

## DIAGNOSTIC AND TREATMENT METHODS

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## THE FIRST HUMAN HEART TRANSPLANT IN THE FAR EASTERN FEDERAL DISTRICT OF THE RUSSIAN FEDERATION

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**ABSTRACT**

The article describes a clinical case - the first experience of heart transplantation in a remote region of the Russian Federation with hard-to-reach settlements in extreme climatic and geographical conditions. The surgery was performed on July 6, 2018 in the city of Yakutsk, the Sakha Republic (Yakutia), the Far Eastern Federal District, the Russian Federation. Some data on the stages of the formation and development of heart transplantation abroad and in Russia are given. The preparatory stage for this surgery and the organization of the collection of the donor organ are described. Of the 95 patients with chronic heart failure with a decrease in the ejection fraction, 4 patients were selected for inclusion on a waiting list for heart transplantation. All patients were males with severe chronic heart failure with a functional grade III-IV according to NYHA classification. They had an expansion of the cavities and a decrease in the pumping function of the heart below 30%. Then clinical observation data are given. After a complete examination of the recipient, a clinical diagnosis was made: I42.0 Dilated cardiomyopathy. I48.1 Permanent atrial fibrillation, tachysystolic variant. I50.0 CHF 2B Stage, NYHA FC III. I34.0 Mitral valve failure grade 3. I36.1 Tricuspid valve failure grade 2. I27.2 Pulmonary hypertension grade 1. Details are given of the technique of donor heart removal surgery, explantation and heart transplantation. The features of the heart transplantation surgery in this clinical observation are indicated. The data of functional methods of research, the results of myocardial biopsy and coronary angiography of the transplanted heart in the postoperative period are presented. The patient was discharged on the 26th day after the operation, upon the examination after 4 months the state of health is satisfactory, there are no signs of heart failure or transplant rejection. Based on the results obtained, the possibility of implementation and the need to conduct such operations in remote regions of the Russian Federation are discussed.

**Keywords:** heart transplantation, first experience, Yakutia, Far Eastern Federal District.

**Introduction.** At present, heart transplantation is the main radical surgical method for treating terminal heart failure [4, 11]. According to the register of the International Society of Heart and Lung Transplantation (ISHLT), 4 to 5 thousand human heart transplantations are performed annually in the world [9]. The vast majority of these surgeries are carried out in Europe and North America (Fig. 1). In Russia in recent years, there has also been an increase in transplantation operations, including heart. The number of clinics where the HT is carried out has increased. So, in 2018, the first successful HT surgeries were conducted in the Altai Territory, the Southern Urals (Chelyabinsk), Rostov-on-Don and in Yakutsk. The number of completed HTs per year in the Russian Federation increased from 49 in 2009 to 220 in 2016 [2].

The first successful human heart transplantation was performed at the Groote Shuur Hospital (South Africa) in December 1967 by C. Barnard [8]. Despite the fact that the surgery was performed flawlessly, the patient lived for 18 days and died of bilateral pneumonia. The second heart transplantation (HT) was conducted in 1968 at Stanford University (USA) by the famous American heart surgeon N. Shumway - the author, who proposed the biatrial method of orthotopic heart transplantation (OHTT). The

first transplantation operations were accompanied by a high degree of rejection of donor organs, thereby worsening the survival rate of the recipients. As a result, until the discovery of cyclosporine-based immunosuppression in 1980, the number of these operations was small. Immunosuppression significantly improved the results of transplantations, the number of heart transplantations increased [10]. However, there remain quite a lot of problems in the field of heart transplantation. In Russia, the first heart transplantations were performed by A.A. Vishnevsky (1968), G.M. Soloviev (1974), V.I. Burakovsky (1983), V.I. Shumakov (1986).

Unfortunately, they were unsuccessful. In the national medical practice, the first successful heart transplantation was performed at the Federal Research Center of Transplantology and Artificial Organs and the Ministry of Health of the USSR by the Academician V.I. Shumakov in 1987 [7].

