Basics of EKG Interpretation

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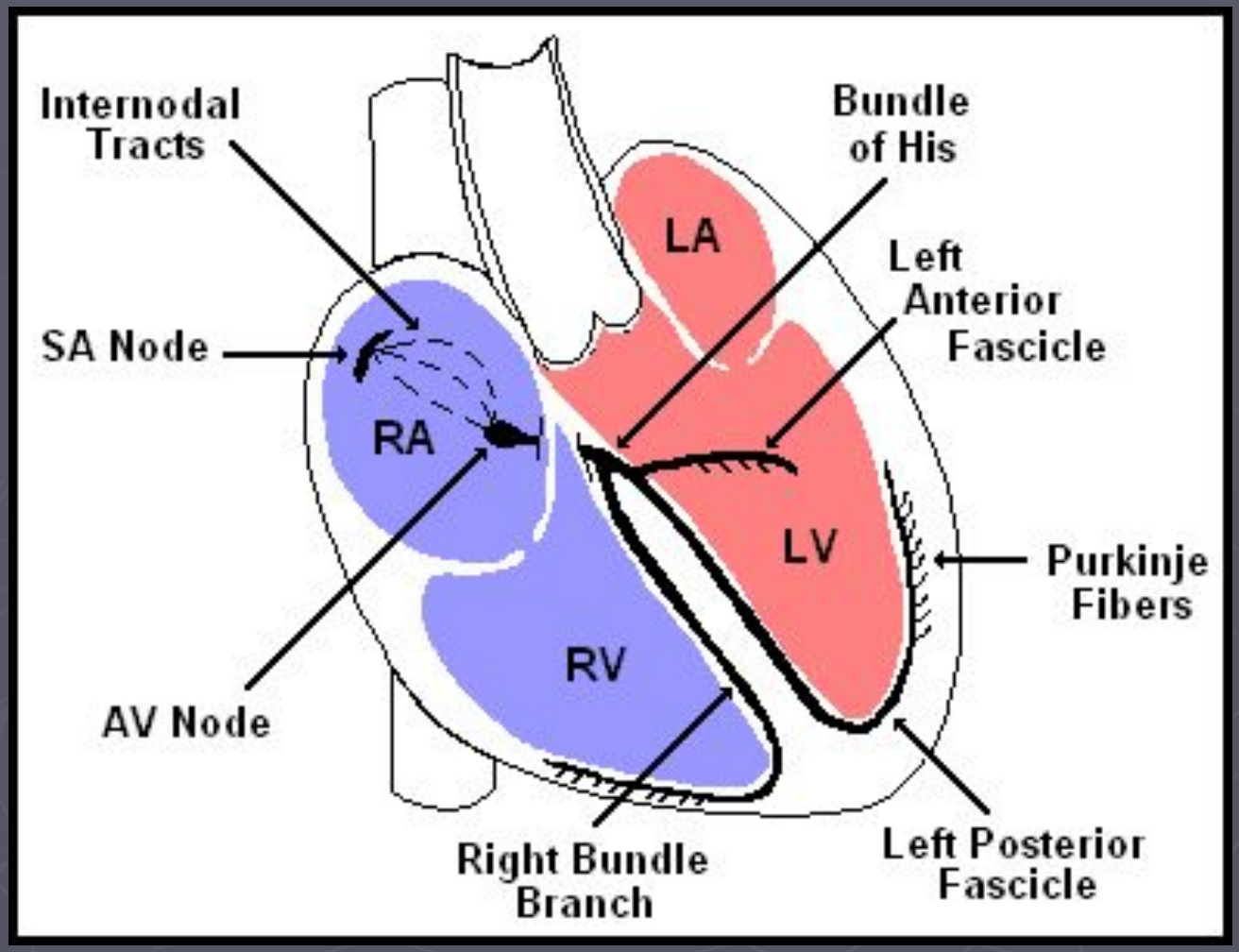
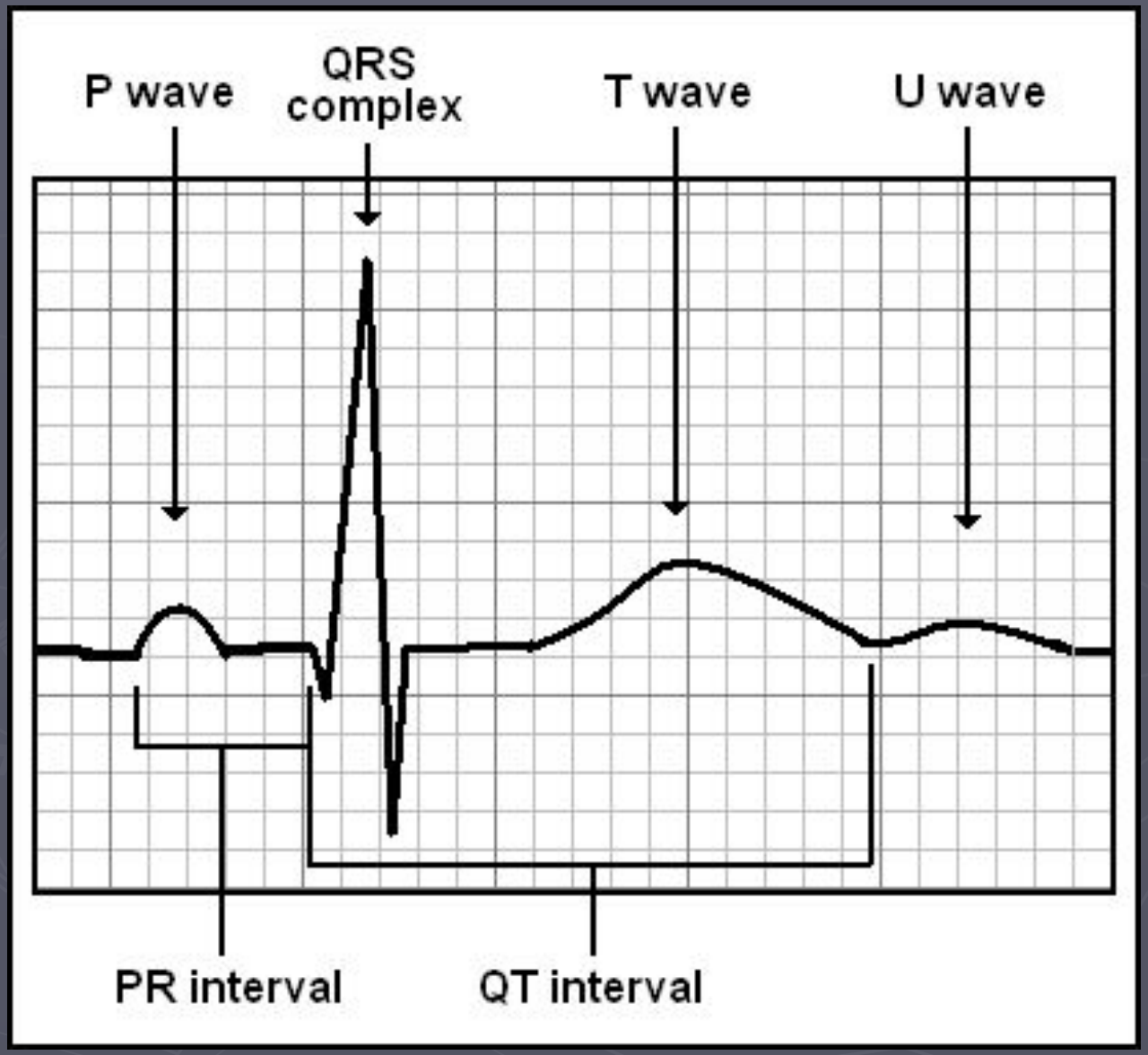
Outline

1. Review of the conduction system
2. QRS breakdown
3. Rate
4. Axis
5. Rhythms

The Normal Conduction System



Waveforms and Intervals



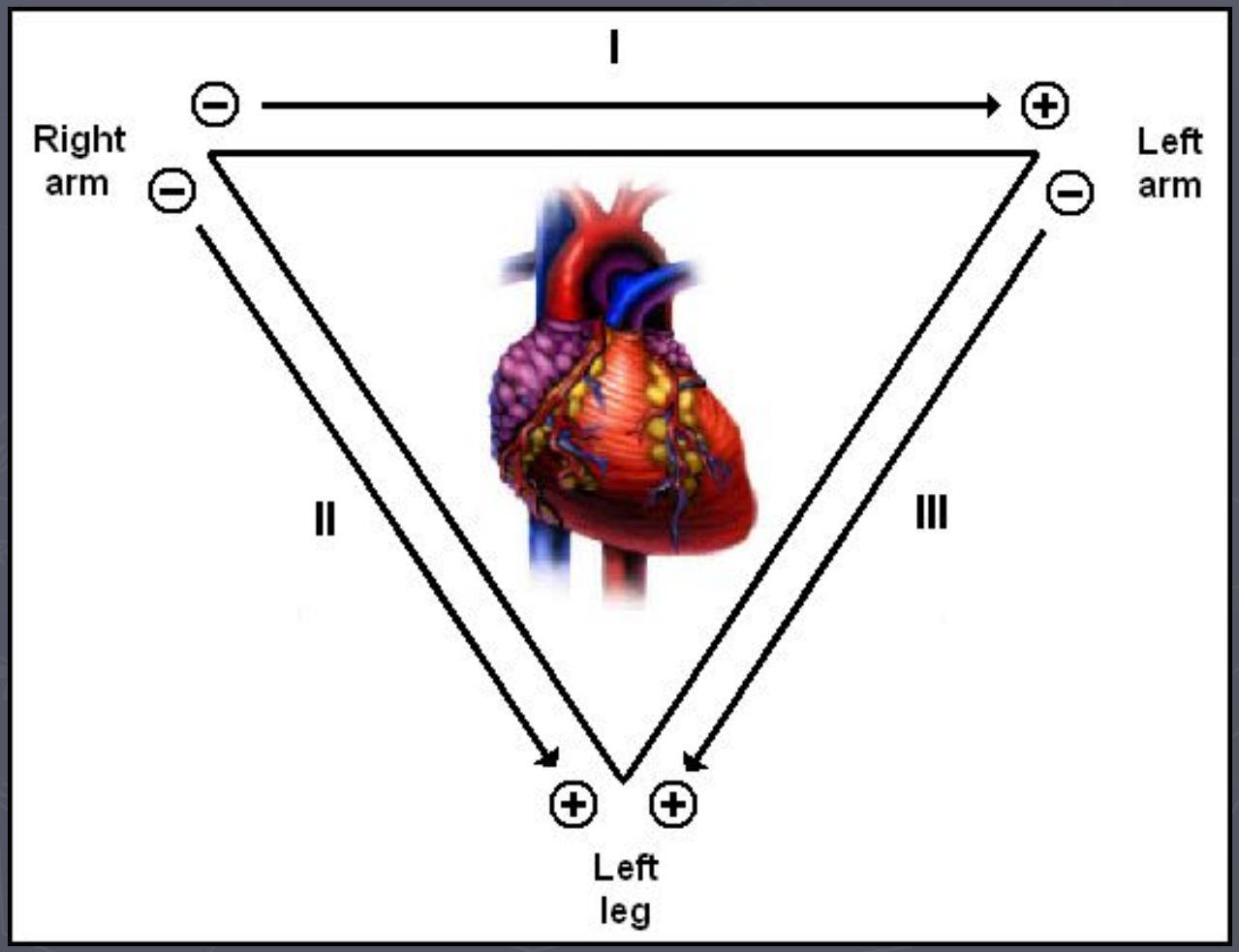
EKG Leads

The standard EKG has 12 leads:

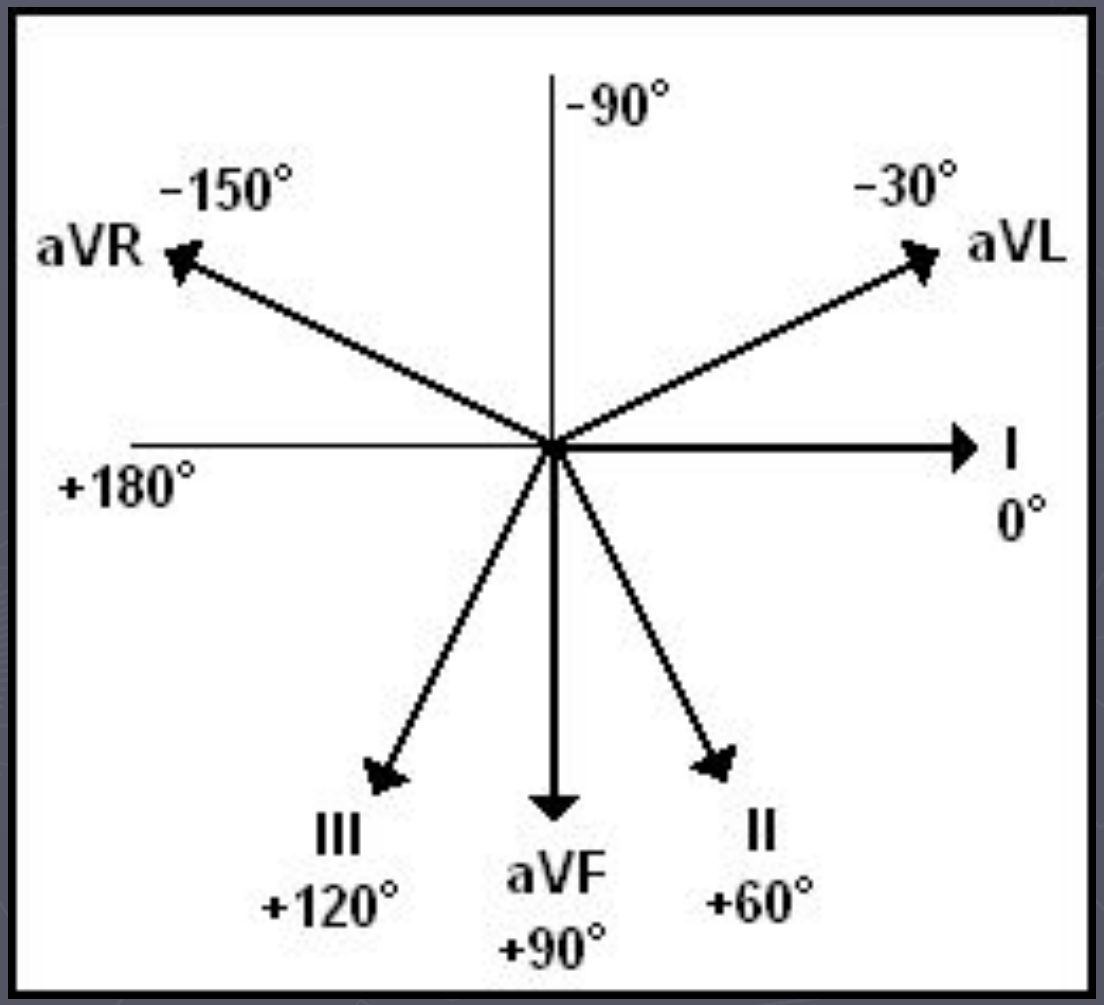
- 3 Standard Limb Leads
- 3 Augmented Limb Leads
- 6 Precordial Leads

The axis of a particular lead represents the viewpoint from which it looks at the heart.

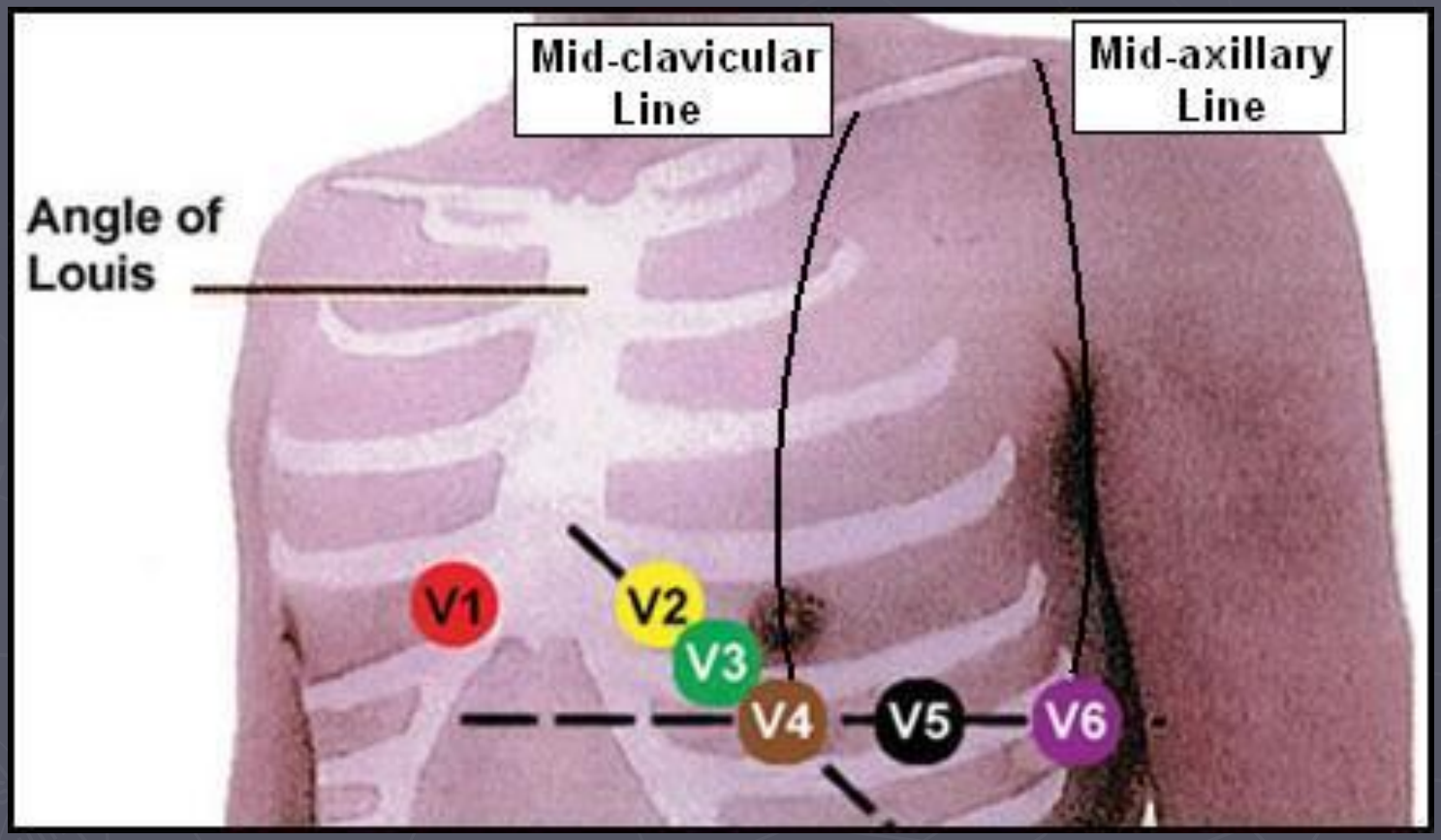
Standard Limb Leads



All Limb Leads

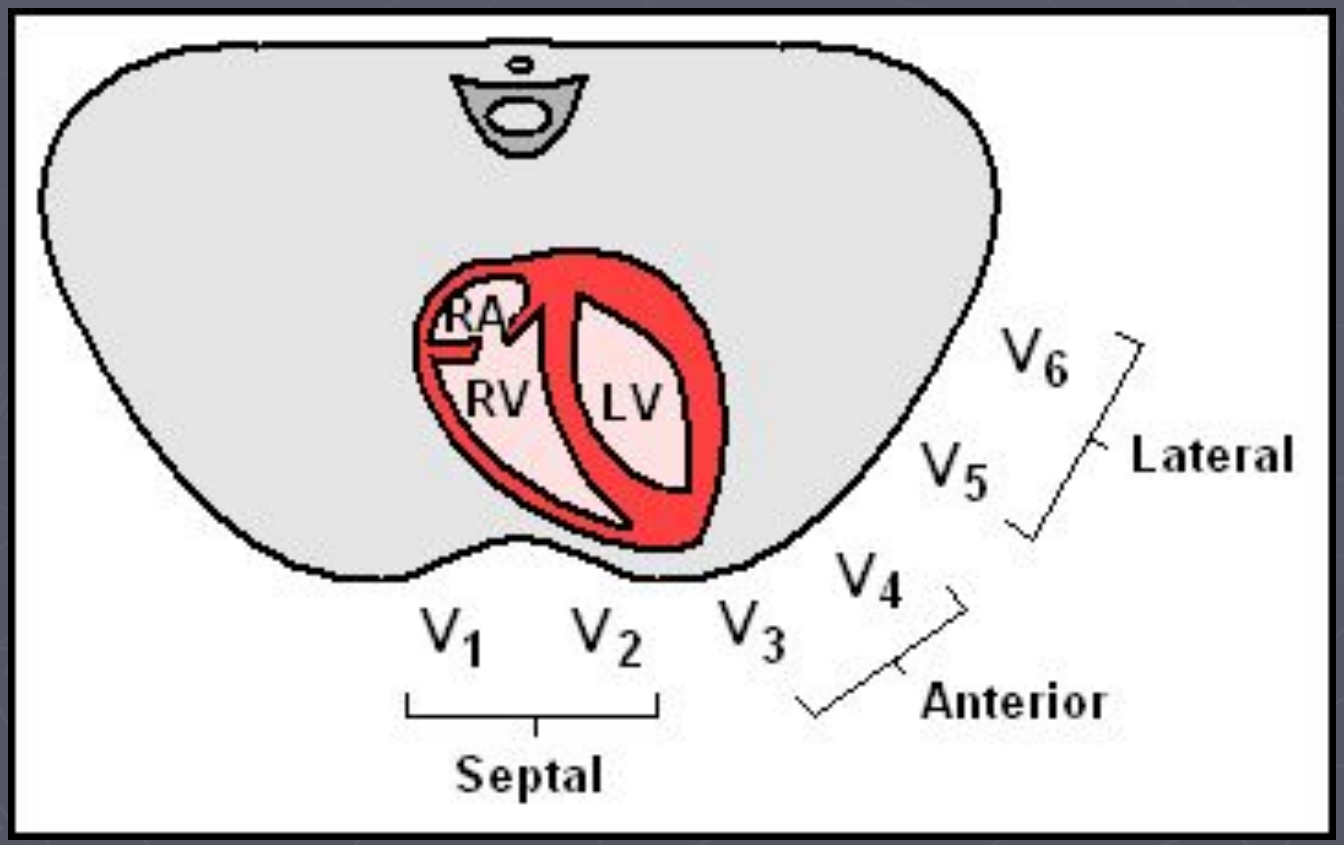


Precordial Leads



Adapted from: www.numed.co.uk/electrodepl.html

Precordial Leads



Anatomic Groups
(Summary)

I Lateral	aVR None	V_1 Septal	V_4 Anterior
II Inferior	aVL Lateral	V_2 Septal	V_5 Lateral
III Inferior	aVF Inferior	V_3 Anterior	V_6 Lateral

Rate

- Rule of 300
- 10 Second Rule

Rule of 300

Take the number of "big boxes" between neighboring QRS complexes, and divide this into 300. The result will be approximately equal to the rate

Although fast, this method only works for regular rhythms.

What is the heart rate?

www.uptodate.com

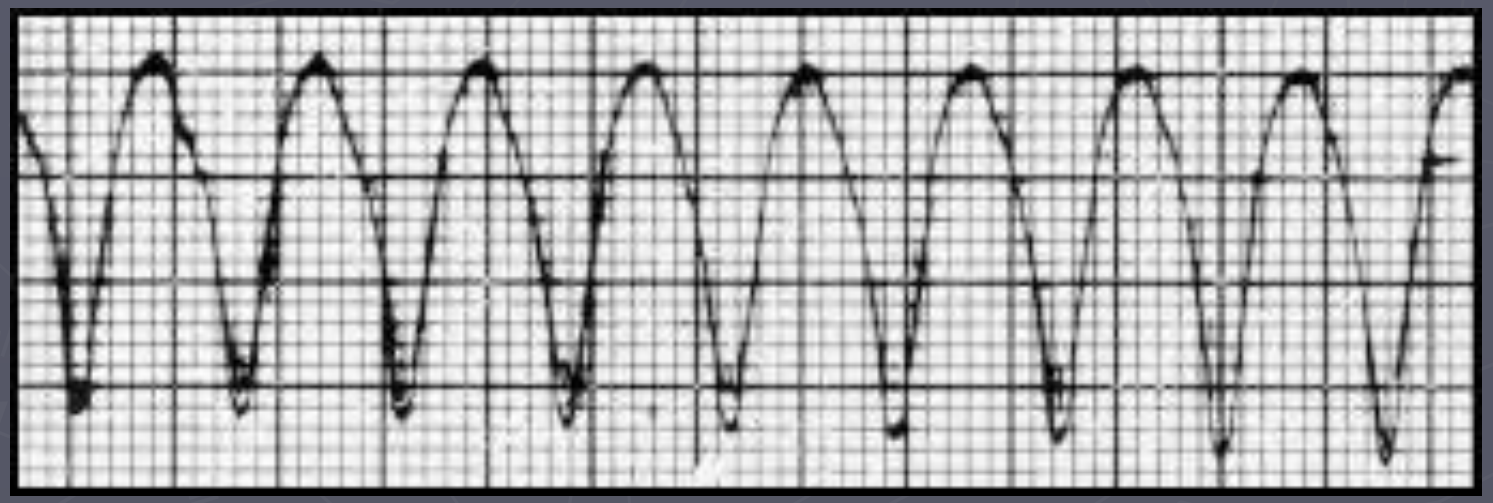
(300 / 6) = 50 bpm

What is the heart rate?

www.uptodate.com

(300 / ~ 4) = ~ 75 bpm

What is the heart rate?



(300 / 1.5) = 200 bpm

The Rule of 300

It may be easiest to memorize the following table:

# of big boxes	Rate
1	300
2	150
3	100
4	75
5	60
6	50

10 Second Rule

As most EKGs record 10 seconds of rhythm per page, one can simply count the number of beats present on the EKG and multiply by 6 to get the number of beats per 60 seconds.

This method works well for irregular rhythms.

What is the heart rate?

The Alan E. Lindsay ECG Learning Center ; http://medstat.med.utah.edu/kw/ecg/

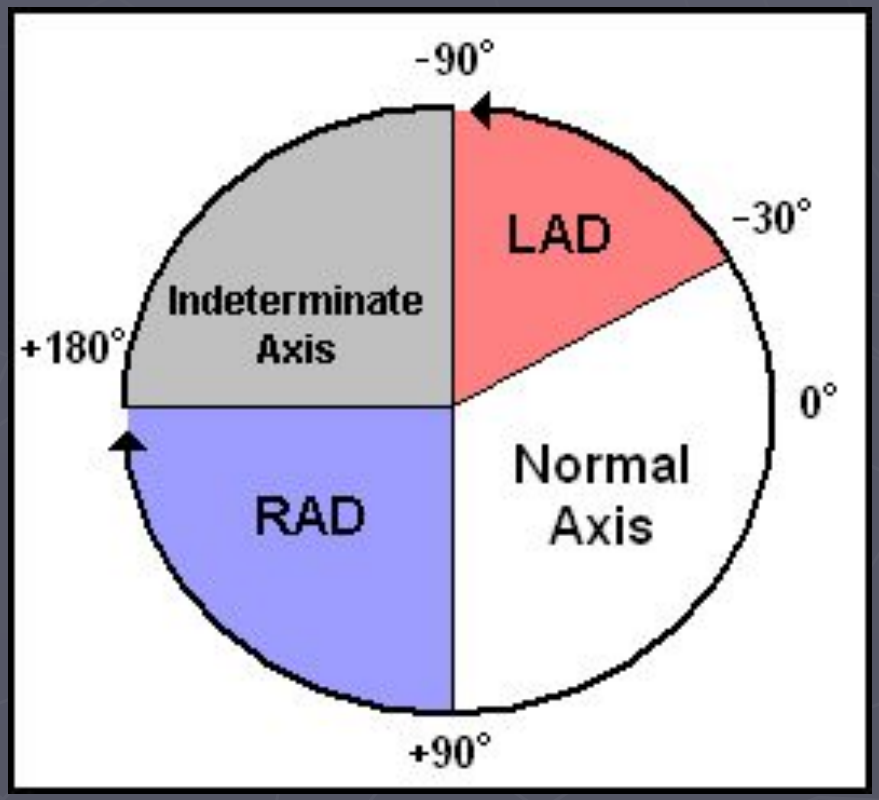
33 x 6 = 198 bpm

The QRS Axis

By near-consensus, the normal QRS axis is defined as ranging from -30° to +90°.

-30° to -90° is referred to as a left axis deviation (LAD)

+90° to +180° is referred to as a right axis deviation (RAD)



Determining the Axis

- The Quadrant Approach
- The Equiphasic Approach

Determining the Axis

Predominantly Positive

Predominantly Negative

Equiphasic

The Quadrant Approach

1. Examine the QRS complex in leads I and aVF to determine if they are predominantly positive or predominantly negative. The combination should place the axis into one of the 4 quadrants below.

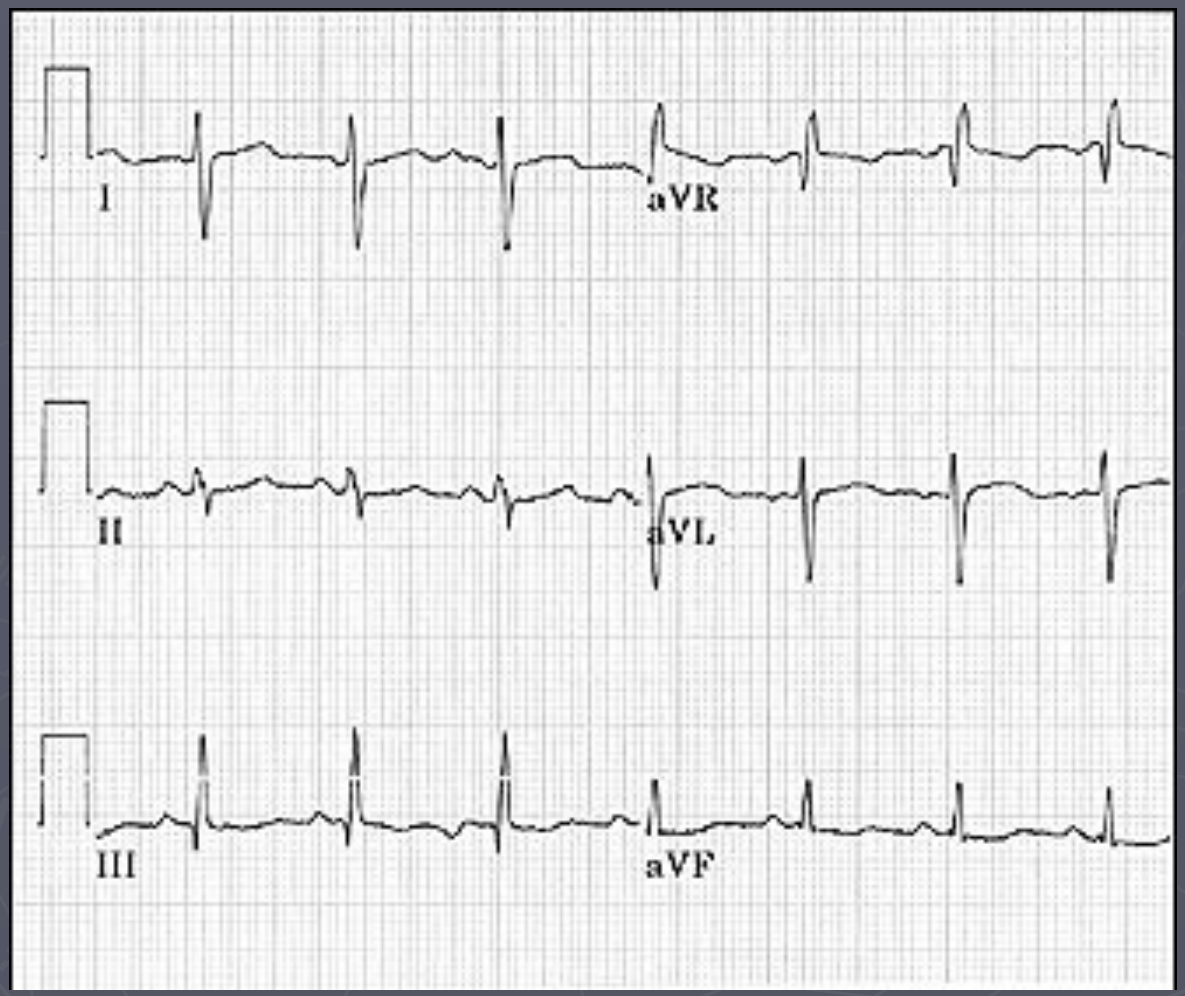
		Lead aVF: Positive	Lead aVF: Negative
Lead I	Positive	Normal Axis	LAD
	Negative	RAD	Indeterminate Axis

The Quadrant Approach

2. In the event that LAD is present, examine lead II to determine if this deviation is pathologic. If the QRS in II is predominantly positive, the LAD is non-pathologic (in other words, the axis is normal). If it is predominantly negative, it is pathologic.

