ECG CHANGES IN ACUTE AND CHRONIC MYOCARDIAL INFARCTION

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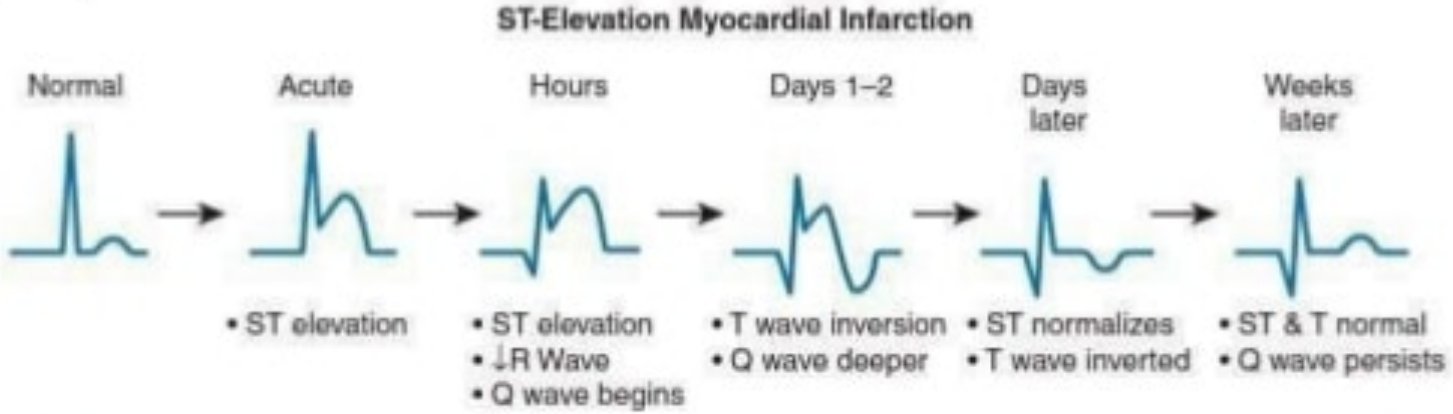
Characteristic Changes in AMI

- ST segment elevation over area of damage
- ST depression in leads opposite infarction
- Inverted T waves
- Pathological Q waves

ST Elevation MI

- Know what to look for-
  - ST elevation > 1mm
  - 2 contiguous leads
- Know where to look-
  - I, AVL, V5, V6 – Lateral
  - V1 V2 V3 V4 – Anterior
  - II, III, AVF – Inferior



- According to the ACC/AHA guidelines for STEMI, there must be "New ST elevation at the J point in at least **2 contiguous leads** of ≥ **2 mm (0.2 mV) in men** or **1.5 mm (0.15 mV) in women** in leads **V2–V3**

and/or

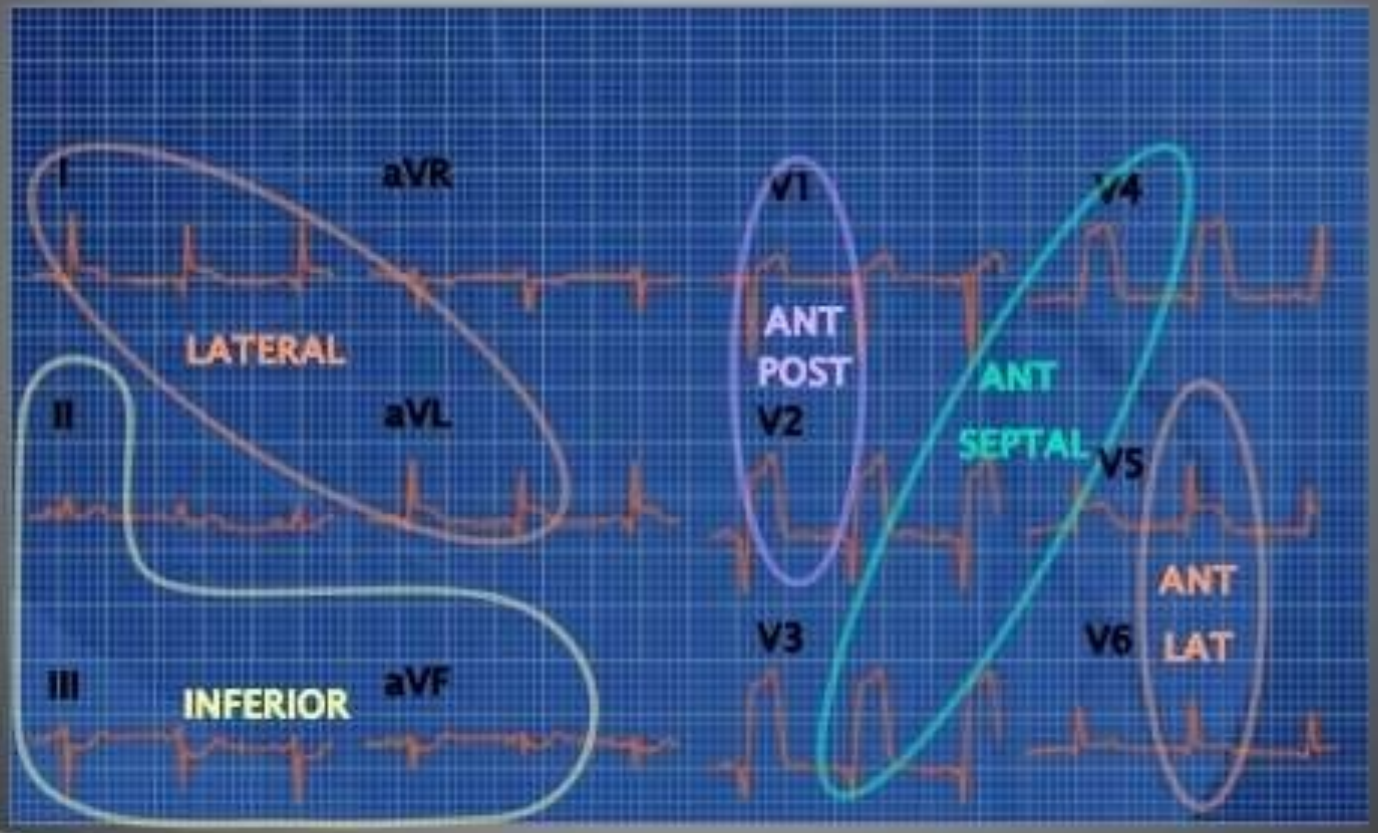
- of **≥1 mm (0.1 mV) in other contiguous chest leads or the limb leads**."

- Thus, 1 mm in any 2 contiguous leads EXCEPT leads V2 or V3 where the elevation must be 2 mm in men or 1.5 mm in women.

ECG evolution in non-reperfused myocardial infarction

Normal		
Peaked T wave		minutes
Progression of ST segment elevation		minutes - hours
Loss of R wave, Q wave formation		hours - days
T wave inversion		days
T wave normalisation persisting Q wave		days - weeks - months

Location of infarct combinations



Anterior Wall ST Elevation MI

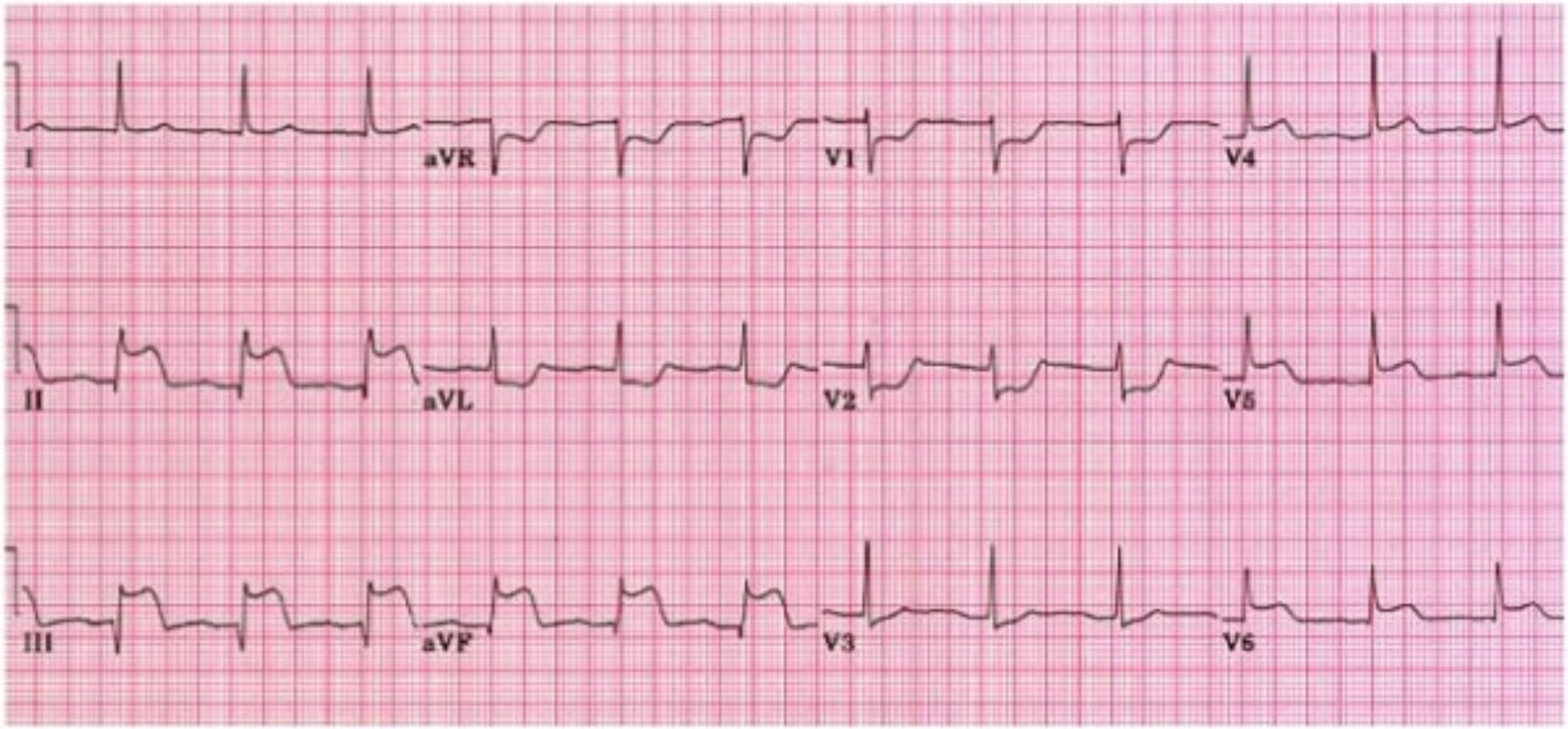
ECG Findings:

