CASE REPORT

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Transplantation of infant kidneys – The surgical technique *en bloc* and transplant position variation: A case report

Transplantacija dečjih bubrega – hirurška tehnika *en bloc* i varijacija pozicije transplantata

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Abstract

Introduction. Due to the ever-present lack of kidney transplant grafts, more and more organs obtained from the so-called "marginal donors" group are accepted, which can provide suboptimal effect of transplantation, depending on their characteristics and/or implantation techniques. **Case report.** We presented a case with successful variation of kidney position with modified approach of kidney transplantation from an infant to an adult female patient with normal postoperative recovery. Urethral anastomosis was performed without antireflux procedure and this has not led to the development of reflux disease at an early stage. **Conclusion.** The position of a pair of kidneys proved to be satisfactory despite the growth of the kidney to the expected size and relatively small pelvis. There were no problems with venous stasis and kidney function from the very beginning was good.

Key words:
kidney transplantation; child; adult; surgical procedures, operative; postoperative period.

Apstrakt

Uvod. Zbog uvek prisutnog nedostatka graftova za transplantaciju bubrega, sve se više prihvataju organi iz grupe takozvanih „marginalnih donora". Ovo je grupa koja može da obezbedi optimalni efekat transplantacije, u zavisnosti od karakteristike organa i/ili tehnike implantacije. **Prikaz slučaja**. Pokazali smo uspešnu varijaciju pozicije para bubrega i modifikovanog pristupa transplantacije bubrega od deteta odrasloj ženskoj osobi. Ureteralna anastomoza rađena je bez antirefluksne procedure i to nije dovelo do razvoja refluksne bolesti u ranoj fazi. Postoperativni tok protekao je uredno. **Zaključak.** Položaj para bubrega pokazao se kao zadovoljavajući i pored rasta bubrega do očekivanih razmera i relativno male karlice. Nije bilo nikakvih problema sa venskom stazom i funkcijom bubrega.

Ključne reči:
transplantacija bubrega; deca; odrasle osobe; hirurgija, operativne procedure; postoperativni period.

Introduction

Growing disproportion between the number of patients waiting for kidney transplantation and adequate donors leads to expanding indications of cadaveric transplantation to so-called marginal donors [1], which have a certain degree of nephron deficit related to age and concomitant diseases, such as diabetes, hypertension etc. [2]. Besides the mentioned, this group comprises of very old or very young donors. Apart from problems with immunology and increased risk of early organ rejection, there are certain technical problems related to the choice and type of vascular and ureteral anastomosis and graft position in this group of patients [3].

As infant kidneys are small, it is common to use a pair of infant kidneys for transplantation to one patient of adequate body mass. Developmental discrepancy of such transplantation poses several problems, such as problem of venous run off from transplant and creation of urinary anastomosis complicated by strong urinary detrusor and weak ureters of donor [4].

We presented cadaveric transplantation of infant kidneys into a female adult, accompanied by the description of the surgical technique.

Case report

After confirmation of cerebral death due to malignant cerebral edema and hepatic insufficiency as a complication of

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primary disease – tyrosinemia, and in accordance to parents' decision on organ donation, the organ donor, male aged 2 years and 7 months, was indicated for kidney explantation. Explantation was performed at the Institute for Mother and Child Health Care of Serbia, Belgrade, using standard technique, based on the principles of multiorgan explantation. Both kidneys *en bloc* with aorta and vena cava were explanted. Irrigation with 1,000 mL Eurocollins® solution was performed *in situ* through venous confluent, with clamp of proximal and oversewing of distal parts of aorta and vena cava, practically without primary warm ischemia, and with cold storage during about 10 h.

Intraoperatively, dimensions of left and right kidney were approximately 6 × 4 × 1.3 cm, diameter of renal arteries was about 4 mm, while aorta and vena cava were about 10 mm.

After adequate recipient had not been found at the mentioned Institute, organs were offered to the Clinic for Nephrology and Clinical Immunology, Clinical Center of Vojvodina, Novi Sad, where the most convenient recipient was found on the waiting list (AB, Rh+, HLA compatibility 2/6, "cross-match" negative).

It was a female patient, age 29 (weight 47 kg, height 151 cm) in terminal stage of renal insufficiency, without diuresis. The disease was basically caused by bilateral vesicoureteral reflux with consecutive development of reflux nephropathy. It was diagnosed five years ago, since the patient underwent the hemodialysis program at the Institute for Internal Diseases, Clinic for Nephrology and Immunology, Clinical Center of Vojvodina. Dialysis was performed *via* distal arteriovenous (AV) fistula on the left arm. The patient also suffered from hypertension, chronic gastritis, and she underwent subtotal parathyroidectomy due to secondary hyperparathyroidism. Despite the dialysis (three times a week), preoperative laboratory work up indicated azotemia (urea 14.6 mmol/L, creatinine 406 mmol/L). Abdominal ultrasound verified bilateral renal atrophy, while findings on other abdominal organs were normal. The patient had been enrolled in the program for cadaveric kidney transplantation since 2003.

