

EKG 101

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PGY2, not a cardiologist.

Objectives

- Approach to reading an EKG
- Myocardial Ischemia
- Blocks
- Tachyarrhythmia and Bradyarrhythmia
- Other Miscellaneous EKGs

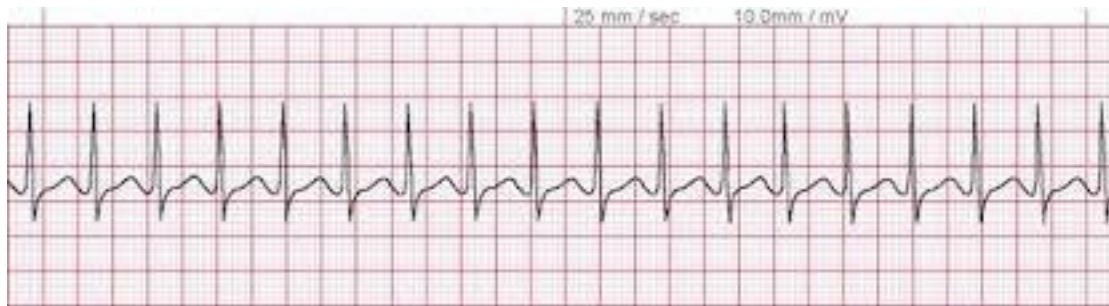
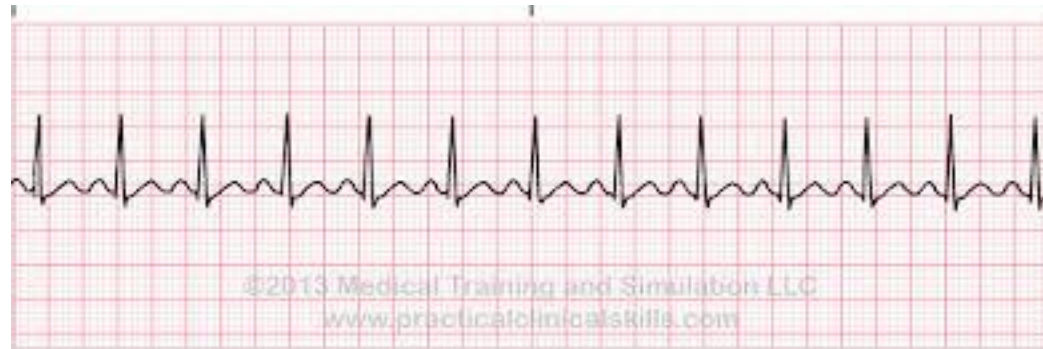
Before you interpret an EKG

- One of the most important parts of EKG interpretation is comparing the current EKG with any previous EKGs available.
- Minor changes in between EKGs can have huge implications (in the right clinical context).
- Reading an EKG can be intimidating but the key is forming a system that works for you.
- Take a DEEP Breath! (It's an "EasyG," Dr. Ortiz)

Approach to Reading an EKG

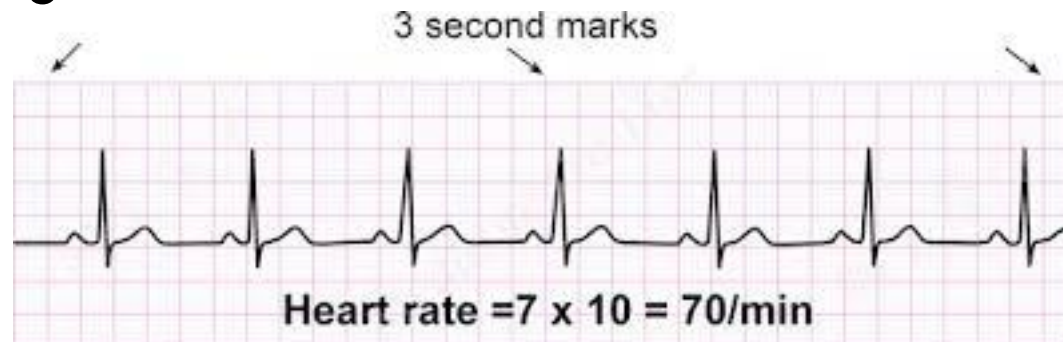
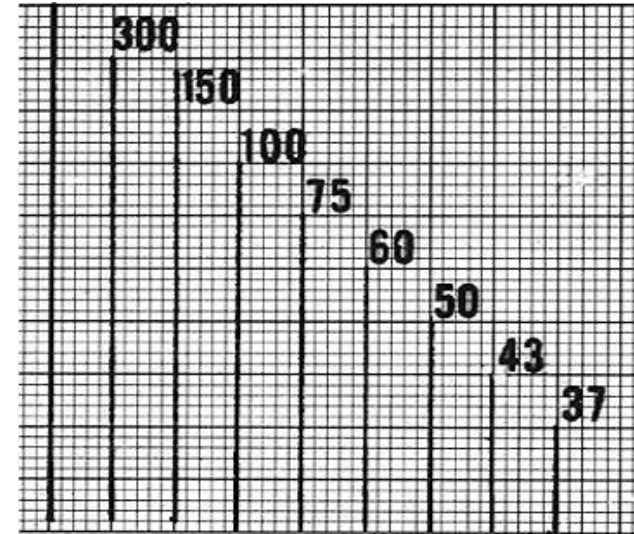
- Step 1: Rate
- Step 2: Rhythm
- Step 3: Axis
- Step 4: Intervals
- Step 5: P wave
- Step 6: QRS Complex
- Step 7: ST segment-T wave
- Step 8: Overall interpretation

What is the Rate?



Rate

- Quick Estimate
 - “300, 150, 100, 75, 60, 50”
- Alternative Methods
 - Count the 6 second strip and multiply by 10
 - Count the number of beats on the EKG and multiply by 6

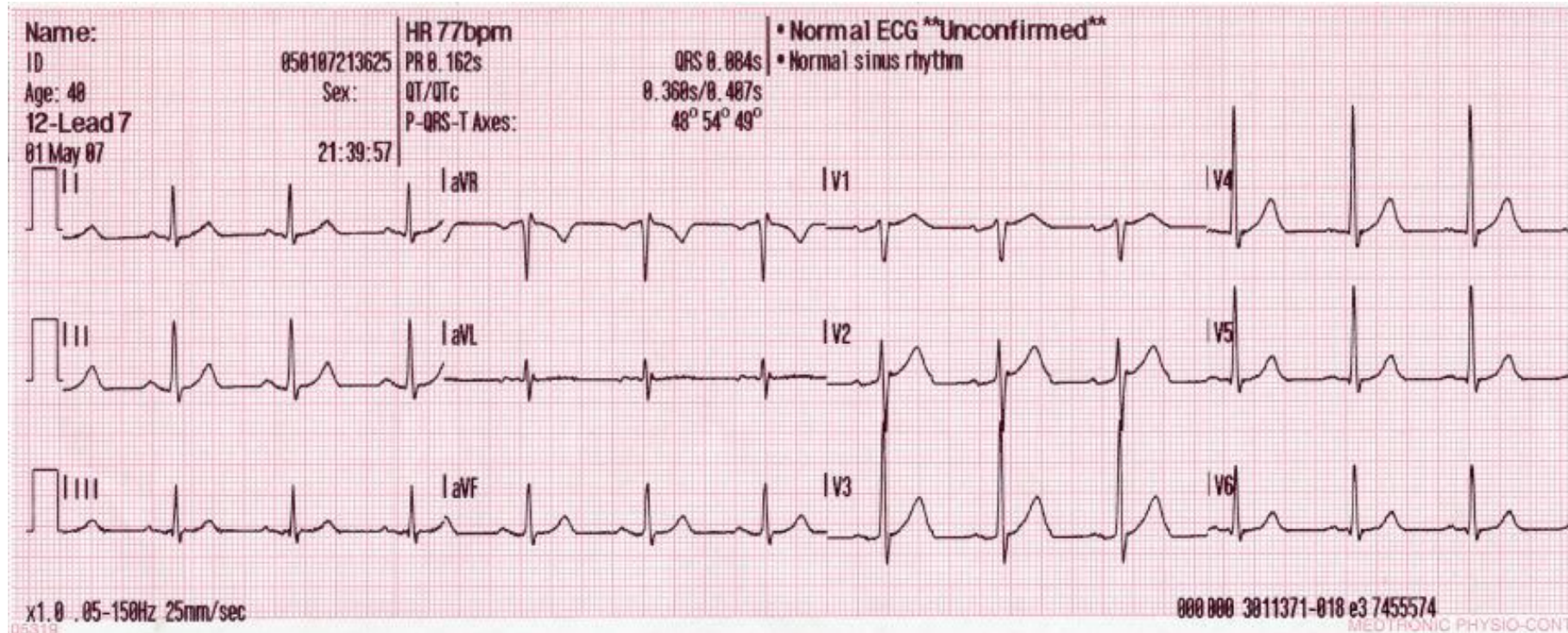


Is it Sinus?

