

EKG

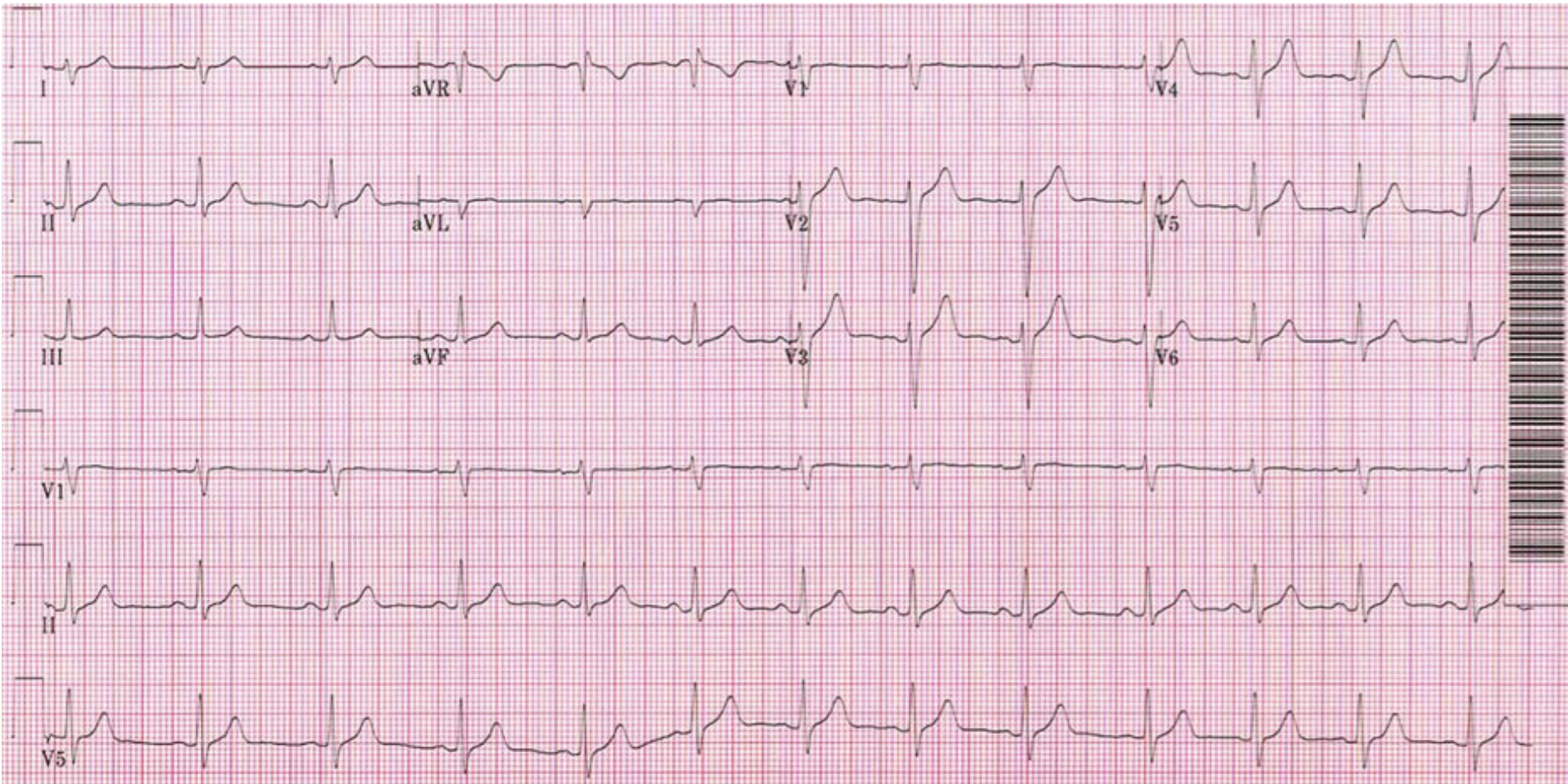
Akihiro Kobayashi MD PGY-4
General Cardiology Fellow

I will cover • • •

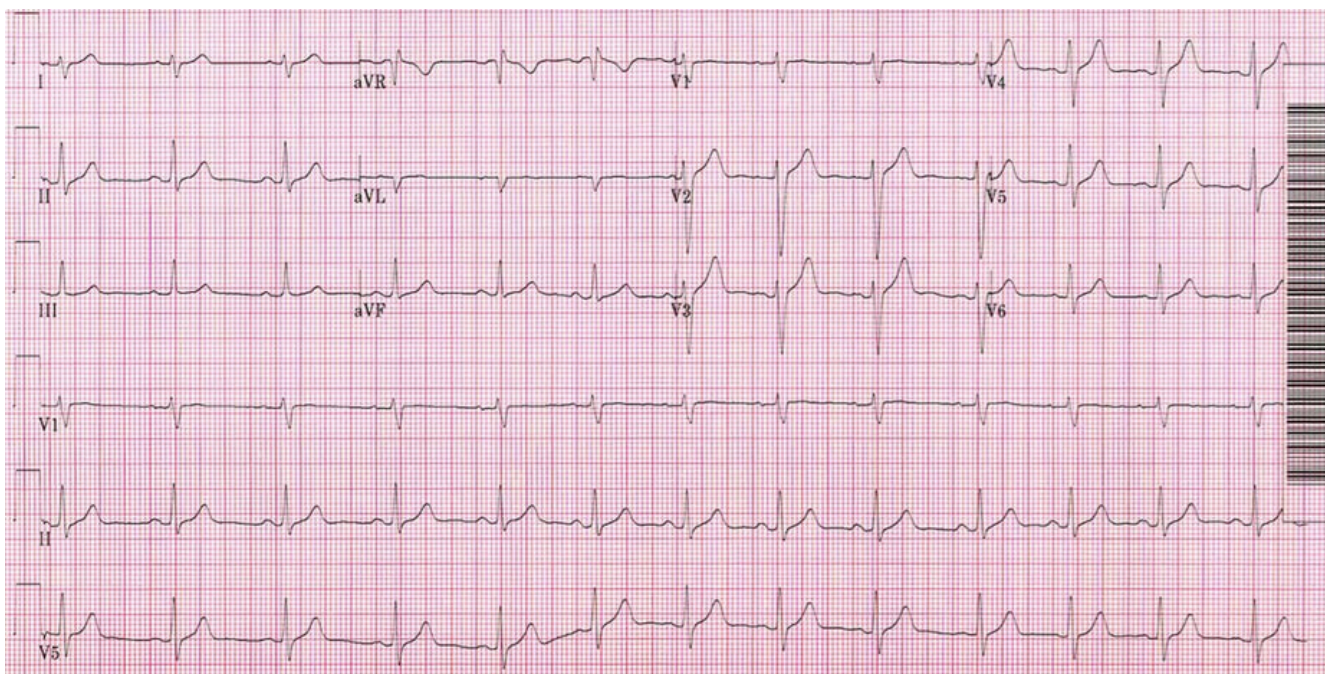
Case based EKG-reading practice

- Chest pain EKGX8
- Fast EKG X3
- Slow EKGX2

Case 0



Reading



HR: $13 \times 6 = 78$

Rhythm: Sinus

Axis: Slightly Right

QRS: Narrow

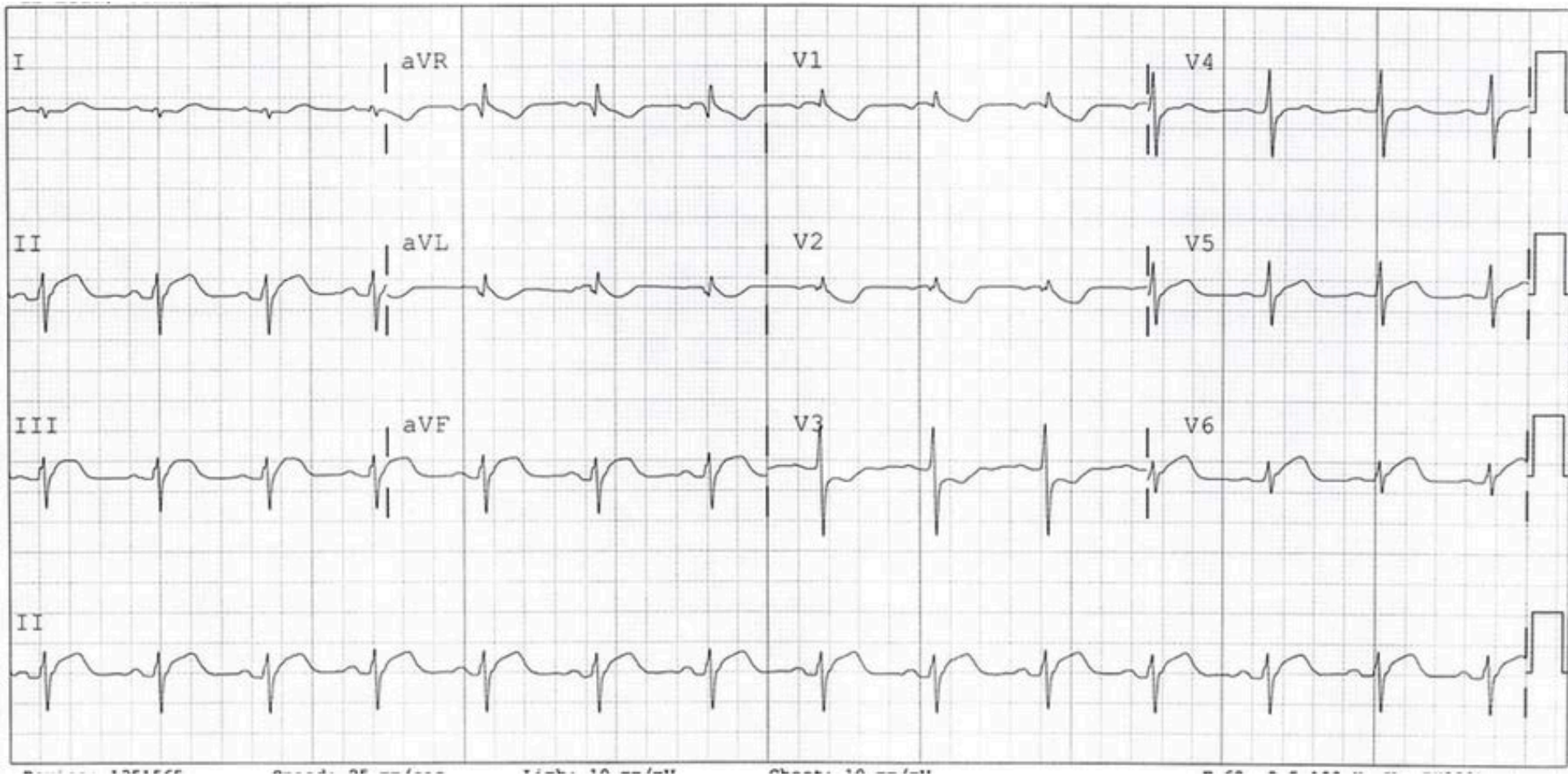
Q-wave: No

ST-T: OK

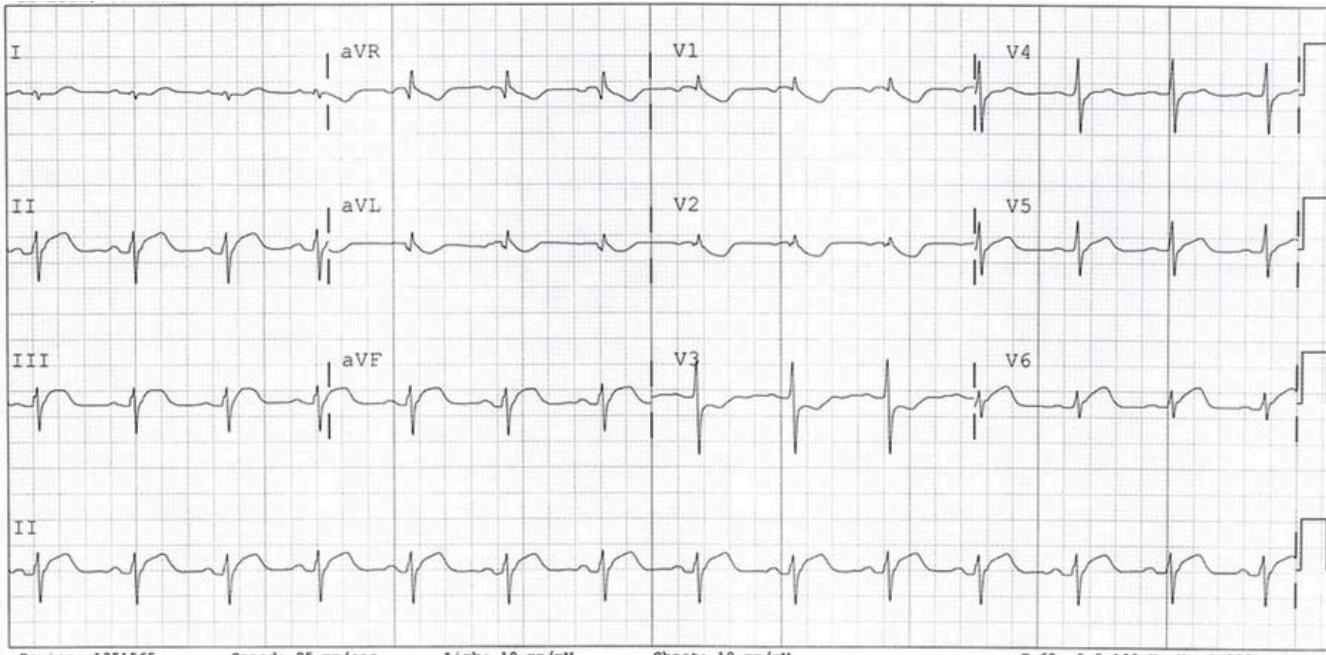
QT: Normal

Case 1

66 yo F HTN HLD p/w 5 hours of CP



Reading



HR: $14 \times 6 = 84$

Rhythm: Sinus

Axis: Left

QRS: Narrow

Q-wave: No

ST-T: STE and STD

QT: Normal

Definition of ST elevation

PRACTICE GUIDELINE

2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction

A Report of the American College of Cardiology Foundation/
American Heart Association Task Force on Practice Guidelines

*Developed in Collaboration With the American College of Emergency Physicians and
Society for Cardiovascular Angiography and Interventions*

ST elevation at J point in at least 2 contiguous leads

1) **Men: 2 mm in lead V2-V3**

2) **Women: 1.5 mm in leads V2–V3**

and/or

3) **1 mm** in other precordial or the limb leads

Why different Men vs. Women?

In healthy men:

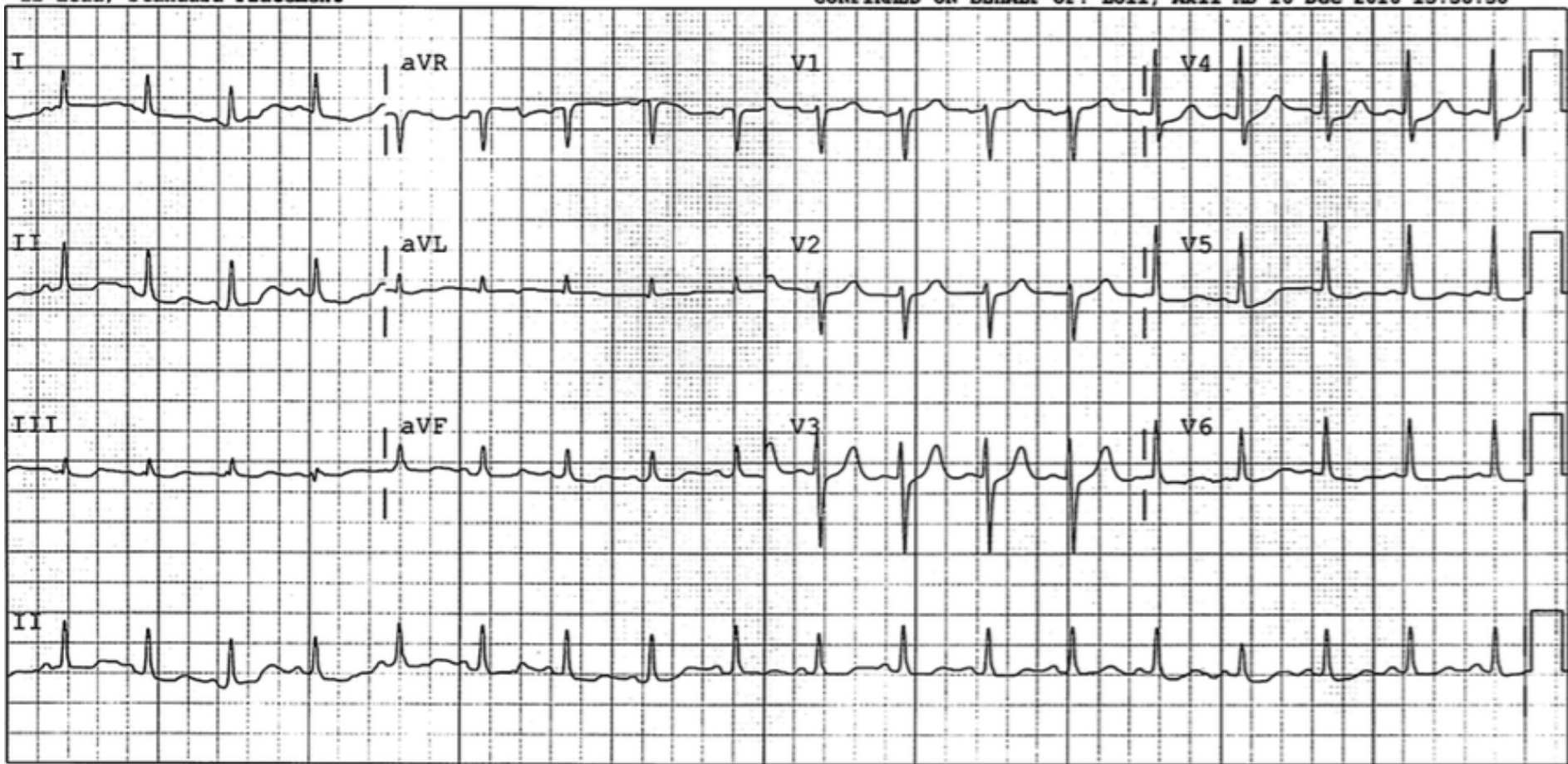
J-point elevation can be as much as 0.25 mV in leads V2 or V3, but it decreases with increasing age.

