



**SNS COLLEGE OF ALLIED HEALTH SCIENCES**

SNS Kalvi Nagar, Coimbatore - 35

Affiliated to Dr MGR Medical University, Chennai



**DEPARTMENT OF CARDIAC TECHNOLOGY**

PAPER II: ADVANCED ECG / HOLTER /TMT

UNIT IV : EXERCISE PHYSIOLOGY



# TREAD MILL TEST



- ✓ IT IS A STRESS TEST THAT 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<sub>2</sub> UPTAKE INCREASES.
- ✓ INCREASED ENERGY DEMANDS OF EXERCISING MUSCLE
- ✓ INCREASED SYMPATHETIC TONE
- ✓ INCREASED CARDIAC OUTPUT
- ✓ INCREASED MYOCARDIAL O<sub>2</sub> 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 ZONE 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= $208-(0.7*\text{AGE})$

WOMEN HEART RATE MAX= $206-(0.88*\text{AGE})$

CAD WITH BETA BLOCKERS HR MAX= $164-(0.7*\text{AGE})$



# FUNCTIONAL CAPACITY

FUNCTIONAL CAPACITY CAN ALSO EXPRESSED AS **MET'S**.

“ ONE MET'S IS DEFINED AS AMOUNT OF O<sub>2</sub> CONSUMED WHILE SITTING AT REST AND IS EQUAL TO **3.5ml** OF O<sub>2</sub> PER KILOGRAM BODY WEIGHT PER MIN”.

**MET'S MEN = 15-(0.15 AGE)**

**MET'S WOMEN = 14.7-(0.13 AGE)**



# 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.



# INDICATION FOR TERMINATING TMT

- ✓ ST ELEVATION ( $>1.0\text{mm}$ ) IN LEADS WITHOUT Q WAVES CAUSED BY PRIOR MI (OTHER THAN  $a_{VR}$ ,  $a_{VL}$ ,  $V_1$ )
- ✓ DROP IN SYSTOLIC BP OF  $10\text{mmHg}$  DESPITE AN  $4^{\text{TH}}$  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 (DKS)

$$DTS = \text{EXERCISE TIME} - (5 * \text{MAXST}) - (4 * \text{ANGINA INDEX})$$

## ANGINA INDEX

0=NO ANGINA DURING EXERCISE

1=NON-LIMITING ANGINA

2=EXERCISE LIMITED ANGINA

## RISK

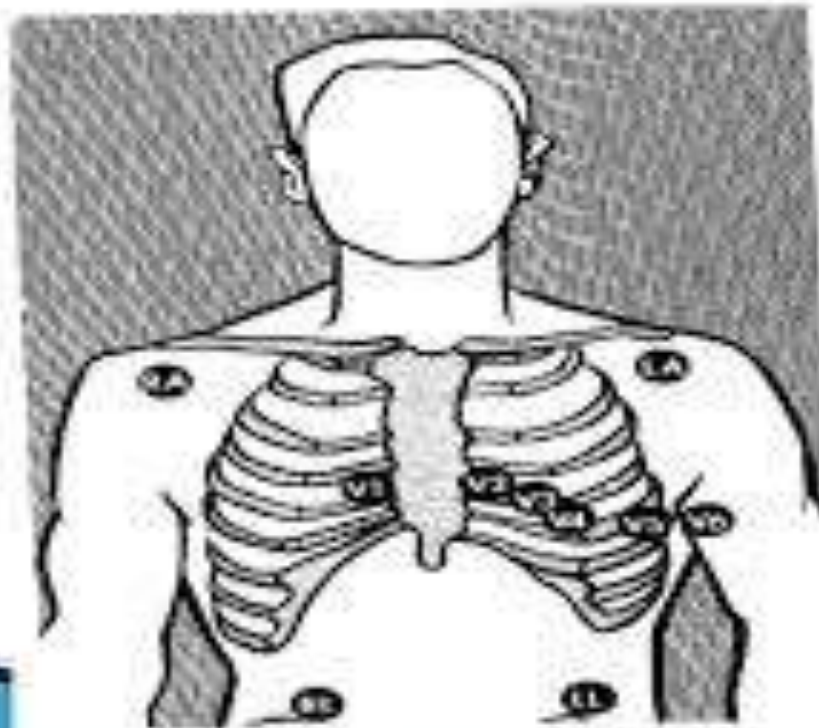
$\geq +5$  (LOW RISK)

