



Arrhythmic Complications of MI

Teferi Mitiku, MD

Assistant Clinical Professor of Medicine

University of California Irvine

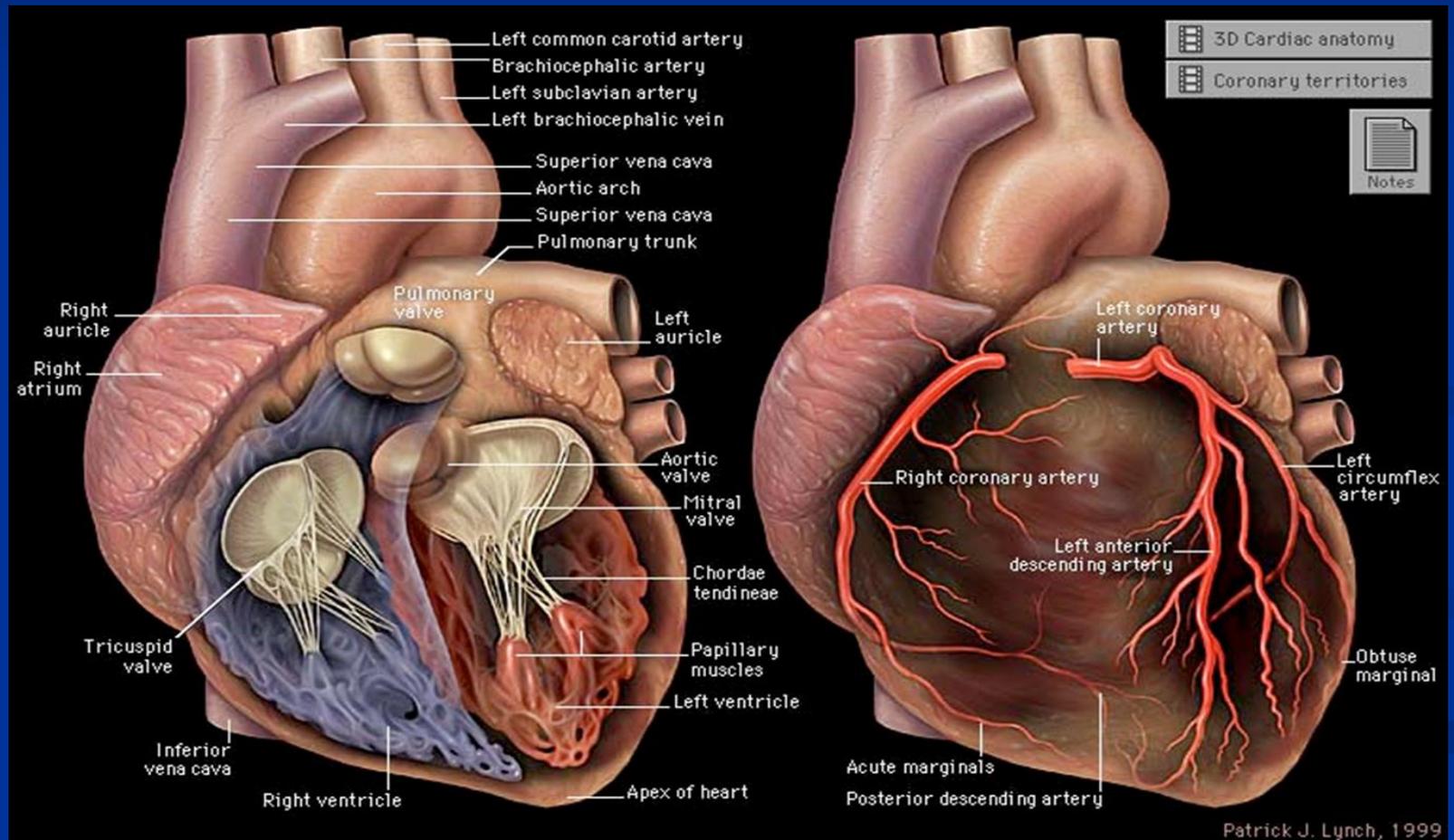


Objectives

- Brief overview -Pathophysiology of Arrhythmia
- ECG review of typical STEMI's
- Bradyarrhythmias
- Tachyarrhythmias
- Treatment strategy for arrhythmias

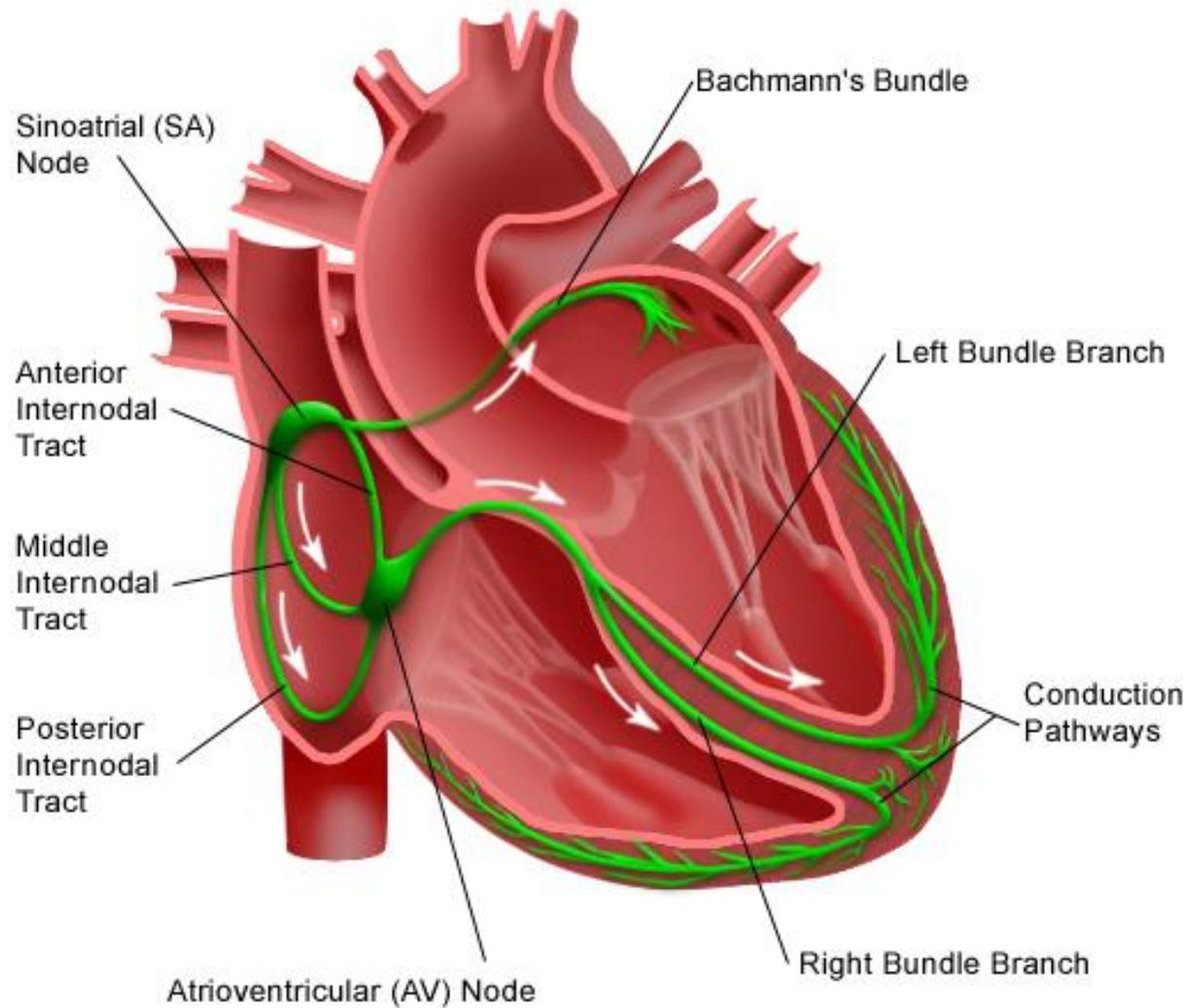


The heart

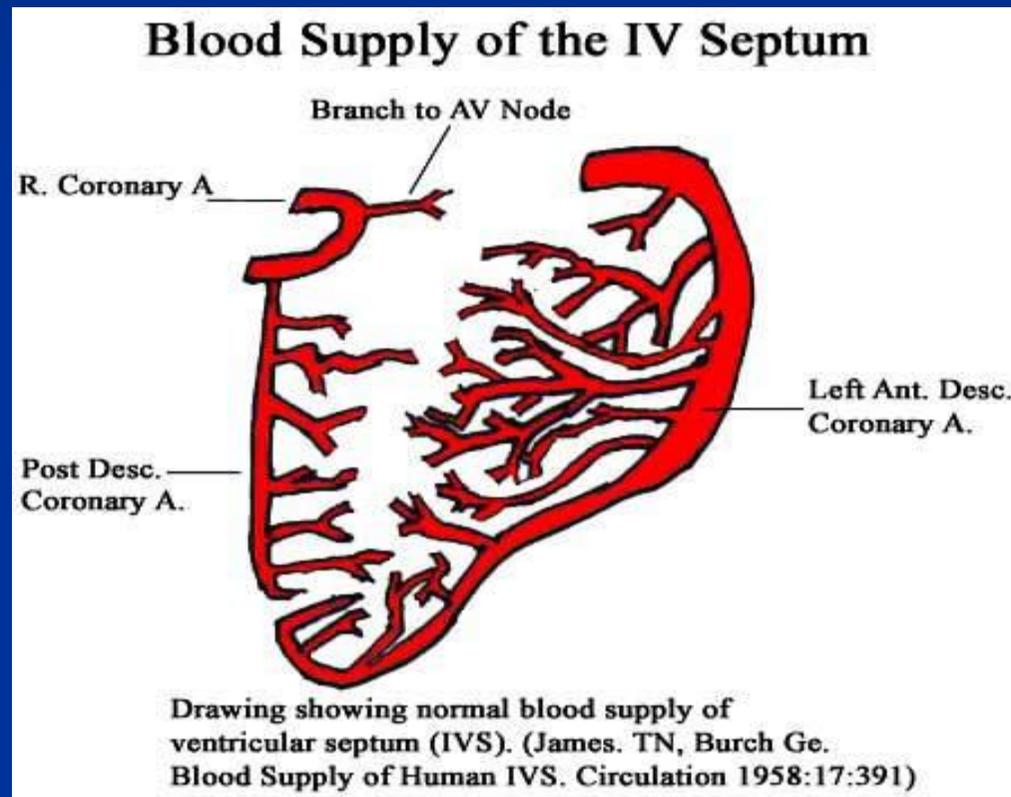


Patrick J. Lynch, 1999

Electrical System of the Heart



Blood supply of the septum



Think Anatomically

- RCA supplies at or above the A-V node
 - A-V node
 - S-A node

- LAD supplies below the A-V node
 - His-Purkinje system
 - Distal conduction system



“Code Blue”



Arrhythmic Complications of MI

- 90% of patients develop some form of arrhythmia
 - During or immediately after the event
 - Most benign and self-limited
- 25% within the first 24 hours
- First Hour
 - Risk of serious arrhythmias, such as VF or VT
 - The risk declines thereafter
- Higher with an STEMI
- But the arrhythmias that result in hypotension
 - Increase myocardial oxygen requirements
 - Predispose the patient to develop additional malignant ventricular arrhythmias



Pathophysiology of arrhythmic complications

- MI results:
 - Autonomic dysfunction
 - Enhanced automaticity
- The damaged myocardium acts as substrate
 - Re-entrant circuits
 - Changes in tissue refractoriness
- Hypoxia
- Electrolyte imbalances:
 - Hypokalemia and Hypomagnesemia



Classification of peri-infarction arrhythmias

■ Supraventricular Tachyarrhythmia's

- Sinus tachycardia
- Premature atrial contractions
- Paroxysmal SVT
- Atrial flutter
- Atrial fibrillation

■ Accelerated Junctional Rhythms

■ Bradyarrhythmias

- Sinus bradycardia
- junctional bradycardia
- Atrioventricular (AV) blocks
- First-degree AV block
- Second-degree AV block
- Third-degree AV block

■ Intraventricular Blocks

- Left anterior fascicular block (LAFB)
- Right bundle branch block (RBBB)
- Left bundle branch block (LBBB)

■ Ventricular Arrhythmias

- Premature ventricular contractions (PVCs)
- Accelerated Idioventricular Rhythm
- Ventricular tachycardia
- Ventricular fibrillation

■ “Reperfusion Arrhythmias”



Arrhythmias in Acute MI

Rhythm

Cause

- Sinus Bradycardia
 - Vagal tone ↑
 - SA nodal artery perfusion ↓
- Sinus Tachycardia
 - CHF
 - Volume depletion
 - Pericarditis
 - Chronotropic drugs (e.g. Dopamine)
- PAC's, atrial fib,
PVC's, VT, VF
 - CHF
 - Atrial Ischemia
 - Ventricular ischemia
 - CHF
- AV block (1°, 2°, 3°)
 - IMI: Incr. Vagal tone and dec. AV nodal artery flow
 - AMI: Destruction of conduction tissue



Objectives

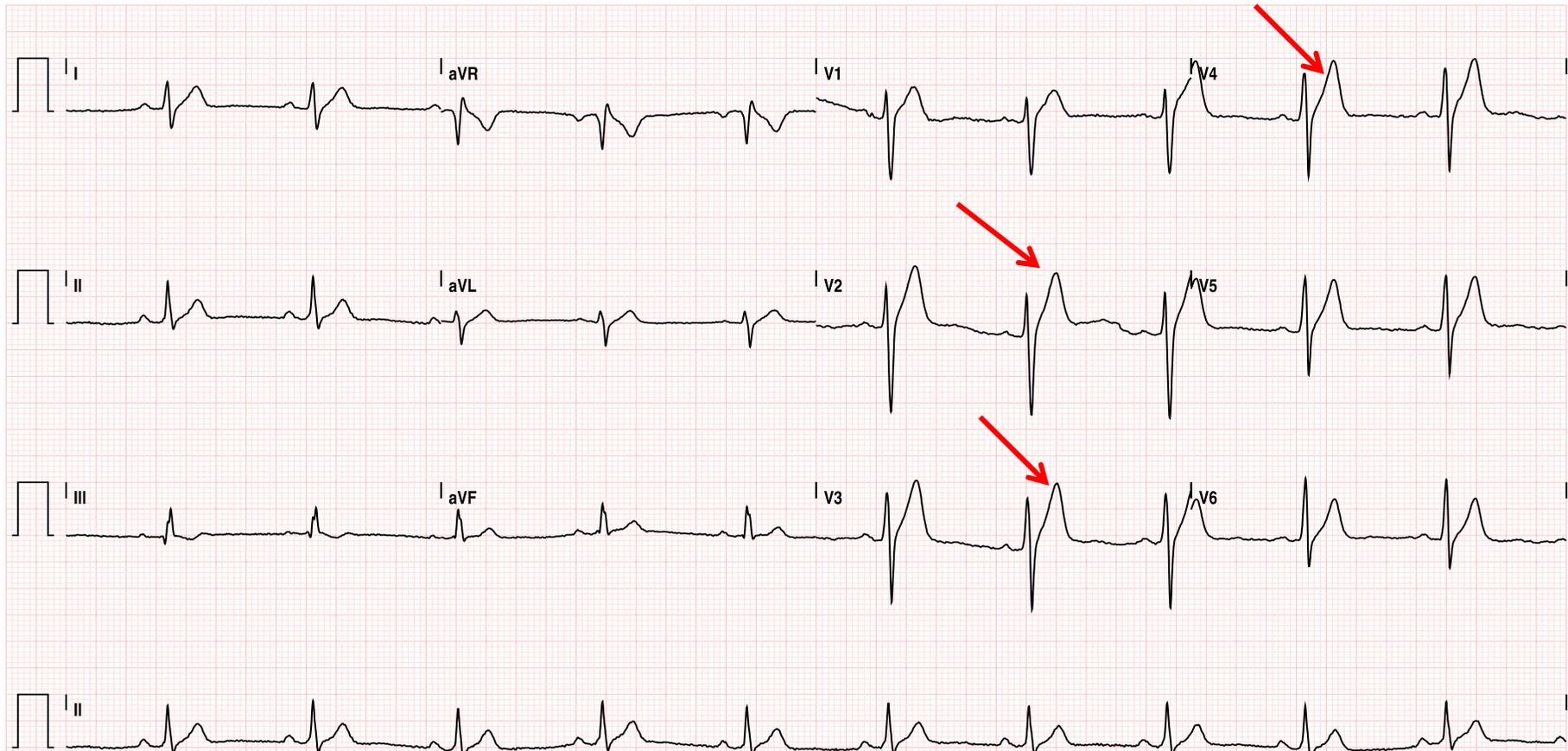
- Brief overview of Pathophysiology of Arrhythmia
- ECG review of typical STEMI's
- Bradyarrhythmias
- Tachyarrhythmias
- Treatment strategy for arrhythmias



