Isfahan Cardiovascular Research Institute

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WHO Collaborating Center

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Paraclinic tests in AMI

Exercise test

Exercise test

Table 3. Summary of Tests for Detection of Coronary Artery Disease

Test	*Sensitivity (%)*	*Specificity (%)*	*Limitations*	*Advantages*
Cardiac catheterization	98	82	Invasive, requires radiation	Preferred test, allows for detection and intervention
Exercise single-photon emission computed tomography	85	85	Cannot assess myocardium or valves, heart rhythm irregularities may affect results, soft tissue attenuation artifacts, requires radiation	Assesses myocardial perfusion and regional/global function at rest and during stress, good prognostic data and negative predictive value
Exercise stress testing	68	77	Requires normal baseline electrocardiography, not recommended for patients with history of percutaneous coronary intervention or coronary artery bypass grafting	Less expensive, limited equipment required, good prognostic data and negative predictive value
Stress echocardiography	79	87	Image quality affected by body habitus and dependent on operator, limited time for imaging postexercise	Assesses cardiac structure, global and segment function at rest and during stress, relatively inexpensive, does not require radiation, good prognostic data and negative predictive value

Information from references 10 through 14.

Indications-STEMI

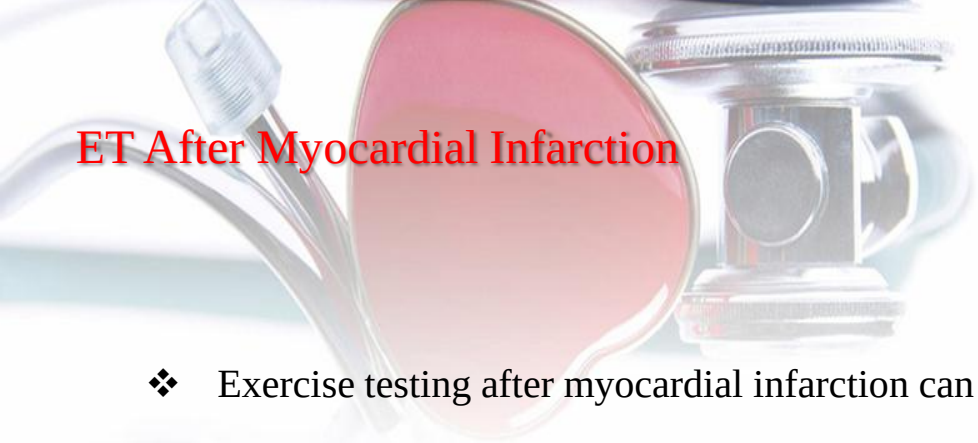
- Before discharge for patients who underwent successful thrombolysis and did NOT undergo diagnostic coronary angiography
- Before discharge in patients who came with late presenting STEMI and did NOT undergo diagnostic coronary angiography

ABSOLUTE SONTRAINDICATIONS

- Within 24 hours of troponin positive ACS
- Within 7 days for high dose DSE after STEMI
- Left ventricular failure with symptoms at rest (in tertiary centres viability may be assessed using low dose dobutamine stress).
- Recent history (within the last week) of life threatening arrhythmias.
- Severe dynamic or fixed left ventricular outflow tract obstruction although low dose DSE may be useful.
- BP >220/120
- Recent pulmonary embolism or infarction.
- Thrombophlebitis or active deep vein thrombosis.
- Known hypokalaemia (particularly for Dobutamine stress)
- Active endocarditis, myocarditis, or pericarditis.

When not to do it?
When It is not safe

- ACS – Acute Phase
- Uncontrolled arrhythmia
- Uncontrolled HF, uncontrolled HTN
- Symptomatic Severe Ao stenosis
- Acute PE
- Suspected or known dissecting aneurysm
- Active or suspected myocarditis, pericarditis, or endocarditis
- Acute noncardiac disorder that may affect exercise performance or be aggravated by exercise



ET After Myocardial Infarction

- Exercise testing after myocardial infarction can be performed
  - before or soon after hospital discharge for prognostic assessment,
  - for exercise prescription,
  - for evaluation of further medical therapy, and
  - for interventions including coronary revascularization.

Exercise Testing After Myocardial Infarction:

- Submaximal exercise testing provides sufficient data to assess the effectiveness of current pharmacologic management as well as activities of daily living and early ambulatory exercise therapy recommendations.