		Lead aVF	
		Positive	Negative
Lead I	Positive	Normal Axis	LAD
	Negative	RAD	Indeterminate Axis

Quadrant Approach: Example 1



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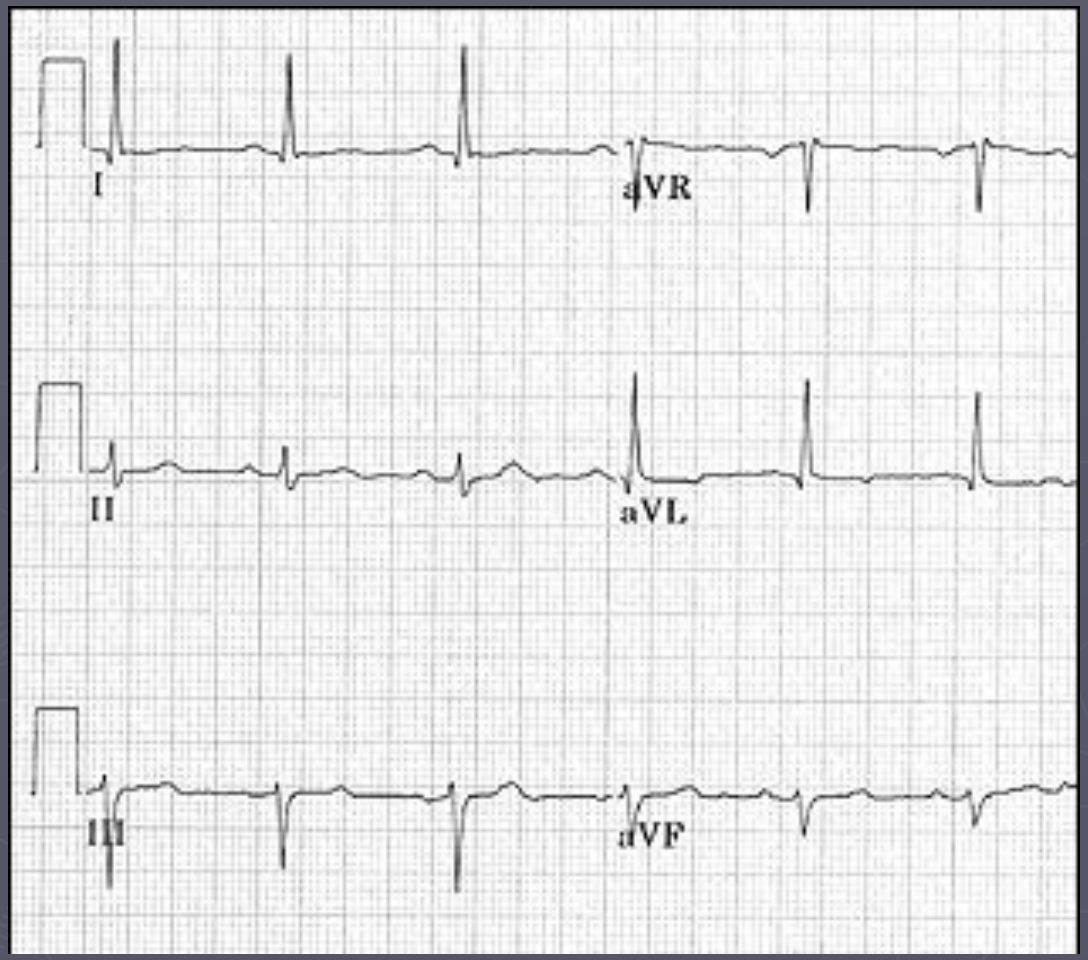
Negative in I, positive in aVF □ RAD

Quadrant Approach: Example 2



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Positive in I, negative in aVF → **Predominantly positive in II** →

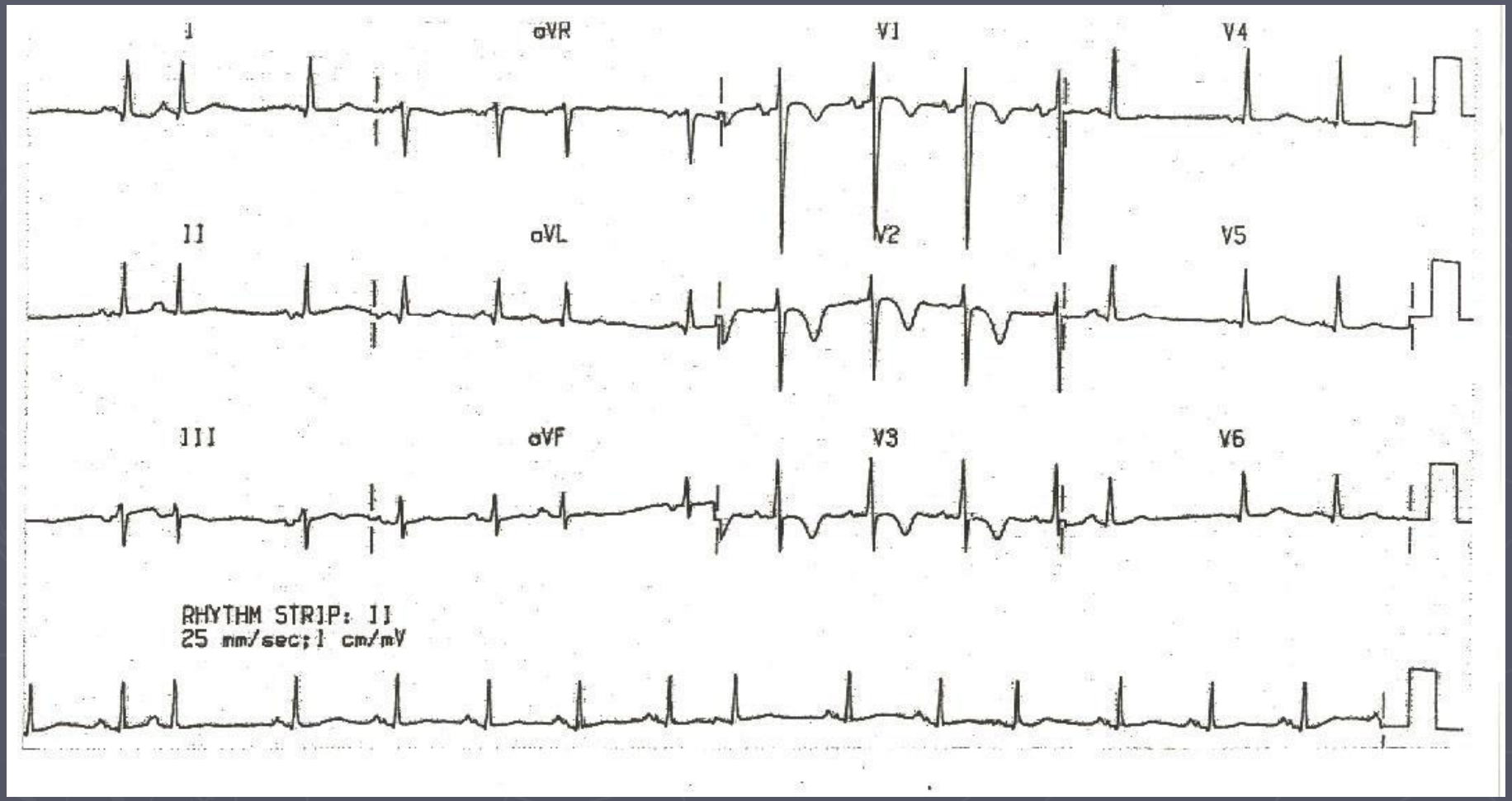
Normal Axis (non-pathologic LAD)

The Equiphasic Approach

1. Determine which lead contains the most equiphasic QRS complex. The fact that the QRS complex in this lead is equally positive and negative indicates that the net electrical vector (i.e. overall QRS axis) is perpendicular to the axis of this particular lead.

2. Examine the QRS complex in whichever lead lies 90° away from the lead identified in step 1. If the QRS complex in this second lead is predominantly positive, than the axis of this lead is approximately the same as the net QRS axis. If the QRS complex is predominantly negative, than the net QRS axis lies 180° from the axis of this lead.

Equiphasic Approach: Example 1



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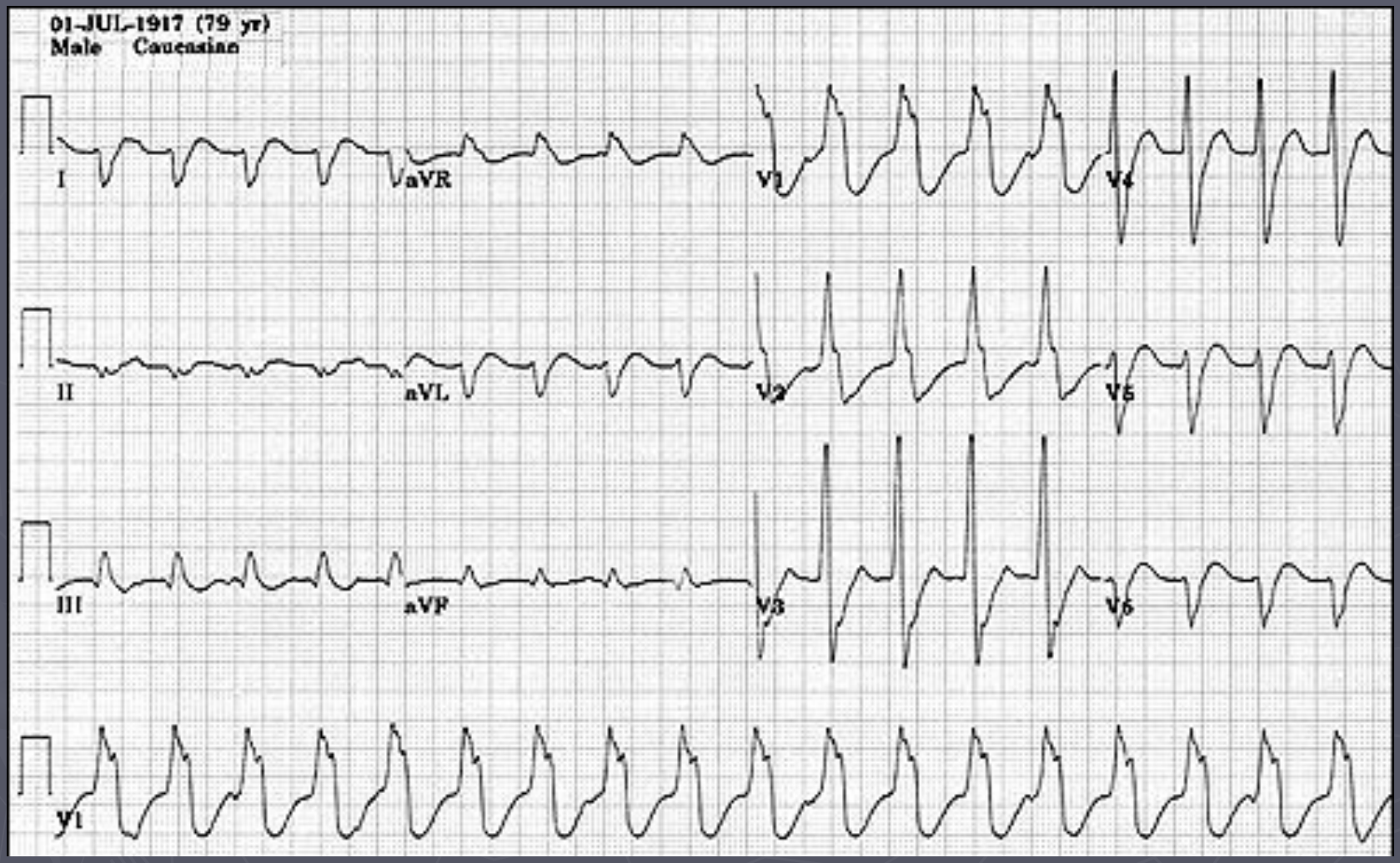
Equiphasic in aVF □ Predominantly positive in I □ QRS axis ≈ 0°

Equiphasic Approach: Example 2



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Equiphasic in II □ Predominantly negative in aVL □ QRS axis ≈ +150°

Systematic Approach

- Rate
- Rhythm
- Axis
- Wave Morphology
  - P, T, and U waves and QRS complex
- Intervals
  - PR, QRS, QT
- ST Segment

Rhythms/Arrhythmias

- Sinus
- Atrial
- Junctional
- Ventricular

Sinus Rhythms: Criteria/Types

- P waves upright in I, II, aVF
- Constant P-P/R-R interval
- Rate
- Narrow QRS complex
- P:QRS ratio 1:1
- P-R interval is normal and constant

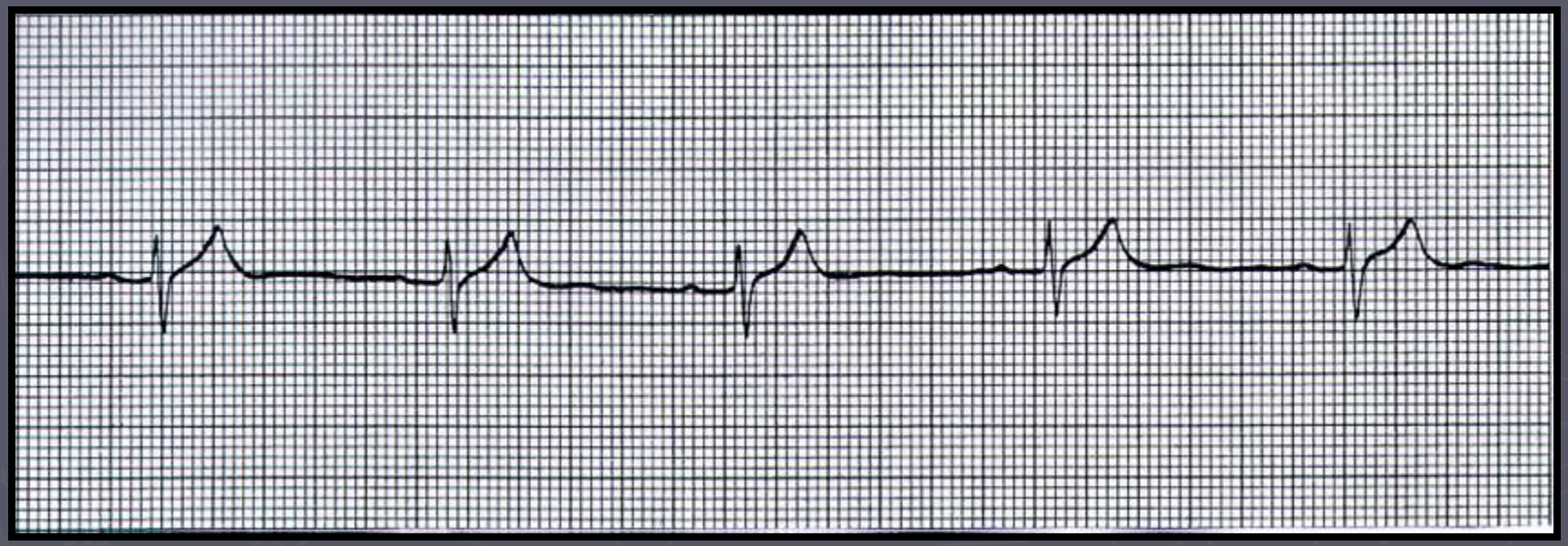
Sinus Arrhythmias: Criteria/Types

- Normal Sinus Rhythm
- Sinus Bradycardia
- Sinus Tachycardia
- Sinus Arrhythmia

Normal Sinus Rhythm

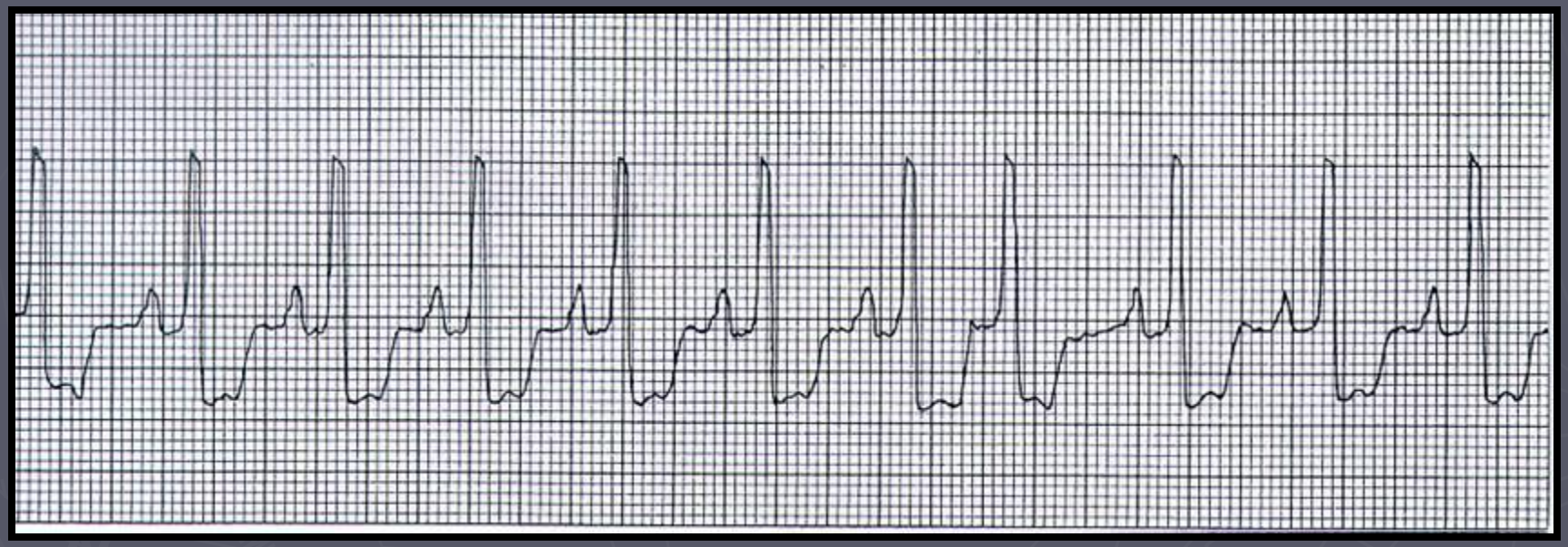
- **Rate is 60 to 100**

Sinus Bradycardia



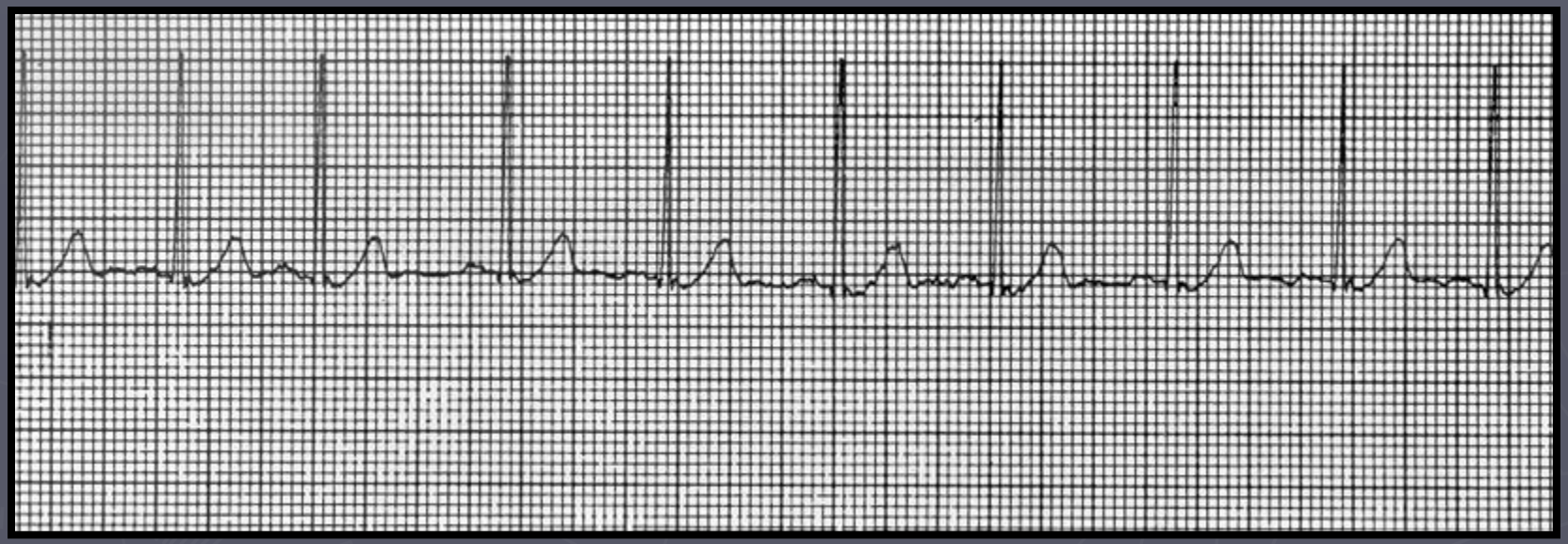
- Can be normal variant
- Can result from medication
- Look for underlying cause

Sinus Tachycardia



- **May be caused by exercise, fever, hyperthyroidism**
- **Look for underlying cause, slow the rate**

Sinus Arrhythmia



- **Seen in young patients**
- **Secondary to breathing**
- **Heart beats faster**

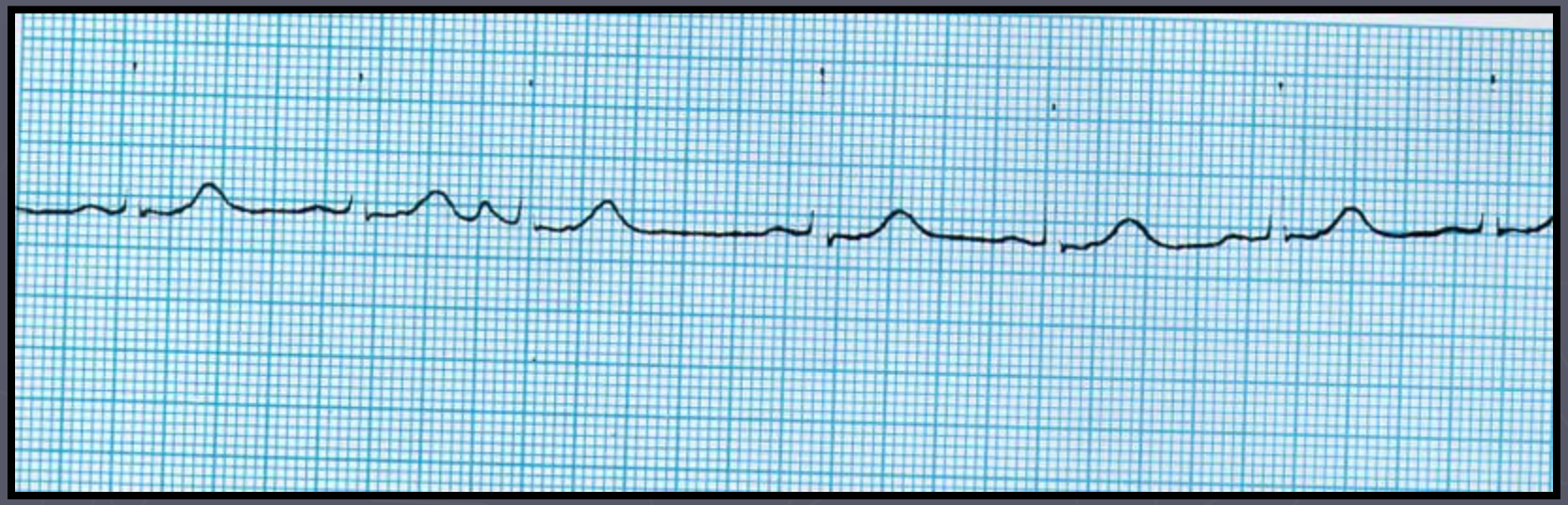
Atrial Arrhythmias: Criteria/Types

- P waves inverted in I, II and aVF
- Abnormal shape
  - Notched
  - Flattened
  - Diphasic
- Narrow QRS complex

Atrial Arrhythmias: Criteria/Types

- Premature Atrial Contractions
- Ectopic Atrial Rhythm
- Wandering Atrial Pacemaker
- Multifocal Atrial Tachycardia
- Atrial Flutter
- Atrial Fibrillation

Premature Atrial Contraction



- **QRS complex narrow**
- **RR interval shorter than sinus QRS complexes**
- **P wave shows different morphology than sinus P wave**

Ectopic Atrial Rhythm

- **Narrow QRS complex**
- **P wave inverted**

Wandering Atrial Pacemaker

- **3 different P wave morphologies possible with ventricular rate < 100 bpm**

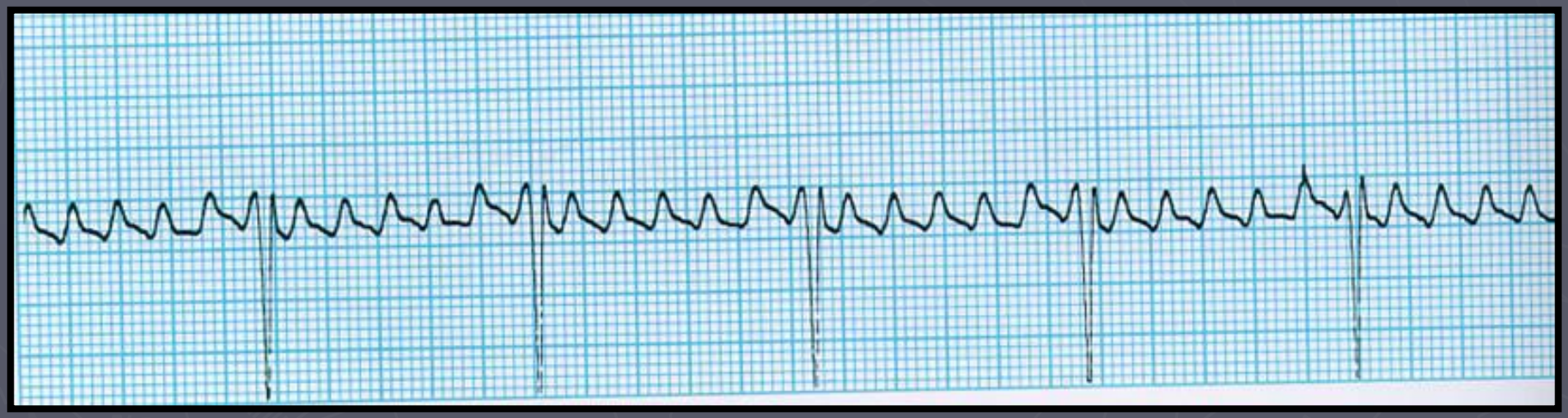
Multifocal Atrial Tachycardia

- **3 different P wave morphologies with ventricular rate> 100 bpm**

Atrial Flutter

- **Regular ventricular rate 150 bpm**
- **Varying ratios of F waves to QRS complexes, most common is 4:1**
- **Tracing shows 2:1 conduction**

Atrial Flutter



- **Tracing shows 6:1 conduction**

Atrial Fibrillation

- **Tracing shows irregularly irregular rhythm with no P waves**
- **Ventricular rate usually > 100 bpm**

Atrial Fibrillation

- **Tracing shows irregularly irregular rhythm with no P waves**
- **Ventricular rate is 40**

Atrial Tachycardia

- **Tracing shows regular ventricular rate with P waves that are different from sinus P waves**
- **Ventricular rate is usually 150 to 250 bpm**

Junctional Arrhythmias: Criteria

- P wave
  - May be absent
    - Buried in QRS
  - If present
    - inverted in leads I, II, and aVF
    - Inverted after QRS

Junctional Arrhythmias: Criteria

- PR interval < 0.12 secs
- Rate: Varies
- Narrow QRS complex

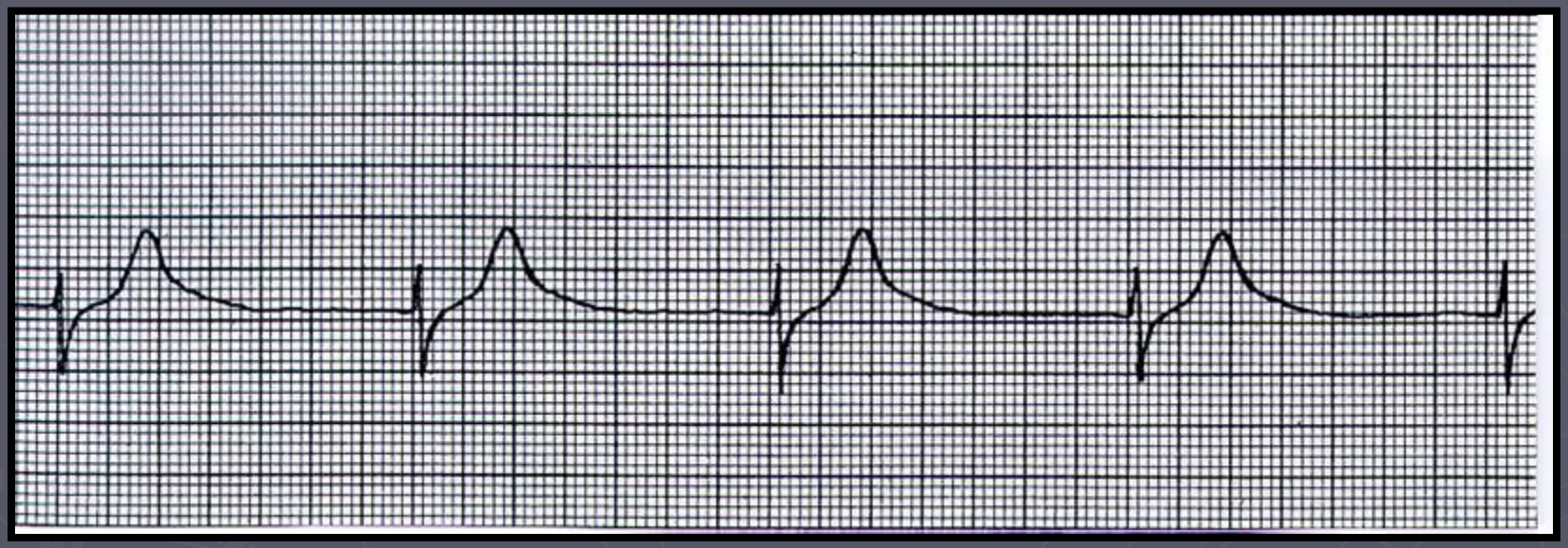
Junctional Arrhythmias: Types

- Premature Junctional Contractions
- Junctional Escape Rhythm
- Accelerated Junctional Tachycardia
- Junctional Tachycardia
- Reentrant Tachycardia
- AVNRT

Premature Junctional Contractions

- **R-R interval is shorter**
- **Beat is early, narrow QRS complex**
- **Inverted P wave**
- **P wave can be buried in QRS complex**

Junctional Escape Rhythm



- **Junctional origin**
- **Rate is 40 to 60**

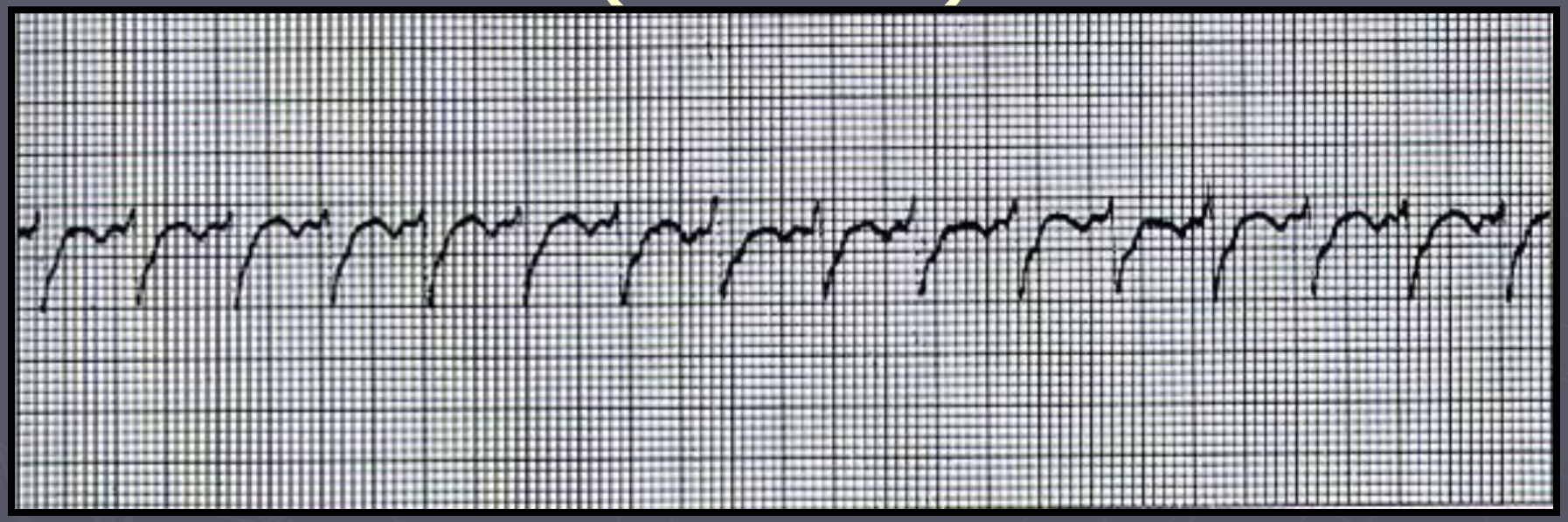
Accelerated Junctional Tachycardia

- **Junctional origin**
- **Rate is 60 to 100**

Junctional Tachycardia

- **Junctional origin**
- **Rate is > 100**

AV Nodal Reentrant Tachycardia (AVNRT)



- **Secondary to bypass tract within AV node**
- **Premature Atrial Contraction (PAC) depolarizes**

Rate Summary

- Sinus Tachycardia - 100-160 BPM
- Atrial Tachycardia - 150-250 BPM
- Atrial Flutter - 150-250 BPM
- Junctional Tachycardia - 100-180 BPM

AV Nodal Blocks

- **Delay conduction of impulses from sinus node**
- **If AV node does not let impulse through, no QRS complex is seen**
- **AV nodal block classes: 1^{st}, 2^{nd}, 3^{rd} degree**

1st Degree AV Block

- PR interval constant
- >.2 sec
- All impulses conducted

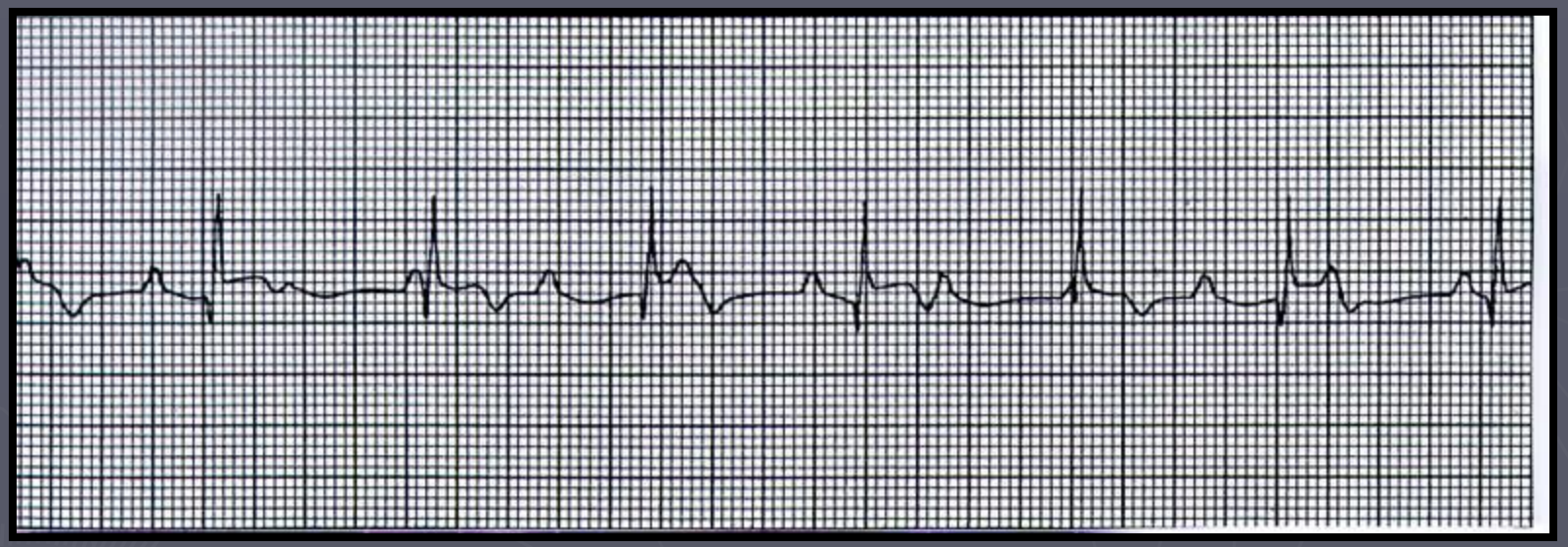
2nd Degree AV Block Type 1

- **AV node conducted each impulse slower and finally no impulse is conducted**
- **Longer PR interval, finally no QRS complex**

2nd Degree AV Block Type 2

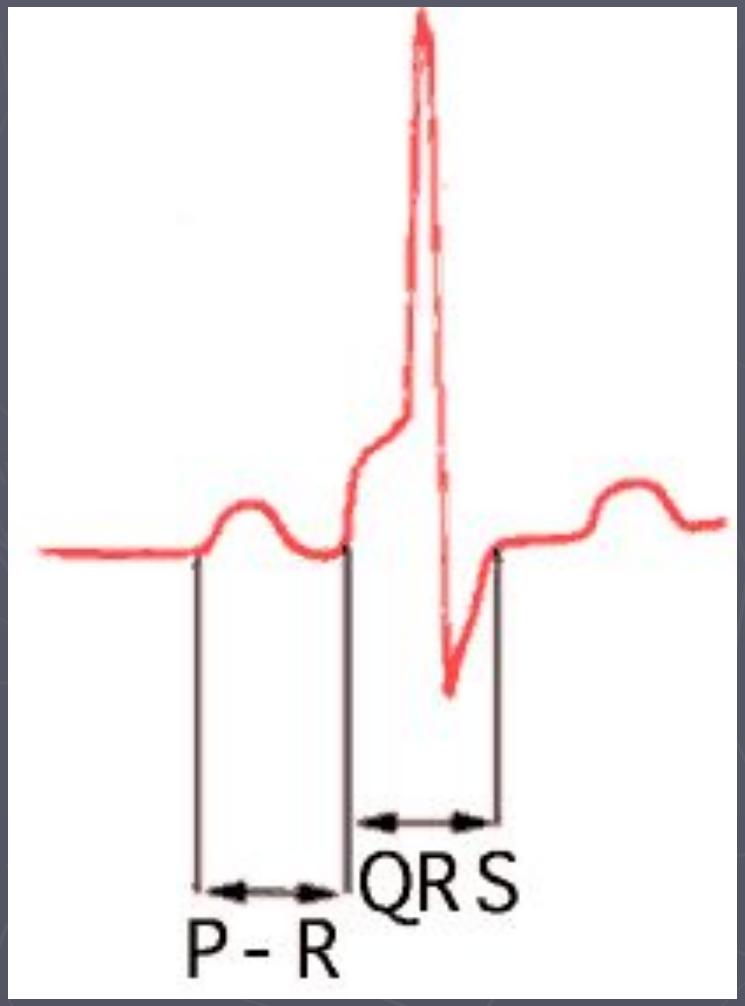
- **Constant PR interval**
- **AV node intermittently conducts no impulse**

