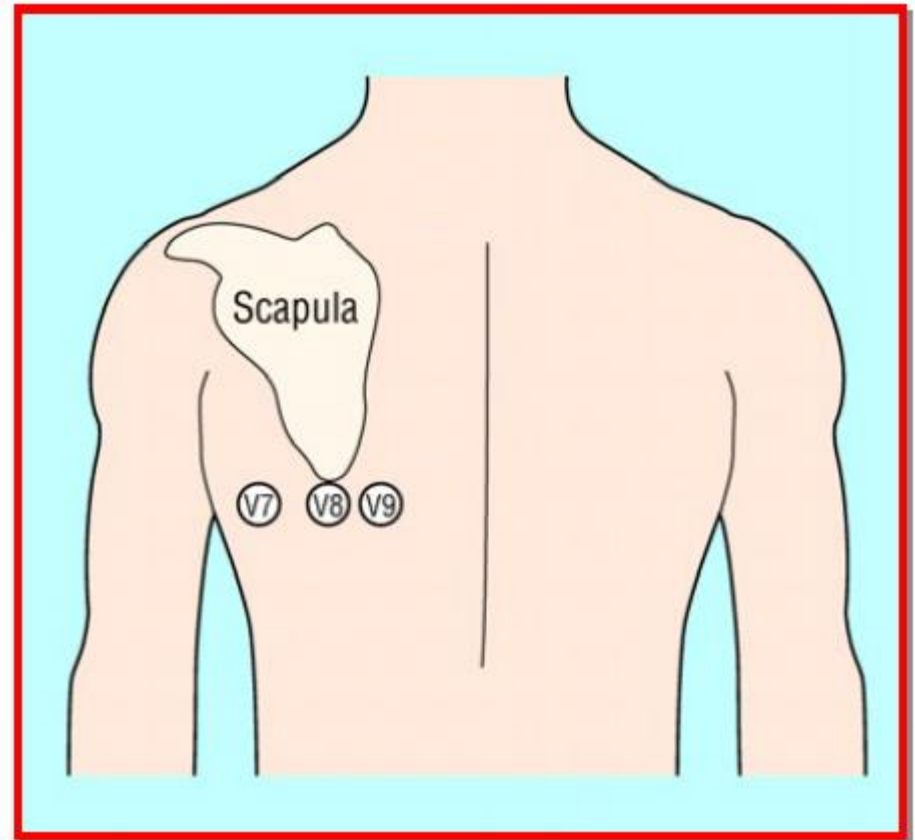
IIa

Posterior wall STEMI (concomitant with inferior wall MI)



- **Posterior Leads**

- Leads V7-9 are placed on the posterior chest wall in the following positions.
- V7 – Left posterior axillary line, in the same horizontal plane as V6.
- V8 – Tip of the left scapula, in the same horizontal plane as V6.
- V9 – Left paraspinal region, in the same horizontal plane as V6.



The degree of ST elevation seen in V7-9 is typically modest – note that only 0.5 mm of ST elevation is required to make the diagnosis of posterior MI

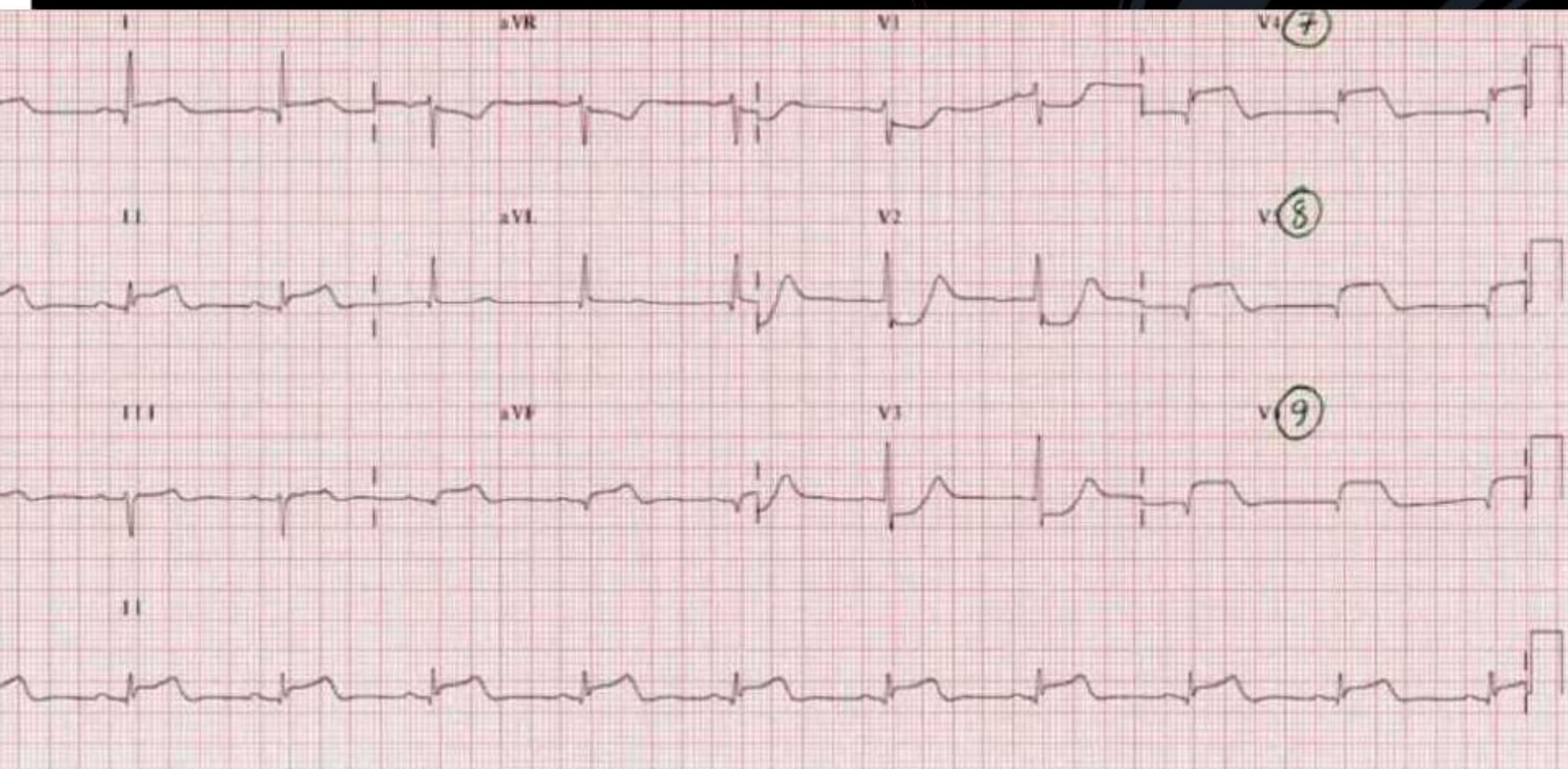
Posterior wall MI

Isolated posterior myocardial infarction

Isolated ST depression ≥ 0.5 mm in leads V_1 – V_3 and ST-segment elevation (≥ 0.5 mm) in posterior chest wall leads V_7 – V_9

- Should be managed as a STEMI

V7 - V9 posterior lead



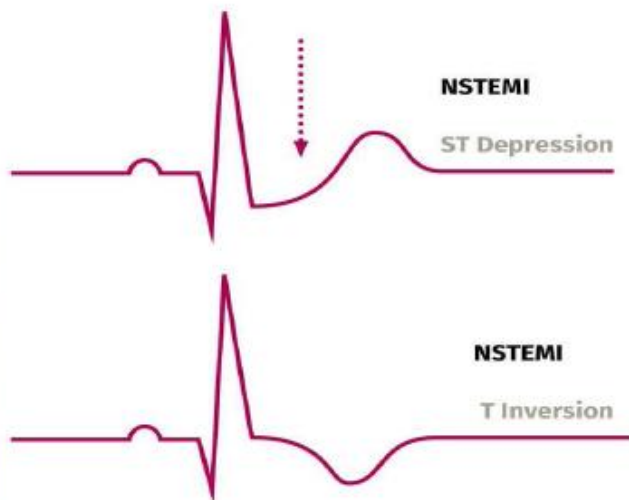
Non ST elevation MI

- ▶ ECG features can be any of the following:
 - ▶ 1. ST depression (70–80% sensitivity)
 - ▶ 2. T wave inversion (10–20% sensitivity)
 - ▶ 3. Both ST depression and T wave inversion
 - ▶ 4. Normal ECG

ECG in ischemia(NSTEMI)

