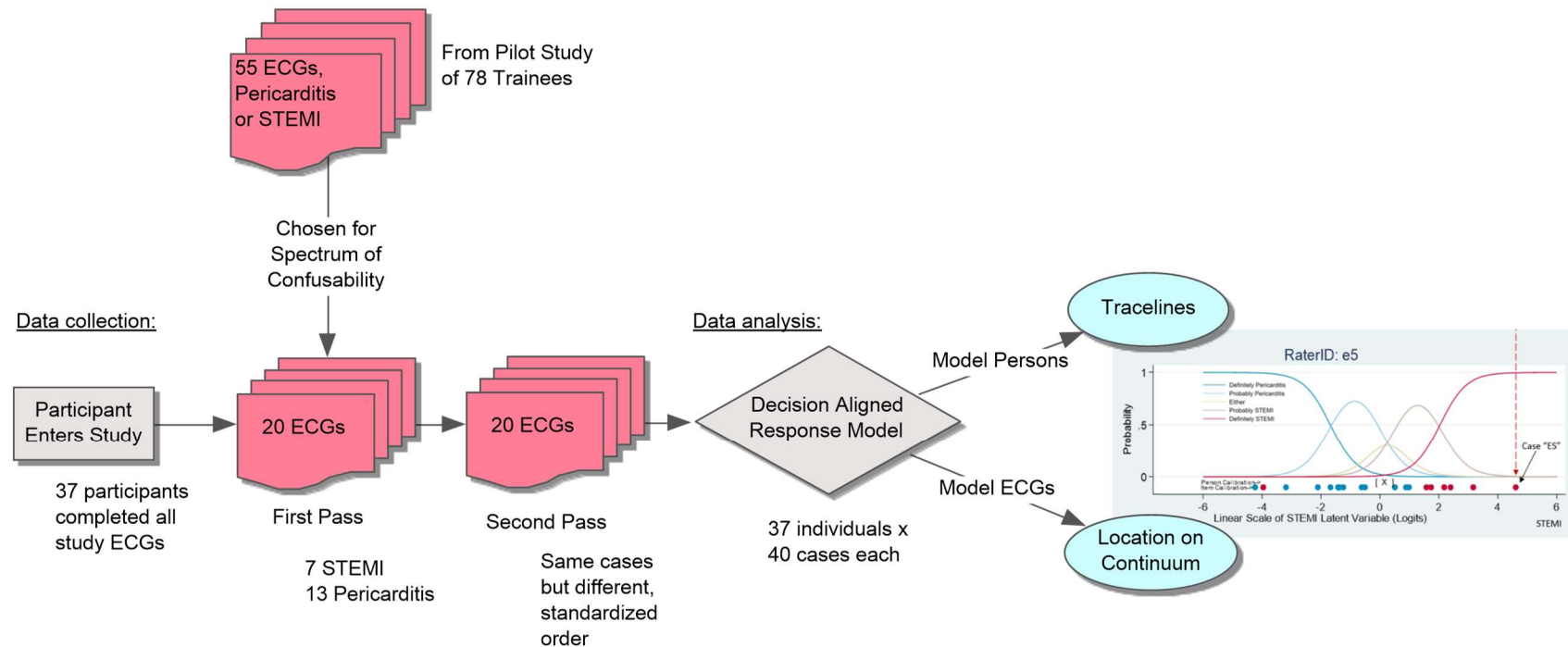


## Supplemental Digital Appendix 1

### Decision-Aligned Response Model Study Flow Diagram



55 ECGs from a prior study were considered for the proportion of the participants that had chosen either Pericarditis or STEMI as their top diagnosis. Based on this pilot data, twenty of the ECGs were chosen to create a full spectrum of “confusability”, one diagnosis for the other. Participants in this study rated the 20 ECGs twice each, using the following five Likert-type categories: “Definitely Pericarditis”, “Probably Pericarditis”, “Either”, “Probably STEMI”, “Definitely STEMI”. We subsequently applied the Decision-Aligned Response Model (see text) to the data-matrix, allowing us to model both where an ECG fell along the spectrum of confusability (dots on the bottom of the figure) and how a given individual (tracelines) would be predicted to rate those cases and ones like them using the five Likert-type categories. Abbreviations: ECG, electrocardiogram; STEMI, ST-Elevation Myocardial Infarction.

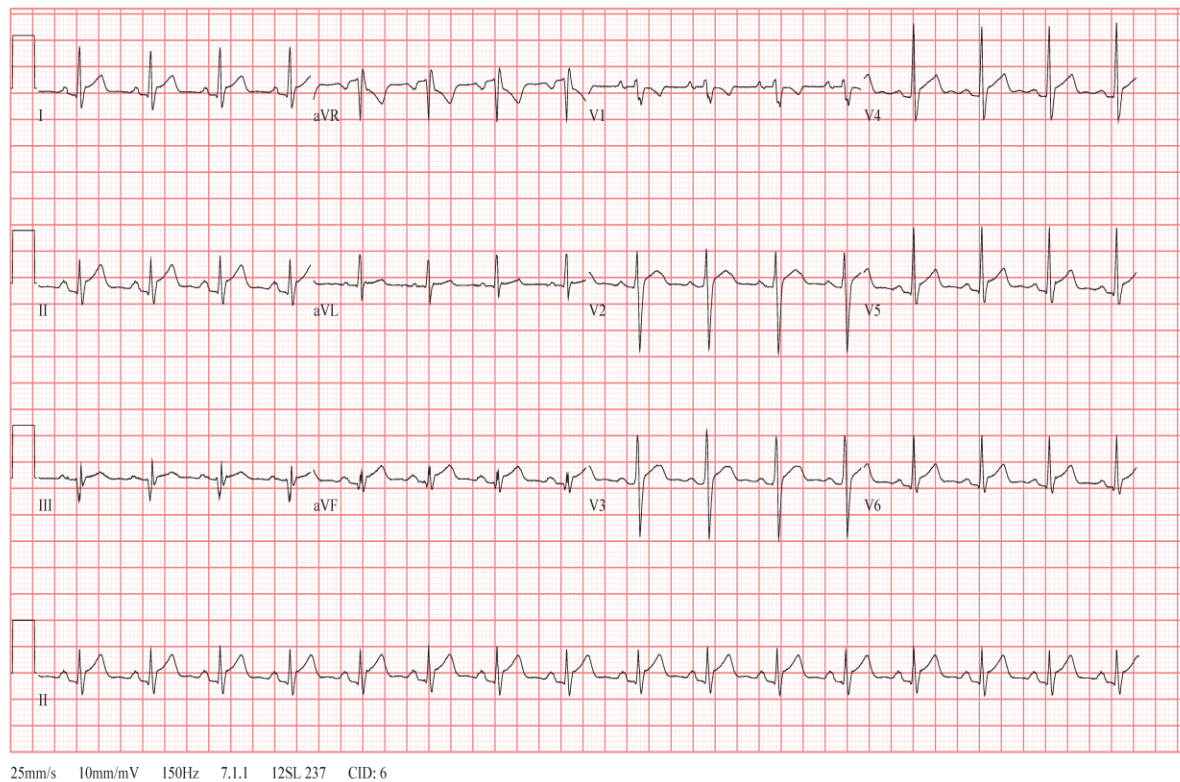
# Supplemental Digital Appendix 2

## **ECGs Used in a Decision-Aligned Response Model Study**

# CASE 1: BK

|              |          |     |  |
|--------------|----------|-----|--|
| Vent. rate   | 96       | BPM | NORMAL SINUS RHYTHM                          |
| PR interval  | 152      | ms  | ACUTE PERICARDITIS                           |
| QRS duration | 100      | ms  | ABNORMAL ECG                                 |
| QT/QTc       | 328/414  | ms  | WHEN COMPARED WITH ECG OF 20-JAN-2009 17:08, |
| P-R-T axes   | 52 18 47 |     | NO SIGNIFICANT CHANGE WAS FOUND              |

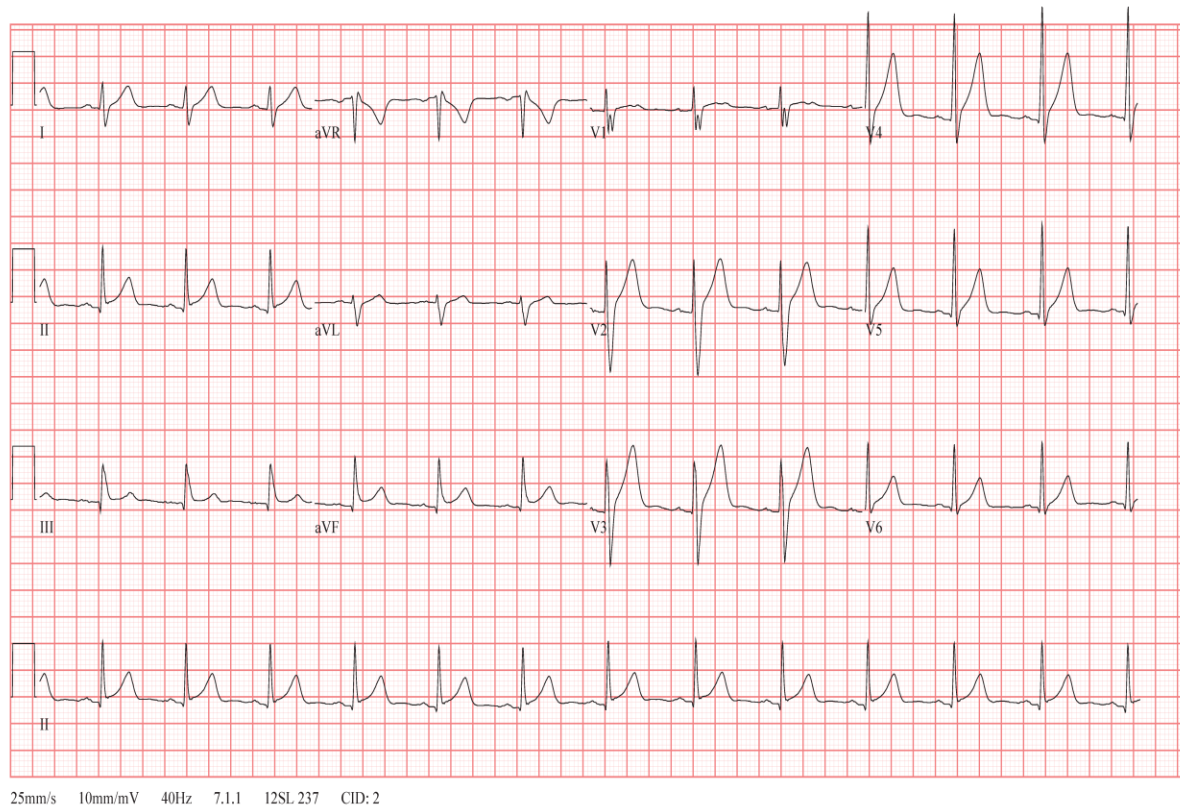
Test ind:CP-15-LEAD ECG



# CASE 2: AX

|              |          |     |  |
|--------------|----------|-----|--|
| Vent. rate   | 77       | BPM | NORMAL SINUS RHYTHM                                    |
| PR interval  | 160      | ms  | DIFFUSE ST ELEVATION, CONSIDER EARLY REPOLARIZATION OR |
| QRS duration | 112      | ms  | PERICARDITIS   |
| QT/QTc       | 376/425  | ms  | BORDERLINE ECG   |
| P-R-T axes   | 24 76 47 |     | NO PREVIOUS ECGS AVAILABLE                             |

