

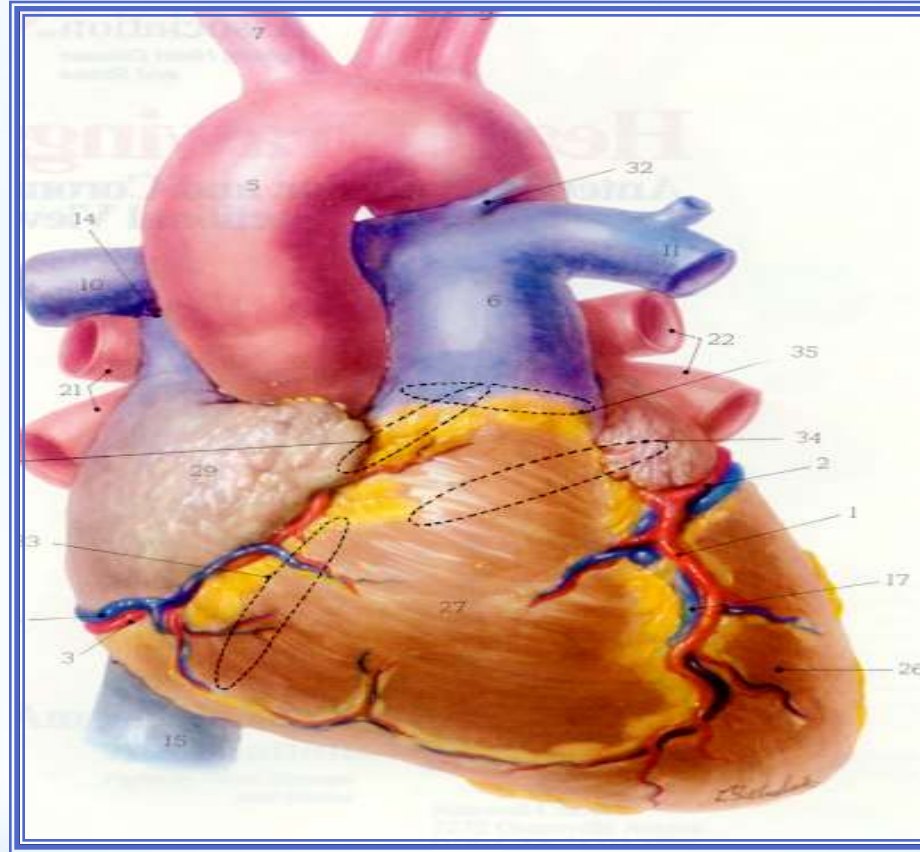


**CREIGHTON UNIVERSITY
EMS EDUCATION**

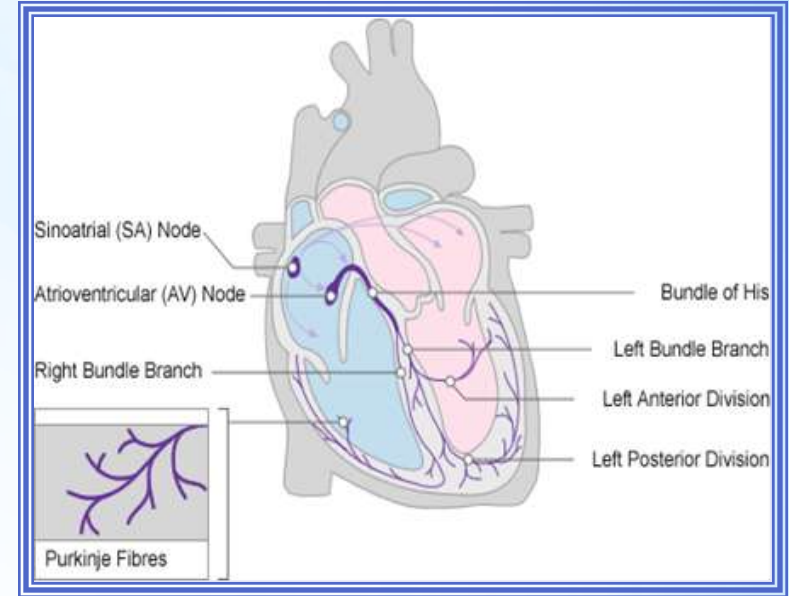
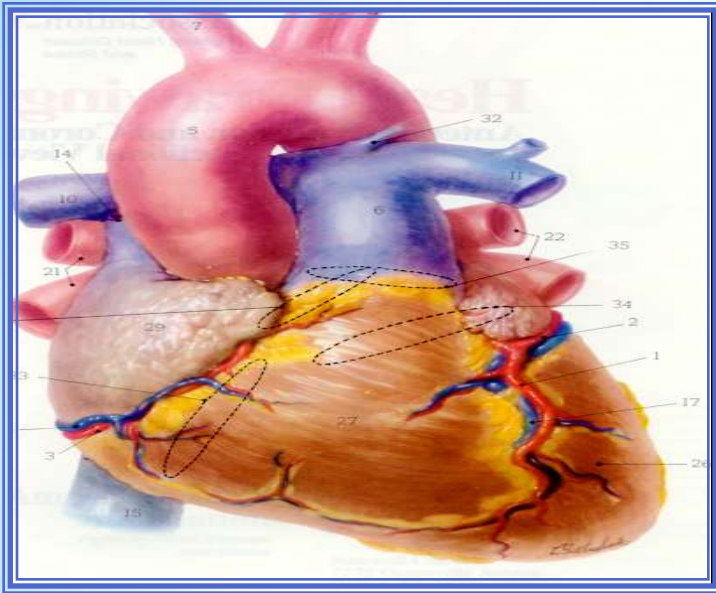
**ADVANCED 12 LEAD ECG CONCEPTS
2012**

- * Enhances 12 lead ECG Detection of Myocardial Ischemia, Injury And Infarction
- * Recognize Blocks in Electrical Activity
 - Bundle Branch Blocks & Bi Fascicular Blocks
 - Identify Precursors to Complete Heart Block
- * Helps to recognize ECG Rhythms and Disturbances

ADVANCED 12 LEAD ECG



CORONARY ANATOMY



INFERIOR WALL

RCA

SA Node 55%
 AV Node 90%
 Bundle of His
 Left Posterior Fascicle

ANTERIOR WALL

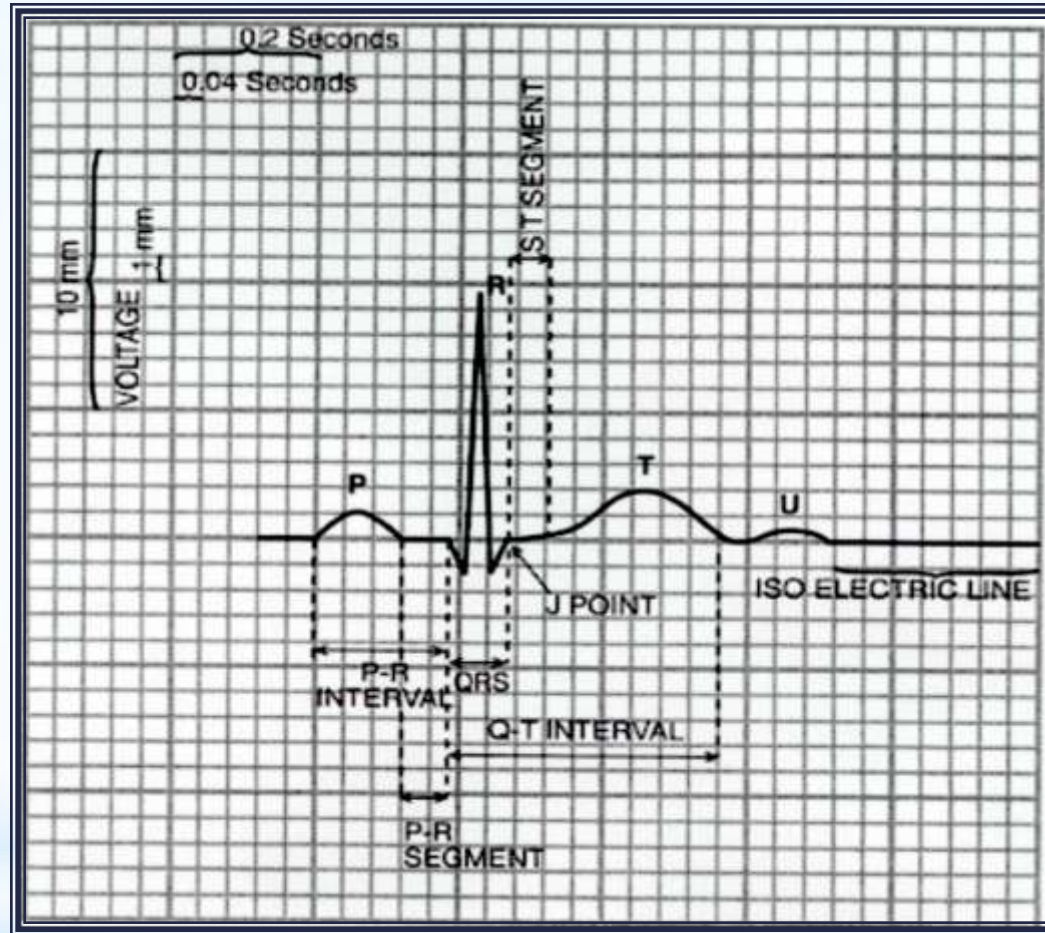
LAD

Bundle of His
 Left Anterior Fascicle
 Right Bundle Branch
 Left Posterior Fascicle

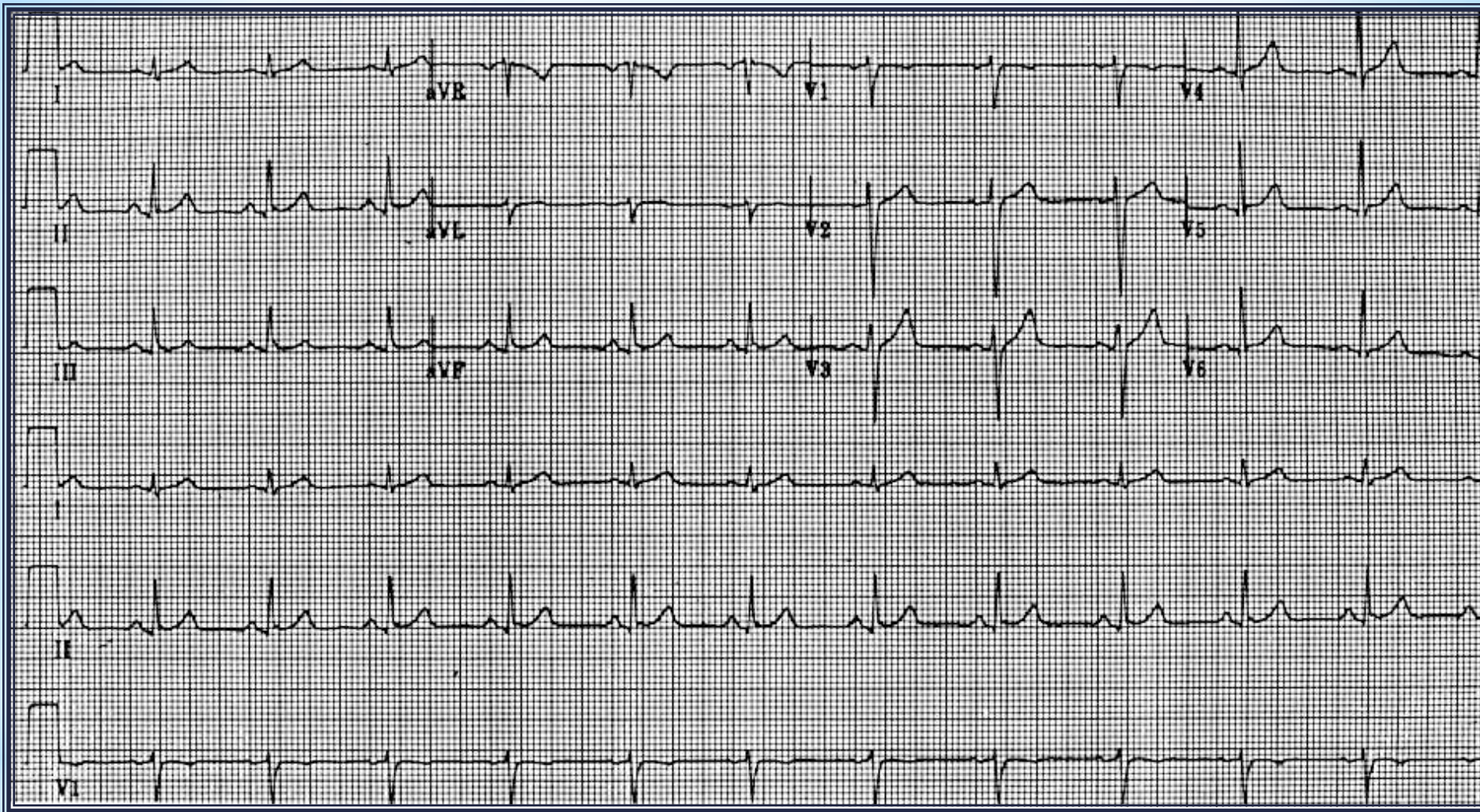
LATERAL WALL

LCX

SA Node 45%
 AV Node 10%
 (Inferior Wall 10%)



12 LEAD CONCEPTS



NORMAL 12 LEAD

2/15/2012

* Ischemia



* Injury



* Infarction



TRIAD OF INFARCTION

ECG rate & rhythm

Identify & treat patient

If pt. stable perform 12 Lead ECG

- ▶ Calibration mark
10mm/1mv
- ▶ P wave upright in lead 1
- ▶ Evaluate QRS
 - ▶ > 3 boxes

(Inclusion Criteria)

- ▶ Patient **18 years** old or older
- ▶ Ischemic Discomfort for **30 minutes** but less than **12 hours**
- ▶ ST Elevation greater than **1mm** in 2 contiguous Limb Leads or **2mm** or greater in 2 contiguous Chest Leads

or

Presumed **New LBBB**

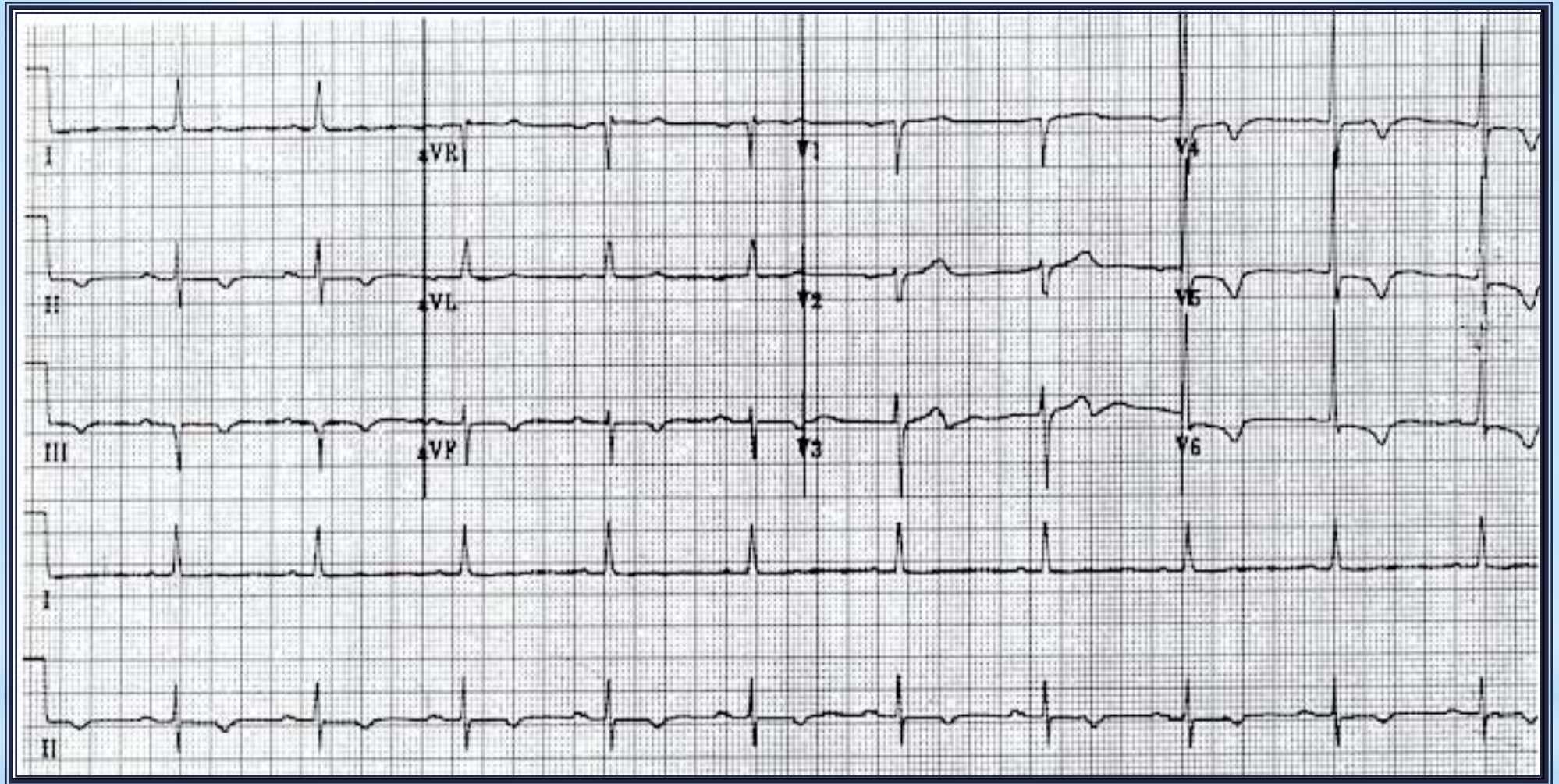
(Sgarbossa Criteria are Highly Specific for Acute Myocardial Infarction)

STEMI CHECKLIST

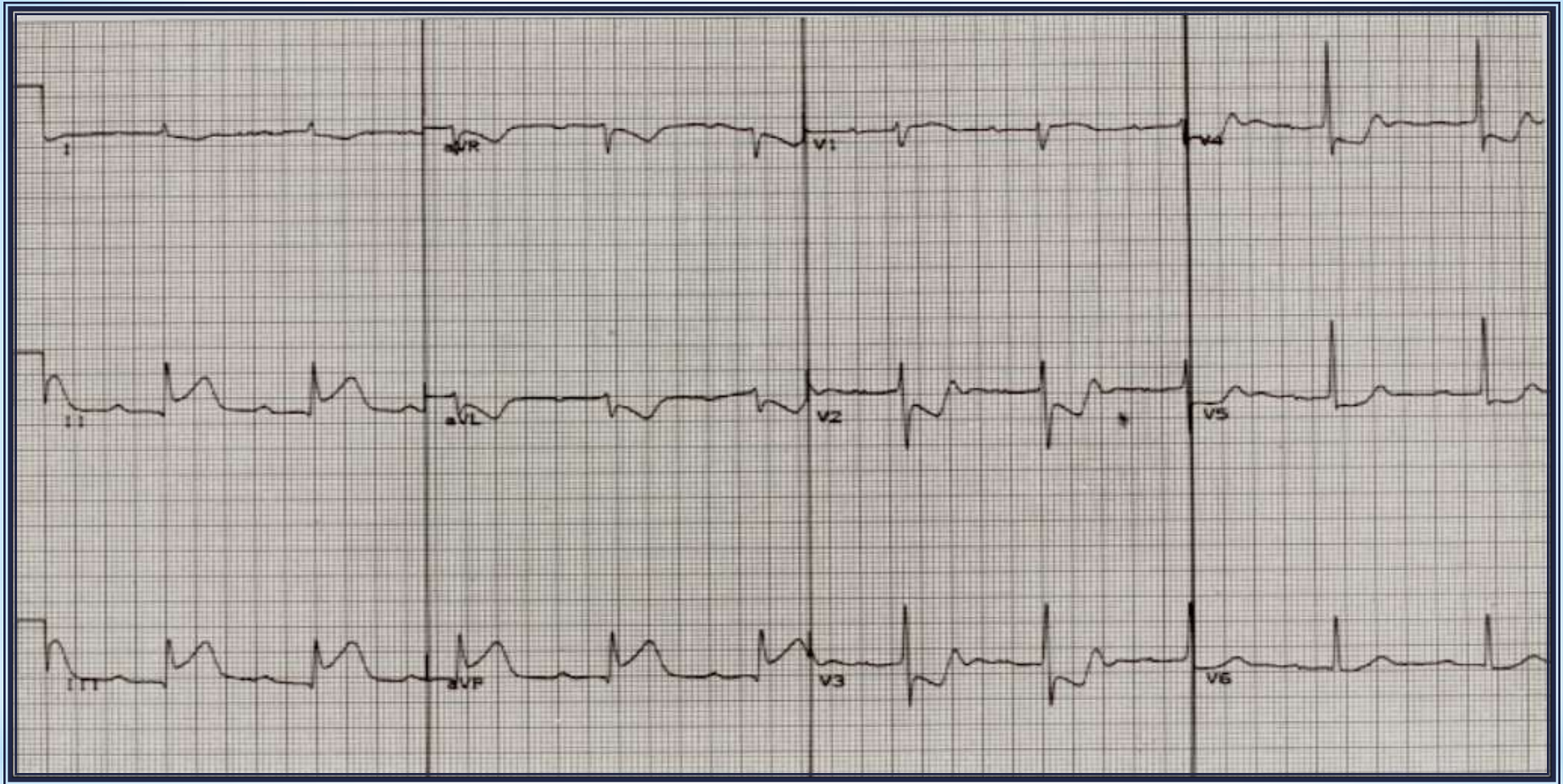
STEMI CHECKLIST

(Exclusion Criteria)

- ⊙ Active Internal Bleeding
 - > 4 Weeks
- ⊙ Stroke or TIA
- ⊙ Any Surgery
 - > 4 Weeks
- ⊙ Brain Tumors, AVM, Aneurysms
- ⊙ Bleeding Disorders
 - > Hemophilia
- ⊙ Presenting HTN
 - > 180 systolic or 110 diastolic
- ⊙ Use of Amphetamines or Cocaine
 - > 3 days
- ⊙ Cardiogenic Shock
 - > BP less 90 or intubated
- ⊙ Recent Trauma
 - > Includes CPR for 2 minutes
- ⊙ Back Pain / Dissecting Aneurysm
- ⊙ Pericarditis or Endocarditis
- ⊙ Pregnancy
- ⊙ Oral Anticoagulants
 - > 3 days

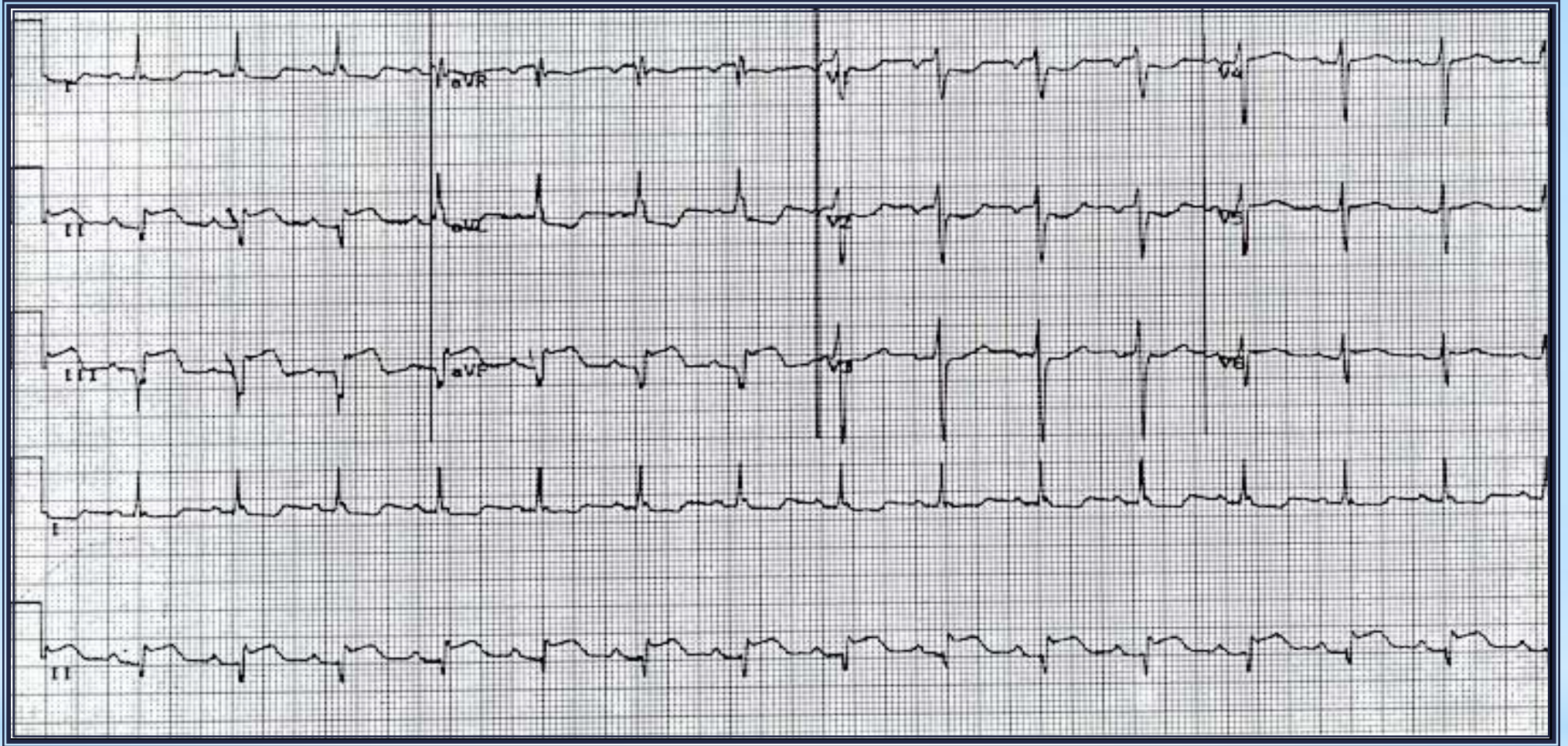


ISCHEMIA

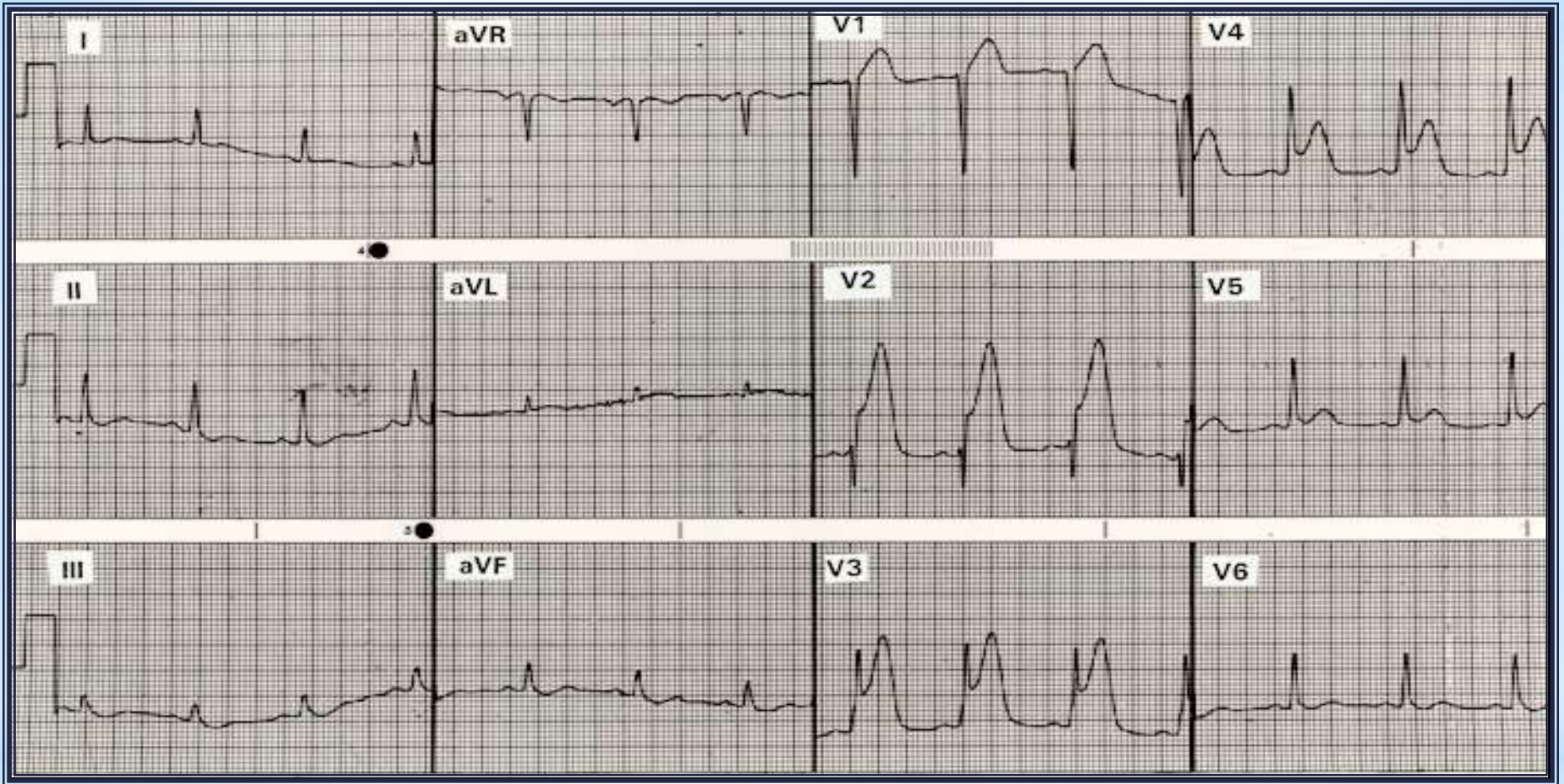


INFERIOR WALL INJURY - STEMI

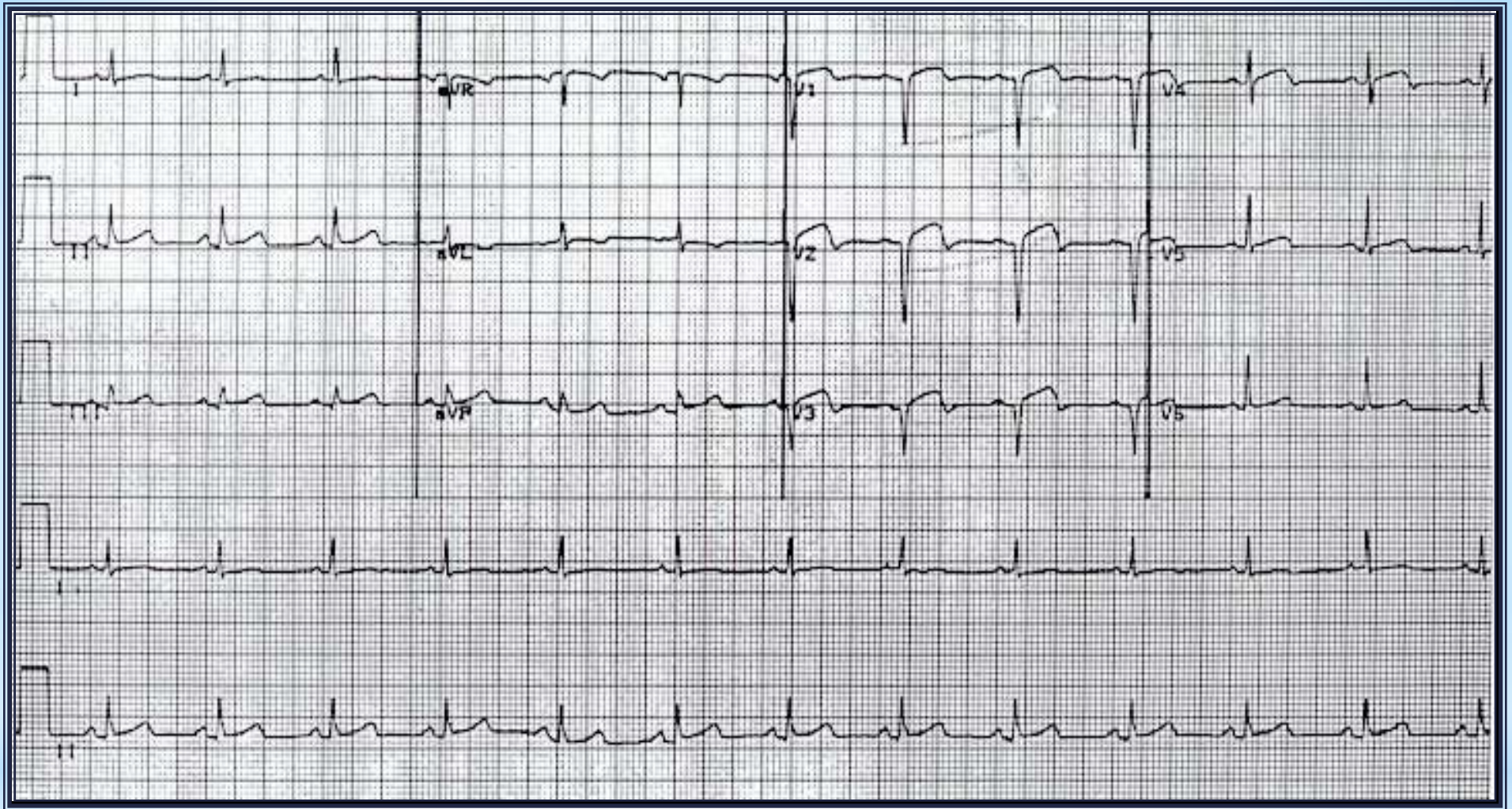
2/15/2012



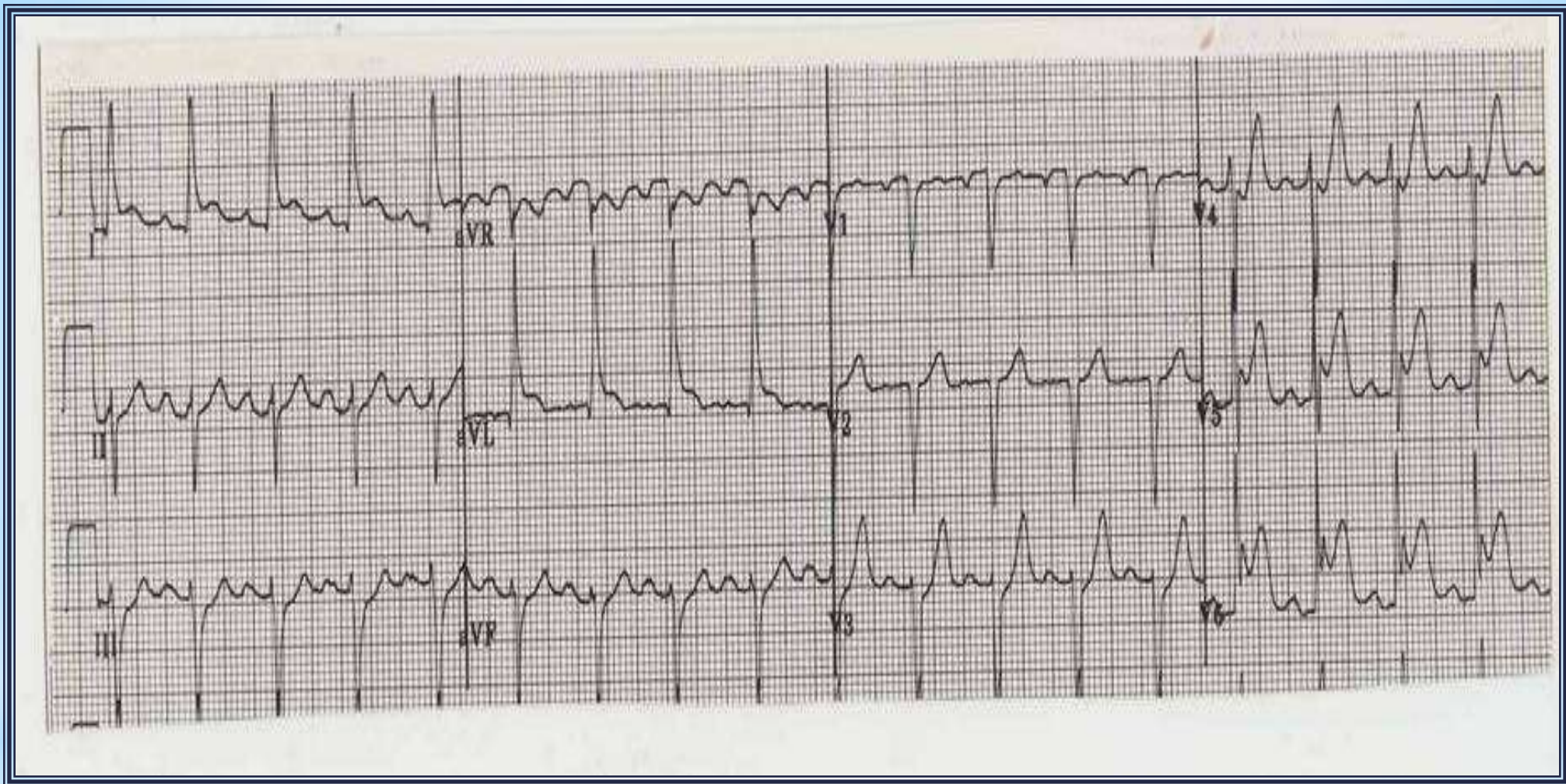
INFERIOR WALL INFARCTION - STEMI



ANTERIOR WALL INJURY - STEMI



ANTERIOR WALL INFARCTION - STEMI



LATERAL WALL INJURY - STEMI

2/15/2012

THE UNUSUAL

MYOCARDIAL INFARCTIONS

50% of Inferior Wall MI'S

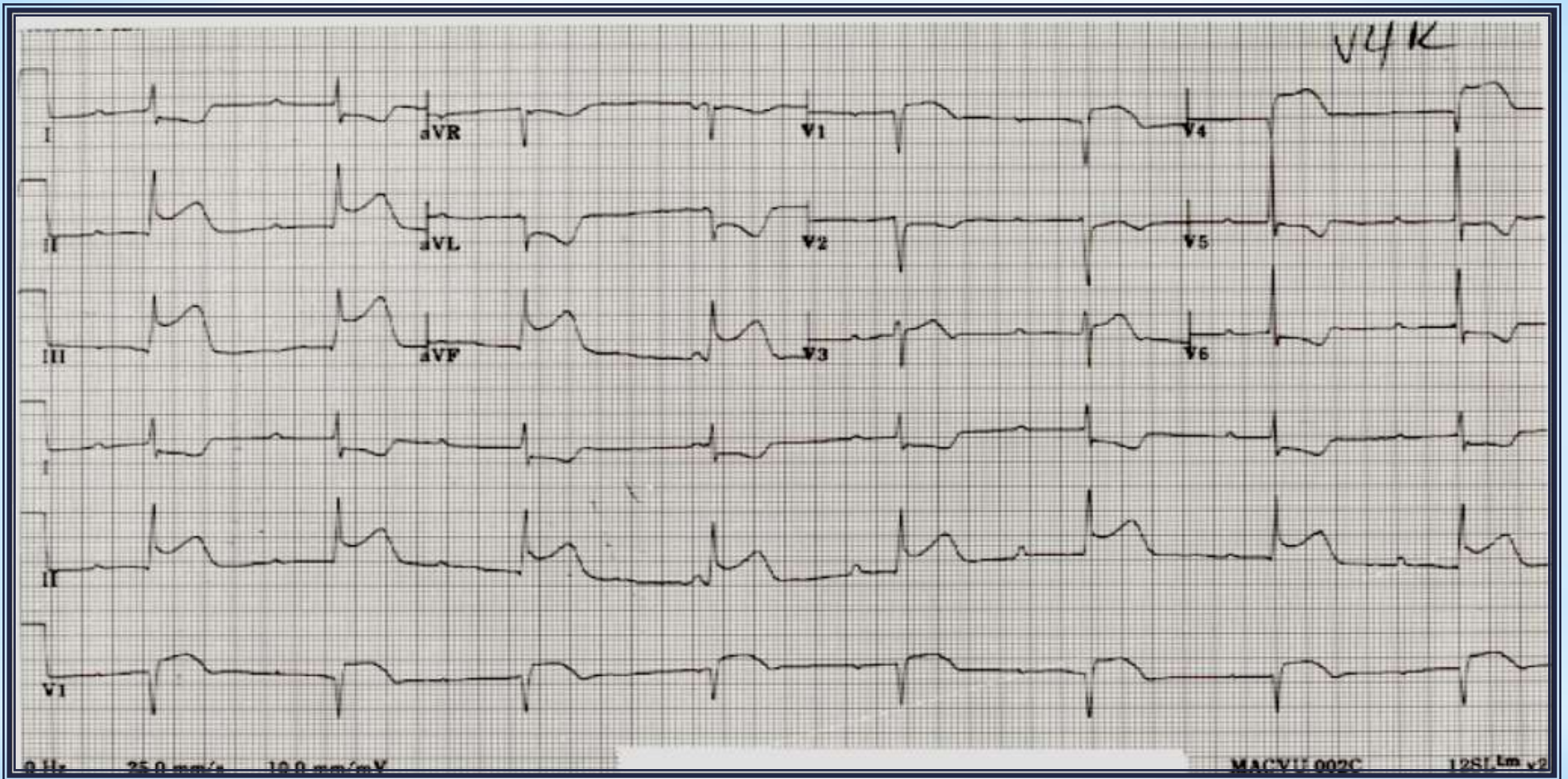
15 or 18 Lead ECG'S

- use V4R Lead

Symptoms

- Hypotension
- Clear BBS

RIGHT VENTRICULAR STEMI



RIGHT VENTRICULAR WALL STEMI

Common / Inferior Wall MI

15 or 18 Lead ECG'S

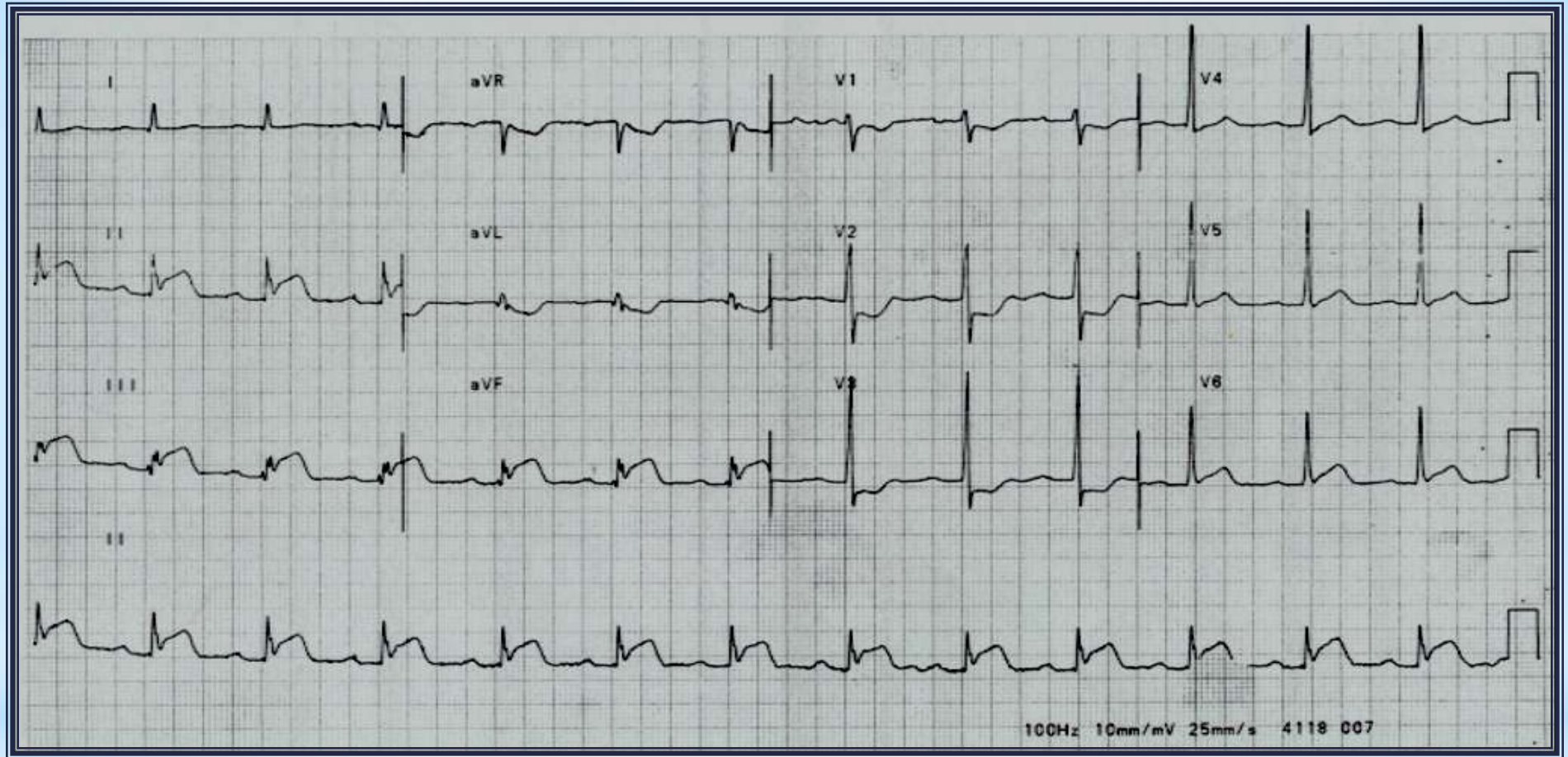
Field use 12 Lead ECG

Reciprocal Changes

V1, V2&V3 Tall R Waves

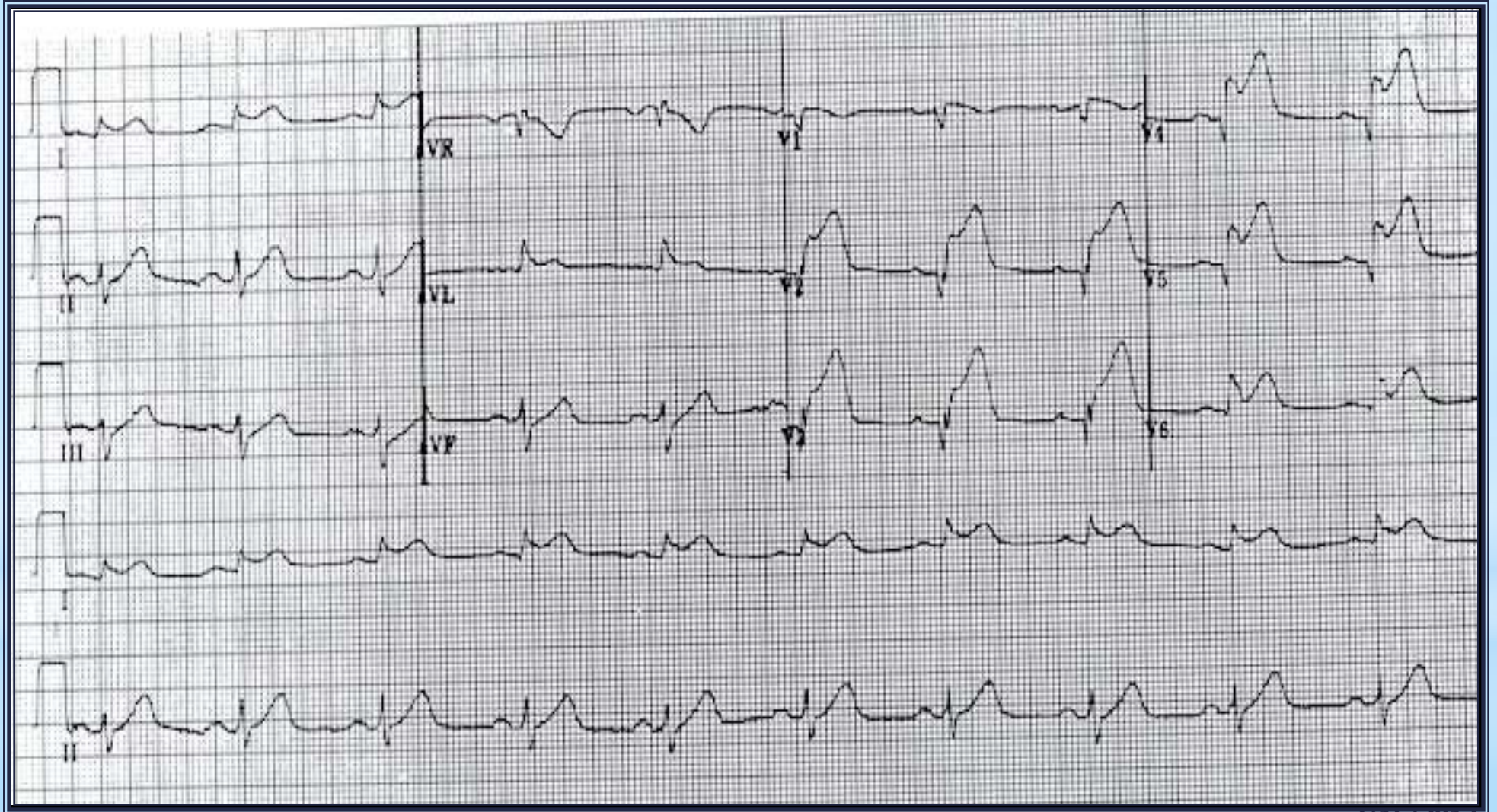
ST-T Depression

POSTERIOR WALL STEMI



POSTERIOR WALL STEMI

GLOBAL STEMI



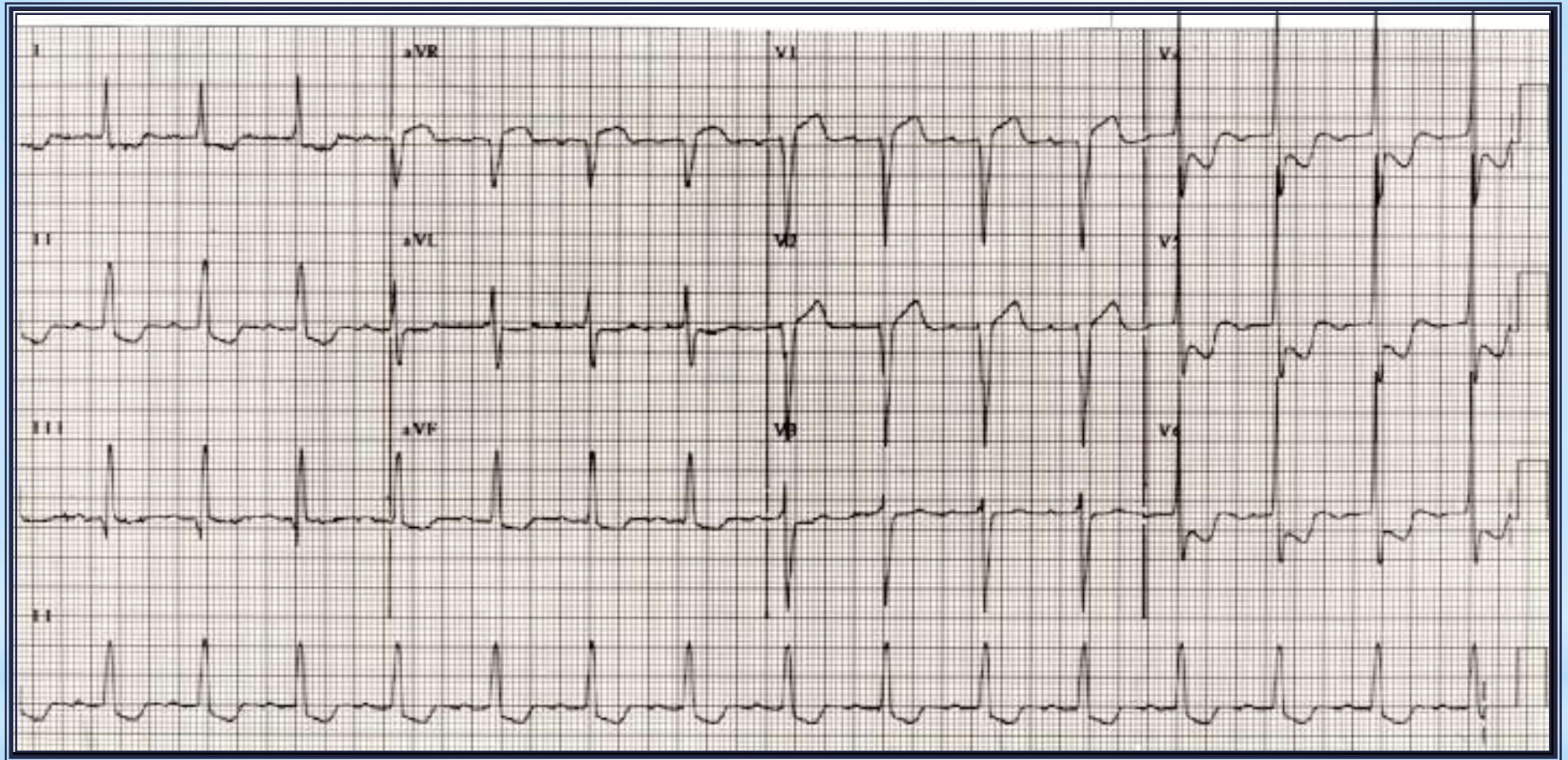
“ *Sub-Endocardial* Wall MI ”