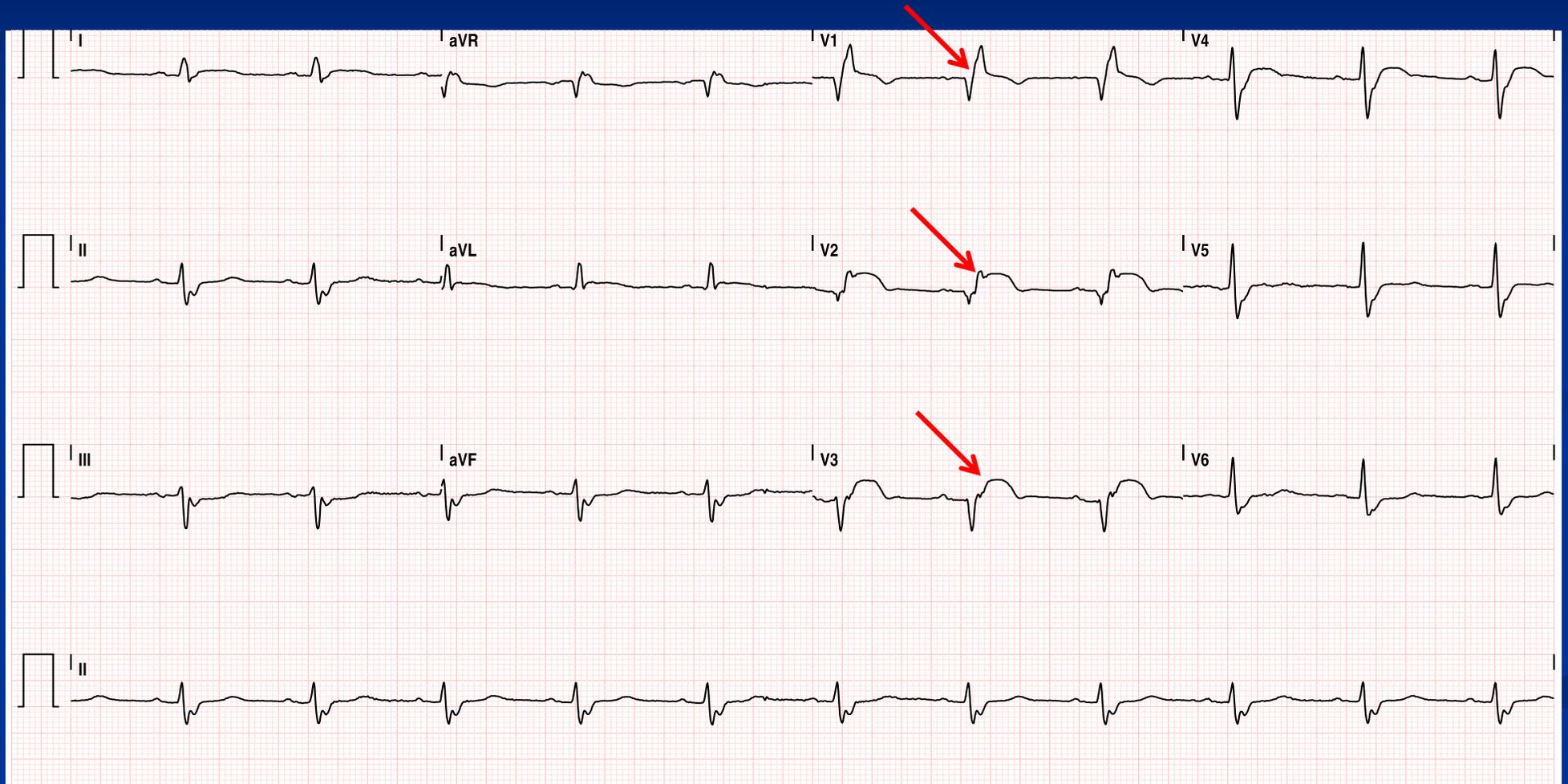
Hyper-acute T waves

REF ID: PATEL, PALAK
LOCATION CODE: DH58.
SEX: Male TECH ID: 123

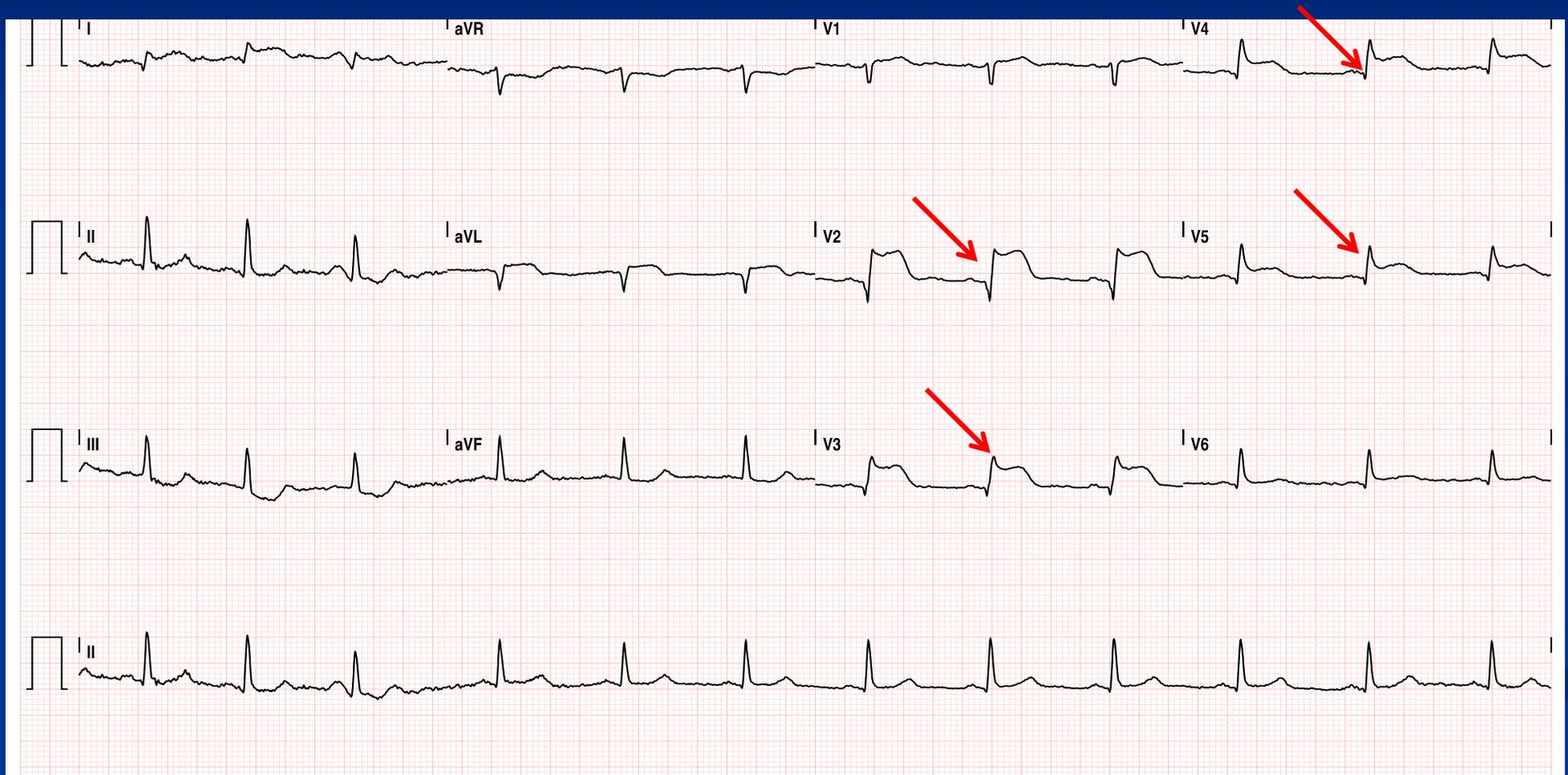
P-R-T axes: 48 79 33
Avg RR: 947 ms
QTcB: 340 ms



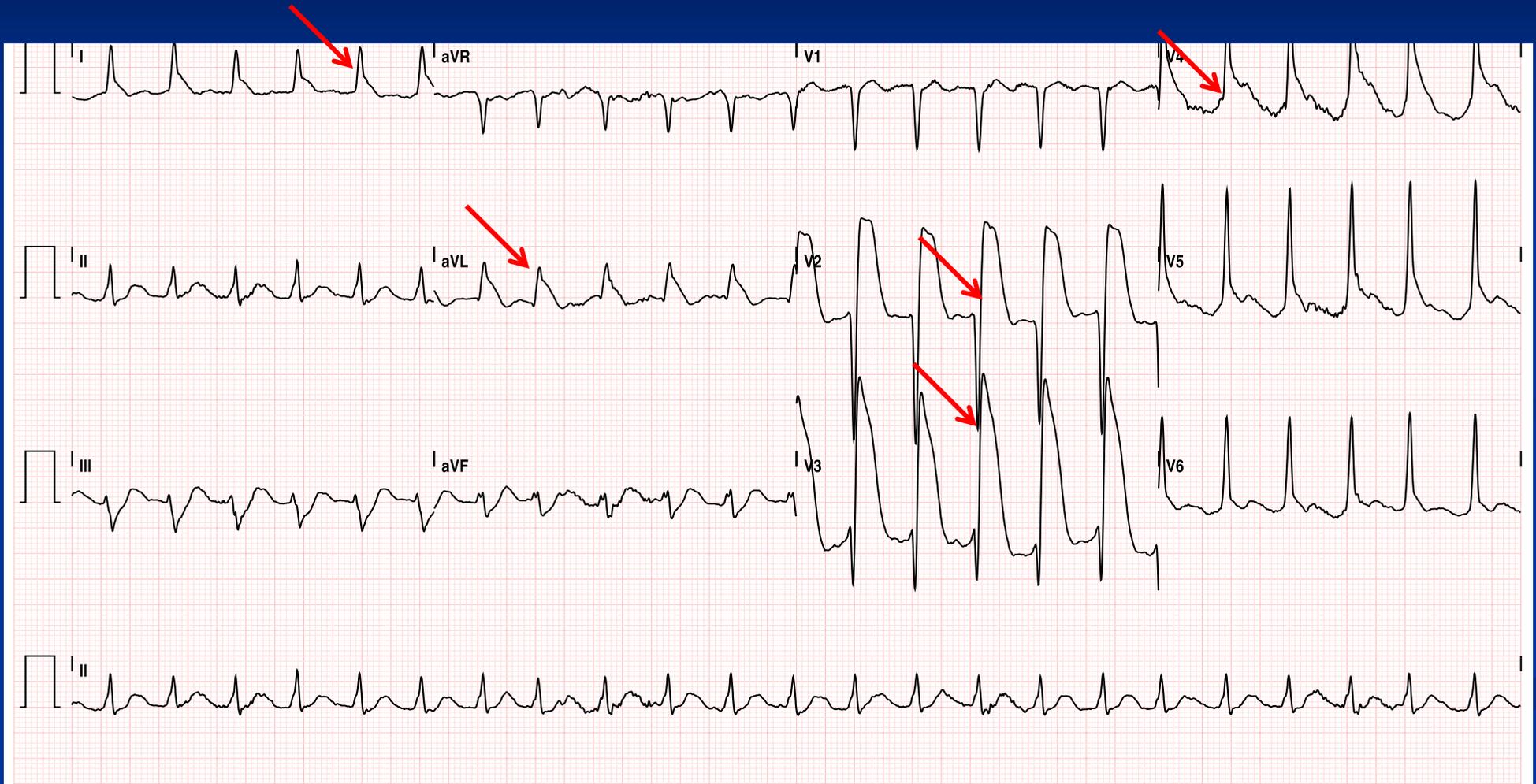
Septal MI



Anteroseptal and Anterior MI

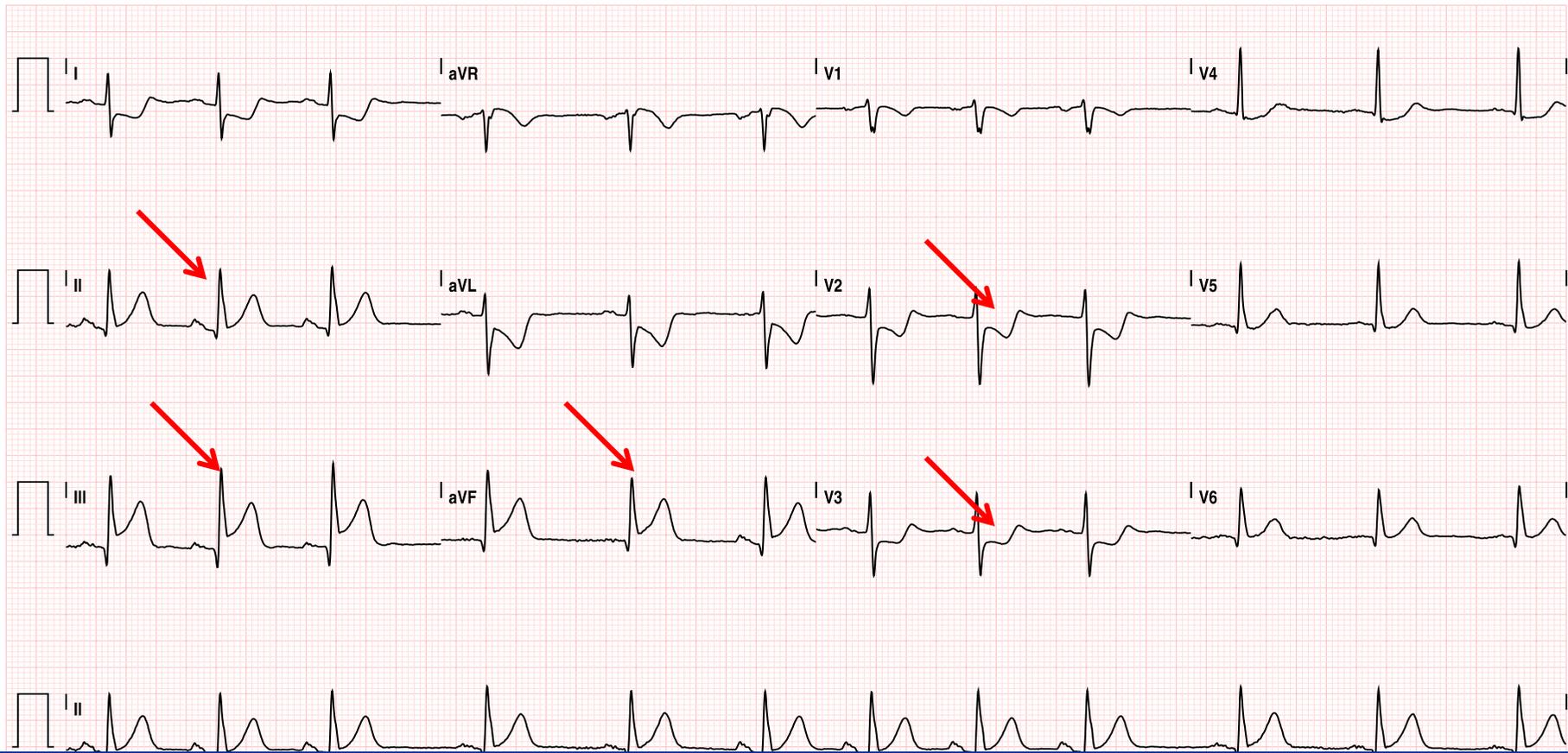


Anterior and lateral wall MI



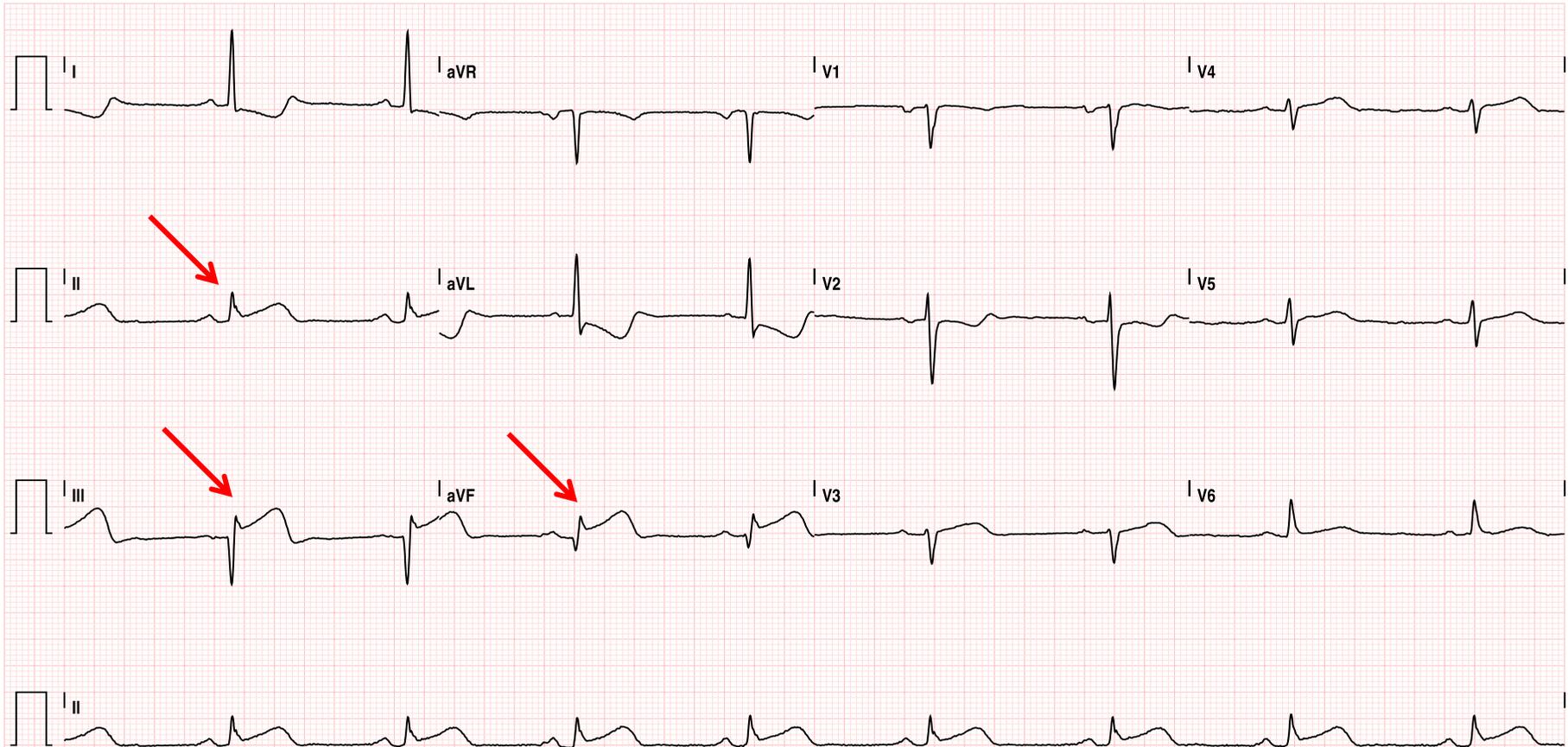
Inferior with posterior extension

REF ID: LARRAM, SHADI
LOCATION CODE: ED
SEX: Male
TECH ID: 158
P-R-T axes: 54 93 90
Avg RR: 854 ms
QTcB: 391 ms