Test ind:OVERDSE



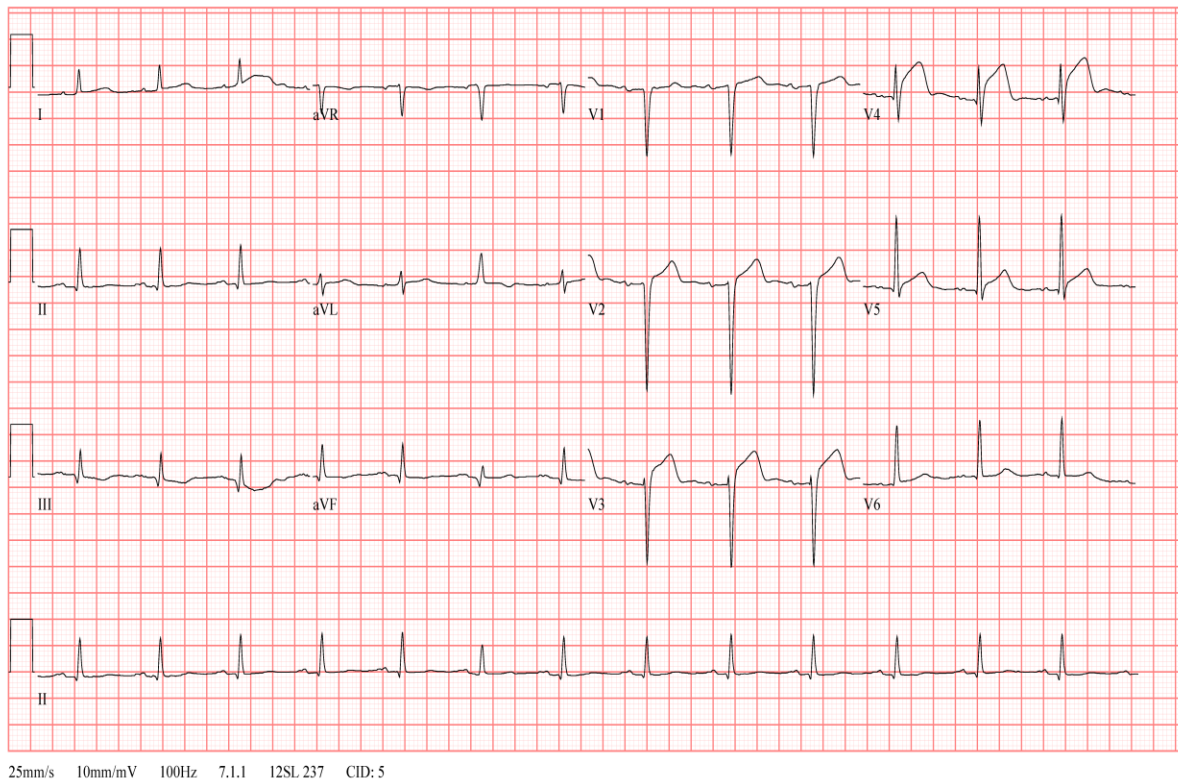
# CASE 3: EE

11-FEB-1928 (80 yr)  
Male

|              |         |     |
|--------------|---------|-----|
| Vent. rate   | 81      | BPM |
| PR interval  | 182     | ms  |
| QRS duration | 98      | ms  |
| QT/QTc       | 382/443 | ms  |
| P-R-T axes   | 65 52   | -17 |

SINUS RHYTHM WITH  
ANTEROLATERAL INJURY PATTERN  
\*\*\*\*\* ACUTE MI \*\*\*\*\*  
ABNORMAL ECG  
WHEN COMPARED WITH ECG OF 22-MAY-2008 19:44,  
SERIAL CHANGES OF EVOLVING ANTERIOR INFARCT  
PRESENT

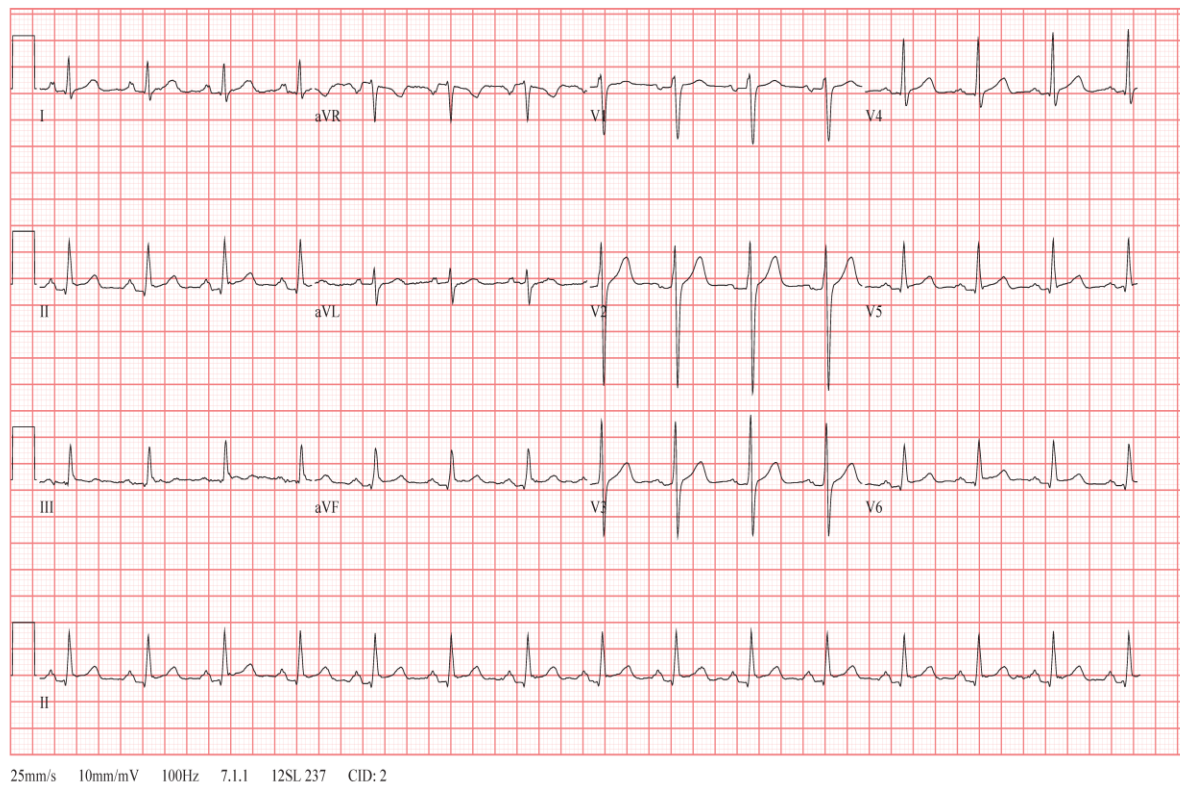
Test ind:



# CASE 4: CT

|              |          |     |   |
|--------------|----------|-----|---|
| Vent. rate   | 87       | BPM | NORMAL SINUS RHYTHM   |
| PR interval  | 170      | ms  | DIFFUSE ST ELEVATION CANNOT RULE OUT ACUTE MYOCARDIAL INFARCTION OR |
| QRS duration | 102      | ms  | PERICARDITIS  |
| QT/QTc       | 360/433  | ms  | ABNORMAL ECG  |
| P-R-T axes   | 36 67 46 |     | NO PREVIOUS ECGS AVAILABLE  |

Test ind:



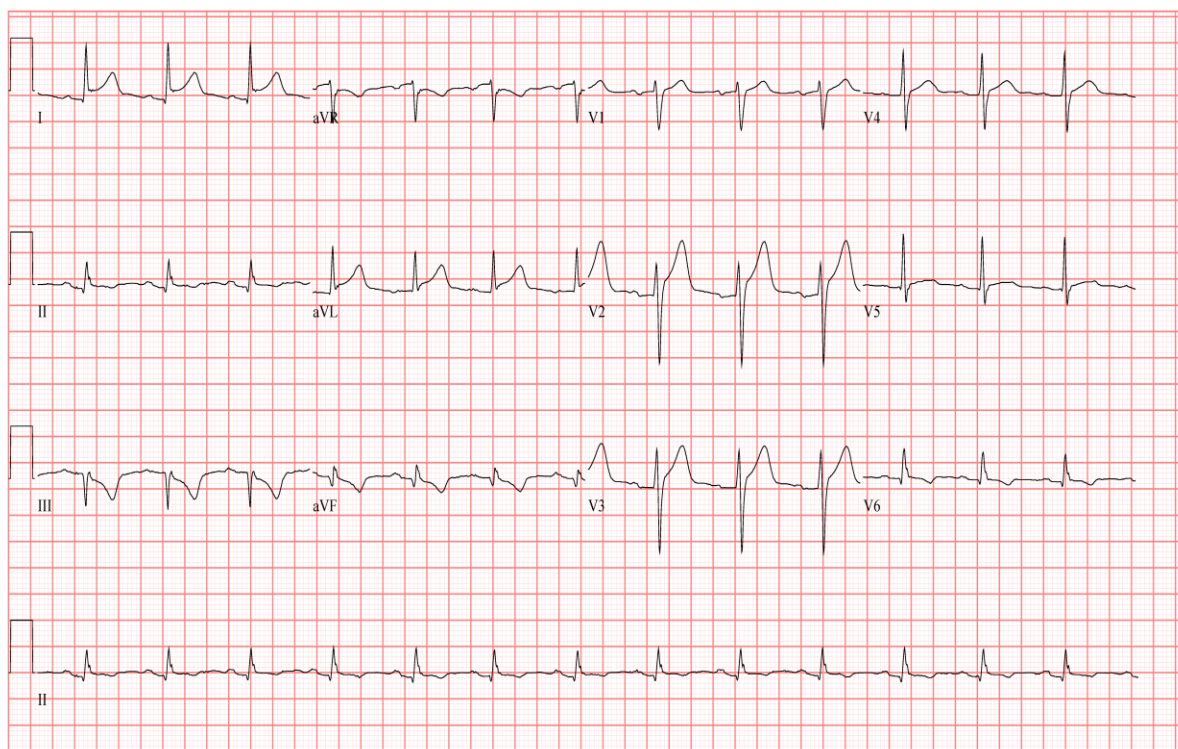
# CASE 5: ER

07-SEP-1951 (58 yr)  
Male

|              |           |     |
|--------------|-----------|-----|
| Vent. rate   | 81        | BPM |
| PR interval  | 198       | ms  |
| QRS duration | 100       | ms  |
| QT/QTc       | 380/441   | ms  |
| P-R-T axes   | 64 -4 -24 |     |

