

## Clinical Research

# Multiple Renal Arteries in Patients with Kidney Transplantation: Initial Experiences of The New Kidney Transplant Center

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### ABSTRACT

**Objective:** Multiple renal artery grafts of kidney transplant patients developing complications and results for long-term kidney function were evaluated.

**Material and Method:** From 2010 to 2014, 115 kidney transplant patients were evaluated retrospectively. A sum of, 115 donor nephrectomies were performed in our institution. Kidney were transplanted with a single artery to 99 patients and sixteen (approximate 14%) with more than one. For five of these 16 patients, the organs were transplanted from a cadaver and eleven were transplanted from living donors.

**Results:** Mean age was 38,5 years (range 9–58 years), mean follow up time was 22,5 month (min. 3,5 and max. 41 month) and mean cold ischemia time was 153 minutes for living donor transplantations and 1396 minutes for cadaveric transplantation, and also warm ischemia time was 236 seconds for living donor transplantation. In all cases, the grafted kidney began to function immediately after reperfusion. Fourteen of the recipients had no any early kidney dysfunction, a problem that is usually attributed to prolonged anastomosis time.

**Conclusion:** Transplanting kidneys with multiple renal arteries may result in significant risks. Prolonged cold or hot ischemia time may elevate incidence of non functional graft and rejection. Results of this study points that unifying artery anastomosis at the backtable would reduce the risk.

**Key Words:** Kidney transplantation, Multiple arteries, Ischemia.

### ÖZET

#### Böbrek Naklinde Çoklu Arter: Yeni Bir Böbrek Transplant Merkezinin Başlangıç Deneyimi

**Amaç:** Birden fazla renal arter anastomozu yapılan böbrek nakilli hastalarda gelişen komplikasyonlar ve uzun dönem nakil böbrek fonksiyon sonuçlarını değerlendirmek.

**Gereç ve Yöntem:** 2010 ile 2014 yılları arasında yapılan 115 böbrek nakil hastasının verilerini geriye dönük olarak inceledik. Toplamda 115 donör nefrektomi ameliyatı gerçekleştirildi. Bunlardan 99 tanesinde transplante edilen böbrekte tek ve 16 tanesinde (yaklaşık %16) ise birden fazla renal arter vardı. Bu 16 hastadan 5 tanesine kadavra ve 11 tanesinde canlı donörden böbrek nakli yapıldı.

**Bulgular:** Çalışmaya dahil edilen hastaların ortalama yaşı 38,5 (9-58 yaş arası) ve ortalama takip süreleride 22,5 ay ( en az 3,5 ay ve en fazla 41 ay) idi. Kadavradan yapılan nakillerde ortalama soğuk iskemi süresi 1396 dakika iken canlı vericili böbrek nakillerinde bu süre 153 dakika olarak ölçüldü. Aynı zamanda canlı vericili böbrek nakillerinde sıcak iskemi süreside 236 saniye olarak ölçüldü. Vakaların tümünde reperfüzyonu takiben böbrek fonksiyonları hemen başladı. 14 vakada erken dönemde böbrek fonksiyonlarından herhangi birinde bozukluk olmadı.

**Sonuç:** Böbrek naklinde birden çok arter anastomozu bazı riskler taşır. Uzamış sıcak ve soğuk iskemi sürelerine bağlı sıklıkla greft fonksiyon kaybı ve rejeksiyonu gözlenebilir. Backtable işlemi sırasında yapılan iyi bir hazırlık ile iskemi süresi artmadan greft fonksiyonları korunarak multiple arterli hastalarda güvenle böbrek nakli yapılması daha uygun olacaktır.

**Anahtar Kelimeler:** Böbrek nakli, Çoklu arter, İskemi.

Renal transplantation is the current definitive treatment option for end stage renal failure (1) due to developing of surgical techniques and postoperative immunosuppression.

In developing countries, major sources of transplanted organs are living donors. Donors are evaluated for renal vascular abnormalities with computerized tomography (CT) or magnetic resonans imaging (MRI) preoperatively. Most common vascular

abnormaliy is existence of multiple renal arteries. This means that previous contraindications in the past are currently just one more challenge to overcome. Their existence results in prolongation of operation time and may increase risk of graft failure (tubular necrosis, delayed graft function and even rejection) (2, 3).

The aim of this study is to search outcome and complication rate differences of patients with only one artery and with multiple arteries compared with the

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relevant literature.