3rd Degree AV Block



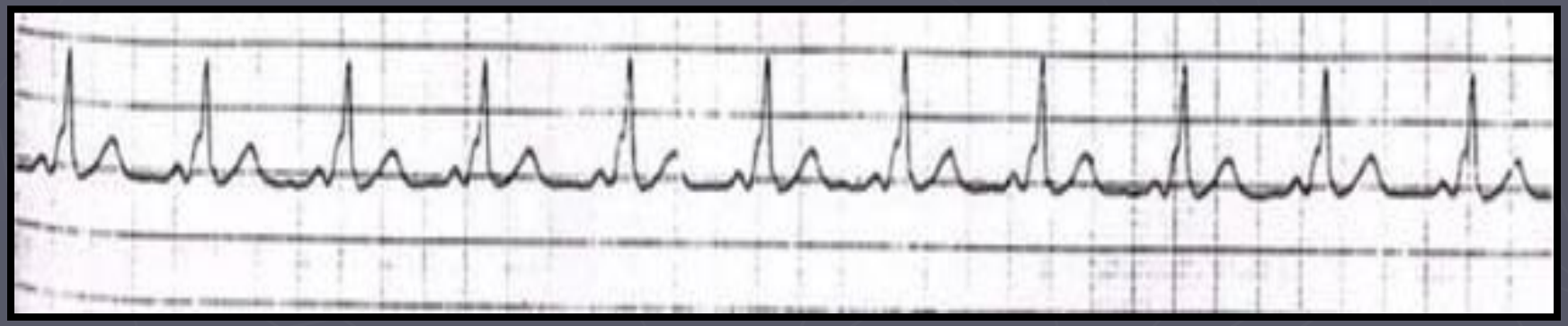
- AV node conducts no impulse
- Atria and ventricles beat at intrinsic rate (80 and 40 respectively)
- No association between P waves and QRS complexes

Another Consideration: Wolfe-Parkinson-White (WPW)



- **Caused by bypass tract**
- **AV node is bypassed, delay**
- **EKG shows short PR interval <.11 sec**
- **Upsloping to QRS complex (delta wave)**

WPW



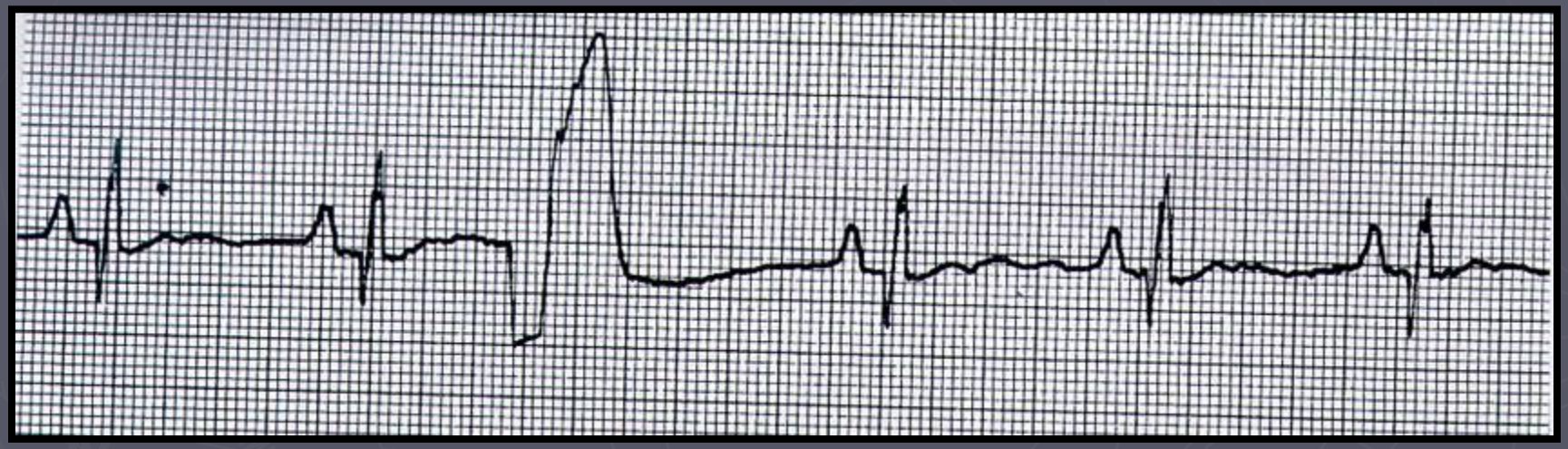
- **Delta wave, short PR interval**

Ventricular Arrhythmias: Criteria/Types

- Wide QRS complex
- Rate : variable
- No P waves

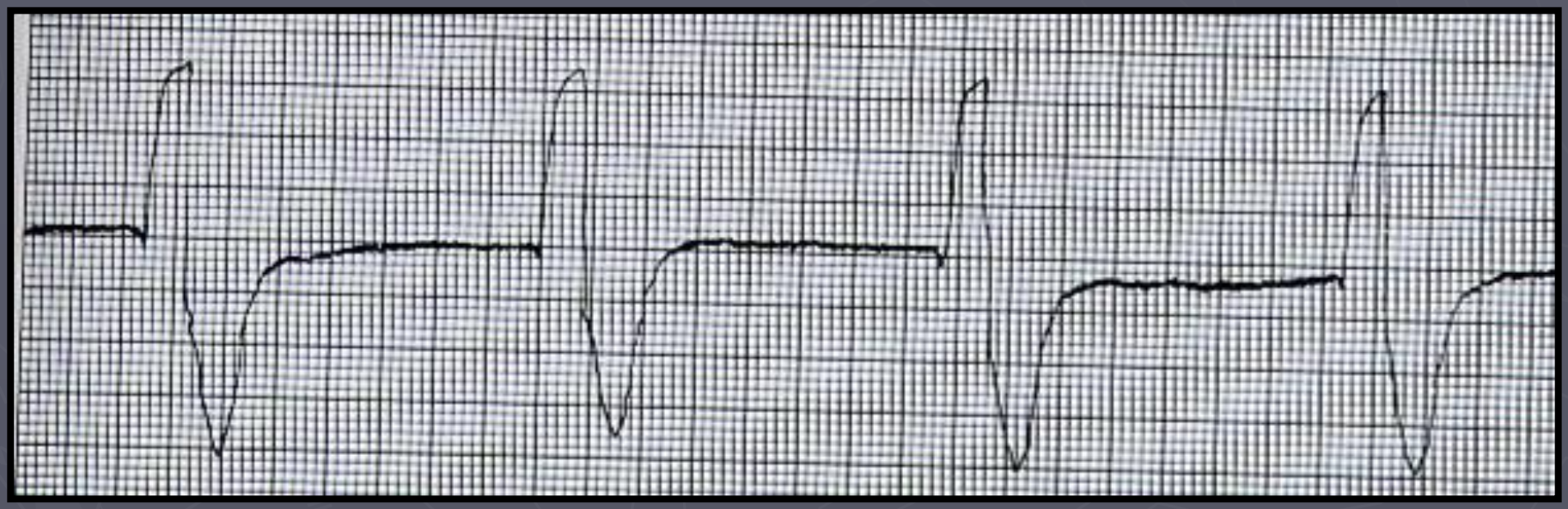
- Premature Ventricular Contractions
- Idioventricular Rhythm
- Accelerated IVR
- Ventricular Tachycardia
- Ventricular Fibrillation

Premature Ventricular Contraction



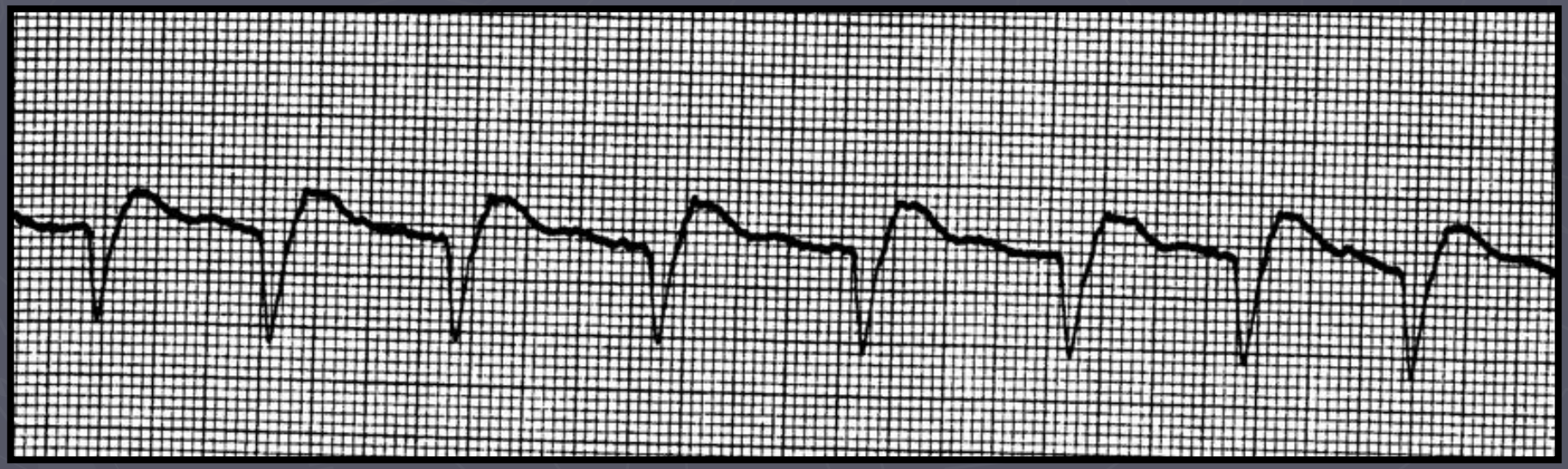
- **Occurs earlier than sinus beat**
- **Wide, no P wave**

Idioventricular Rhythm



- **Escape rhythm**
- **Rate is 20 to 40 bpm**

Accelerated Idioventricular Rhythm

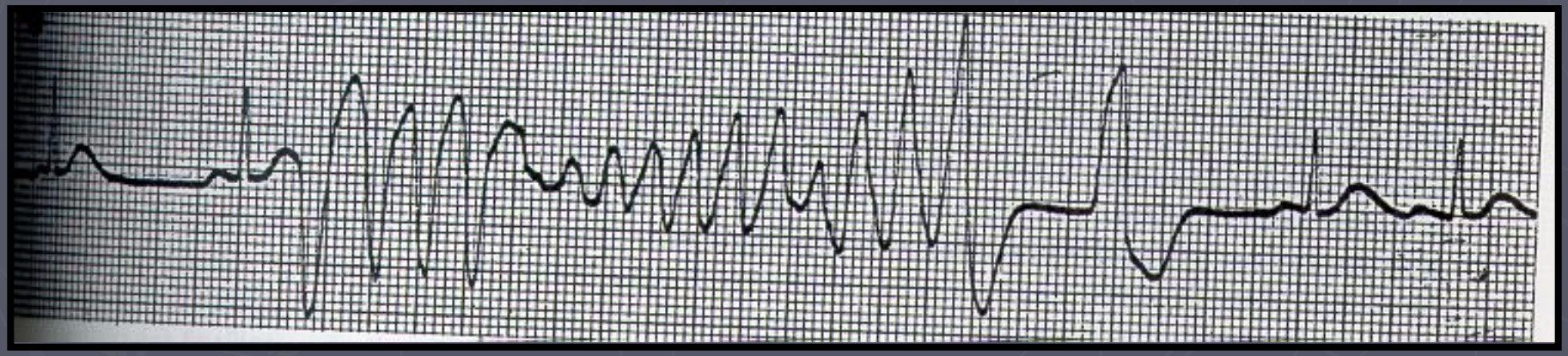


- **Rate is 40 to 100 bpm**

Ventricular Tachycardia

- **Rate is > than 100 bpm**

Torsades de Pointes

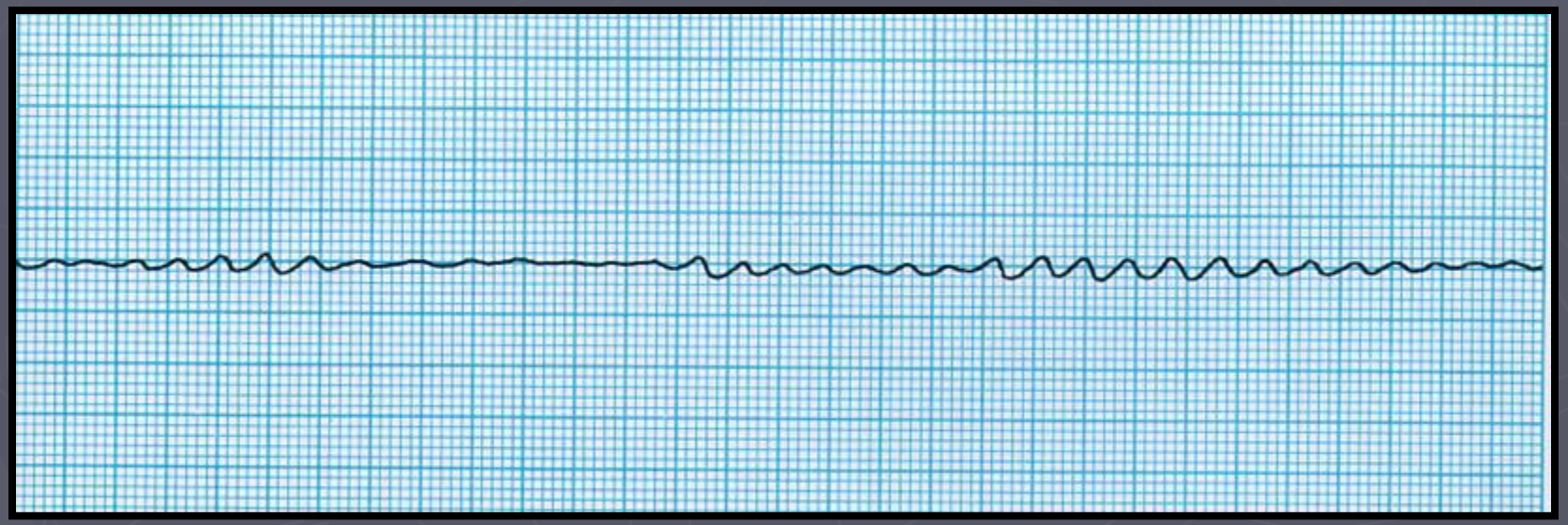


- **Occurs secondary to prolonged QT interval**

Ventricular Tachycardia/Fibrillation

- **Unorganized activity of ventricle**

Ventricular Fibrillation



Chamber Enlargements

Left Ventricular Hypertrophy (LVH)

- Differential Diagnosis
  - Hypertension (HTN)
  - Aortis Stenosis (AS)
  - Aortic Insufficiency (AI)
  - Hypertrophic Cardiomyopathy (HCM)
  - Mitral Regurgitation (MR)
  - Coarctation of the Aorta (COA)
  - Physiologic

Left Ventricular Hypertrophy (LVH)

- False positive
  - Thin chest wall
  - Status post mastectomy
  - Race, Sex, Age
  - Left Bundle Branch Block (LBBB)
  - Acute MI
  - Left Anterior Fascicular Block
  - Incorrect standardization

EKG Criteria: Diagnosis of LVH

Criteria in Males	Sens	Spec	LR+	LR-
Cornell voltage (RaVL +SV3 >25 mm)	19.1	95.0	3.8	0.9
Max [SV1, SV2, RV5, or RV6] ≥ 30 mm	17.8	95.1	3.6	0.9
R aVL >11 mm	16.4	95.1	3.3	0.9
RV5 or RV6 >25 mm	14.2	86.4	1.0	1.0
RI + SIII >25 mm	10.3	98.1	5.4	0.9
Max SV1 or SV2 ≥ 25 mm	5.2	96.6	1.5	1.0
R I, II, or III > 20 mm	0.0	99.8	0.0	1.0

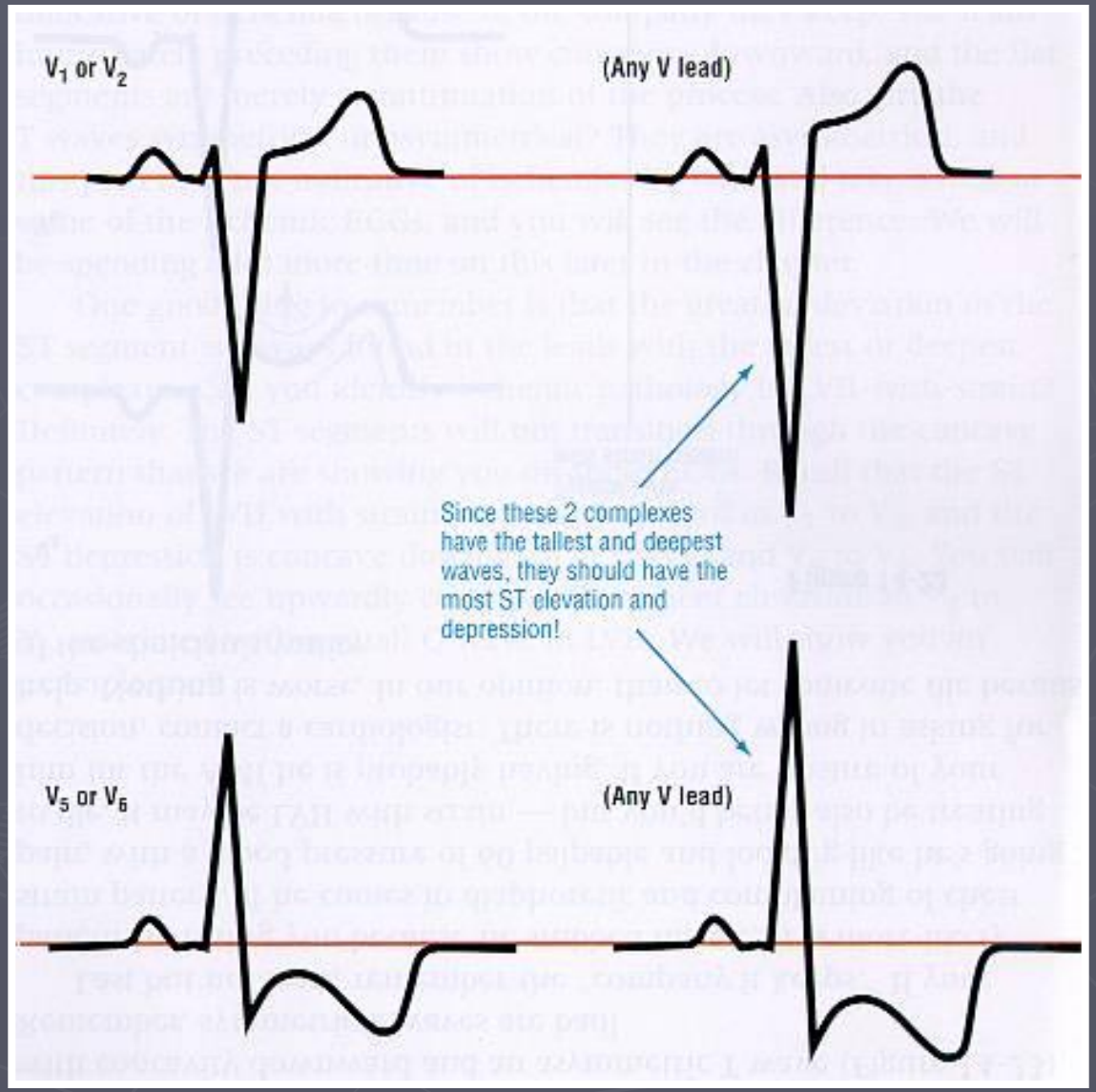
Criteria in Females	Sens	Spec	LR+	LR-
Cornell voltage (RaVL +SV3 >20 mm)	18.6	95.0	3.7	0.9
R aVL > 11 mm	10.1	98.2	5.6	0.9
RV5 or RV6 >25 mm	8.0	97.8	3.6	0.9
RI + SIII > 25 mm	6.0	99.2	7.5	1.0
Max [SV1, SV2, RV5, or RV6] ≥ 30 mm	4.0	99.6	10.0	1.0
Max SV1 or SV2 ≥ 25 mm	1.7	99.8	8.5	1.0
R I, II, or III > 20 mm	0.3	99.9	3.0	1.0

EKG Criteria

- -S V1, V2 + R V5,V6 > 35 42.5% 95% (Sokolow-Lyon)
- -R V5 orV6 > 27 25% 98%
- -R V5 or V6 > 25 Framingham 14% 86%
- -R plus S > 45 any lead 45% 93%

- Limb leads
- -R in L + S in V3 >25 in men,
- and >20 in women. 16% 97%
- (Cornell Voltage)
- -R in I + S in III > 25 10.6% 100%
- -R in L > 11 man, 9 wom 10.6% 100%
- -R in avF > 20 1.3% 99.5%
- -S in avR > 14

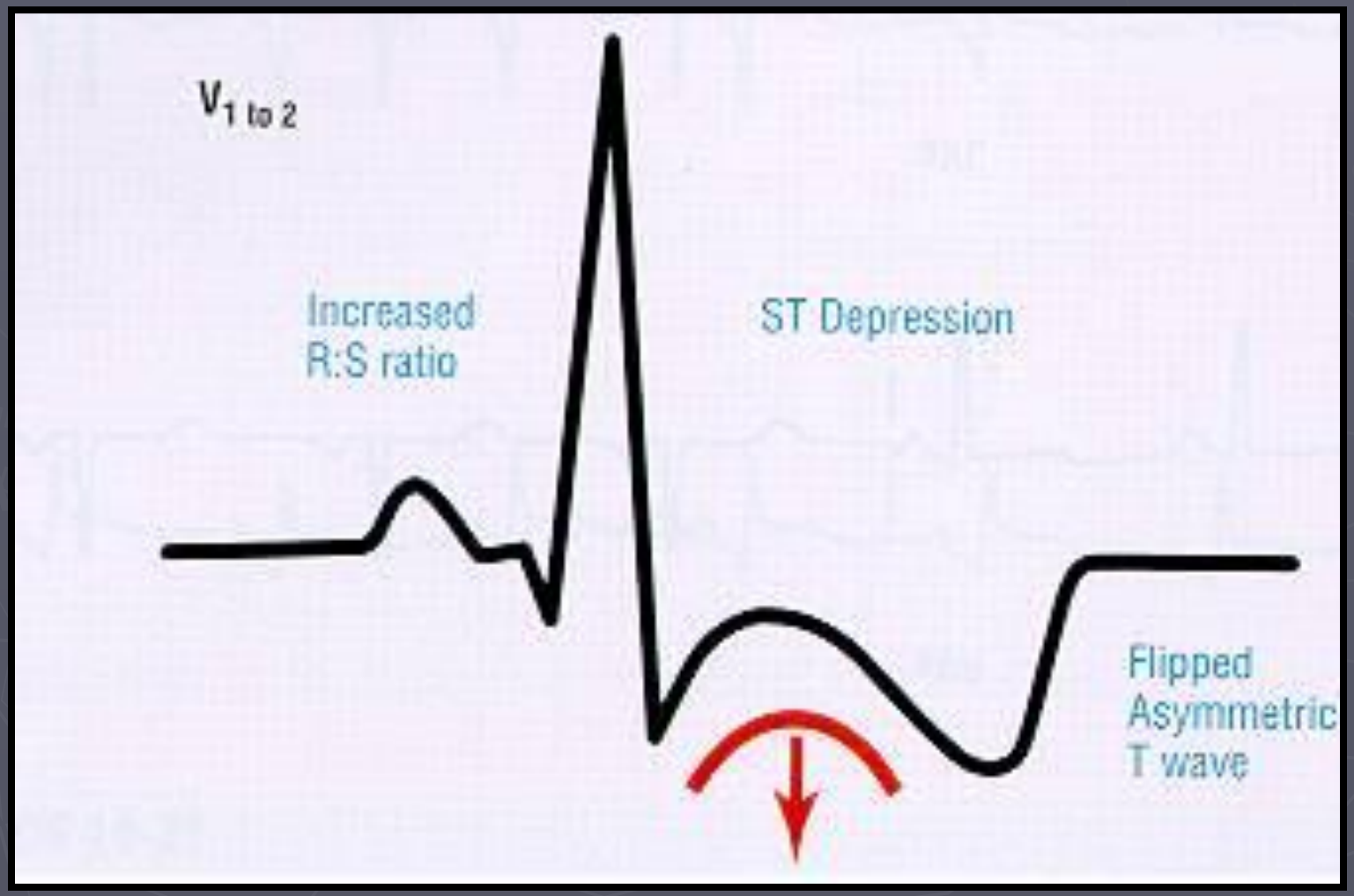
LVH with Strain



Right Ventricular Hypertrophy

- Reversal of precordial pattern
  - R waves prominent in V1 and V2
  - S waves smaller in V1 and V2
  - S waves become prominent in V5 and V6

Right Ventricular Hypertrophy



Right Ventricular Hypertrophy: Causes

- Chronic Obstructive Pulmonary Disease
- Pulmonary HTN
  - Primary
- Pulmonary Embolus
- Mitral Stenosis
- Mitral Regurgitation
- Chronic LV failure

Right Ventricular Hypertrophy: Causes

- Tricuspid Regurgitation
- Atrial Septal Defect
- Pulmonary Stenosis
- Tetralogy of Fallot
- Ventricular Septal Defect

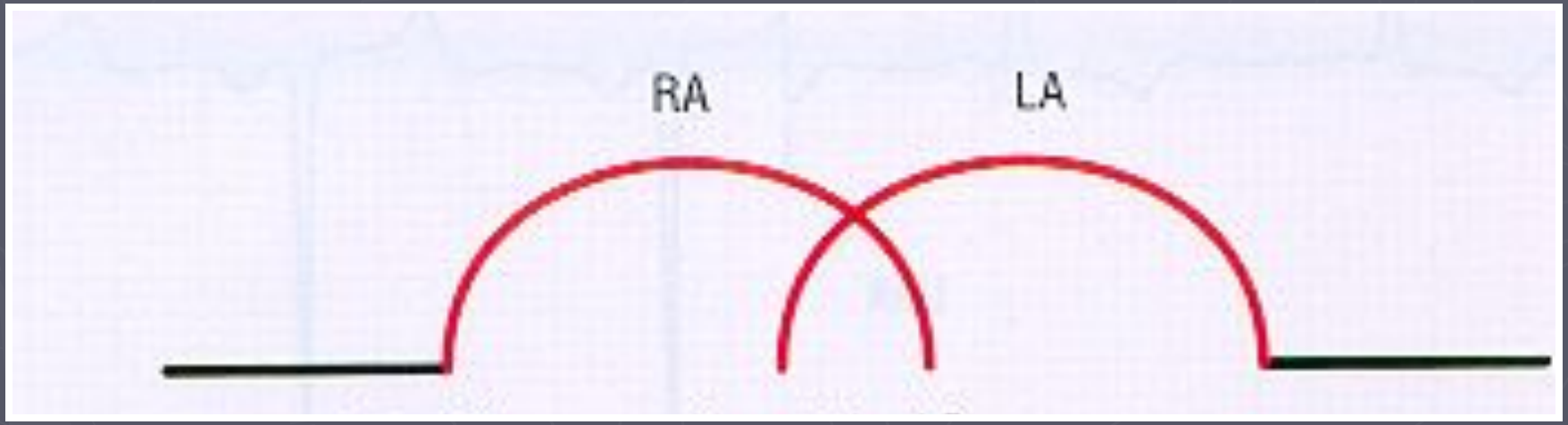
Left Atrial Enlargement: Causes

- Mitral Stenosis
- Mitral Regurgitation
- Left ventricular hypertrophy
- Hypertension
- Aortic Stenosis
- Aortic Insufficiency
- Hypertrophic Cardiomyopathy

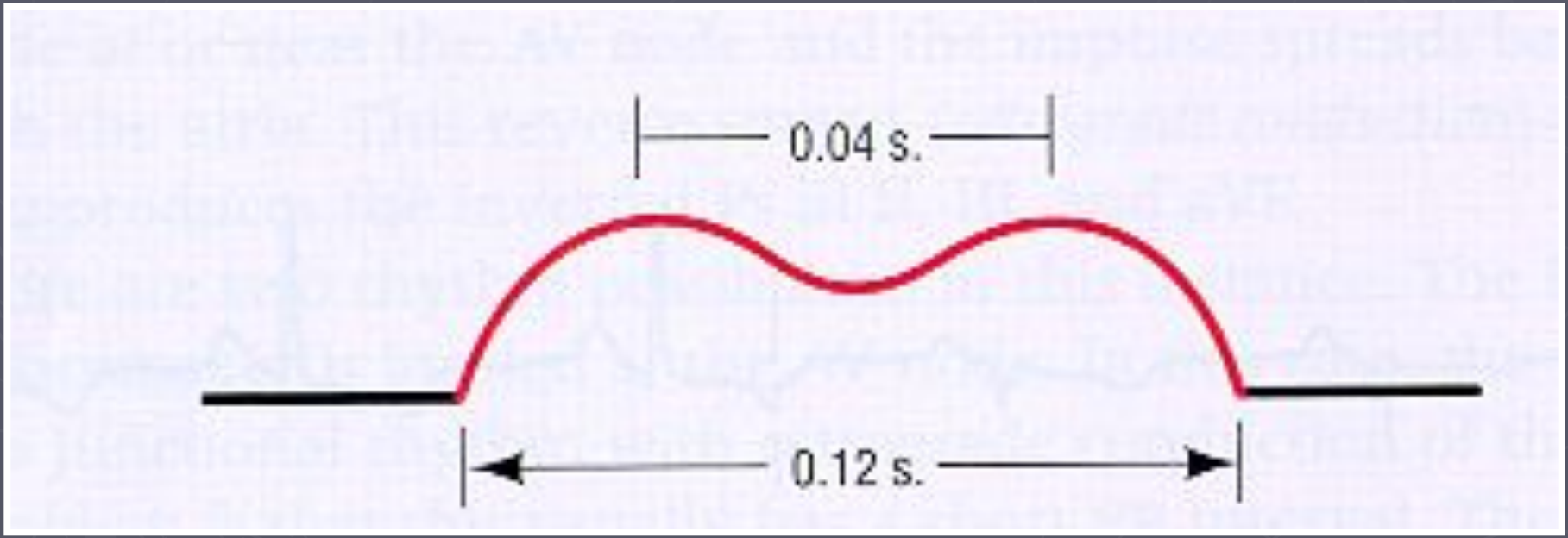
Left Atrial Enlargement: Criteria

- P wave
- Notch in P wave
  - Any lead
  - Peaks > 0.04 secs
- V1
  - Terminal portion of P wave $\geq$ 1mm deep and $\geq$ 0.04 sec wide

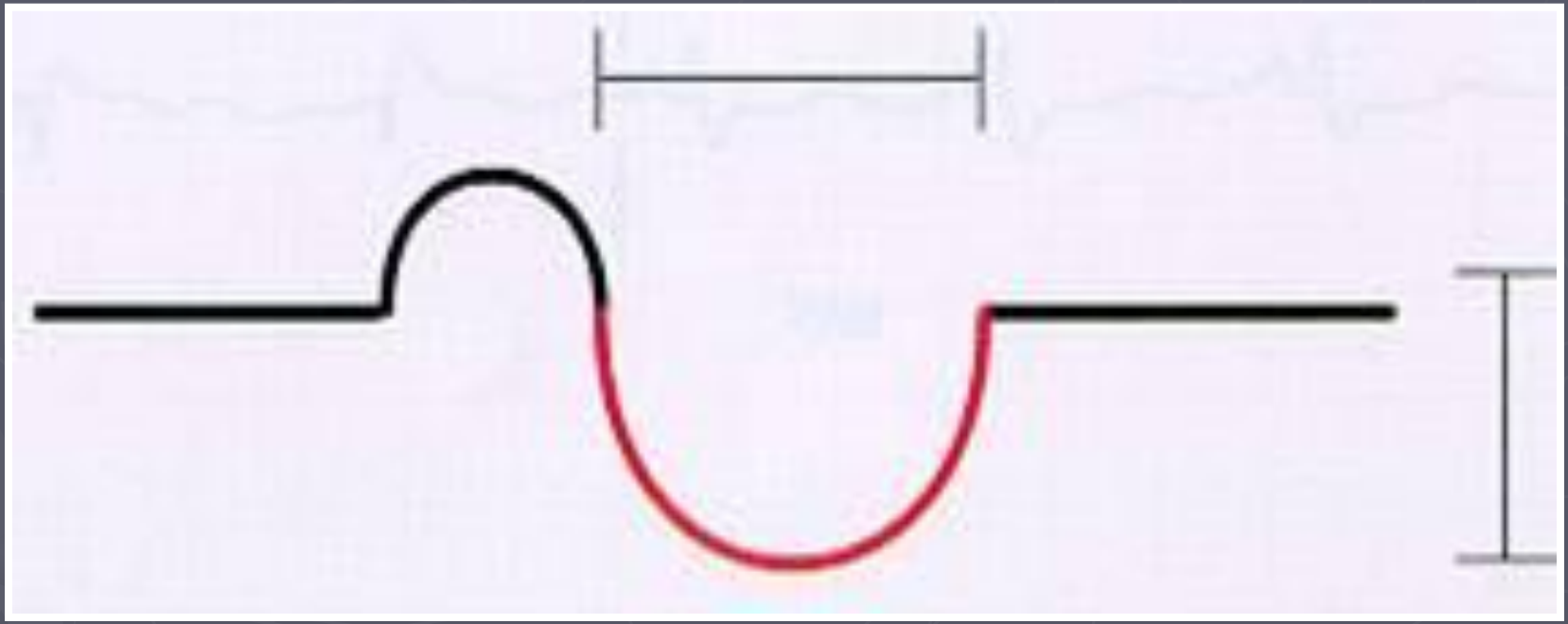
Lead II



P Wave: Left Atrial Enlargement



Left Atrial Enlargement
Lead V1



Right Atrial Enlargement: Causes

- CHD
  - Tricuspid Stenosis
  - Pulmonary Stenosis
- COPD
- Pulmonary HTN
- Pulmonary Embolus
- Mitral Regurgitation
- Mitral Stenosis