NORMAL SINUS RHYTHM  
INFERIOR INFARCT (CITED ON OR BEFORE 10-DEC-2009)  
ANTEROLATERAL INJURY PATTERN  
\*\*\*\*\* ACUTE MI \*\*\*\*\*  
ABNORMAL ECG  
WHEN COMPARED WITH ECG OF 08-APR-2010 00:26,  
ST MORE ELEVATED IN LATERAL LEADS

Test ind:



25mm/s 10mm/mV 100Hz 7.1.1 12SL 239 CID: 8



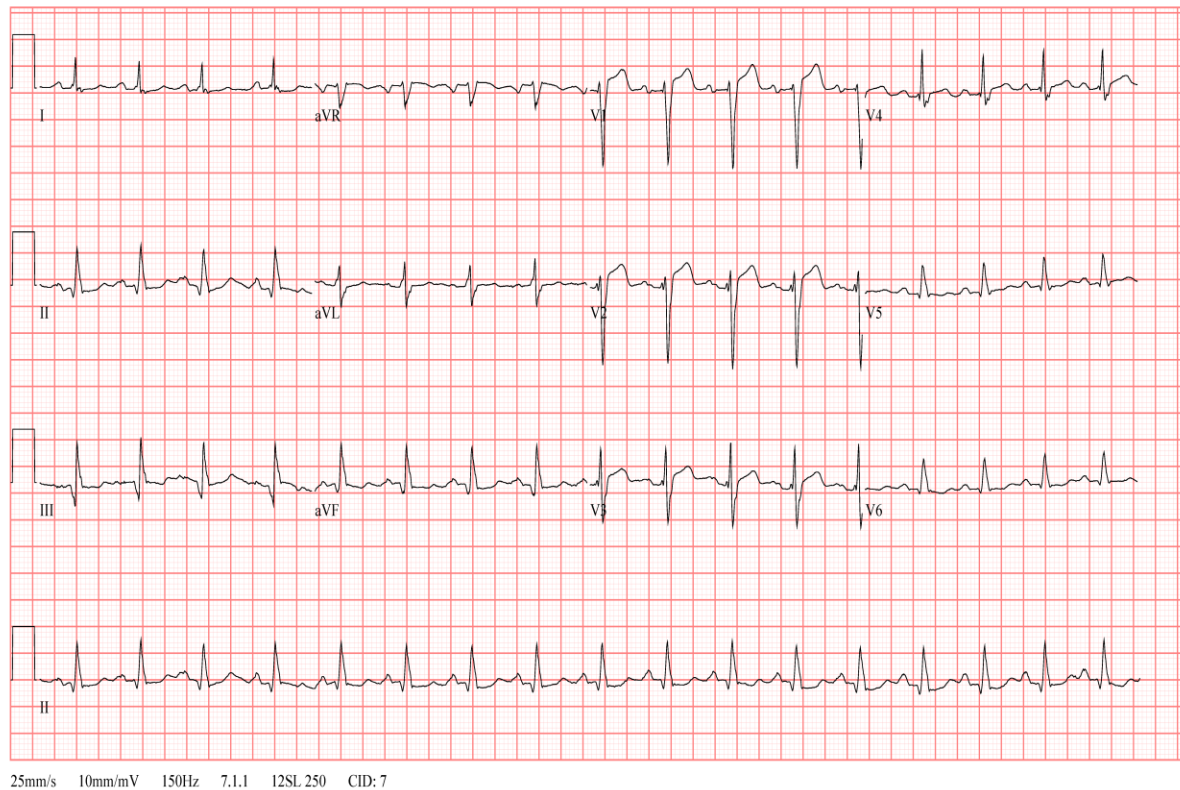
# CASE 6: CY

28-AUG-1950 (52 yr)  
Male Caucasian

|              |           |     |
|--------------|-----------|-----|
| Vent. rate   | 102       | BPM |
| PR interval  | 174       | ms  |
| QRS duration | 118       | ms  |
| QT/QTc       | 330/430   | ms  |
| P-R-T axes   | 48 60 -37 |     |

SINUS TACHYCARDIA  
POSSIBLE INFERIOR INFARCT (CITED ON OR BEFORE 18-MAR-2003)  
ANTERIOR INJURY PATTERN  
\*\*\*\*\* ACUTE MI \*\*\*\*\*  
ABNORMAL ECG  
WHEN COMPARED WITH ECG OF 18-MAR-2003 11:53, (UNCONFIRMED)  
RIGHT BUNDLE BRANCH BLOCK IS NO LONGER PRESENT

Test ind:





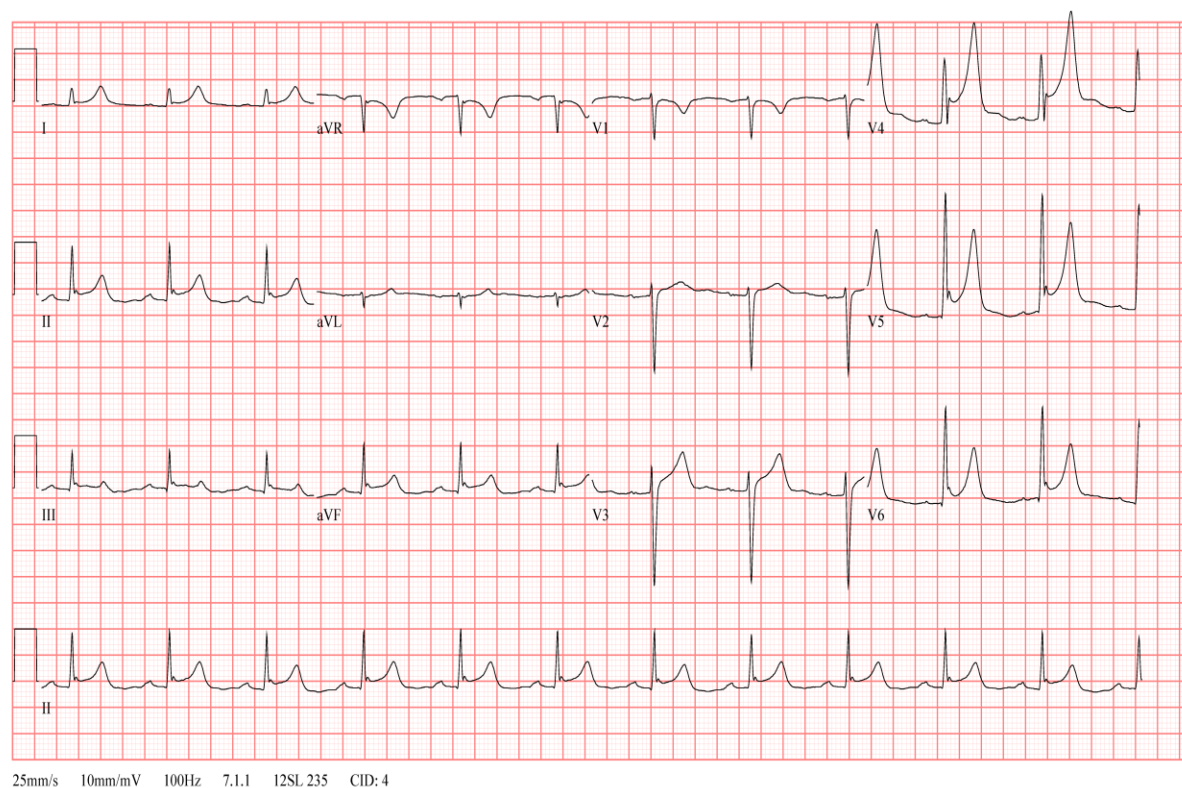
# CASE 7: JO

23-AUG-1958 (47 yr)  
Male

|              |          |     |
|--------------|----------|-----|
| Vent. rate   | 68       | BPM |
| PR interval  | 182      | ms  |
| QRS duration | 100      | ms  |
| QT/QTc       | 414/440  | ms  |
| P-R-T axes   | 74 72 43 |     |

SINUS RHYTHM  
ST ELEVATION, CONSIDER EARLY REPOLARIZATION, ANTEROLATERAL INJURY PATTERN OR  
ACUTE MYOCARDIAL INFARCTION  
ST ELEVATION, CONSIDER EARLY REPOLARIZATION, INJURY PATTERN INFERIOR LEADS OR  
ACUTE MYOCARDIAL INFARCTION  
ABNORMAL ECG  
WHEN COMPARED WITH ECG OF 07-MAR-2006 14:32, (UNCONFIRMED)  
NO SIGNIFICANT CHANGE WAS FOUND

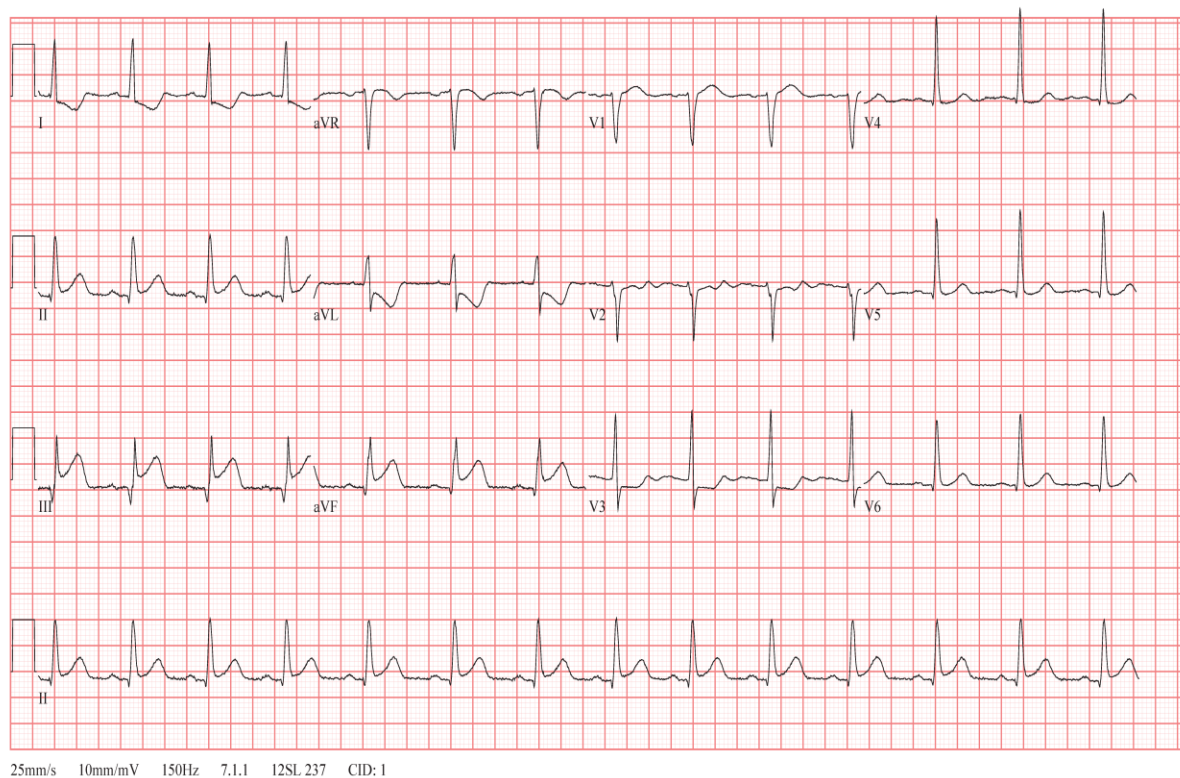
Test ind:ST ELEVATION



# CASE 8: LE

|              |         |     |  |
|--------------|---------|-----|--|
| Vent. rate   | 82      | BPM | <b>*** AGE AND GENDER SPECIFIC ECG ANALYSIS ***</b><br>NORMAL SINUS RHYTHM<br>ST ELEVATION CONSIDER INFERIOR INJURY OR ACUTE INFARCT<br>***** ACUTE MI *****<br>ABNORMAL ECG<br>NO PREVIOUS ECGS AVAILABLE |
| PR interval  | 178     | ms  |  |
| QRS duration | 102     | ms  |  |
| QT/QTc       | 394/460 | ms  |  |
| P-R-T axes   | 47 50   | 106 |  |