ST-depression and T wave changes

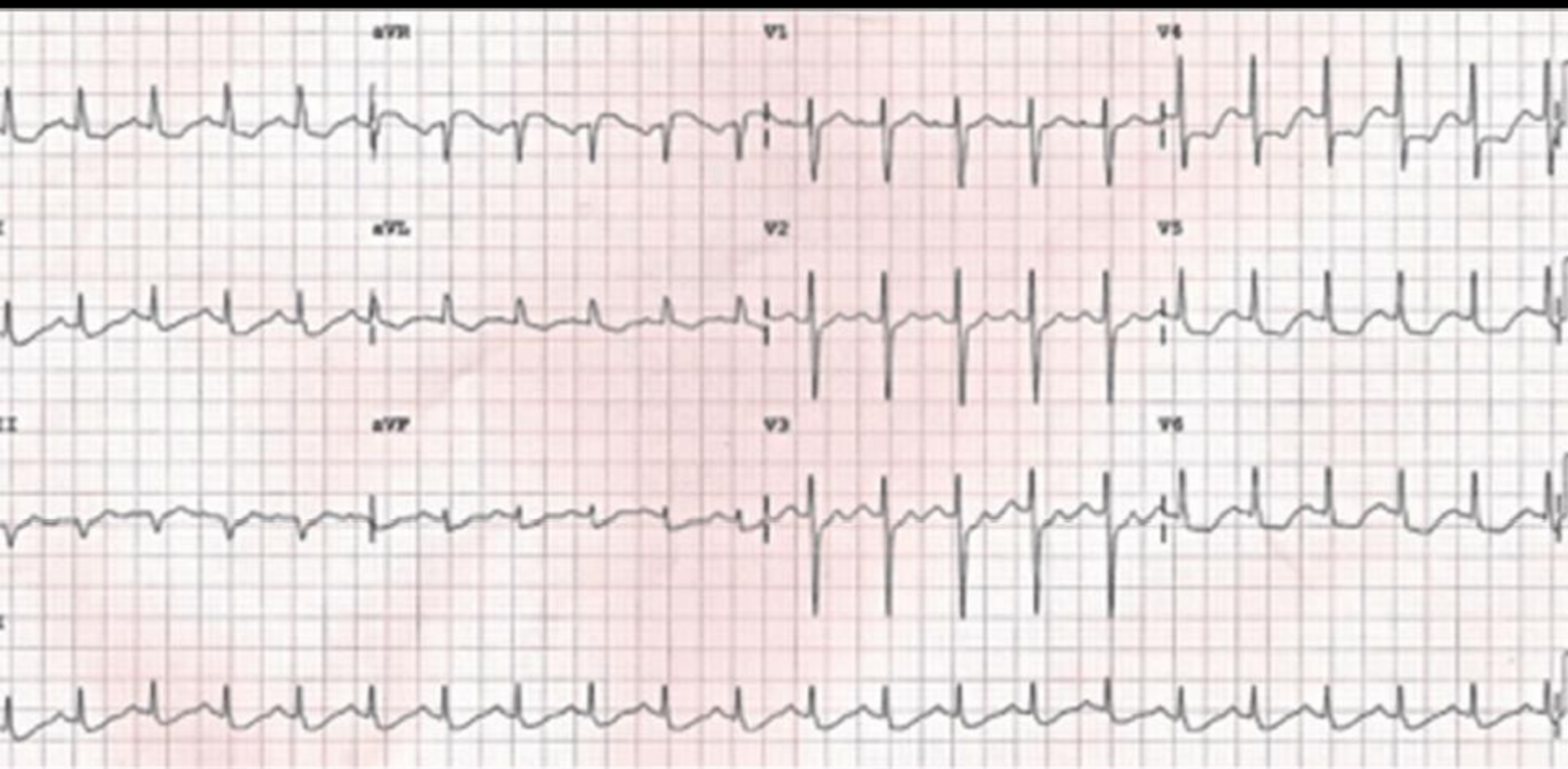
New horizontal or downsloping ST-depression ≥ 0.5 mm in two contiguous leads and/or T inversion > 1 mm in two contiguous leads with prominent R wave or R/S ratio > 1 .