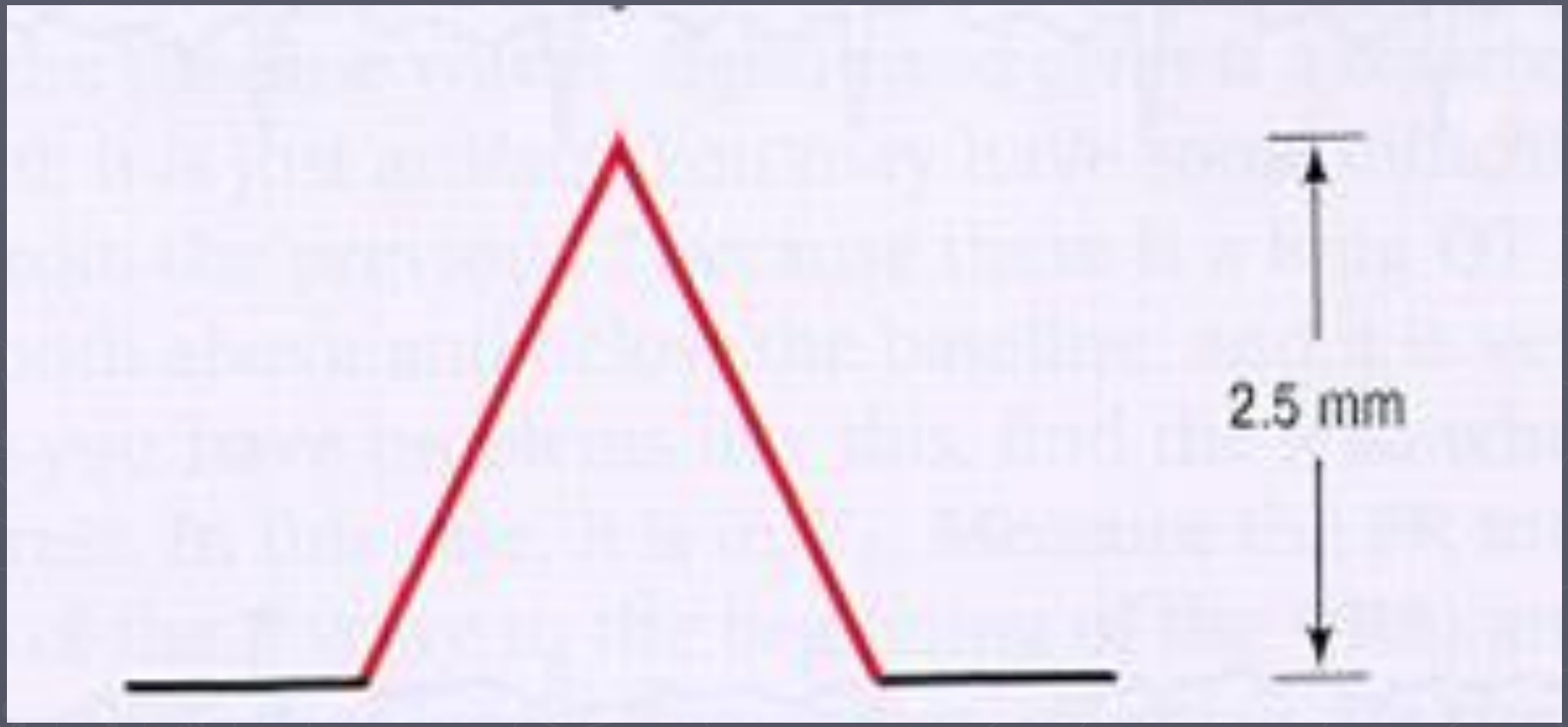
Right Atrial Enlargement: Criteria

- Tall, peaked P wave

  $\geq$ 2.5 mm in any lead

- Most prominent P waves in leads I, II and aVF

Right Atrial Enlargement



Bundle Branch Blocks

Bundle Branch Blocks

- Left
  - Complete
  - Incomplete
- Right
  - Complete
  - Incomplete

- Complete
  - QRS > .12 secs
- Incomplete
  - QRS .10 - .12 secs

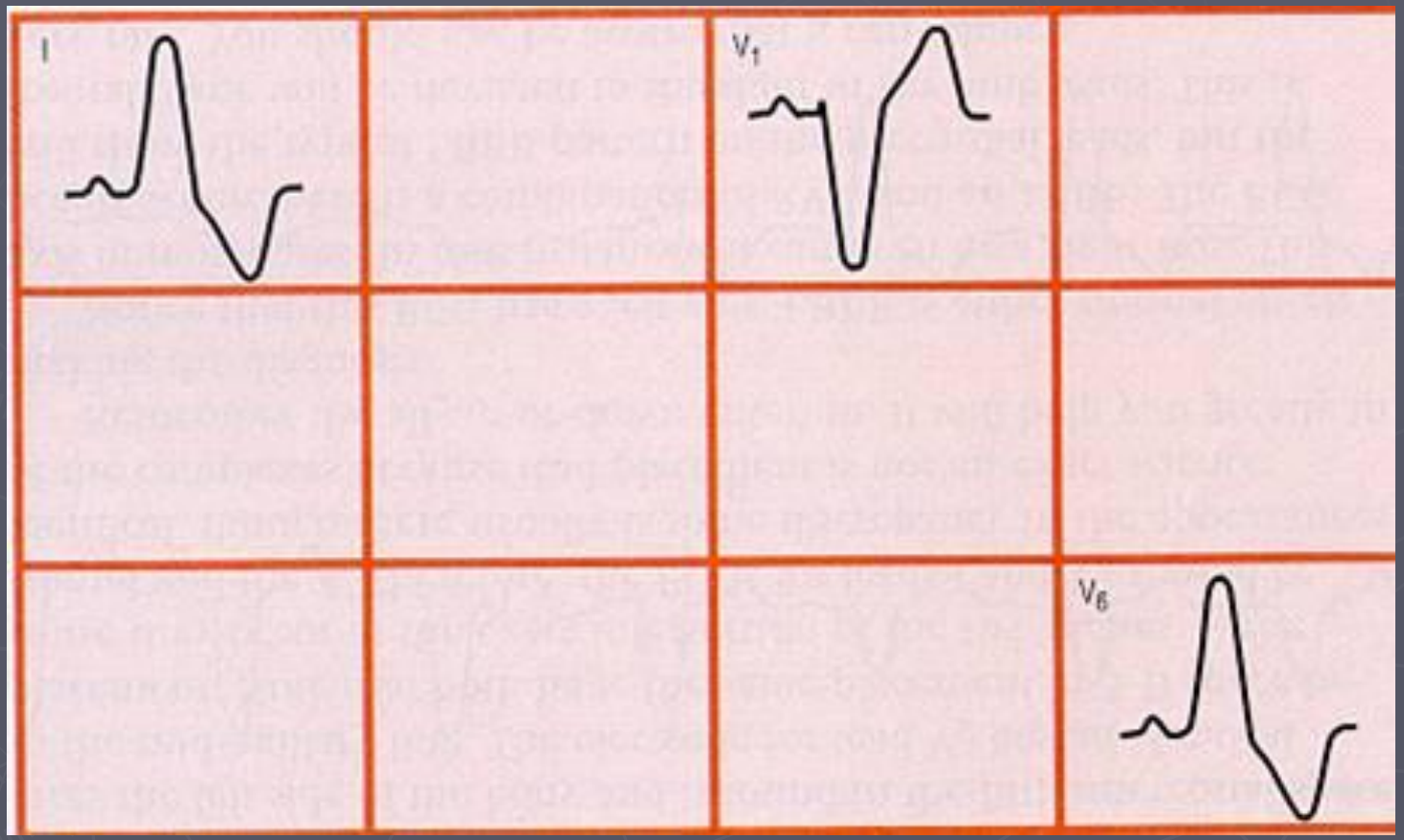
Left Bundle Branch Block: Causes

- Normal variant
- Idiopathic degeneration of the conduction system
- Cardiomyopathy
- Ischemic heart disease
- Aortic Stenosis
- Hyperkalemia
- Left Ventricular Hypertrophy

Criteria for Left Bundle Branch Block (LBBB)

- Bizarre QRS Morphology
  - High voltage S wave in V1, V2 & V3
  - Tall R wave in leads I, aVL and V5-6
- Often LAD
- QRS Interval
- ST depression in leads I, aVL, & V5-V6
- T wave inversion in I, aVL, & V5-V6

Left Bundle Branch Block



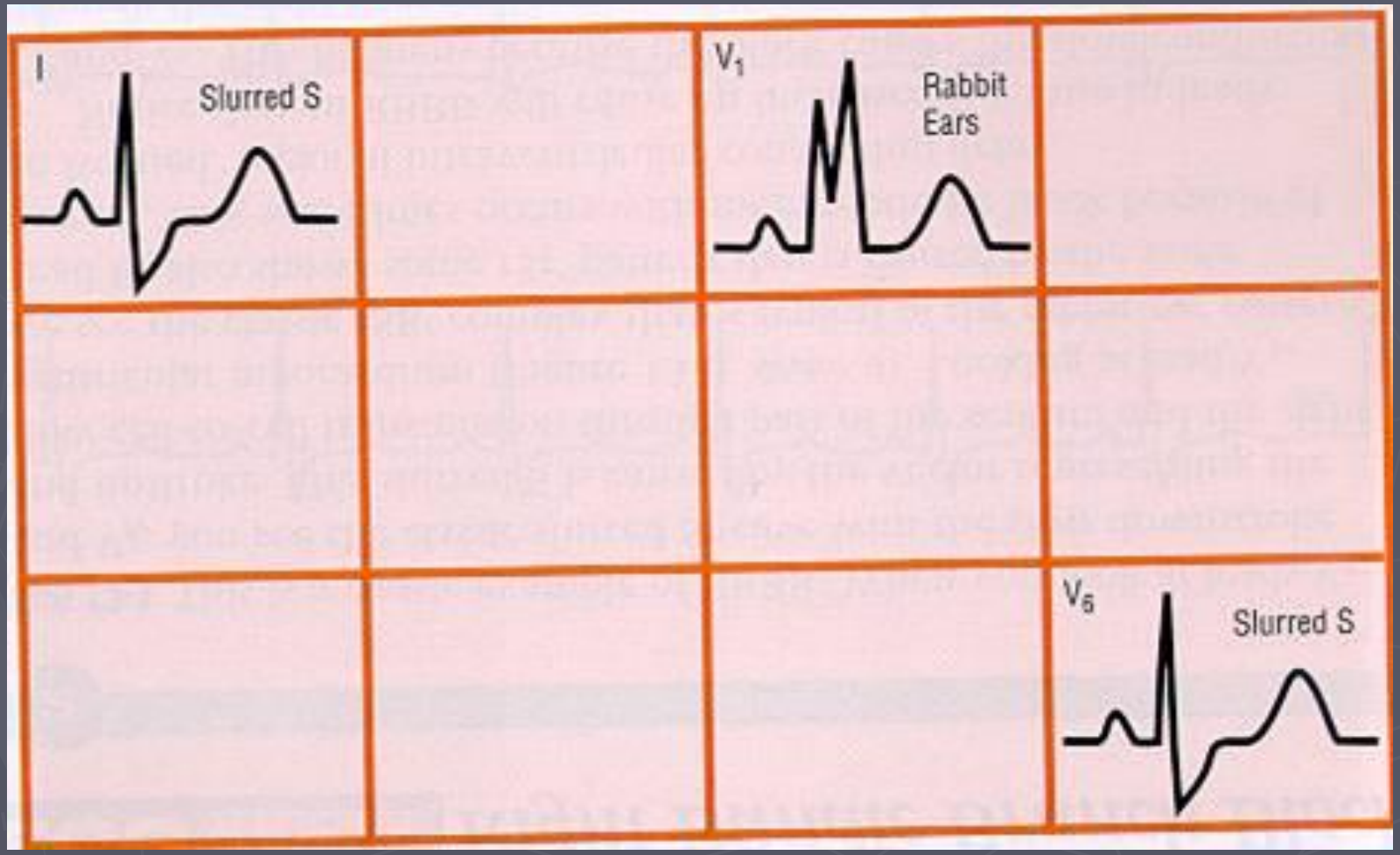
Right Bundle Branch Block: Causes

- Idiopathic degeneration of the conduction system
- Ischemic heart disease
- Cardiomyopathy
- Massive Pulmonary Embolus
- Ventricular Hypertrophy
- Normal Variant

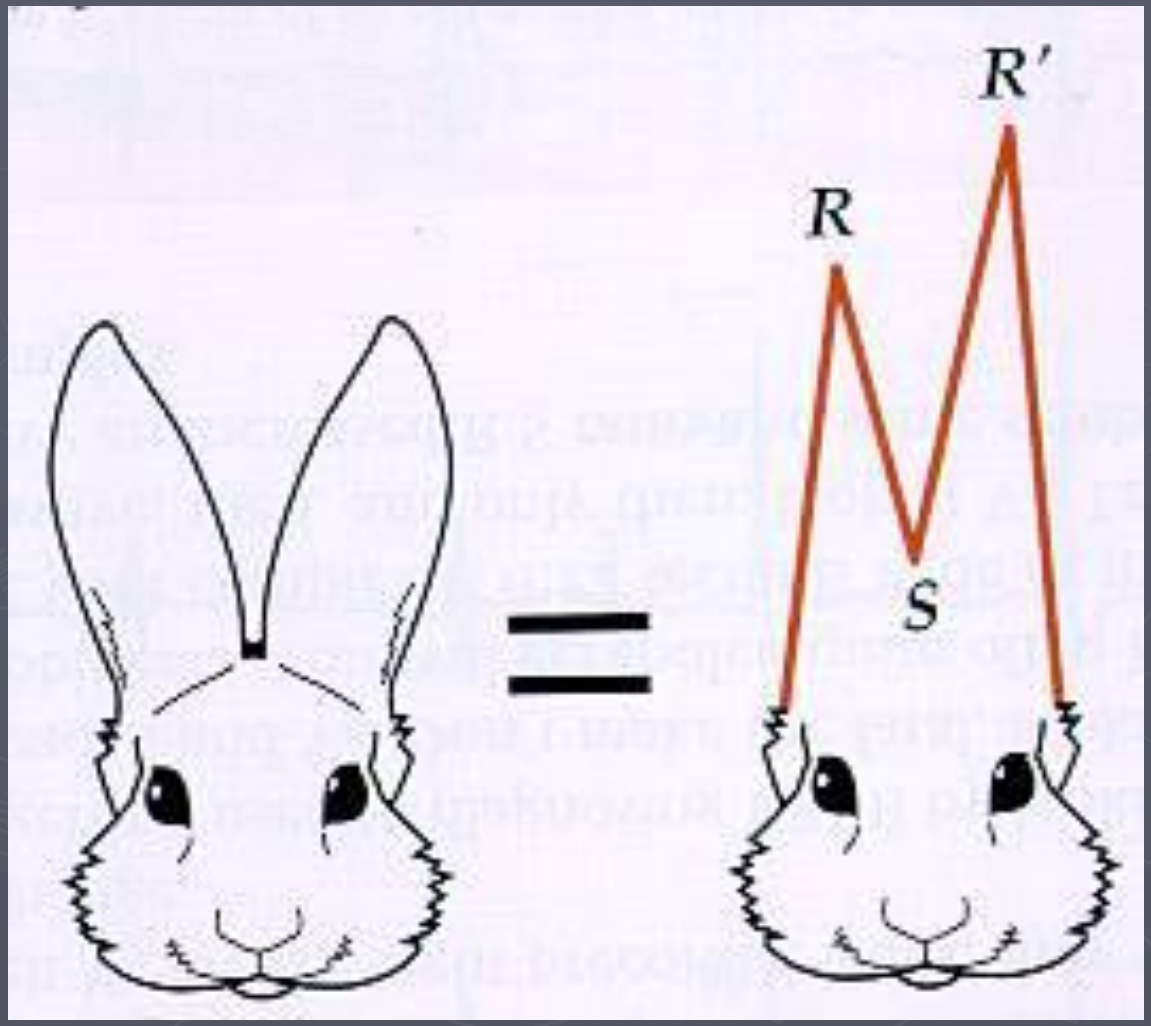
Criteria for Right Bundle Branch Block (RBBB)

- QRS morphology
  - Wide S wave in leads I and V4-V6
  - RSR’ pattern in leads V1, V2 and V3
- QRS duration
- ST depression in leads V1 and V2
- T wave inversion in leads V1 and V2

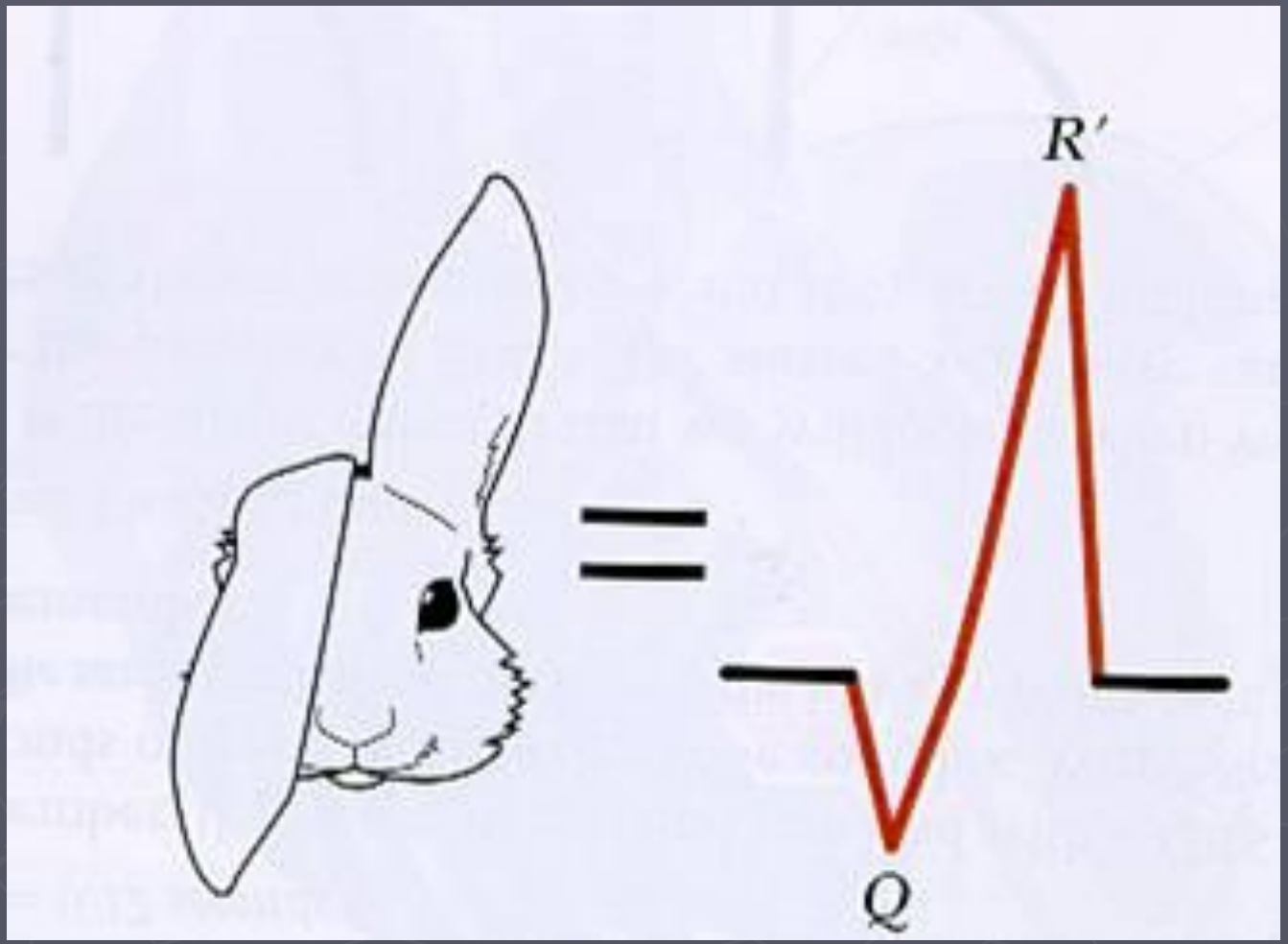
Right Bundle Branch Block



Right Bundle Branch Block

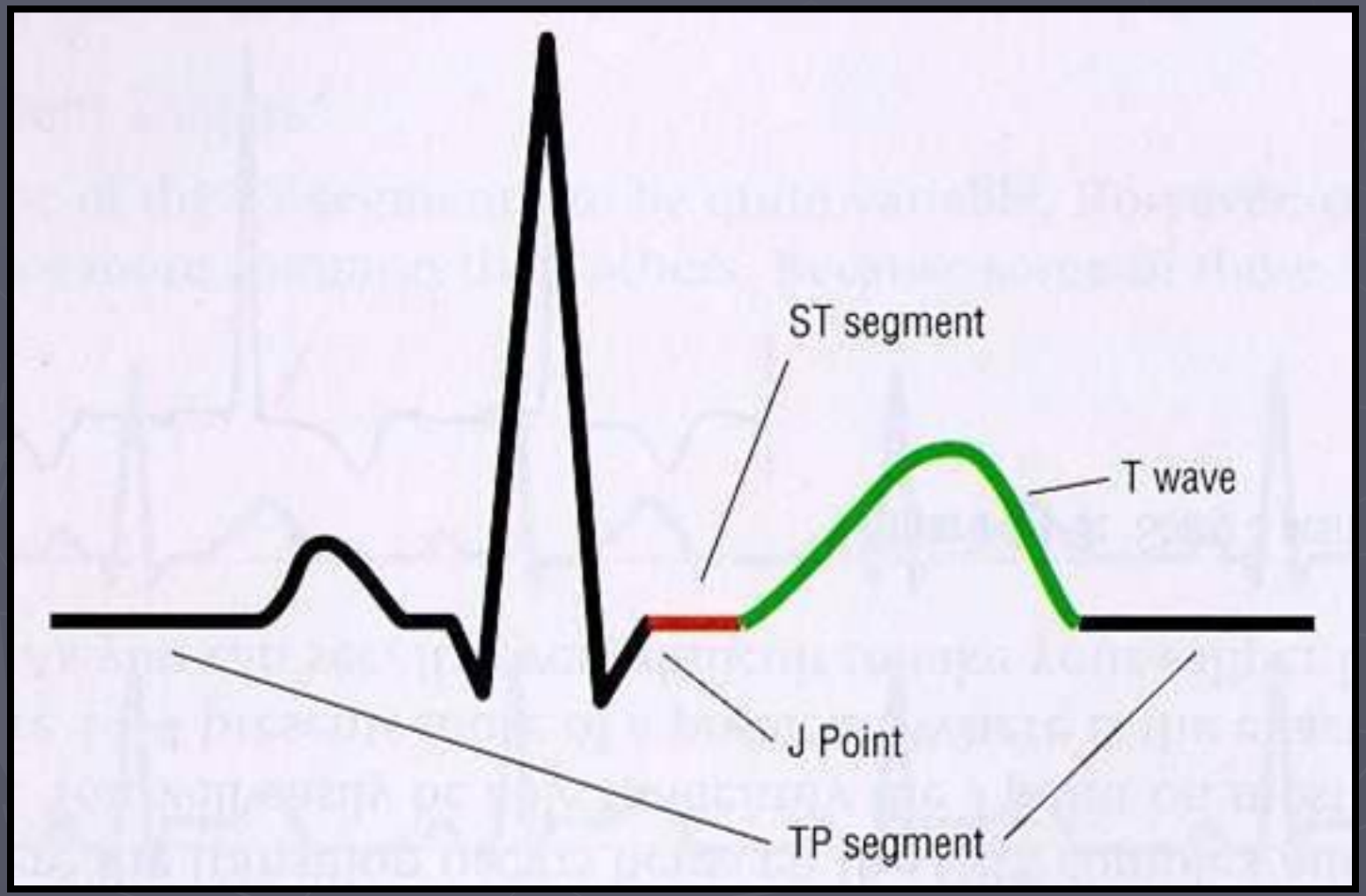


Anterior Septal with RBBB

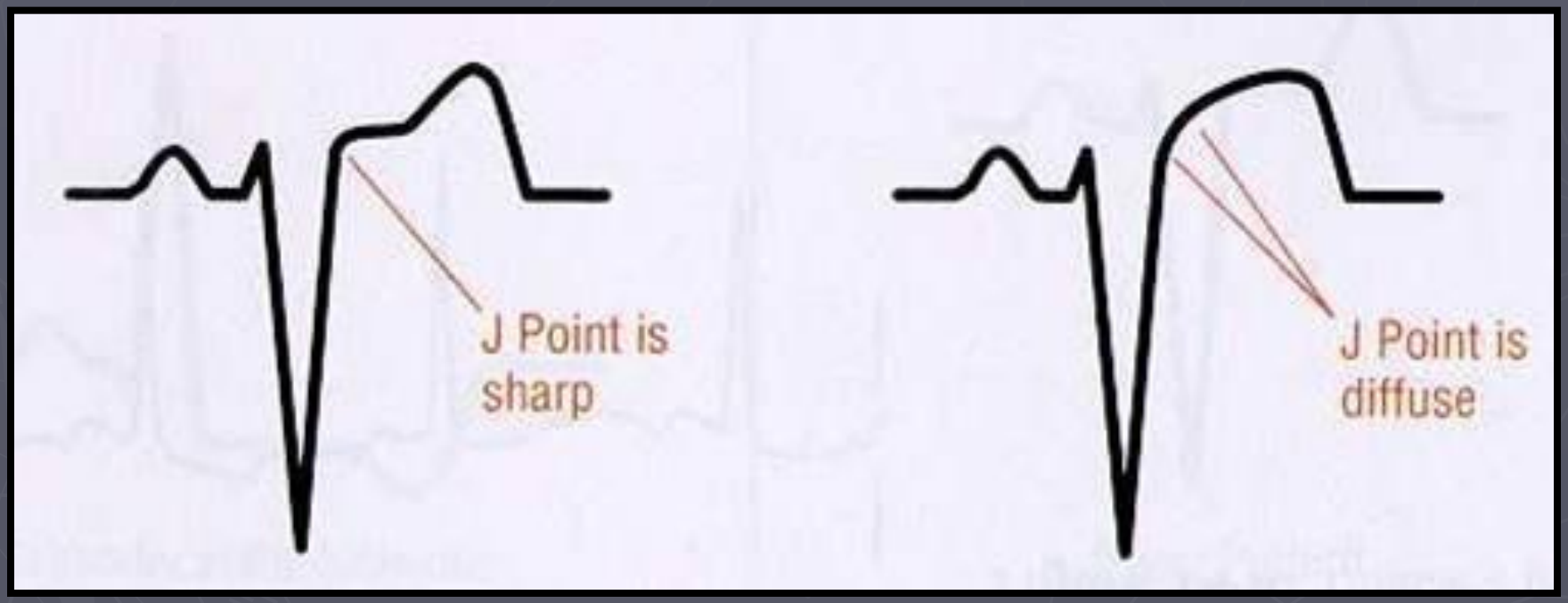


Ischemia and Infarction

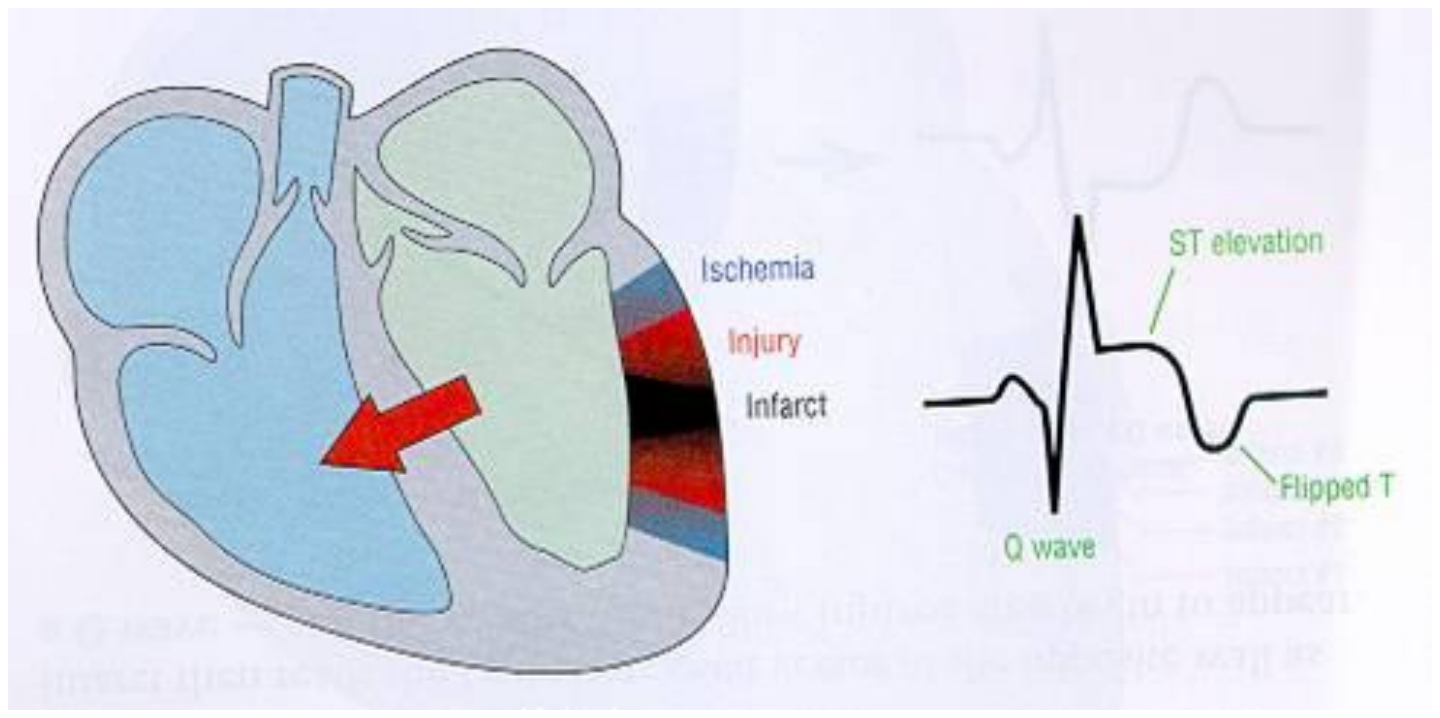
Normal Complexes and Segments



J Point

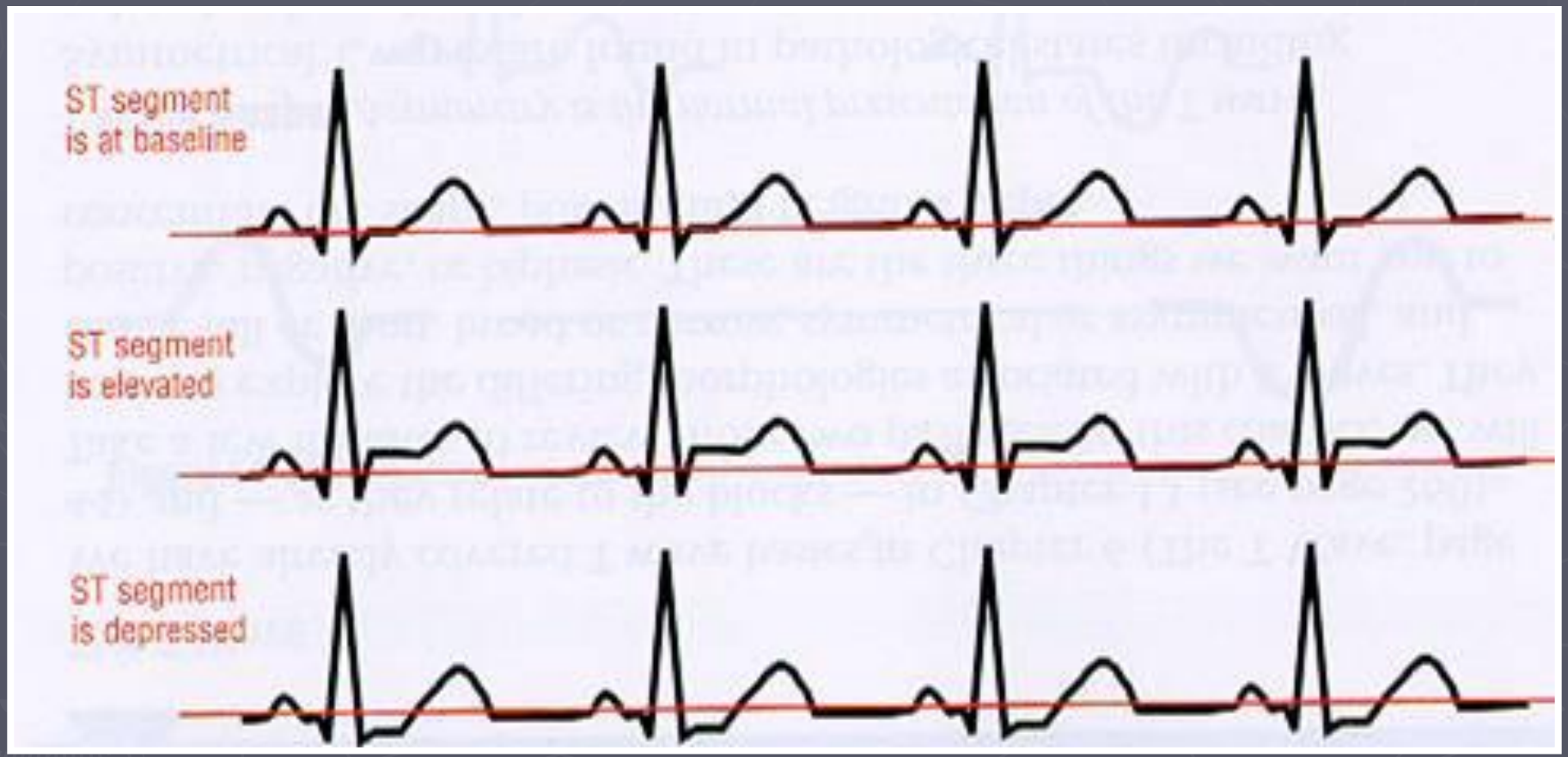


Ischemia



- **T wave inversion, ST segment depression**
- **Acute injury: ST segment elevation**
- **Dead tissue: Q wave**

