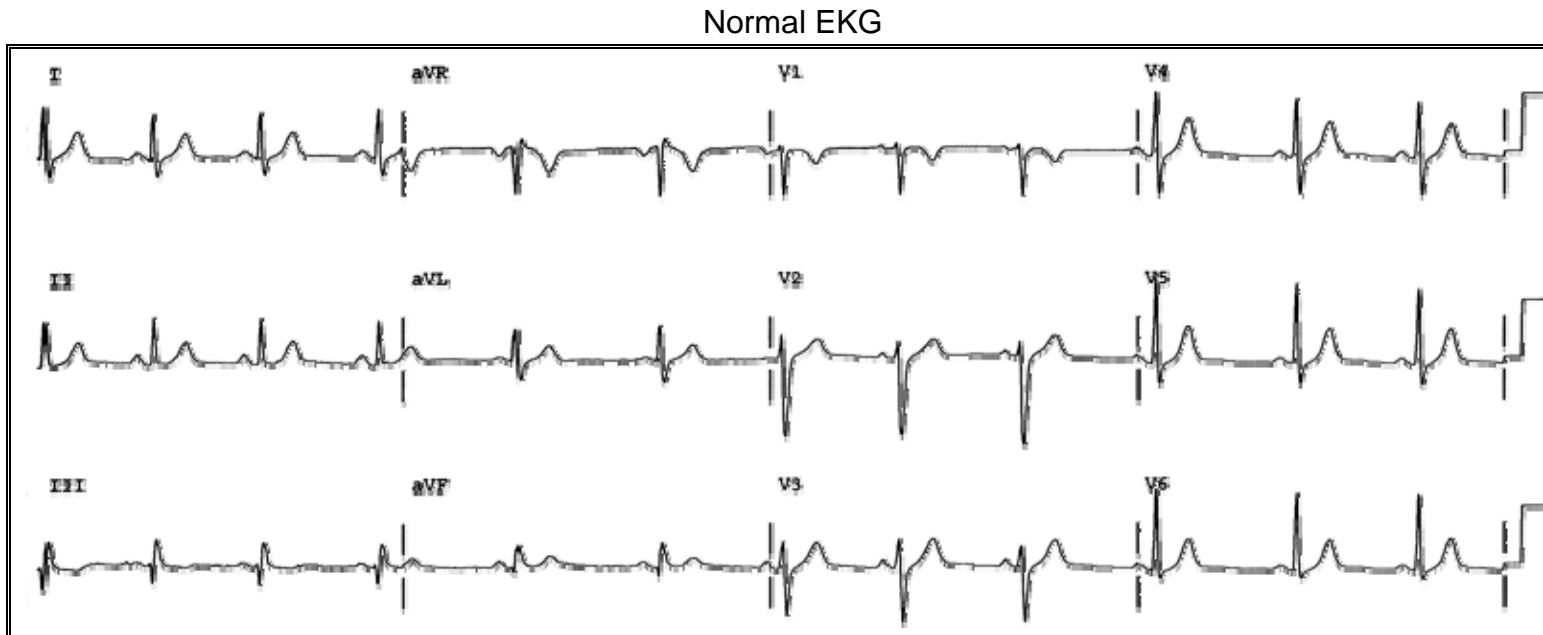


EKG INTERPRETATION

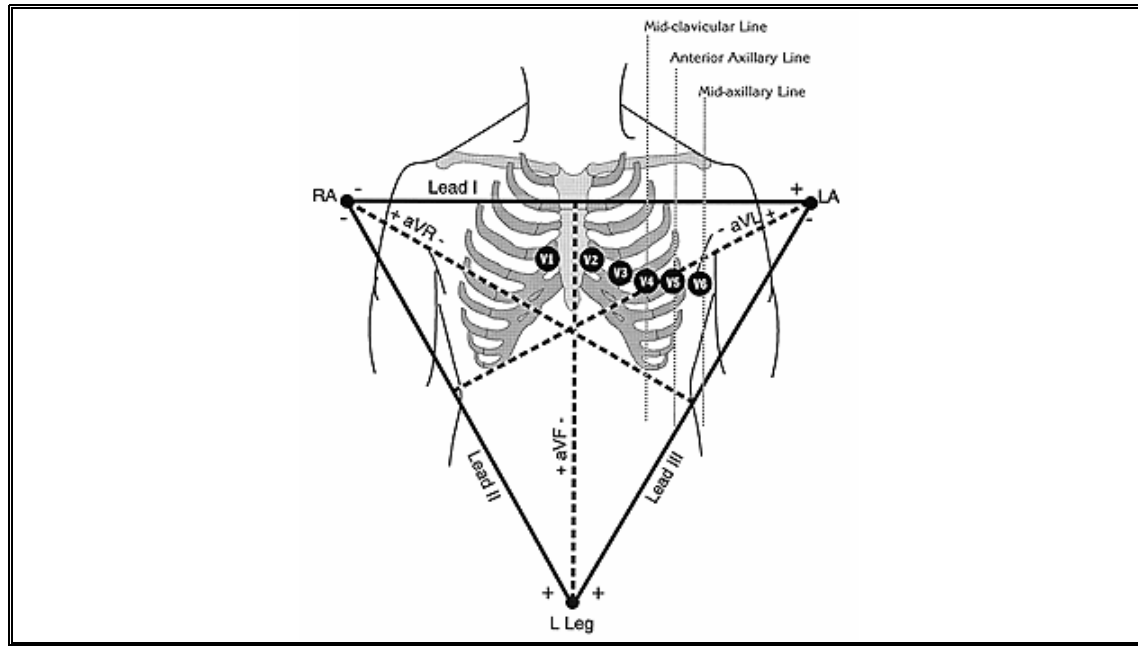
EKG Basics



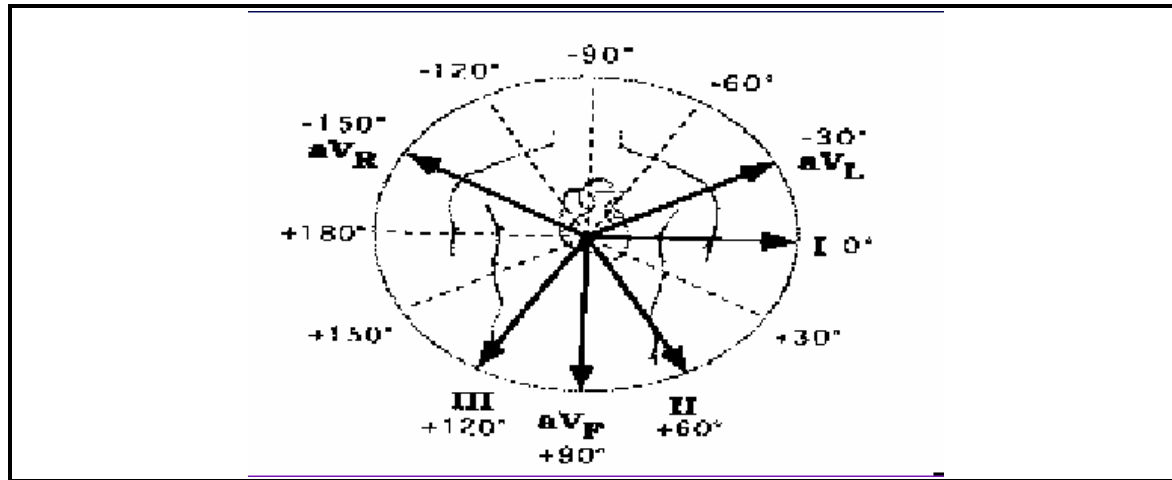
Anatomy of the EKG

- Anterior – V1-V6
- Inferior – II, III, AVF
- Lateral – V4-V6, I, AVL
- Septal – V1-V2

Lead Placement



Axis of Heart

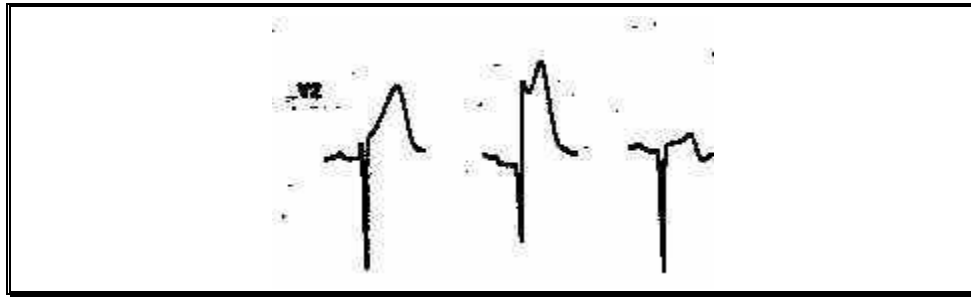


ACUTE MYOCARDIAL INFARCTION

Specific EKG characteristics to look for in ACS:

- Q waves
- Lack of R wave progression in precordial leads
- ST segment depression or elevation
- T wave abnormalities

Evolution of AMI (hyperacute T, ST elevation, Q wave)