ST depression

T wave inversion

Horizontal ST/T segment depression in V4-V6



ST SEGMENT



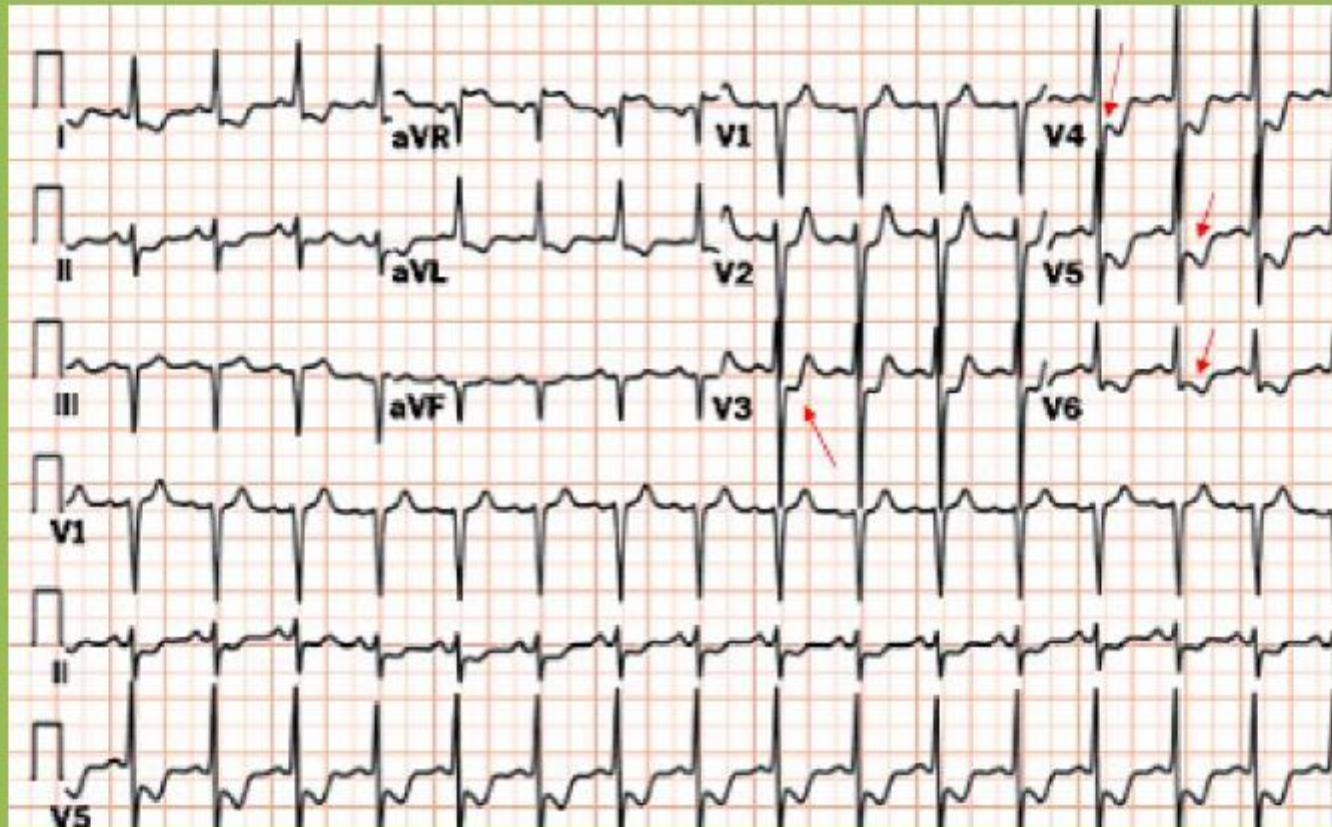
MYOCARDIAL ISCHEMIA

1mm ST-segment depression

Symmetrical, tall T wave

Long QT- interval

A **ST depression is more suggestive of myocardial ischaemia** than infarction



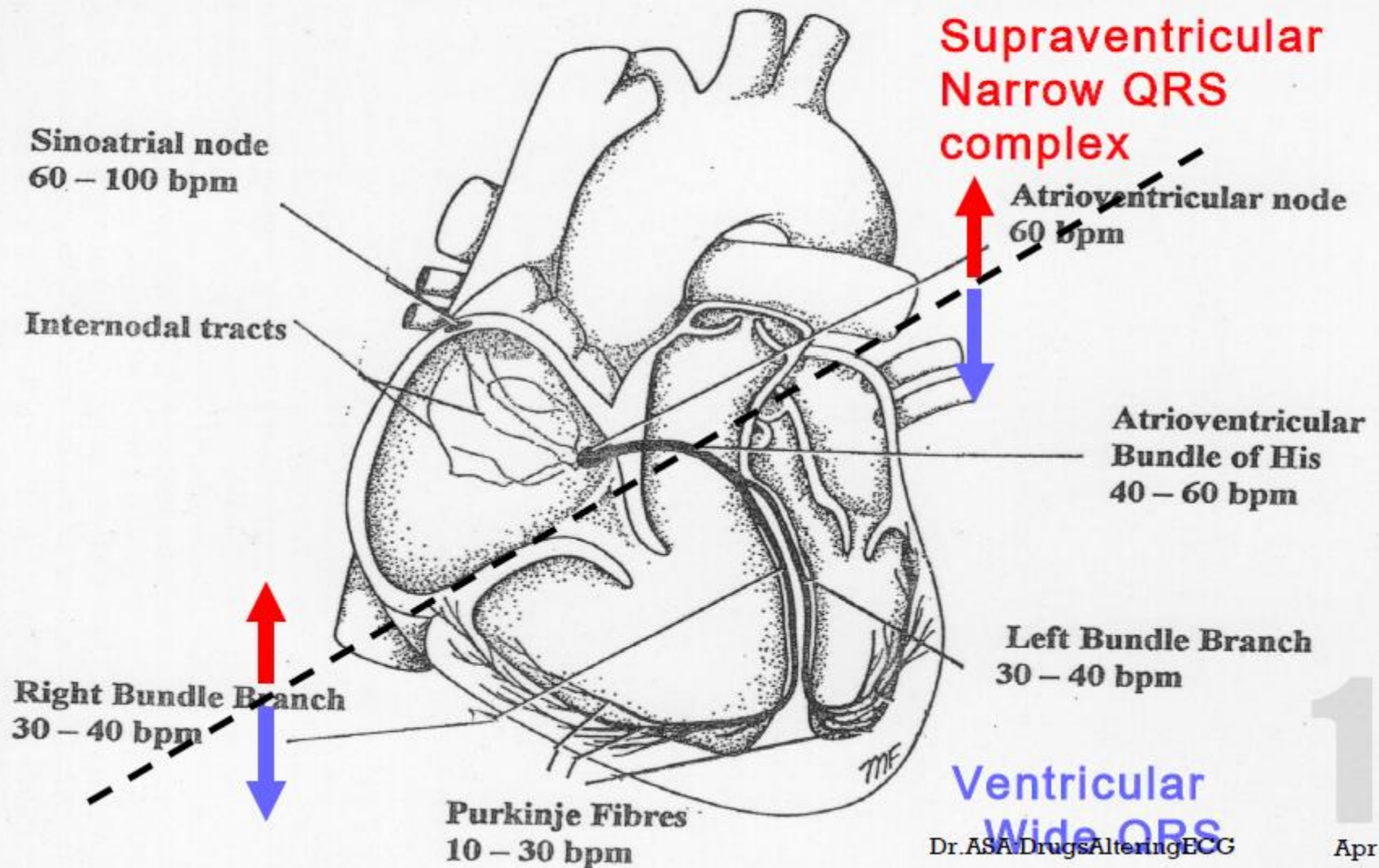
ARRHYTHMIA IN ECG



This session

- Supraventricular arrhythmia
- Ventricular arrhythmia

Conduction Pathways



The Rhythm

- Is it fast or slow?
- Is it regular or irregular?
- Are there p waves present?
 - Are all p waves the same?
 - Does each QRS have a p wave?
 - Is the PR interval constant?

The Rhythm

- Are the p waves and QRS complexes associated with each other?
- Are the QRS complexes narrow or wide?
- Are the QRS complexes grouped or not?
- Are there dropped beats?

The Rhythm

Supraventricular Rhythms

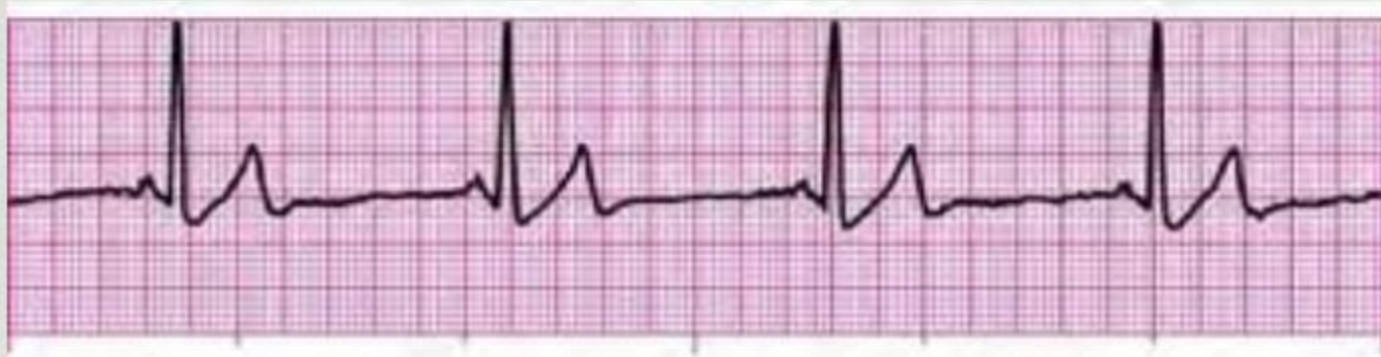
- Dr mohagheh assistant professor of cardiology

Normal Sinus Rhythm



- Rate: 60 - 100 bpm
- Regular
- P wave present
- P:QRS ratio: 1:1
- PR Interval: Normal
- QRS width: Normal
- Grouping: None
- Dropped: None

Sinus Bradycardia



- Rate: Less than 60
- Regular
- P wave present
- P:QRS ratio: 1:1
- PR Interval: Normal
- QRS width: Normal
- Grouping: None
- Dropped: None

Sinus Tachycardia

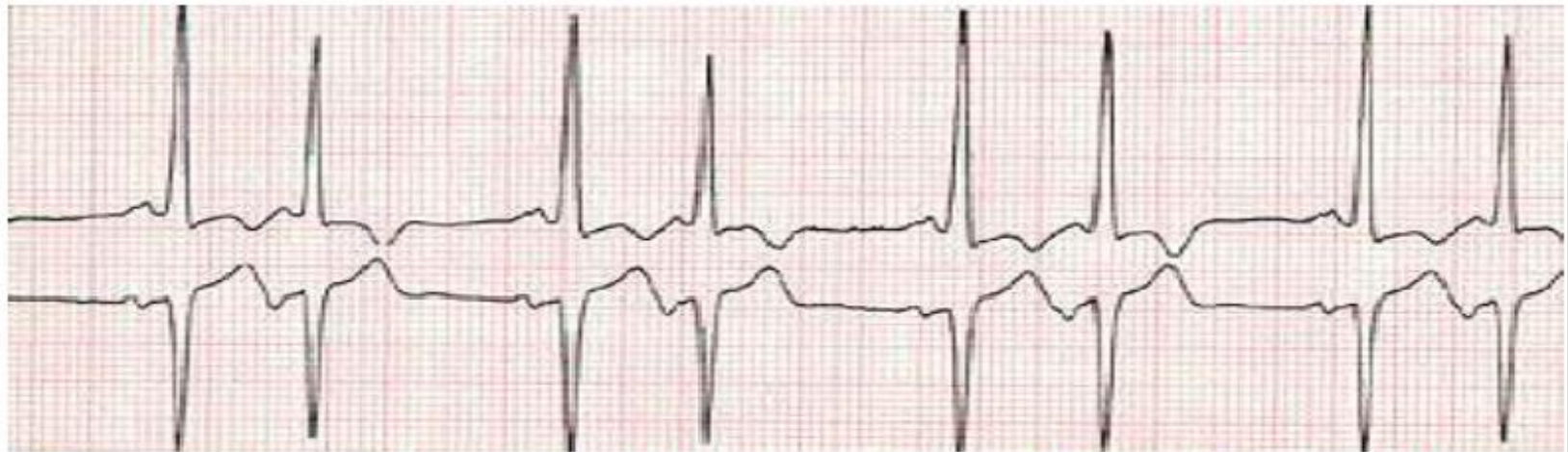


- Rate: Greater than 100
- Regular
- P wave present
- P:QRS ratio: 1:1
- PR Interval: Normal
- QRS width: Normal
- Grouping: None
- Dropped: None



Atrial Rhythms

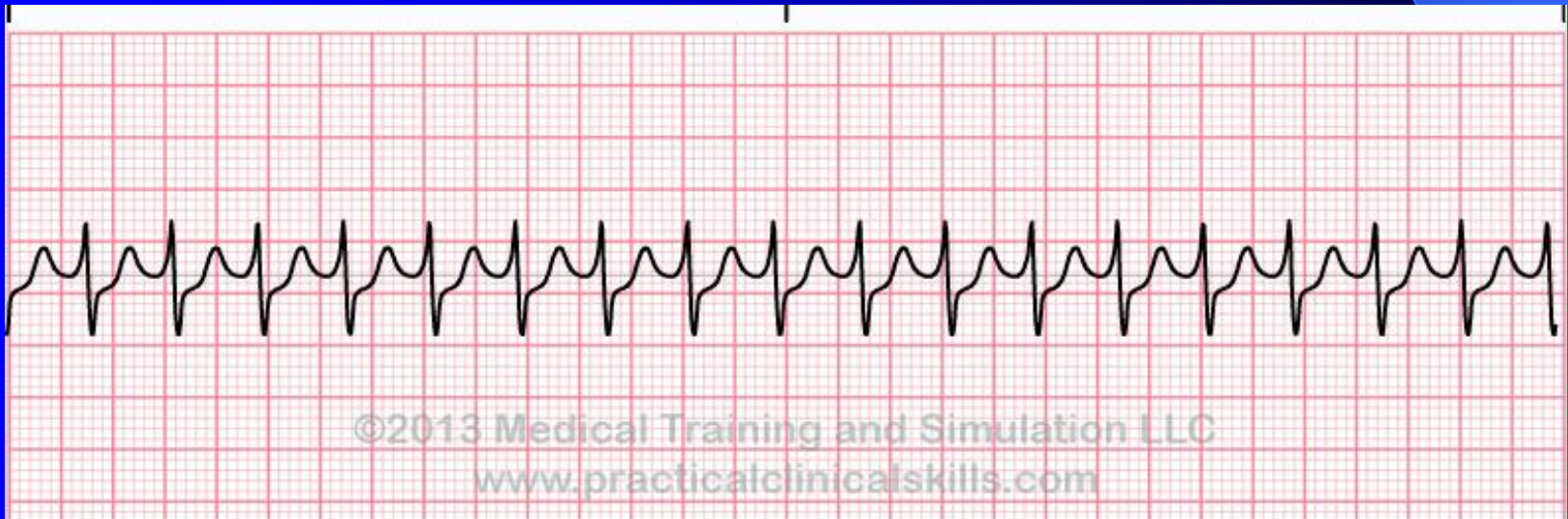
Premature Atrial Contraction (PAC)