Measurements

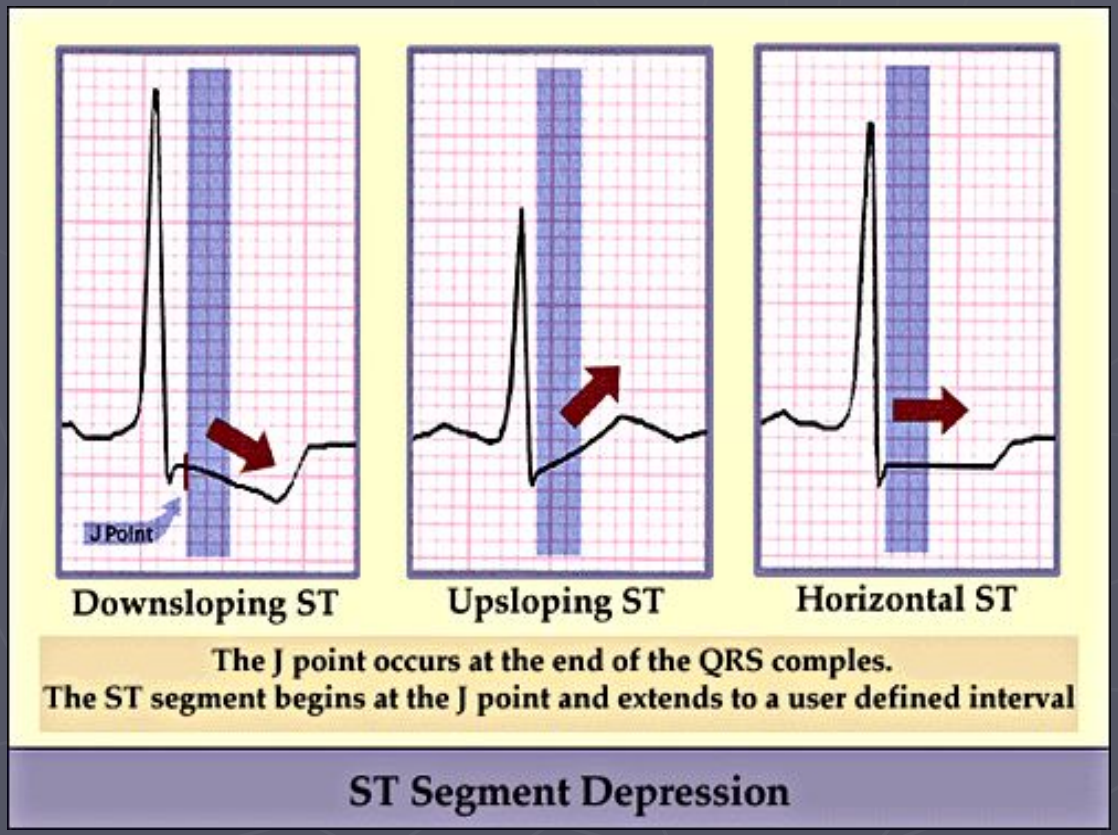


ST-Segment Elevation

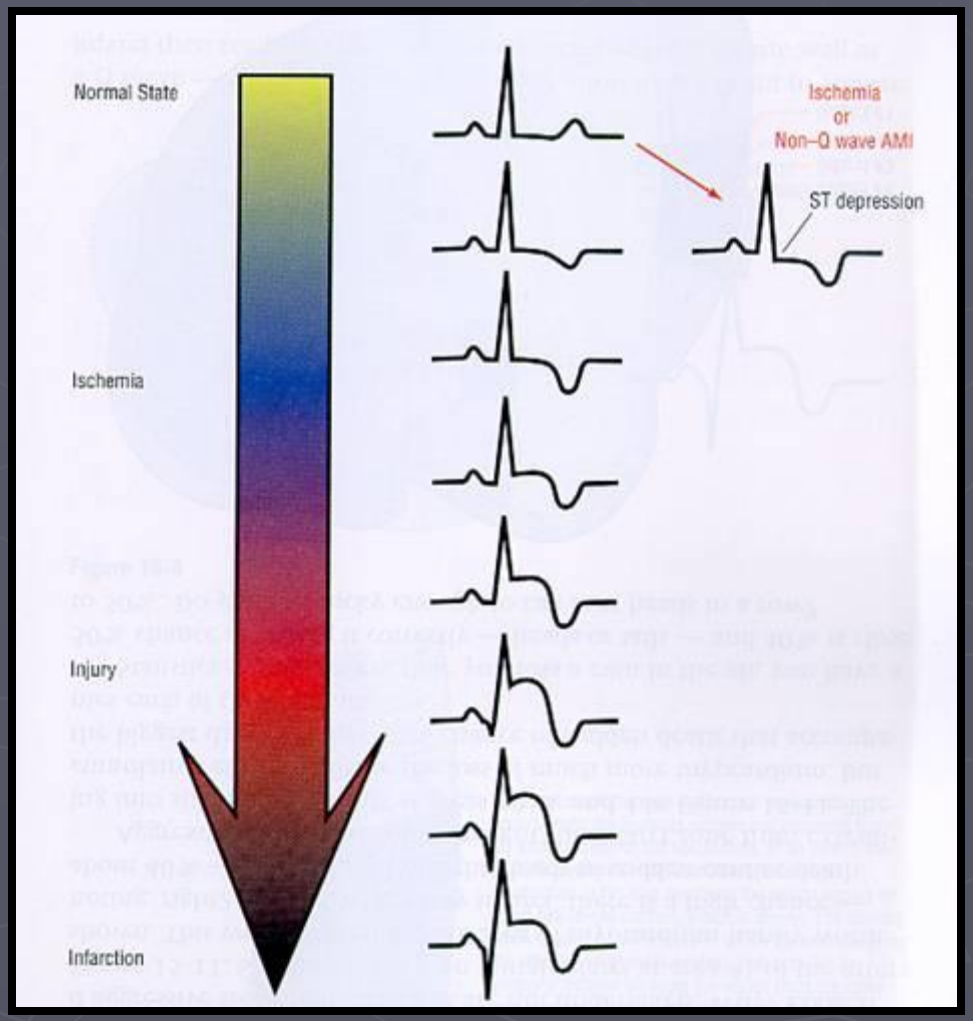
ST Segment Depression

Can be characterised as:-

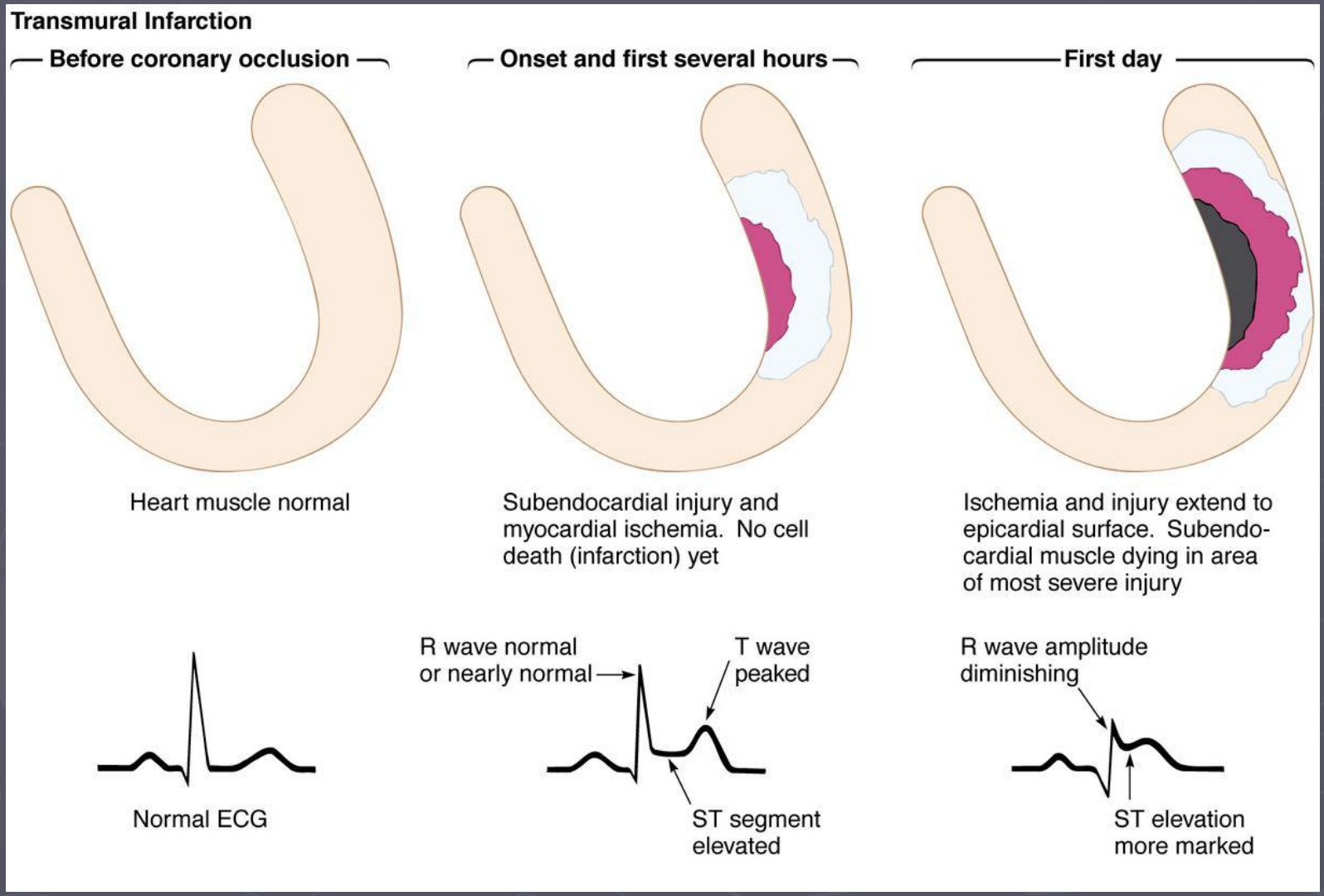
- Downsloping
- Upsloping
- Horizontal

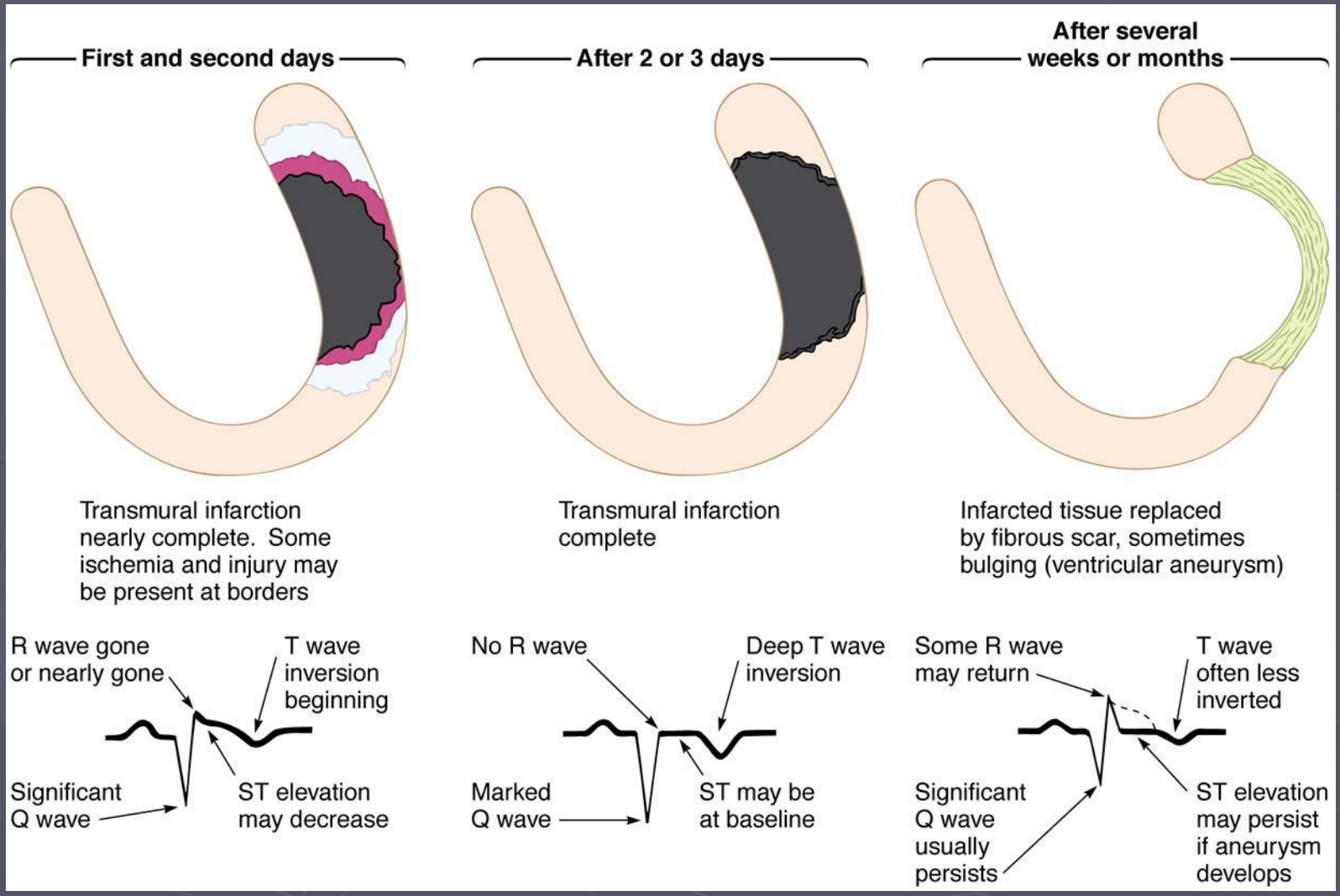


EKG Changes: Ischemia → Acute Injury→ Infarction

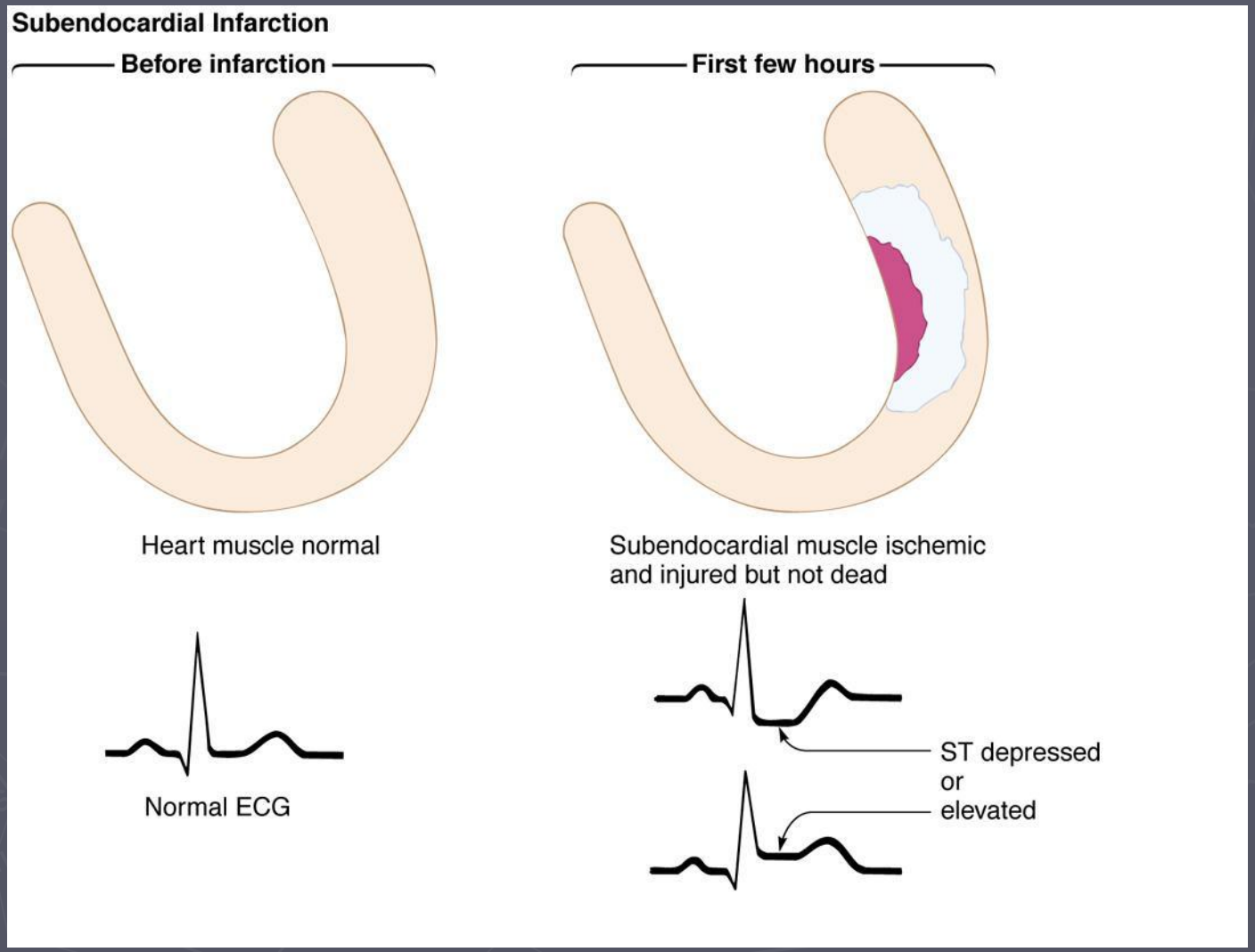


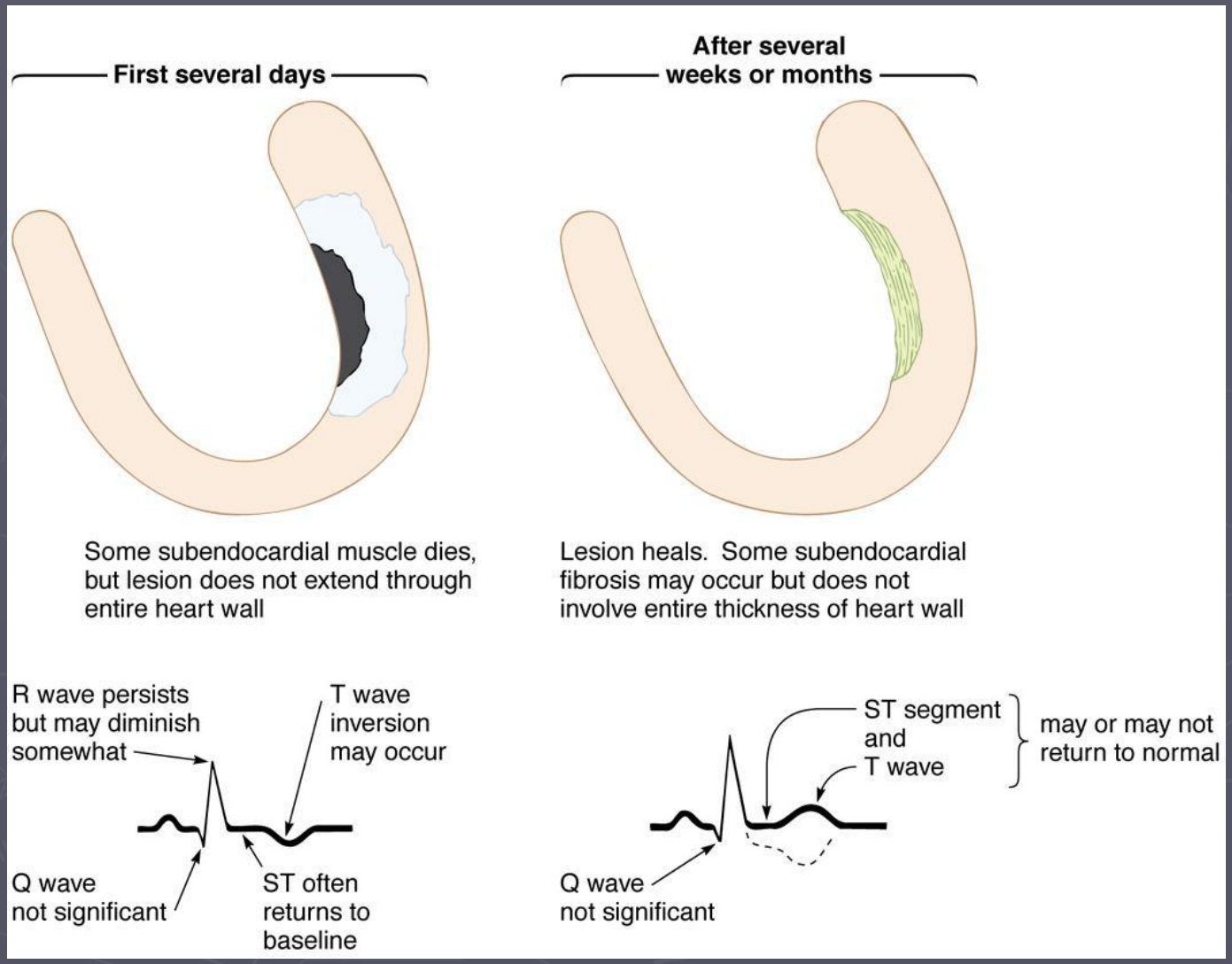
Evolution of Transmural Infarction



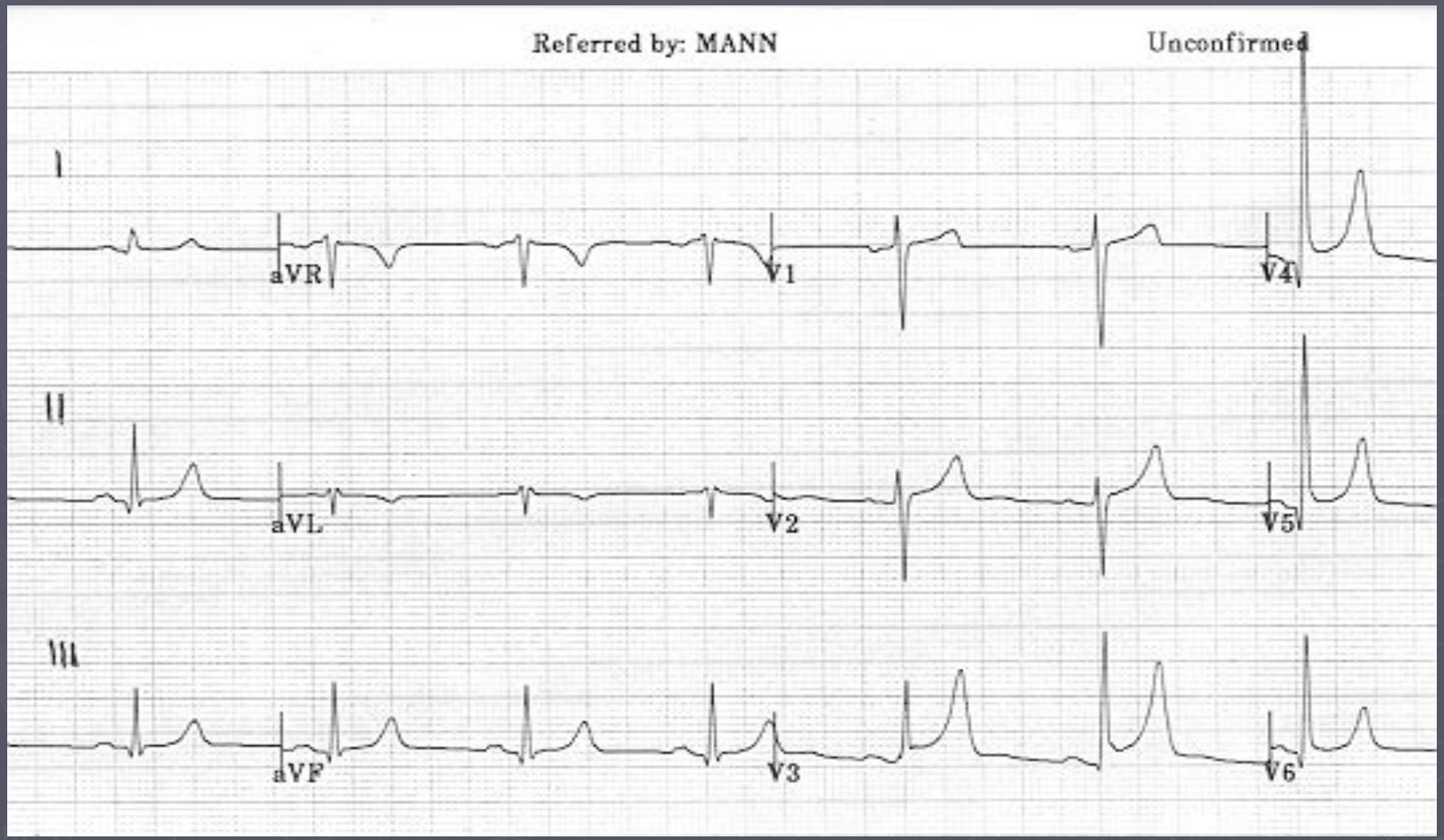

First and second days
After 2 or 3 days
After several weeks or months
Transmural infarction nearly complete. Some ischemia and injury may be present at borders
Transmural infarction complete
Infarcted tissue replaced by fibrous scar, sometimes bulging (ventricular aneurysm)
R wave gone or nearly gone
T wave inversion beginning
Significant Q wave
ST elevation may decrease
No R wave
Deep T wave inversion
Marked Q wave
ST may be at baseline
Some R wave may return
T wave often less inverted
Significant Q wave usually persists
ST elevation may persist if aneurysm develops

Evolution of a Subendocardial Infarction




First several days
After several weeks or months
Some subendocardial muscle dies, but lesion does not extend through entire heart wall
Lesion heals. Some subendocardial fibrosis may occur but does not involve entire thickness of heart wall
R wave persists but may diminish somewhat
T wave inversion may occur
Q wave not significant
ST often returns to baseline
ST segment and T wave
may or may not return to normal
Q wave not significant

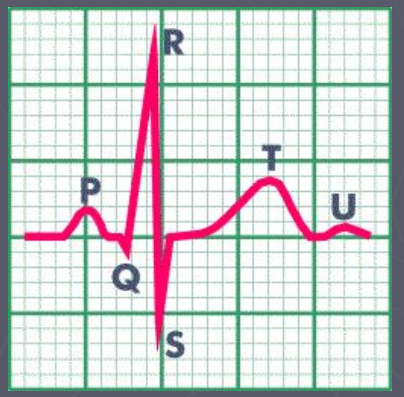
Hyperacute T waves



Q Waves

Non Pathological Q waves

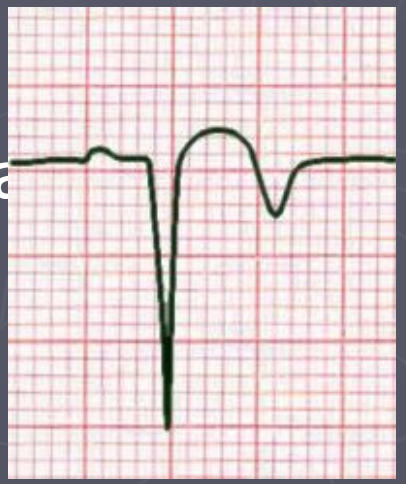
Q waves of less than 2mm are normal

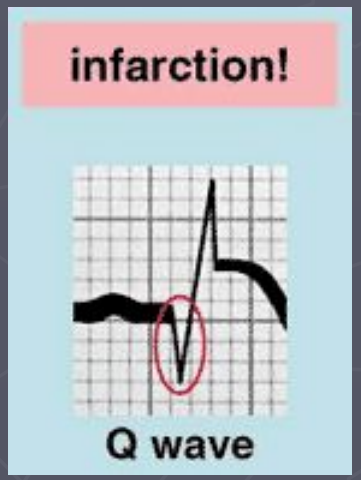


Pathological Q waves

Q waves of more than 2mm indicate full thickness myocardia damage from an infarct

Late sign of MI (evolved)

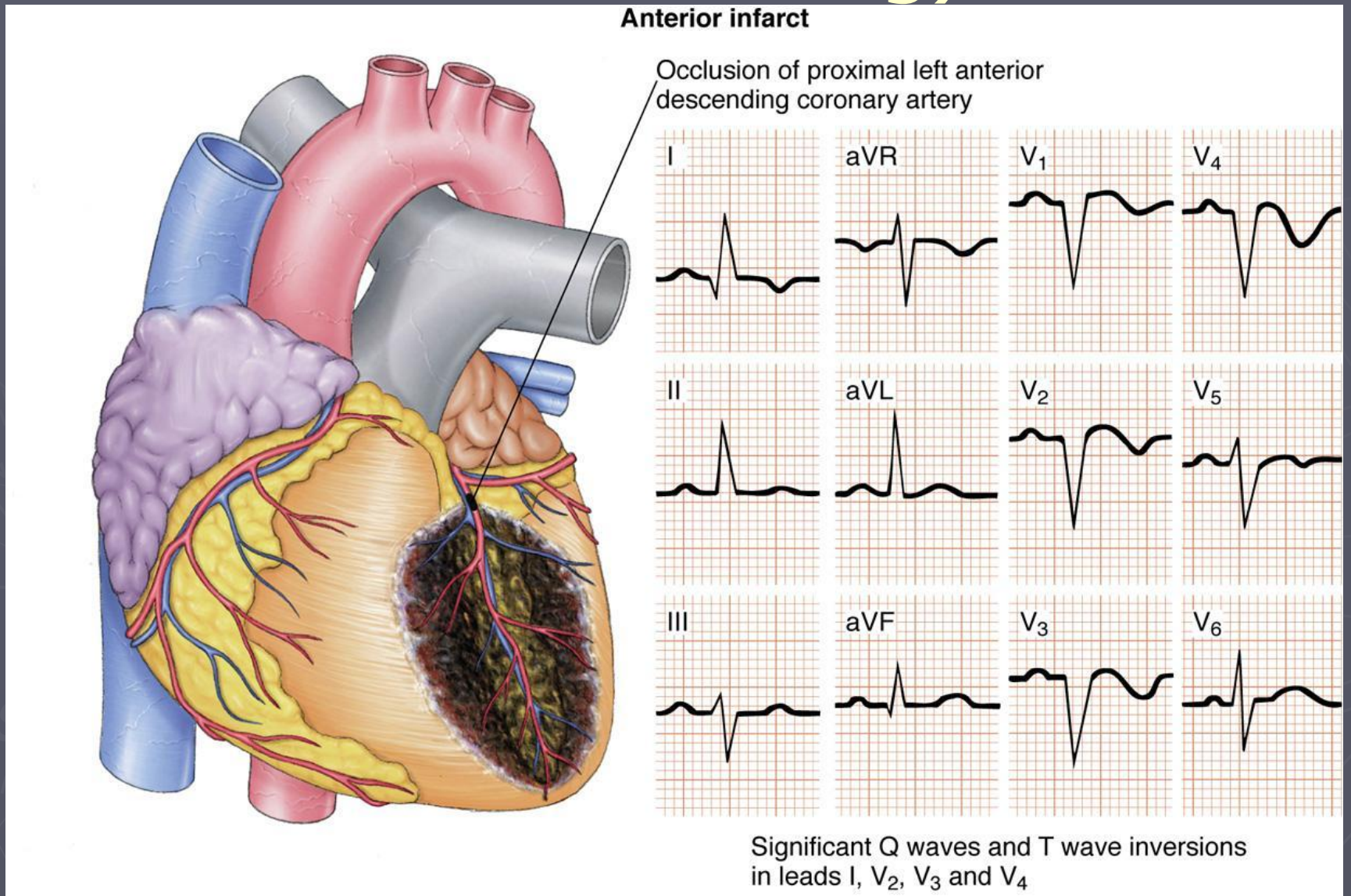




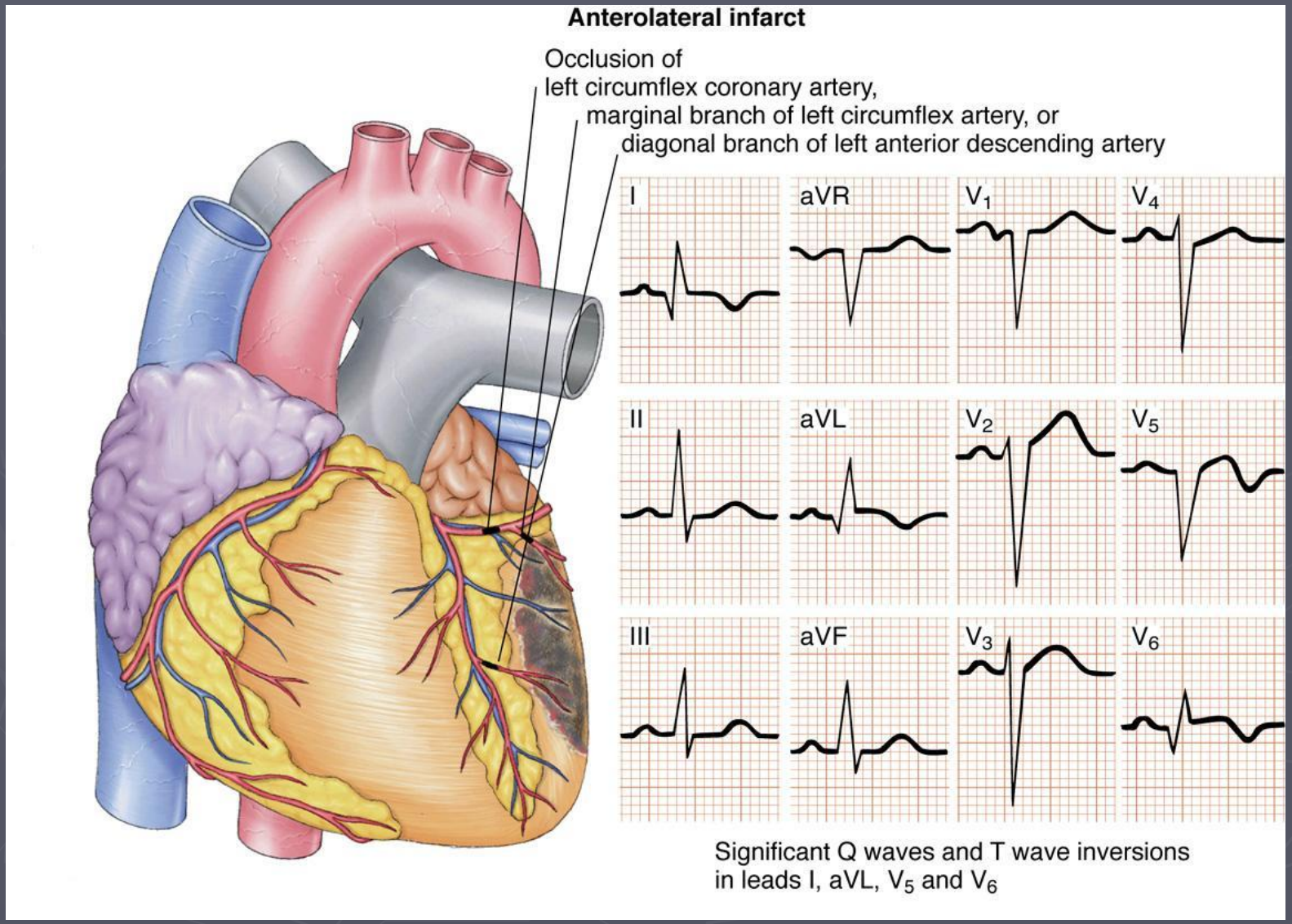
Look for Grouped Patterns (Footprints)

- ST Depressions = Ischemia
- ST Elevations = injury
- Q Waves & T Wave Inversion = Infarction

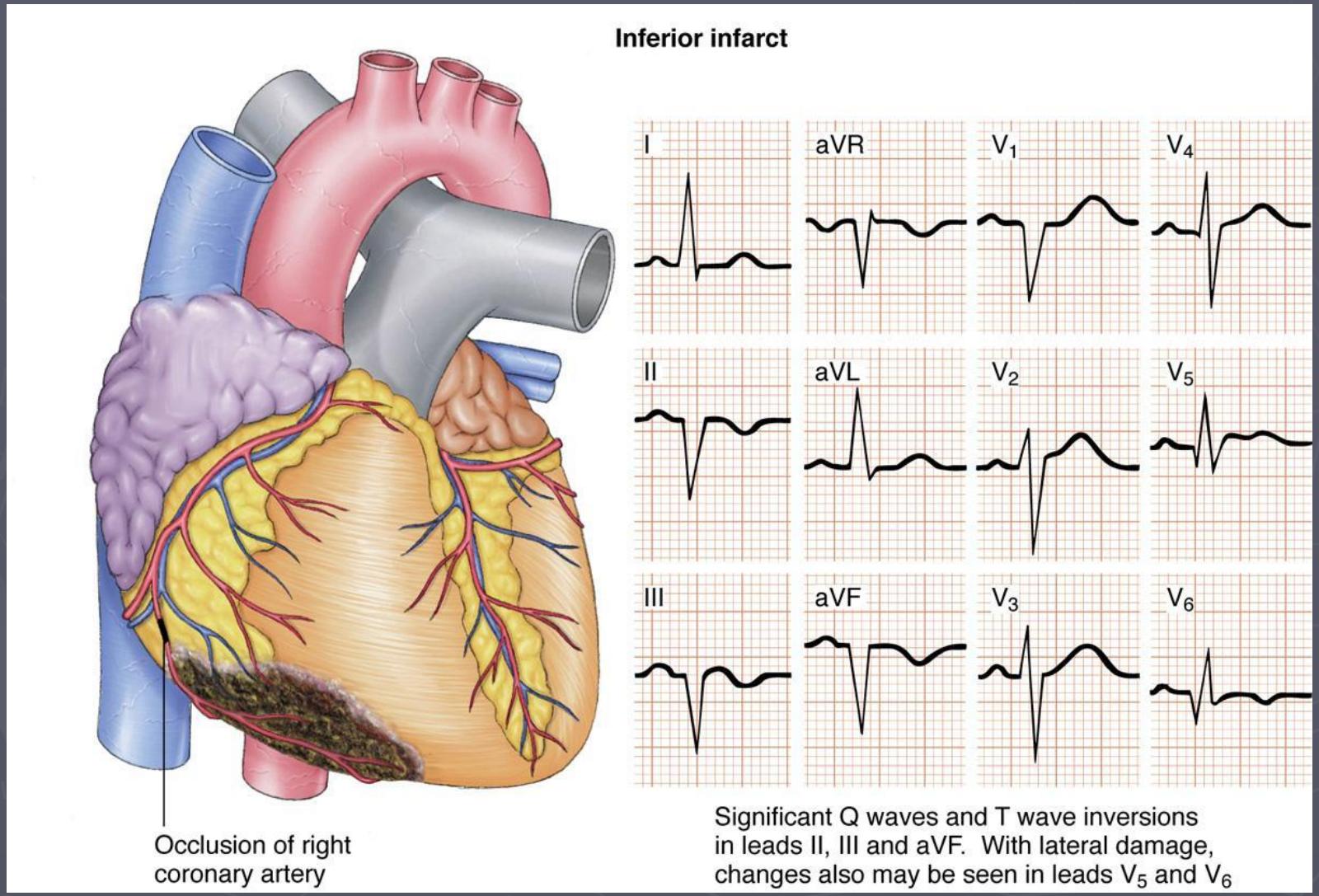
Anterior Septal (Left Anterior Descending)



Anterior Lateral (Left Circumflex)



Inferior (Right Coronary Artery)



54 yr
Male

Loc:36

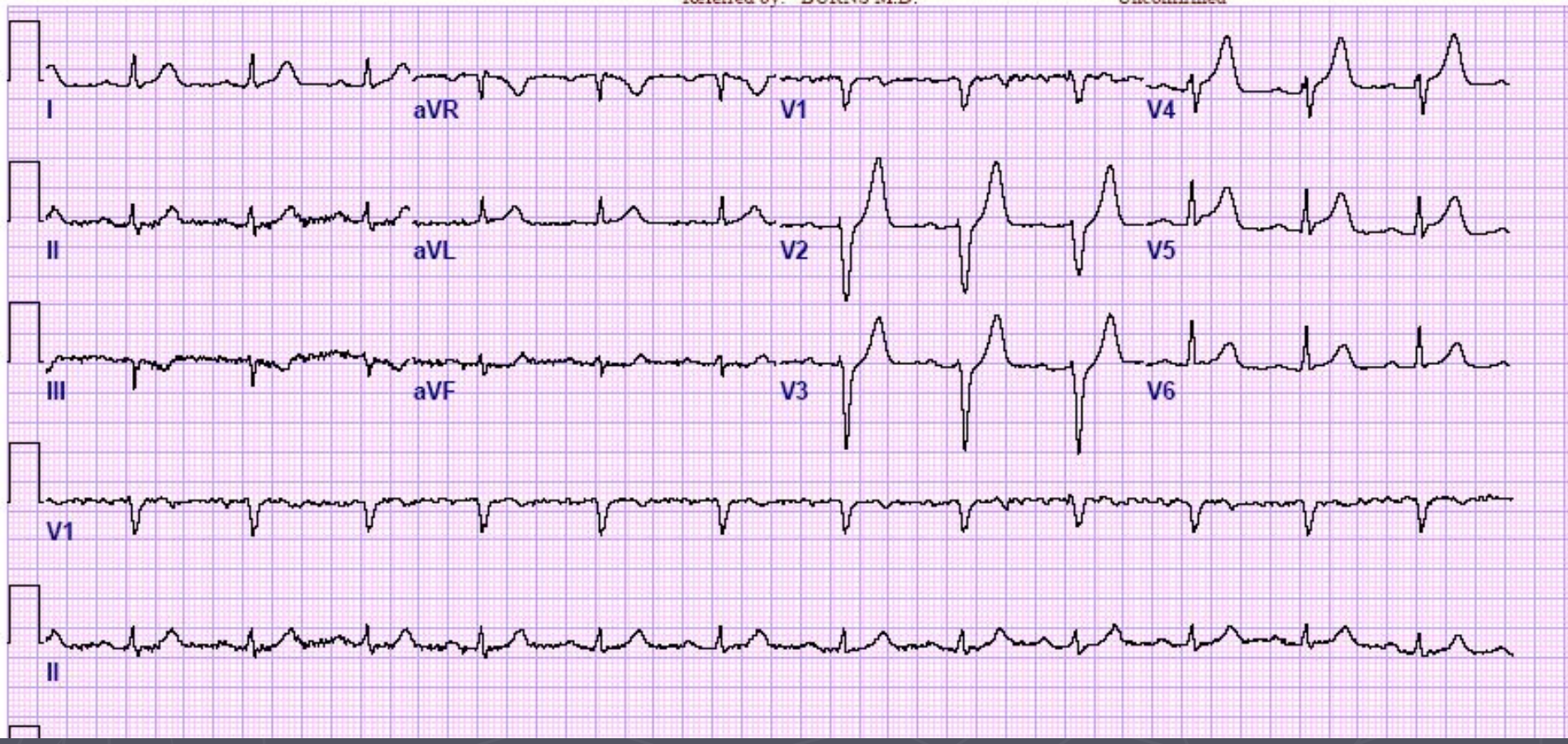
Vent. rate	75	BPM
PR interval	200	ms
QRS duration	96	ms
QT/QTc	382/426	ms
P-R-T axes	24 -13	7

NORMAL SINUS RHYTHM
ST ELEVATION, CONSIDER EARLY REPOLARIZATION, PERICARDITIS, OR INJURY
JUNCTIONAL ST DEPRESSION, PROBABLY NORMAL
ABNORMAL ECG

Technician:EDDIE LUJAN ER
Test ind:CP

Referred by: BURNS M.D.