- 1. ST segment elevation in the anterior leads at the J point and sometimes in septal or lateral leads depending on the extent of the myocardial infarction.
- 2. Reciprocal ST segment depression in the inferior leads (II, III and aVF).

Inferior Wall ST Elevation MI

ECG findings:

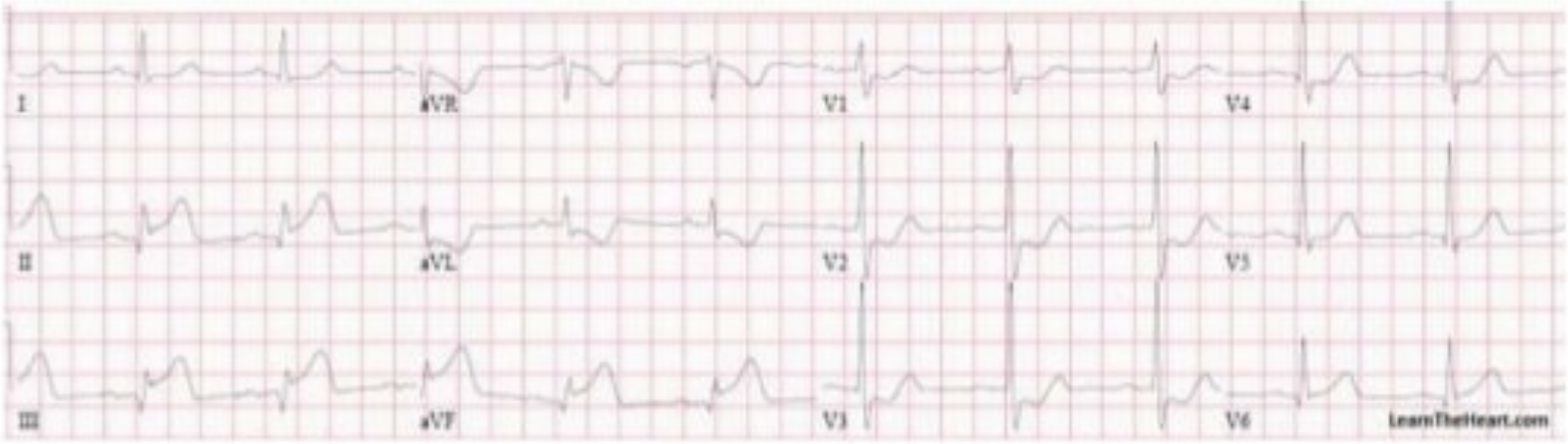
- ST segment elevation in the inferior leads (II, III, and aVF)
- Reciprocal ST segment depression in the lateral and/or high lateral leads (I, aVL, V5 and V6)


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6

Posterior Wall MI ECG

ECG findings:

- ST segment depression in the septal and anterior precordial leads (V1 to V4).
- The ratio of the R wave to the S wave in leads V1 or V2 is > 1.
- ST elevation in the posterior leads of a posterior ECG (leads V7 to V9).
- ST elevation in the inferior leads (II, III, and aVF) may be seen if an inferior MI is also present.


I
aVR
V1
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II
aVL
V2
V5
III
aVF
V3
V6
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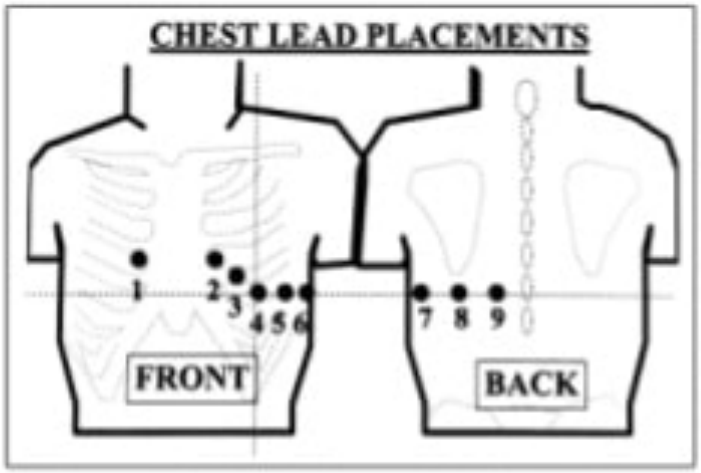
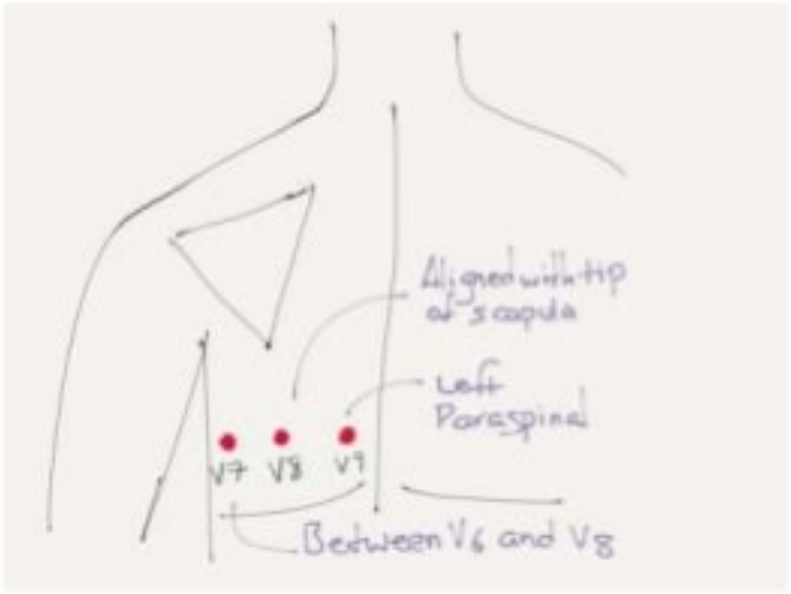
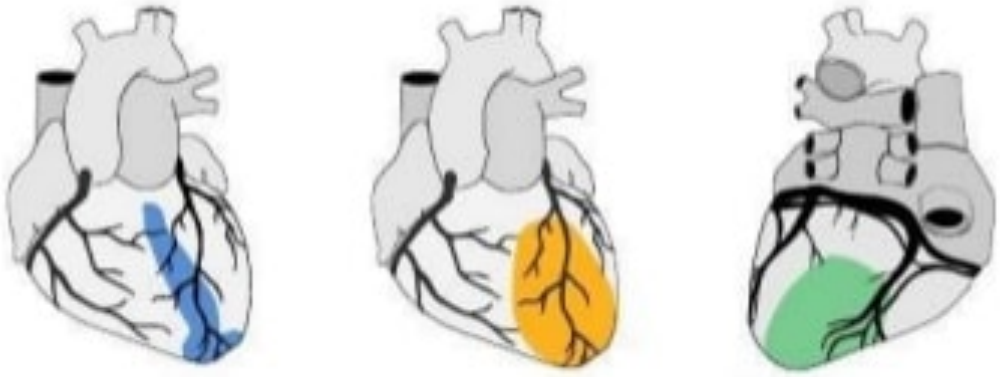