Test ind:



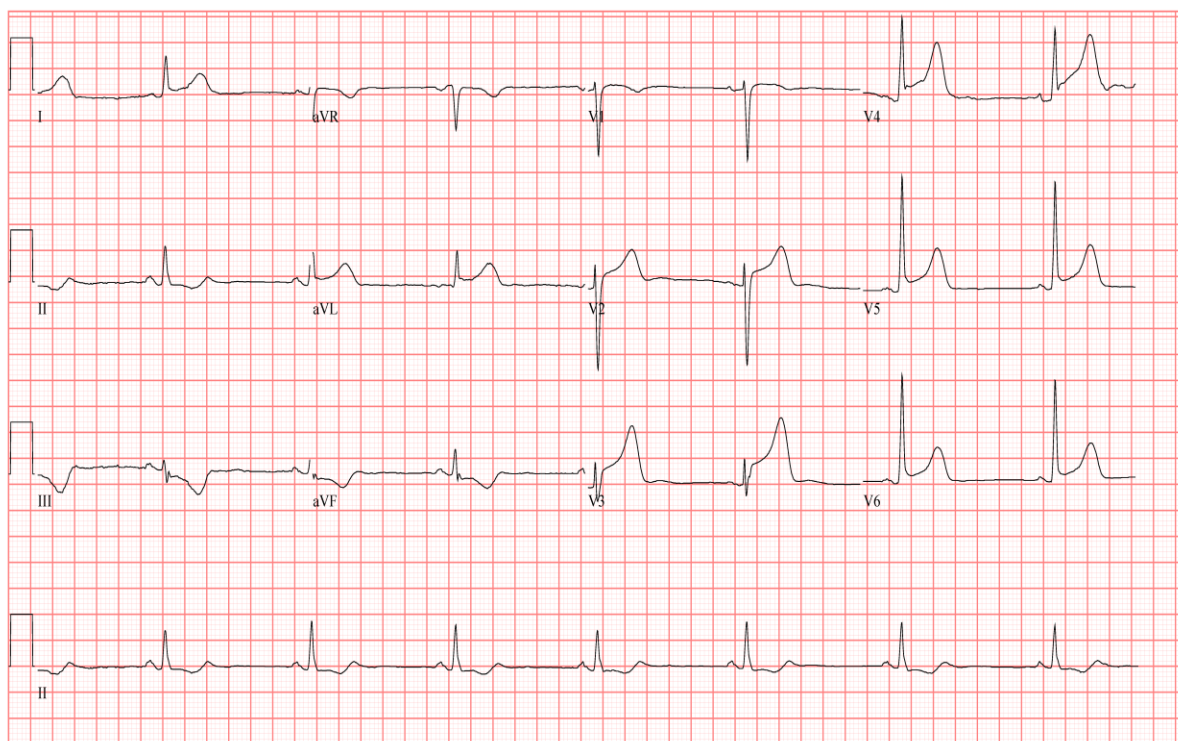
# CASE 9: ES

02-JUN-1938 (70 yr)  
Female Caucasian  
126lb

Vent. rate 45 BPM  
PR interval 148 ms  
QRS duration 88 ms  
QT/QTc 482/416 ms  
P-R-T axes 71 20 -26

MARKED SINUS BRADYCARDIA  
ST ELEVATION CONSIDER ANTEROLATERAL INJURY OR ACUTE INFARCT  
\*\*\*\*\* ACUTE MI \*\*\*\*\*  
ABNORMAL ECG  
WHEN COMPARED WITH ECG OF 09-SEP-2008 10:21,  
SIGNIFICANT CHANGES HAVE OCCURRED

Test ind:CP



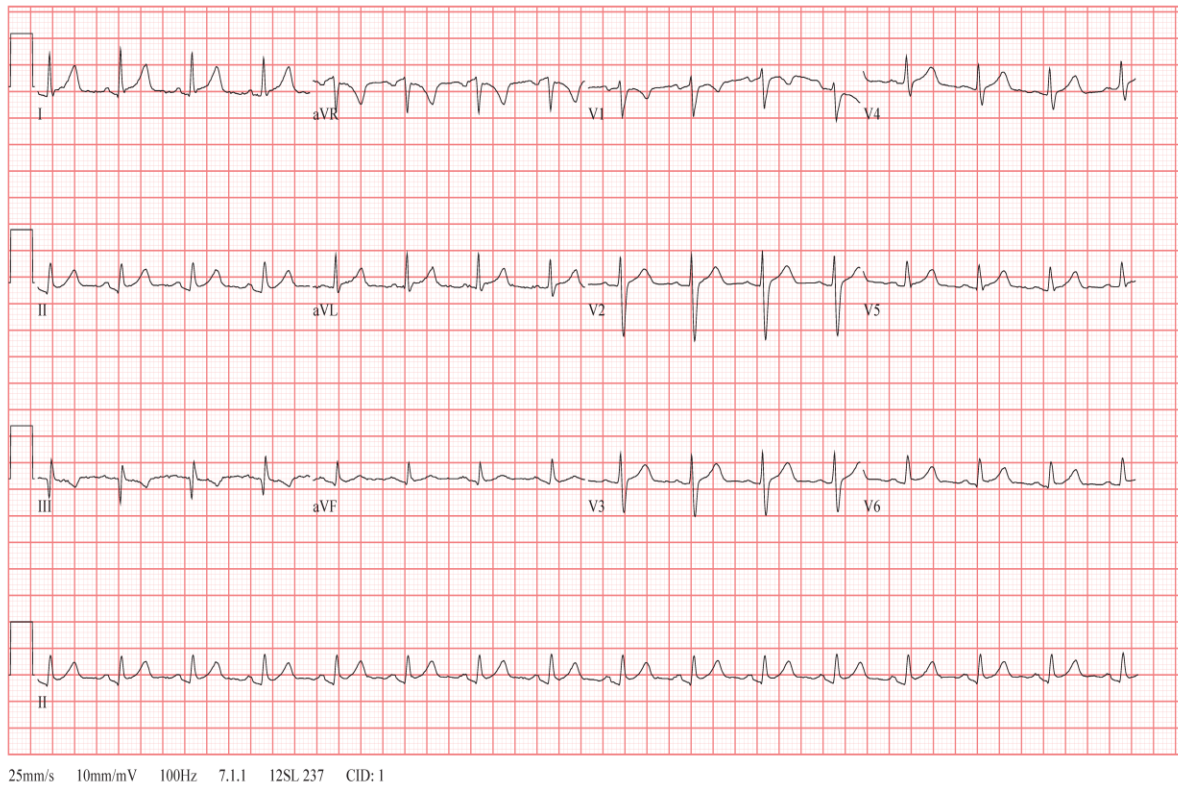
25mm/s 10mm/mV 100Hz 7.1.1 12SL 237 CID: 6

# CASE 10: IT

|              |          |     |                               |
|--------------|----------|-----|-------------------------------|
| Vent. rate   | 92       | BPM | NORMAL SINUS RHYTHM           |
| PR interval  | 148      | ms  | SLIGHT ST ELEVATION DIFFUSELY |
| QRS duration | 90       | ms  | PR INTERVAL DEPRESSION        |
| QT/QTc       | 348/430  | ms  | ACUTE PERICARDITIS (POST-OP?) |
| P-R-T axes   | 40 20 18 |     | ABNORMAL ECG                  |

WHEN COMPARED WITH ECG OF 18-MAY-2012 23:27,  
CRITERIA FOR PERICARDITIS IS NOW PRESENT

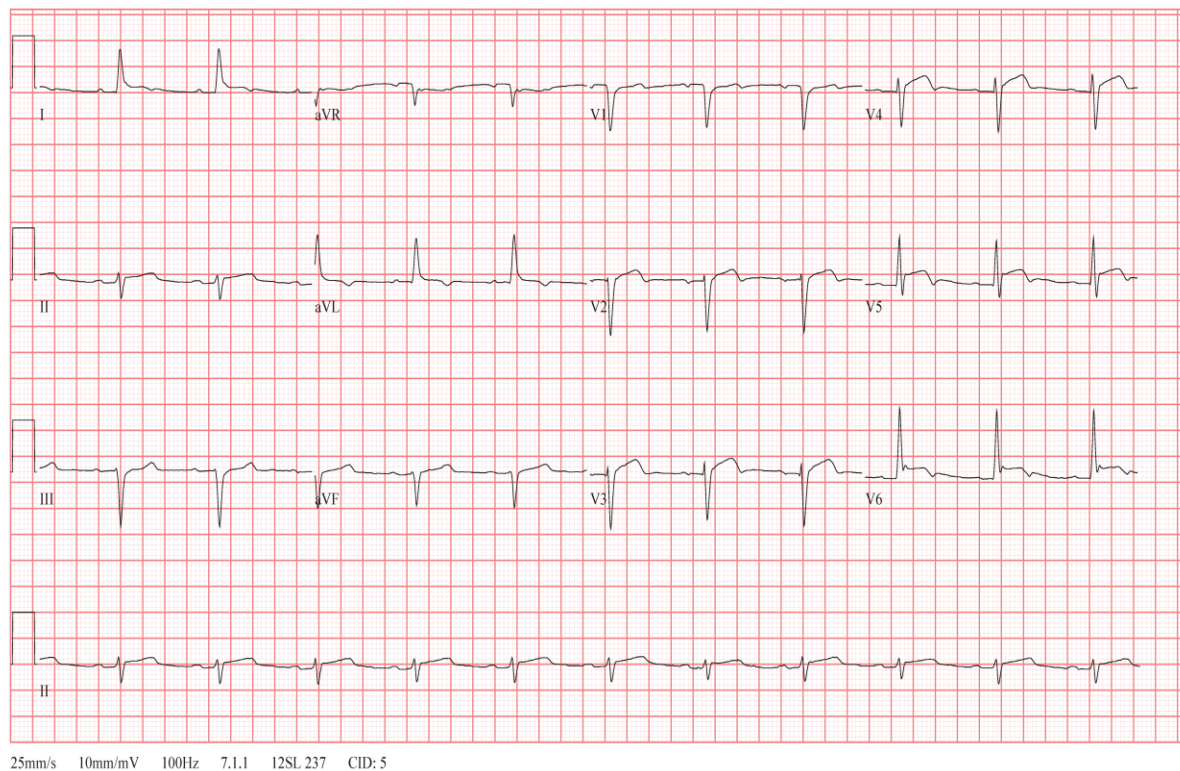
Test ind:ST ELEVATION



# CASE 11: LC

|              |         |     |  |
|--------------|---------|-----|--|
| Vent. rate   | 68      | BPM | NORMAL SINUS RHYTHM  |
| PR interval  | 202     | ms  | LEFT AXIS DEVIATION  |
| QRS duration | 86      | ms  | PERICARDITIS   |
| QT/QTc       | 420/446 | ms  | ABNORMAL ECG   |
| P-R-T axes   | 42 -39  | 51  | WHEN COMPARED WITH ECG OF 19-APR-2012 23:57,<br>LEFT BUNDLE BRANCH BLOCK IS NO LONGER PRESENT<br>ACUTE PERICARDITIS IS NOW PRESENT |