In healthy women:

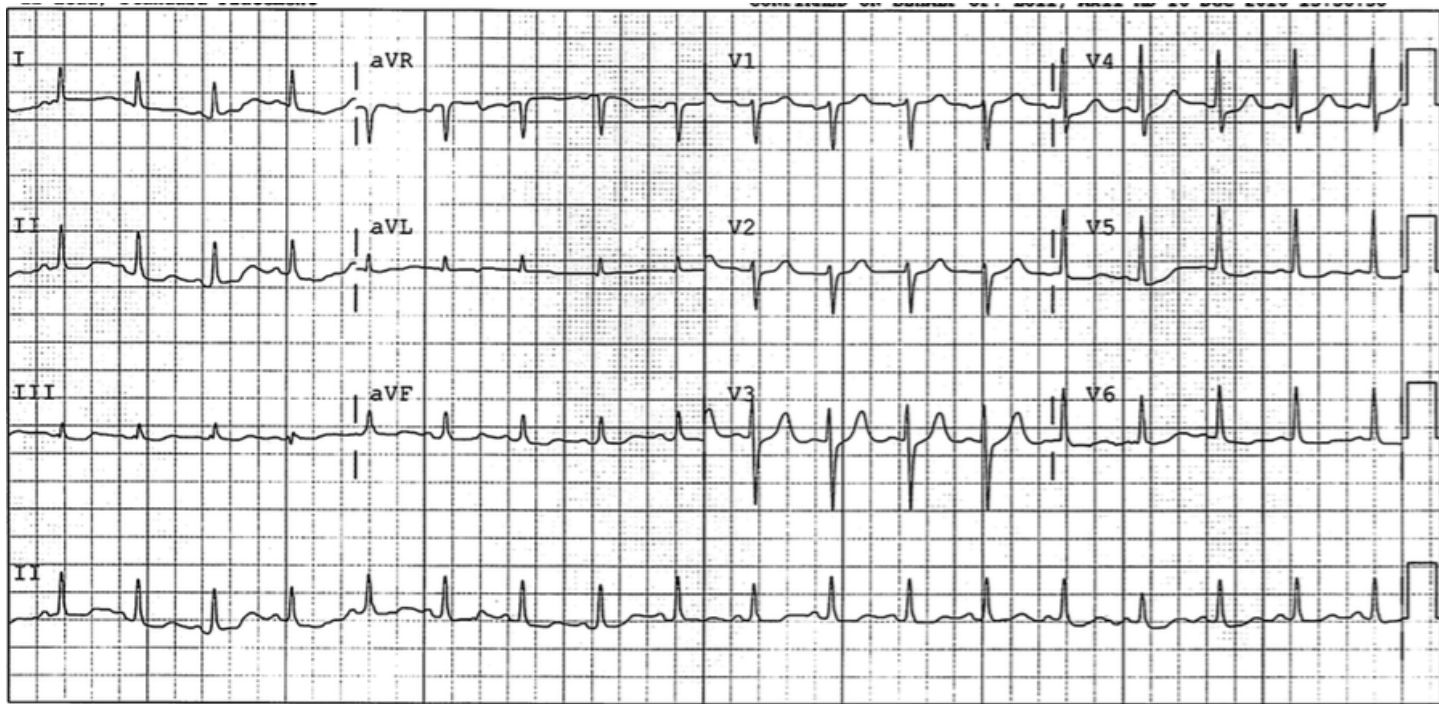
J point elevation in healthy women in leads V2 and V3 is less than in men.

Case 2

55 yo M with HTN HLD p/w 1 hour CP.



Reading



HR: $18 \times 6 = 128$

Rhythm: Sinus

Axis: Normal

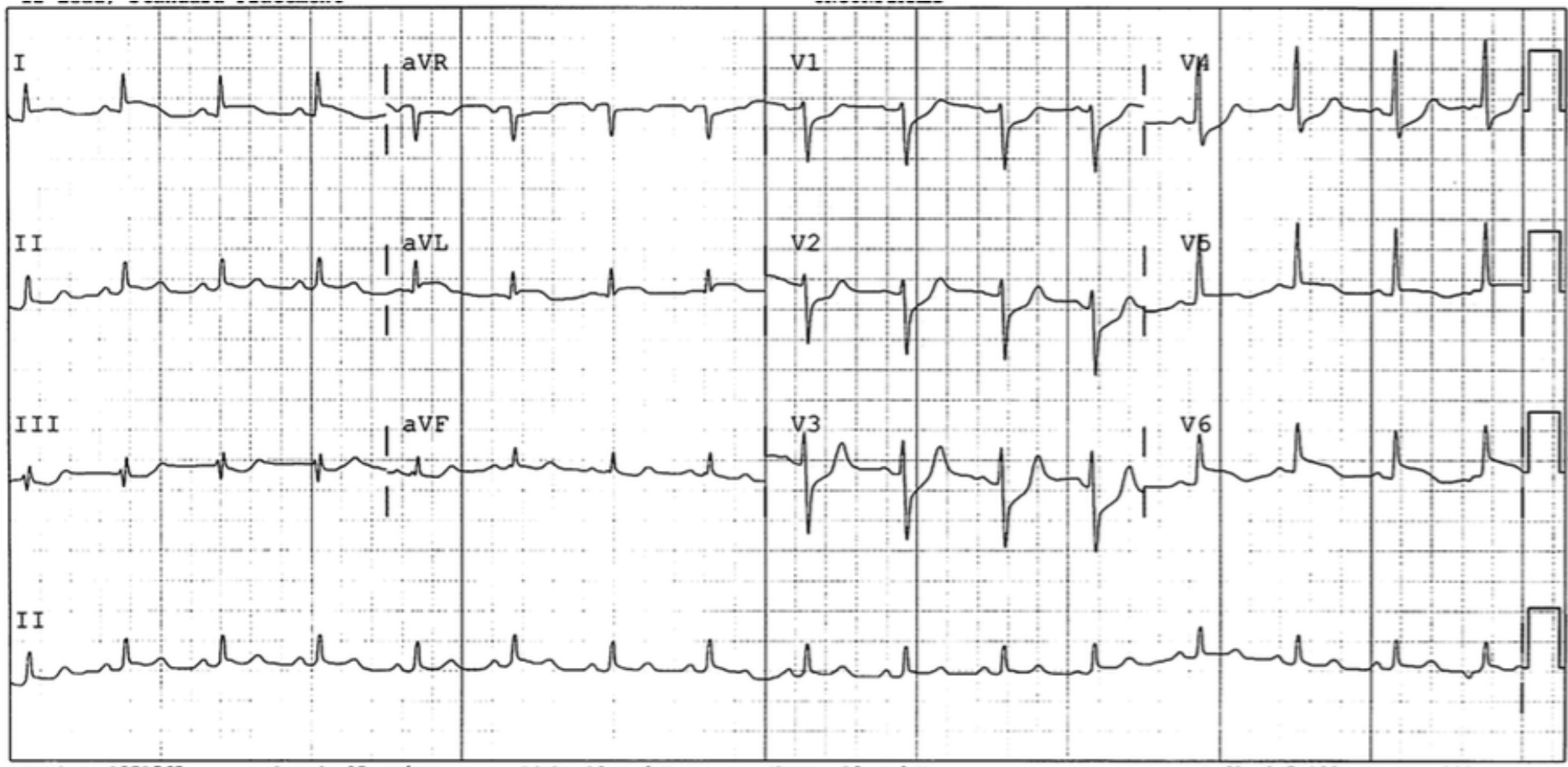
QRS: Narrow

Q-wave: No

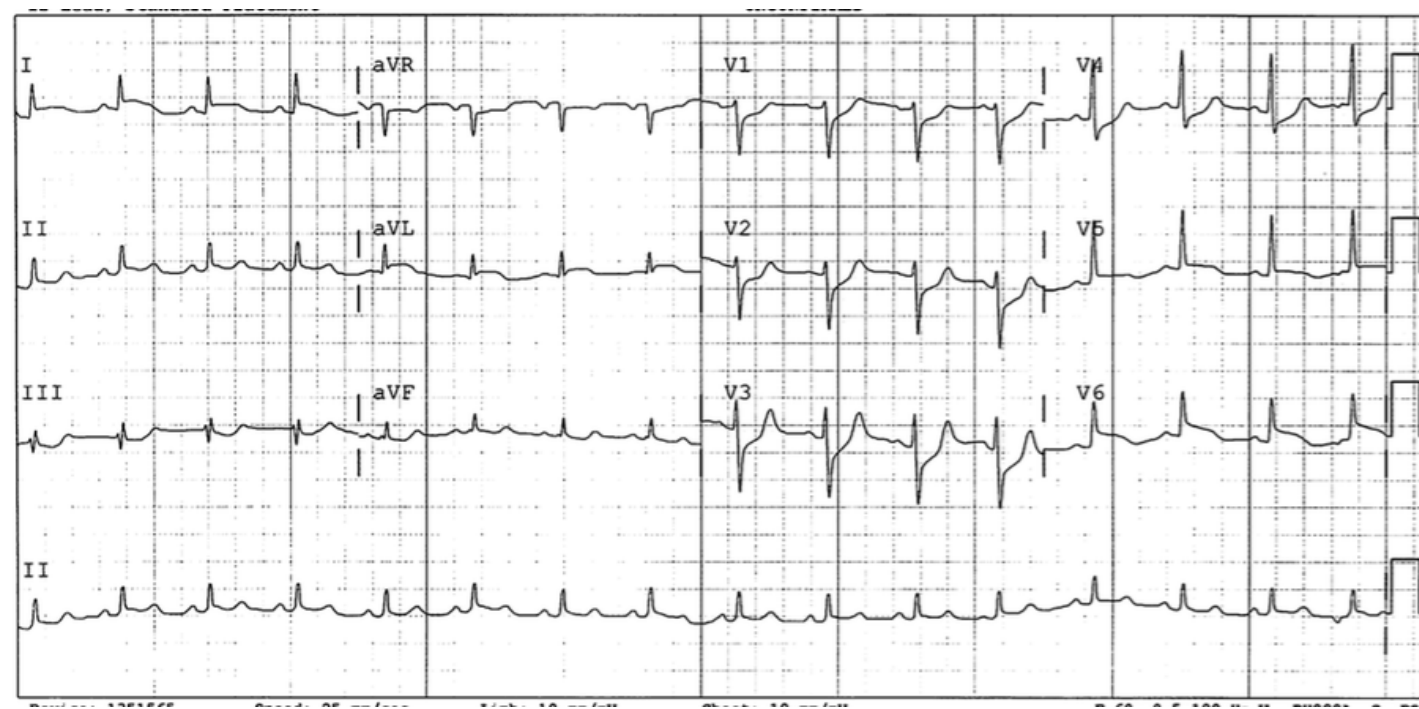
ST-T: Non spe

QT: Normal

Repeat EKG



Reading



HR: $16 \times 6 = 96$

Rhythm: Sinus

Axis: Normal

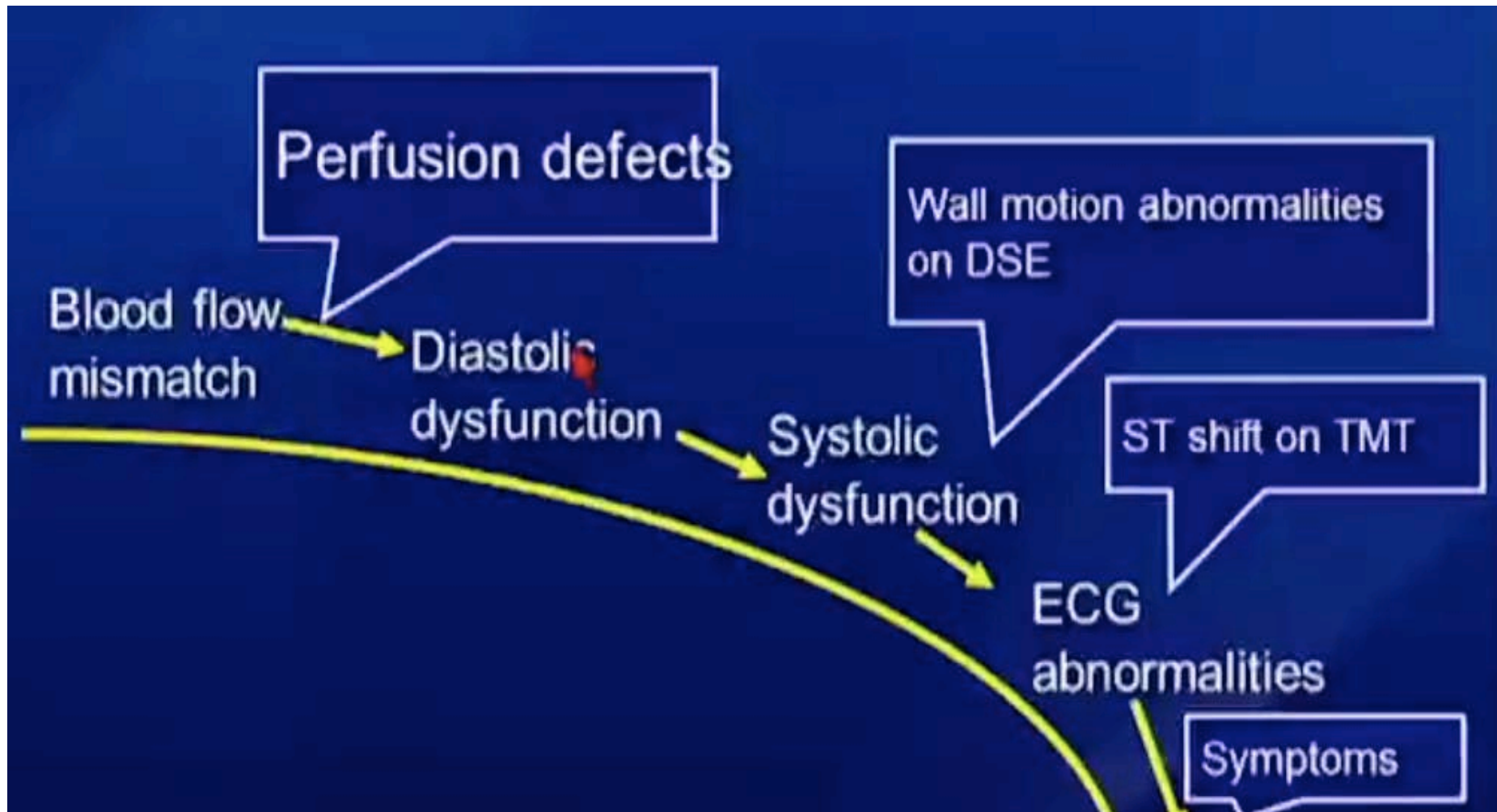
QRS: Narrow

Q-wave: No

ST-T: **STE/STD**

QT: Normal

Ischemic Cascade



Please repeat EKG

ESC/ACCF/AHA/WHF Expert Consensus Document

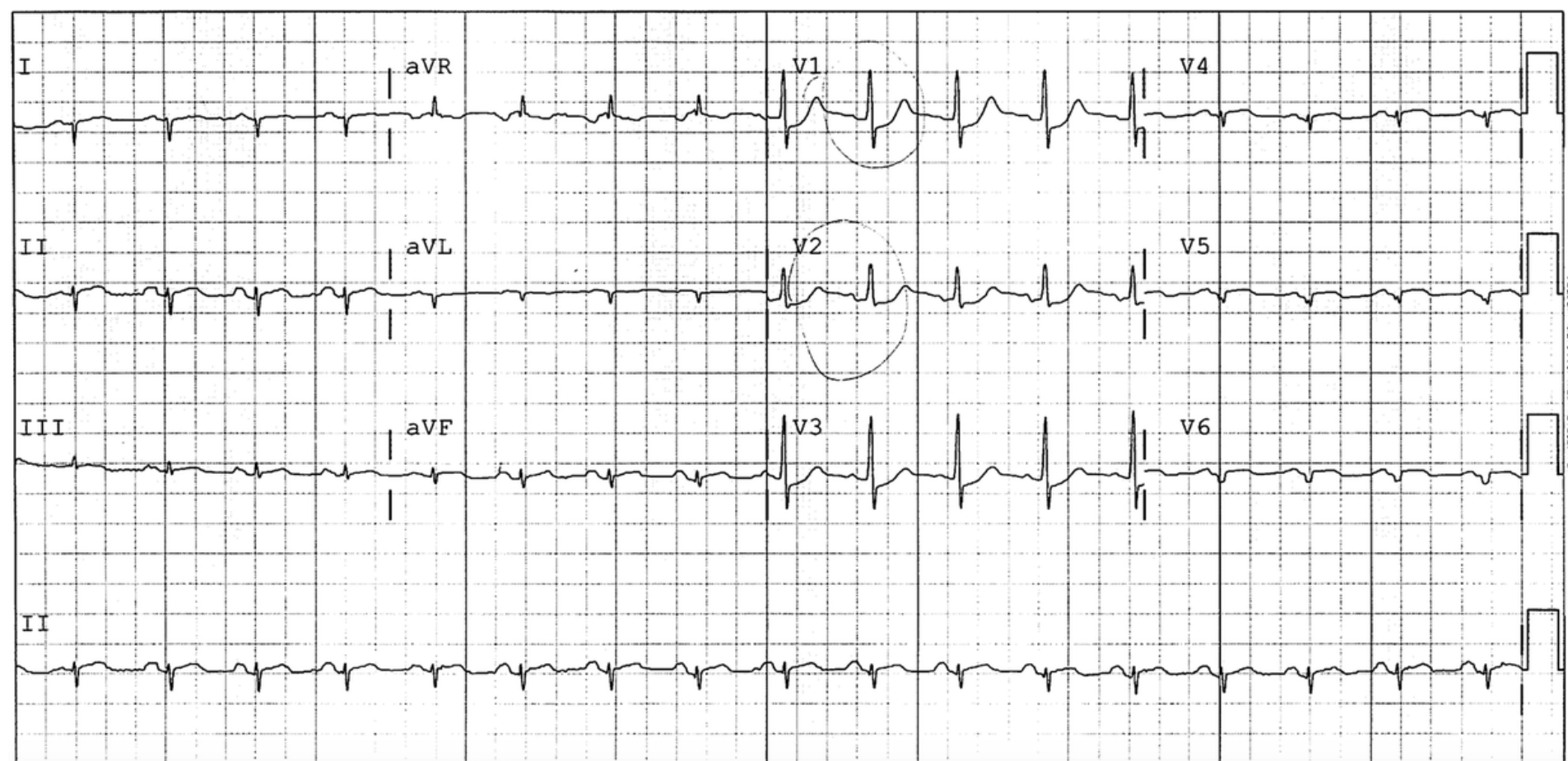
Third Universal Definition of Myocardial Infarction

Kristian Thygesen, Joseph S. Alpert, Allan S. Jaffe, Maarten L. Simoons, Bernard R. Chaitman, and Harvey D. White: the Writing Group on behalf of the Joint ESC/ACCF/AHA/WHF Task Force for the Universal Definition of Myocardial Infarction

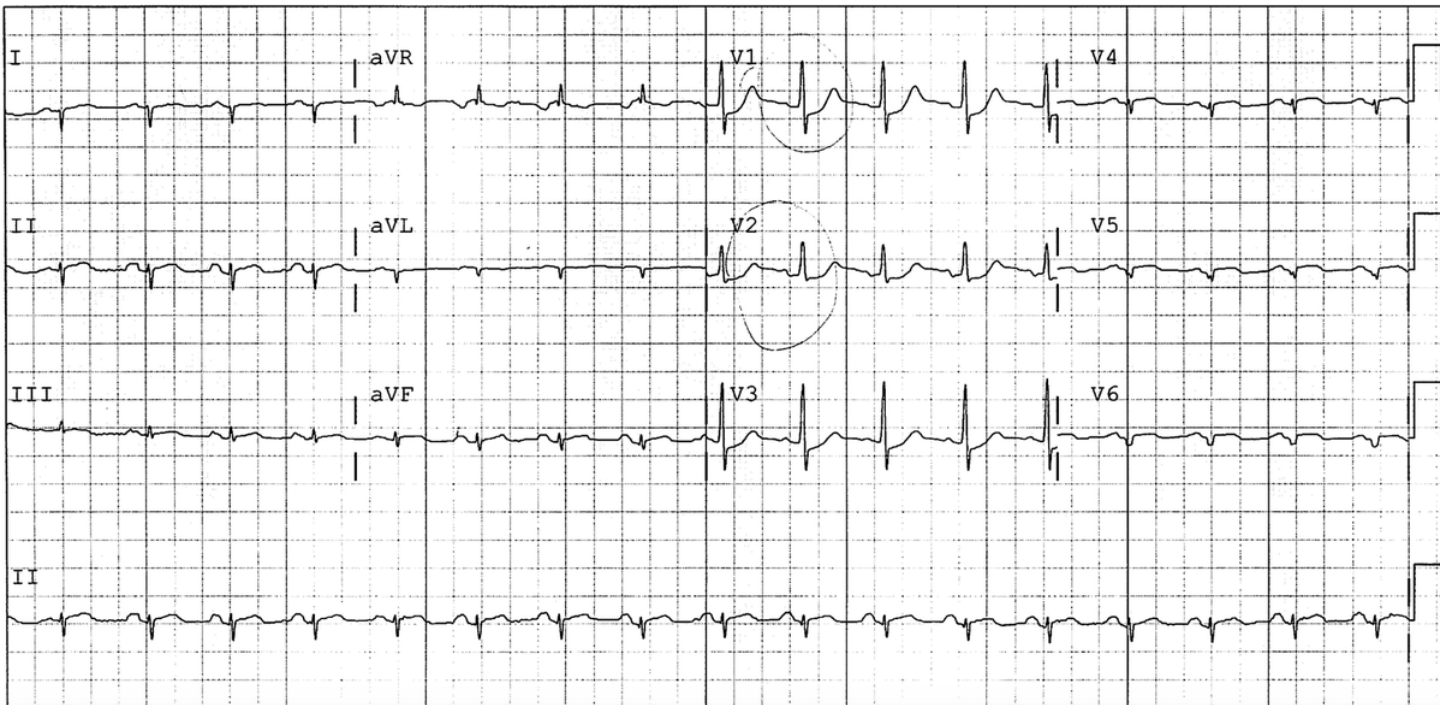
In a case of an initial EKG is non-diagnostic, repeat EKG should be performed at **15–30** min intervals.