CHEST LEAD PLACEMENTS
1
2
3
4
5
6
7
8
9
FRONT
BACK


Aligned with tip of scapula
Left Paraspinal
V7
V8
V9
Between V6 and V8

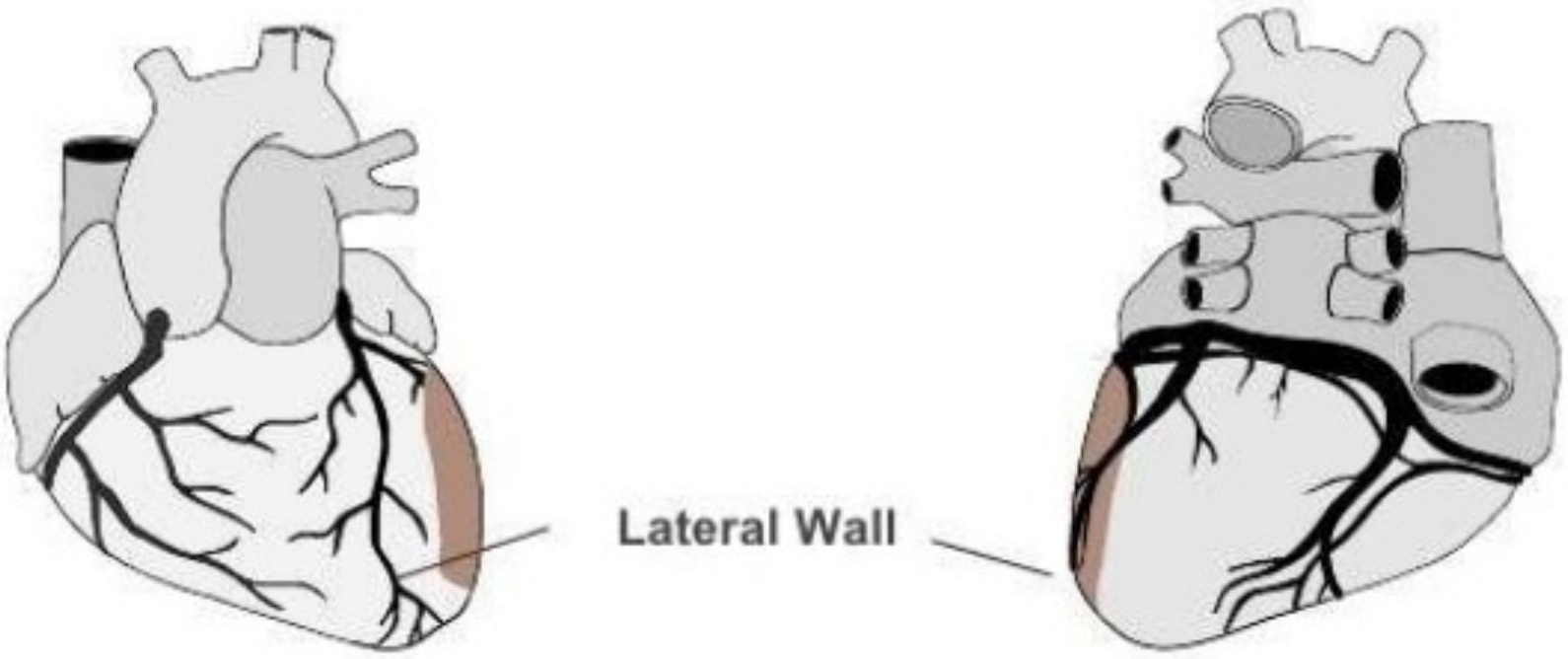
Localization



I	aVR	V1	V4
II	aVL	V2	V5
III	aVF	V3	V6

Inferior: II, III, AVF
Septal: V1, V2
Anterior: V3, V4
Lateral: I, AVL, V5, V6

Posterior MI


Lateral Wall

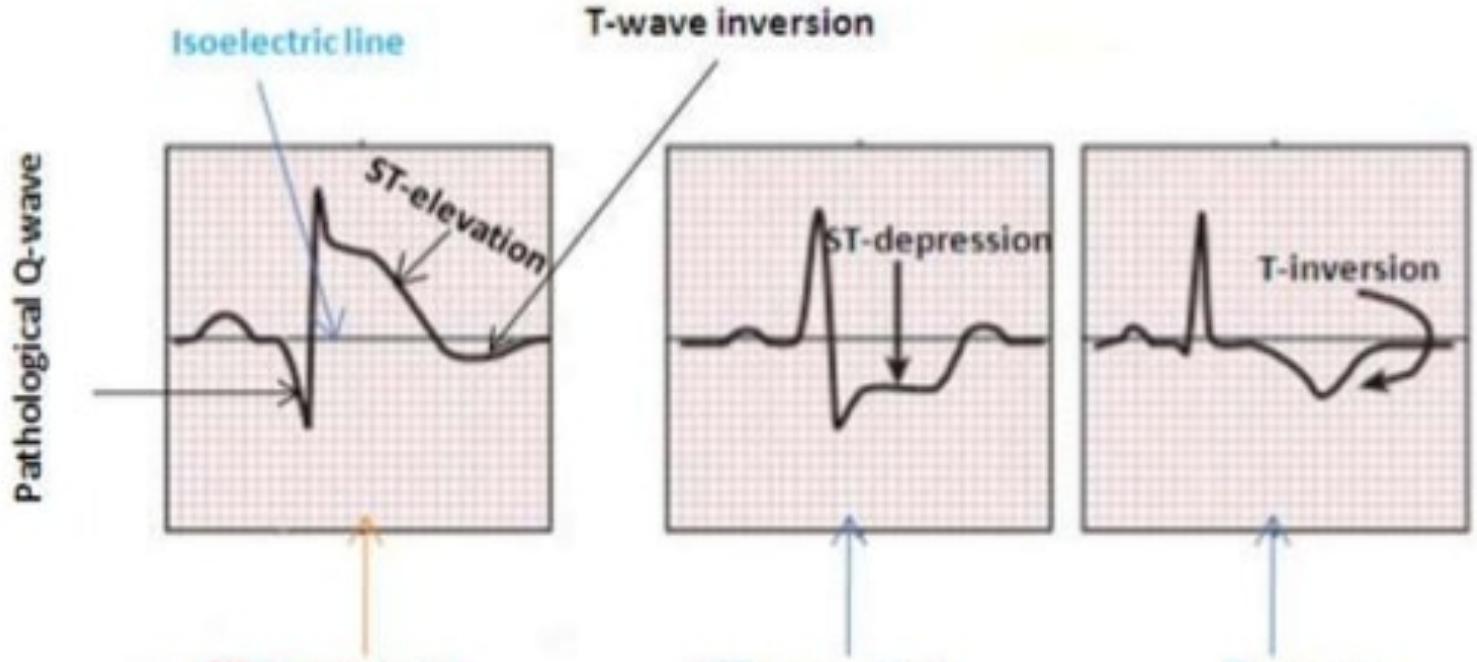
Reciprocal Changes in MI

- Commonly observed on ventricular wall opposite to the transmural injury.
- Increases the specificity of STEMI.
- In AWMI – Reciprocal changes in inferior leads are seen in 40 –70% of the cases.
- In IWMI – Reciprocal depression in I and avL and lateral leads.

Non ST elevation MI

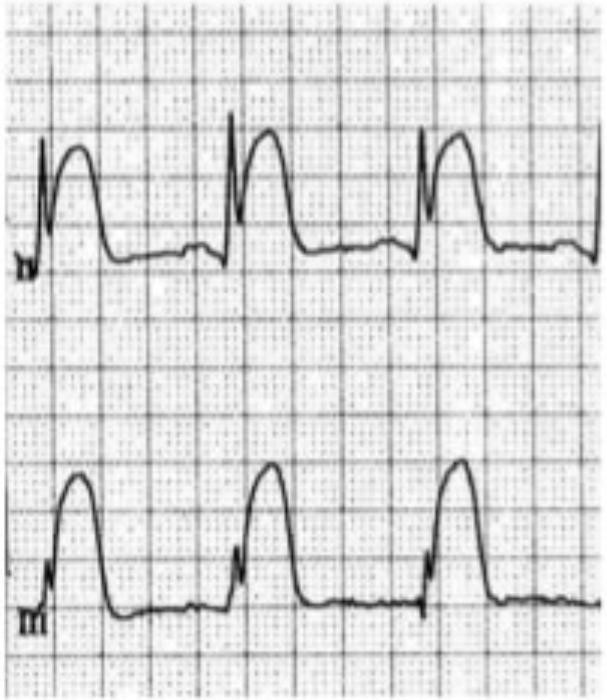
- ECG features can be any of the following:

- 1. ST depression (70-80% sensitivity)
- 2. T wave inversion (10-20% sensitivity)
- 3. Both ST depression and T wave inversion
- 4. Normal ECG

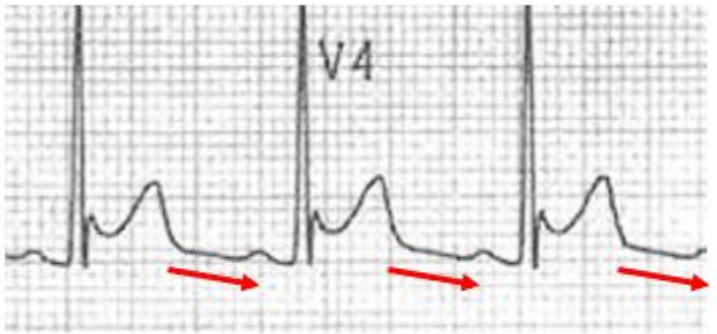

Isoelectric line
T-wave inversion
Pathological Q-wave
ST-elevation
ST-depression
T-inversion
ST-segment elevation in stemi
ST-segment depression in nstemi
T-wave inversion in nstemi

