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LIVING-RELATED KIDNEY TRANSPLANTATION: FIRST EXPERIENCE AT ST. LUKE'S CLINICAL HOSPITAL

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Kidney transplantation (KT) is regarded as the most effective therapeutic approach for people with end-stage renal disease. However, for a number of reasons – constant increase in the incidence of diseases contributing to formation and development of chronic kidney disease, as well as continuing shortage of donor organs – 78–95% of patients in need of a kidney transplant do not receive the necessary treatment, and the waiting list stretches for several years. This paper presents the first outcomes of KT for chronic glomerulonephritis performed at St. Luke's Clinical Hospital in St. Petersburg, in collaboration with the staff of Shumakov National Medical Research Center of Transplantology and Artificial Organs.

Keywords: living-related kidney transplant, chronic glomerulonephritis.

INTRODUCTION

Today, kidney transplantation (KT) is the most effective renal replacement therapy (RRT) modality for end-stage chronic kidney disease (CKD) [1, 2]. Unlike other RRT methods (hemodialysis and peritoneal dialysis, hemodiafiltration), providing only removal of low-molecular-mass toxins and metabolites, as well as excess water, the transplanted kidney performs all the functions of the affected organ – urinary, detoxification, metabolic, biosynthesis of hormones and neurotransmitters, other bioactive substances, etc.

Over the past 2021, 1384 kidney transplants were performed in our country; the number of deceased and living (related) donors was 1183 and 201, respectively. At the same time, 6313 potential recipients were included in the 2021 waiting list. Consequently, in 2021, only 21.9% of patients who needed transplantation from the 2021 waiting list received a kidney transplant [3, 4].

According to the Registry of the Russian Transplant Society, the absolute number of annual KTs increased 2.5-fold from 2006 to 2021 [3, 4]. During the same observation period and to approximately the same degree, the absolute number of persons on the waiting list also increased, while the average waiting time for KT practically did not change. As a result, over the past 15 years, the annual need for KT has remained unmet in approximately 78–95% of patients with end-stage CKD [4]. The reasons for the discrepancy between the demand and possibilities of transplantation care include, firstly, a constant increase in the incidence of type 2 diabetes mellitus, bronchial asthma, hypertension, coronary heart disease, chronic heart failure and other conditions contributing to the formation and development of CKD; secondly, persistent shortage of donor kidneys [1, 3, 4].

In 2019, our country approved and adopted the departmental target program "Organ donation and transplantation in the Russian Federation"; it was aimed at increasing the availability of medical care through human organ transplantation. Implementation of the program began on December 29, 2021, at St. Luke's Clinical Hospital in St. Petersburg. In May 2022, the first kidney allotransplantation from a related donor was successfully performed. The article presents the first results of the approved program.

The paper presents the first outcomes of related kidney transplantation in chronic glomerulonephritis performed at St. Luke's Clinical Hospital, St. Petersburg, jointly with the staff of Shumakov National Medical Research Center of Transplantology and Artificial Organs.

CASE DESCRIPTION

A 34-year-old man complained of recurrent high blood pressure (BP) up to 140–150/80–90 mmHg (against the background of continuous use of nifedipine (10 mg in the morning) and bisoprolol (25 mg in the evening), he had usual blood pressure of 120–130/80 mmHg), tendency

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to a fall in body weight from 54 to 49 kg over 2–3 years. When collecting the medical history, the man completely denied the existence of nephrological diseases in his relatives. With regard to himself, he noted that in childhood he underwent cystoscopy prescribed for chronic pyelonephritis or cystitis, that he suffered from angina at the age of 27, which, according to the patient, was complicated by acute glomerulonephritis (he remembers that there was pain in his lumbar region, was treated by a therapist, was consulted by a nephrologist, the issue of kidney biopsy was discussed, which was not performed because the patient unilaterally stopped visiting medical specialists). Five years after that, skin itching suddenly appeared. On this occasion, he was examined by a therapist, a gastroenterologist, and a dermatologist. Atopic dermatitis was diagnosed, treatment was prescribed with positive effect. He remembers that the doctors talked about "elevated creatinine level" (the patient later found his old tests, creatinine levels from 2019 was 193 μmol/l). One and a half years later, he had episodes of symptomatic arterial hypertension and associated headaches; he was examined by a nephrologist, who diagnosed chronic glomerulonephritis and stage 4–5 CKD. The doctor prescribed medication therapy (nifedipine 10 mg in the morning, bisoprolol 2.5 mg in the evening, polysorb 1 tbsp. per day, milurit 100 mg (1 tablet, due to the identified hyperuricemia) every other day, aquadetrim 2 drops per day). Other medical history details: at the age of 8, he had surgery for unilateral cryptorchidism; at the age of 32, chronic hepatitis B with minimally pronounced biochemical and histological activity was detected accidentally during examination. Objectively: general state was satisfactory, skin was dark-colored, dry, mild hyperpigmentation in the nipple area, funnel-shaped chest deformity, pronounced thoracic kyphosis. Breathing in the lungs was vesicular, no wheezing was heard, respiratory rate was 15 per minute. Heart sounds were clear, rhythm was correct, heart rate (HR) and BP were 68 bpm and 140/95 mmHg, respectively. The tongue was moist and clean, the abdomen was soft, painless on palpation, and the liver edge was not palpable. Bowel and bladder functions were not violated.

