12 Lead ECG Interpretation- Part 3 Assessing for CAD

Leslie L Davis, PhD, RN, ANP-BC, FAANP, FACC, FAHA, FPCNA

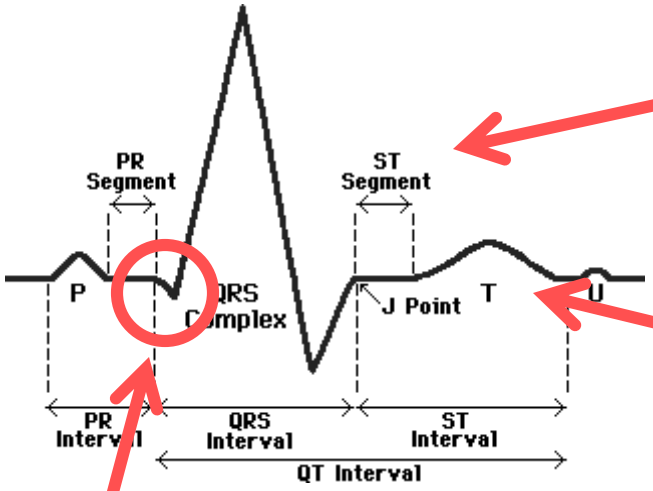
Associate Professor of Nursing,

Univ of NC at Chapel Hill

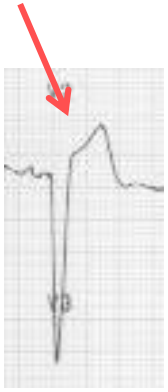
No disclosures relevant to this presentation.

Assessing for CAD:

Ways the ECG can change include:

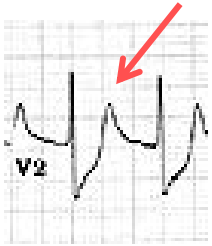


ST elevation & depression

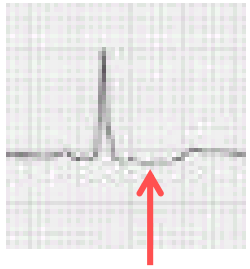


T-waves

peaked

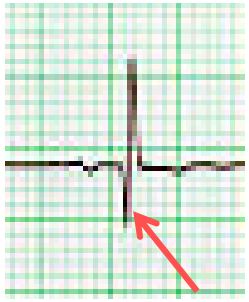


flattened



inverted

Appearance of pathologic Q-waves



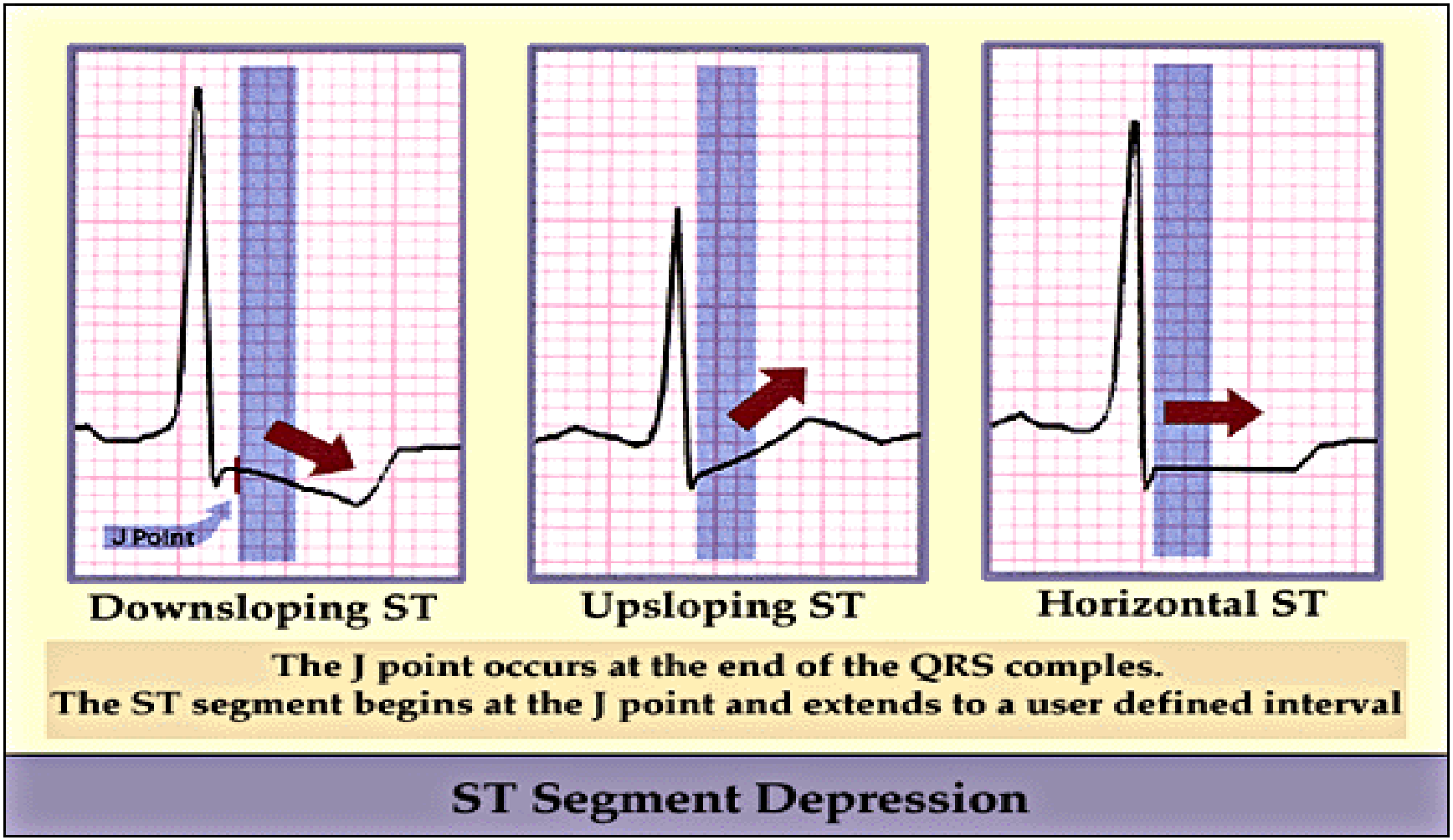
EKG Waveforms courtesy of UCSF SOM, Drs. L. Zimmerman & J. Feldman

12 EKG Evidence of Ischemia, Injury, Infarction

- Acute Ischemia:
- First sign of decreased blood flow to myocardium. Reversible.
- May be the first change of an MI.
- Classic EKG changes:

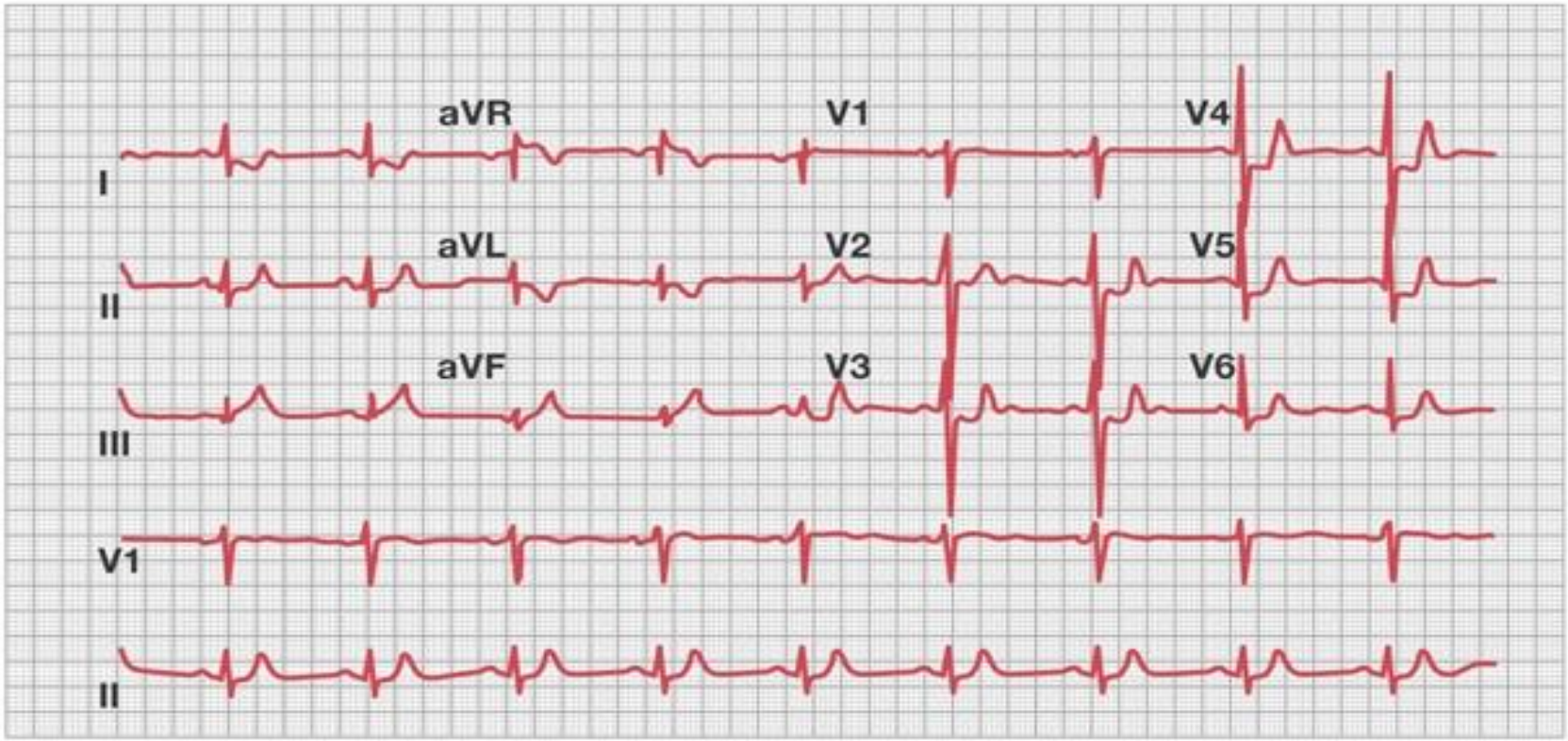
T wave inversion or ST segment depression

ST Segment Depression



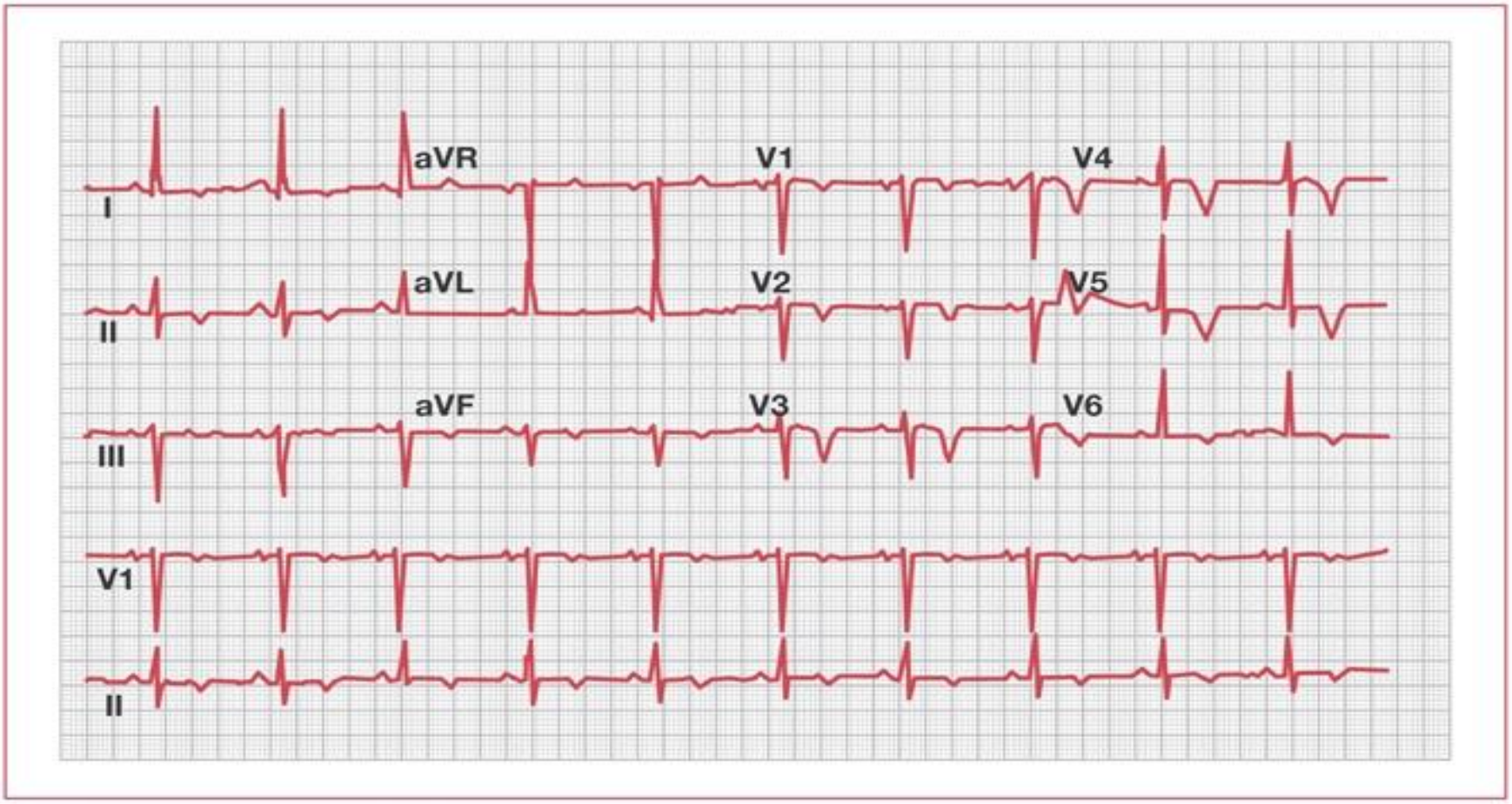
http://library.med.utah.edu/kw/ecg/mml/ecg_st.gif