Case 3

62 yo M with HTN p/w CP.



Reading



HR: $17 \times 6 = 102$

Rhythm: Sinus

Axis: Right

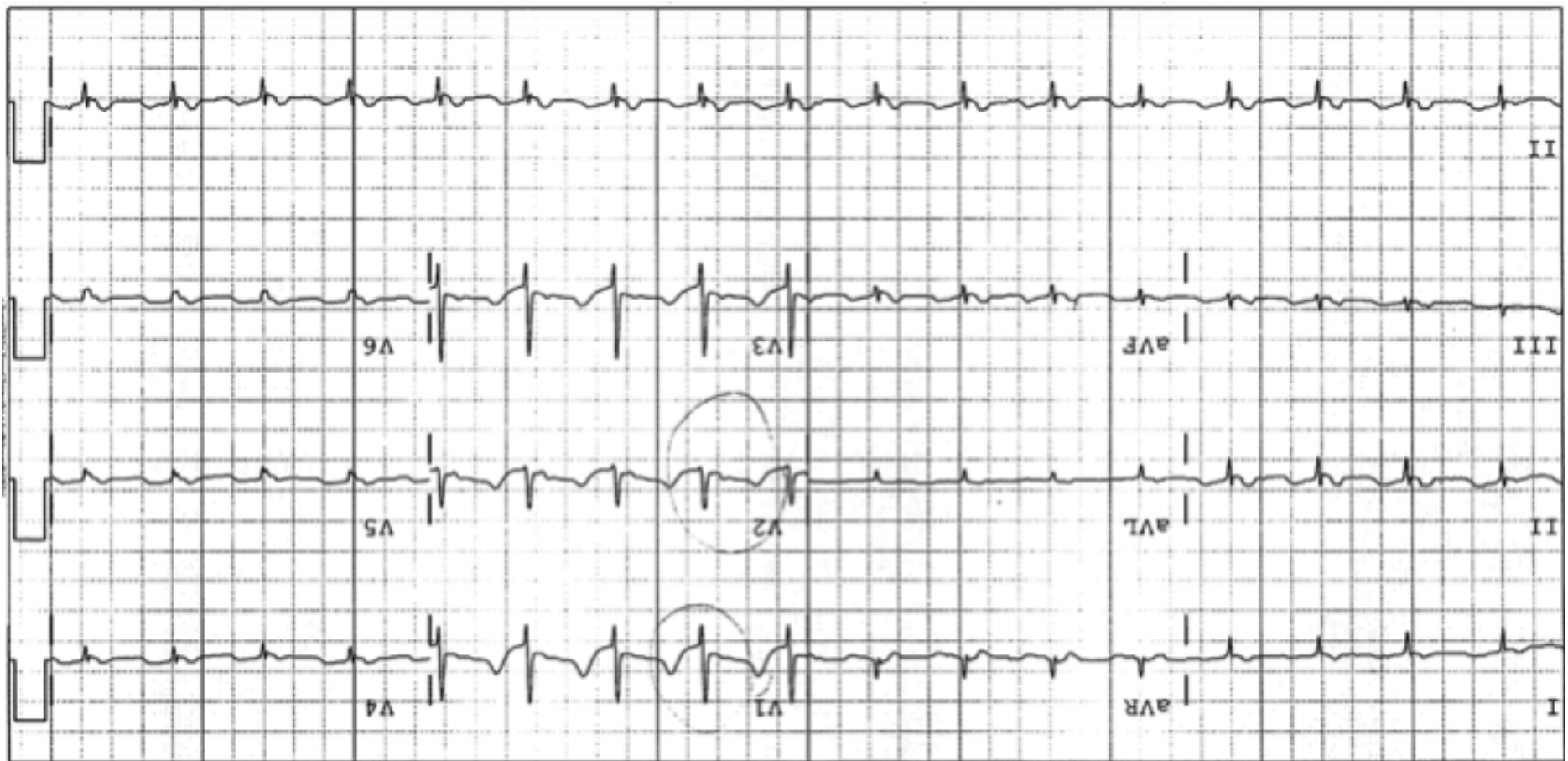
QRS: Narrow

Q-wave: No

ST-T: STD

QT: Normal

Posterior wall STEMI



STD in V1-V3 with Tall R-wave

ESC/ACCF/AHA/WHF Expert Consensus Document

Third Universal Definition of Myocardial Infarction

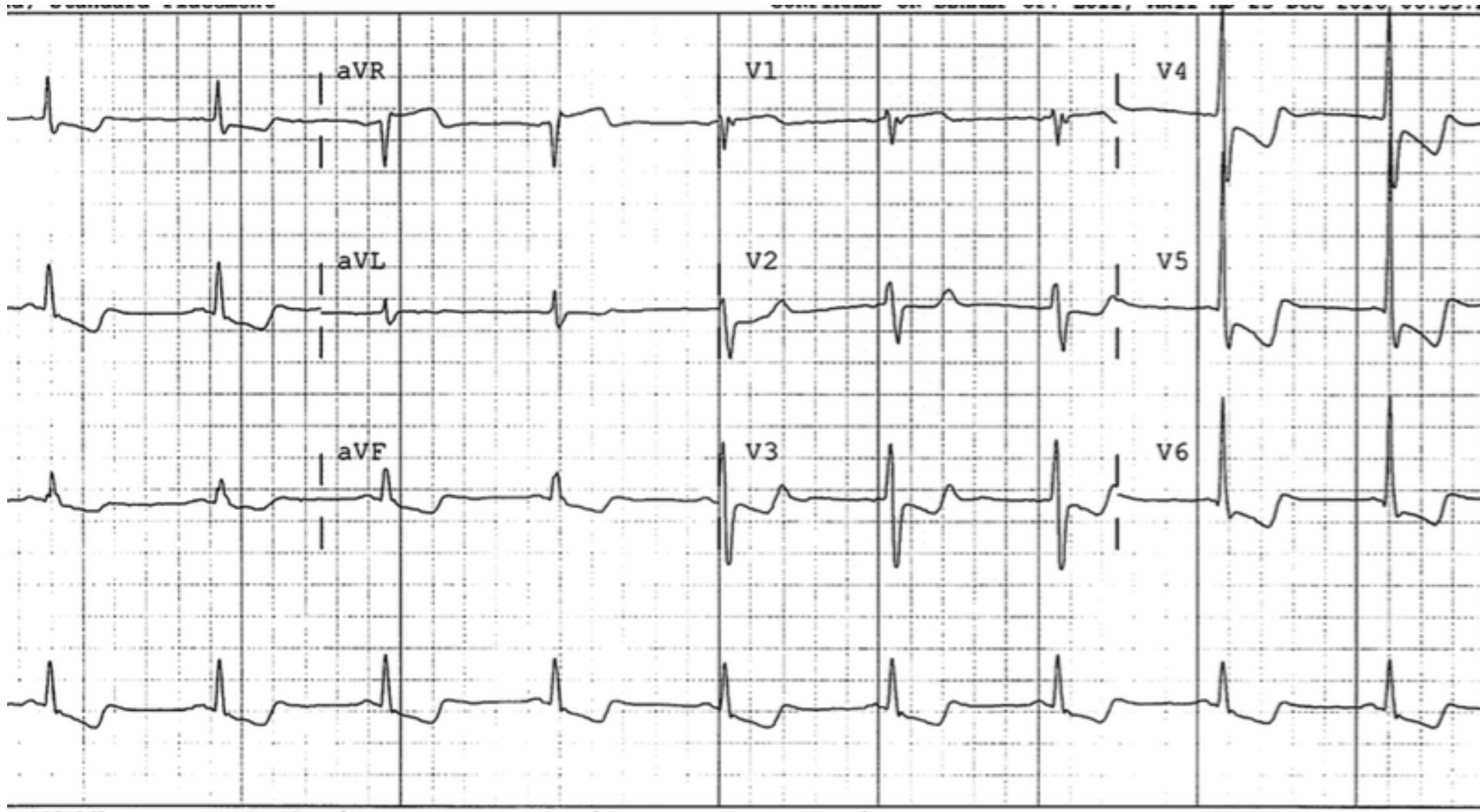
Kristian Thygesen, Joseph S. Alpert, Allan S. Jaffe, Maarten L. Simoons, Bernard R. Chaitman, and Harvey D. White: the Writing Group on behalf of the Joint ESC/ACCF/AHA/WHF Task Force for the Universal Definition of Myocardial Infarction

LCX MI is **often missed** and is best captured using posterior leads (V7,V8, V9).

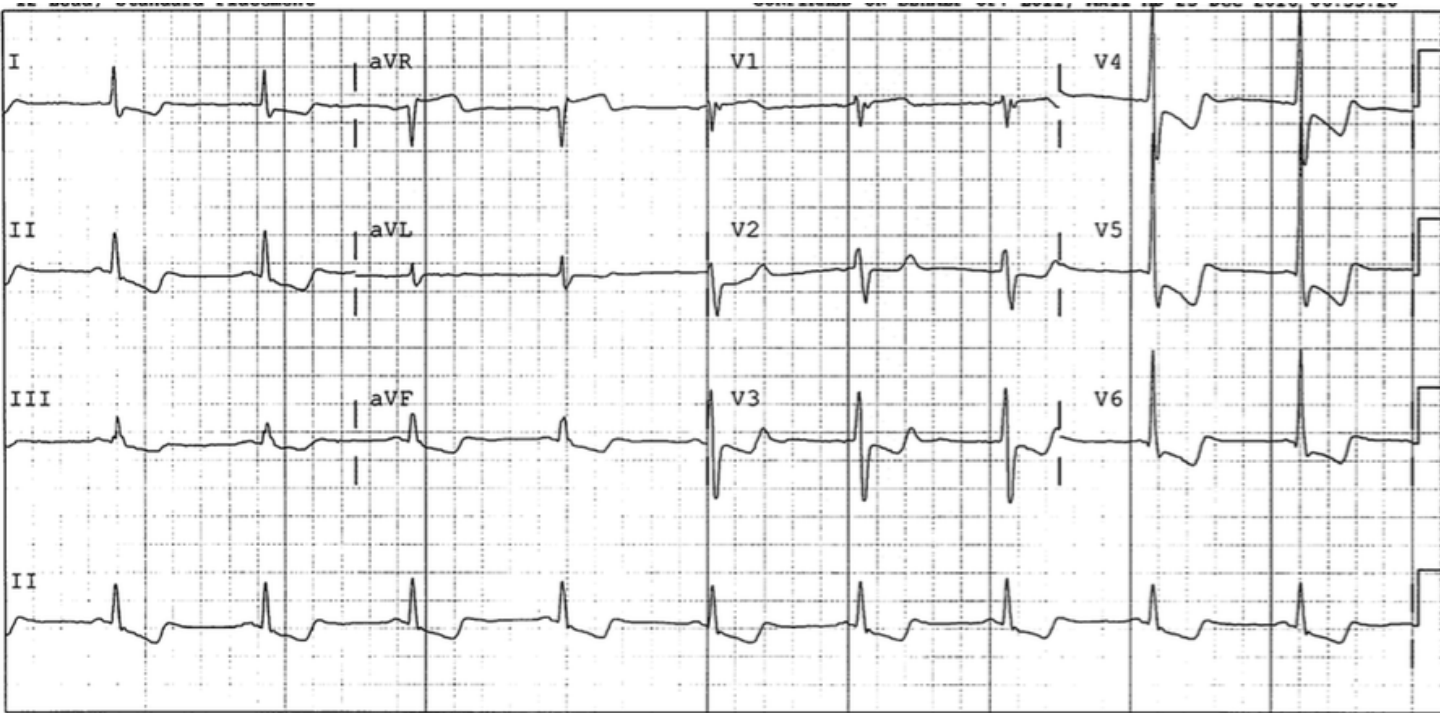
Recording of these leads is strongly recommended in patients with ST-segment depression in leads V1–3.

Case 4

66 yo M with p/w 1 hour of Abdominal pain



Reading



HR: $9 \times 6 = 54$

Rhythm:

Sinus

Axis: Normal

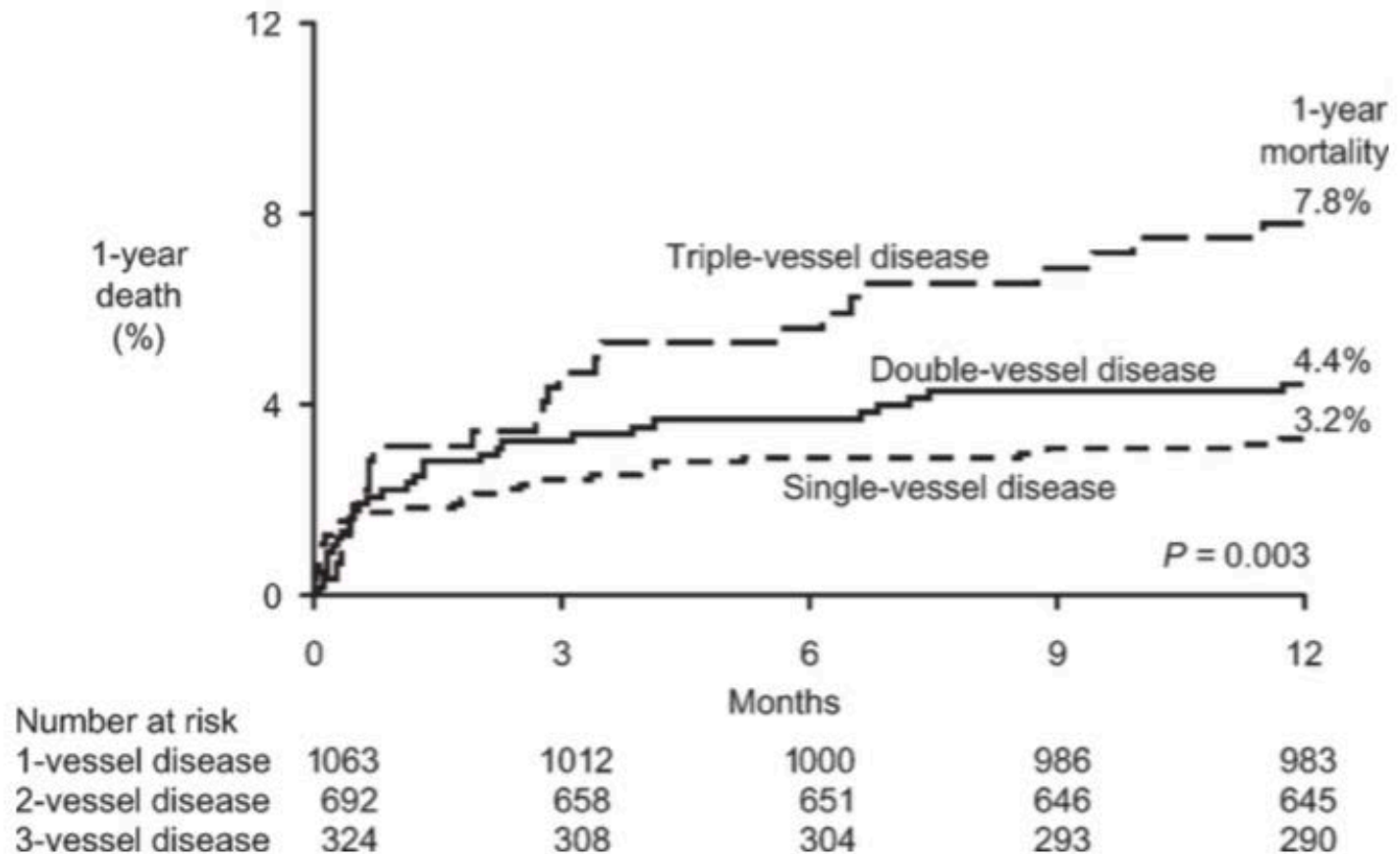
QRS: Narrow

Q-wave: No

ST-T: STE STD

QT: Normal

ACS and Number of diseased vessel



STE in lead aVR with STD

ORIGINAL ARTICLE

Predictive Value of ST-Segment Elevation in Lead aVR for Left Main and/or Three-Vessel Disease in Non-ST-Segment Elevation Myocardial Infarction