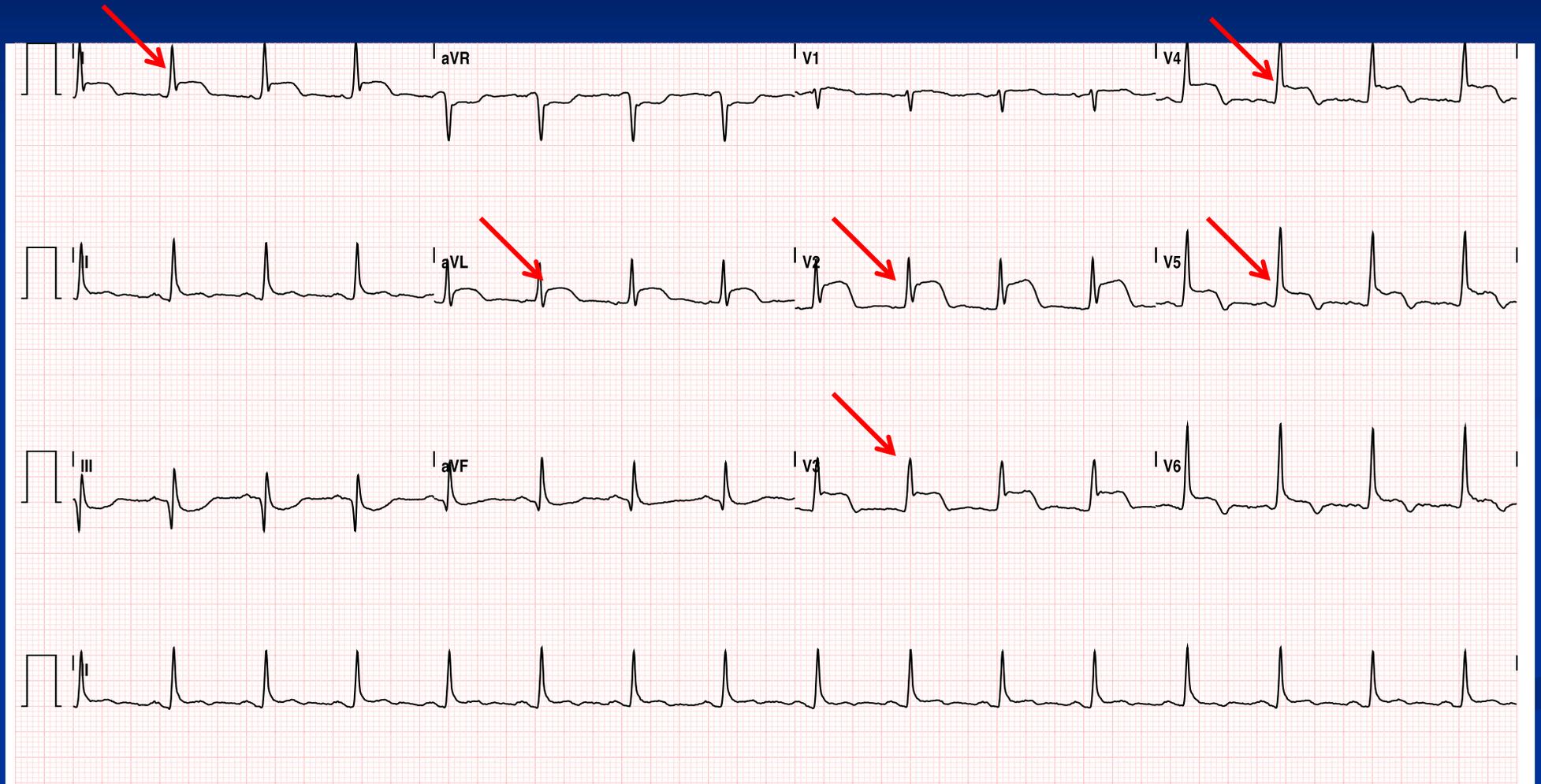


Inferior MI

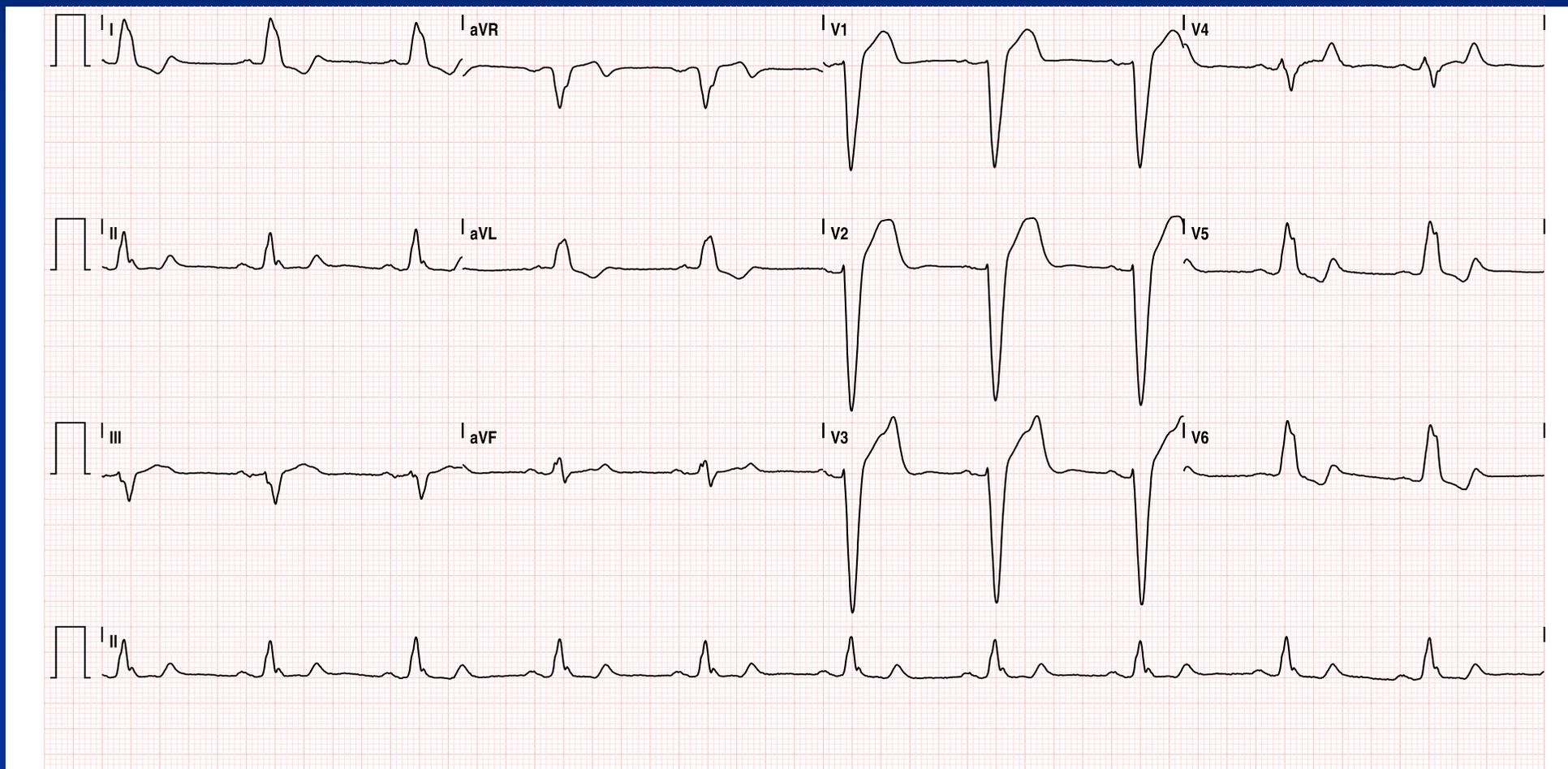
REF MD: KATZER, ROBERT
LOCATION CODE: ED
SEX: Female
TECH ID: 23
P-R-T axes: 30 3 103
Avg RR: 1182 ms
QTcB: 447 ms
Reviewed By: Telen Mitiku, MD 7/2/2015 11:01:34 AM



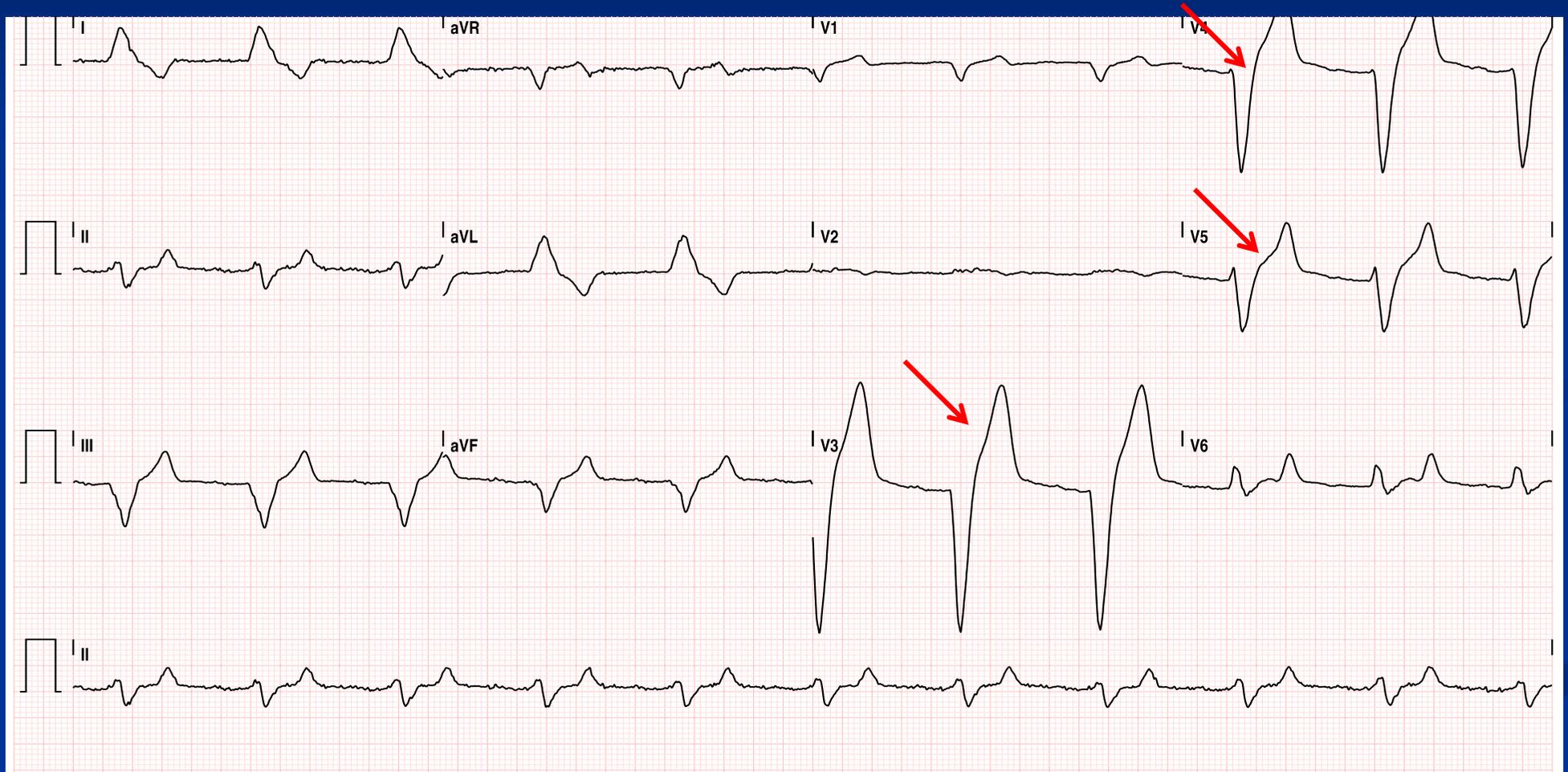
Anterior and lateral mi



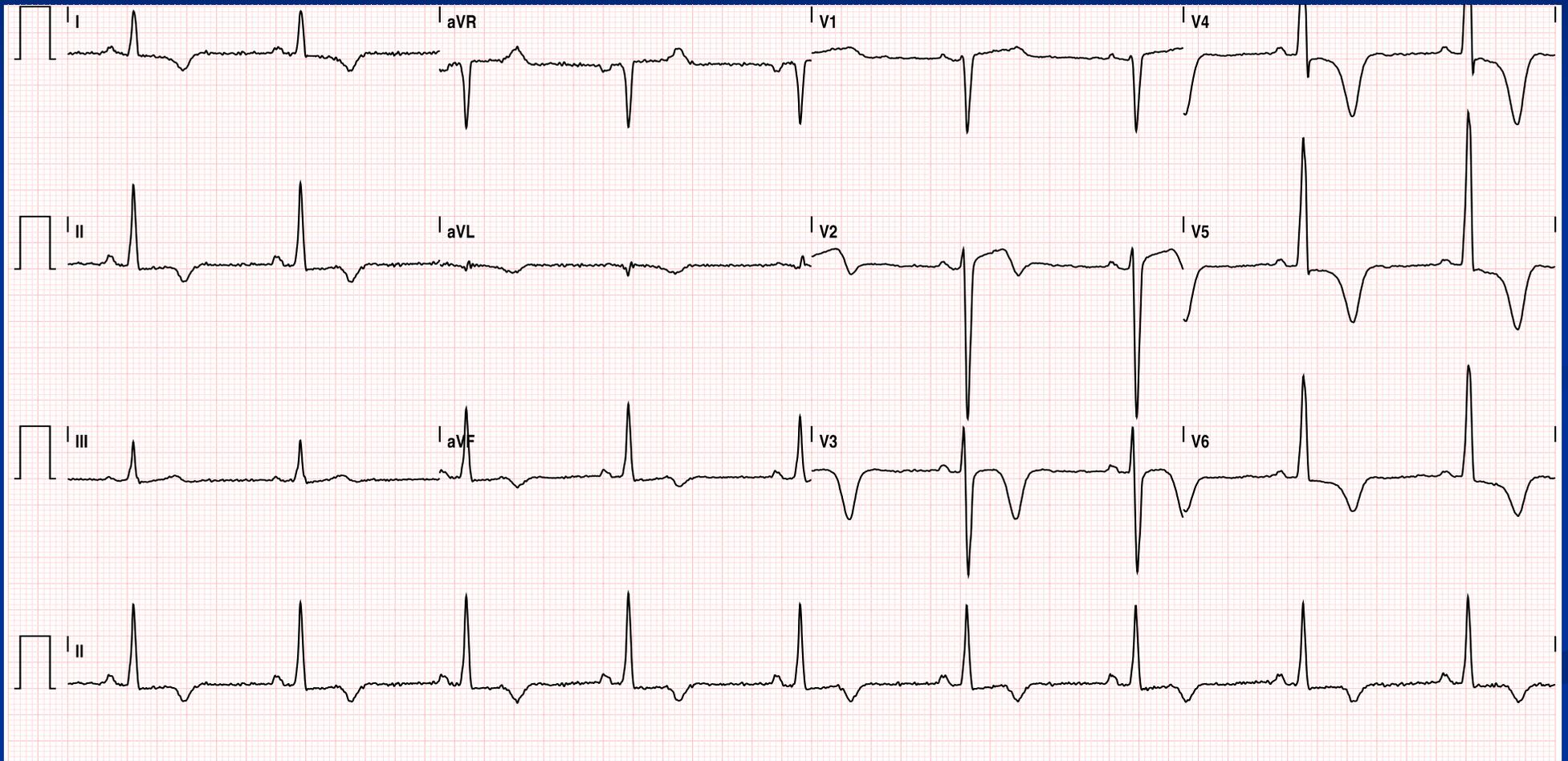
LBBB



Hyperkalemia



Left Ventricular Hypertrophy



Objectives

- Brief overview of Pathophysiology of Arrhythmia
- ECG review of typical STEMI's
- Bradyarrhythmias
- Tachyarrhythmias
- Treatment strategy for arrhythmias



Bradyarrhythmias

■ Signal Generation

- Sinus bradycardia
- Sinus arrest (“Sick Sinus Syndrome”)
- Junctional bradycardia

■ Signal Propagation

- Atrioventricular block
- First degree
- Second degree- type I (Wenckebach) / type II
- Third degree

■ Distal conduction

- His Purkinje and beyond



Sinus bradycardia

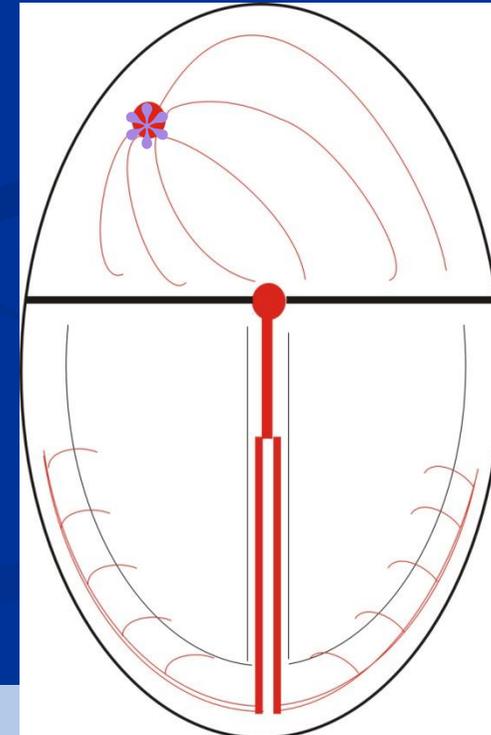


Rate < 60bpm

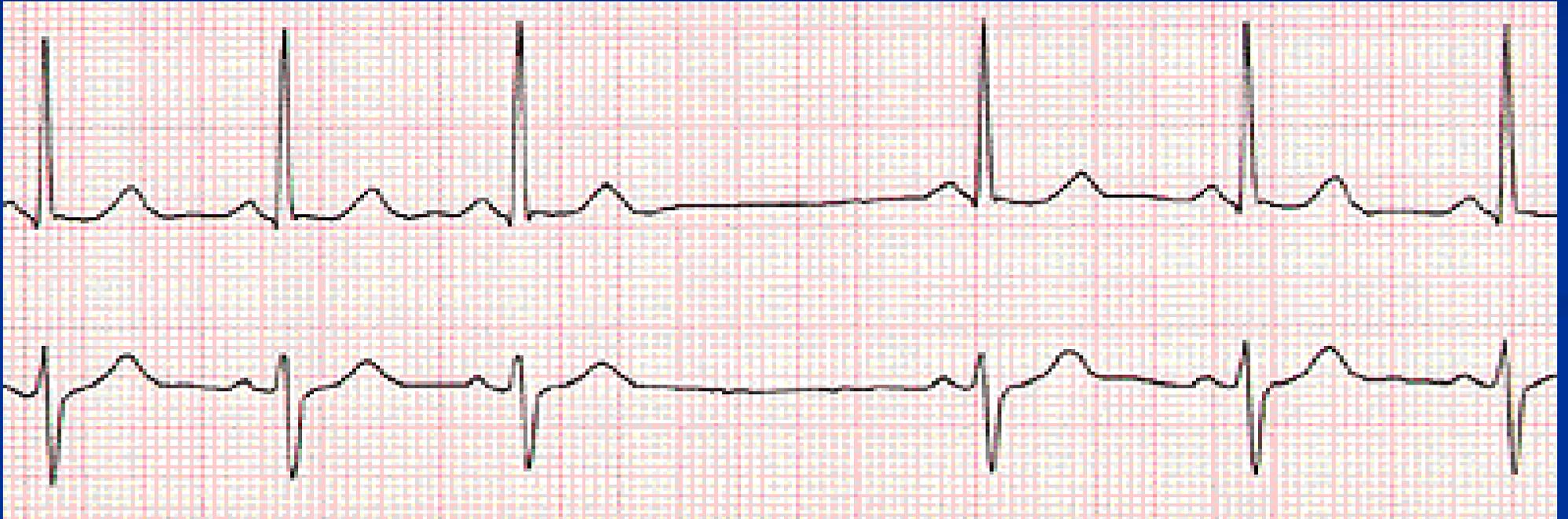
Regular, narrow QRS

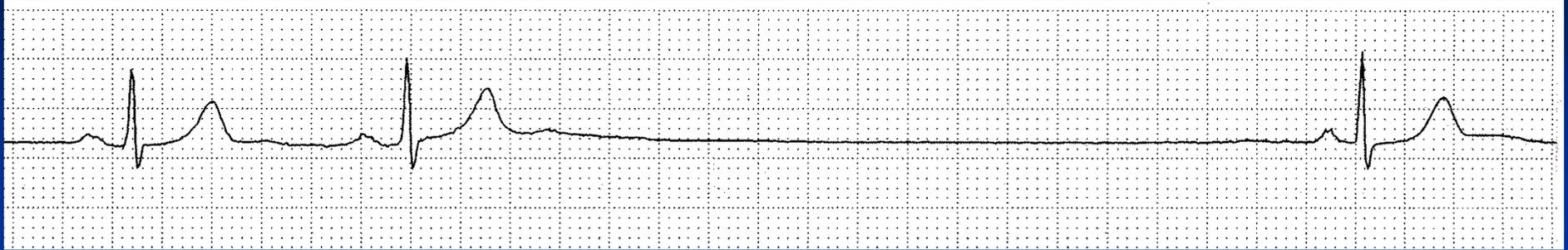
P waves present

P:QRS is 1:1



Sinus node disease





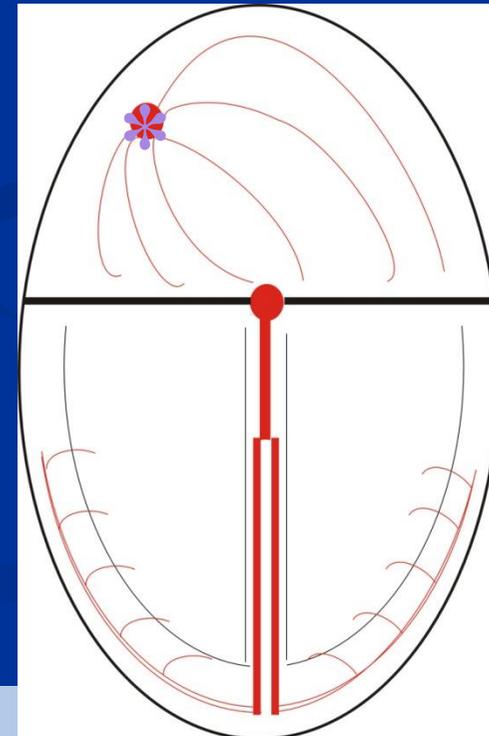
Rate < 60bpm

Irregular, narrow QRS

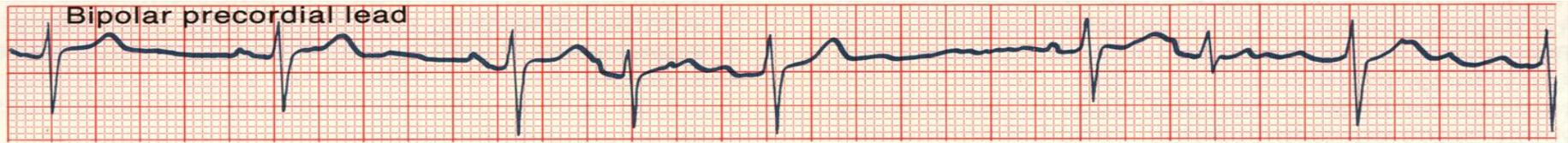
P waves present

P:QRS is 1:1

Pause with absence of P wave



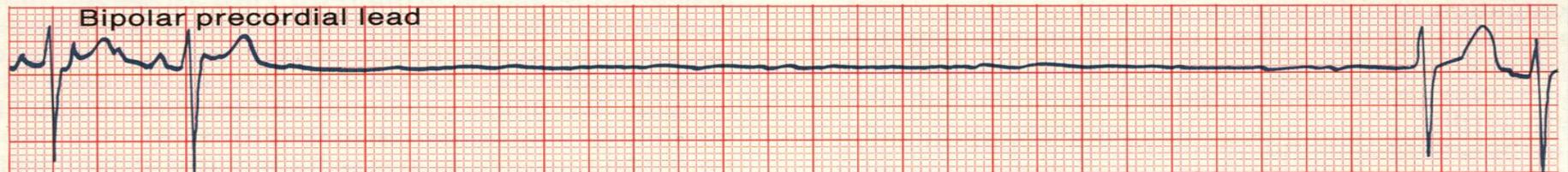
Sick Sinus Syndrome



A Alternation between sinus bradycardia and atrial flutter



B Atrial flutter



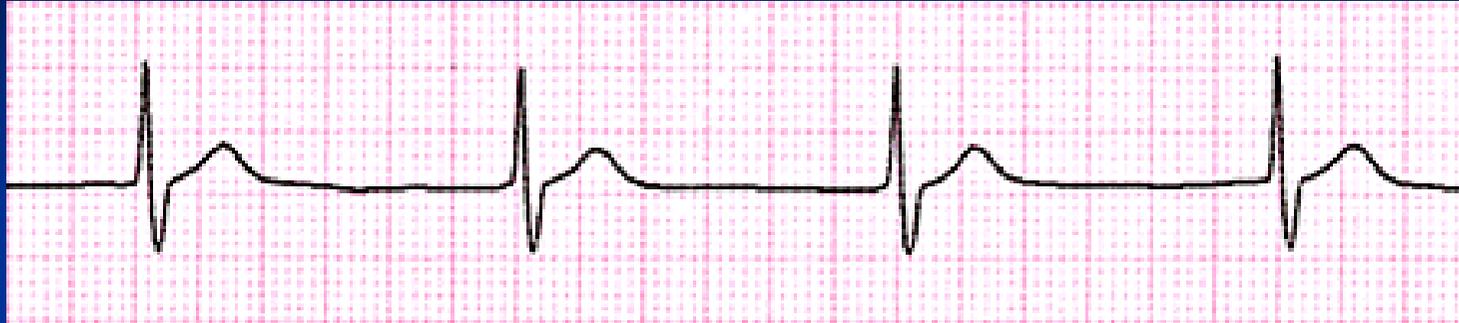
C The end of an episode of atrial flutter followed by SA block or sinus arrest with no signs of atrial activity for a period of 5.5 s ending with an AV junctional escape