- Symptom-limited graded exercise tests are considered safe and appropriate early after discharge (~14–21 d) for exercise prescription and physical activity counseling and further assessment of pharmacologic management efficacy.

Exercise test

- The use of low level exercise testing early after infarction (within 3 weeks) can serve two purposes.
- It can identify those patients who are at high risk for a future coronary event and who should be given more intensive medical or surgical therapy.
- It can also identify low risk patients who would not require additional noninvasive or invasive studies and could have an accelerated rehabilitation and return to normal daily activities.
- The screening of patients for the early exercise test is the first step in risk stratification. Those patients deemed unable to undergo exercise testing, usually because of recurrent chest pain, congestive heart failure or complex ventricular arrhythmias, are at increased risk for a recurrent event.

Exercise test

- important predictors of recurrent cardiac events include the presence of ischemic ST segment depression (especially greater than 2 mm), low exercise capacity, complex ventricular arrhythmias and inadequate blood pressure response .

- In early studies evaluating the significance of early post infarction exercise testing, the most important predictor of cardiac mortality was the presence of myocardial ischemia.

- In the most recent post infarction trial , however, an inadequate blood pressure response (peak systolic blood pressure less than 110 mm Hg) and the presence of ventricular couplets were the only exercise predictors of increased mortality.

- It may be that continued evidence of myocardial ischemia on the exercise test influenced the decision to recommend revascularization procedures and that this therapy altered the poorer survival of patients with post infarction ischemia.

Exercise test

- Equally important in the early risk stratification of patients after a myocardial infarction is the identification of low risk patients who would require less intensive diagnostic evaluations and therapeutic interventions . Among patients whose exercise test does not disclose evidence of myocardial ischemia, the first year mortality rate is less than 2% .

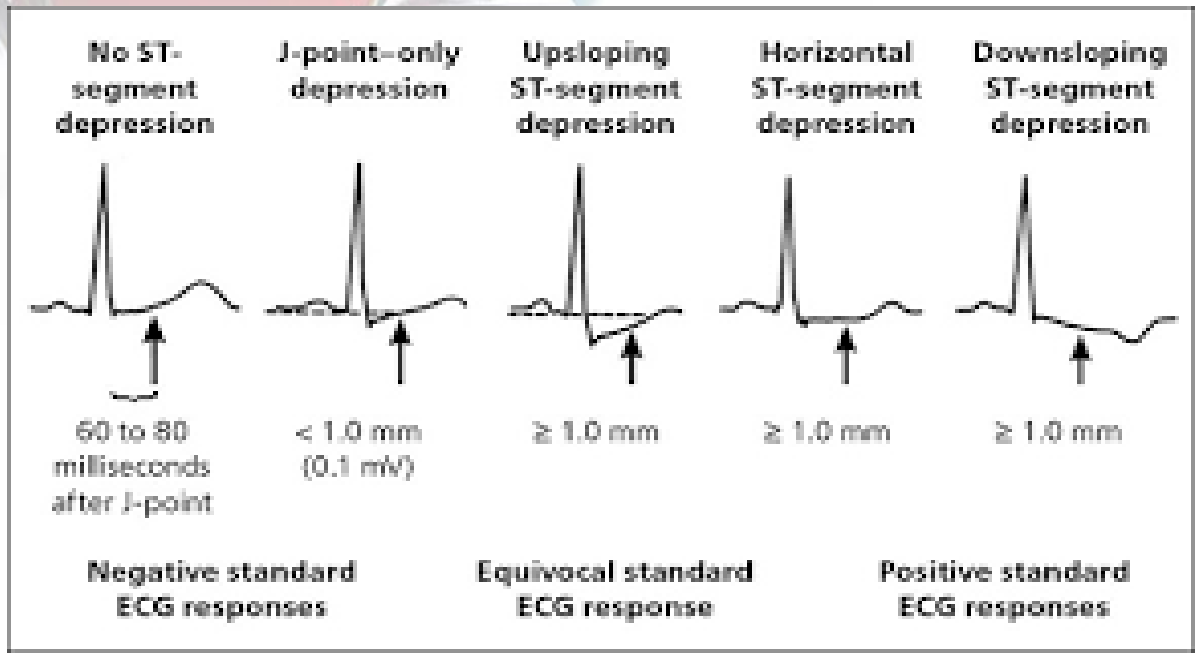
- Some of the controversial areas involving early exercise testing that require further studies include 1) the best end point of exercise testing (heart rate-limited versus symptom limited), 2) the optimal timing of the exercise test (7 to 10 days versus 3 to 6 weeks), and 3) the role of adjunctive exercise nuclear procedures such as thallium-20l scintigraphy and radionuclide ventriculography.