“Non Q Wave MI”

ST-T Wave Depressions

Symptoms & Treatment

NON STEMI MI



NON STEMI MI

2/15/2012

Acute Pericarditis

Left Bundle Branch Block

Early Repolarization

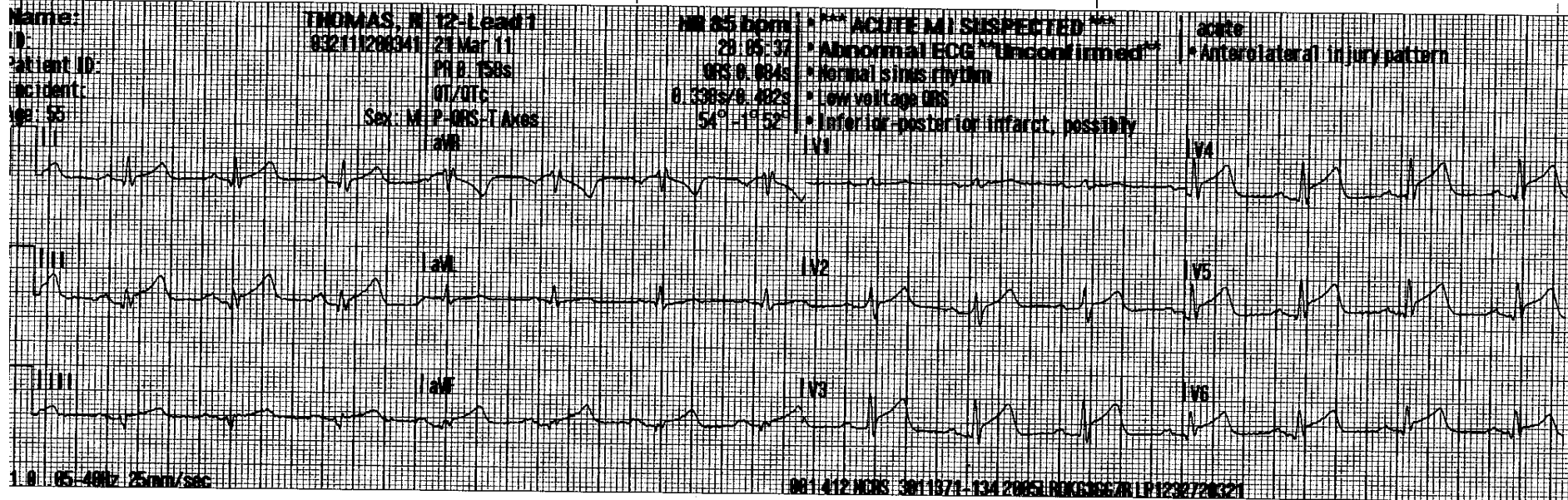
Ventricular Pacemakers

Left Ventricular
Hypertrophy

Ventricular Rhythms

THE GREAT MIMICS

ACUTE PERICARDITIS



Name:

ID:

Patient ID:

Incident:

Age: 44

052003003611

12-Lead 1

20 May 03

PR 0.080s

QT/QTc

Sex:

P-QRS-T Axes

aVR

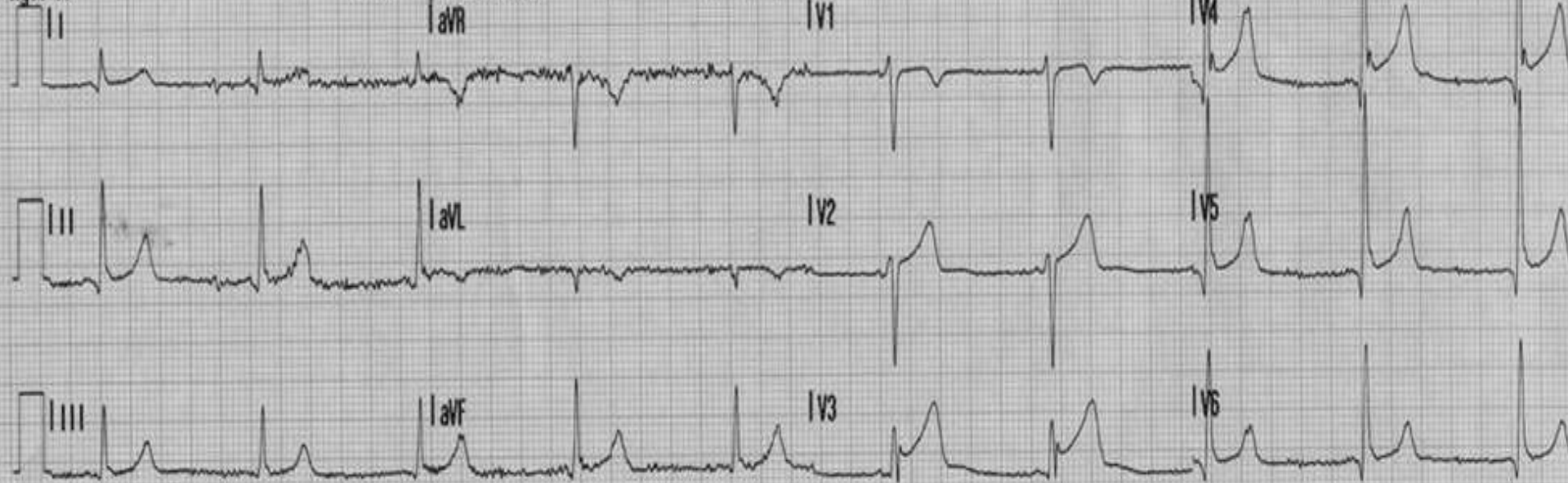
HR 58 bpm

08:46:20

QRS 0.098s

0.420s/0.412s

45° 71° 68°

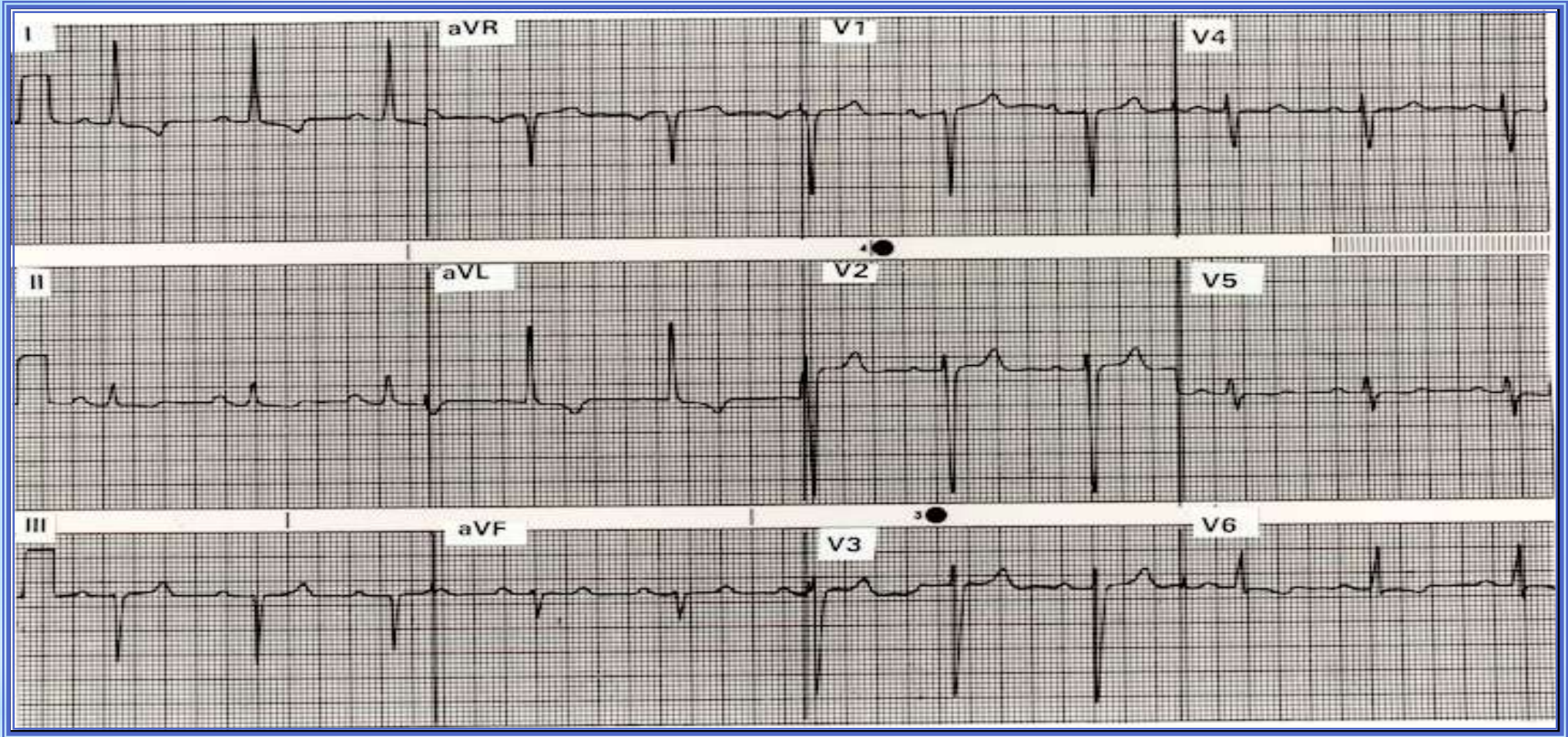


x1.0 05-40Hz 25mm/sec

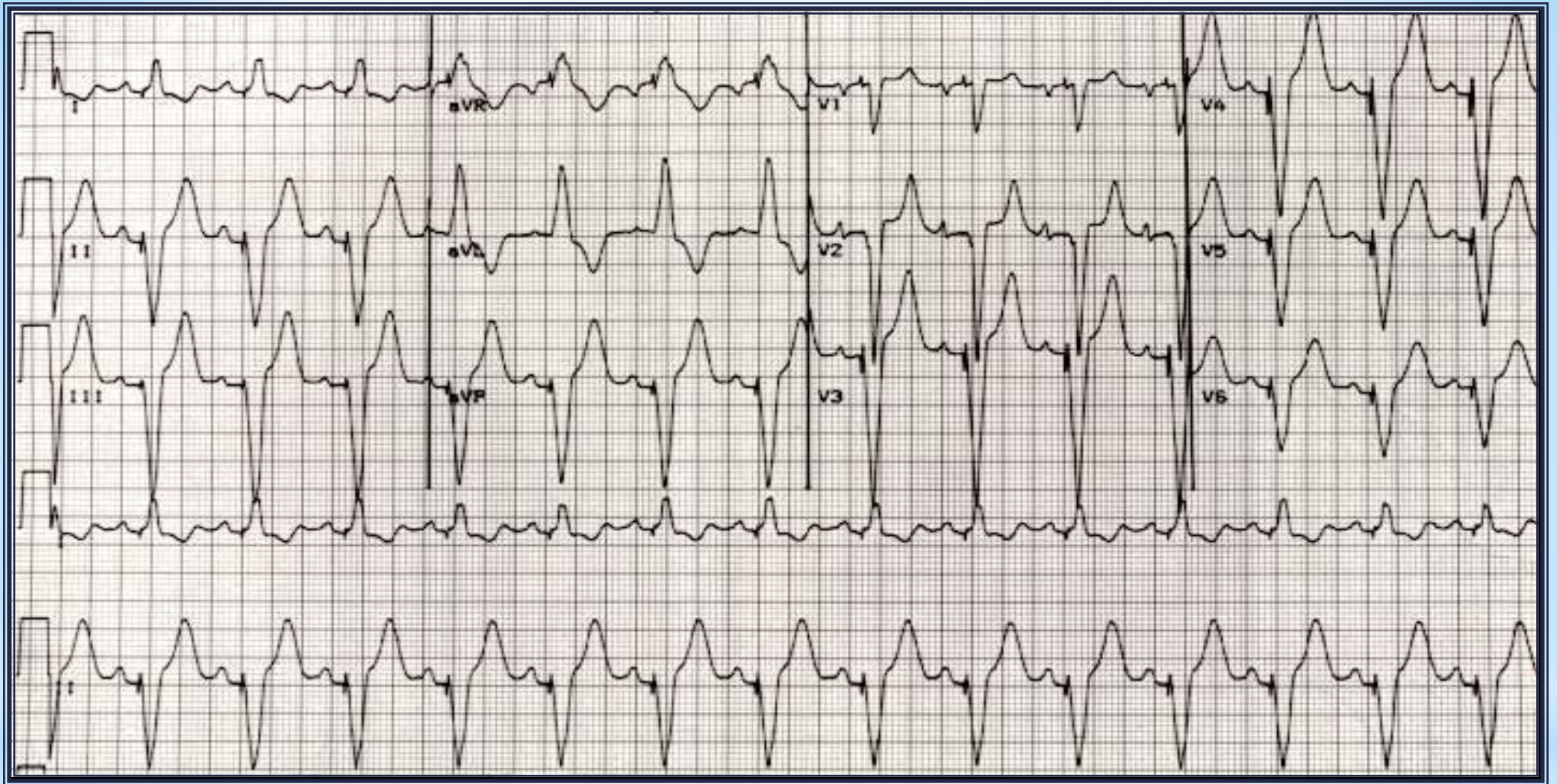
METRONIC PHYSIO-CONTROL

RESCUE 34 000 3011371-072 2G04KROKGJSP7R LP1212200021

EARLY REPOLARIZATION

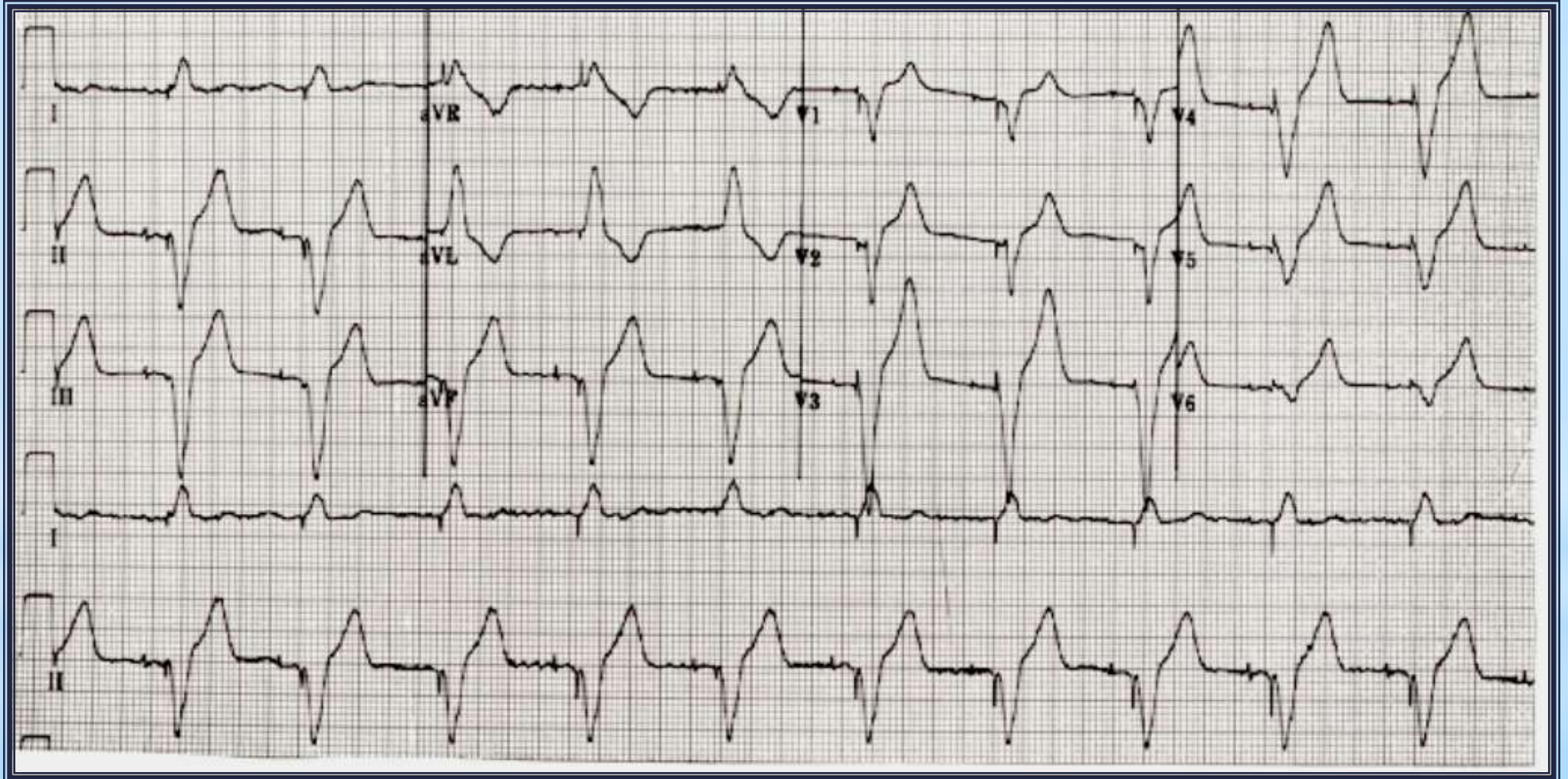


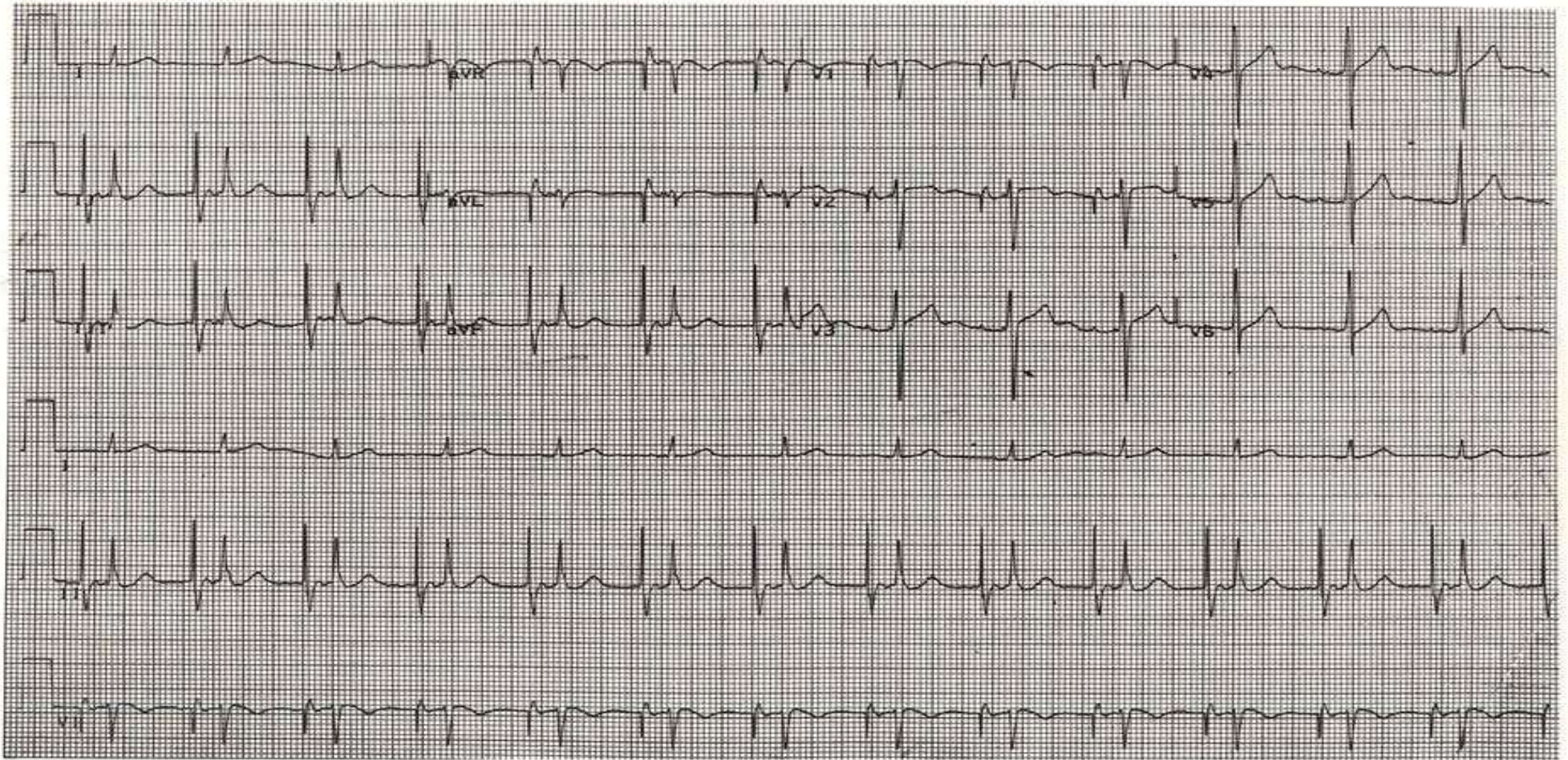
LEFT VENTRICULAR HYPERTROPHY



VENTRICULAR PACEMAKER

AV PACEMAKER





ATRIAL PACEMAKER

ELECTRICAL AXIS



THE THEORY OF ELECTRICITY

CAUSES OF AXIS DEVIATION

▶ LAD

- ▶ Inferior Wall STEMI
- ▶ Bi-Fascicular Block

▶ V-TACH

▶ COPD

▶ WPW

▶ BBB

▶ LVH

▶ RV PACING

▶ K + OD

▶ RAD

▶ Anterior Lateral STEMI

▶ Bi-Fascicular Block

▶ V-TACH

▶ COPD

▶ WPW

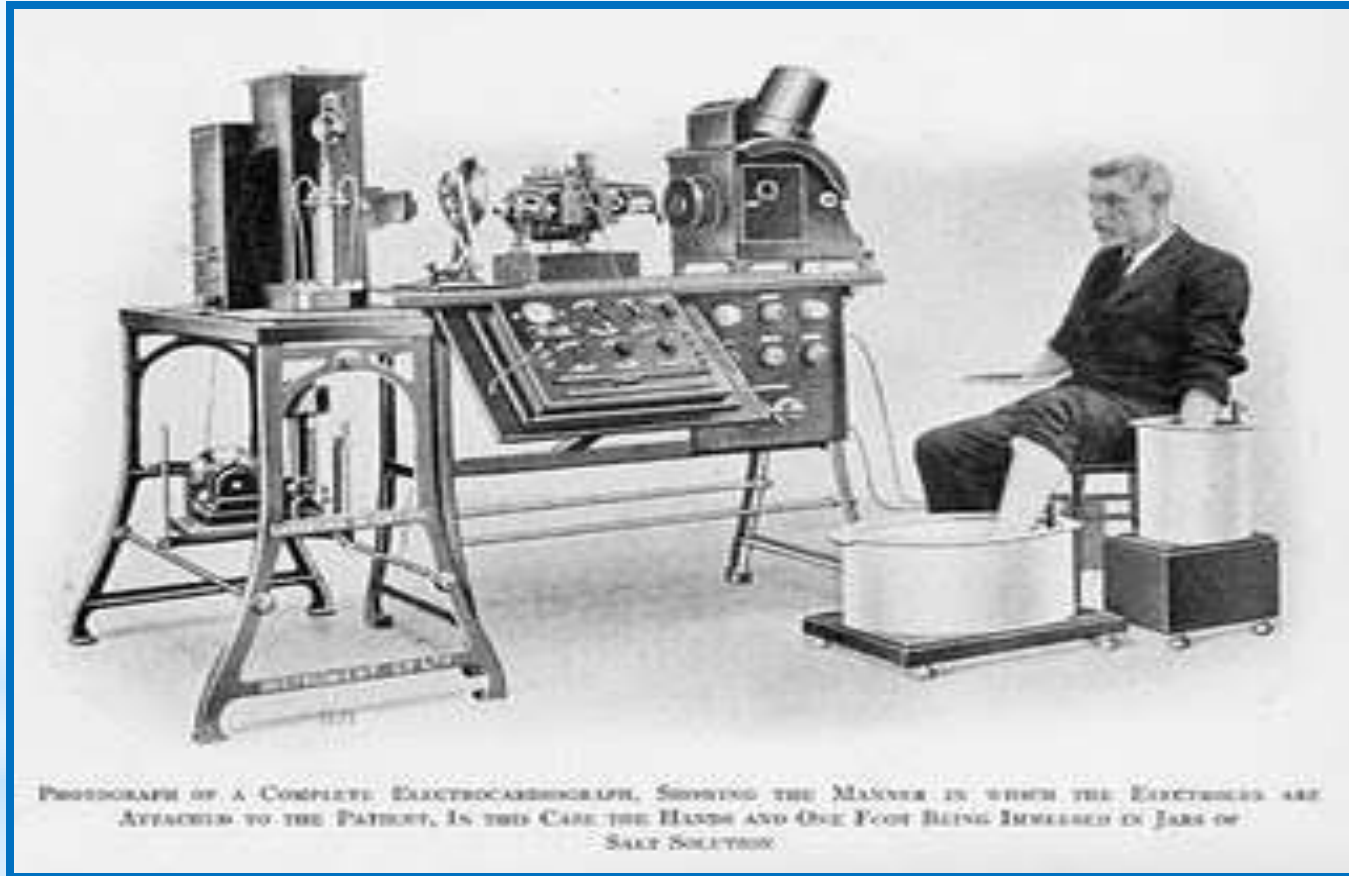
▶ BBB

▶ RVH

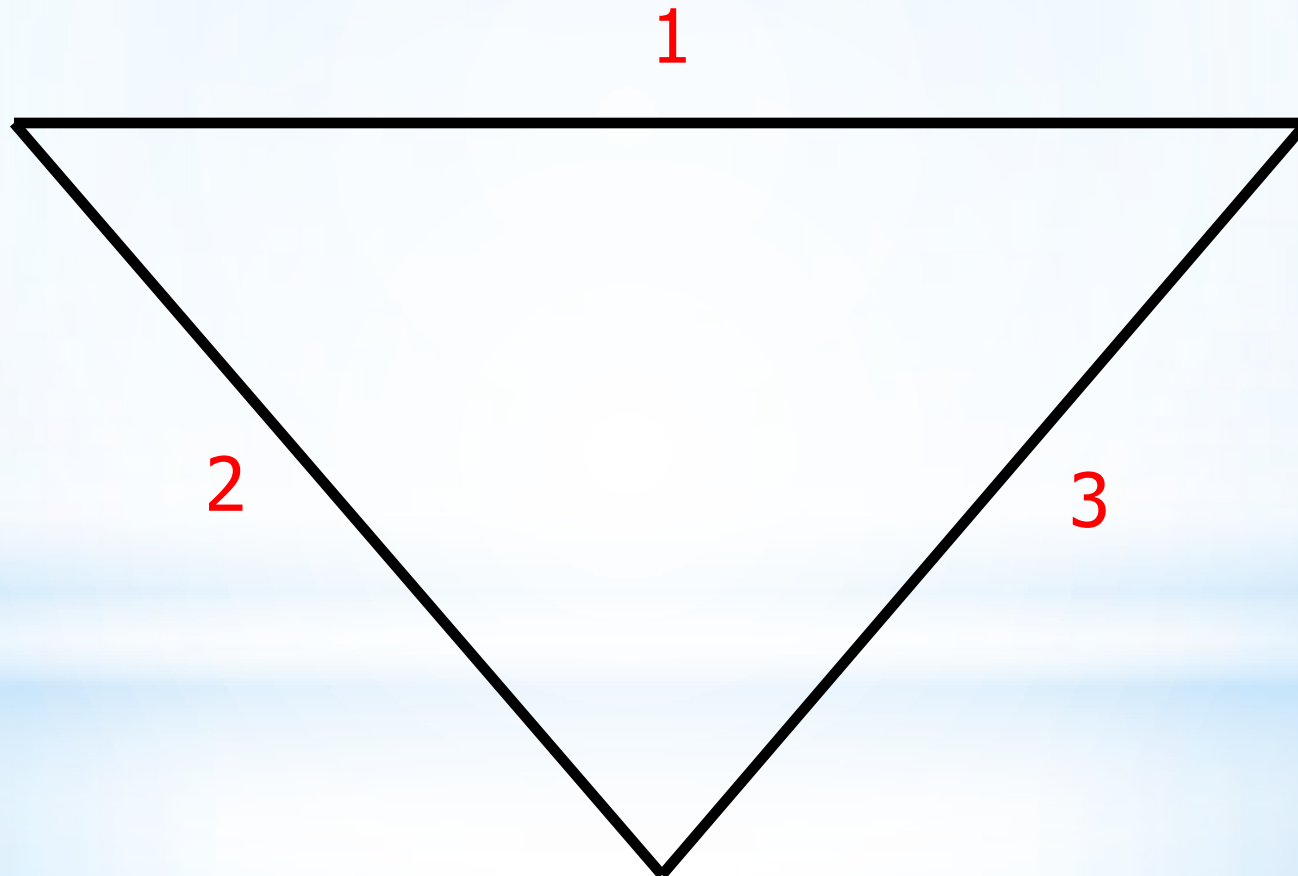
▶ P Embolus

▶ Dextrocardia

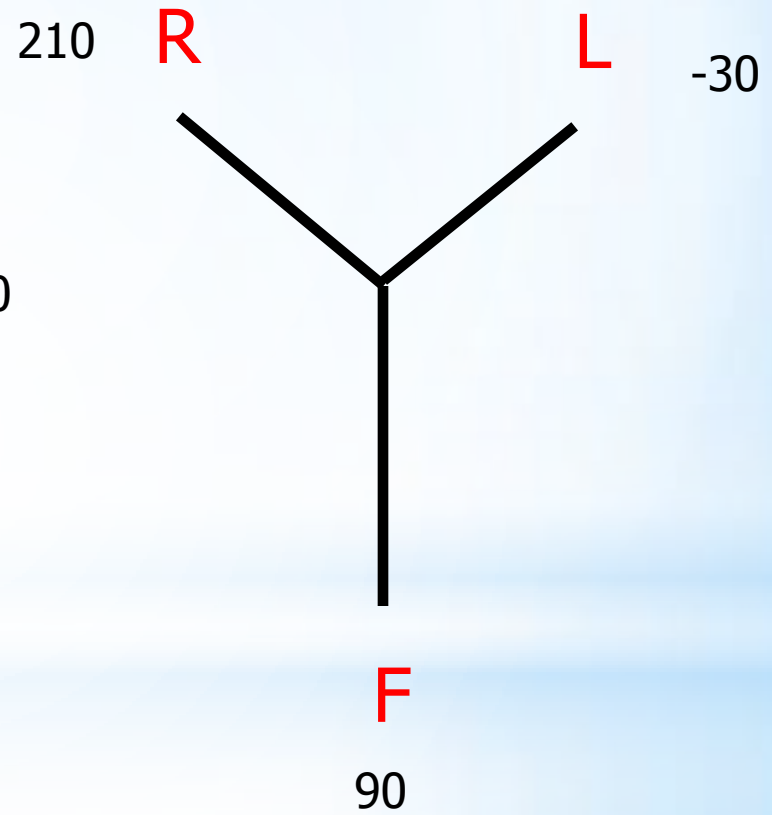
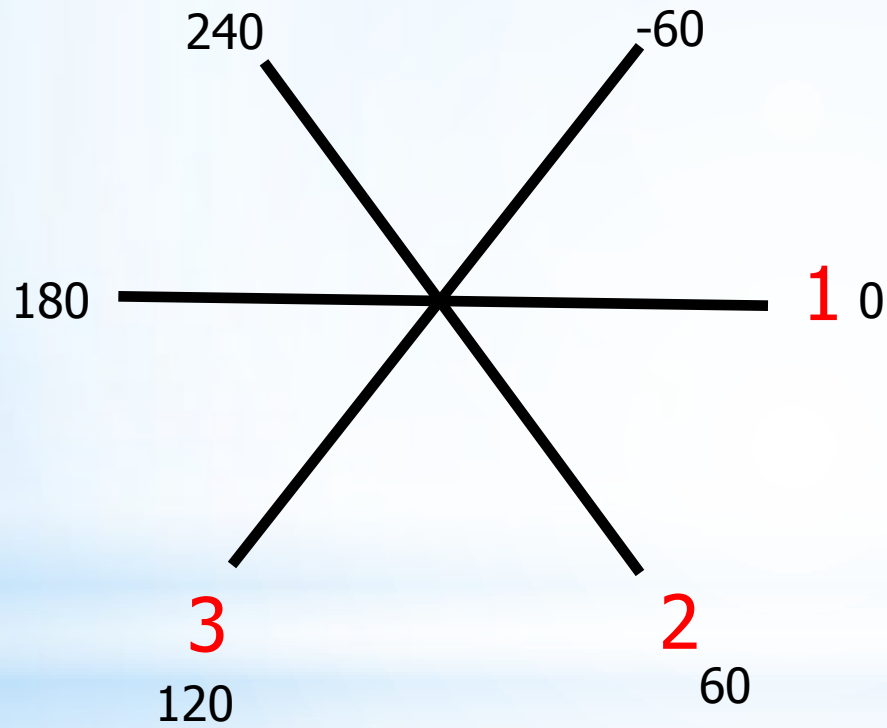
“DR. EINTHOVEN I PRESUME”



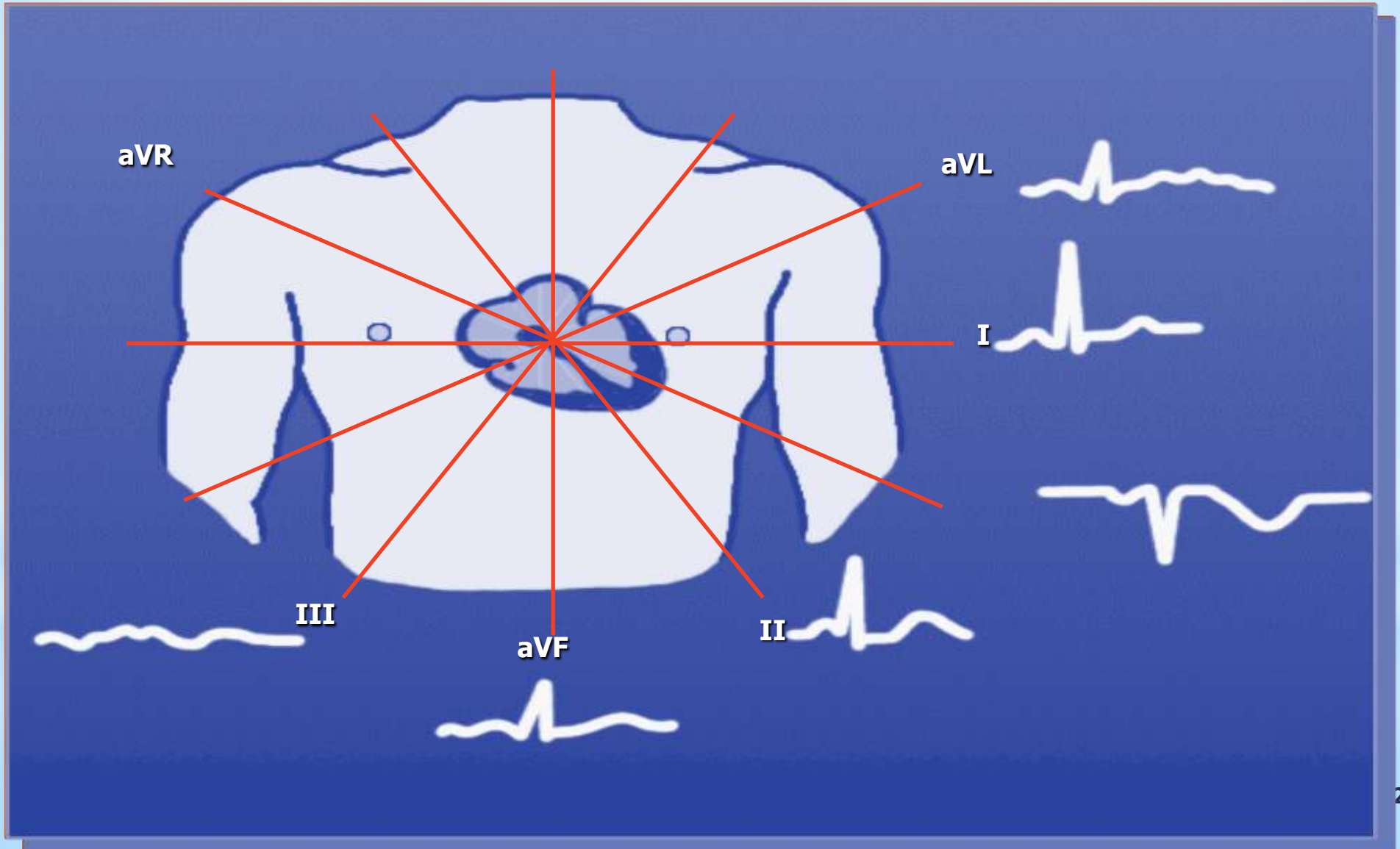
EINTHOVENS TRIANGLE



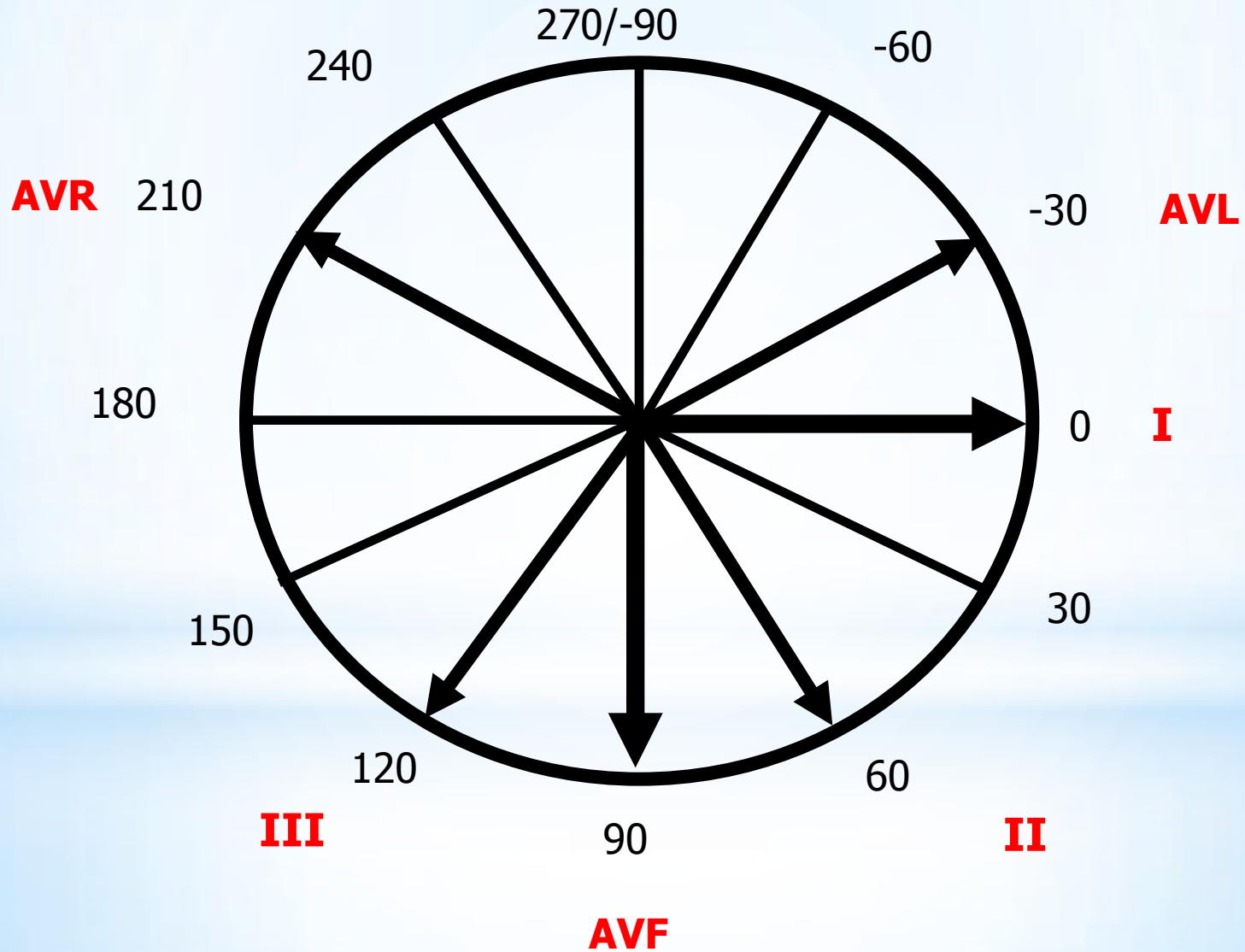
IMPORTANT RELATIONSHIPS



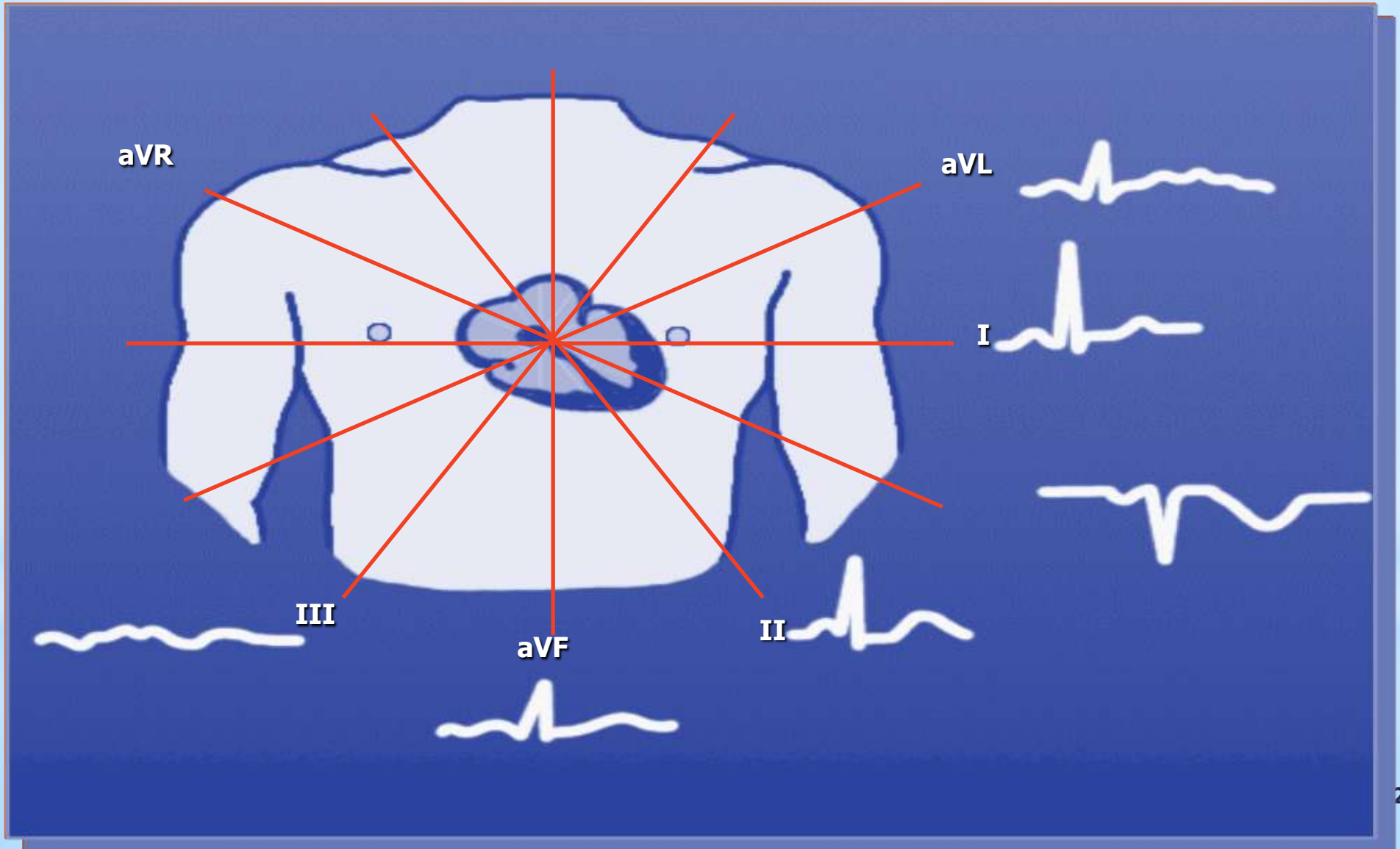
Limb Lead Axis



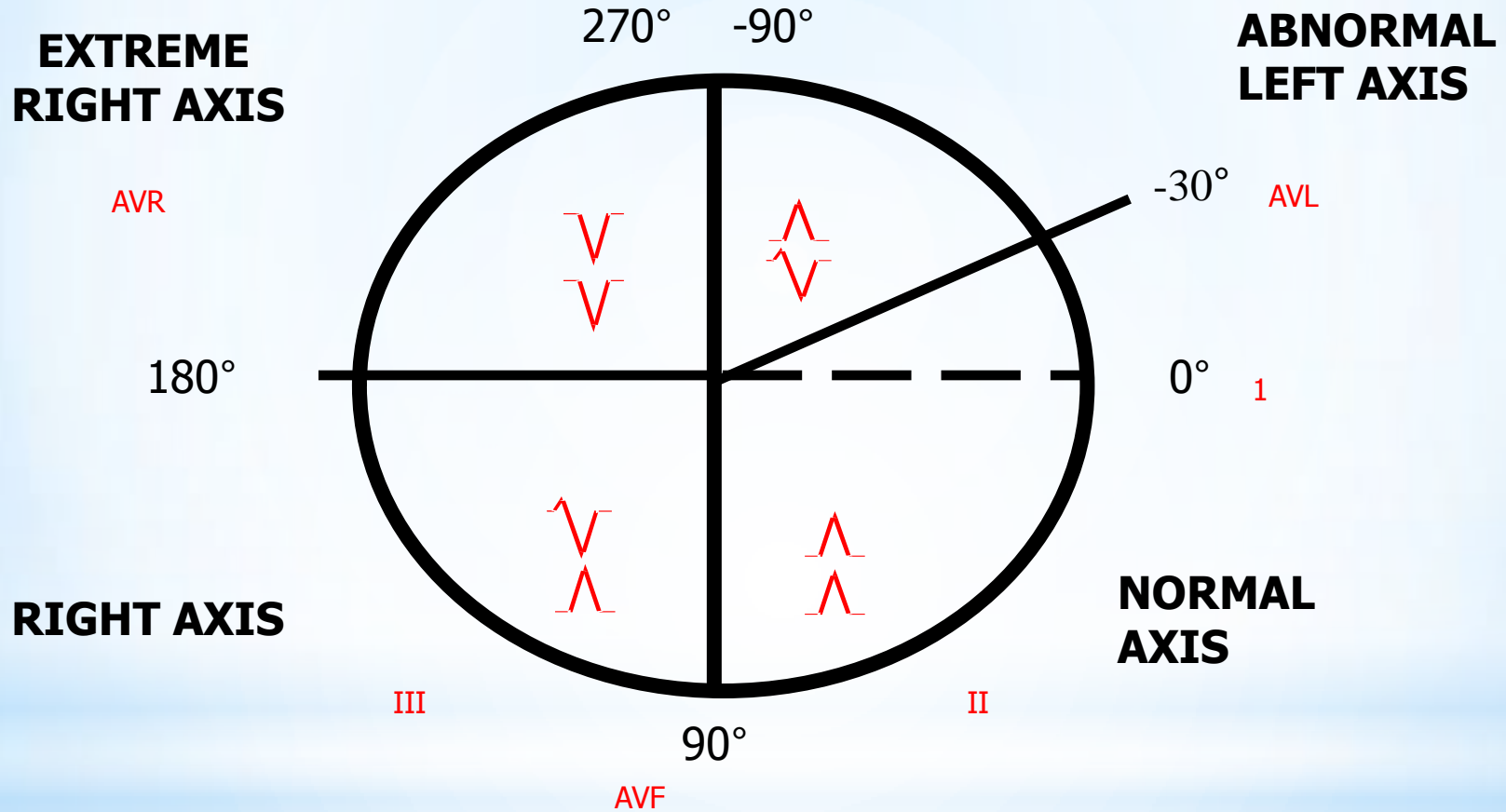
AXIS REFERENCE DIAGRAM



Limb Lead Axis

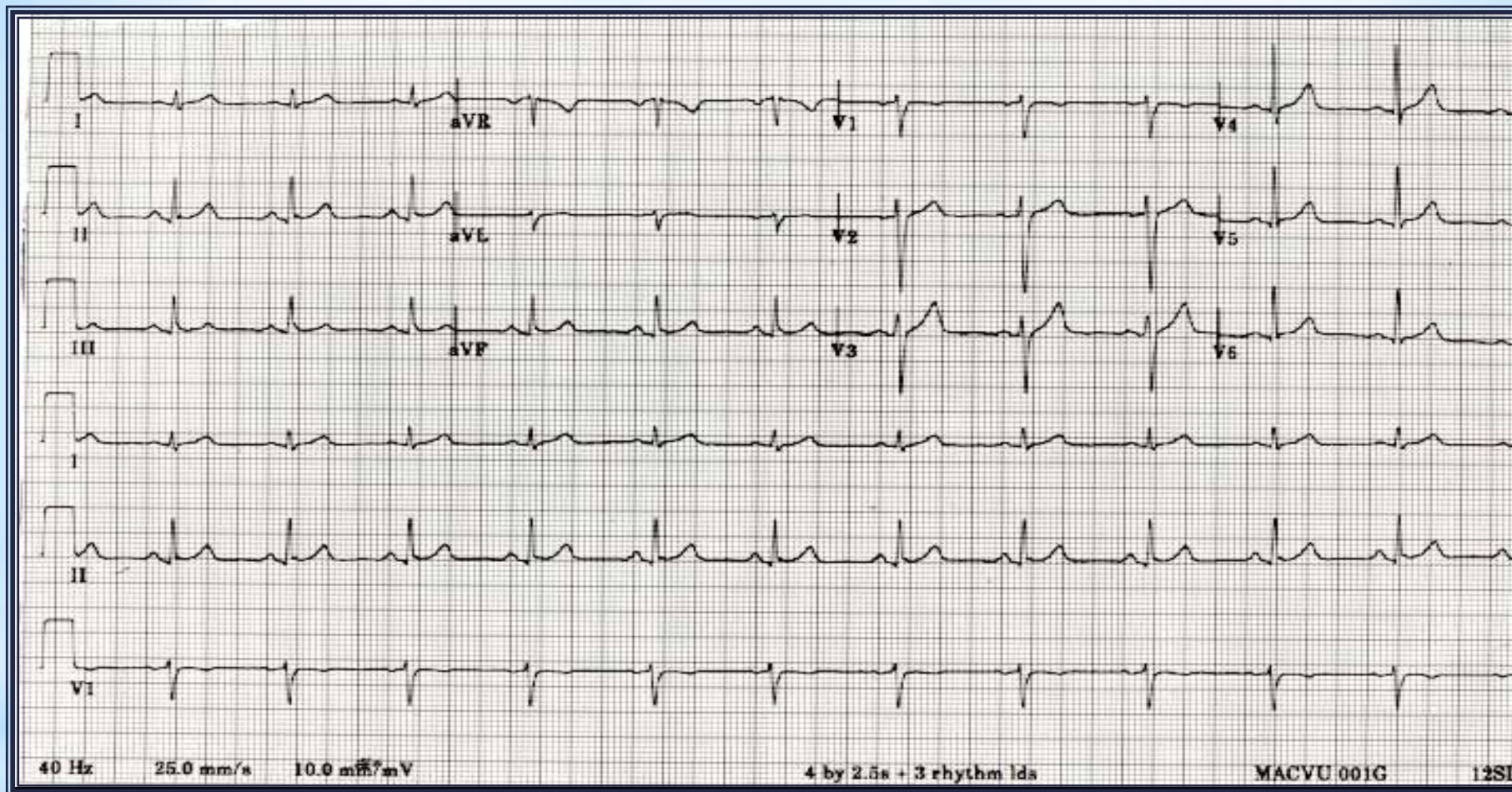


QUADRANT SYSTEM

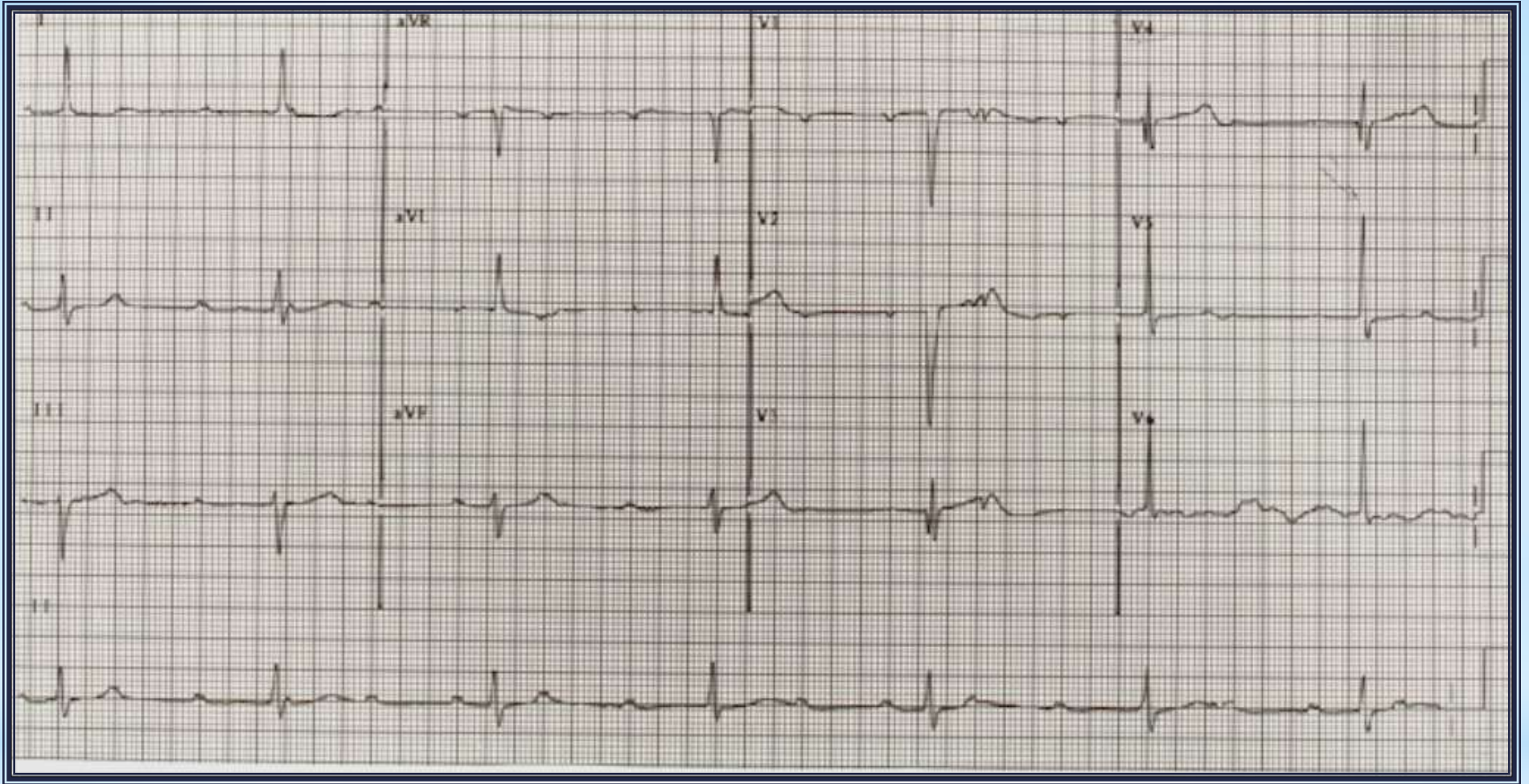


-Leads I, AVF
QRS

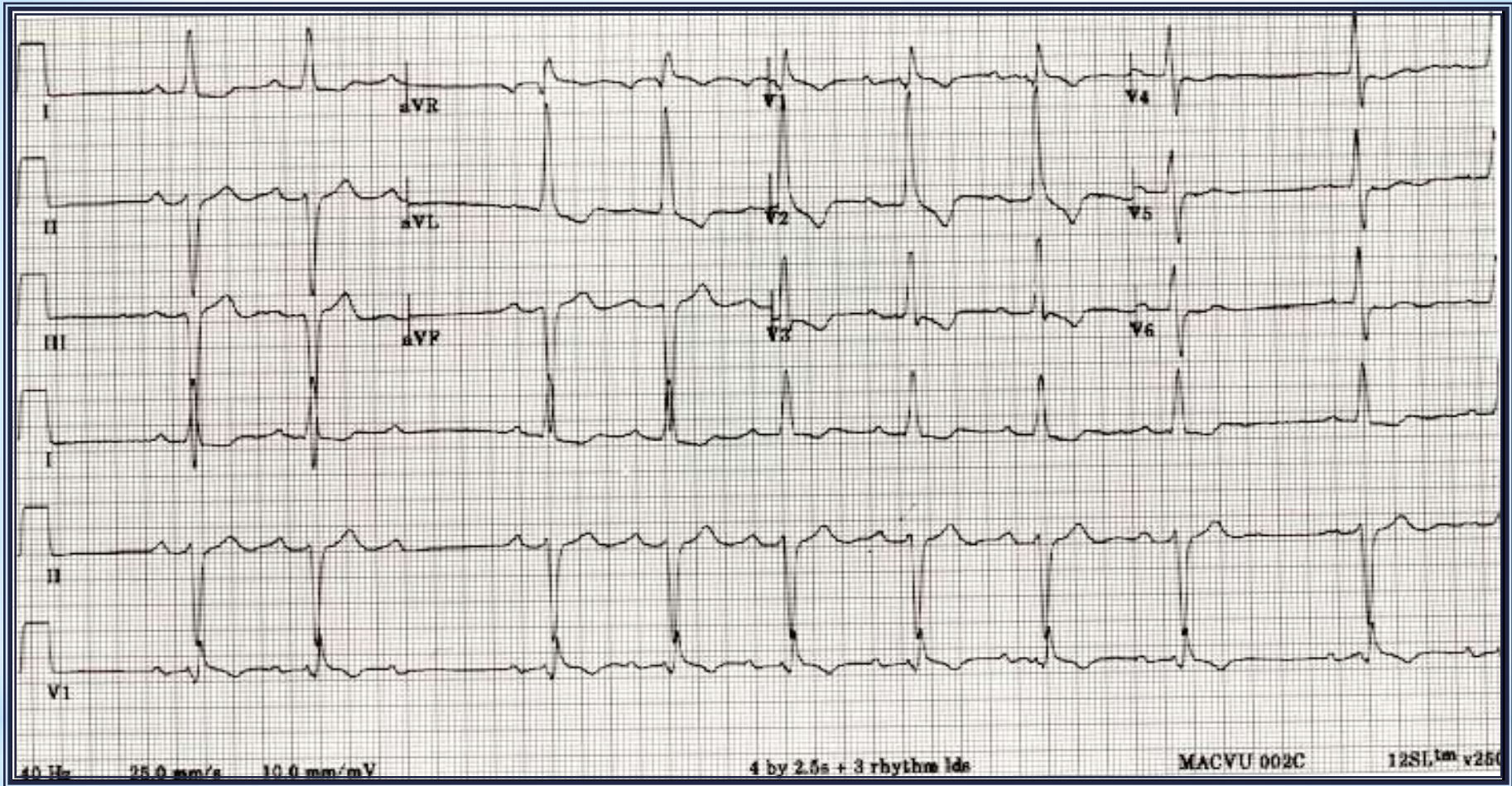
	NORMAL	ABN LEFT	RIGHT	ABN. RT.
I	+	+	-	-
AVF	+	-	+	-



