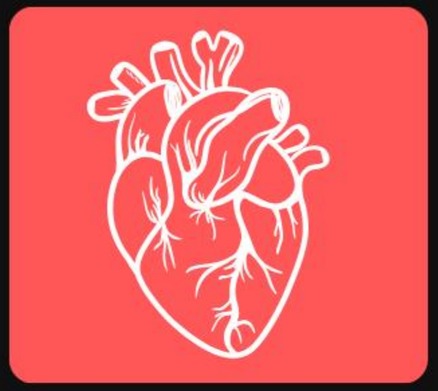
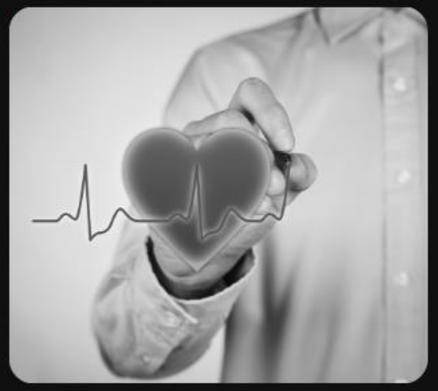








Sneaky Cases of ACS:

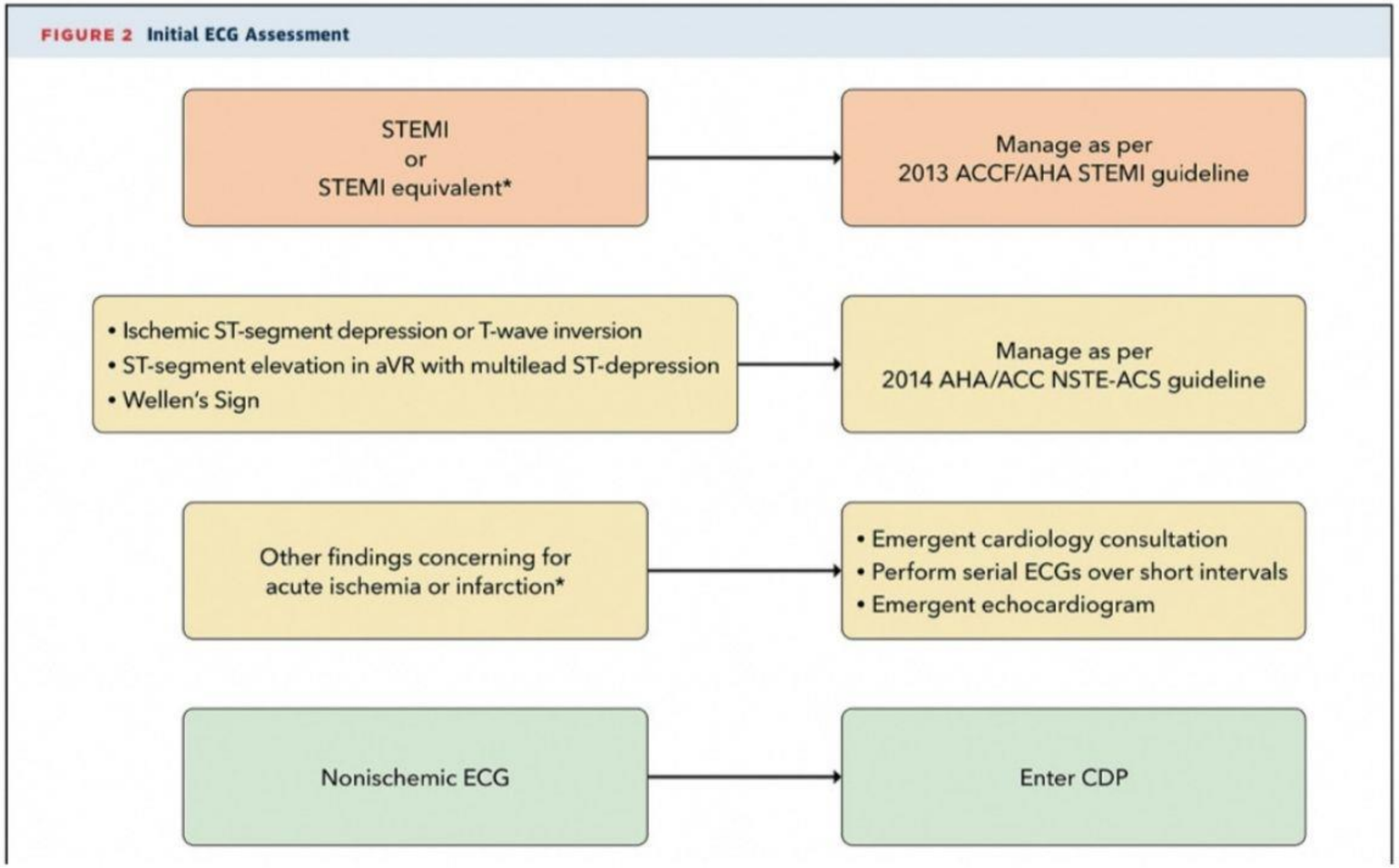
New STEMI Equivalents You Must Know to Stay Safe

Presented By:

Jennifer Carlquist

PA-C, ER-CAQ

Kontos M, de Lemos J, et al. 2022 ACC Expert Consensus Decision Pathway on the Evaluation and Disposition of Acute Chest Pain in the Emergency Department. J Am Coll Cardiol. 2022 Nov, 80 (20) 1925–1960.
https://doi.org/10.1016/j.jacc.2022.08.750





Wellen's
Dewinters
Hyperacute T waves

THE LIST

TABLE 1 Electrocardiogram Findings Suggestive of Ischemia

FINDING	CRITERIA
STEMI equivalents	
Posterior STEMI	**Criteria:** ■ Horizontal ST-segment depression in V_1-V_3 ■ Dominant R-wave (R/S ratio >1) in V_2 ■ Upright T waves in anterior leads ■ Prominent and broad R-wave (>30 ms) **Confirmed by:** ■ ST-segment elevation of ≤0.5 mm in at least 1 of leads V_7-V_9*
Left bundle branch block or ventricular paced rhythm with Sgarbossa Criteria	A total score ≥3 points is required: ■ Concordant ST-segment elevation ≥1 mm in leads with a positive QRS complex (5 points) ■ Concordant ST-segment depression ≥1 mm in leads V_1-V_3 (3 points) ■ Discordant ST-segment elevation ≥5 mm in leads with a negative QRS complex (2 points) If there is discordant ST-segment elevation ≥5 mm, consider ST/S ratio <−0.25
Left bundle branch block or ventricular paced rhythm with Smith-modified Sgarbossa Criteria	Positive if any of the following are present: ■ Concordant ST-segment elevation of 1 mm in leads with a positive QRS complex ■ Concordant ST-segment depression of 1 mm in V_1-V_3 ■ ST-segment elevation at the J-point, relative to the QRS onset, is at least 1 mm and has an amplitude of at least 25% of the preceding S-wave
De Winter Sign	■ Tall, prominent, symmetrical T waves arising from upsloping ST-segment depression >1 mm at the J-point in the precordial leads ■ 0.5-1 mm ST-segment elevation may be seen in lead aVR
Hyperacute T waves	Broad, asymmetric, peaked T waves may be seen early in STEMI Serial ECGs over very short intervals are useful to assess for progression to STEMI
ECG findings consistent with acute/subacute myocardial ischemia	
aVR ST-segment elevation	Most often caused by diffuse subendocardial ischemia and usually occurs in the setting of significant left main coronary artery or multivessel coronary artery disease ■ ST-segment elevation in aVR ≤1 mm ■ Multilead ST-segment depression in leads I, II, Val, and/or V_4-V_6 ■ Absence of contiguous ST-segment elevation in other leads
ST-segment depression	Horizontal or downsloping ST-segment depression ≥0.5 mm at the J-point in 2 or more contiguous leads is suggestive of myocardial ischemia
Wellen's syndrome	Clinical syndrome characterized by: ■ Biphasic or deeply inverted and symmetric T waves in leads V_2 and V_3 (may extend to V_6) ■ Recent angina ■ Absence of Q waves
Inverted T waves	May be seen in ischemia (subacute) or infarction (may be fixed and associated with Q waves) in continuous leads

BASIC 12 LEAD

Non specific ST T wave Changes



Posterior MI

Depression in v2, v3
Isolated



Wellens

Biphasic T wave Changes
in v2 v3



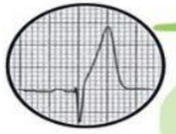
Dewinters

ST depression in V3 v4
with Hyperacute T waves



AVR

1 mm elevation in AVR
plus widespread
ST depression



Hyperacute T waves

Large T waves that are
almost as big as the QRS

5 Things

DE WINTERS

WELLENS

AVR

HYPERACUTE T WAVES

POSTERIOR MI



NSSTW

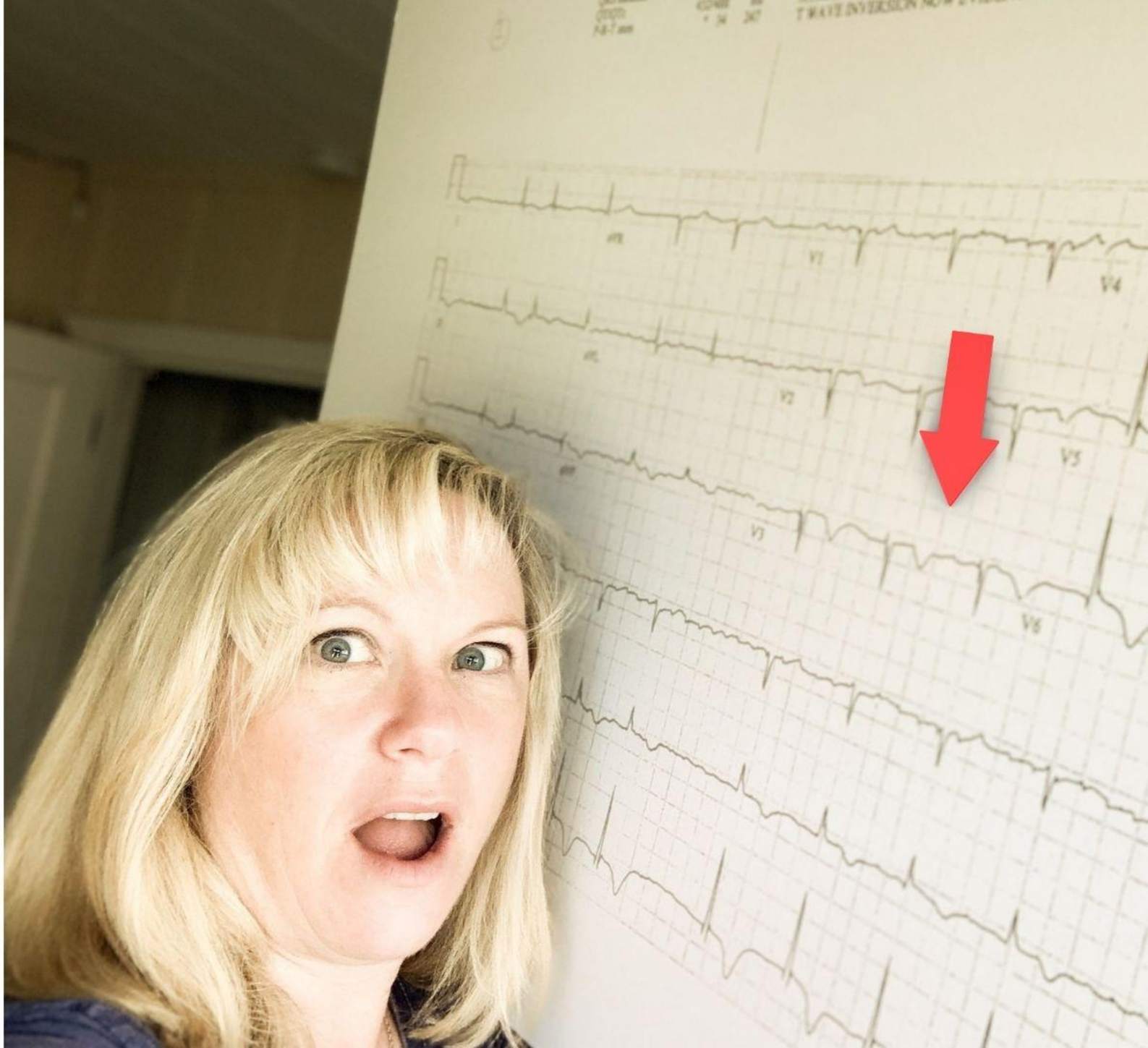
HYPERACUTE

BIPHASIC

INVERTED

SYMMETRIC

DWINTERS



FINDING	CRITERIA
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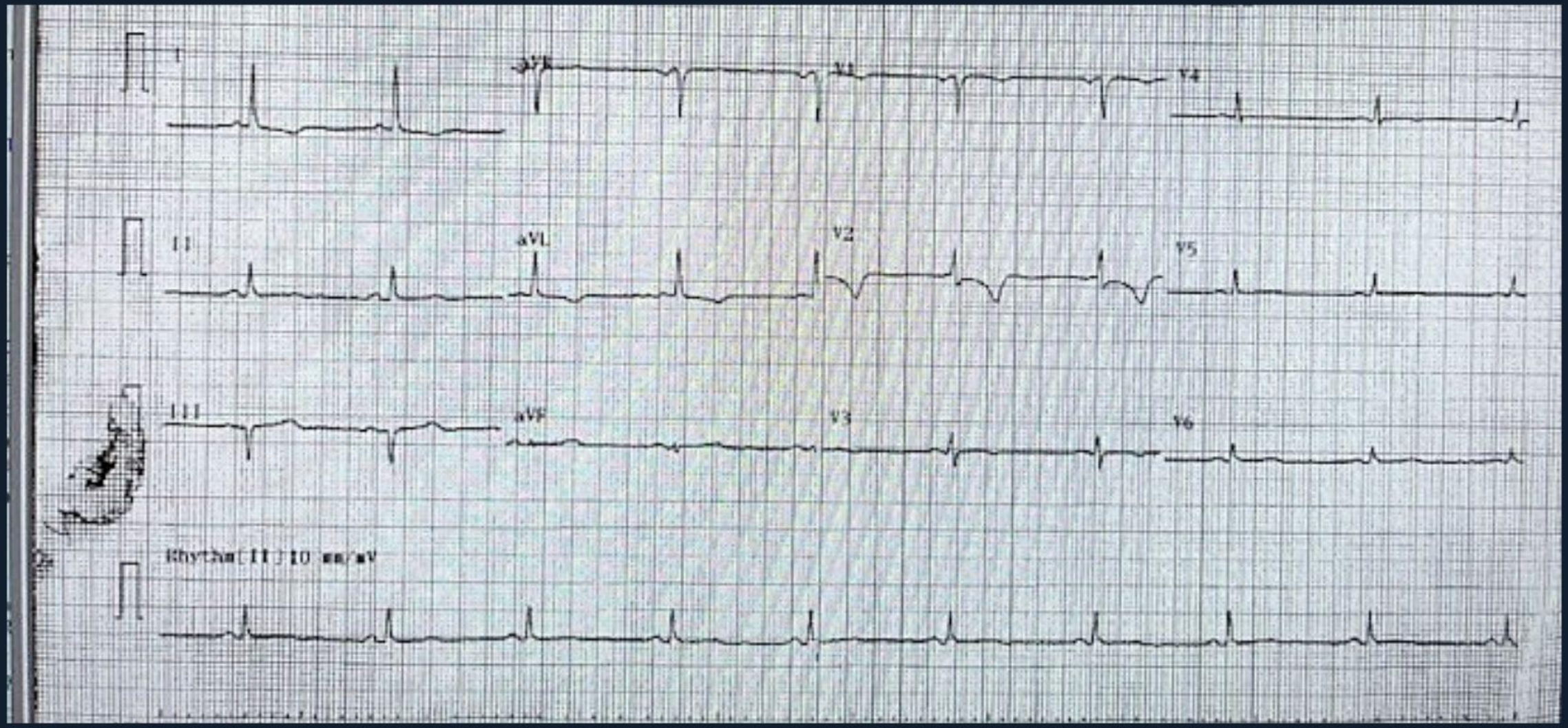
The Case



54 Y/o F Cardio Visit

- Presented to cardiology with chest pain and syncope x 3 this month
- Pain worse with exertion, doe noted
- No longer able to **push through** the walk
- Was given nitro it **helped**

THE EKG





MEDICAL HISTORY

- Hyperlipidemia
- Hypertension
- Smoker

FAMILY HISTORY

- Hypertension
- Brother and mom have pacemaker

STRESS TEST

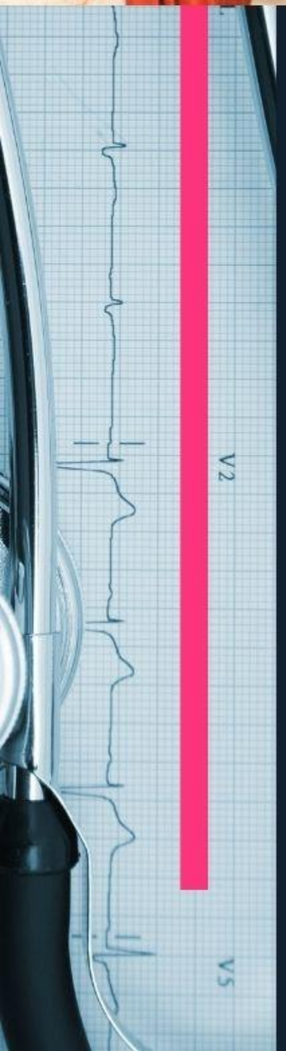
- In stage two ST elevation in **AVR**
- ST depression into **multiple** leads persisting in 23 minutes into recovery



CATH:

- Complex **multivessel** coronary artery disease
- **Severe** distal **left main stenosis**
- Left anterior descending artery is occluded in its proximal portion and fills to left to left collaterals.
- The circumflex has tandem high grade stenosis in proximal mid and distal portion and appears to be codominant
- The right coronary artery is **occluded at its origin** and the posterior descending trunk feels through faint collaterals from the distal circumflex
- Left ventricular function well-preserved with ejection fraction about **50-60%** with mild apical hypokinesia





RECOMMENDATION:

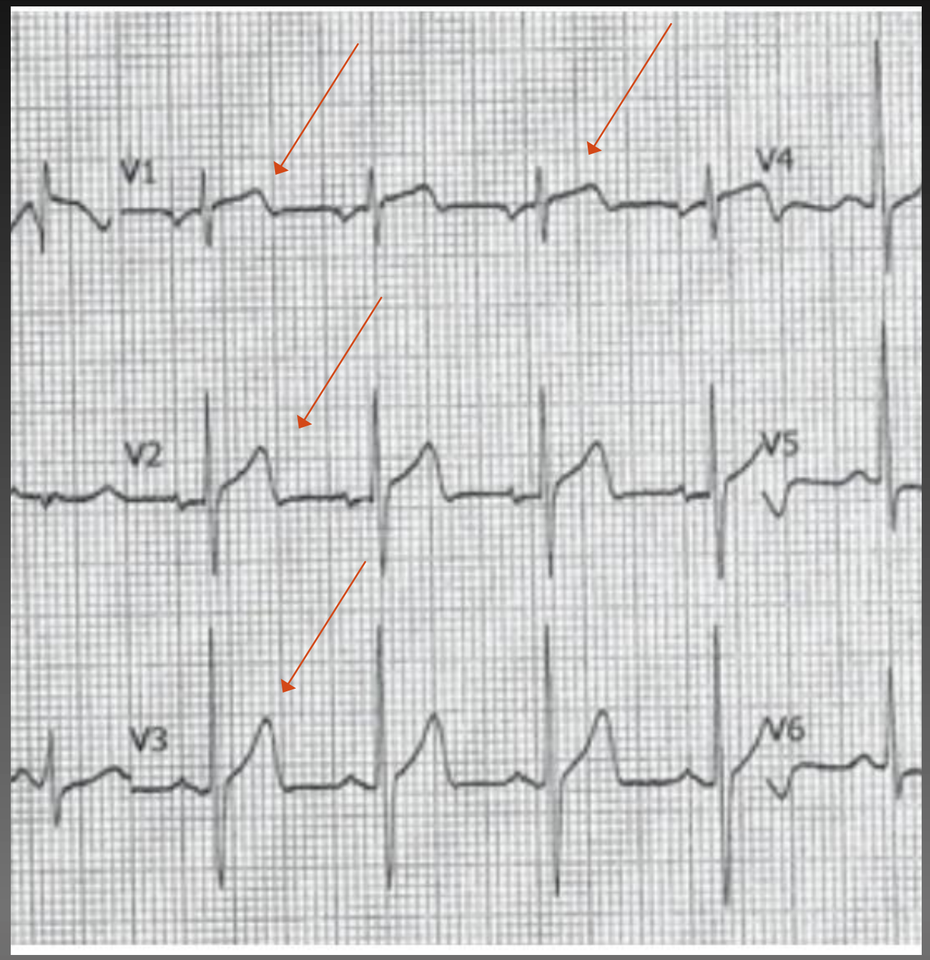
Conclusions

- Severe Multi-vessel coronary artery disease with preserved left-ventricular function

- Complex and multi-vessel coronary artery disease best served by coronary artery bypass surgery cardiothoracic's consultation has been sought

HYPERACUTE T WAVES

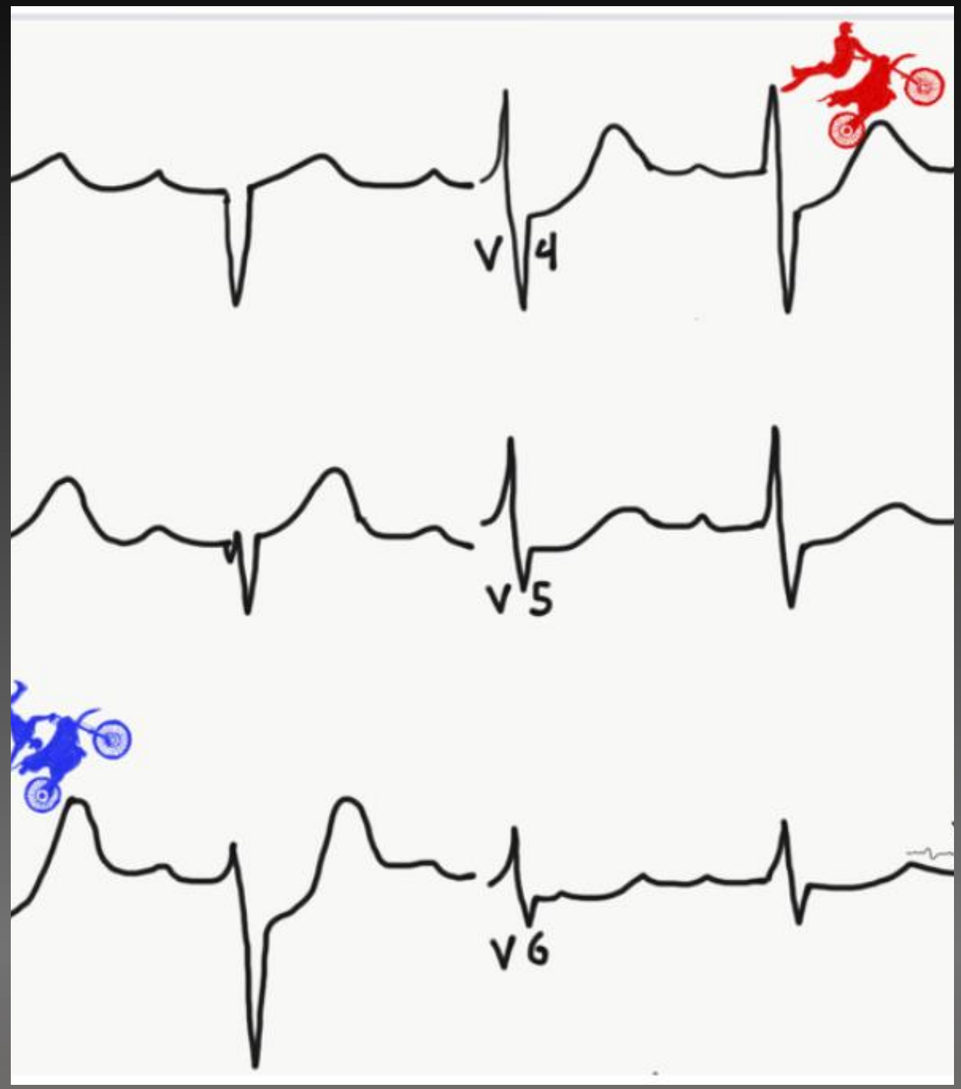
These are broad based T waves that are bigger than they should and precede a STEMI. (Noted in v2, v3.)



De Winters T Waves

This is indicative of **acute LAD** occlusion.

(Noted in v3, v4. ST depression and peaked T waves in the precordial leads.



WELLEN'S WARNING

Deeply inverted or biphasic T waves in V2-3, which is highly specific for a critical stenosis of the left anterior descending artery (LAD).

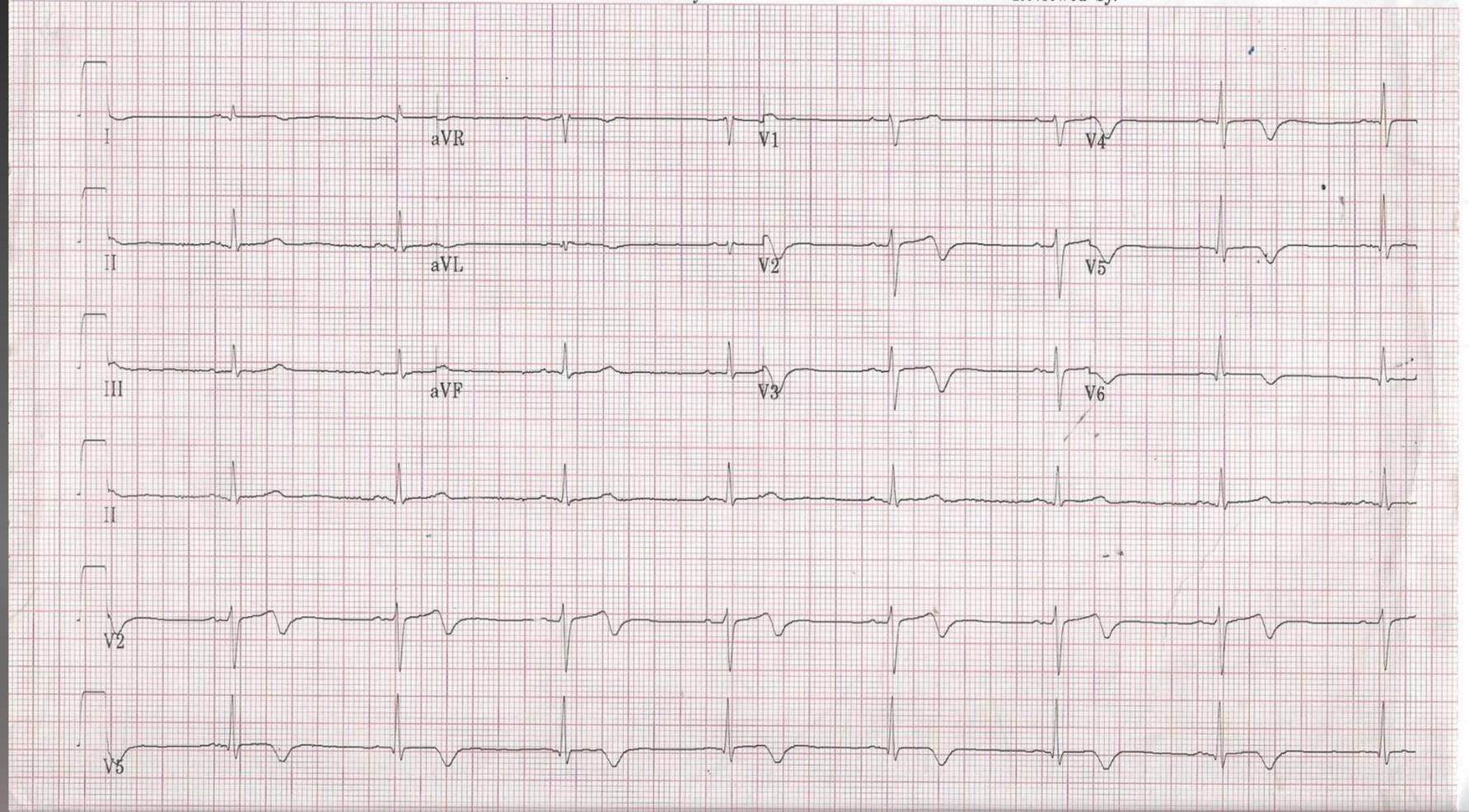
Patients may be pain free by the time the ECG is taken and have normally or minimally elevated cardiac enzymes; however, they are at **extremely high risk** for extensive anterior wall MI within the next few days to weeks.



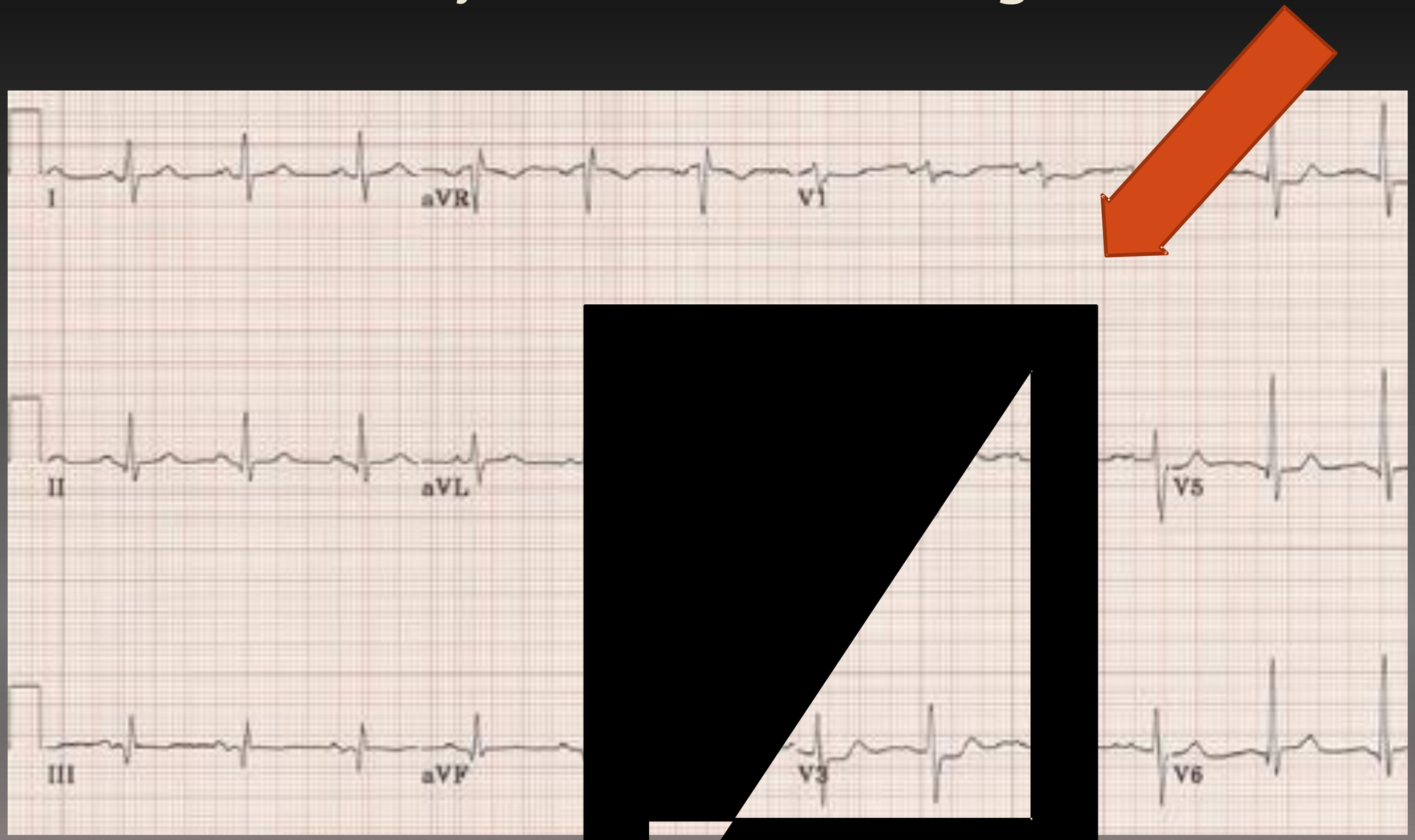
Vent. rate	48 bpm	Sinus bradycardia
PR interval	150 ms	T wave abnormality, consider anterolateral ischemia
QRS duration	92 ms	Prolonged QT
QT/QTc	522/466 ms	Abnormal ECG
P-R-T axes	49 70 77	

Referred by:

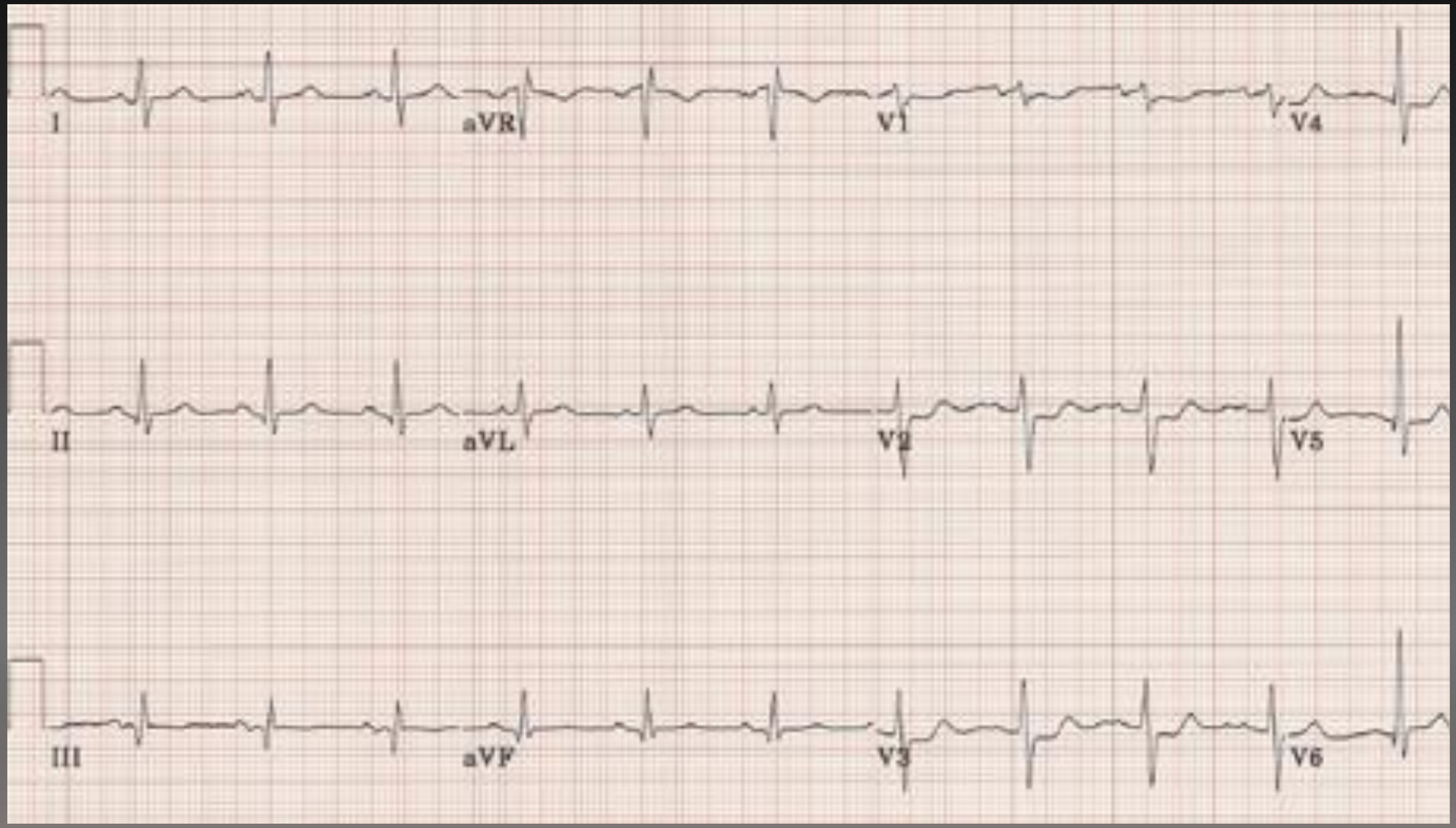
Reviewed by:



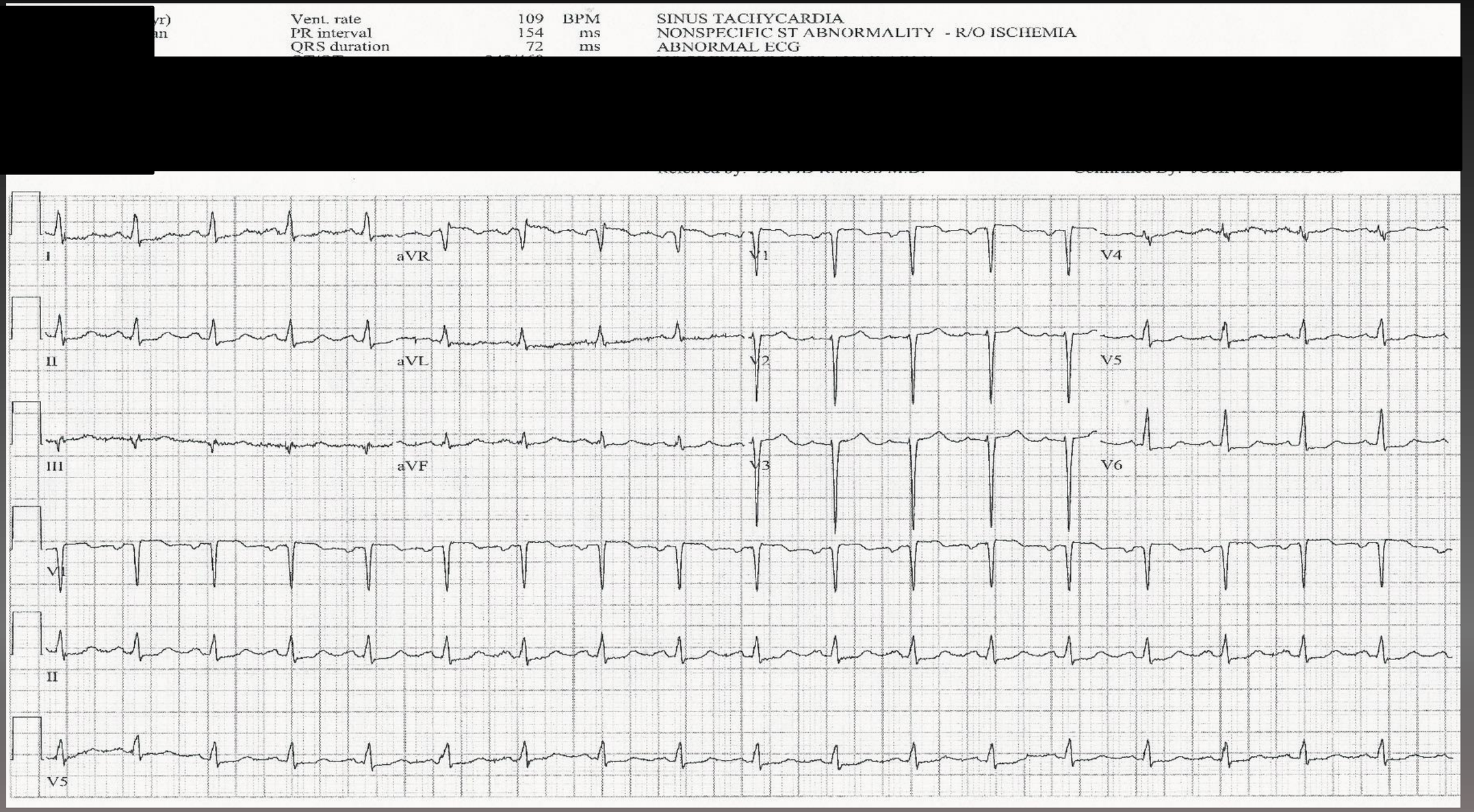
50 y/o male with “indigestion”



50 y/o male with “indigestion”



38 y/o female school teacher – “weak”



ER note

- Sent to ER by urgent care for “abnormal cxr”

- “Pt. states sent for increasing cough and DOE x 1 week. C/O swelling to legs for 1 week. Denies hx of renal or heart disease. Denies fever, chest pain, abd pain or N/V/D.”

Diagnostics

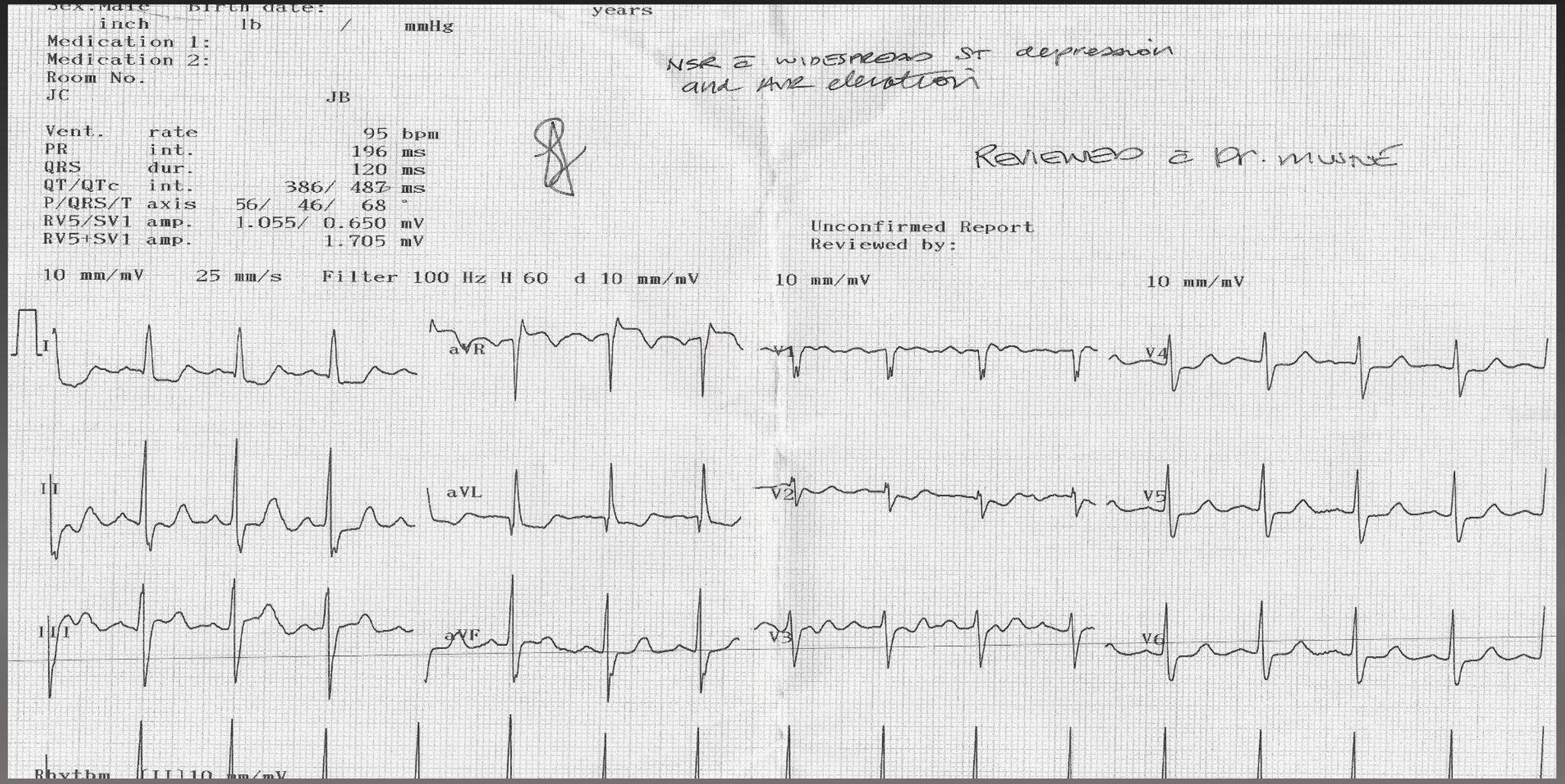
- Labs: TSh 2.2, BNP 6131, Trop <0.015, Glucose 310
- CXR: Left pleural effusion
- CTA: no PE
- Nuclear Stress test: Mod – severe LAD, RCA lesions, EF 20%



What happened?

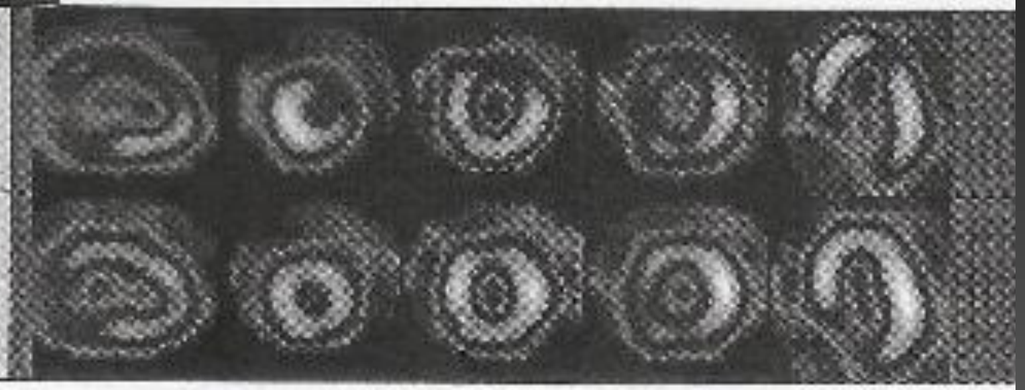
bypass!
EF of 20%
She lived….

78 y/o male with shoulder pain when I work out



His stress test

PERFUSION FINDINGS

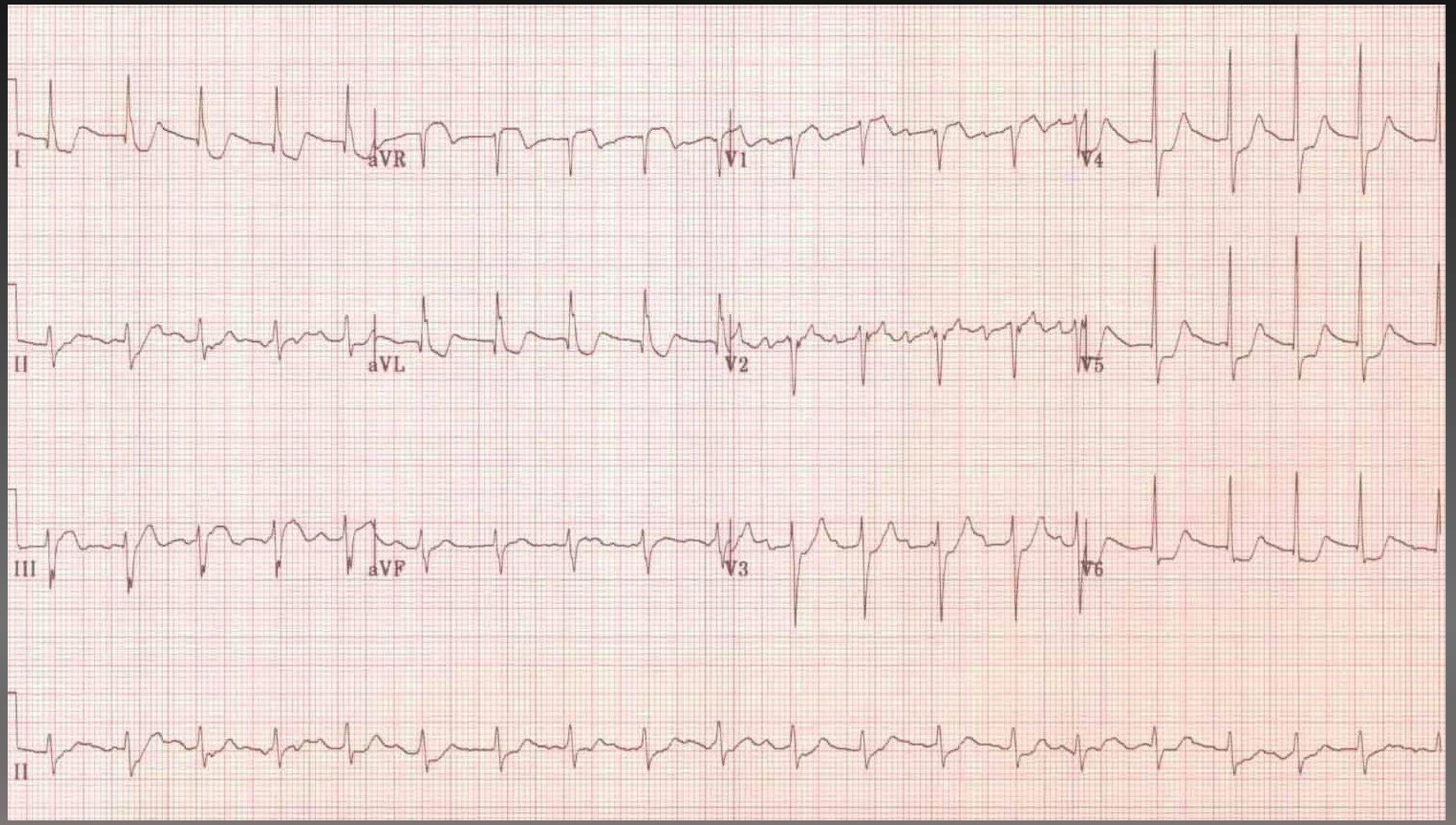
Stress Images	
Rest Images	

Overall Study Quality:	good
Extra Cardiac Activity:	normal
Study Artifacts:	None

LV Myocardial Perfusion Defects:
(1) Moderate sized moderate to severe anterolateral completely reversible defect consistent
typical of the mid LAD and or LCx.

Scan Significance: abnormal and indicates an intermediate risk for hard cardiac events
Stress/Rest LV Volume Ratio: 0.97, normal

AVR





OMINOUS FINDING!

- Elevation of more than 1mm in aVR in the setting of Acute Coronary syndrome is associated with left main disease
- Not a stemi, but should be treated like one
- PCI
- Associated with an increase in mortality



CASE

42 Y/O MALE PRESENTED WITH INTERMITTENT CHEST PAIN.



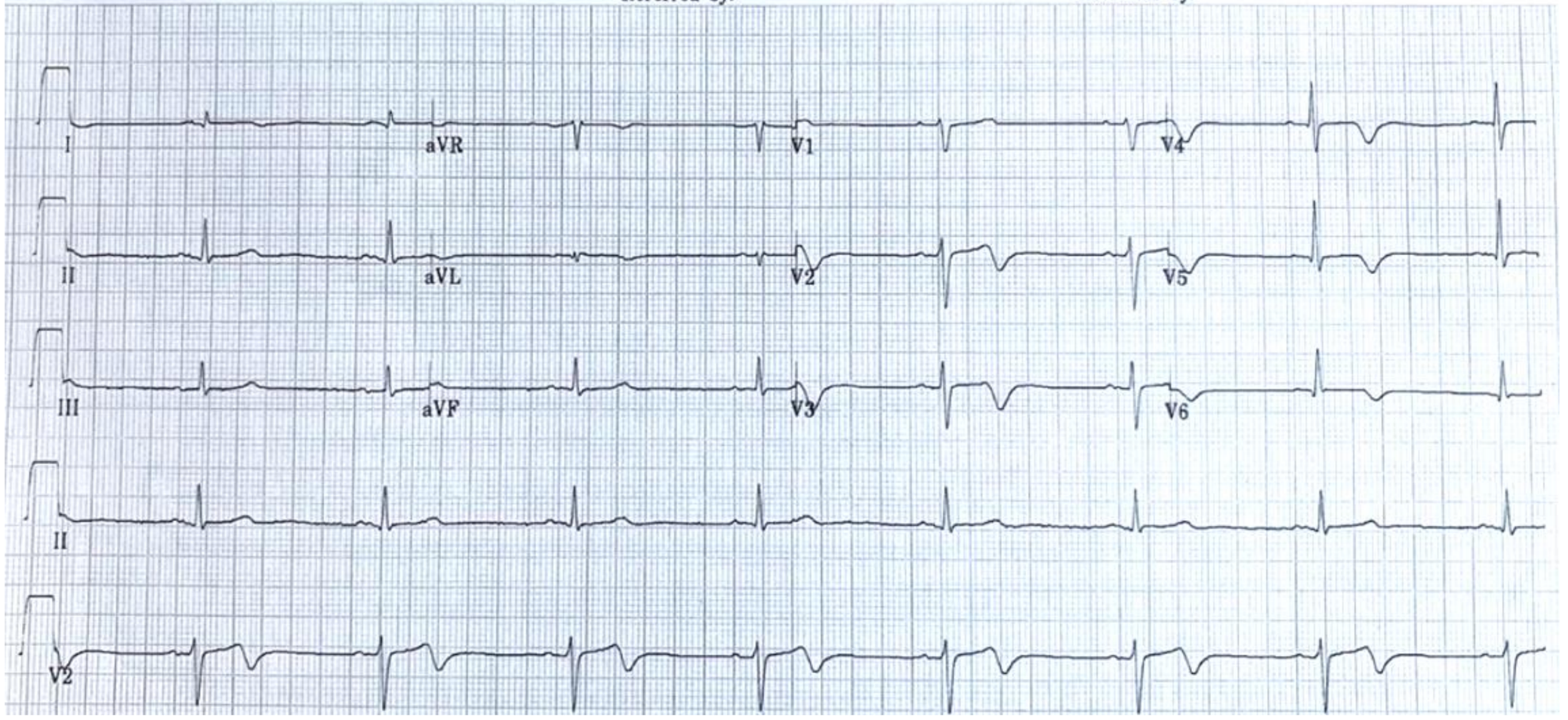
HX: HTN, smoking, hyperlipidemia. severe, possible ehlers danlos. High stress lifestyle. Worked as a mechanic. Thin framed.