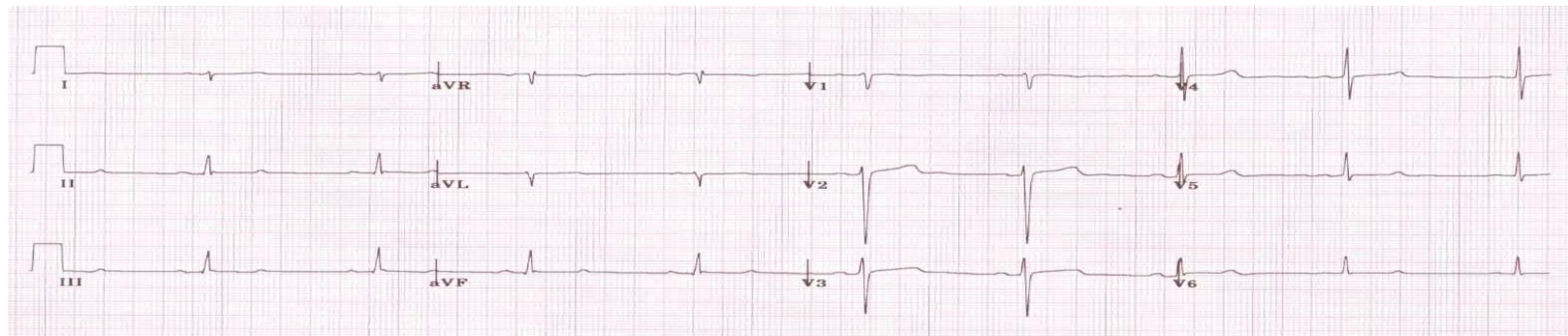
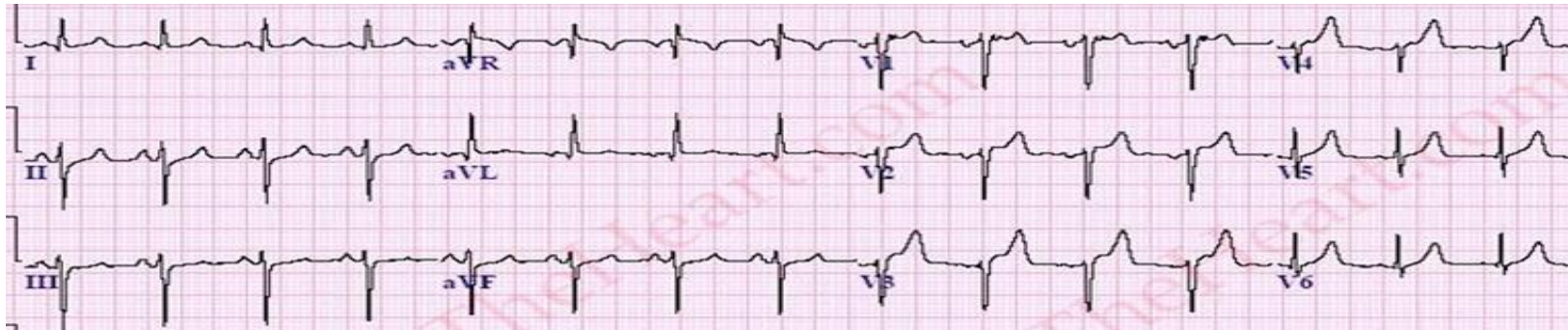
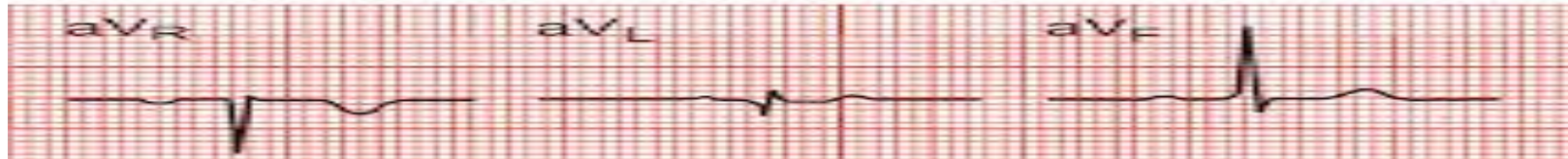
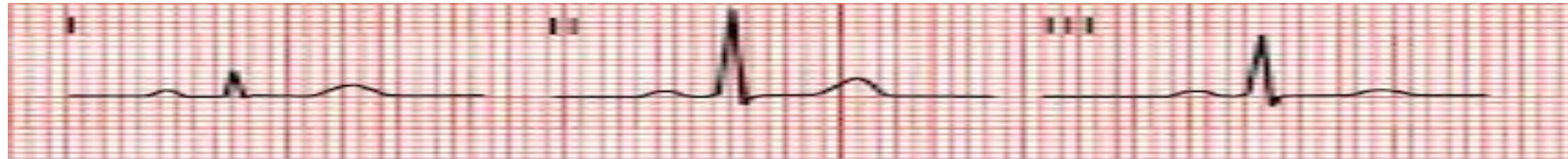


Rhythm

- P wave before every QRS?
- Every P waves followed by QRS?
- Regular Vs Irregular?

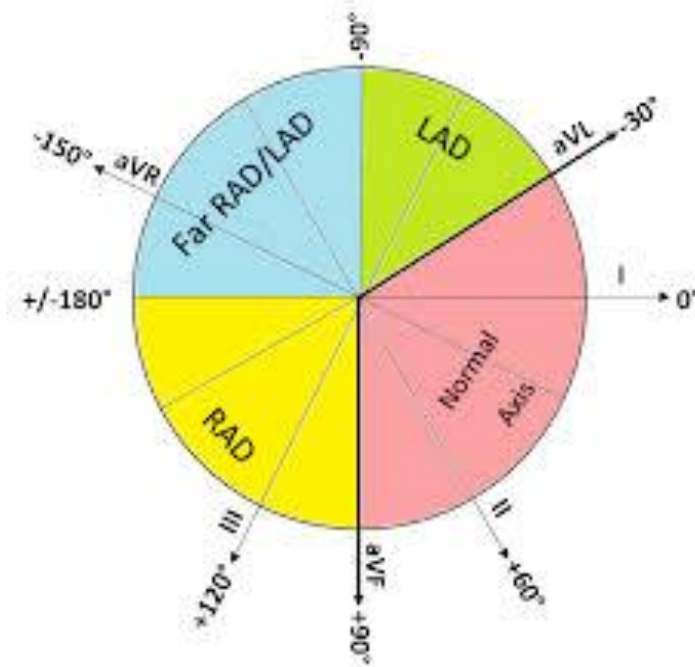


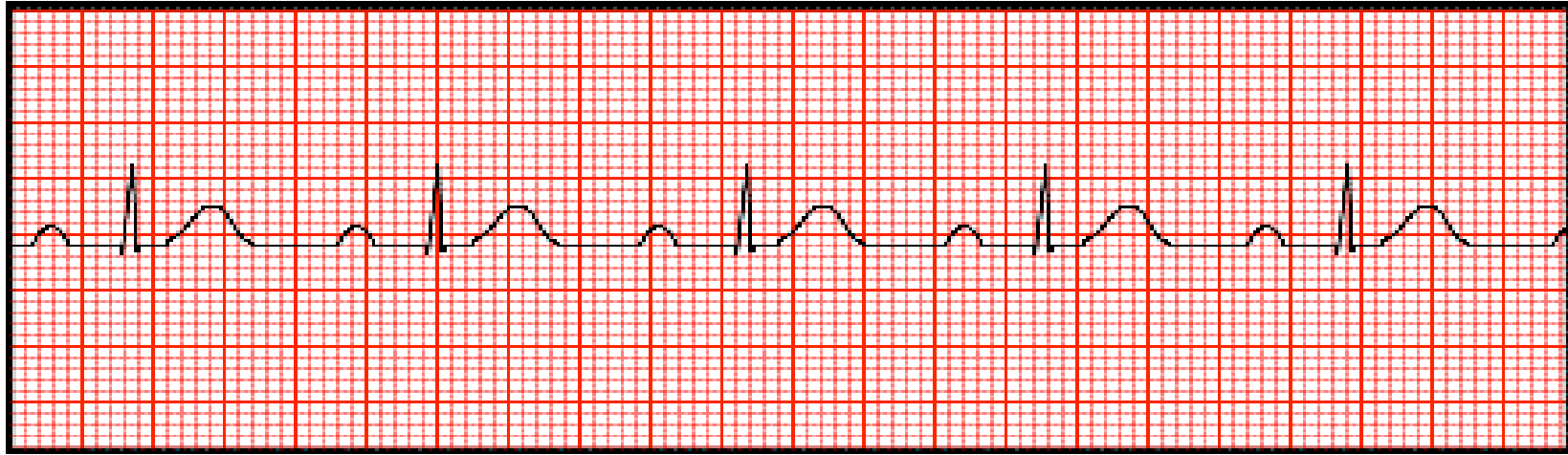
What is the Axis?

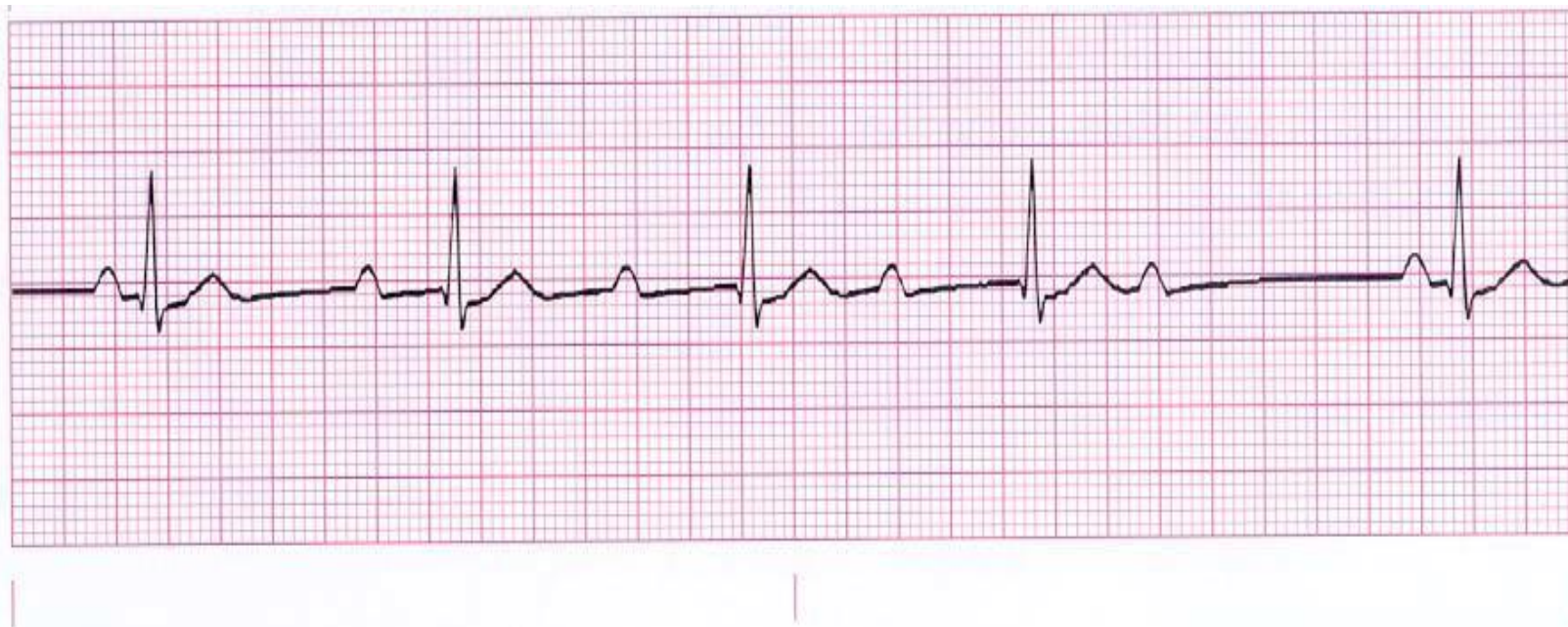
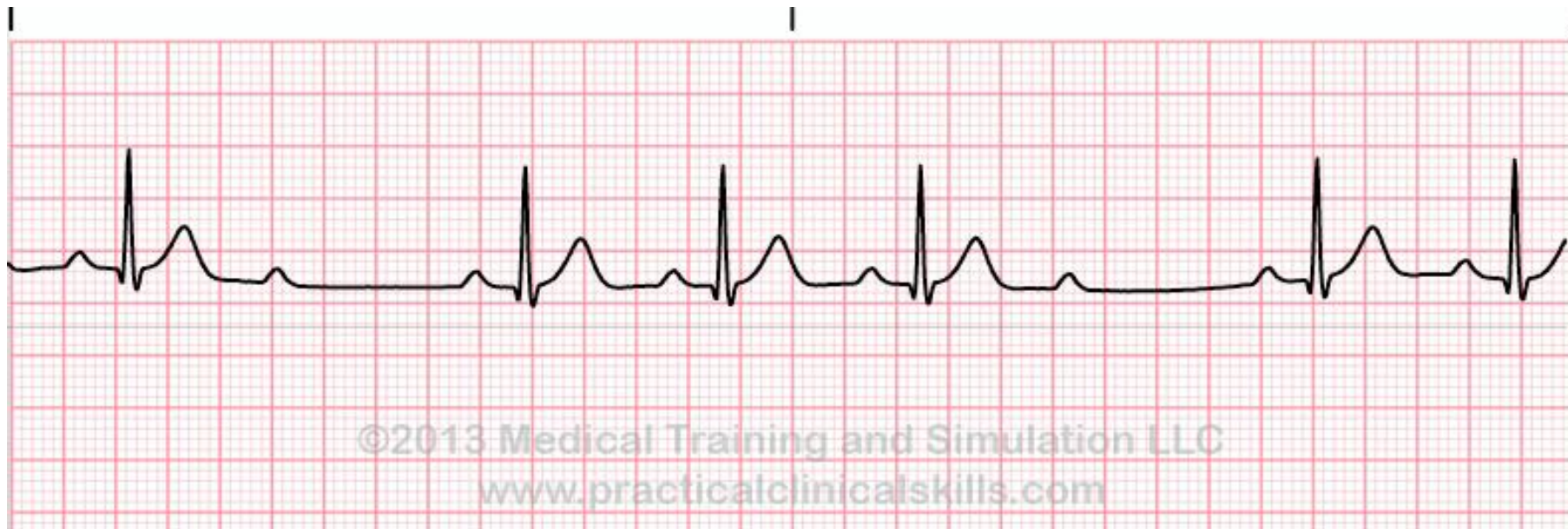