D AV junctional rhythm followed by two sinus complexes



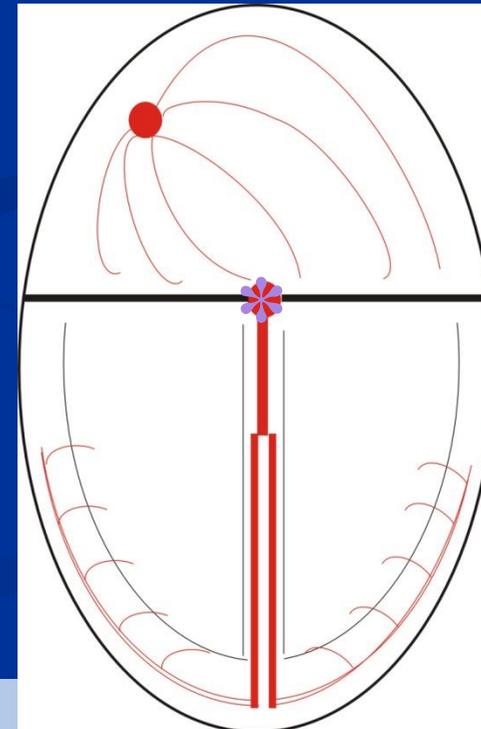
Junctional bradycardia



Rate < 60bpm

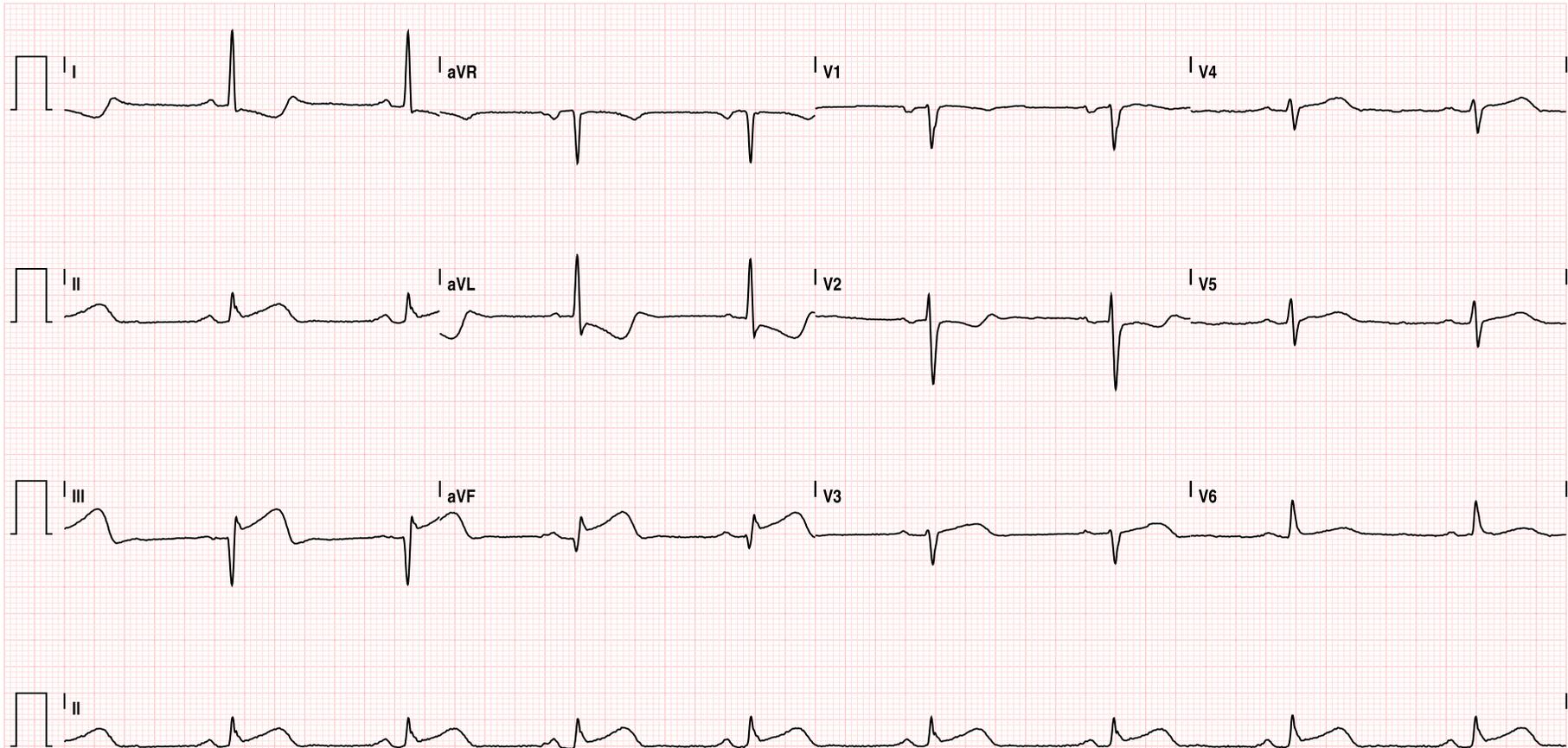
Regular, narrow QRS

No P waves



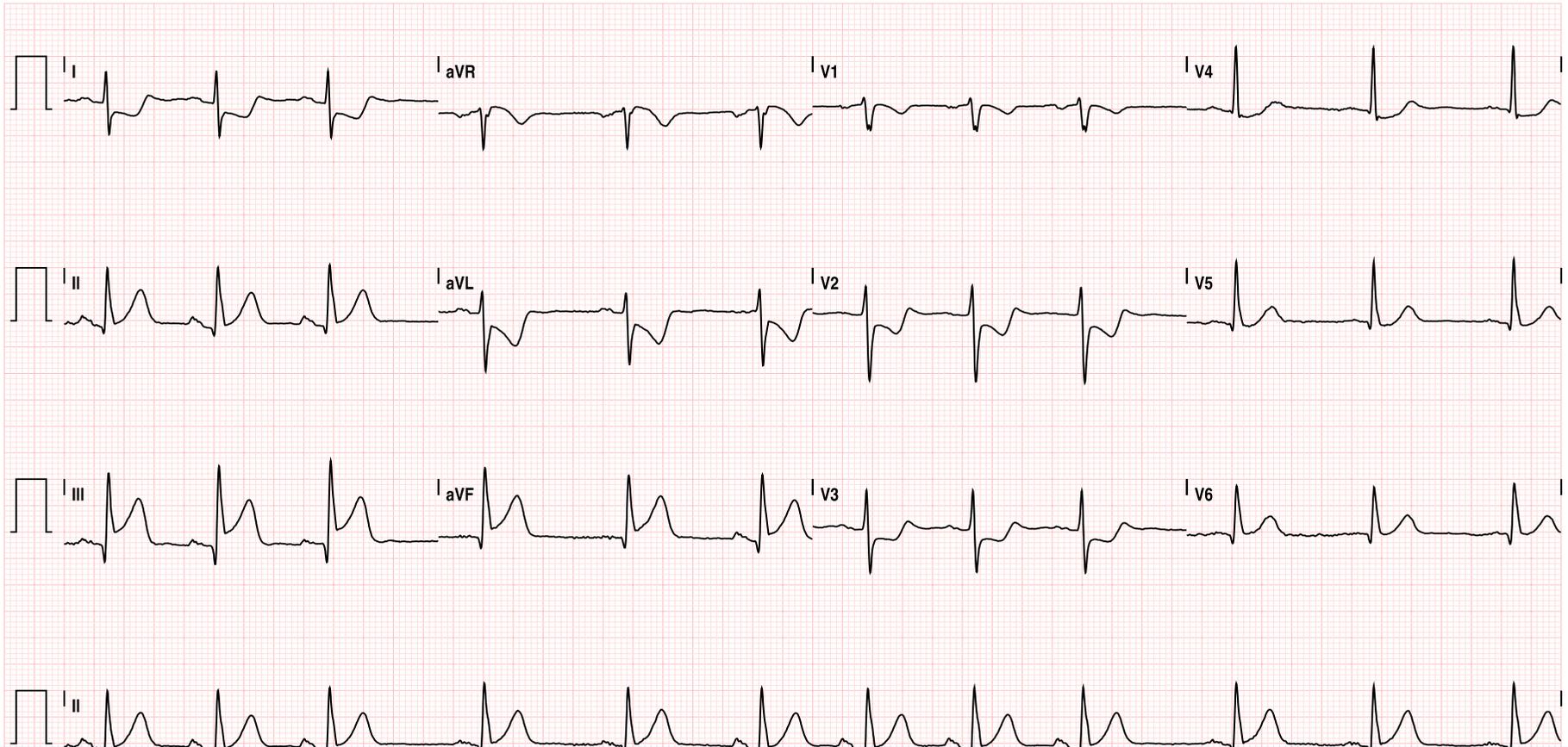
Inferior wall MI

REF MD: KATZER, ROBERT
LOCATION CODE: ED
SEX: Female
TECH ID: 23
P-R-T axes: 30 3 103
Avg RR: 1182 ms
QTcB: 447 ms
Reviewed By: Telen Mitiku, MD 7/2/2015 11:01:34 AM

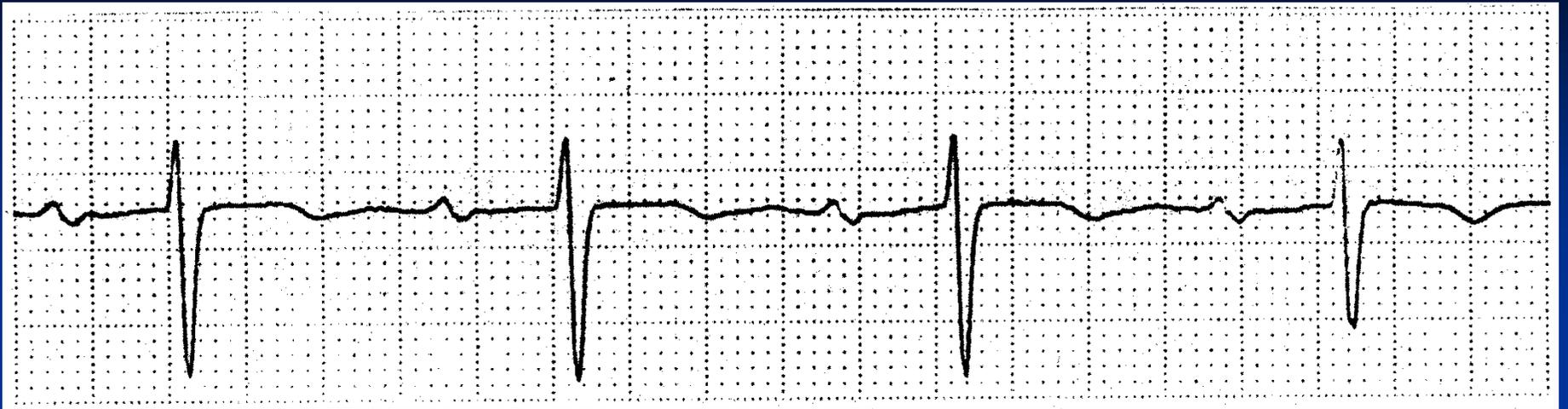


IMI with posterior ext

REF ID: LARRAM, SHADI
LOCATION CODE: ED
SEX: Male
TECH ID: 158
P-R-T axes: 54 93 90
Avg RR: 854 ms
QTcB: 391 ms



First degree AV block

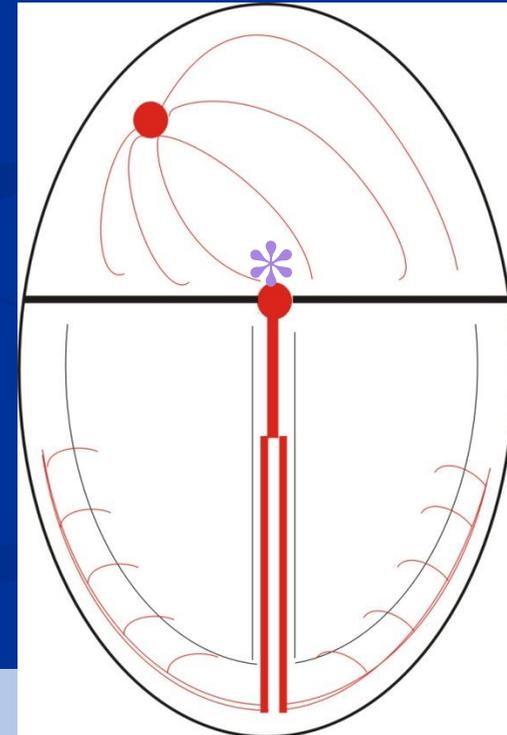


Rate variable

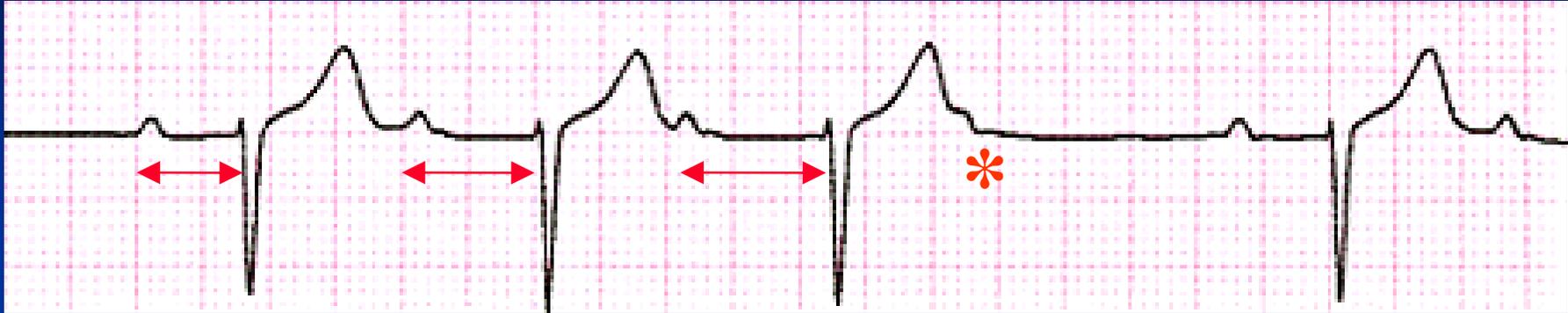
Regular, narrow QRS

P waves present

**P:QRS is 1:1 with PR interval
>200ms**



Second degree AV block (type I)



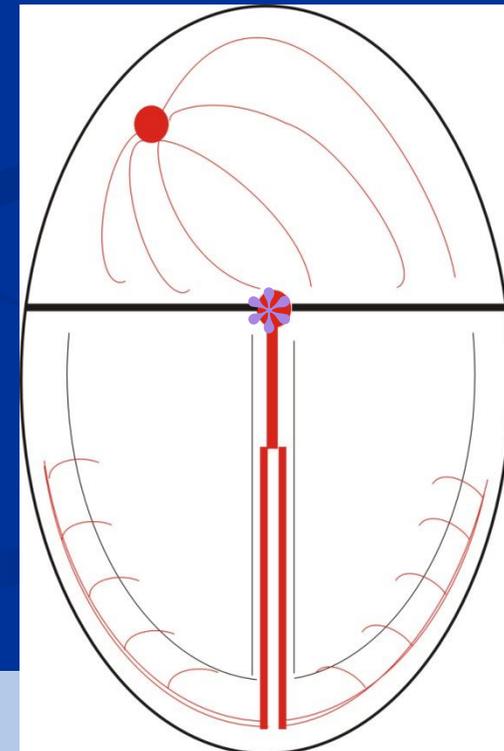
Rate < 60bpm

Irregular narrow QRS

P:QRS not 1:1

increasing PR interval

then dropped beat



Second degree AV block (type II)