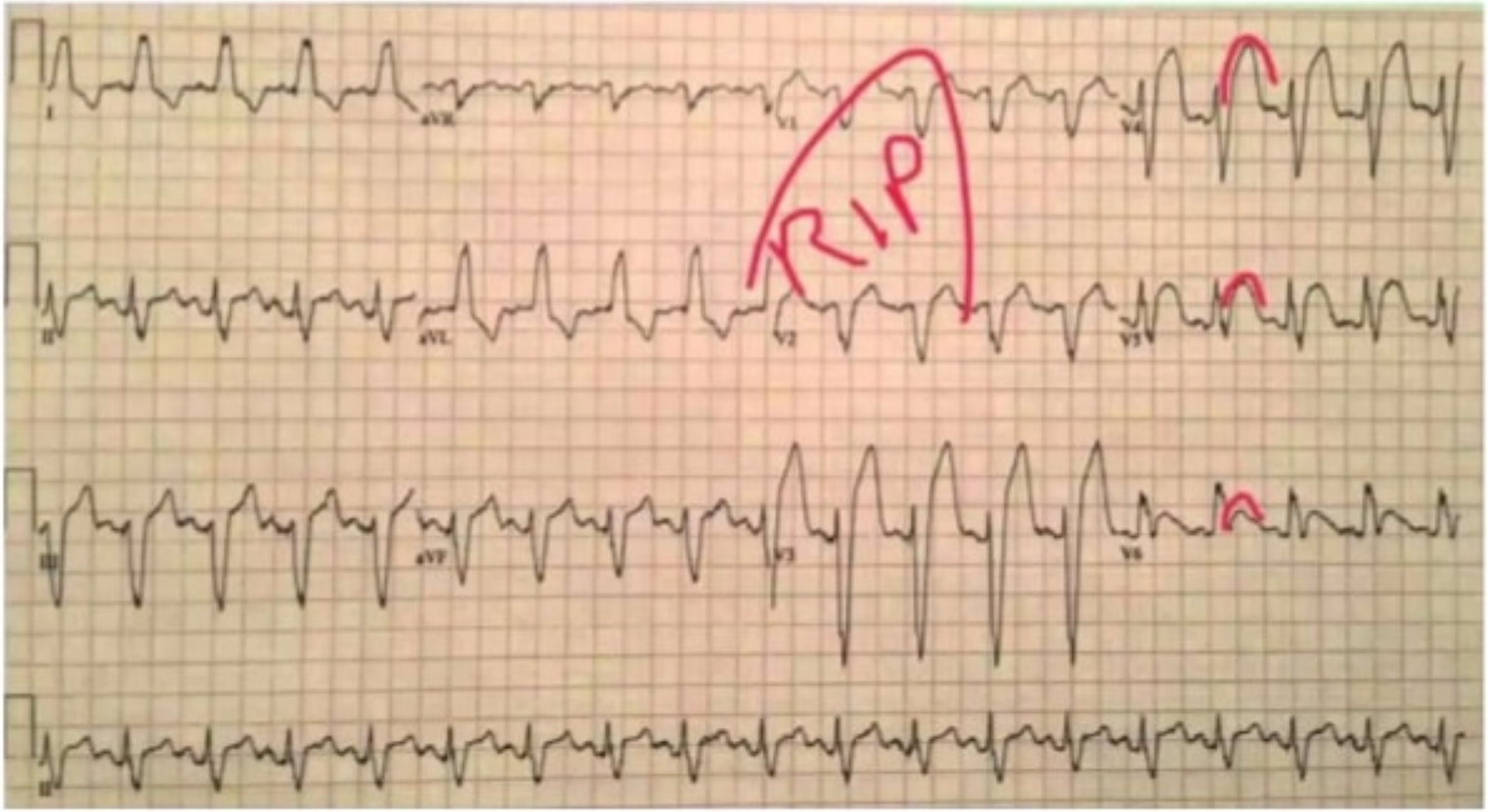
STEMI vs Acute Pericarditis

- Step 1: RULE IN STEMI
  - Check for ST depression (except in avR and V1)
  - ST elevation in III > II
  - Horizontal or convex upward (Tombstone) STE
  - R-T sign (Checkmark sign)*
- Step 2: Factors that strongly favor Pericarditis
  - PR depression in multiple leads
  - Spodick sign (T-P Segment down-sloping)*



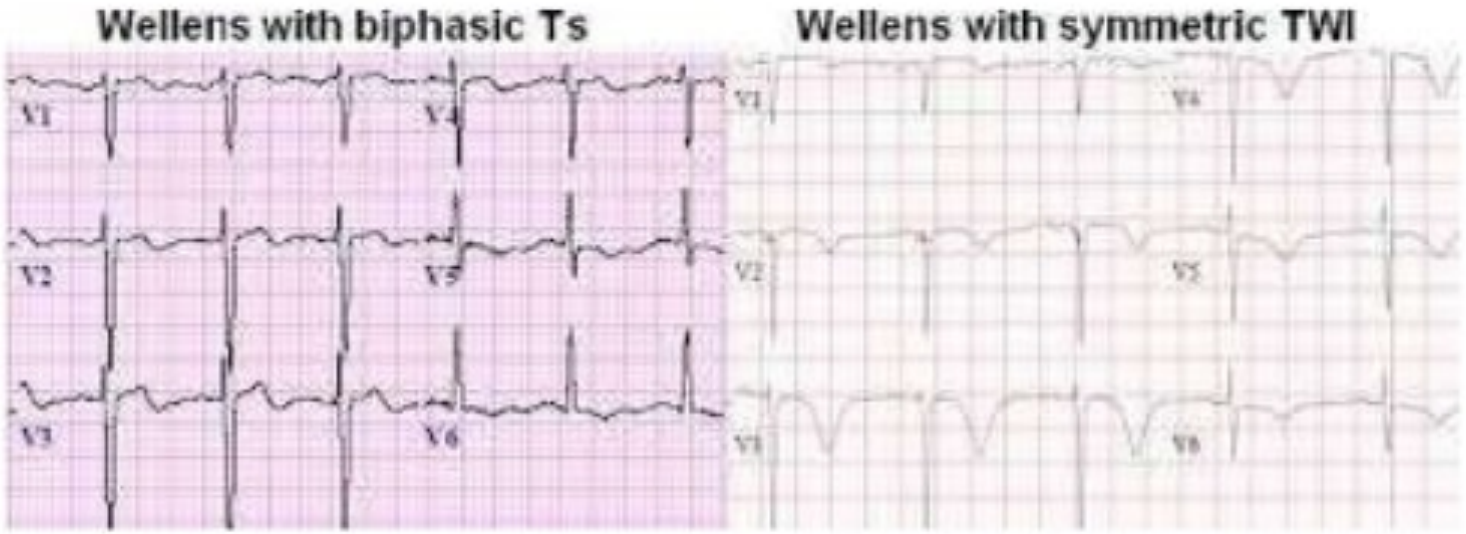
Spodick sign: Downsloping TP segment




RIP

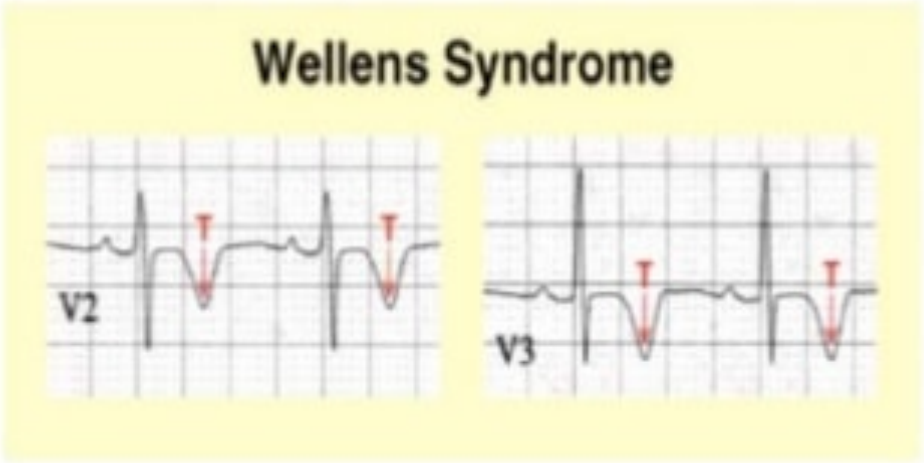
Wellens' Syndrome

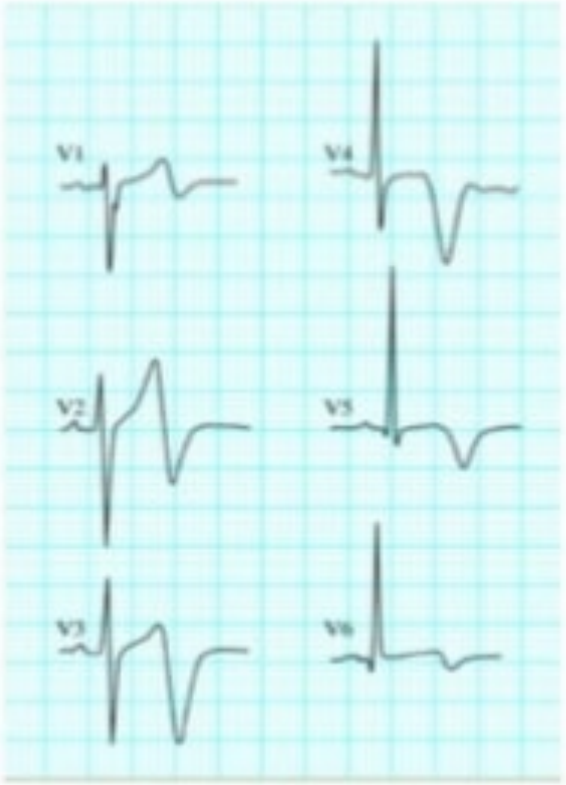
- Wellens' syndrome (or sign) is a pattern of deeply inverted or biphasic T waves in V2–3, which is highly specific for a critical stenosis of the left anterior descending artery (LAD).
- ***Subacute LAD occlusion** (within the next week)