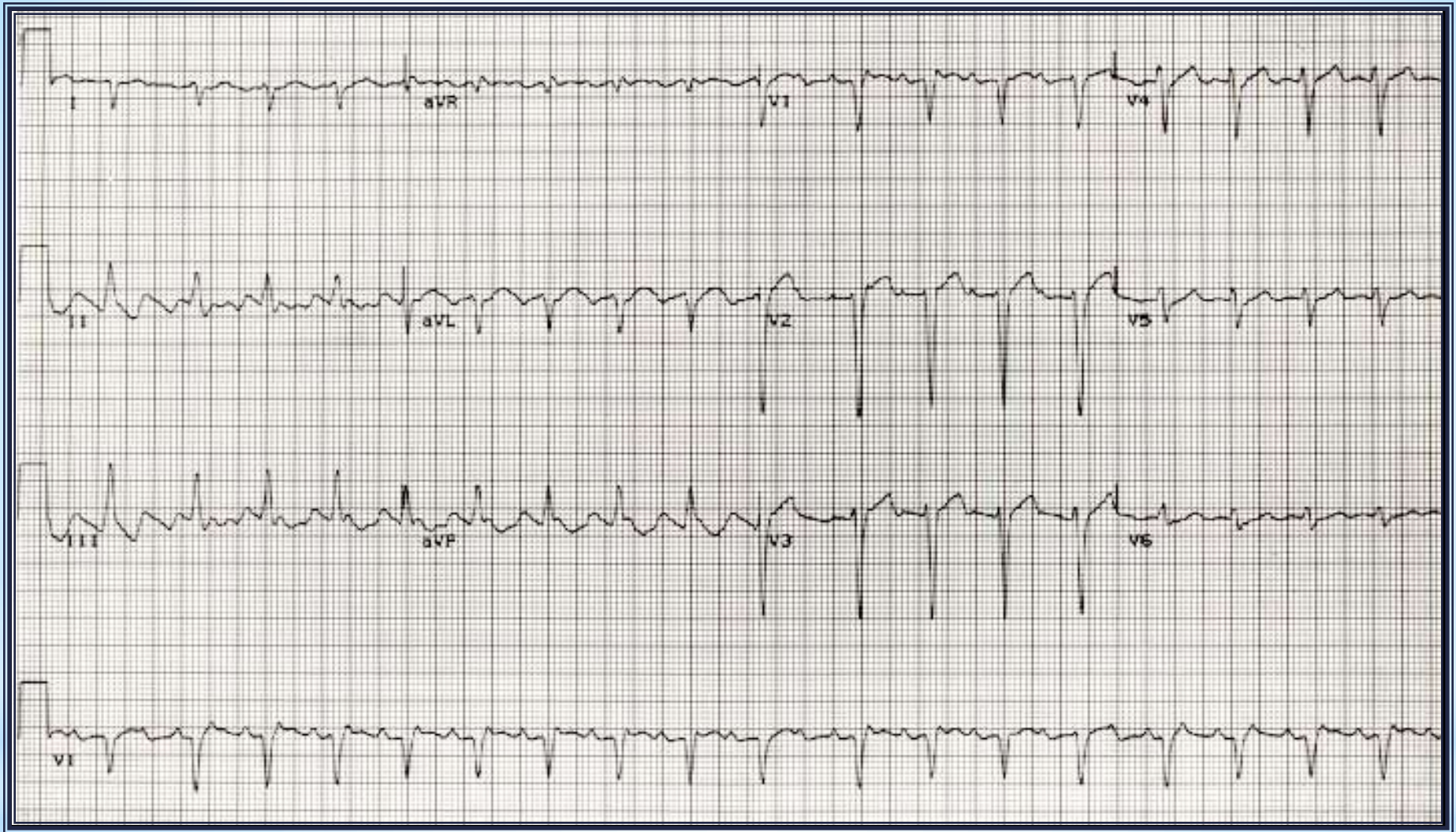
AXIS 1



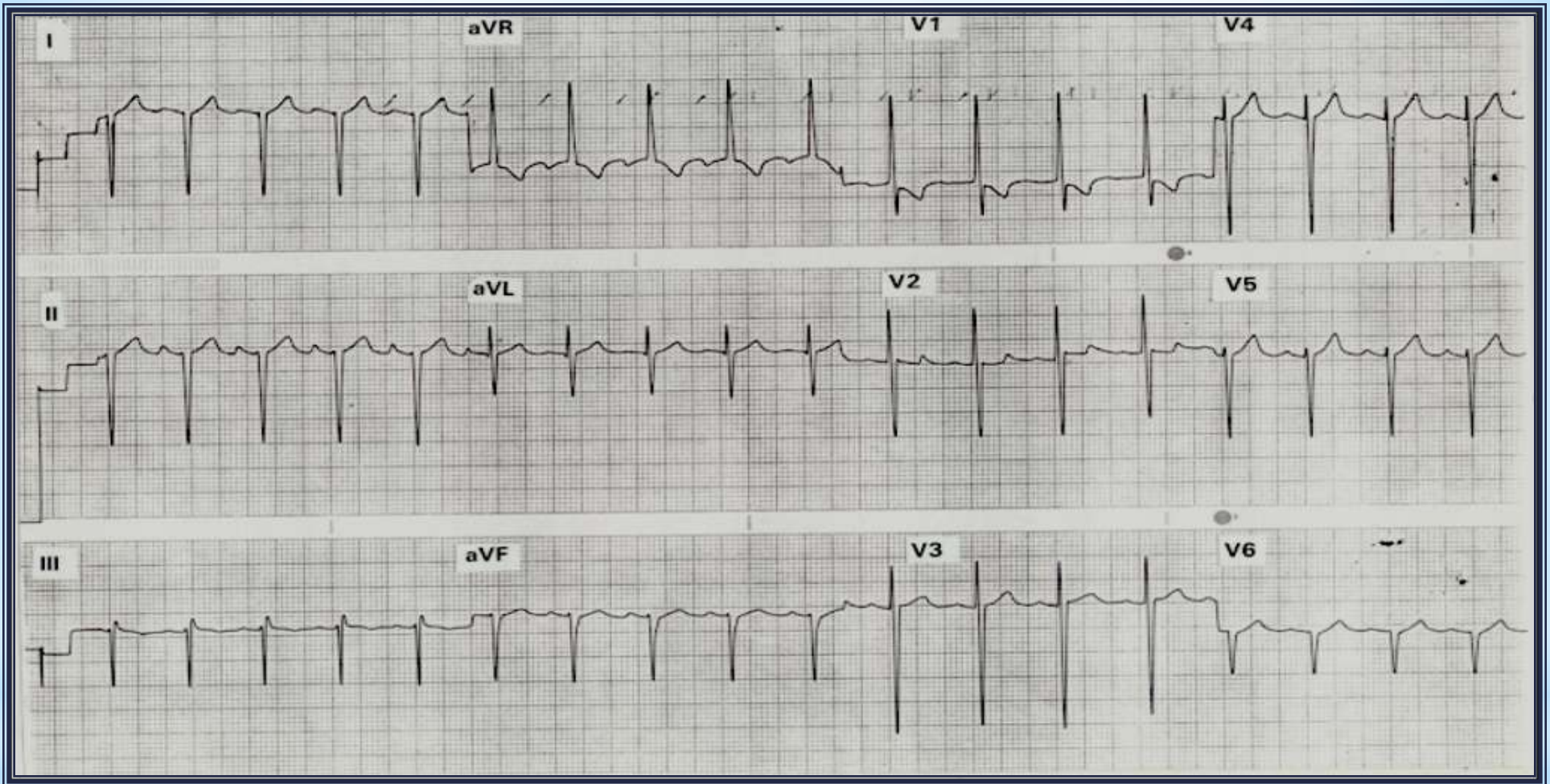
AXIS 2



AXIS 3



AXIS 4

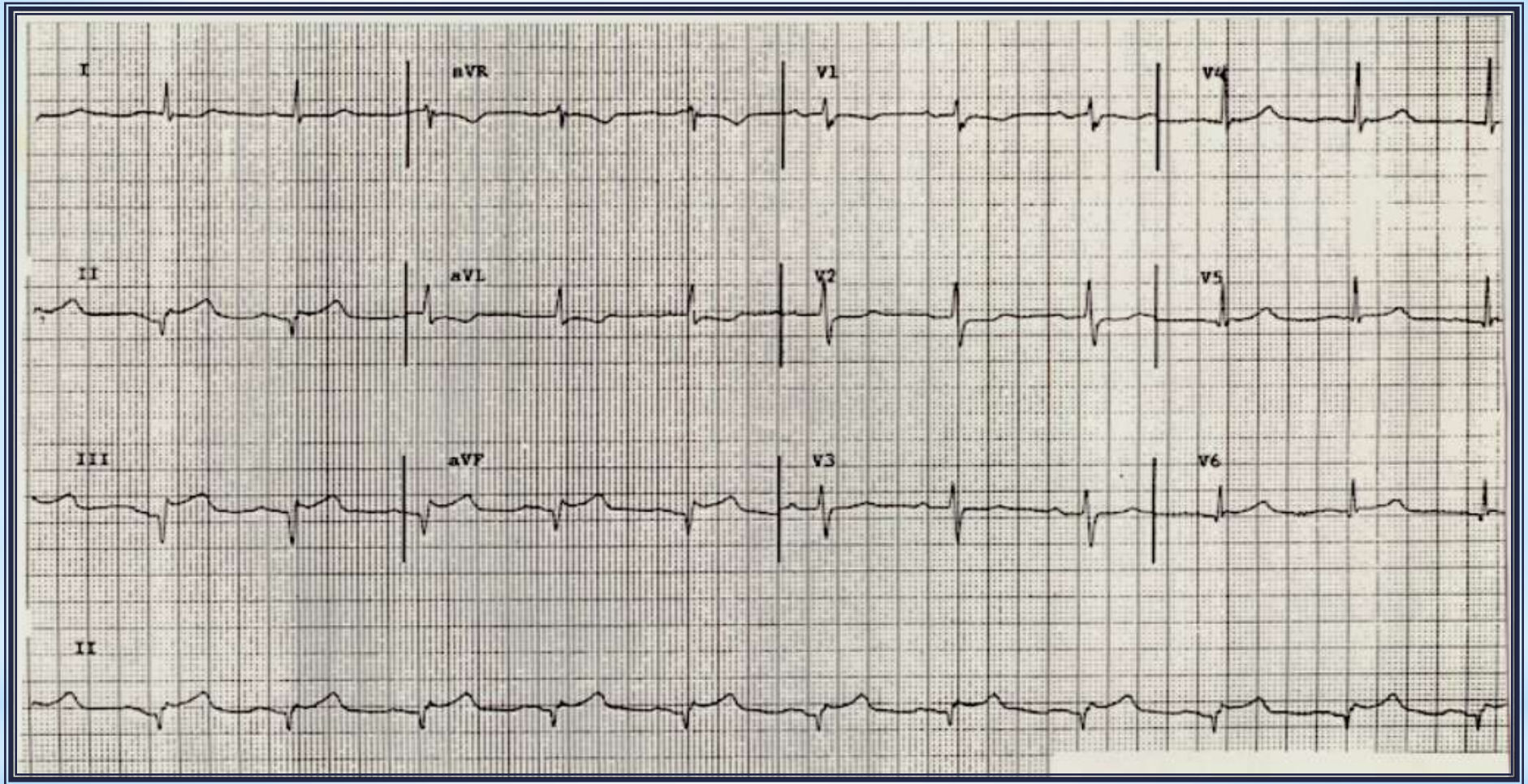


AXIS 5

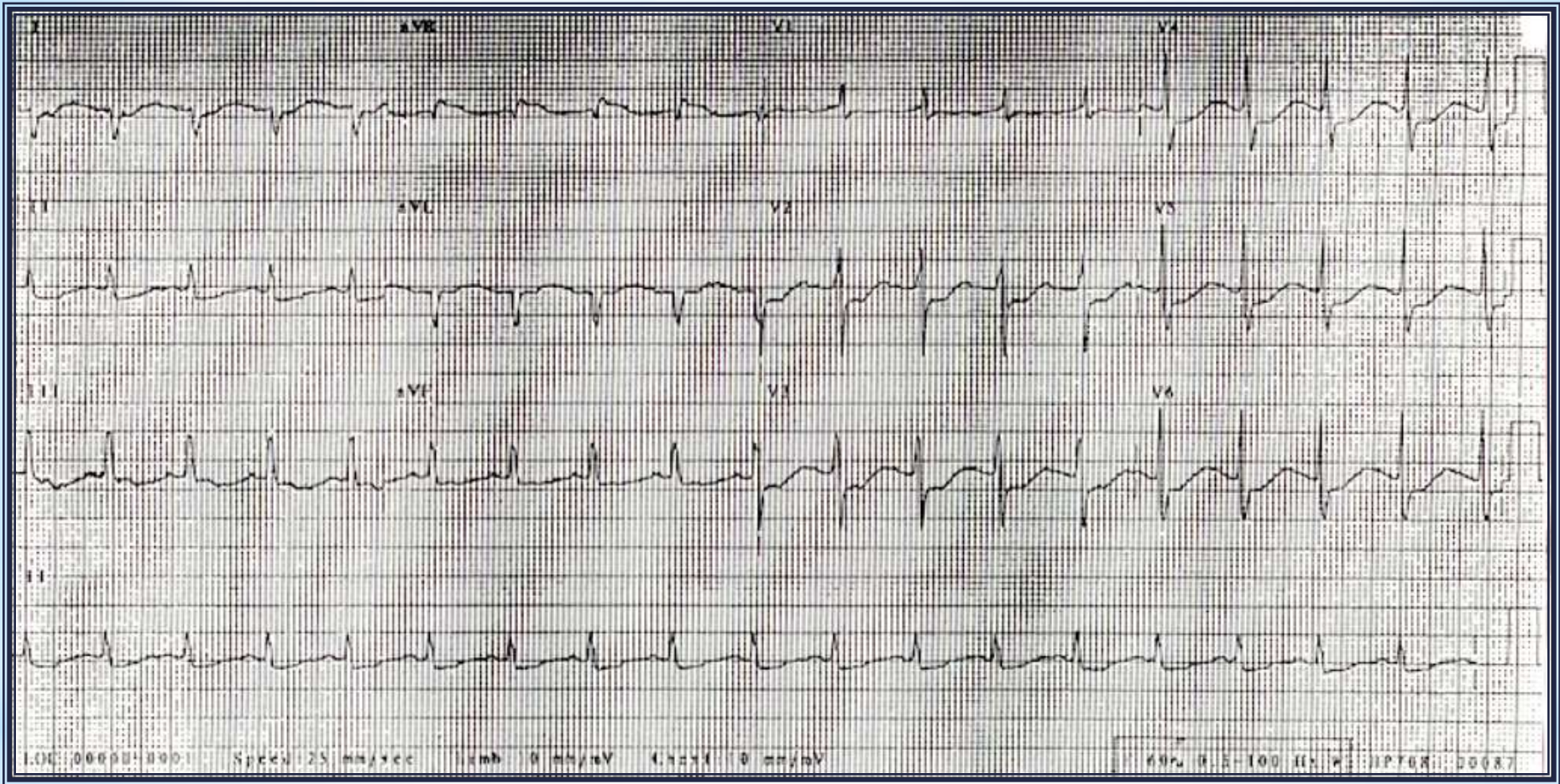


DEXTROCARDIA

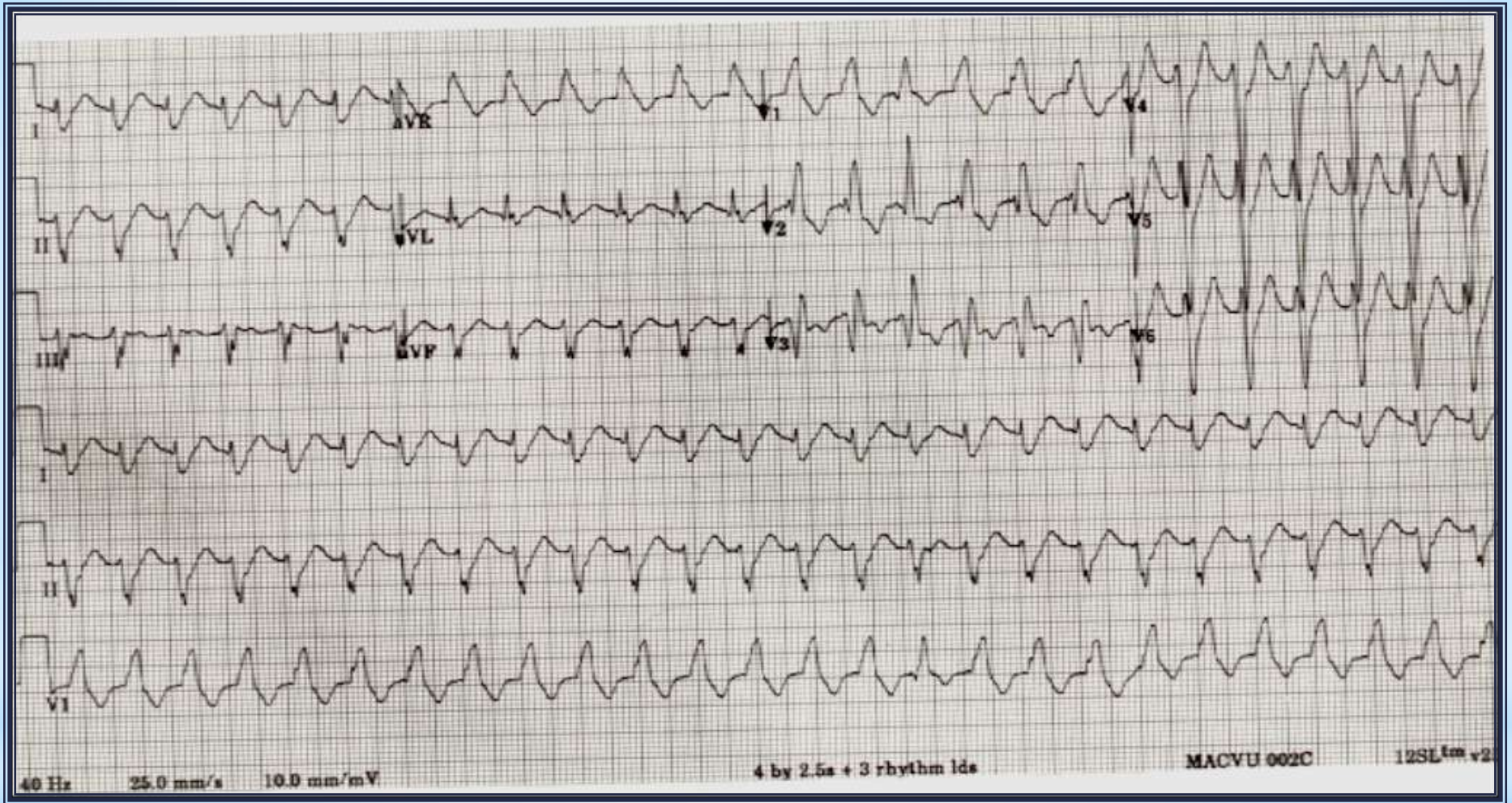
2/15/2012



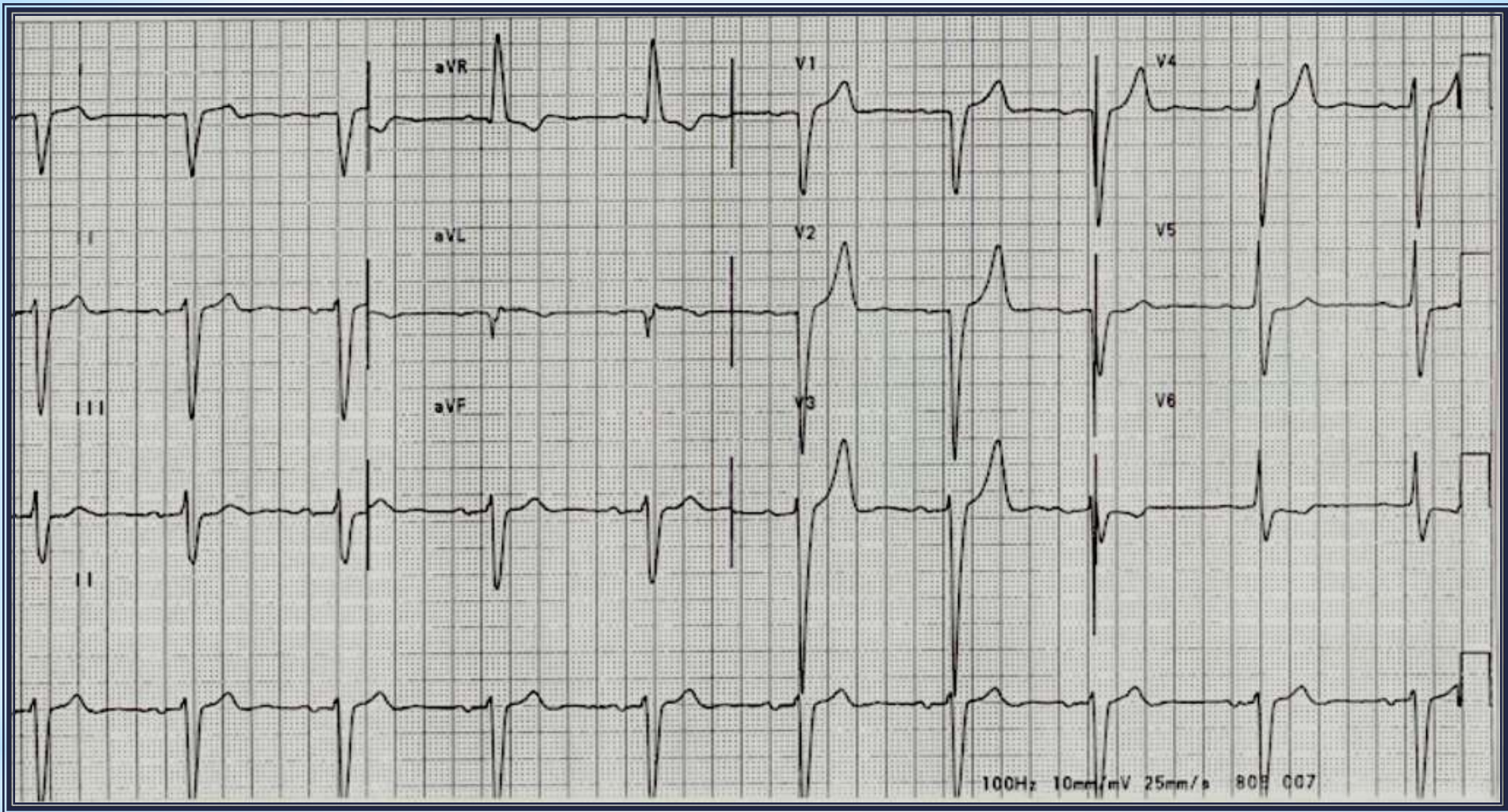
AXIS 6



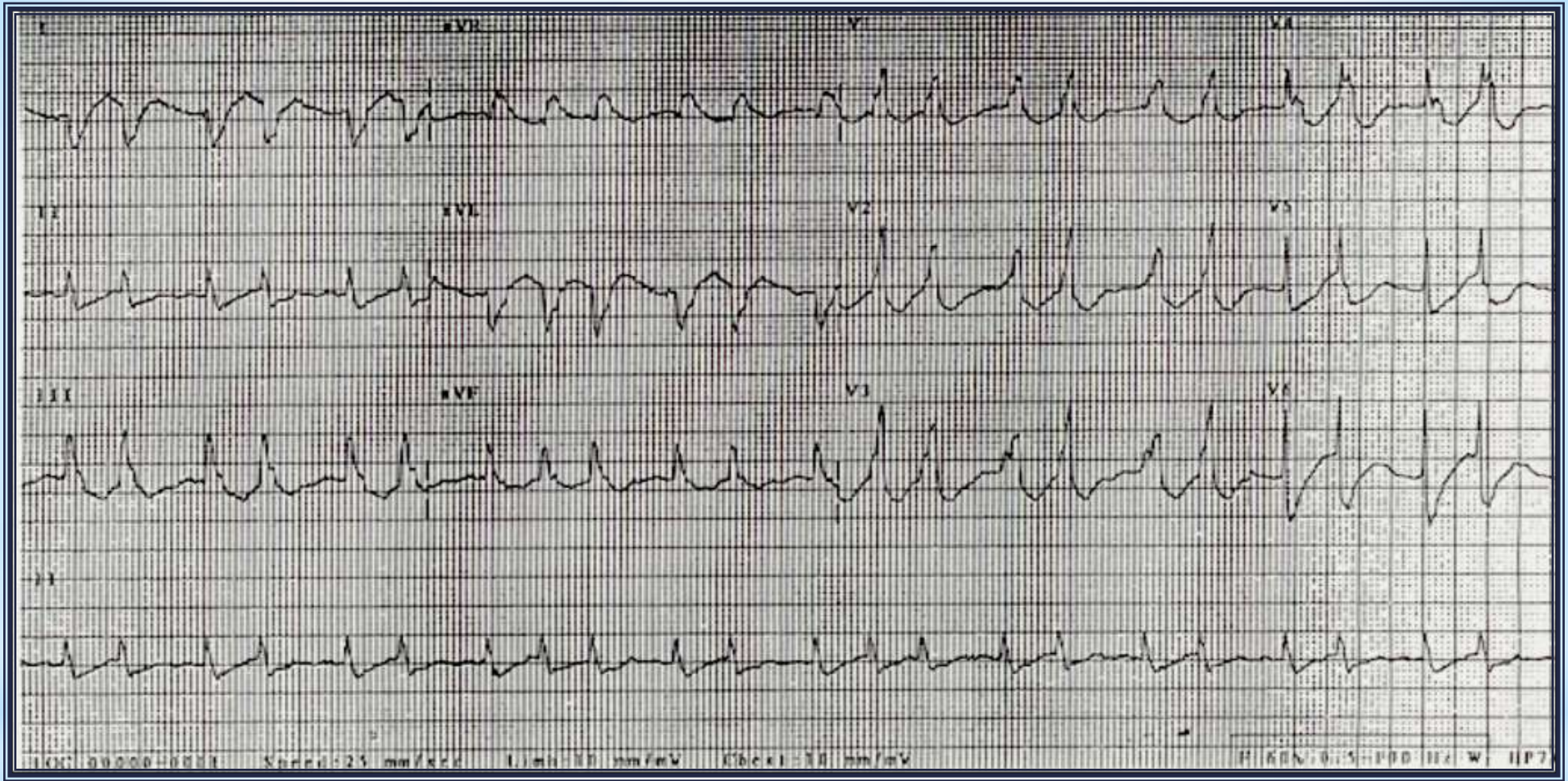
AXIS 7



AXIS 8



AXIS 9



AXIS 10

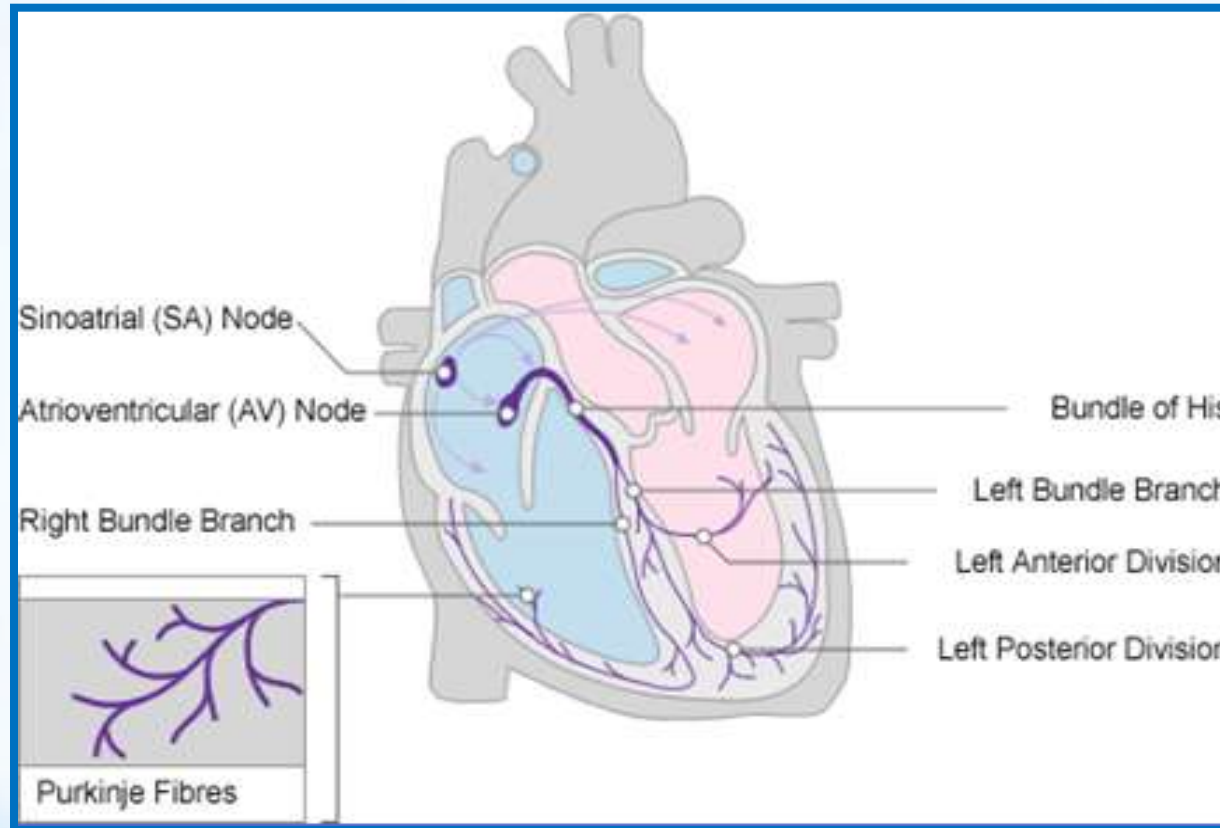
“ IF ONE OF THE BRANCHES OF THE BUNDLE OF HIS IS BLOCKED, THE IMPULSE TRAVELS DOWN TO THE OTHER VENTRICLE FIRST. HAVING ACTIVATED THIS VENTICLE, THE IMPULSE SPREADS THROUGH THE SEPTUM TO THE OTHER VENTRICLE AND ACTIVATES THAT LAST”

* *QRS*

LBBB .12 \geq

RBBB .11 \geq

BUNDLE BRANCH BLOCKS



BUNDLE BRANCH BLOCKS

Ischemic Heart Disease

STEMI

HTN

Cardiomyopathy

Aortic Stenosis

Acute Heart Failure

Hyperkalemia

Tumors

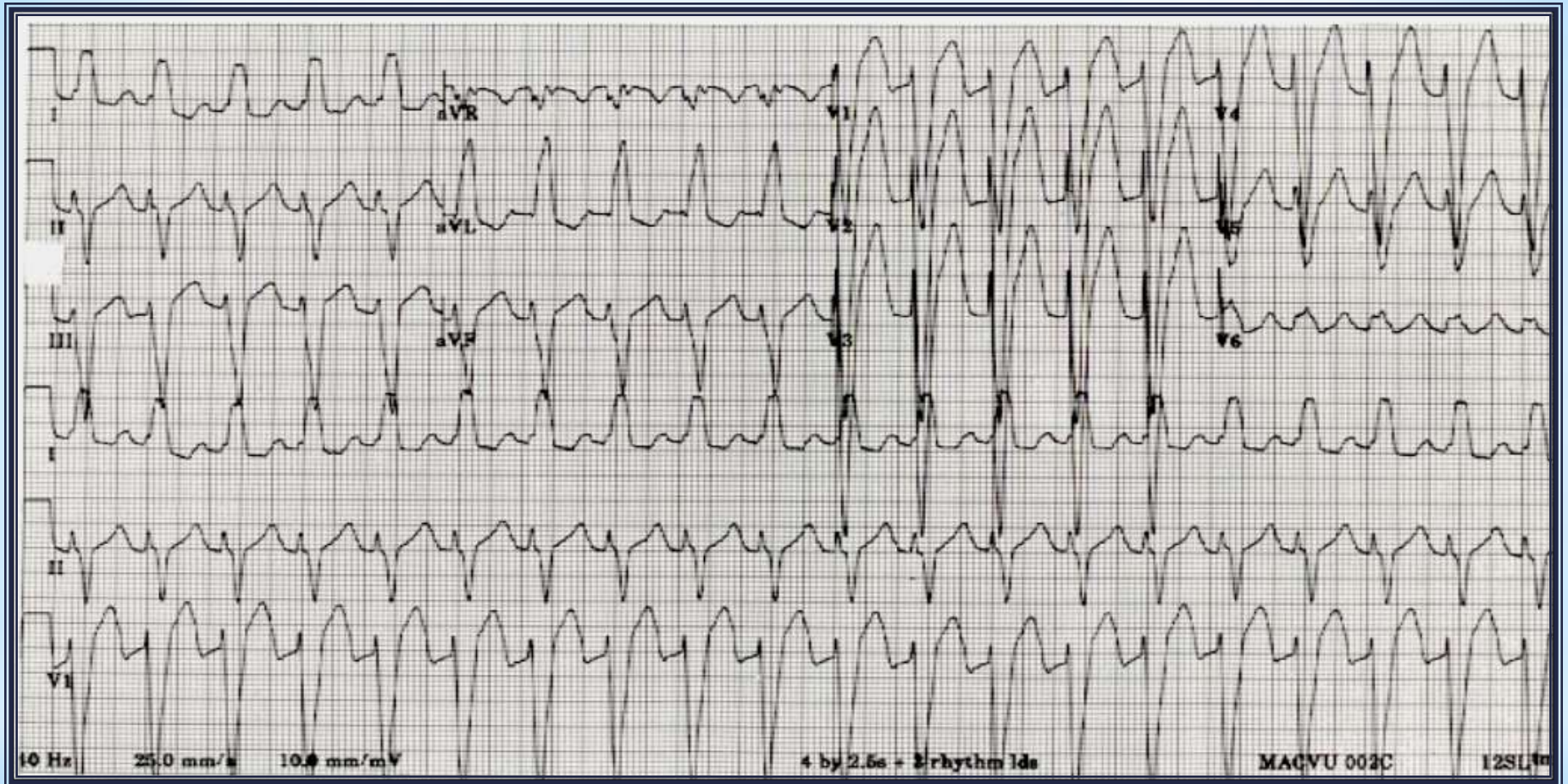
Trauma

Syphilis

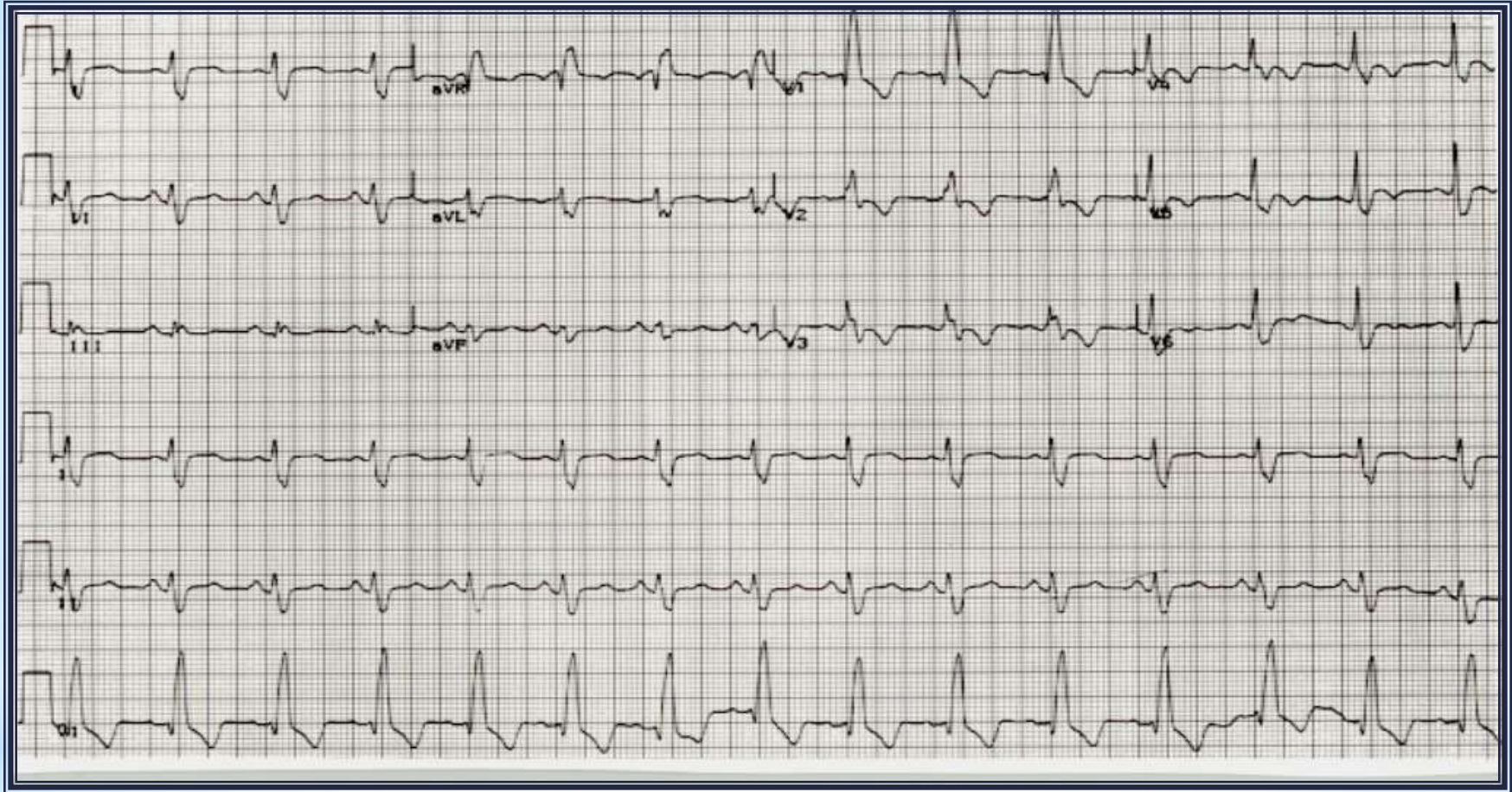
Acute Infections

Exotic Diseases

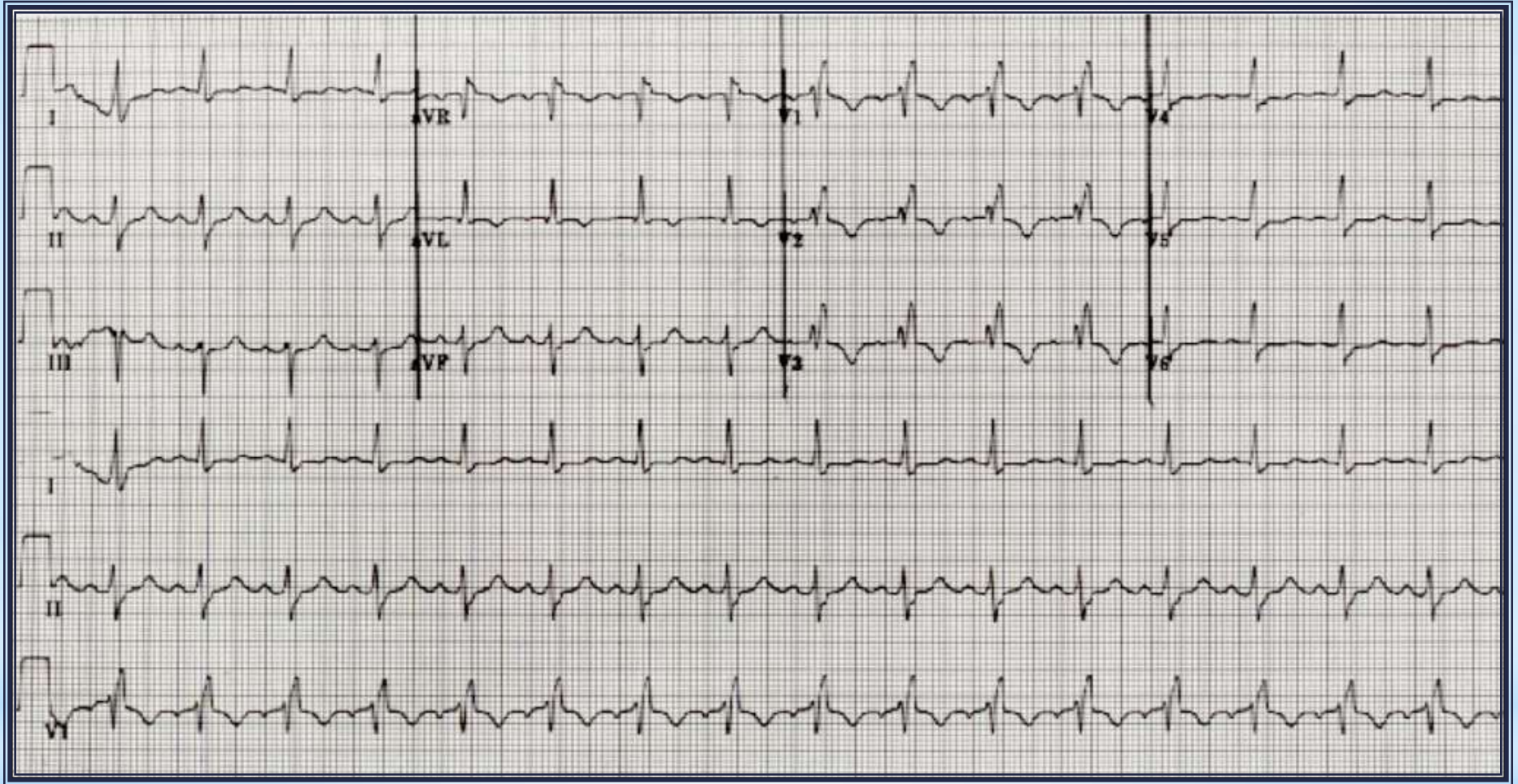
CAUSES OF BBB



LBBB # 2



RBBB # 1



RBBB # 2

2/15/2012

- **ABNORMALITY IN THE ANTERIOR OR POSTERIOR DIVISION OF THE LEFT BUNDLE BRANCHES**
- **ANTERIOR DIVISION IS LONGER, THINNER & LIES ANTERIOR (Single Blood Supply)**
- **POSTERIOR DIVISION IS SHORTER, THICKER & LIES POSTERIOR (Double Blood Supply)**

HEMIBLOCKS

* Right Bundle Branch Block

W/

LAH or LPH

* Suspect w/

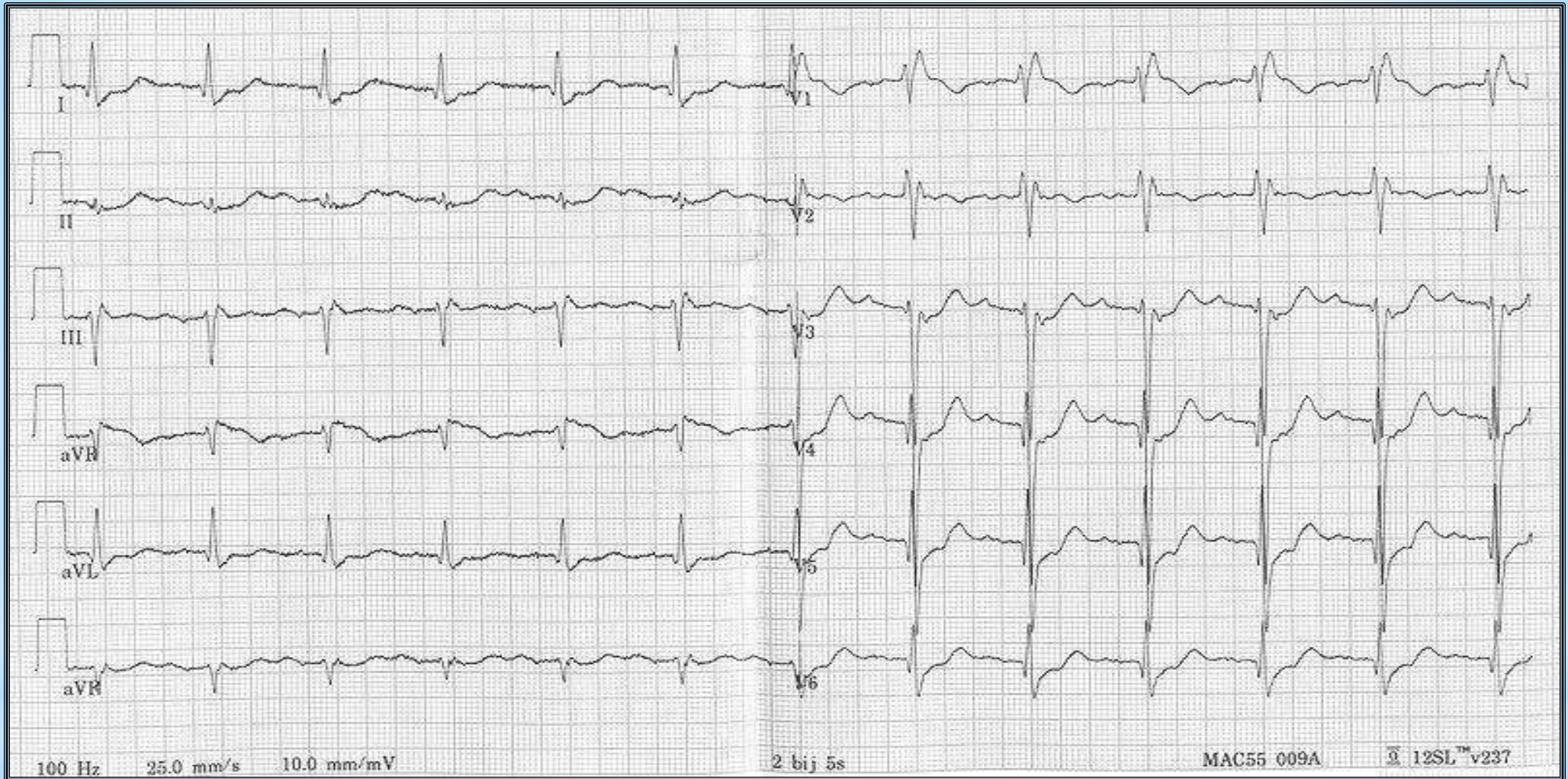
RBBB w/**LAD**

= Bifascicular Block Anterior

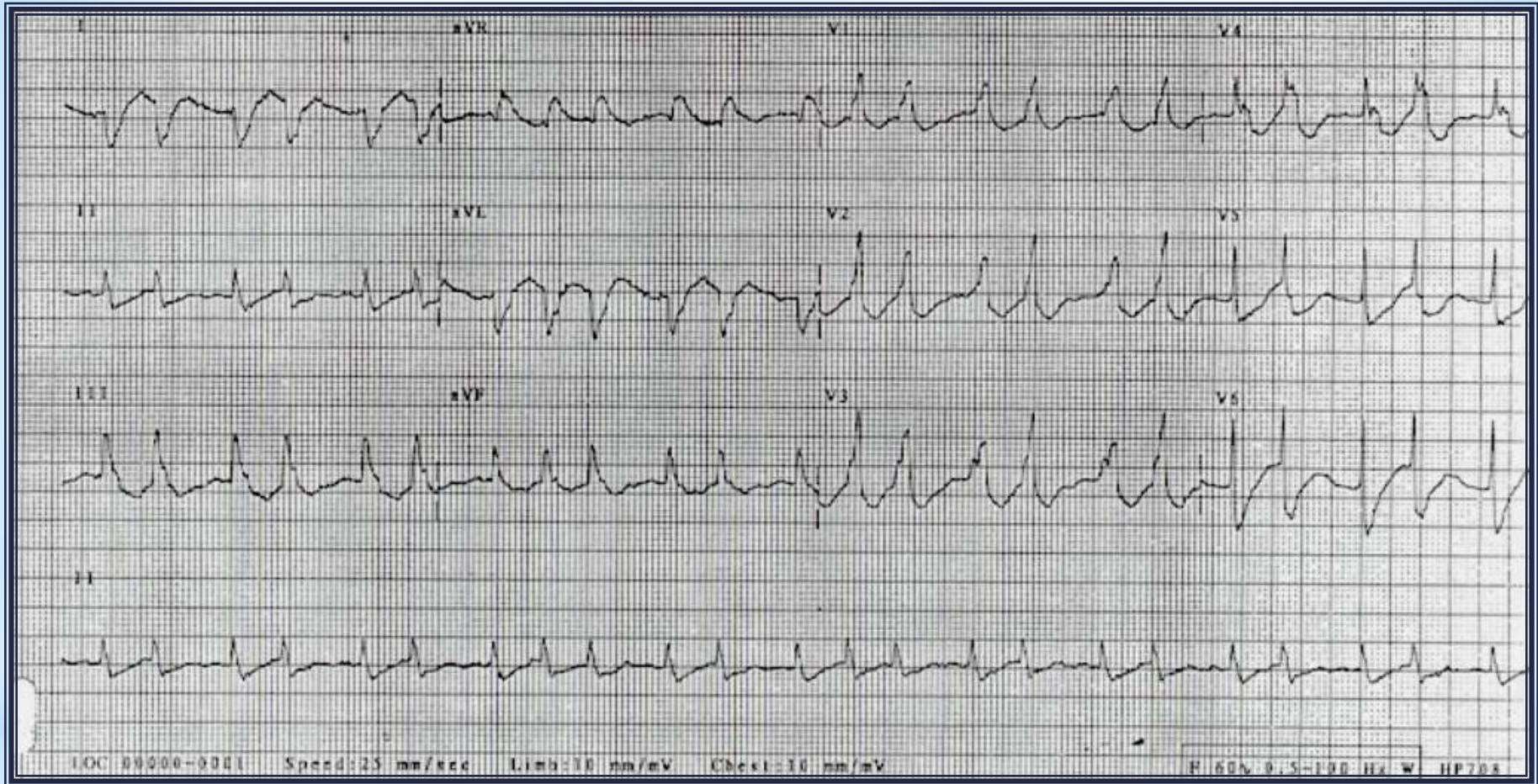
RBBB w/**RAD**

= Bifascicular Block Posterior

BI-FASCICULAR BLOCK



BI-FASCICULAR ANTERIOR



BI-FASCICULAR POSTERIOR

➤ 1ST Degree AV Block with BBB

➤ All Types of Second Degree AV Block

➤ Bifasicular Blocks

➤ Posterior

➤ Medications to Use With Caution:

- ANTI ARRHYTHMICS

- *ATROPINE*

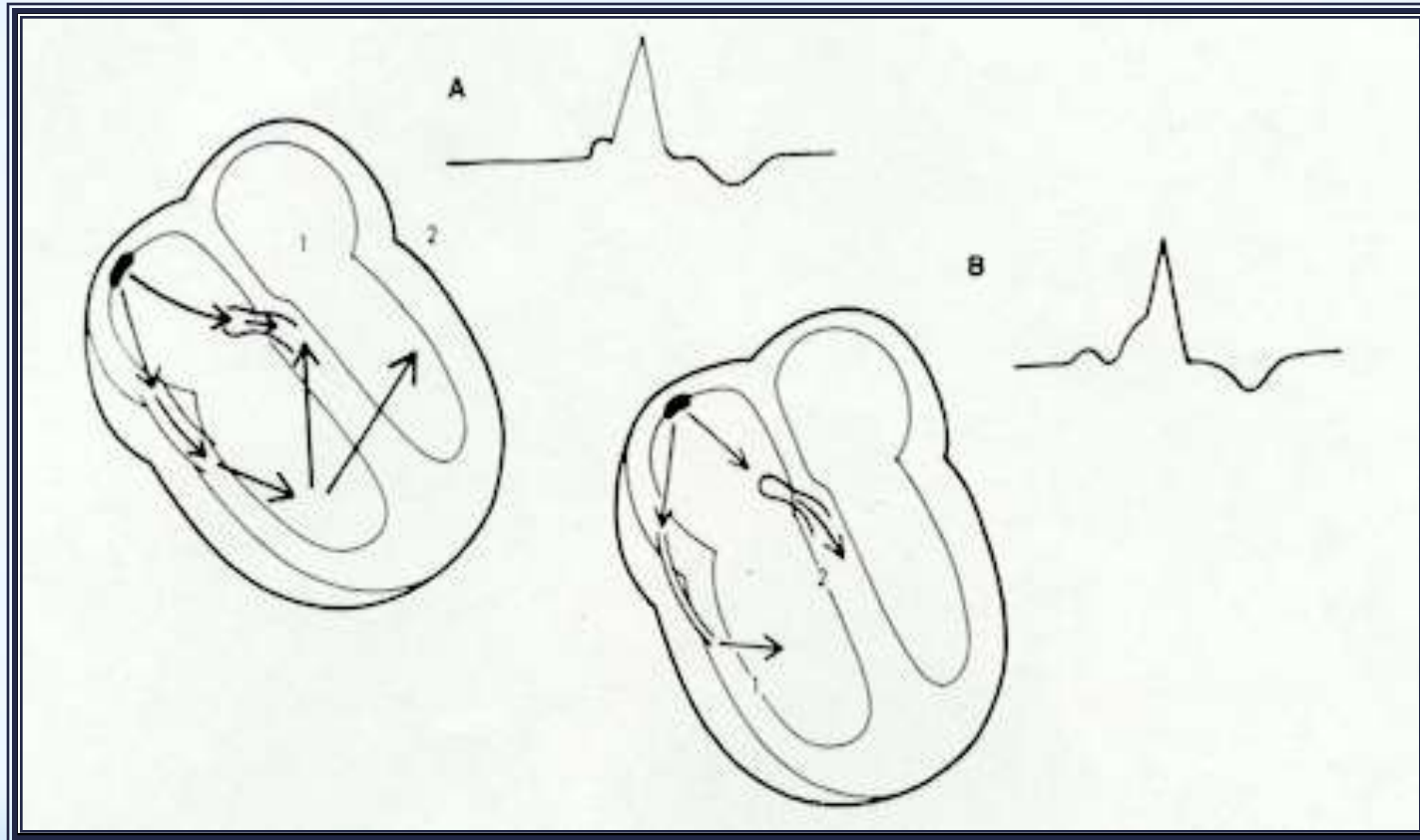
- *MORPHINE*

PRE CURSERS TO COMPLETE HEART BLOCK

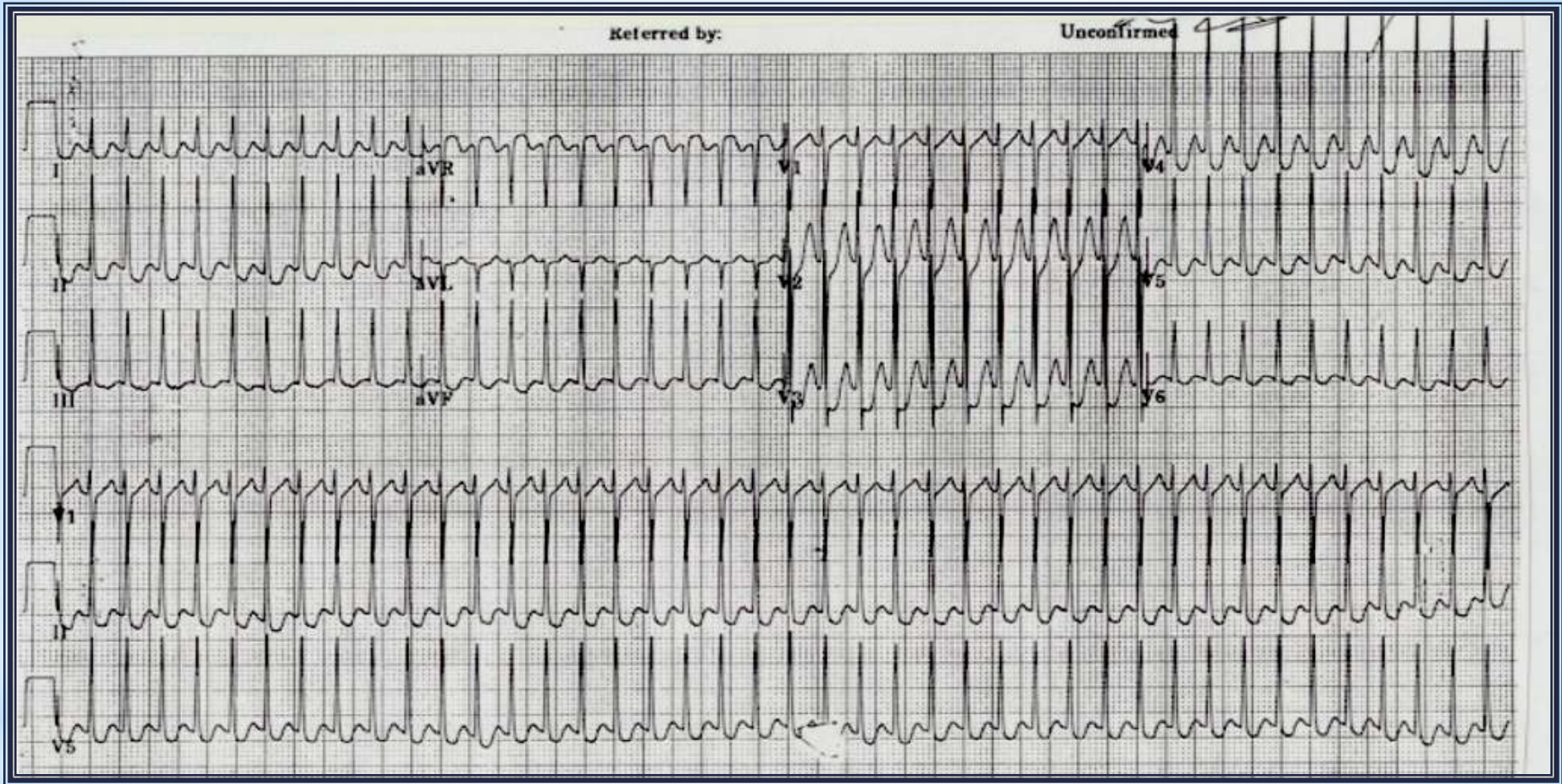
Pre Excitation Syndrome Uses Accessory Pathways SVT and Hypotension

- * Short P-R Interval
- * Widened QRS / *Delta Wave*
- * ST-T Changes

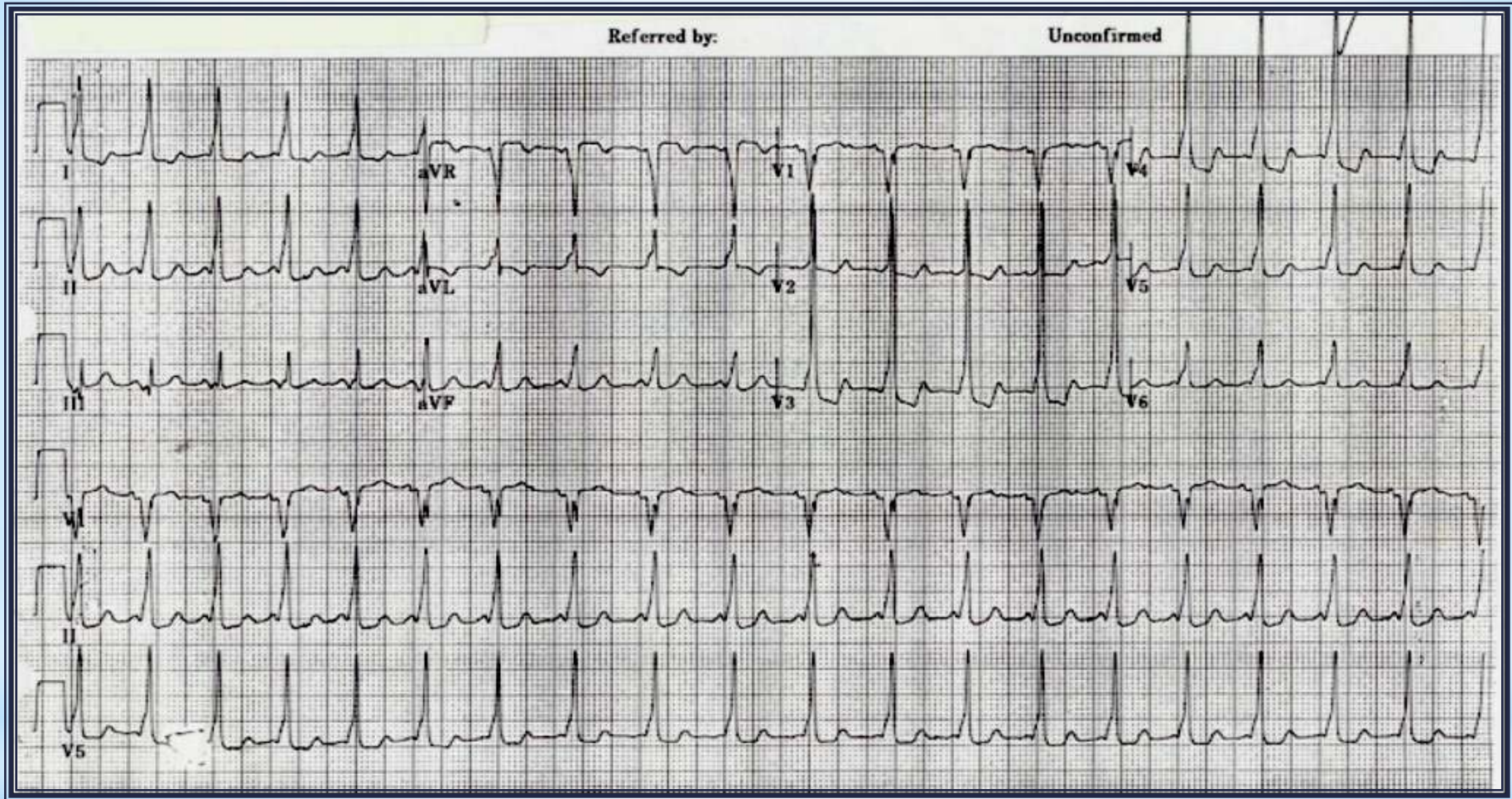
WPW SYNDROME



WPW PATHWAYS



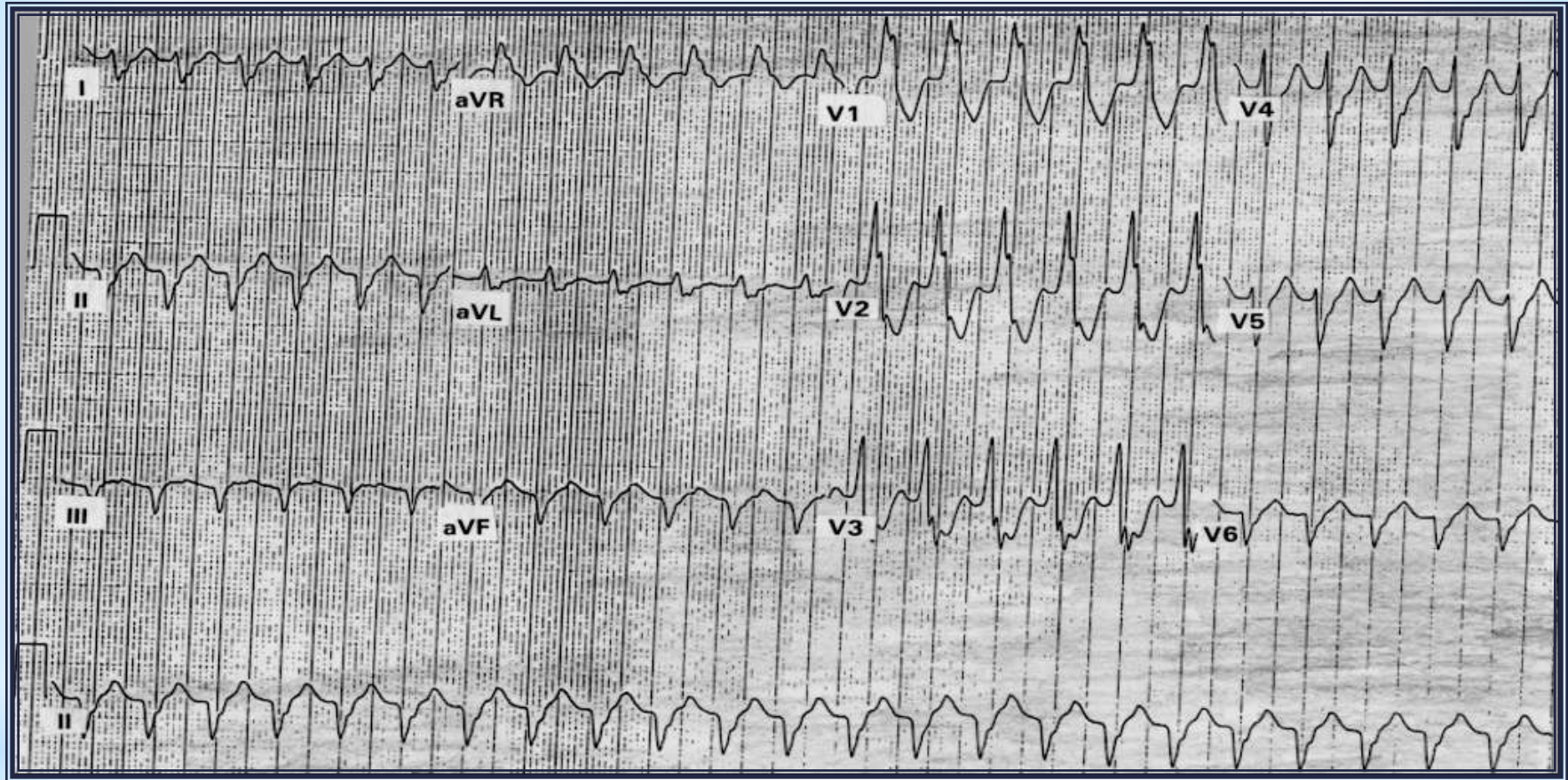
WPW SYNDROME



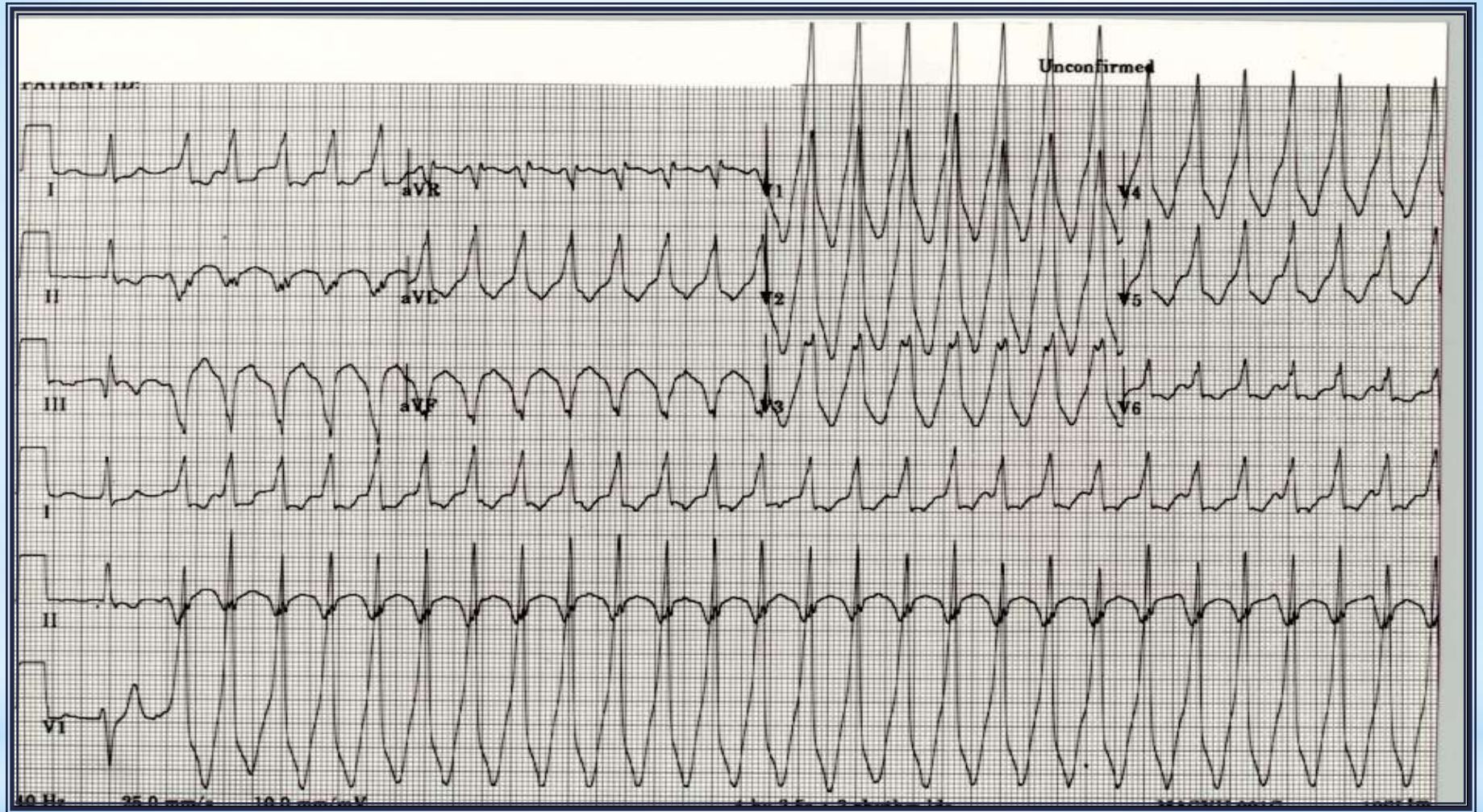
WPW SYNDROME

- * > .14 Seconds
- * V1 Clues
- * Concordance in V Leads
- * Extreme Right Axis
- * HX of AMI

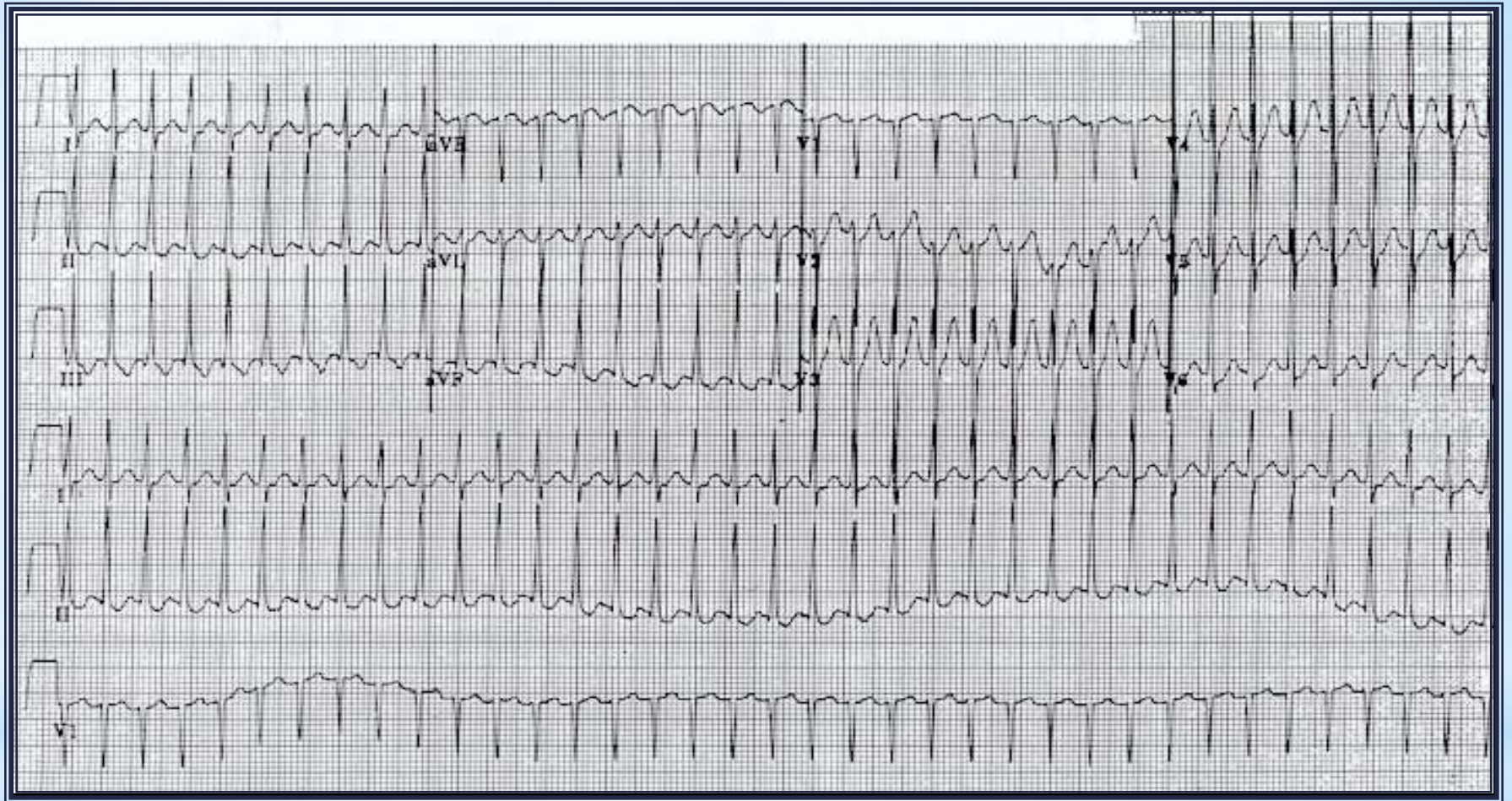
WHY V - TACH ?



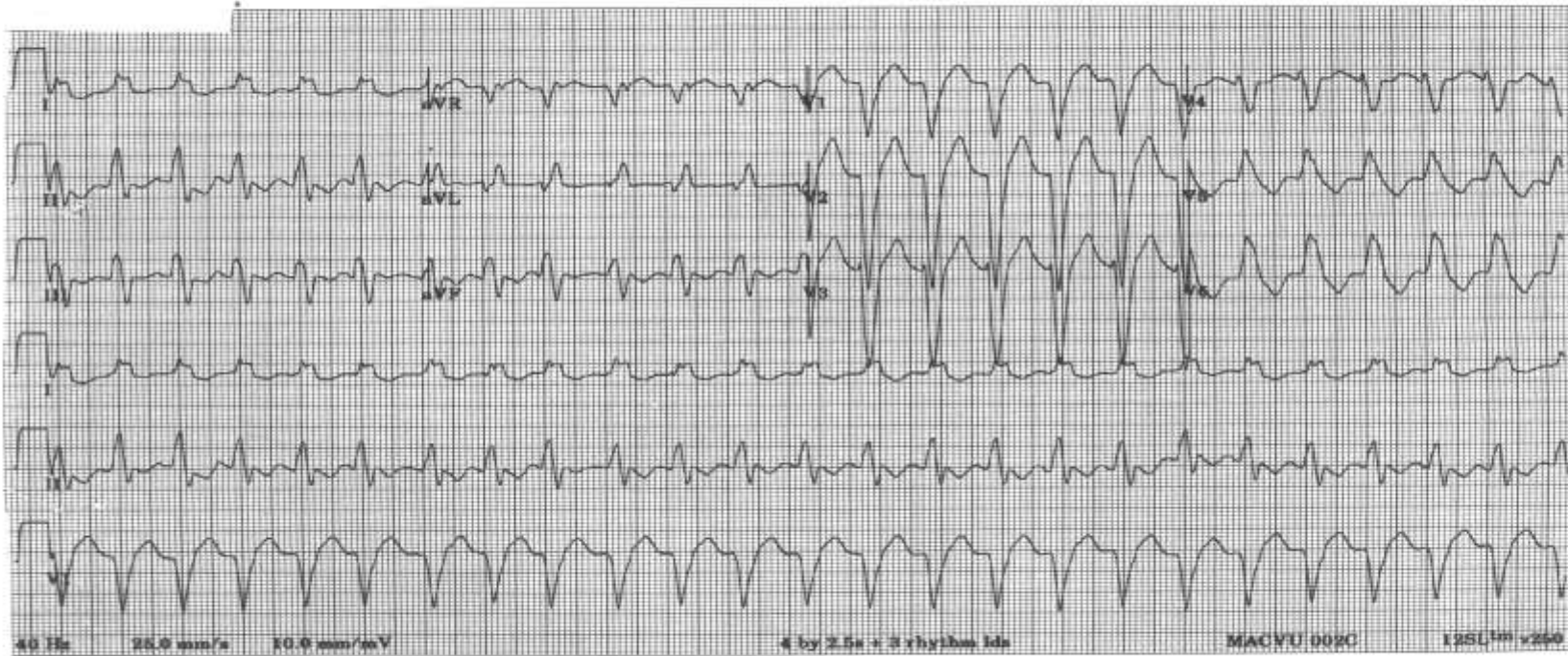
V-TACH - 1



V-TACH - 2



SVT



WIDE TACH ?

ADVANCED ECG Workshops

2/15/2012

WORKSHOP 1

2/15/2012

Name:

ID:

Incident:

Age: 48

112593223988

Sex:

12-Lead 1

25 Nov 99

PR 0.142s

QT/QTc

P-QRS-T Axes

aVR

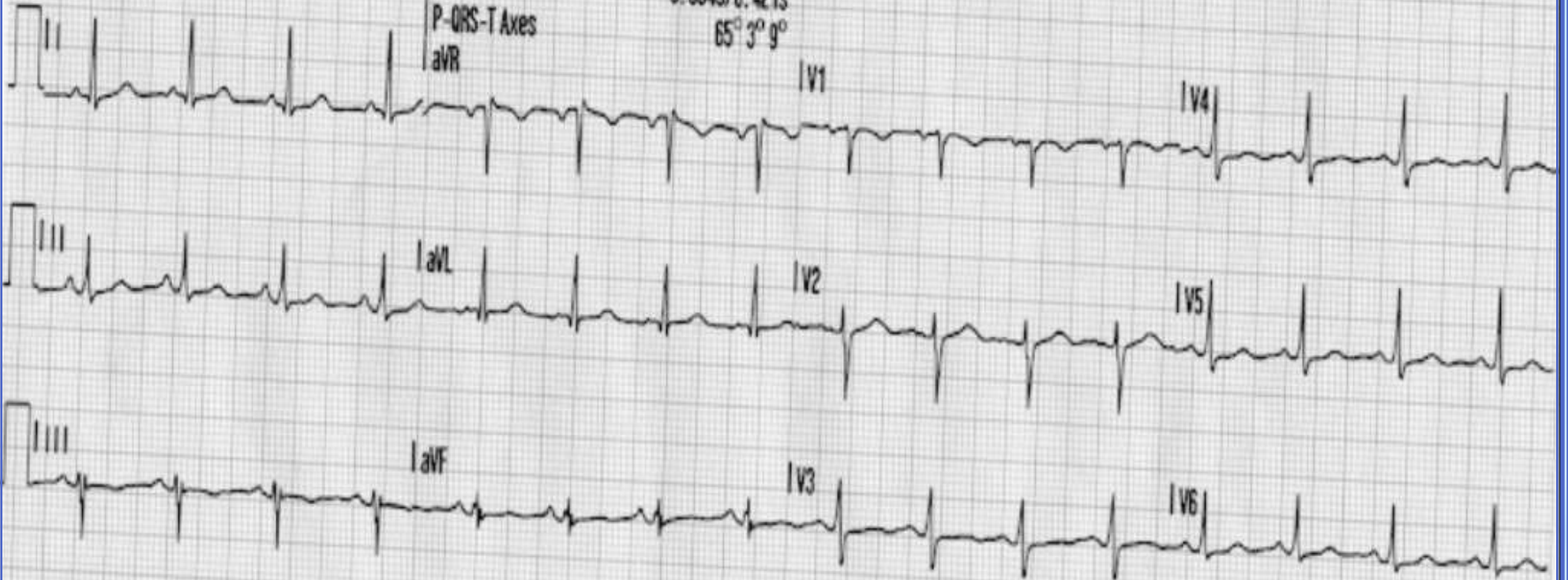
HR 96 bpm

22:44:25

QRS 0.084s

0.334s/0.421s

65° 3° 9°



1.0 .05-150Hz 25mm/sec

5319

RESCUE 44 NO LAUDER FR 3811371-822 2804KR04G4687R LP128475643

* Ecg 1

2/15/2012

Name:

12-Lead 1

ID: 811100115244

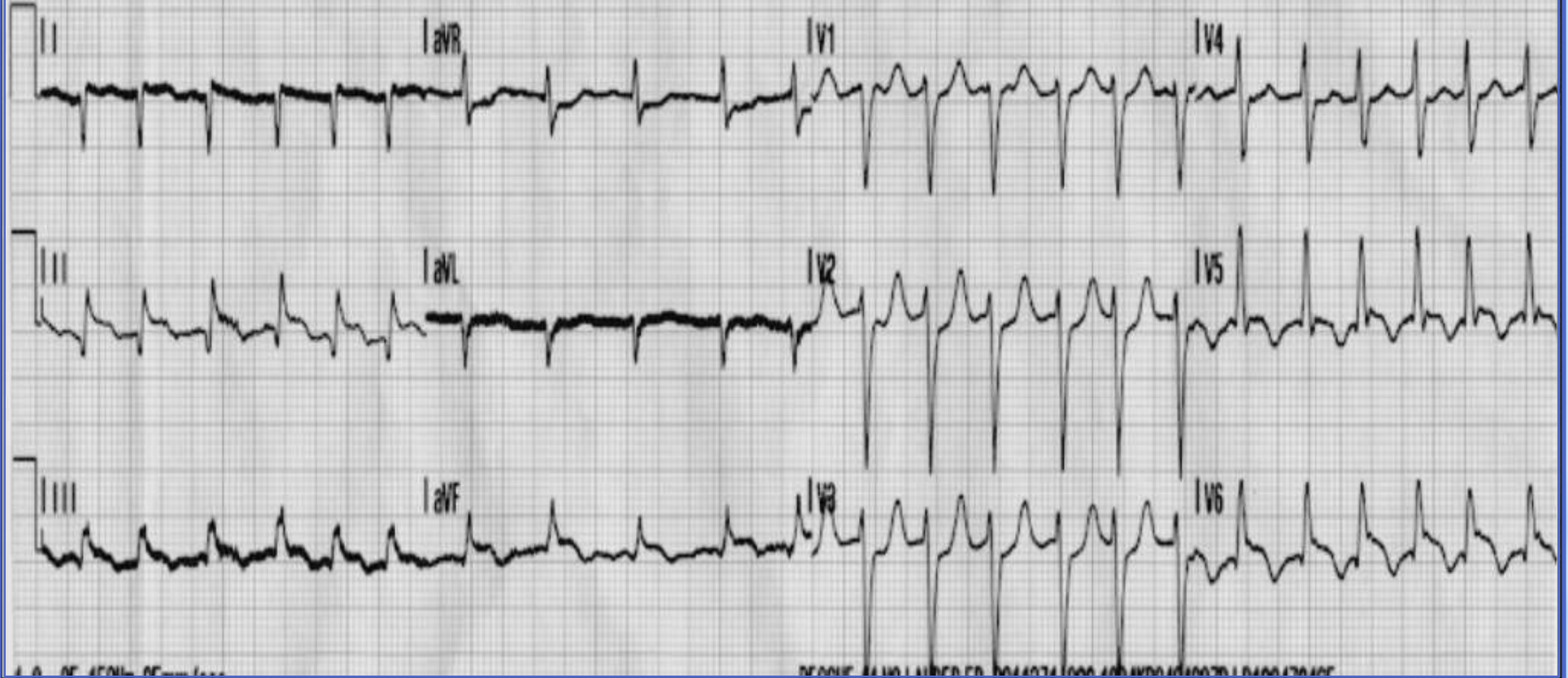
11 Jan 00

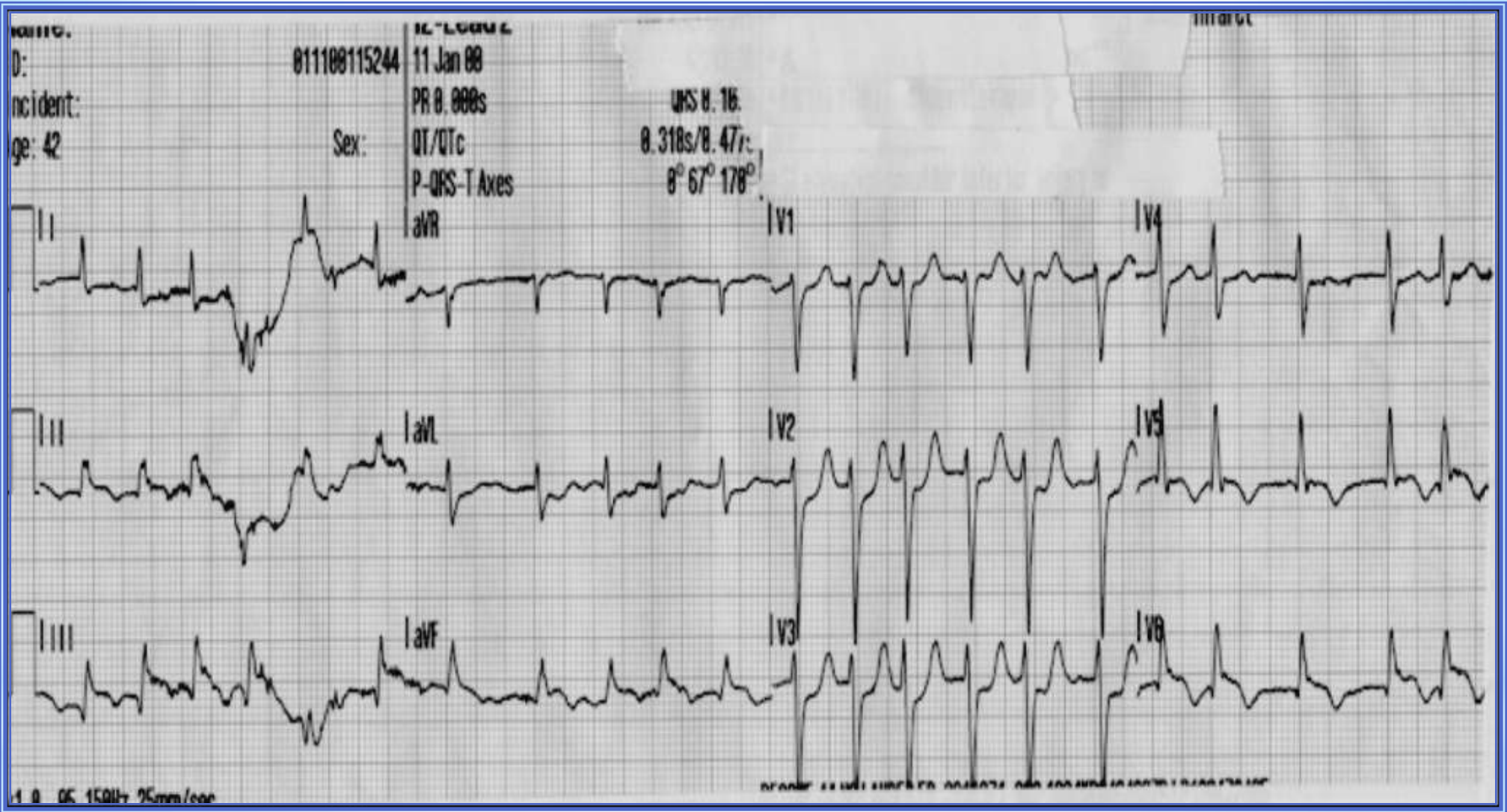
12:04:39 Interpretation

Incident:

Age: 42

Sex:





Name:

ID:

Incident:

Age: 62

080899283226

Sex:

12-Lead 1

08 Aug 99

PR 0.118s

QT/QTc

P-QRS-T Axes

aVR

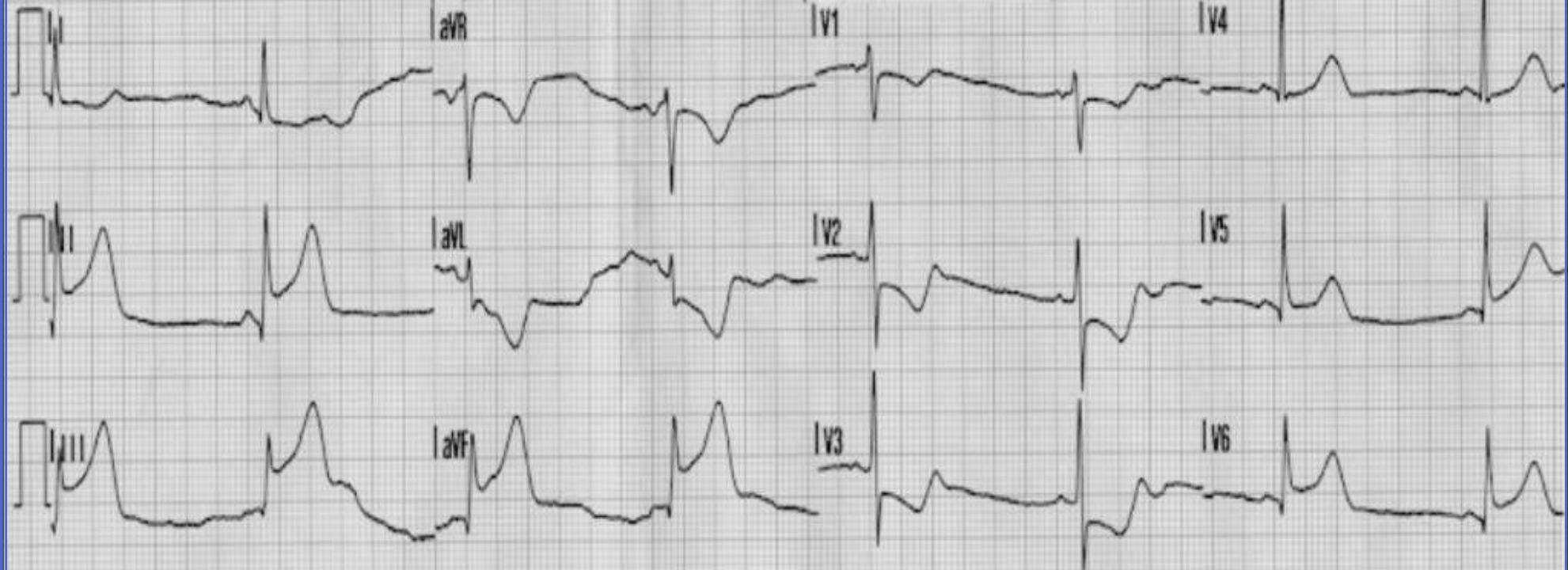
HR 45 bpm

28:37:07

QRS 0.084s

0.492s/0.425s

37° 62° 94°



x1.0 .05-150Hz 25mm/sec

RESCUE 44 MD LAUDER FR 3811371-822 1004KR04G4G07R LP129472465

Name:

12-Lead 2

HR 64 bpm

ID:

121200070400

12 Dec 00

07:25:06

Incident:

PR 0.160s

QRS 0.084s

Age: 48

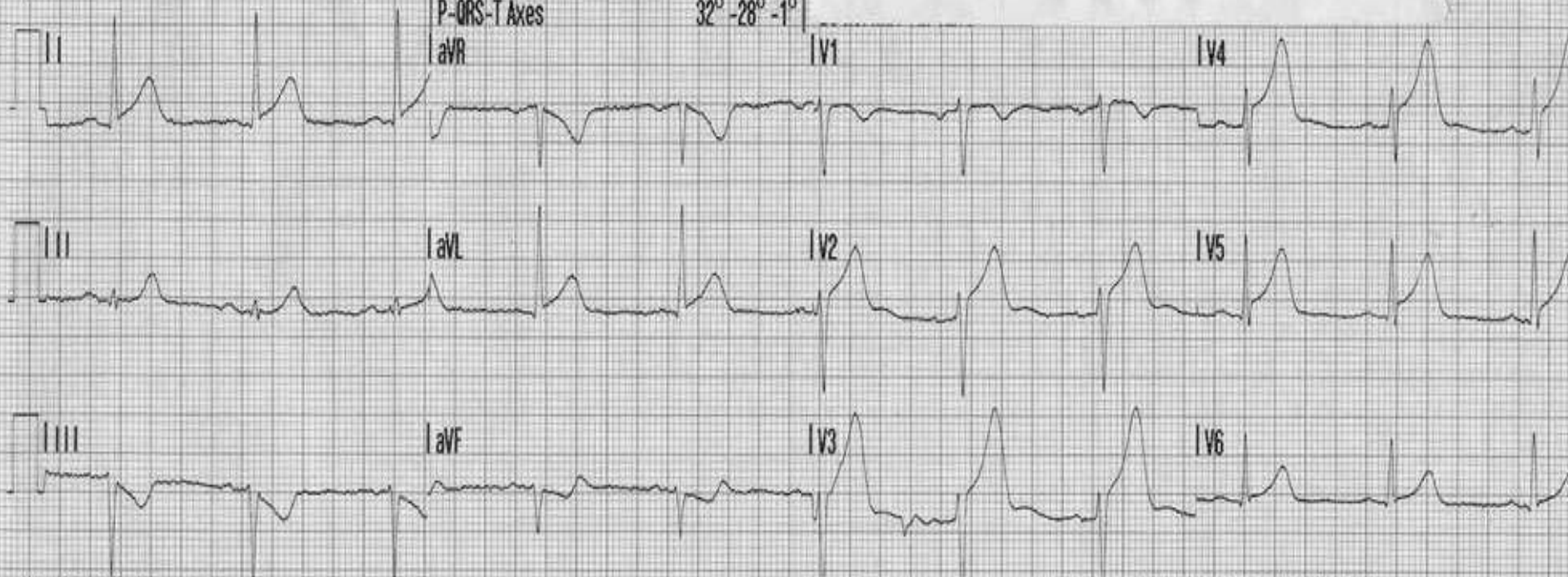
Sex:

QT/QTc

0.392s/0.404s

P-QRS-T Axes

32° -28° -1°



x1.0 .05-40Hz 25mm/sec

NY 44 NLS

011371-070 10S4KR0KGJSP7R LP1212209821

Name:

ID:

Incident:

Age: 85

111799165388

Sex:

12-Lead 1

17 Nov 99

PR 0.182s

QT/QTc

P-QRS-T Axes

aVR

HR 98 bpm

17:01:40

QRS 0.134s

0.374s/0.477s

63° -54° 105°



Name:

ID:

Incident:

Age: 82

072000074827

12-Lead 2

20 Jul 00

PR 0.132s

Sex:

QT/QTc

P-QRS-T Axes

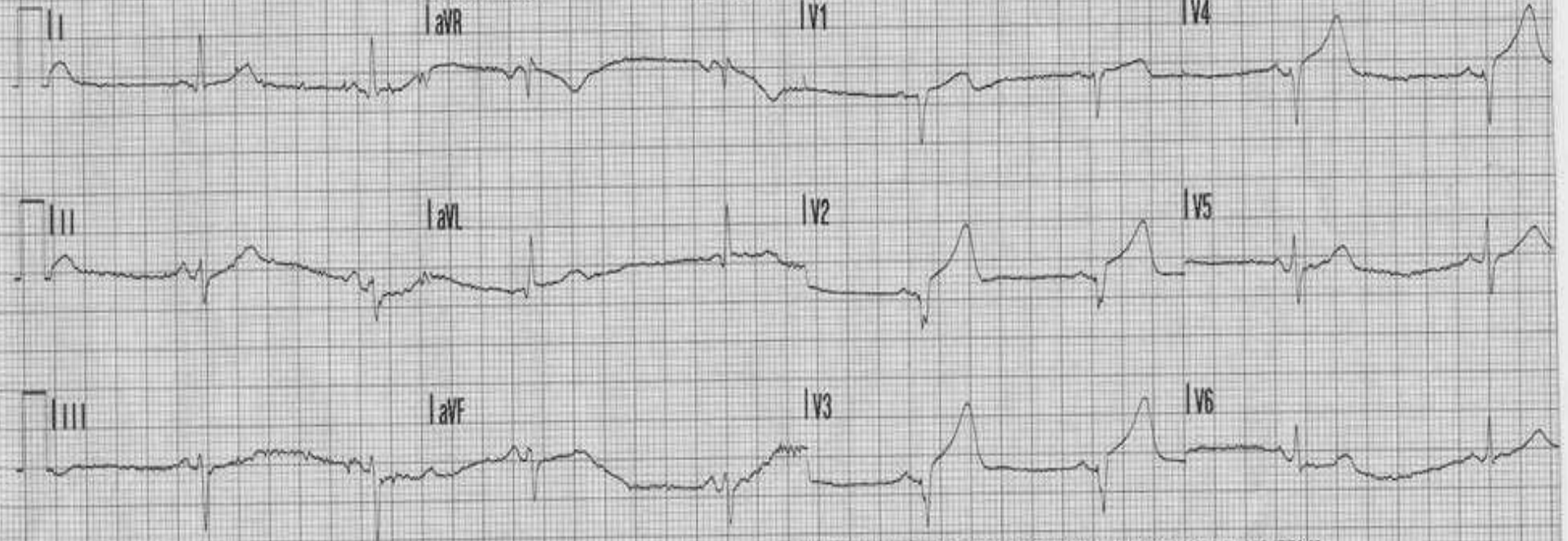
HR 49 bpm

07:55:00

QRS 0.090s

0.478s/0.431s

69° -33° 45°



x1.0 05-40Hz 25mm/sec

ENGINE 44 NN LAUDER FR 3811371-067 20G4KROKJG07R LP128475643

Name: | 12-Lead 1

ID: [REDACTED]

Patient ID: [REDACTED]

Incident: [REDACTED]

PR 0.196s

QRS 0.092s

QT/QTc

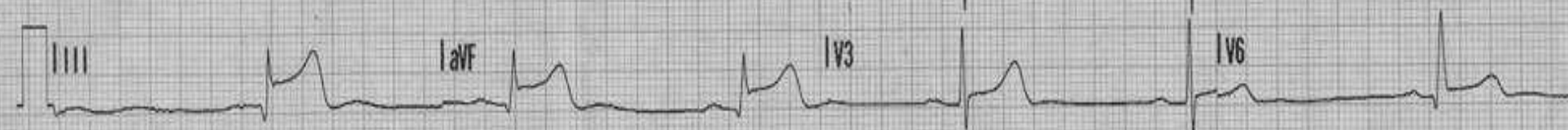
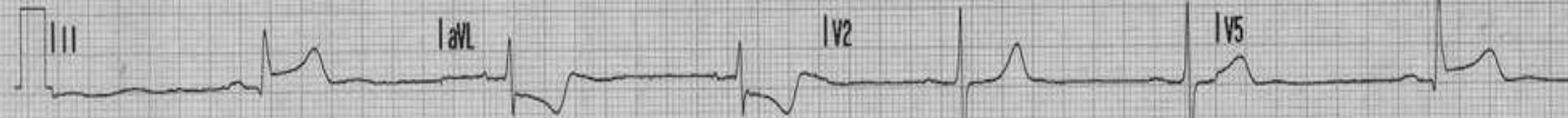
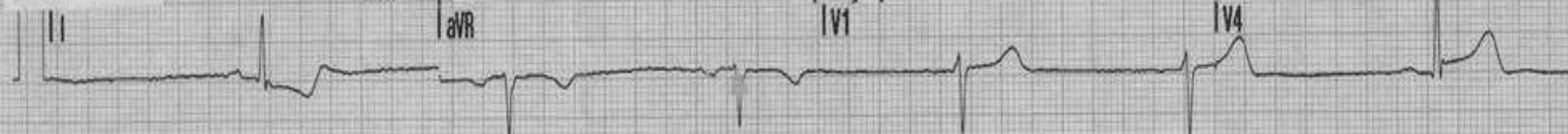
0.500s/0.402s

Sex: F

aVR

V1

V4



x1.0 0.05-40Hz 25mm/sec

MEDTRONIC PHYSIO-CONTROL

PN 805319

Name:

ID:

Incident:

Age: 88

112599854223

12-Lead 1

25 Nov 99

PR 0.080s

Sex:

QT/QTc

P-QRS-T Axes

aVR

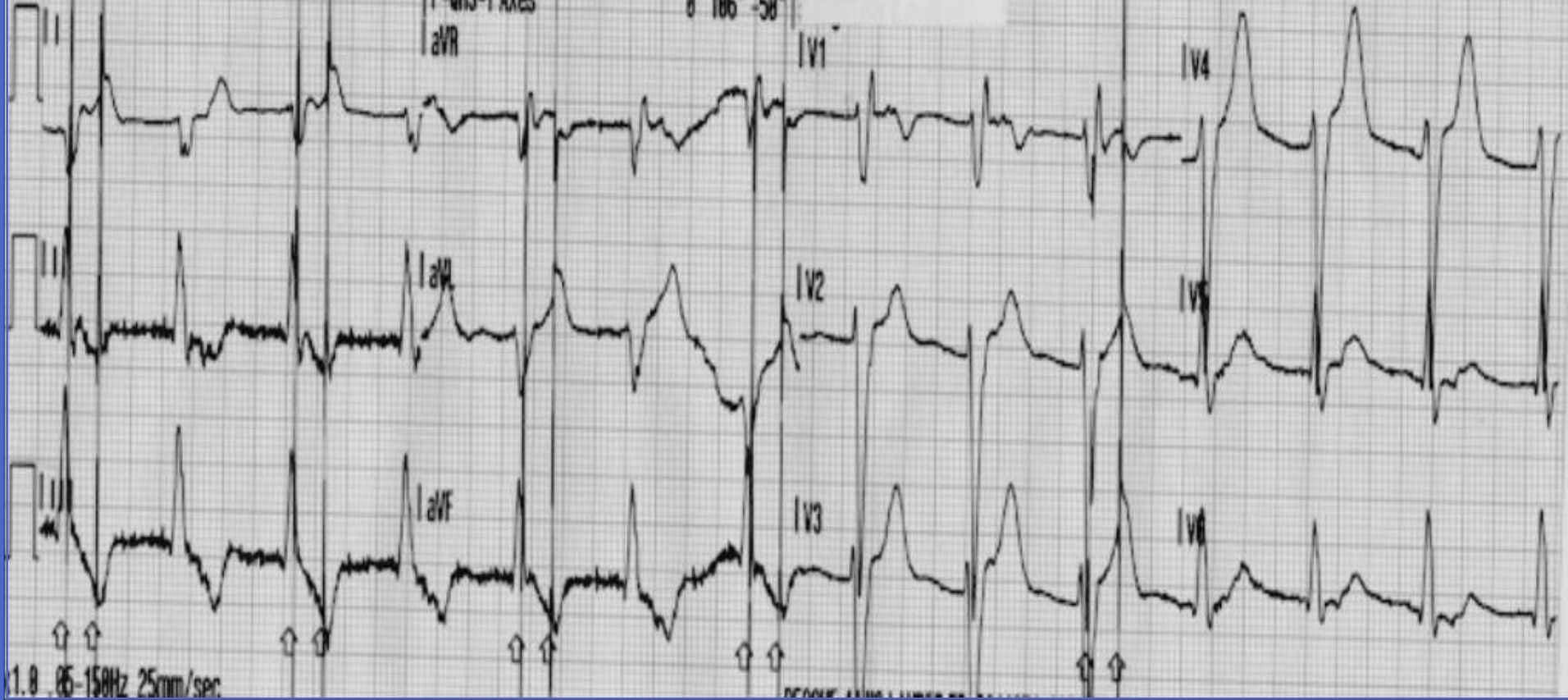
HR 104 bpm

05:47:34

QRS 0.142s

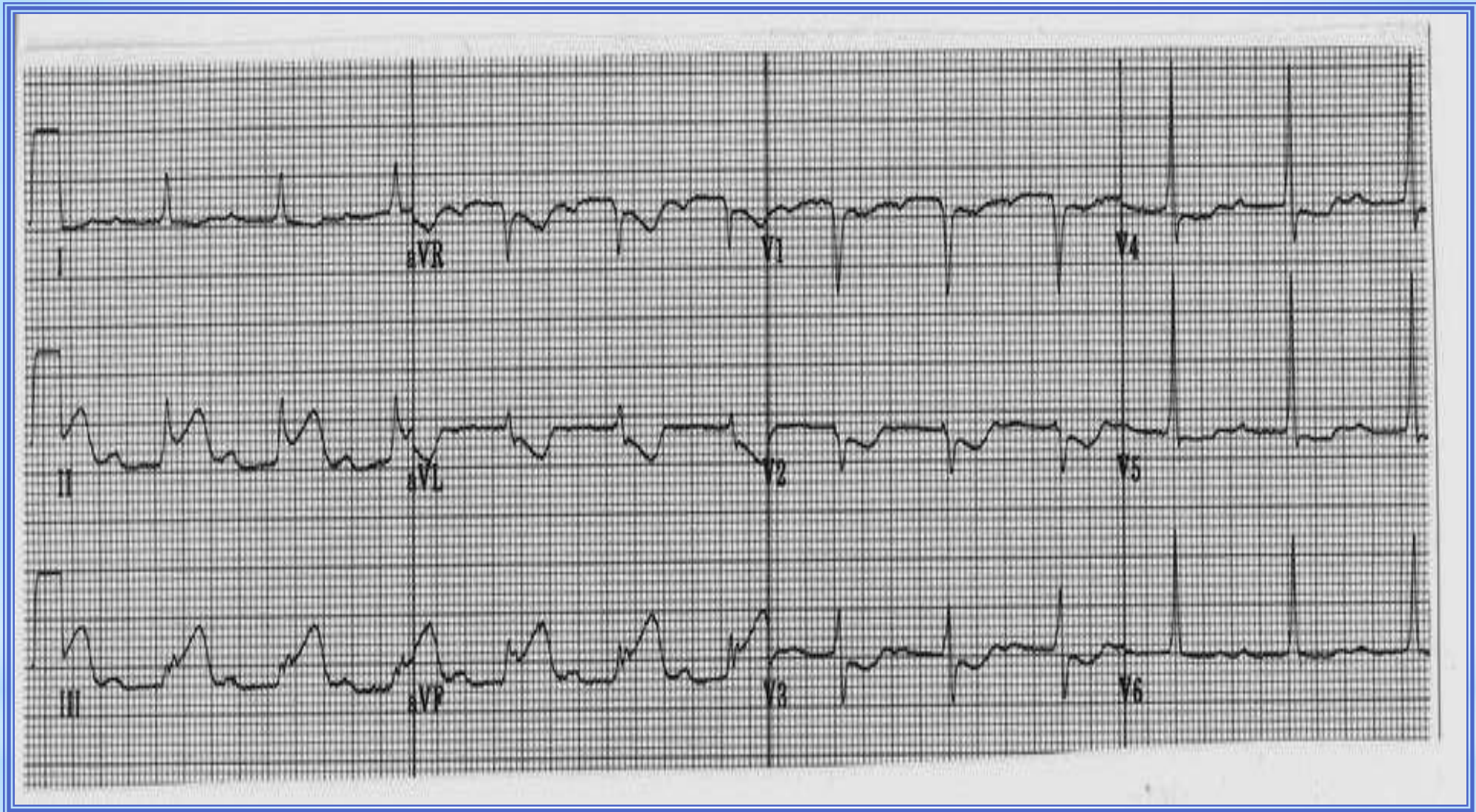
0.422s/0.554s

8° 106° 58°



ECG 9

2/15/2012



Name:

ID:

Patient ID:

Incident:

Age: 84

888404194521

12-Lead 1

04 Aug 04

PR 0.232s

QT/QTc

P-QRS-T Axes

aVR

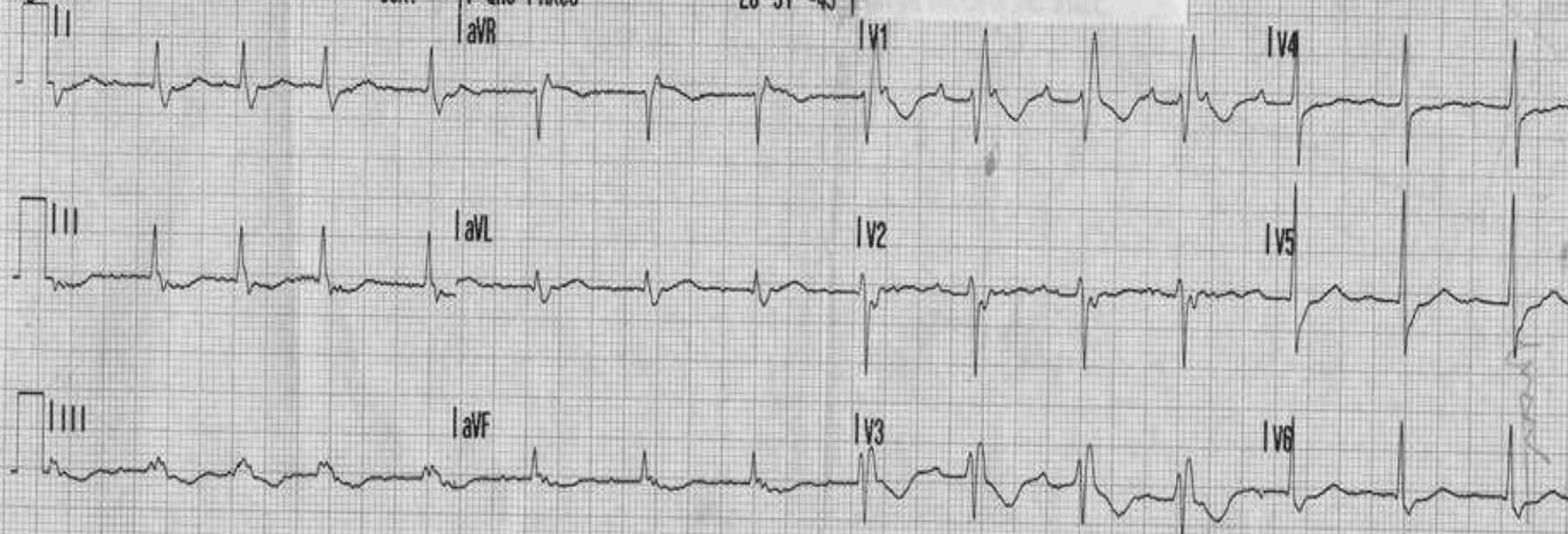
HR 92 bpm

28:09:22

QRS 0.132s

0.368s/0.455s

28° 51° -45°

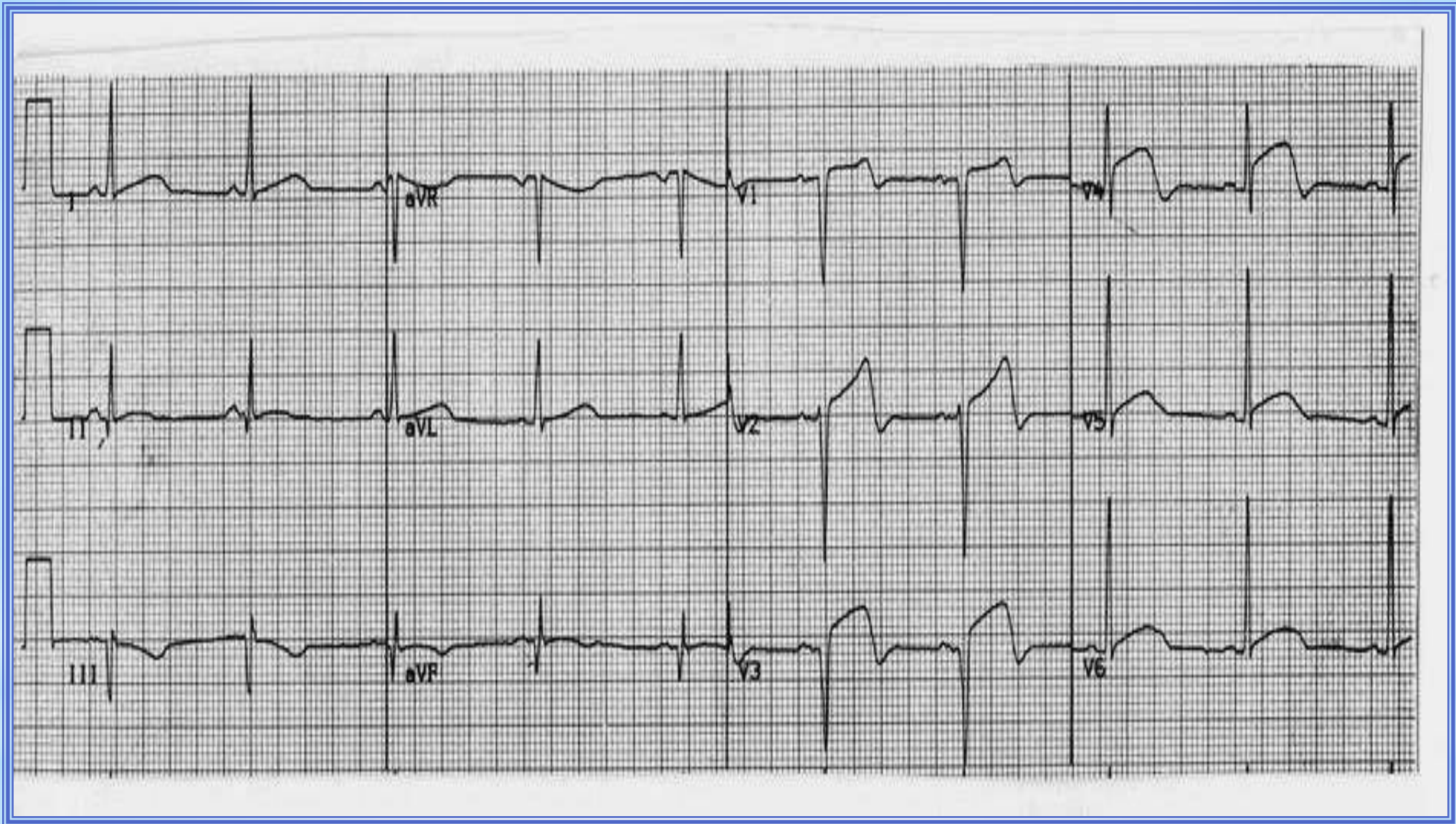


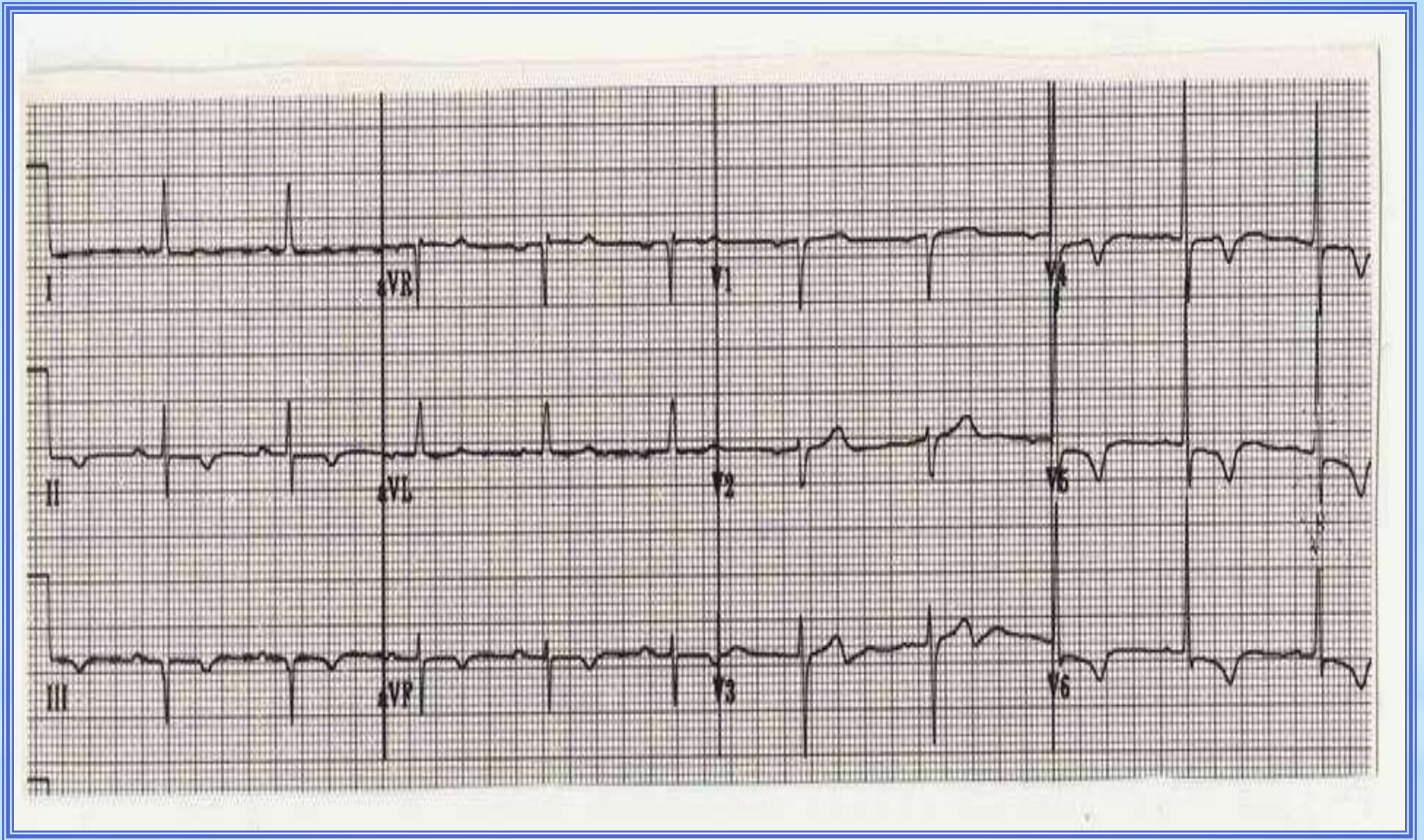
x1.0 .05-40Hz 25mm/sec

PRINTED IN U.S.A.

ENG 34 000 3011371-095 2684KROKGI687R LP128475643

P/N 805319





Name:

ID:

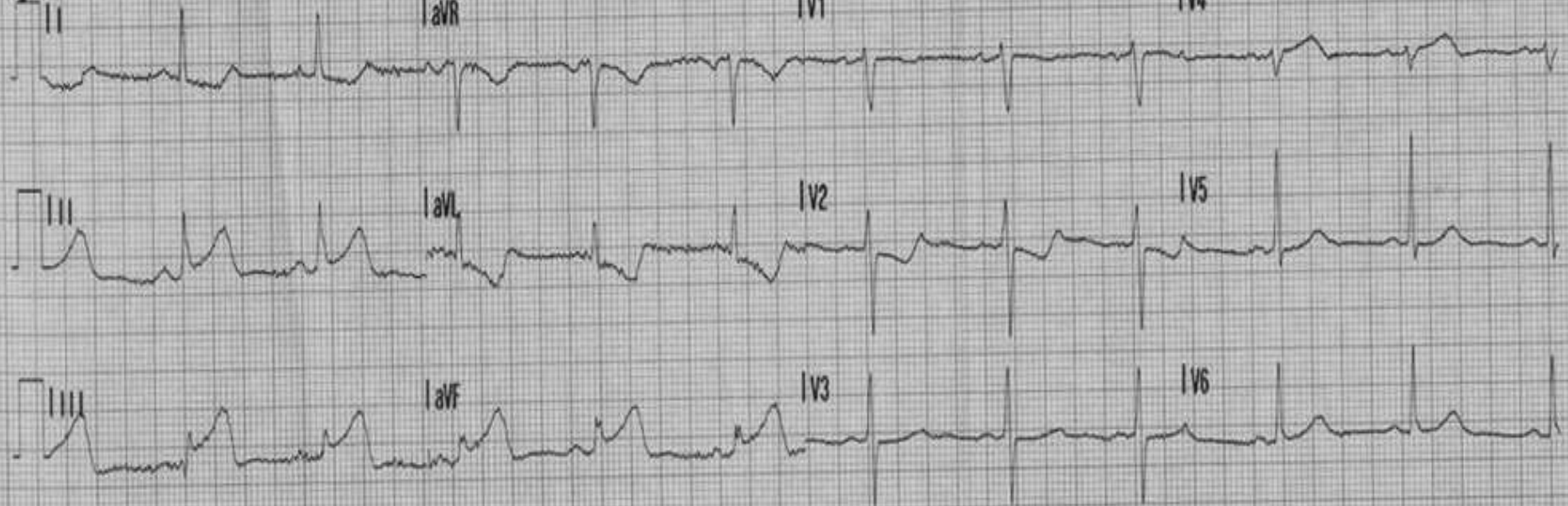
Patient ID:

Incident:

Age: 61

Sex:

R sided



12 LEAD 100% 25mm/100ms

PRINTED IN U.S.A.

RESCUE 34 000 3811371-099 2804KROKJSP7R LP1213818674

Name:

ID:

Patient ID:

Incident:

Age: 69

878685214986

12-Lead 2

06 Jul 05

PR 0.118s

QT/QTc

Sex:

P-QRS-T Axes

aVR

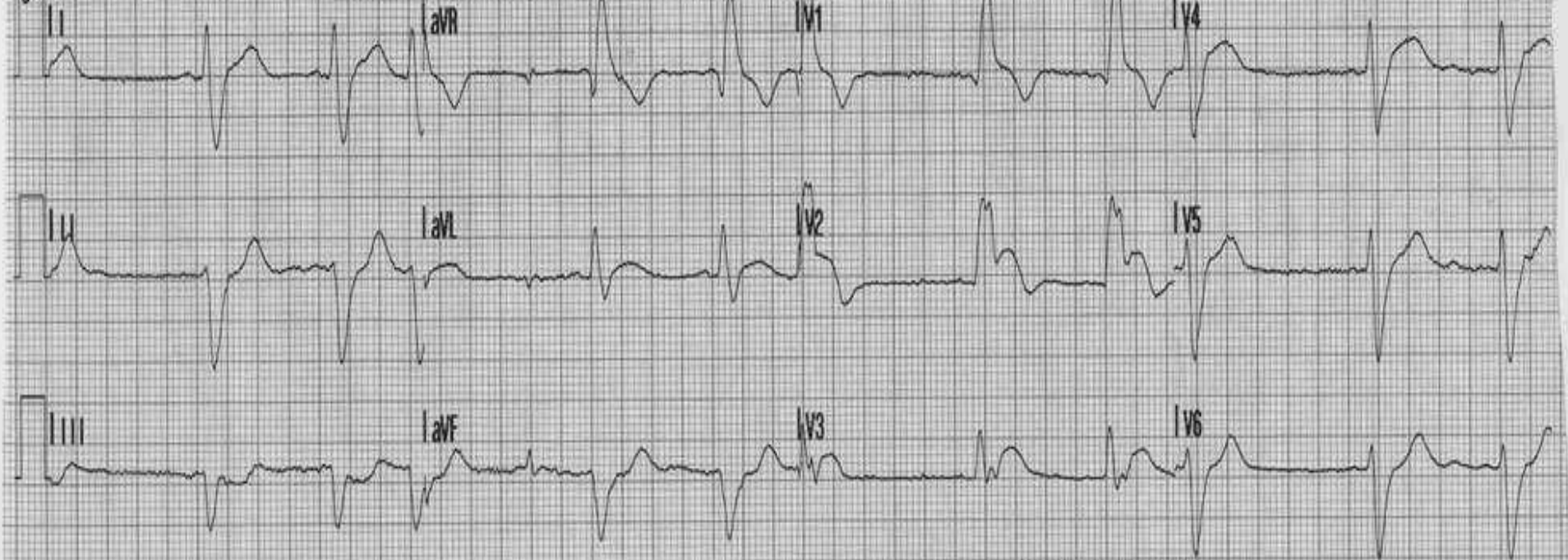
HR 69 bpm

21:53:08

QRS 0.186s

0.468s/0.501s

-22° 258° 41°



x1.0 05-40Hz 25mm/sec

REYNOLDS MEDICAL

RESCUE 44 000 3011371-120 2004KROK.G.JSP7R LP1212209821

PRINTED IN U.S.A.

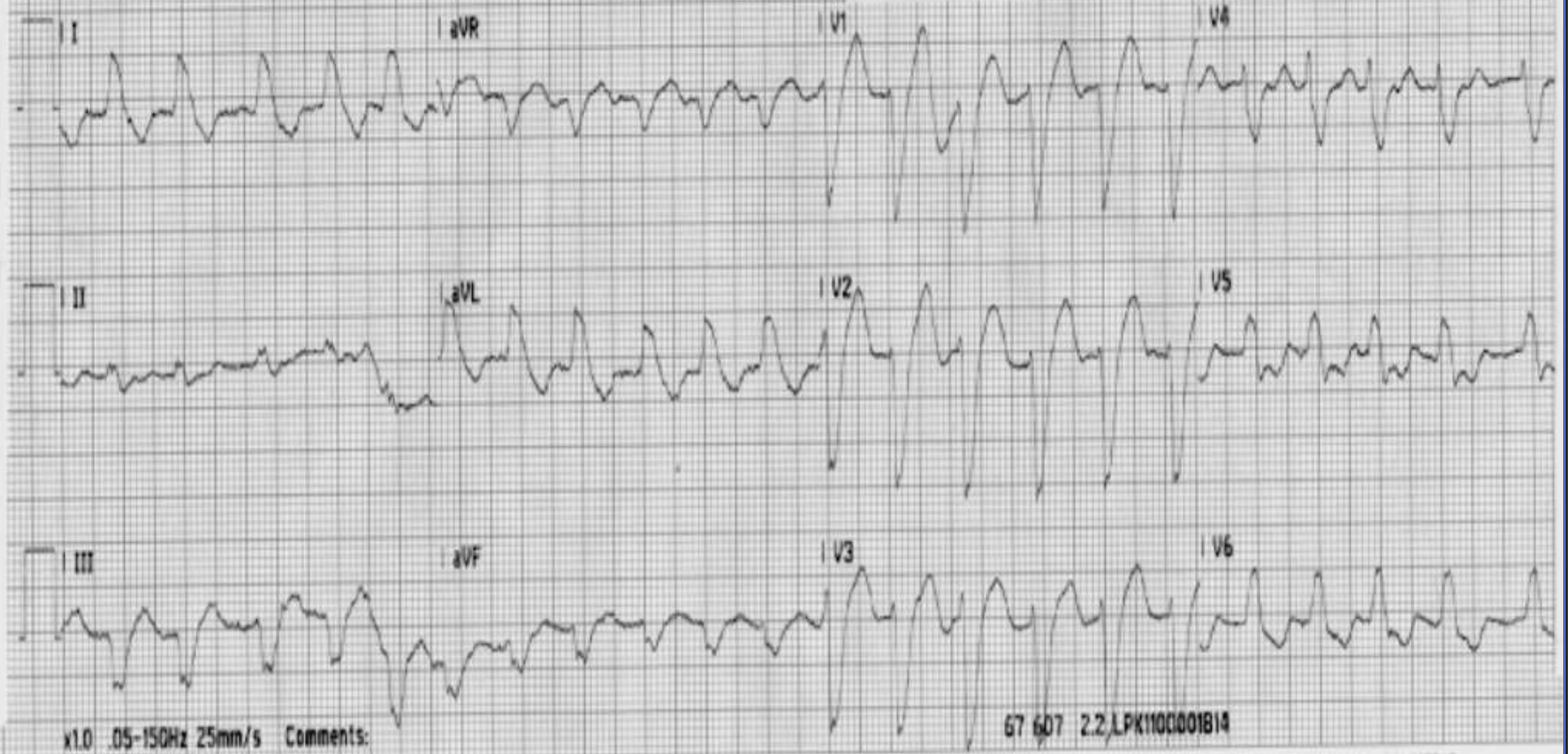
P/N 805319

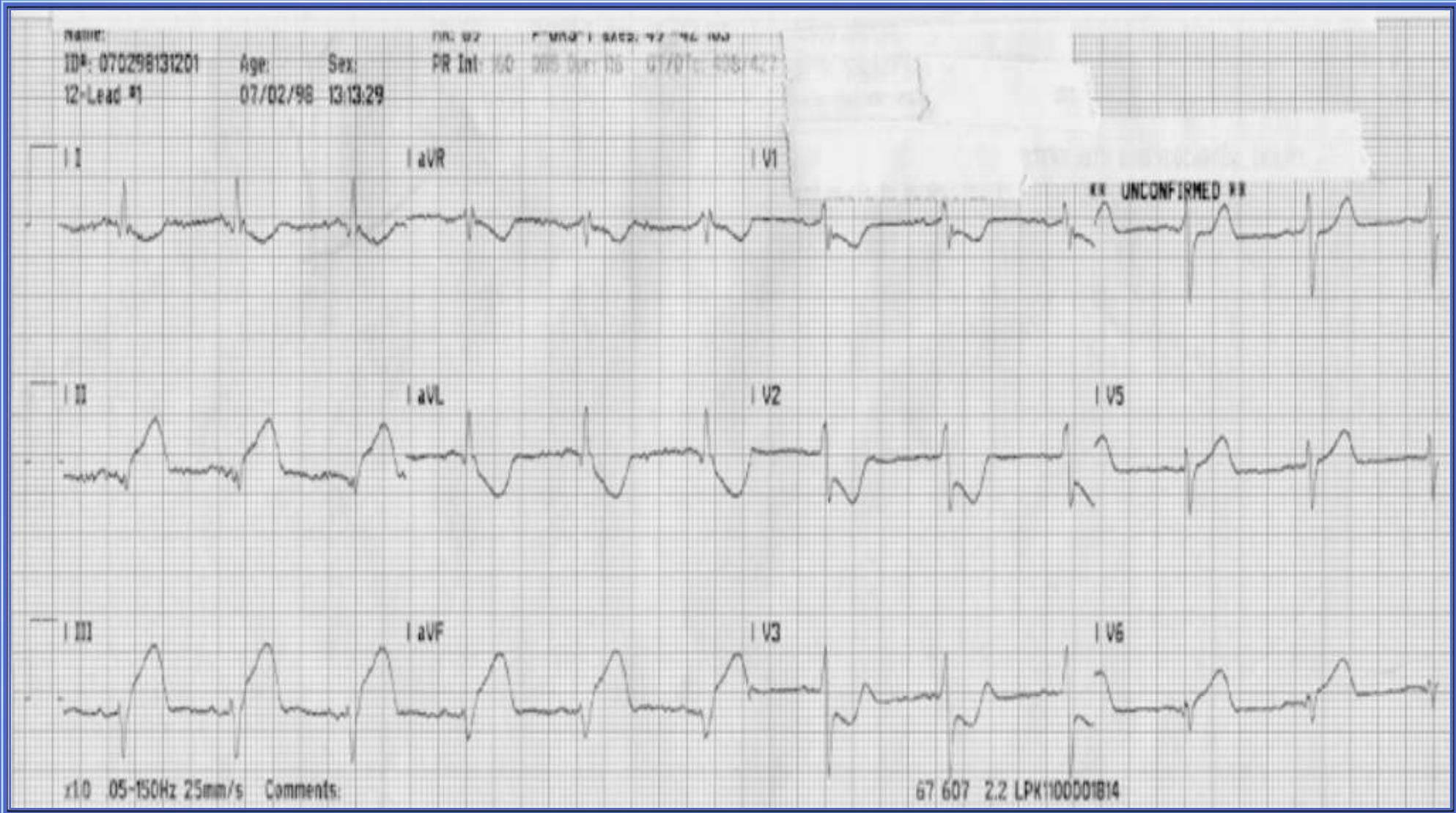
* ECG 15

2/15/2012

Name: HR: 135 P-QRS-T axes: 999 -18 141
ID#: 090396203716 Age: Sex: PR Int: 0 QRS Dur: 140 DT/DTc: 360/439
12-Lead #1 09/03/96 20:41:43

** UNCONFIRMED **





* ECG 17

2/15/2012

Name:

ID:

Incident:

Age: 71

112199128219

12-Lead 2

21 Nov 99

PR 0.122s

Sex:

QT/QTc

P-QRS-T Axes

aVR

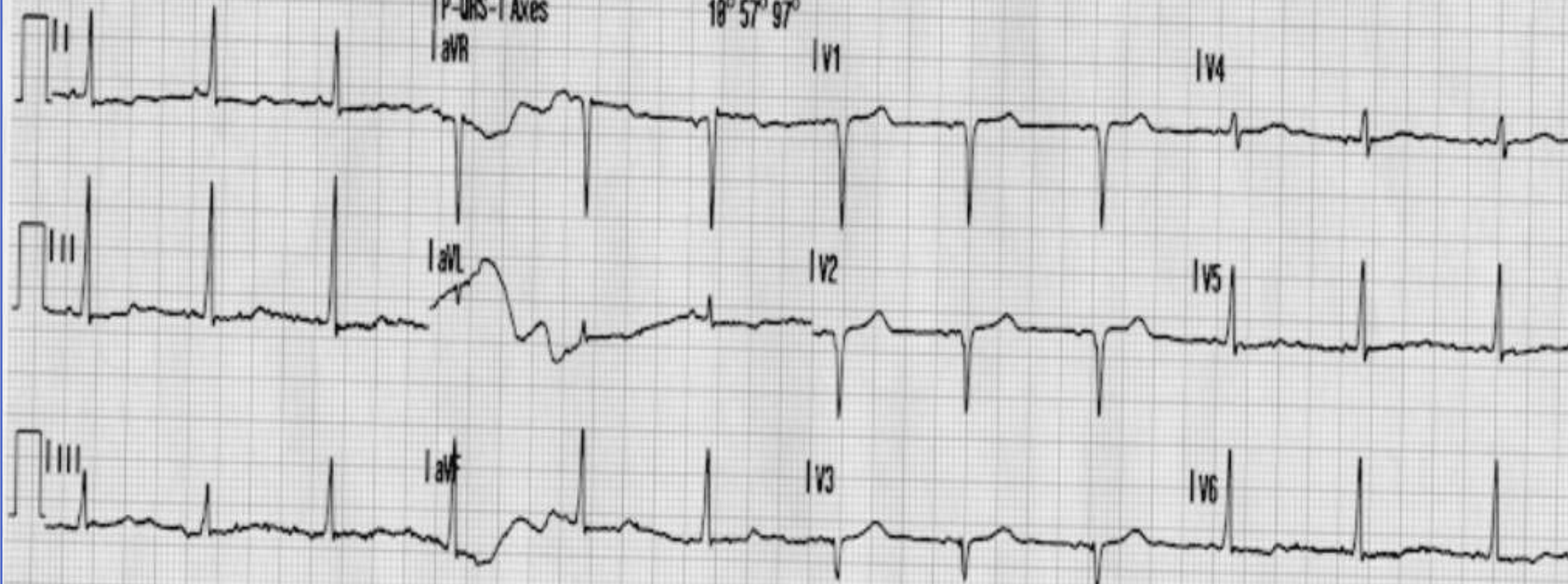
HR 71 bpm

12:38:22

QRS 0.082s

0.390s/0.423s

18° 57° 97°

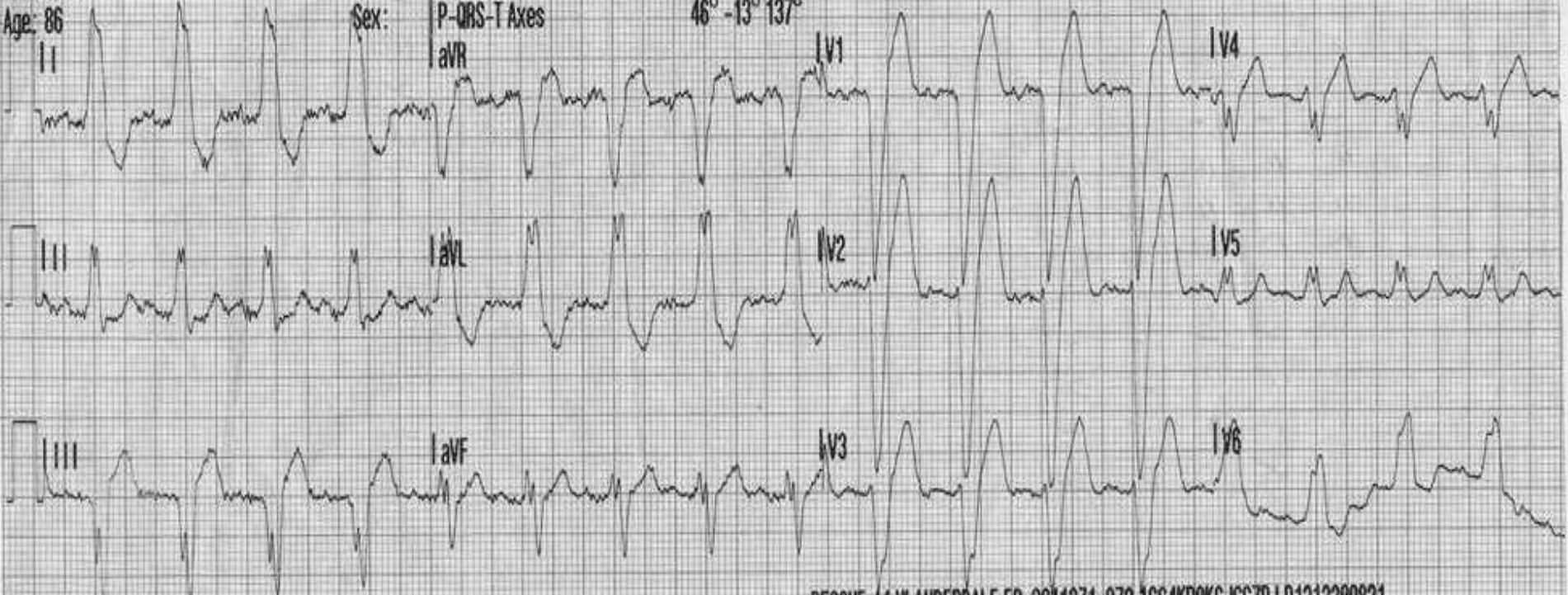


x1 0 05-150Hz 25mm/sec

RFSP1E AA N01 A1MFD FR 2011171_022 2001AYD0ACAC070 | D190175217

Name: [Redacted]
ID: [Redacted]
Pat: [Redacted]
Incident: [Redacted]
Age: 86
II

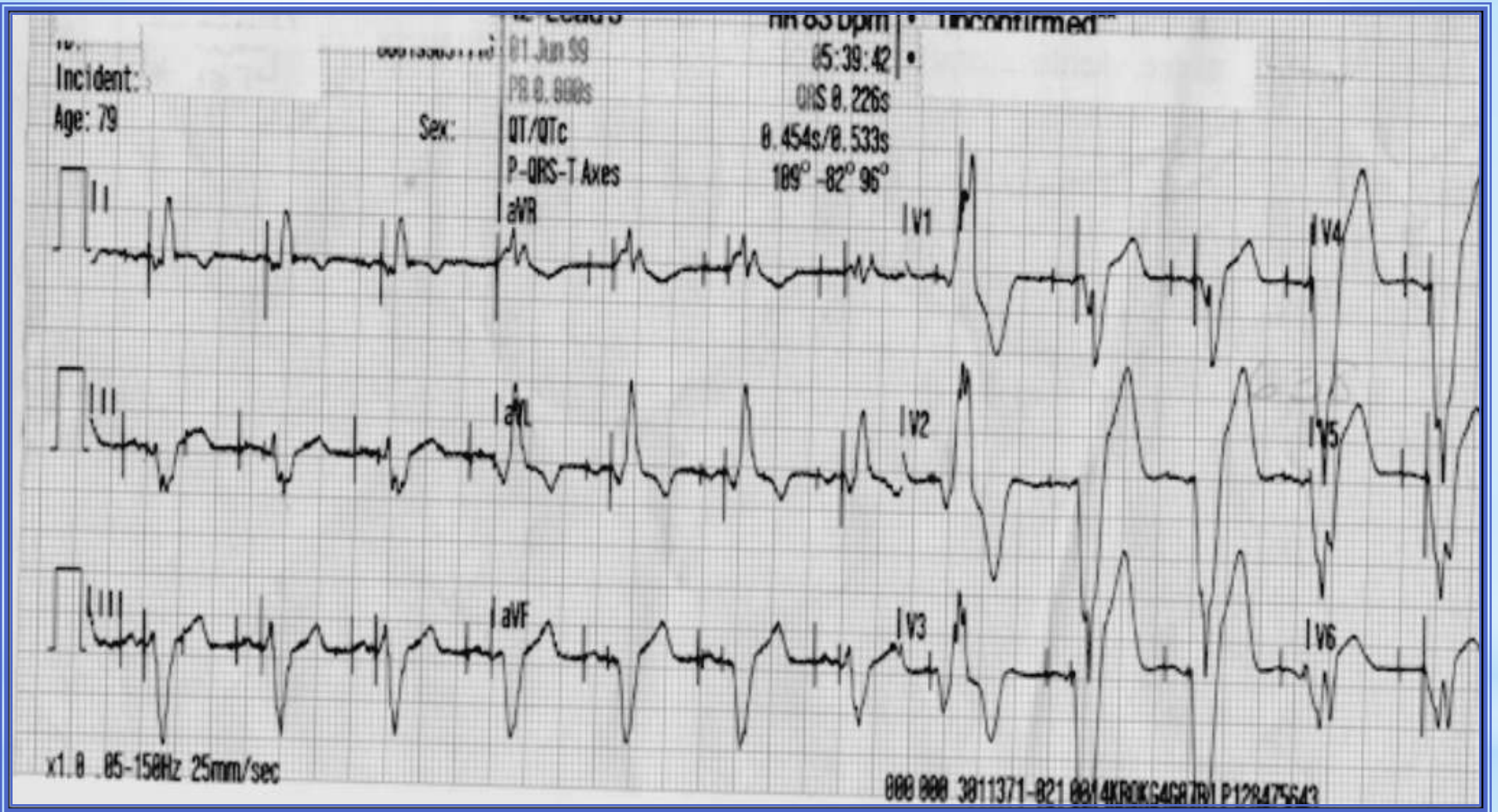
12-Lead 1
1241 19 Nov 81
PR 0.186s
QT/QTc
P-QRS-T Axes
aVR
HR 107 bpm
13:58:48
QRS 0.146s
0.336s/0.448s
46° -13° 137°

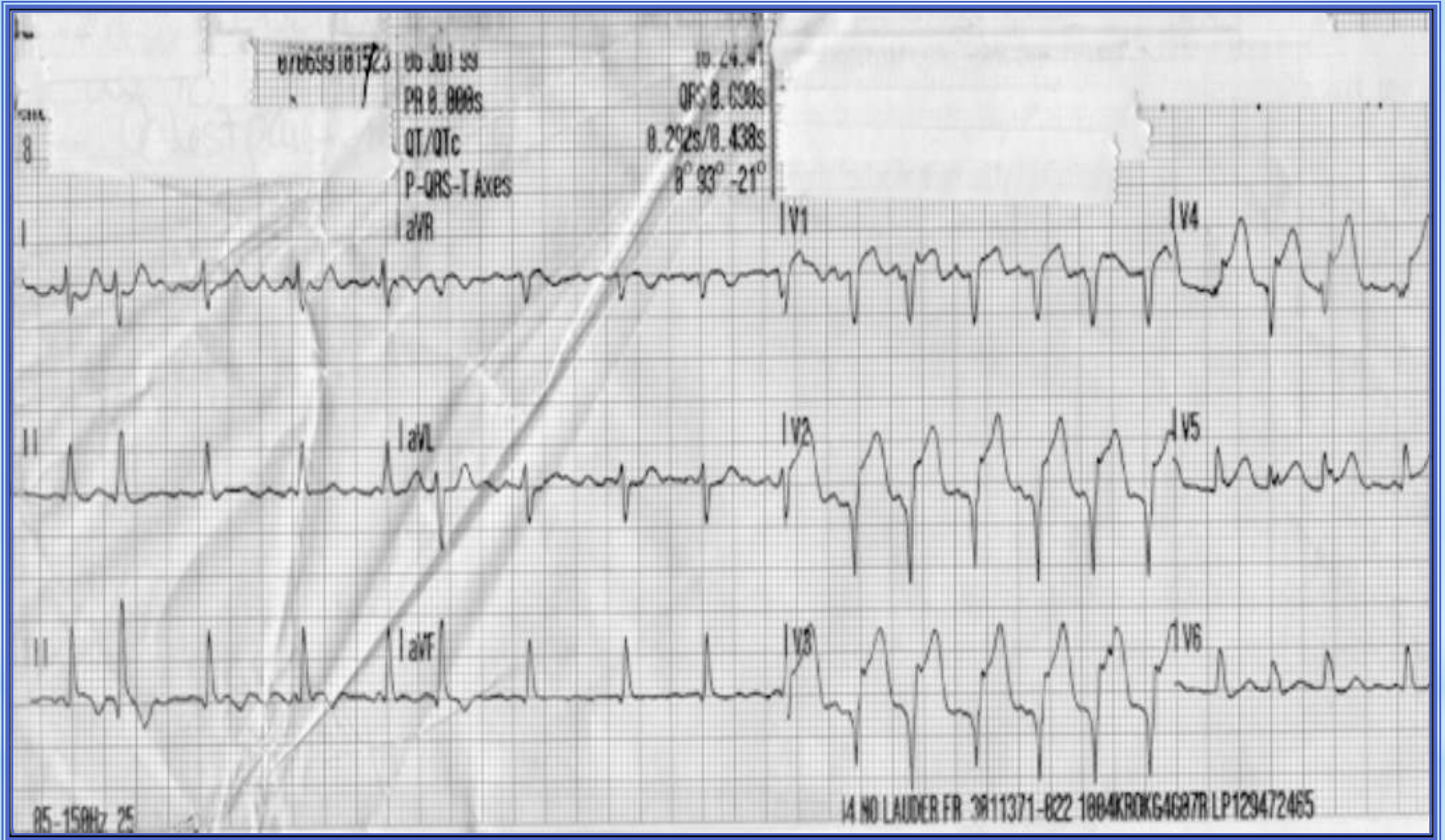


x1.0 .05-40Hz 25mm/sec

PRINTED IN U.S.A.