Vent. rate	48 bpm
PR interval	150 ms
QRS duration	92 ms
QT/QTc	522/466 ms
P-R-T axes	49 70 77

Sinus bradycardia
T wave abnormality, consider anterolateral ischemia
Prolonged QT
Abnormal ECG

Referred by:

Reviewed by:



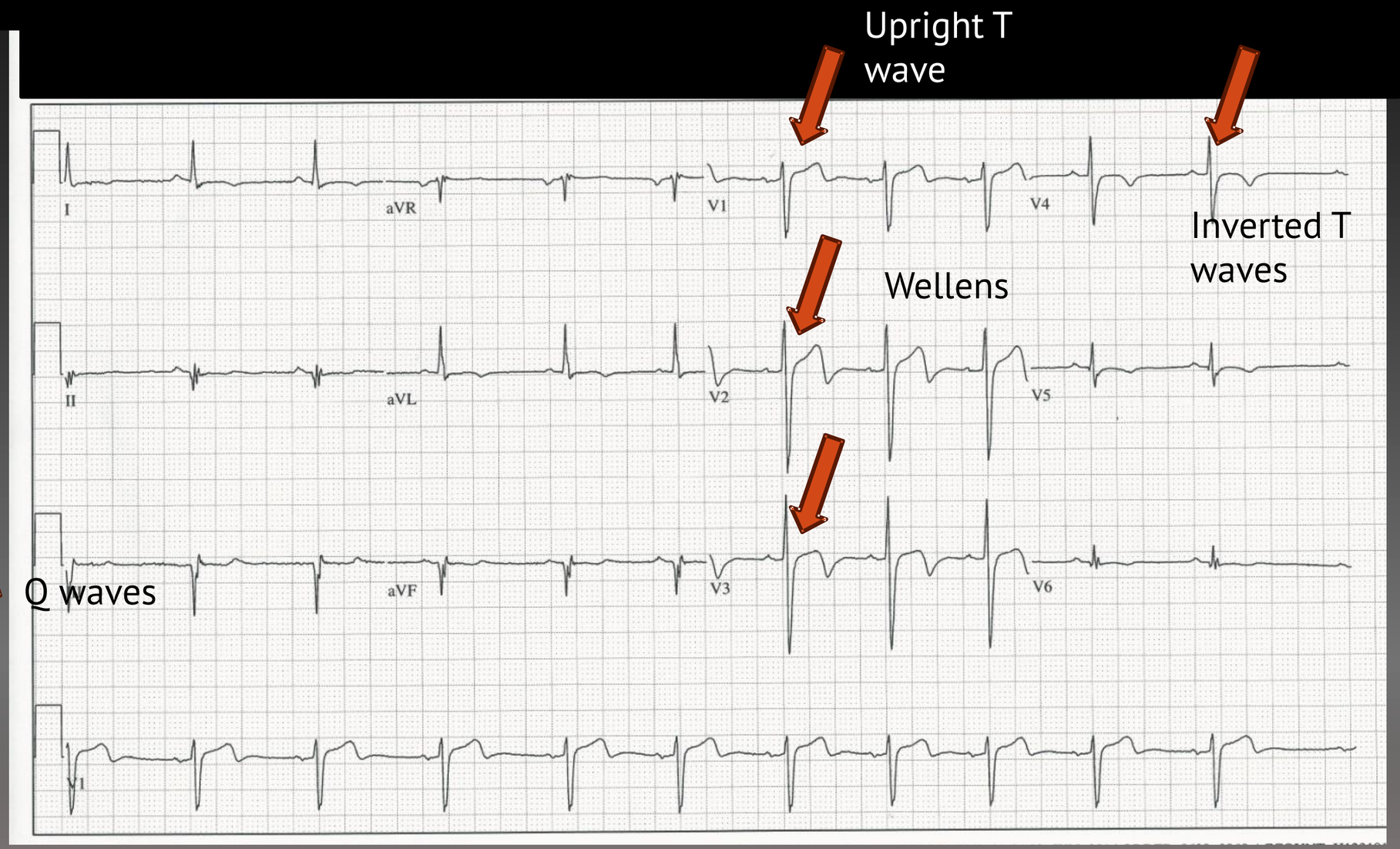
42 year old male C/P – clinic EKG





PMD NOTE

- "Has chest tightness after dinner, worse laying down, sometimes when sitting. Connection to activity, but not consistently so. Eases with doing less. No lightheadedness, dizziness, sweats."


Upright T wave
Inverted T waves
Wellens
Q waves
I
aVR
V1
V4
II
aVL
V2
V5
aVF
V3
V6
V1



What happened?

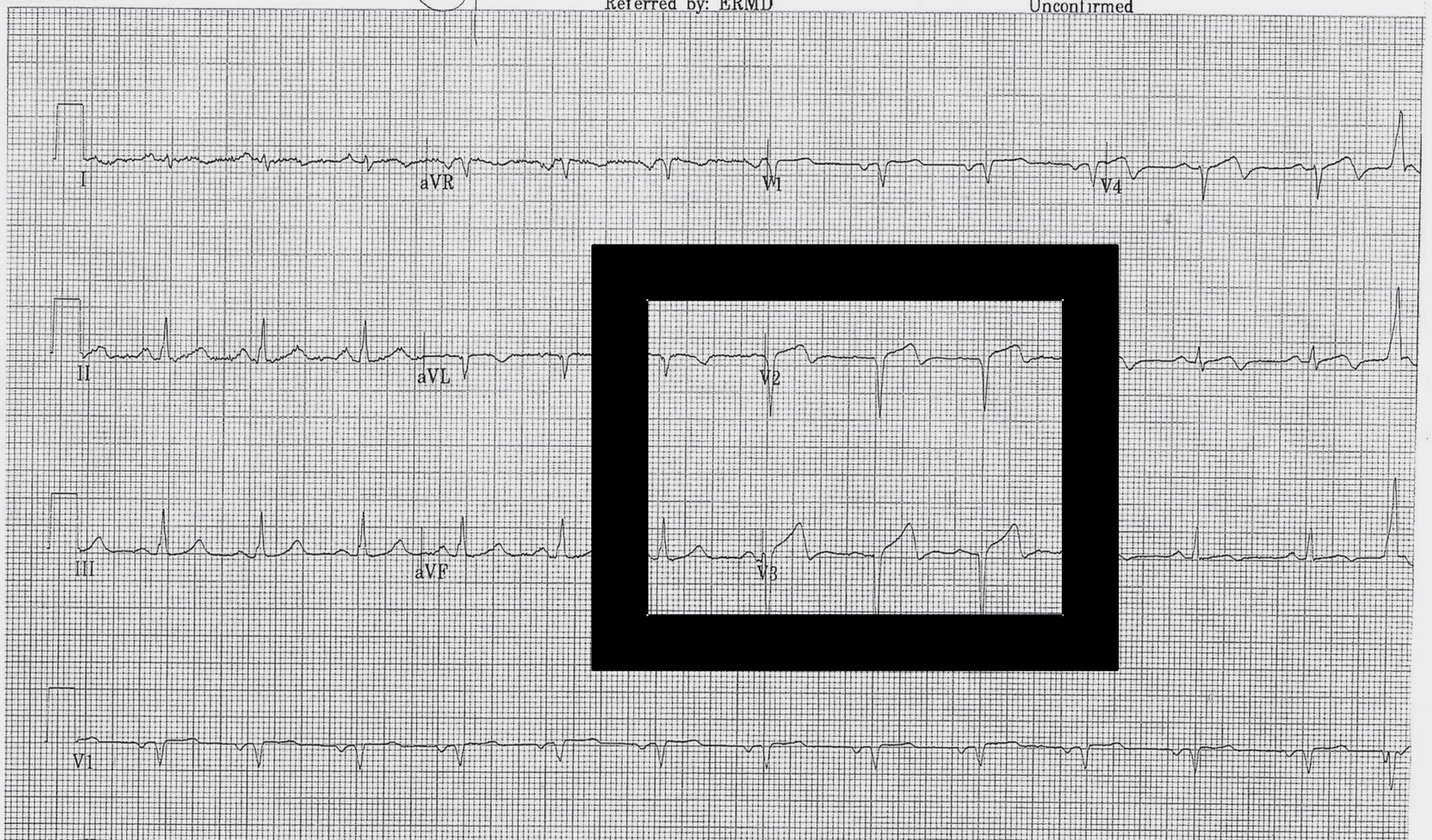
5 vessel bypass.
EF of 40%.

Vent. rate	79	bpm
PR interval	164	ms
QRS duration	78	ms
QT/QTc	400/458	ms
P-R-T axes	57 91	79

Sinus rhythm with occasional premature ventricular complexes
Possible Left atrial enlargement
Rightward axis
Septal infarct, age undetermined
T wave abnormality, consider lateral ischemia
Abnormal ECG

Referred by: ERMD

Unconfirmed



4 Flavors of Wellens

v2

V3

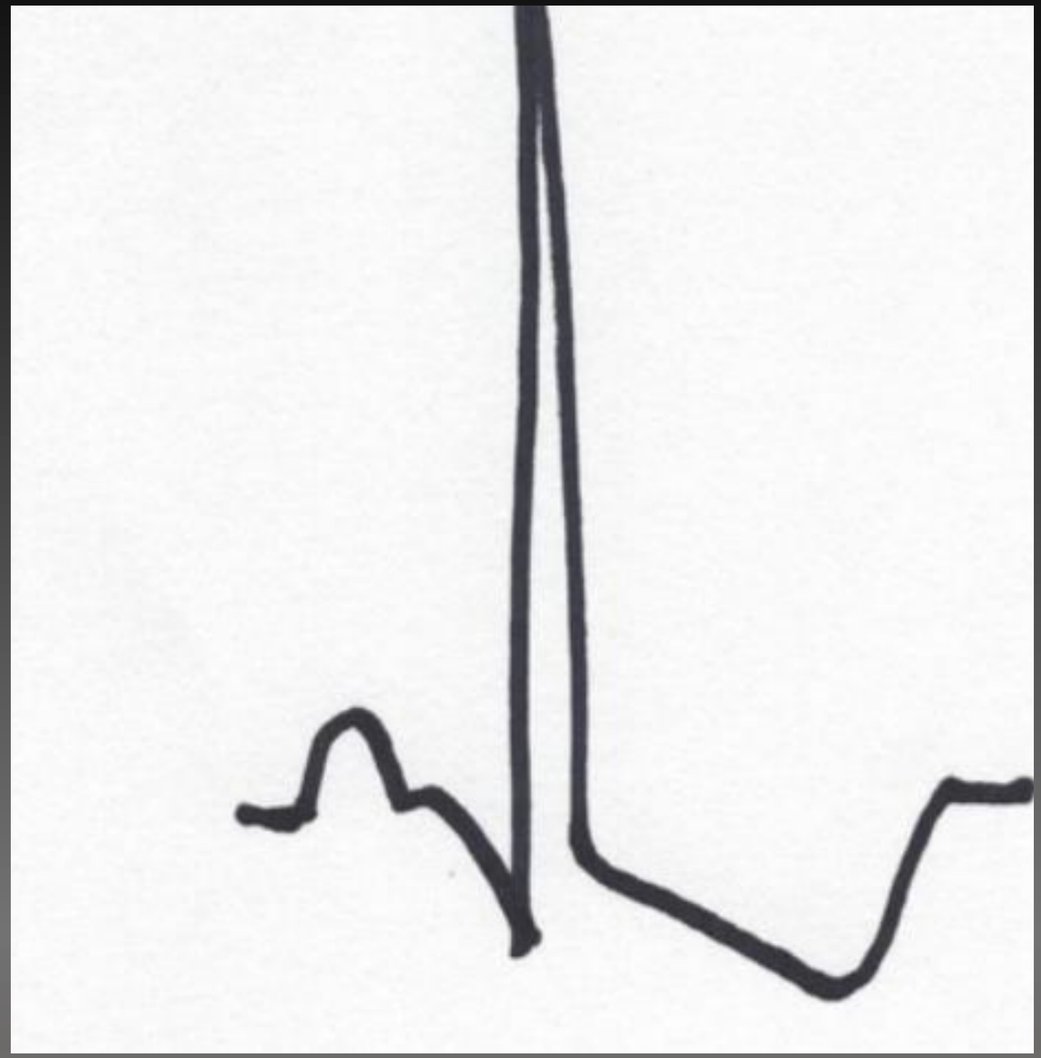


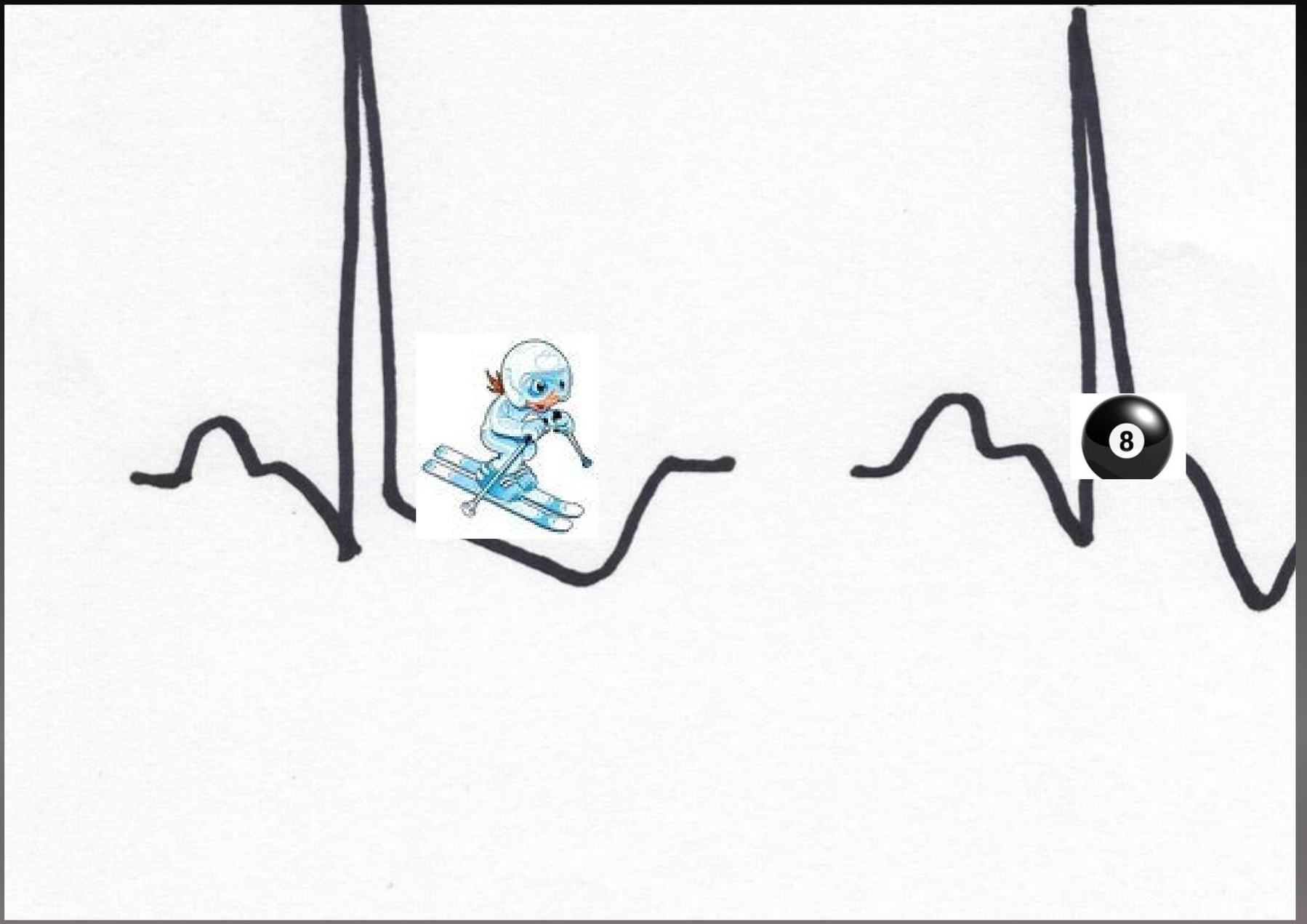


STRAIN PATTERN

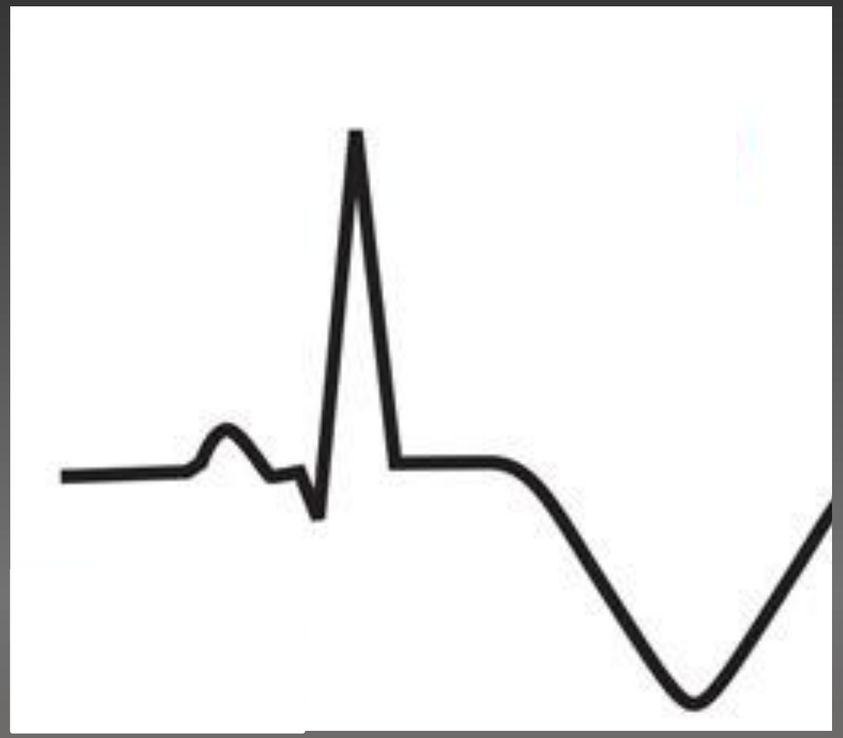
This means the patient has a **large ventricle**.

The appearance of the ST segment is deep, inverted and looks like a **reverse check mark**.




