

# Stress examination of the cardiovascular system

**ECG** recording, blood pressure measurement and monitoring of the patient's difficulties during exercise and then in the recovery phase after the interruption of exercise.

The examination is mainly carried out as part of the diagnosis of ischemic heart disease, when detecting rhythm disorders during exercise and when objectifying problems that appear during exercise.

Stress **echo** expands the above by displaying the momentum of the left ventricle of the heart during exercise. [1]

**Myocardial stress perfusion scintigraphy** has a very high diagnostic and prognostic value.

## Forms of stress

- bicycle ergometer
- moving treadmill
- pharmacy
  - sympathomimetics: dobutamine
  - vasodilatation: adenosine, dipyridamole

## Investigative methods

### Stress electrocardiography

- to determine the patient's performance, to allow physical exertion, to control treatment or for prognostic and diagnostic reasons
- the easiest method
- ECG recording is part of other more complex stress tests
- the patient is examined in the morning, 2 hours after a meal, at an ambient temperature of 18–20 °C
- it is performed on a bicycle ergometer or a moving treadmill
- **END POINTS = reason for ending the test,**
  - physiological = achieving maximal or submaximal HR,
  - pathological:
    - subjective = pain, dyspnea, fatigue...,
    - objective = drop in blood pressure, arrhythmia.
- **It is determined:**
  - working tolerance = highest completed load,
  - work capacity = exercise completed without developing signs of ischemia.

**It is not different in healthy people.**

- We rate the difficulties using *the Borg scale*:
  - 7 = reaching the anaerobic threshold
  - +++ non-invasive, easily repeatable
  - the result cannot be applied to everyday life (stress, diet...)

### Stress echocardiography

It is examined transthoracic or transesophageal. We use **pharmacy, bicycle ergometer, moving treadmill or cardiostimulation** as a load.

### Perfusion scintigraphy

It allows visualization of the change in left ventricular perfusion. Today, it is already one of the most frequently used non-invasive examination methods in cardiology.

## Load forms - details

### Bicycle ergometry

- During 2-4 stress levels we reach **maximum heart rate (HR) = 220 - age**, or **submaximal HR = 200 - age**.
- we register HR, BP and ECG lying down, sitting, during hyperventilation and in the break between stages,
- own weight is not applied when pedalling,

- the total consumption of  $O_2$  depends on the size of the load,
- degrees are selected at  $0.5 \text{ W kg}^{-1}$  weight after 2–4 min.

### Treadmill

- walking or running
- total consumption depends on the fitness of the patient,
- the load is given by the treadmill movement speed.

### Dipyridamole test

- **Dipyridamole** prevents the breakdown of adenosine,
- administration –  $0.56 \text{ mg. kg}^{-1}$  weight after 4 min, then  $0.28 \text{ mg}$  after 2 min + imaging methods or ECG,
- adenosine receptors are irritated → *increase in coronary flow in stenosis* → pain + change on the echocardiograph,
- we cancel the ischemia **with aminophylline**,
- contraindications – bronchial asthma.

### Dobutamine test

- **Dobutamine** – stimulation of  $\beta$ -receptors → increase in heart rate +  $O_2$  consumption → ischemia + pain,
- administration – increasing doses from  $5 \mu\text{g. kg}^{-1} \cdot \text{min}^{-1}$  for 3 min until reaching 85% max. HR,
- a vasodepressor reflex may occur = hypotension, bradycardia,
- use – assessment of the myocardium at rest,
- test in lower dobut. doses to assess a dysfunctional myocardium at rest.

### Cardiostimulation load

- Sympathetic influence is eliminated, but ischemia can be quickly induced and cancelled + a minimum of disturbing influences (movement, sweating, etc.),
- **electrode into the oesophagus** and after 3 minutes we increase the number of pulses from  $90/\text{min}^{-1}$ ,
- to detect impairment of segmental momentum, not exercise tolerance, as neither blood pressure nor contractility increases.

## Other tests

### Mental stress test

- E.g. subtracting a two-digit number from a three-digit number...

### Cold test

- To cause coronary spasms + hyperventilation.

## References

1. <http://kardiologiebrandys.cz/service/zatezove-ekg-ergometrie/>
  - ČEŠKA, Richard, et al. *Interna*. 2., aktualizované vydání vydání. Triton, 2015. s. 49, s. 80. ISBN 9788073878856.