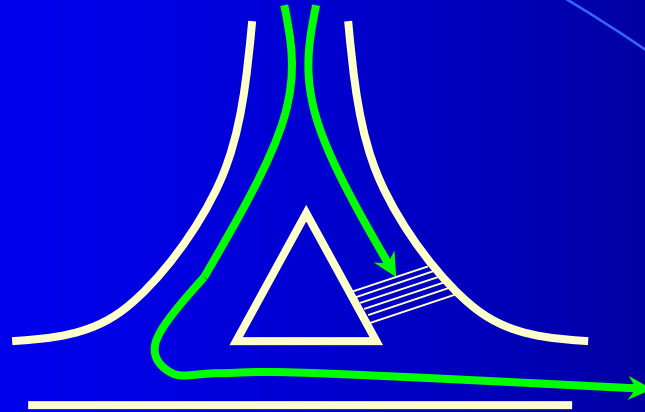
Heart Rate	Rhythm	P Wave	PR Interval (sec.)	QRS (Sec.)
NA	Irregular	Premature & abnormal or hidden	.12 - .20	<.12

SVT: Overview

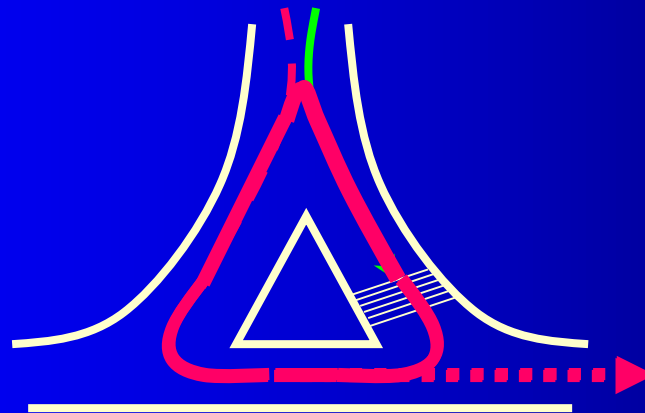
- **Definition:** from *Hurst's the Heart*. All tachyarrhythmia that either originate from or incorporate supraventricular tissue in a re-entrant circuit.



Reentry Arrhythmias

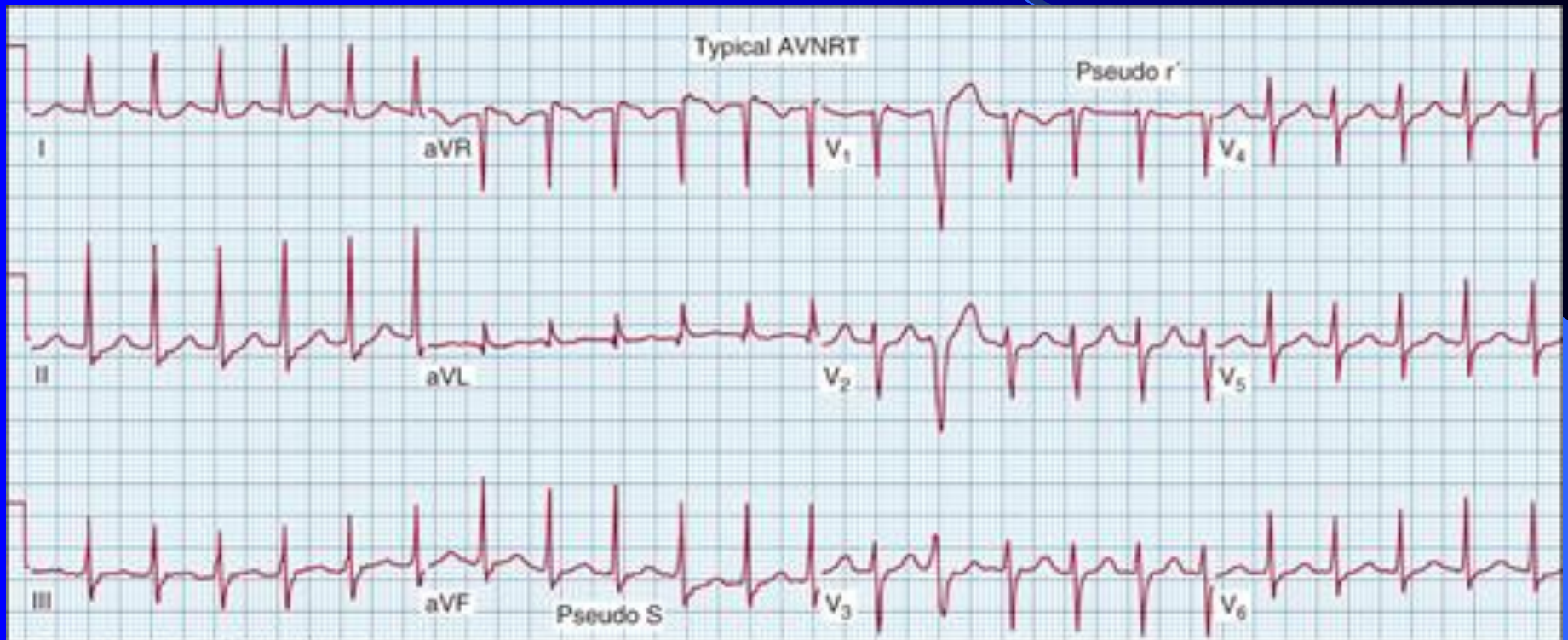


Normal



Re-entrant
Tachycardia

Typical AVNRT



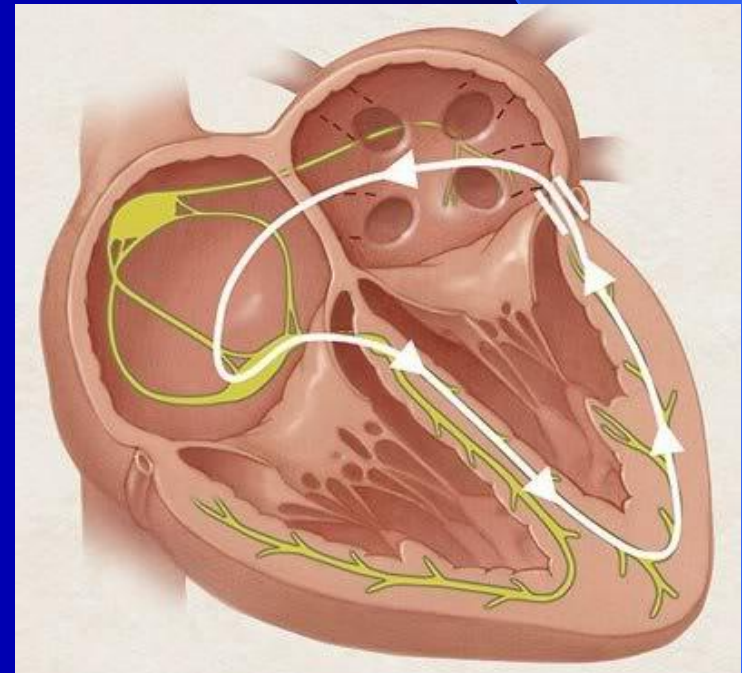
Source: Valentin Fuster, Robert A. Harrington, Jagat Narula, Zubin J. Eapen: Hurst's The Heart, Fourteenth Edition: www.accessmedicine.com Copyright © McGraw-Hill Education. All rights reserved.

AVNRT Management

- Benign rhythm: Treat to alleviate symptoms
- Acute management
 - Vagal Maneuvers
 - Adenosine (nearly 100% effective at terminating AVNRT)
 - DC cardioversion if unstable
 - CCB and Beta blockers
- Long term management
 - Catheter Ablation: If symptomatic
 - Medical therapy with BB, CCB, or antiarrhythmic