8

4 differentials for flipped T waves

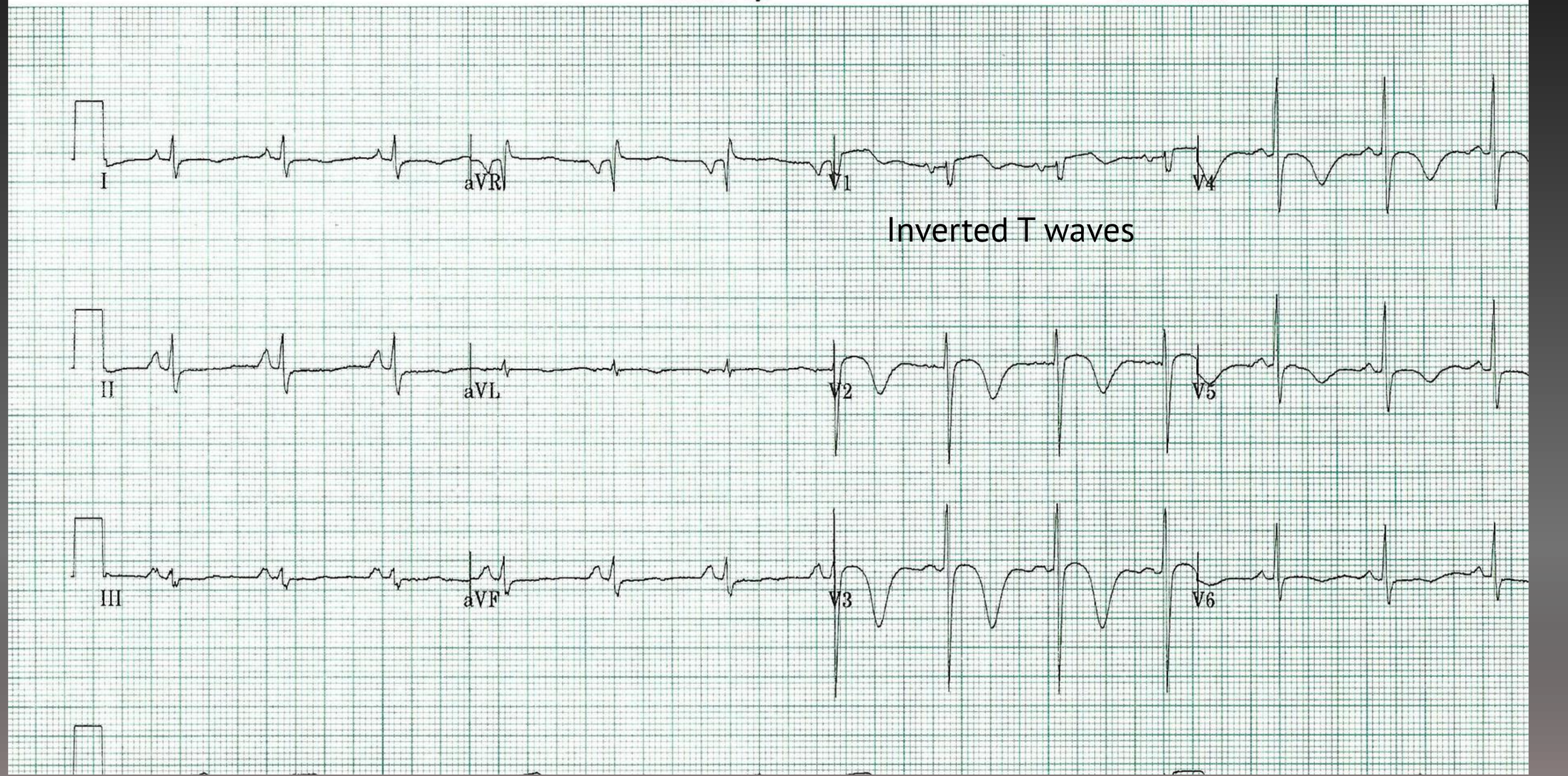


1. **ACS**
2. **PE**
3. **ICH**
4. **Cardiomyopathy**

Vent. rate	79 bpm	Normal sinus rhythm
PR interval	144 ms	Right atrial enlargement
QRS duration	86 ms	ST & Marked T wave abnormality, consider anterolateral ischemia
QT/QTc	462/529 ms	Prolonged QT
P-R-T axes	69 24 238	Abnormal ECG

ician:
nd: F

Referred by: Unconfirmed

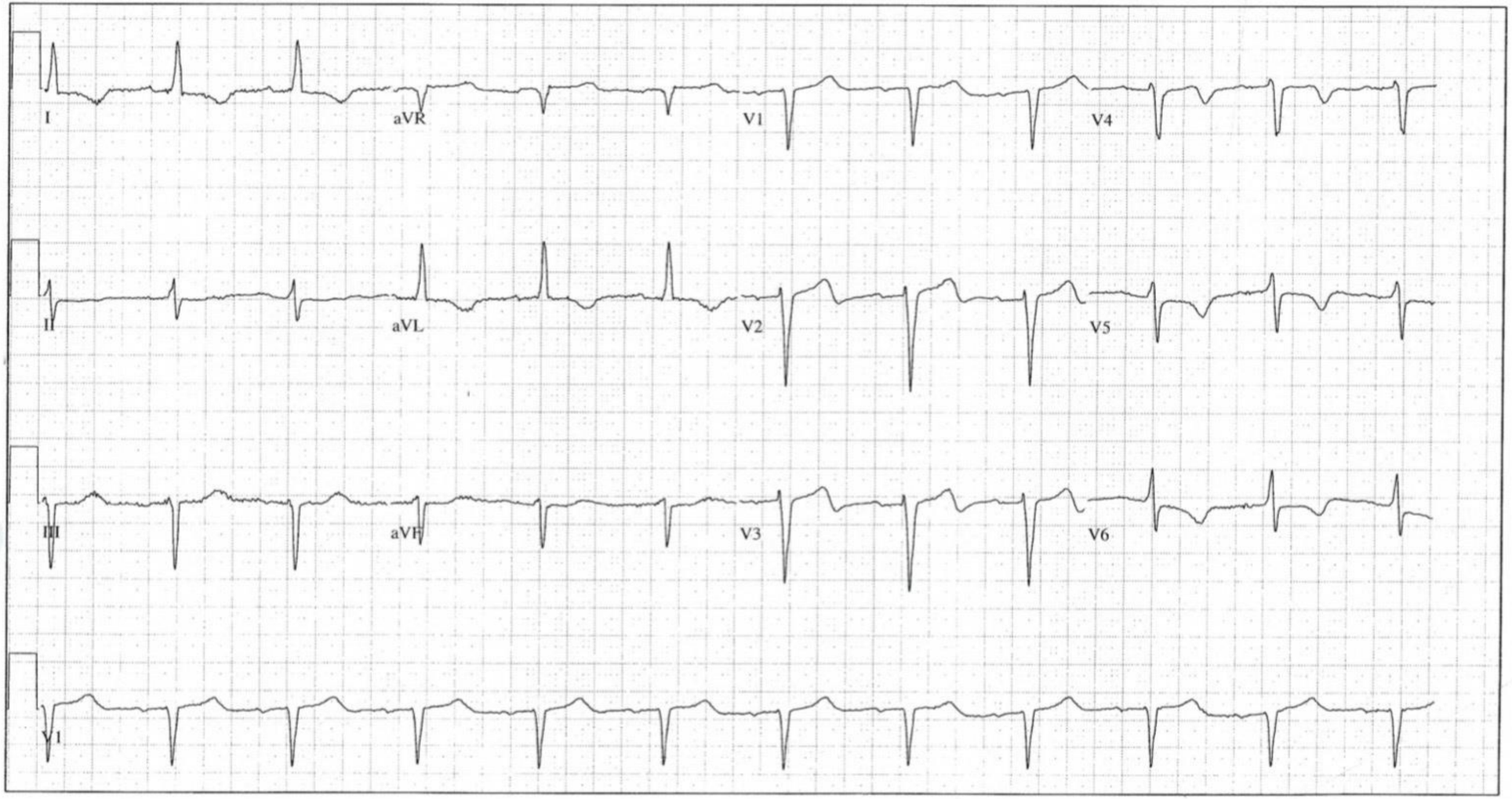


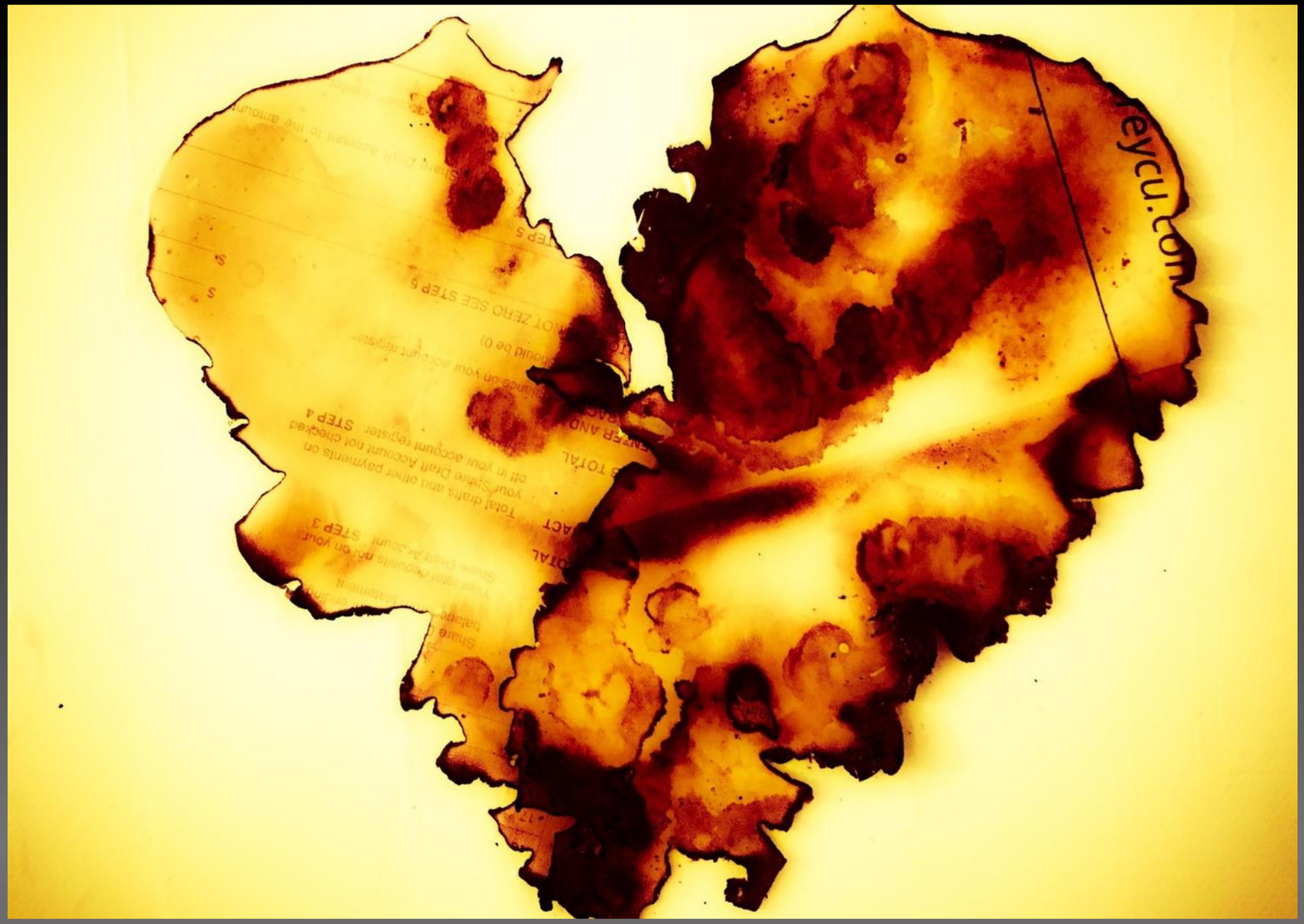
Inverted T waves

Vent. rate	68	BPM
PR interv	220	ms
QRS dura on	114	ms
QT/QTc	492/523	ms
P–R–T axes	–11 –38	155

SINUS RHYTHM WITH 1ST DEGREE A–V BLOCK
LEFT AXIS DEVIATION
LEFT VENTRICULAR HYPERTROPHY
CANNOT RULE OUT ANTERIOR INFARCT
ST AND T WAVE ABNORMALITY, CONSIDER LATERAL ISCHEMIA
PROLONGED QT
ABNORMAL ECG
WHEN COMPARED WITH ECG OF 07–APR–2019 18:05, (UNCONFIRMED)
NON–SPECIFIC CHANGE IN ST SEGMENT IN ANTERIOR LEADS

17





Workbook

1. **Big** Sick vs. **Little** Sick

2. Rate

3. Rhythm

4. Intervals (Use the **family**)

5. Axis

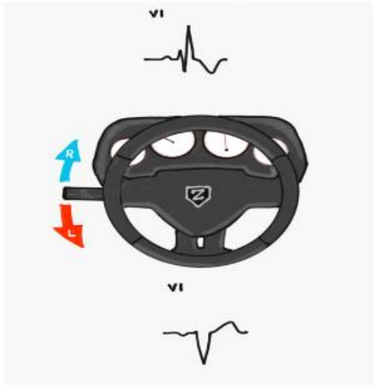
6. **ST Segments**

7. Hypertrophy / Voltage

8. **T** wave analysis- (all waves)

9. **Q Waves?** Married? Wide?

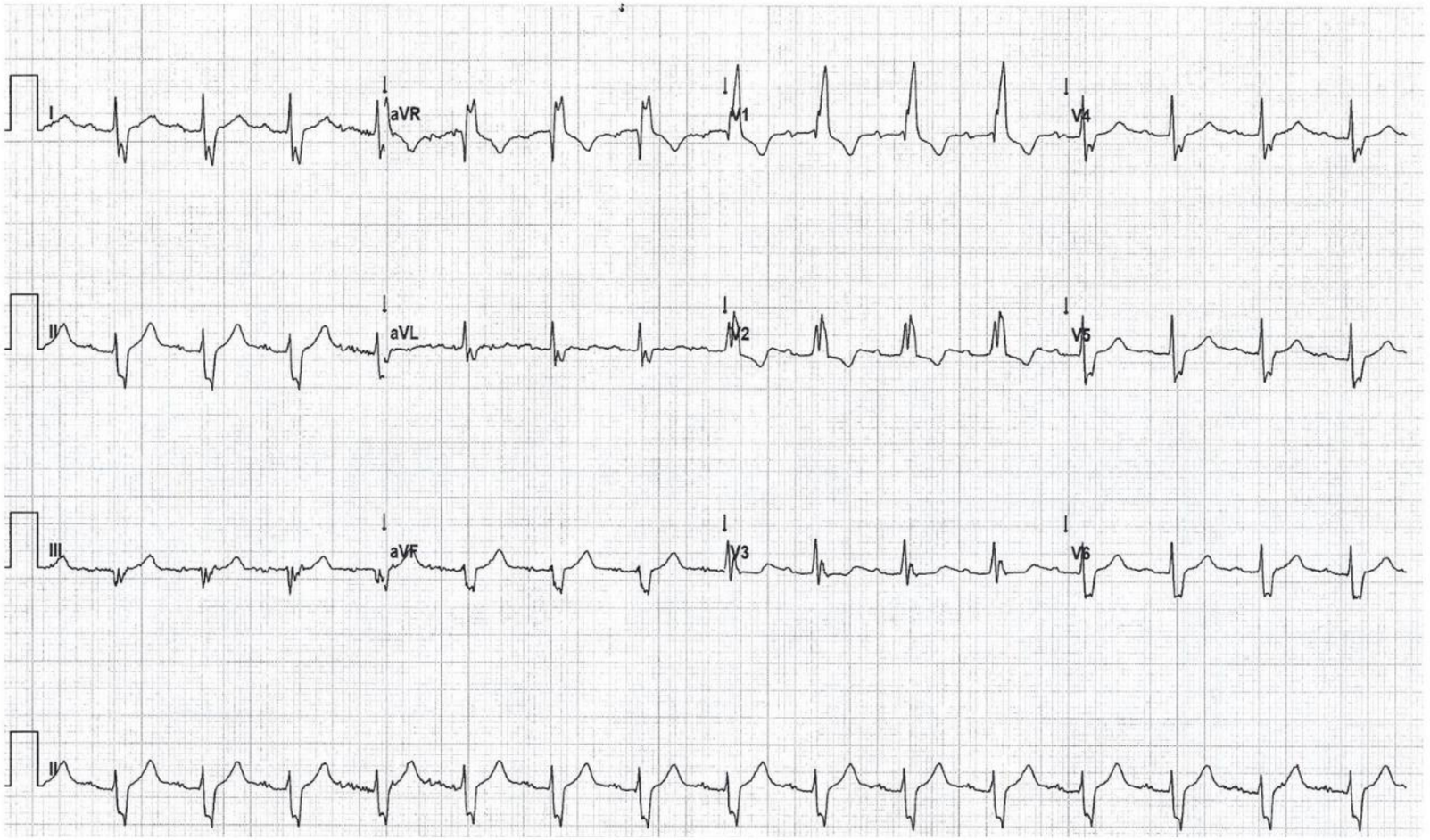
10. Chief Complaint Based Approach



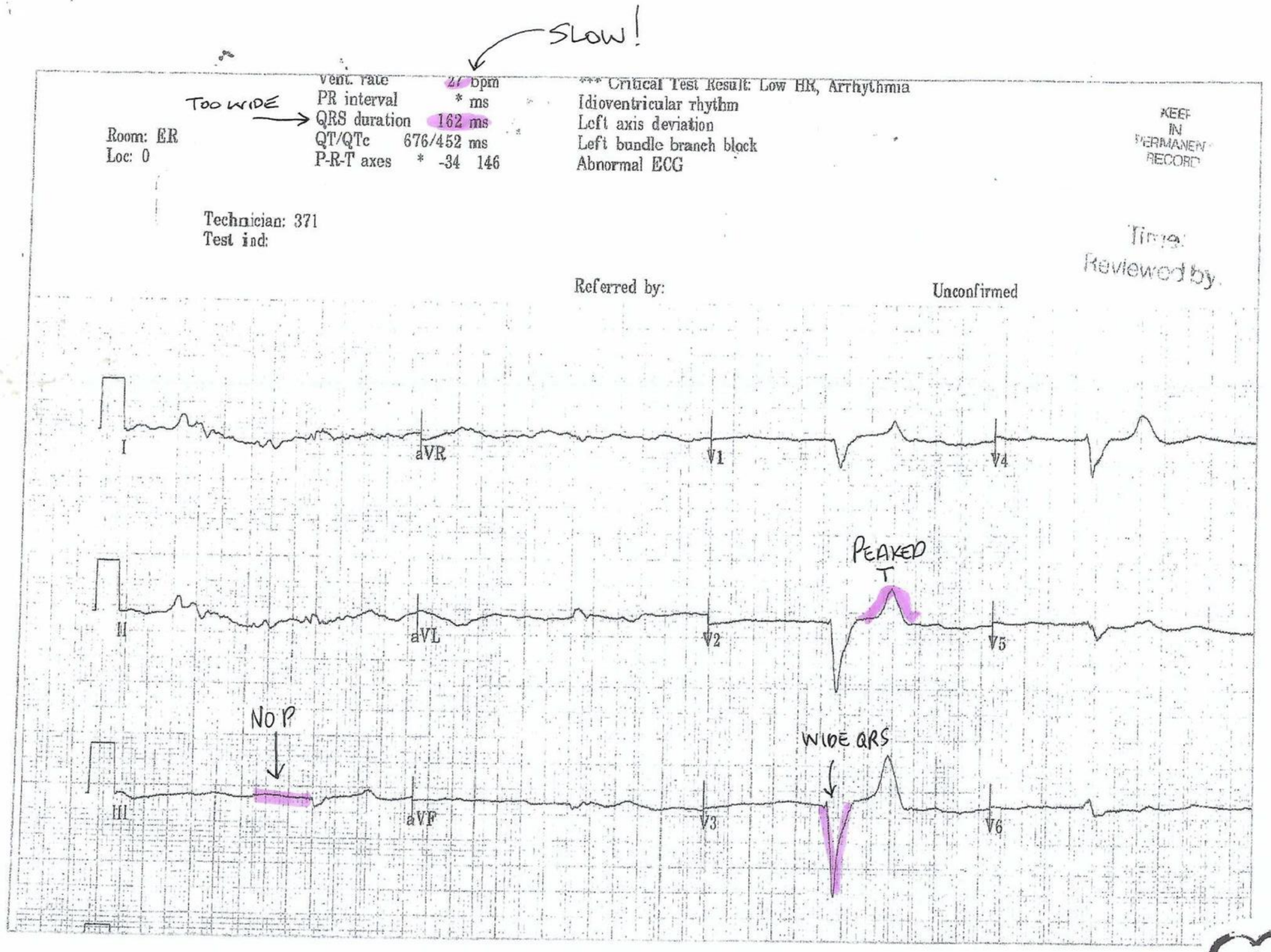
PR int: 203 ms
QRS dur: 146 ms
QT/QTc: 382 / 432 ms
P-R-T axes: 15 -84 56