Unconfirmed



54 yr
Male

Loc:36

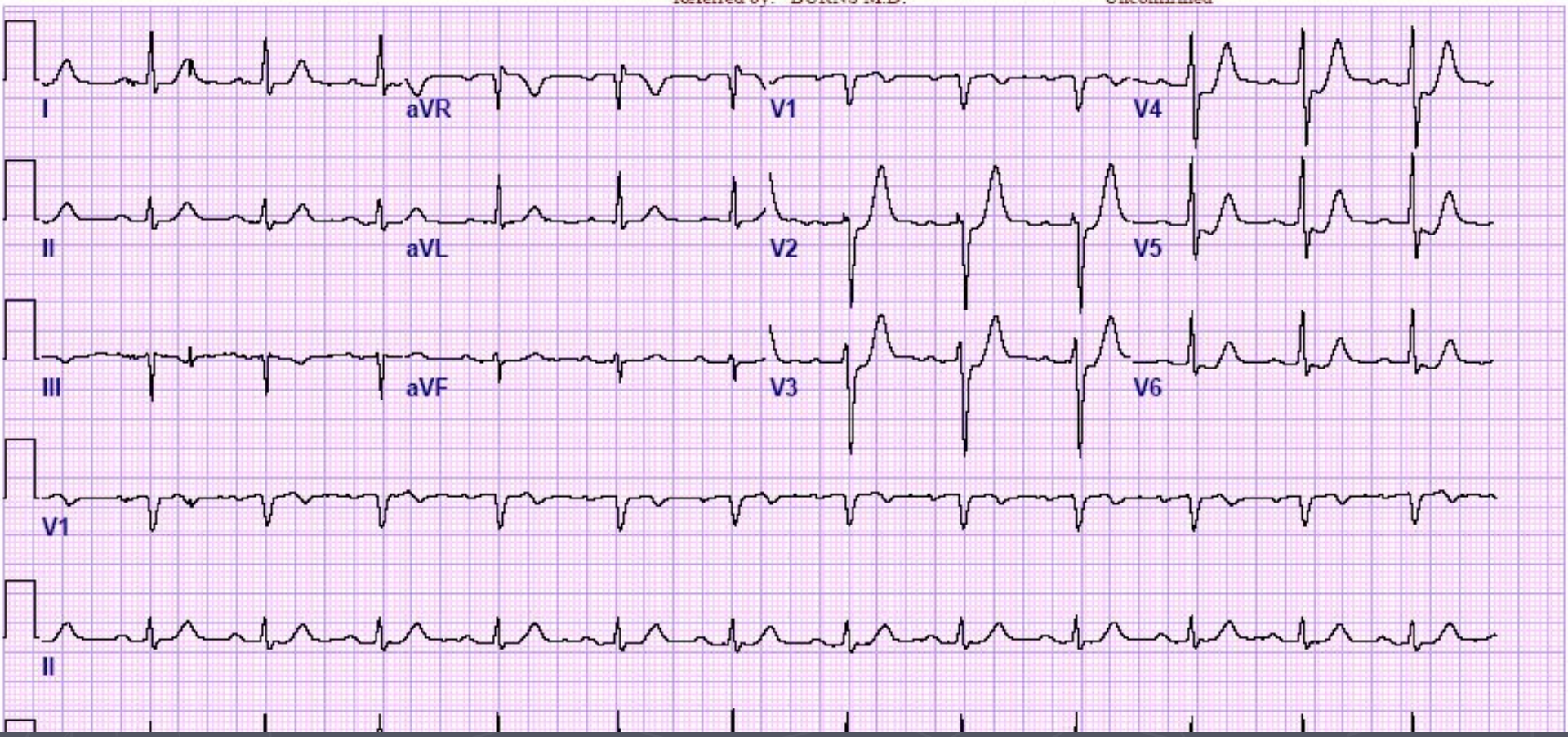
Vent. rate	76	BPM
PR interval	216	ms
QRS duration	104	ms
QT/QTc	388/436	ms
P-R-T axes	38 -19	19

SINUS RHYTHM WITH 1ST DEGREE AV BLOCK
ST ABNORMALITY, POSSIBLE DIGITALIS EFFECT
ABNORMAL ECG

Technician:EDDIE LUJAN ER

Referred by: BURNS M.D.

Unconfirmed



54 yr
Male

Loc:36

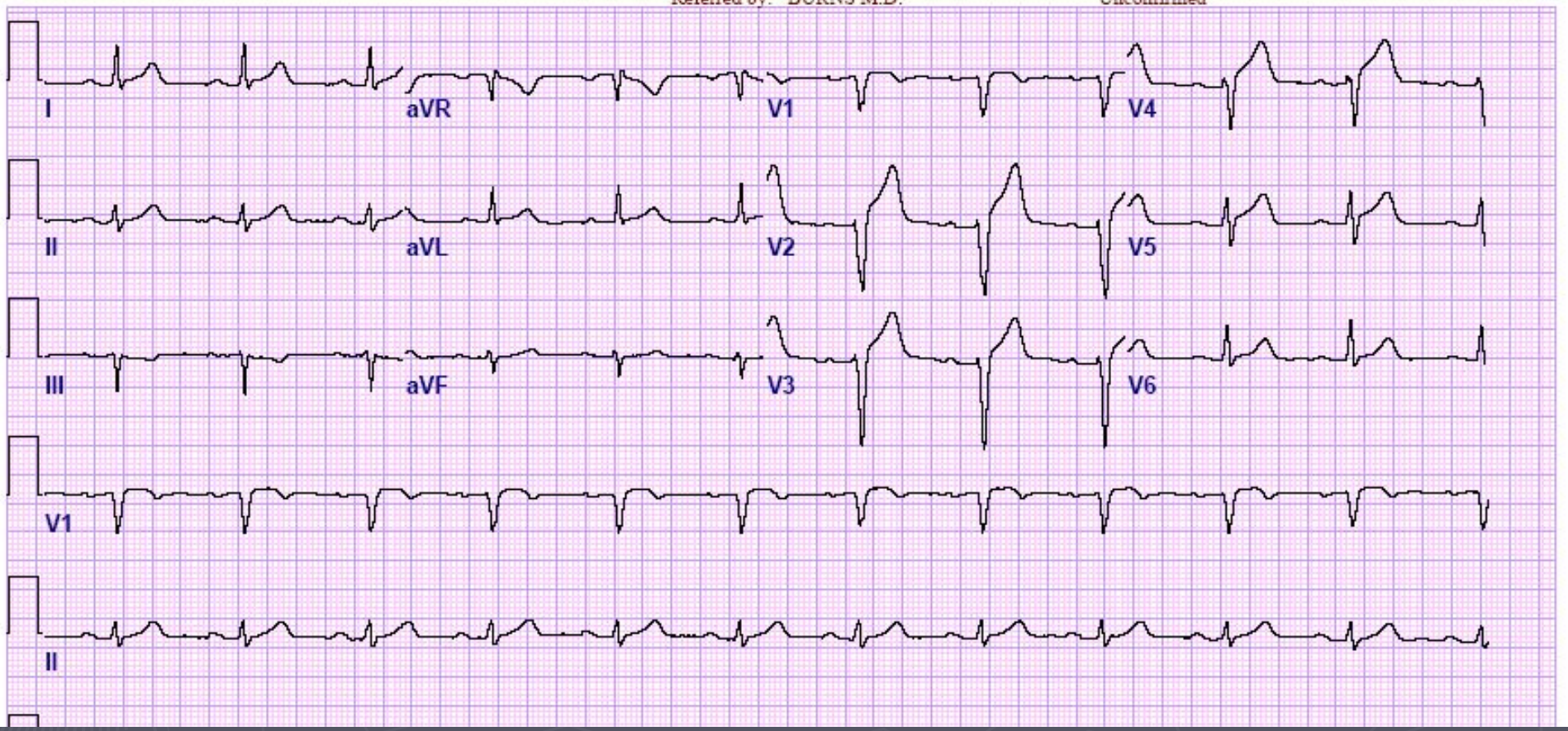
Vent. rate	70	BPM
PR interval	212	ms
QRS duration	104	ms
QT/QTc	398/429	ms
P-R-T axes	45 -22	20

SINUS RHYTHM WITH 1ST DEGREE AV BLOCK
ST ELEVATION CONSIDER ANTERIOR INJURY OR ACUTE INFARCT
** ** ** ** * ACUTE MI * ** ** ** **
ABNORMAL ECG

Technician:EDDIE LUJAN ER

Referred by: BURNS M.D.

Unconfirmed



55 yr
Male Oriental

Loc:53

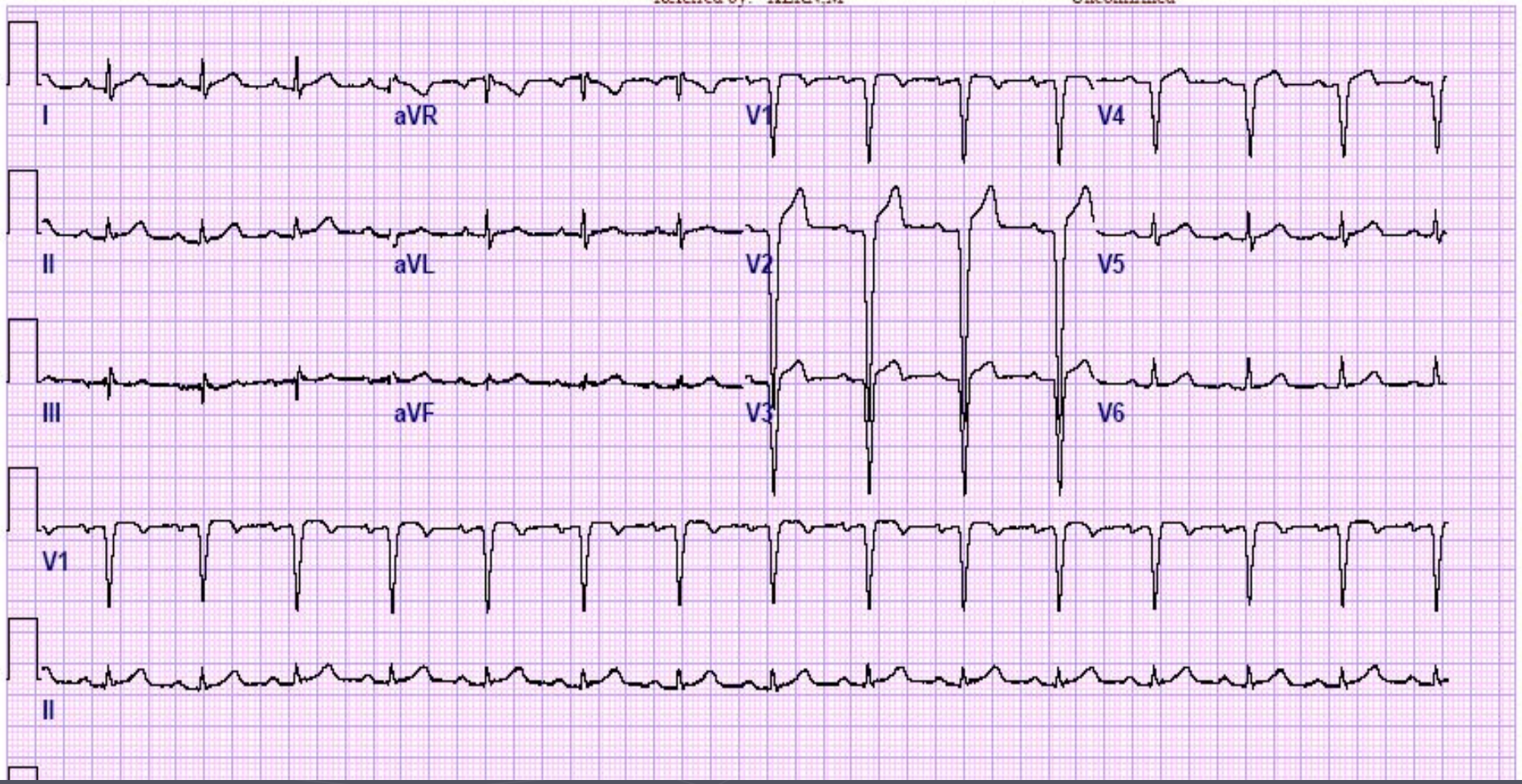
Vent. rate	89	BPM
PR interval	184	ms
QRS duration	102	ms
QT/QTc	352/428	ms
P-R-T axes	39 19	34

NORMAL SINUS RHYTHM
ANTEROSEPTAL INFARCT , POSSIBLY ACUTE
** ** ** ** * ACUTE MI * ** ** ** **
ABNORMAL ECG

Technician:JONAH PINAWIN
Test ind:MI

Referred by: KERN,M

Unconfirmed



55 yr
Male Oriental

Loc:53

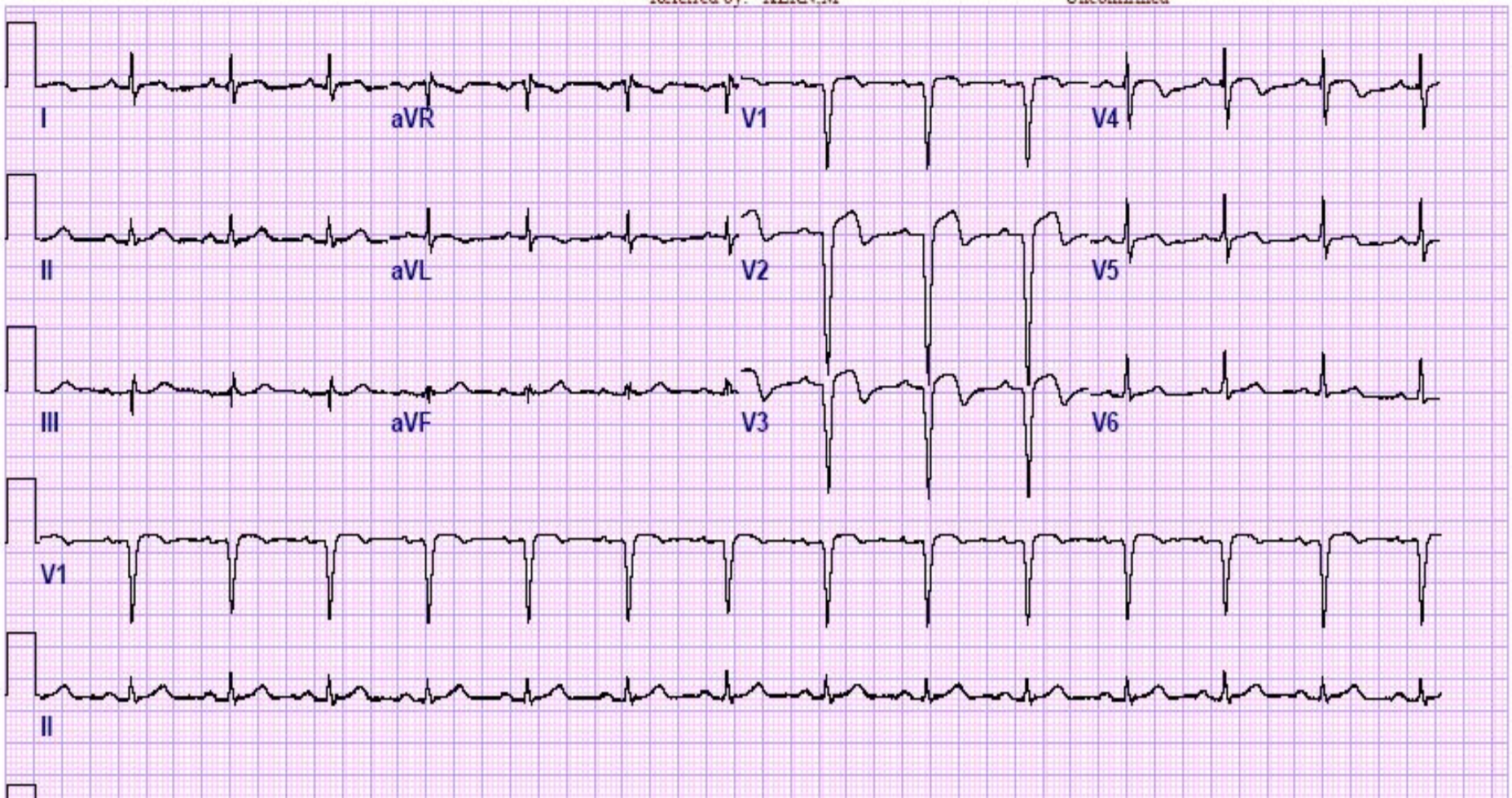
Vent. rate	85	BPM
PR interval	166	ms
QRS duration	96	ms
QT/QTc	384/456	ms
P-R-T axes	43 21	83

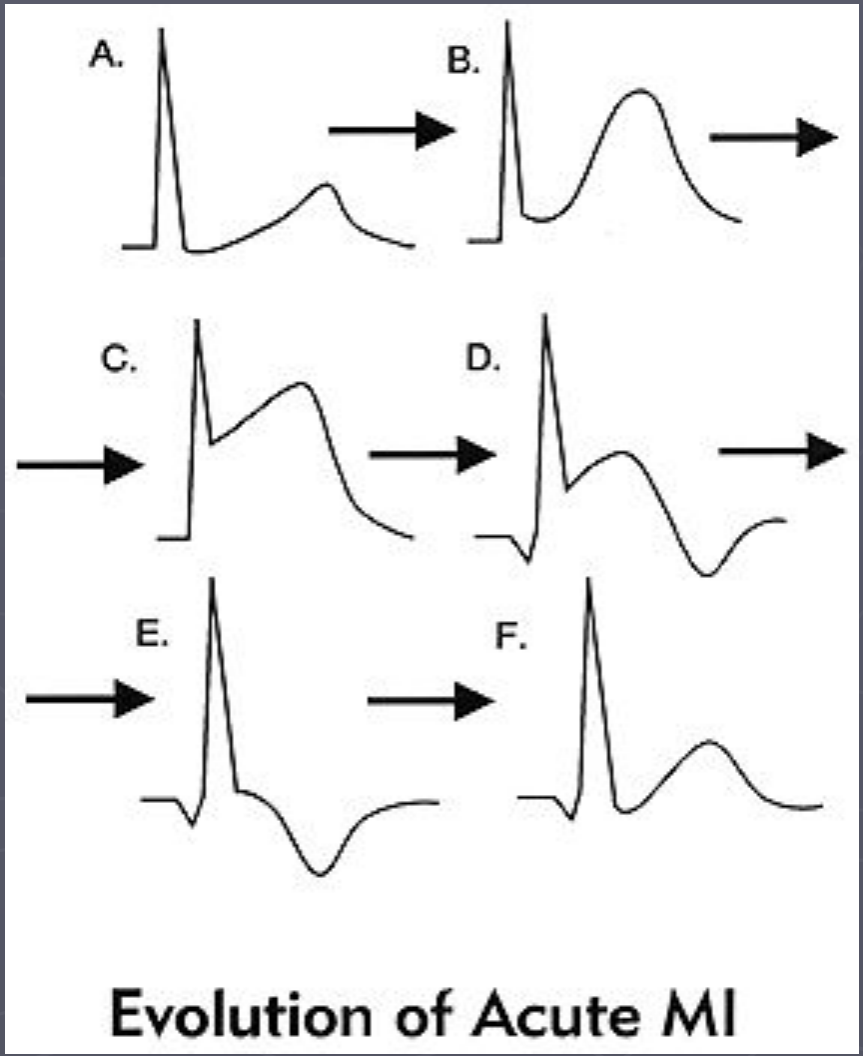
NORMAL SINUS RHYTHM
ANTEROSEPTAL INFARCT , POSSIBLY ACUTE
T WAVE ABNORMALITY, CONSIDER LATERAL ISCHEMIA
** ** ** ** * ACUTE MI * ** ** ** **
ABNORMAL ECG