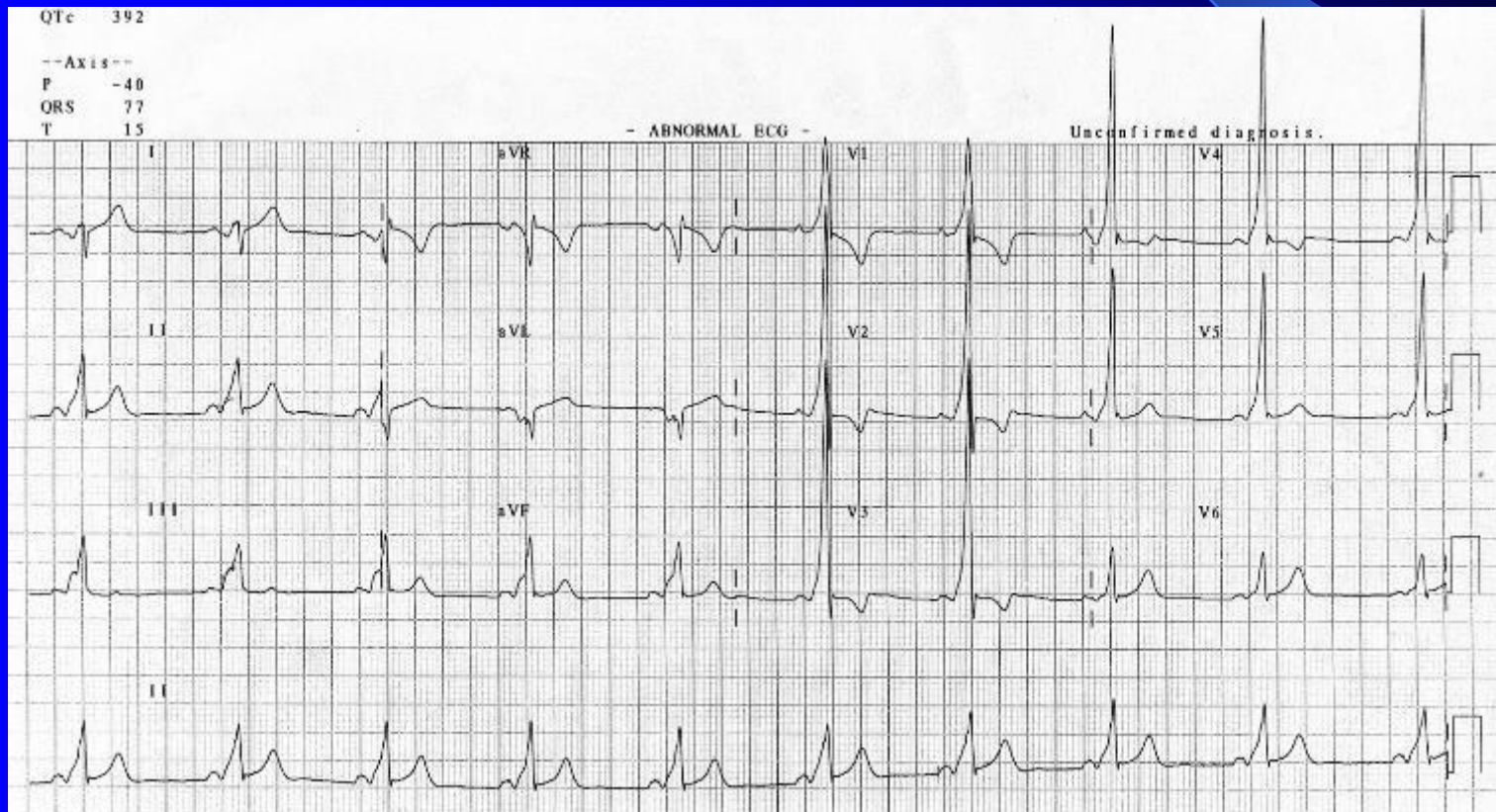
AVRT: Accessory Pathway

- **Accessory Pathway:** Extranodal tract for electrical conduction
 - In WPW: **Bundle of Kent**
- **Pre-excitation:** early activation of ventricles via AP (e.g. WPW)
- **AVRT:** Re-entrant circuit involving AP



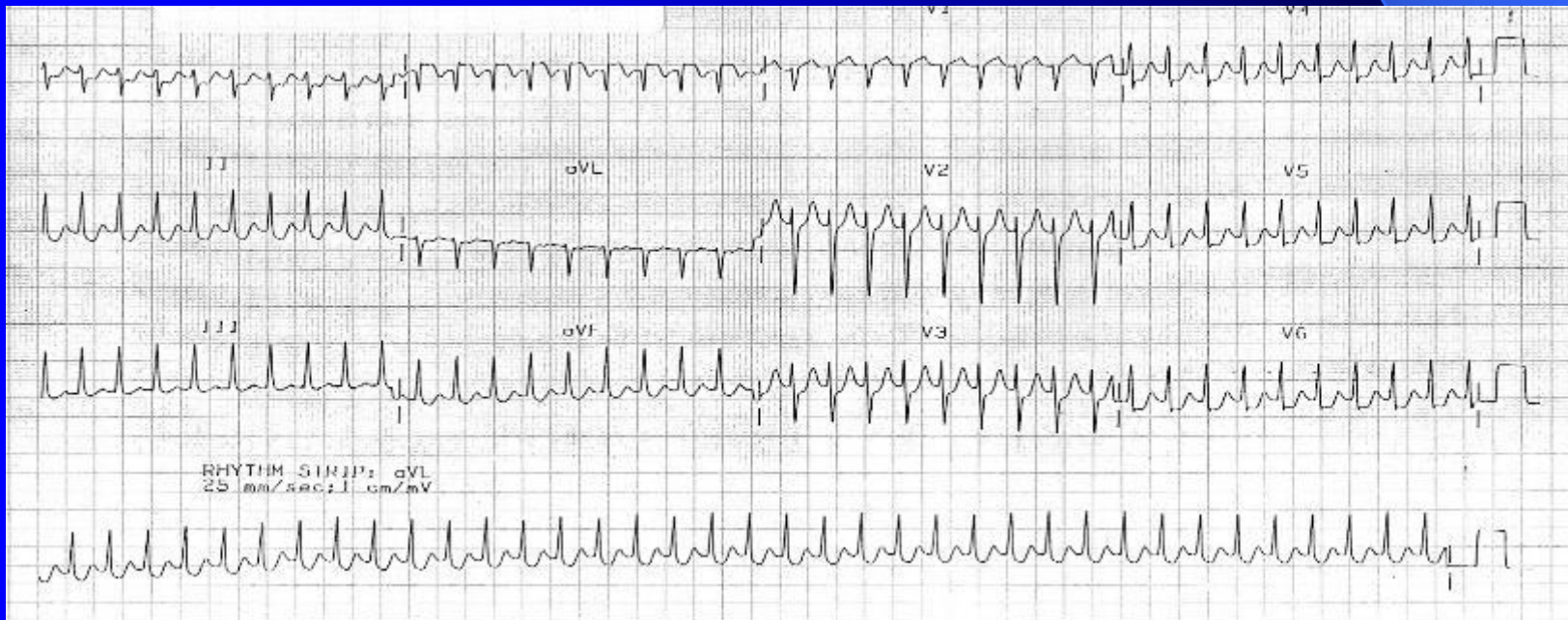
Pre-excitation EKG

- Anterograde conduction via AP in sinus:
 - Delta wave
 - Shorter PR interval (<120 ms)