ABNORMAL ECG

UNCONFIRMED REPORT

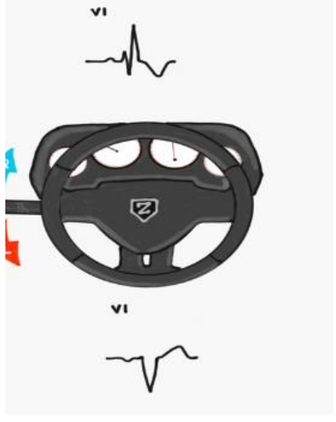


EKG #2

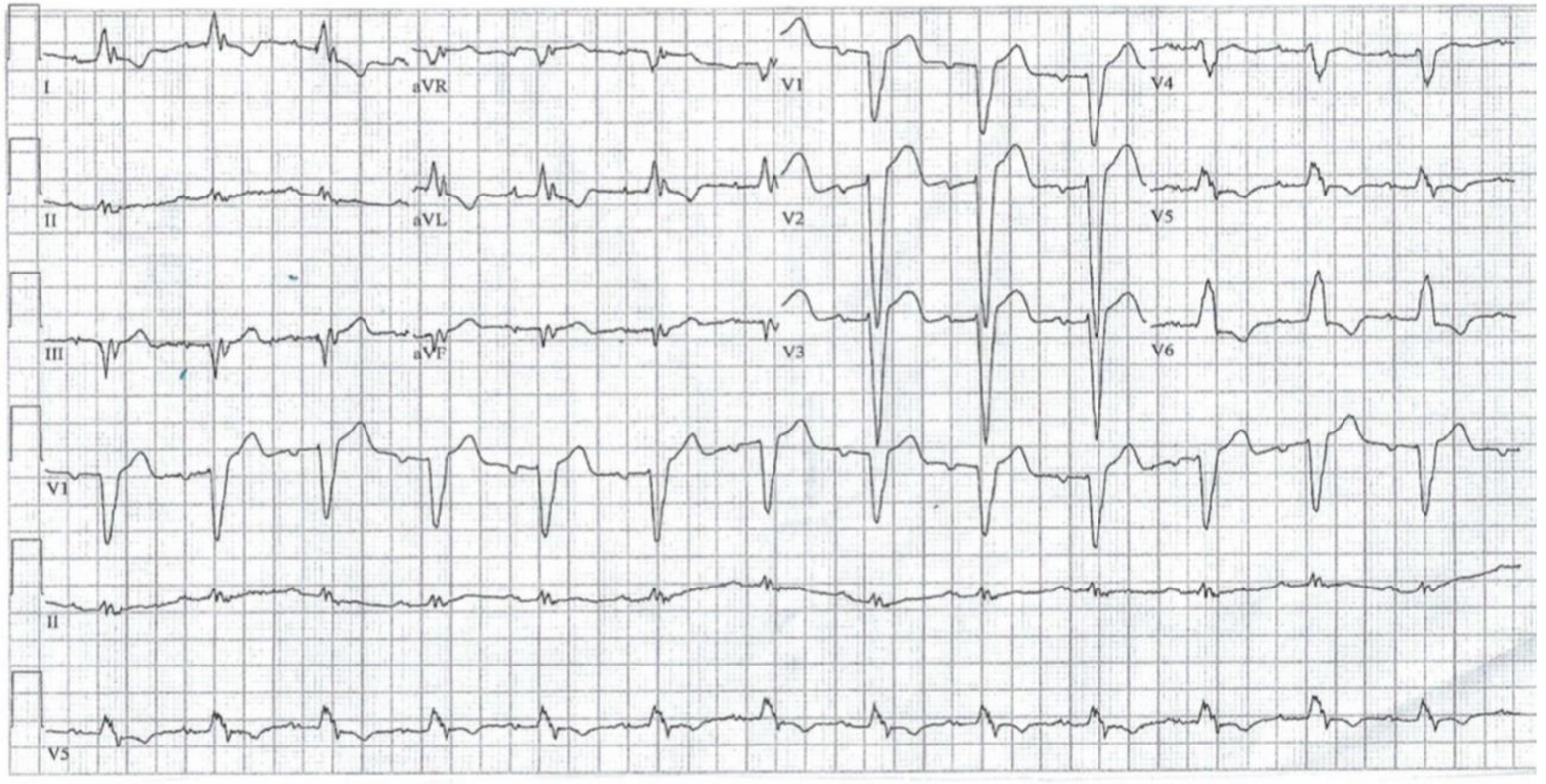


5. Prolonged QT

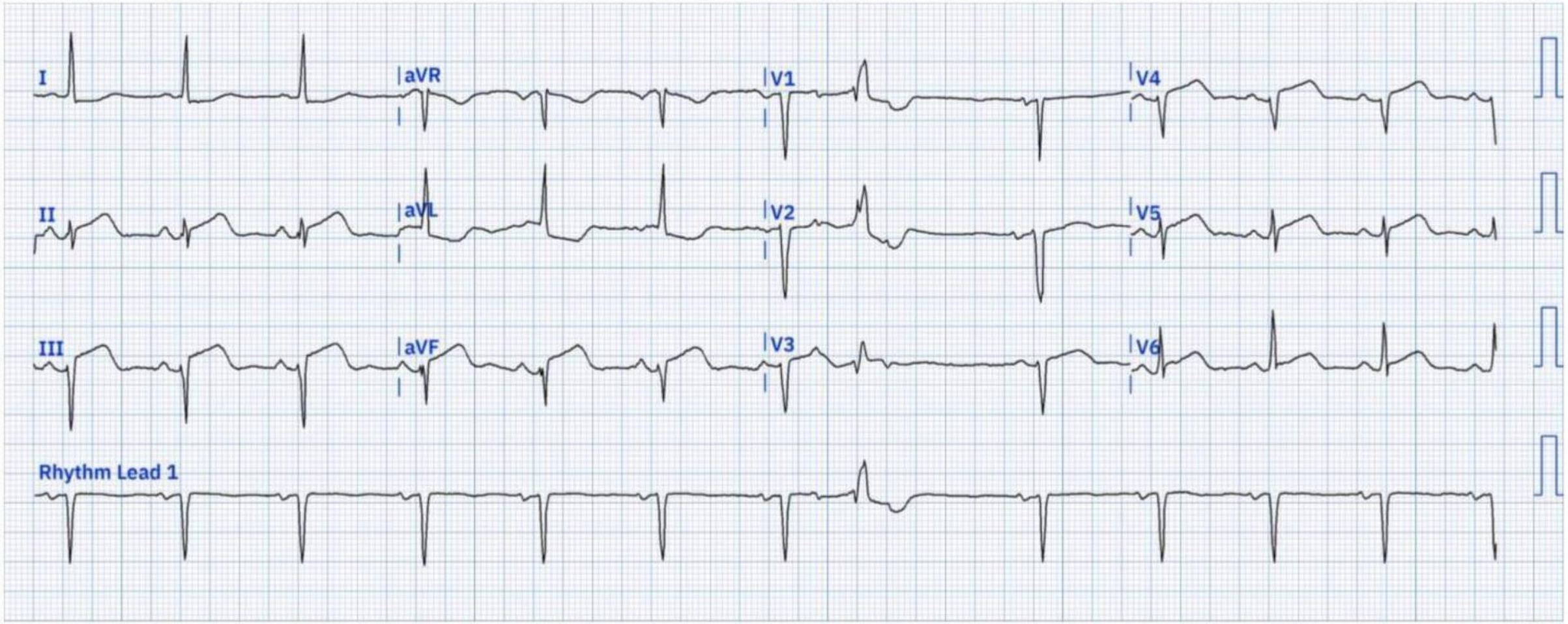
1. Bradycardia 2. WIDE QRS 3. No P wave. 4. PEAKED T



Vent. rate	81	BPM	SINUS RHYTHM WITH 1ST DEGREE A-V BLOCK
PR interval	220	ms	LEFT BUNDLE BRANCH BLOCK
QRS duration	150	ms	ABNORMAL ECG
QT/QTc	414/480	ms	NO PREVIOUS ECGS AVAILABLE
P-R-T axes	34 -26	130	



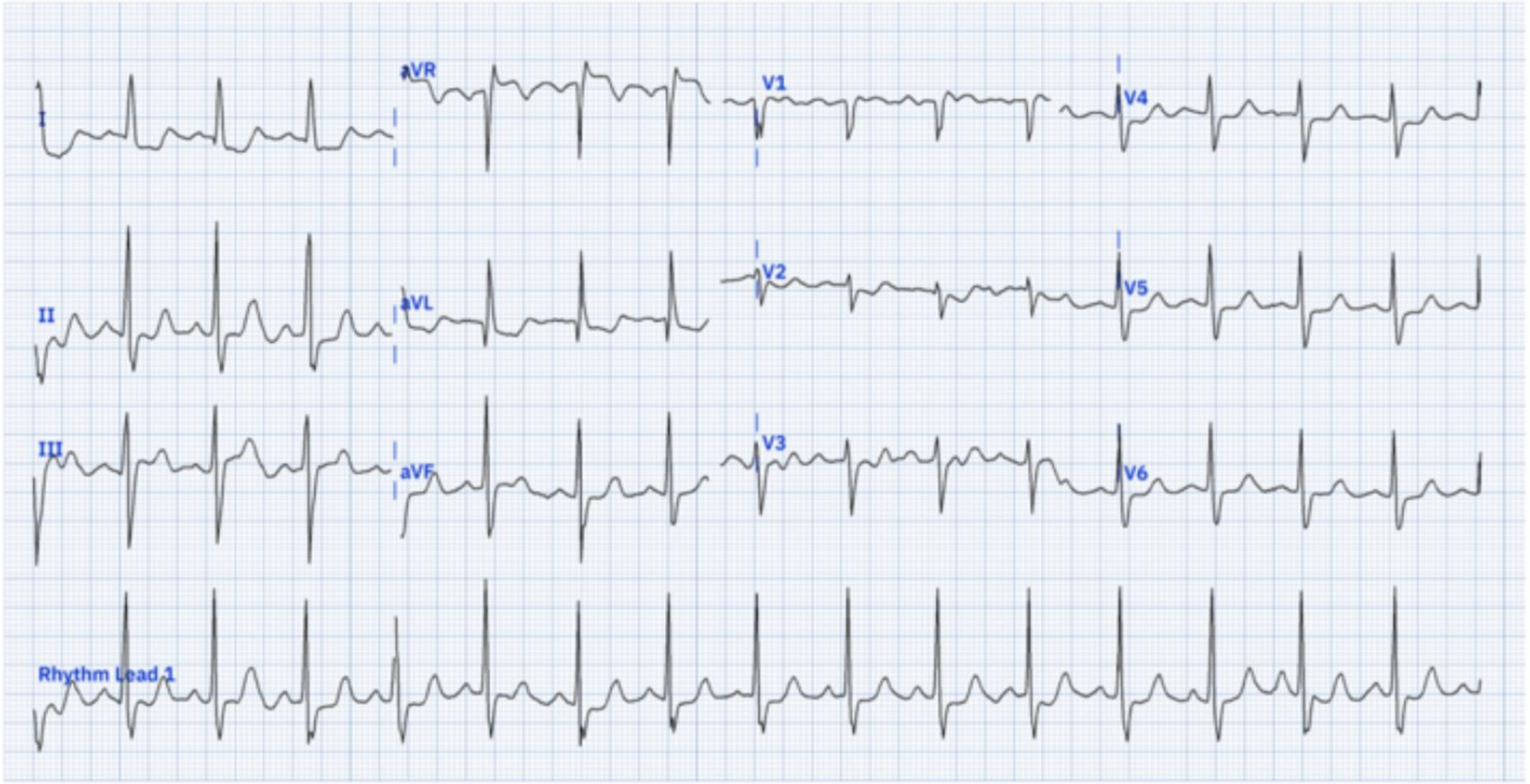
EKG #3



58 y/o M with chest pain and diaphoresis

EKG #4

95 bpm	Normal	QRS Duration	118 ms
		QT / QTcFra	389 / 446 ms
		PP Interval	630 ms



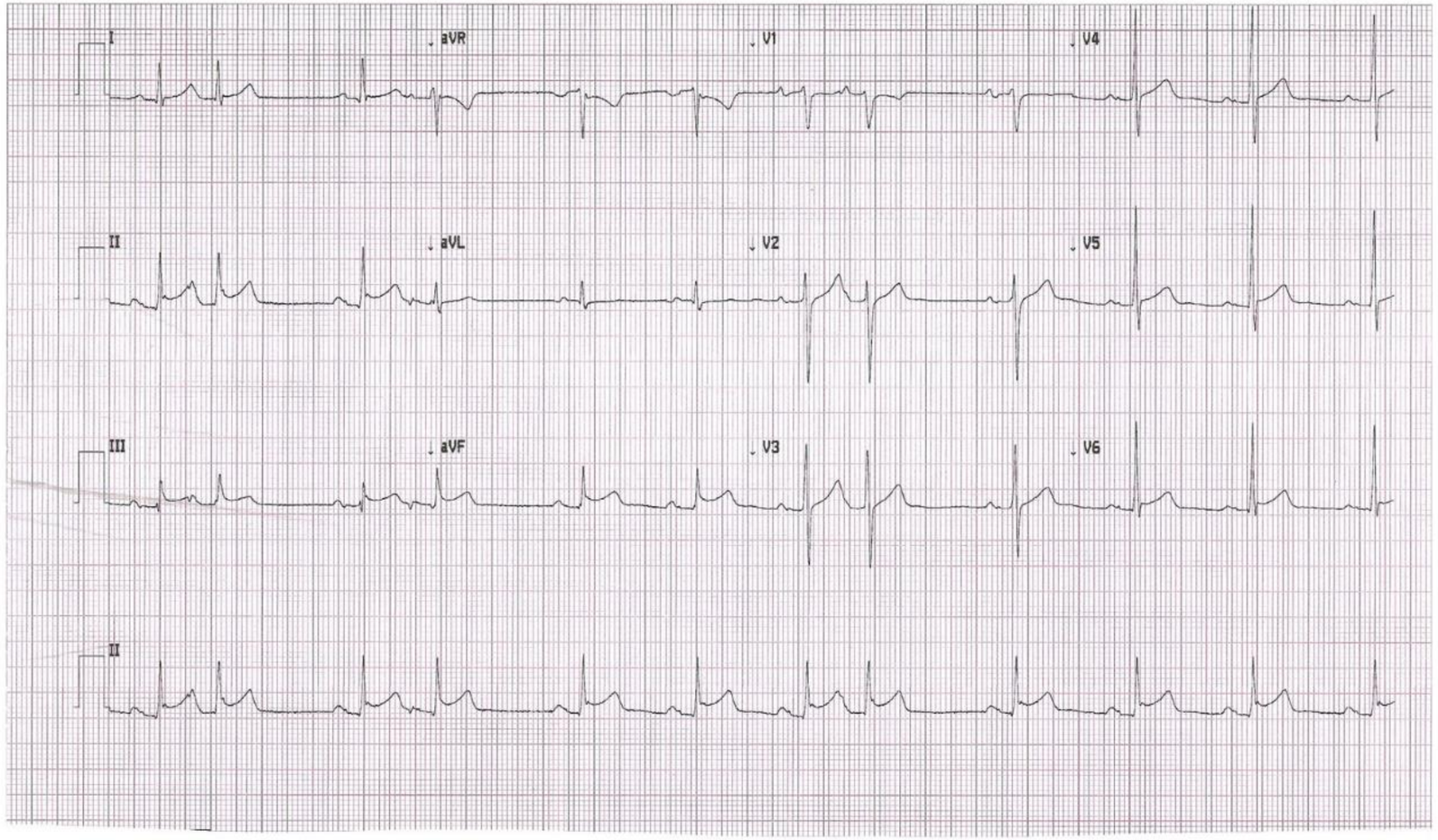
79 y.o M with left shoulder pain “when I work out”

EKG #5

Vent rate	70 BPM
PR int	197 ms
QRS dur	97 ms
QT/QTc	376/397 ms
P-R-T axes	59 51 59