Axis

QRS deflection		Axis
Lead 1	aVF	
Positive	Positive	Normal
Positive	Negative	LAD
Negative	Positive	RAD
Negative	Negative	Extreme RAD or Extreme LAD







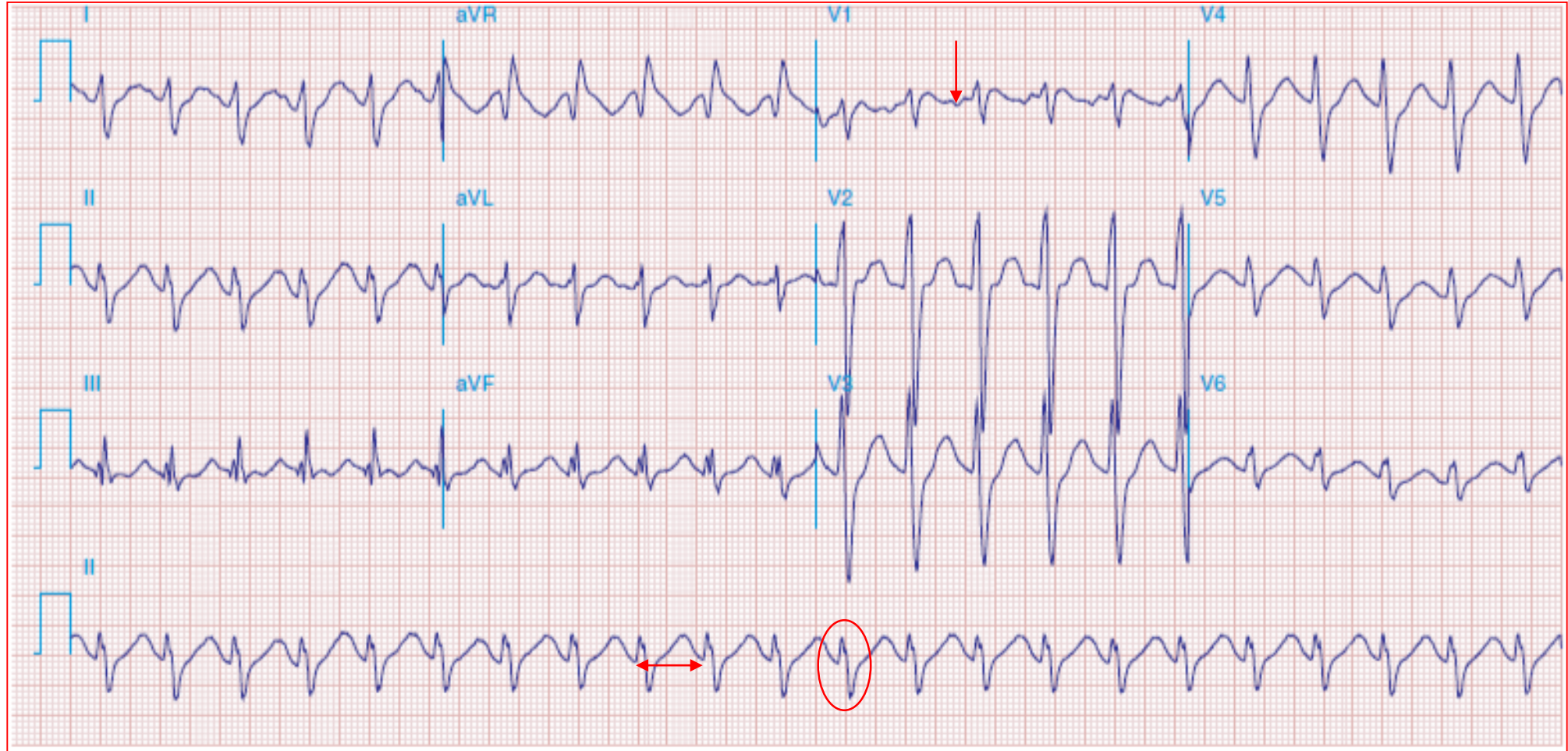
Blocks

- AV blocks
 - First degree block
 - PR interval fixed and > 0.2 sec
 - Second degree block, Mobitz type 1
 - PR gradually lengthened, then drop QRS
 - Second degree block, Mobitz type 2
 - PR fixed, but drop QRS randomly
 - Type 3 block
 - PR and QRS dissociated

Intervals

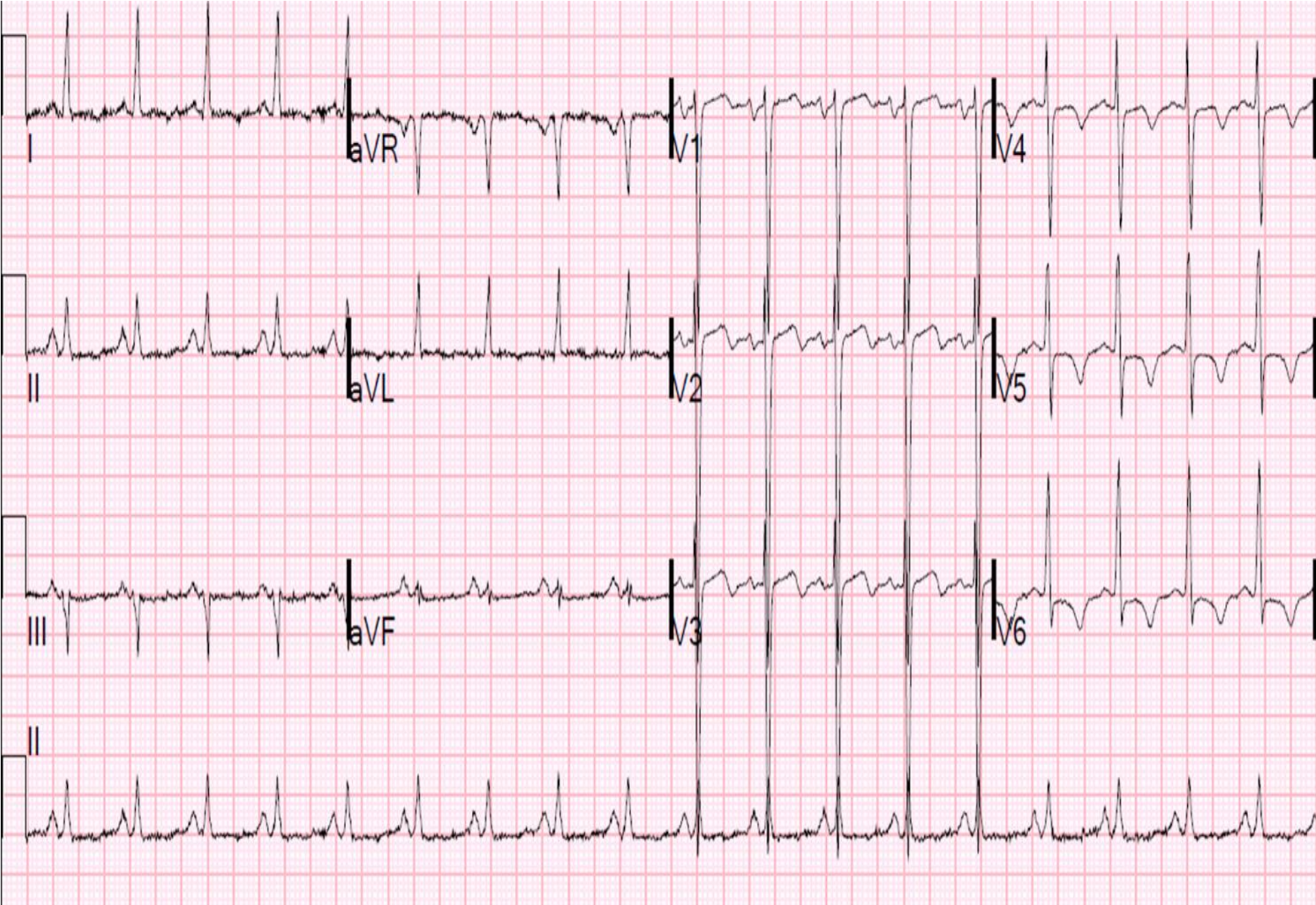
- PR
 - Normal PR interval is 0.20 sec (less than 1 large box)
- QRS
 - Normal QRS <0.12sec (Less than 3 small Boxes)
- QT interval
 - 450 ms in men and 460 ms in women
 - Based on sex and The HR
 - With normal HR, usually less than Half of the RR interval
- QTc
 - Corrects for the HR
 - $QTm/\sqrt{(R-R)}$

17 year old female found by her room mate unconscious



Causes of QT prolongation

- Drugs (Na channel blockers), Antipsychotics
- Hypocalcemia
- Hypomagnesemia
- Hypokalemia
- Hypothermia
- AMI
- Congenital
- Increased ICP