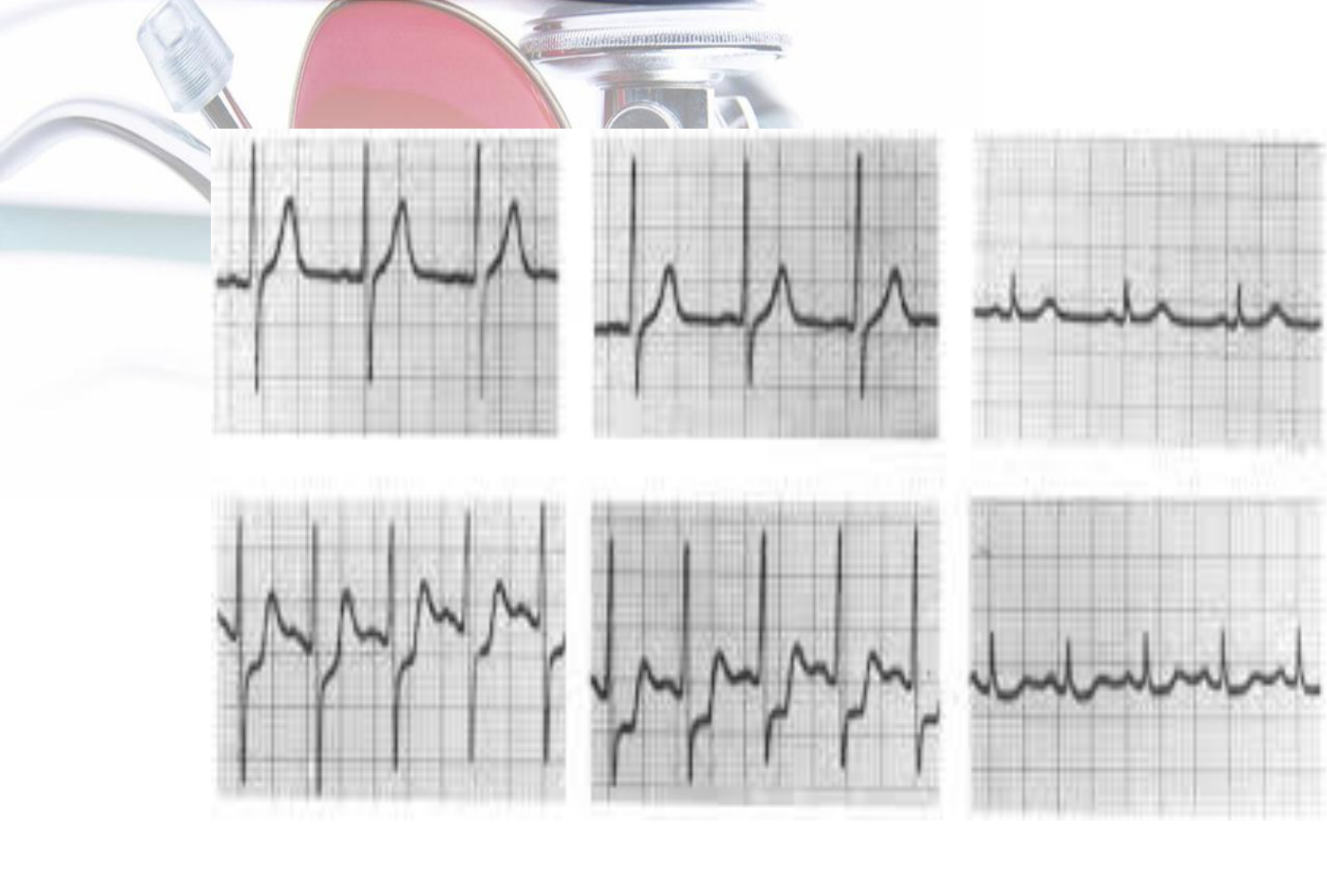
Exercise testing late after myocardial infarction.

- The interactions between clinical and exercise variables are still unclear. Another important question that remains unanswered by this study is the role of exercise testing at 6 months after infarction in patients who have already undergone earlier exercise testing. It is not clear how much more information the late exercise test would add to the risk stratification of patients who had performed a test soon after myocardial infarction.