RESCUE 44 MI. LAUDERDALE FL 3011371-072 1GG4KROKJGG7R LP1212209821
P/N 805319





* ECG 21

2/15/2012

Name:

12-Lead 1

HR 78 bpm

ID:

070999214054

09 Jul 99

21:47:28

Incident:

PR 0.174s

QRS 0.118s

Age: 49

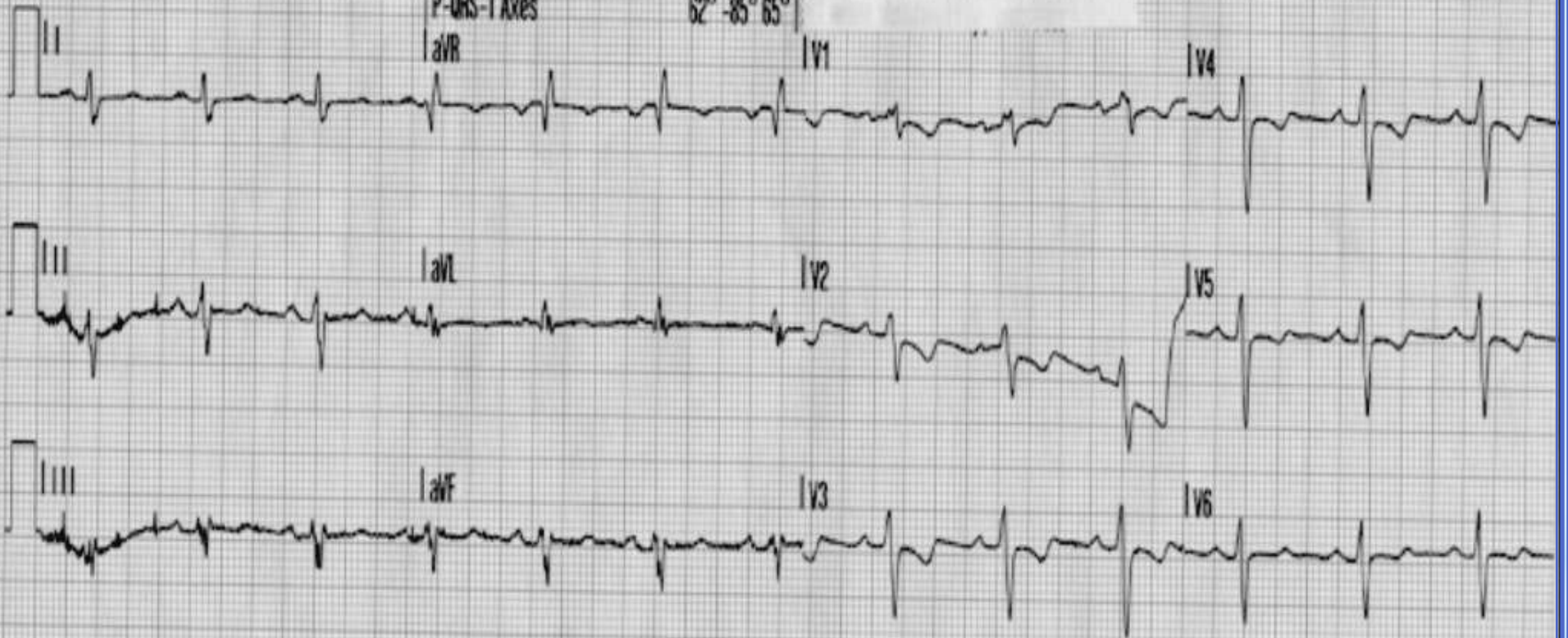
Sex:

QT/QTc

0.382s/0.435s

P-QRS-T Axes

62° -85° 65°



x1.0 85-150Hz 25mm/sec

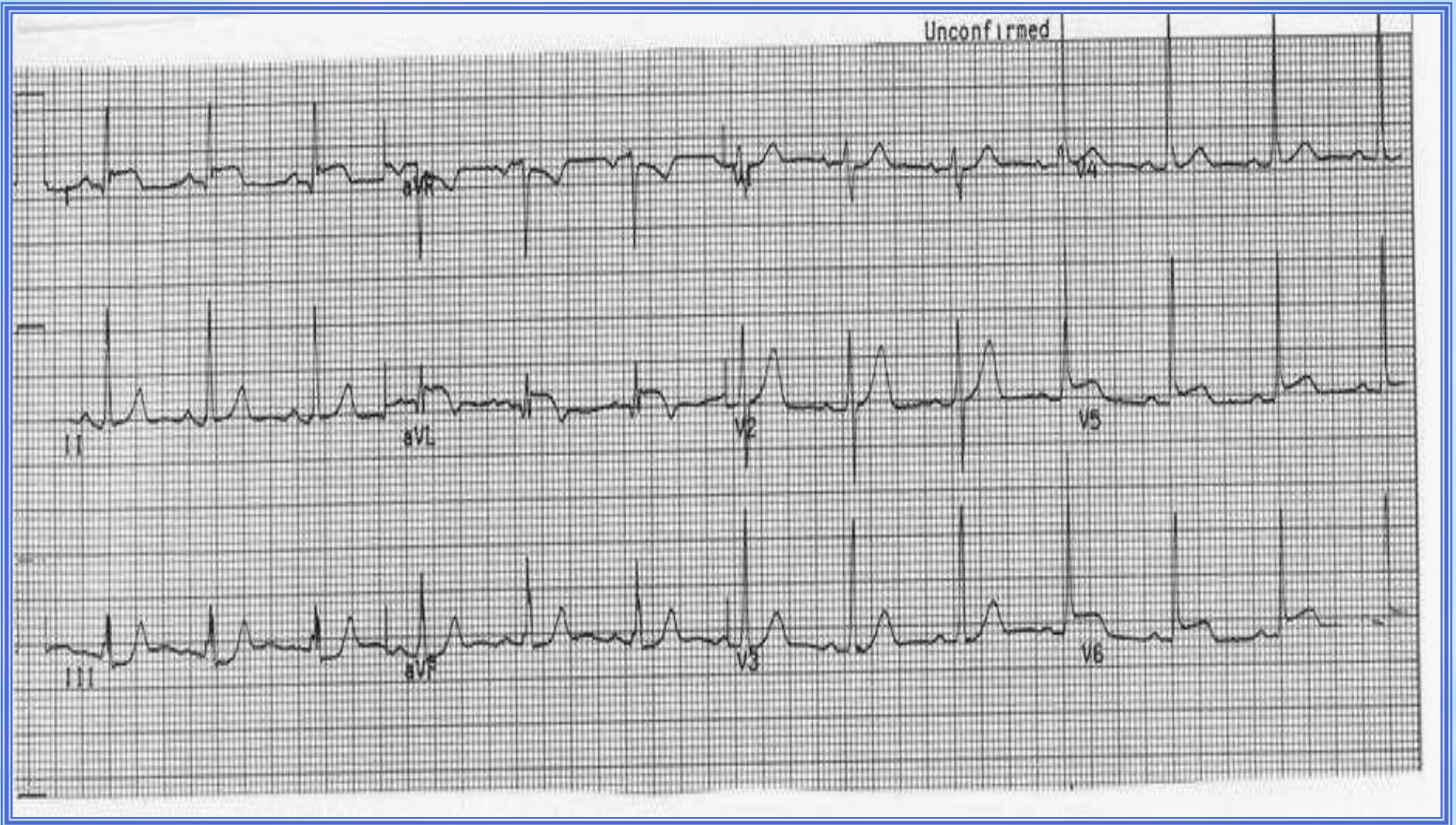
RESCUE 44 NO LAUDER FR 3011371-822 1004KROK64607R LP129472465

PHYSIOCONTROL

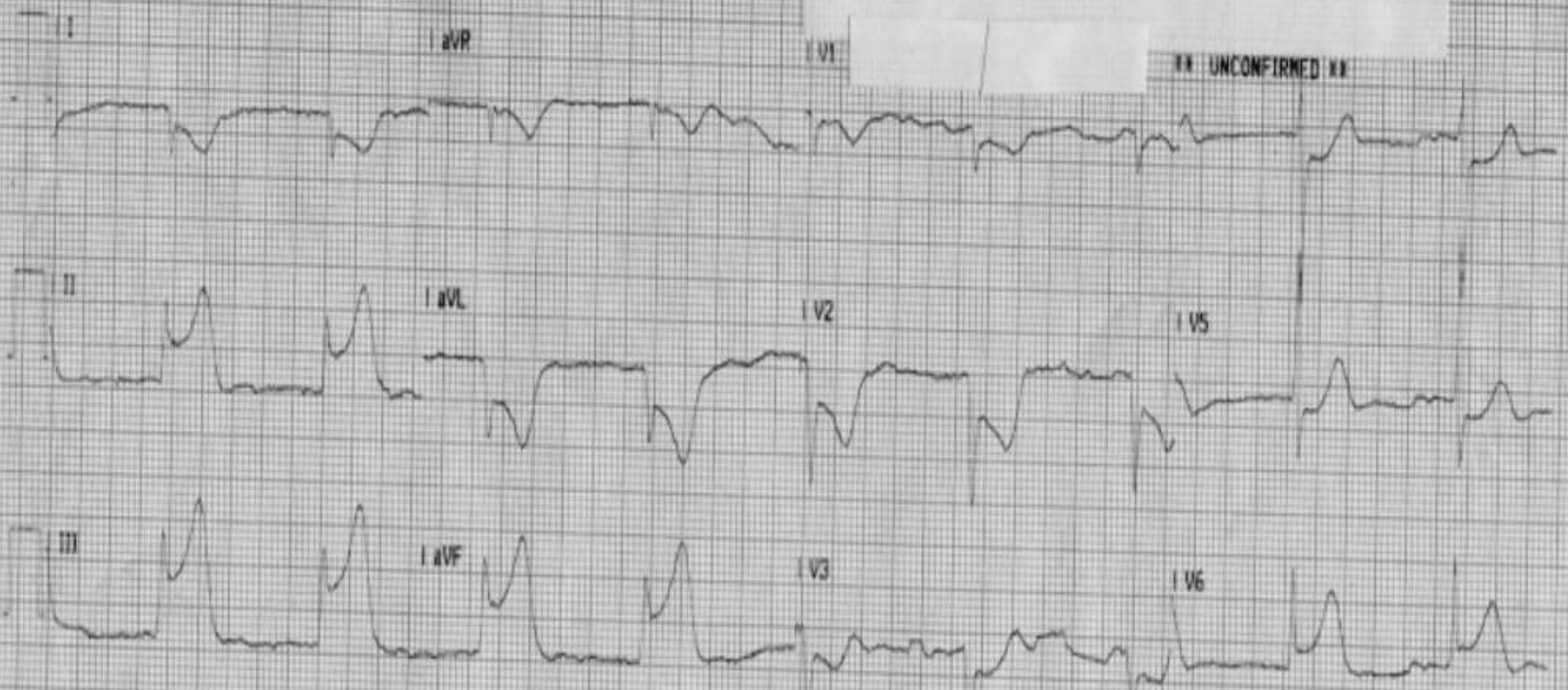
04105514

* ECG 22

2/15/2012



ID# 022397162627 Age: 83 Sex: F
12-Lead #1 02/23/97 16:32:17
HR: 55 P-QRS-T axes: 999 109 106
PR Int: 0 QRS Dur: 84 QT/QTc: 416/406



UNCONFIRMED

x1.0 05-150Hz 25mm/s Comments: CP 30MINS

67 607 22 LPR00001814

Name:

HR: 79

P-QRS-T axes: 36 47 37

ID#: D51197170112

Age:

Sex:

PR Int: 136

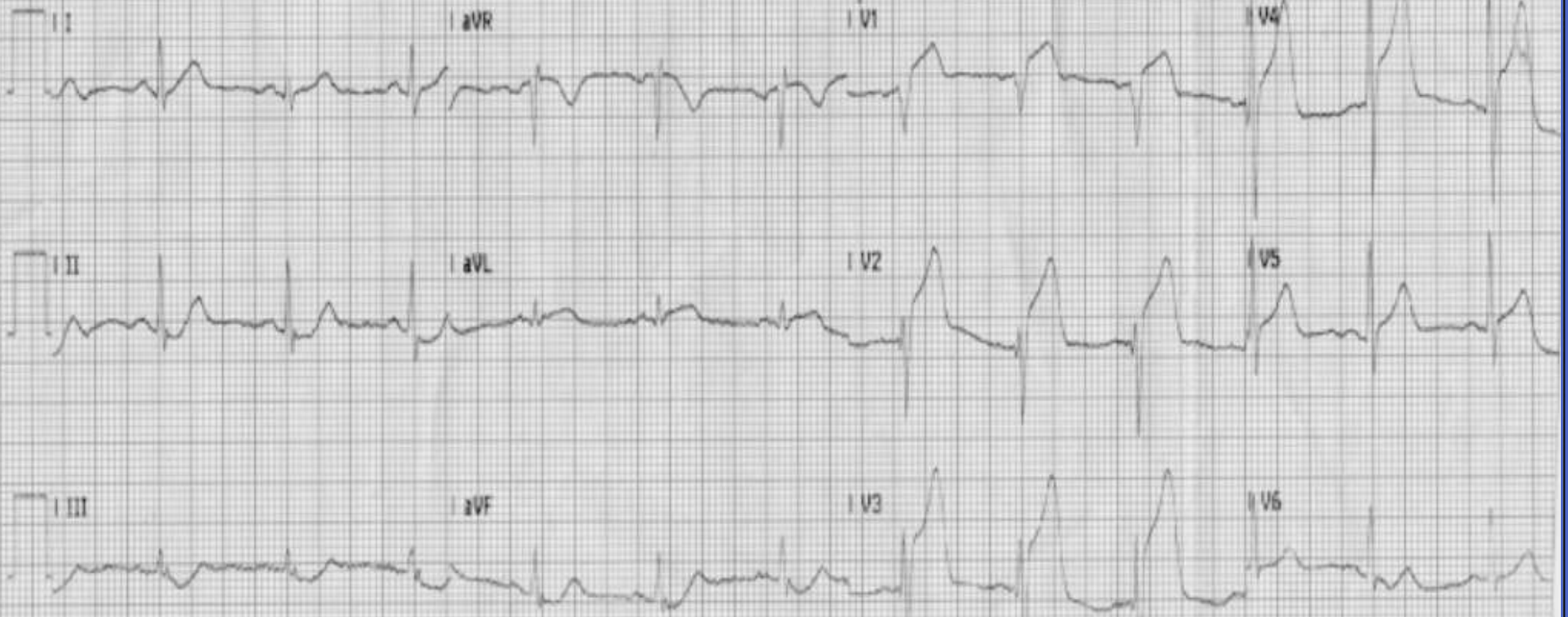
QRS Dur: 92

QT/QTc: 344/378

12-Lead #1

05/11/97

17:01:18



vt.D 05-150Hz 25mm/s Comments:

67 507 2.2 LPK1100001814

* ECG 25

2/15/2012

Name:

ID:

Patient ID:

Incident:

Age: 75

070105142809

12-Lead 1

01 Jul 05

PR 0.080s

QT/QTc

Sex:

P-QRS-T Axes

aVR

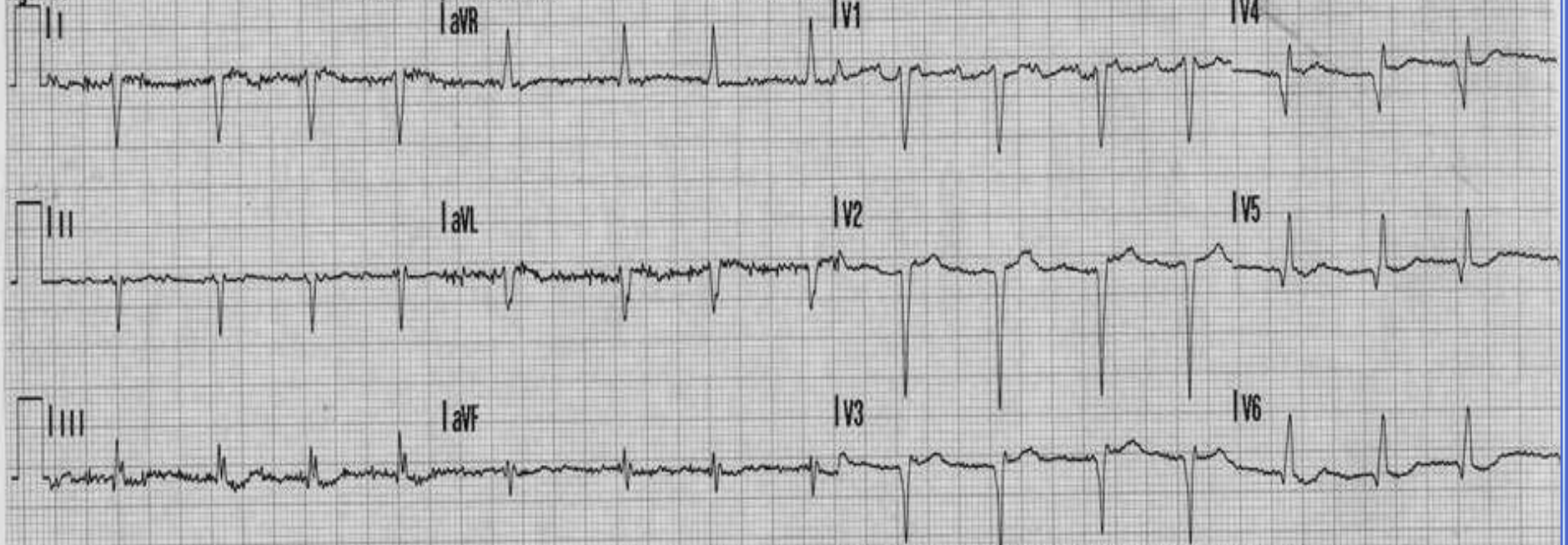
HR 98 bpm

14:32:55

QRS 0.080s

0.316s/0.483s

8° 189° 82°



x1.0 .05-40Hz 25mm/sec

P/N 805319

RESCUE 34 000 3811371-120 2804KROKJG07R LP129472465

REDAUX MEDICAL



ECG 26

2/15/2012

Name:

ID:

Patient ID:

Incident:

Age: 56

Sex:

12-Lead 3

21 Sep 83

PR 0.138s

QT/QTc

P-QRS-T Axes

aVR

HR 59 bpm

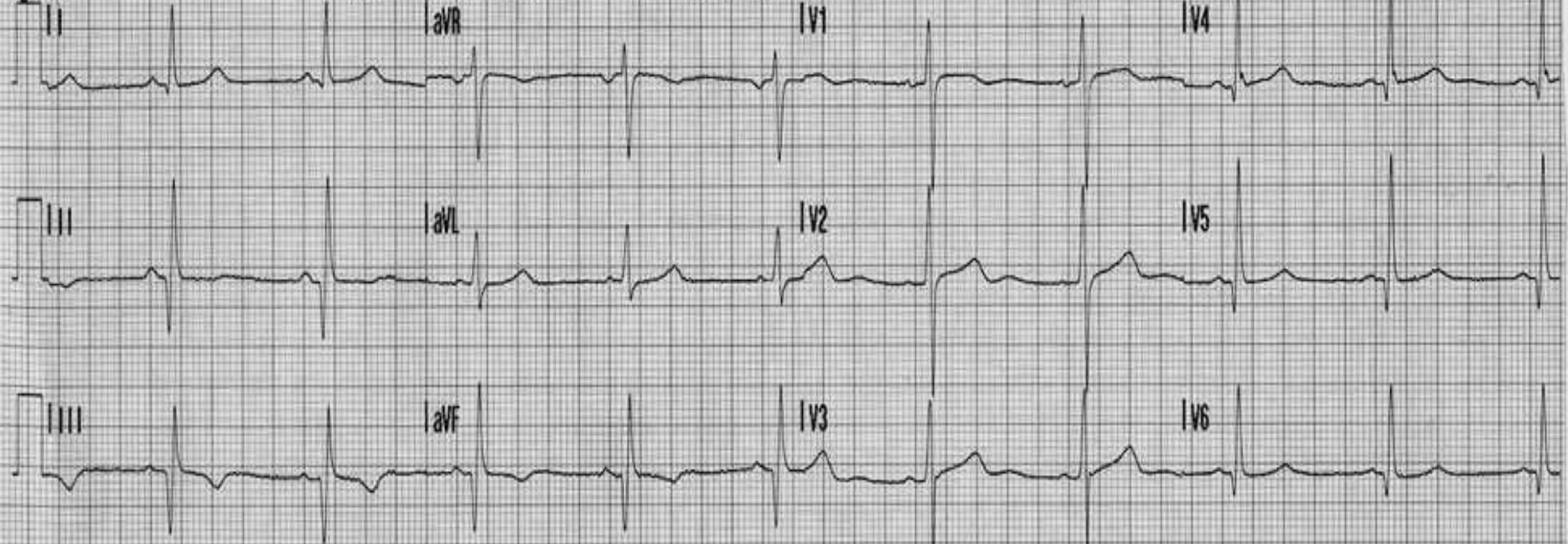
09:46:27

QRS 0.098s

0.432s/0.427s

46° 29° -27°

Abnormal ECG **Unconfirmed**



x1.0 .05-40Hz 25mm/sec

P/N 805311

ENG 34 000 3811371-090 2G84KROKJG87R LP128475643

REVIEW ALL

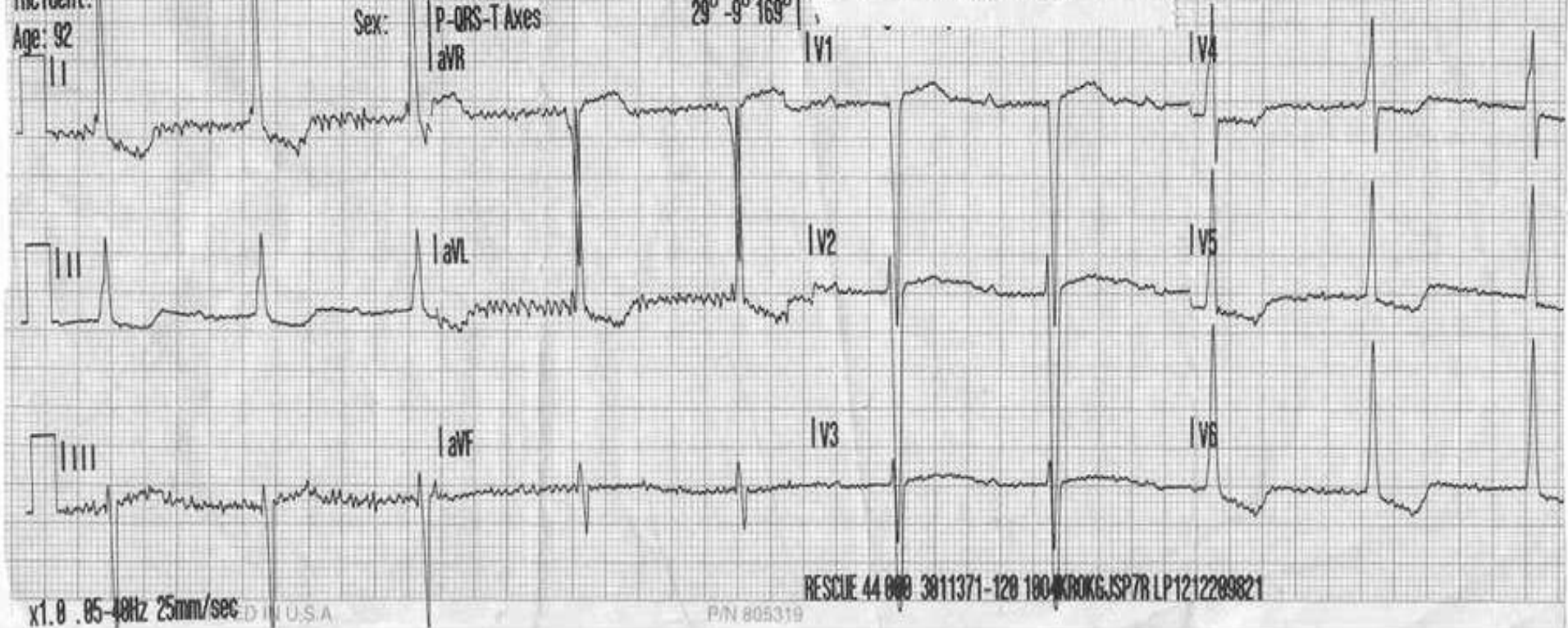
PRINT

Name:
ID:
Patient ID:
Incident:
Age: 92

820105124402

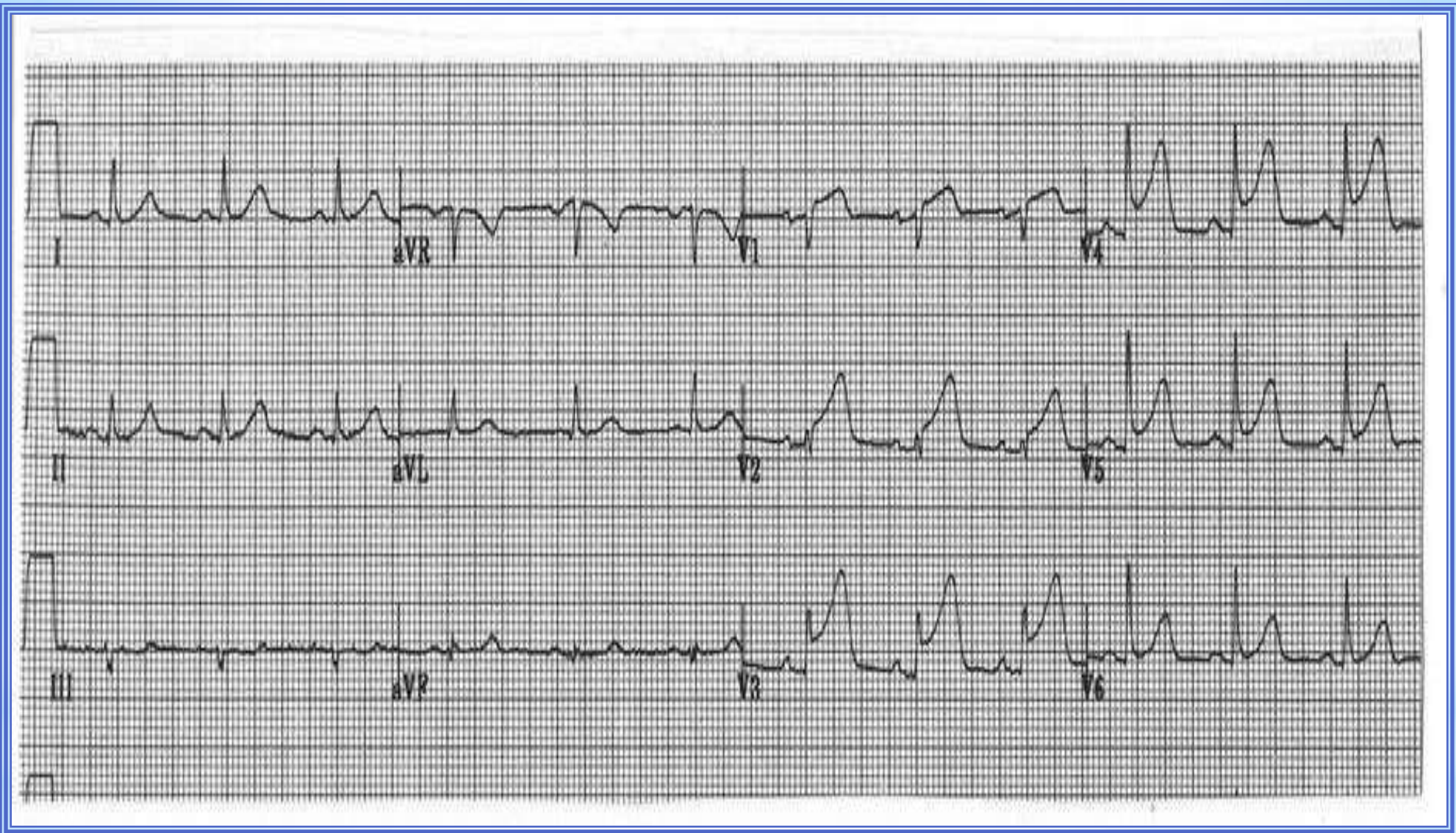
12-Lead 2
01 Feb 05
PR 0.382s
QT/QTc
P-QRS-T Axes
aVR

HR
13:04:47
QRS 0.116s
0.426s/0.414s
29° -9° 169°



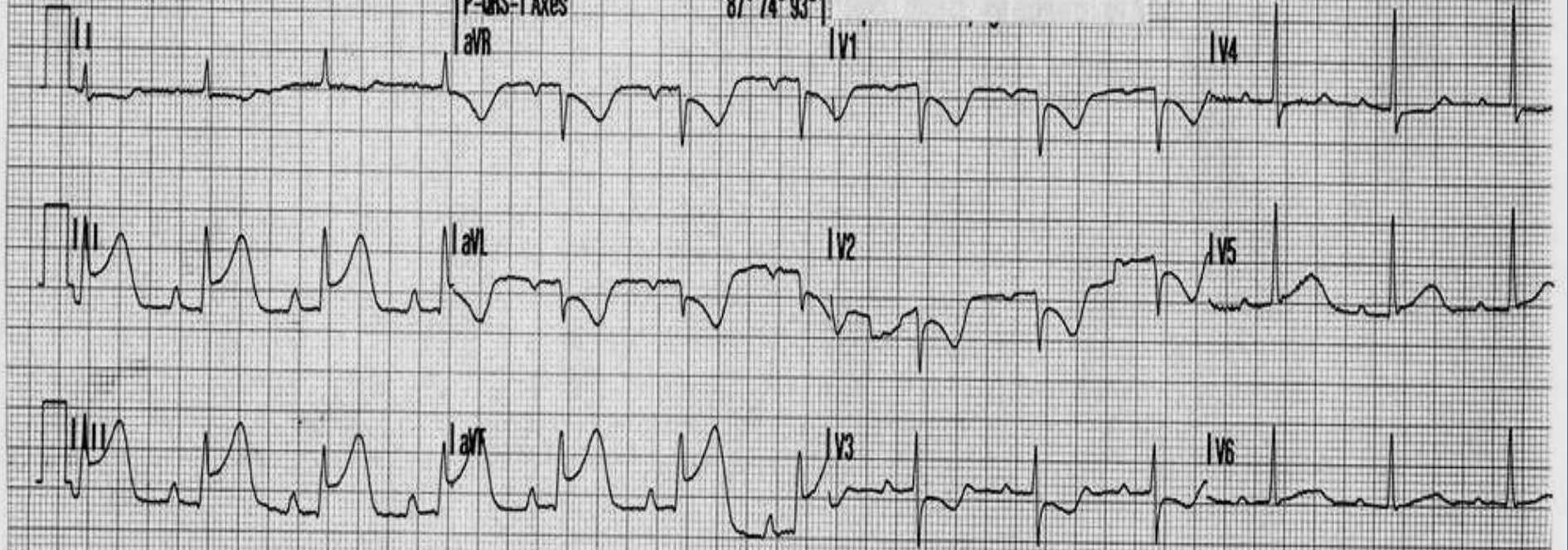
* ECG 28

2/15/2012



Incident:
Age: 66

173881135945	38 Jul 81	14:06:33
Sex:	PR 0.218s	QRS 0.076s
	QT/QTc	0.412s/0.463s
	P-QRS-T Axes	87° 74° 93°
	aVR	
	IV1	
	IV4	

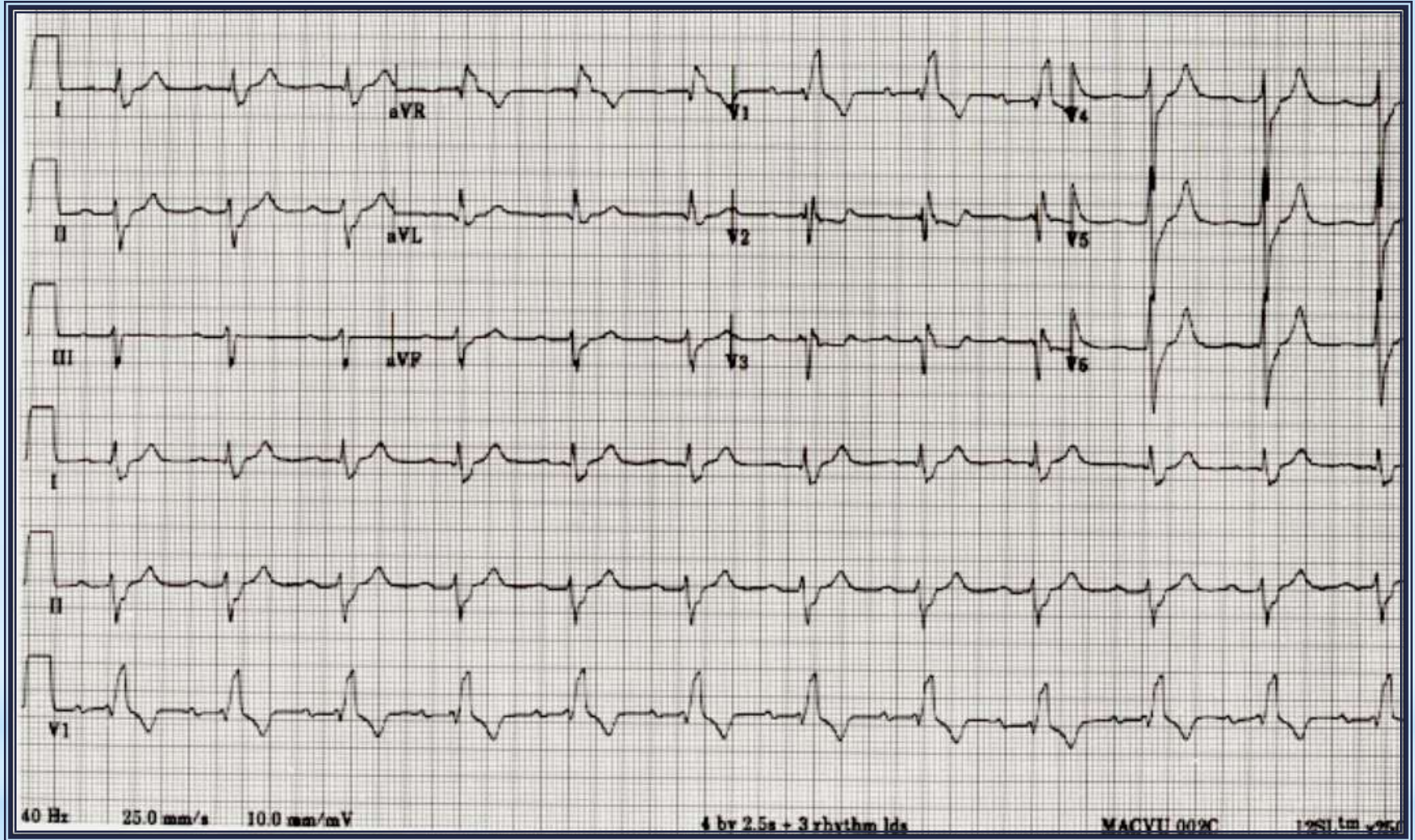


x1.0 05-40Hz 25mm/sec

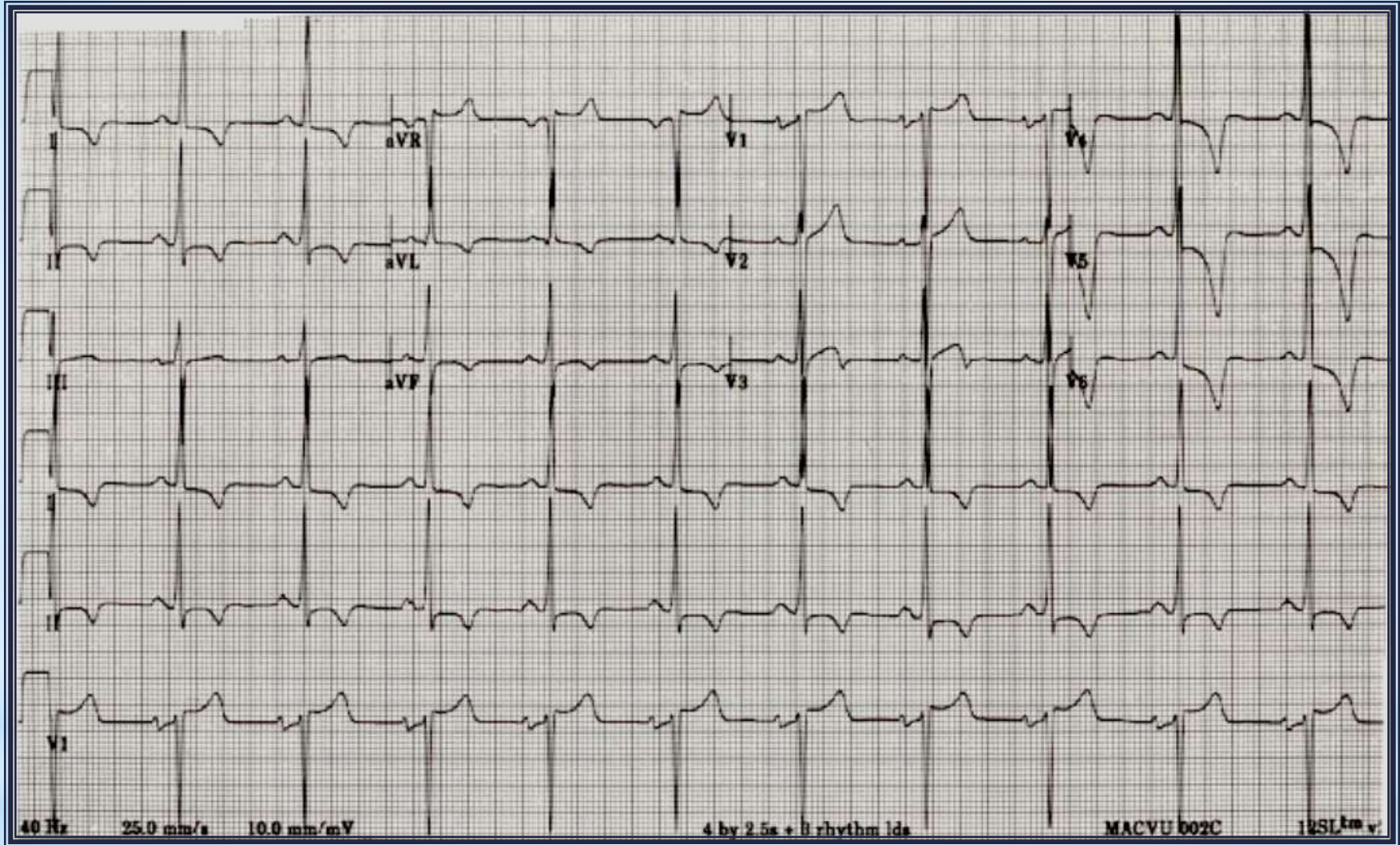
TRIDENT 44 N LAUDERDALE FL 3811371-878 1804KROK.GISP7R1P1212289821