Transplantology in Yakutia began in 2001 with the transplantation of a kidney from a relative. After the first successful operations, the second stage in the development of transplantology in our republic was the transplantation of fragments of a related liver. As of July 2017, 82 kidney transplants and 7 liver frag-

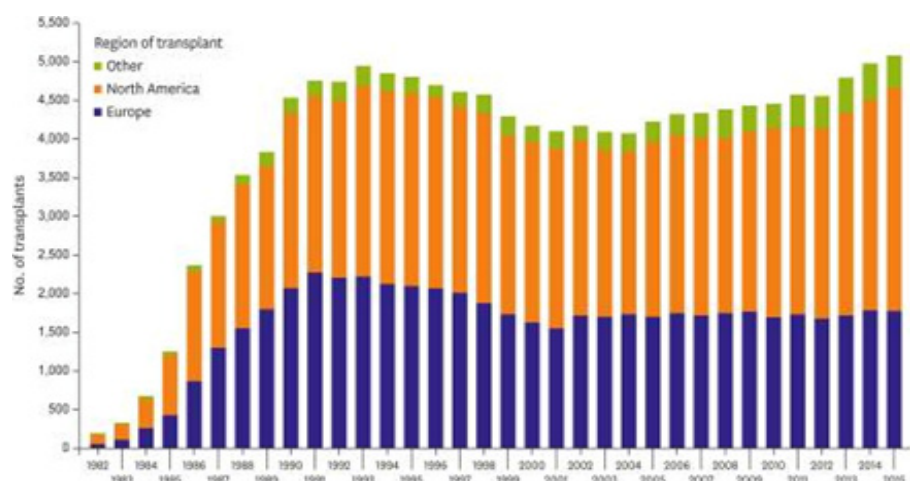


Fig. 1. Number of heart transplants by year and geographical region

ment transplants from a related donor were performed in the Republic of Sakha (Yakutia) [3].

Since 2016, a new stage in the development of transplantation in Yakutia has begun - this is the introduction of cadaver organ transplantation into clinical practice. Transplantations of the cadaveric kidney, fragments of the cadaveric liver, cadaver cornea were carried out [6]. All this was preceded by a great preparatory work.

The next task was the implementation of a heart transplantation. According to the chief transplantologist of the Russian Federation S.V. Gautier, the need for a heart transplant is met by only 22% [1]. The urgency of the HT problem in Republic of Sakha (Yakutia) is due to the high incidence of circulatory system diseases among population, including chronic heart failure, due to coronary heart disease, previous myocardial infarction, dilated cardiomyopathy. Also, an important role in the development and aggravation of cardiovascular diseases is played by the natural and socioeconomic extreme conditions of life in the North. The inhabitants of the north are more likely than southerners to be exposed not only to colds, but also to cardiovascular diseases (CVD) [5]. It is well known that in order to perform a successful HT, the recipient must reside in the area where the clinic performing the HT is located, since at any moment a cadaveric donor organ may be collected. Based on the above, the importance of the development of transplantology in regions with large multidisciplinary medical centers with the ability to perform organ transplantations is obvious.

The purpose of our message is the implementation of the first successful HT in the Far Eastern Federal District of the Russian Federation. The surgery was performed on July 6, 2018 with the participation of two leading clinics of the city of Yakutsk, the Republic of Sakha (Yakutia): Republican Hospital No. 1 - the National Center of Medicine and the Republican Hospital No. 2 - the Center for Emergency Medical Aid.

**Clinical observation.** Before the implementation of the HT in the Republican Hospital No. 1 - the National Center of Medicine, the first stage was a large organizational and methodological work, equipment was purchased, specialists were trained, a waiting list of the donor heart was formed. We selected 4 people from 95 patients suffering from chronic heart failure with a decrease in the pumping function of the heart of various degrees on the waiting list of the donor

heart. Among the selected patients, two suffered from coronary heart disease with the development of ischemic cardiomyopathy and two were with dilated cardiomyopathy. All of the patients were males with severe chronic heart failure with a functional grade III-IV according to NYHA classification. There was an expansion of the cavities and a decrease in the pumping function of the heart below 30%.

Patient A., 58 years old, was admitted to the RH#1 - NCM with complaints of shortness of breath at the slightest exertion, sometimes at rest, feeling of lack of air, general weakness, decreased tolerance to physical exertion, pressing pain in the region of the heart, dizziness.

From the anamnesis, it is known that for the first time an enlargement of the heart was detected on a planned fluorography in 2009, but the state of health was relatively satisfactory and the patient did not undergo further examination. Since 2014, the patient had been experiencing shortness of breath and periodic pressing pain in the heart with moderate physical exertion. A sharp deterioration of health and a decrease in tolerance to physical exertion had been noted since 2016. The patient was examined in the Republican Cardiology Clinic: dilatation of the heart chambers and atrial fibrillation were detected, and conservative treatment with dynamic observation was recommended. In 2017, he was hospitalized in the cardiac surgery department of RH#1 for further examination and deciding on HT necessity.