+4 to -10 (MODERATE RISK)

$\leq -11$  (HIGH RISK)

# MASON - LIKAR MODIFICATION

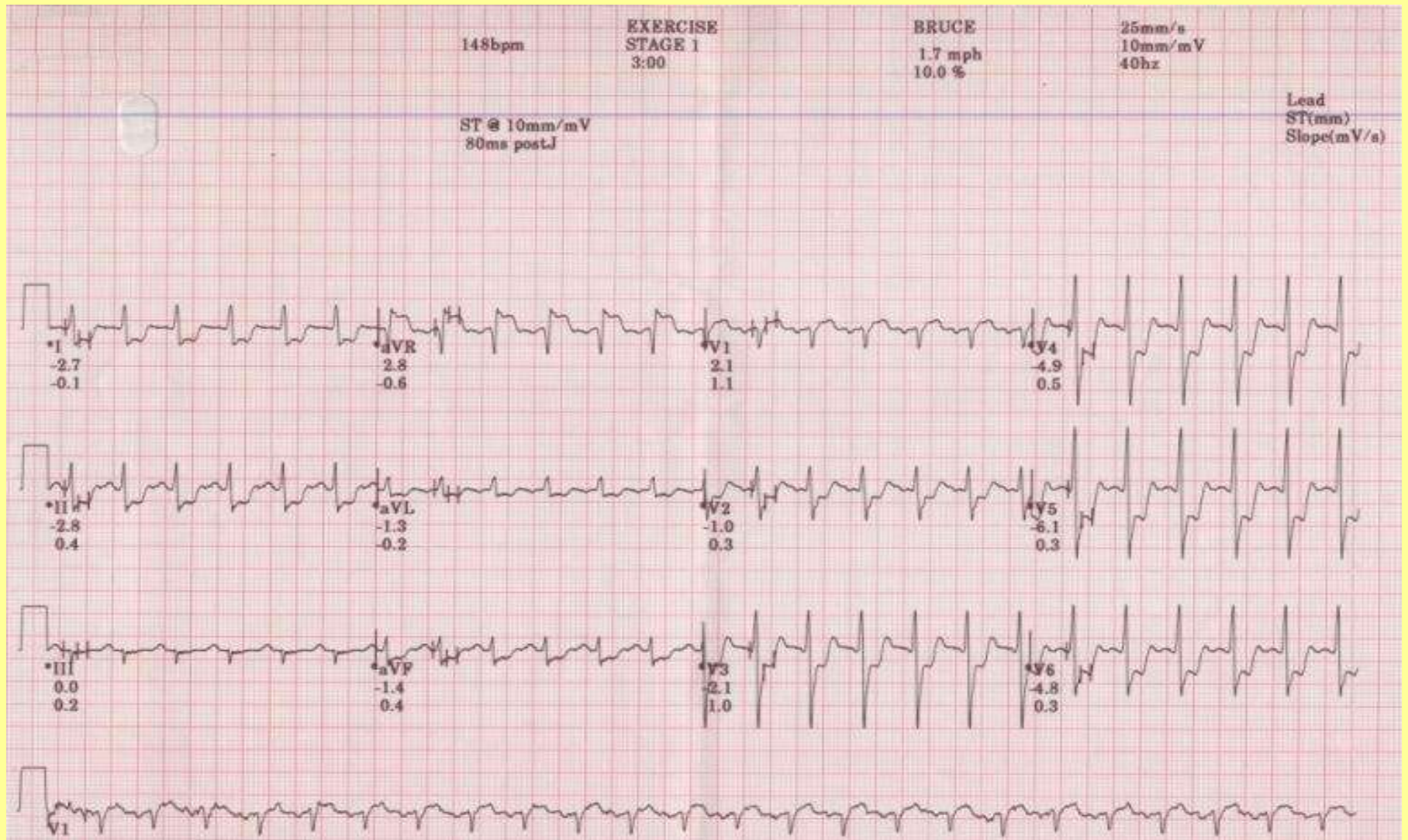
Mason - Likar modification





