SNS COLLEGE OF ALLIED HEALTH SCIENCES

SNS Kalvi Nagar, Coimbatore - 35

Affiliated to Dr MGR Medical University, Chennai

DEPARTMENT OF CARDIAC TECHNOLOGY-II YEAR

UNIT V : TMT

TREAD MILL TEST

- ✓ IT IS A STRESS TEST THST MEASURES THE HEART RHYTHM WHEN THE HEART IS STRESSED BY EXERCISE SUCH AS WALKING or RUNNING ON THE TREADMILL.
- ✓ DURING DYNAMIC EXERCISE TOTAL BODY O_2 UPTAKE INCREASES.
- ✓ INCREASED ENERGY DEMANDS OF EXERCISING MUSCLE
- ✓ INCREASED SYMPATHETIC TONE
- ✓ INCREASED CARDIAC OUTPUT
- ✓ INCREASED MYOCARDIAL O_2 DEMAND.

TMT PROTOCOLS

✓ BRUCE PROTOCOL

STANDARD TEST IN CARDIOLOGY, COMPRISED OF MULTIPLE EXERCISE STAGES OF 3 MINUTES.

AT EACH STAGE ,THE GRADIENT AND SPEED OF TMT ARE ELEVATED TO INCREASE WORK OUTPUT

✓ MODIFIED BRUCE PROTOCOL

MOST OFTEN USED IN OLDER INDIVIDUALS OR THESE WHOSE EXERCISE CAPACITY IS LIMITED BY CARDIAC DISEASE.

HOLD TO ASSESS OTHER THAN ARRHYTHMIA

- ## NAUGHTON PROTOCOL

  SUB MAXIMAL EXERCISE TEST DESIGNED TO KEEP YOU IN A HEART RATE GONE THAT IS LOWER THAN YOUR MAXIMAL HEART RATE.

- ## CORNELL PROTOCOL
- ## ERGOMETRY (CYCLE)
- ## ERGOMETRY (RAMP)

HEART RATE RESPONSE(220-AGE)

BY KA-WONEN FORMULA

MEN HEART RATE MAX=208-(0.7*AGE)

WOMEN HEART RATE MAX=206-(0.88* AGE)

CAD WITH BETA BLOCKERS HR MAX=164-(0.7*AGE)

FUNCTIONAL CAPACITY

FUNCTIONAL CAPACITY CAN ALSO EXPRESSED AS MET'S.

" ONE MET'S IS DEFINED AS AMOUNT OF O_2 CONSUMED WHILE SITTING AT REST AND IS EQUAL TO 3.5ml OF O_2 PER KILOGRAM BODY WEIGHT PER MIN".

MET'S MEN = 15-(0.15 AGE)

MET'S WOMEN =14.7-(0.13 AGE)

BLOOD PRESSURE AND HEART RATE CHANGES

- Normal BP response is to increase in systolic BP with progressively increase of workload peak response ranging from 160mmHg to 200mmHg.
- Failure to incrrease in SBP beyond 120mmHg or fall in SBP Below standing resting value during progressive excerise is abnormal
- hypertensive response to excercise is SBP rises more than 210mmHg and DBP more than 115mmHg.

INDICATIONS FOR TMT

- ✓ DIAGNOSE FUNCTIONAL CAPACITY OF PATIENT
- ✓ DIAGNOSE ATYPICAL HEART DISEASE(ANGINA,CAD)
- ✓ DURING VALVULAR HEART DISEASE TO FIND VALVULAR OBSTRUCTION SEVERITY
- ✓ PERIPHERAL ARTERY DISEASE IS ALSO DIAGNOSED.

INDIACATION FOR TERMINATING TMT

- ✓ ST ELEVATION (>1.0mm) IN LEADS WITHOUT Q WAVES CAUSED BY PRIOR MI (OTHER THAN a VR , a VL ,V1
- ✓ DROP IN SYSTOLIC BP OF 10mmhg DESPITE AN 4^{TH} IN WORKLOAD WHEN ACCOMPENATE BY ANY OTHER EVIDENCE OF ISCHEMIA
- ✓ MODERATE TO SEVERE ANGINA
- ✓ CNS SYMPTOMS-DIZZINESS,SYNCOPE
- ✓ SIGNS OF POOR PERFUSION-CYANOSIS or PALLER
- ✓ VENTRICULAR TACHYCARDIA
- ✓ TECHNICAL DIFFICULTIES
- ✓ PATIENT REQUEST TO STOP