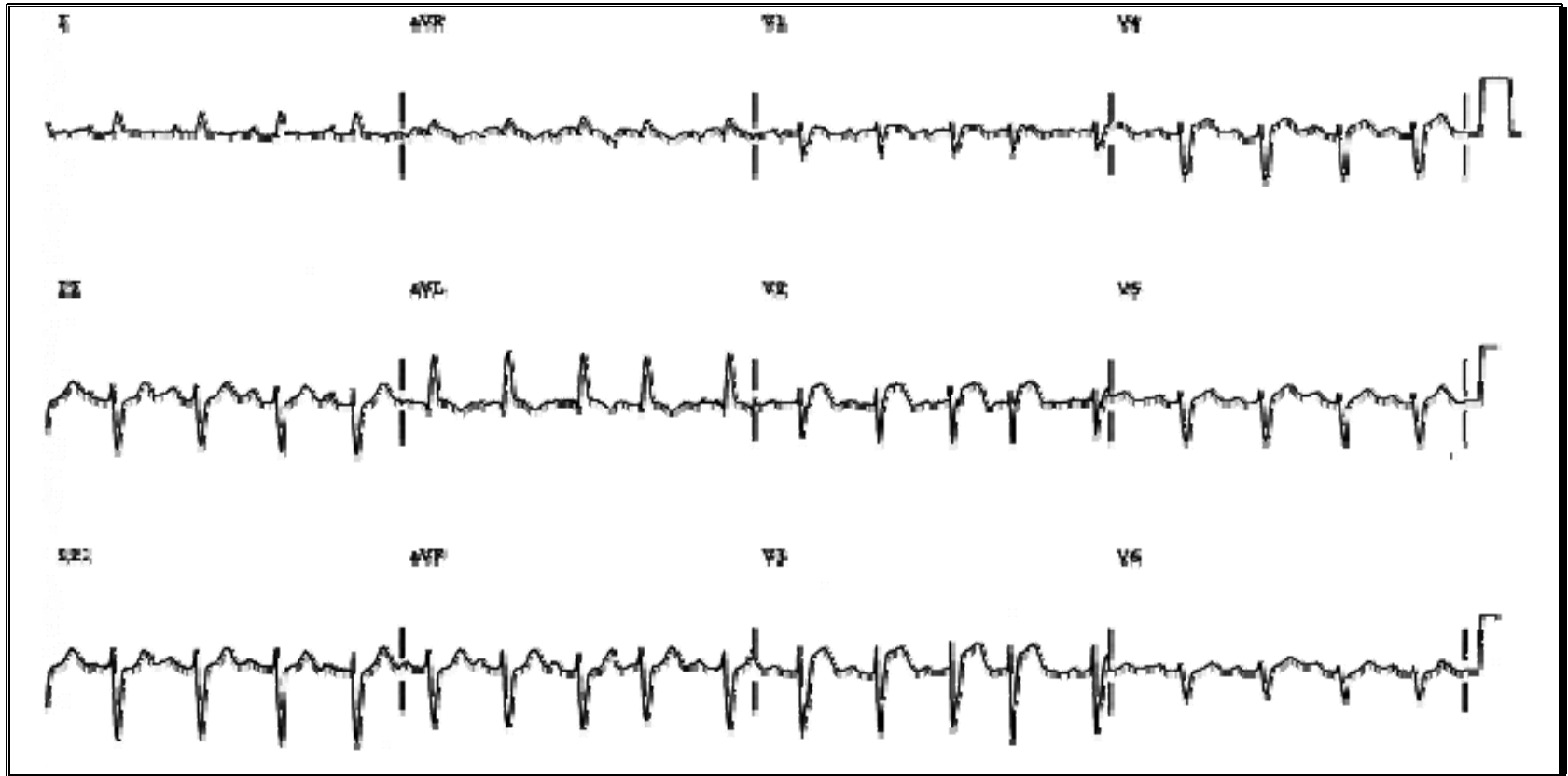


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CASE #1

* EKG findings:

* Diagnosis ?



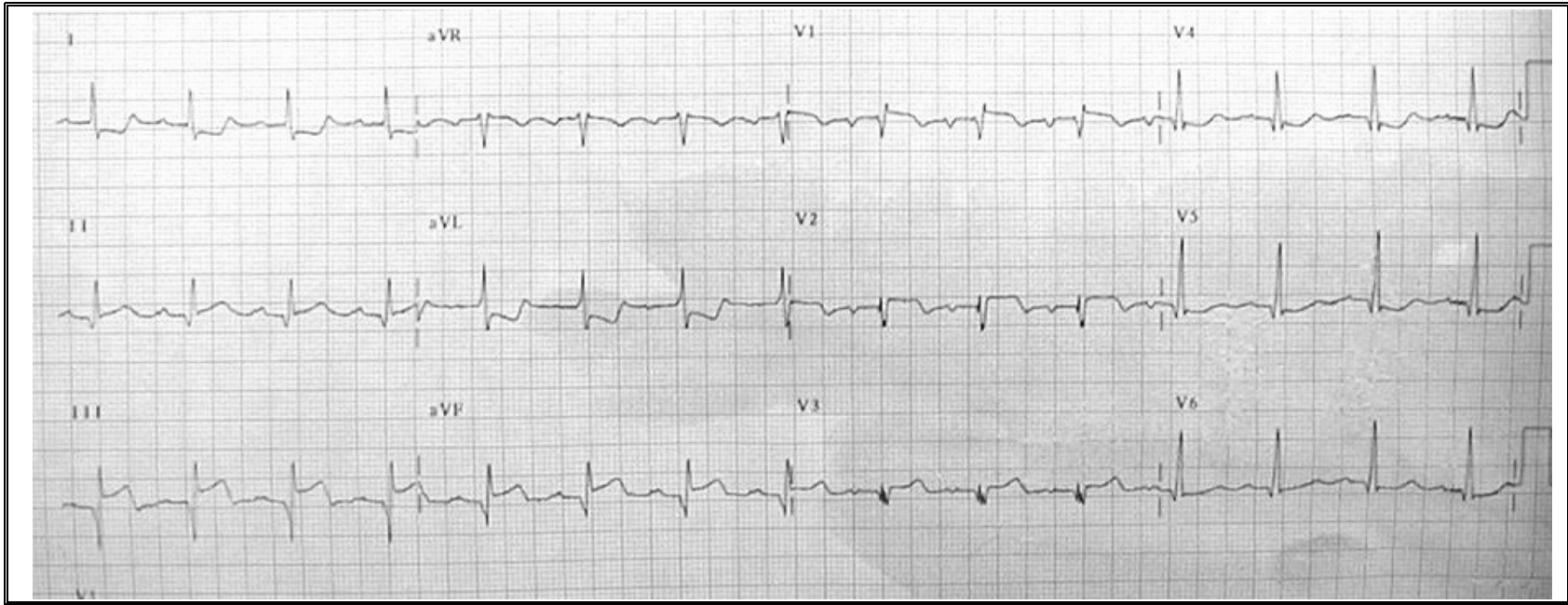
*Answer: Acute Anterior MI

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CASE #2a

* EKG findings:

* Diagnosis?



*Answer: Acute Inferior Wall MI

*Question: What else would you ask for and why?