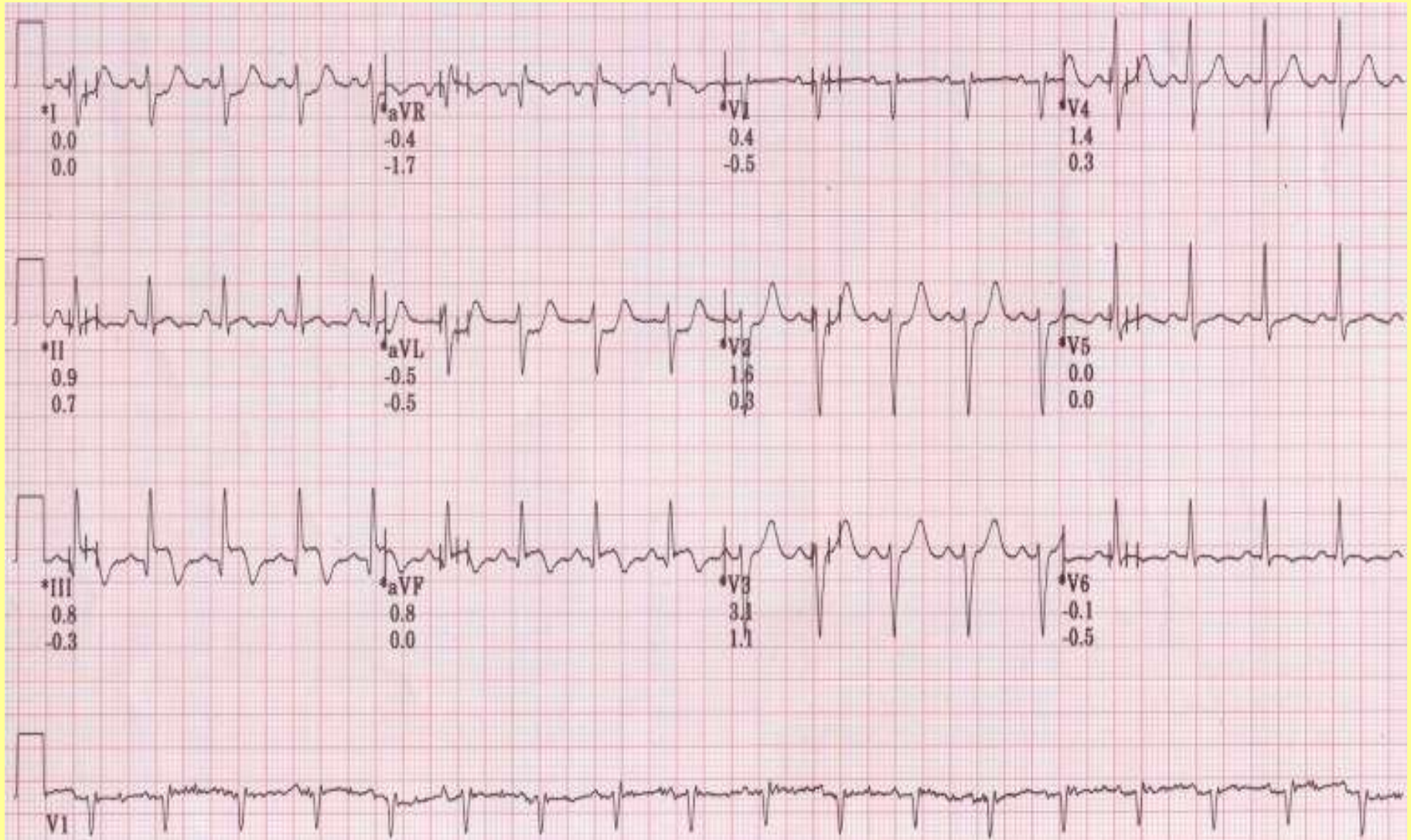
# POSITIVE TMT

- ✓ ST DEPRESSION IN LATERAL AND INFERIOR LEADS (1.5mm IN AMPLITUDE, 80msec IN DURATION)