CONTRAINDICATION

- ✓ SYMPTOMATIC SEVERE AORTIC DISSECTION / STENOSIS
- ✓ ACUTE MI WITHIN 48 HOURS
- ✓ UNSTABLE ANGINA PECTORIS IN ACUTE PHASE
- ✓ PRESENCE OF POTENTIALLY SERIOUS ARRHYTHMIA
- ✓ DECOMPENSATED HEART FAILURE
- ✓ PULMONARY EMBOLISM IN ACUTE PHASE
- ✓ ENDOCARDITIS
- ✓ ACUTE MYOCARDITIS/PERICARDITIS

DUKE TREADMILL SCORE

- Duke Treadmill Score:
- The equation for calculating the Duke treadmill score (DTS) is DTS=exercise time−(5×ST deviation)−(4×exercise angina), with 0=none, 1=nonlimiting, and 2=exercise-limiting.

- The score typically ranges from −25 to +15. These values correspond to low-risk (with a score of ≥+5), moderate-risk (with scores ranging from −10 to +4), and high-risk (with a score of ≤−11).

- From the exercise test, mean ST deviation was 0.6 mm, the average exercise duration was 6.7 minutes, and angina occurred during exercise in 50% of patients. Cardiac catheterization revealed significant coronary disease in 61% of patients, whereas 27% of patients had severe coronary disease. Average ejection fraction was 56%. The overall cardiac mortality rate was 8.2%.

DUKE TREADMILL SCORE (DKS)

DTS=EXERCISE TIME –(5* MAXST)-(4 *ANGINA INDEX)

ANGINA INDEX

0=NO ANGINA DURING EXERCISE

1=NON-LIMITING ANGINA

2=EXERCISE LIMITED ANGINA

RISK

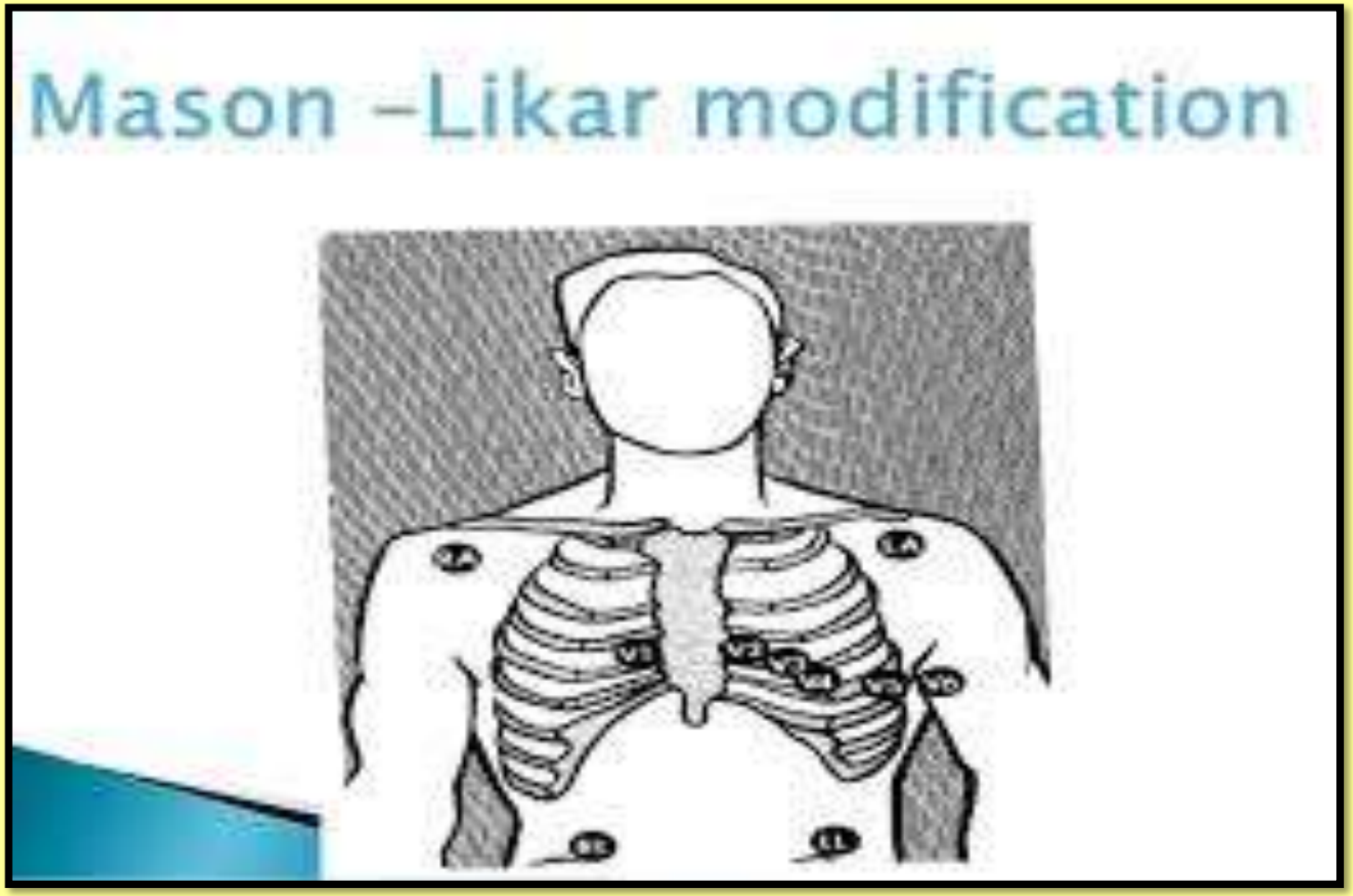
>=+5(LOW RISK)

