

# Heart transplant

250px|náhled|vpravo|Christiaan Neethling Barnard - první člověk, který provedl transplantaci srdce

**Heart transplant**<sup>[1]</sup> is an established clinical method for the treatment of terminal stages of heart failure. Transplantation itself is a surgical method, however it is part of the entire treatment program of a multidisciplinary team. It is indicated only in a certain group of patients, which requires the availability of a donor graft, and has complications associated with the procedure.

In the Czech Republic, approximately 5 heart transplants / 1,000,000 people are performed annually. Legally, a potential donor is anyone who is allowed to be entered in the register for donors until death. However, if not registered, it is a common practice to follow the wishes of the deceased's family. They may choose whether to donate the dead relative's organs. On the waiting list for heart transplants in Czech republic, 52 % of patients are diagnosed with **dilated cardiomyopathy** and 40 % of patients are diagnosed with advanced **ischemic heart disease**. Heart transplantation in the Czech Republic is performed by two centers, IKEM in Prague and CKTCH in Brno.

The history of heart transplants dates back to the 60s of the 20th century. Norman Shumway in particular took part in the development of the surgical technique of heart transplantation and the first heart transplant in humans was performed by Christiaan Barnard .

## Types of transplantation

250px|vpravo|náhled|Transplantované srdce v hrudníku příjemce

It is possible to divide transplants according to location and origin of the graft:

- heterotopic allotransplantation - No longer used today;
- orthotopic allotransplantation - Most commonly used today;
- transplantation of heart and lung
- xenotransplantation - not used, previously there were experiments with chimpanzee hearts;
- cellular transplantation - Theoretical transplantation of cells that restore cardiomyocytes.

## Indication

Heart transplantation is performed in patients with heart failure ,who are unable to tolerate physical exercise,require circulatory support, Develop organ disorders (increase in serum creatinine, increase in bilirubin, increase in PAR), hyponatremia, hypochloremia and begin to undergo cachexia. Indication criteria include:

- NYHA III–IV unresponsive to treatment, supplemented with spiroergometry;(VO<sub>2</sub> max to 12 ml/kg/min);
- life prognosis is less than 1 year;
- there is no other treatment alternative than transplantation;
- age less than 60 years ;
- there is a history of good adherence to previous treatment and a good psychosocial environment (ie it cannot be performed in alcohol dependent patients, etc.).

## Bridging heart transplantation

Methods that allow the patient to prolong the life expectancy of the patient while waiting for a transplant. This includes:

- revascularization;
- anti-remodeling interventions - endoventricular patch (synthetic or biological) are mainly used for ventricular aneurysms as a complication of a heart attack, elimination of scar tissue from the circulation from the bloodstream will increase the ejection fraction;
- resynchronization - this is mainly biventricular pacing, which allows a more physiological transfer of the action potential than monoventricular pacing and thus increase the ejection fraction;
- mechanical circulatory support.

## Preoperative examination

The recipient must have a compatible blood group in the ABO system comparable height and weight(± 15 %) and a transplantable status as determined by the tests performed below. Recipient to be transplanted with a compatible heart graft also depends on their position in the waiting list.

## Basic examination

The patient must undergo a routine preoperative examination, which includes medical history, physical examination, ECG, heart + lung X-ray, ECHO, and basic biochemistry.

## Spiroergometry

Spiroergometrie Spirometry, and in particular spiroergometry, is performed to indicate the patient's prognosis if no transplant is performed. (Prognosis shorter than 1 year is one of the indication criteria.)  $VO_2 \text{ max} \leq 10 \text{ ml/kg/min}$ . indicates a poor prognosis, but even provides information on the evolution of this parameter over time.

## Catheterization of pulmonary artery

Iron

A left heart failure causes congestion in the pulmonary circulation and thus secondary pulmonary hypertension. If pulmonary hypertension is irreversible and the patient is transplanted with a healthy heart that is not adapted to this burden, it would dilate. It is therefore necessary to rule out irreversible pulmonary hypertension in advance, and therefore pulmonary catheterization is performed. Exact transpulmonary gradient (TPG) and PAR values vary by workplace, however  $TPG \geq 15$  or  $PAR \geq 3$  corresponds to an increased risk of pulmonary hypertension and  $TPG > 20$  or  $PAR > 4$  is a contraindication to transplantation. Prostaglandin E1 (alprostan) is used to differentiate between reversible and irreversible pulmonary hypertension .

## Donor graft

The deceased's donor graft is ideally taken from a man under 55 years of age or a woman under 60 years of age with a known history, ECG, echocardiography, catecholamine and CK-MB levels ( $< 0.5 \text{ mmol/l}$ ). Legislatively, a donor can be anyone who is not in the register of non-donor organs, however, according to the customs of workplaces, the consent of the deceased's family is required in the Czech Republic.