P Wave

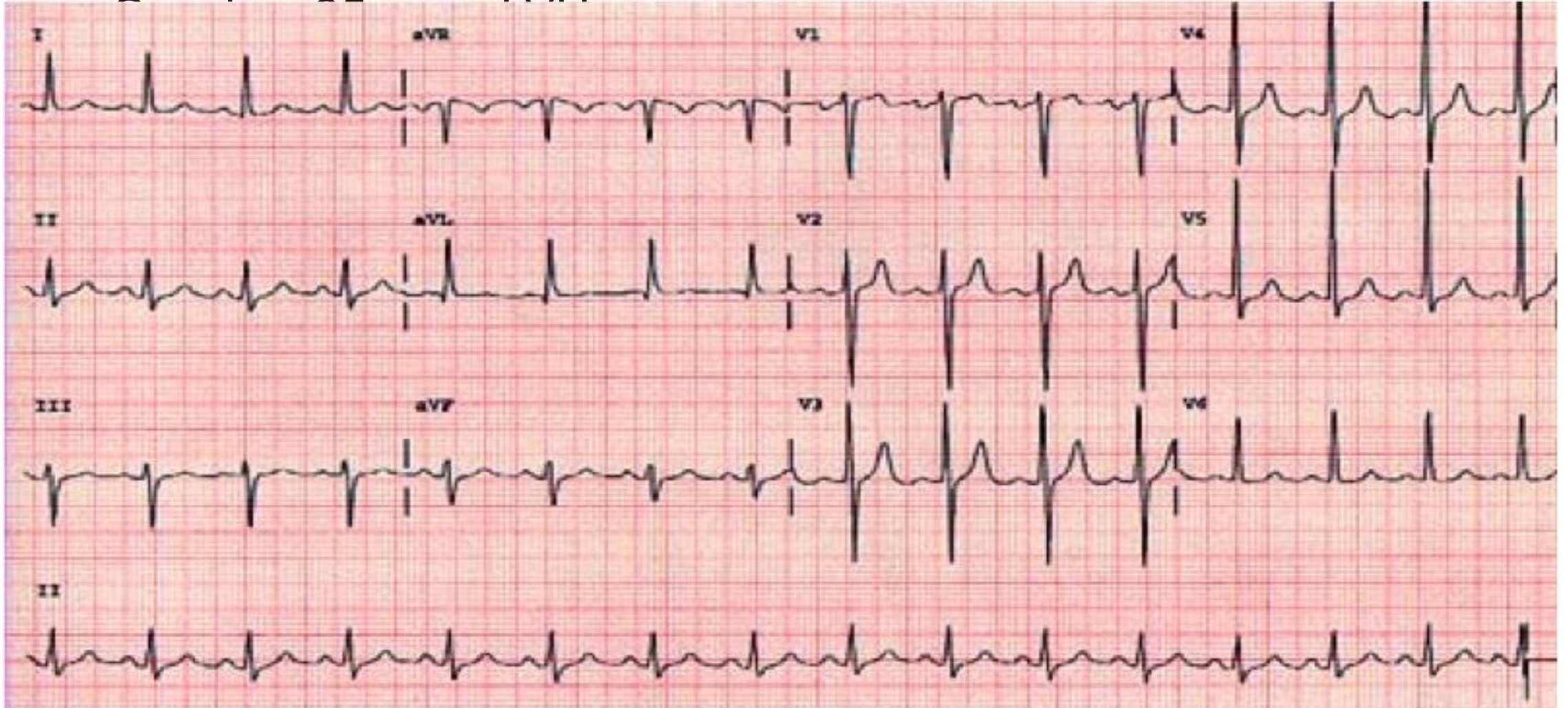
- Upright In Lead II → Sinus rhythm
- The P wave can also help with atrial enlargement
 - L Atrial Enlargement
 - Lead II: Bifid P wave with total P wave duration of >110ms
 - Lead V1: Biphasic P wave with terminal negative portion > 1mm deep
 - R Atrial Enlargement
 - Lead II: Peaked P waves >2.5mm
 - Lead I: Peaked P wave >1.5mm

QRS Complex

- Dr. Mohan's 4 things to look for in a QRS complex
 - Amplitude (Helps with LVH)
 - Duration (Bundle Branch)
 - Q waves (Old MIs)
 - R wave progression

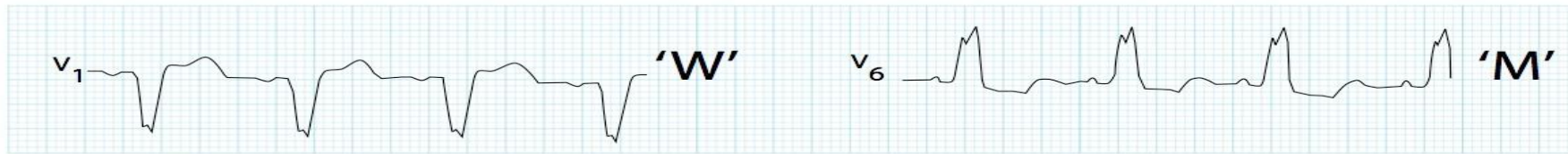
Amplitude

- Add the larger S wave of V1 or V2 in mm, to the larger R wave of V5 or V6.

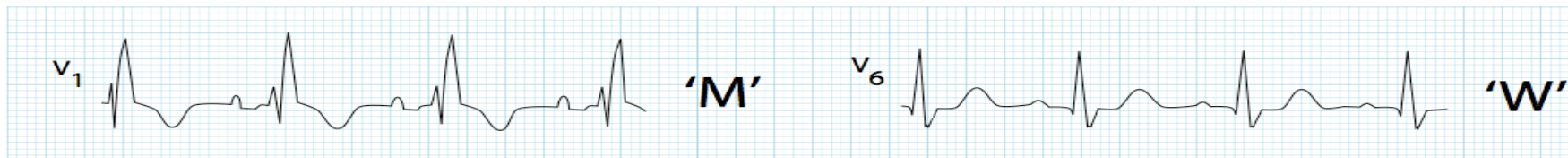


Duration

- Normal Duration <0.12 sec
- If prolonged, have to think about RBBB or LBBB
 - LBBB
 - Dominant S wave in V1 and Broad monophasic R wave in lateral leads (I, aVL, V5-

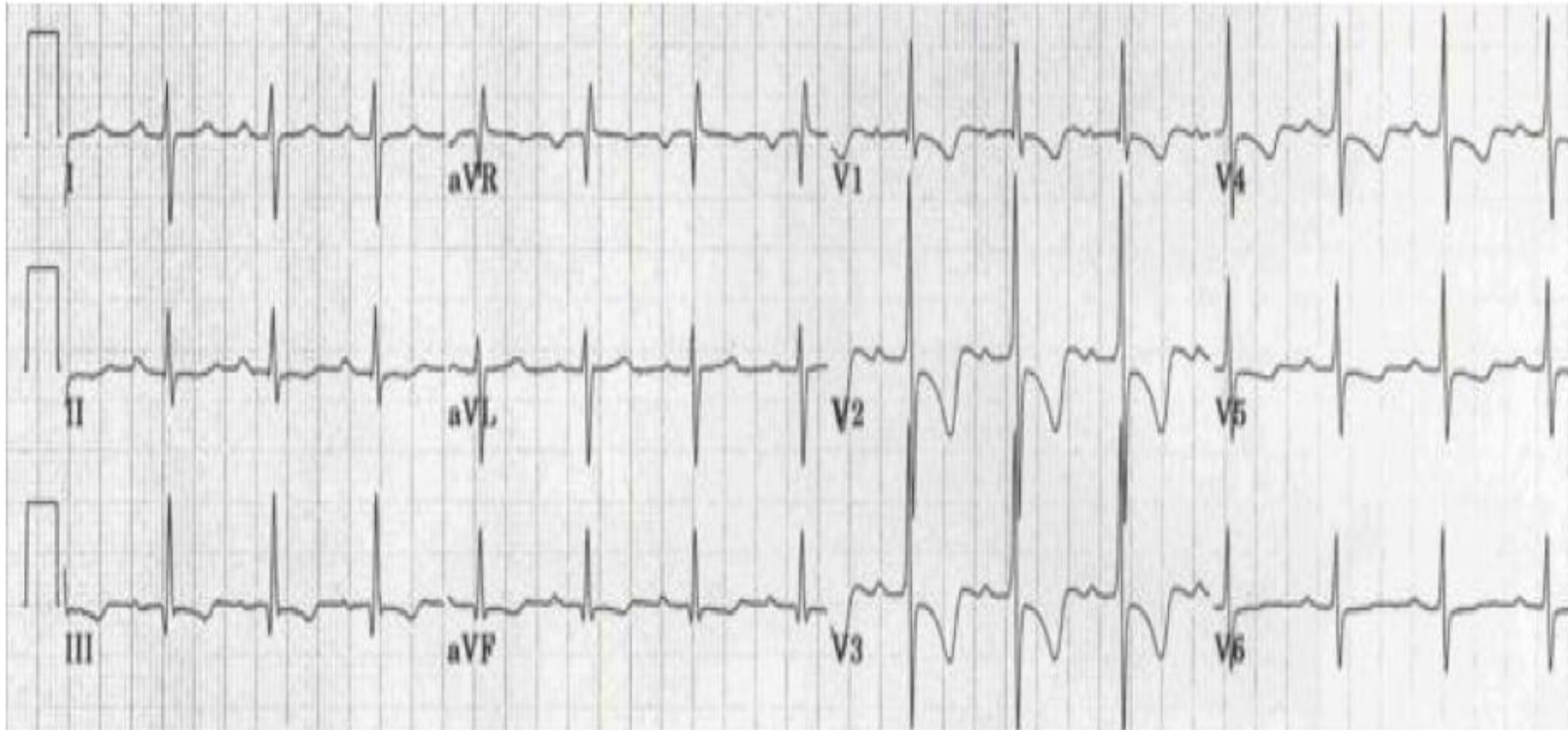


- RBBB
 - RSR' pattern in V1-3 ('M-shaped' QRS complex) and Wide, slurred S wave in the