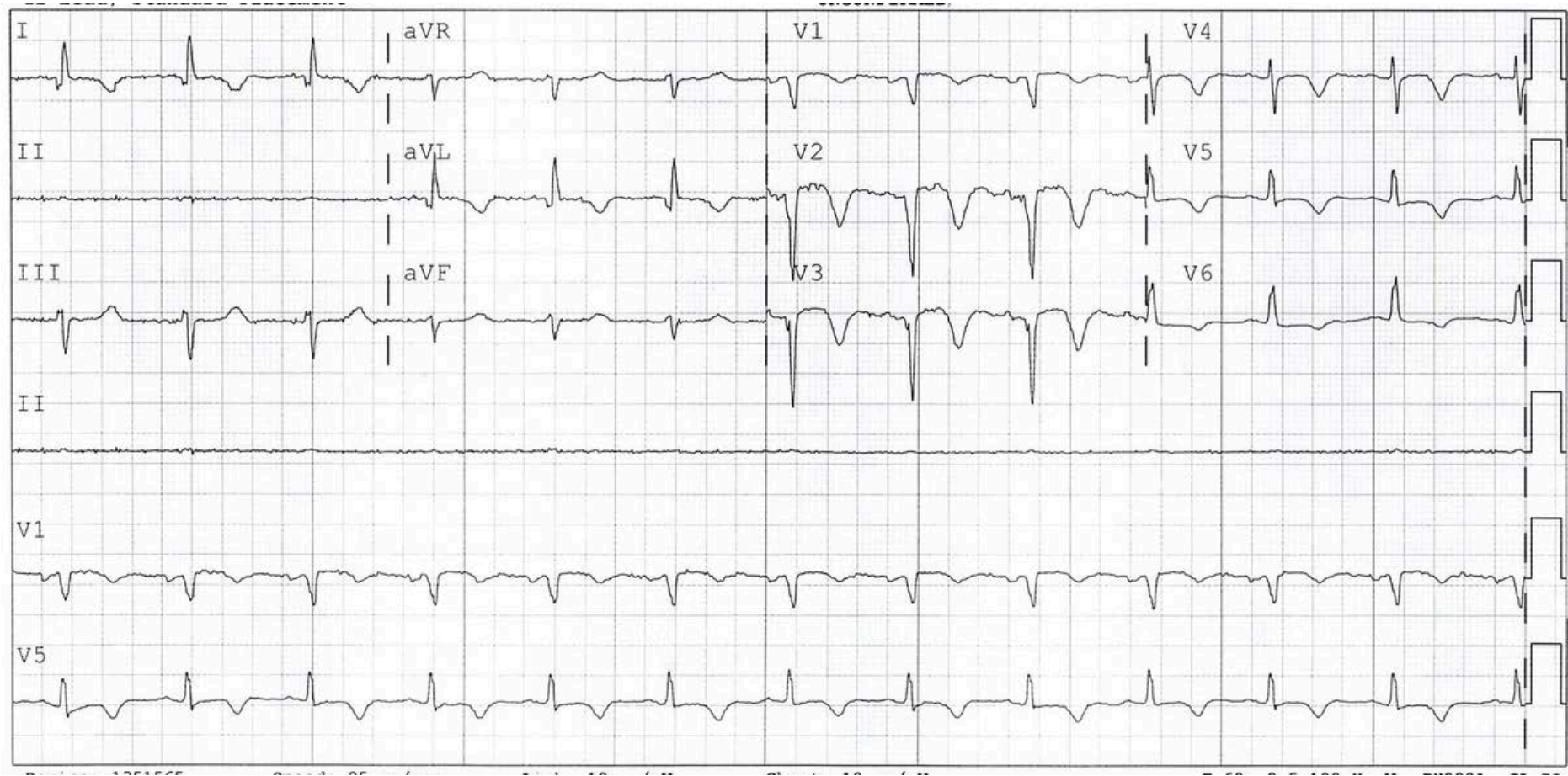
Naoki Misumida, M.D.,* Akihiro Kobayashi, M.D.,* John T. Fox, M.D.,†
Sam Hanon, M.D.,† Paul Schweitzer, M.D.,† and Yumiko Kanei, M.D.†

Table 3. Predictive Values of ST-Segment Elevation in Lead aVR and ST-Segment Depression for Left Main/Three-Vessel Disease.

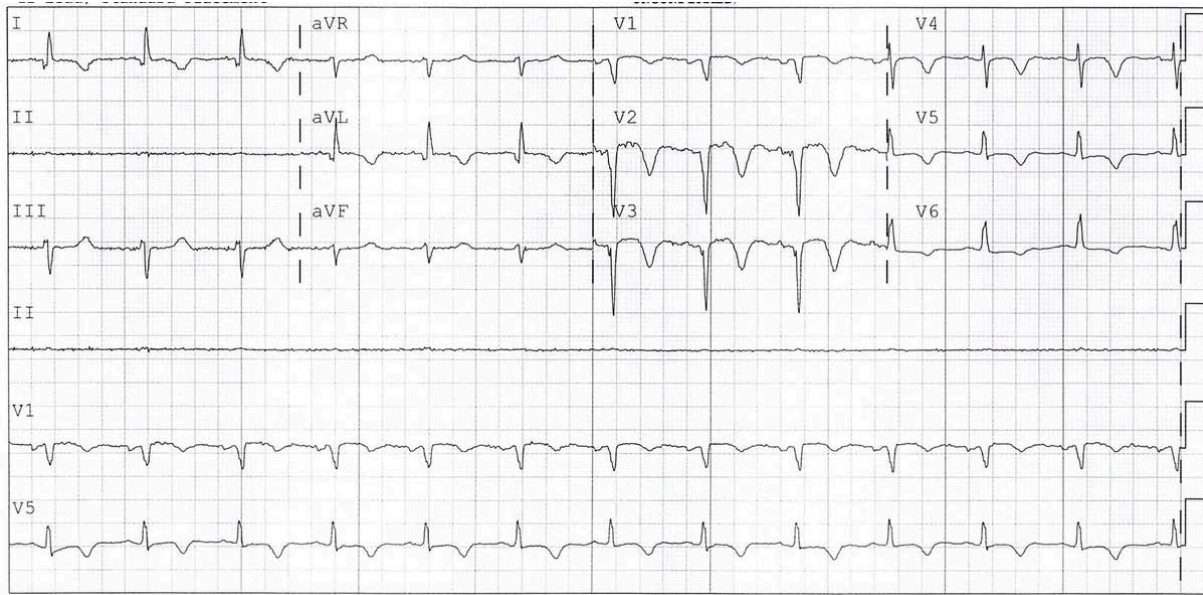
	Sensitivity	Specificity	PPV	NPV	Predictive Accuracy
Anterior ST depression (V ₁ –V ₄)	31%	90%	48%	81%	76%
Lateral ST depression (I, aVL, V ₅ , and V ₆)	45%	77%	37%	82%	70%
Inferior ST depression (II, III, and aVF)	24%	88%	38%	79%	73%
ST elevation in lead aVR \geq 0.05 mV	43%	80%	39%	82%	71%
ST elevation in lead aVR \geq 0.1 mV	33%	89%	48%	81%	76%
ST elevation in lead aVR \geq 0.15 mV	13%	98%	69%	79%	78%

Case 5

76yo M with HTN DM HLD with CP.



Reading



HR: $13 \times 6 = 78$

Rhythm: Probable SR

Axis: Left

QRS: Narrow

Q-wave: V1-V3

ST-T: TWI

QT: Prolonged

Wellens sign

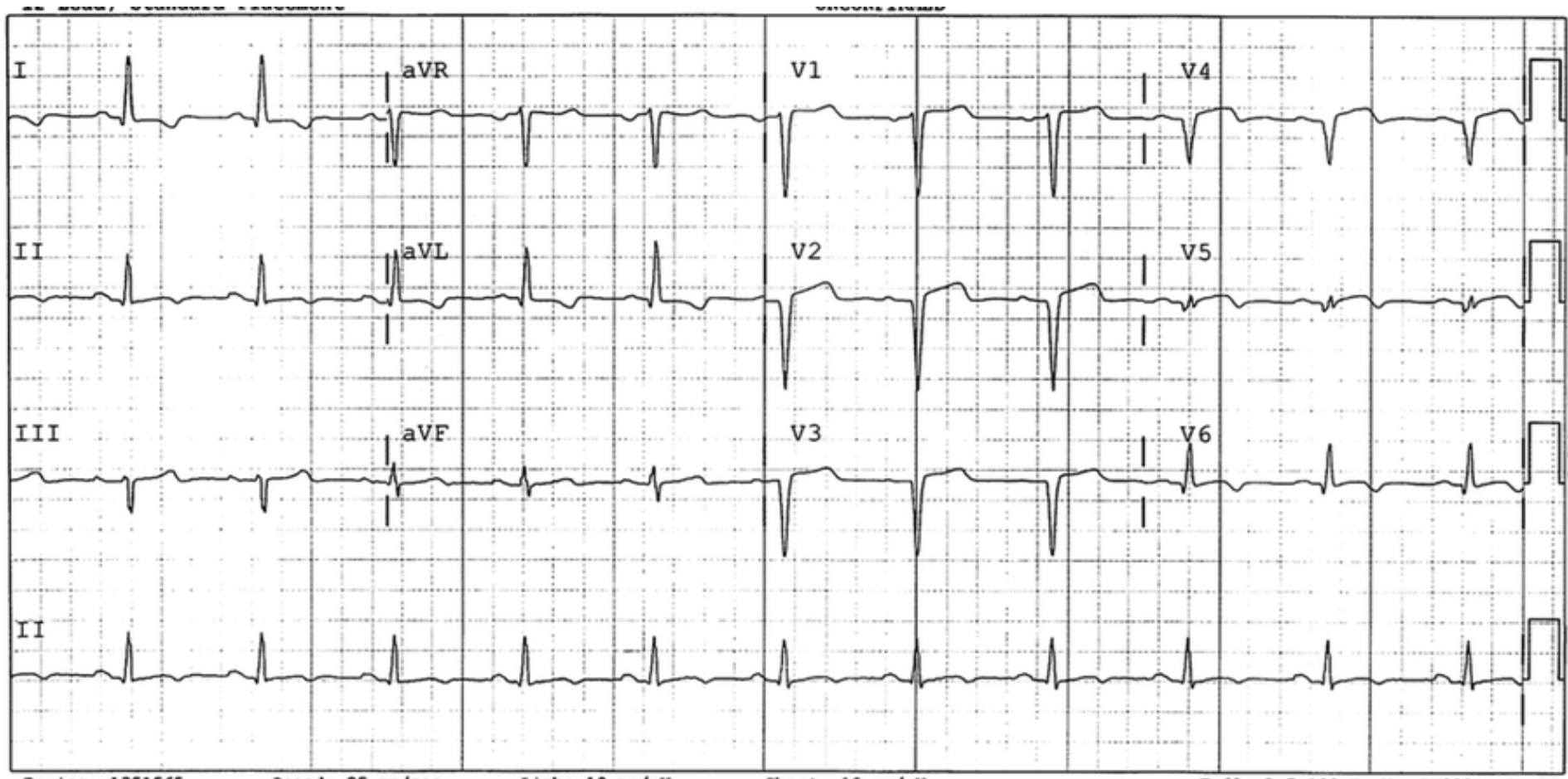
Characteristic electrocardiographic pattern indicating a critical stenosis high in left anterior descending coronary artery in patients admitted because of impending myocardial infarction

In patients admitted to the hospital because of unstable angina, a subgroup can be recognized that is at high risk for the development of an extensive anterior wall myocardial infarction. These patients, who show characteristic ST-T segment changes in the precordial leads on or shortly after admission, have a critical stenosis high in the left anterior descending coronary artery. Of 145 patients consecutively admitted because of unstable angina, 26 (18%) showing this ECG pattern, suggesting that this finding is not rare. In spite of symptom control by nitroglycerin and beta blockade, 12 of 16 patients (75%) who were not operated on developed a usually extensive anterior wall infarction within a few weeks after admission. In view of these observations, urgent coronary angiography and, when possible, coronary revascularization should be done in patients with unstable angina who show this ECG pattern. (AM HEART J 103:730, 1982.)

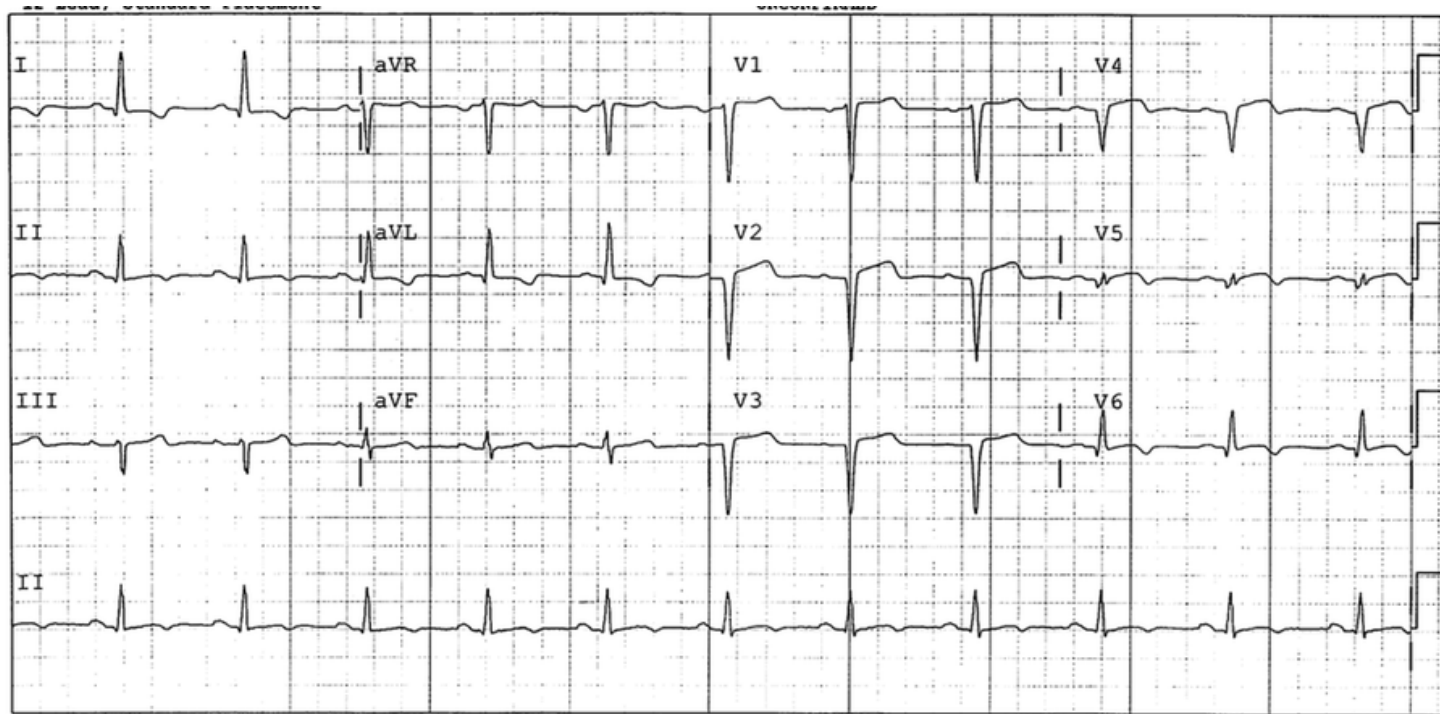
- Wellens sign: **Biphasic TWI at V2 and V3**
- 26 out of 143 **(18%)** with unstable angina
- 75%** of pts with Wellens sign developed **extensive Ante-MI**

Case 6

50 yo F with MI PCI with CP and Palpitation.



Reading



HR: $11 \times 6 = 66$

Rhythm: Sinus

Axis: Normal

QRS: Narrow

Q-wave: V1-3

ST-T: STE, TWI

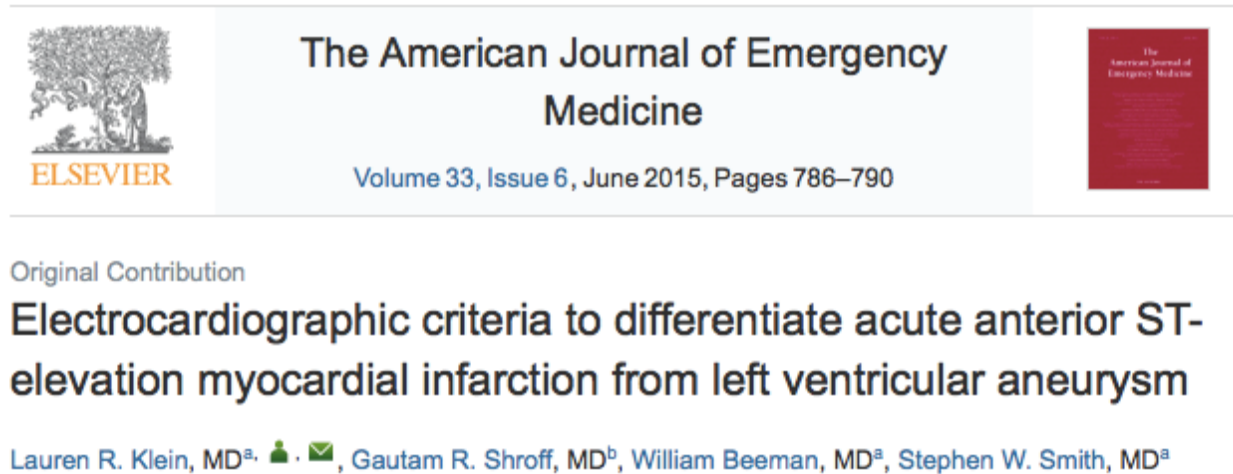
QT: Normal

Cath Clean

LVG and Echo showing: **Aneurysm**



Anterior STEMI vs. LV Aneurysm

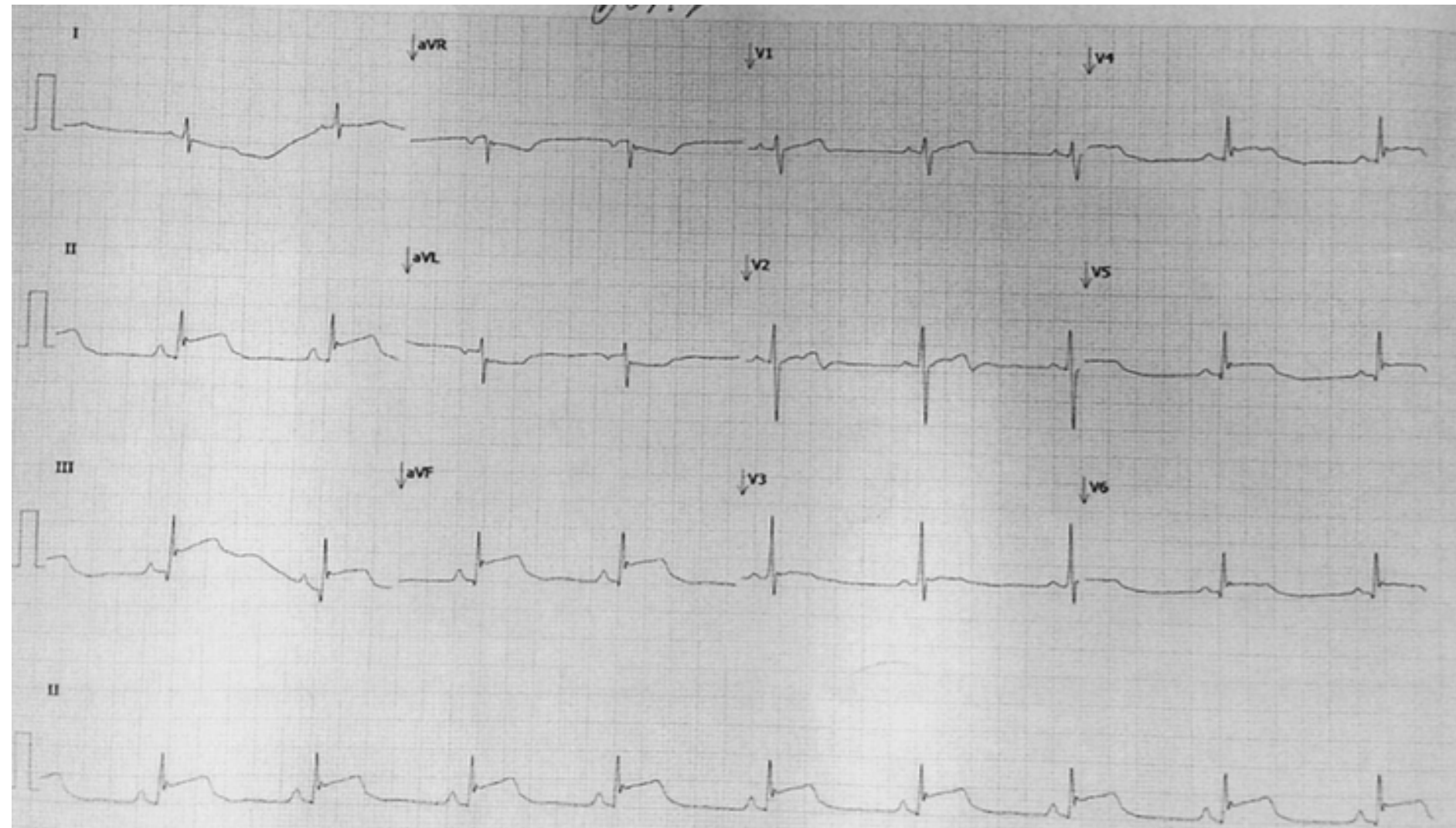


Criteria: (maximum ratio in V1-V4)