High risk indicators exercise stress testing

- Early positive-stage I: Mortality >5%/year
- Strongly positive > 2.5 mm ST depression
- ST elevation > 1 mm in leads without Q waves
- Fall in SBP >10 mm HG
- Early onset ventricular arrhythmia's
- Chronotropic incompetence Ex HR <120/min not due to drugs
- Prolonged Ischaemic changes in recovery > 2mm lasting > 6 minutes in multiple leads


No ST-segment depression
J-point–only depression
Upsloping ST-segment depression
Horizontal ST-segment depression
Downsloping ST-segment depression
60 to 80 milliseconds after J-point
< 1.0 mm (0.1 mV)
≥ 1.0 mm
≥ 1.0 mm
≥ 1.0 mm
Negative standard ECG responses
Equivocal standard ECG response
Positive standard ECG responses



12 lead ECG after 4min 30sec exercise: HR 139/min

Possible causes of false positive ETT for CAD

- Female gender
- Hyperventilation
- Mitral Valve Prolapse Syndrome
- LVH
- Drugs (digoxin)
- Anemia
- Electrolyte disturbances (hypokalemia)
- Lead Misplacement
- Pre-existing cardiac abnormalities (e.g. LBBB, WPW, Cardiomyopathy, Valvular Heart Disease

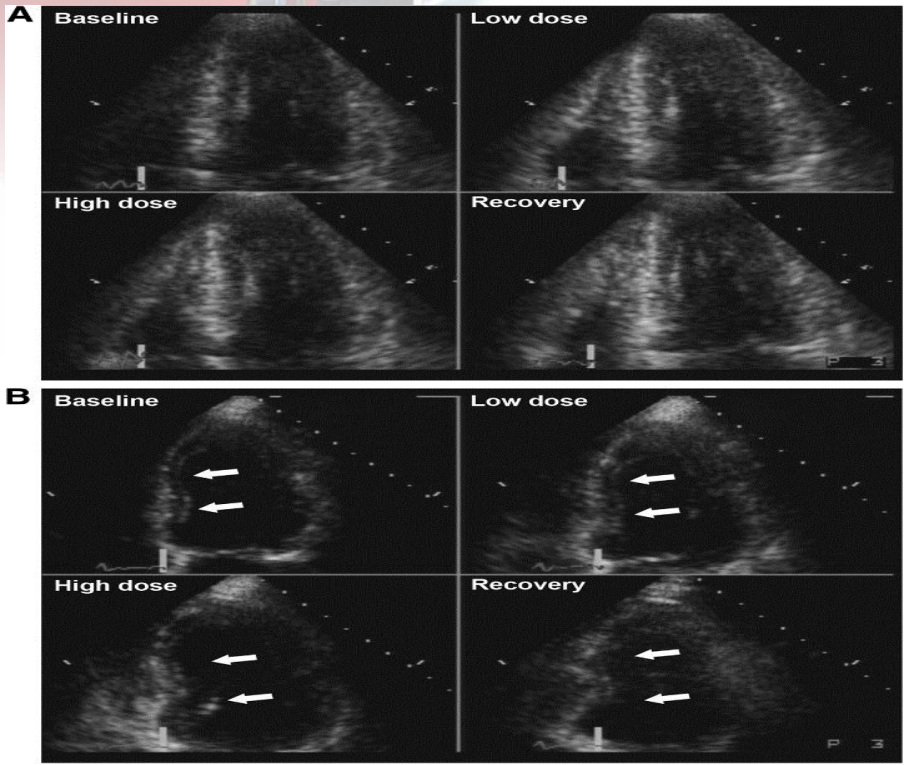
Stress Echocardiogram

Interpretation:

Table 1 Interpretation of exercise and pharmacologic stress echocardiography

Nature of tissue	Resting function	Low dose	Peak/post-stress function
Normal	Normal	Normal	Hyperkinetic
Ischaemic	Normal	Normal (may worsen with severe CAD)	Worse than rest
			Worse than adjacent segments
			Tardokinesis (delayed contraction)
Viable, ischaemic	Rest WMA	Improvement at low dose	Reduction (compared with low dose)
Viable, non-ischaemic	Rest WMA	Improvement at low dose	Sustained improvement
Infarction	Rest WMA	No change	No change

CAD, coronary artery disease; WMA, wall motion abnormalities (severe hypokinesis, akinesis, dyskinesis).


A
Baseline
Low dose
High dose
Recovery
B
Baseline
Low dose
High dose
Recovery