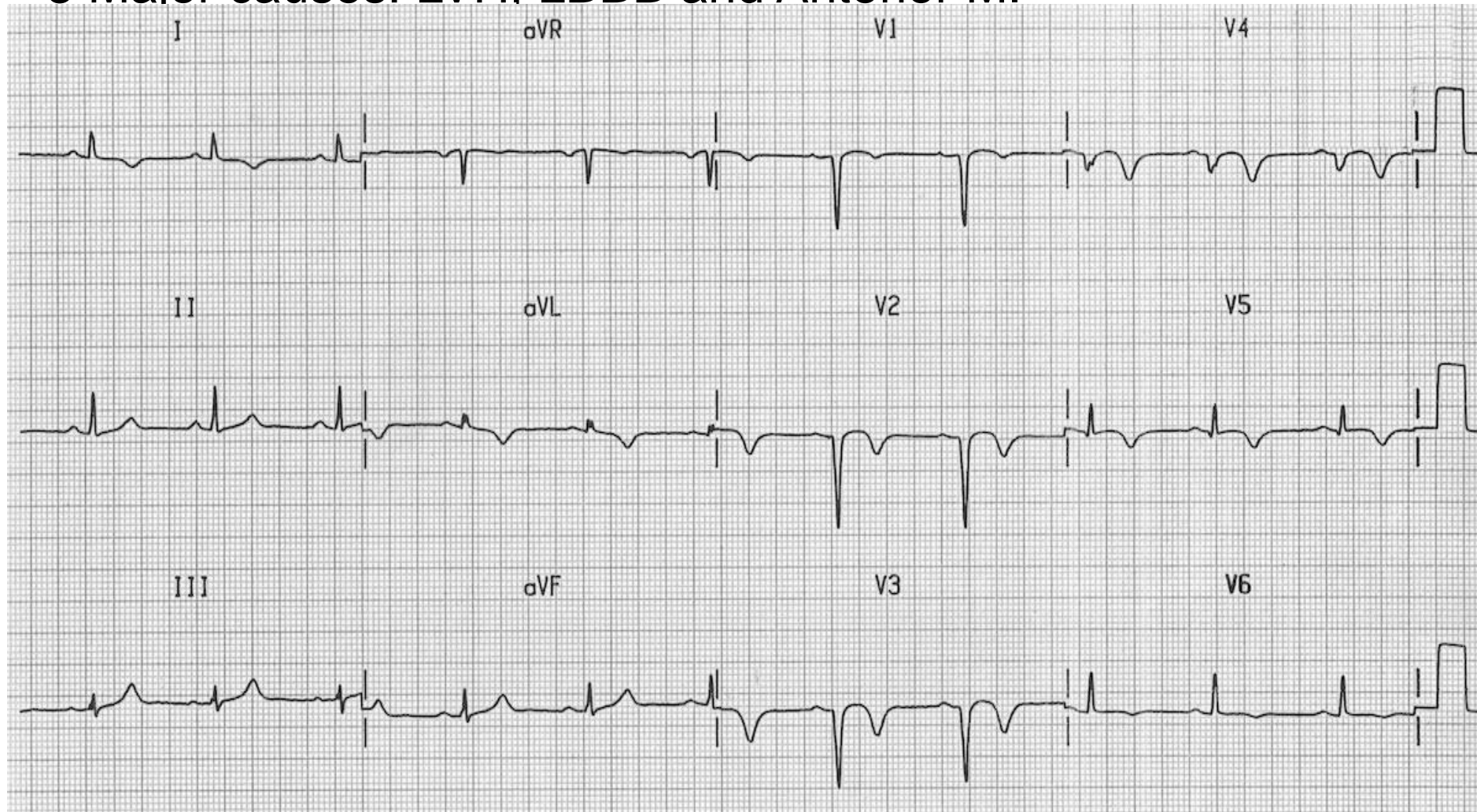
R wave Progression

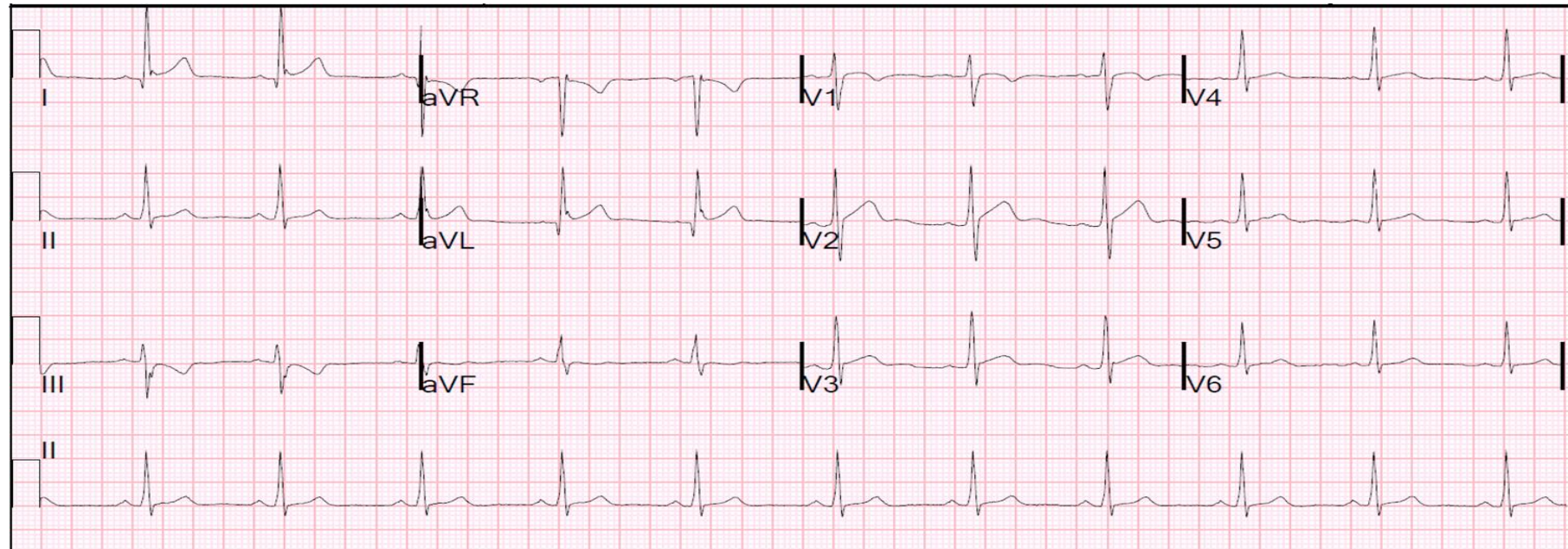
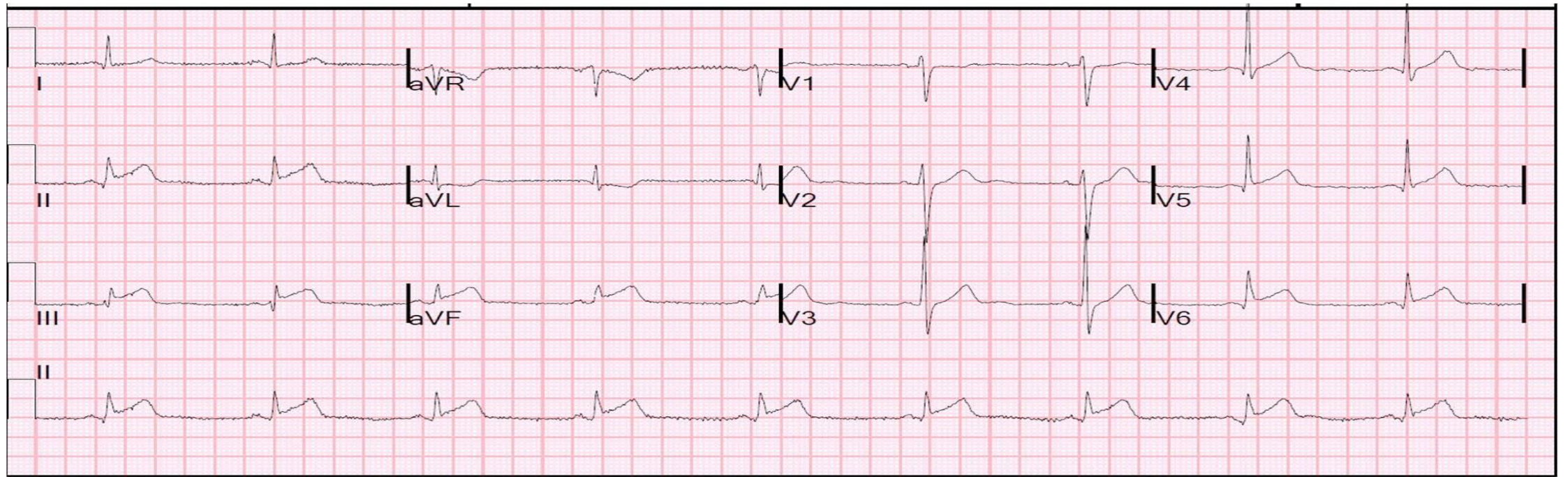
- Usual Transition between V3-V4
- Early Progression
 - 3 major causes: RBBB, RVH and Posterior MI



R Wave progression

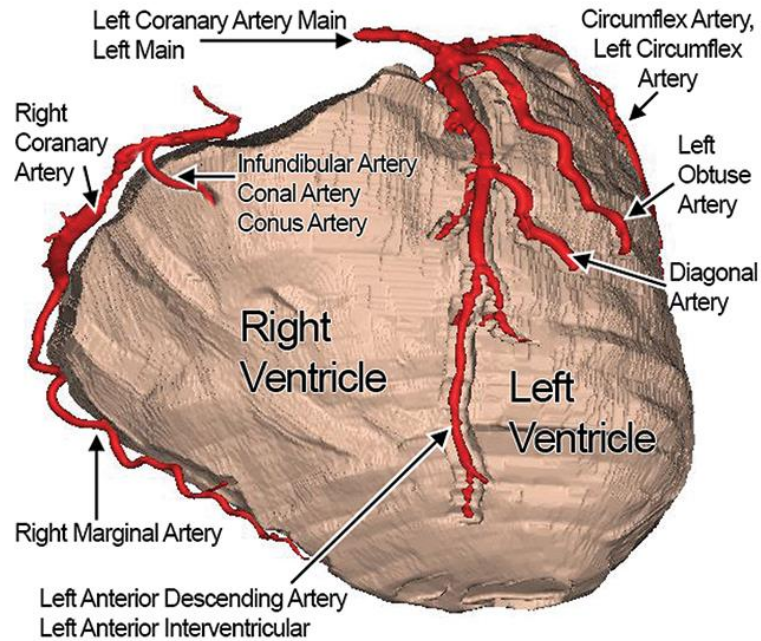
- Late R wave Progression
 - 3 Major causes: LVH, LBBB and Anterior MI