En bloc implantation of a pair of infant kidneys was performed at the Clinic for Vascular and Transplantation Surgery, Clinical Center of Vojvodina, Novi Sad. The kidneys were heterotopically positioned: the left kidney was placed in the right iliac fossa, while the right one in the pelvis, right below aortic bifurcation, medial to iliac vessels, "straddling" them. Arterial and venous anastomosis were created at the level of proximal segments of transplant aorta and vena cava with corresponding arterial and venous iliac blood vessels of recipient as lateroterminal (L-T) type, by single/anterior wall/ and extended /posterior wall/ sutures (Figure 1). The distal parts of the aorta and the vena cava were oversewn immediately below renal arteries and veins. After *in situ* fusion of the ureter by single sutures, we tried to create ureterocystoneostomy (UCN) on the posterior vesical wall, but we aborted it due to the occurrence of stasis within pyelocaliceal system. Implantation of fusioned ureters in the upper wall of the urinary bladder was performed by suture through all the layers of vesical and ureteral walls, without antireflux and with protection by a JJ stent for each ureter. The uniform kidney perfusion was detected, together with diuresis, which was 150 mL from after 30 minutes until the end of the operation (Figure 2).

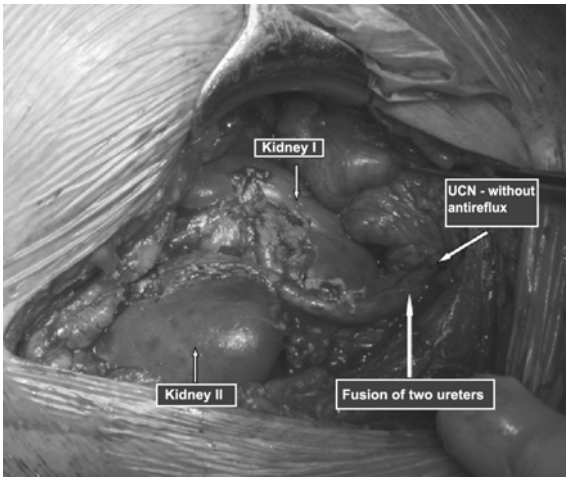

Fig. 1 – Arteriar and venous anastomoses of transplant aorta and *v. cava* with corresponding arterial and venous illiac blood vessels of the recipient (latero-terminal type).

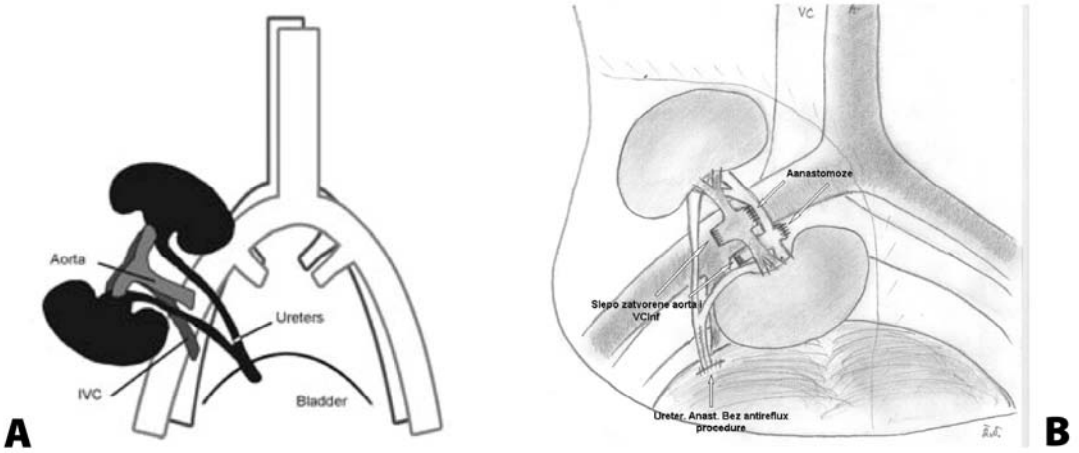

Fig. 2 – a) Placement of both kidneys in the reight iliac blood vessels and distal parts of the transplant aorta and *v. cava*; b) Implantation of fusioned ureters in the upper wall of urinary bladder with a JJ stent for each ureter.

The patient's postoperative recovery was normal. Daily diuresis during hospitalization was about 1,000 mL, and drop of blood urea nitrogen (BUN) and creatinine levels (BUN: 30 → 7 mmol/L, creatinine: 600 → 98 mmol/L) was detected. Control ultrasound and Doppler examinations revealed enlargement of both kidneys, whose new dimensions measured about 8 × 4 × 1.5 cm (both left and right), normal flow through arterial and venous anastomosis, without stasis in pyelocaliceal system, without significant fluid collections in retroperitoneum and drainage secretion. The kidney positions remained unchanged. Immunosuppressive therapy in accordance to the protocol (antithymocyte globulin – ATG, methylprednisolone 750 mg, mycophenolate mofetil) was administered. The patient was discharged from hospital to further home care on the day 9 of hospitalization.