ST depression



http://www.ncbi.nlm.nih.gov/books/NBK2214/

T Wave Inversion



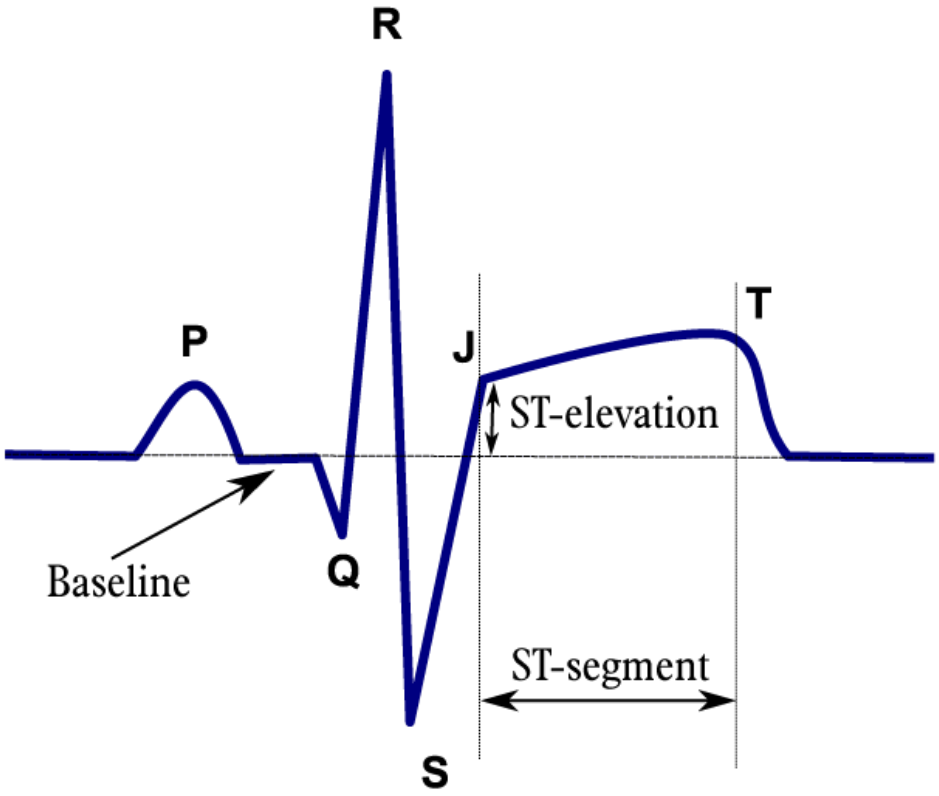
http://www.ncbi.nlm.nih.gov/books/NBK2214/

Ischemia, Injury, Infarction

- Acute Injury:
- Prolonged ischemia. Heart develops an injury pattern.
- After 4-6 hours this injury (MI) becomes permanent.
- Classic EKG changes:

ST segment elevation

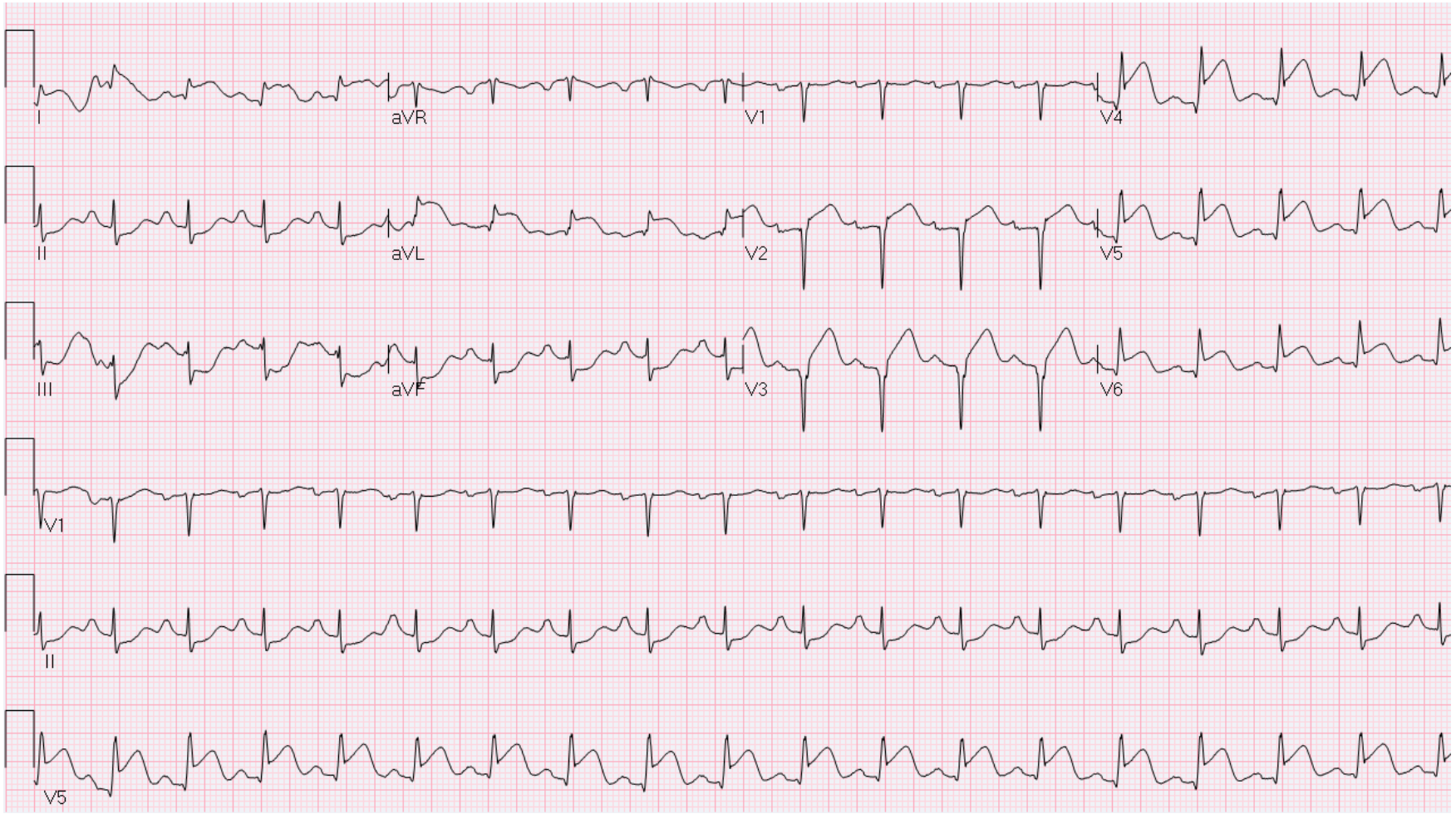
Measuring ST Elevation



How to measure ST elevation?

Source: Rob Kreuger, Medical illustrator, AMC, The Netherland
Avail at: http://en.ecgpedia.org/wiki/File:Stelevatie_en.png

Where is the ST elevation?



Anatomic Groups on the EKG

I Lateral	aVR	V1 Septal	V4 Anterior
II Inferior	aVL Lateral	V2 Septal	V5 Lateral
III Inferior	aVF Inferior	V3 Anterior	V6 Lateral

Image courtesy of Colin M.L. Burnett & Wikipedia
https://upload.wikimedia.org/wikipedia/commons/3/33/Contiguous_leads.svg

Ischemia, Injury, Infarction

- Infarction:
- Usually related to injury patterns (walls of the heart) as supplied by the infarct related artery.
- Classic ECG changes:

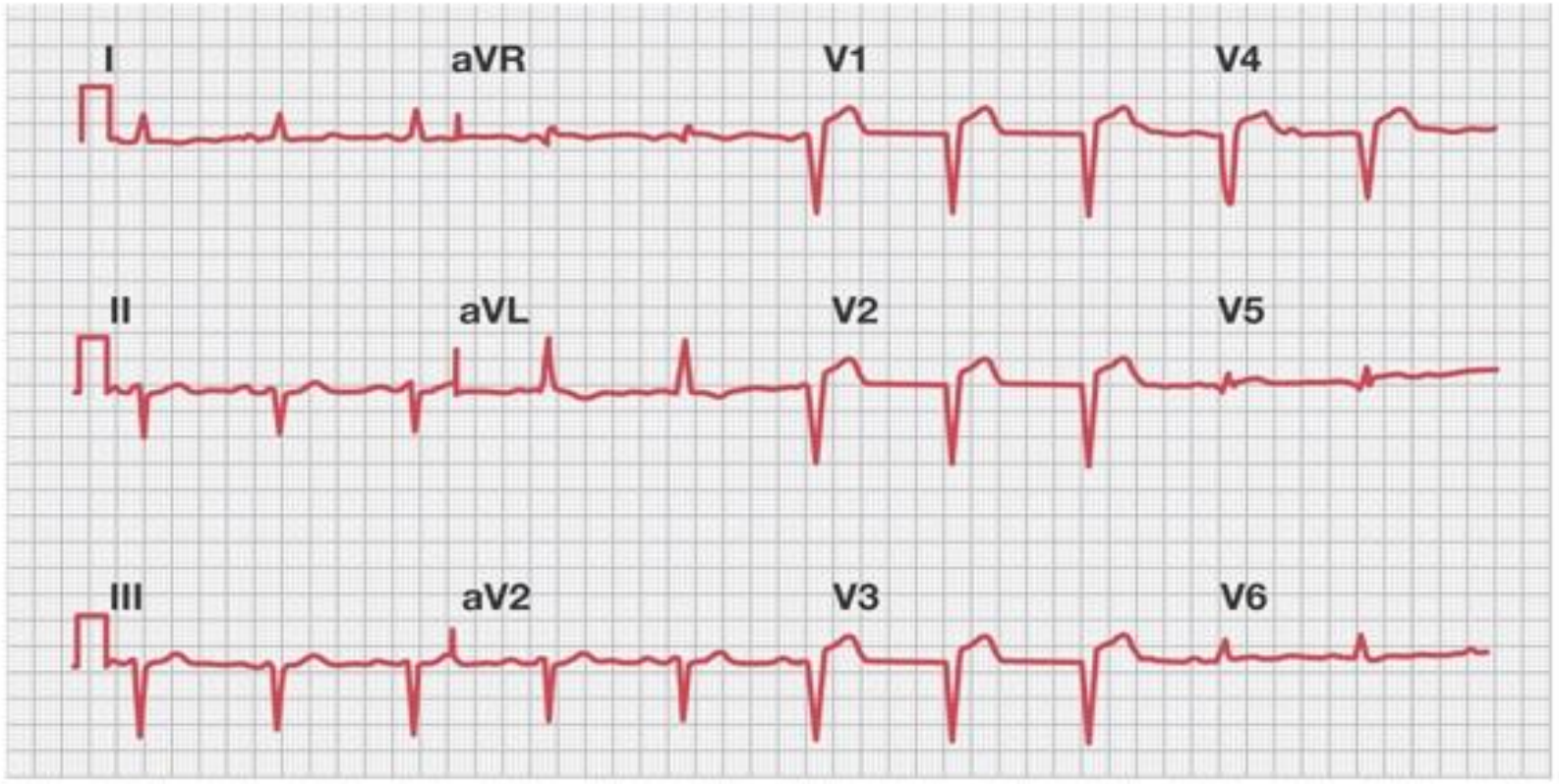
Presence of Q wave

- May have a non-Q wave MI
  - Diagnosed by (+) cardiac biomarkers

Pathologic “Q Waves”

- Criteria for a *significant Q wave:*
- At least one square (.04 sec) wide.
- At least one third of the entire QRS amplitude.
- MI criteria usually to have “Q waves” in two contiguous leads.
- No longer referred to as a “transmural” MI.