+4 to -10(MODERATE RISK)

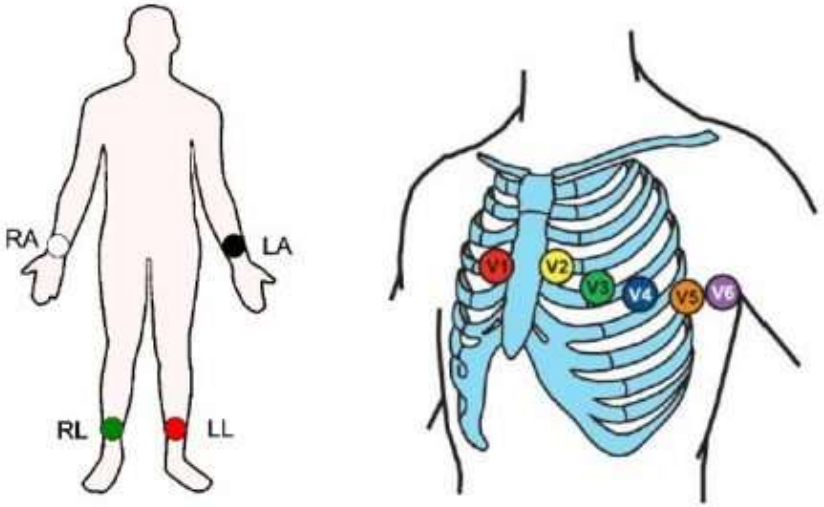
<=-11(HIGH RISK)

- High-risk patients were more often older and male, with a greater frequency of cardiac risk factors, typical anginal symptoms, congestive heart failure, and prior myocardial infarction. During the treadmill test, peak heart rate, systolic blood pressure, and exercise time were lower for high-risk than for low- or moderate-risk DTS patients. All of the high-risk patients had ≥1 mm of ST-segment deviation, and 94% had exertional chest pain

MASON –LIKAR MODIFICATION



MASON -LIKER MODEFICATION



RA – right forearm or wrist
LA – left forearm or wrist
LL – left lower leg, proximal to ankle
RL – right lower leg, proximal to ankle
V1 – 4-th intercostal space, right sternal edge
V2 – 4-th intercostal space, left sternal edge
V3 – midway between V2 and V4
V4 – 5-th intercostal space, mid-clavicular line
V5 – anterior axillary line in straight line with V4
V6 – mid-axillary line in straight line with V4 and V5