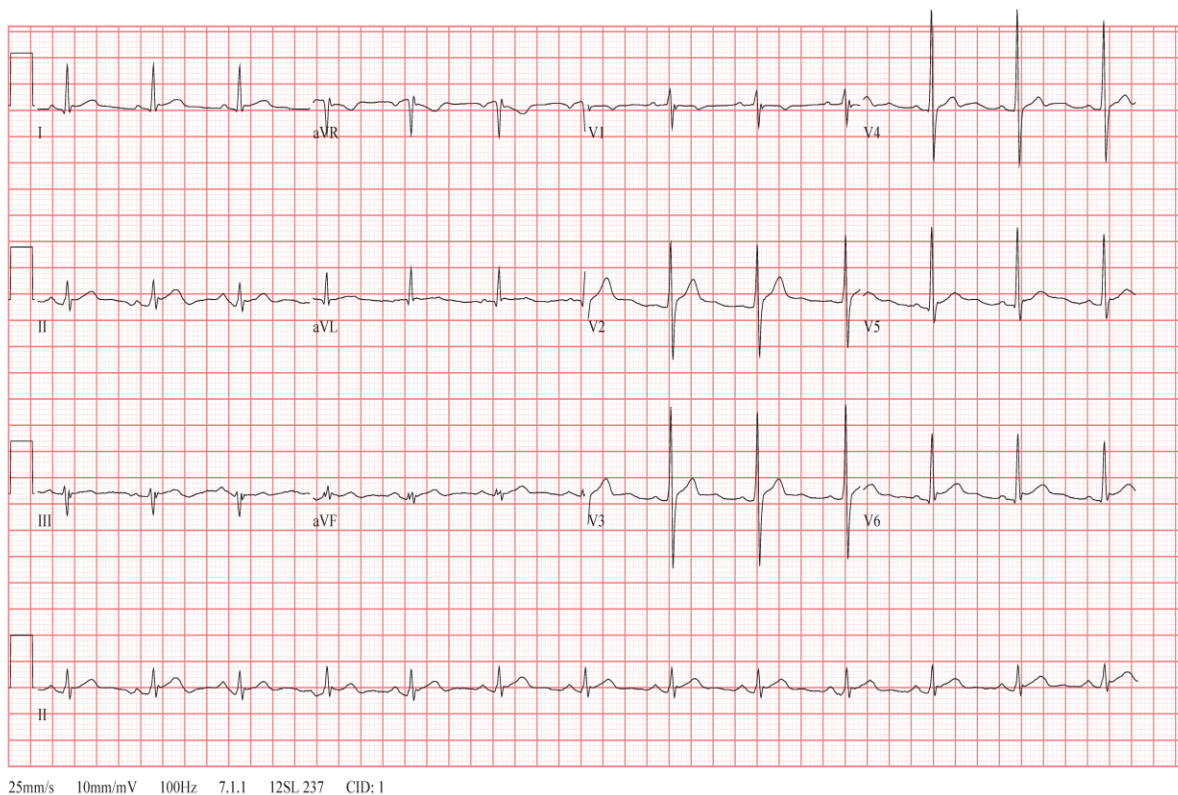
Test ind:



# CASE 12: IS

|              |         |     |  |
|--------------|---------|-----|--|
| Vent. rate   | 76      | BPM | NORMAL SINUS RHYTHM                          |
| PR interval  | 166     | ms  | ST ELEVATION PROBABLY PERICARDITIS           |
| QRS duration | 88      | ms  | ABNORMAL ECG                                 |
| QT/QTc       | 348/391 | ms  | WHEN COMPARED WITH ECG OF 21-AUG-2012 20:41, |
| P-R-T axes   | 64 5 40 |     | ST ELEVATION IS NOW PRESENT                  |

Test ind:





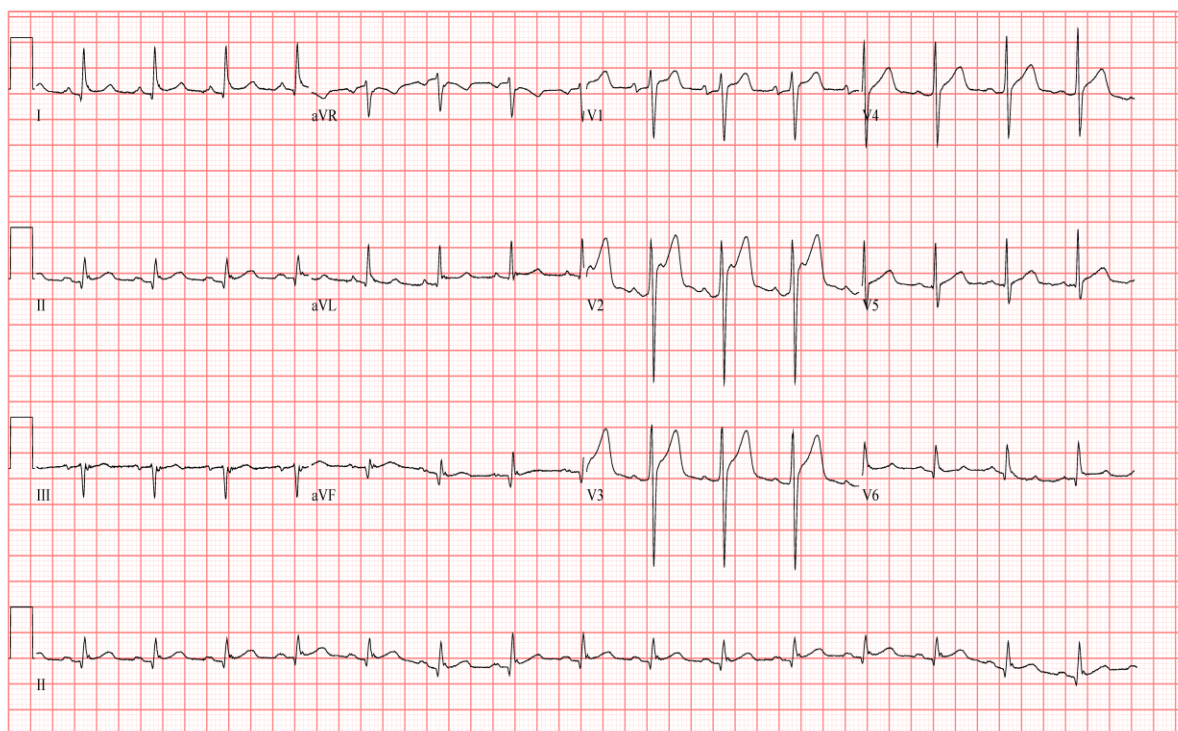
# CASE 13: CI

08-DEC-1932 (71 yr)  
Male Asian

|              |         |     |
|--------------|---------|-----|
| Vent. rate   | 92      | BPM |
| PR interval  | 154     | ms  |
| QRS duration | 104     | ms  |
| QT/QTc       | 356/440 | ms  |
| P-R-T axes   | 22 -9   | 28  |

NORMAL SINUS RHYTHM  
ANTERIOR INJURY PATTERN  
\*\*\*\*\* ACUTE MI \*\*\*\*\*  
ABNORMAL ECG

Test ind:



25mm/s 10mm/mV 150Hz 7.1.1 12SL 235 CID: 6



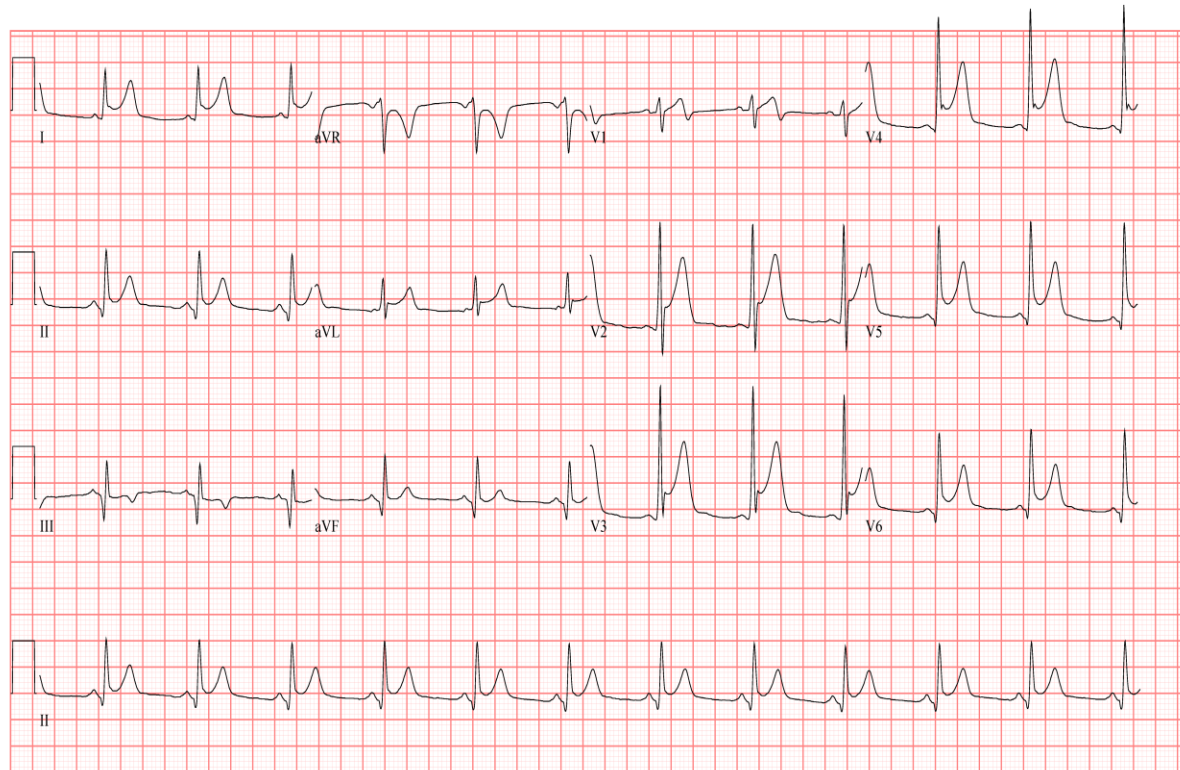
# CASE 14: BP

05-MAR-1950 (58 yr)  
Male Caucasian

|              |         |     |
|--------------|---------|-----|
| Vent. rate   | 71      | BPM |
| PR interval  | 128     | ms  |
| QRS duration | 90      | ms  |
| QT/QTc       | 366/397 | ms  |
| P-R-T axes   | 65 35   | 23  |