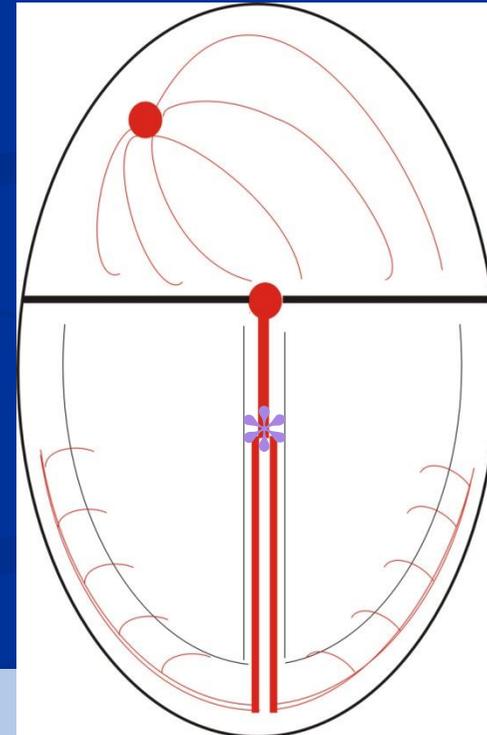


Rate < 60bpm

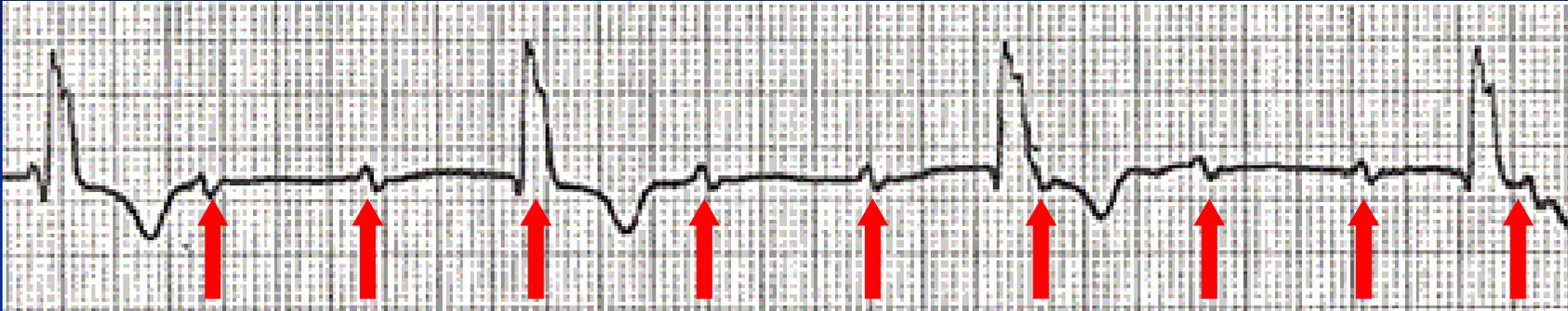
Irregular narrow QRS

P:QRS not 1:1

normal PR interval with
intermittent dropped beats



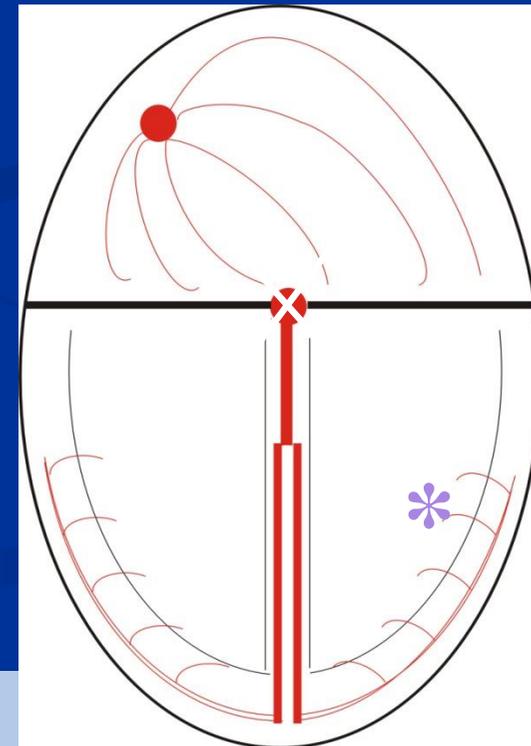
Third degree (complete) AV block



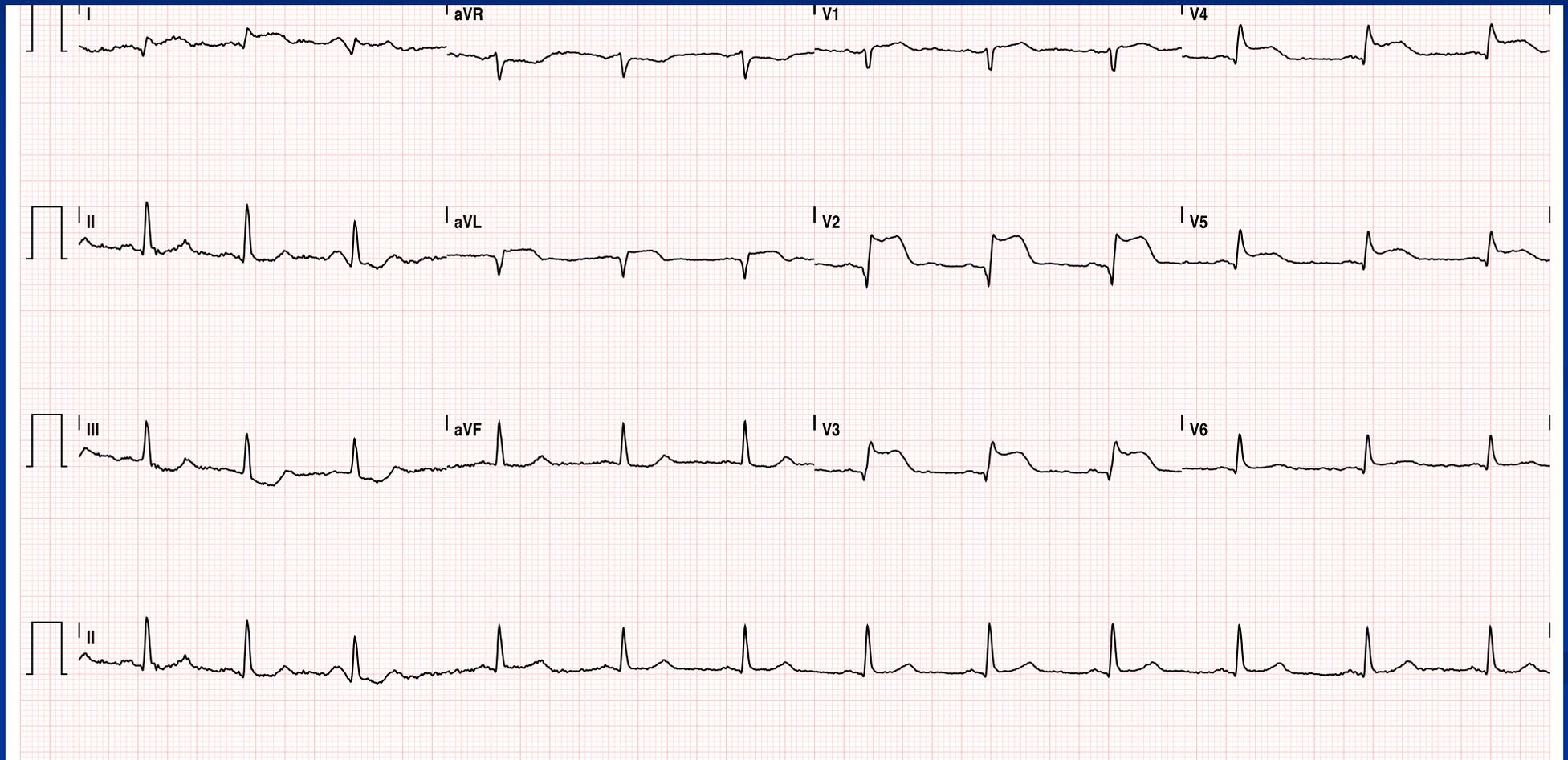
Rate < 60bpm

Regular broad QRS

No relation between P and QRS

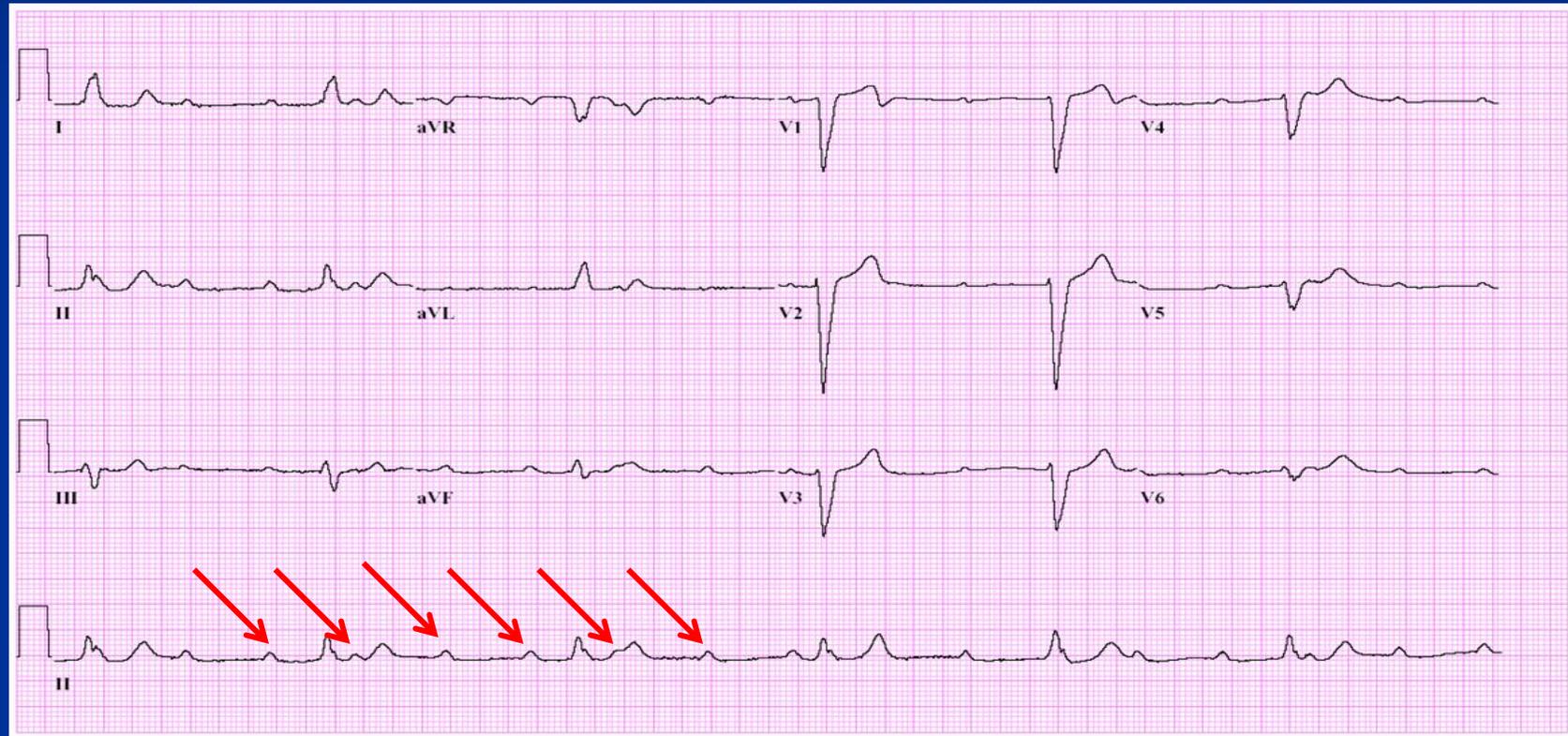


Anterior and Anteroseptal



Diagnosis?

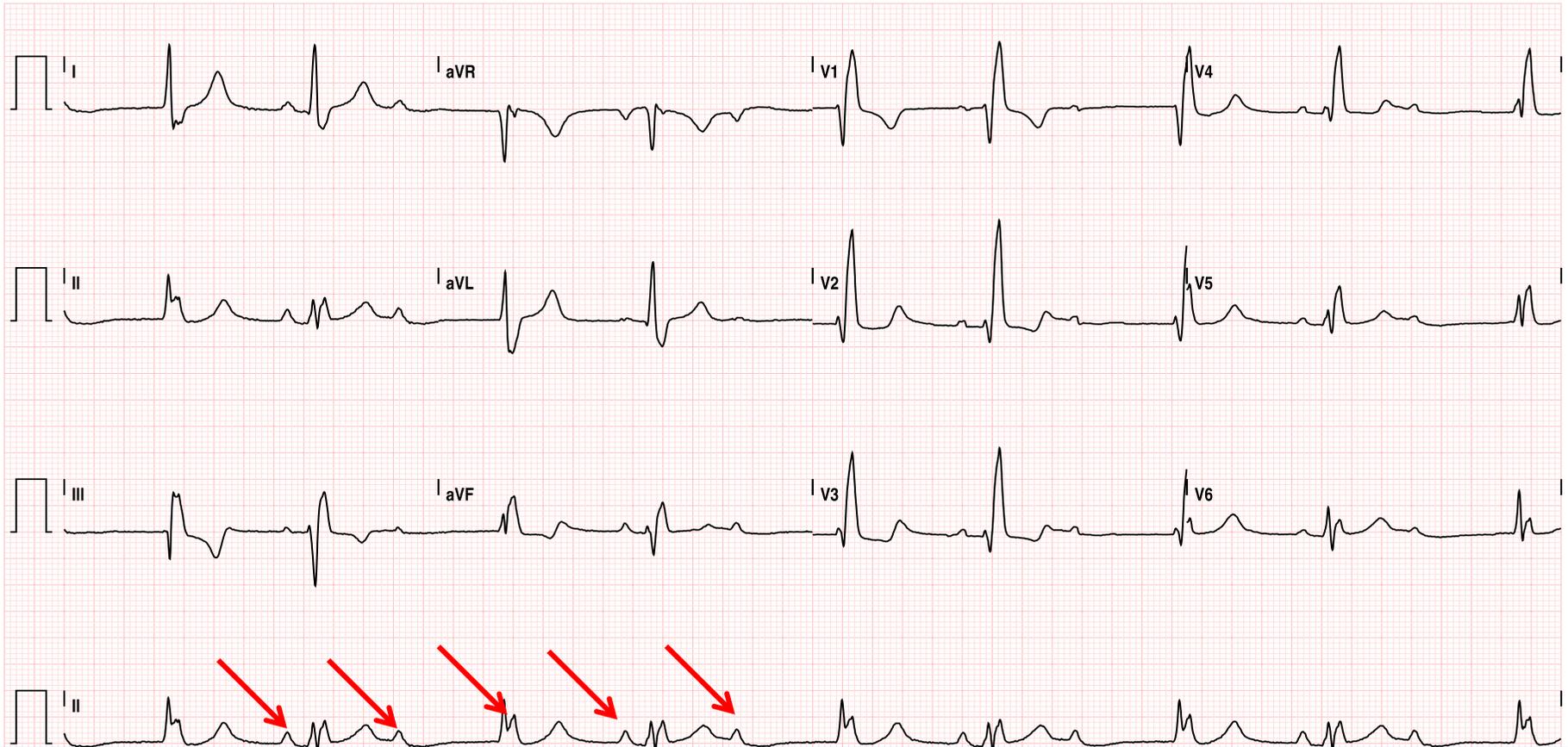
LBBB with Complete Heart block



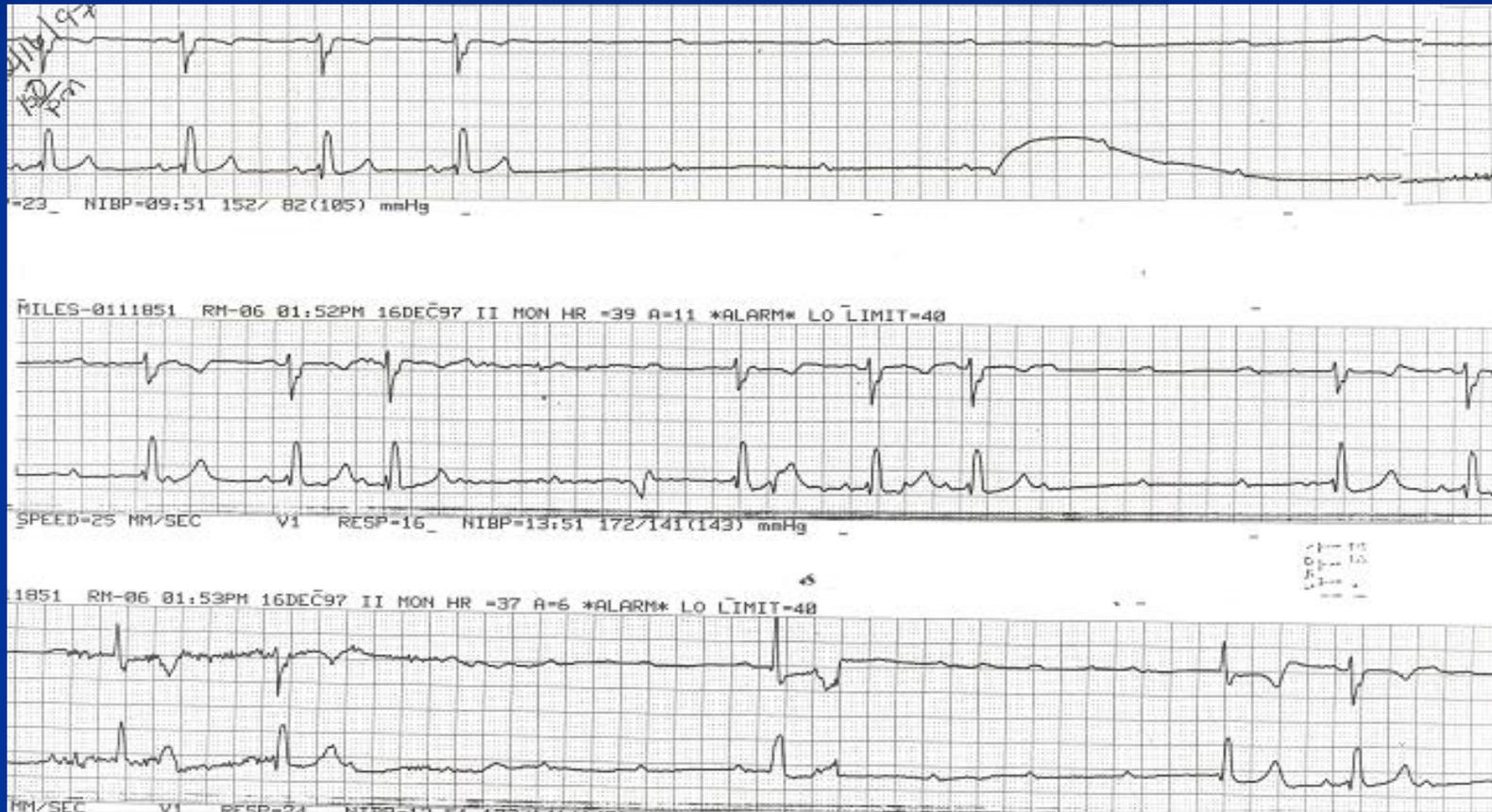
Diagnosis?

RBBB with Complete heart block

REF ID: ESPINOSA, TAMINAH
LOCATION CODE T5.
SEX Male TECH ID 120
P-R-T axes: 52 2 14
Avg RR: 1107 ms
QTcB: 460 ms



LBBB to CHB



Objectives

- Brief overview of Pathophysiology of Arrhythmia
- ECG review of typical STEMI's
- Bradyarrhythmias
- Tachyarrhythmias
- Treatment strategy for arrhythmias



Tachyarrhythmias

- Irregular

- Atrial fibrillation

- Regular

- Narrow QRS

- Sinus tachycardia

- Supraventricular tachycardia (SVT)

- Atrial flutter

- Broad QRS

- Ventricular tachycardia

- SVT with Bundle Branch Block



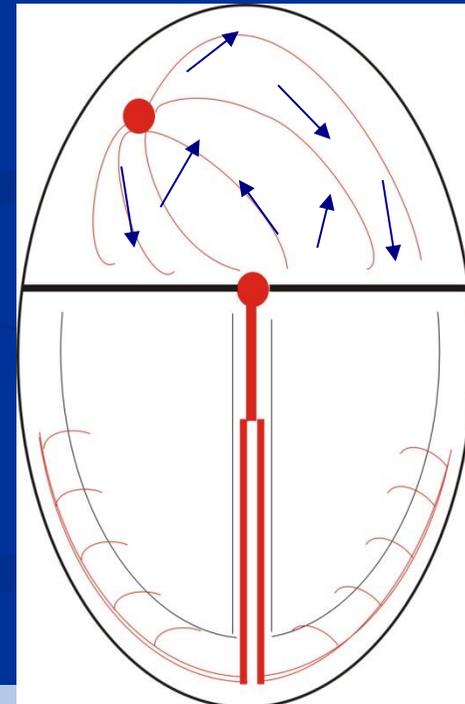
Atrial fibrillation



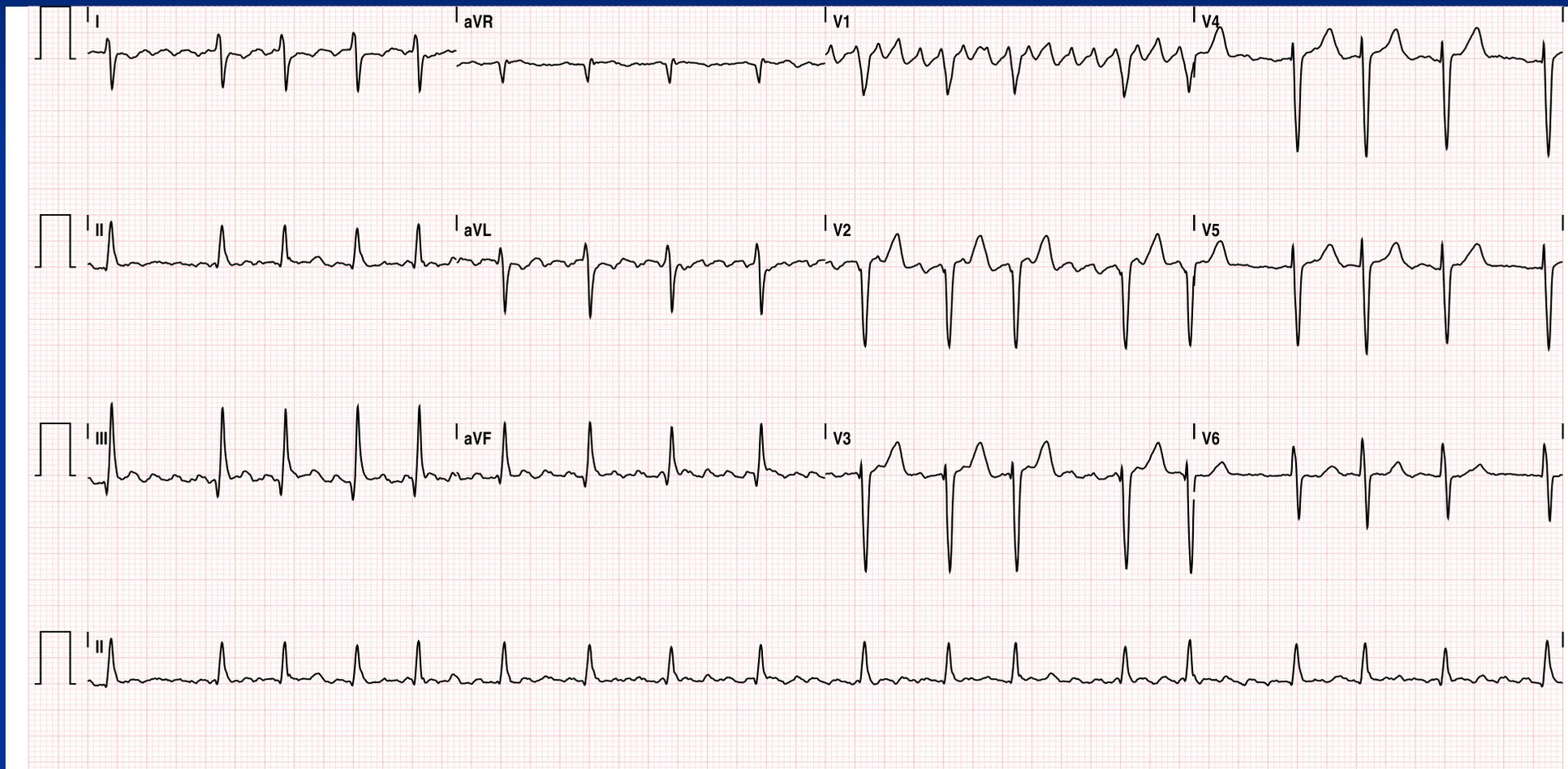
Rate variable

Irregular, narrow QRS

No P waves



Coarse afib



Diagnosis?