The examination of the patient showed negative dynamics. According to echocardiography (EchoCG), there was an increase in all chambers of the heart with a left ventricular end diastolic diameter of 7.1 cm (end diastolic volume 220 ml), end systolic diameter of 5.5 cm (end systolic volume 176 ml). There was also a significant decrease in myocardial contractility with diffuse left ventricular hypokinesis (ejection fraction using Teichholz formula — 22%, Simpson's formula — 20%), mitral valve insufficiency of grade 3, tricuspid valve insufficiency of grade 2. The calculated systolic pressure in the right ventricle was 29.1 mm Hg. According to coronary angiography and left ventriculography, moderate atherosclerotic lesions of the coronary arteries without hemodynamically significant narrowings, diffuse hypokinesis of the left ventricular myocardium were detected.

After a full examination, a clinical diagnosis was made: I42.0 Dilated cardiomyopathy. I48.1 Permanent atrial fibrillation, tachysystolic variant. I50.0 CHF 2B

Stage, NYHA grade III. I34.0 Mitral valve failure of 3 degree. I36.1 Tricuspid valve failure of 2 degree. I27.2 Pulmonary hypertension grade 1.

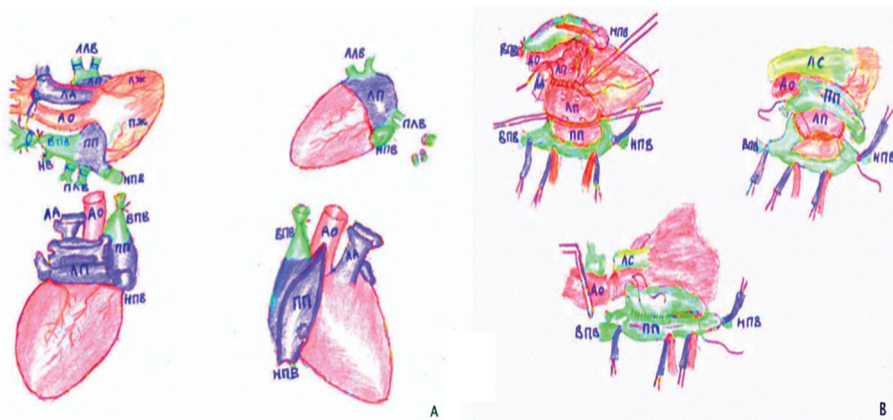
Taking into account the progression of heart failure and the ineffectiveness of conservative treatment, as well as on the basis of the results of laboratory and instrumental examinations, the patient was offered orthotopic heart transplantation (OTHT). Consent was obtained, the patient was included in the waiting list for OTHT.

On July 6, 2018, an orthotopic heart transplantation was performed.

In our republic, the clinic where a donor's brain death is determined, followed by removal of the cadaveric organs, is Republican Hospital No. 2 - the Emergency Medical Center, which provides emergency medical care throughout the Sakha Republic (Yakutia). When performing the collection of donor organs, coordinated joint work is carried out between the two republican hospitals. Removal of the donor heart was carried out simultaneously with other surgical teams using the method of multiorgan organ removal (heart, liver, kidney).

For the donor heart collection, the technique recommended by the Federal Research Center for Transplantology and Artificial Organs named after Academician V.I. Shumakov (Fig. 2A) was used.

After pericardiotomy, a visual and palpatory assessment of the donor heart was performed. Then the aorta and the pulmonary artery were mobilized. In the next stage the superior vena cava (SVC) was dissected free from the surrounding tissue high before the bifurcation with the nameless vein and harnessed by dacron, then the inferior vena cava (IVC) was dissected from the surrounding tissue. Incisions were made on the pericardium next to the IVC, for subsequent convenient clamping with a clamp. After systemic heparinization (5000 U), the ascending aorta was cannulated at a high level. The SVC was tied up with dacron, a clamp was fixed on the IVC at the level of the diaphragm with its intersection at  $\frac{1}{2}$ . The inferior pulmonary vein was cut for decompression of the left sections. Then the ascending aorta was clamped and antegrade cardioplegia was began with a cooled solution of custodiol (3 liters) with simultaneous external cooling of the heart with crumbled ice. The pericardium was widely opened to better evacuate the preservative solution into the pleural cavity. Removal of the heart was completed by cutting off the IVC, all pulmonary veins, aorta, pulmonary arter-



**Fig. 2.** A - scheme of donor heart removal, B - scheme of donor heart implantation. Abbreviations: Ao - aorta, ЛА - pulmonary artery, ЛП - left atrium, ПП - right atrium, ЛЖ - left ventricle, ПЖ - right ventricle, ВПВ - superior vena cava, НПВ - inferior vena cava, ЛЛВ - left pulmonary veins, ПЛВ - right pulmonary veins.

ies and SVC. After the final assessment, the removed heart was placed in a three-layer sterile package: the 1st layer with Custodiol, the 2nd with ice water, the 3rd with ice and transported in a special thermal container to RH#1.

