Ergometry

Ergometry is a non-invasive examination method that allows to monitor the work of the heart during exercise. Excessive load is induced by a special device - a bicycle ergometer or a treadmill. **Cardiac disorders** may occur during the examination, which are not apparent during resting ECG measurements. If a patient has narrowed or clogged blood vessels supplying the heart, the heart is insufficiently perfused during the test, which causes changes in ECG results.

Ergometr

The ergometer consists of two parts - the exercise bike and ECG measuring device.

Principle of ergometry

During a physically demanding activity, the consumption of oxygen and energy in the muscles increases. Increased demand for the supply of these substances through the blood to the muscles leads to dilation of the arteries in the stressed area. On the contrary, in the currently less needed parts of the body, they narrow (eg in the digestive tract). There is also an increase in cardiac activity. The consumption of oxygen and energy in the heart muscle increases, so the coronary vessels supplying the heart dilate to allow a larger blood supply. However, if atherosclerotic plaques are present on the walls of the heart vessels, this enlargement is not anymore possible.

Insufficient supply of oxygen and nutrients to the area of the heart supplied by the narrowed blood vessel will then result in severe chest pain.

Indication for examination

Ergometry can be prescribed by a doctor for several reasons.

- Ergometry is most often performed when **heart disease** is suspected (so-called coronary heart disease) and to subsequently determine the nature of the disease.
- Furthermore, ergometry can be performed in patients who have a history of the disease and the doctor checks this way and assesses the possible development of the disease.
- With this examination, the doctor evaluates the correctness of the therapy procedure, eg after an acute myocardial infarction.
- It can also verify the effectiveness of the drugs used and, if necessary, decide to change to a more suitable drug or, if necessary, adjust the dosage.
- Another case where the examination is performed is the determination of the tolerable load during training, especially in patients with heart disease who are ordered to rehabilitate. It can also be performed on top athletes who experience extreme physical activity. Today, athletes perform at least a regular ECG, and not just those at the highest level. For athletes, it is also possible to find out the ideal training level of load during the examination.
- Less often, ergometric examination is used to assess valve defects and arrhythmias.

Contraindication

- Examination might be very dangerous if the patient suffers from severe heart rhythm problems, unstable angina or narrowing of the aorta.
- Ergometry cannot be performed if the patient is experiencing an acute inflammatory disease.
- The examination should be postponed if the patient reports symptoms such as dyspnoea, dizziness, chest pain before starting.
- Examination also cannot be performed if the patient is unable to undergo physical exertion, whether for reasons of acute - injury or sudden illness, or chronic - lung problems or other muscular or joint pathology.
- Another reason for not performing the examination is if the patient suffering from a disease with a variable course is in a phase of deterioration. Examples are diabetes mellitus, bronchial asthma, arterial hypertension. Under certain conditions, the test can be performed in a phase of improvement and satisfactory treatment.

Complications

- The most significant (as well as the most serious) risks of ergometry include the development of **acute myocardial infarction**, in 0.05% of patients.
- The risk is naturally higher in patients with ischemic heart disease or especially in the early phase of myocardial infarction.
- The risk of sudden death is approximately 0.01%.Another risk is possible muscle or joint injuries resulting from excessive stress. This risk is particularly high in patients of retirement age.
- Minor complications such as dizziness, weakness or persistent fatigue may also occur.

Preparation for the examination

It is recommended not to eat or drink in large quantities, not to smoke and not to perform unusual physical effort for at least 3 hours before the examination. It is advisable to bring sports shoes and sportswear (shorts, T-shirt) and a towel.

After consultation with the indicating physician, it is necessary to discontinue drugs called beta-blockers (eg Vasocardin, Betaloc, Egiloc, Tenormin, Concor, Lokren, Sectral 2-3) 2-3 days before the examination. Beta-blockers in the diagnostic test adversely affect the heart rate and pressure response, and therefore the patient performs a load with reduced oxygen consumption in the myocardium.

Nitrates (Cardiket, Isomer, Iso-Mack, Mycor, Nitro-Mack, Mono Mack, Olicard, Sorbimon, Corvaton, Molsihexal nutné) must be discontinued 24 hours before the examination. These drugs can increase exercise tolerance, affect the rate of depression or elevation of the T wave in their favor, and thus make ergometry little conclusive.

The course of examination

The stress test is performed on an ergometer in the presence of a doctor. Before starting the examination, the electrodes are attached to the patient's chest and secured. Lying down, a resting recording of the heart's electrical activity (ECG) is recorded to compare any changes to the ECG during exercise.

The examination is started by the patient slowly stepping on the examination wheel. After a few minutes, at periodic intervals, the load (resistance to which the patient treads) begins to increase. At the same time, as the intensity of the load increases, the heart's oxygen requirements begin to increase. During the examination, blood pressure is measured at regular intervals (the measuring cuff is placed on the arm), and the ECG curve is continuously monitored.

If the patient reaches a peak of strength or the patient develops symptoms such as chest pain, shortness of breath, dizziness, feeling faint, the patient will warn the doctor, who will end the test after considering the condition. The test may also be terminated by a physician for safety reasons (dangerously high blood pressure, severe cardiac arrhythmias, or changes in the ECG indicating severe cardiac muscle disturbance - ischemia).

After the end of the load, the patient sits on the ergometer for another 5-7 minutes and rests, his ECG and blood pressure are still recorded.

The duration of the examination is usually approximately 15 minutes. At the end of the test, the doctor will evaluate the course of the examination.

- ***Measurement and load***
  - Two heart rate values are calculated 1. *Submaximal*: 200 - patient age 2. *Maximum*: 220 - patient age. The test is primarily aimed at reaching submaximum, and if there is no medical indisposition, the maximum value can be continued.
  - Recommended load and ergometer speed during the examination:
    1. degree of load: 0.5 W / kg: 45-50 rpm;
    2. degree of load: 1.0 W / kg: 50-55 rpm;
    3. degree of load: 1.5 W / kg: 60-65 rpm;
    4. degree of load: 2.0 W / kg: 65-70 rpm;
    5. degree of load: 2.5 W / kg:> 70 rpm.

Examination evaluation

The result of the test is always evaluated by an expert - an experienced cardiologist. If the test was positive, which means the patient developed chest pain due to excessive exercise during the examination or developed specific changes on the ECG curve, there is a high probability of the presence of ischemic heart disease. Your doctor may then recommend that you have another examination, such as echocardiography or heart angiography. It can also adjust the treatment and determine what burden is already unsuitable and dangerous for the heart and what activities one should avoid. The patient's age, sex, nature of pain, personal and family history are important factors in determining the correct diagnosis and treatment.

In a negative test, the patient has no problems at maximum load. The ECG curve corresponds to age and exercise.

Factors influencing the examination

It was found that ergometric examination has, for unknown reasons, a lower detectability of the disease by women than by men. Therefore, this test is performed more often in men. Test results may be further affected by several factors that relate to the patient's overall physical fitness. These include limited mobility of the lower limbs, the use of certain medications, smoking and other diseases.