Workshop 2

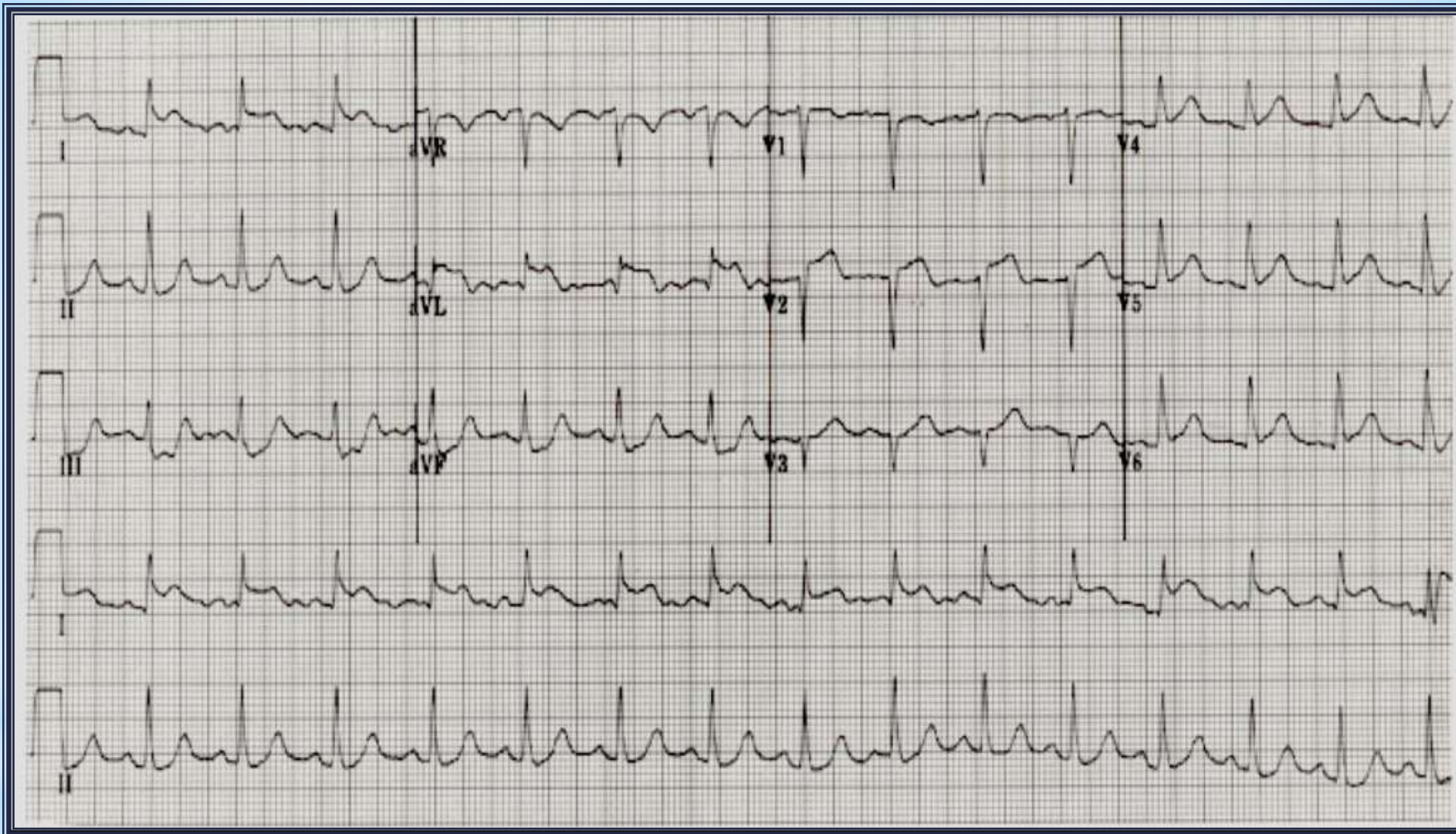
2/15/2012



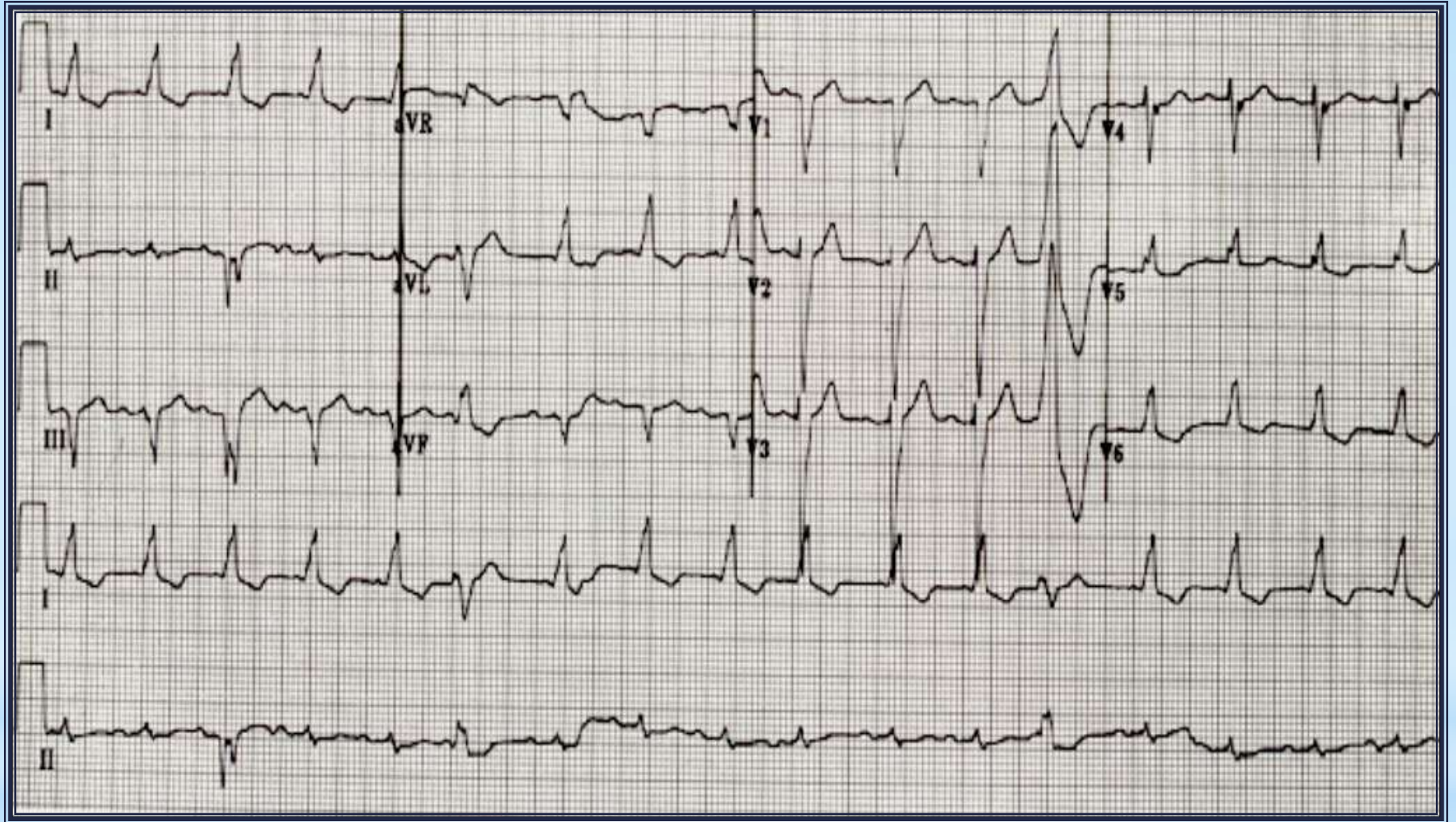
* ECG # 1



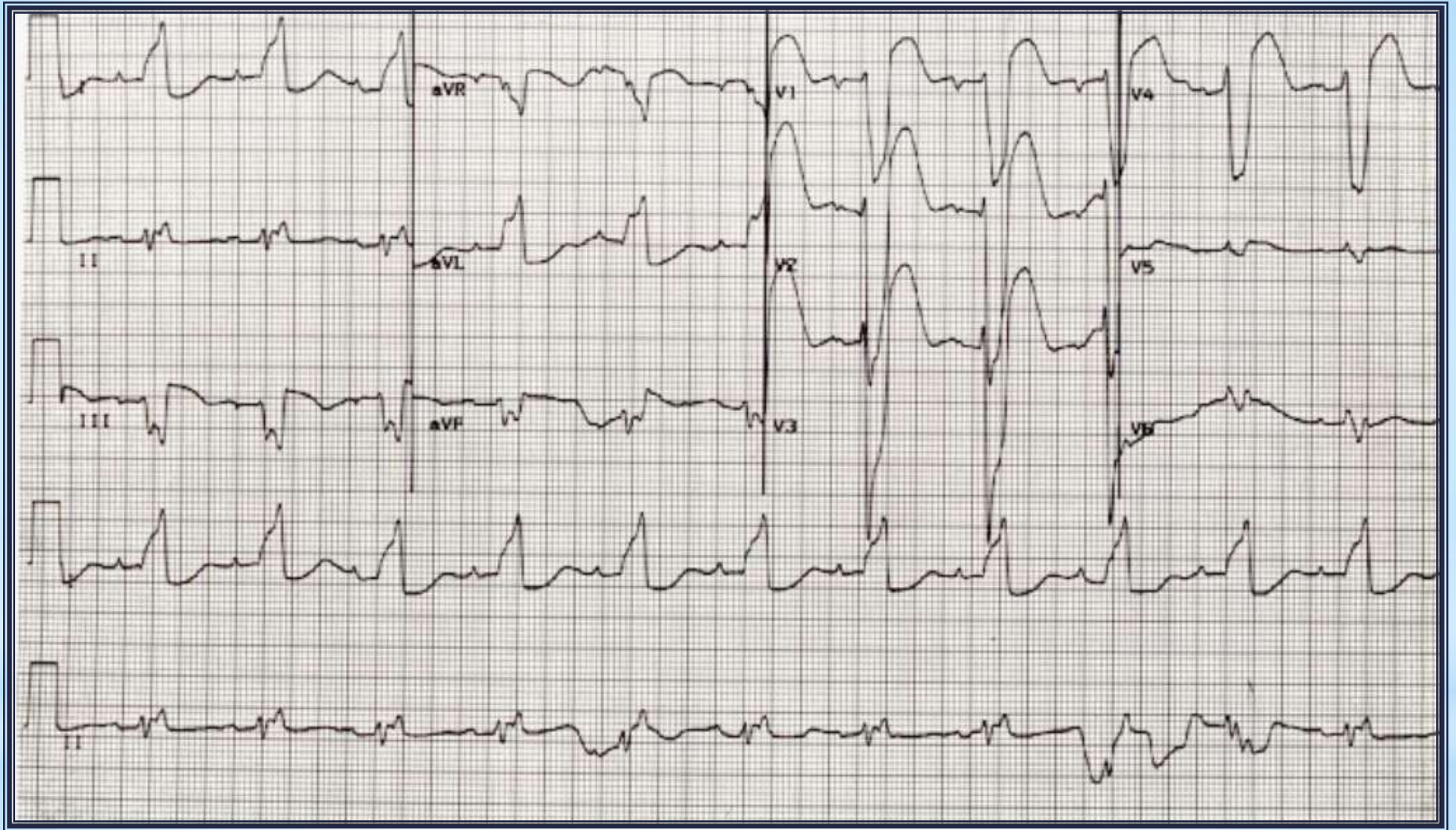
* ECG # 2



* ECG # 3

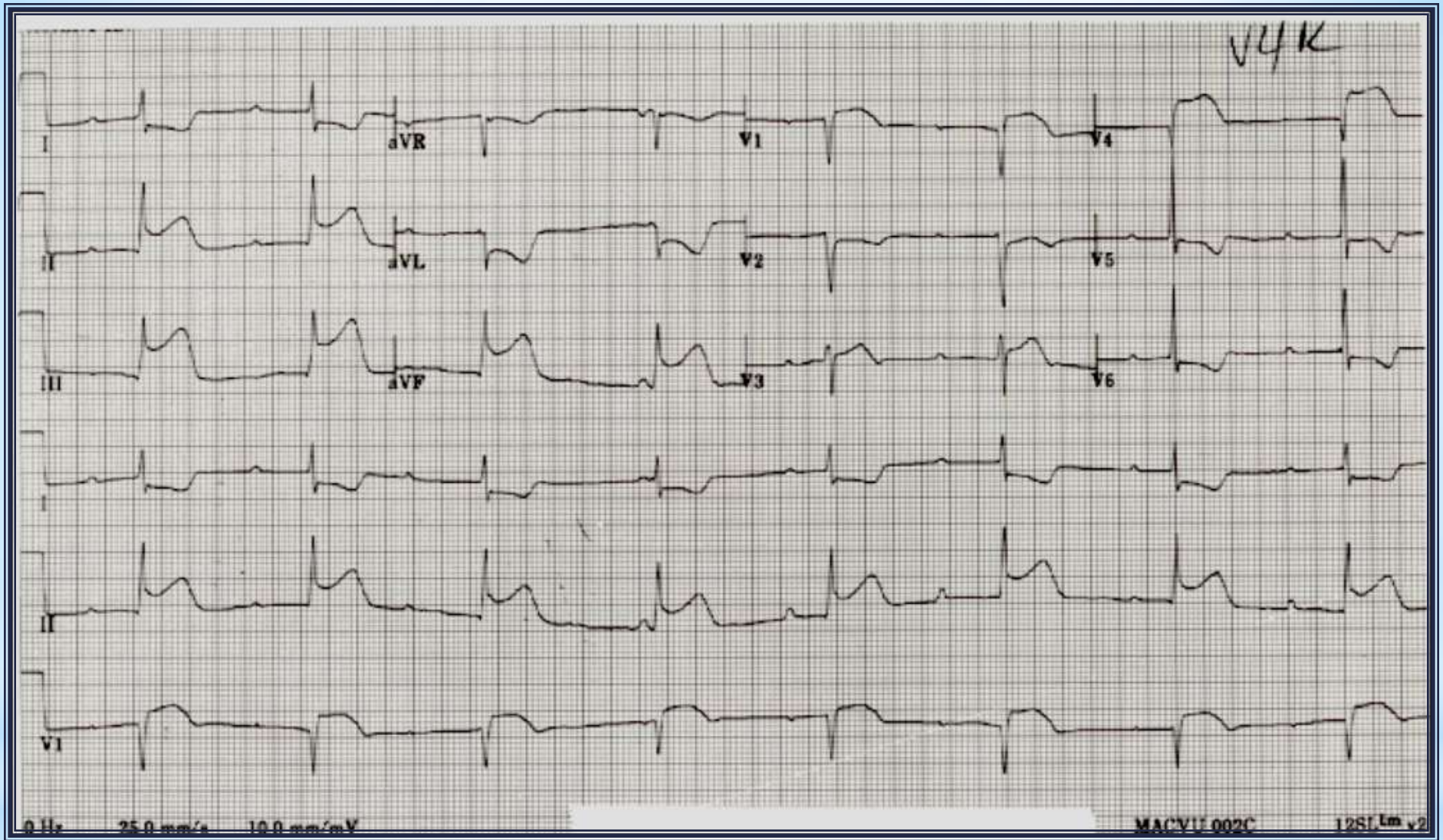


* ECG # 4

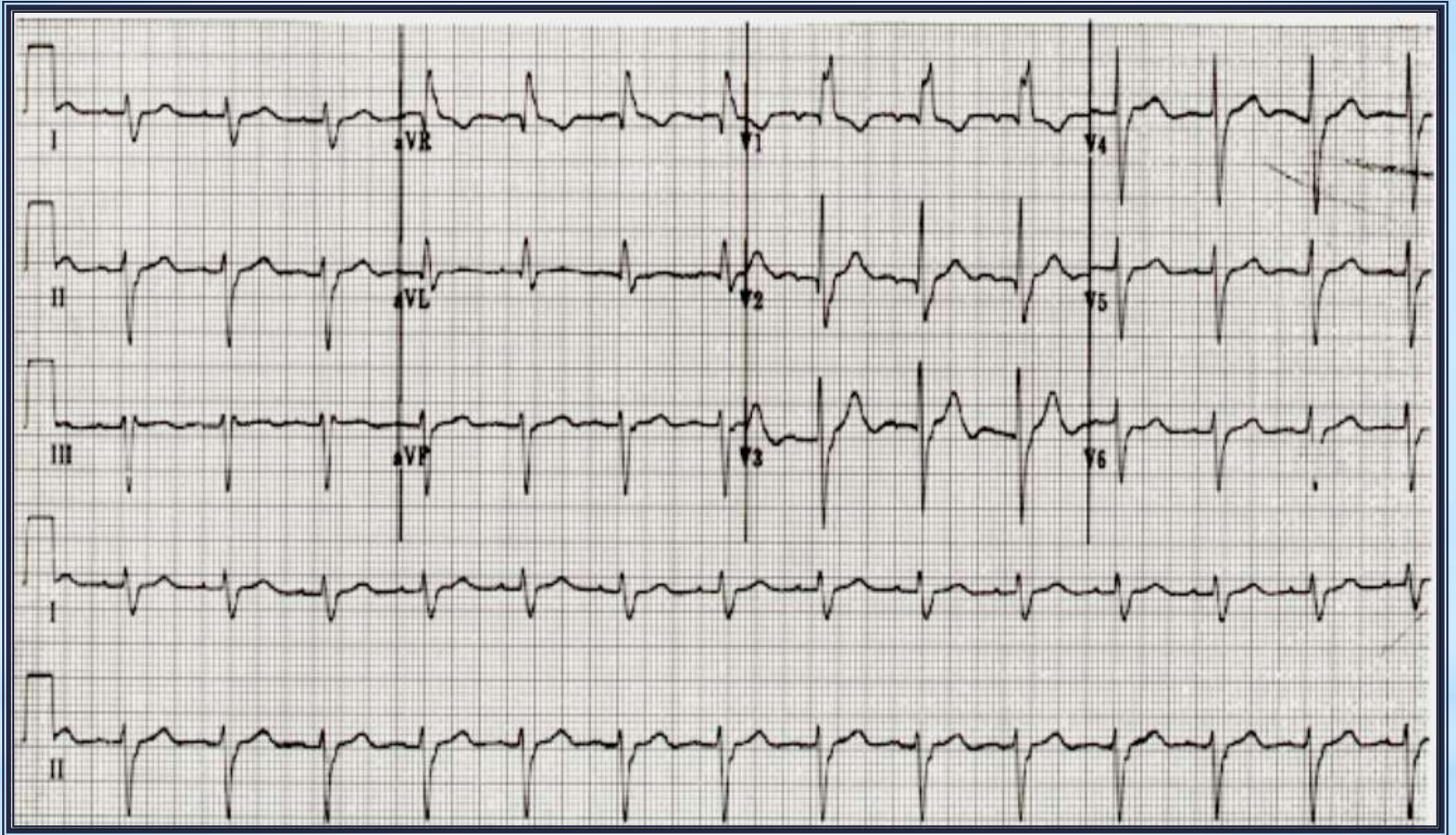


* ECG # 5

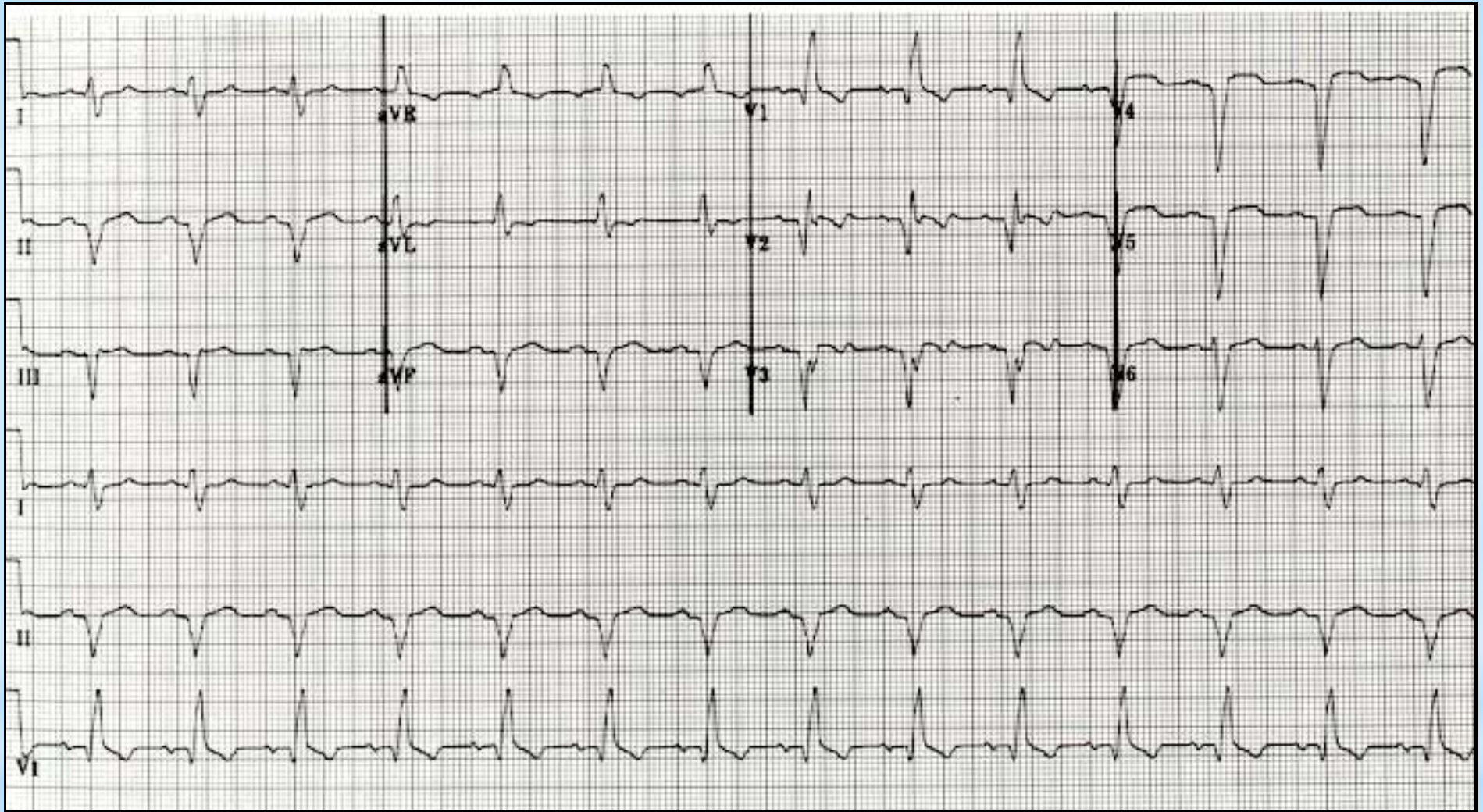
2/15/2012



* ECG # 6



* ECG # 7

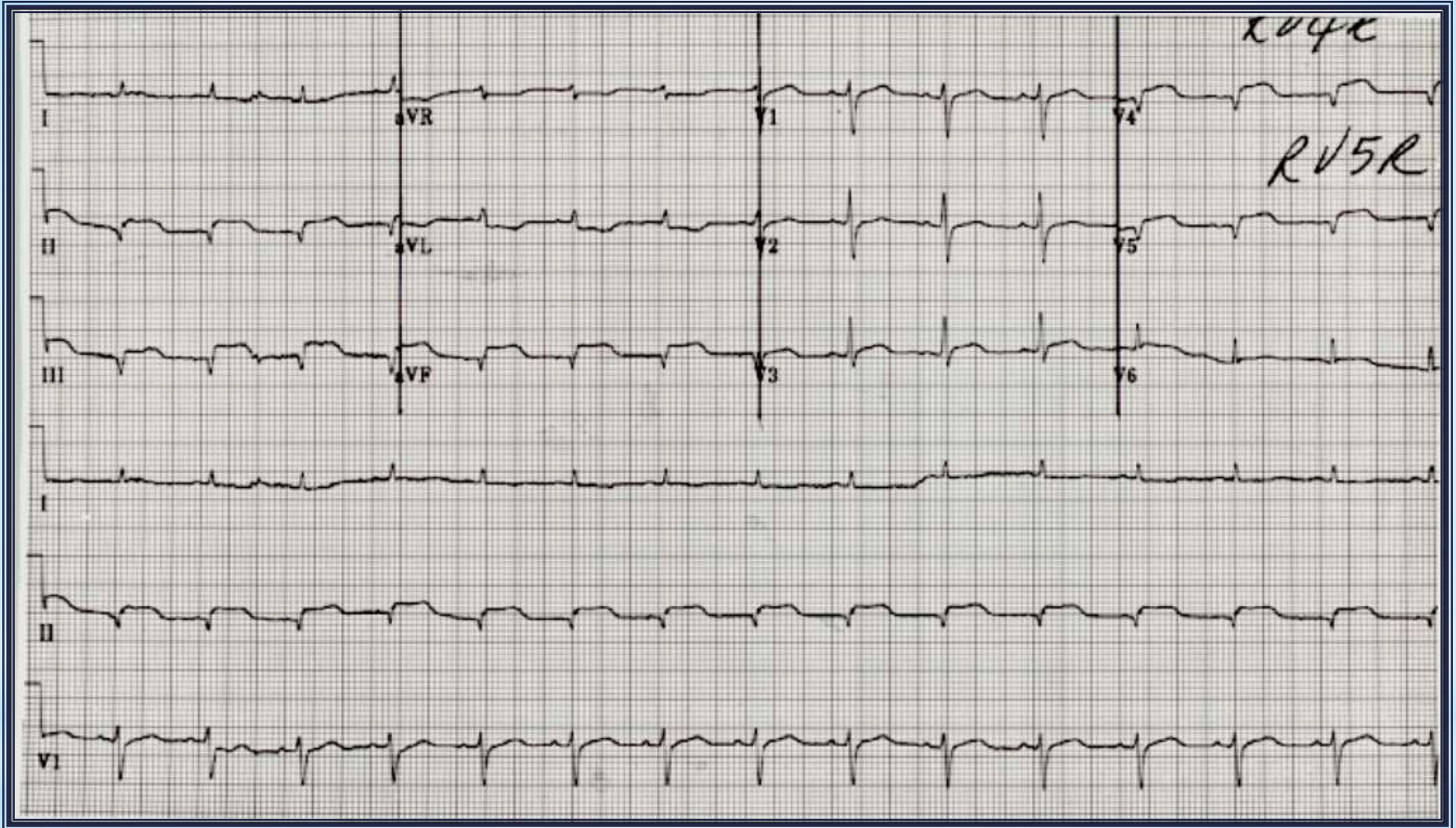


* ECG # 8

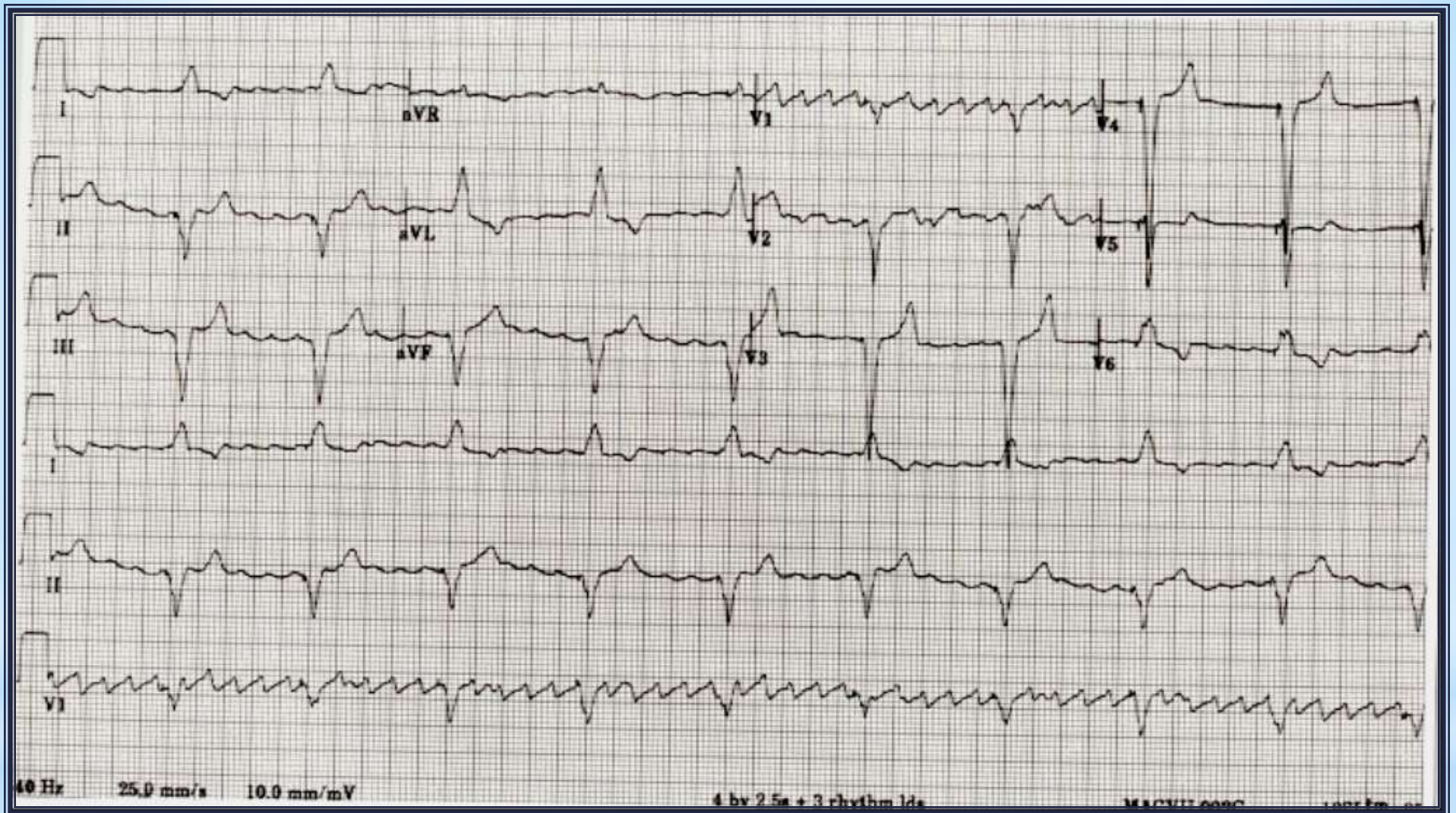


* ECG # 9

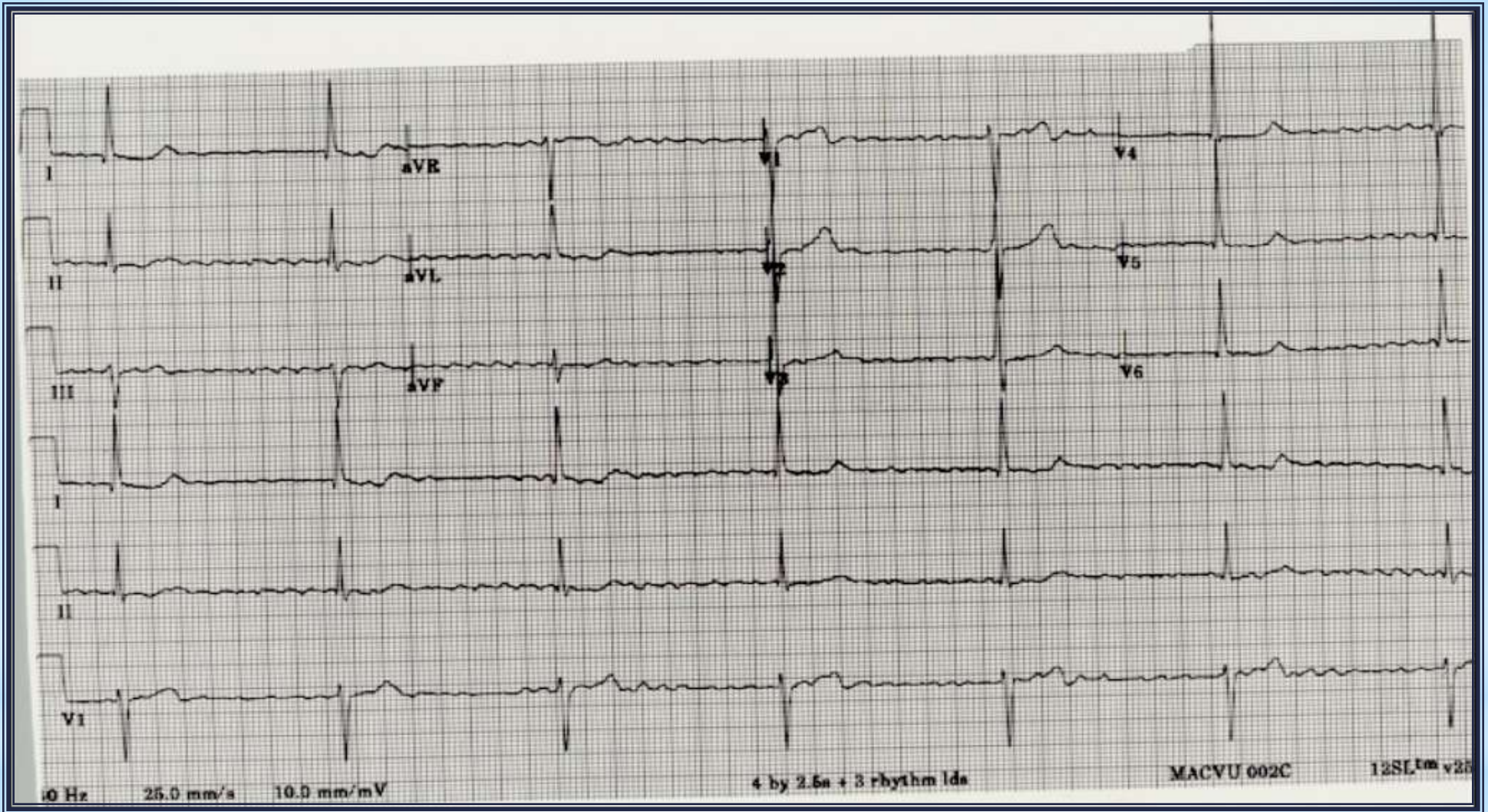
2/15/2012



* ECG # 10

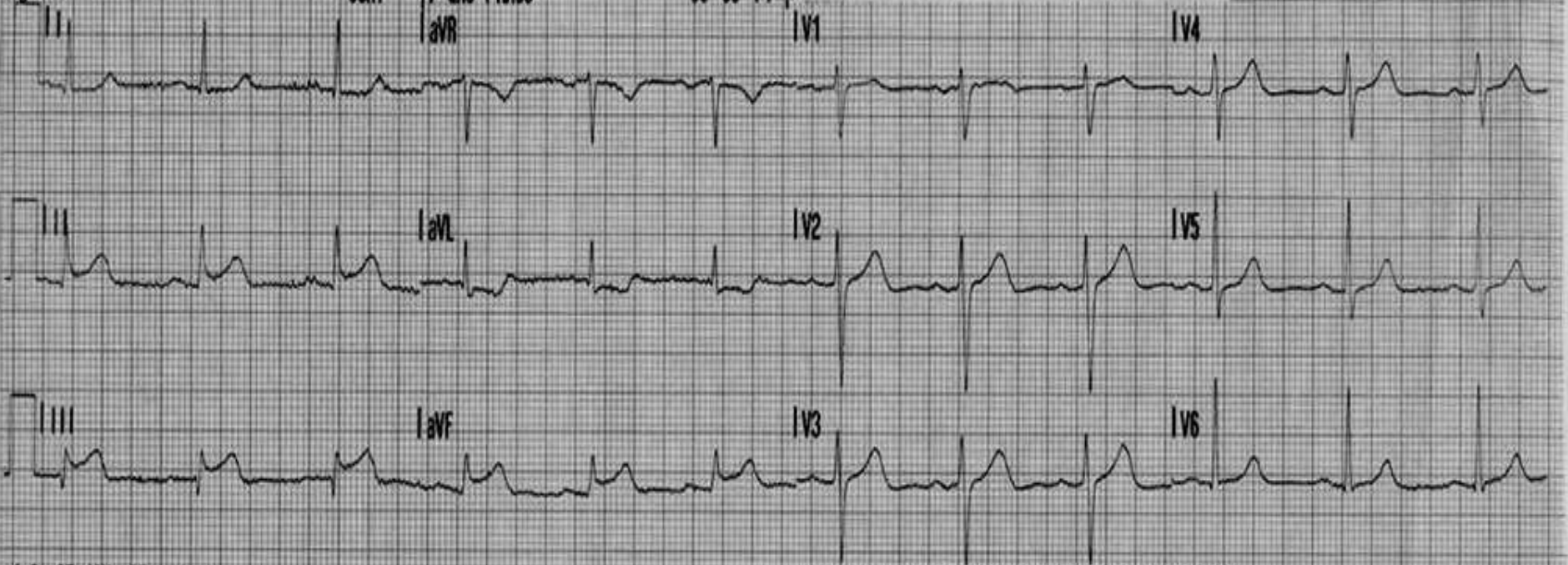


* ECG # 11



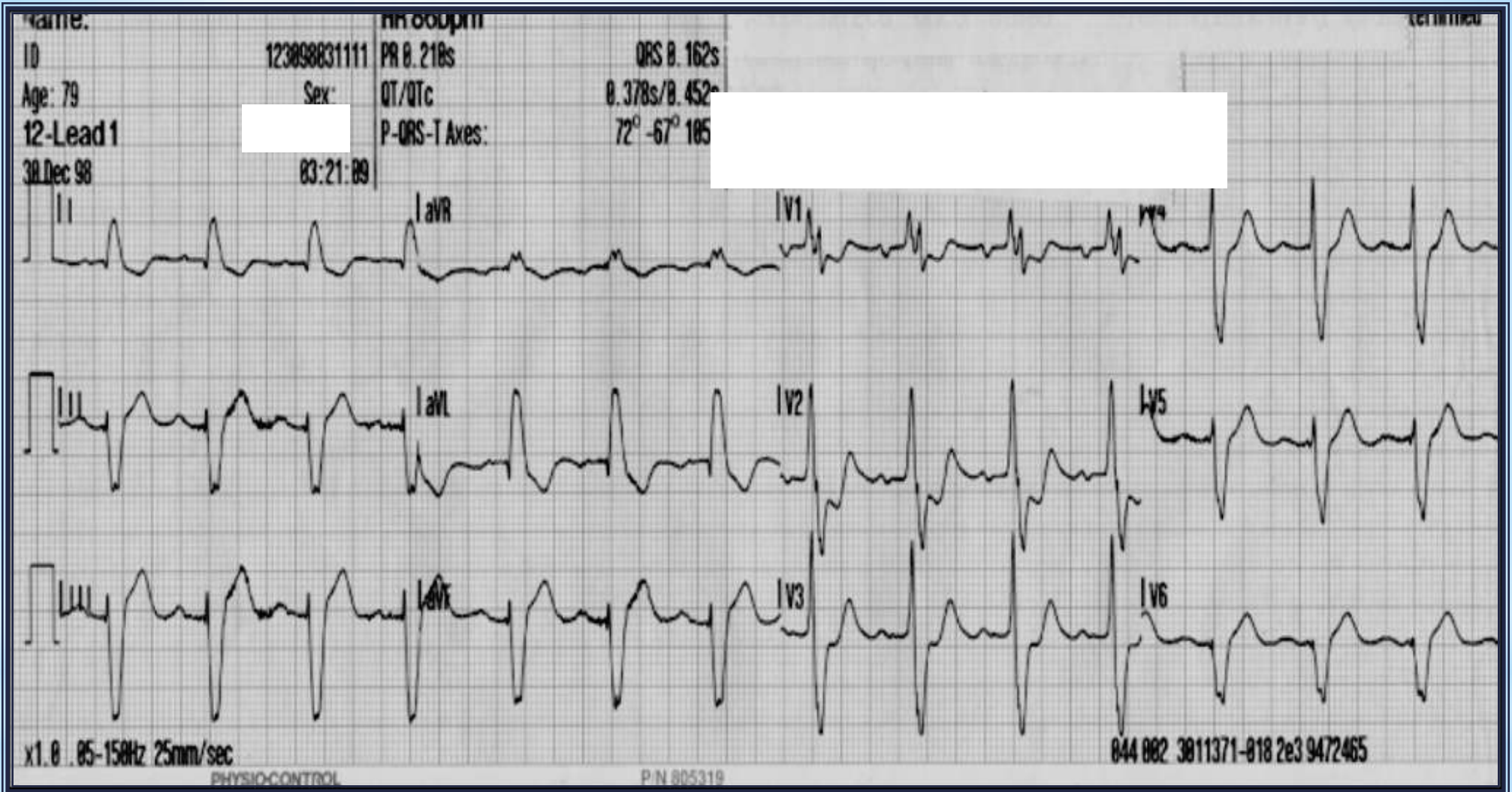
* ECG # 12

Name: 12-Lead 1 HR 70 bpm
ID: 831782872784 17 Mar 82 07:31:28
Patient ID: PR 0.168s QRS 0.086s
Incident: QT/QTc 0.374s/0.483s
Age: 56 Sex: P-QRS-T Axes 65° 38° 74°
aVR

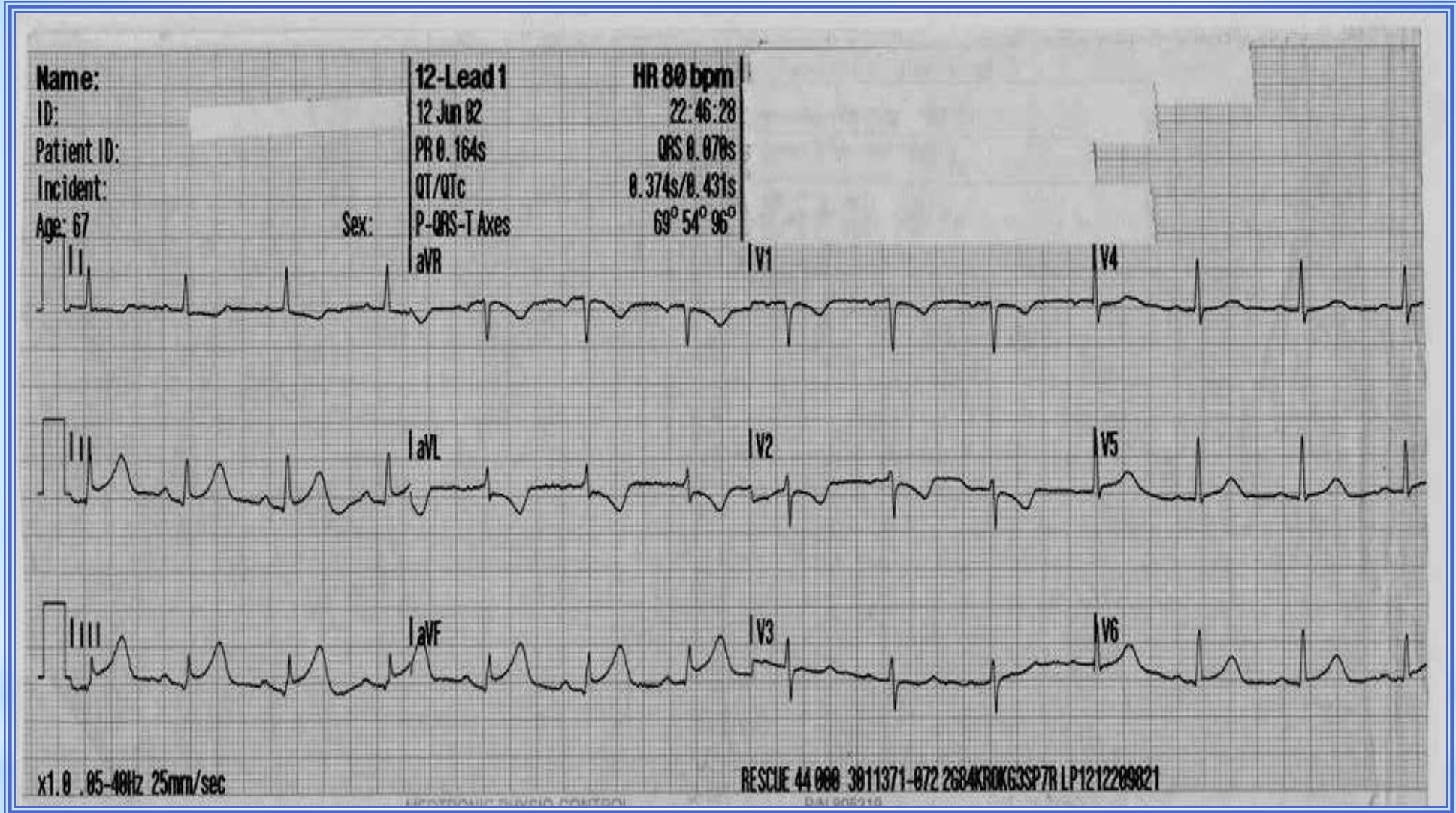


PRINTED IN U.S.A. P/N 805319

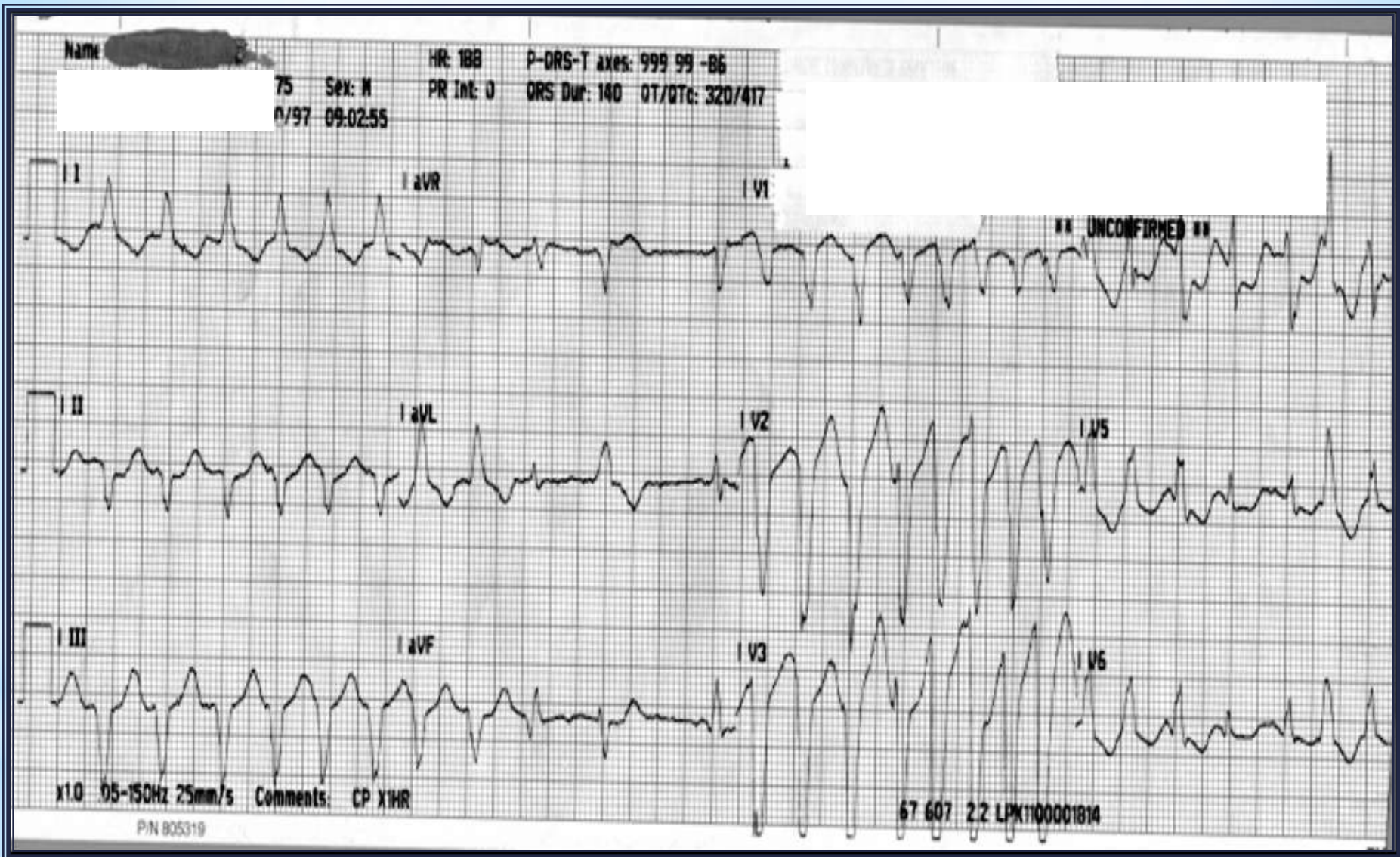
* ECG # 13



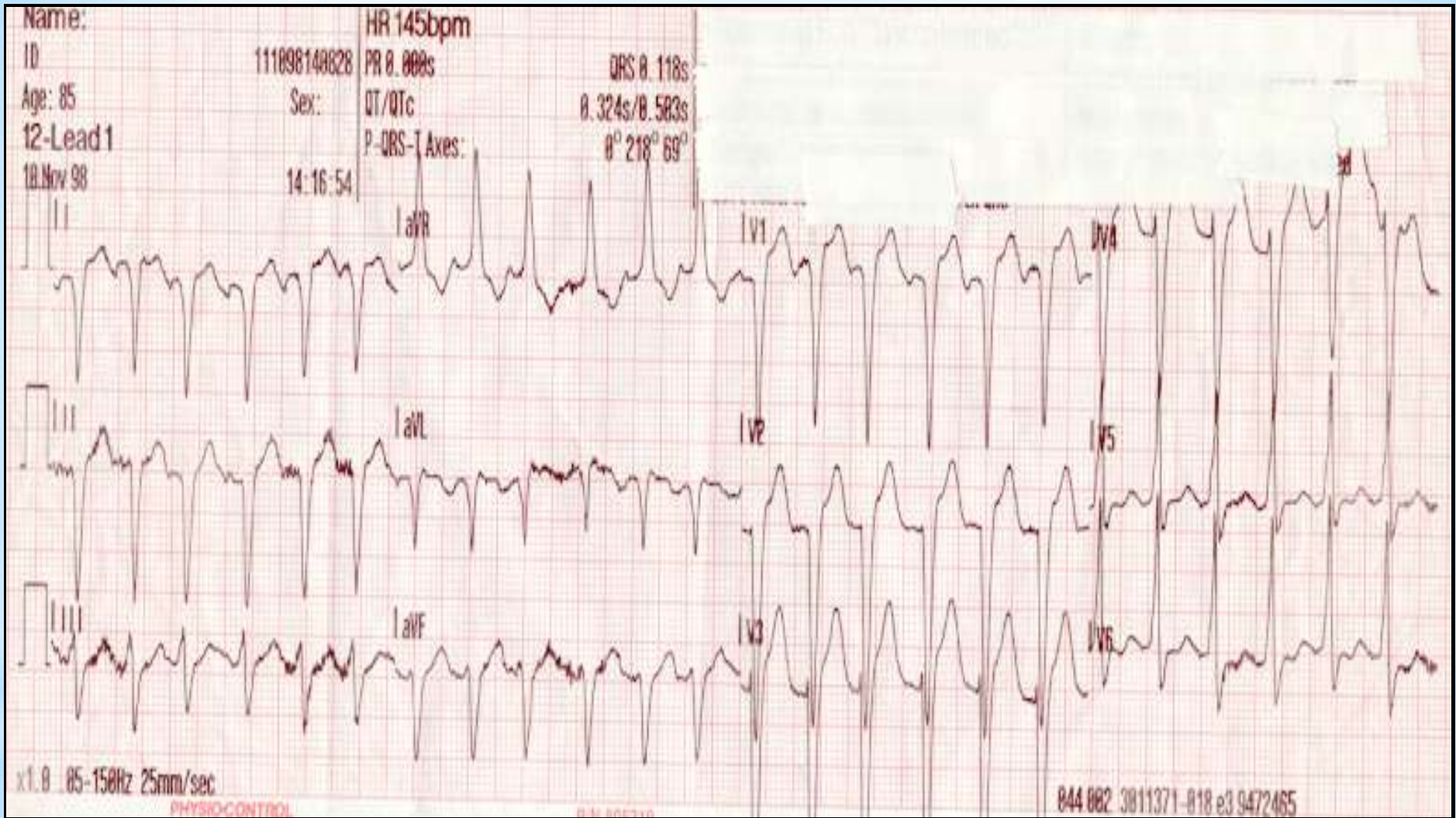
* ECG # 15



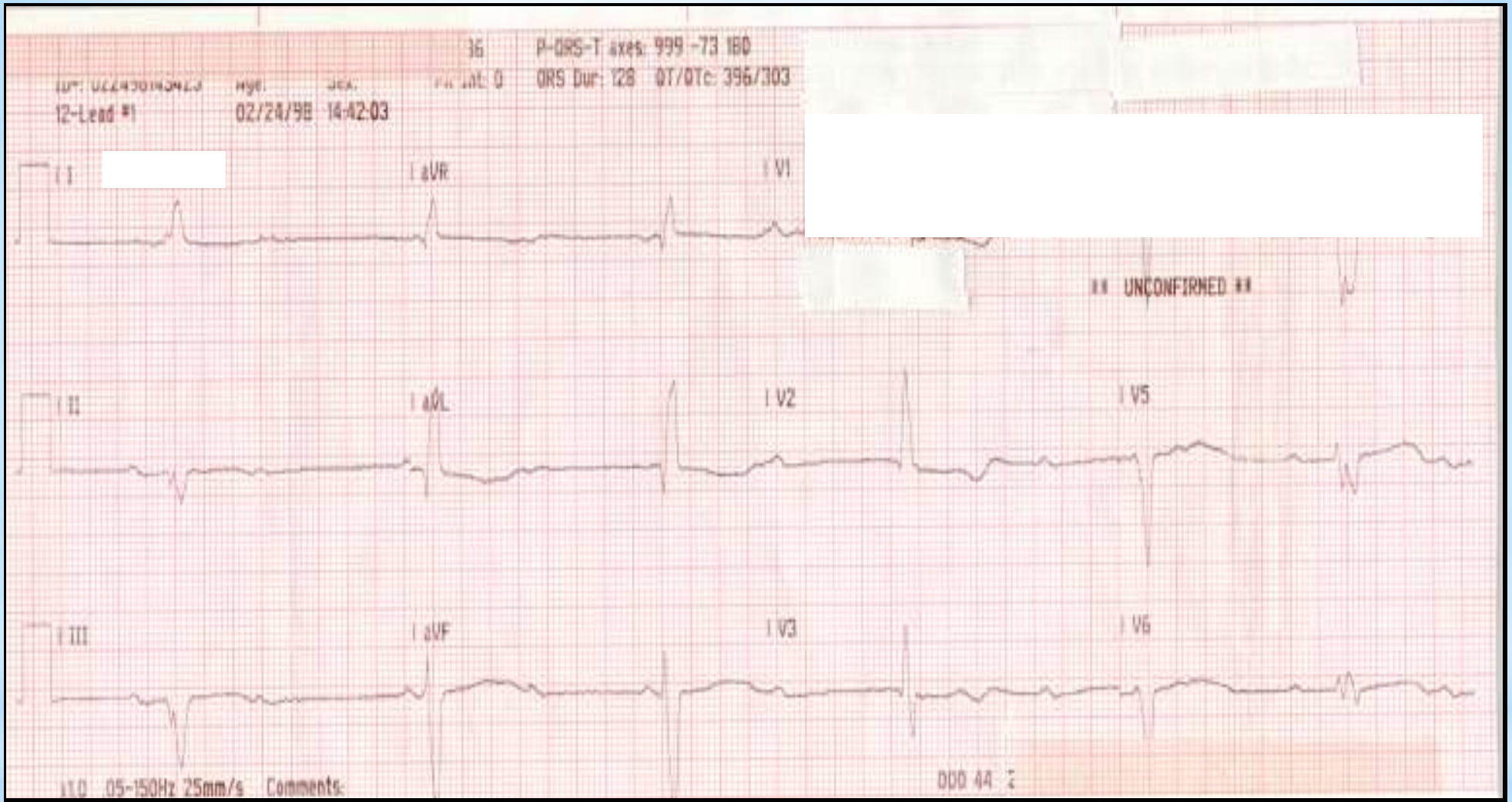
* ECG # 16



* ECG # 17

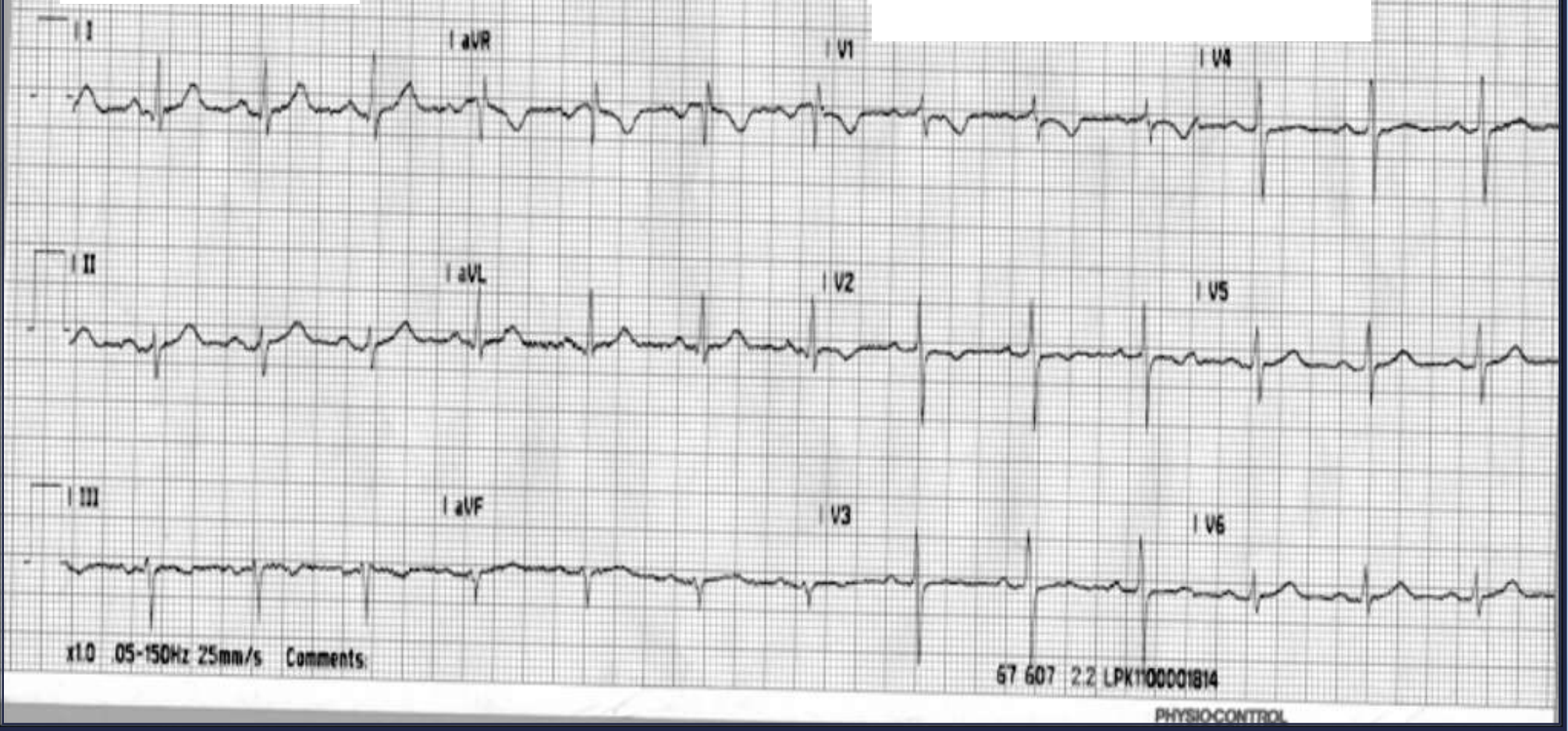


* ECG # 18

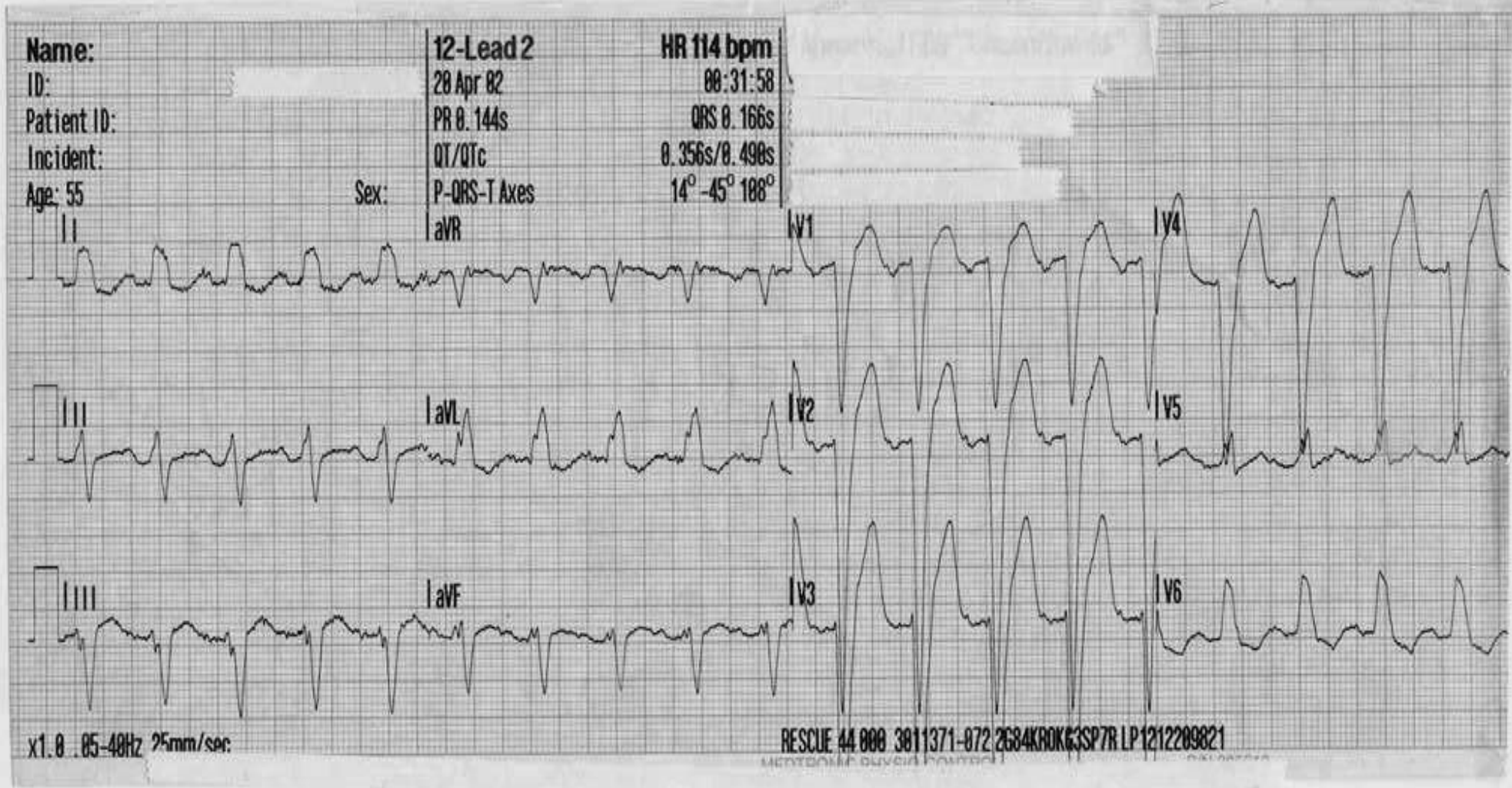


* ECG # 19

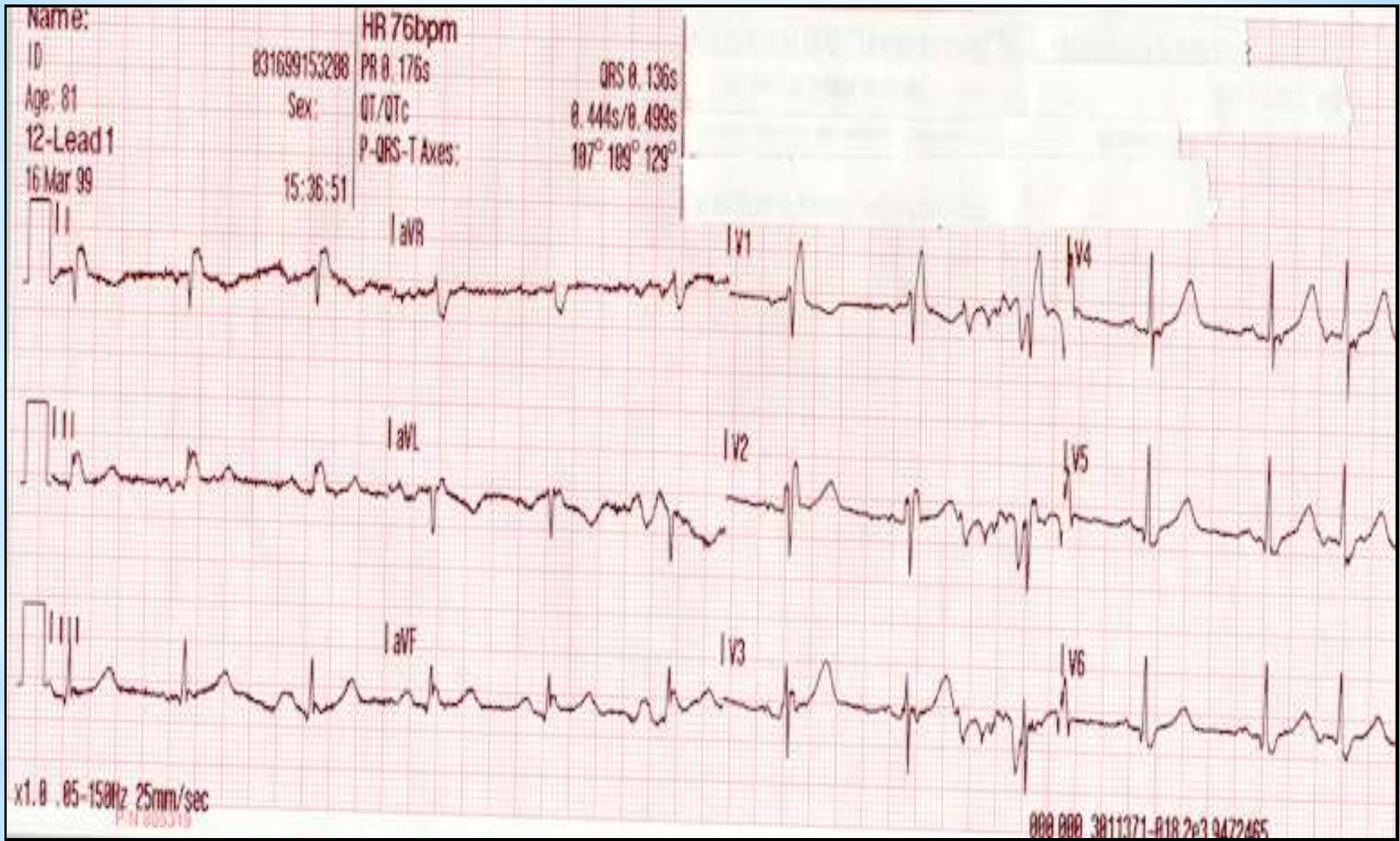
HR: 81 P-QRS-T axes: 13 -33 21
Sex: PR Int: 184 QRS Dur: 92 QT/QTc: 372/410
225141



* ECG # 20

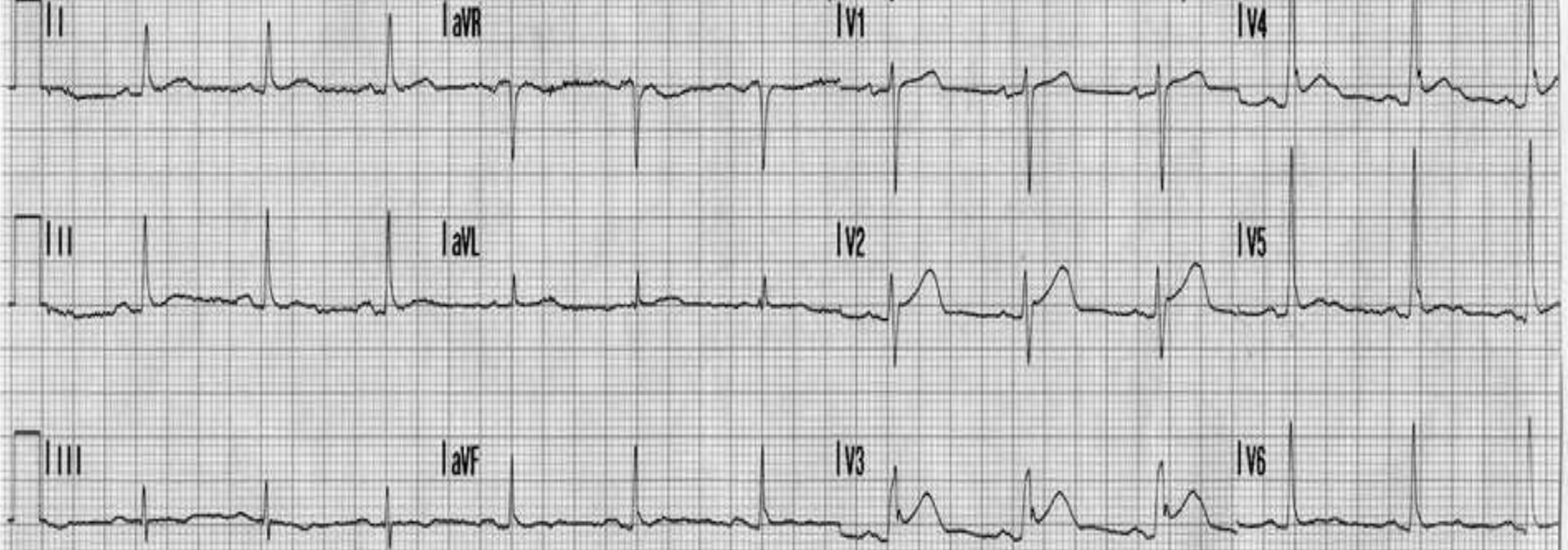


* ECG # 21



* ECG # 22

Name:	[REDACTED]	12-Lead 1	HR 75 bpm
ID:	[REDACTED]	02 Oct 01	20:51:34
Patient ID:	[REDACTED]	PR 0.160s	QRS 0.092s
Incident:	2374	QT/QTc	0.360s/0.402s
Age: 46	Sex: M	P-QRS-T Axes	56° 46° 26°

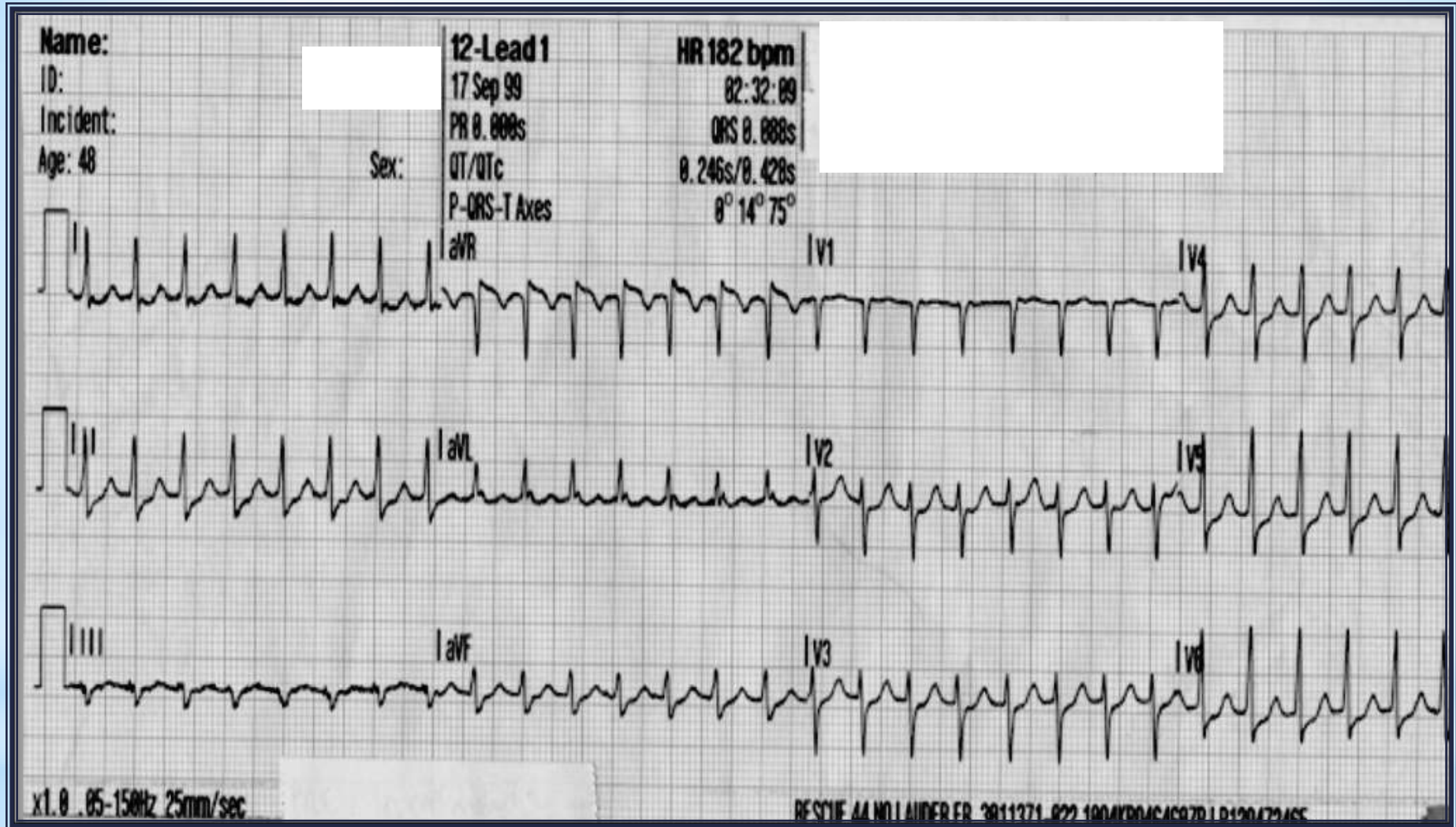


x1.0 .05-40Hz 25mm/sec

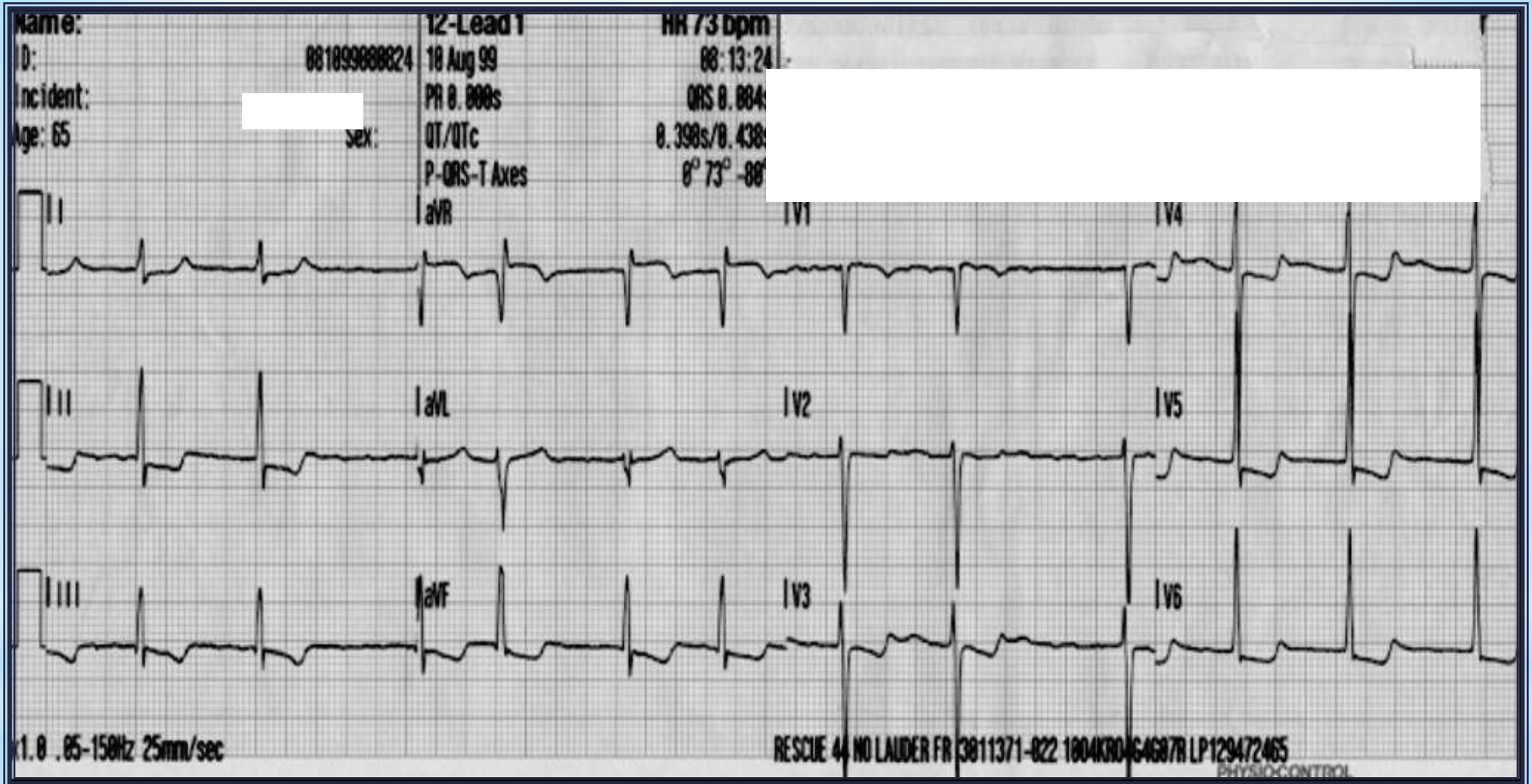
TRIDENT 44 NLAUDERDALE FR 3811371-872 1664KROKJGG7R LP1212289821