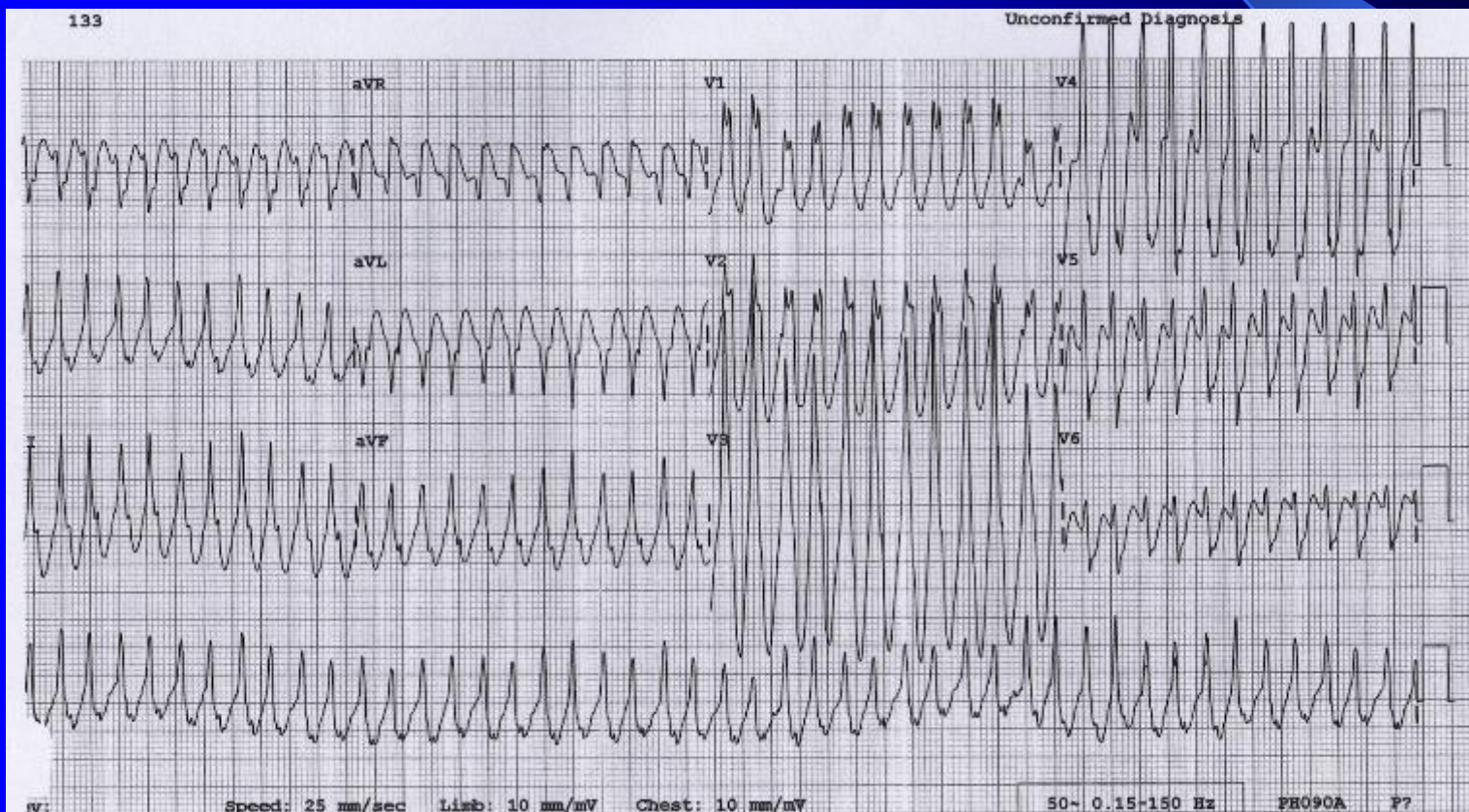
Orthodromic AVRT EKG

- Rate 200 – 300 bpm
- P- waves are retrograde and often buried
- QRS is narrow



Antidromic AVRT: EKG

- 200 – 300 bpm
- Wide QRS complex



Acute Management of AVRT

- **Orthodromic:**

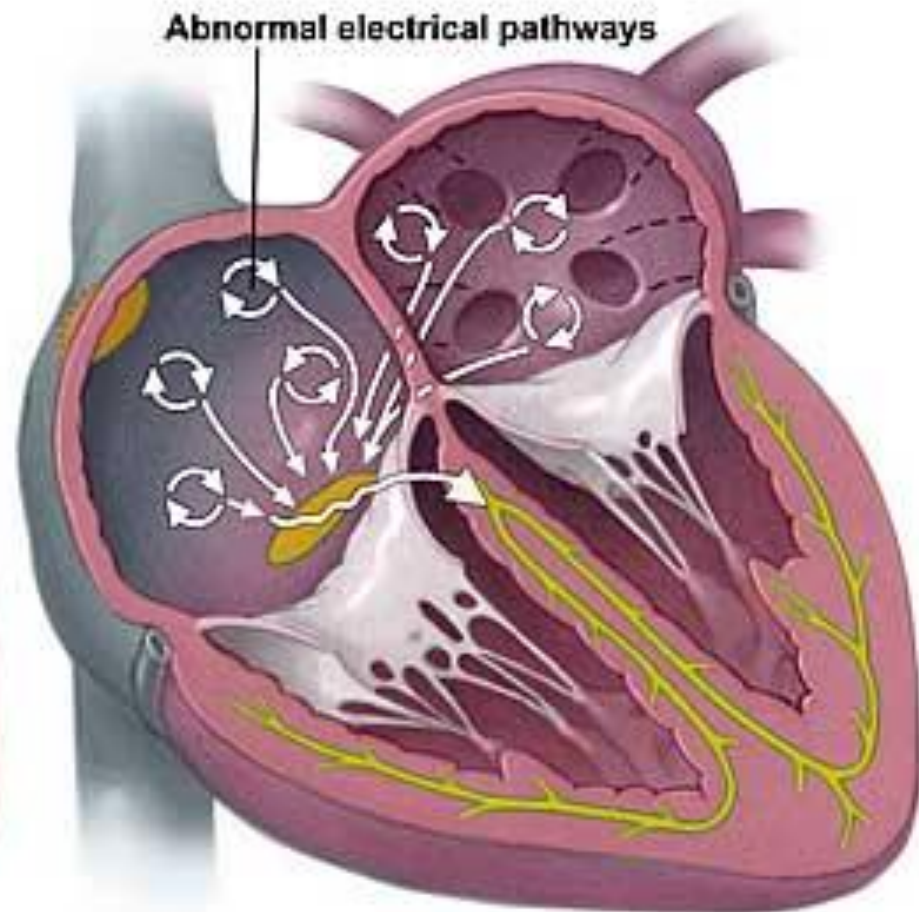
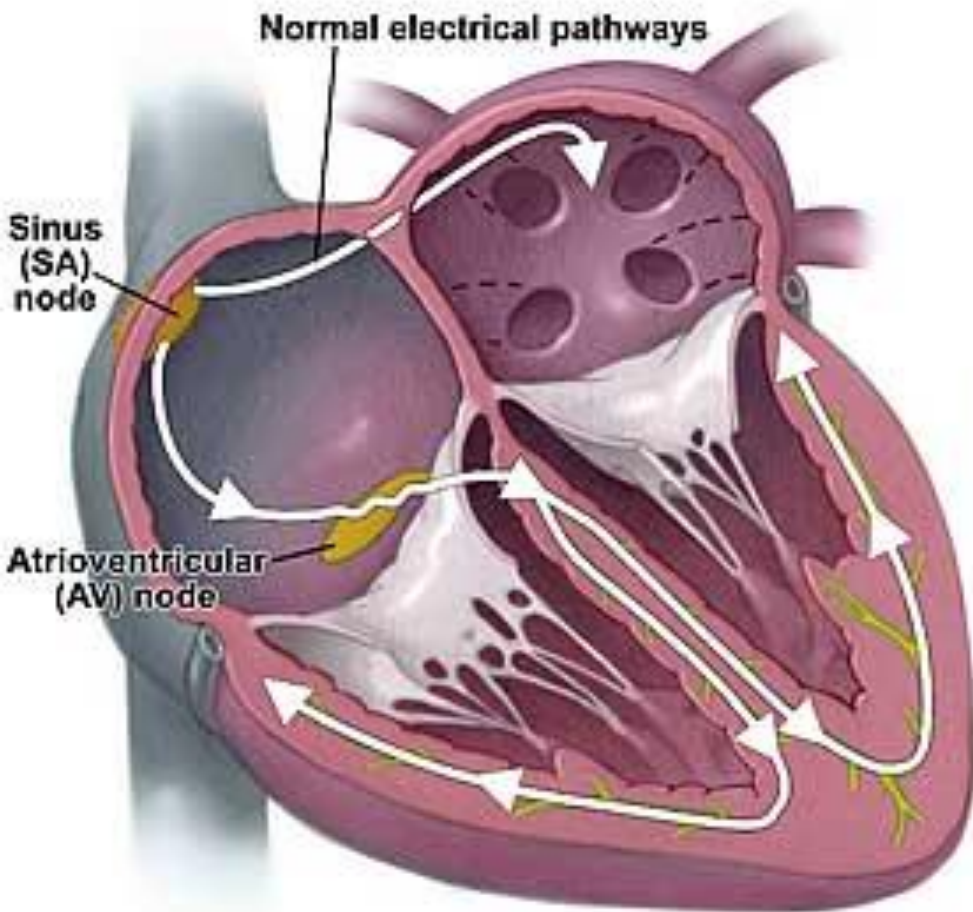
- Vagal maneuvers
- Adenosine
- CCB
- If unstable then DC cardioversion

- **Antidromic**

- If uncertainty if VT or AVRT manage as VT
- 1st choice drug is: **procainamide**

● Atrial fibrillation(AF)

- Dr mohagheh assistant professor of cardiology



Normal sinus rhythm



Atrial fibrillation



Atrial Fibrillation



- Rate: Variable
- Irregularly irregular
- P waves chaotic
- P:QRS ratio: None
- PR Interval: None
- QRS width: Normal
- Grouping: None
- Dropped: None



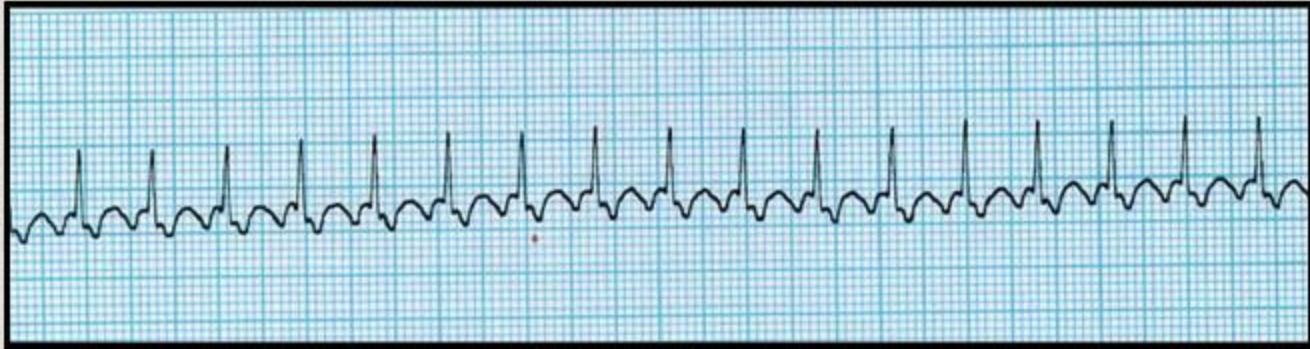
Atrial Rhythms

Atrial Fibrillation



Heart Rate	Rhythm	P Wave	PR Interval (sec.)	QRS (Sec.)
Var.	Irregular	Wavy irregular	NA	<.12