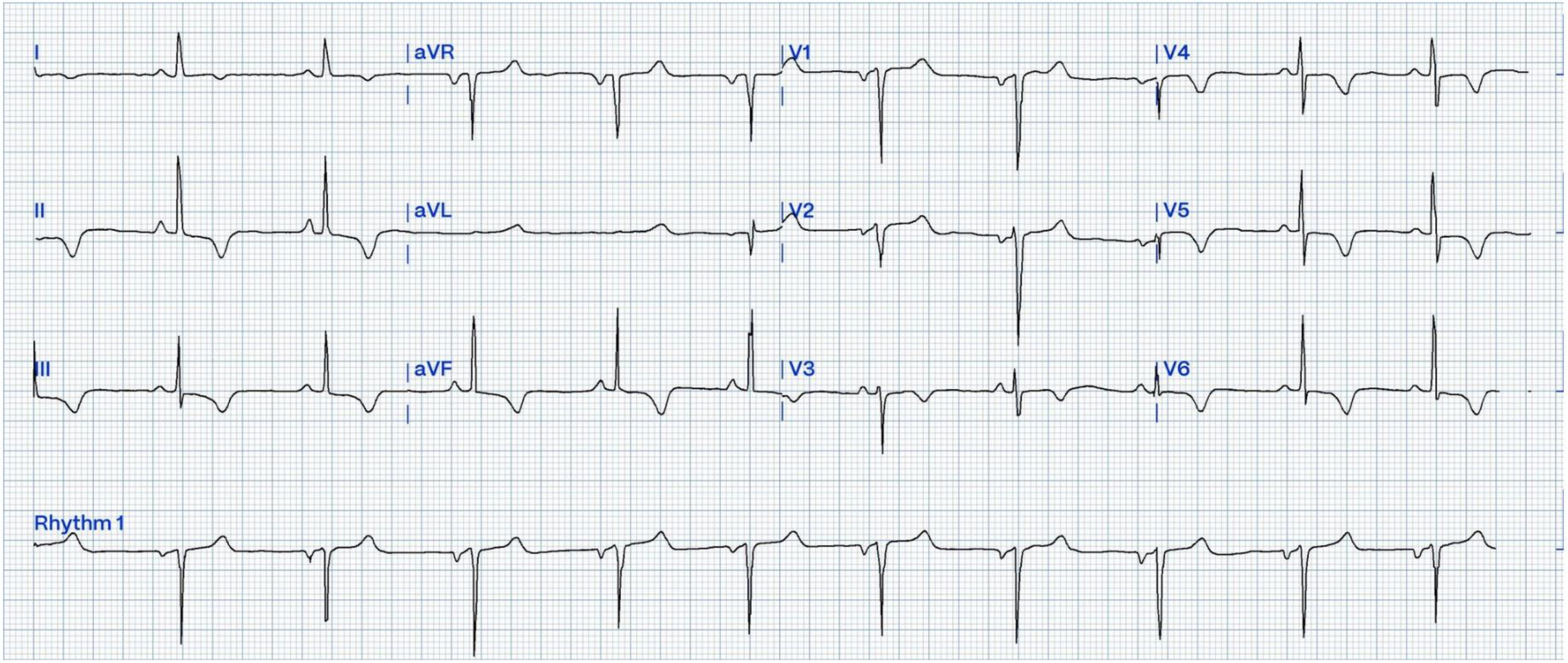
SINUS RHYTHM WITH OCCASIONAL SUPRAVENTRICULAR PREMATURE COMPLEXES
ST ELEVATION, CONSIDER INFERIOR INJURY [MARKED ST ELEVATION W/O NORMALLY INFLECTED T WAVE IN II/aVF]
ACUTE MI

UNCONFIRMED REPORT



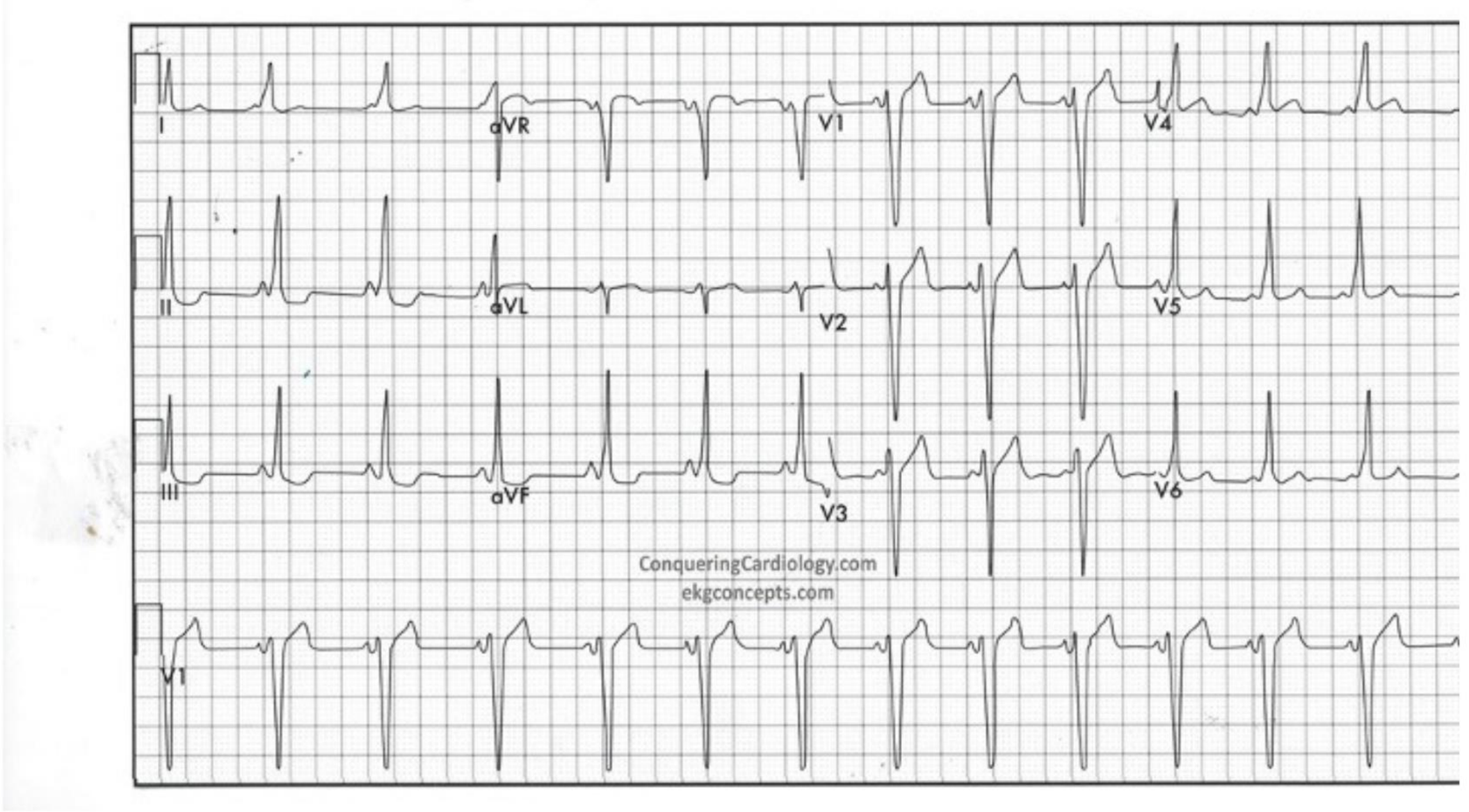
70 y.o M with back pain radiated to my chest better with Motrin

EKG #6



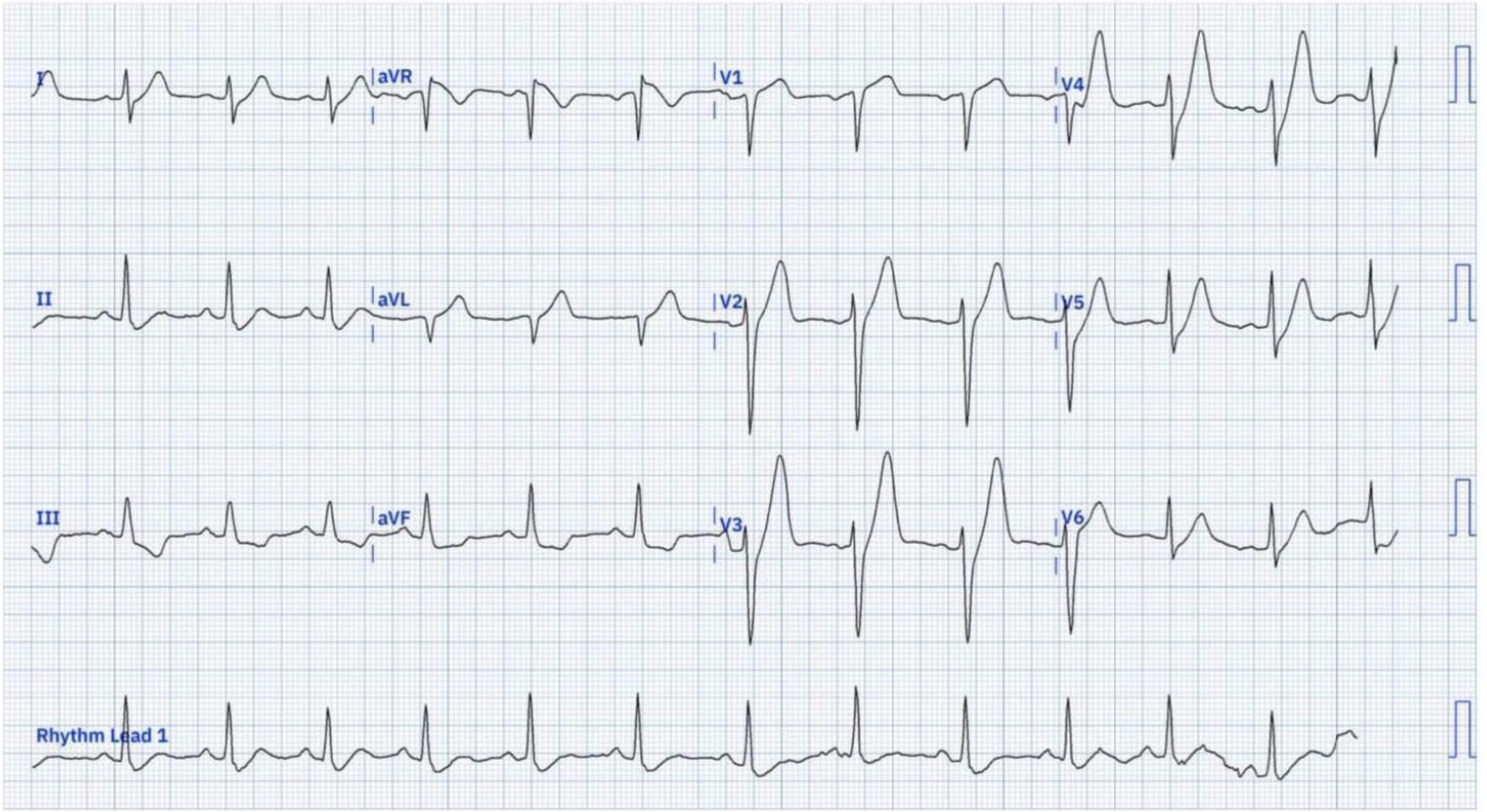
56 y.o Male crushing chest pain

EKG #7



18 y.o M with palpitations

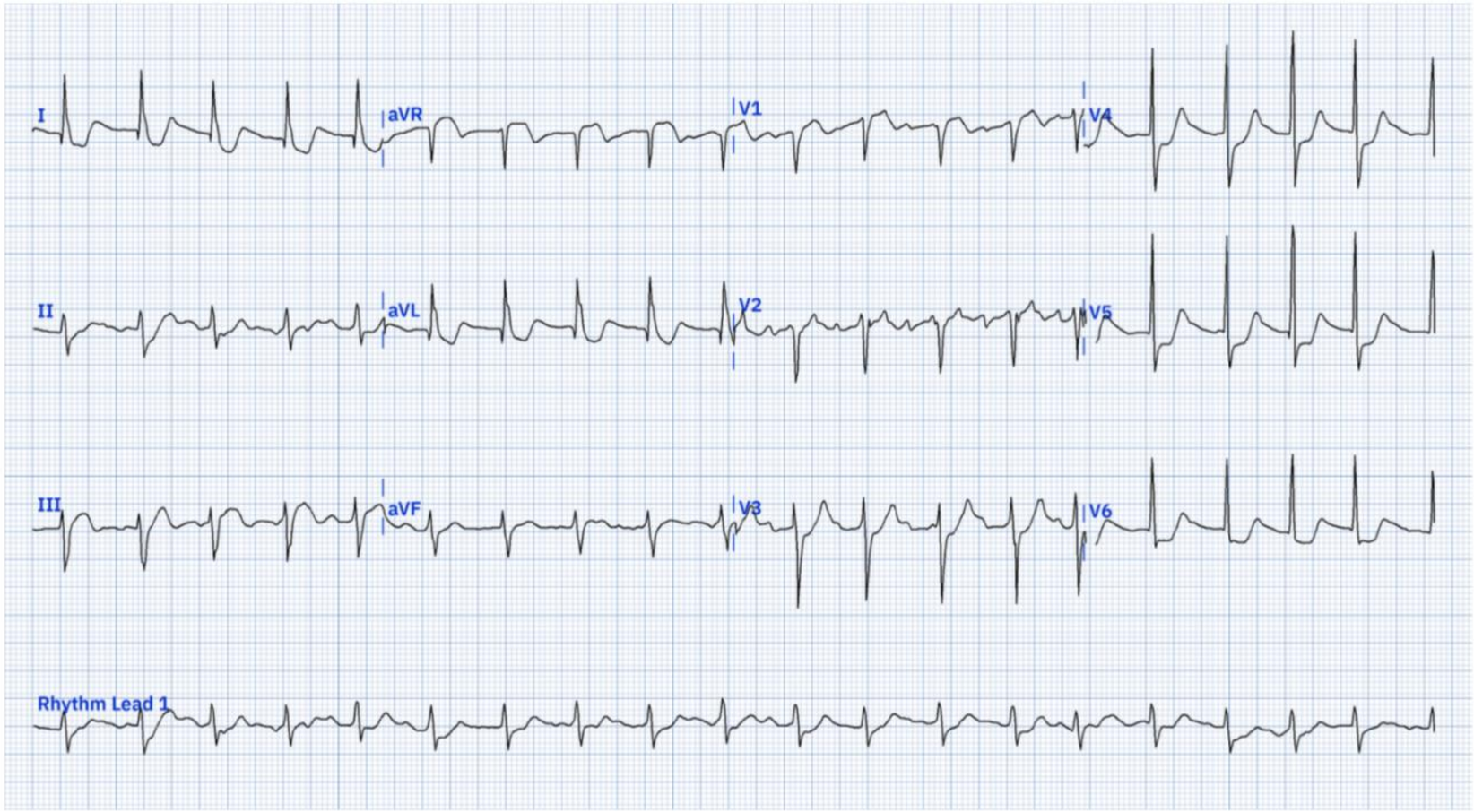
EKG #8



69 y.o M with chest pain

EKG #9

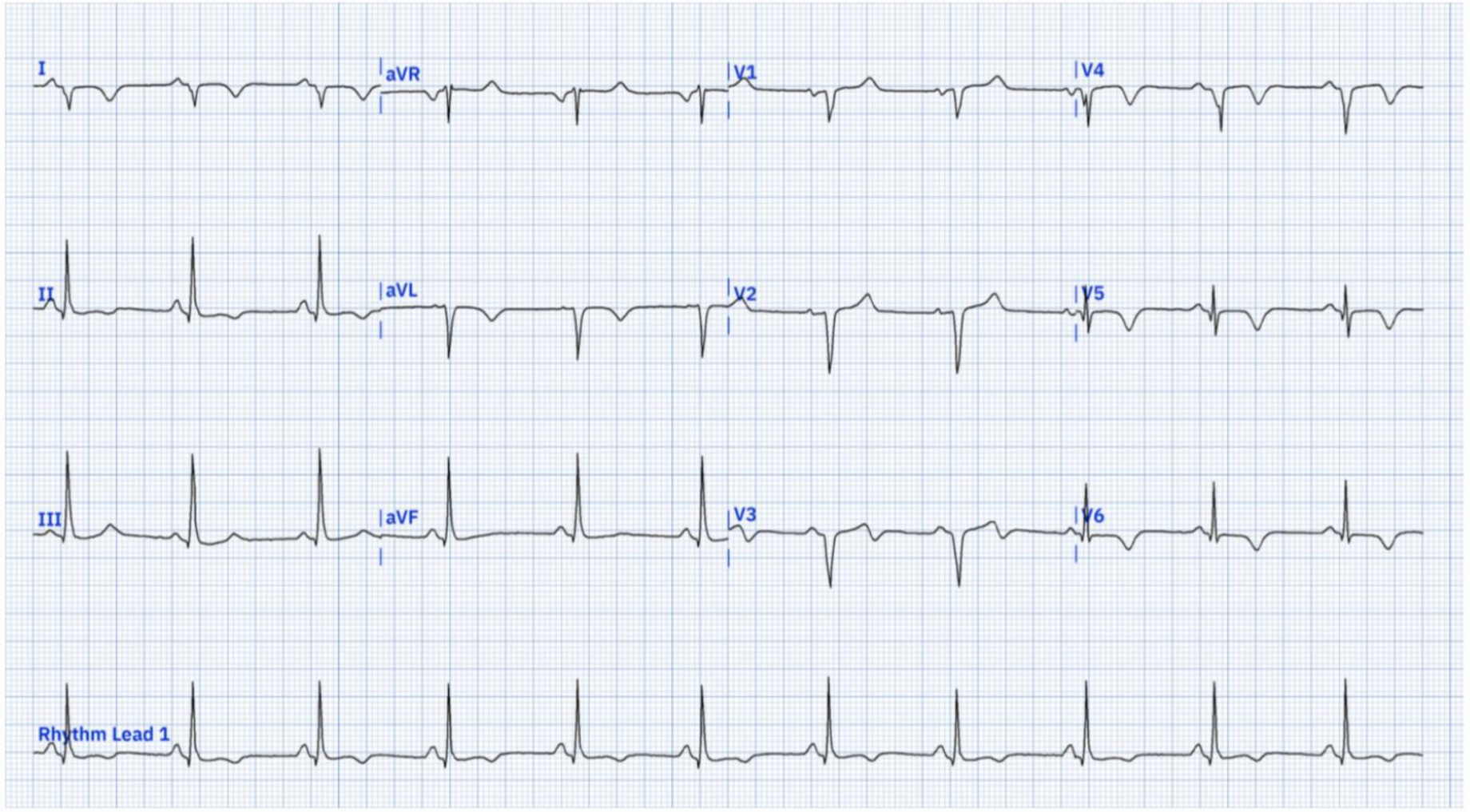
Heart rate	Cardiac Axis				
115 bpm	Normal	PR Interval	0 ms	RR Interval	521 ms
		QRS Duration	92 ms	PP Interval	0 ms
		QT / QTcFra	340 / 413 ms		



67 y.o M with L shoulder pain “when I work out”