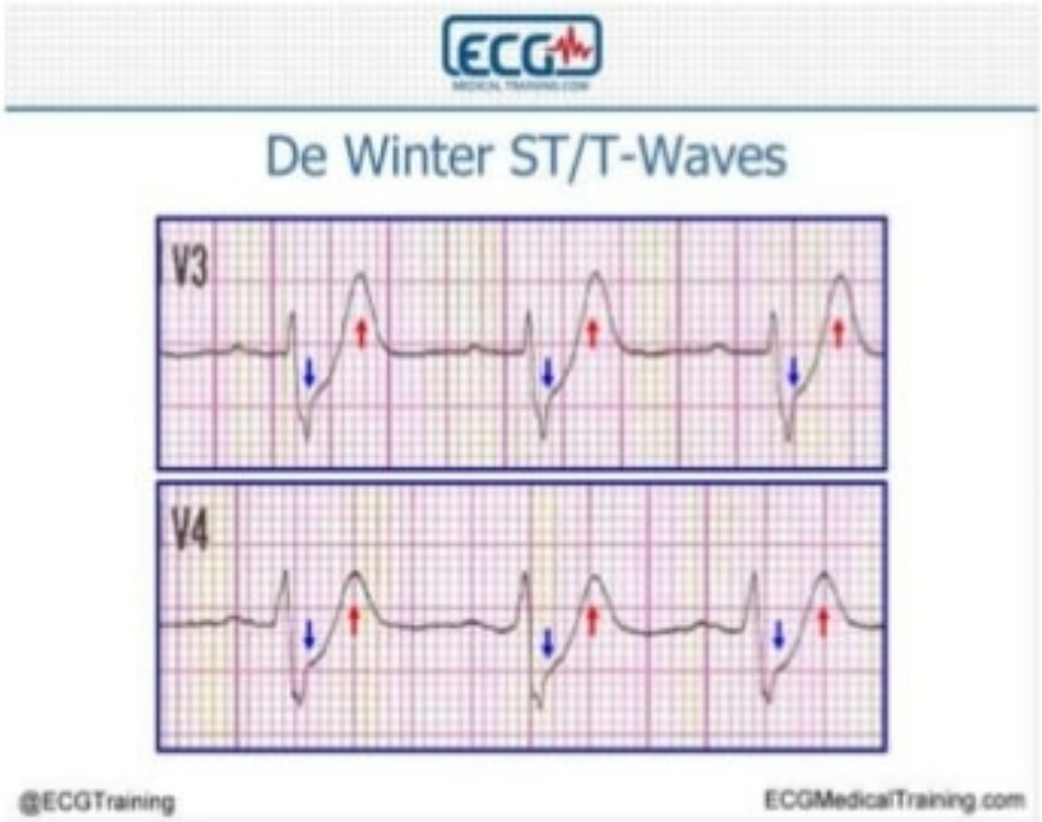
Type I (75% of Cases)

Type II (25% of Cases)





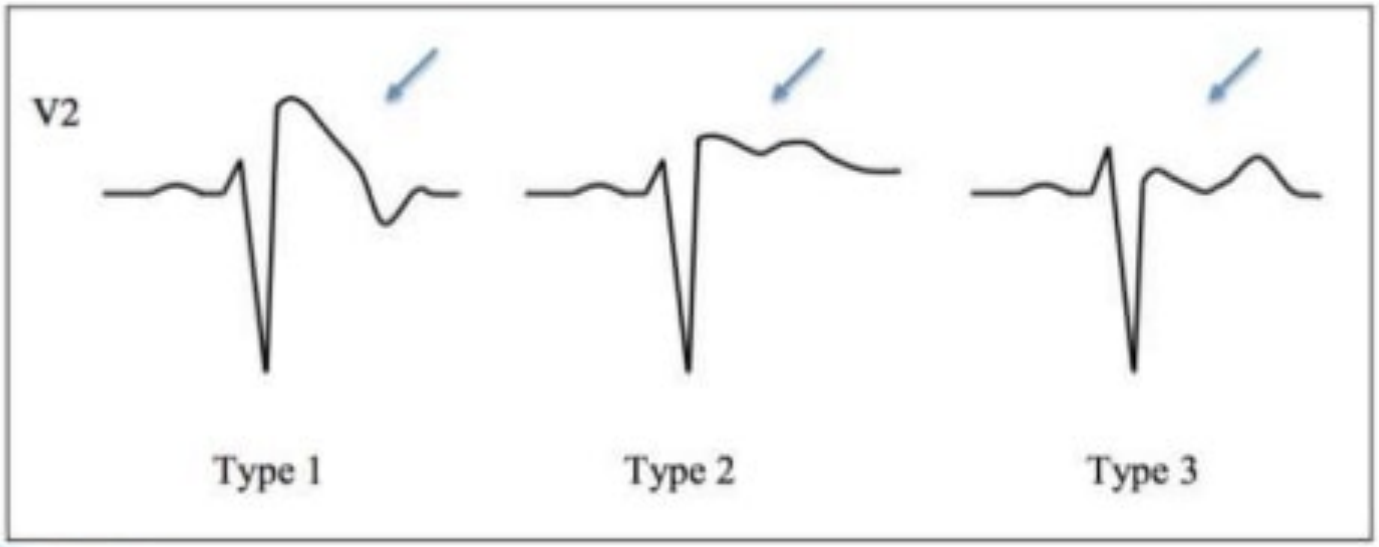
De Winter ST/T waves

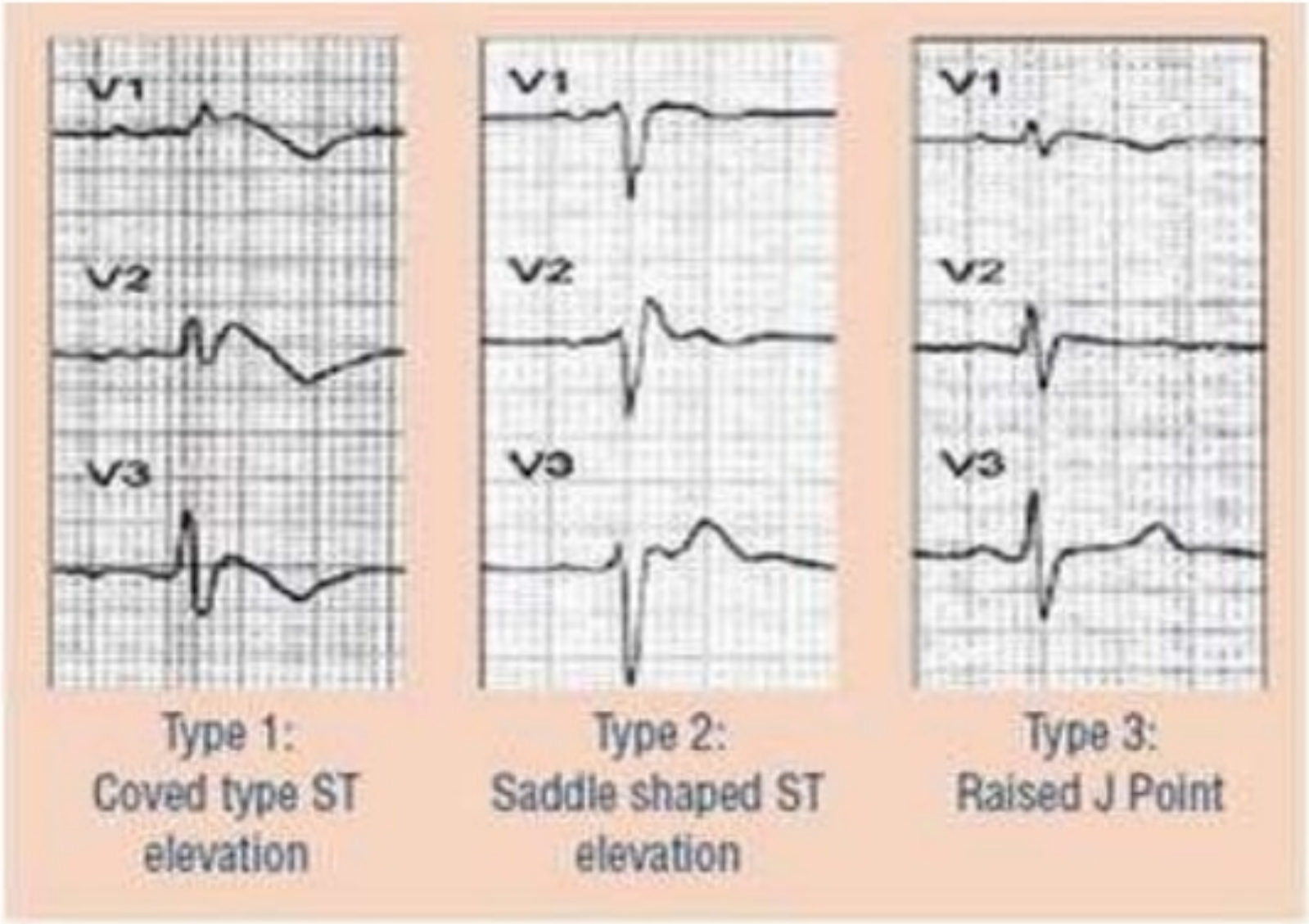


- ECG abnormality described by de Winter et al. in 1998
- Suspicious for **Acute LAD occlusion**
- Characterized by 1-3 mm of ST-depression with upright, symmetrical T-waves

Brugada Syndrome

- A hereditary syndrome, marked by right bundle branch block and ST segment elevation in the right precordial leads, and a high risk of sudden death from ventricular arrhythmias.