After completion of the donor heart collection stage, the surgery was started on the recipient. The operation was performed under artificial blood circulation (IC) and hypothermia up to 28 ° C. The heart of the recipient was explanted, leaving venae cavae with atrial areas and forming a site with the mouths of the pulmonary veins, the ascending aorta and the pulmonary artery (Fig. 3). The OHTT operation was performed using the biaxial technique. Stitching the donor heart to the recipient was started from the left atrium. Due to the flaccidity of the walls of the atrium of the recipient, the anastomosis of the posterior wall between the left atria was performed with a double-row suture (Fig. 2B). In our opinion, such a suture should be applied immediately in order to prevent bleeding, since subsequently it will be technically difficult to carry out hemostasis in this hard-to-reach area. After the anastomosis between the atria anastomoses of the pulmonary artery and then the aorta were formed. The duration of the clamping of the aorta was 2 hours and 8 minutes, the time of artificial blood circulation was 3 hours and 28 minutes, the total surgery time was 5 hours and 15 minutes. Ischemia time of the donor heart was 2 hours and 48 minutes.

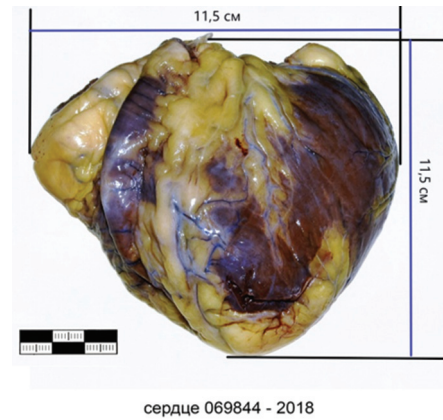
Trachea extubation was performed on the first day 8 hours after the OHTT. Cardiotoxic support was carried out with moderate doses of adrenaline and dopamine. In the early postoperative period, signs of renal failure were observed

with an increase in creatinine up to 330 mmol/l, which was resolved with conservative therapy and a reduction in the dose of tacrolimus.

Immunosuppressive therapy was carried out in a three-component scheme, including a calcineurin inhibitor (tacrolimus), mycophenolate (sodium mycophenolate) and a corticosteroid (metipred). To identify early signs of rejection and graft dysfunction, echoCG and measuring of myocardial necrosis markers were performed daily. An endomyocardial biopsy was also performed on the 5th and 11th day after the operation, also before the patient's discharge on the 26th day, which confirmed the absence of cellular and humoral rejection. Coronary angiography was performed on the 26th day after the HT, which did not reveal hemodynamically significant stenosis (Fig. 4).

The patient was discharged in a satisfactory condition on the 28th day for further postoperative rehabilitation, outpatient treatment and dynamic observation.

Four months after the OHTT at the

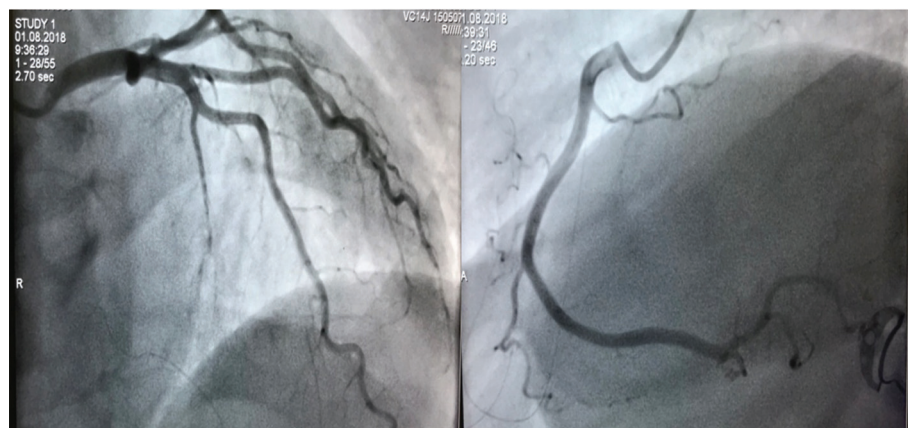


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**Fig. 3.** The heart of the recipient A. 58 years old, without atria. Mass without atria was 385 grams (normal heart mass is 250-280 gr.). Dimensions 11.5x11.5x5.5 cm