Can you find the Q waves?



http://www.ncbi.nlm.nih.gov/books/NBK2214

Evolutionary ECG Changes in an infarction

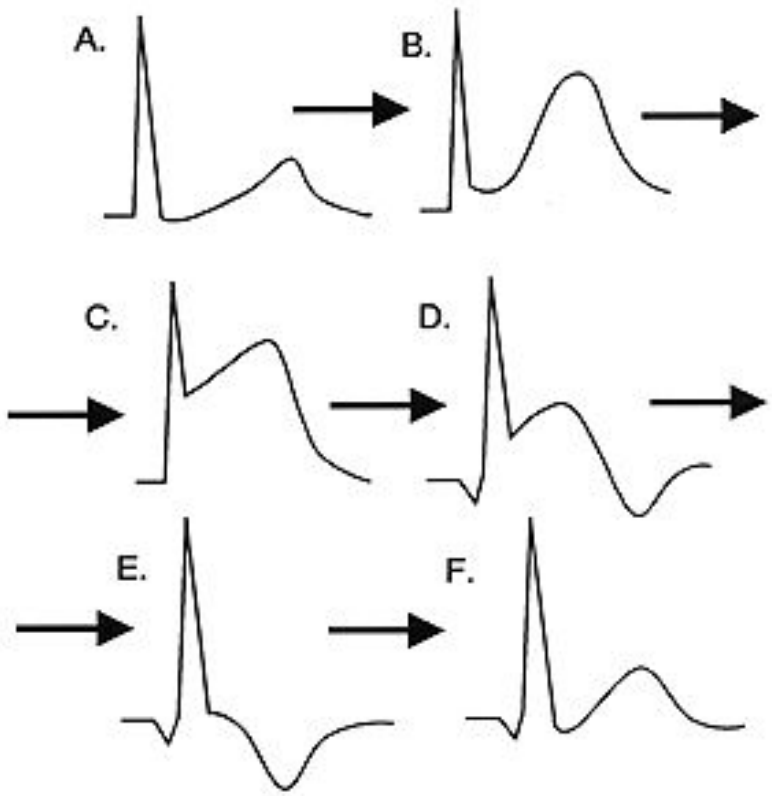
A. Normal ECG prior to MI

B. Ischemia from coronary artery occlusion results in ST depression (not shown) and peaked T-waves

C. Acute injury: marked ST elevation begins to merge with t wave

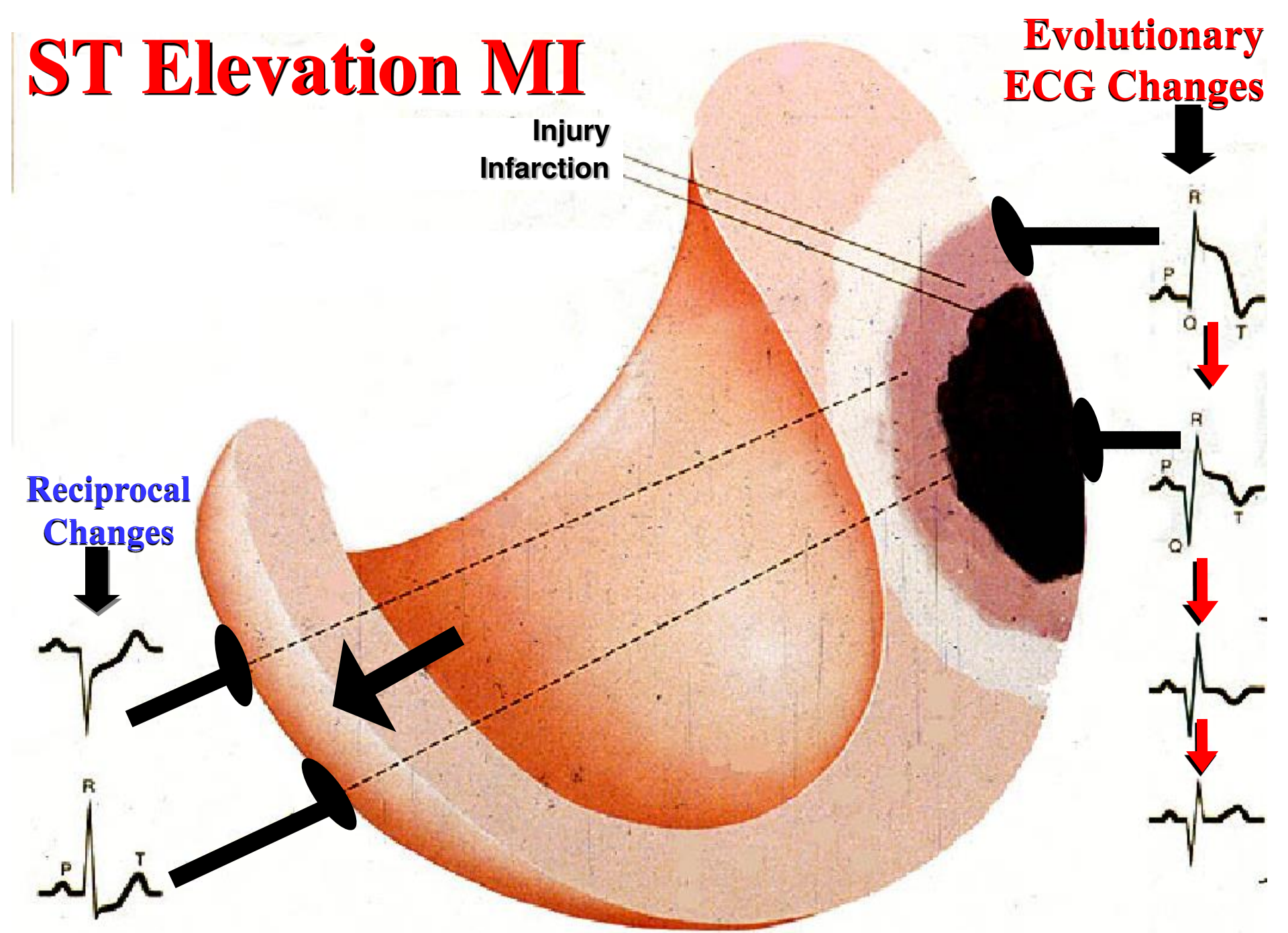
D/E. Ongoing infarction with appearance of pathologic Q-waves and T-wave inversion

F. Fibrosis (months later) with persistent Q- waves, but normal ST segment and T- waves



EKG Waveforms: Dr Frank G. Yanowitz, University of Utah School of Medicine

ST Elevation MI

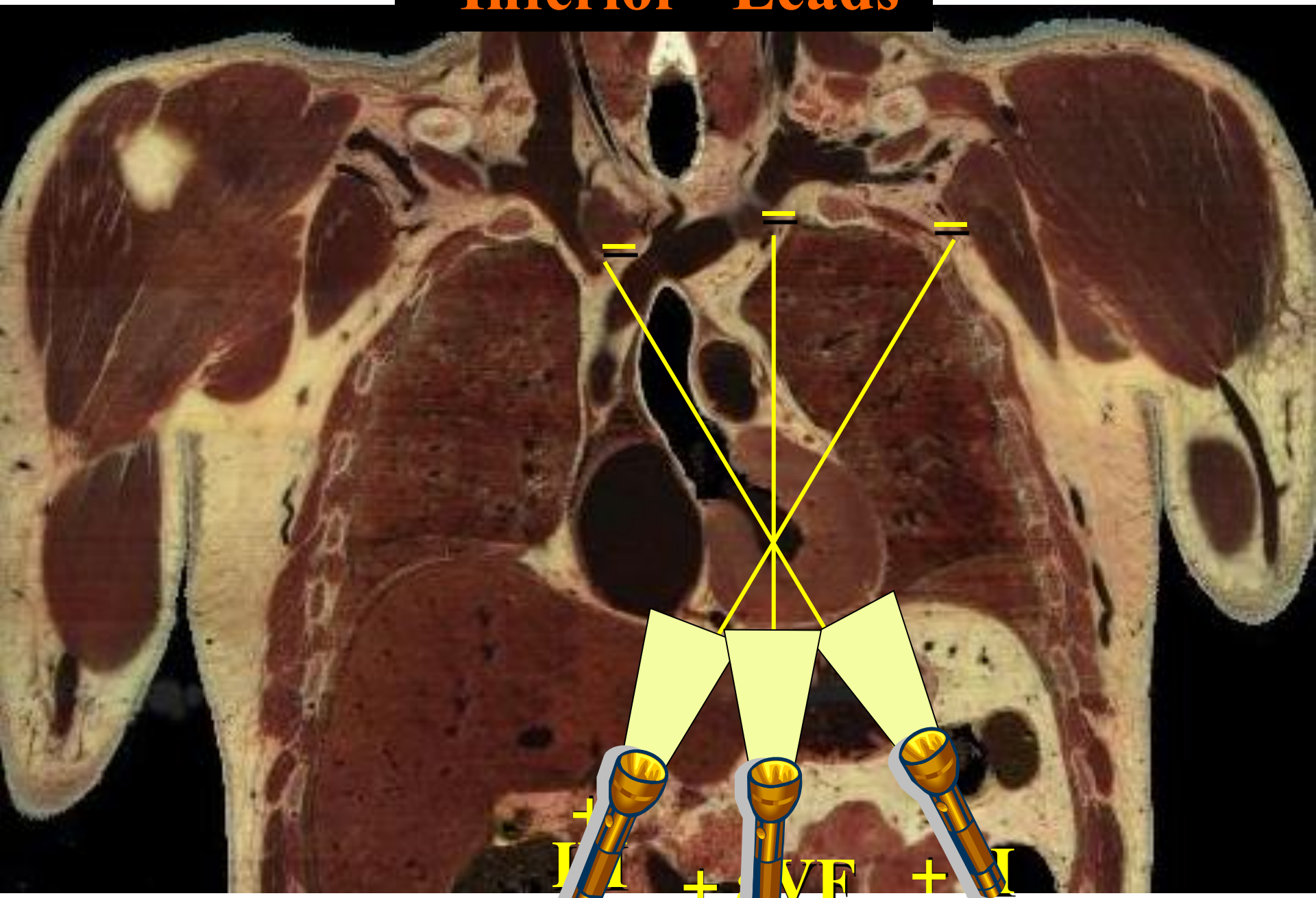


Slide Courtesy of Dr Barbara Drew, UCSF, School of Nsg

Patterns of Injury: Inferior Wall MI

- EKG changes to: *Leads II, III, aVF.*
- Occlusion of RCA in 90% of patients.
- Involves diaphragmatic wall of heart.
- Reciprocal changes in lateral leads.
- Can be (L) axis deviation (going away from necrotic tissue).
- Complications: Heart blocks, brady/tachy, A fib, hypotension, or N/V.

“Inferior” Leads



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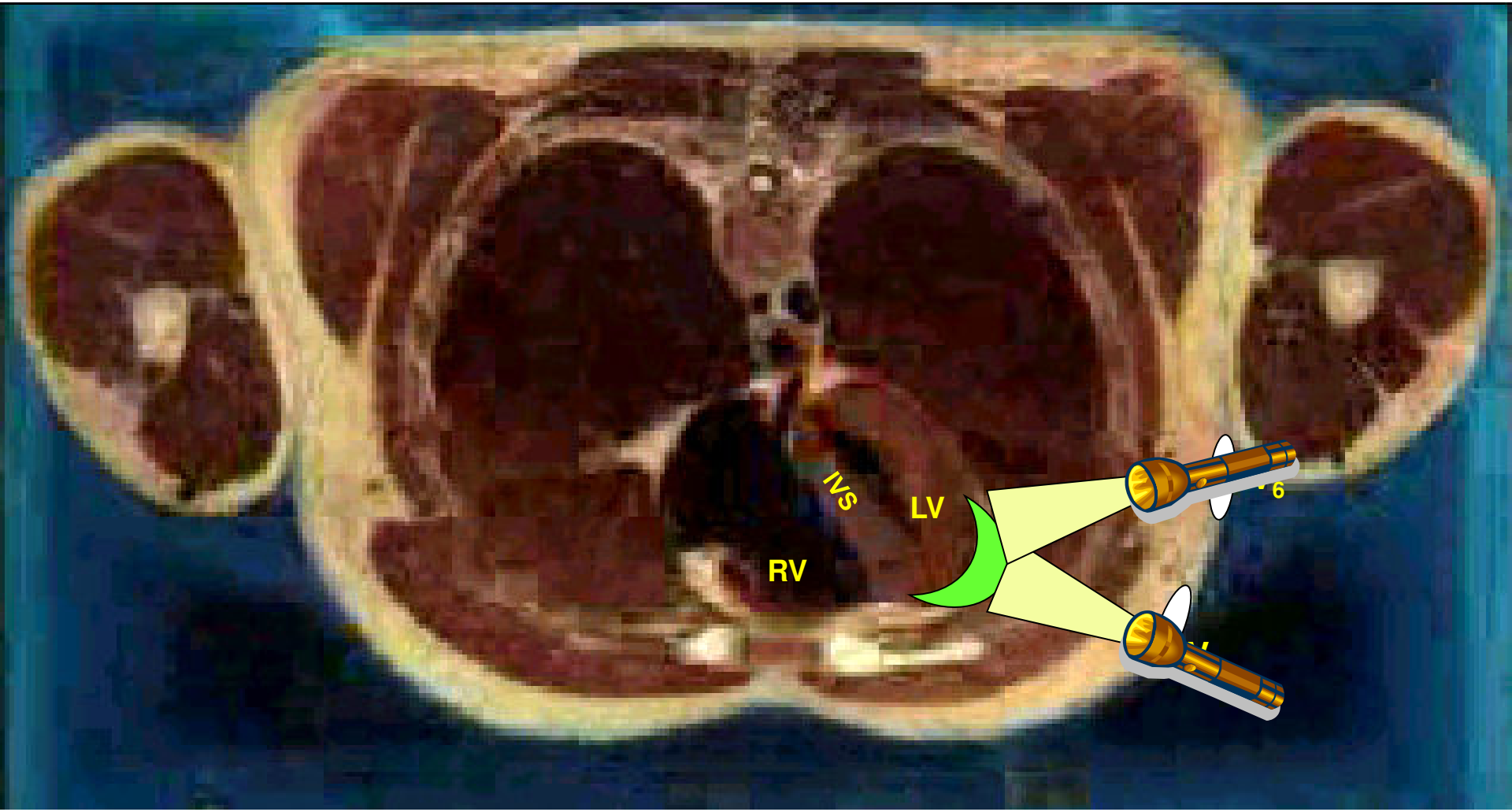
II Inferior	aVL Lateral	V_2 Septal	V_5 Lateral
III Inferior	aVF Inferior	V_3 Anterior	V_6 Lateral

Image courtesy of Colin M.L. Burnett & Wikipedia

Lateral Wall MI

- EKG Changes to: Leads I, aVL,&/or V5, V6.
- Occlusion of (L) Circumflex
- Usually involves (L) lateral wall of heart.
- Complications (similar to anterior MI): pump failure dependent on amt of damage to LV; papillary muscle dysfunction; bradycardias.

Lateral Leads



Slide Courtesy of Dr Barbara Drew, UCSF, School of Nsg

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III Inferior	aVF Inferior	V_3 Anterior	V_6 Lateral

Image courtesy of Colin M.L. Burnett & Wikipedia

Anterior Wall MI

- EKG changes: V 1 - V 6 with ST elevation; Loss of R wave progression.
- Occlusion of the LAD
- Involves the anterior wall of the (L) ventricle, anterior 2/3 of ventricular septum, and (L) bundle branch.
- Complications: CHF, shock, BBB, heart block, LV thrombus/aneurysm; highest death rate.