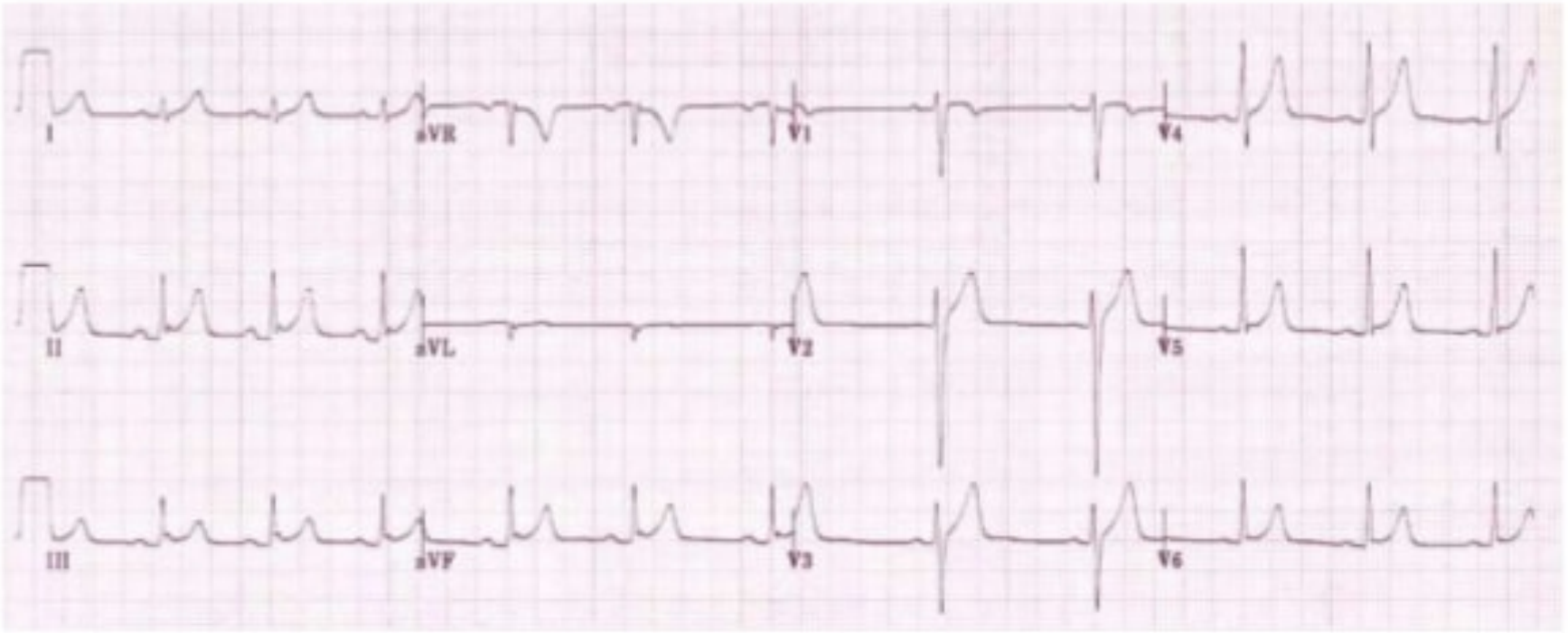
Type 1:
Coved type ST elevation

Type 2:
Saddle shaped ST elevation

Type 3:
Raised J Point

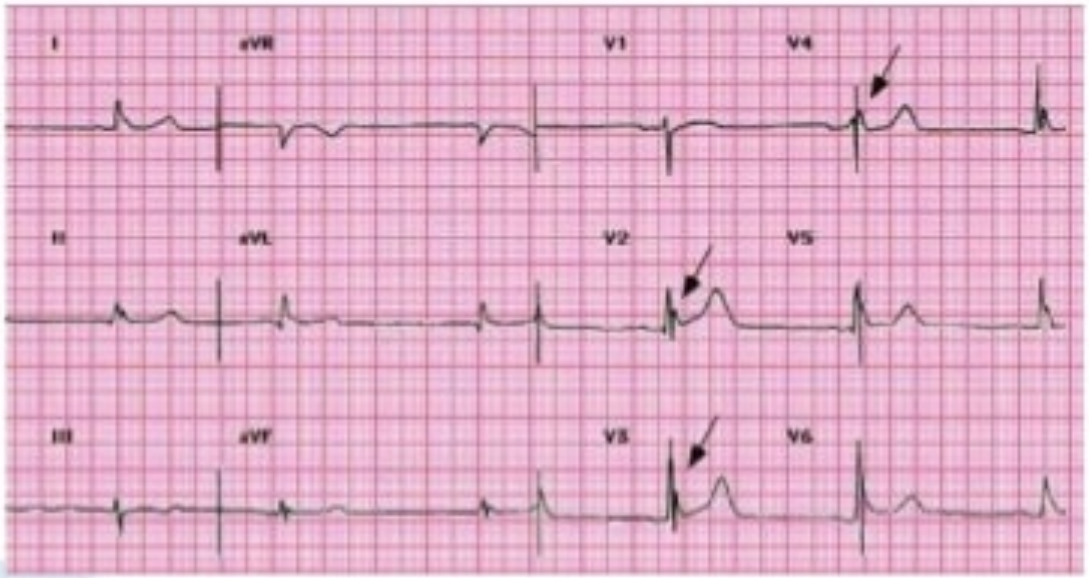
Benign Early Repolarization

- Widespread concave ST elevation.
- Notching or slurring at the J-point.
- Prominent, slightly asymmetrical T-waves that are concordant with the QRS complexes
- No reciprocal ST depression to suggest STEMI (except in aVR).
- ST changes are relatively stable over time (no progression on serial ECG tracings).