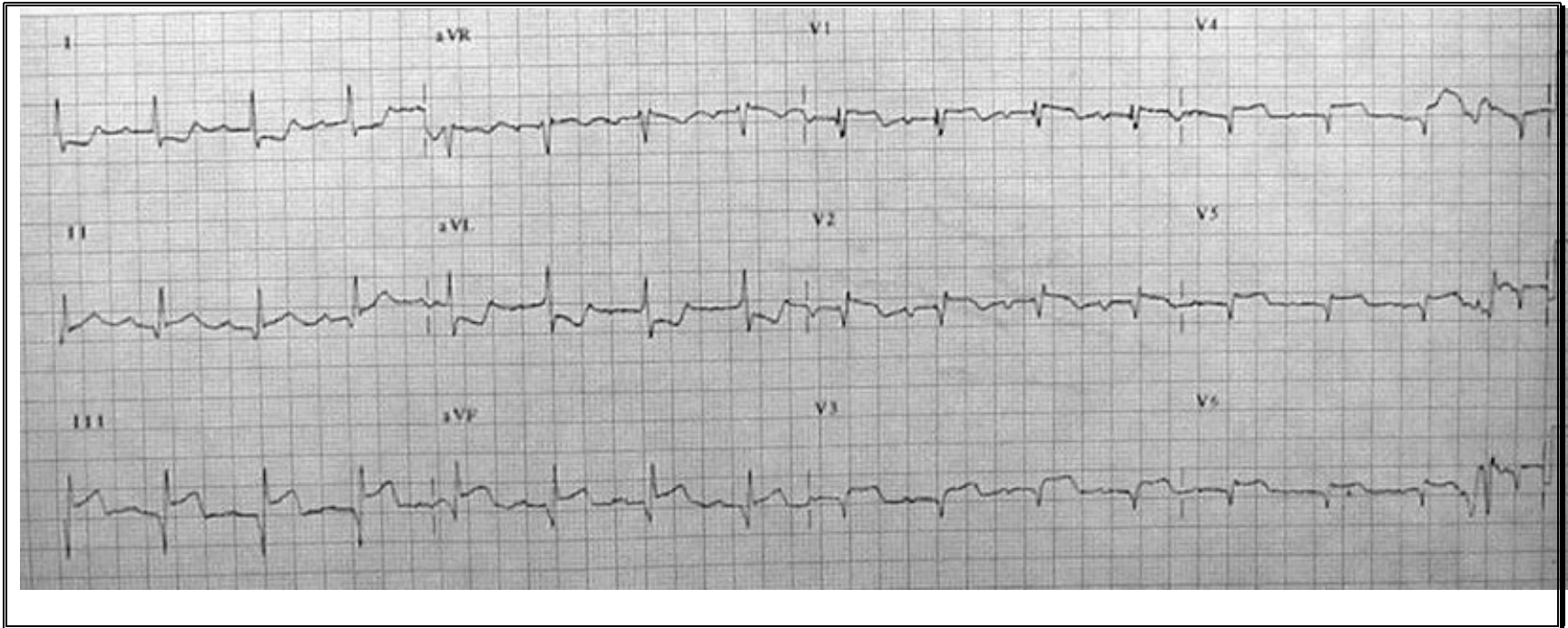
*Answer: Right-sided EKG leads looking for RV involvement

CASE #2b

* EKG findings:

* Diagnosis?

Right-sided EKG leads



*Answer: Right Ventricular Infarction

- Associated with inferior wall MI
- Mortality of IWMI = 6%
- Mortality of IWMI + RV = 31%
- Very sensitive to preload (and thus nitrates)
- Give generous IV fluids to maintain BP.
- EKG: ST elevation in V4R (100% specific)
- Complications: Hypotension, Complete AV block, RBBB

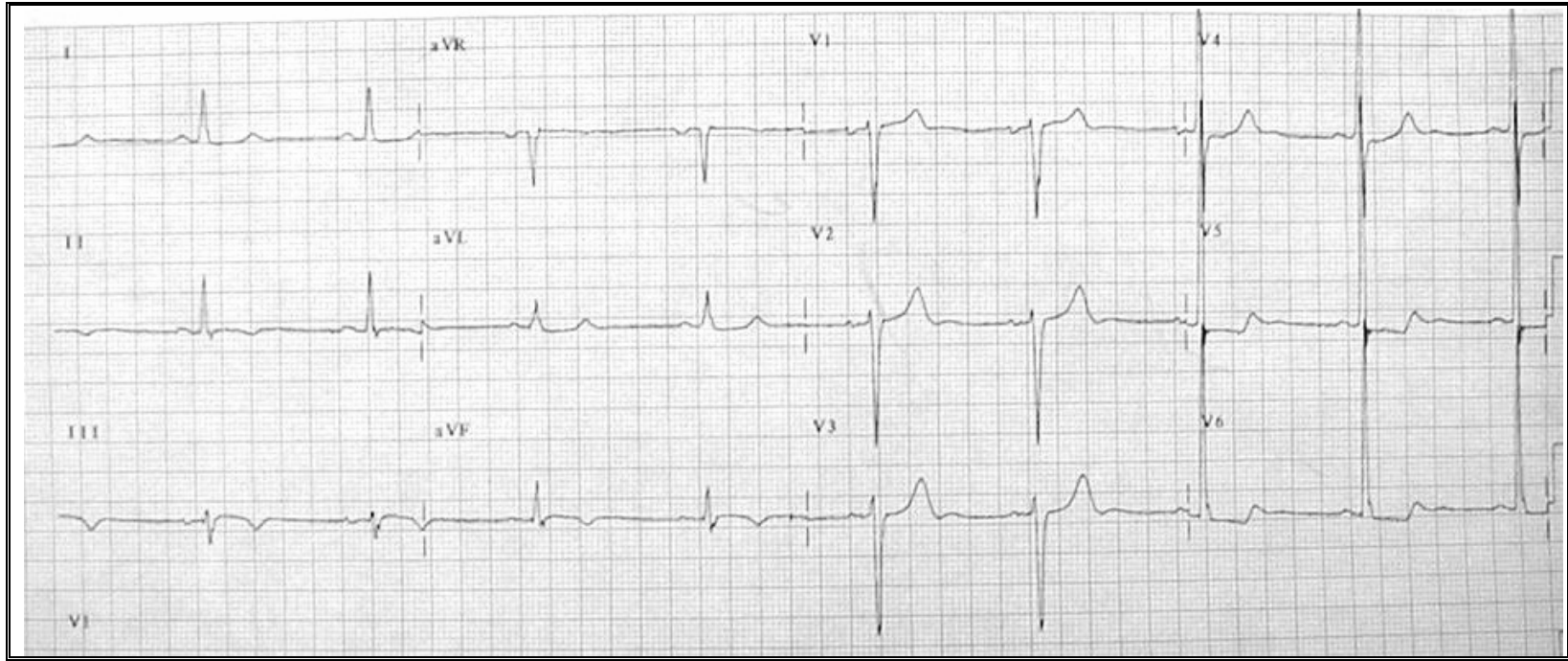
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- PEARL: Check right-sided leads when evidence of inferior wall (II, III, F) ischemia!