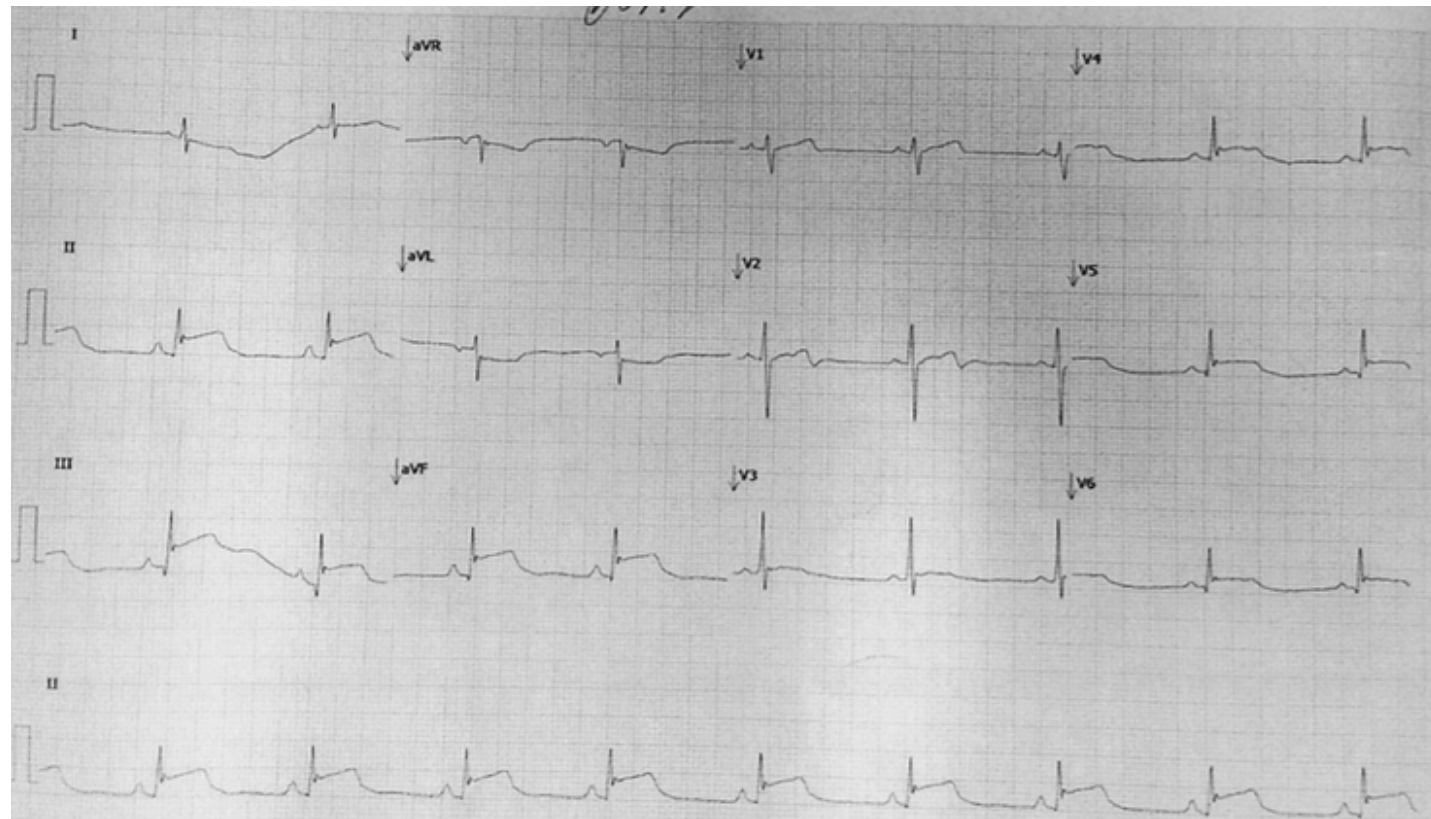
Sensitivity: 91.5%, Specificity: 81.3%, Accuracy was 89.3%

Case 7

19 yo M with 5 hours of CP



Reading



HR: $9 \times 6 = 54$

Rhythm: Sinus

Axis: Normal

QRS: Narrow

Q-wave: None

ST-T: STE STD

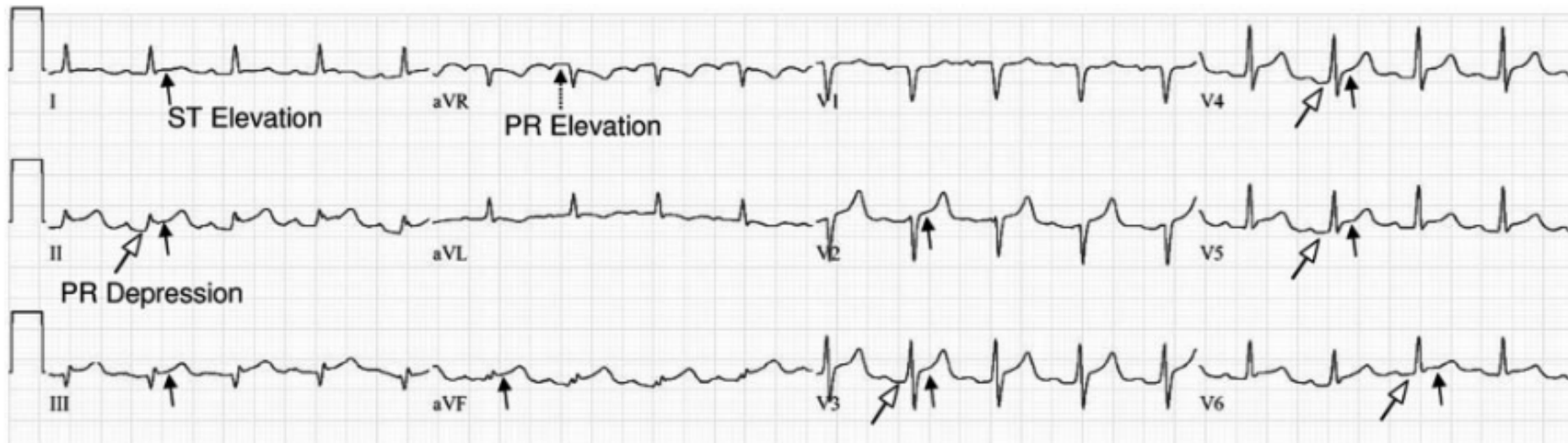
QT: Normal

Cath Clean and Normal Echo MRI showing: Peri-myocarditis

Contemporary Reviews in Cardiovascular Medicine

Pericardial Disease

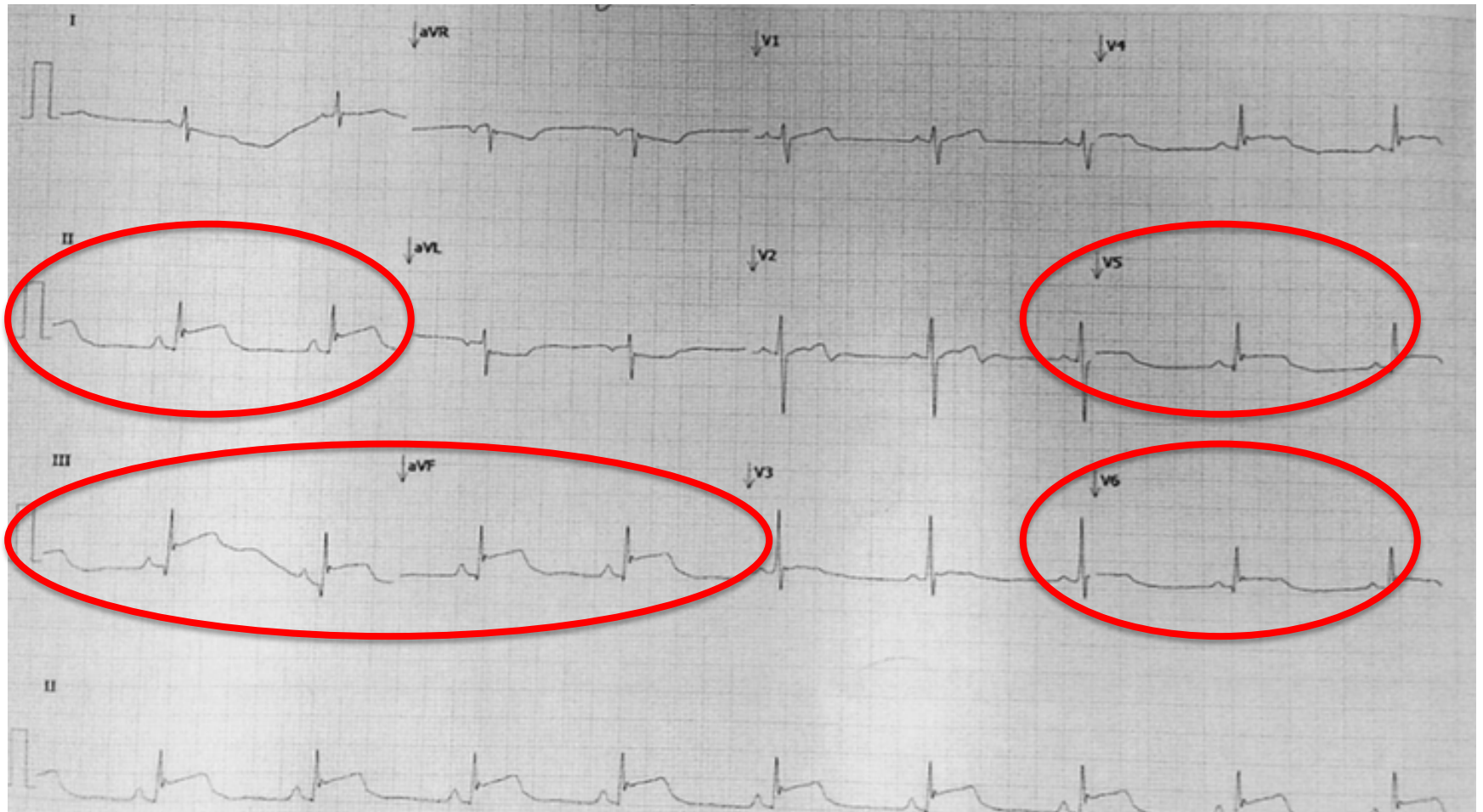
William C. Little, MD; Gregory L. Freeman, MD



Typical EKG:

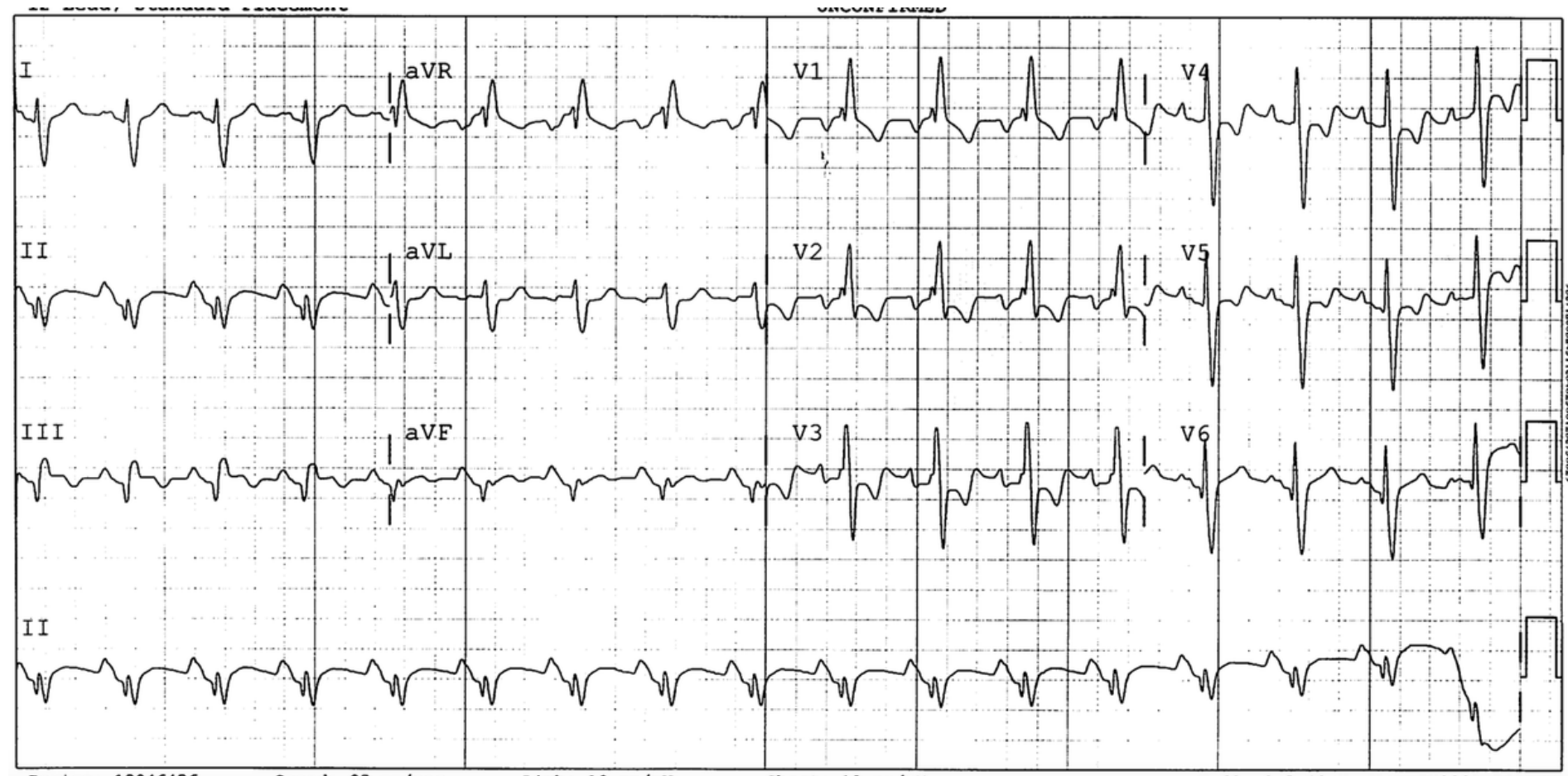
Diffuse ST elevation in association with PR depression

Our Case: STE at Inferior and lateral leads

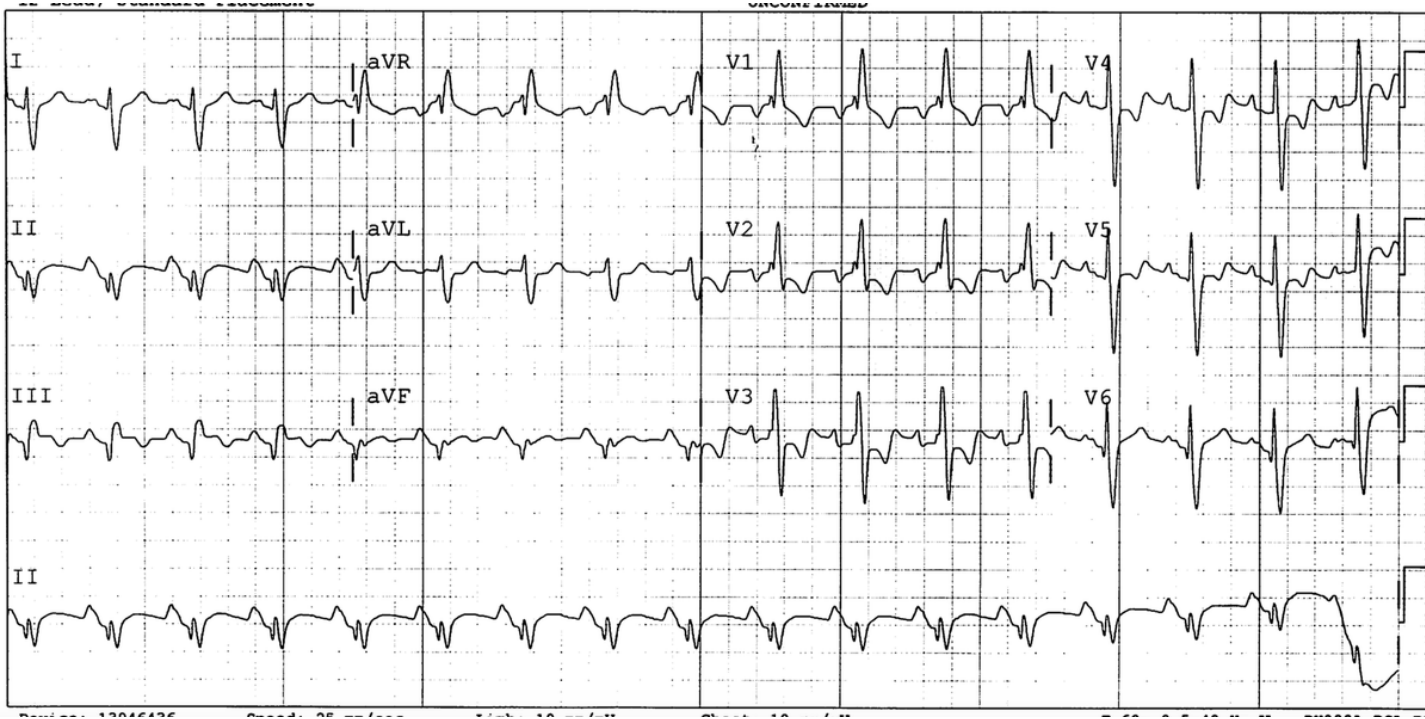


Case 8

40 yo F HTN p/w SOB and CP.