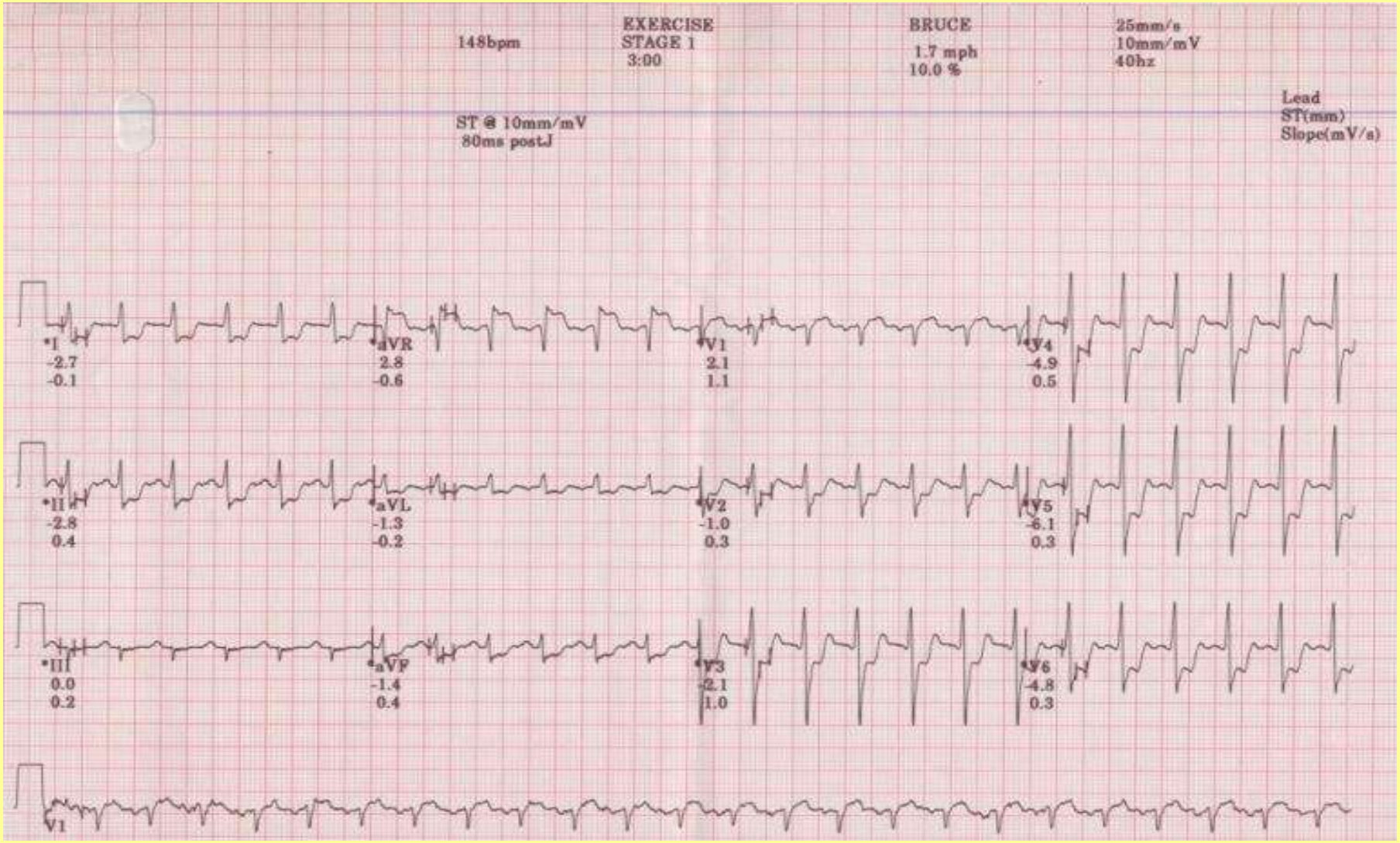
Figure 23: 12 leads resting ECG electrode placement