CASE #3

* EKG findings:

* Diagnosis?

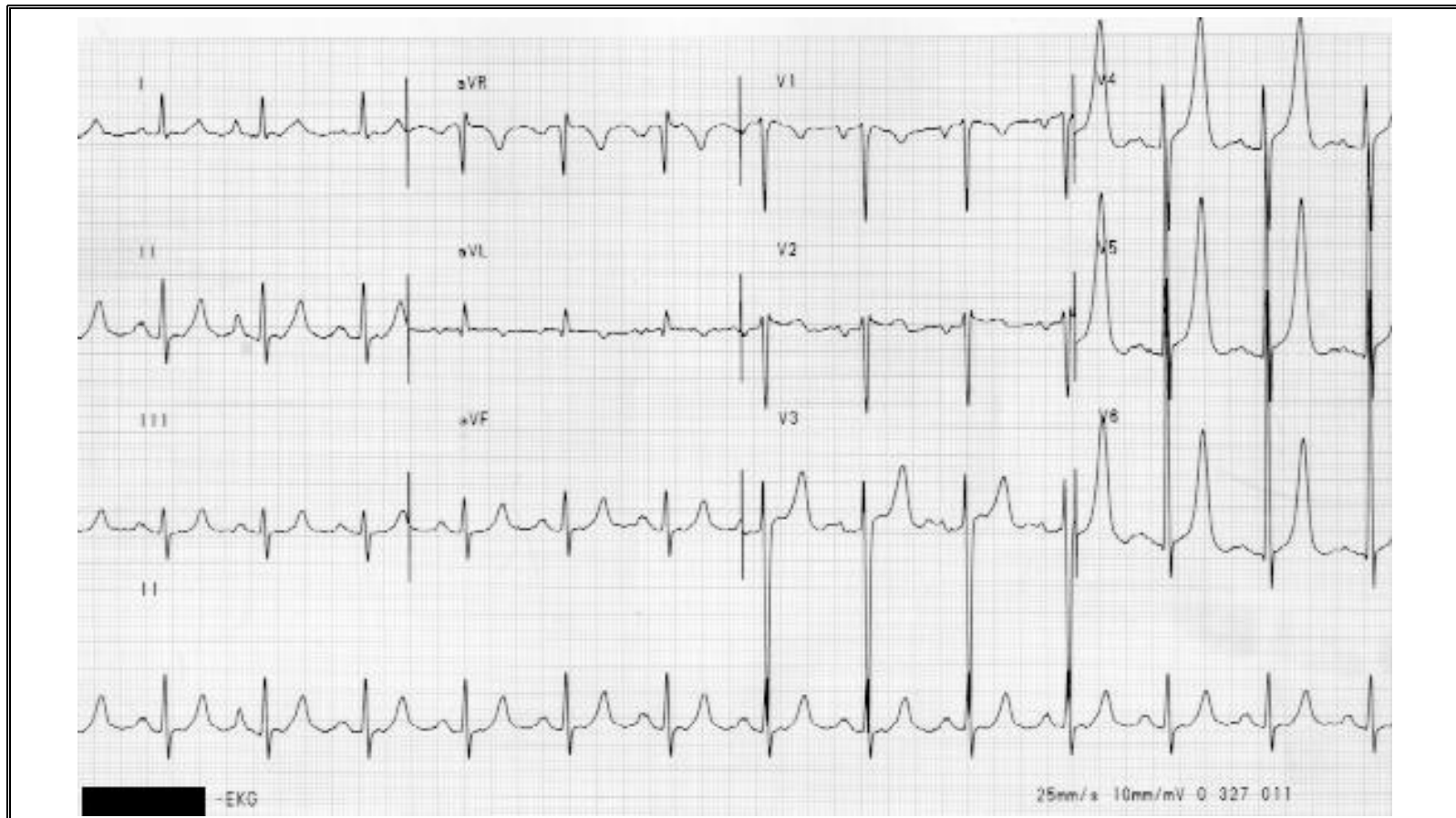


*Answer: Inferior-lateral ischemia

CASE #4

* EKG findings:

* Diagnosis?