Technician:JONAH PINAWIN
Test ind:MI

Referred by: KERN,M

Unconfirmed

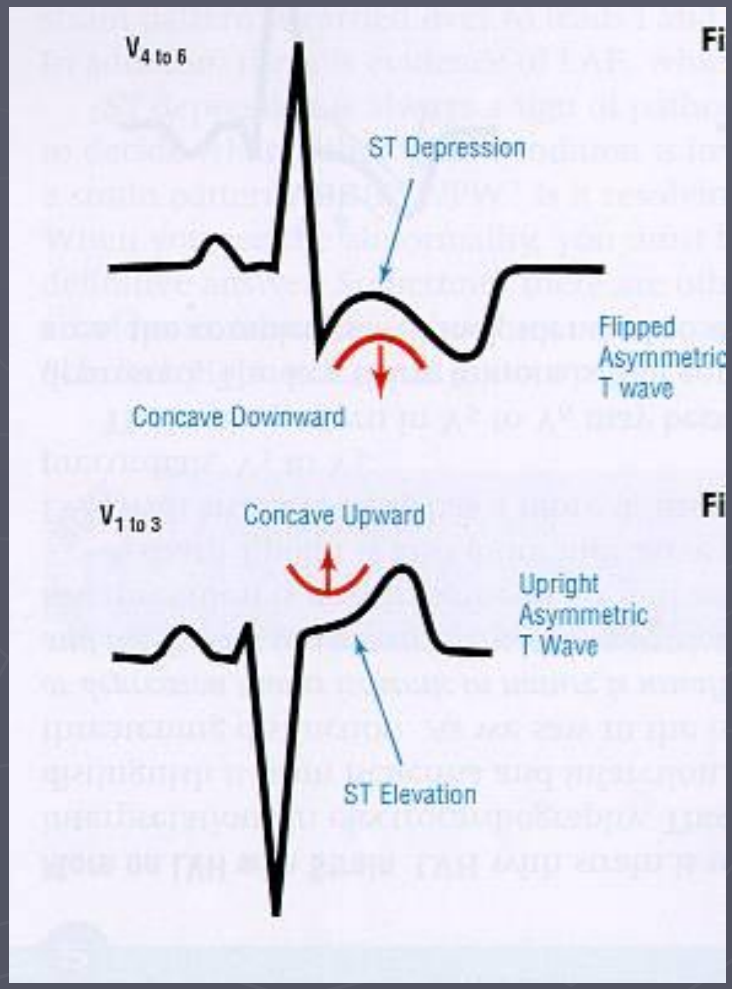




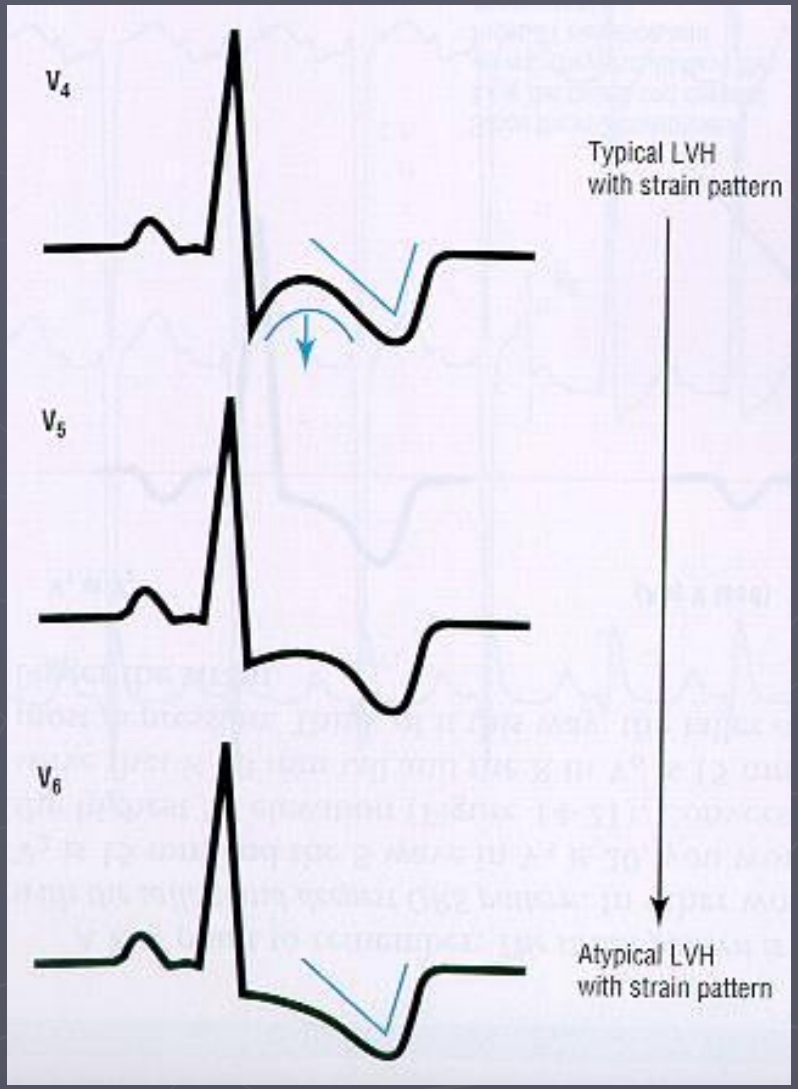
Evolution of Acute MI

ST-T Wave Changes

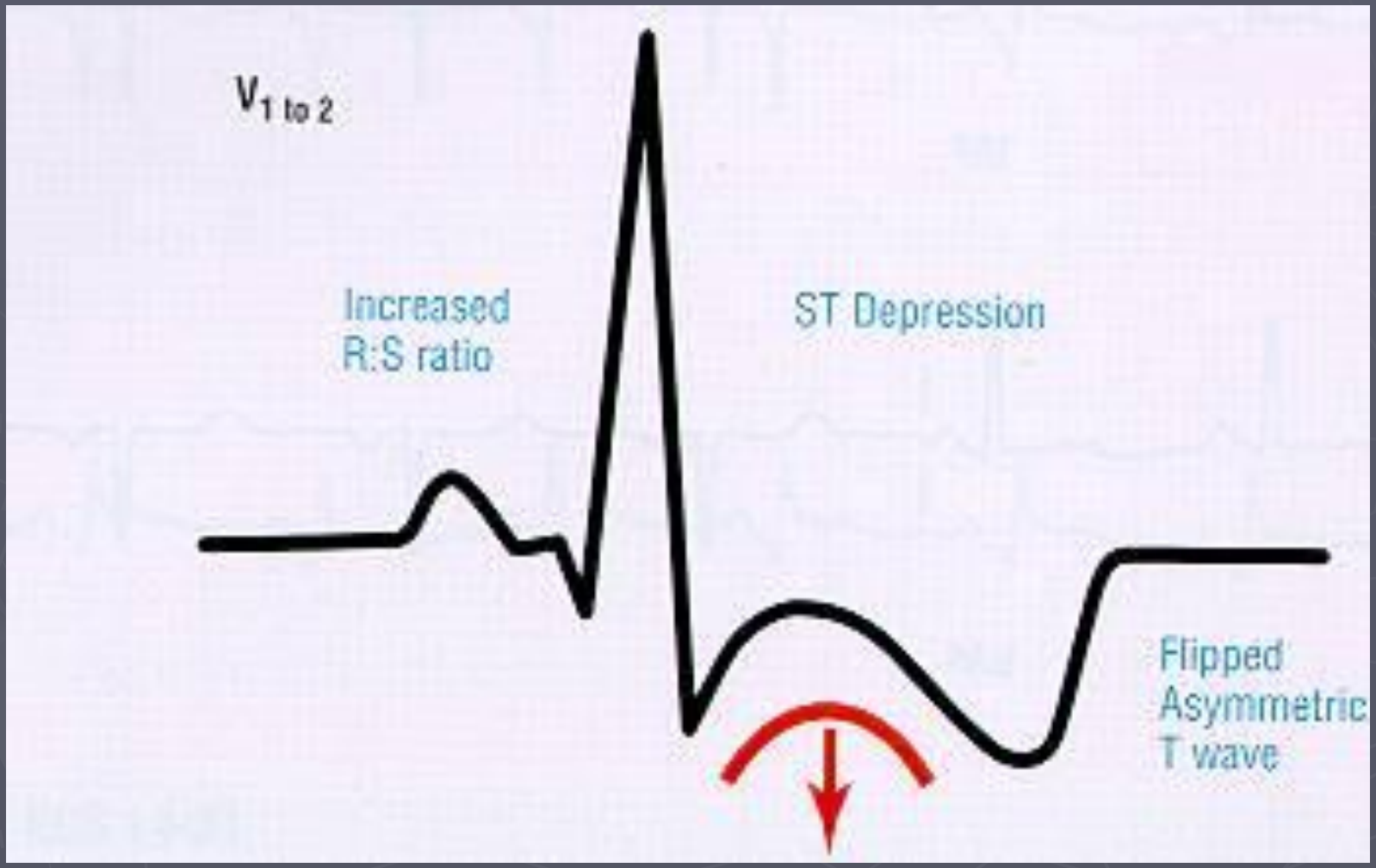
Strain in Hypertrophy



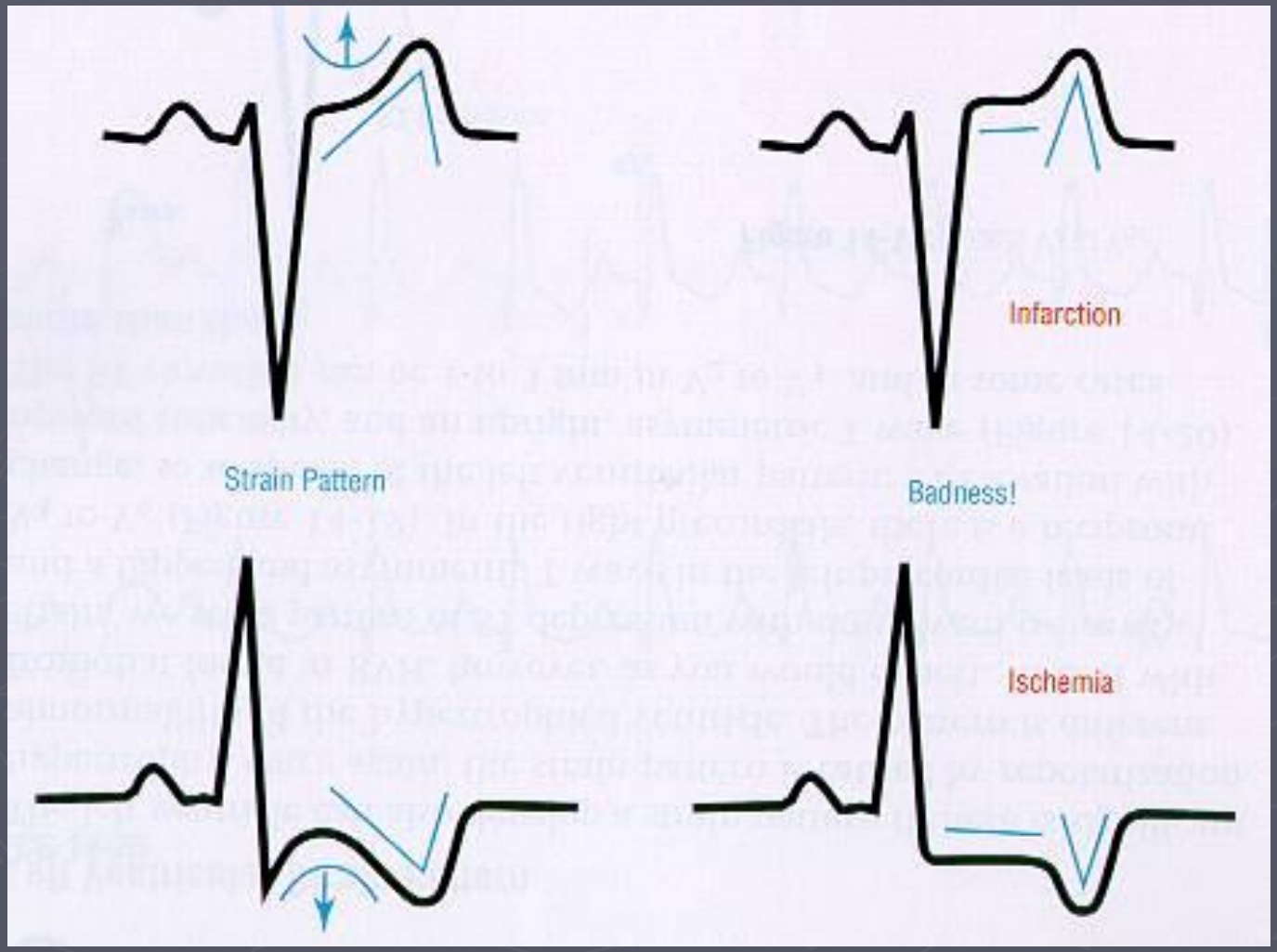
Strain in LVH



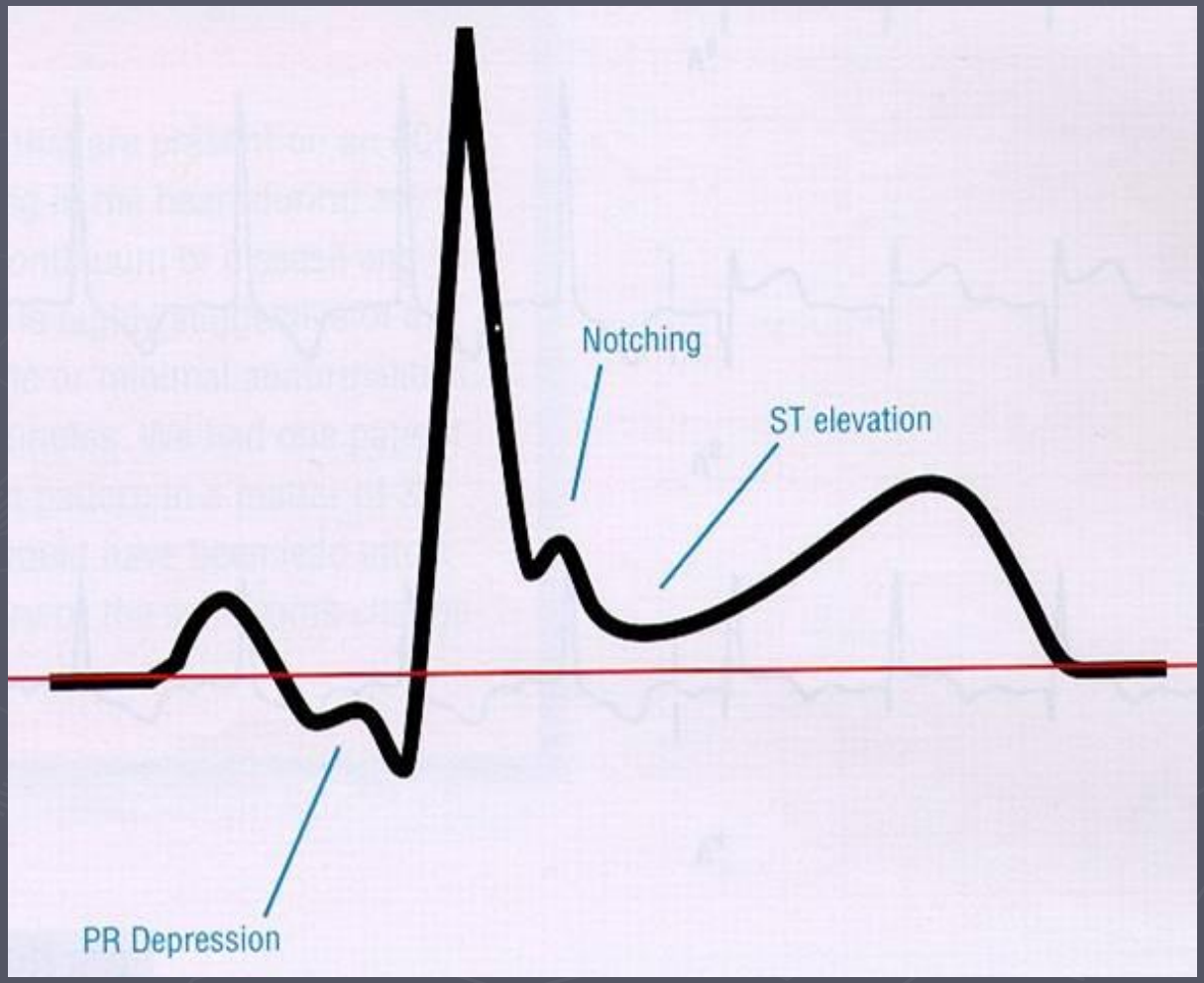
Strain in RVH



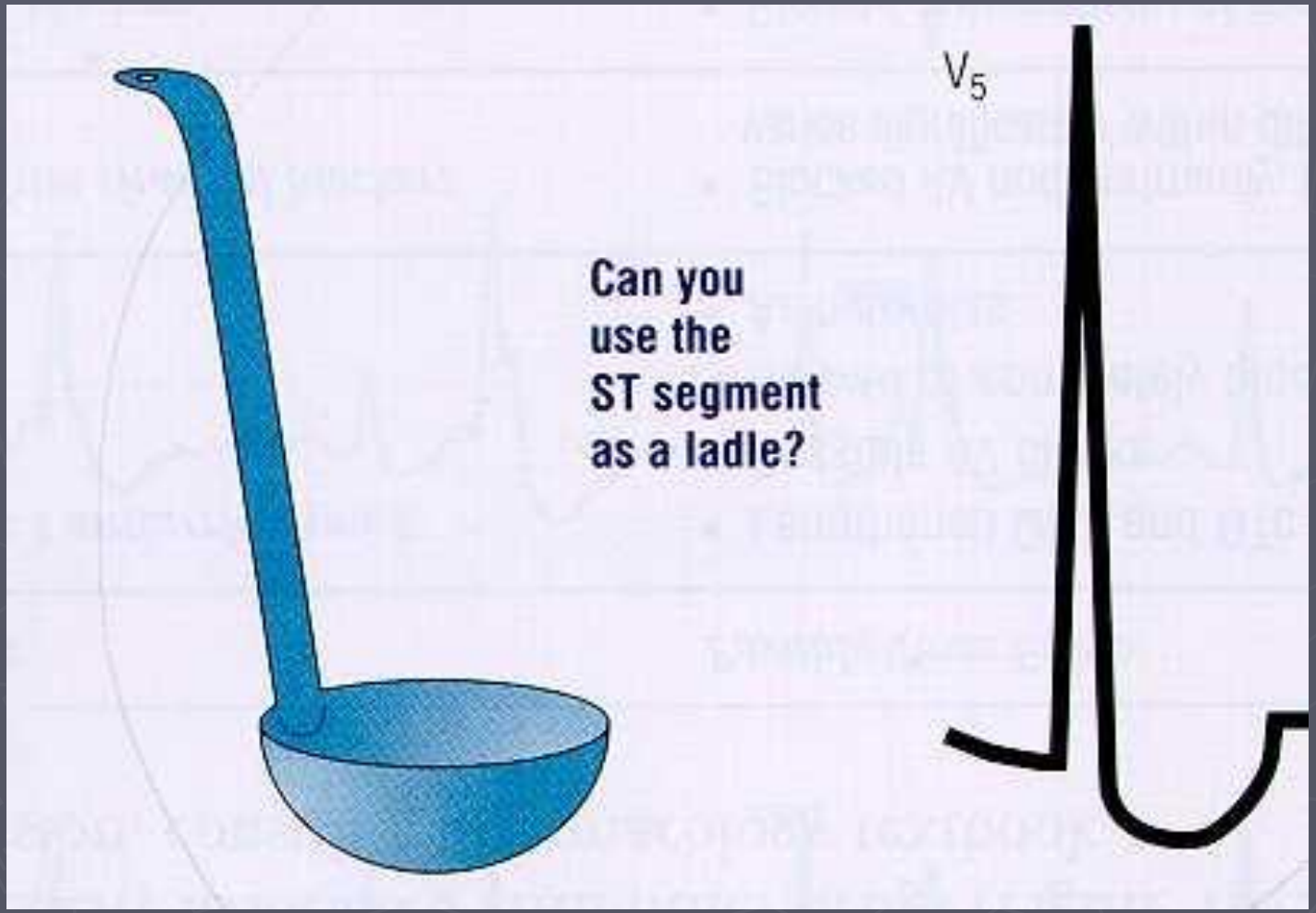
Strain vs Infarction



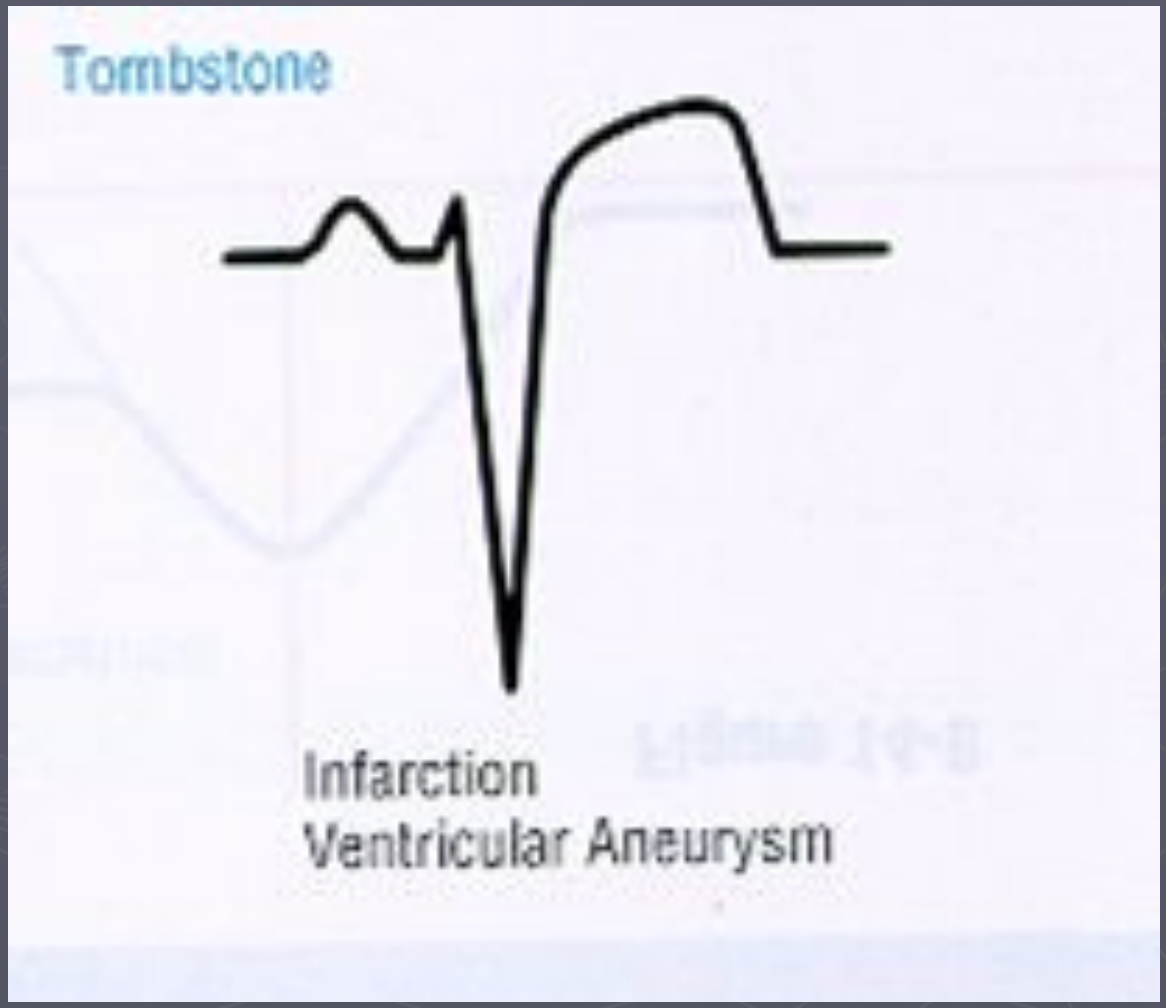
Pericarditis



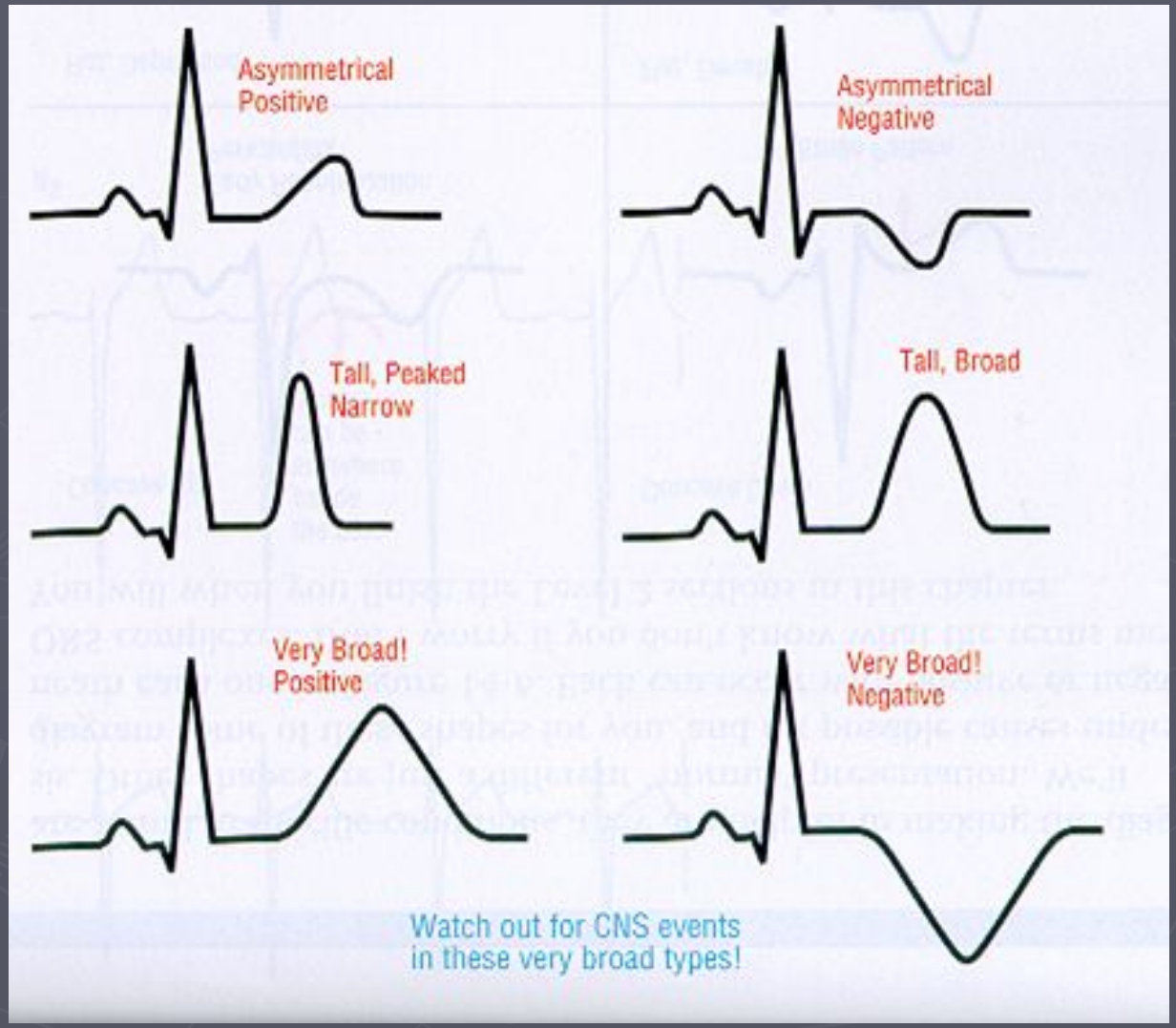
Digoxin Changes



Ventricular Aneurysm

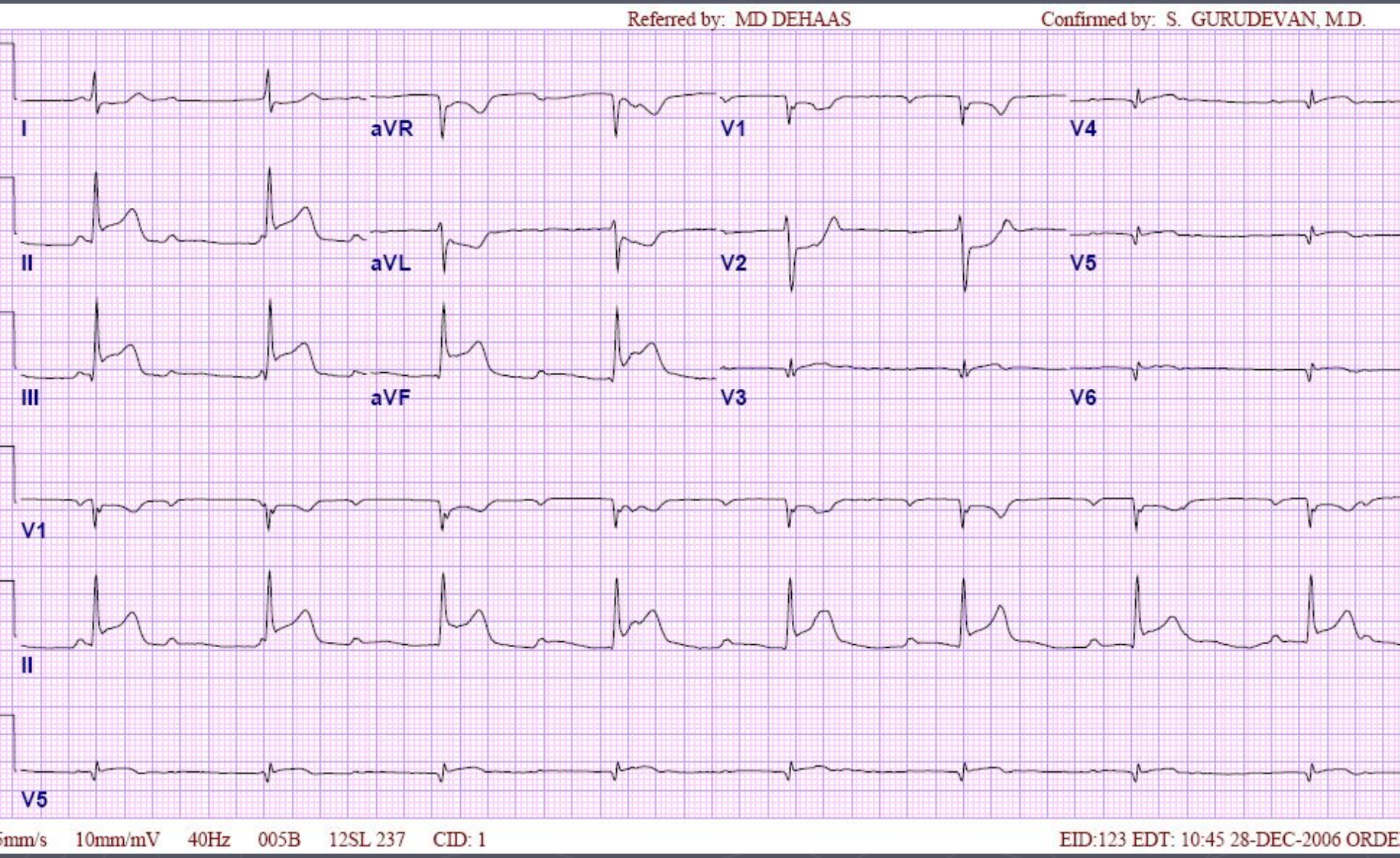


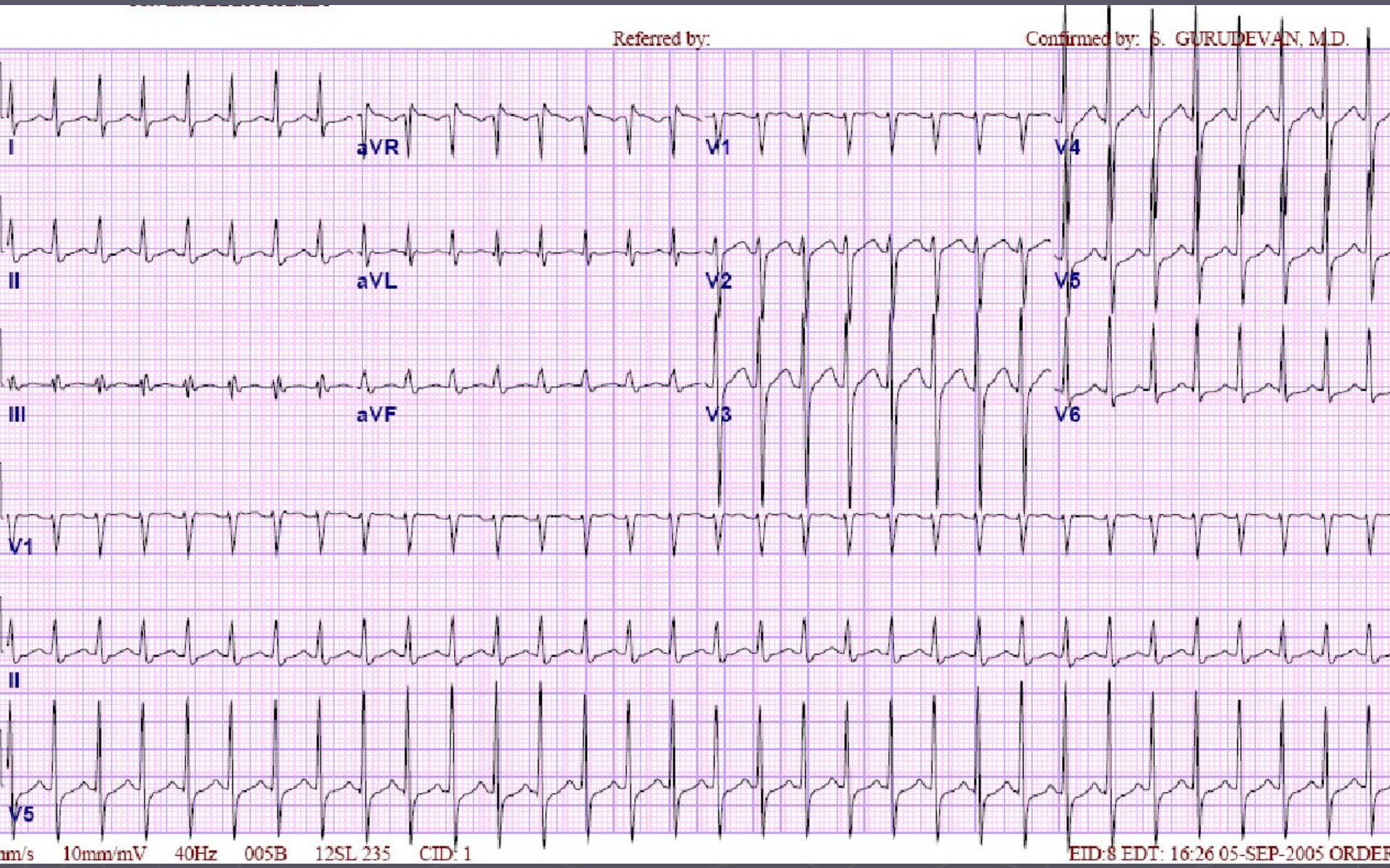
T waves

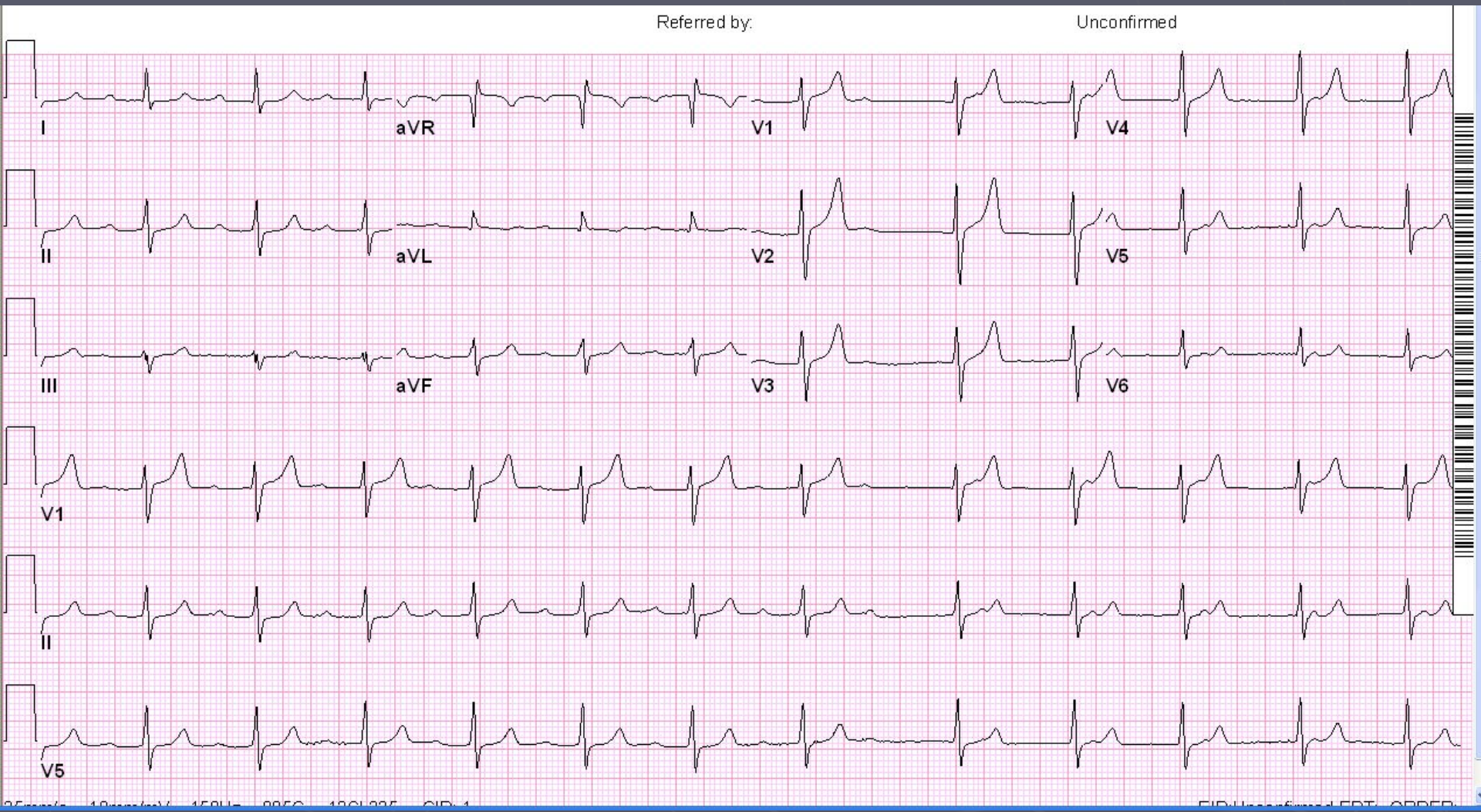

Asymmetrical
Positive
Asymmetrical
Negative
Tall, Peaked
Narrow
Tall, Broad
Very Broad!
Positive
Very Broad!
Negative
Watch out for CNS events
in these very broad types!

Summary

- Basic physiology of the conduction system
- Origin of a normal EKG
- Systematic approach to reading an EKG
- Major abnormalities when reading an EKG


Referred by: MD DEHAAS
Confirmed by: S. GURUDEVAN, M.D.
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5
5mm/s 10mm/mV 40Hz 005B 12SL 237 CID: 1
EID:123 EDT: 10:45 28-DEC-2006 ORDE

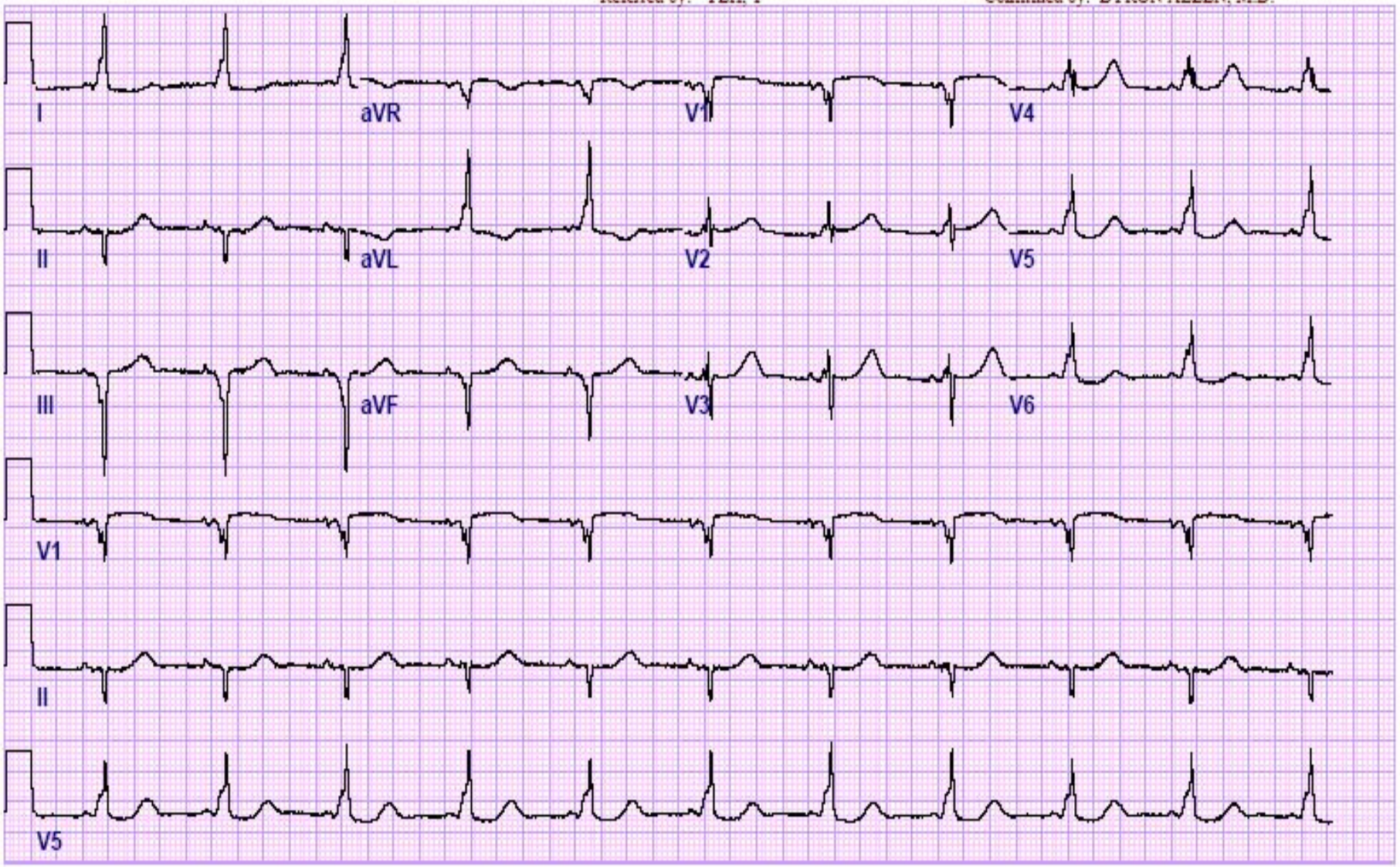

Referred by:
Confirmed by: S. GURUDEVAN, M.D.
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5
10mm/mV
40Hz
005B
12SL 235
CID: 1
EID:8 EDT: 16:26 05-SEP-2005 ORDER


Referred by:
Unconfirmed
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5

Loc:5 P-R-T axes 55 -46 109

Technician:JONAH PINAWIN
Test ind:ARRHYTH

Referred by: YEH, T Confirmed by: BYRON ALLEN, M.D.



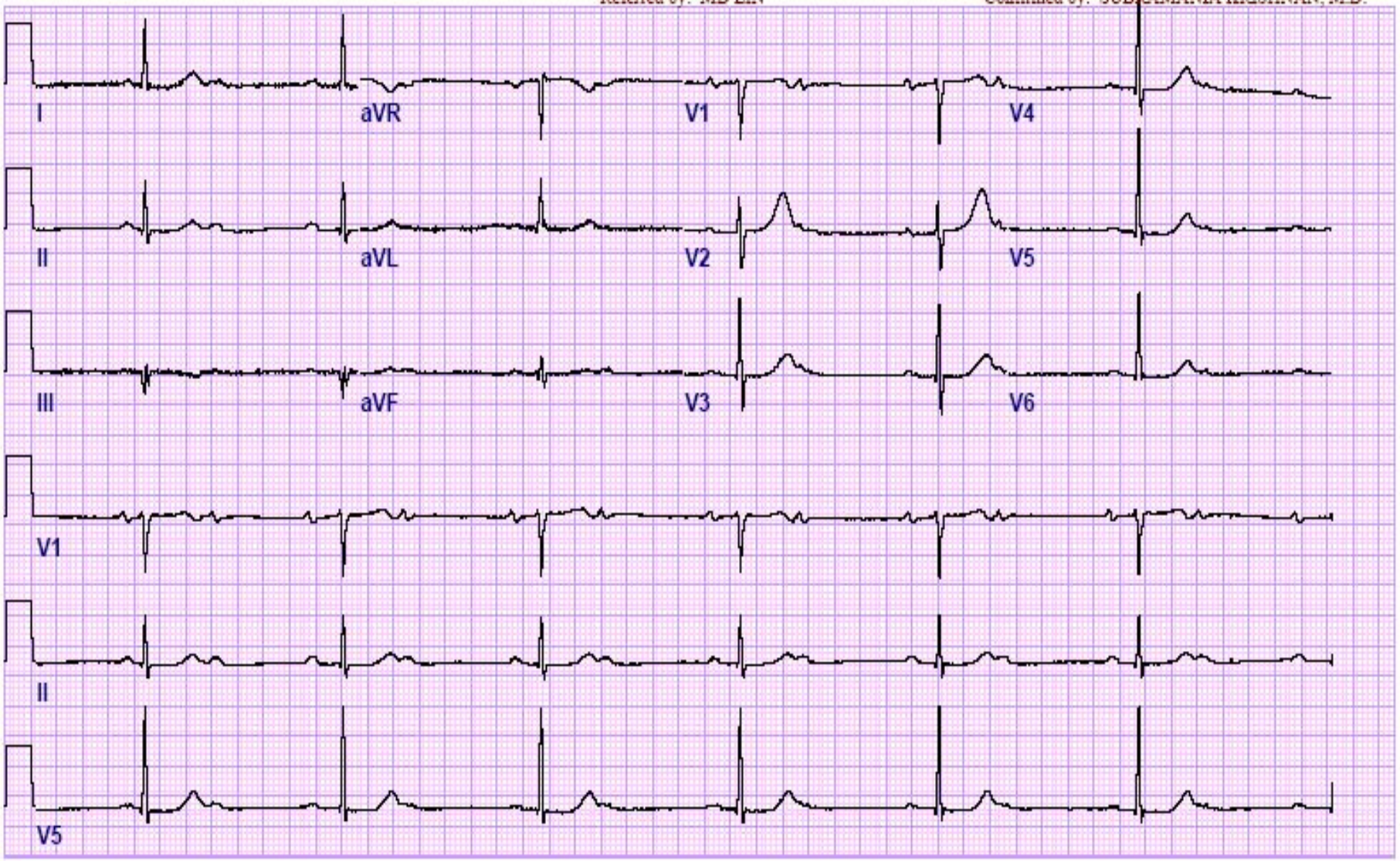
25mm/s 10mm/mV 150Hz 005B 12SL 237 CID: 1

EID:123 EDT: 11:40 07-DEC-2006 ORDER:

Loc:54 P-R-T axes 47 4 16

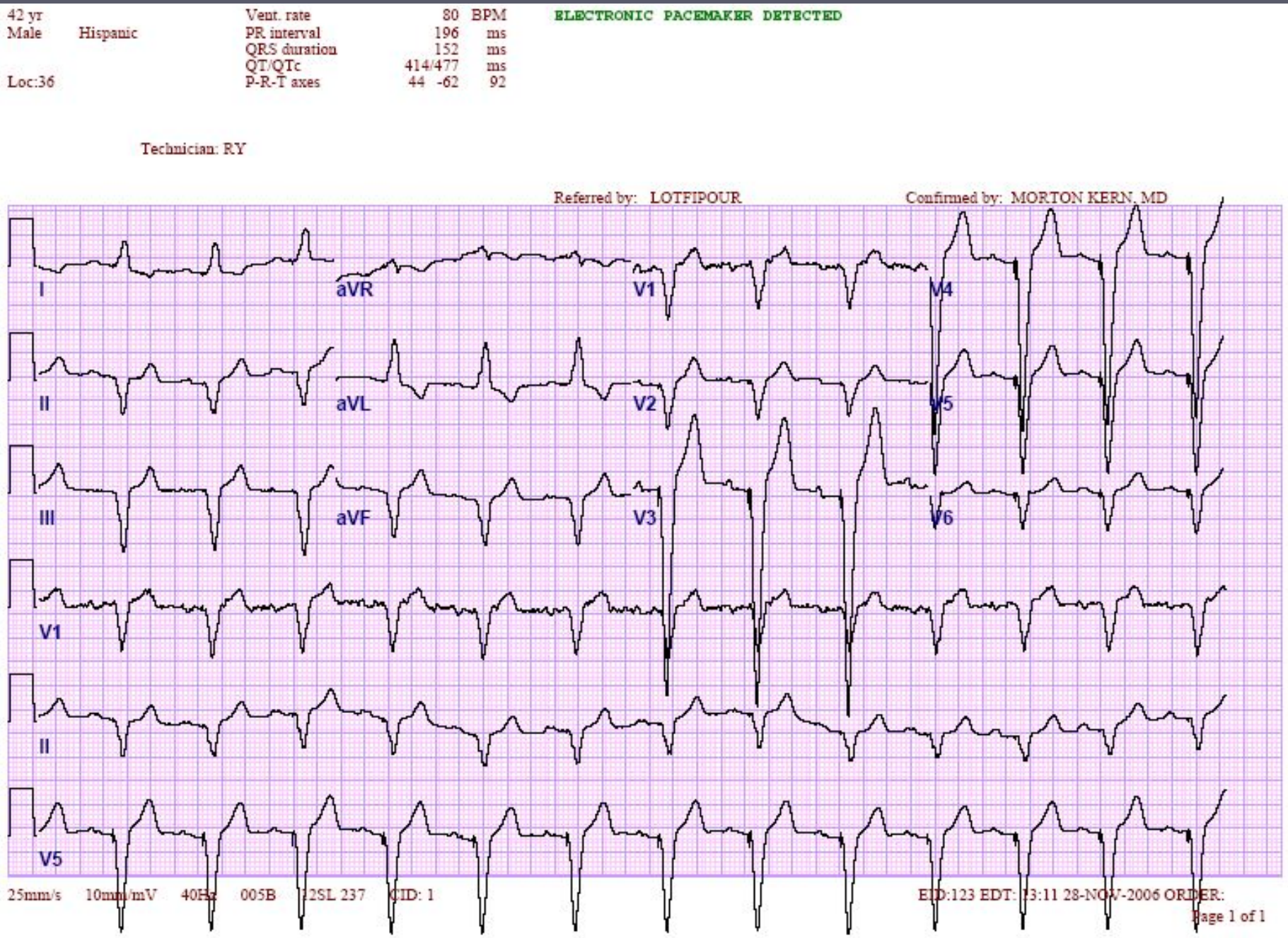
Technician: LKMB
Test ind:BRADYCARDIA

Referred by: MD LIN Confirmed by: SUBRAMANIA KRISHNAN, M.D.