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6

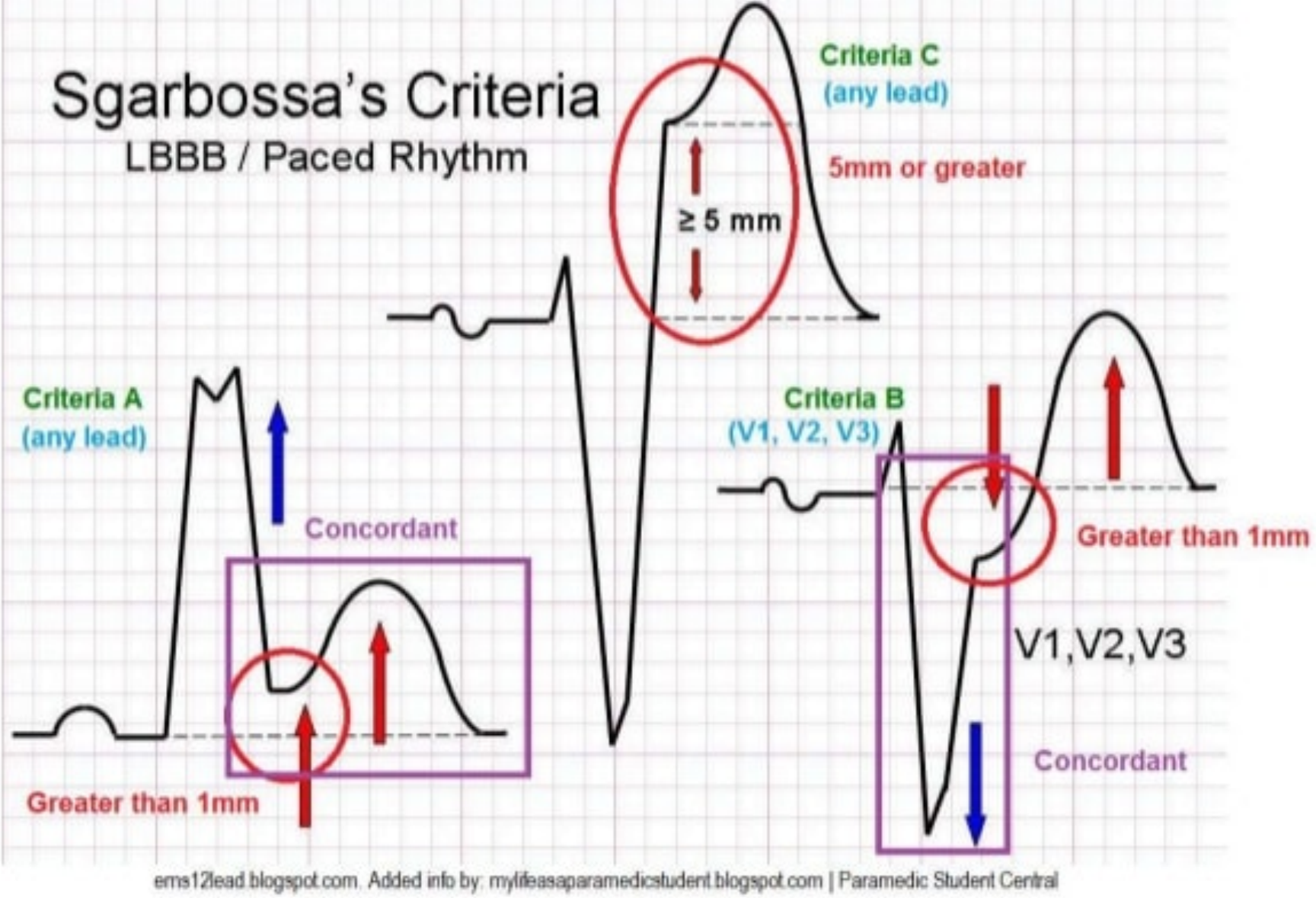
Hypothermia

- Osborne Waves (= J waves)
- Prolonged PR, QRS and QT intervals
- Shivering artefact
- Ventricular ectopy
- Cardiac arrest due to VT, VF or asystole



Sgarbossa's Criteria

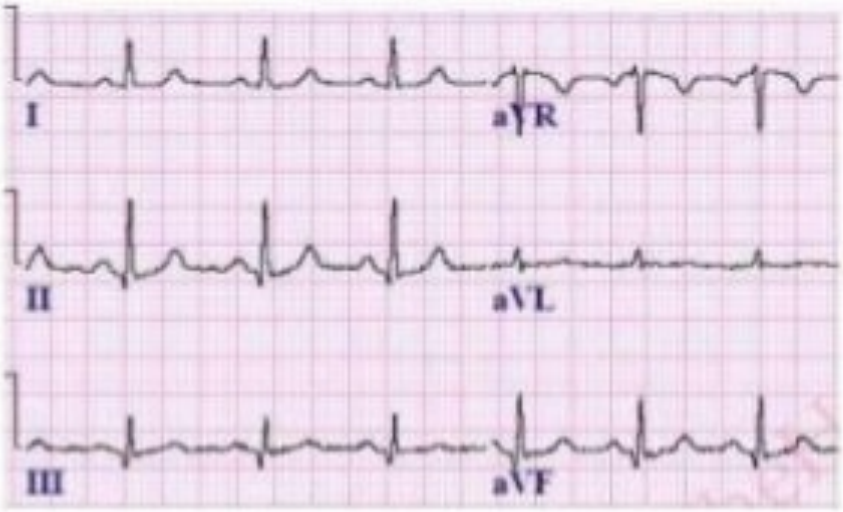
- STelevation ≥1 mm in a lead with a positive QRS complex (ie: concordance) – 5 points
- ST depression ≥1 mm in lead V1, V2, or V3 – 3 points
- ST elevation ≥5 mm in a lead with a negative (discordant) QRS complex – 2 points
- ≥3 points = 90% specificity and 20% sensitivity


Sgarbossa's Criteria
LBBB / Paced Rhythm
Criteria C
(any lead)
5mm or greater
≥ 5 mm
Criteria A
(any lead)
Concordant
Greater than 1mm
Criteria B
(V1, V2, V3)
Greater than 1mm
V1,V2,V3
Concordant
ems12lead.blogspot.com. Added info by: mylifeasaparamedicstudent.blogspot.com | Paramedic Student Central

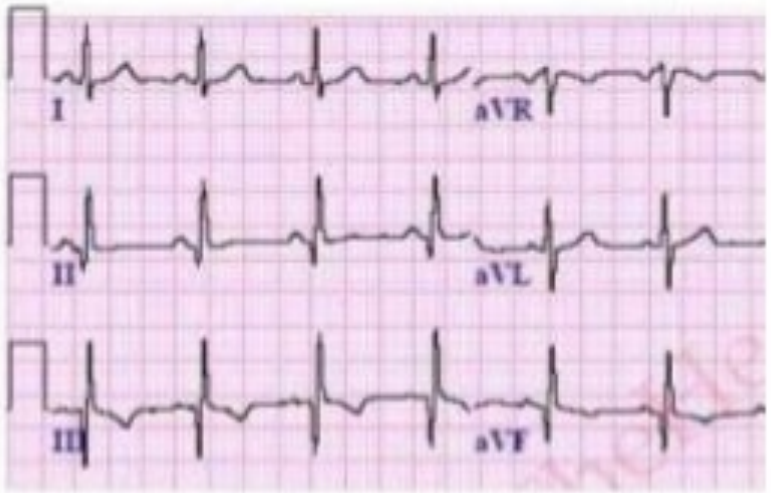
ECG in Chronic MI

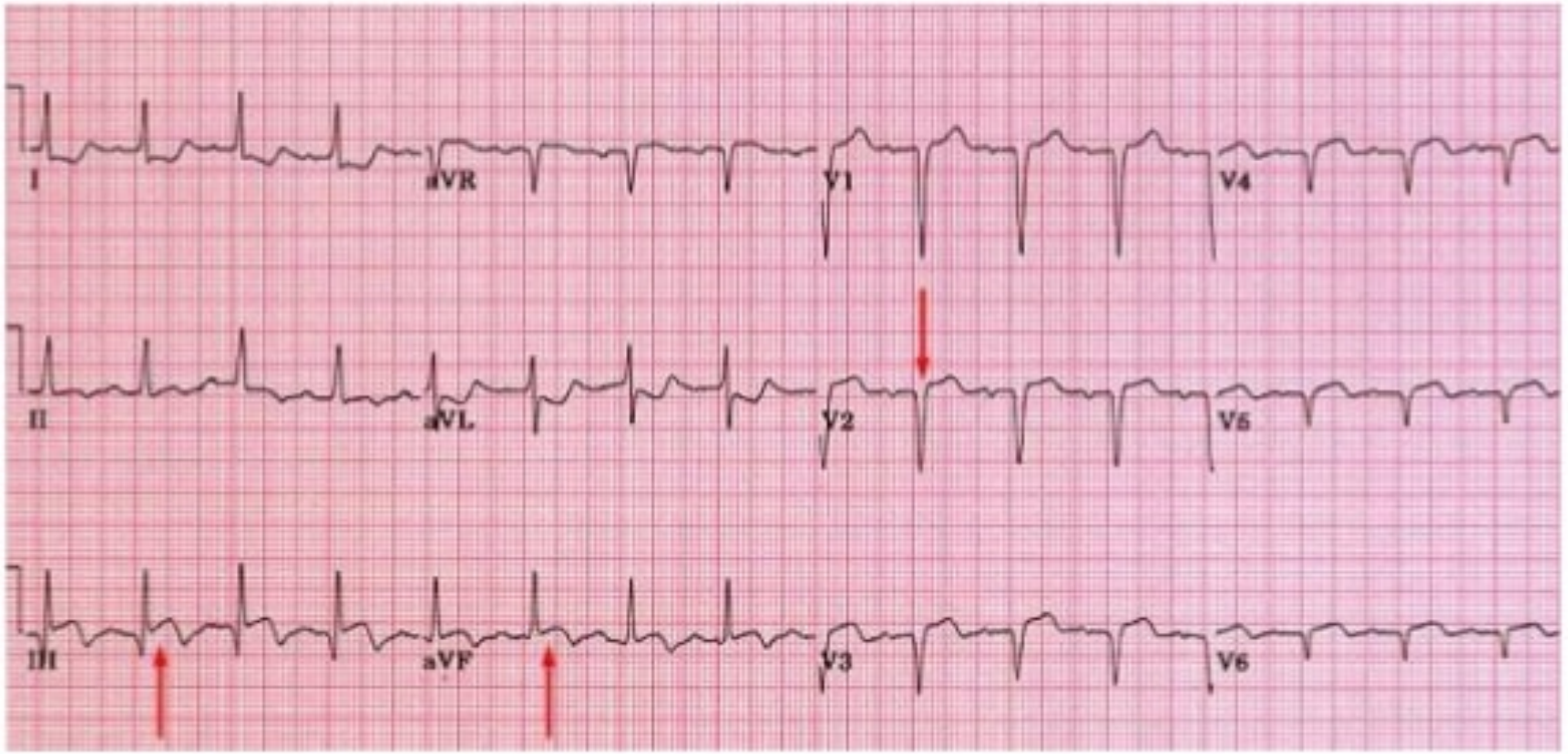
- Pathologic Q waves tend to be deeper and wider, and as with ST/T wave changes should be seen in at least 2 contiguous (neighbouring) leads.