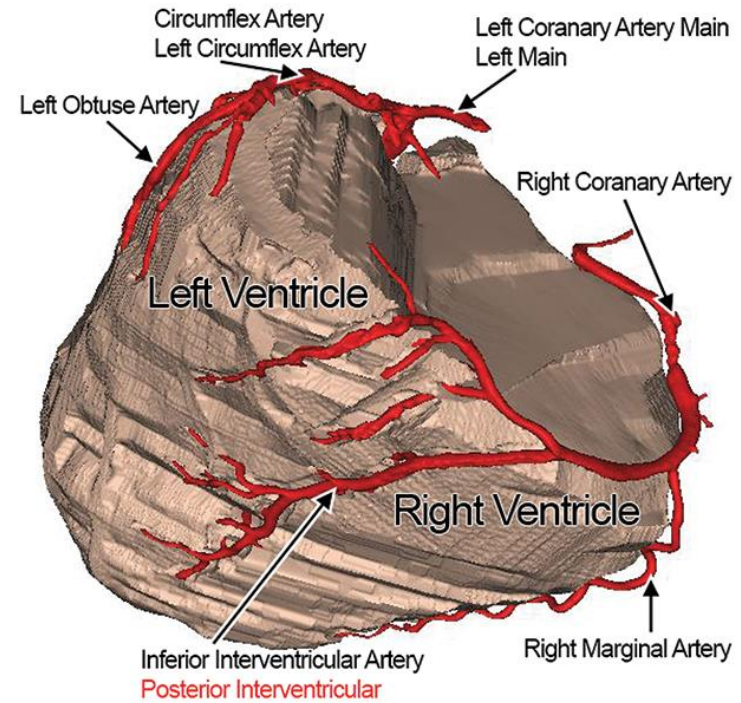


Coronary Artery Anatomy

Anterior View



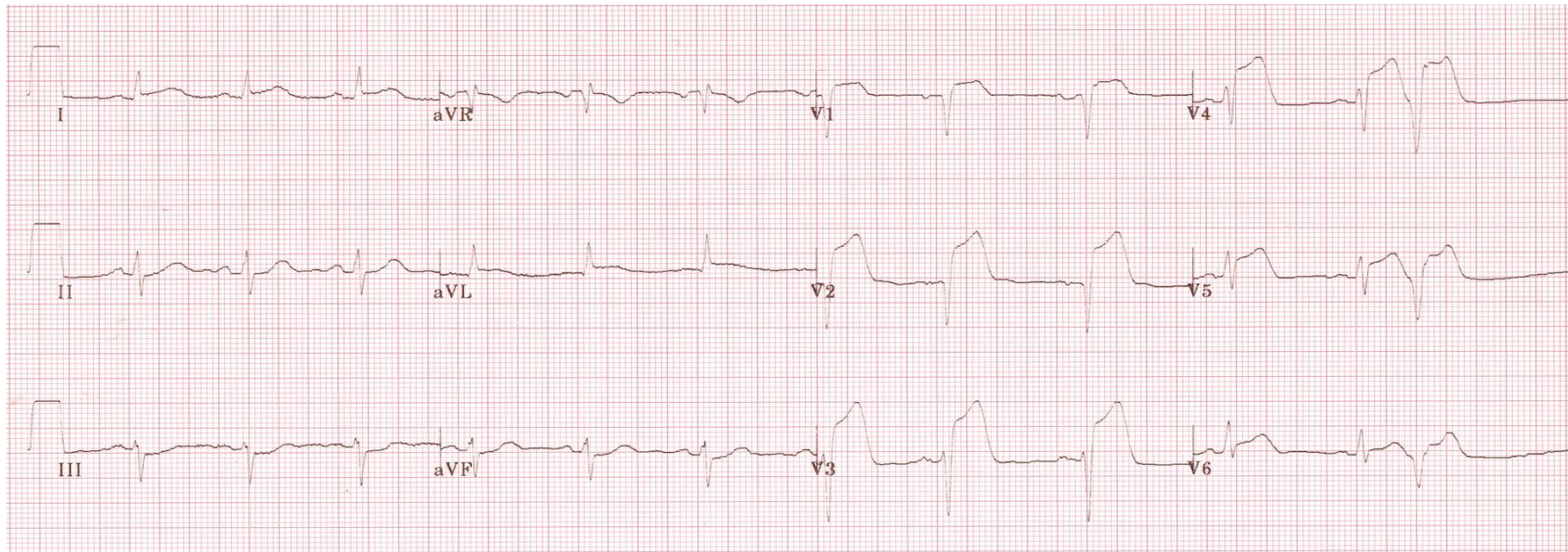
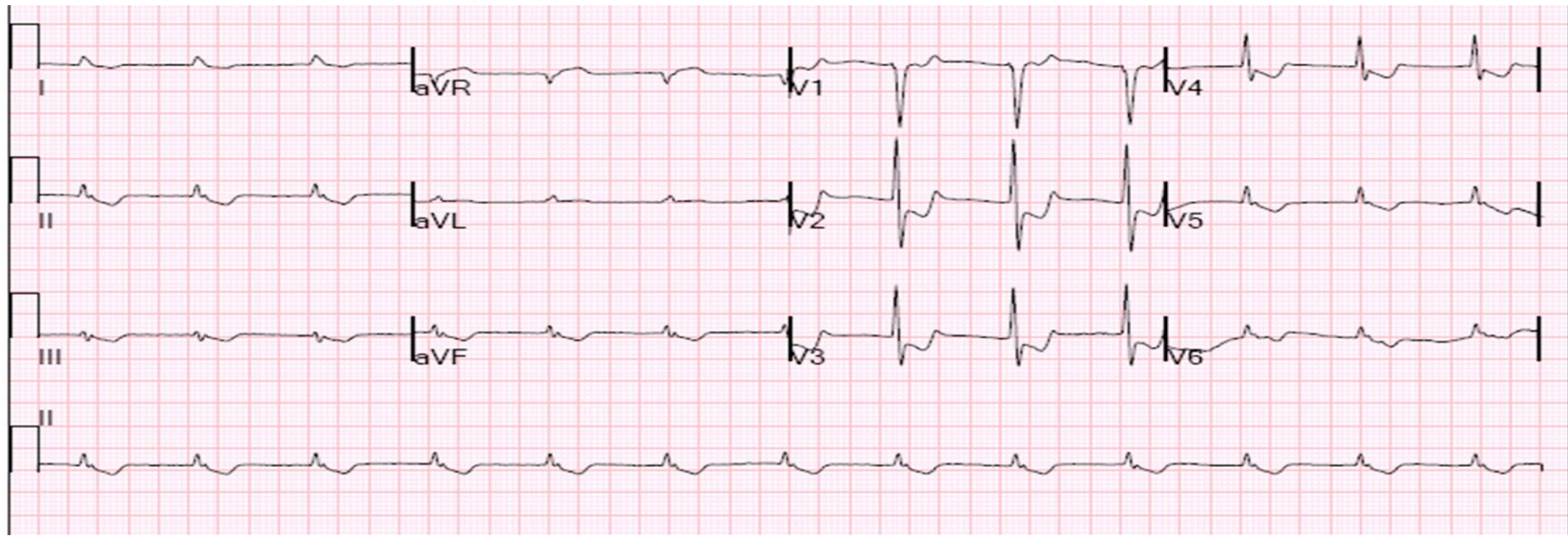
Posterior View



STEMI

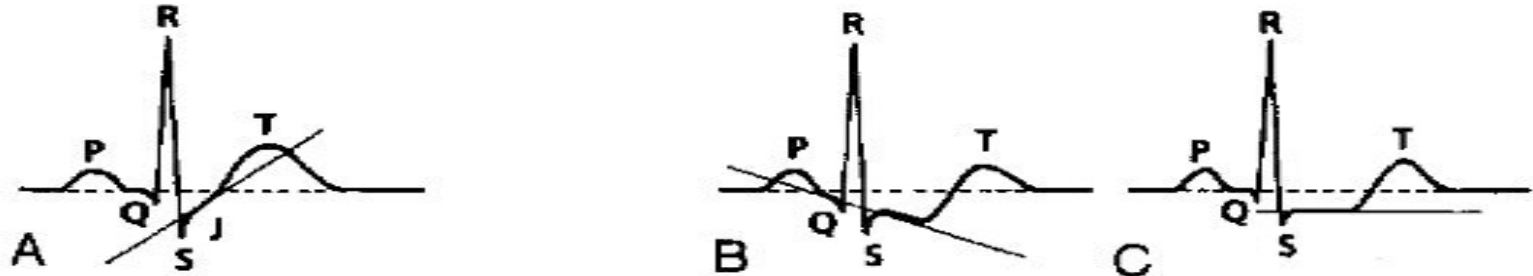
- ≥ 2 mm of ST segment elevation in 2 contiguous precordial leads in men (1.5 mm for women)
- ≥ 1 mm in other leads (2 contiguous)
- 2 Other Categories considered to be STEMI even though there might not be true ST elevations: New LBBB and Posterior MI

SITE	FACING	RECIPROCAL
INFERIOR	II, III, aVF	I, aVL <small>EMS12Lead.com</small>
HIGH LATERAL	I, aVL	II, III, aVF
ANTERIOR	V1, V2, V3, V4	NONE
POSTERIOR	NONE	V1, V2, V3, V4



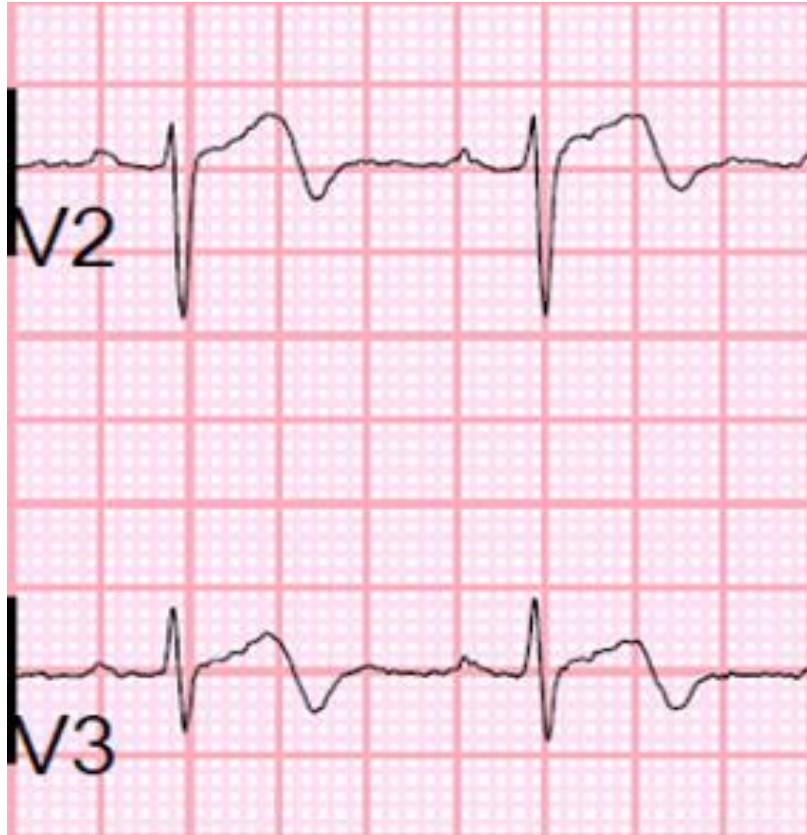
ST Depression

- ST depression can be either upsloping, downsloping, or horizontal (see diagram below).



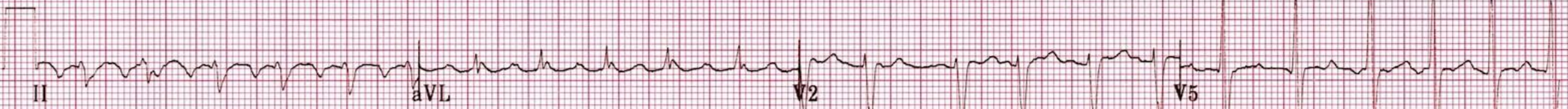
- Horizontal or downsloping ST depression ≥ 0.5 mm at the J-point in ≥ 2 contiguous leads indicates myocardial ischemia.
- ST depression ≥ 1 mm is more specific and conveys a worse prognosis.
- ST depression ≥ 2 mm in ≥ 3 leads is associated with a high probability of NSTEMI and predicts significant mortality (35% mortality at 30 days).
- Upsloping ST depression is non-specific for myocardial ischemia.