“Anterior” Leads

Slide Courtesy of Dr Barbara Drew, UCSF, School of Nsg

Matching Anatomy to V Leads

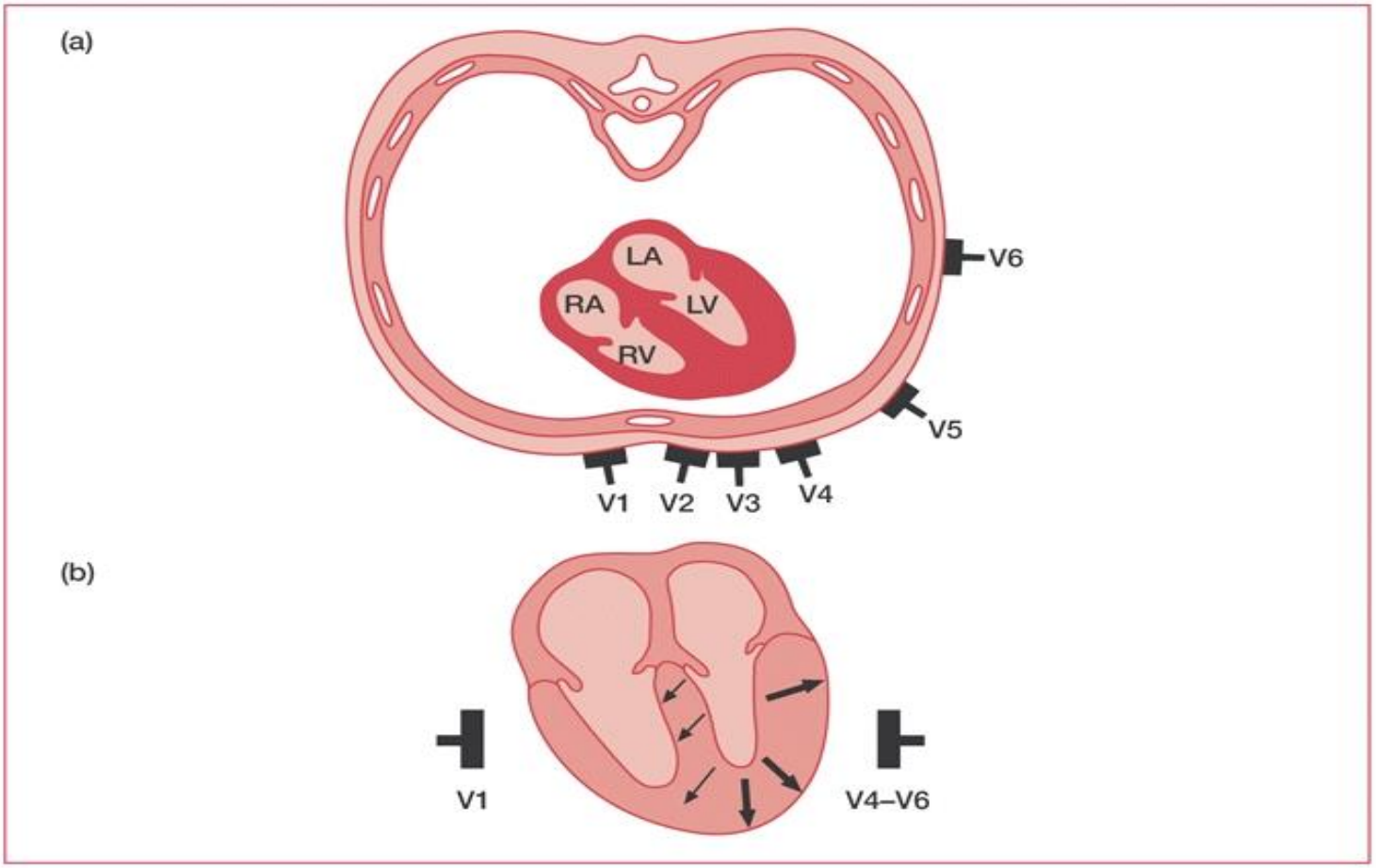

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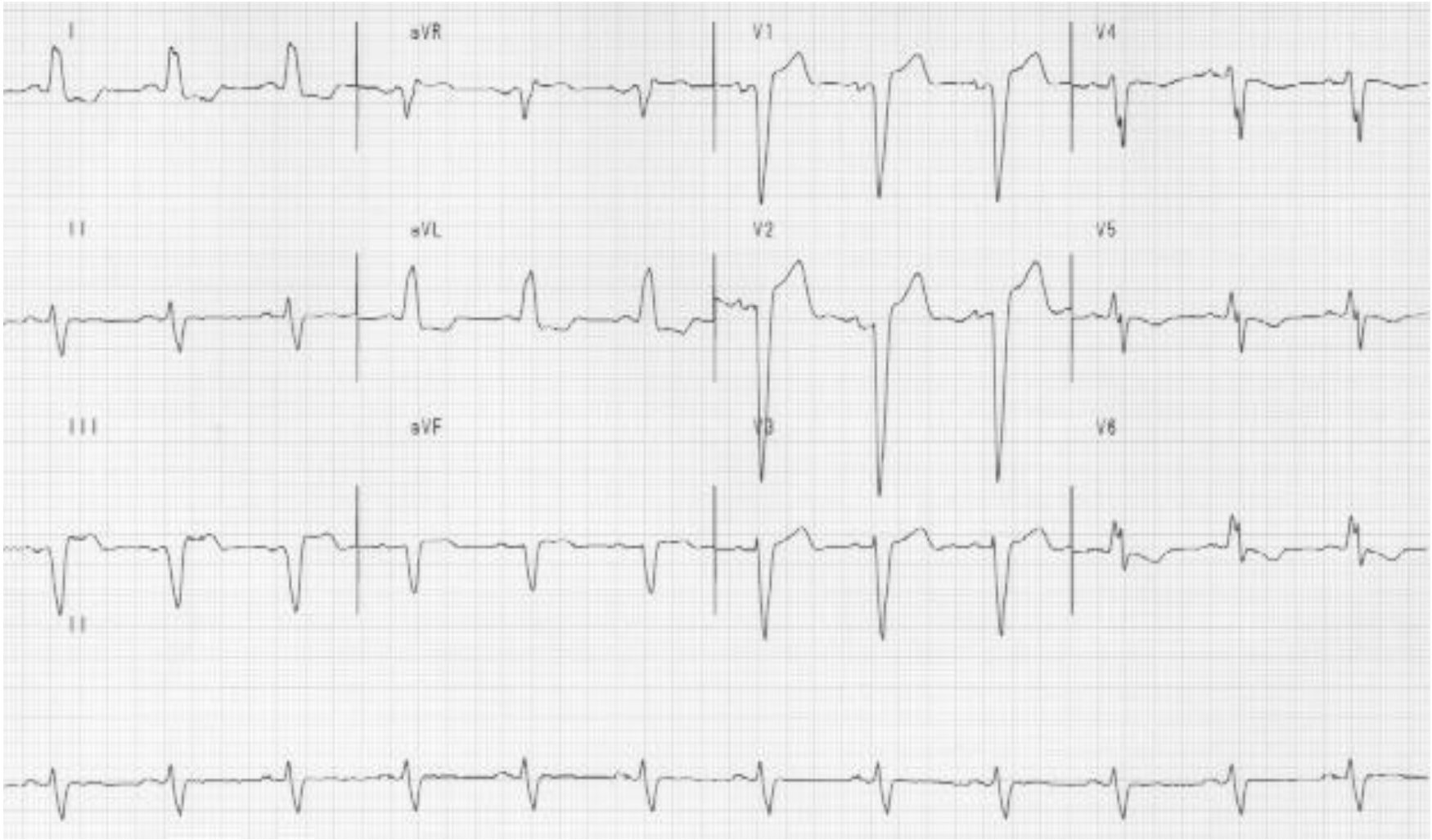
Image courtesy of Colin M.L. Burnett & Wikipedia

Example: Anterior/Lateral MI with Reciprocal Changes

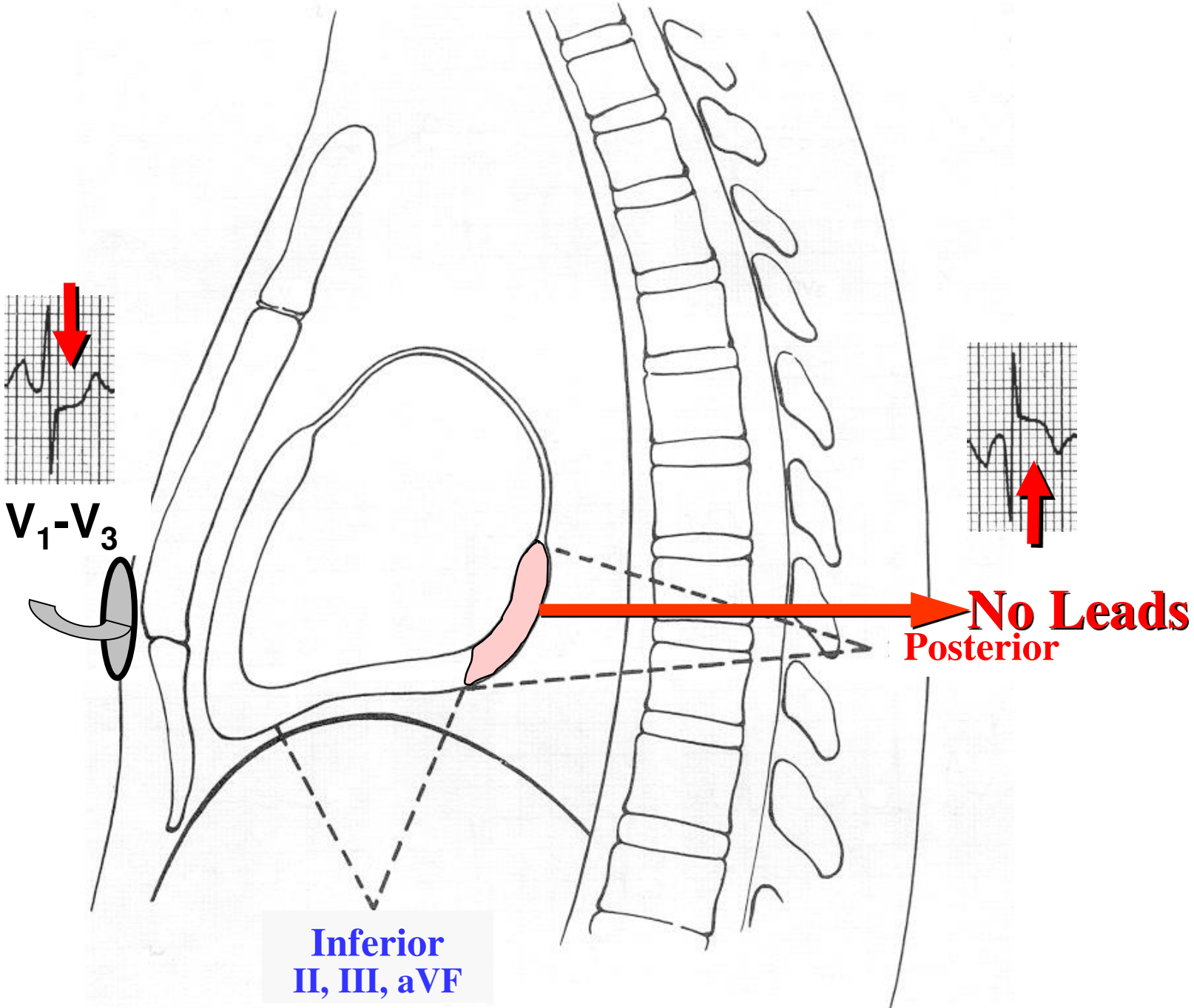
http://en.wikipedia.org/wiki/File:12_Lead_EKG_ST_Elevation_tracing_color_coded.jpg#file

Anterior STEMI with LBBB



Posterior Wall MI

- Look for reciprocal changes in septal area (V1, V2 = ST depression & tall/wide R waves); mirror image of ST elevation.
- Occlusion = right coronary artery (RCA) in 90% of patients
- Involves = posterior surface of the heart.
- Complications: bradycardias, heart block, ventricular dysfunction.



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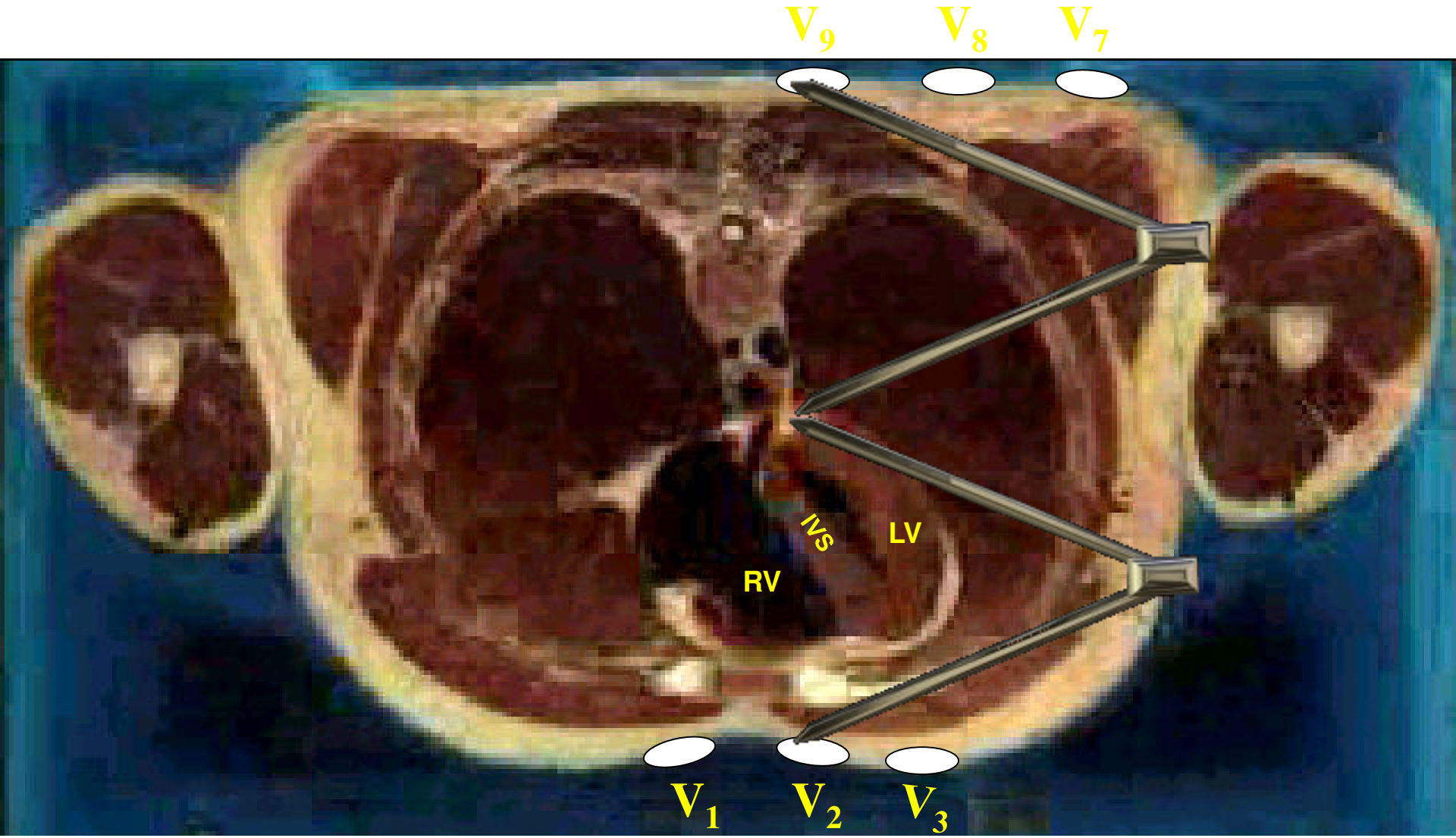