control examination, the patient feels satisfactory, does not show any special complaints, notes a significant increase in exercise tolerance. According to EchoCG, the systolic function of the left ventricle is preserved (EF = 69%), the left-ventricular diastolic diameter is 4.4 cm. An endomyocardial biopsy was performed, confirming the absence of signs of rejection. Considering the early postoperative period, immunosuppressive therapy was continued according to a three-component scheme: Tacrolimus, Myfortik, Metypred.

**Discussion.** The first successful heart transplantation in the Far Eastern Federal District showed the possibility of performing this operation in remote regions of the Russian Federation. In this clinical case, the achievement of a positive result was due to the existence of large multidisciplinary medical centers with appropriate material and technical equipment, qualified personnel and highly professional solution of organizational issues on the transplantation of cadaveric organs. Thus, taking into account the socio-



**Fig. 4.** Patient A., 58 years old. Coronary angiography on the 26th day after heart transplantation. Left and right coronary arteries pool.



economic, climatic and geographical features of the Republic of Sakha (Yakutia), the development of transplantology in the largest region of the Russian Federation is a necessary measure to improve the quality of high-tech medical care in cardiovascular surgery.

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## TECHNICAL FEATURES OF THE KIDNEY LAPAROSCOPIC RESECTION WITH SUPER-SELECTIVE BALLOON EMBOLIZATION OF THE RENAL ARTERY

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### ABSTRACT

The article is devoted to the study of the results in the surgical treatment of patients with renal neoplasms using a new method of kidney resection, which has its own technical features.

Their essence lies in the temporary superselective embolization of the renal artery, which allows turning off the affected part of the kidney from the circulation. Embolization allows minimizing the blood loss that occurs as well as preserving blood flow in the unaffected areas of the kidney, thereby protecting the remaining part of the kidney from ischemia. As a result, the postoperative period proceeds with a more rapid recovery of kidney function.

**Objective:** to improve the results of renal neoplasms surgery.

**Materials and methods.** Laparoscopic resection of the kidney with superselective balloon embolization from October 2015 to October 2017 was performed in 14 patients. The average age of the operated was 54.5 (from 29 to 72) years, among them 3 men and 11 women.

**Conclusion.** The proposed method of superselective balloon embolization of the renal artery intraorganic branches has its peculiarities which make it possible to perform a complete intraoperative hemostasis of the renal parenchyma segment in which the tumor-like formation is located. At the same time, the functional state of the rest of the kidney does not decrease, transluminal temporary embolization of the segmental or lobar artery of the kidney reliably blocks the blood flow, preventing massive uncontrolled bleeding. Maintaining blood flow to the intact parenchyma is an important factor in preventing acute kidney damage during organ-sparing operations. No need for skeletonization of the kidney arteries for their temporary clipping allows laparoscopic resection of the kidney to mid-level urological endosurgeon physicians without the help of highly skilled experts, which implies massive use of this technique in multidisciplinary clinics.

**Keywords:** selective renal artery embolization, kidney resection, kidney neoplasms, minimally invasive kidney surgery.

**Introduction.** Over the past decade, an increase in the number of patients with kidney cancer has been recorded worldwide. This is undoubtedly due to the wide spread of various methods of early diagnosis, which, in turn, leads to the fact that in 60-70% of patients a localized form of the disease is revealed [1, 5, 8, 10, 15, 23]. In 2014, Schiffmann et al showed that open radical nephrectomy was still the method of choice for stage T1 kidney

cancer [19]. However, the initial stages of T1-T2 are increasingly becoming indications for resection of the kidney [6, 8, 9, 12, 17, 18]. Kidney resection is comparable to a total nephrectomy for oncologic outcomes [13]; overall survival of patients [21] is higher and long-term renal and cardiovascular function [11, 22] is better. Thus, according to the principles of the European Association of Urology [7], nephron-sparing surgery is shown for

kidney cancer stage T1 [4, 14, 19].

Kidney resection for tumors with a size of less than 4 cm with the improvement of laparoscopic technology is increasingly performed by laparoscopic access [8].

Resection of a malignant tumor of the kidney is only possible while observing the principles of ablatics, for which an adequate hemostasis in the surgical wound is necessary for visual control of the surgical edge. Bleeding can be avoid-