Normal Q waves



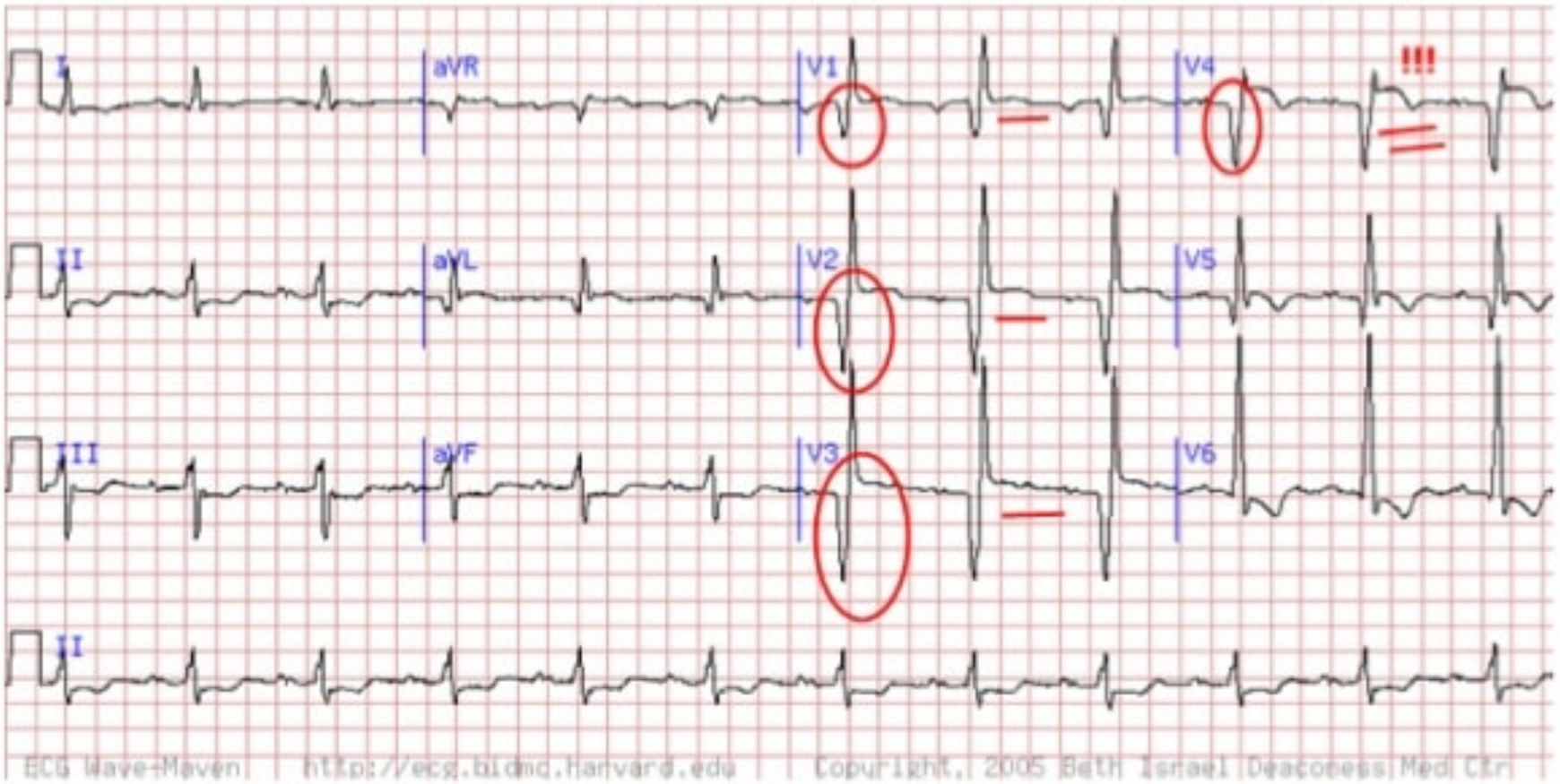
Pathologic Q waves




I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6

LV Aneurysm

- ST elevation seen > 2 weeks following an acute myocardial infarction.
- Most commonly seen in the precordial leads.
- May exhibit concave or convex morphology.
- Usually associated with well-formed Q- or QS waves.
- T-waves have a relatively small amplitude in comparison to the QRS complex


I
aVR
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II
ECG Wave-Maven
http://ecg.bidmc.harvard.edu
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- **Factors favouring Left Ventricular Aneurysm**
- ECG identical to previous ECGs (if available).
- Absence of dynamic ST segment changes.
- Absence of reciprocal ST depression.

- **Factors favouring Acute STEMI**
- New ST changes compared with previous ECGs.
- Dynamic / progressive ECG changes — the degree of ST elevation increases on serial ECGs.
- Reciprocal ST depression.
- High clinical suspicion of STEMI — ongoing ischaemic chest pain, sick-looking patient (e.g. pale, sweaty), haemodynamic instability.

Case

(Dr. Baruch Fertel, Cleaveland Clinic)

- 36 yo smoker with chest pain *4 hours
  - Sharp pain
  - Worse sitting back
  - Better sitting forward
  - No radiation
  - No relief with NTG

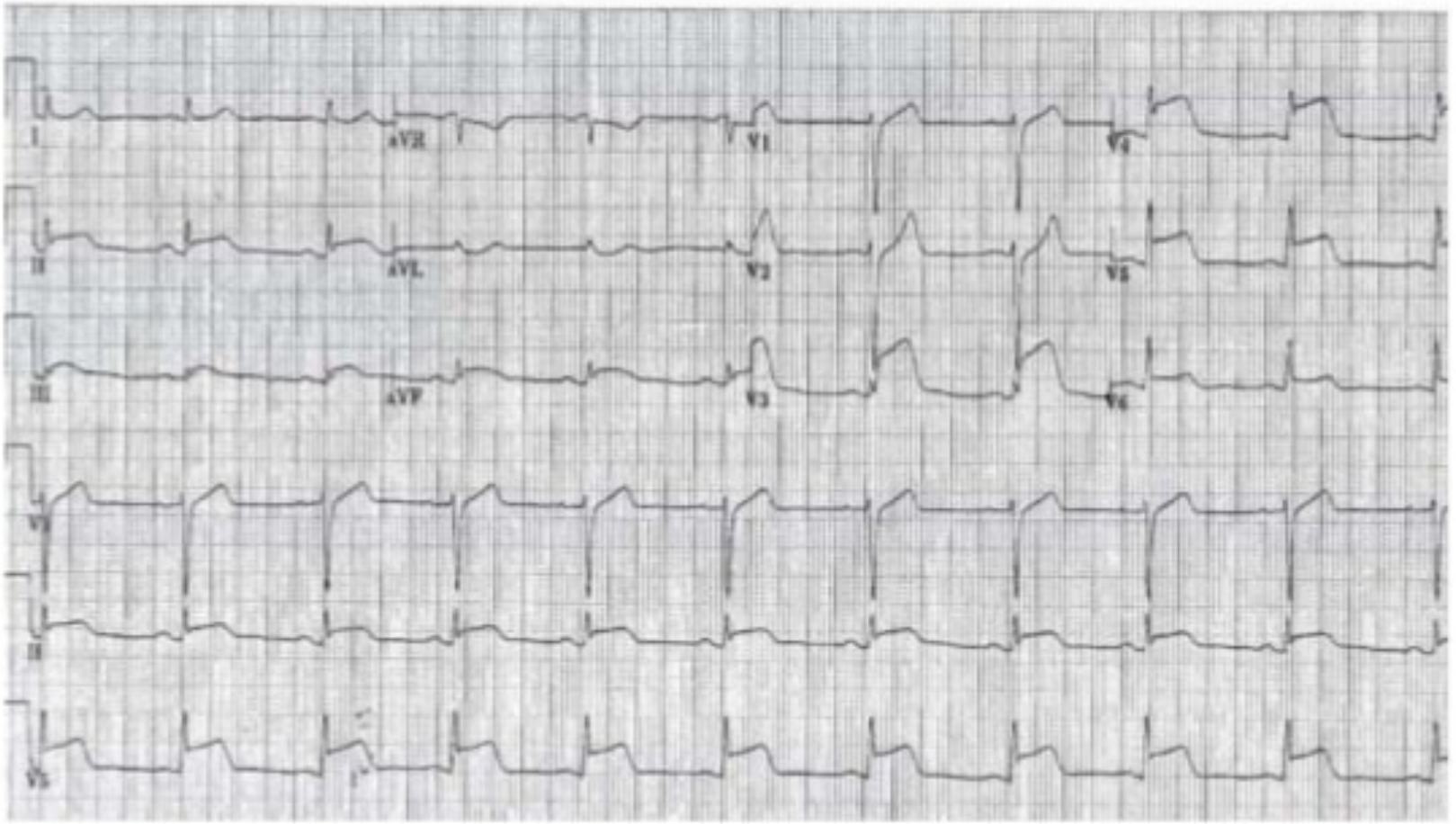
Male Black

Room:
Loc: 2

Vent. rate 92 bpm
PR interval 160 ms
QRS duration 90 ms
QT/QTc 406/412 ms
P-R-T axes 64 48 59

Normal sinus rhythm
Acute pericarditis
Abnormal ECG

Technician: KMT




THANK YOU