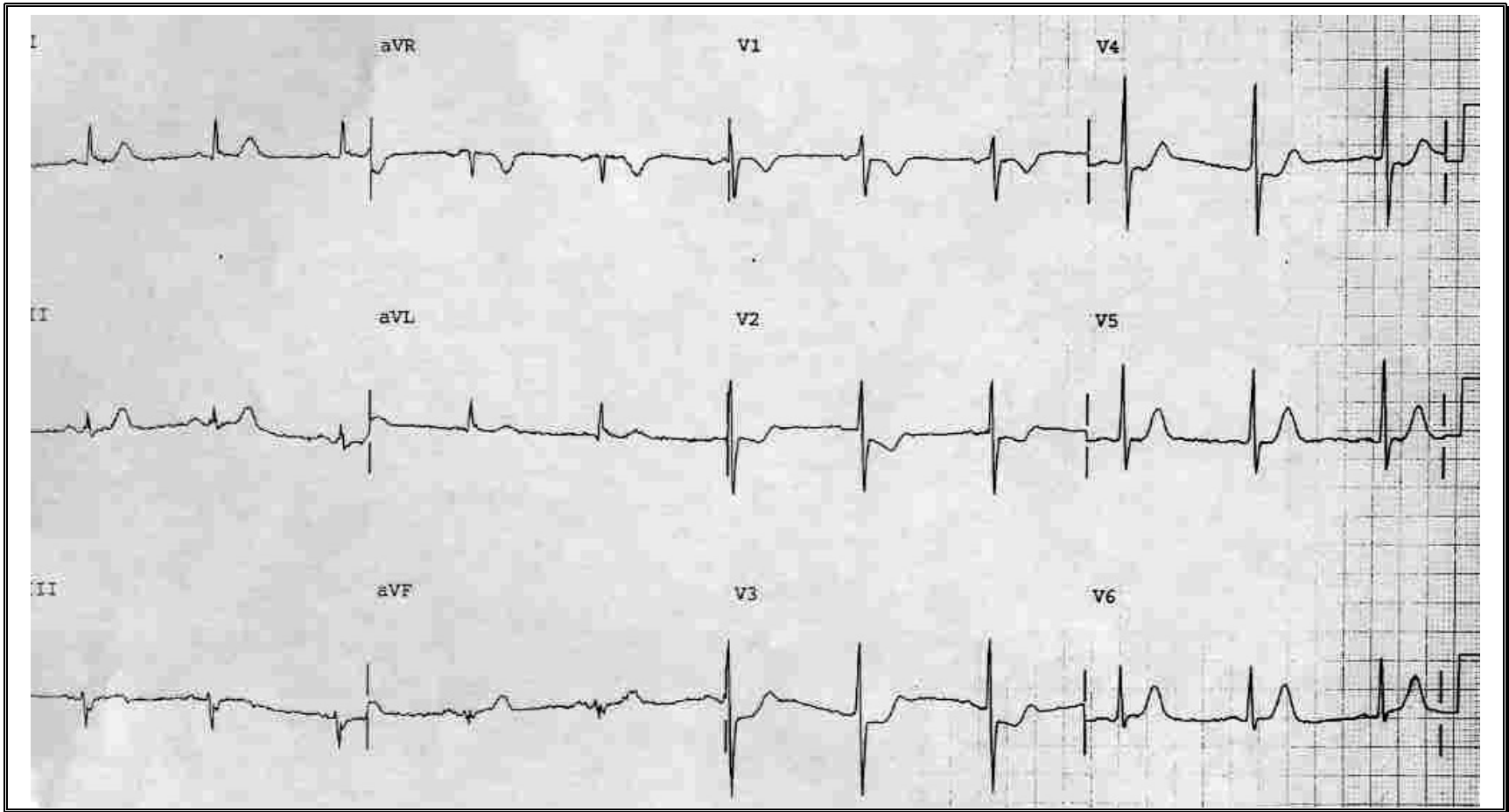
*Answer: Hyperacute anterior MI

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CASE #5

* EKG findings:

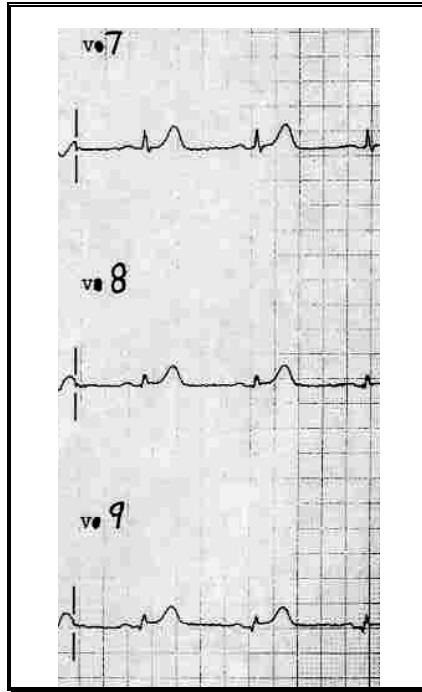
* Diagnosis?



- Answer: Posterior wall MI

Posterior wall MI

- * Flip case #5's EKG over and invert it to look for a posterior MI!
- * You can also obtain posterior leads (V7-V9) which wraps over towards the patient's left scapula.
- * A posterior MI exists if you have ST elevation in any of leads V7-V9.