Wellens T Waves



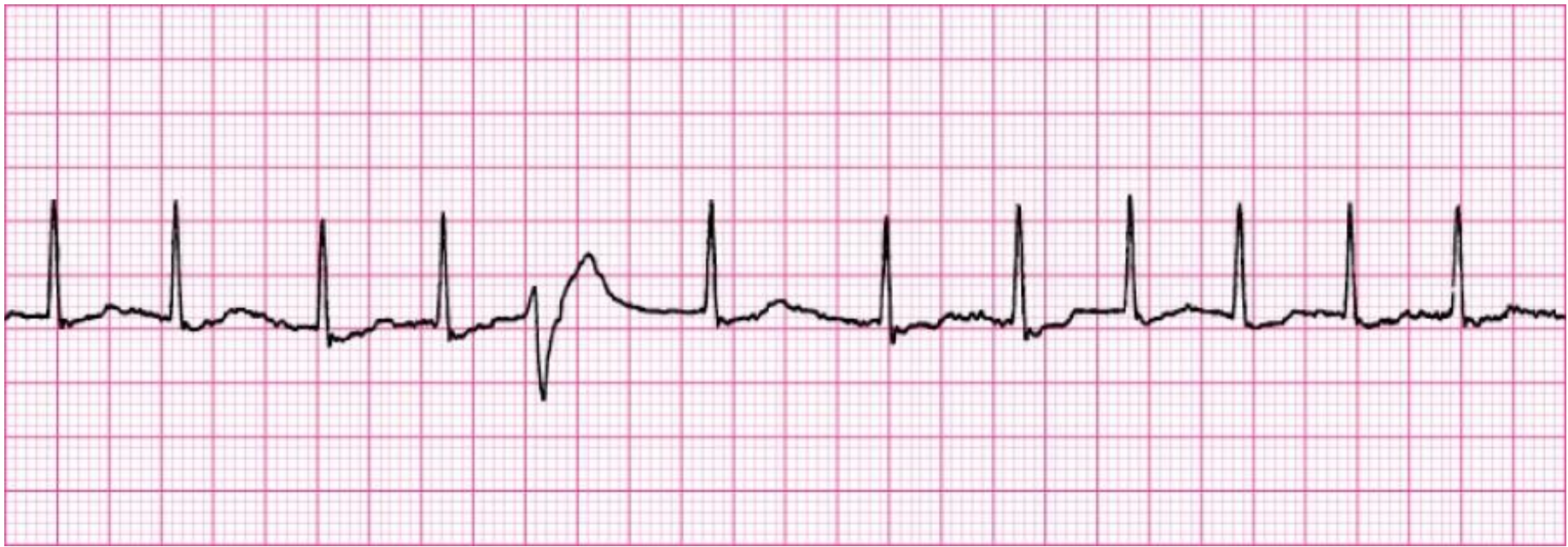
T wave Inversion

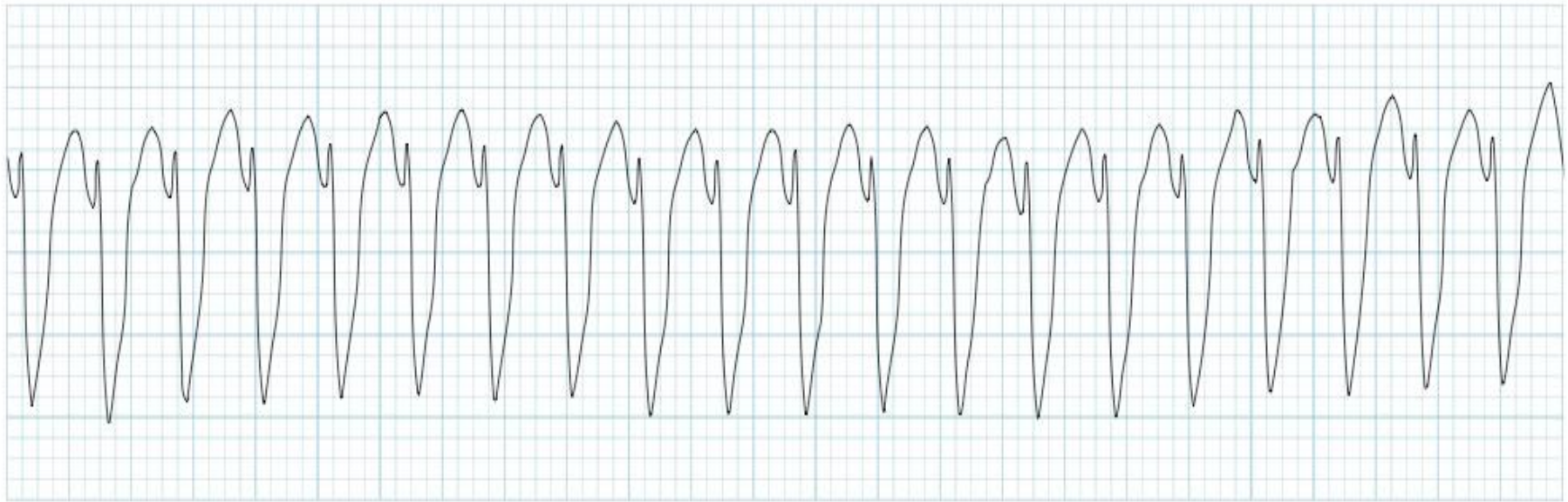
- At least 1 mm deep
- Present in ≥ 2 continuous leads that have dominant R waves (R/S ratio > 1)
- Dynamic — not present on old ECG or changing over time
- Wellens' syndrome is a pattern of inverted or biphasic T waves in V2-4 (in patients presenting with ischemic chest pain) that is highly specific for critical Stenosis of the left anterior descending artery.



Tachycardia

- Narrow Complex Vs. Wide Complex
- Regular Vs. Irregular
- Regular Narrow Complex Tachycardia: Sinus Tachycardia, Atrial Tachycardia, A flutter, SVT, AVNRT
- Irregular Narrow Complex Tachycardia: A Fib, A flutter with Variable Block, MAT etc
- Regular Wide complex Tachycardia: VT, V-Flutter, Tachycardia with aberrancy, Hyperkalemia
- Irregular Wide Complex Tachycardia: Torsades, V-Fib Etc.



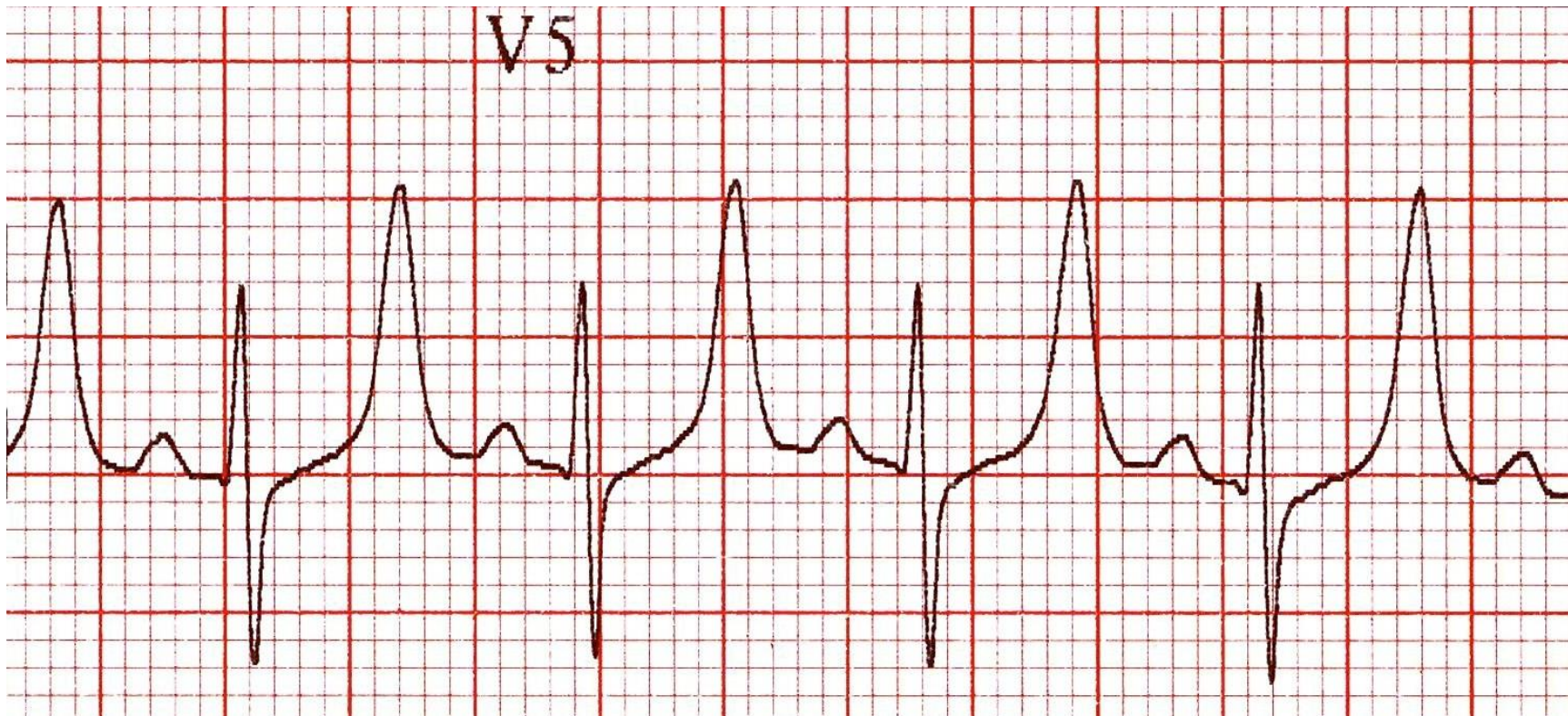


Bradycardia

- Narrow Vs Wide Complex
- Regular Vs. Irregular
- Regular narrow complex bradycardia: Sinus, Junctional, Complete AV block (junctional escape), A-flutter with high degree block.
- Irregular narrow complex bradycardia: Sinus, A-fib with slow ventricular response, A-flutter with variable block, Type I and Type II second degree block.
- Regular wide complex bradycardia: Idioventricular rhythm, Complete AV block (ventricular escape), Regular bradycardias with aberrancy or bundle branch block
- Irregular wide complex bradycardia: Type 1 and type 2 second degree blocks, Irregular bradycardias with bundle branch block.