Artifact



Sinus tachycardia

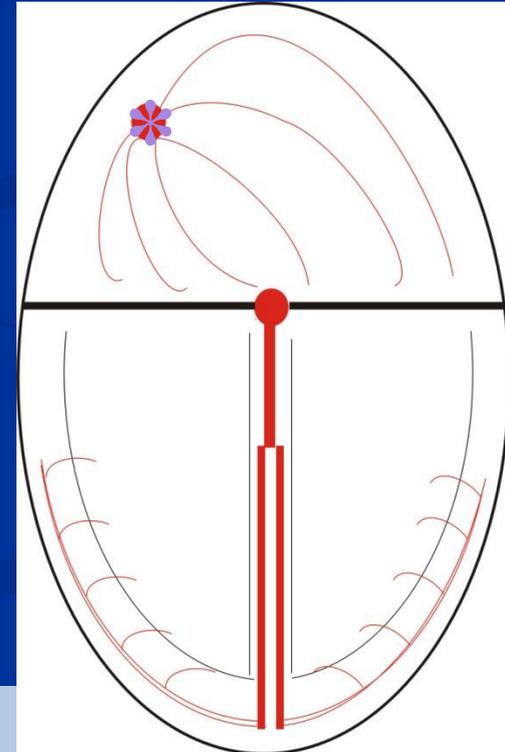


Rate > 100bpm

Regular, narrow QRS

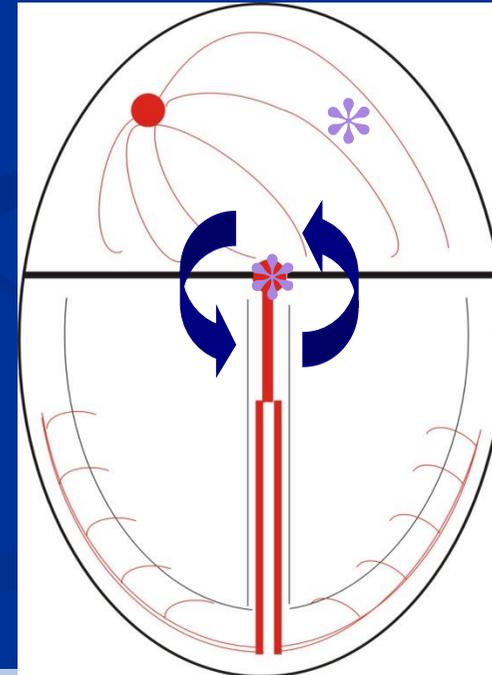
P waves present

P:QRS is 1:1



Supraventricular tachycardias

- Atrial tachycardia
- Junctional tachycardia
- AV re-entrant tachycardia
- AV node re-entrant tachycardia



Supraventricular tachycardia

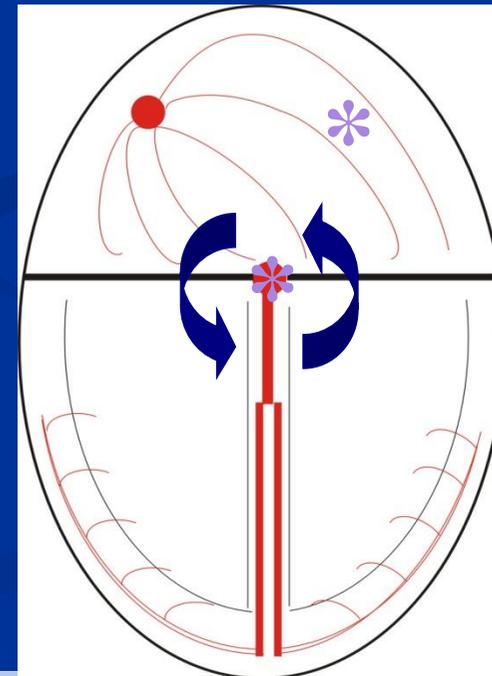


Rate > 100bpm

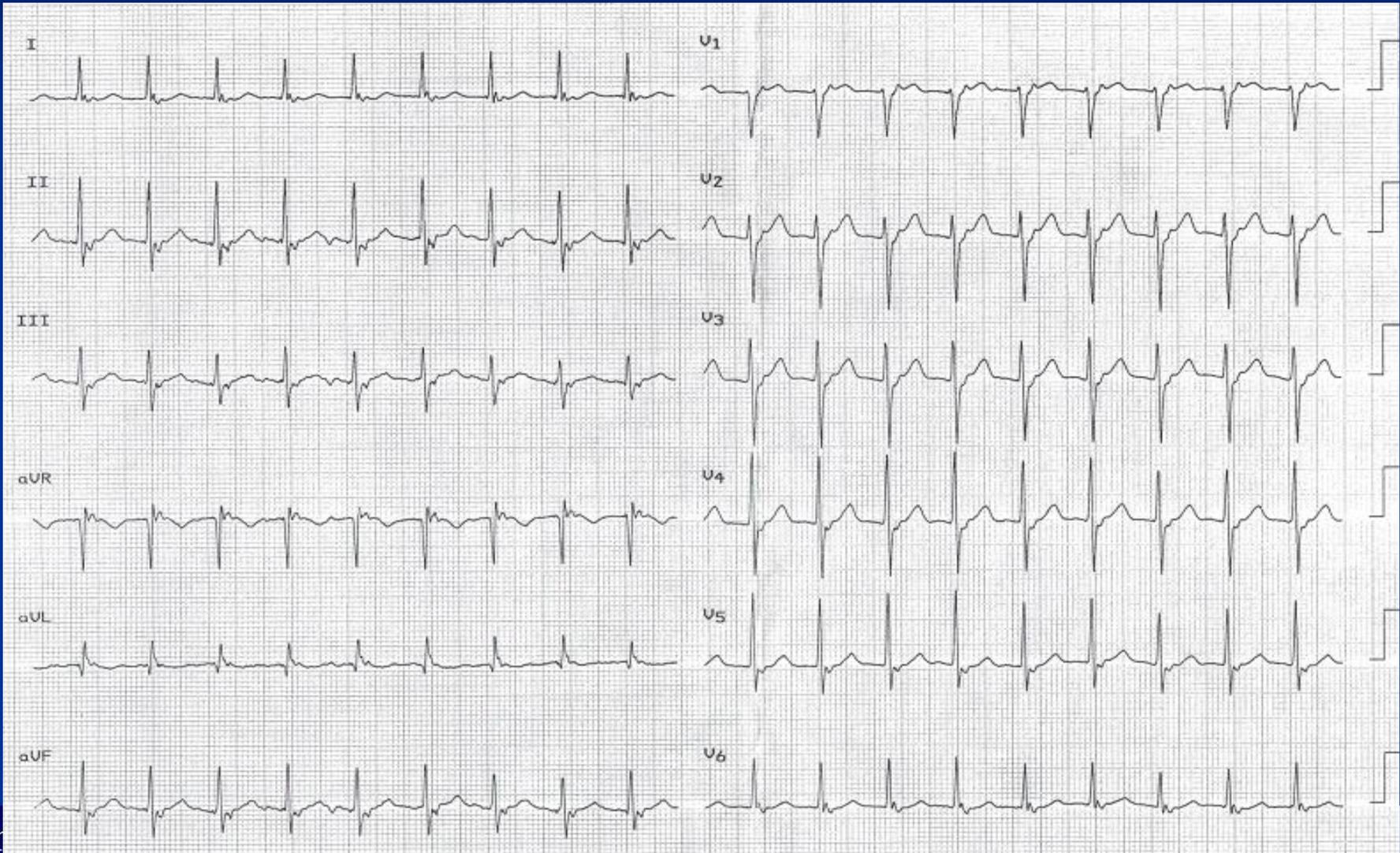
Regular, narrow QRS

P waves variable

- not apparent, or after QRS



SVT--- AVNRT



Atrial flutter

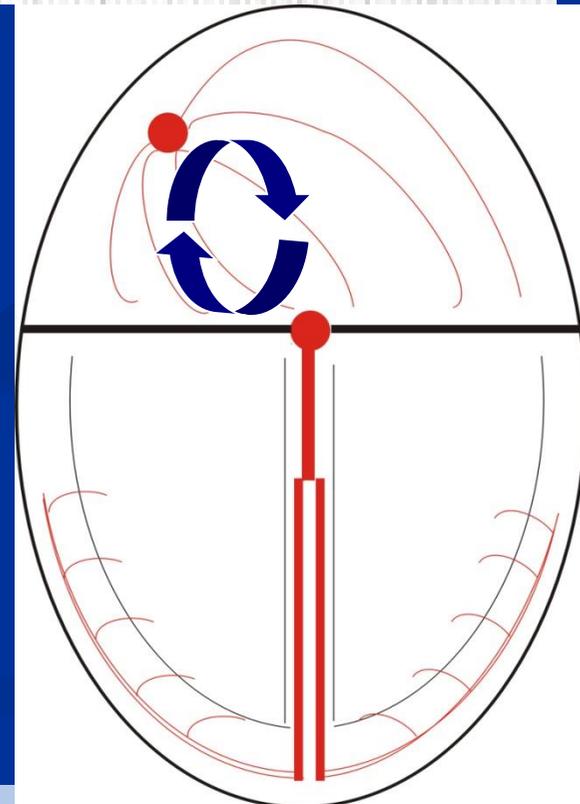


Rate variable

Regular, narrow QRS

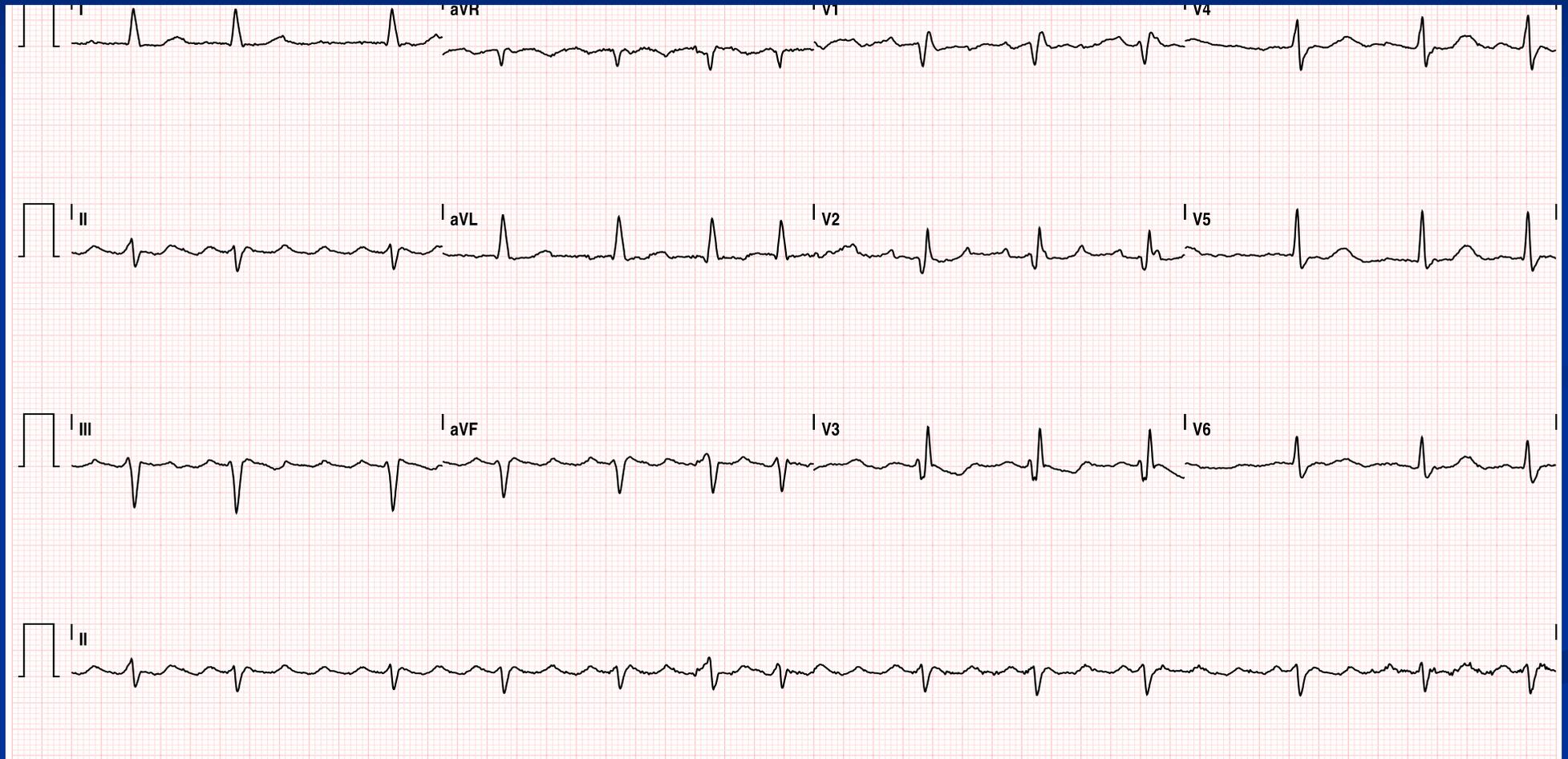
Sawtooth atrial activity 300bpm

- variable AV block

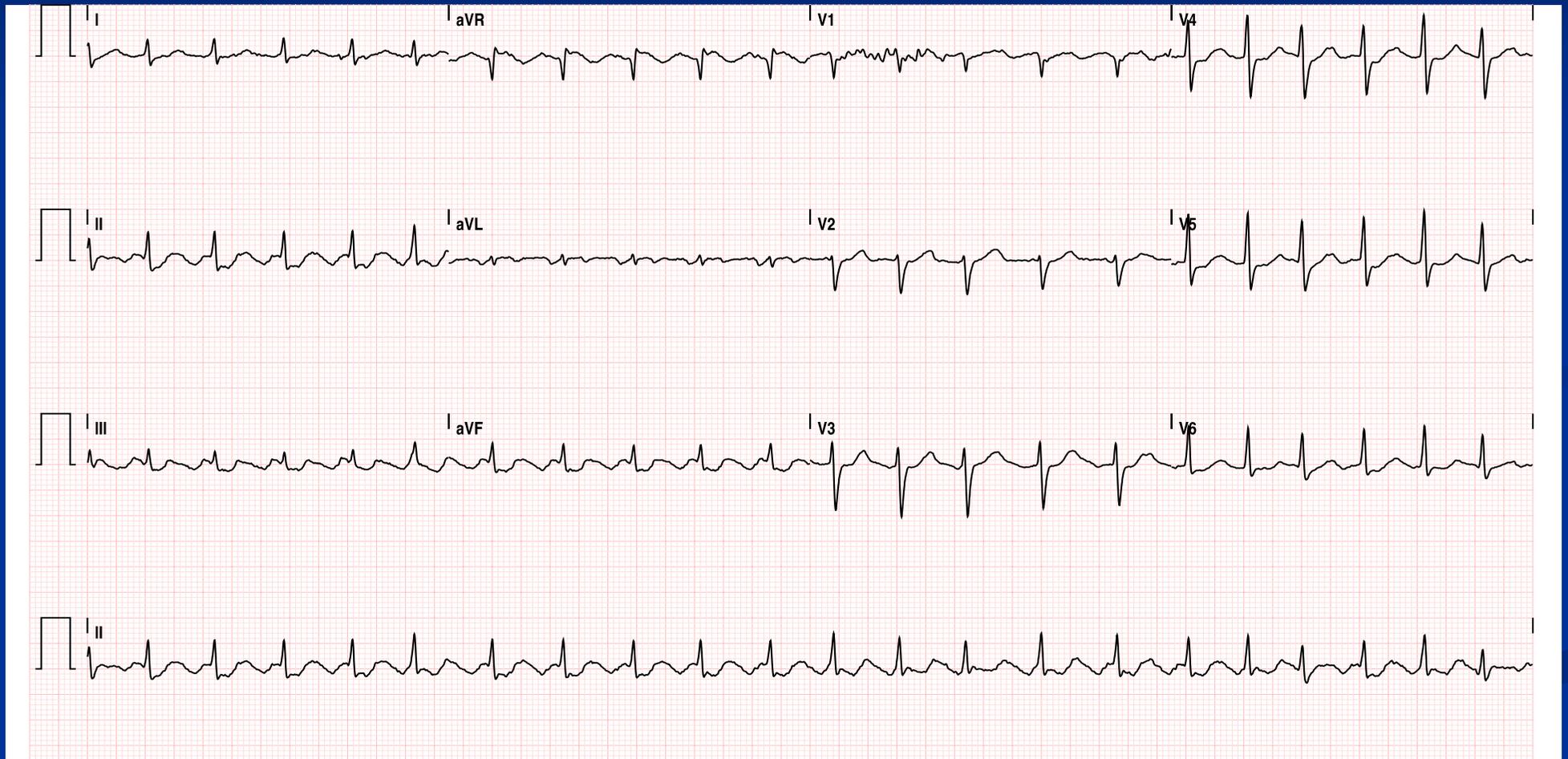


Diagnosis?