Preoperative examination included assessment of the cardiovascular system (ECG, daily ECG and BP monitoring, echocardiography and Doppler echocardiography, duplex scanning: a) head and neck vessels, b) arteries and veins of the lower extremity, consultations with a cardiologist and a cardiovascular surgeon), respiratory system (lung radiography, spirography, spirography with a bronchodilator test), gastrointestinal tract (esophagogastroduodenoscopy), urinary system (multispiral CT scan of kidneys and urinary tract, consultation with nephrologist), endocrine glands (determination of serum levels of glucose, ionized and total calcium, phosphorus, parathyroid and thyroid hormones, examination by an endocrinologist), the nervous system (examination by a neurologist and a psychiatrist), ENT organs and organs of vision, as well as a comprehensive ultrasound of the liver, gallbladder, pancreas, spleen, kidneys, and laboratory blood and urine tests (cellular and biochemical compositions, blood coagulation and anticoagulant activity, determination of HBsAg antigen (HBsAg) to hepatitis B virus in blood, bacteriological analysis of urine for aerobic and facultative anaerobic microorganisms), identification of recipient antibodies to the donor's major histocompatibility complex.

Preoperative examination results indicated hypochromic anemia due to a decrease in circulating red blood cell count to 3.77×10^{12}/l and a hemoglobin levels of up to 106 g/l, microhematuria and proteinuria (0.5 g/l) in the urine, hyperazotemia due to increase in serum uric acid, urea and creatinine levels to 425.6 μmol/l, 36.2 mmol/l and 493.6 μmol/l, respectively, decrease in glomerular filtration rate (GFR) to 10.76 ml/min/1.73 m^2, increase in serum α-amylase activity to 128.0 U/l, ultrasound signs of parenchymal cysts and nephrosclerosis of the right and left kidneys, CT scan signs of diffuse thinning of the parenchyma of both kidneys, in addition: 1) electrocardiographic – sinus bradycardia and local intraventricular conduction disorders; 2) adhesive left-sided otitis media without exacerbation; 3) hyperglycemia up to 5.85 mmol/l; 4) mild myopia, hypertensive retinal angiosclerosis.

Based on the data obtained during diagnostic activities, the council of specialists made the following diagnosis: main diagnosis – chronic glomerulonephritis; complications of the main diagnosis: stage 5 CKD (GFR 10.76 ml/min/1.73 m^2), hyperphosphatemia, hyperuricemia, chronic nephritic syndrome without exacerbation, stage 1 secondary hypertension, mild anemia; concomitant diagnosis: mild myopia, hypertensive retinal angiosclerosis, chronic hepatitis B infection without activity, pre-dialysis patient. The council of specialists decided that RRT was necessary.

When choosing the RRT technique, we took into account the desire of the patient's blood relative (mother) to become a kidney donor for the patient. Also considered were the results of examination of this potential related donor, which, firstly, showed no contraindications for donor nephrectomy; secondly, multispiral CT scans showed signs of right renal artery tripling with a branching to the upper segment parenchyma of the proximal accessory vessel into the renal hilum – main and distal accessory vessels with a late proximal division.

Single-port left laparoscopic nephrectomy (LESS, laparoendoscopic single-site surgery) in the donor was performed in the right-side position under endotracheal general anesthesia (Fig. 1).