Posterior MI with ST elevation in V9

- *Can be isolated or can occur with inferior or lateral MI (R coronary or L circumflex A, respectively)
- *Suspect when EKG shows:
 - o ST depression > 1 mm in V1-V3
 - o Tall R in V1 or V2
 - o Tall, upright T wave in V1 or V2
- *EKG "Pearl":
 - o Quick evaluation: Flip and invert EKG and look at V1-V3 for ST elevation / T wave inversion
 - o Posterior leads (V7-V9): Wraps towards left scapula. Mirror image of septal leads (V1-V3)

ST ELEVATION

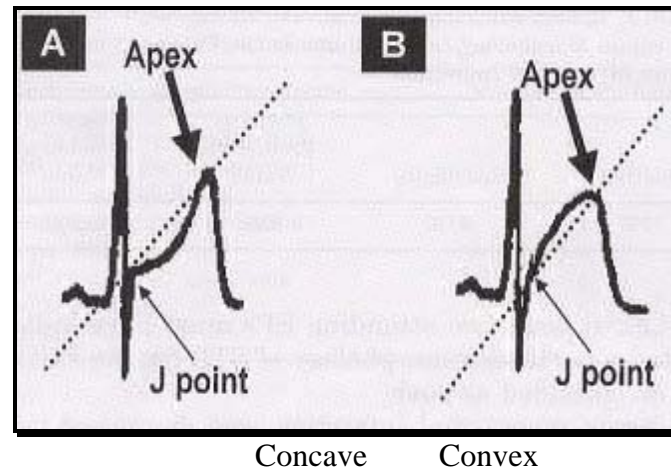
Differential diagnosis

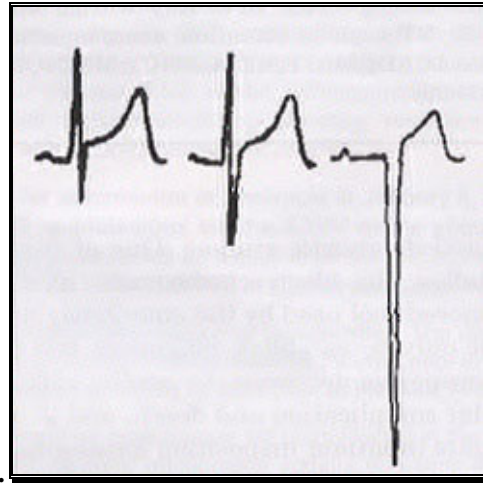
- First think cardiac ischemia (ACS)
- Then consider: Benign early repolarization, pericarditis, BBB, LV aneurysm

The majority (85%) of ST elevations on EKG's are not from an acute MI.

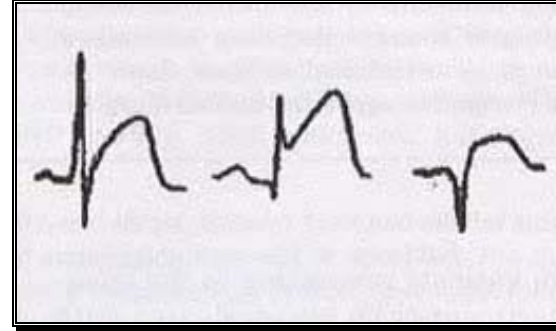
Typical ST morphology

- AMI → convex or straight ST elevation (“frowny face”)
- Benign early repolarization → concave ST elevation (“smiley face”)
- Pericarditis → concave ST elevation (“smiley face”) and often associated with PR depression
- BBB → concave ST elevation (“smiley face”) with discordant QRS complex, usually < 5 mm elevation
- LV aneurysm --> Usually of V1-V2 and is unchanged if compared to prior EKG's. Usually has evidence of prior anterior infarction (poor R wave progression and Q waves)