Atrial Flutter



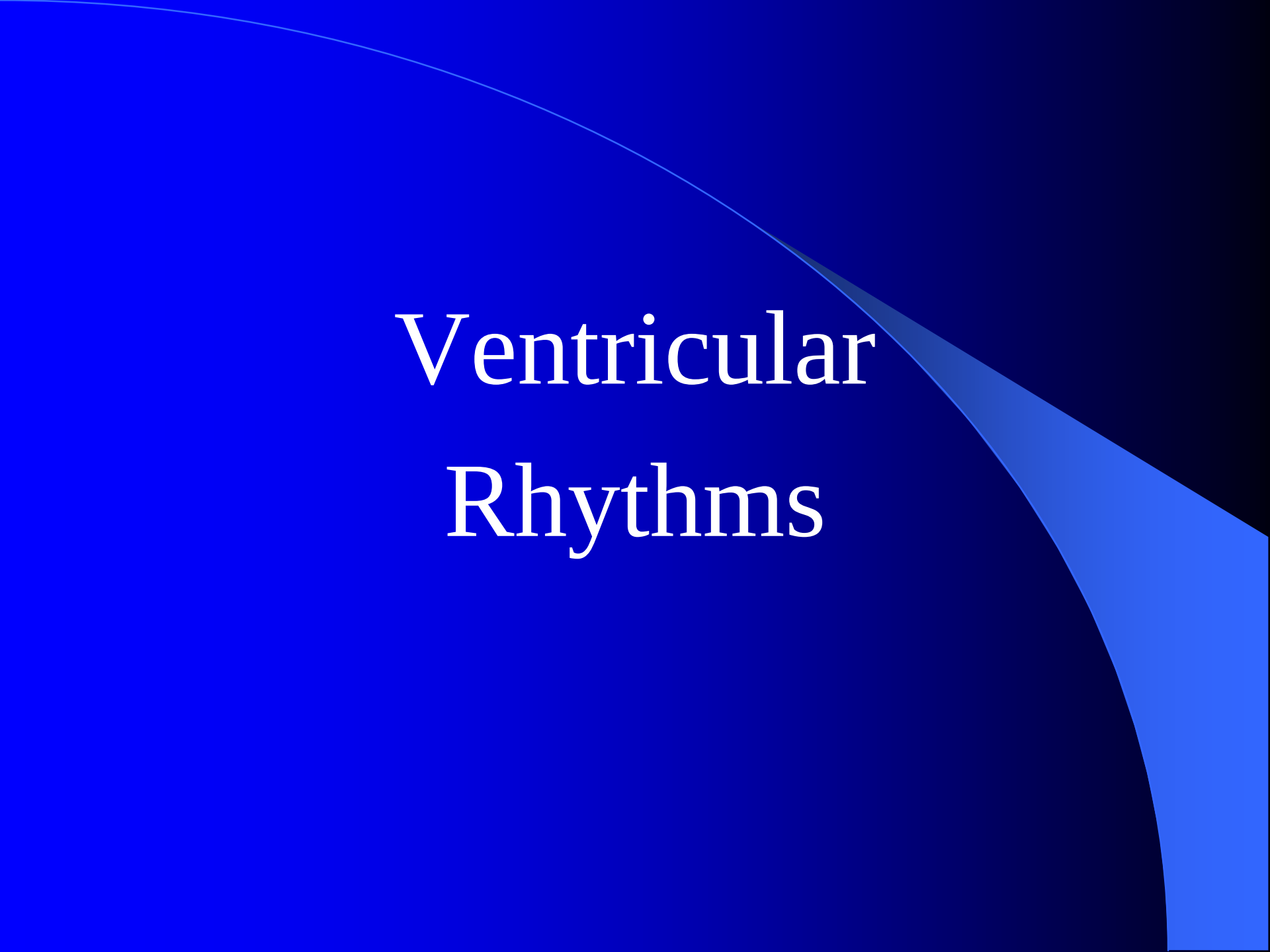
- Rate: atrial- 250-350, ventricular 125-175
- Usually regular
- P wave- flutter waves
- P:QRS ratio: Often 2:1
- PR Interval: Variable
- QRS width: Normal
- Grouping: None
- Dropped: None

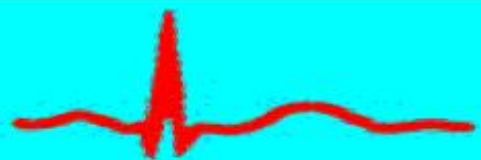
Junctional Rhythm



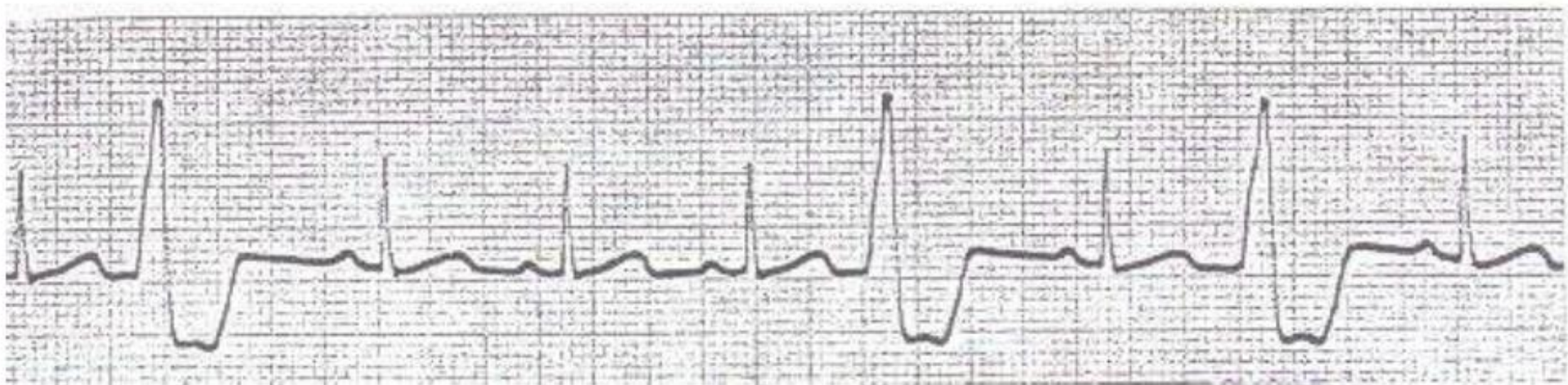
- PR Interval: None, short or negative
- QRS width: Normal
- Grouping: None
- Dropped: None

Ventricular Rhythms

A decorative graphic element consisting of a large, light blue arc that starts from the top left and curves towards the bottom right, ending in a solid blue triangular shape.



Ventricular Rhythm



PVC

Idioventricular Rhythm



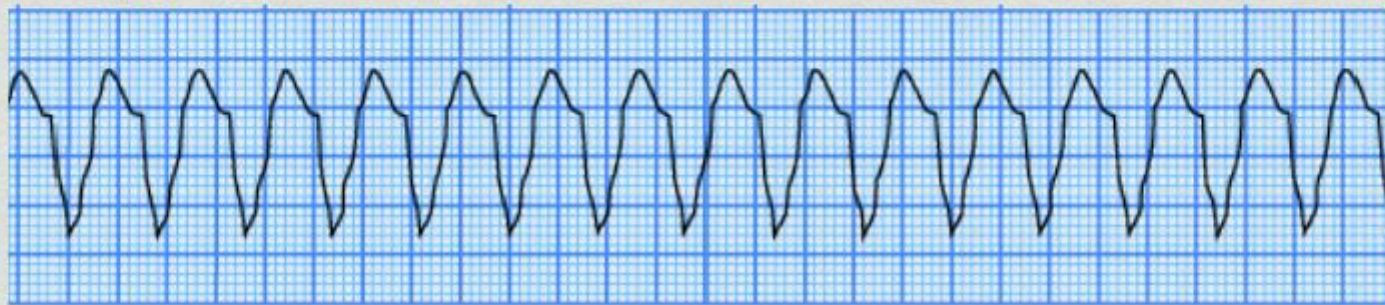
- Rate: 20 - 40 bpm
- Regular
- P wave absent
- P:QRS ratio: None
- PR Interval: None
- QRS width: Wide, bizarre
- Grouping: None
- Dropped: None

Accel. Idioventricular Rhythm



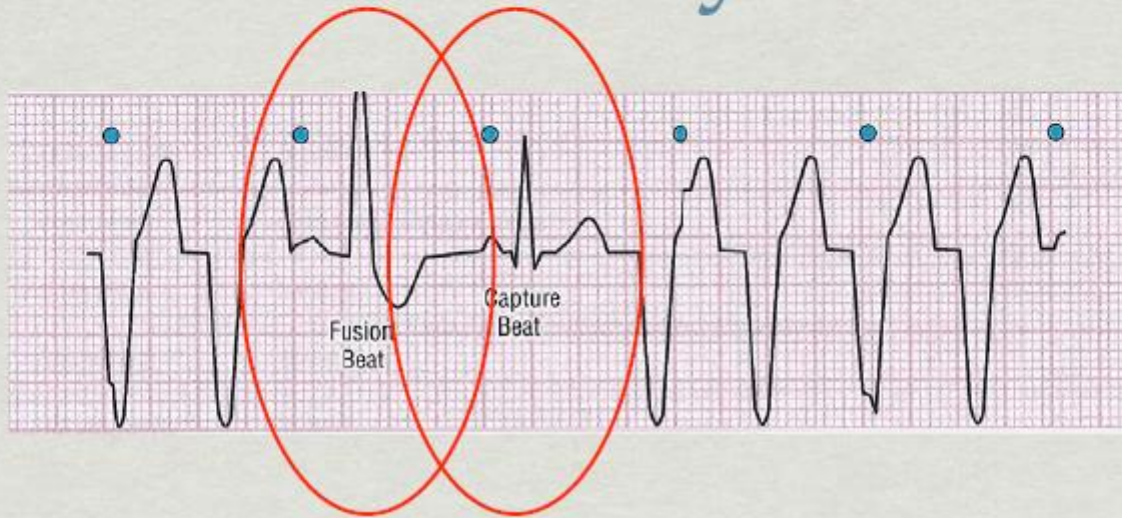
- Rate: 40 - 100 bpm
- Regular
- P wave absent
- P:QRS ratio: None
- PR Interval: None
- QRS width: Wide, bizarre
- Grouping: None
- Dropped: None

