Exercise Stress Testing

Holter ECG

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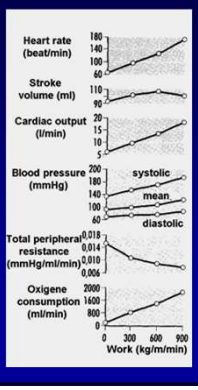
Indications for exercise stress test ECG

- It is advisable to be performed if the suspicion of coronary artery disease is raised and there are no contraindications to the test.
- After a myocardial infarction (>10 days) to detect residual ischemia if no reperfusion treatment was applied.
- Monitoring after a revascularization therapy (PTCA, CABG)
- To assess exercise capacity in heart failure.
- Searching for exercise-induced arrhythmias and chronotropic incompetence (SSS) or to determine refractoriness of the accessory pathway in WPW syndrome.
- To assess exercise tolerance and perioperative risk before high-risk surgery (lungs, great vessels).

Contraindications for exercise stress test ECG

- Acute stage of AMI (first few days)
- Unstable angina
- Severe aortic stenosis and hypertrophic cardiomyopathy
- Current high blood pressure ($RR_{systolic}$ >160 mmHg)
- Hypokalaemia;
- Severe or unstable heart failure (NYHA class III-IV);
- Severe disturbances of impulse formation and conduction, ventricular arrhythmias;
- Acute pericarditis, myocarditis, febrile illness, anemia;
- Left ventricular thrombus, acute thromboembolism.

Cardiovascular effects of physical exercise



cardiac output = heart rate X stroke volume

$$\text{cardiac output} = \frac{\text{mean arterial pressure}}{\text{total peripheral resistance}}$$

total O_2 consumption ≈ cardiac output

Indirect assessment of cardiac O_2 demand

Rate-pressure product

systolic blood pressure X heart rate

Heart rate limits during exercise test ECG

Age-predicted maximal frequency: 220 – age

Submaximal frequency: 85% of maximal frequency

(MET) Unit of body O_2 consumption

1 metabolic equivalent (MET)

= 3.5 ml O_2 consumption/min/kgbodyweight

Doubling the heart rate: 9-12 MET

< 4 MET – poor exercise tolerance
4-7 MET – moderate exercise tolerance
> 7 MET – good exercise tolerance

Additional terms:
- maximal O_2 consumption
- anaerobic threshold

Limits of cardiac O_2 uptake during exercise testing

1. Coronary stenosis
2. Increased O_2 demand
3. Tachycardia
4. Low systemic diastolic and high left ventricular end-diastolic pressure
5. Compression of subendocardial and subepicardial vessels
6. Pathological intramural blood redistribution

Protocols of exercise testing

Mechanical:

- static exercise (e.g. handgrip)
- dynamic exercise (e.g. ergometer, treadmill)

Pharmacodynamic:

- dipyridamol
- dobutamin

Combined:

- dipyridamol and myocardium scintigraphy (SPECT)
- dobutamin – dipyridamol and echocardiography

Physiologic ECG alterations during exercise testing

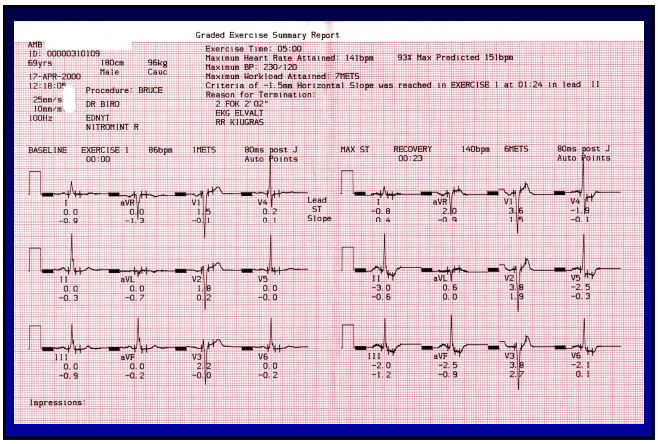
1. Increase in heart rate
2. Reduction of PQ distance
3. Increase of P wave amplitude
4. Right axis
5. Reduction in R and T wave amplitudes
6. Ascending ST depression

Pathologic ECG alterations during exercise testing

Pathologic ST-T changes:

- junctional ST depression
- horizontal ST depression
- descending ST depression
- ST elevation (with or without Q waves)

ST-T changes and location of ischaemia



Indications for Holter monitoring

1. With complaints (palpitation, syncope, vertigo)
2. Without complaints (HOCM, DCM, bad cardiac function after MI, WPW, elongated QT, SCD risk)
3. Antiarrhythmic treatment (needed?, effective?, proarrhythmic?)
4. Paroxismal atrial fibrillation (anticoagulant therapy?)
5. Sick sinus syndrome
6. Silent and non-silent ischaemias (Printzmetal angina, effectiveness of antiischaemic therapy), or when excercise testing cannot be performed

Final exam test bank – Int-1.13

If acute myocardial infarction is suspected, the following diagnostic procedures should be carried out, except for:

A) ECG

B) blood tests (to measure CK-MB and troponin)

C) physical examination

D) cardiac stress test

E) echocardiography

Final exam test bank – Int-1.30

In the diagnostic workup of a 60-year-old patient with a history of smoking who has chest pain at exertion, the first step should be:

A) stress echocardiography

B) exercise test

C) stress perfusion scintigraphy

D) Holter ECG monitoring

E) stress MRI

Final exam test bank – Int-1.44

Contraindications of cardiac exercise tests:

1) acute myocardial infarction
2) chronic heart failure
3) unstable angina
4) beta-blocker therapy

A) Answers 1, 2 and 3 are correct
B) Answers 1 and 3 are correct
C) Answers 2 and 4 are correct
D) Only answer 4 is correct
E) All of the answers are correct

Final exam test bank – Int-1.151

What kind of examination would you NOT perform?
A 40-year-old woman with obesity had an accident and lay in her bed for 3 weeks. She has been coughing dry for 3 days. In the day of the examination she has bizarre mordant chest pain.