## MATERIAL AND METHOD

We performed 115 Kidney Transplantation from living and cadaveric donors from November 2010 to March 2014. Detailed clinical history was taken and physical examination was performed to the recipients. All living donors were evaluated according the criteria of Amsterdam Forum (4) Human leukocyte antigen (HLA) typing and tissue crossmatch between donors and their recipients were carried out just before transplantation. All patients and their donors were of compatible blood groups. Routinely methylprednisolone (MP) was delivered just before surgery as induction immunosuppression. Prophylactic antibiotics and low-molecular-weight heparin were delivered to all patients. Recipient bladders were lavaged with 300 mL gentamycin added saline solution and about 200 mL of this solution was retained in the bladder cavity by clamping Foley catheter.

There are only two transplant surgeons in our kidney transplant team. Therefore, transplantation procedure begins with the donor nephrectomy. As soon as dissection is completed implantation area is prepared, which is extraperitoneally located on the right or left iliac fossa of recipient. Following donor nephrectomy, we immediately began implantation procedures of recipient. All renal vessels were anastomosed to external or common iliac vessels in an end-to-side fashion, using a continuous 6-0 polypropylene suture. In two children recipients, we anastomosed one face of renal artery with continuous suture and the other face of renal artery with one-by-one suture technique. There were some artery abnormalities. These abnormalities were evaluated in terms that correction techniques applied, to the effect of postoperative graft life and other complications. Seven of these patients who had one more renal arteries were female (%44) and nine were male (56%) and mean age was 37,8 (range 9-58). In five of the cases, organs were transplanted from a cadaver and eleven were transplanted from living donors. In seven cases, common arterial orifice (CAO) was created (Figure 1) followed by end to side anastomosis, in the other 9 patients, each artery were individually end to side anastomosis (Figure 2). Recipients and their donors were followed in the transplant clinic during whole hospitalization. Fluid replacement was given according to urine output at postoperative first night and balance was ensured by about +500 or +1000 mL (amount of fluid delivery volume more than urine drainage fluid). Oral fluid intake was ensured in the six to eight hours postoperatively. Intravenous fluid replacement was decreased on the first postoperative day and generally was stopped on the second day. Complete blood count, coagulation profile, and routine biochemistry tests including renal function tests were performed at the same night of the operation and daily during

hospitalization. Immunosuppressive drug level was controlled and regulated on postoperative day two and then daily in this period. Transplanted kidneys were not radiologically imaged routinely in the postoperative hospitalization period. Patients were followed by outpatient nephrology clinic after being discharged.

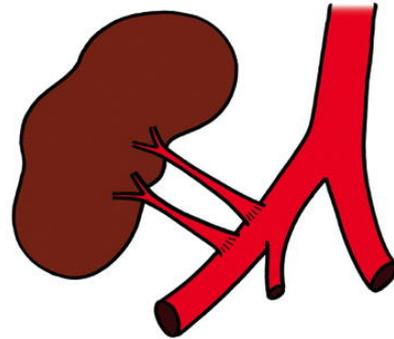


Figure 1. Description of common arterial orifice.

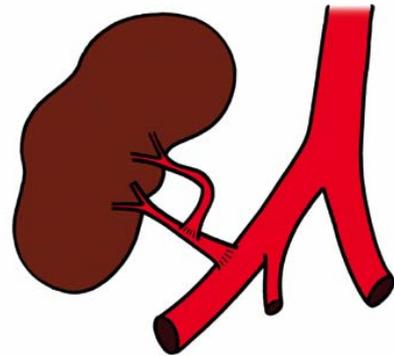


Figure 2. Description of end to side anastomosis.

## RESULTS

Double renal artery kidneys were transplanted to sixteen of 115 recipients. Of these, male to female ratio was 9:7. mean age was 38,5 years (range 9–58 years). Four patients and their donors had three HLA mismatches. Two patients had two HLA mismatches. Two patient had four mismatches, two patients had five mismatches, three had six mismatches, three had one mismatch Blood groups of recipient and donor and causes of ESRD in patients are shown in Table 1. Left kidney donor nephrectomy was preferred when possible. In case of vascular problems or any other contraindication right kidney nephrectomy was performed. Left donor nephrectomy to right donor nephrectomy ratio was 13:3. Right iliac fossa was usually preferred for implantation in recipients. In case of a vascular problem or a surgical necessity such as native nephrectomy or possible pancreas transplantation in future, left iliac fossa was chosen. The right iliac fossa was used in all of recipients On the 16 patients who had double renal arteries, mean hot ischemia time was 235.8 second on living donor renal transplanted, mean cold ischemia time was 152 minute