Flutter



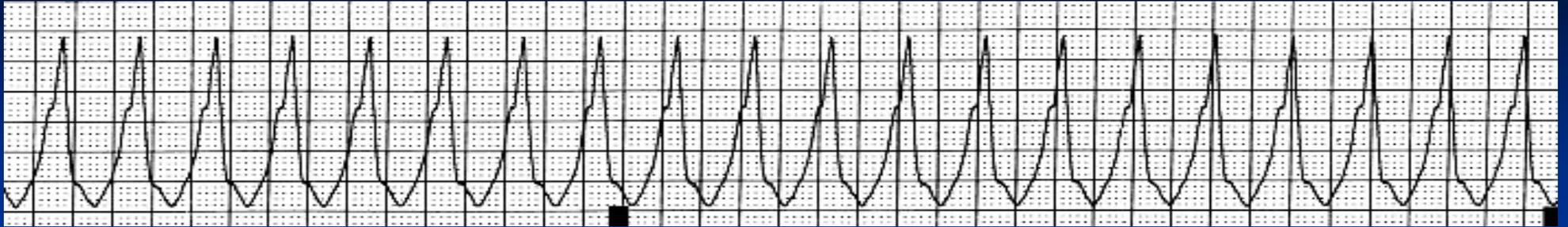
Flutter



Arrhythmic Complications: Ventricular Arrhythmias

- Greatest in the first hour \sim (4.5%) with massive MI's
 - \sim 80% occur within 12 hours
- Secondary or late VF >48 hours after an MI
 - Associated with pump failure and cardiogenic shock
 - In-hospital mortality rate of 40-60%
- Each minute of uncorrected VF is associated a 10% decrease in the likelihood of survival
- Intravenous amiodarone and lidocaine
- If not in cardiogenic shock- Beta Blockers- reduce VF and mortality

Ventricular tachycardia

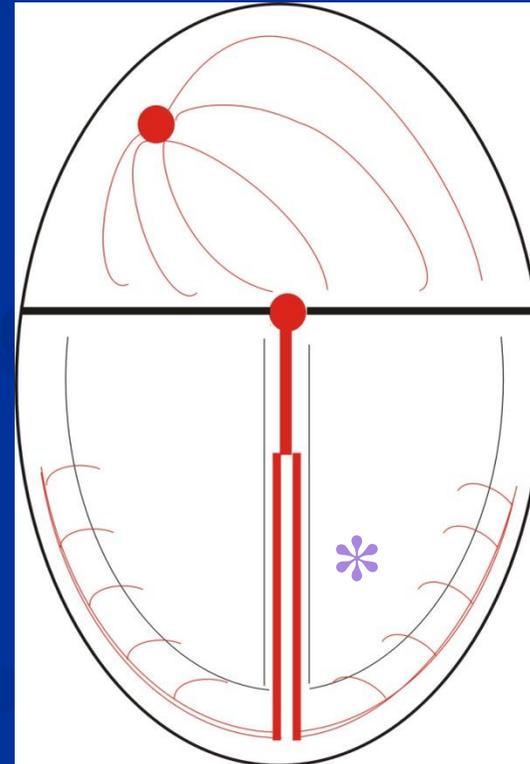


Rate > 100bpm

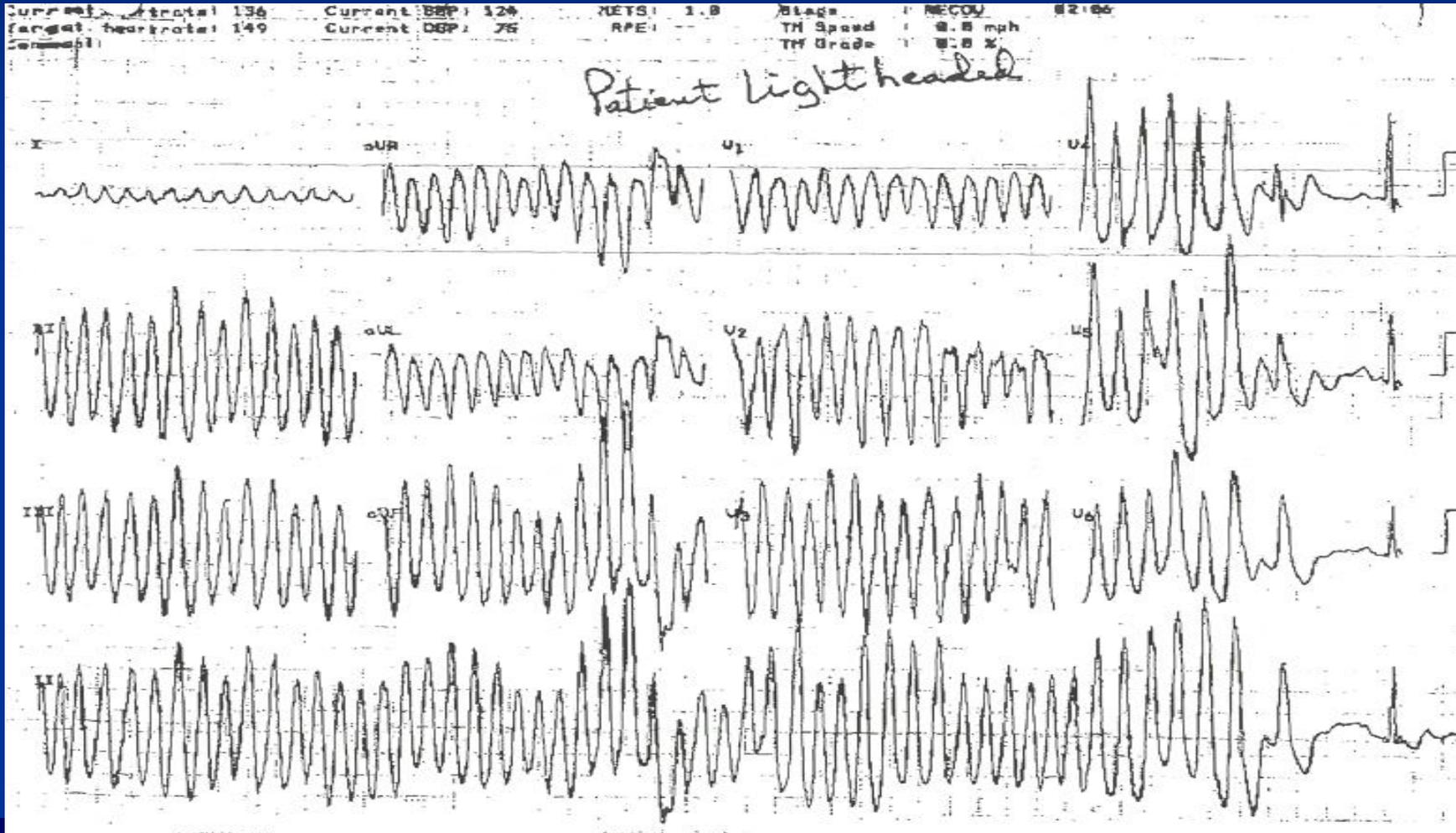
Regular, broad QRS

P waves variable

- may be dissociated



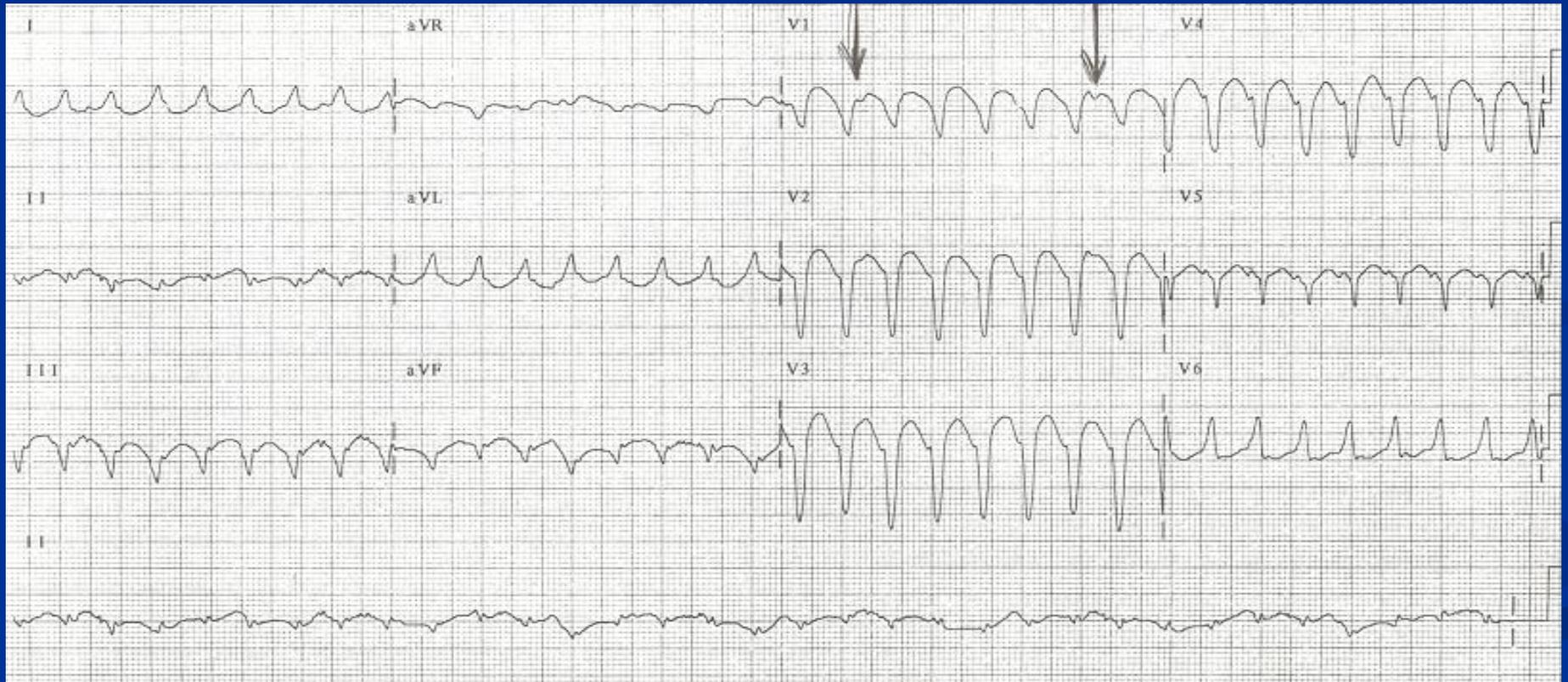
Sustained VT



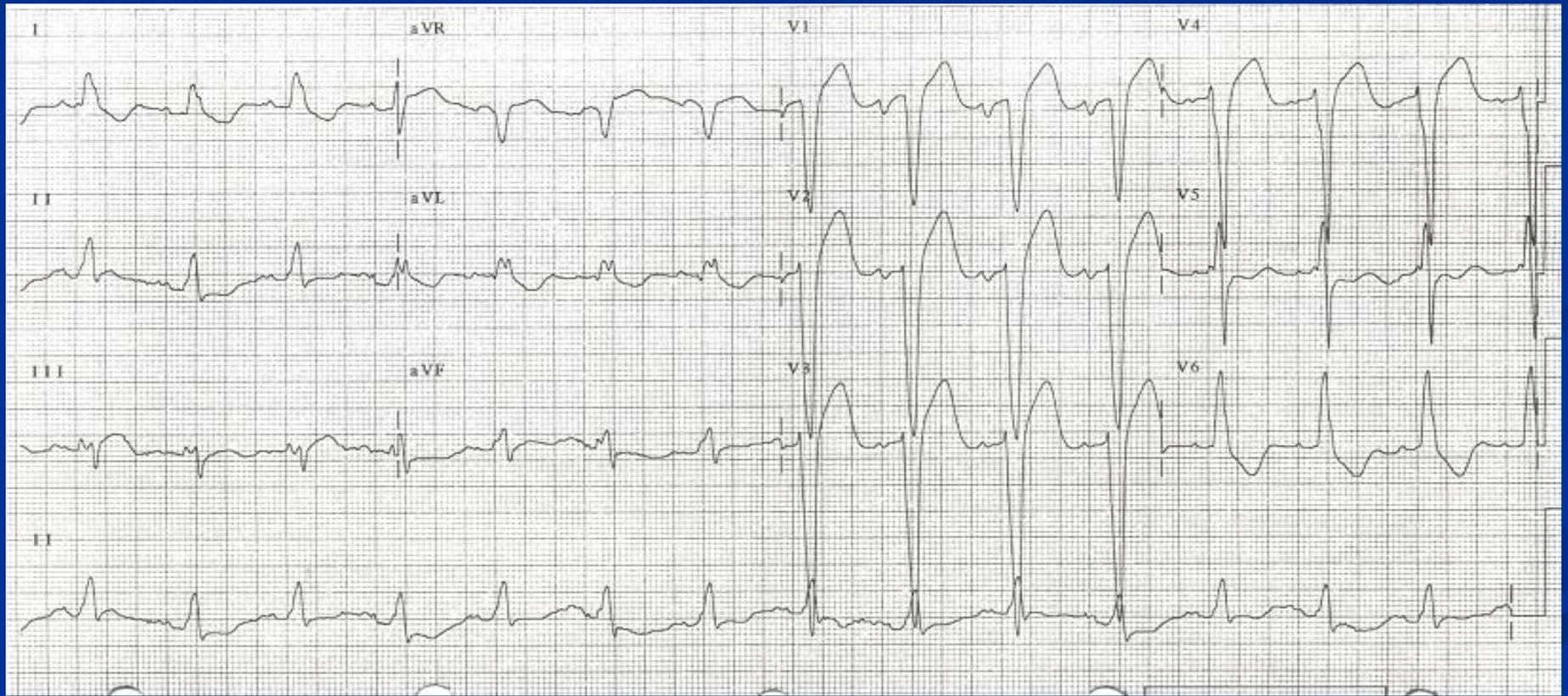
Left Posterior Fascicular Tachycardia

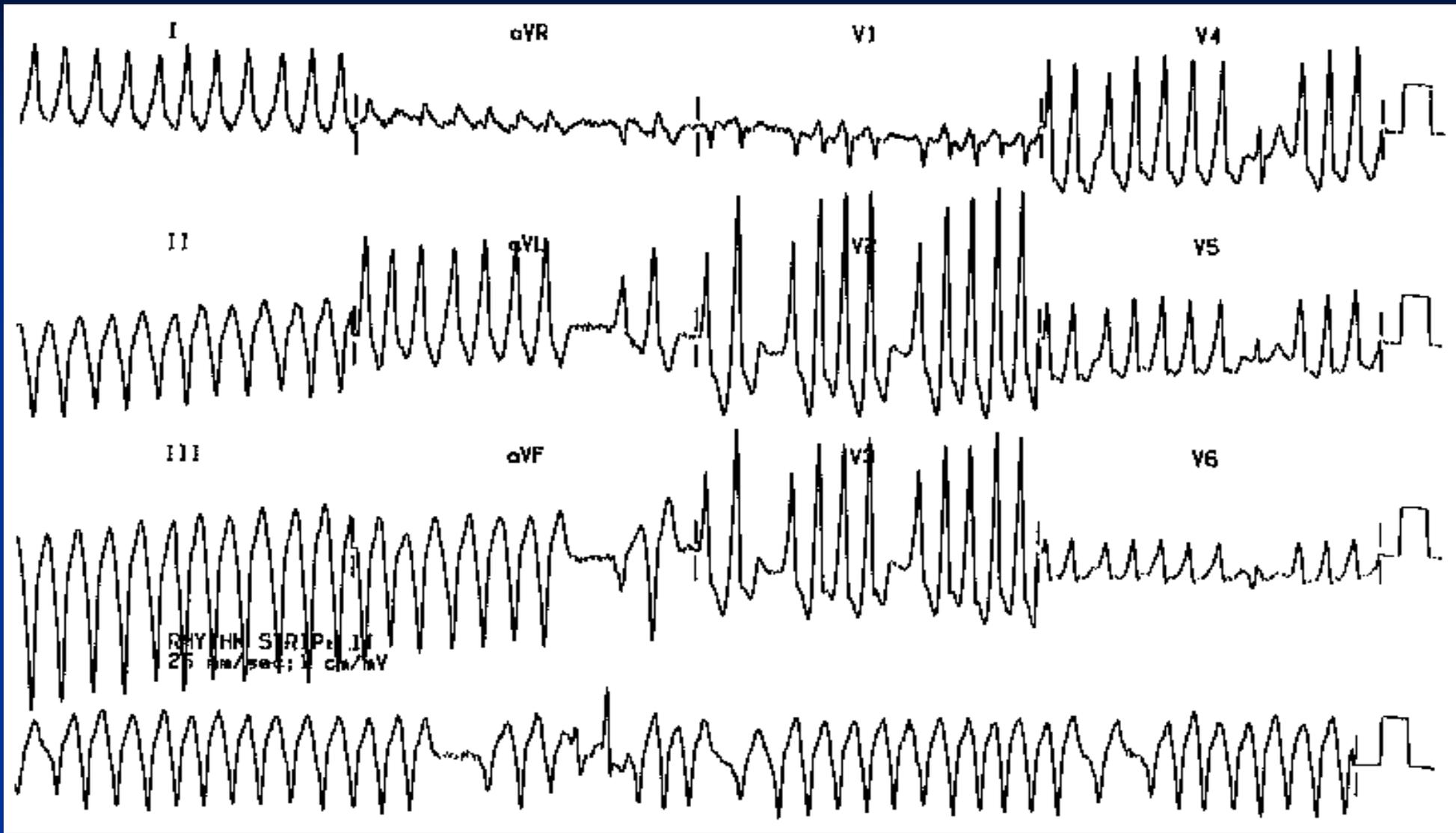


Sustained VT

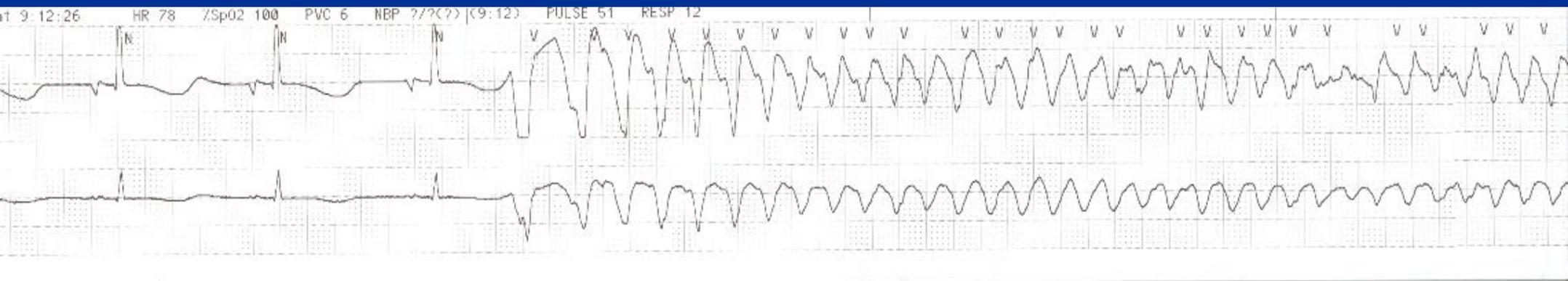


Baseline EKG p DCCV LBBB and AMI





Prolonged QT with Torsades



Objectives

- Brief overview of Pathophysiology of Arrhythmia
- ECG review of typical STEMI's
- Bradyarrhythmias
- Tachyarrhythmias
- Treatment strategy for arrhythmias



Treatment strategy

■ First assess the patient and CHECK THEIR PULSE

- Are they compromised?
- low BP, impaired consciousness, heart failure, chest pain
- Assess the ECG

■ Treat with electricity

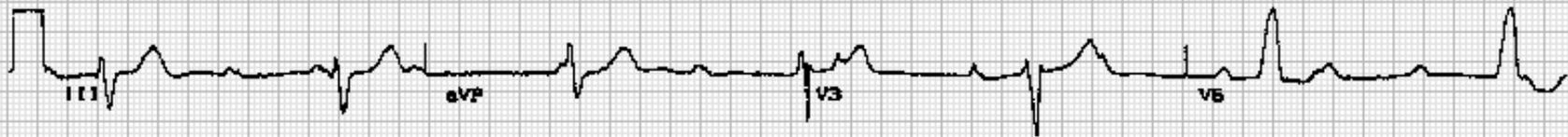
- DC cardioversion / temporary pacing

■ If not

- Look for reversible causes / treat with drugs



89 yo female with Syncope, BP 75/40



Complete Heart Block



Third degree (complete) AV block

- What factors predict a high risk of asystole?
 - Recent asystole
 - Mobitz type II AV block
 - Third degree heart block with broad QRS
 - Ventricular pause >3 seconds