NORMAL SINUS RHYTHM  
INFERIOR INFARCT (CITED ON OR BEFORE 16-FEB-2009)  
ANTEROLATERAL INJURY PATTERN  
\*\*\*\*\* ACUTE MI \*\*\*\*\*  
ABNORMAL ECG  
WHEN COMPARED WITH ECG OF 16-FEB-2009 21:22,  
ST MORE ELEVATED IN ANTERIOR LEADS

Test ind: ?MI



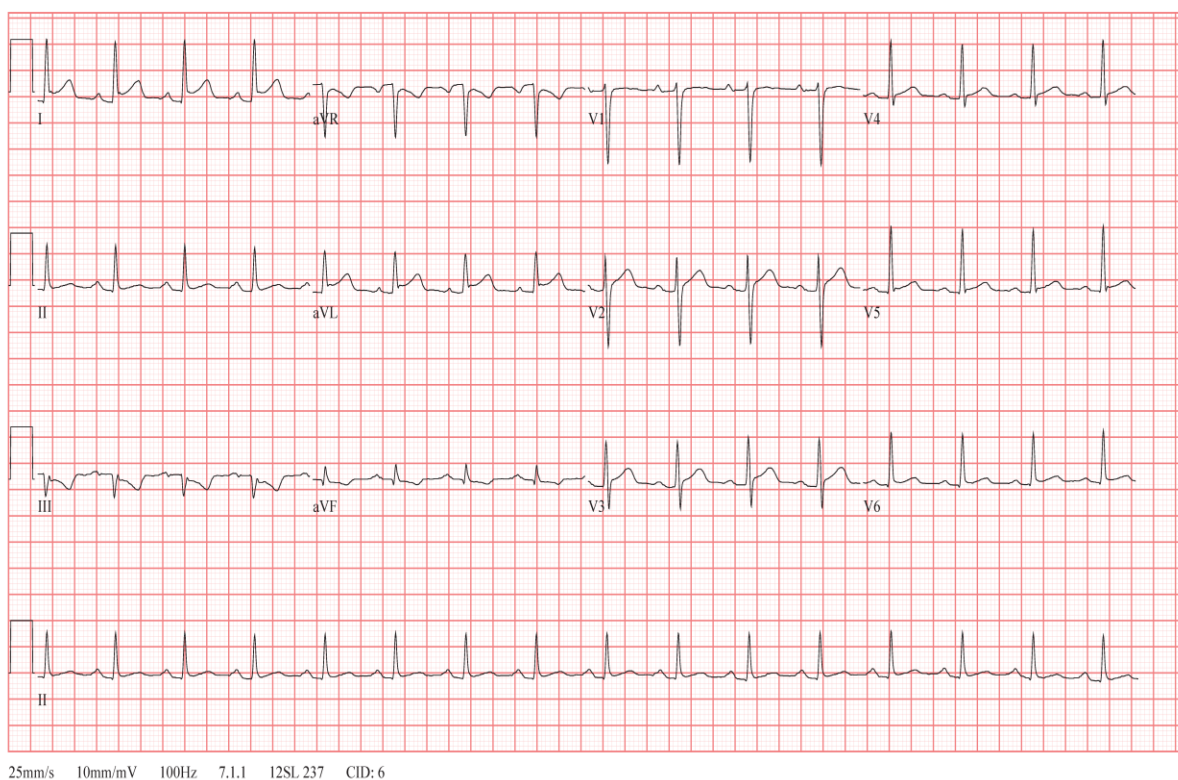
25mm/s 10mm/mV 100Hz 7.1.1 12SL 237 CID: 5

# CASE 15: BM

Vent. rate 94 BPM  
PR interval 180 ms  
QRS duration 84 ms  
QT/QTc 338/422 ms  
P-R-T axes 38 11 -10

NORMAL SINUS RHYTHM  
ST ELEVATION CONSIDER PERICARDITIS, INJURY OR ACUTE INFARCT  
ABNORMAL ECG  
WHEN COMPARED WITH ECG OF 01-AUG-2009 14:48,  
ST NOW DEPRESSED IN INFERIOR LEADS  
ST MORE ELEVATED IN LATERAL LEADS

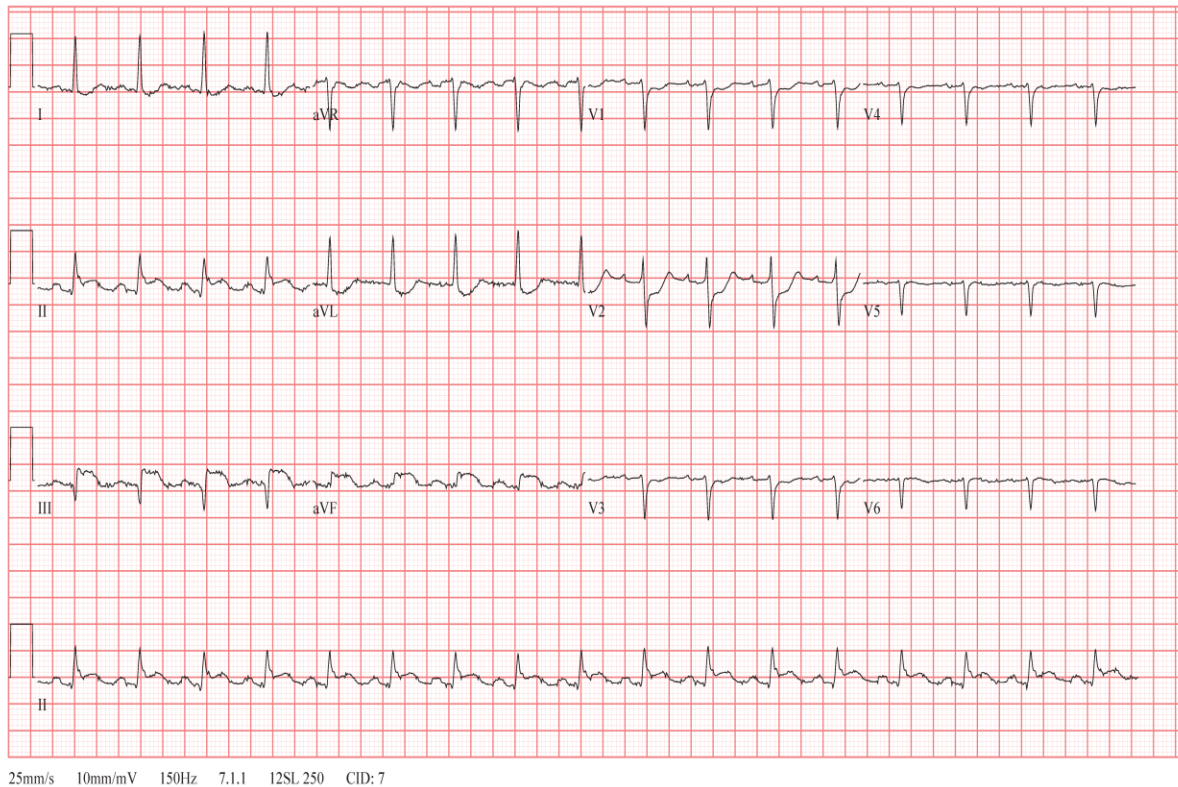
Test ind:5/10 CHEST PAIN



# CASE 16: ED

|              |          |     |  |
|--------------|----------|-----|--|
| Vent. rate   | 103      | BPM | SINUS TACHYCARDIA  |
| PR interval  | 174      | ms  | INFERIOR INJURY PATTERN                                    |
| QRS duration | 94       | ms  | ***** ACUTE MI *****                                       |
| QT/QTc       | 320/419  | ms  | ABNORMAL ECG   |
| P-R-T axes   | 54 11 72 |     | WHEN COMPARED WITH ECG OF 10-DEC-2003 16:16, (UNCONFIRMED) |
|              |          |     | NO SIGNIFICANT CHANGE WAS FOUND                            |