Reading



HR: $17 \times 6 = 102$

Rhythm: Sinus

Axis: **Right**

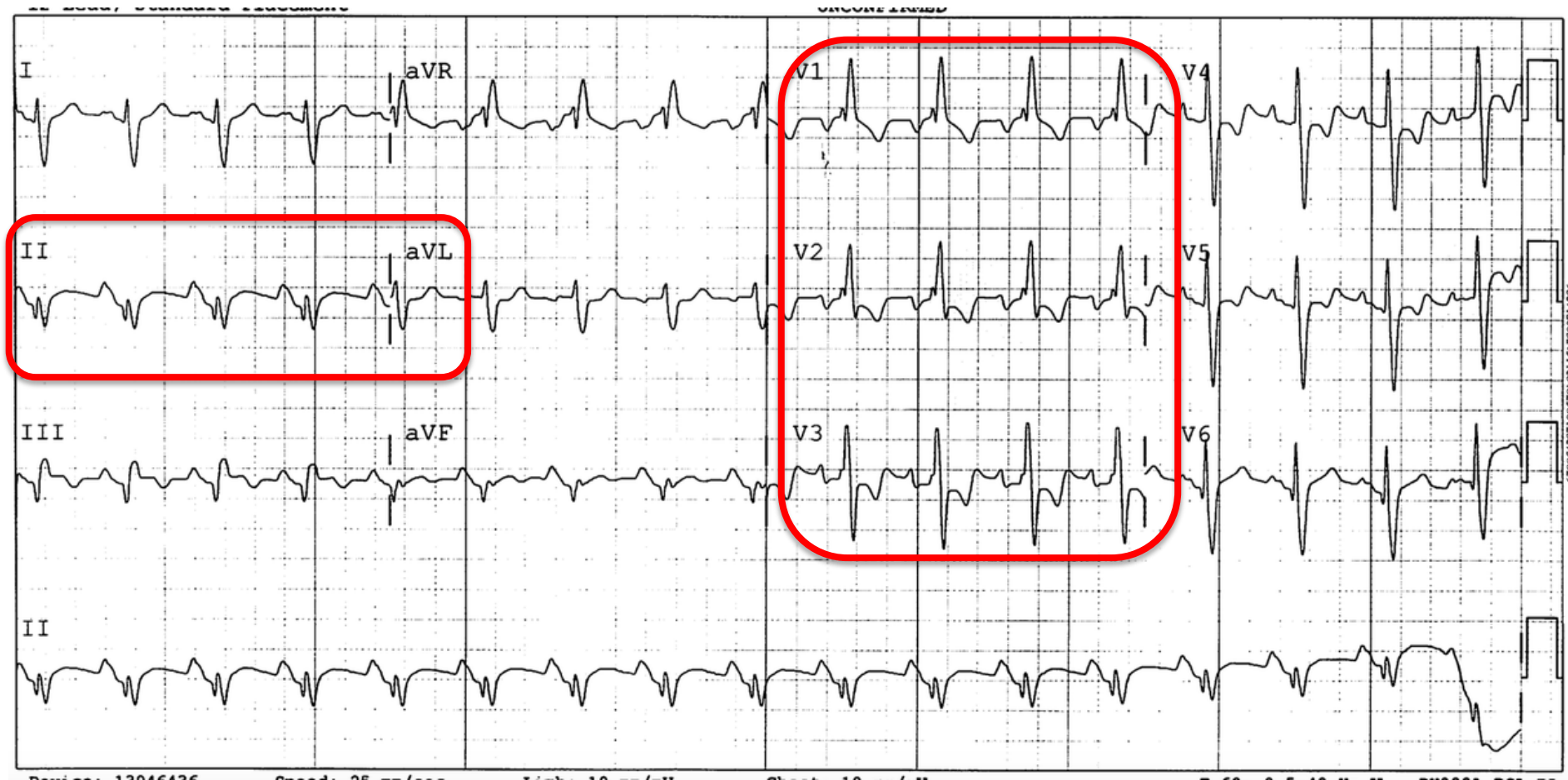
QRS: Wide

Q-wave: No

ST-T: Non spe

QT: Normal

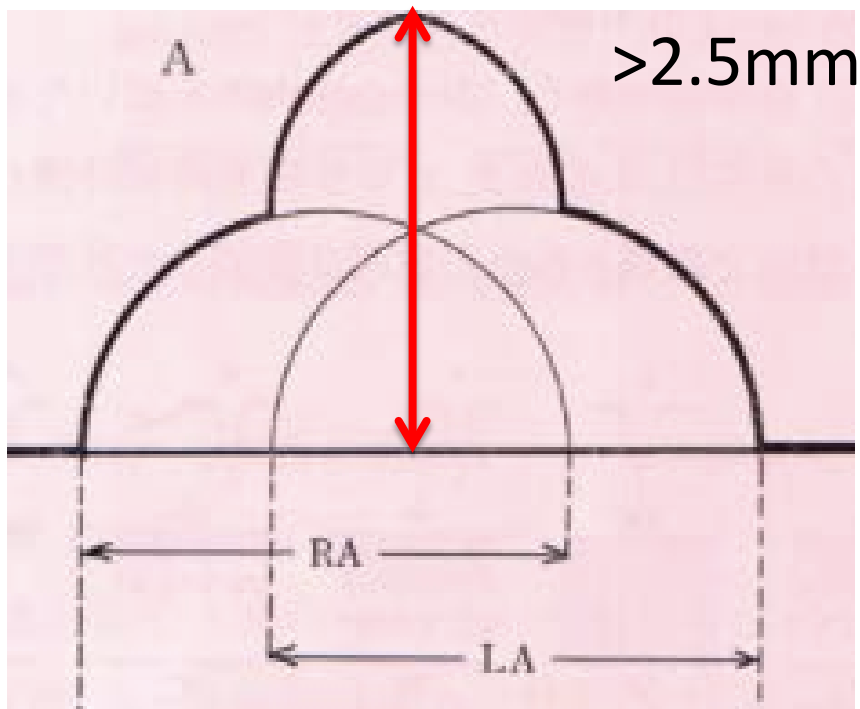
Back to EKG



RA enlargement and RVH

1) P wave > 2.5mm

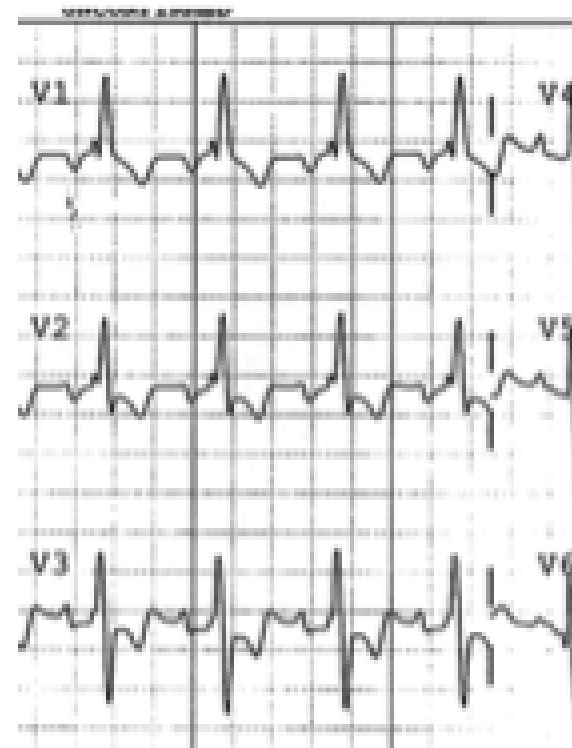
Lead II



1) RAD

2) V1: $R/S \geq 2$ and $R \geq 5m$

3) V6 $R/S < 1$



CTA: Negative For PE

Echo: RV dilatation and dysfunction

Dx: Pulmonary HTN (WHO class 1)

Fast EKG

Fast and Wide

1) VT

2) SVT with aberrancy

-AT

-Afib

-AF

-JT

-AVNRT/AVRT

-ST



-RBBB

-LBBB

-IVCD

Fast and Narrow

1) SVT

-AT

-Afib

-AF

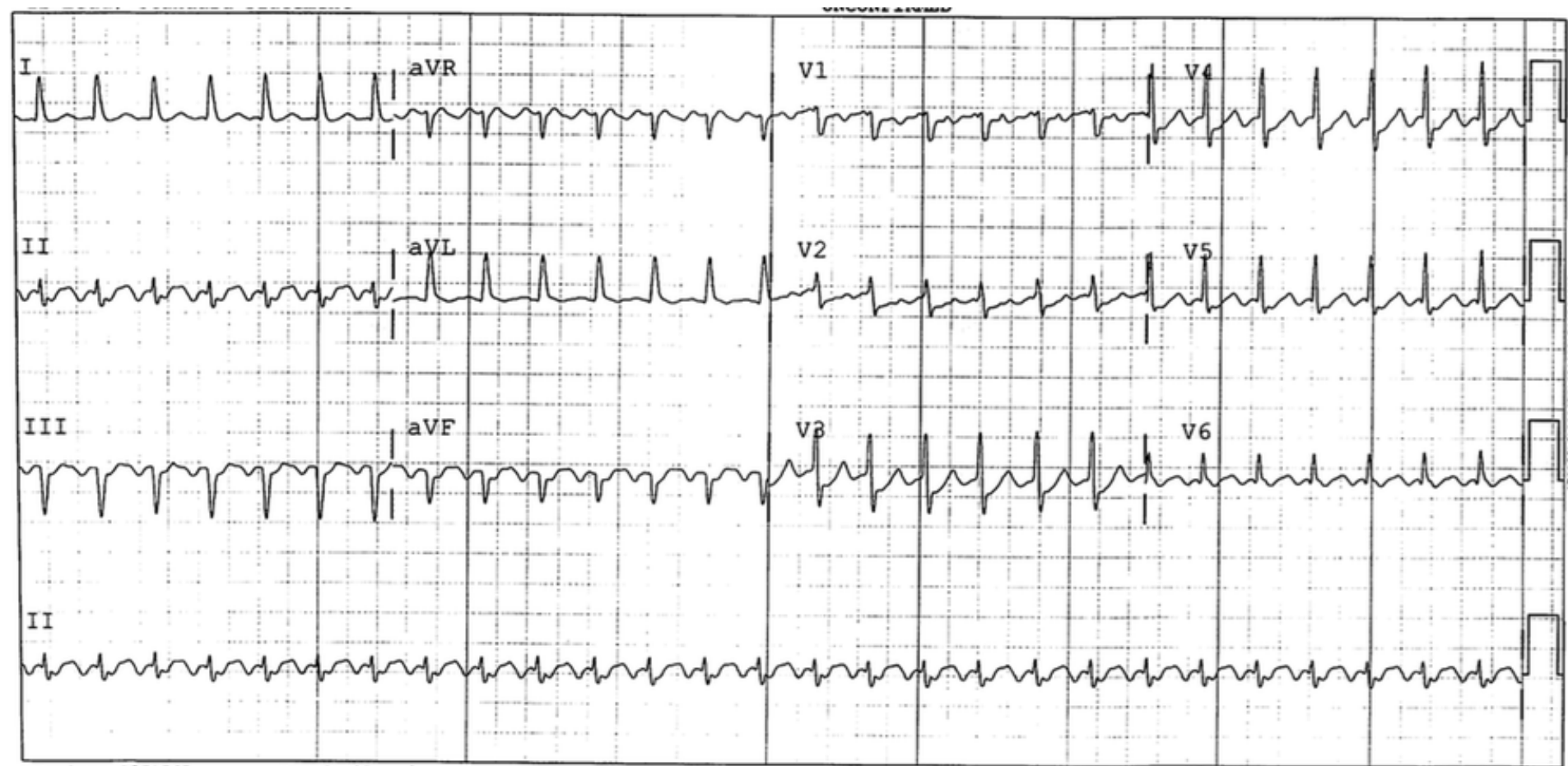
-JT

-AVNRT/AVRT

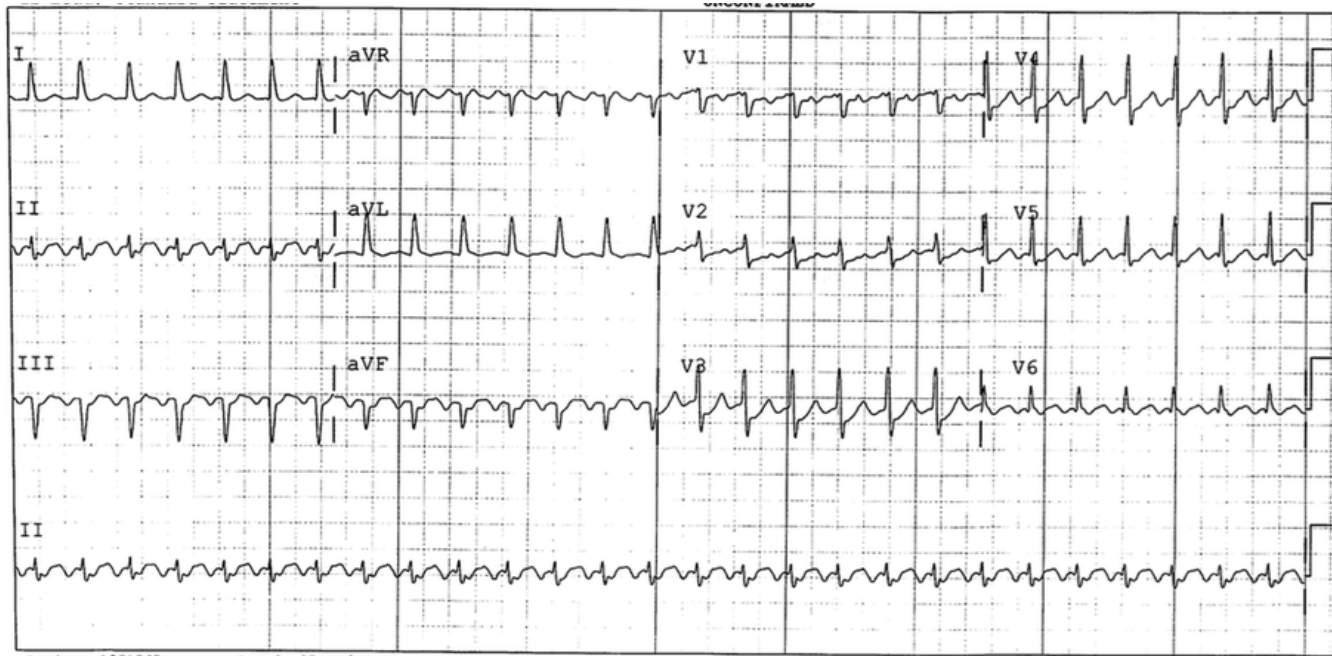
-ST

Case 9

69 yo M with palpitation



Reading



HR: $27 \times 6 = 162$

Rhythm: ?

Axis: left

QRS: Narrow

Q-wave: None

ST-T: Normal

QT: Normal

Fast

Fast and Wide

1) VT

2) SVT with aberrancy

-AT

-Afib

-AF

-JT

-AVNRT/AVRT

-ST



-RBBB

-LBBB

-IVCD

Fast and Narrow

1) SVT

-Sinus tachycardia: P-wave

-Atrial tachycardia: P-wave

-Afib: Irregular

-AF: HR 150

-AVNRT/AVRT: HR 170-190

-Junctional tachycardia: No P-wave

Fast and Narrow

1) Do you see P-wave in front of QRS

-Sinus tachycardia: P-wave

-Atrial tachycardia: P-wave

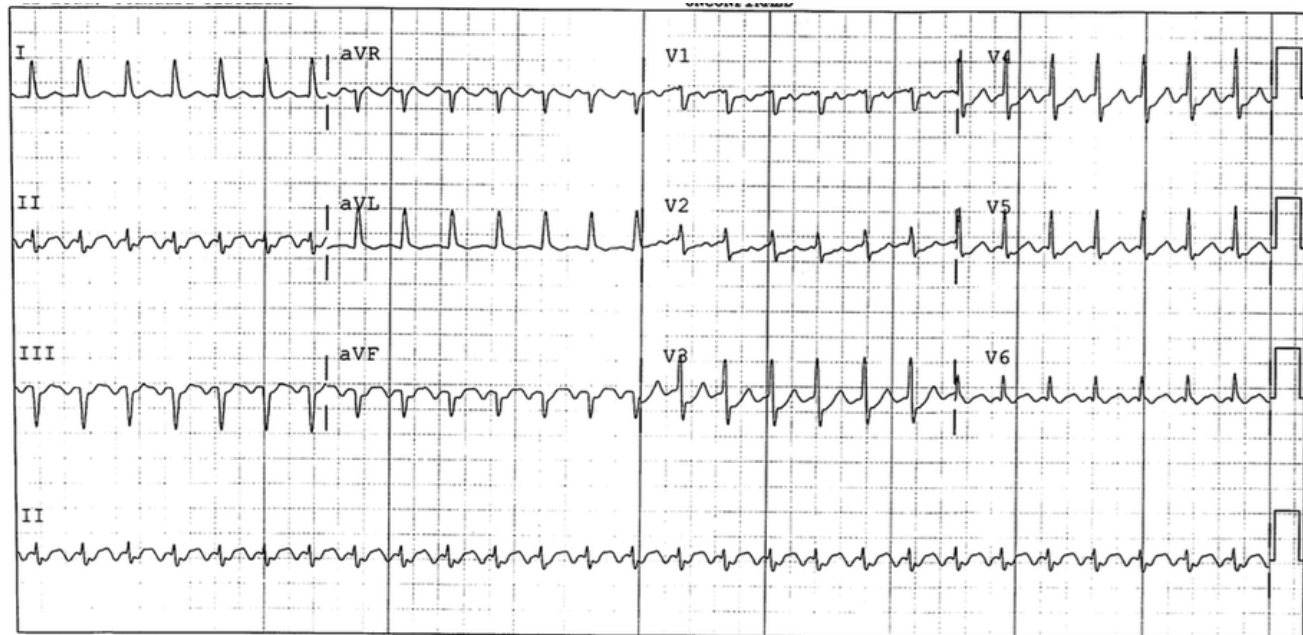
2) Irregular?

-Afib>AF

3) HR ?