* ECG # 23

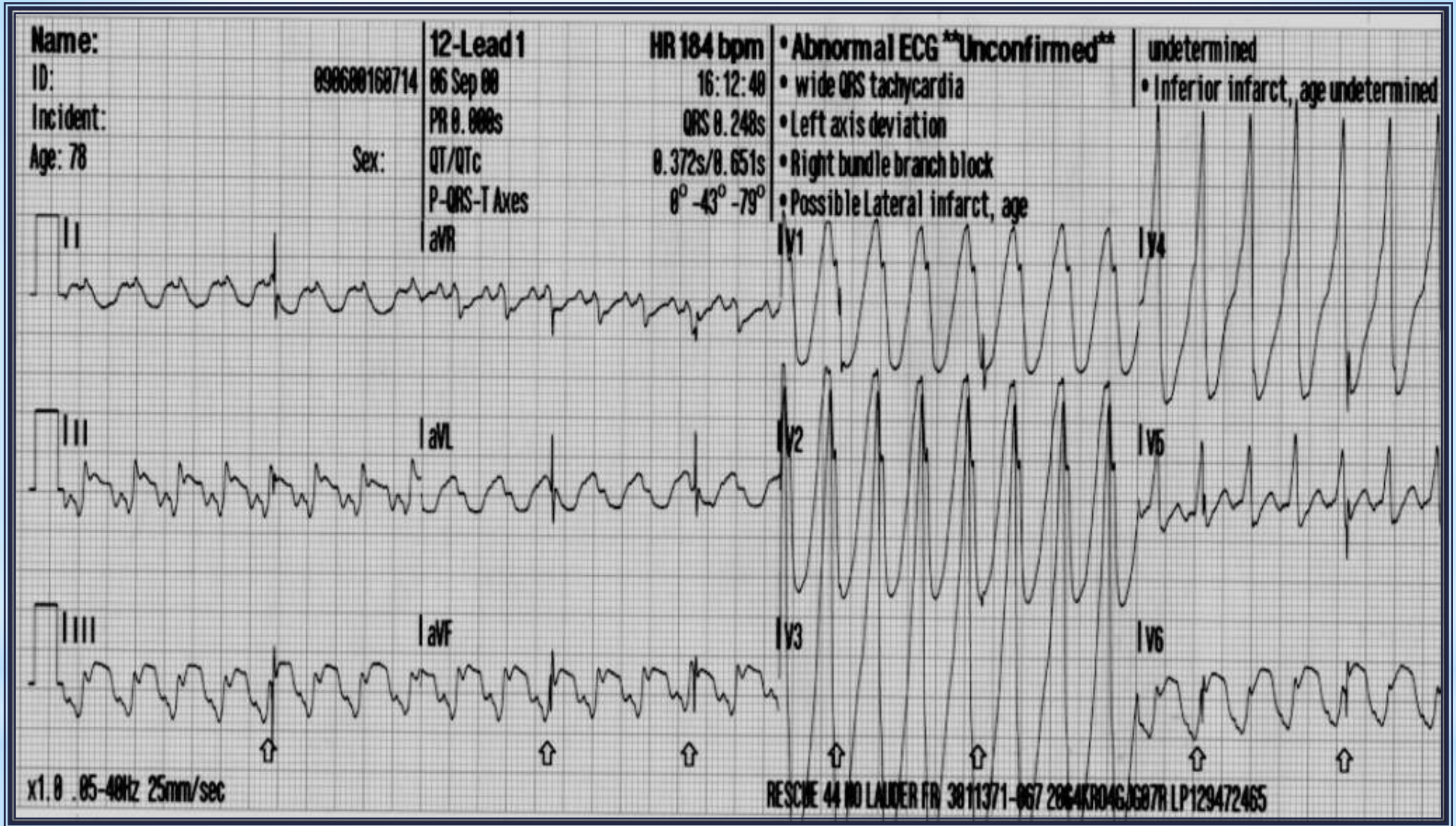
2/15/2012



* ECG # 24

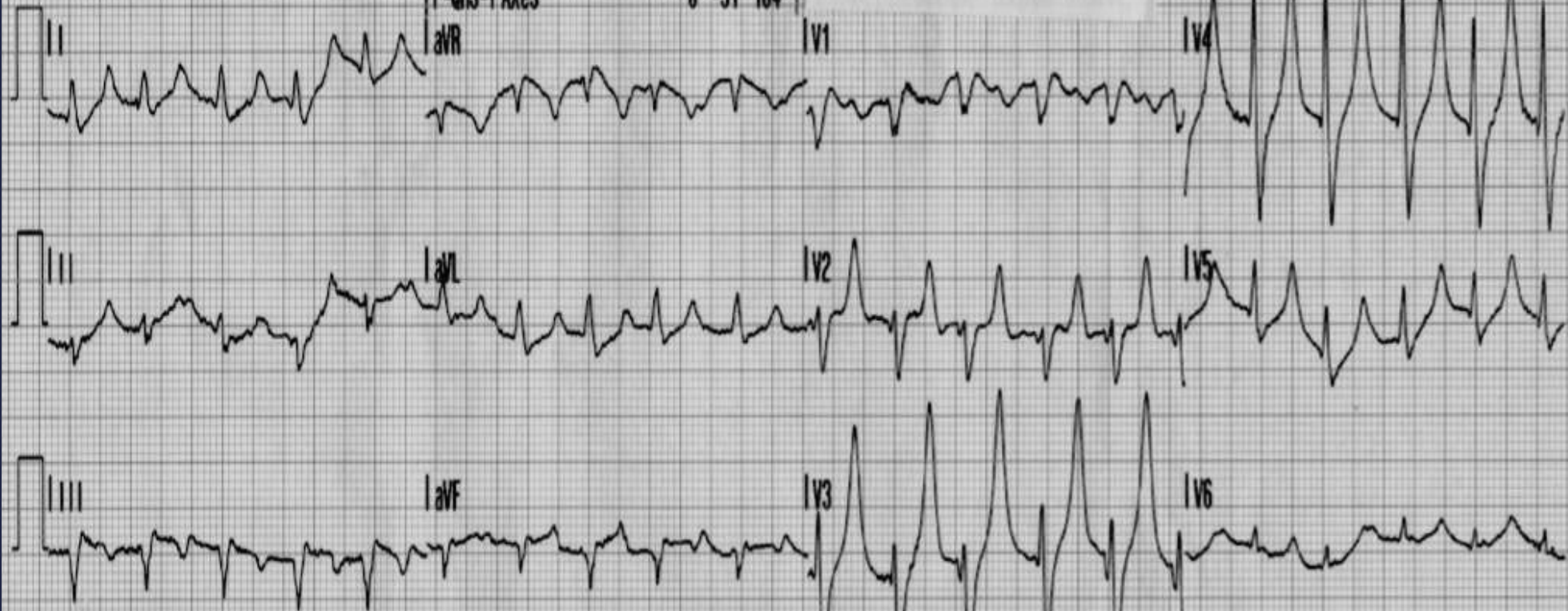


* ECG # 25



* ECG # 26

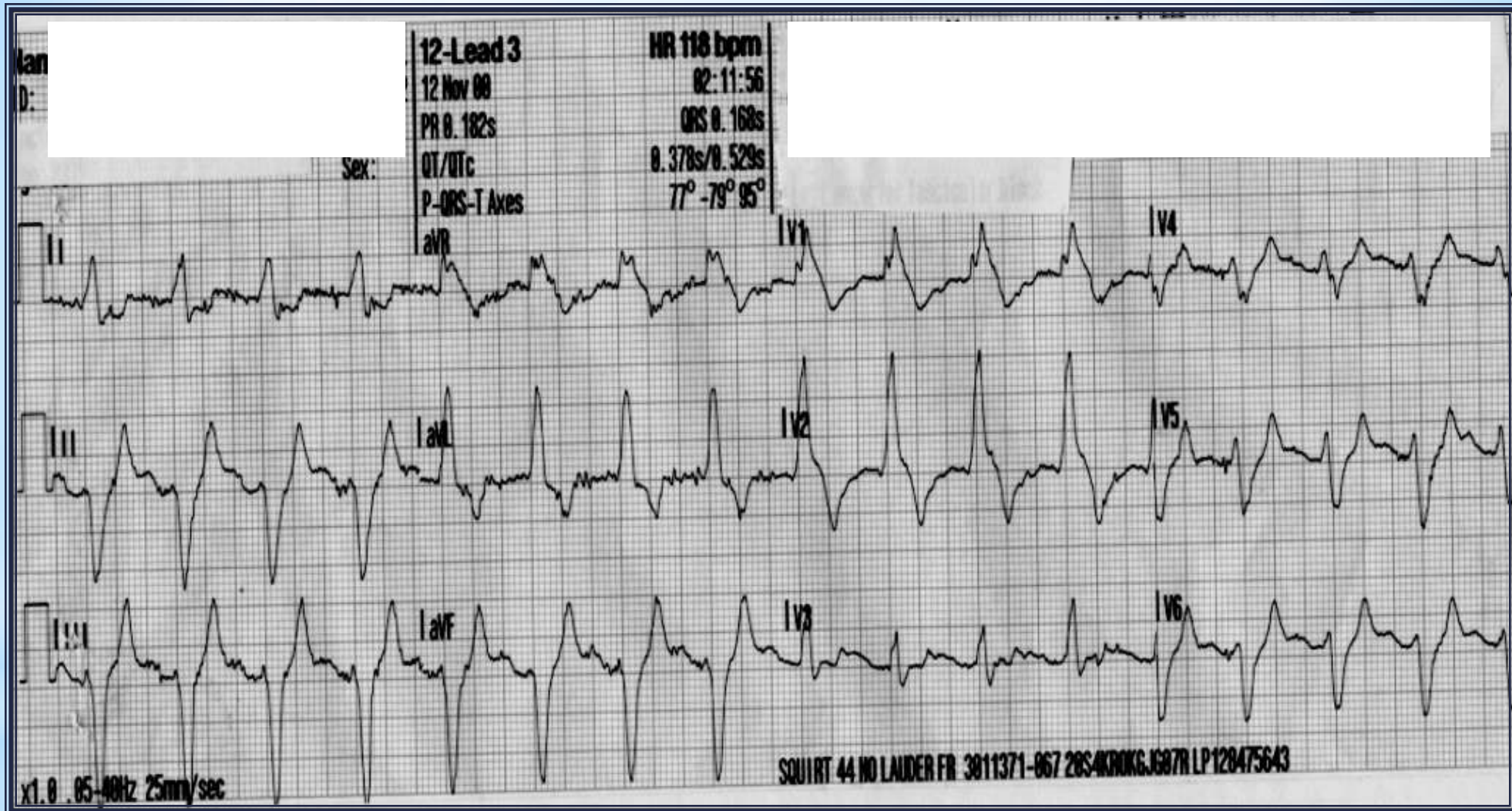
Name: [REDACTED] 12-Lead 4 HR 247 Dpm
ID: [REDACTED] 11 Jan 08 22:12:08
Incident: PR 0.000s QRS 0.130s
Age: 48 Sex: QT/QTc 0.190s/0.385s
P-QRS-T Axes 0° -51° 104°



x1.0 05-150Hz 25mm/sec

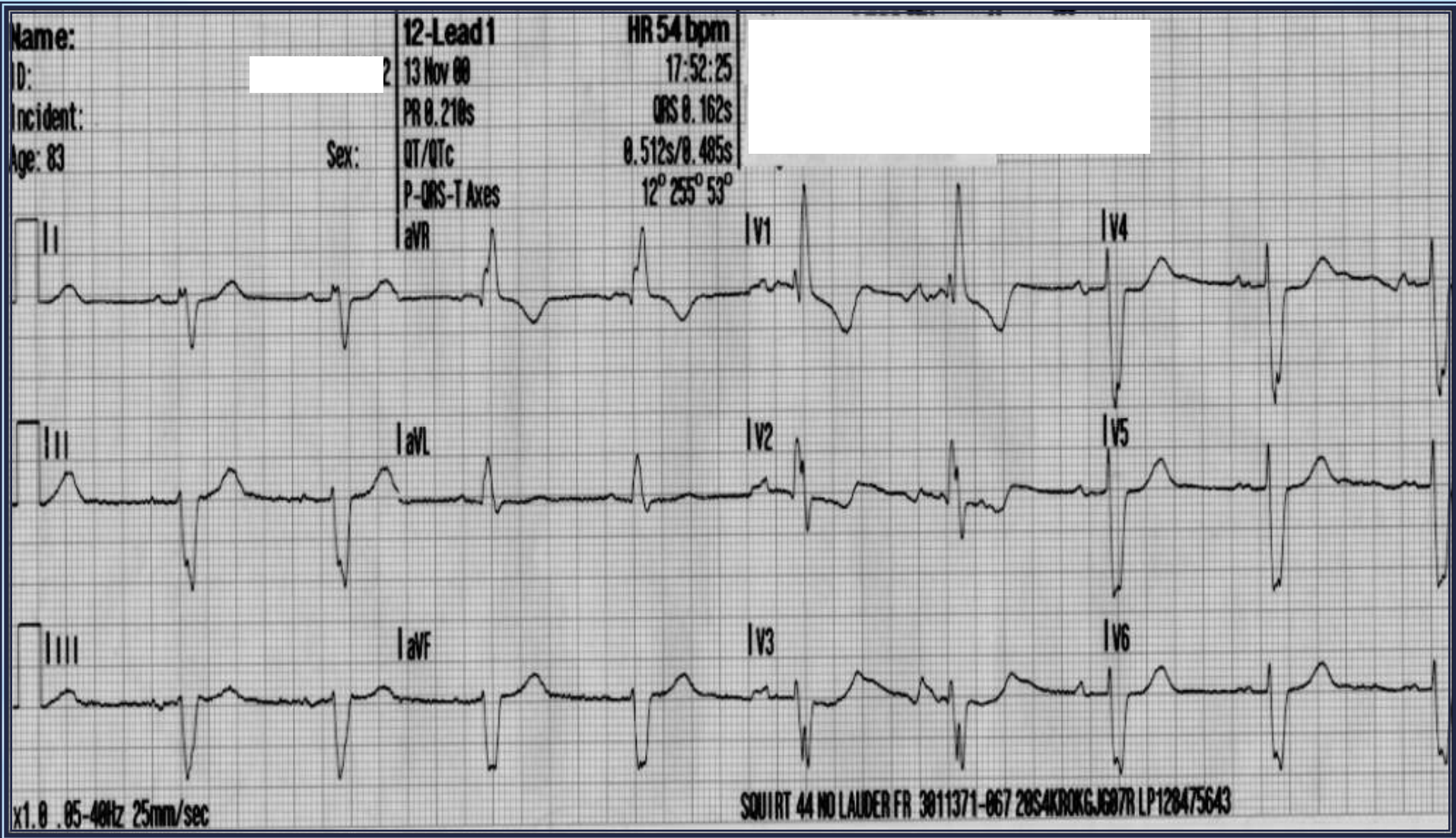
RESCUE 44 NOVA LAUDER FR 3811371-822 1804KRD4G4697R LP129472465

* ECG # 27

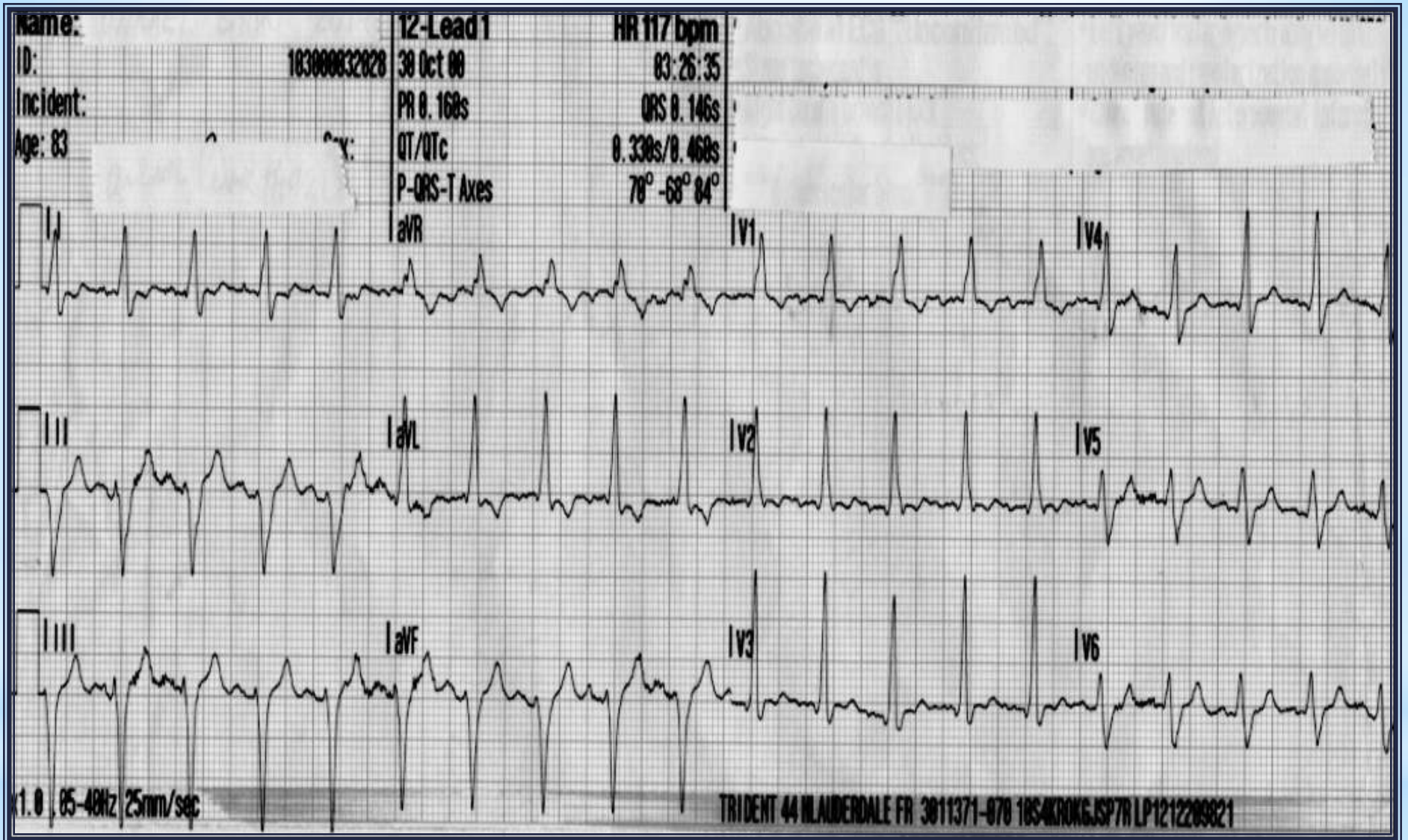


* ECG # 28

2/15/2012



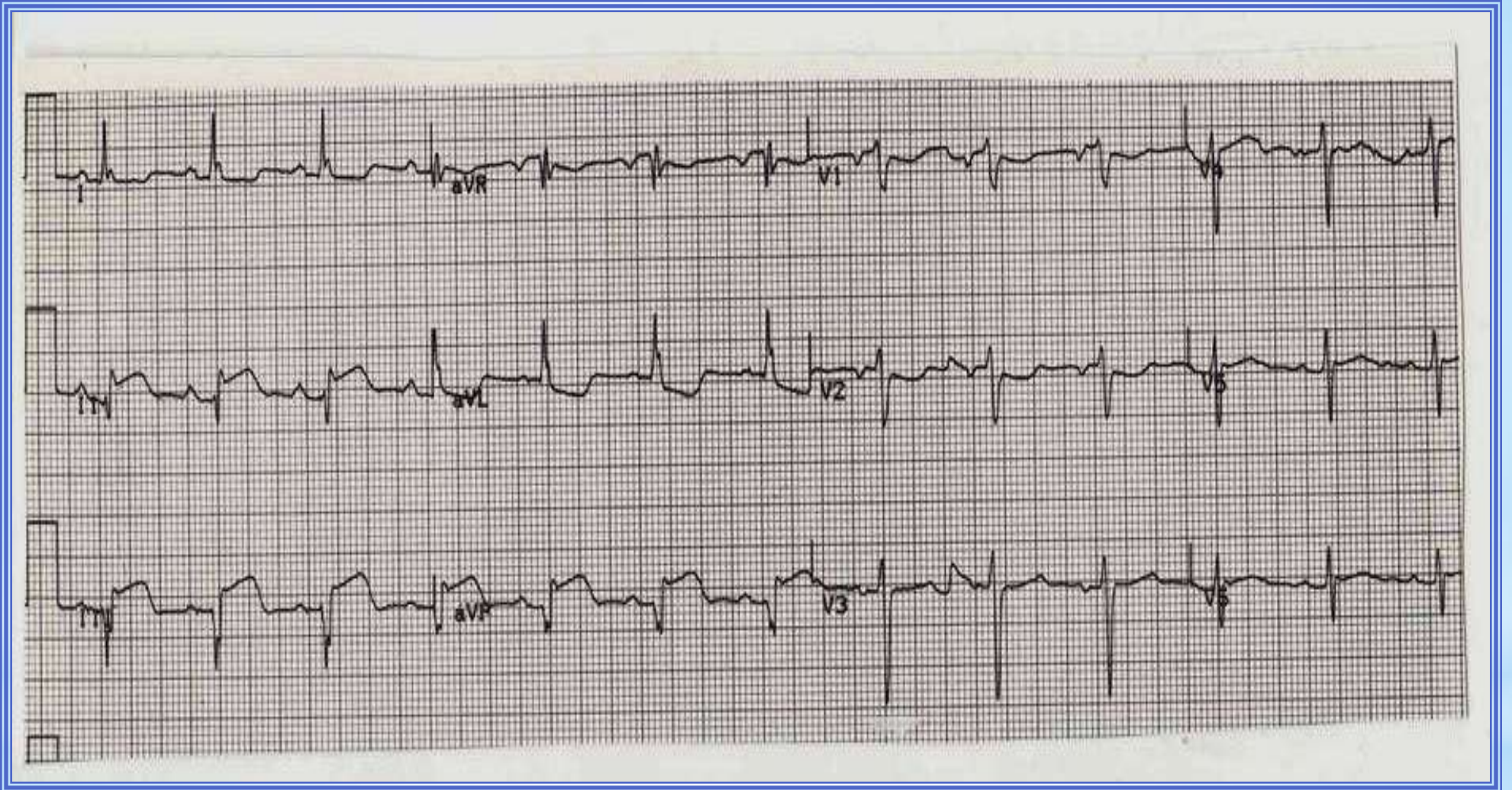
* ECG # 29



* ECG # 30

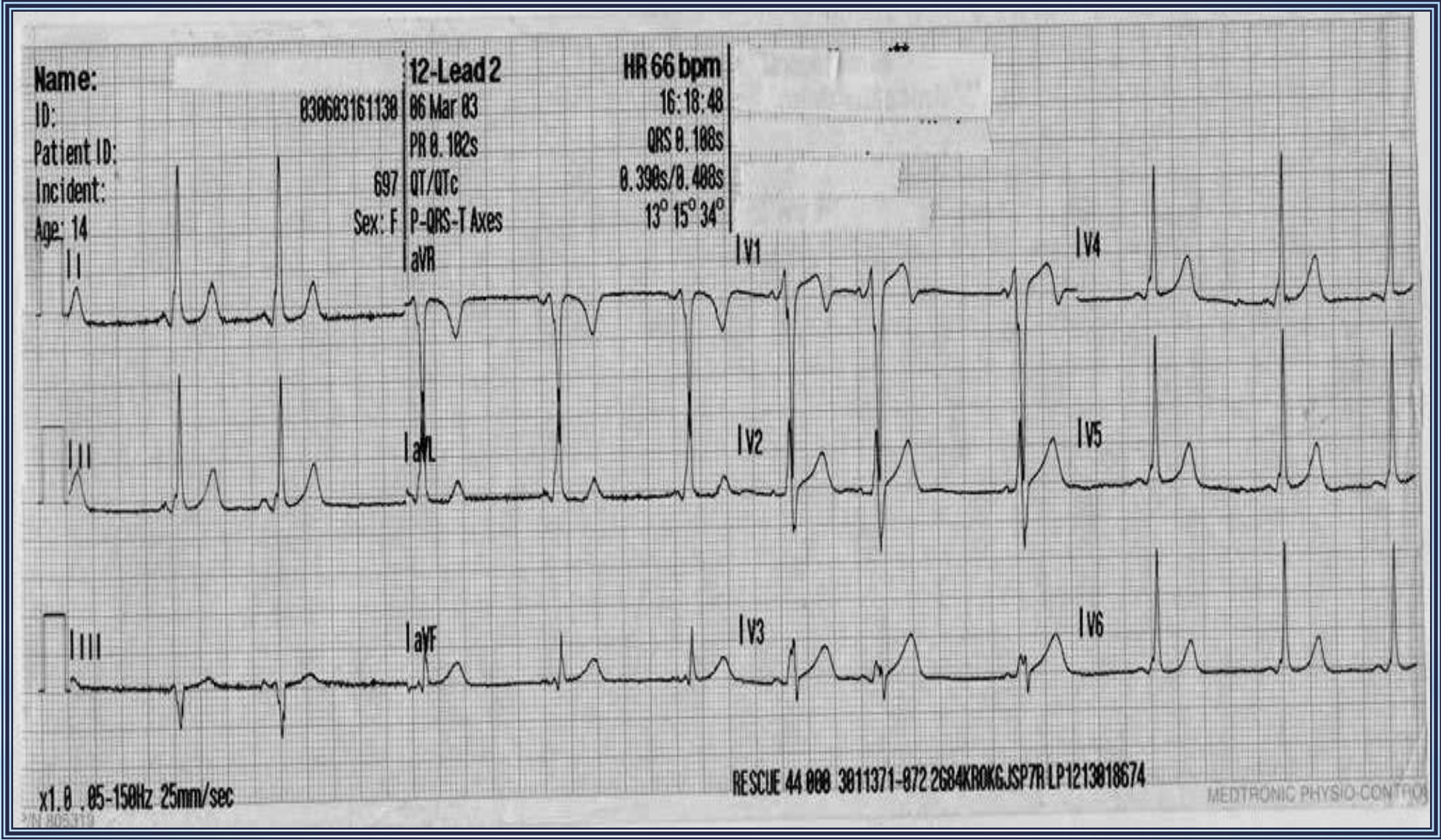


* ECG # 31



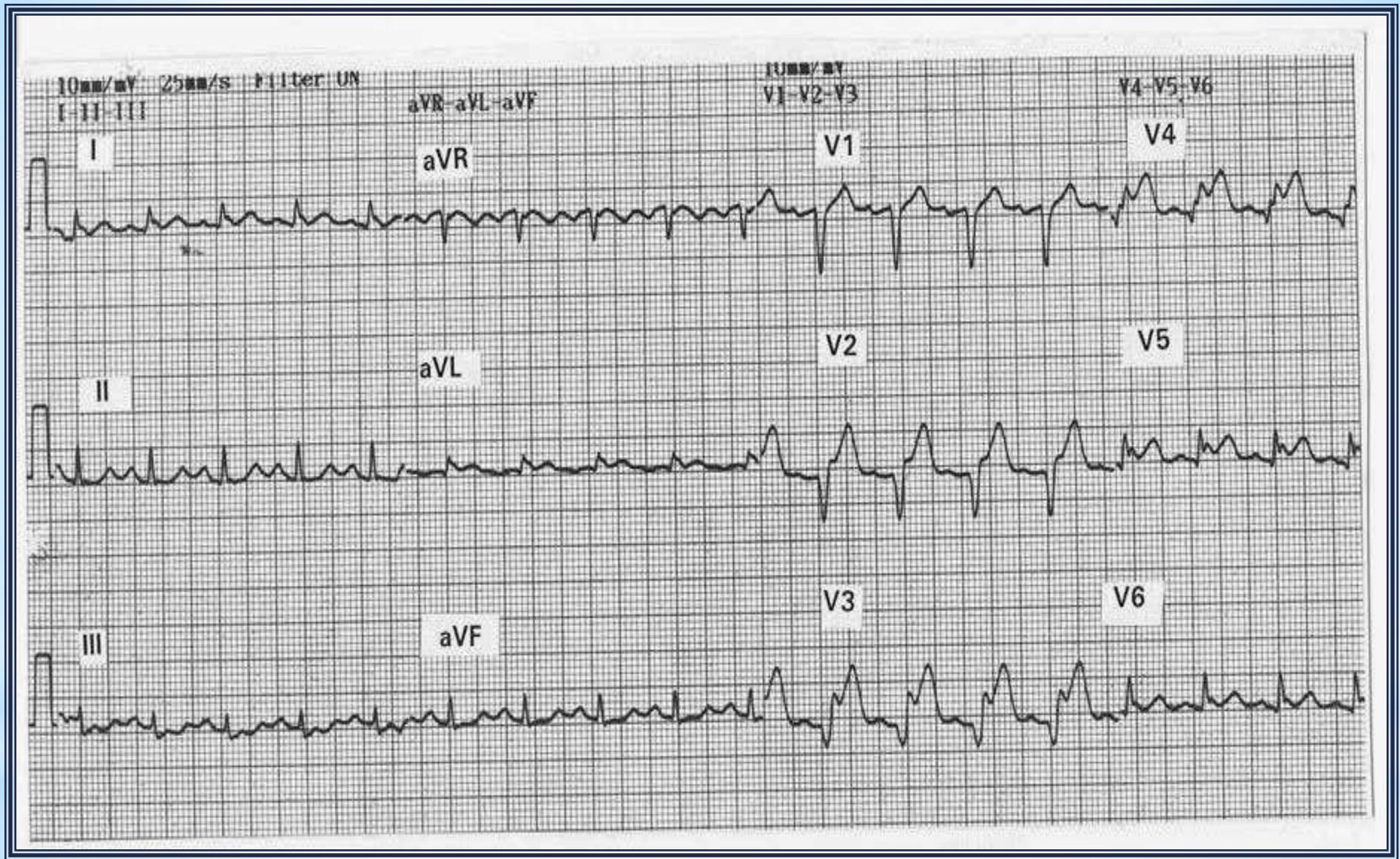
* ECG # 32

2/15/2012



* ECG # 33

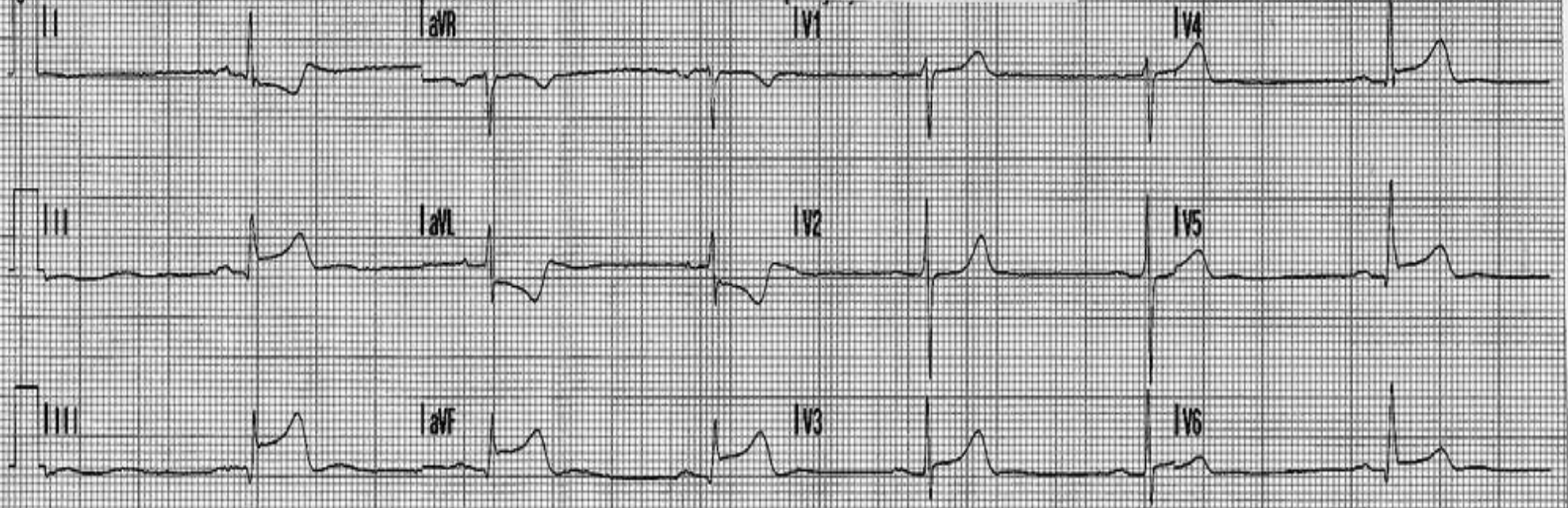
2/15/2012



* ECG # 34

2/15/2012

Name:	[REDACTED]	12-Lead 1	HR 39 bpm
ID:	[REDACTED]	21 Mar 03	03:32:57
Patient ID:	[REDACTED]	PR 0.196s	QRS 0.092s
Incident:	[REDACTED]	QT/QTc	0.500s/0.402s
Age: 67	Sex:	P-QRS-T Axes	47° 61° 103°



x1.0 .05-40Hz 25mm/sec

MEDTRONIC PHYSIO-CONTROL

RESCUE 34 000 3011371-072 2604KROK6.JSP7R LP1212200021
P/N 805319

* ECG # 35

2/15/2012

Name:

12-Lead I

ID:

18 Jan 83

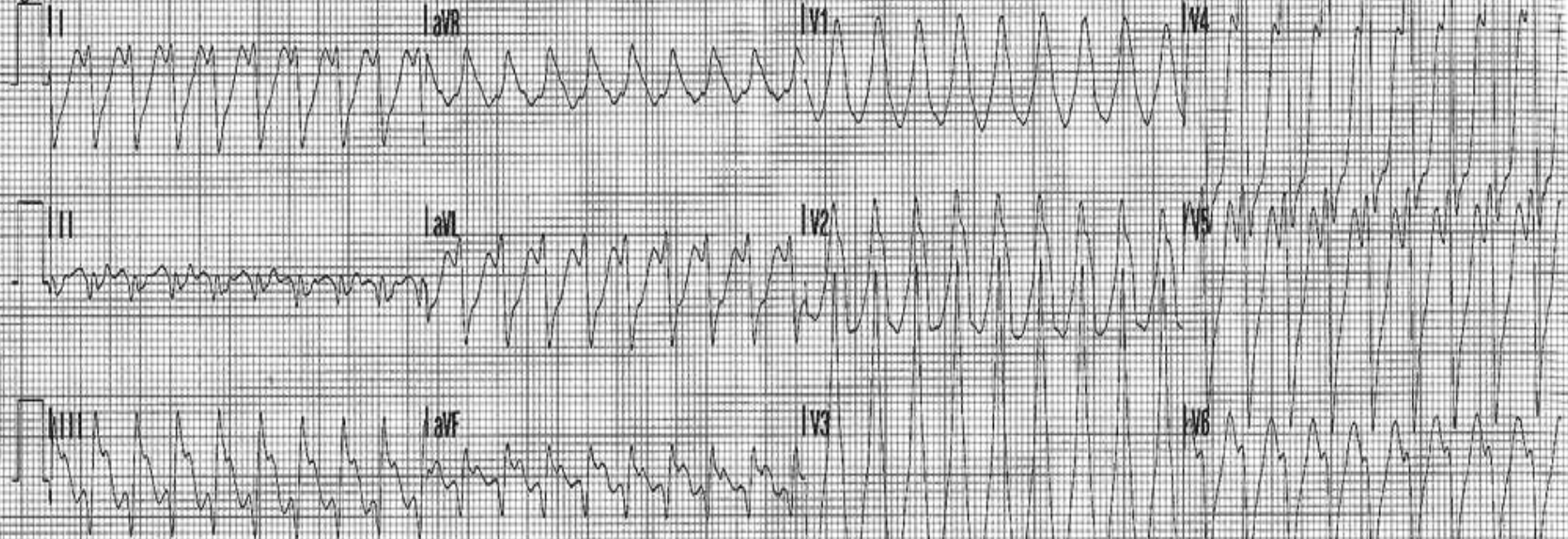
17:02:11

Patient ID:

Incident:

Age: 68

Sex:



x1.0 05-40Hz 25mm/sec

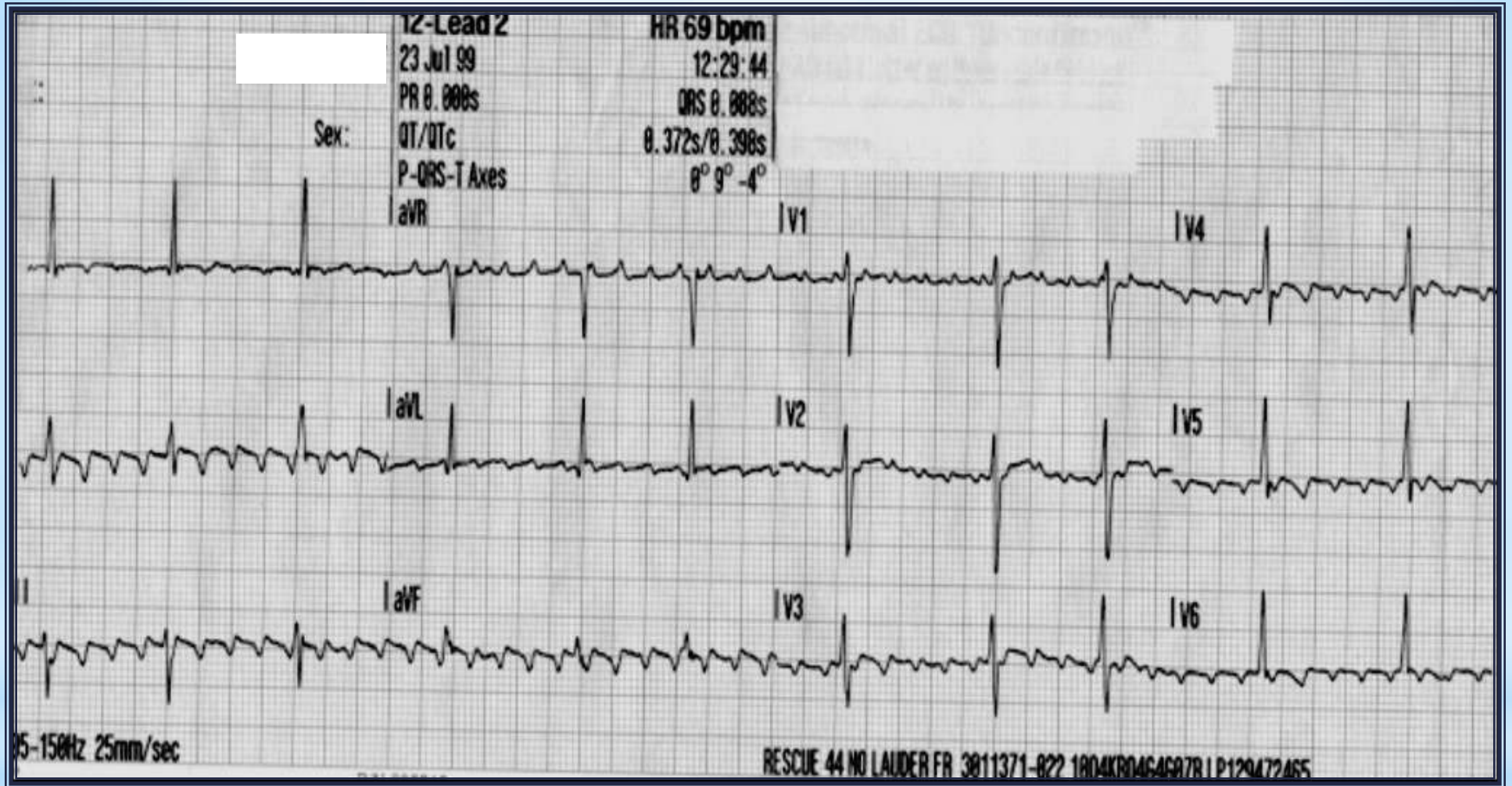
EDTRONIC PHYSIO-CONTROL

P/N 805319

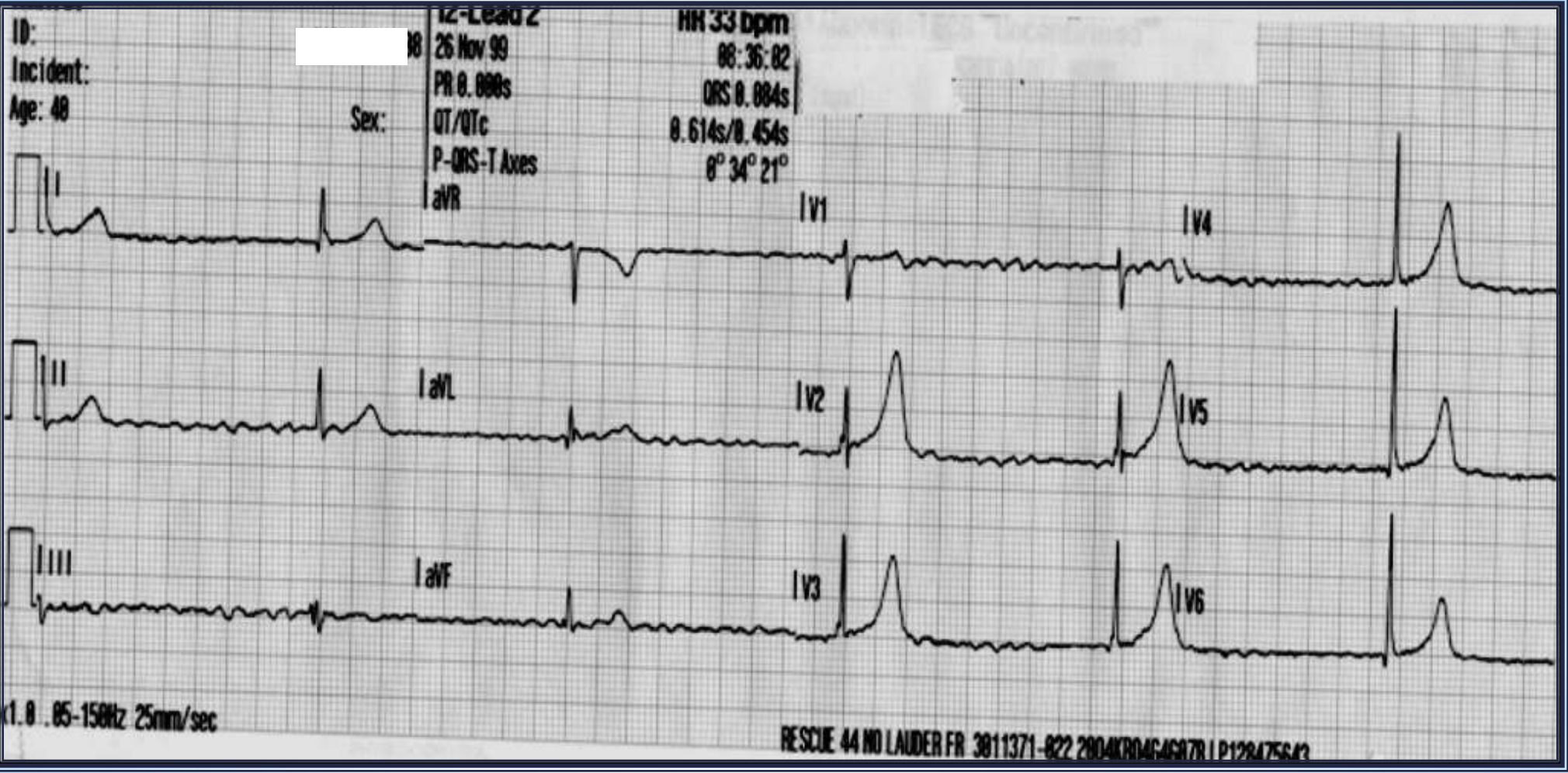
RESCUE 34 000 381371-072 2604K90KGS27R LP1212289821

* ECG # 36

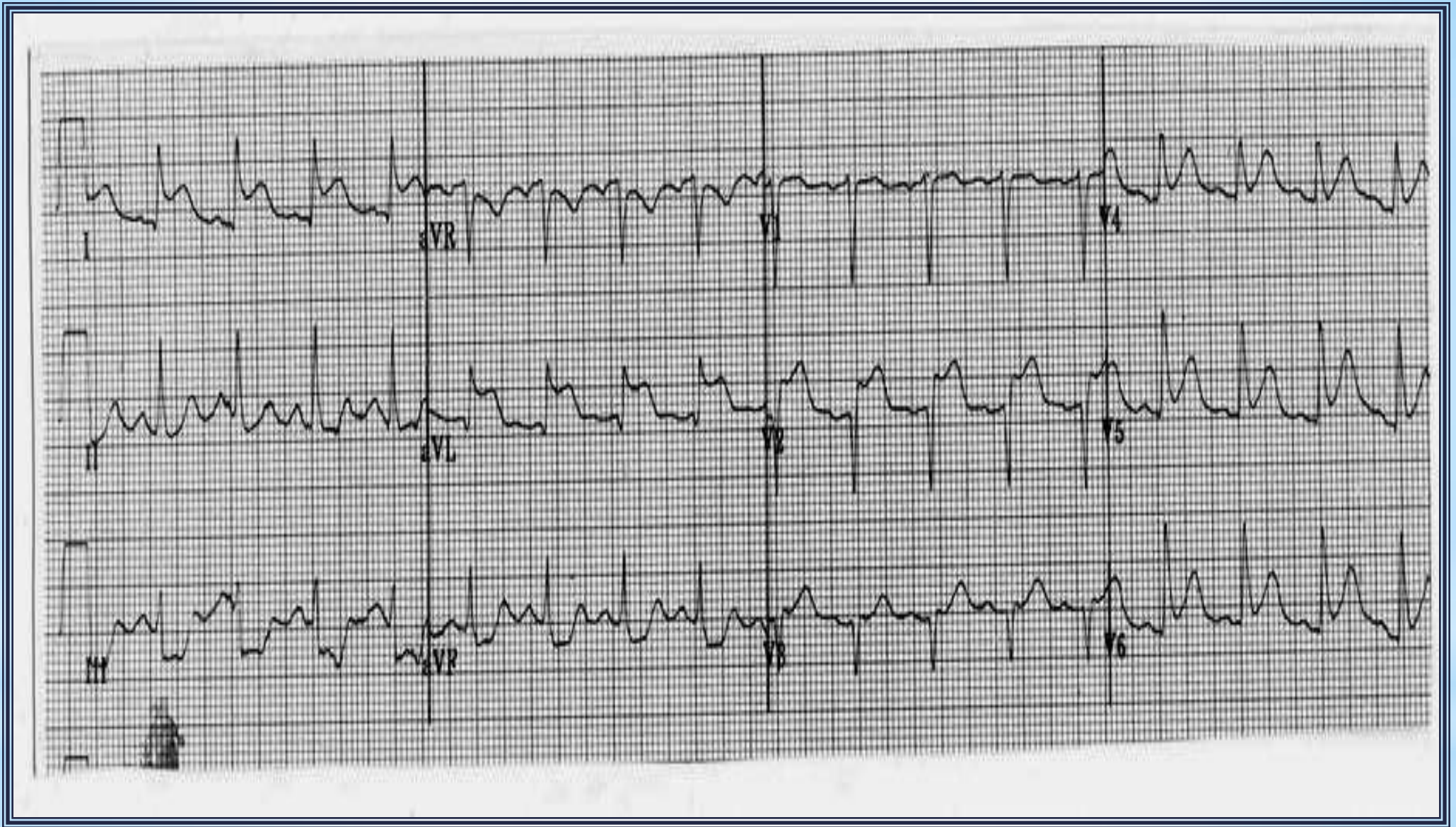
2/15/2012



* ECG # 37



* ECG # 38



* ECG # 39

2/15/2012

Name:

ID:

Patient ID:

Incident:

Age: 68

Sex:

12-Lead 2

07 Jan 03

PR 0.280s

QT/QTc

P-QRS-T Axes

aVR

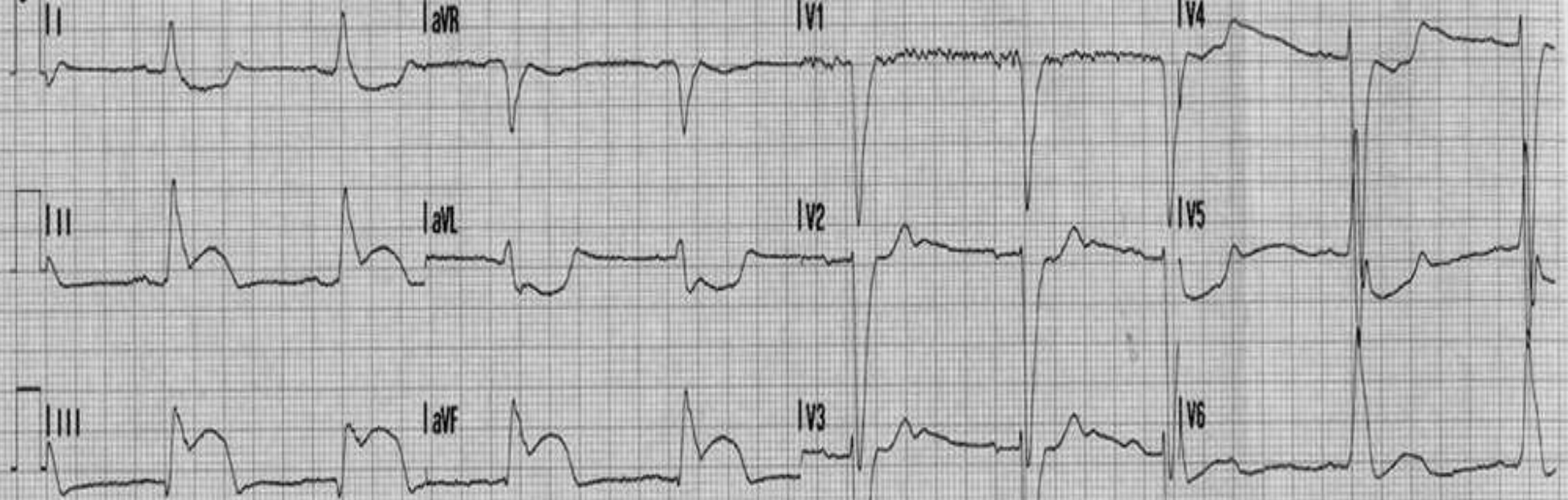
HR 53 bpm

18:55:30

QRS 0.168s

0.512s/0.488s

25° 64° 104°



x1.0 .05-40Hz 25mm/sec

MEDTRONIC PHYSIO-CONTROL

RESCUE 34 000 3811371-072 2684KROKG.JSP7R LP1212289821

P/N 805319

* ECG # 40

2/15/2012