Laparoscopic port access was performed 2 cm above the umbilicus. After CO_2 insufflation, a single-port (Nelis, Kyung-gi, Korea) was installed. Next, the descending colon was mobilized, then using the ThunderBeat

Fig. 1. Single-port left laparoscopic nephrectomy in the donor

instrument (Olympus, Japan), the kidney was isolated from fatty tissue from all sides. The renal artery and vein below the level of the aorta were treated selectively. Two Hem-o-Lok clips (Teleflex, Mexico) were placed on the renal artery, then the vessel was cut off using scissors. As low as possible to the junction of the inferior vena cava and renal vein, the renal vein was similarly crossed. The ureter was isolated to the lower third, crossed with a Hem-o-Lok clip. After desufflation and incision (8 cm) in the continuation of trocar access, the abdominal cavity was opened in layers, the kidney and part of the upper third of the ureter were removed in one block. The intervention was completed with hemostasis control (dry), layer-by-layer suturing and iodine treatment of the wound, application of aseptic dressing. The kidney was placed in cold preservation with Custodiol solution (solution volume was 1 liter, Dr. Franz Kjoller Chemie GmbH, Germany); static cold preservation lasted for 35 minutes (Fig. 2).

Allotransplantation of donor (related) kidney to the recipient on the right (left kidney) and stenting of the left ureter was performed under endotracheal anesthesia with muscle relaxants; the operation started with bladder drainage with a Foley urethral catheter No. 16, then bladder was filled with 0.9% sodium chloride solution in 100 ml volume. After treating the surgical field with an oblique typical incision in the right iliac region, the retroperitoneal space was accessed in layers, the lower epigastric vessels were isolated, ligated and crossed, and the spermatic cord was taken aside. Then the external iliac artery (EIA) and external iliac vein (EIV) were isolated and mobilized. The kidney graft, which had one artery up to 4 cm in length, one vein and one ureter, was placed in the wound, clamps were placed on the EIV and venotomy of up to 2.5 cm was performed. Vascular anastomoses were made between: 1) the graft vein and the EIV by end-to-side continuous sutures with Prolene 5/0 suture (Johnson & Johnson, USA); 2) between the graft artery and the EIA by end-to-side continuous sutures with Prolene 6/0 suture. At the start of blood flow (180 minutes from the beginning of intervention), the kidney turned pink, acquired satisfactory turgor; inflow of urine in infrequent drops was noted, Lich-Gregoir ureteroneocystostomy anastomosis using PDS 5/0 suture (Johnson & Johnson, USA), with ureteral stenting with 12 cm, 7 Fr internal ureteral stent was placed. The operation was completed by controlling hemostasis (dryly), washing the wound with a 1% solution of povidone-iodine, establishing a closed drainage into the retroperitoneal space through a counter-opening in the upper corner of the wound, layer-by-layer suturing of the wound, and applying an aseptic dressing. Separately, we note the following: the graft was transplanted into the right iliac region retroperitoneally. From the moment the incision was made in the right iliac region, basiliximab (20 mg) and prednisolone (500 mg) were injected intravenously in order to prevent acute graft rejection, followed by the use of a standard triple-combination immunosuppressive therapy regimen, including tacrolimus, mycophenolate mofetil, and methylprednisolone. Transplant functioning was accompanied by normalization of nitrogenous metabolism on postoperative day 2 (decrease of serum urea levels from 36 mmol/l to 5.6 mmol/l and creatinine from 493.6 μmol/l to 104.5 μmol/l); and by change of

Fig. 2. Graft preparation: explanted graft is placed in ice chips after custodiol perfusion

daily diuresis from 6000 ml by urethral catheter within 48 hours after the intervention to 1540 ml on postoperative day 3. Postoperative immunosuppressive therapy was provided on days 0 and 4 by administration of basiliximab (20 mg), tacrolimus (2 mg, 2 times a day with subsequent correction depending on tacrolimus serum levels), mycophenolate mofetil (1000 mg, 2 times a day), methylprednisolone (16 mg, in the morning). The patient was discharged on day 12 after surgery in a satisfactory condition.

There were no surgical complications in the donor after the intervention. The right kidney function was fully restored on day 1 of the postoperative period.

CONCLUSION

The presented clinical case demonstrates a successful solution to problems associated with expansion of high-tech care for St. Petersburg residents.

The introduction of a new type of high-tech care for patients at St. Luke's Clinical Hospital will increase the volume of transplant care for the residents of St. Petersburg and Leningrad Oblast in general.

The authors declare no conflict of interest.

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