25mm/s 10mm/mV 150Hz 005B 12SL 237 CID: 1

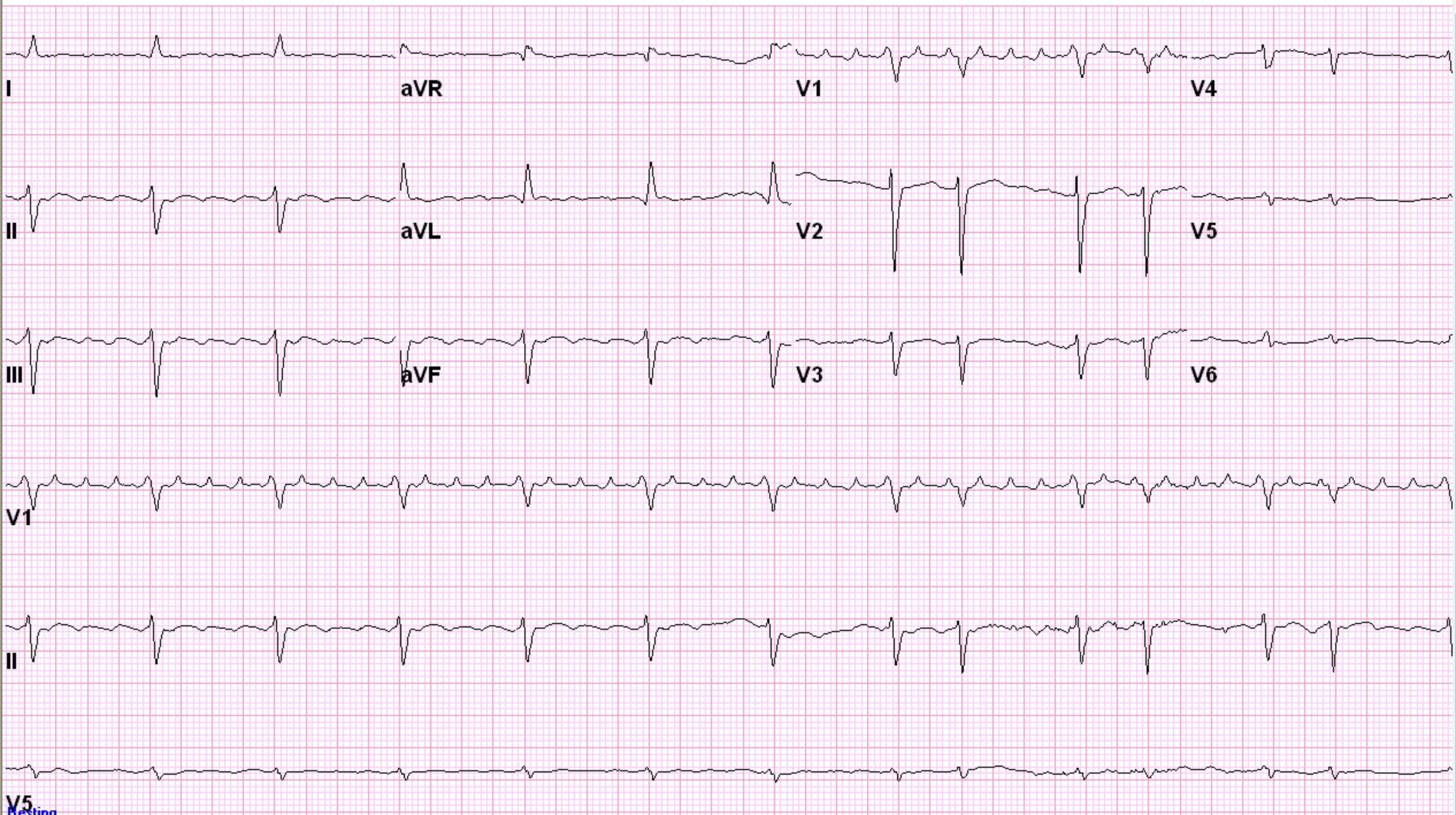
EID:123 EDT: 13:23 04-DEC-2006 ORDER:


42 yr
Male Hispanic
Loc:36
Vent. rate 80 BPM
PR interval 196 ms
QRS duration 152 ms
QT/QTc 414/477 ms
P-R-T axes 44 -62 92
ELECTRONIC PACEMAKER DETECTED
Technician: RY
Referred by: LOTFIPOUR
Confirmed by: MORTON KERN, MD
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5
25mm/s 10mm/mV 40Hz 005B 12SL 237 CID: 1
EID:123 EDT: 13:11 28-NOV-2006 ORDER:
Page 1 of 1

File Tools Help

Zoom 113 Page 1 Study

Referred by: Confirmed by: STEVE APPLEBY



Resting

11/28/2006 02:13:00

m/s 10mm/mV 100Hz 005C 12SL86 CID: 1 EID:9 EDT: 10:16 07-DEC-

File Tools Help

Zoom 100 Page Study

MADISON, ELROY M ID:403781882 06-DEC-2006 10:31:33 LONG BEACH VA MEDICAL CENTE

26-JAN-1953 (53 yr)
Male Black
71in 187lb

Loc:21 Option:49

Vent. rate	134	BPM
PR interval	*	ms
QRS duration	86	ms
QT/QTc	274/409	ms
P-R-T axes	* 69	43

Atrial fibrillation with rapid ventricular response Ventricular premature comp
phenomenon
Abnormal ECG
When compared with ECG of 14-JUL-2006 13:09,
Atrial fibrillation has replaced Sinus rhythm

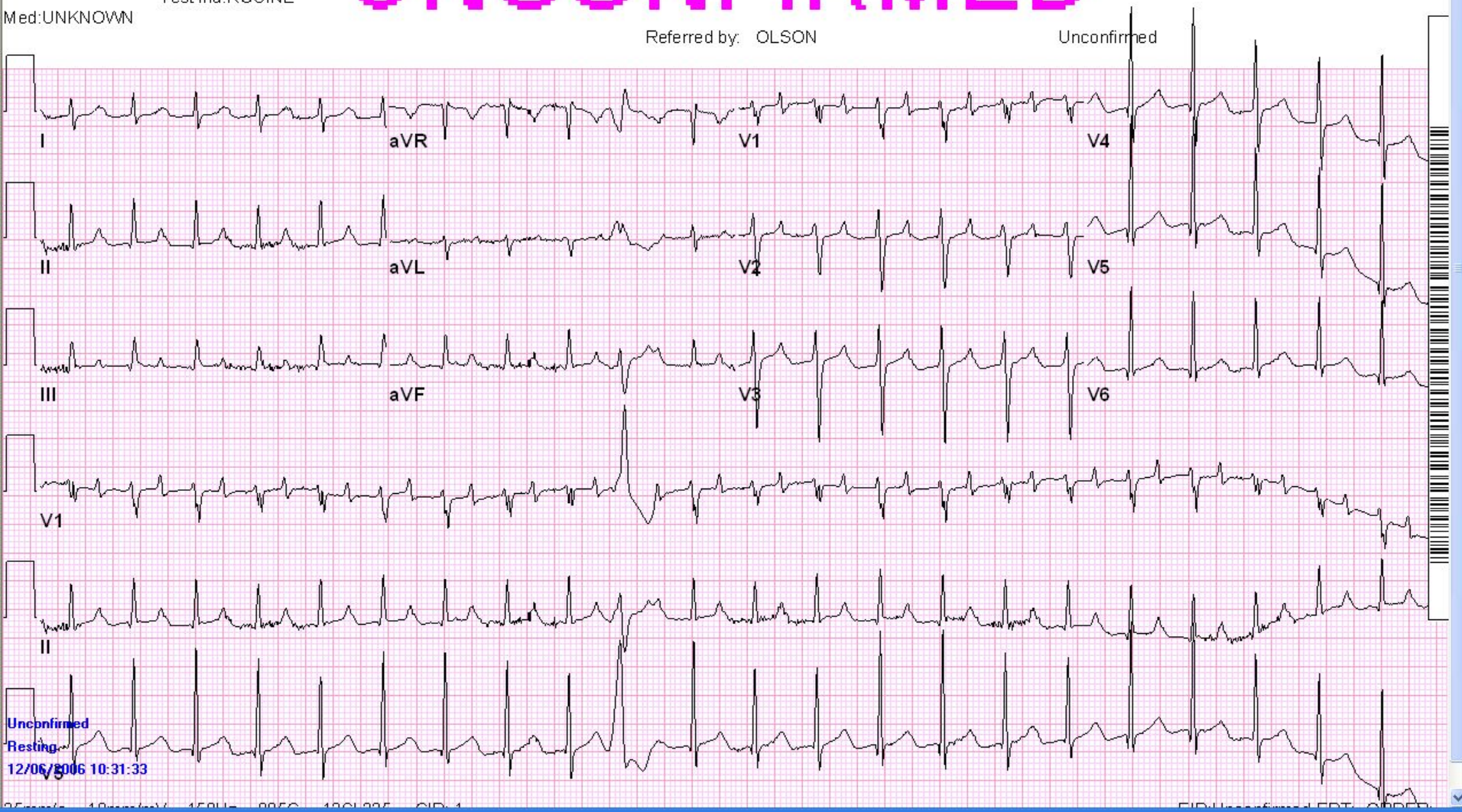
UNCONFIRMED

Technician:ROSALYN BROWN
Test ind:ROUINE

Med:UNKNOWN

Referred by: OLSON

Unconfirmed



Unconfirmed
Resting
12/06/2006 10:31:33

File Tools Help

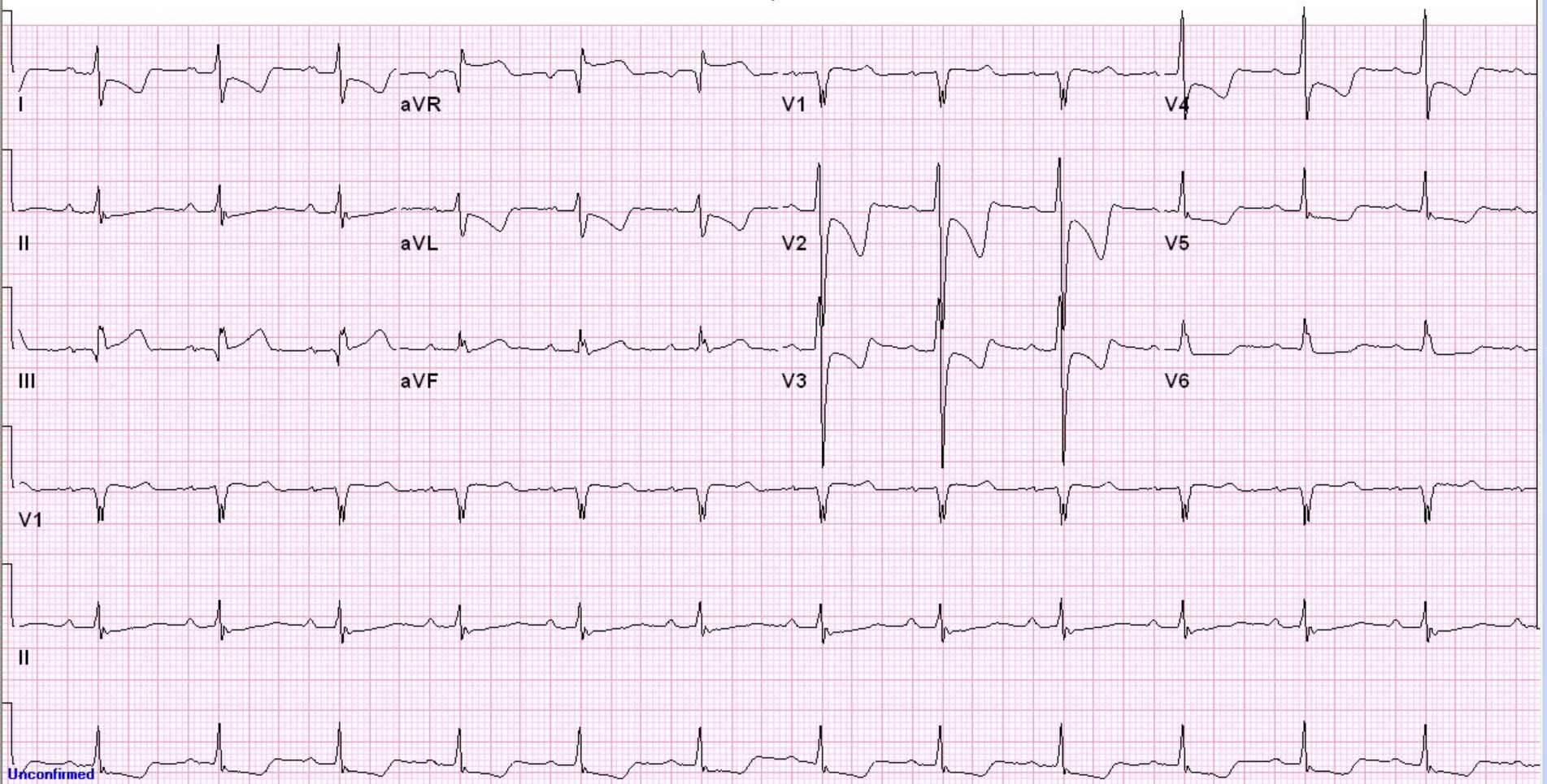
Zoom 103 Page Study

om:BED15
c:3

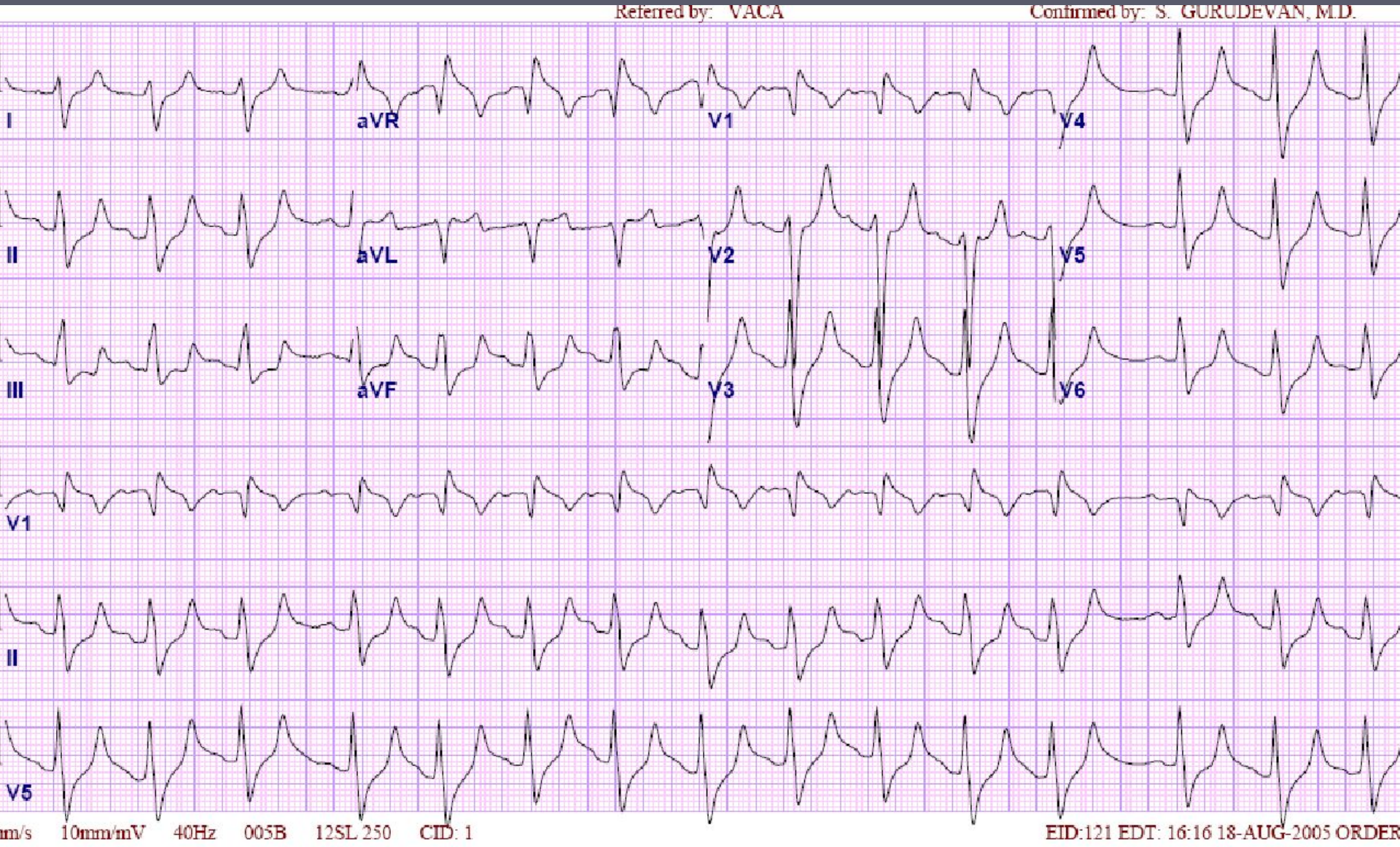
PR interval	183	ms	Rightward axis
QRS duration	108	ms	Marked ST abnormality, possible lateral subendocardial injury
QT/QTc	371/417	ms	Abnormal ECG
P-R-T axes	43 96	154	When compared with ECG of 06-DEC-2006 00:00,
			No significant change was found

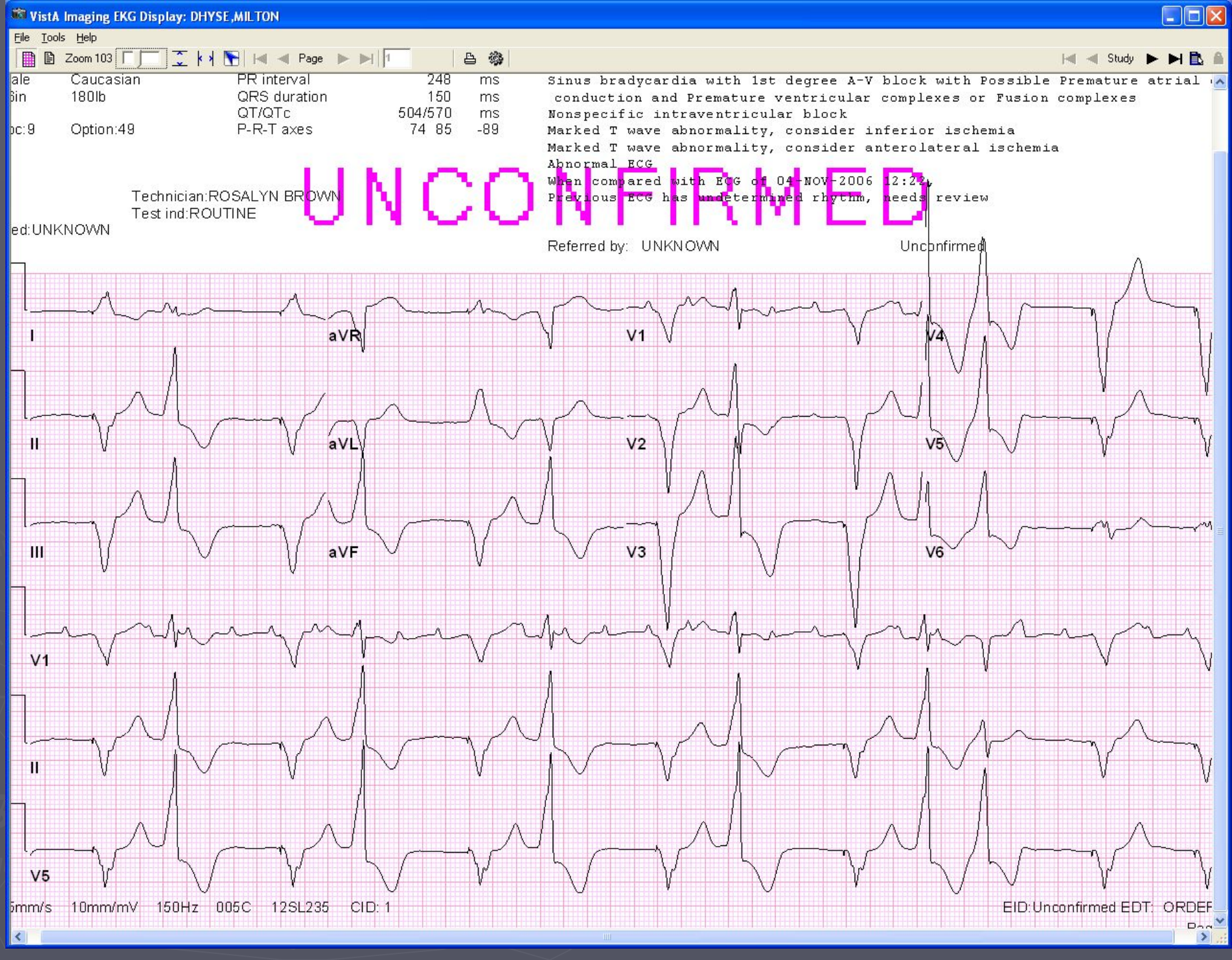
UNCONFIRMED

Referred by: Unconfirmed



Unconfirmed
Resting
12/06/2006 05:22:00
mm/s 10mm/mV 100Hz 005C 12SL86 CID: 1
EID:Unconfirmed EDT: ORDER:


Referred by: VACA
Confirmed by: S. GURUDEVAN, M.D.
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5
mm/s 10mm/mV 40Hz 005B 12SL 250 CID: 1
EID:121 EDT: 16:16 18-AUG-2005 ORDER

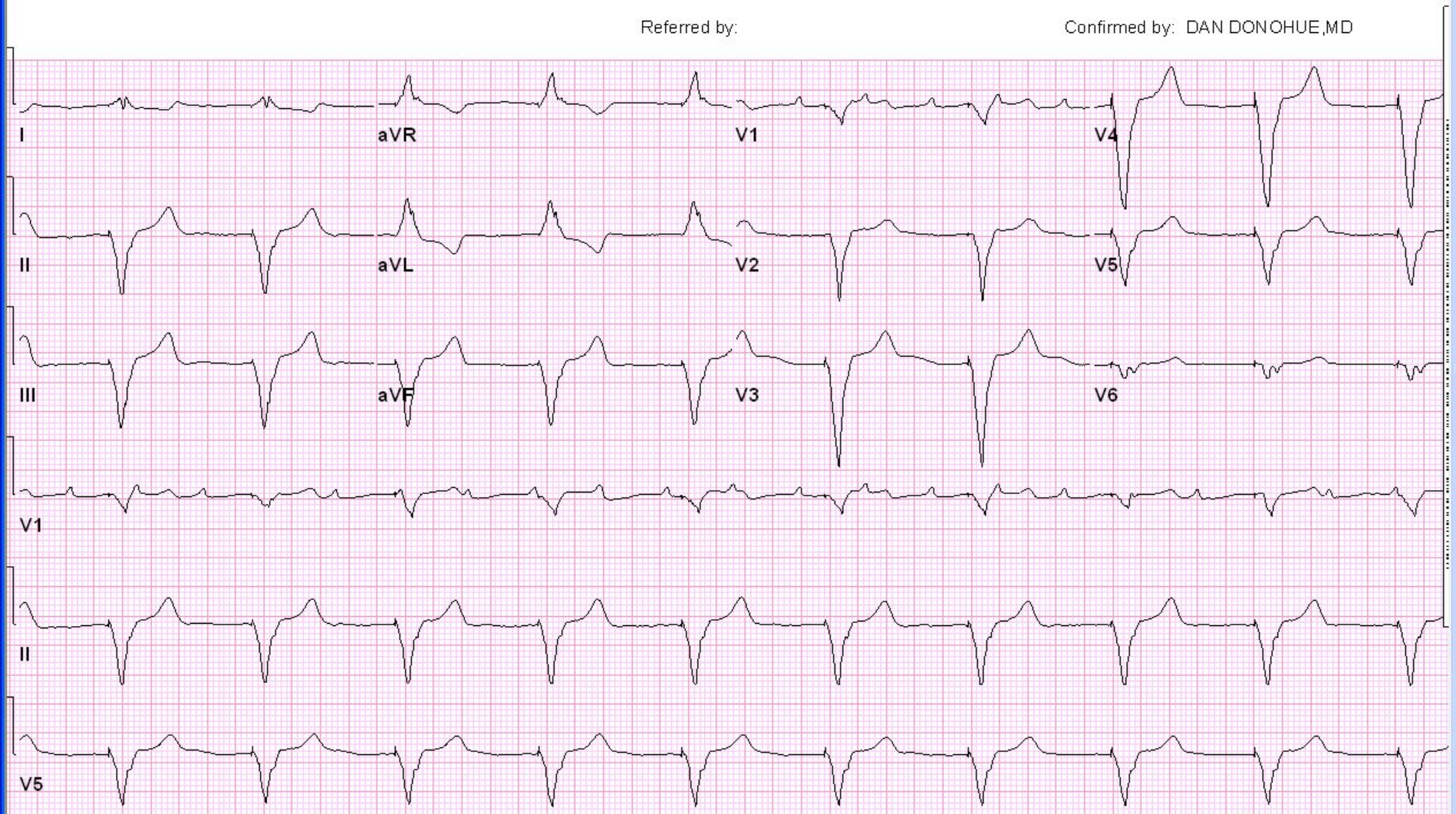

VistA Imaging EKG Display: DHYSE,MILTON
File Tools Help
Zoom 103
Page
Study
ale Caucasian
6in 180lb
oc:9 Option:49
PR interval 248 ms
QRS duration 150 ms
QT/QTc 504/570 ms
P-R-T axes 74 85 -89
Sinus bradycardia with 1st degree A-V block with Possible Premature atrial
conduction and Premature ventricular complexes or Fusion complexes
Nonspecific intraventricular block
Marked T wave abnormality, consider inferior ischemia
Marked T wave abnormality, consider anterolateral ischemia
Abnormal ECG
When compared with ECG of 04-NOV-2006 12:24,
Previous ECG has undetermined rhythm, needs review
UNCONFIRMED
Technician:ROSALYN BROWN
Test ind:ROUTINE
ed:UNKNOWN
Referred by: UNKNOWN
Unconfirmed
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5
5mm/s 10mm/mV 150Hz 005C 12SL235 CID: 1
EID:Unconfirmed EDT: ORDEF

File Tools Help

Zoom 103 Page Study

le	Caucasian	PR interval	28	ms
n	153lb	QRS duration	200	ms
		QT/QTc	533/533	ms
:1		P-R-T axes	* -84	100

Referred by: Confirmed by: DAN DONOHUE,MD



mm/s 10mm/mV 100Hz 005C 12SL86 CID: 1 EID:38 EDT: 11:15 05-JUL-2006 ORDER:

Smolinski, Patricia ID:001988873 27-NOV-2006 21:28:26 UCI MEDICAL CTR

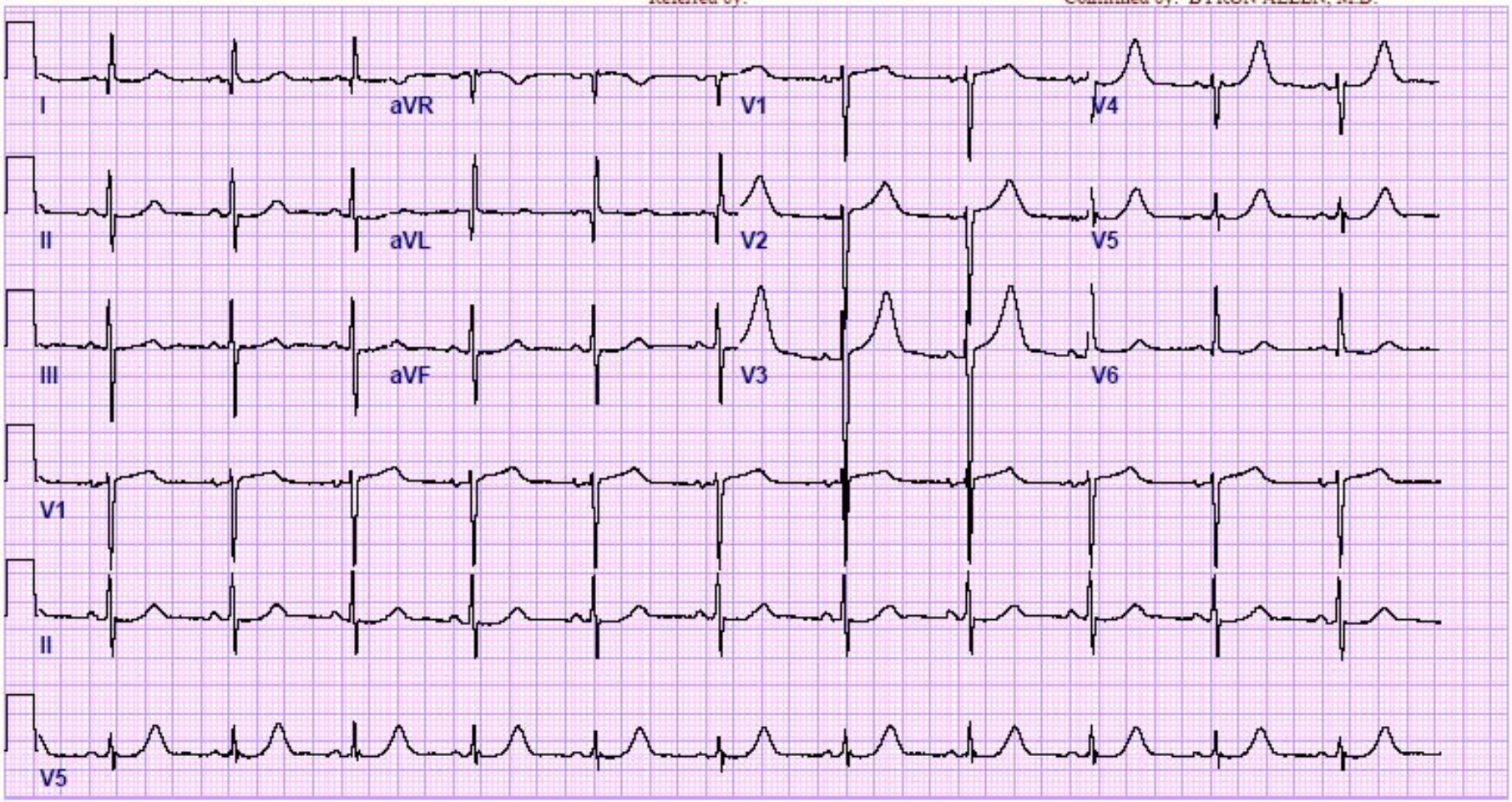
74 yr
Female Caucasian
Loc:5

Vent. rate	68	BPM
PR interval	140	ms
QRS duration	82	ms
QT/QTc	472/501	ms
P-R-T axes	65 -14	57

NORMAL SINUS RHYTHM
POSSIBLE LATERAL INFARCT , AGE UNDETERMINED
ABNORMAL ECG

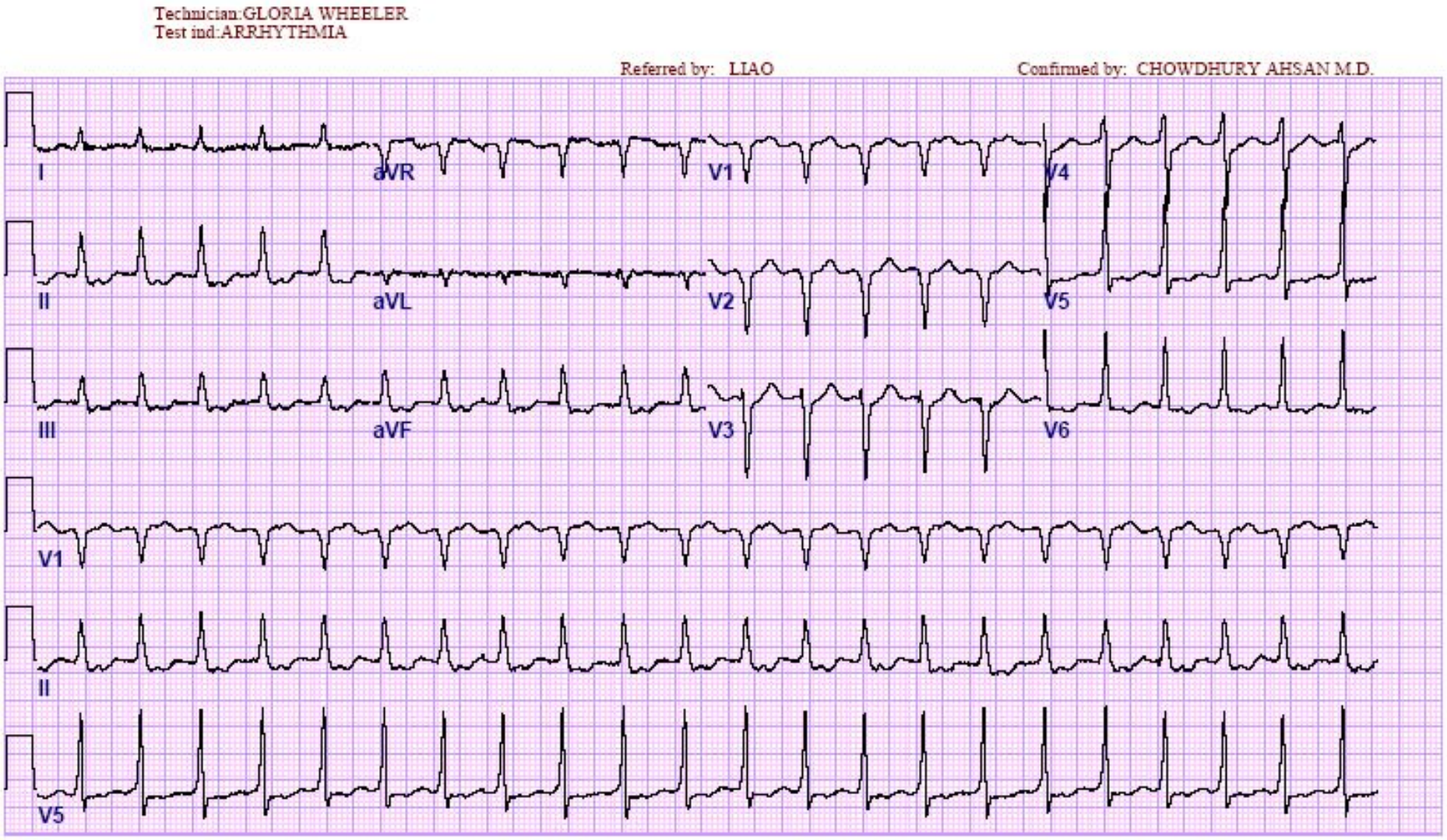
Technician:SUSAN DUNCAN RCS

Referred by: Confirmed by: BYRON ALLEN, M.D.



25mm/s 10mm/mV 150Hz 005B 12SL 237 CID: 1

EID:123 EDT: 11:40 07-DEC-2006 ORDER:


Technician:GLORIA WHEELER
Test ind:ARRHYTHMIA
Referred by: LIAO
Confirmed by: CHOWDHURY AHSAN M.D.
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5
25mm/s 10mm/mV 150Hz 005B 12SL 237 CID: 1
EID:123 EDT: 10:33 28-NOV-2006 ORDER:
Page 1 of 1

BELTRAN, MANUEL ID:546663140 26-NOV-2006 08:57:44 LONG BEACH VA MEDICAL CENTE

21-AUG-1945 (61 yr)
Male Caucasian

Vent. rate	73	BPM
PR interval	146	ms
QRS duration	86	ms
QT/QTc	400/440	ms
P-R-T axes	34 *	57

Normal sinus rhythm
Normal ECG

UNCONFIRMED

Referred by: Unconfirmed