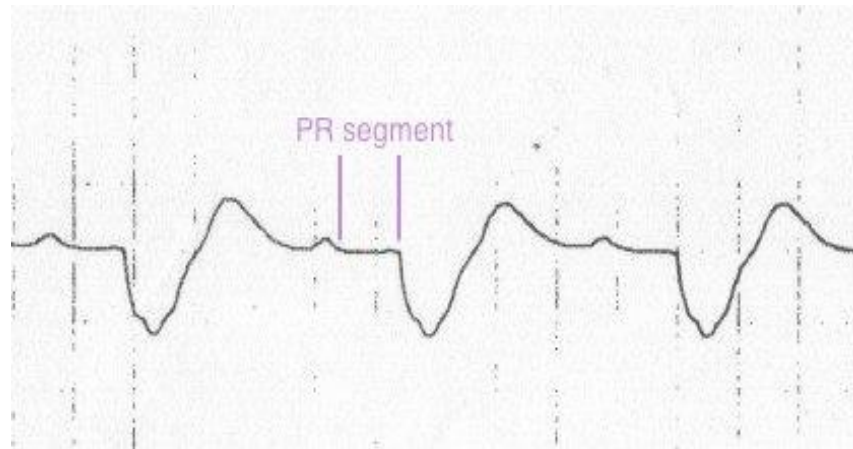
Hyperkalemia

- > 5.5 mEq/L is associated with repolarization abnormalities
- Peaked T waves



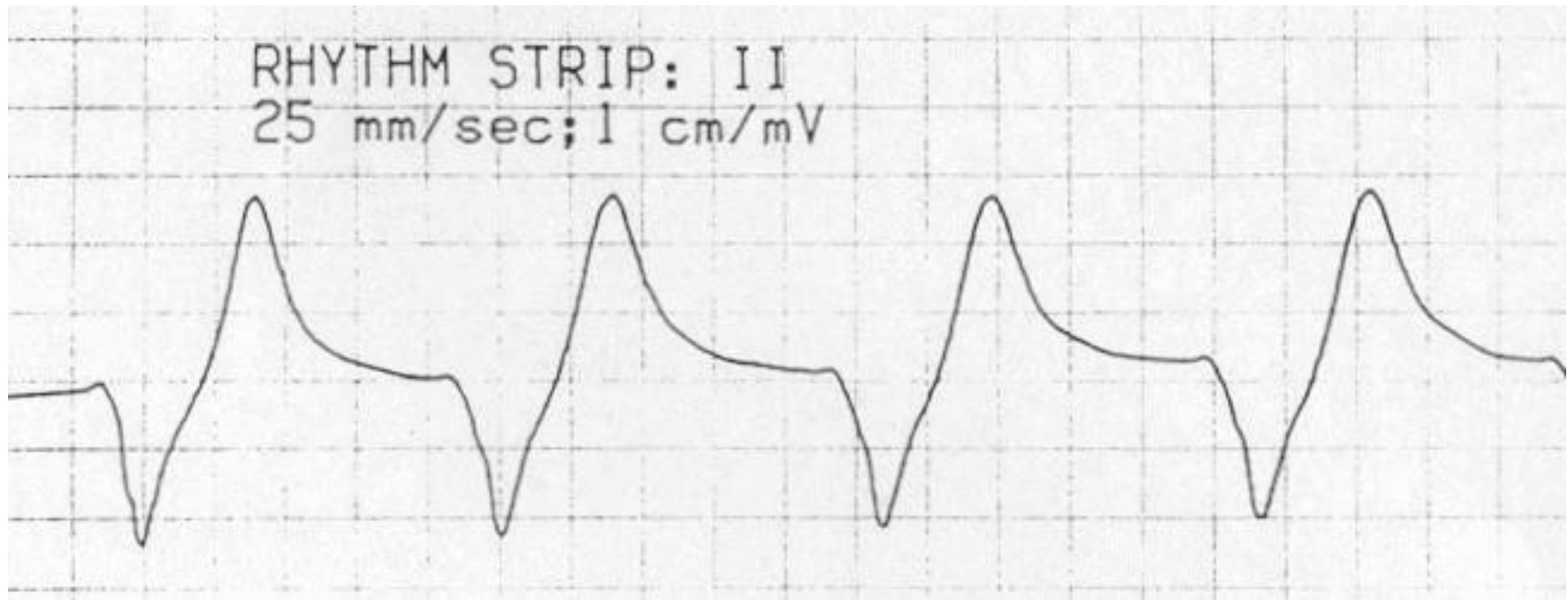
Progression of Hyperkalemia

- > 6.5 mEq/L is associated with progressive paralysis of the atria
- P wave widens and flattens, PR segment lengthens, P waves eventually disappear



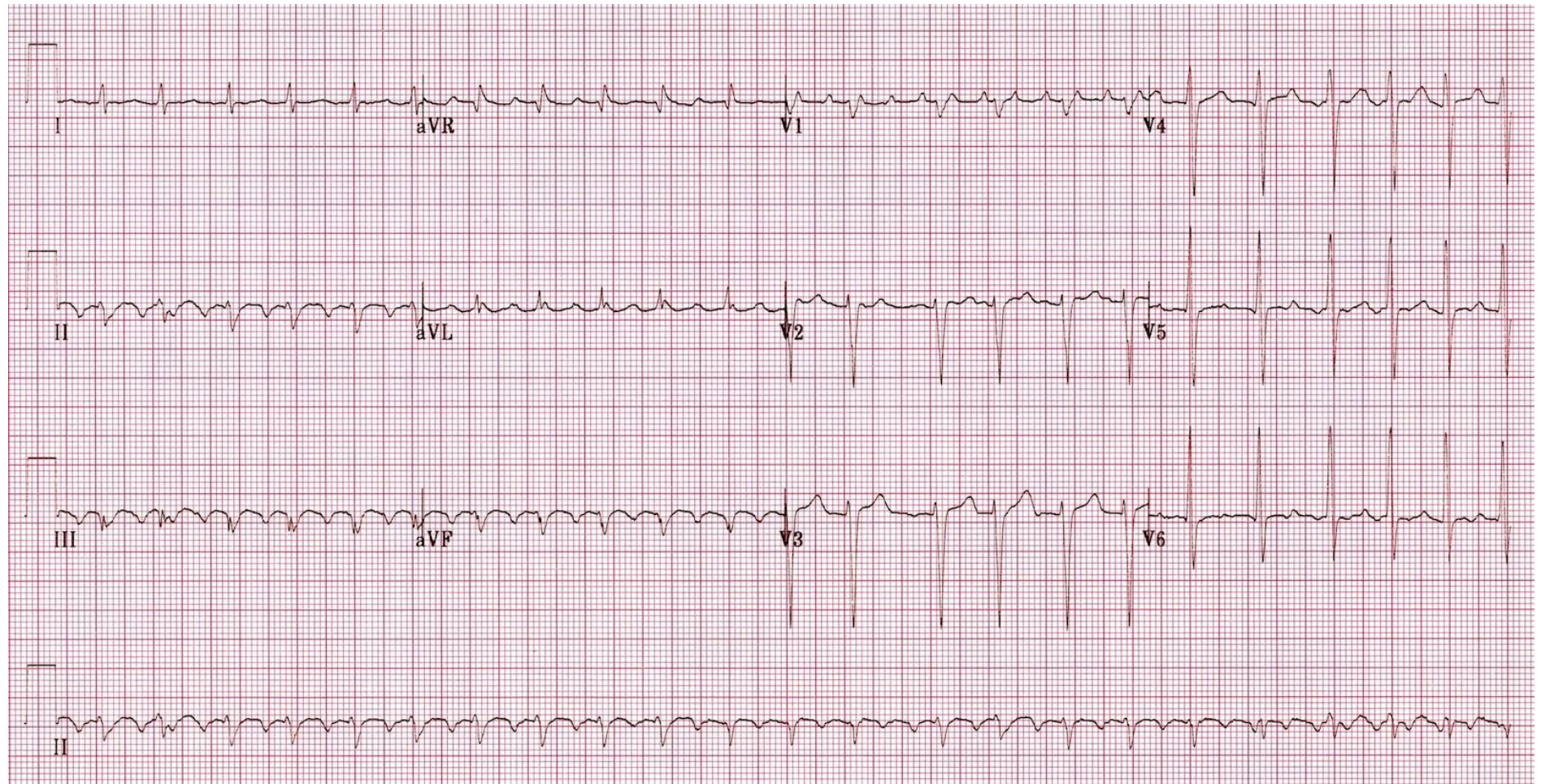
Hyperkalemia Continued

- > 7.0 mEq/L is associated with conduction abnormalities and bradycardia.
- Prolonged QRS interval with bizarre QRS morphology, High-grade AV block with slow junctional and ventricular escape rhythm, Any kind of conduction block (bundle branch blocks, fascicular blocks), Sinus bradycardia or slow AF, Development of a sine wave appearance (a pre-terminal rhythm)

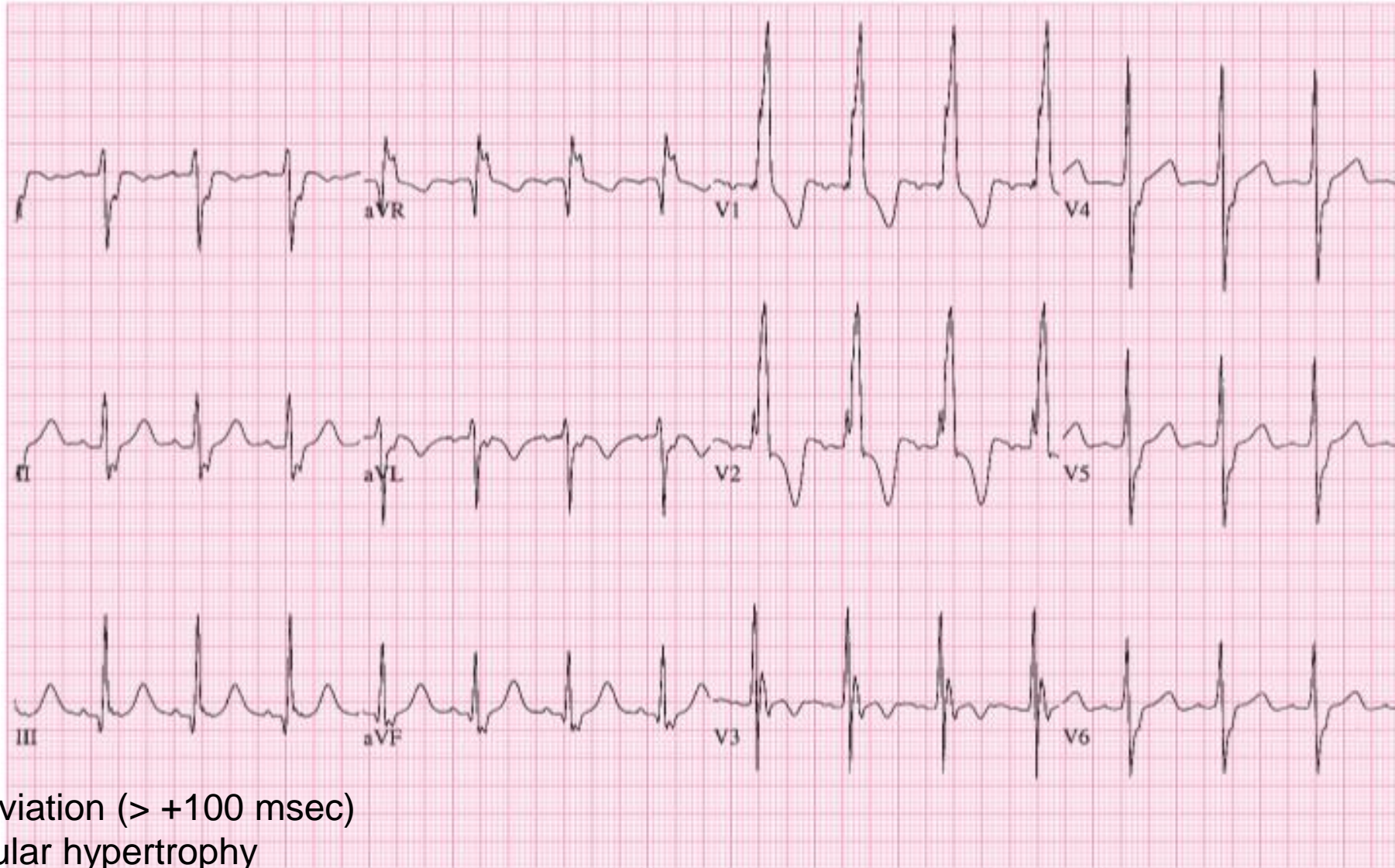


Hyperkalemia Continued

- > 9.0 mEq/L causes cardiac arrest.
 - Asystole
 - Ventricular fibrillation
 - PEA with bizarre, wide complex rhythm



ECG 7. 51-year-old female with shortness of breath:



Codes:

- 07 Sinus rhythm
- 37 Right axis deviation ($> +100$ msec)
- 41 Right ventricular hypertrophy
- 43 RBBB, complete
- 67 ST and/or T wave abnormalities secondary to

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