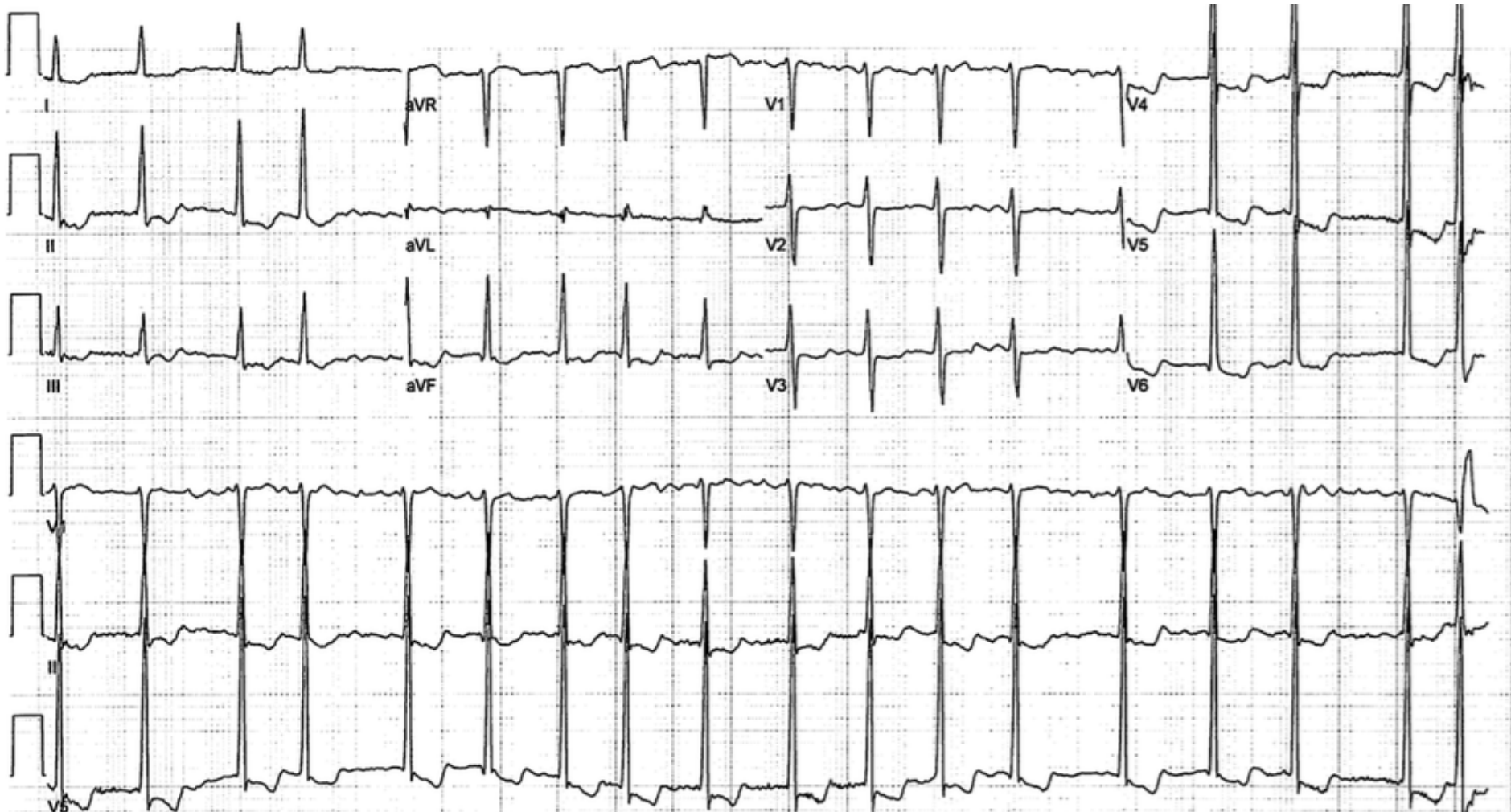
-AF: HR 150

-AVNRT/AVRT: HR 170-190

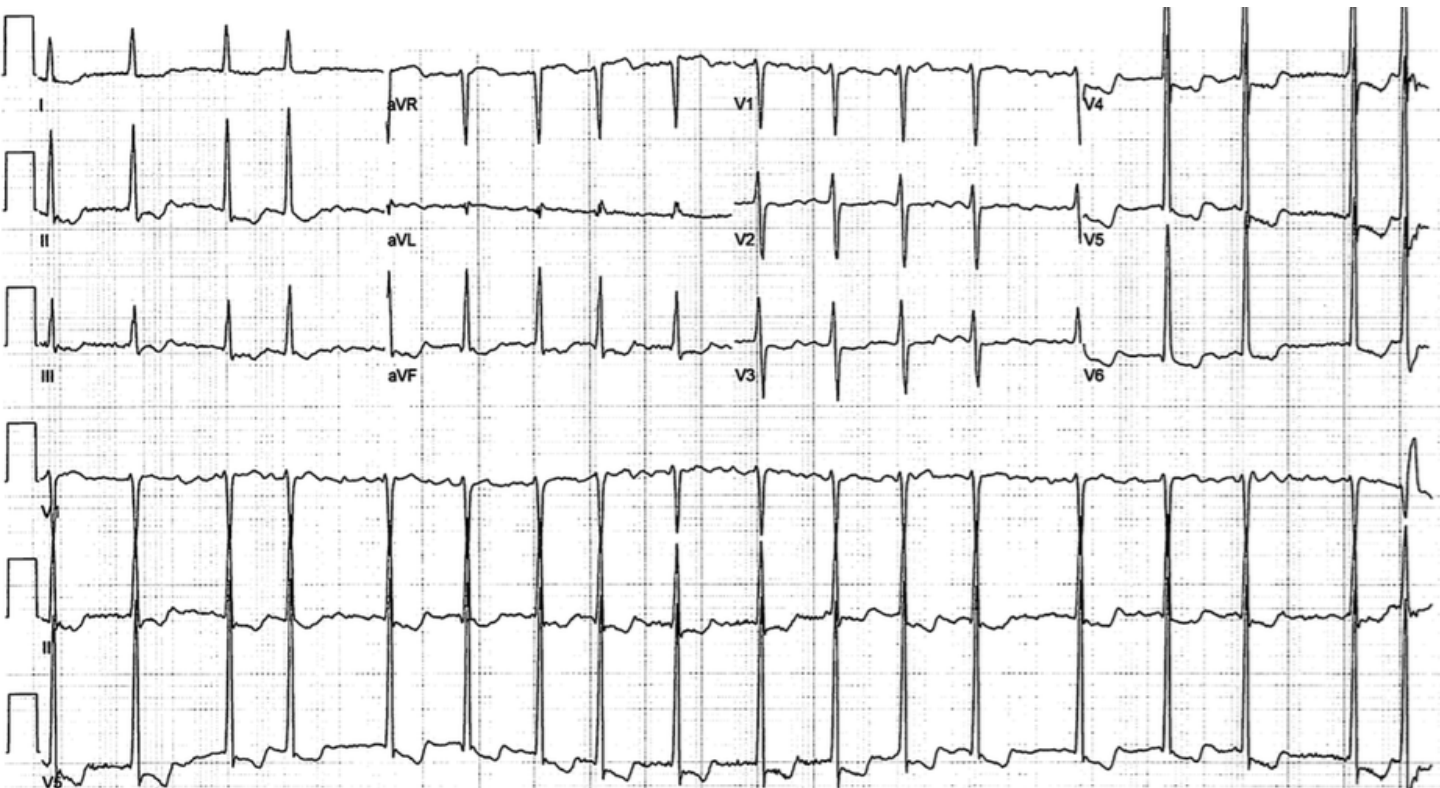


Case 10

45 yo M p/w palpitation



Reading



HR: $18 \times 6 = 128$

Rhythm: ?

Axis: Normal

QRS: Narrow

Q-wave: None

ST-T: Strain

QT: Normal

Fast

Fast and Wide

1) VT

2) SVT with aberrancy

-AT

-Afib

-AF

-JT

-AVNRT/AVRT

-ST



-RBBB

-LBBB

-IVCD

Fast and Narrow

1) SVT

-Sinus tachycardia: P-wave

-Atrial tachycardia: P-wave

-Afib: Irregular

-AF: HR 150

-AVNRT/AVRT: HR 170-190

-Junctional tachycardia: No P-wave

Fast and Narrow

1) Do you see P-wave in front of QRS

-Sinus tachycardia: P-wave

-Atrial tachycardia: P-wave

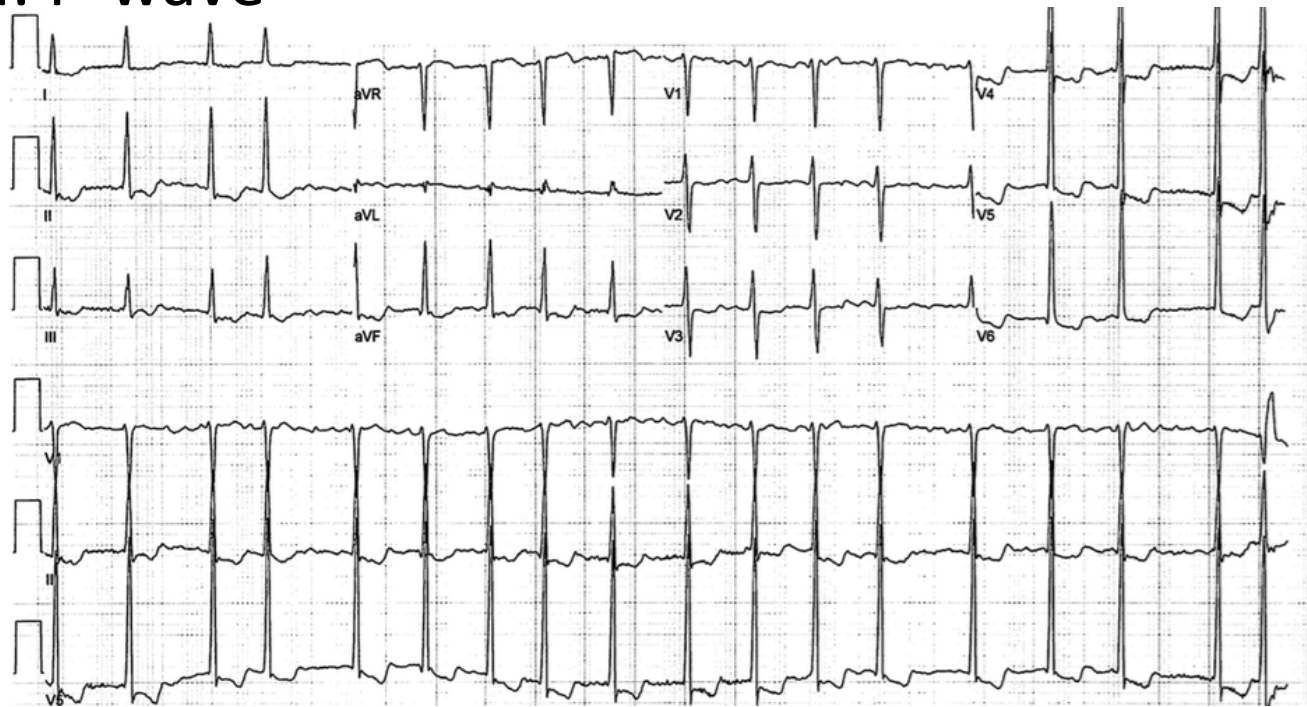
2) Irregular?

Afib>AF

3) HR ?

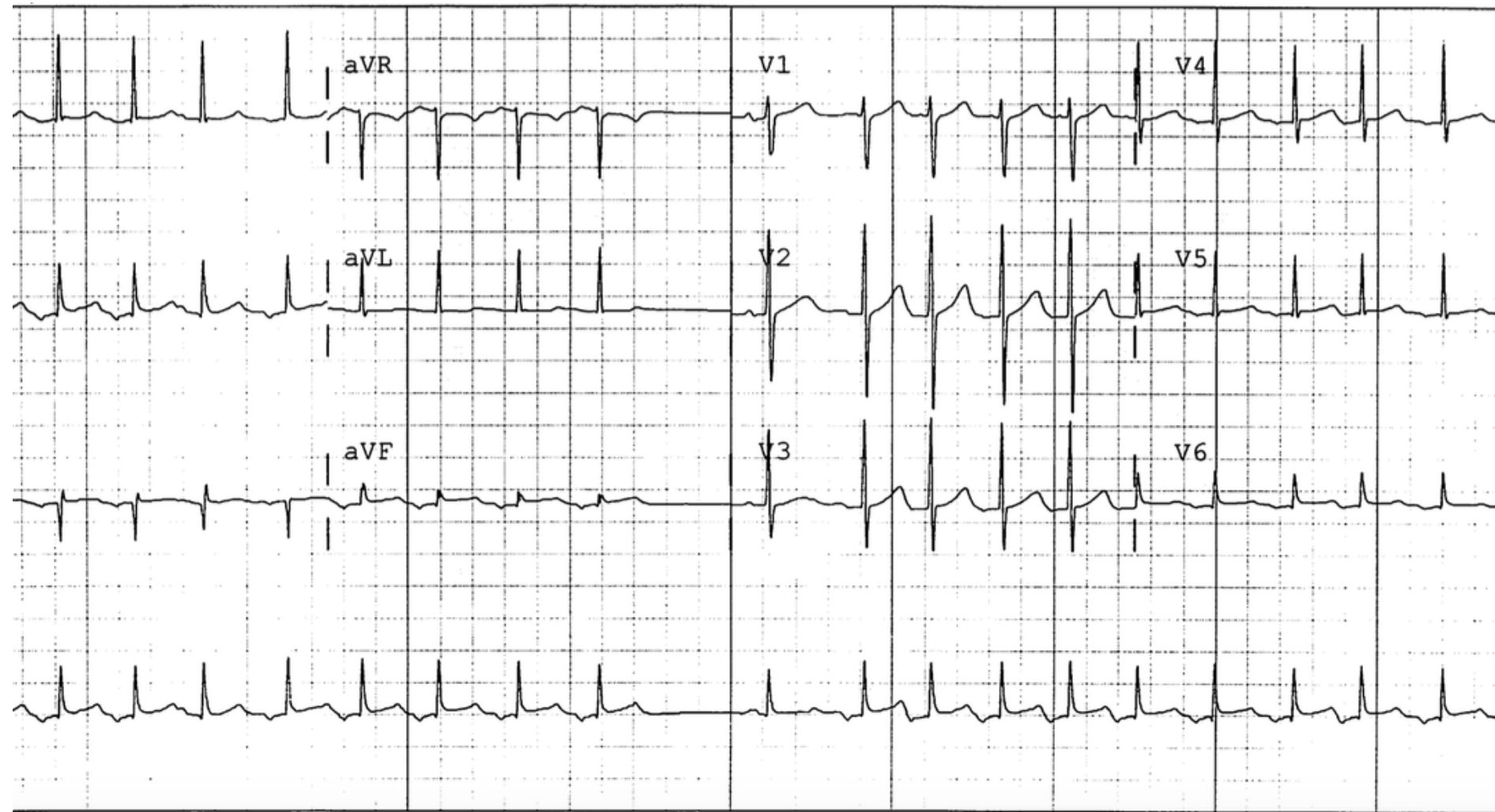
-AF: HR 150

-AVNRT/AVRT: HR 170-190

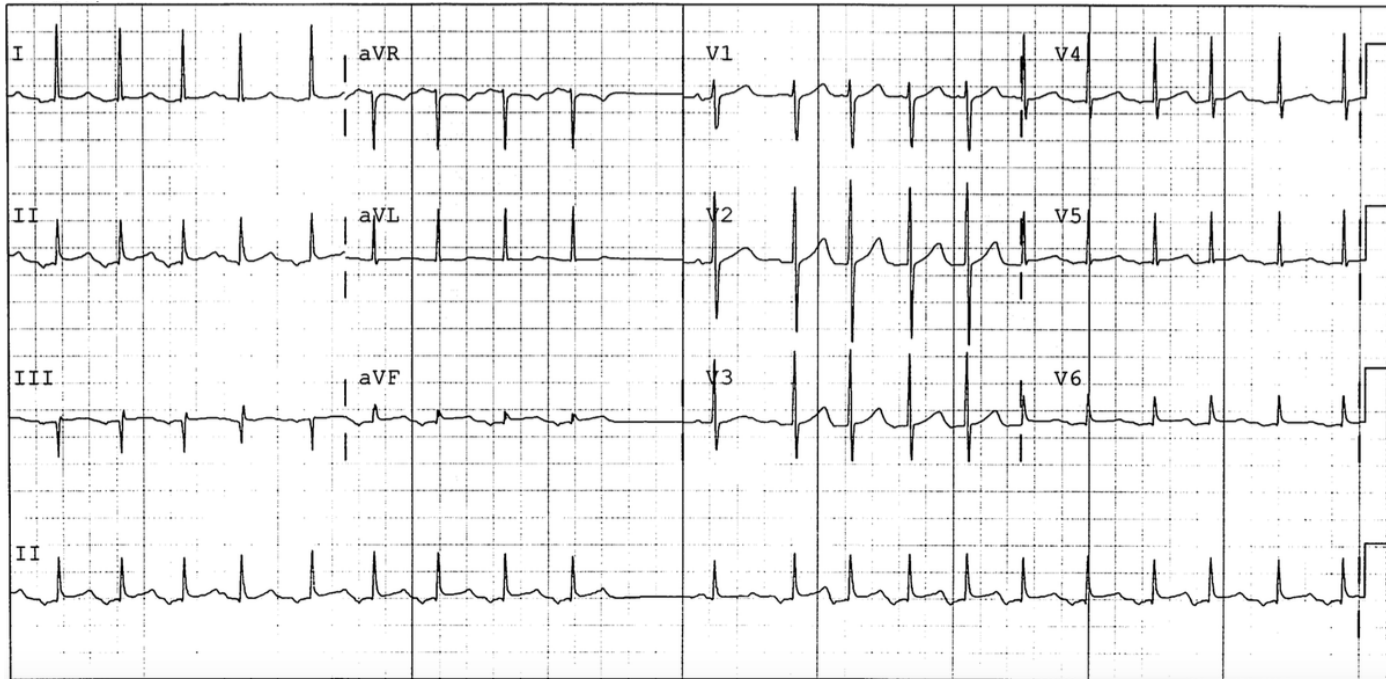


Case 11

71 yo M with palpitation



Reading



HR: $20 \times 6 = 120$

Rhythm: ?

Axis: Normal

QRS: Narrow

Q-wave: None

ST-T: Strain

QT: Normal

Fast

Fast and Wide

1) VT

2) SVT with aberrancy

-AT

-Afib

-AF

-JT

-AVNRT/AVRT

-ST



-RBBB

-LBBB

-IVCD

Fast and Narrow

1) SVT

-Sinus tachycardia: P-wave

-Atrial tachycardia: P-wave

-Afib: Irregular

-AF: HR 150

-AVNRT/AVRT: HR 170-190

-Junctional tachycardia: No P-wave

Fast and Narrow

1) Do you see P-wave in front of QRS

-Sinus tachycardia: P-wave

-Atrial tachycardia: P-wave

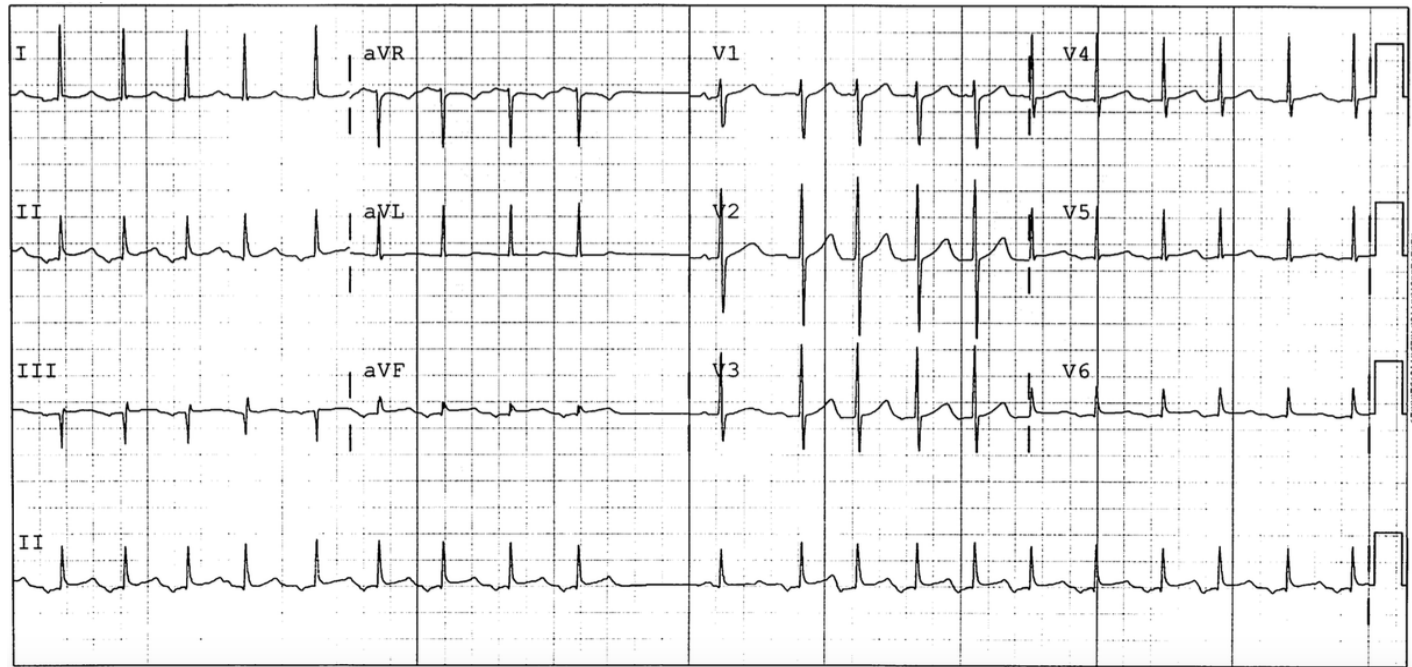
2) Irregular?