Third degree (complete) AV block

- What is this patients risk of asystole?
 - High
- Consider temporary pacing
- Address reversible causes
- Acute MI

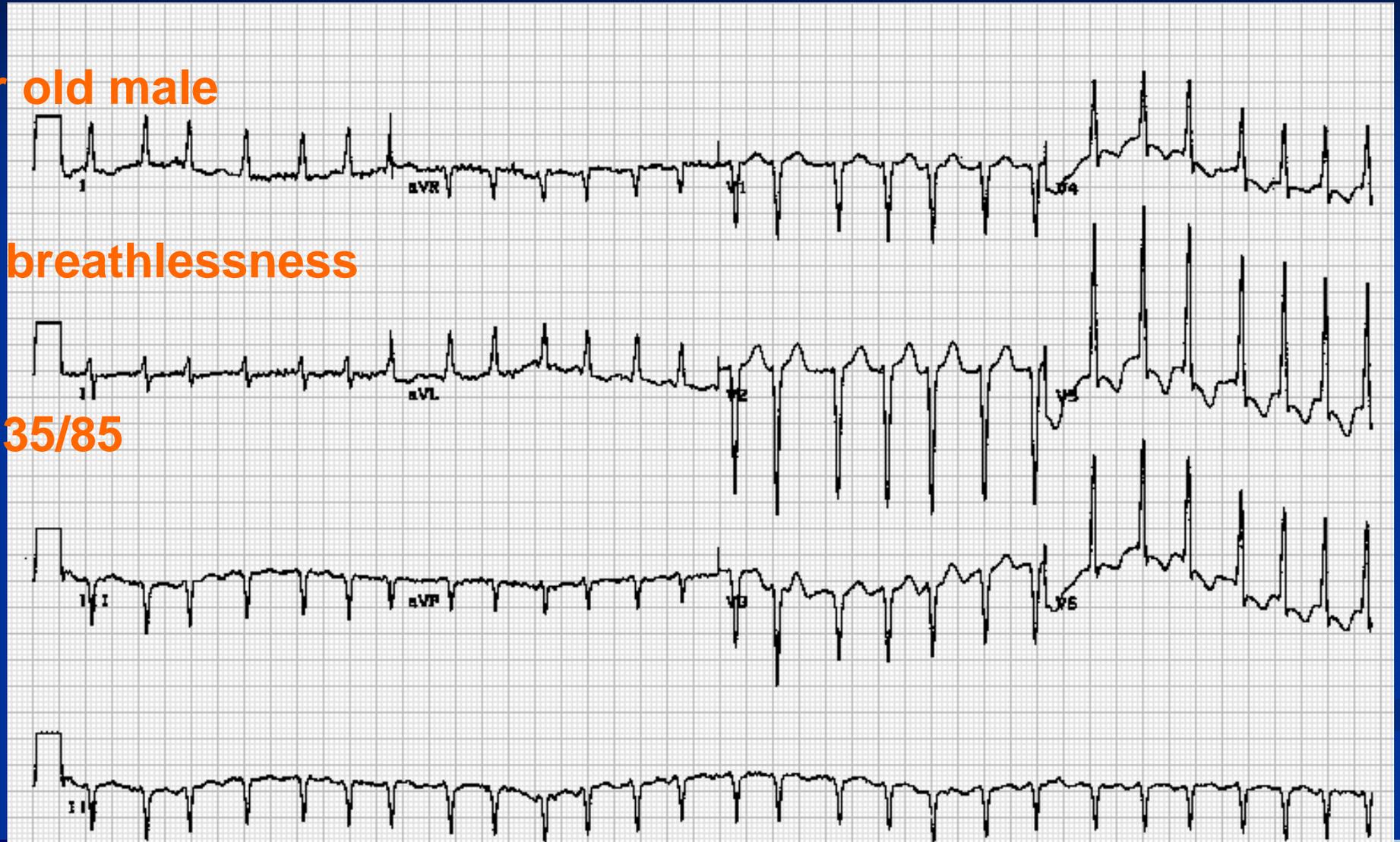


Atrial Fib with RVR

75 yr old male

Mild breathlessness

BP 135/85

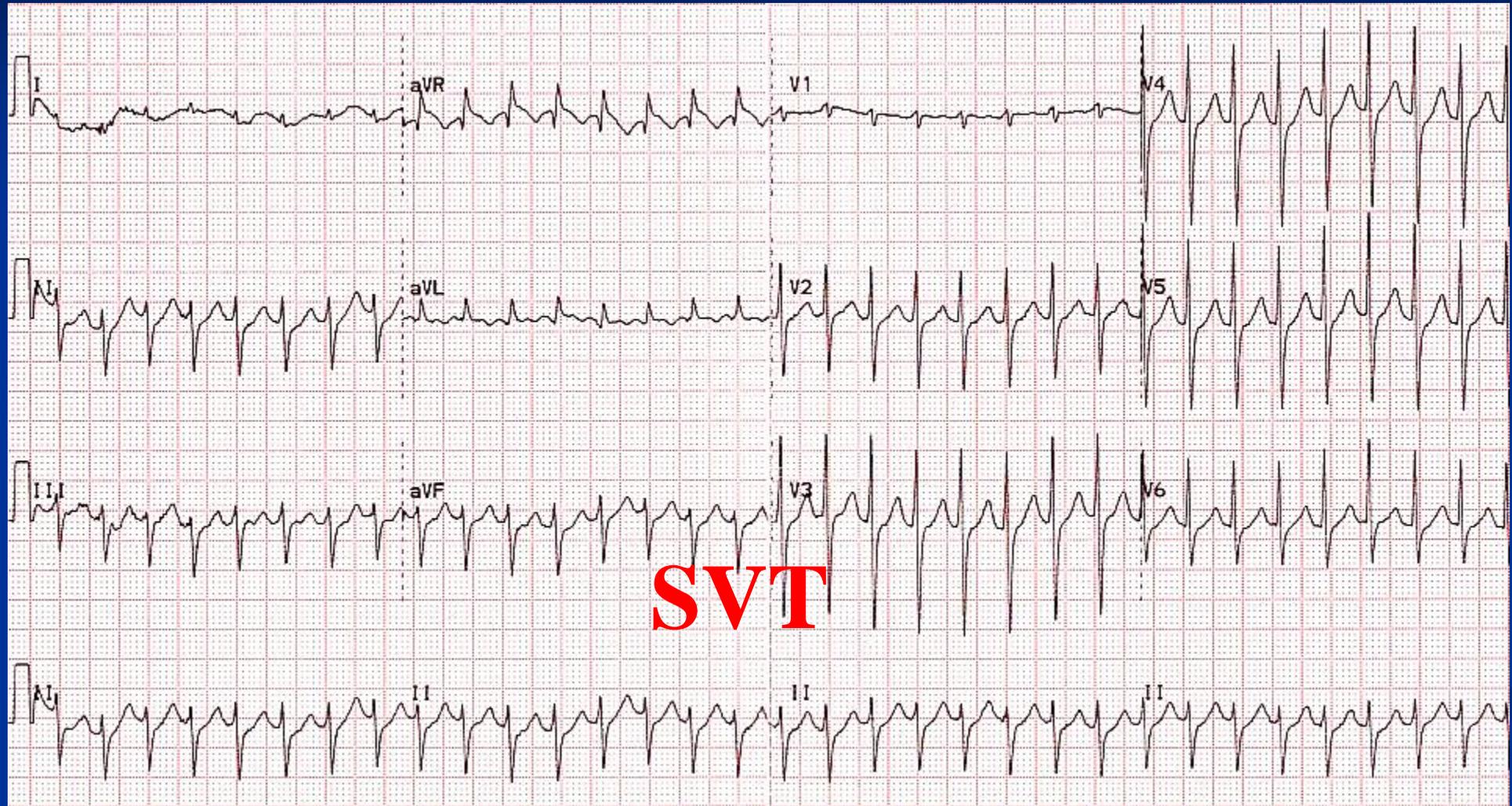


Atrial fibrillation

- Assess the patient
 - If they are compromised DC cardioversion
- If not, decide treatment strategy
 - Rate control vs rhythm control
 - Anticoagulation



47 yo man with palp. BP 120/70



Supraventricular tachycardia

- Assess the patient
 - If they are compromised DCCV
- If not compromised
 - Vagal manoeuvres
 - IV Adenosine
 - Nodal blockers

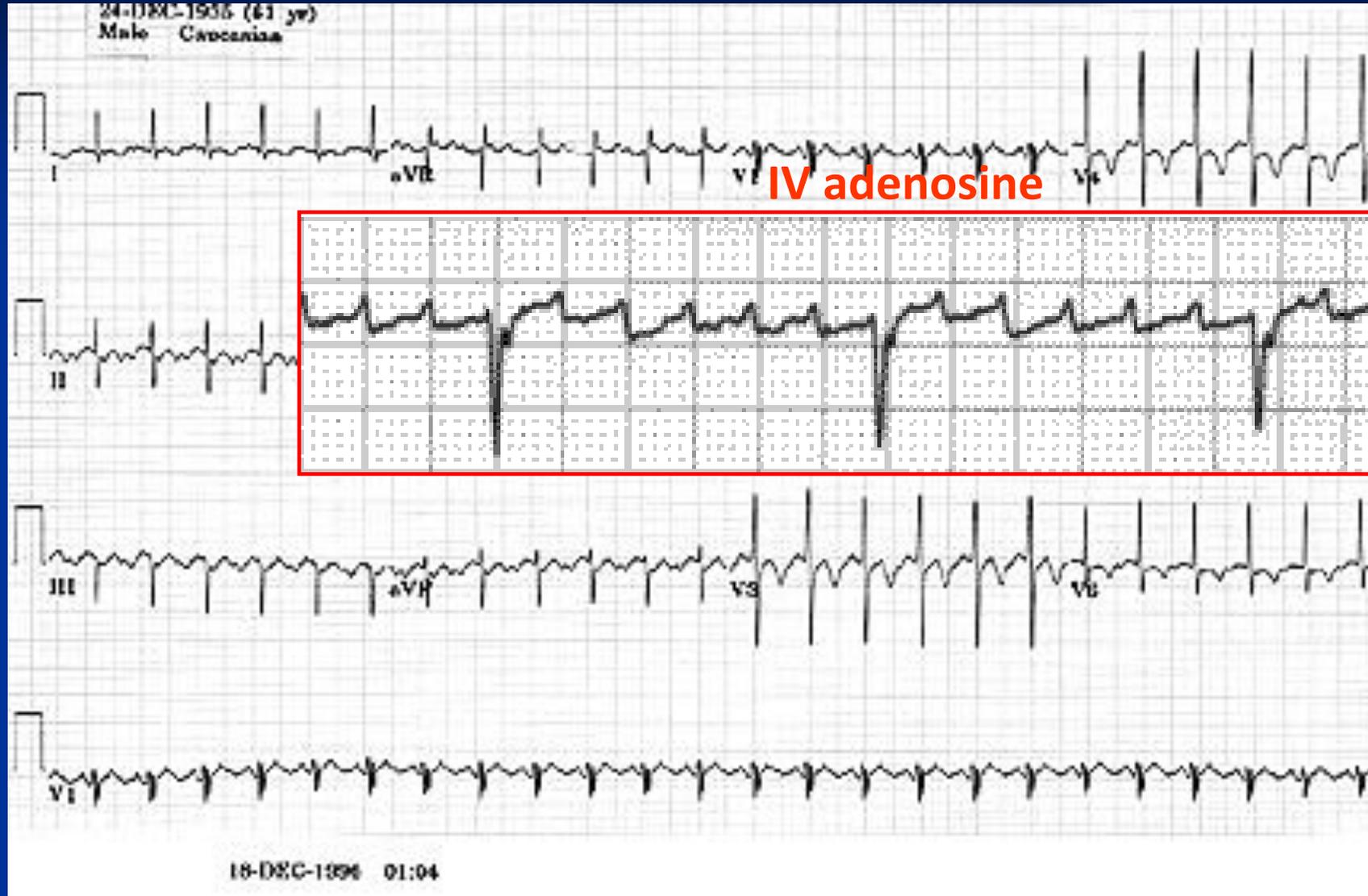


Termination of SVT with Adenosine

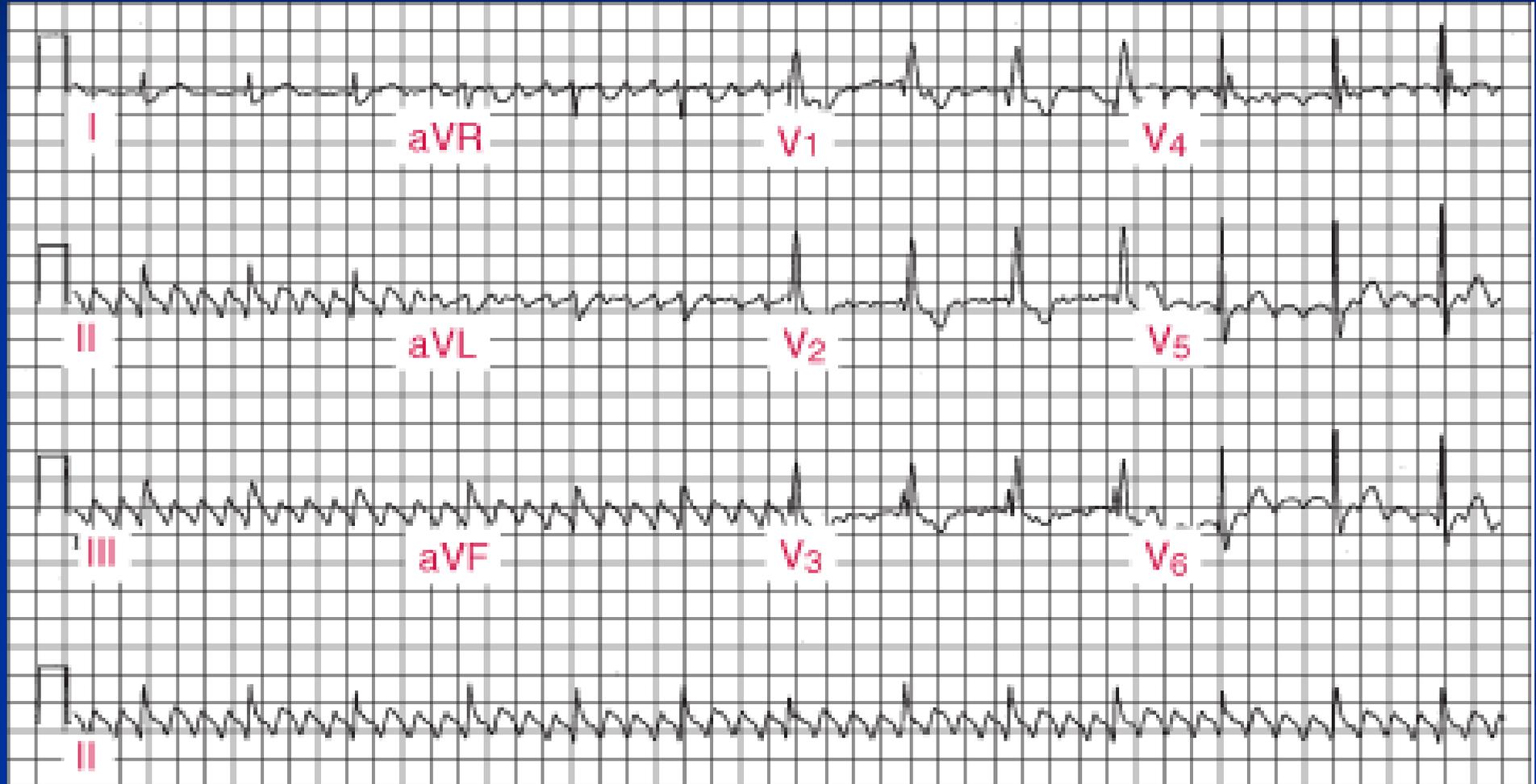
Adenosine 12mg



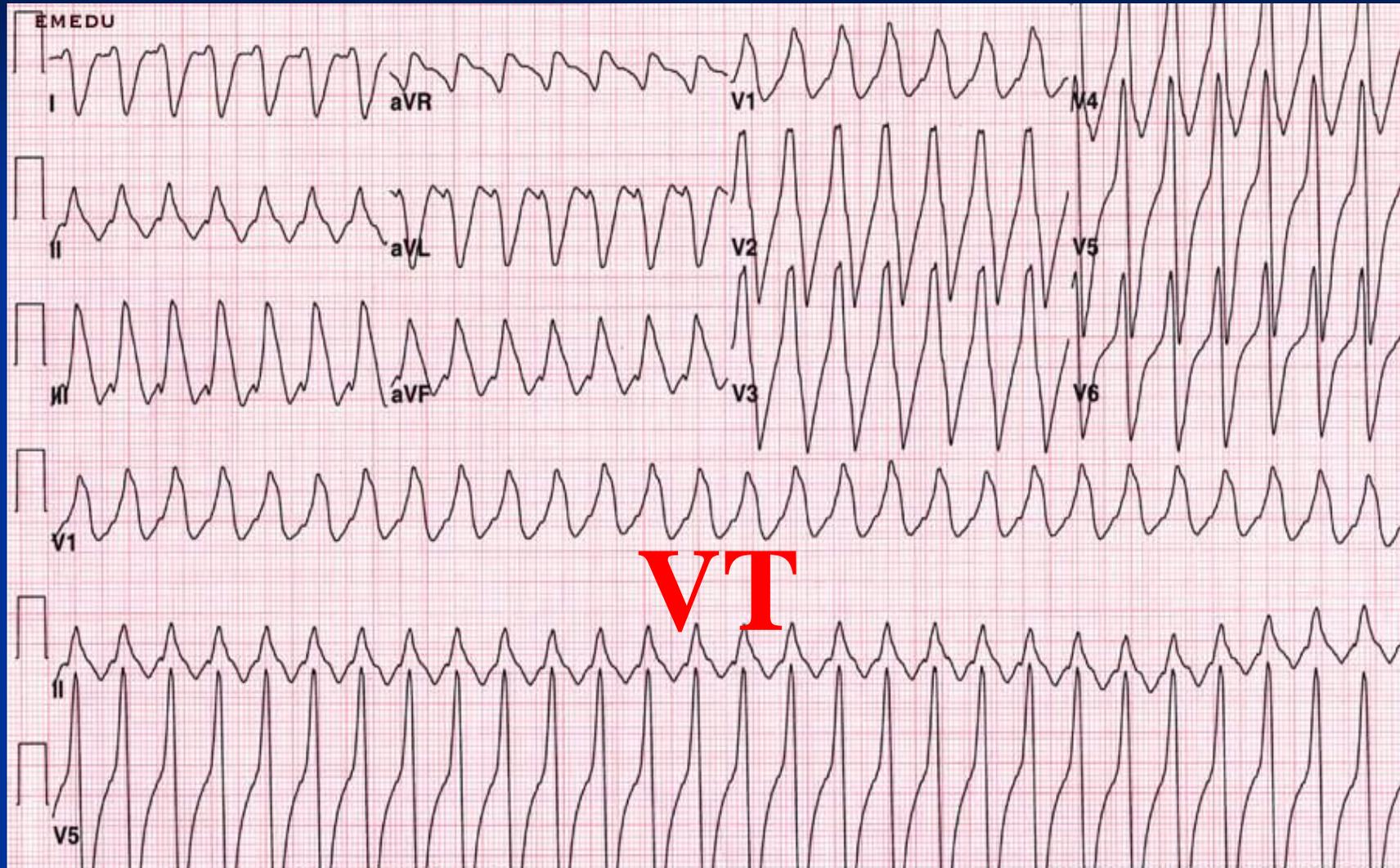
62 yo male with palp.



Following metoprolol



82 yo male with chest pain, bp 80/50



Ventricular tachycardia

■ Assess the patient

- DO THEY HAVE A PULSE?
- No? Use ACLS ALGORITHM

■ Consider Immediate DCCV

- Call anaesthetist
- Secure airway
- Conscious sedation
- Synchronised DC shock

■ If no compromise:

- (GET 12 LEAD ECG
- Consider IV amiodarone/other antiarrhythmics

■ Assess for reversible causes



■ Questions?