Slide Courtesy of Dr Barbara Drew, UCSF, School of Nsg

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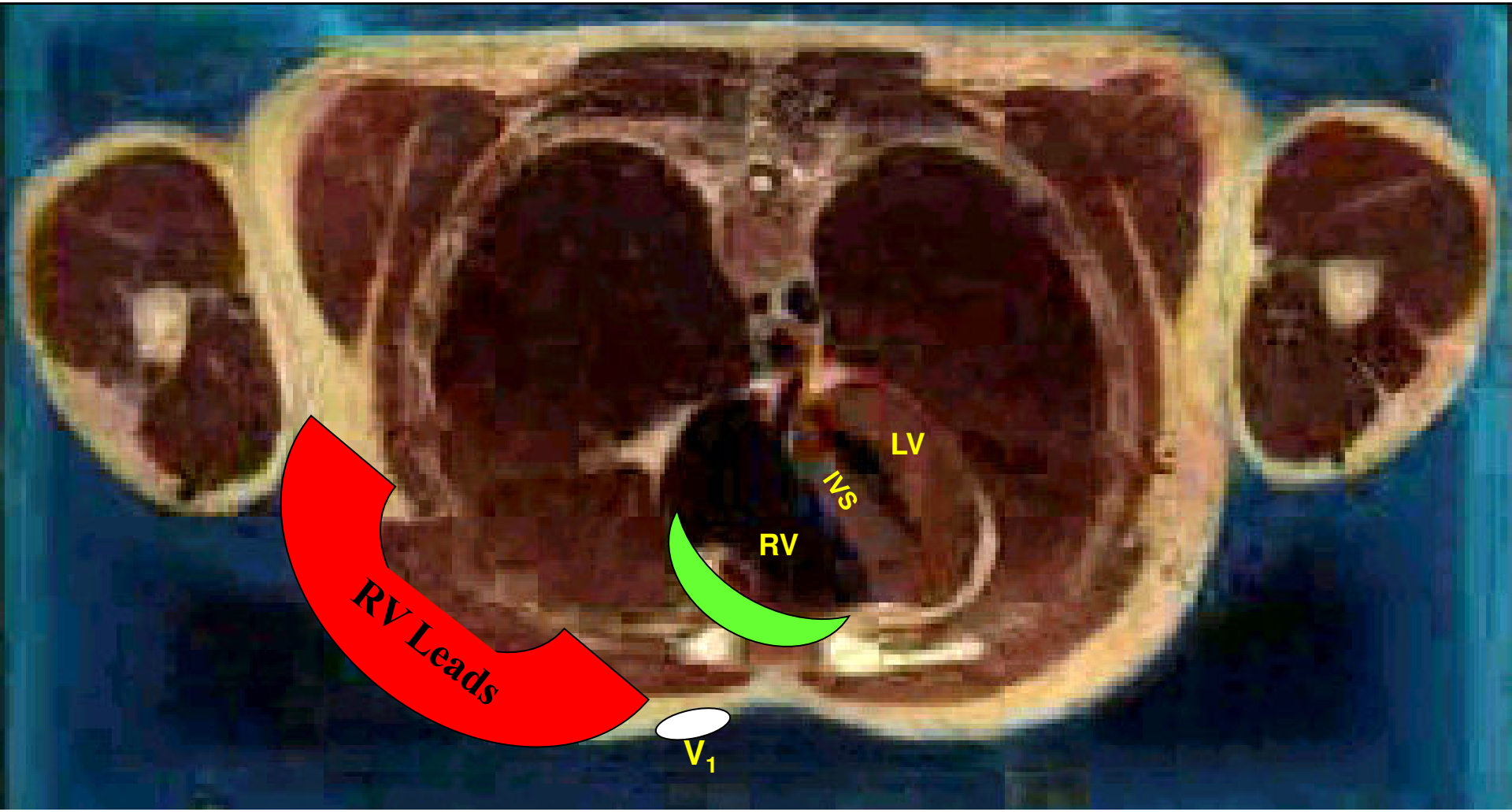
II Inferior	aVL Lateral	V_2 Septal	V_5 Lateral
III Inferior	aVF Inferior	V_3 Anterior	V_6 Lateral

Image courtesy of Colin M.L. Burnett & Wikipedia

RV Infarction

- Usually due to occlusion of RCA – occurs in 50% of those with inferior MI
- If hypotension, JVD, with clear lungs in an Inferior MI, suspect RV infarct.
- Need (R) sided EKG
- EKG changes: ST elevation Lead V4R.
- Rx: aggressive IV fluids to assist in (R) heart filling pressure, reperfusion therapy, and may need pacing.

Right Ventricular Leads



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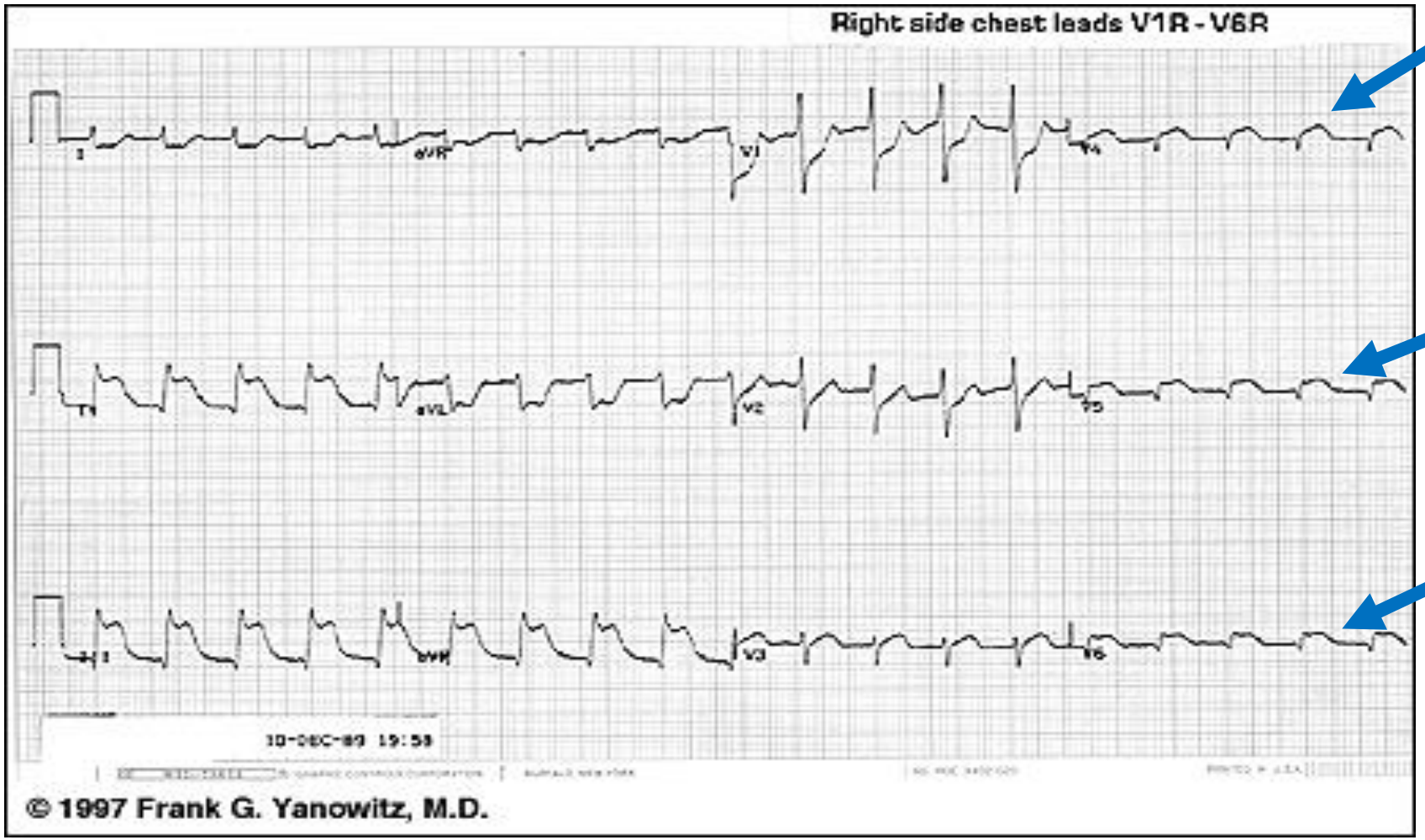
Right Sided Chest Leads



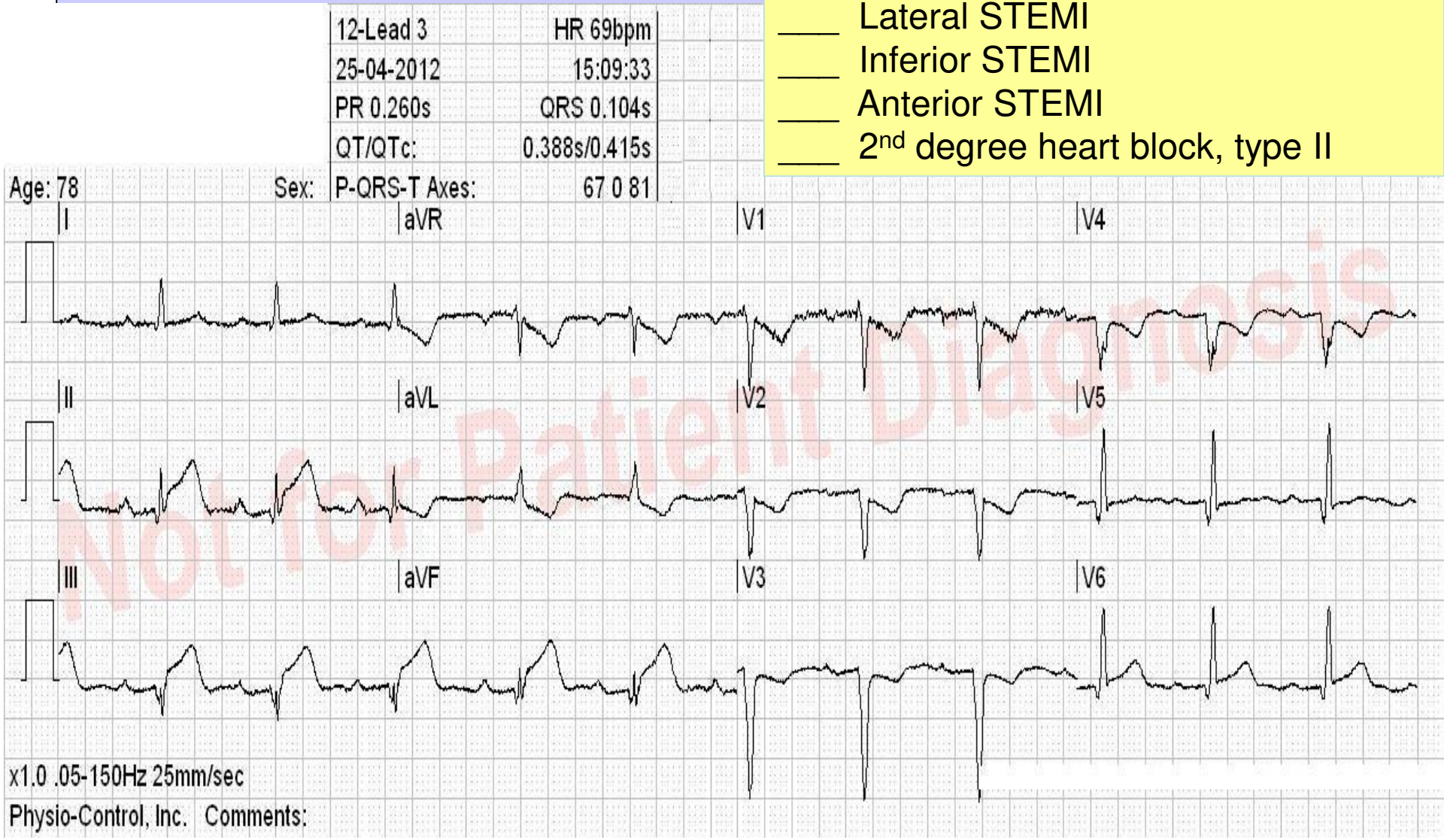
http://library.med.utah.edu/kw/ecg/index.html

Case Studies

TIME TO APPLY WHAT YOU HAVE LEARNED

Case study: Chief complaint: Heart burn; shortness of breath.
PMH: Hypertension (HTN) & Diabetes