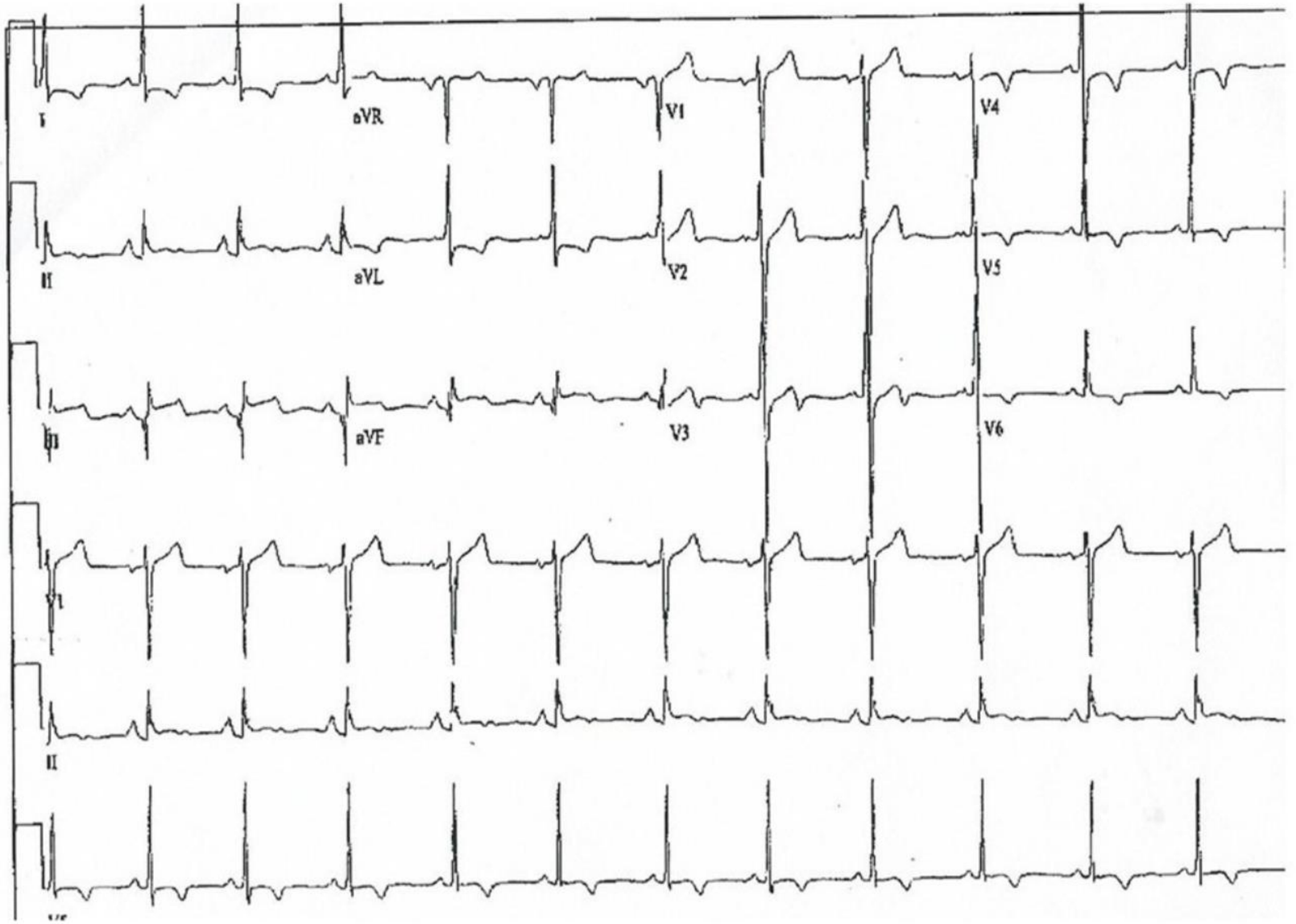
EKG #10

Heart rate	Cardiac Axis				
65 bpm	Right	PR Interval	143 ms	RR Interval	920 ms
		QRS Duration	95 ms	PP Interval	920 ms
		QT / QTcFra	418 / 431 ms		



58 y.o M post cardiac arrest

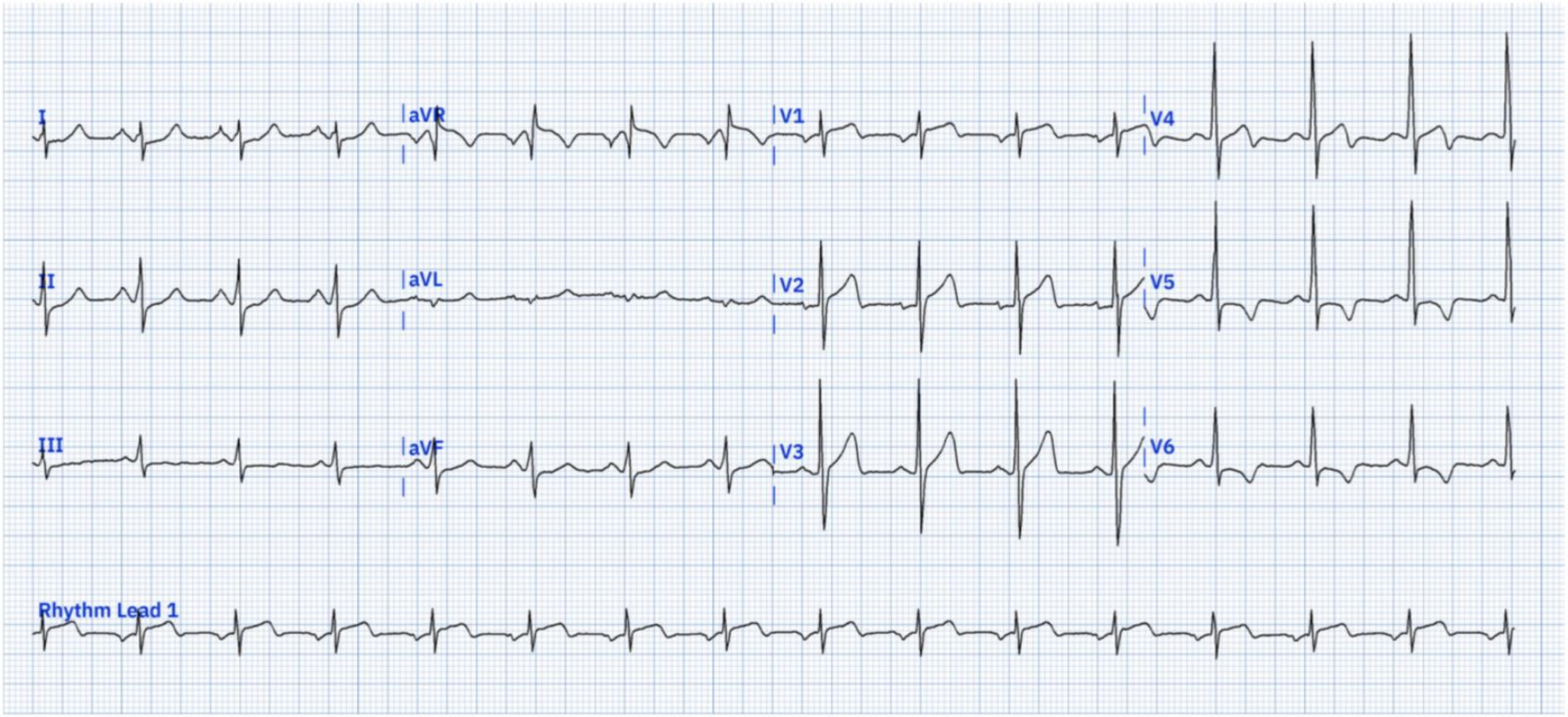
EKG #11



64 y.o F with chest pain and dyspnea

EKG #12

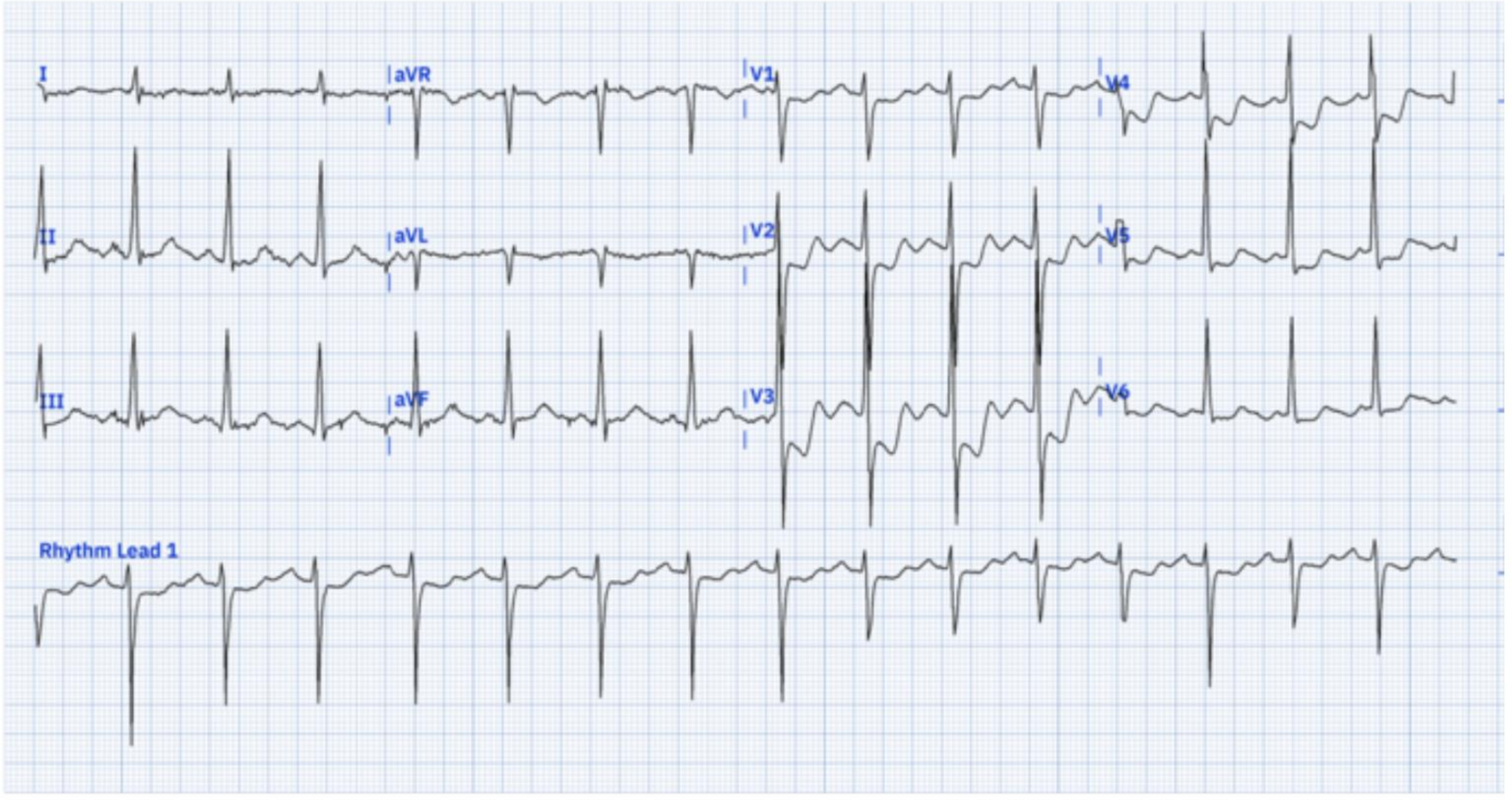
QRS :	80 ms	Normal sinus rhythm
QT / QTcBaz :	348 / 428 ms	Possible Left atrial enlargement
PR :	144 ms	ST & T wave abnormality, consider lateral ischemia
P :	122 ms	Abnormal ECG
RR / PP :	658 / 659 ms	
P / QRS / T :	47 / 89 / 32 degrees	



66 y.o M chest pain for 3 days won’t go to the ER

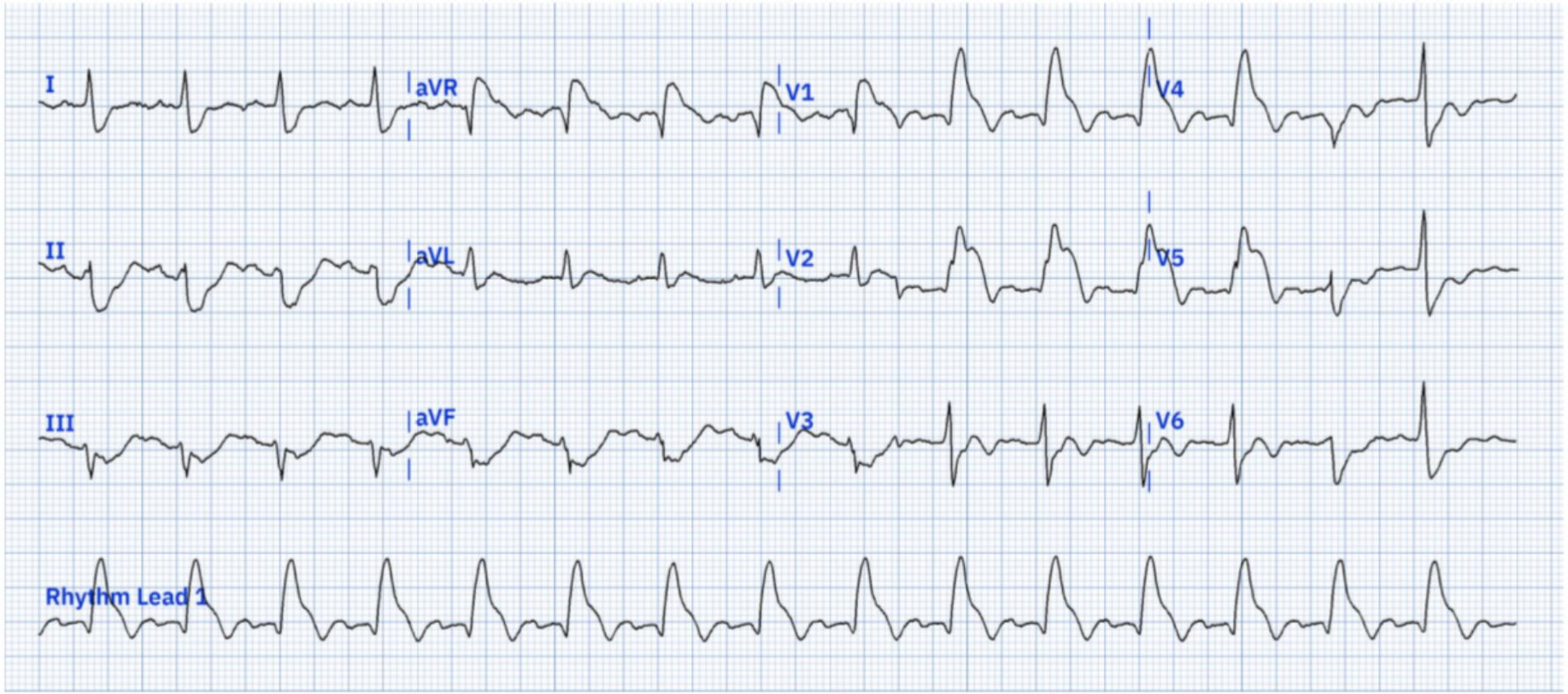
EKG #13

Heart rate	Cardiac Axis	PR Interval	163 ms	RR Interval	604 ms
99 bpm	Normal	QRS Duration	108 ms	PP Interval	604 ms
		QT / QTcFra	374 / 435 ms		



60 y.o Male with indigestion not better with tums

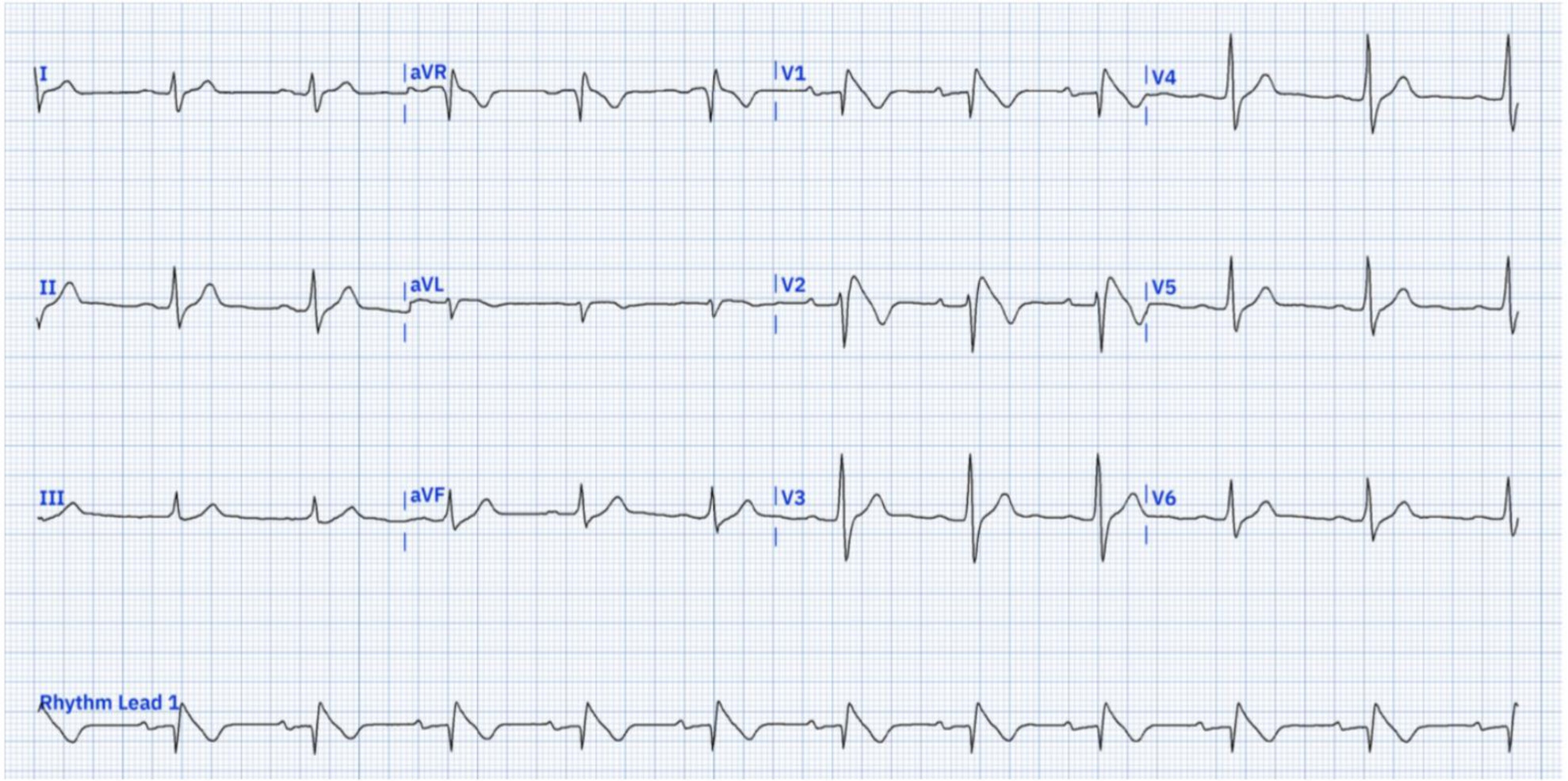
EKG #14



72 y.o M with chest pain that radiates to the left arm

EKG #15

Heart rate	Cardiac Axis				
67 bpm	Normal	PR Interval	200 ms	RR Interval	890 ms
		QRS Duration	123 ms	PP Interval	890 ms
		QT / QTcFra	386 / 403 ms		



22 y.o M with syncope

EKG #16