Benign concave ST elevation



Worrisome convex ST elevation

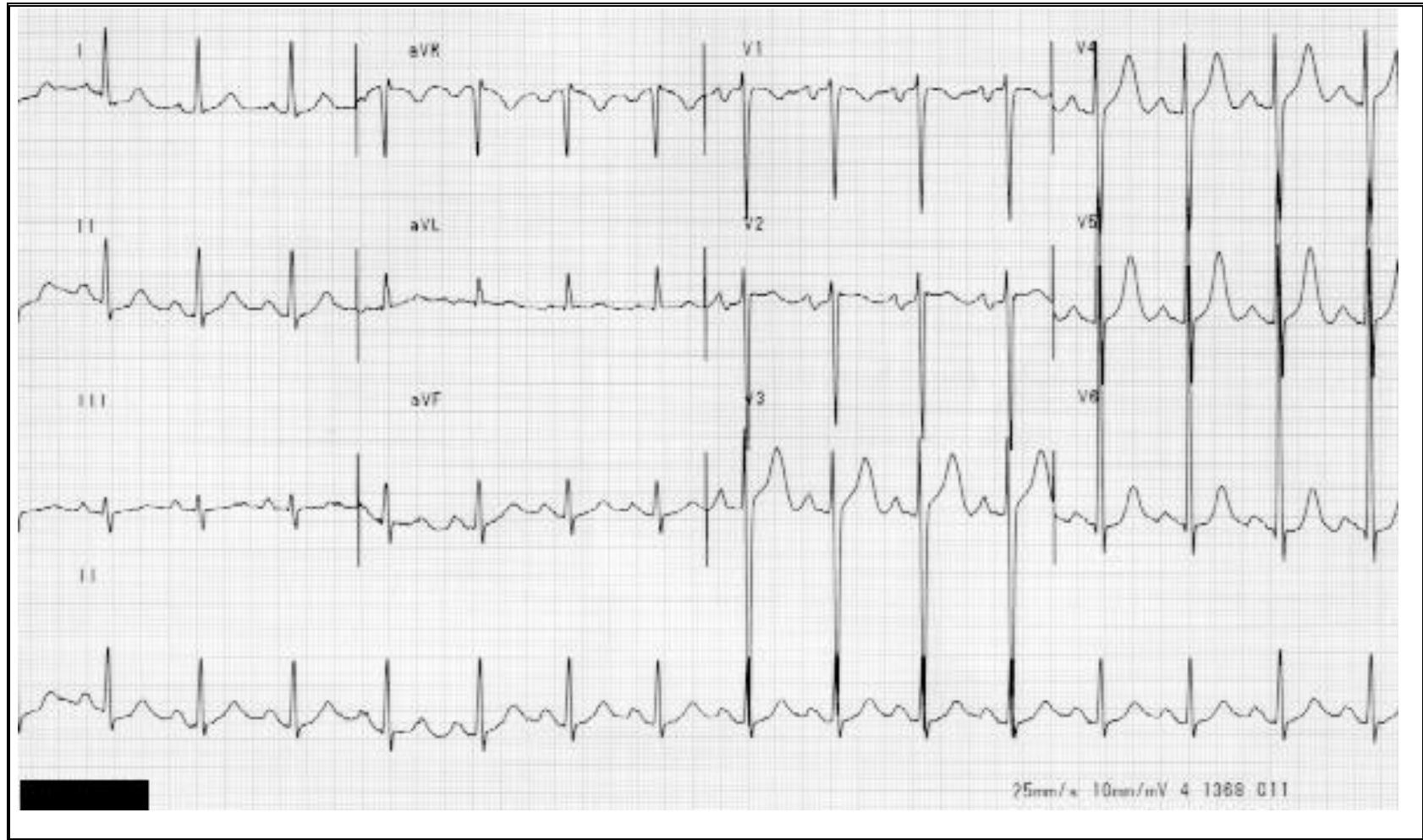
How good is the correlation between non-concave ST elevation (“frowny face” convex morphology) and AMI?

Sensitivity	77%
Specificity	97%
PPV	94% (100% in detecting acute coronary syndrome)
NPV	88%

Brady et al. “Electrocardiographic ST-segment Elevation: The Diagnosis of Acute Myocardial Infarction by Morphologic Analysis of the ST Segment.” *Academic Emergency Medicine*. 10/01, 8(10): 961-7.

Bottom line: Non-concave ST elevation (“frown”) strongly suggests ACS. However, a concave (“smiley”) morphology does not rule it out.

Benign Early Repolarization

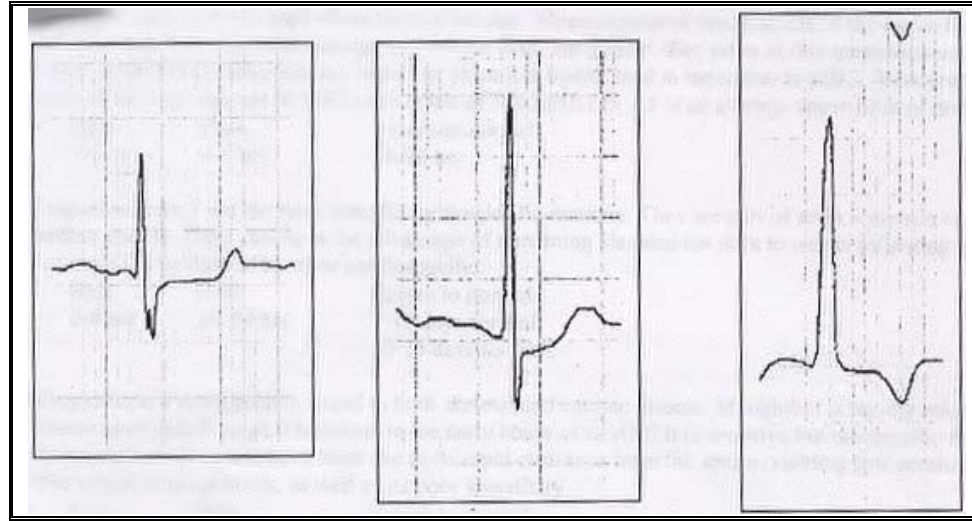


- Concave (smiley), upsloping ST segment (seen in V3)
- Rarely > 4 mm in height
- Usually in V1-V4
- Often associated with LVH or BBB

ST DEPRESSION

Differential diagnosis

- First think cardiac ischemia (ACS)
- Then consider:
 - Strain pattern from ventricular hypertrophy
 - Digoxin effect



Flat ST depression

Upsloping ST depression

Downsloping ST depression
(with asymmetric TWI)

Typical ST Depression Morphology

- Flat ST: Very specific for cardiac ischemia
- Upsloping ST: Somewhat specific for cardiac ischemia
- Downsloping ST (with asymmetric T wave inversion): Suggestive of ventricular hypertrophy with strain.

SUMMARY

1. Methodically examine each EKG you order for evidence of ischemia.
2. Don't forget to order the right-sided EKG (for inferior MI's) and posterior EKG (for worrisome V1-V3).
3. The different ST segment morphologies help in differentiating ischemic from non-ischemic processes.

Good website to see a wide variety of abnormal EKG's: [**http://medstat.med.utah.edu/kw/ecg/index.html**](http://medstat.med.utah.edu/kw/ecg/index.html)