___ Lateral STEMI
___ Inferior STEMI
___ Anterior STEMI
___ 2nd degree heart block, type II



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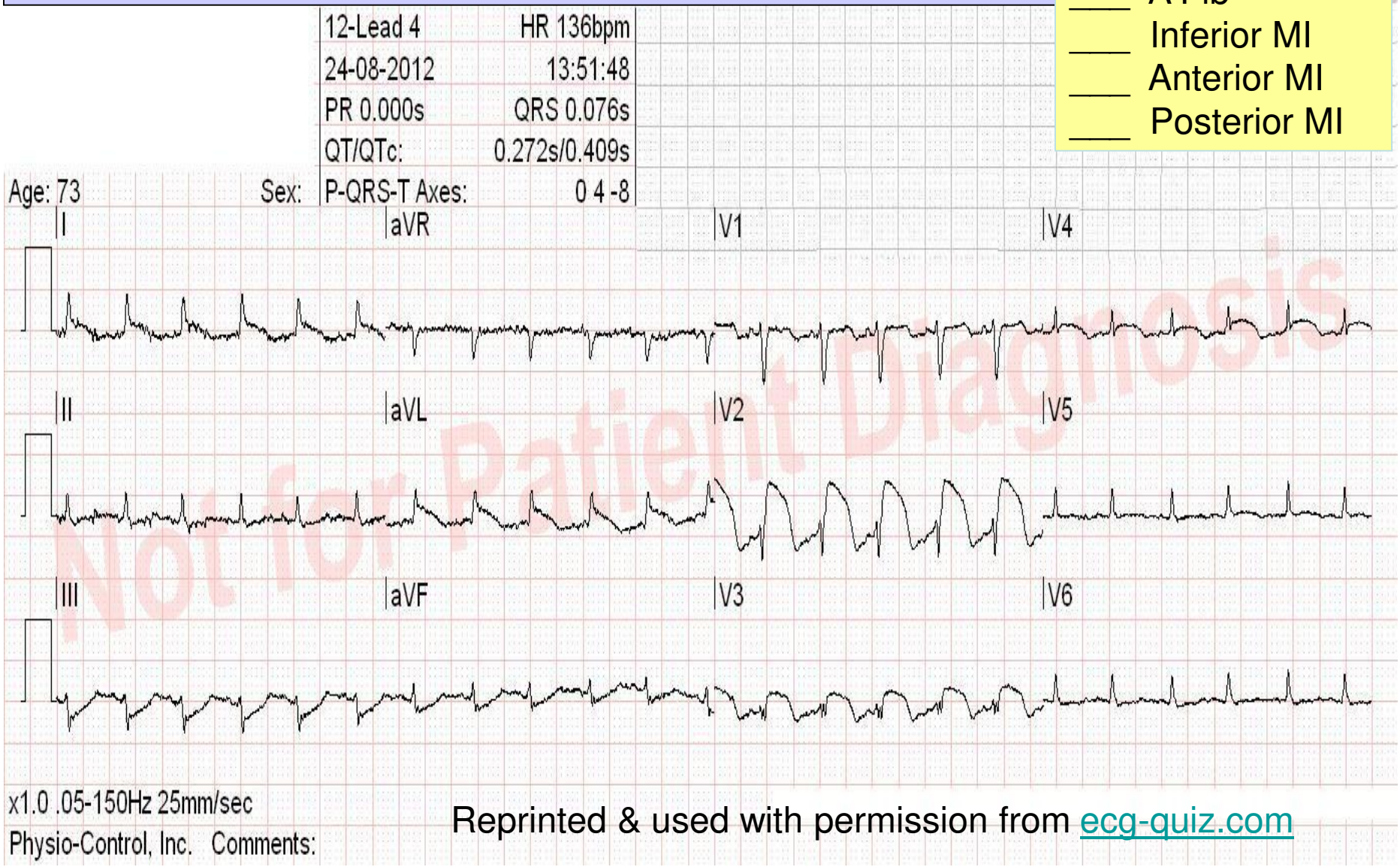
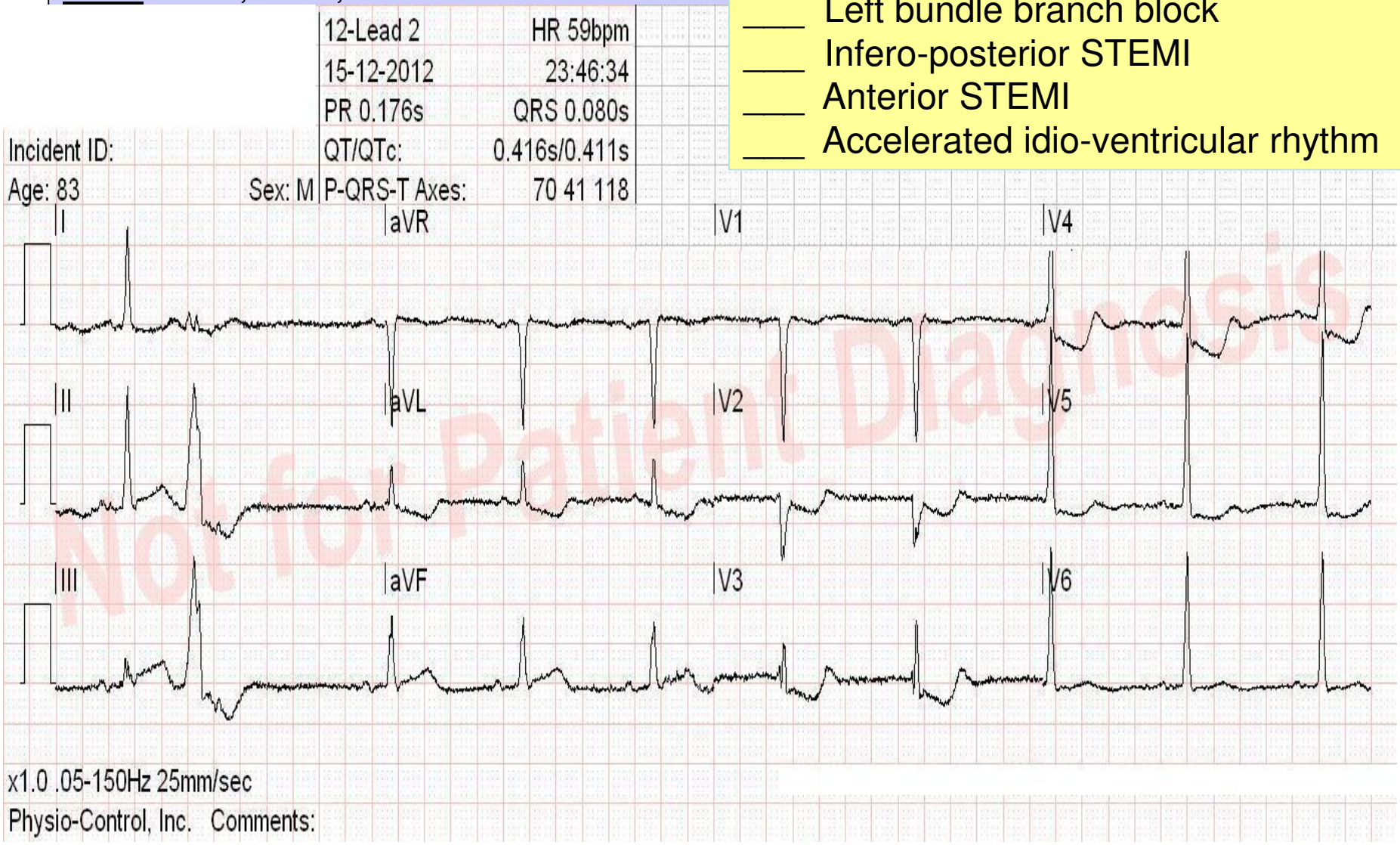
Case study: Patient was discharged from hospital after a syncope of unknown origin. Now twitching and malaise. No angina, no dyspnea.
PMH: HTN, hypothyroidism.

___ A Fib
___ Inferior MI
___ Anterior MI
___ Posterior MI



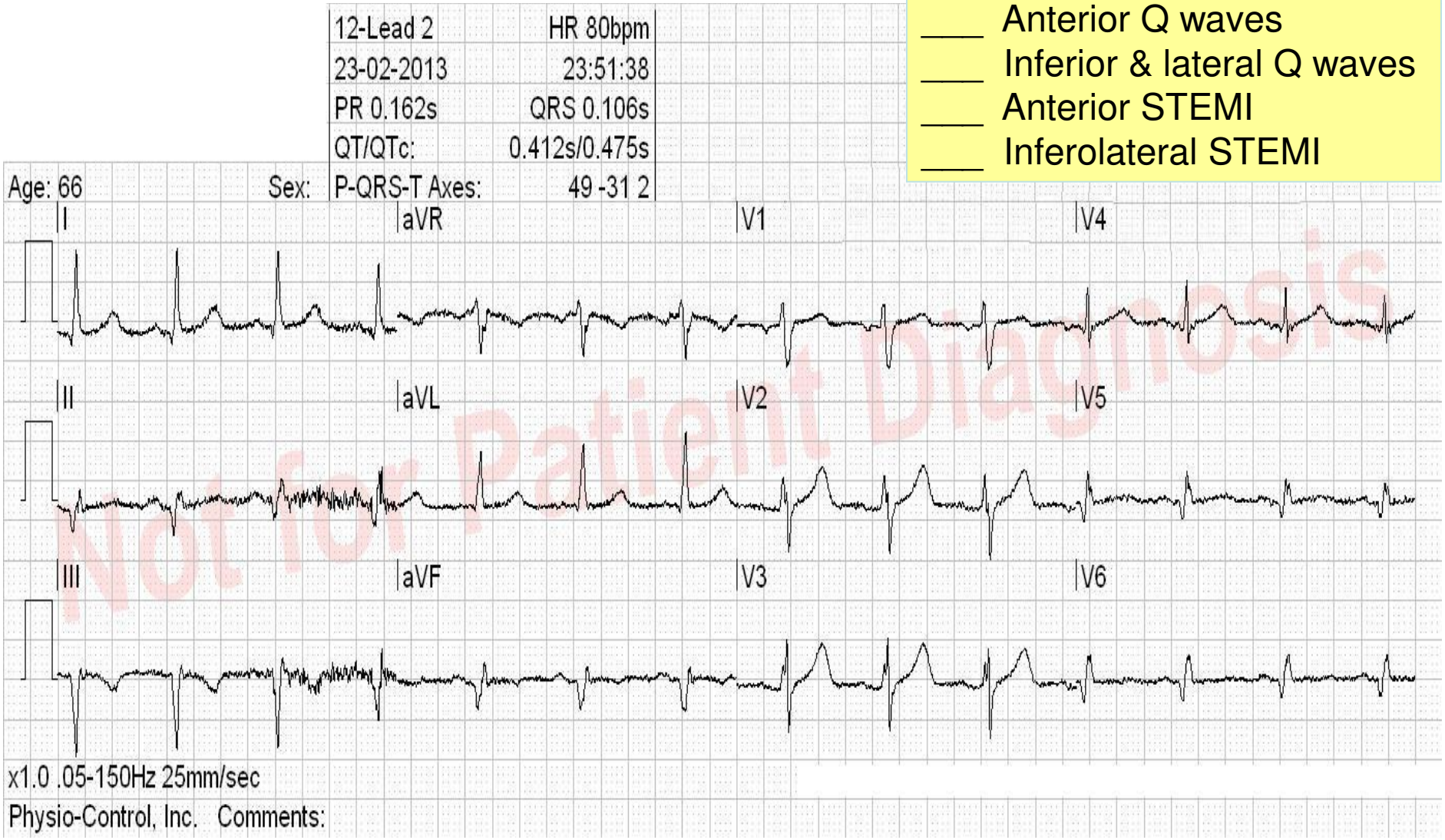
Case study: Patient with chest pressure “8” out of “10; diaphoresis.
PMH: HTN, CAD, arthritis.