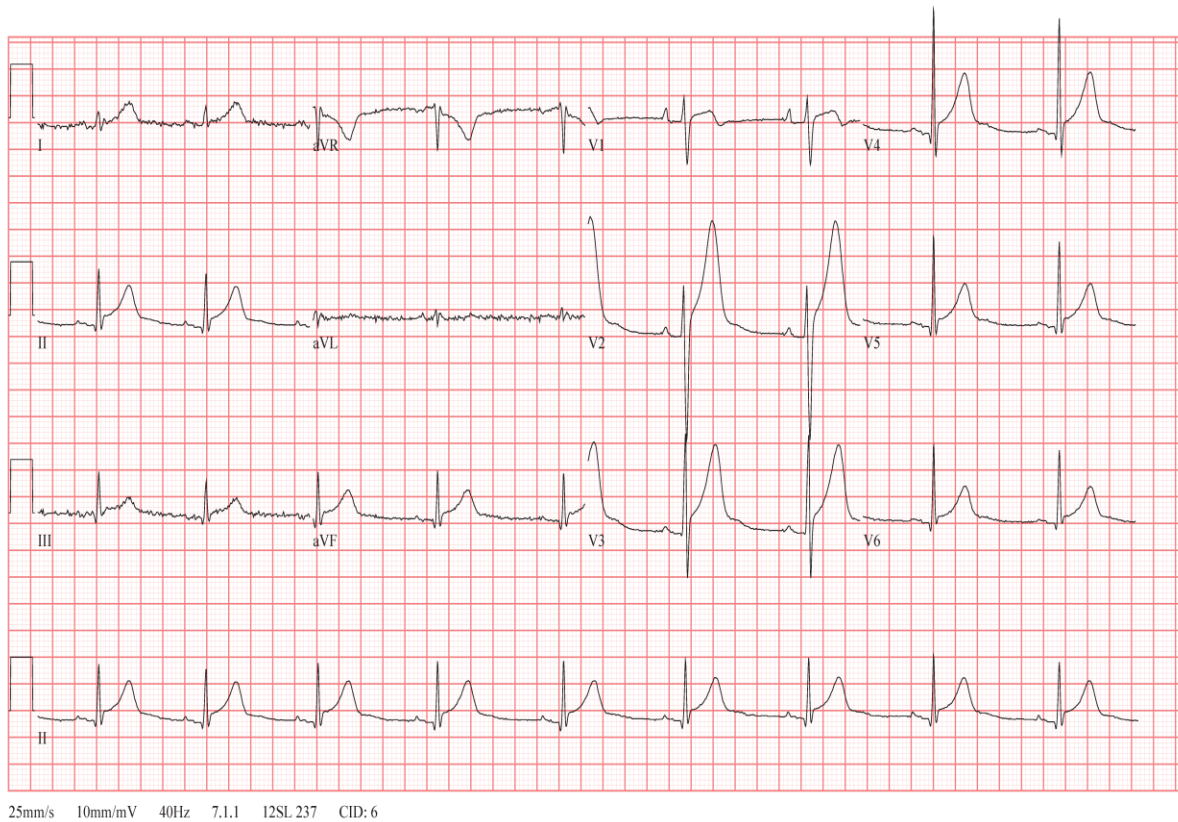
Test ind: CHEST PAIN



# CASE 17: JW

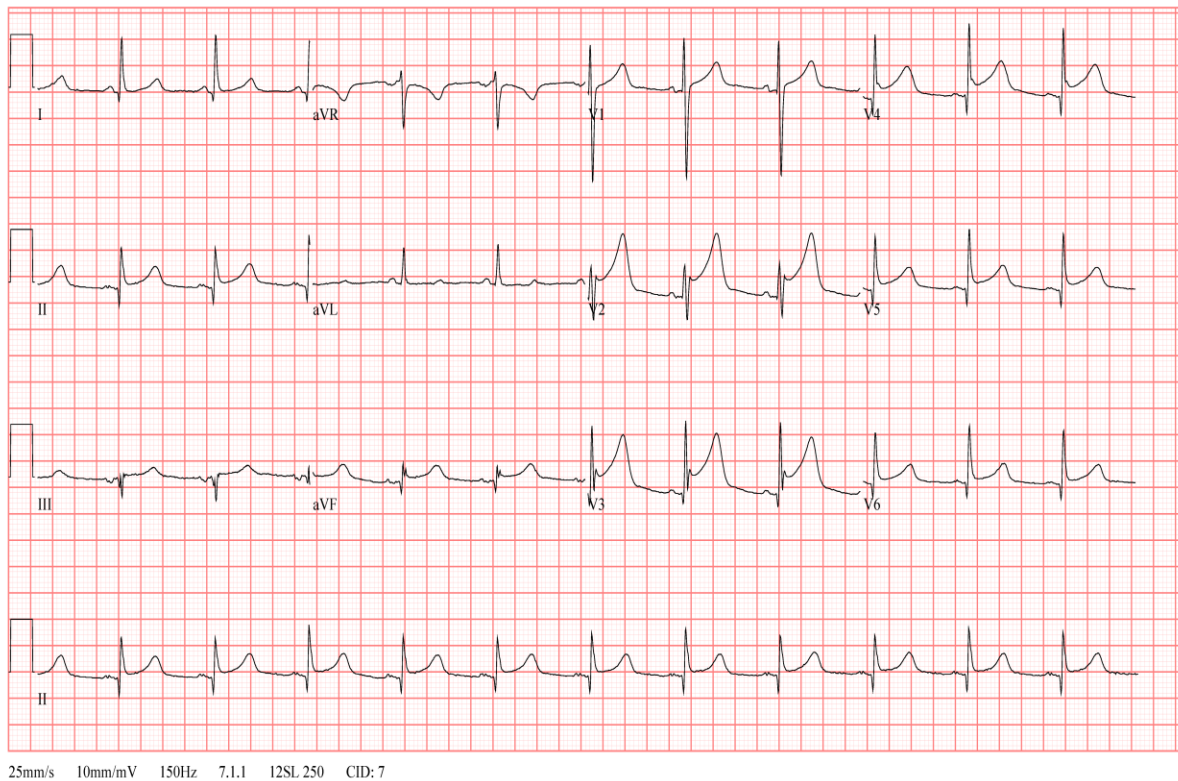
|              |          |     |   |
|--------------|----------|-----|---|
| Vent. rate   | 55       | BPM | SINUS BRADYCARDIA   |
| PR interval  | 164      | ms  | Diffuse ST elevation  |
| QRS duration | 90       | ms  | CONSIDER PERICARDITIS   |
| QT/QTc       | 434/415  | ms  | ABNORMAL ECG  |
| P-R-T axes   | 17 64 53 |     | WHEN COMPARED WITH ECG OF 08-JUL-2010 14:47,<br>NO SIGNIFICANT CHANGE WAS FOUND |

Test ind:



NORMAL SINUS RHYTHM  
INFERIOR INFARCT , NEW  
ANTEROLATERAL INJURY PATTERN  
\*\*\*\*\* ACUTE MI \*\*\*\*\*  
ABNORMAL ECG  
WHEN COMPARED WITH ECG OF 10-MAR-2004 03:25, (UNCONFIRMED)  
ACUTE INFERIOR INFARCT IS NOW PRESENT

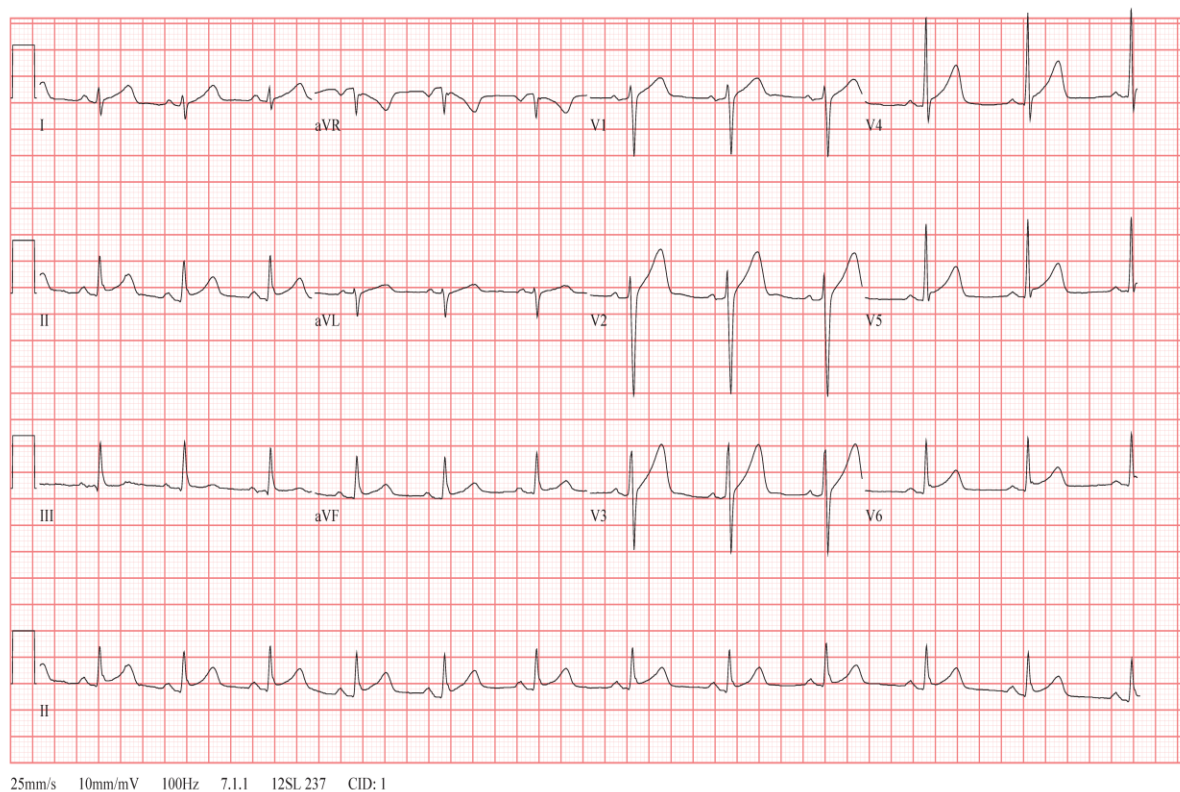
Test ind:



# CASE 19: KN

|              |          |     |   |
|--------------|----------|-----|---|
| Vent. rate   | 70       | BPM | NORMAL SINUS RHYTHM WITH SINUS ARRHYTHMIA<br>EARLY REPOLARIZATION OR<br>PERICARDITIS<br>NORMAL ECG<br>WHEN COMPARED WITH ECG OF 07-APR-2012 20:41,<br>NO SIGNIFICANT CHANGE WAS FOUND |
| PR interval  | 156      | ms  |   |
| QRS duration | 84       | ms  |   |
| QT/QTc       | 408/440  | ms  |   |
| P-R-T axes   | 41 88 39 |     |   |

Test ind:RTN





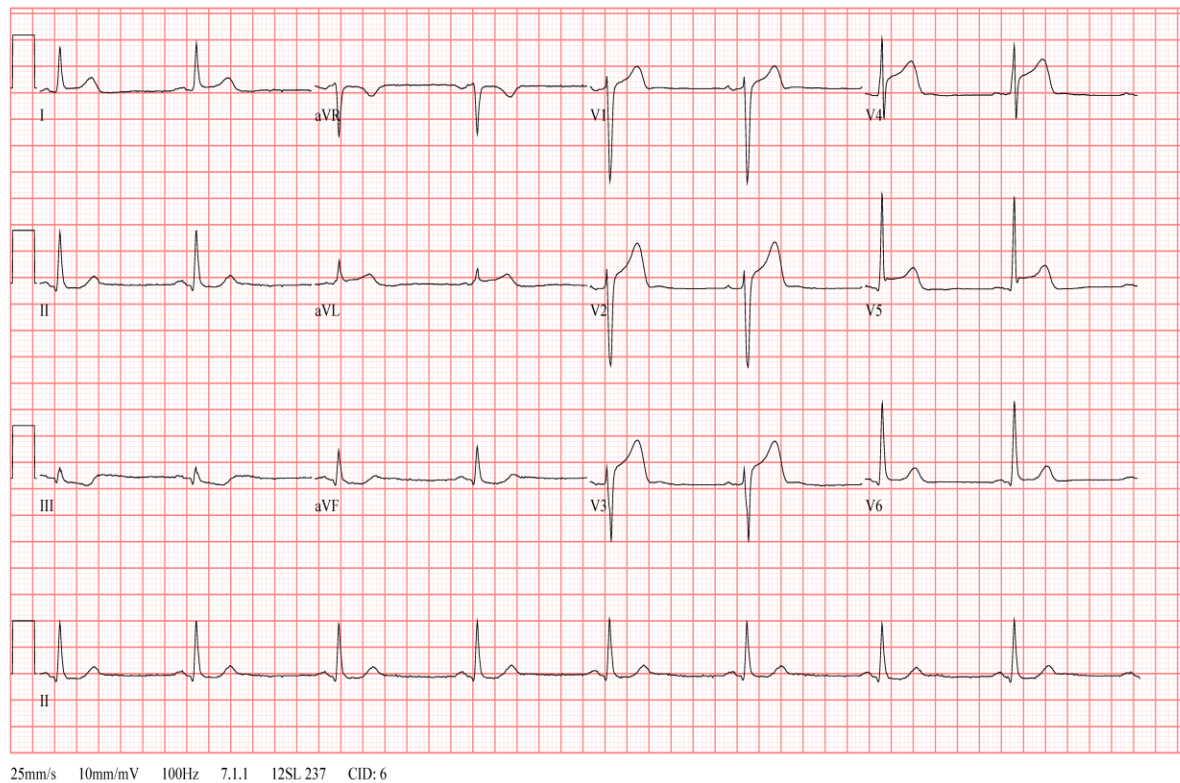
# CASE 20: CL

03-MAR-1959 (49 yr)  
Male

|              |          |     |
|--------------|----------|-----|
| Vent. rate   | 48       | BPM |
| PR interval  | 144      | ms  |
| QRS duration | 108      | ms  |
| QT/QTc       | 434/387  | ms  |
| P-R-T axes   | 55 38 15 |     |