## Surgical technique

Today, the bicaval technique is mainly performed. At present, orthotropic transplantation is performed exclusively, where the patient's heart is removed from the chest and replaced by the donor's heart. The whole operation must be performed very quickly, because the donor's heart must not be left out of the body for more than 4-5 hours. The patient is under general anesthesia and is connected to the extracorporeal circulation, which provides a temporary replacement of the heart's pumping function and gas exchange in the lungs. The diseased heart is disconnected from the two main vessels. The new heart is then placed in and the main vessels are sutured to it. Although it may seem relatively simple, the operation is very demanding.

After the operation, the patient is placed in an intensive care unit (ICU), where he remains connected to a respirator (ventilator). If the postoperative condition proceeds without complications, the ventilator is gradually disconnected. The patient remains under intensive supervision until the date of the first heart tissue biopsy. He is then transferred to a normal ward, where he spends 3-4 weeks before being released home. During this time, possible signs of heart rejection are monitored, blood samples are taken regularly, frequent echocardiographic examinations are performed, and the patient learns to take medication properly and follow a certain regimen.

## Immunosuppressive drugs

A triple combination is used as standard. Possible immunosuppressants are:

- cyclosporin A;
- tacrolimus;
- azathioprine;
- rapamycin;
- mycophenolate mofetil (IMF);
- prednisone.

## Status after transplantation

The transplanted heart is denervated. This results in resting tachycardia, poor exercise tolerance (due to a healthy heart, not due to a failing heart), increased risk of sudden cardiac arrest (again due to a healthy heart), lack of ischemic pain (risk of silent myocardial infarction). **First definition of ecotoxicology (1969): René Truhaut: the study of the adverse effects of chemicals with the aim of protecting natural species and communities. Rachel Carson (1962): the memoir The Silent Spring** highlights the use of pesticides , especially DDT and other agrochemicals. The book led to the establishment of the US Environmental Protection Agency (EPA) in the USA. Introduction of methods describing the toxic effects of human-produced substances on the environment and the organisms contained therein. Systematic implementation of fish toxicity testing methods. In addition to direct toxic effects, the effects of bioconcentration and bioaccumulation are studied - increases in the concentration of foreign substances in the tissues of organisms as a result of exposure from the environment.

**2004 EC ratification: Persistent Organic Pollutants Protocol** to the 1979 Convention on Long-Range Transboundary Air Pollution The aim of the protocol is to limit, reduce or eliminate the discharge, emissions and losses of persistent organic pollutants that have significant adverse effects on human health or the environment due to long-range transboundary air transport.

**In 2006** , Regulation No. 166/2006 of the European Parliament and the EC Council was issued, establishing the **European Register of Releases and Transfers of Pollutants** . It represents a publicly accessible database of pollutant releases into the air, water and soil, information on wastewater, information on pollutant releases from dispersed sources.

**In 2003** , the **proposal for a new framework for legislation covering the safety of chemicals REACH (Registration, Evaluation and Authorization of Chemicals)** was accepted by the European Commission and approved by the European Parliament . Enterprises and firms that import more than 1 ton of a chemical compound per year will be forced to register this chemical in a central data bank. The aim is to improve the protection of the health of nature, including people, to increase the innovation capacity and the ability of the chemical industry to compete in the European Union. The new measures concern not only new chemical substances introduced to the market, but also substances that have been used for a long time. The program aims to ensure that by 2020 at the latest, only chemical substances with known properties and in a way that does not harm human health and the environment are used.

After transplantation, treatment with a combination of  $\beta$ -blockers and ACE inhibitors is indicated!

## Complications

Possible complications from the procedure :

- graft rejection , in particular
- coronary heart disease
- infection
- toxicity and side effects of immunosuppressive therapy
- malignancy

### Graft rejection

Graft rejection can be **peracute**, **early** and **late**. Peracute and late is always humoral, early can be both humoral and cellular. Graft rejection is monitored by regular **endomyocardial biopsy**.

### Coronary graft disease

Coronary artery endovascular sonography is used to monitor coronary graft disease. This is an inevitable complication, but its incidence can be partially reduced or at least delayed in several ways:

- selection of a heart graft with suitable properties (in case of lack of grafts more or less only theoretically);
- early treatment of graft cell rejection (very important);
- prevention of CMV infection (ganciclovir treatment, etc.).

## References

### Related pages

- Srdeční selhání
- Dilatační kardiomyopatie
- Ischemická choroba srdeční
- Pravostranná srdeční katetrizace

### External links

- IKEM Praha (<http://www2.ikem.cz/www>)
- CKTCH Brno (<http://www.cktch.cz/>)
- Transplantace srdce (anglická wikipedie) ([https://en.wikipedia.org/wiki/Heart\\_transplantation%7C](https://en.wikipedia.org/wiki/Heart_transplantation%7C))
- Christiaan Barnard ([https://cs.wikipedia.org/wiki/Christiaan\\_Barnard%7C](https://cs.wikipedia.org/wiki/Christiaan_Barnard%7C))

## References

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Kategorie:Chirurgie Kategorie:Kardiologie