___ Left bundle branch block
___ Infero-posterior STEMI
___ Anterior STEMI
___ Accelerated idio-ventricular rhythm



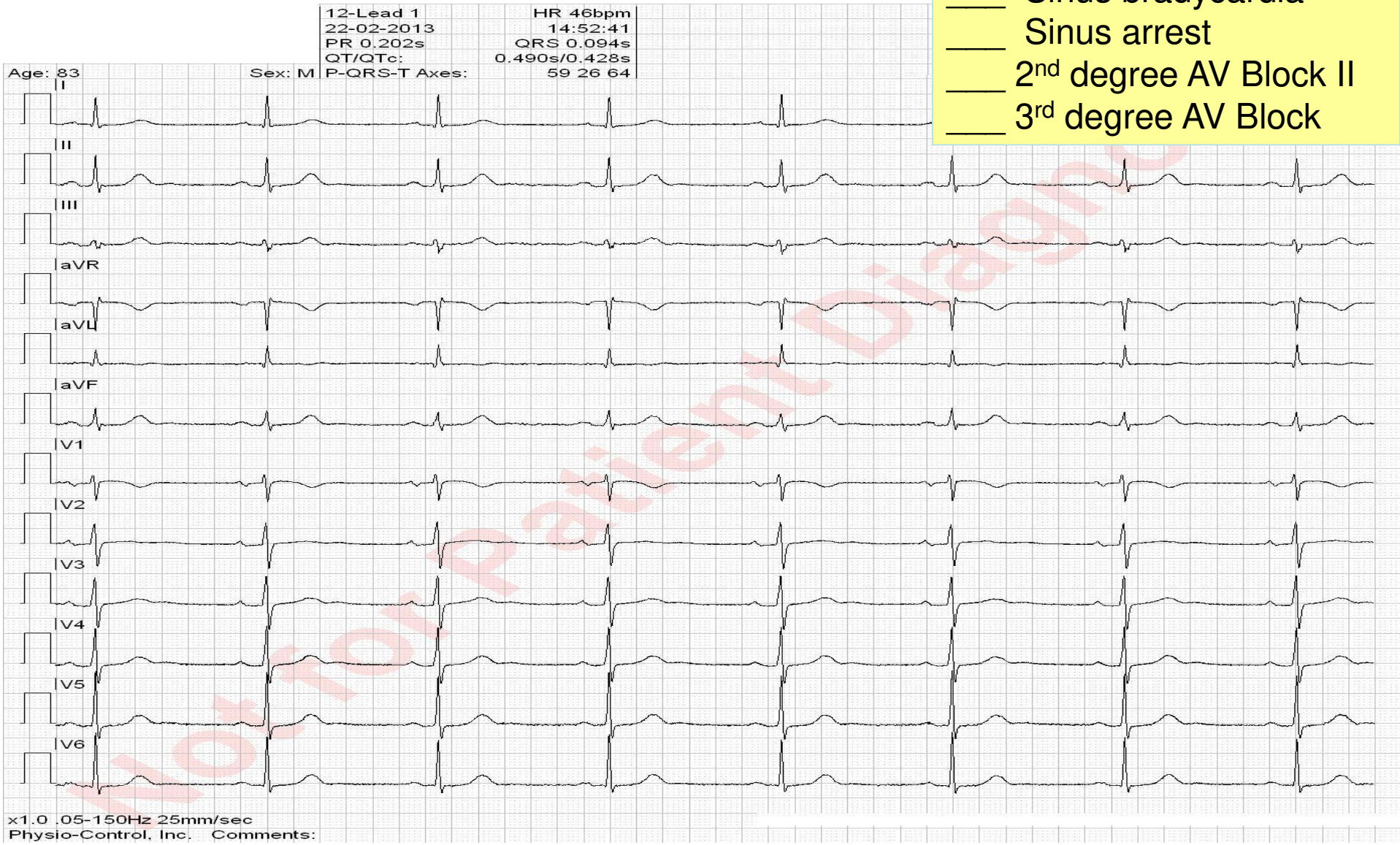
Case study: Patient presents to Emergency Dept; pain (L) side of chest on inspiration; (+) tobacco use; intoxicated.

___ Anterior Q waves
___ Inferior & lateral Q waves
___ Anterior STEMI
___ Inferolateral STEMI



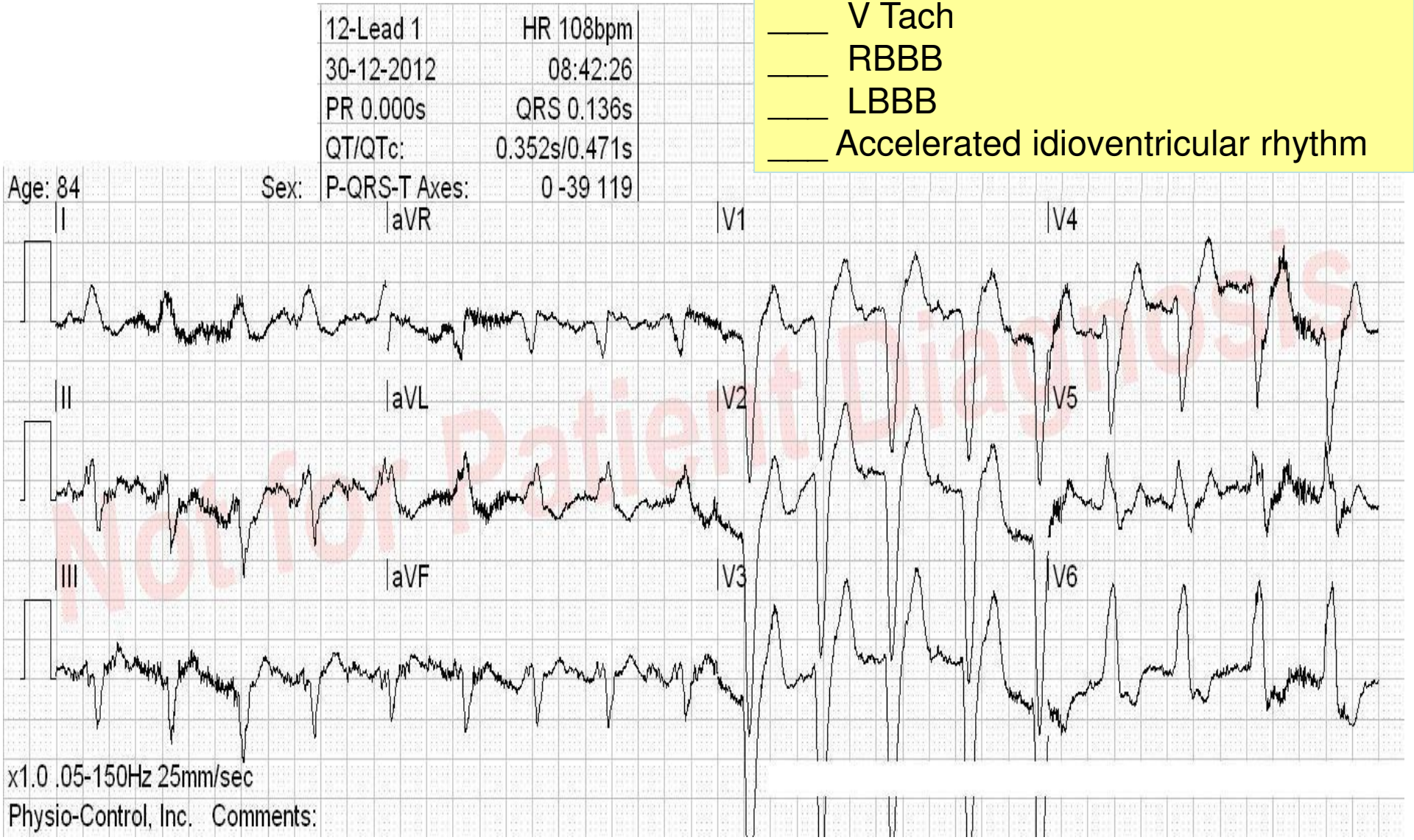
Case study: Patient complained of dizziness & then fell to the ground.

___ Sinus bradycardia
___ Sinus arrest
___ 2nd degree AV Block II
___ 3rd degree AV Block

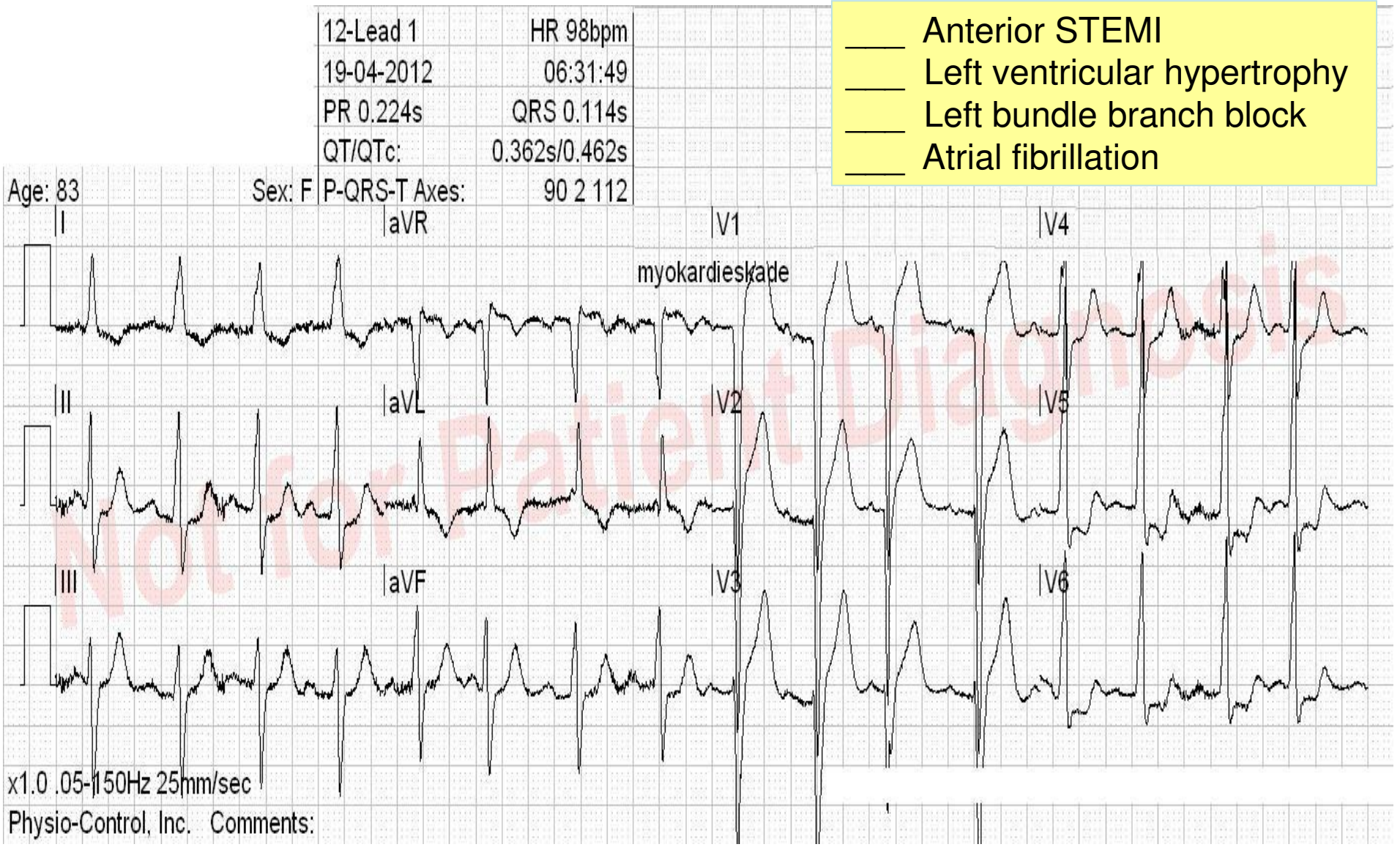


Case study: Pt with increased shortness of breath; woke up with respiratory distress; PMH: aortic stenosis, HTN, & CAD.

___ V Tach
___ RBBB
___ LBBB
___ Accelerated idioventricular rhythm



Case study: Patient 30 minutes of shortness of breath at rest; no chest pain or discomfort. PMH: COPD



___ Anterior STEMI
___ Left ventricular hypertrophy
___ Left bundle branch block
___ Atrial fibrillation

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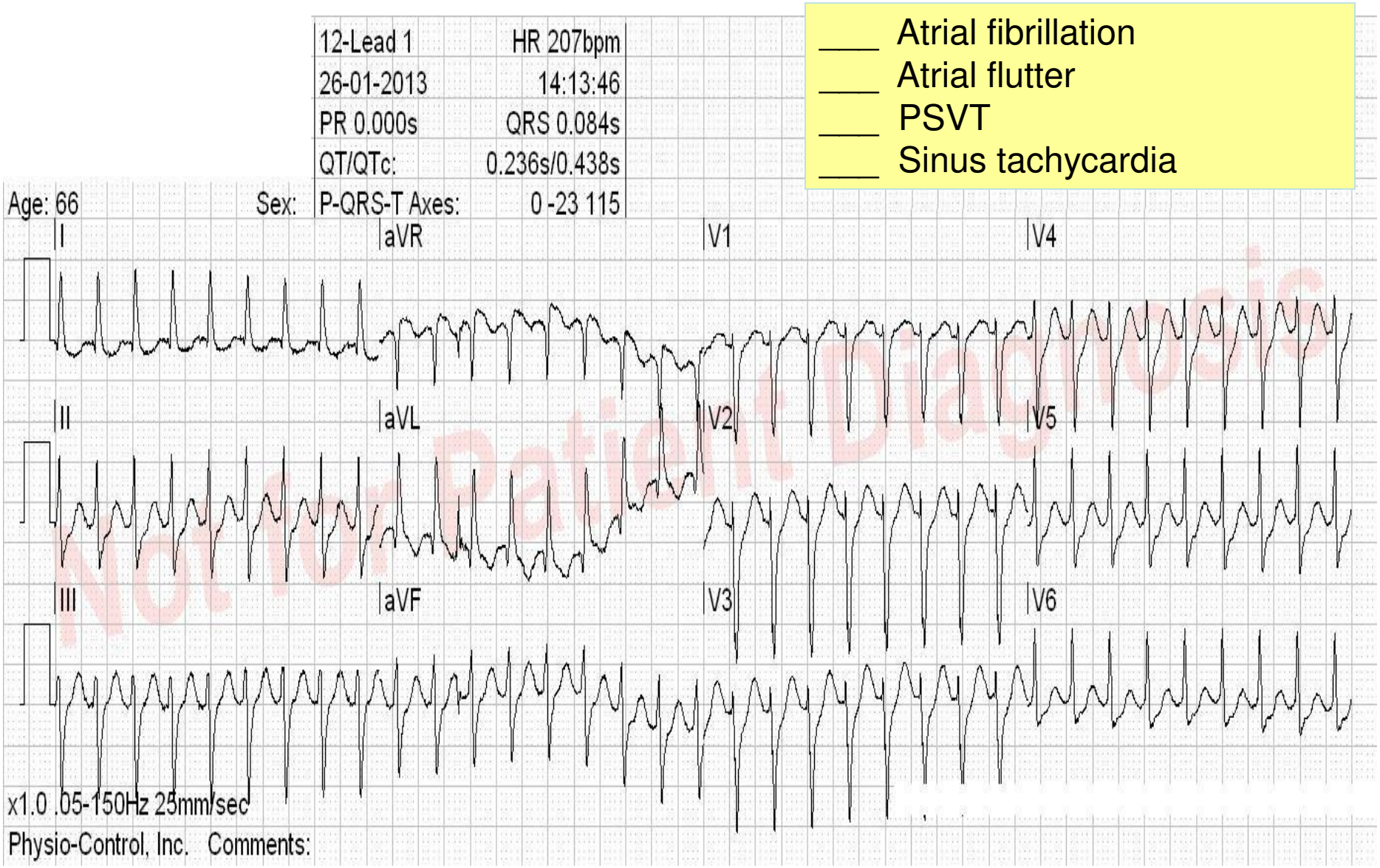
Case study: Patient with pronounced palpitations.