Afib>AF

3) HR ?

-AF: HR 150

-AVNRT/AVRT: HR 170-190



Fast

Fast and Wide

1) VT

2) SVT with aberrancy

-AT

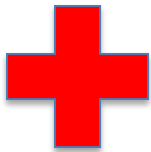
-Afib

-AF

-JT

-AVNRT/AVRT

-ST



-RBBB

-LBBB

-IVCD

Fast and Narrow

1) SVT

-Sinus tachycardia: P-wave

-Atrial tachycardia: P-wave

-Afib: Irregular

-Junctional tachycardia: No P-wave

-AF: HR 150

-AVNRT/AVRT: HR 170-190

Slow HR

1) Make effort to find P-wave between QRSs

1) Determine atrial rate (P-wave) and ventricular rate (QRS)



1) P-wave > QRS complex

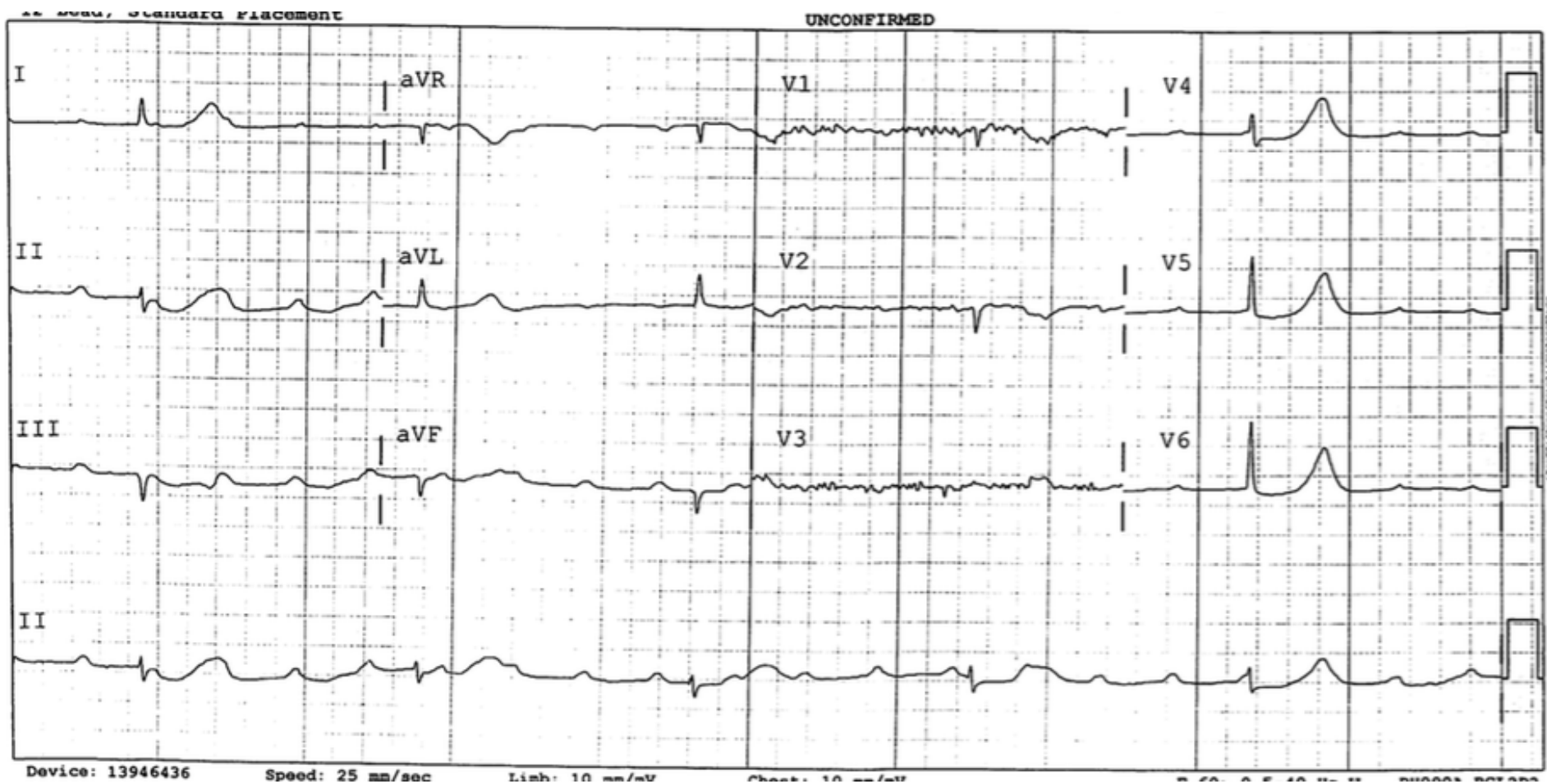
-AV block

2) P-wave = QRS complex

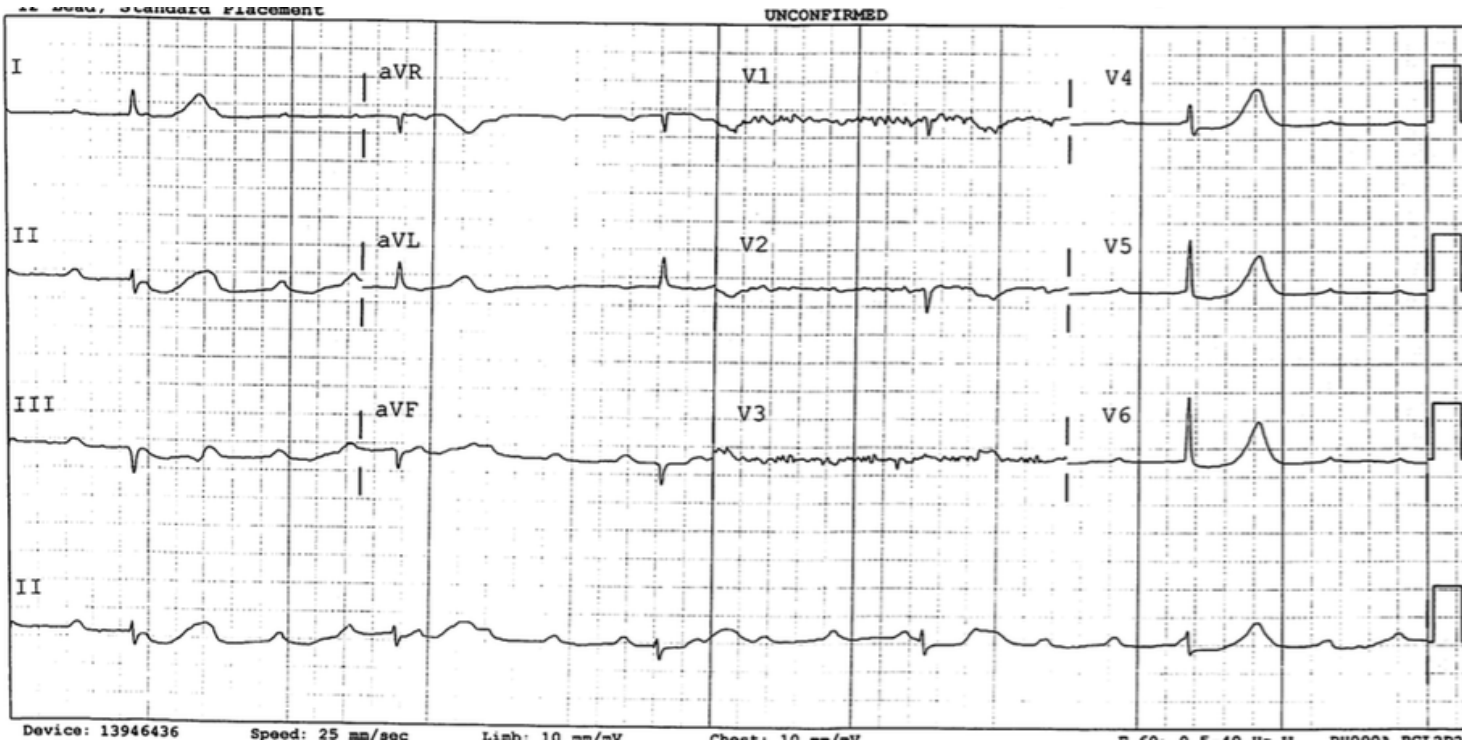
-SSS/ Sinus brad/ Ectopic brad

Case 12

71 yo M with dizziness



Reading



HR: $5 \times 6 = 30$

Rhythm: SR

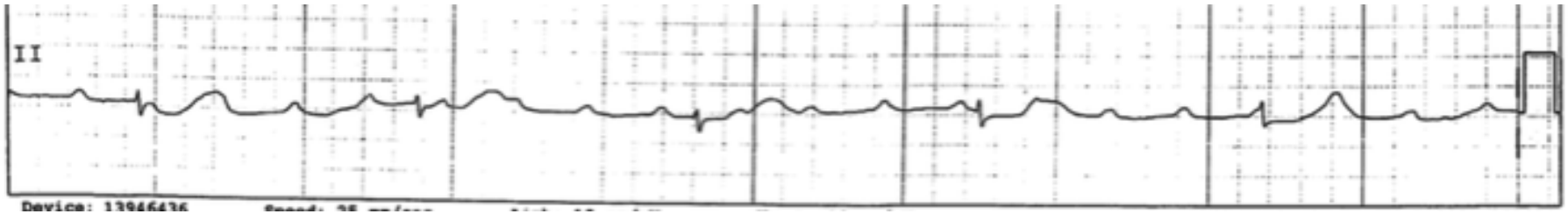
Axis: Left

QRS: Narrow

Q-wave: No

ST-T: Strain

QT: Normal



- 1) Make effort to find P-wave between QRSs
- 2) Determine atrial rate (P-wave) and ventricular rate (QRS)

P-wave: $20 \times 6 = 120$

QRS complex: $5 \times 6 = 30$

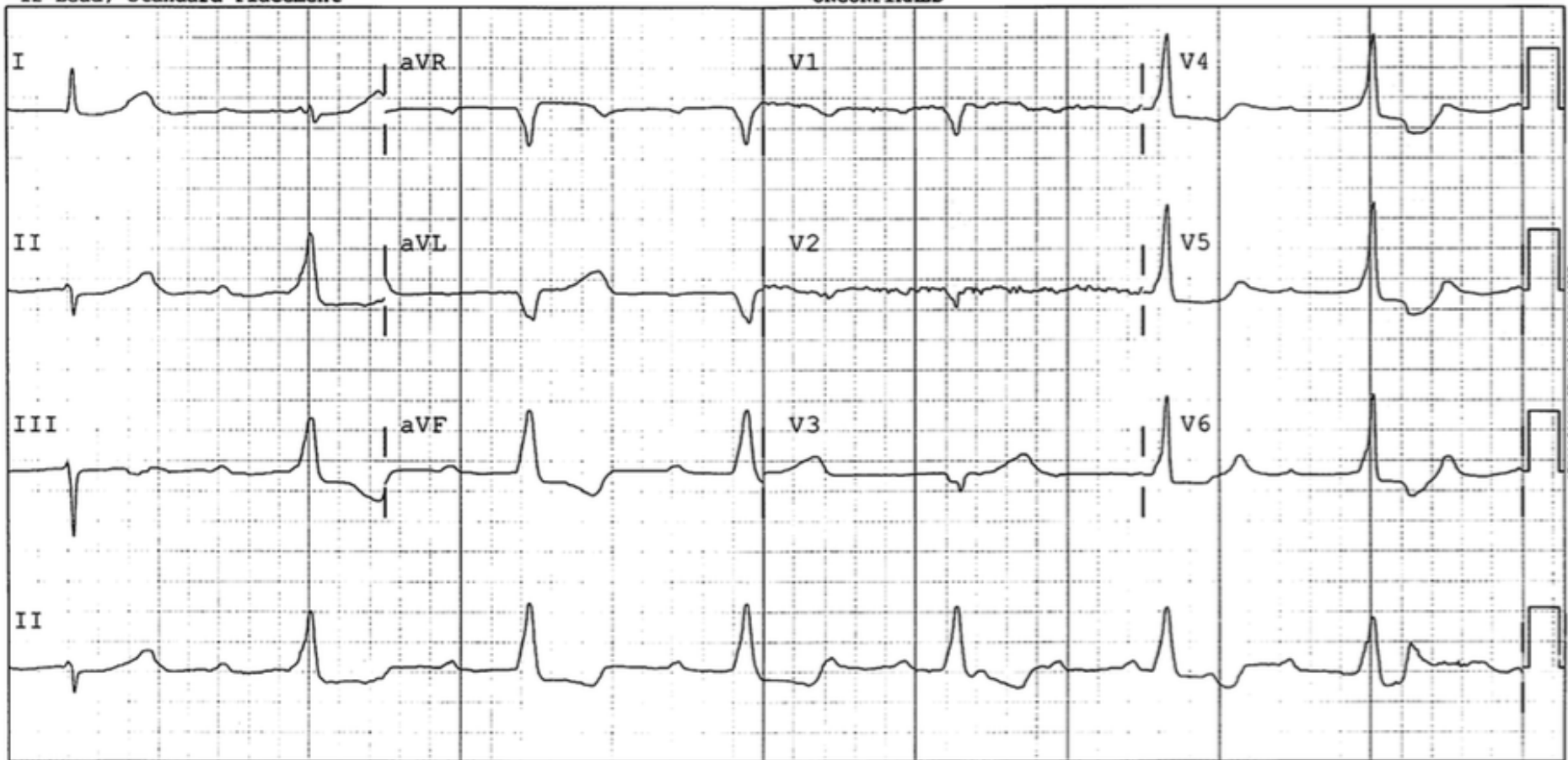


1) P-wave > QRS complex
-AV block

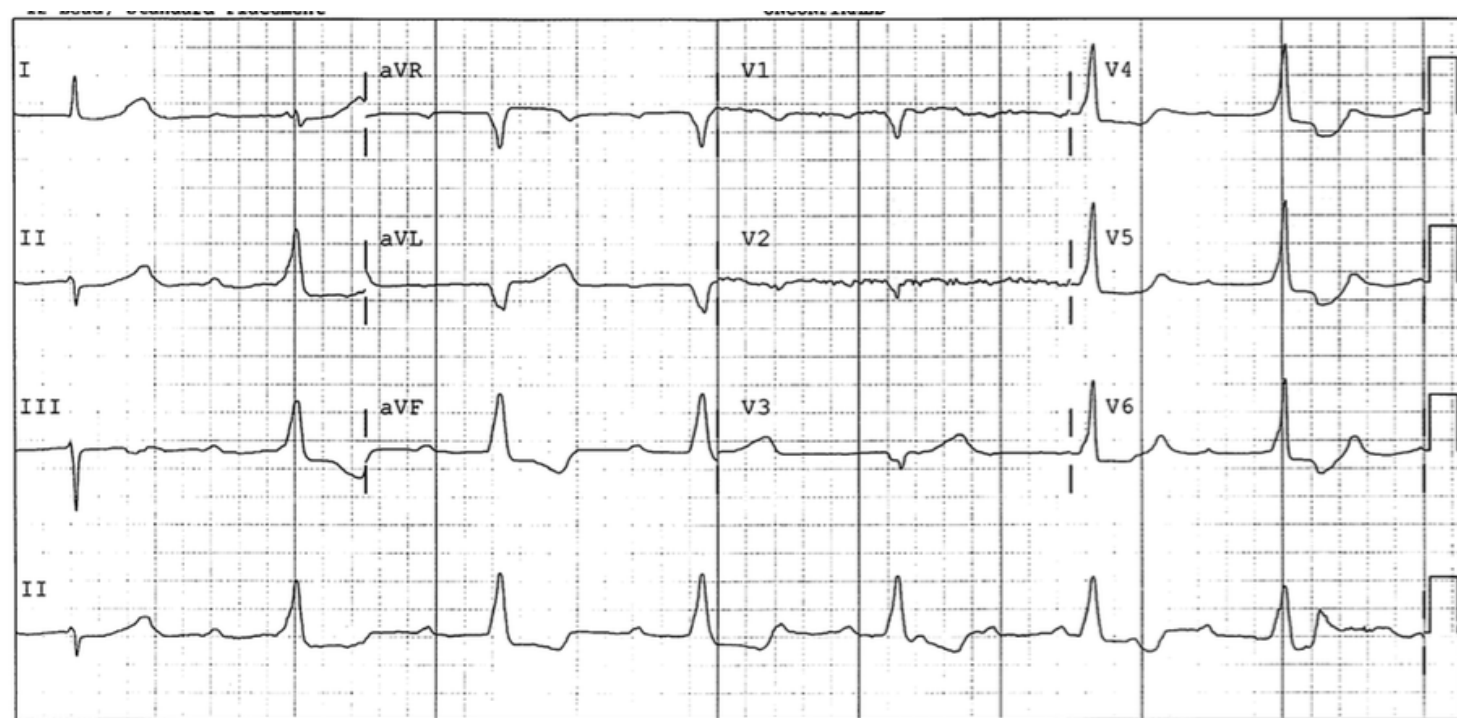
2) P-wave = QRS complex
-SSS/Sinus brad/ Ectopic brad

Case 13

65 yo F with syncope



Reading



HR: $7 \times 6 = 42$

Rhythm: SR

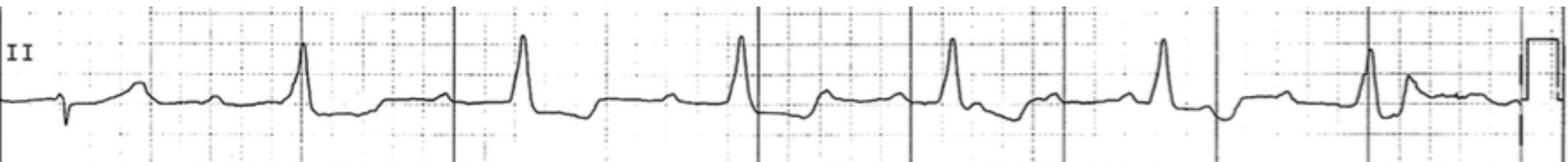
Axis: Left

QRS: Narrow

Q-wave: No

ST-T: Strain

QT: Normal



- 1) Make effort to find P-wave between QRSs
- 2) Determine atrial rate (P-wave) and ventricular rate (QRS)

P-wave: $18 \times 6 = 128$

QRS complex: $7 \times 6 = 42$



1) P-wave > QRS complex
-AV block

2) P-wave = QRS complex
-SSS/Sinus brad/ Ectopic brad

Thank you