Ventricular Tachycardia



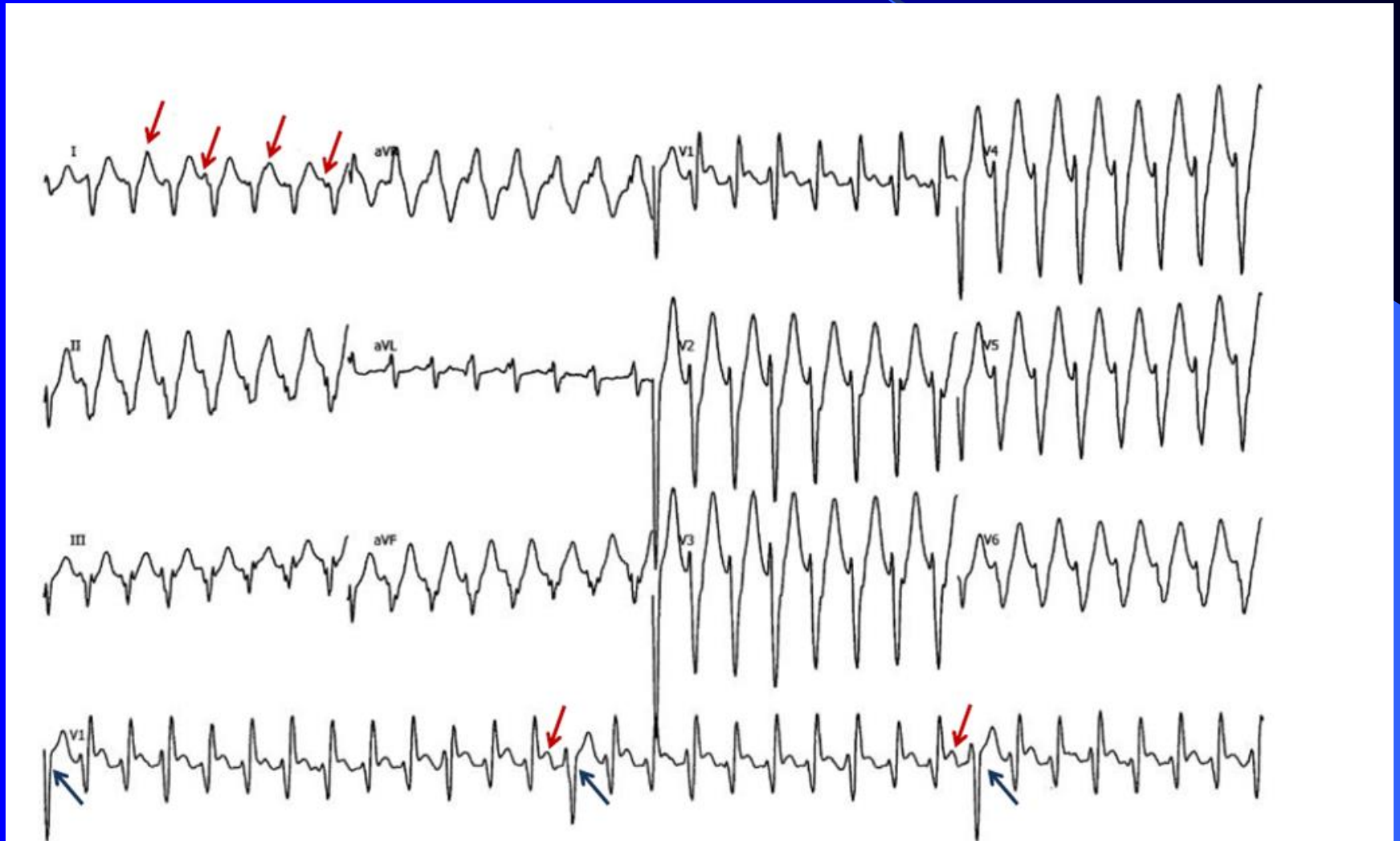
- Rate: 100 - 200 bpm
- Regular
- P wave ?buried
- P:QRS ratio: None
- PR Interval: None
- QRS width: Wide, bizarre
- Grouping: None
- Dropped: None

Ventricular Tachycardia

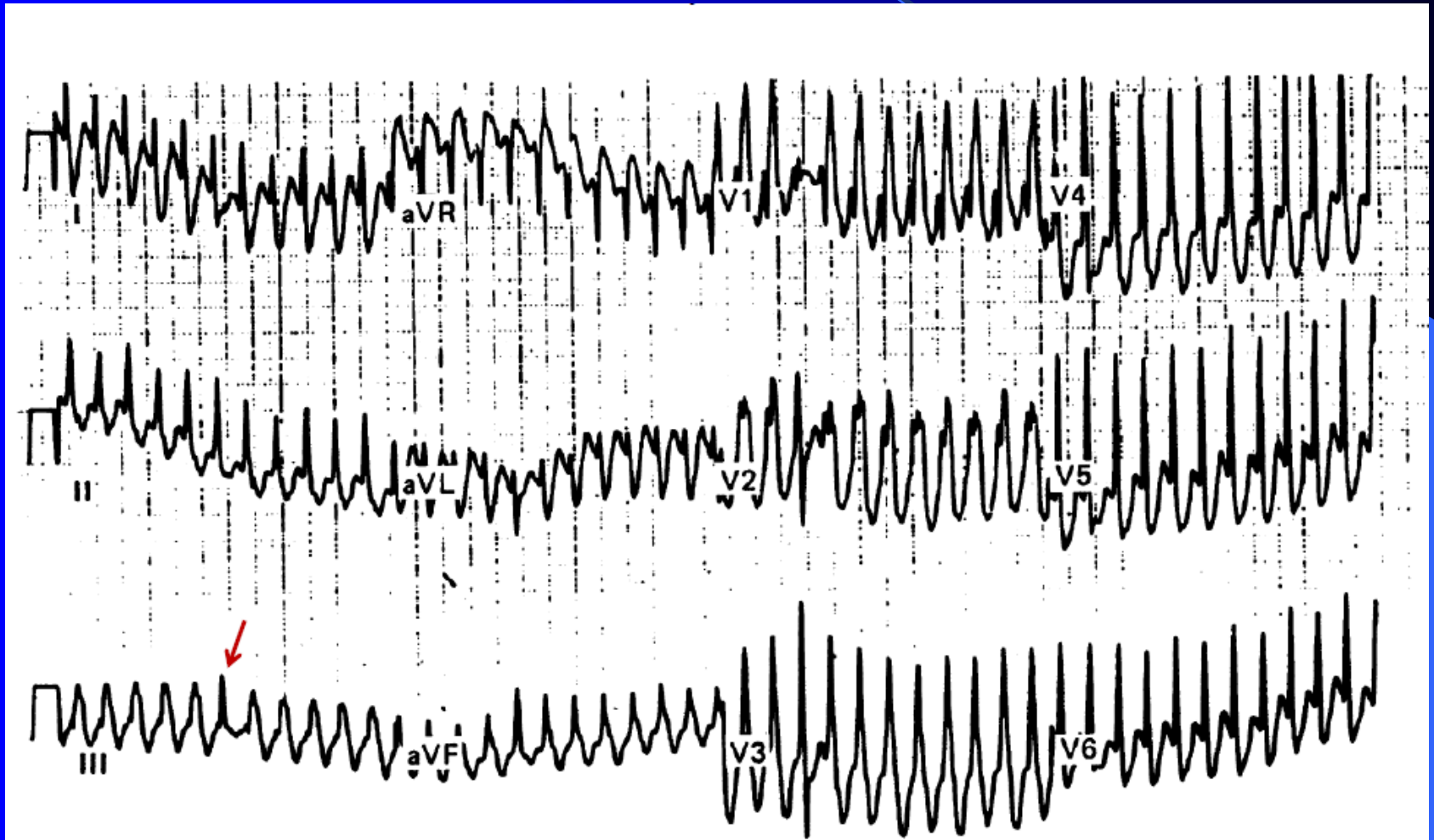


- Fusion Beats
 - Mix between V-tach and sinus morphologies
- Capture Beats
 - Sinus morphology

AV dissociation , Fusion beat ,capture beat

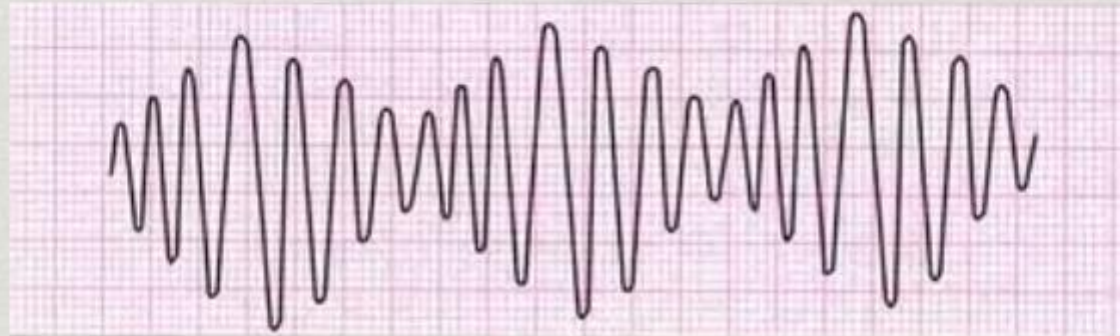


AV dissociation , Fusion beat ,capture beat





Torsades de Pointes



- Rate: 200 - 250 bpm
- Irregular
- P wave: None
- P:QRS ratio: None
- PR Interval: None
- QRS width: Variable
- Grouping: N/A
- Dropped: None

Ventricular Fibrillation



- Rate: Indeterminate
- Irregular
- P wave: None
- P:QRS ratio: None
- PR Interval: None
- QRS width: None
- Grouping: None
- Dropped: No beats

The background is a solid blue color. A thin, light blue curved line starts from the top left and arcs towards the right. A larger, darker blue triangular shape is positioned on the right side, pointing towards the center.

Thank you!