A) ECG
B) D-dimer
C) Blood gases
D) pulmonary CT-angiography
E) treadmill exercise test
F) 2D- echocardiography

Final exam test bank – Int-1.9

The typical feature of Prinzmetal angina:

A) ST segment depression during angina
B) negative T waves during angina
C) pathologic Q waves during angina
D) elevated necroenzymes
E) ST segment elevation during angina

Final exam test bank – Int-1.29

Pathologic Q wave in leads II, III and aVF with isoelectric ST segment and positive T waves indicate:

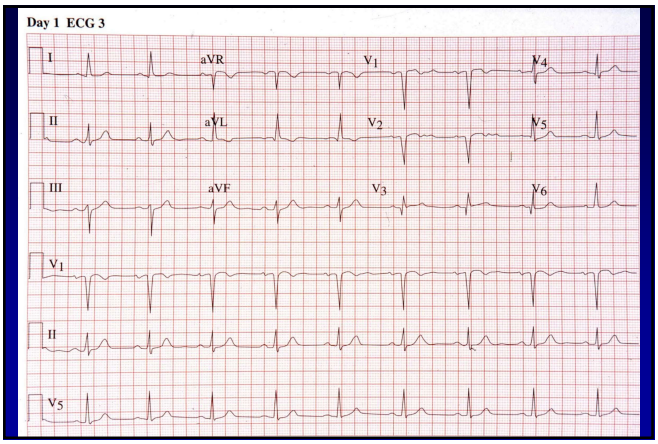
A) acute ischemia

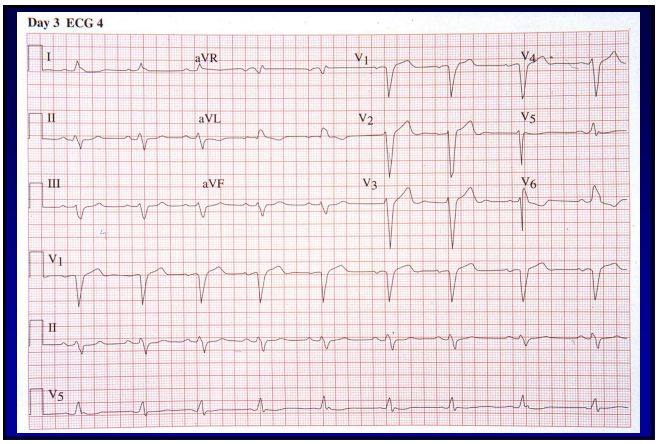
B) acute phase of a progressing myocardial infarction

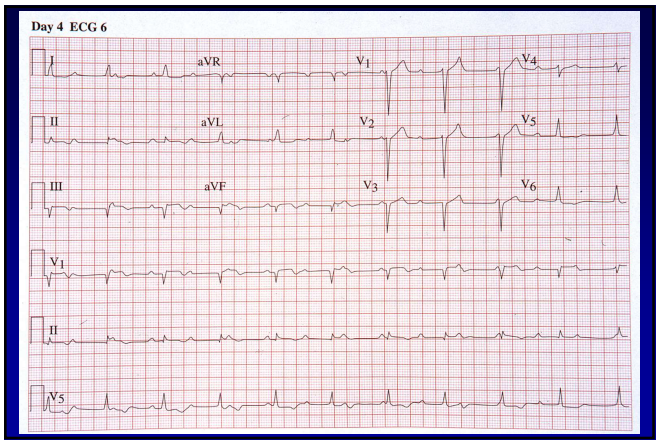
C) previous myocardial infarction

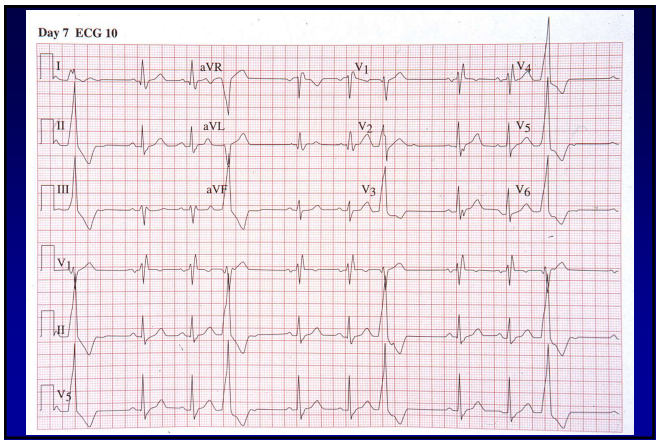
D) aneurysm after myocardial infarction

E) subendocardial ischemia






Day 4 ECG 6
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5


Day 7 ECG 10
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5