Discussion

The presented successful transplantation of a pair of infant kidneys *en bloc* into the adult recipient is very rare in our region. The largest world transplantation centers perform such surgery several times per year, which is still not much compared to hundreds, even thousands of kidney transplantations performed at the same centers every year (less than 5%) [5]. This is quite reasonable as transplantation from marginal donor has much higher risks of complications, while expanding donorship expanded renal criteria (ECD) is caused by the lack of available organs [6].

When a transplantation team is faced with such a task, there is always a dilemma whether to separate the infant kidneys and give chance to two patients, or by transplanting a pair of kidneys *en bloc* and increase chances to a single one – the most appropriate patient. The common technique is a pair of kidneys placement into the iliac fossa on one side, thus creating anastomosis with distal parts of the aorta and the vena cava. According to the experience of other centers, 1- and 5-year graft survival in case of *en bloc* transplantation of two kidneys is retrospectively up to 90% and 70%, and is statistically higher compared to transplantation of a single infant kidney [7, 8].

Certain authors suggest scoring systems based on which the decisions would be made whether the kidneys of marginal donor should be transplanted separately, in pair or discarded [9]. Important criterion is recepient's body mass compared to kidney mass, and values of donor's diuresis, creatinine clearance and the number of functional nephrons determined by renal biopsy [10, 11]. Since a recipient is a person of lower body mass, more often female, it is considered that disproportion leads to hyperfiltration damage as a significant risk factor for early and late rejection reaction [12]. Other considered factors are diseases that preceded the death of donor, vital parameters at the moment and after confirmation of brain death, specificity of explantation procedure, duration of ischemia, anatomical variants of kidneys, ureters and vascular elements, anatomical characteristics of donor, earlier diseases and operations [13, 14].

In the presented case, we took into consideration metabolic disorder – hepatic insufficiency and threatening hepatorenal syndrome which preceded lethal outcome of cadaver, which could decrease the biological value of the kidneys. Also, it is well known that, due to a high incongruence and difference in compliance of infant cadaver and adult recipient vascular elements, in case of creating vascular anastomosis at the level of renal arteries graft faster neointimal hyperplasia at the level of anastomosis occurs, with consecutive development of renovascular hypertension and renal atrophy. This complication can be minimized if anastomosis is created at the level of largest blood vessels, i.e. cadaveric aorta and vena cava.

A valuable experience of surgical technique was obtained. The presented position variant according to our opinion yielded excellent results. According to the literature, the following procedures are most often performed: placement of both kidneys in the right iliac fossa thus creating anastomosis between recipient's iliac blood vessels and distal parts of transplant's aorta and vena cava interposition of transplant's aorta and vena cava on recipient's iliac blood vessels with two arterial and two venous anastomoses, where kidneys are positioned on both sides of right iliac blood vessels.

We recon that the advantages of the presented position are better venous drainage (due to the direction of blood flow in vena cava, decreased venous pressure and improved inflow of transplant's venous blood), better arrangement of vascular elements and ureters, without crossing and knee forming, and shortened time of secondary warm ischemia, as only one venous and one arterial anastomosis needed to be created.

While creating UCN the urinal retention and stasis in caliceal system of both kidneys were detected, assumably caused by disproportion between gracile muscles of infant ureters and thick and strong recipient's detrusor muscle. In this case, implantation of ureter into the upper vesical wall without antireflux is a better solution and recommendation for future similar transplantations, especially because vesicoureteral reflux was the main cause of renal insufficiency in patient (uretero-ureteral anastomosis was abandoned). The alternative is taking vesical fundus section. Carell's patch, with both ureters, and making anastomosis between the donor's part of vesical wall and the recipient's urinary bladder.

In the literature, complications of vascular stalk (perioperative venous and arterial anastomosis) and ureterocystic anastomosis (leak) can be observed in 15% and 25% cases, retrospectively [15, 16]. None of these complications was observed in our patient. Moreover, the postoperative period and one-month follow-up showed that kidney mass was sufficient to compensate azotemia in the presented patient, as well as the tendency of slight enlargement of kidneys even in the early postoperative phase.

Conclusion

En bloc transplantation of a pair of infant kidneys into the adult recipient can give good clinical results with few complications. This extends indications to certain number of marginal donors. The presented variation of renal position and creation of anastomosis (both vascular and urological) is a good solution, which can be used in similar future transplantations. Good results in the first 30 days in the presented patient are encouraging, but a longer follow-up will show the final effect.

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