- ✓ ST ELEVATION  $<1\text{mm}$

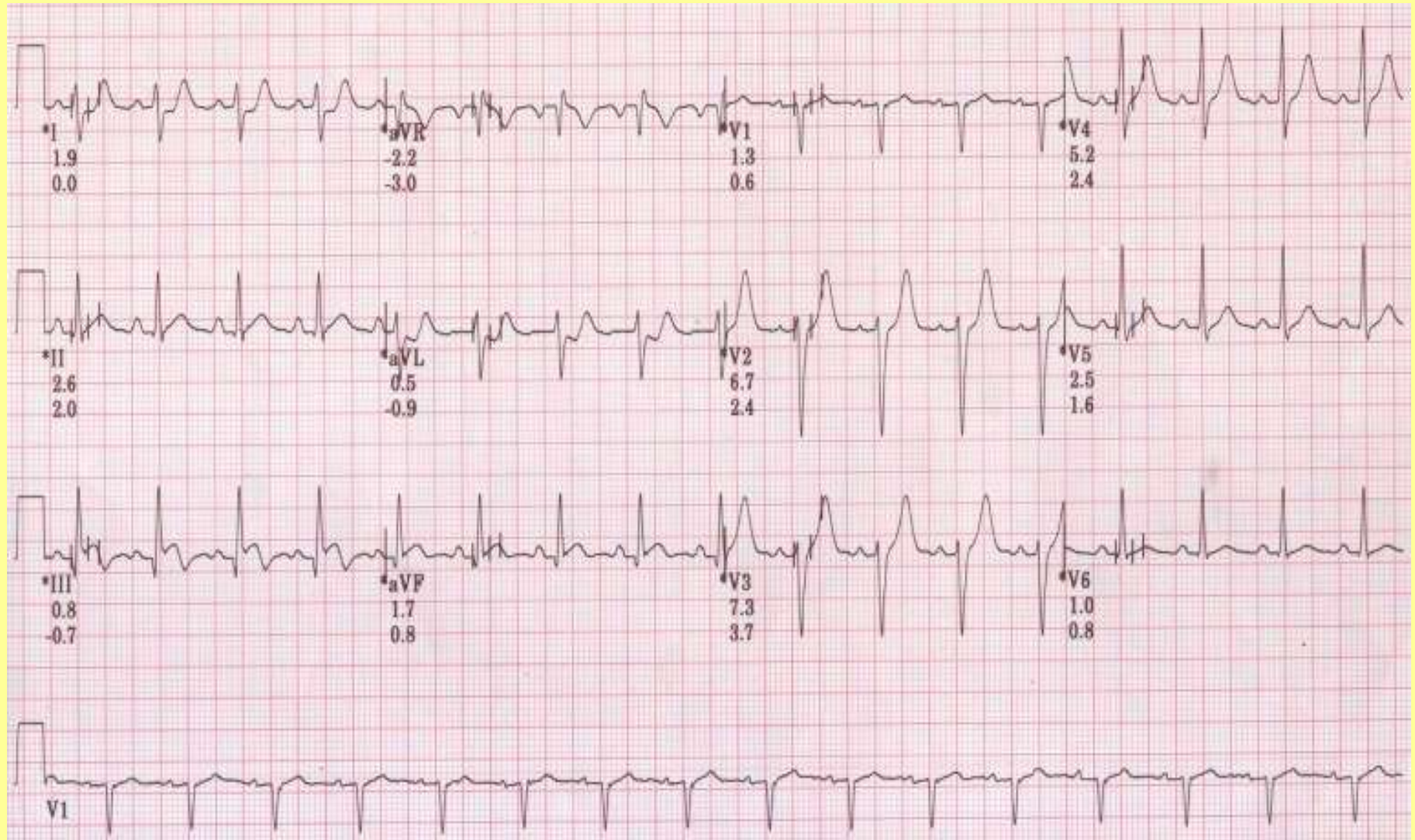




# RECOVERY



# RECOVERY AT 3MIN





**THANK YOU**