POSITIVE TMT

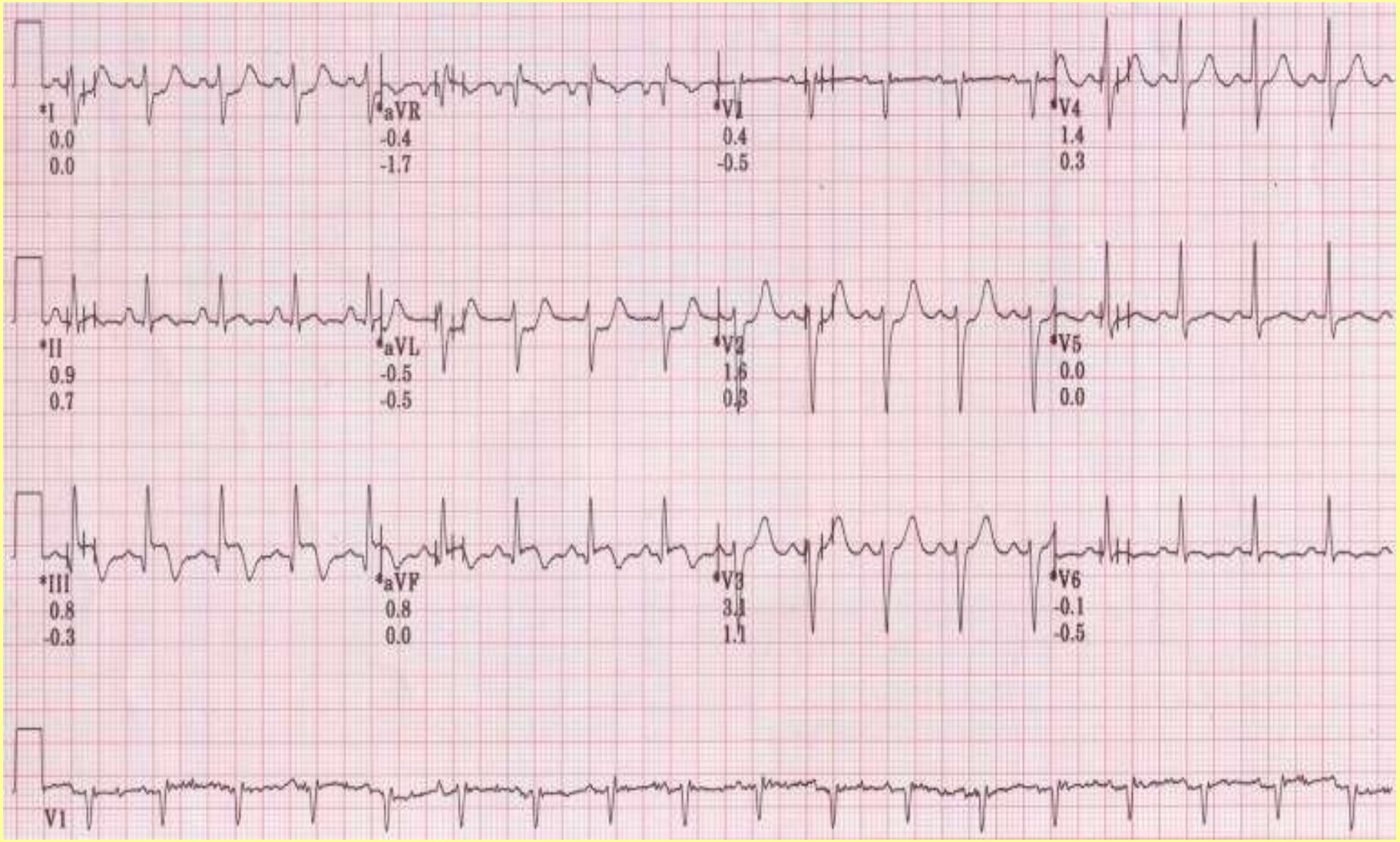
- ✓ ST DEPRESSION IN LATERAL AND INFERIOR LEADS (1.5mm IN AMPLITUDE, 80msec IN DURATION)
- ✓ ST ELEVATION <1mm
- ✓ The sensitivity of a test reflects the proportion of people with the disease in question who are tested positive, whereas the specificity is the proportion of those without the disease who are tested negative.

- Sensitivity and specificity of TMT in people with 25% prevalence of significant CAD.

TMT RESULT	PEOPLE WITH CAD	PEOPLE WITHOUT CAD	TEST REMARKS
TMT TEST POSITIVE	TRUE POSITIVE	FALSE POSITIVE	POSITIVE TEST
TMT TEST NEGATIVE	FALSE NEGATIVE	TRUE NEGATIVE	NEGATIVE TEST


148bpm
EXERCISE
STAGE 1
3:00
BRUCE
1.7 mph
10.0 %
25mm/s
10mm/mV
40hz
ST @ 10mm/mV
80ms postJ
Lead
ST(mm)
Slope(mV/s)
I
-2.7
-0.1
aVR
2.8
-0.6
V1
2.1
1.1
V4
-4.9
0.5
II
-2.8
0.4
aVL
-1.3
-0.2
V2
-1.0
0.3
V5
-6.1
0.3
III
0.0
0.2
aVF
-1.4
0.4
V3
-2.1
1.0
V6
-4.8
0.3
V1

RECOVERY


*I
0.0
0.0
*aVR
-0.4
-1.7
*V1
0.4
-0.5
*V4
1.4
0.3
*II
0.9
0.7
*aVL
-0.5
-0.5
*V2
1.6
0.3
*V5
0.0
0.0
*III
0.8
-0.3
*aVF
0.8
0.0
*V3
3.1
1.1
*V6
-0.1
-0.5
V1

RECOVERY AT 3MIN