MARKED SINUS BRADYCARDIA  
MINIMAL VOLTAGE CRITERIA FOR LVH, MAY BE NORMAL VARIANT  
CANNOT RULE OUT INFERIOR INFARCT, AGE UNDETERMINED  
ANTEROLATERAL INJURY PATTERN  
\*\*\*\*\* ACUTE MI \*\*\*\*\*  
ABNORMAL ECG  
NO PREVIOUS ECGS AVAILABLE

Test ind:



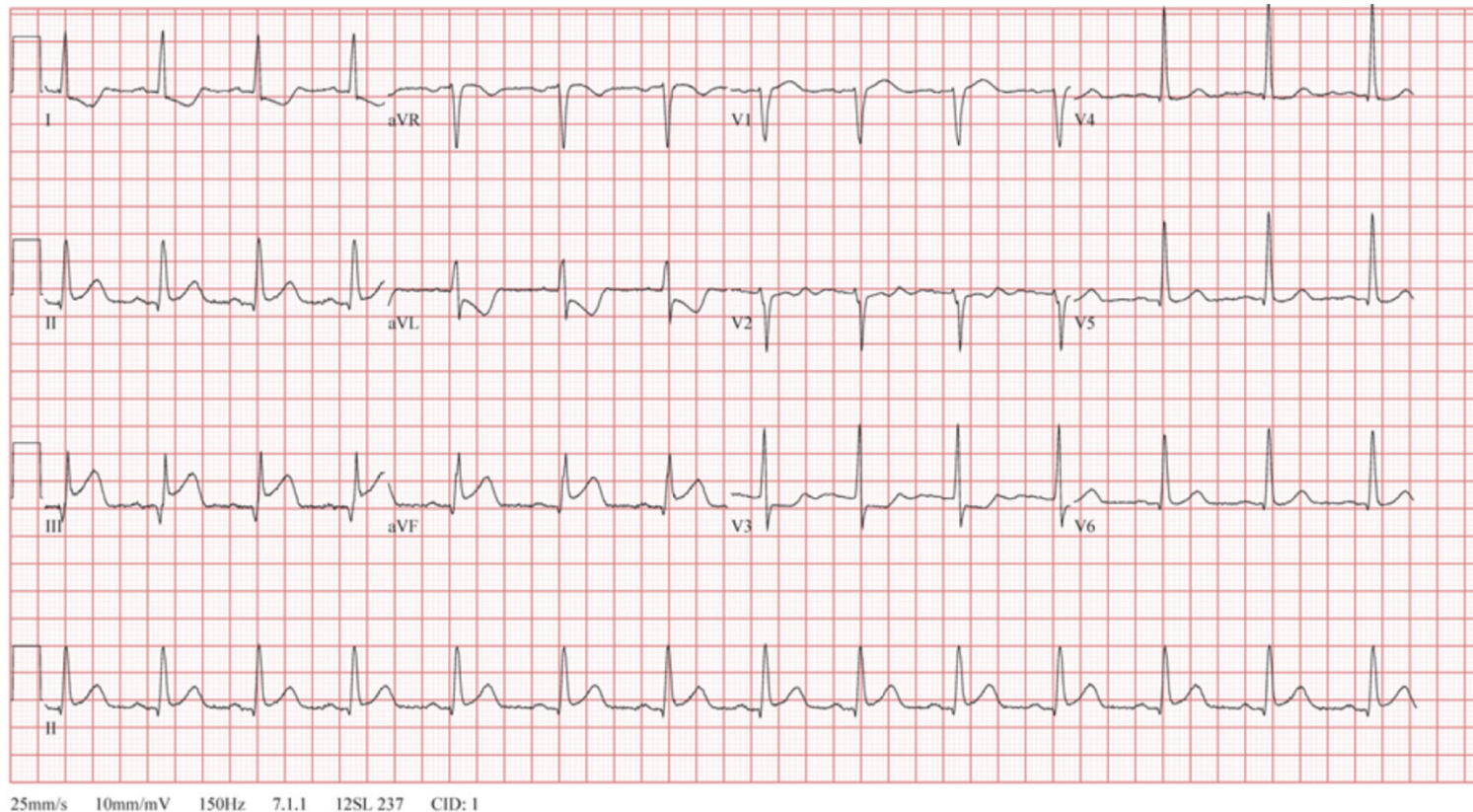


## Supplemental Digital Appendix 3

### Sample Task Included in a Decision-Aligned Response Model Study

#### Case 8/40

To zoom in on the ECG, use "Ctrl ++" (Windows) or "Command ++" (Mac)



**Definitely  
STEMI**

Probably  
STEMI

Either STEMI  
or Pericarditis

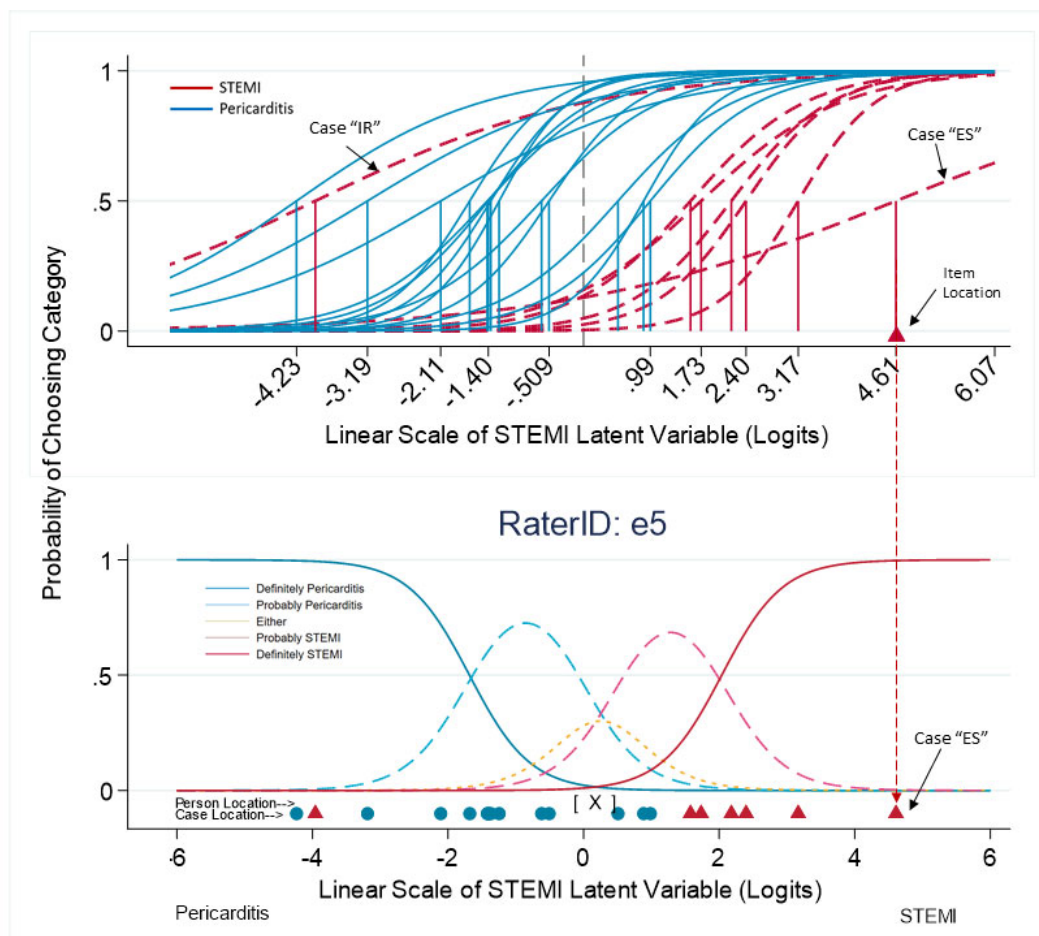
Probably  
Pericarditis

Definitely  
Pericarditis

A full-sized ECG was presented to the participant along with a rating scale, in survey software.

## Supplemental Digital Appendix 4

### Decision-Aligned Response Model Curves for All Items and One Participant



*Top Panel:* Under the Decision-Aligned Response Model conceptualization, the x-scale represents, for cases (top panel), the degree to which a case resembles STEMI or Pericarditis. Each sigmoid curve represents one item/case and where it lies on the modeled continuum. Those shifted to the left (droplines with lower values) are more likely to be declared Pericarditis; cases to the right are more likely to be declared STEMI. The midpoint of the scale (zero logits) represents a case with equal likelihood of diagnosis as Pericarditis or STEMI. Colour of the lines denotes the discharge diagnosis. The psychometric scaling successfully separates the two types of cases along the linear scale. The exceptional case "IR" at -3.96 logits is discussed in the text.

*Bottom Panel:* (Compare with Figure 2) The x-axis again represents the linear logit scale indicating the degree to which a given case is likely to be classified as a STEMI. Modelled Case location/calibrations are directly transposed to be represented by dots along the scale, red (STEMI) and blue (Pericarditis). *Person Location* is the tendency or bias of a person to diagnose cases towards one end of the scale compared to the other. The individual's five tracelines show the probability that this one rater would choose a given response category (e.g., "Probably STEMI") for a case at that location on the latent scale.

## Supplemental Digital Appendix 5

### Overall Test Characteristics by Participant Type in a Decision-Aligned Response Model Study

| Participant Type          | Sensitivity<br>Mean (95%CI) | Specificity<br>Mean (95%CI) | Area Under ROC<br>Mean (95% CI) |
|---------------------------|-----------------------------|-----------------------------|---------------------------------|
| Junior Resident<br>(N=17) | 87.0<br>(59.0,98.2)         | 54.8<br>(35.8,72.5)         | 0.81<br>(0.78, 0.84)            |
| Senior Resident<br>(N=9)  | 88.9<br>(61.8,98.3)         | 46.6<br>(27.6,66.4)         | 0.78<br>(0.73, 0.83)            |
| EM Attending<br>(N=6)     | 84.5<br>(56.2,97.3)         | 61.5<br>(41.0,79.4)         | 0.80<br>(0.74, 0.86)            |
| Cardiologists<br>(N=5)    | 97.1<br>(72.9,99.6)         | 51.5<br>(31.7,71.0)         | 0.87<br>(0.82, 0.92)            |
| OVERALL                   | 88.4<br>(61.1,98.3)         | 53.4<br>(34.1,71.9)         | 0.81<br>(0.79, 0.83)            |

Sensitivity and specificity are calculated based on a dichotomized response in which “Either Pericarditis or STEMI”, the middle category, is considered a positive STEMI call. The Area under the ROC curve calculation is based on the entire 5-point scale.