___ Atrial fibrillation
___ Atrial flutter
___ PSVT
___ Sinus tachycardia

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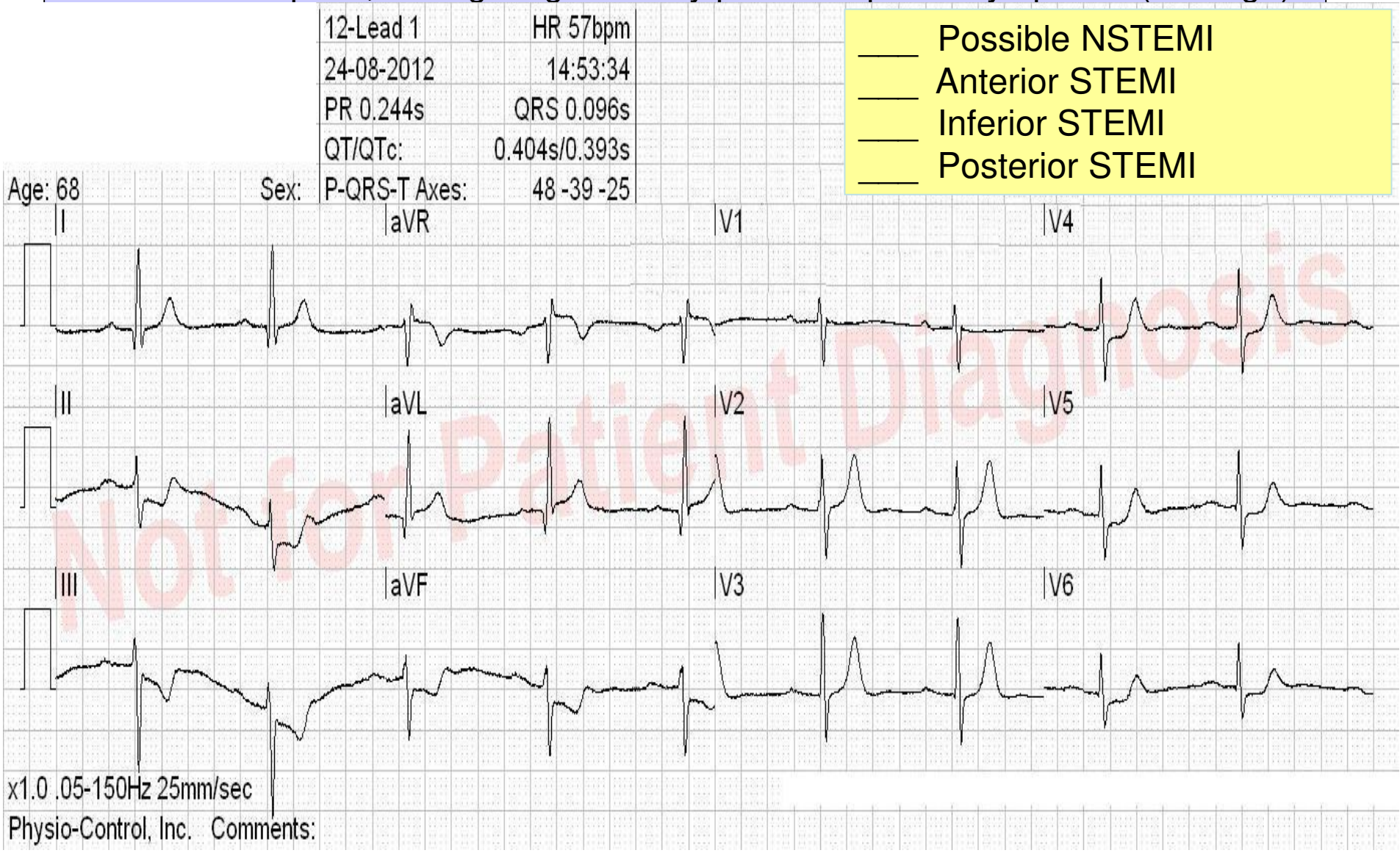
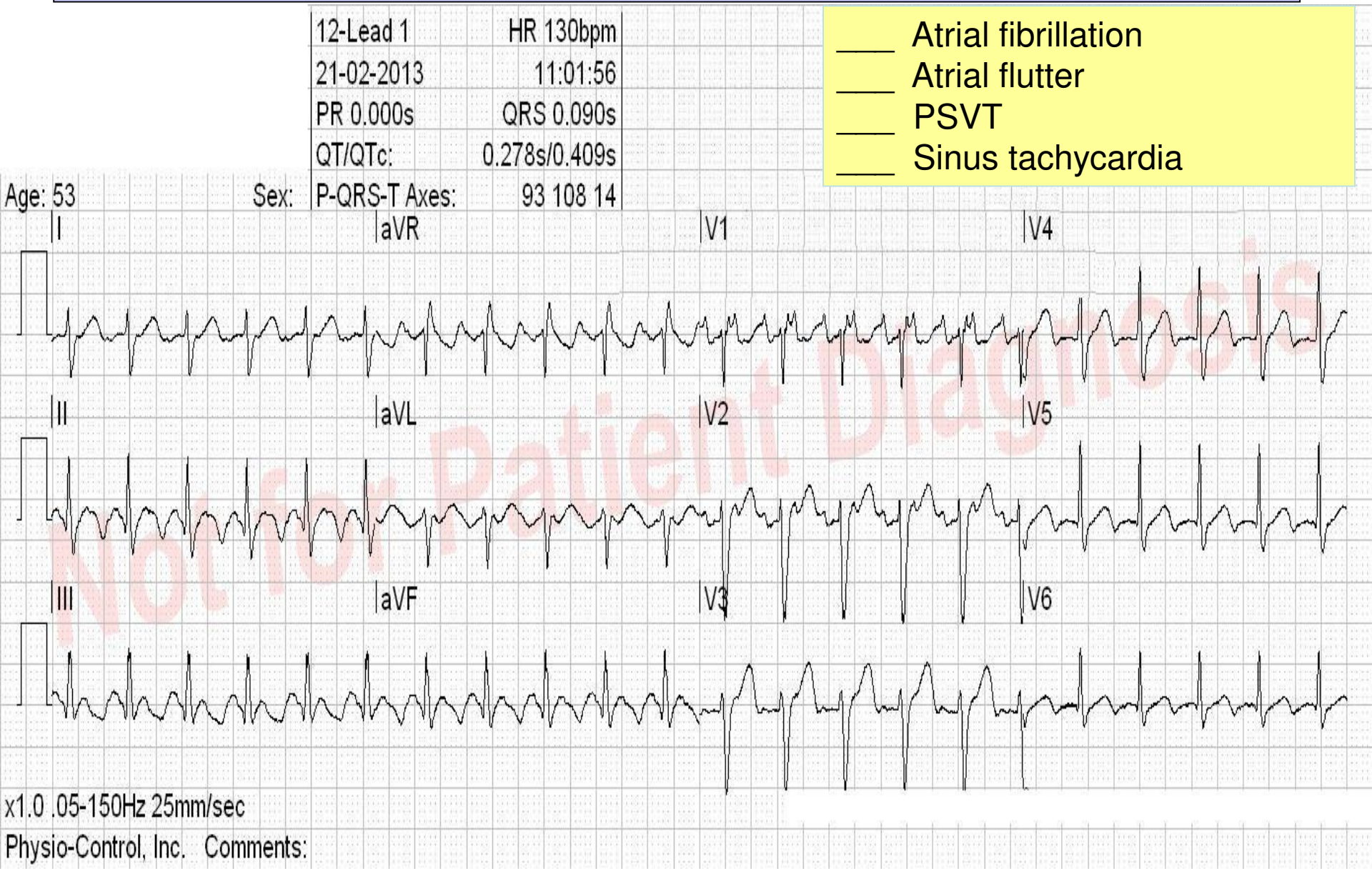
Case study: Patient with hx of CAD. Over the past few weeks symptoms have been more frequent, lasting longer. Today pt woke up with symptoms (1 hr ago).



___ Possible NSTEMI
___ Anterior STEMI
___ Inferior STEMI
___ Posterior STEMI

Case study: Patient with increased shortness of breath & rapid pulse.



___ Atrial fibrillation
___ Atrial flutter
___ PSVT
___ Sinus tachycardia

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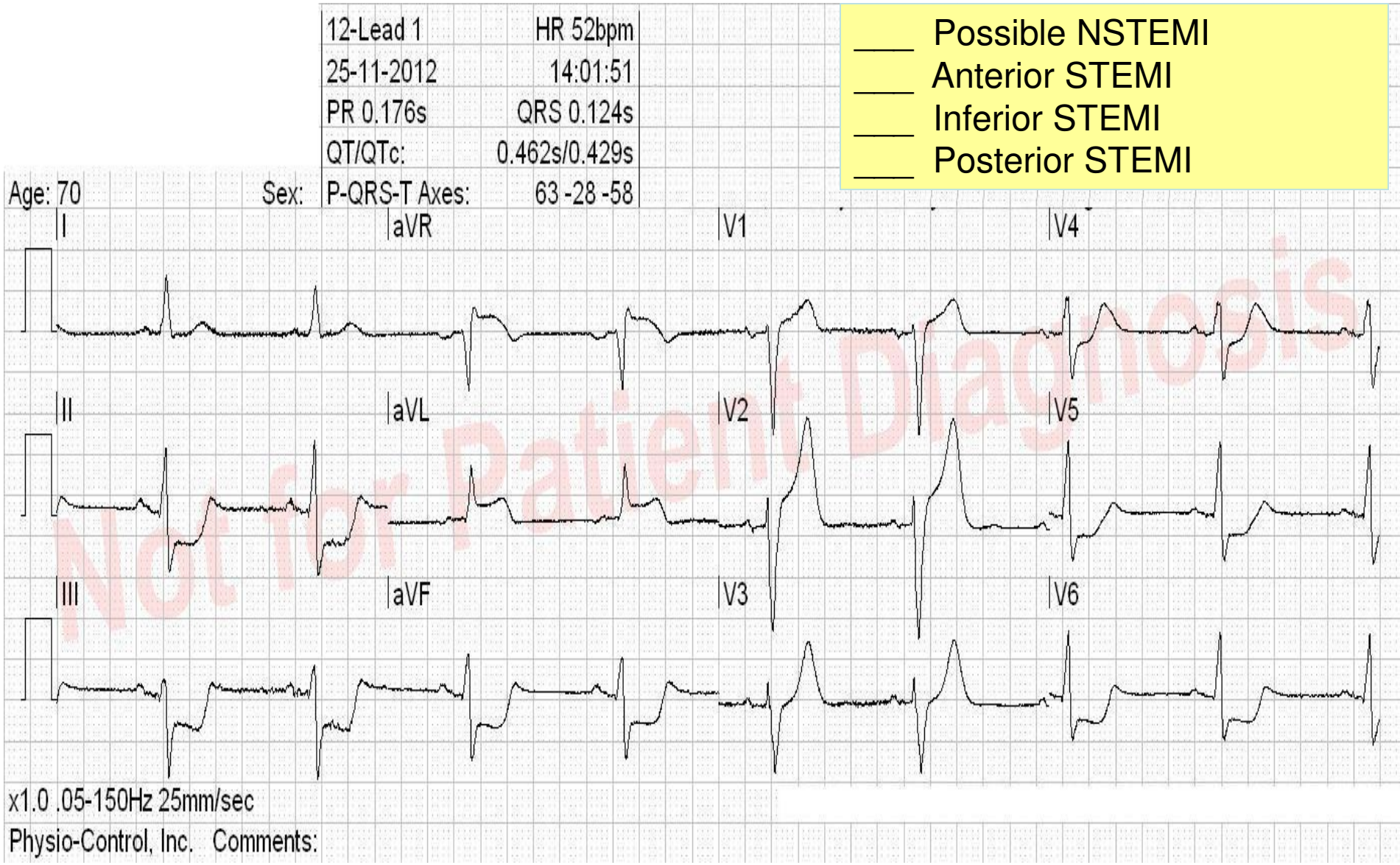
Case study: Patient with sudden onset substernal chest pain.



___ Possible NSTEMI
___ Anterior STEMI
___ Inferior STEMI
___ Posterior STEMI

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Essential Tips for NPs Managing Patients with Suspected ACS

- Importance of serial ECGs/enzymes if sx continue
- Beware of ECG confounders
  - Persons with abnormal baseline ECGs
  - LBBB or RBBB
  - Paced rhythms
- Request ® sided ECG for any STEMI to r/o ® sided involvement (esp for inferior MIs)
- Advocate for reperfusion therapy (PCI or thrombolytics) if indicated
- Weight adjust heparin for light & heavy patients
- Ask questions about *anything different*

Acknowledgements

- EKG images for selected case studies at the end were used & reprinted with permission from Dr. Antoine Ayer; Source: ecg-quiz.com

ECG Tutorial Resources:

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- http://library.med.utah.edu/kw/ecg/ecg_outline/Lesson1/index.html
- http://library.med.utah.edu/kw/ecg/index.html

No disclosures relevant to any of these web sites by Dr. Davis

Answers to Case Studies

1. Inferior MI
2. Anterior MI with A Fib (rapid ventricular response).
3. Inferior-posterior STEMI
4. Inferior & lateral Q waves
5. Sinus bradycardia
6. Left bundle branch block
7. Left ventricular hypertrophy, Cannot rule out anterior STEMI (due to LVH). Not quite LBBB (QRS 0.11). Note: no left axis deviation.
8. PSVT with atypical A Flutter
9. Possible NSTEMI (ST depression in II, III, aVF, V 4-V 6).
10. A Flutter
11. Anterior STEMI with Reciprocal (inferior) ST depression

Questions?

Leslie L Davis, PhD, RN

LLDavis@email.unc.edu