on living donors and was 1396 minutes on cadaveric donors. Mean urination time after transplantation was 6,8 (2-20) minutes. Urine output began immediately after vascular anastomosis. Mean time of discharge from hospital was postoperative day 8 (range 4–18 days). As an induction immunosuppression antithymocyte globulin or basiliximab treatment was initiated. Tacrolimus, mycophenolate mofetil, or enteric coated mycophenolate sodium and corticosteroid were given to recipients as postoperative immunosuppressive drugs. Trimethoprim sulfamethoxazole and valganciclovir were used for prophylaxis. Acyclovir prophylaxis was given child patients instead of valganciclovir. Calcium vitamin D3 were given for replacement treatment. There was no significant difference in the occurrence of vascular and urologic complications, as well as delayed graft function, when we compared grafts with single and multiple arteries. In all cases, the grafted kidney began to function immediately after reperfusion. Fourteen of the recipients had no any early kidney dysfunction, a problem that is usually attributed to prolonged anastomosis time. One of the patients had increased

liver enzymes on postoperative term, and resolved with a regulation of immunosuppressive therapy dosage. Another one had seizures and wound swelling on postoperative 8 days that was discharged. Creatinine level analysis result of the wound aspiration material was 5 mg/dL. Whereupon, the patient was reoperated. Transplanted kidney were minimally functional. Kidney biopsy (Bx) tissue samples were taken. Bleeding was occurred. Urinary leakage was observed. Urine leakage from transplanted kidney was treated with a nephrostomy catheter and double J stents. Immunosuppressive treatment dosages were altered to esolve convulsions. In another case with a cadaveric kidney, the drainage tube material was haemorrhagic. There was subcutaneous hematoma and lack of urinary output. The patient was reoperated three times after transplantation. Due to impaired haemodynamic status, patient was taken to the intensive care unit and died on postoperative day five. Another patient died on postoperative day 38 due to another problem. Transplanted renal arteries were patent in all of other cases.

**Table 1.** Recipient and donor demographics and transplantation related parameters

Patient	Age and Gender	Relation of Donor and Age	Recipient Blood Group	Donor Blood Group	HLA MM	Cause of ESRD	Number of Renal Artery	Type of Artery Anastomosis	Donation
1	45, M	Unrelated, 37	B(+)	B(+)	4	Hypertensive nephropathy	2	EAS	C
2	35, F	Unrelated, 50	AB(+)	A(+)	6	Diabetic nephropathy	2	EAS	L
3	55, F	Husband, 56	AB(+)	A(+)	6	Idiopathic	2	CAO	L
4	31, M	Aunt, 63	A(+)	O(+)	1	IgA nephropathy	2	CAO	L
5	9, F	Unrelated, 4	A(+)	A(+)	4	Idiopathic	2	CAO	C
6	27, F	Mother, 64	A(+)	O(+)	2	Idiopathic	2	CAO	L
7	41, M	Wife, 30	A(+)	A(+)	1	FSGS or IgA nephropathy	2	CAO	L
8	49, F	Husband, 49	AB(+)	A(+)	3	Idiopathic	2	EAS	L
9	43, M	Brother, 56	O(+)	O(+)	2	Idiopathic	2	EAS	L
10	20, M	Mother, 39	O(-)	O(-)	3	RPGN	2	CAO	L
11	37, F	Unrelated, 21	A(+)	A(+)	3	Pyelonephritis	2	EAS	C
12	58, M	Sister, 61	O(+)	O(+)	3	Polycystic Kidney Disease	2	EAS	L
13	49, M	Brother, 47	O(+)	O(+)	5	Idiopathic	2	CAO	L
14	33, M	Unrelated, 21	O(+)	O(+)	5	IgA nephropathy	2	EAS	C
15	53, M	Unrelated, 29	A(+)	A(+)	1	Hypertensive nephropathy	2	EAS	C
16	31, F	Mother, 60	A(+)	O(+)	6	Idiopathic	2	EAS	L

MM, Miss Match EAS, Each artery separately anastomosis CAO, Common arterial orifice FSGS, Focal Segmental Glomerulosclerosis RPGN, Rapidly Progressive Glomerulonephritis C, Cadaver L, Living

## DISCUSSION

Complex vascular anatomy has always posed a challenge to the surgical skills of the operating team (5). Previous studies showed that incidence of multiple renal arteries in the general population is 18% to 30% (6). In our experience, the incidence of multiple renal arteries was 16 %. Transplanting a kidney with multiple renal arteries has several disadvantages, including prolonged warm ischemia time, high incidence of acute tubular necrosis and rejection episodes, high graft function failure, and prolonged hospitalization. Multiple renal arteries have reportedly

been associated with a higher rate of vascular complications, including arterial thrombosis and renal artery stenosis (6-9). Several techniques for bench or in situ reconstruction of multiple renal arteries have been described in order to reduce the incidence of these vascular complications (10). In grafts from cadaver donors, the Carrel aortic patch is the standard technique of vascular reconstruction in renal transplants with a single and multiple arteries (11). In kidney transplants with multiple anastomoses, revascularization can be done either simultaneously after the entire arterial

engraftment is completed or sequentially. Using the latter technique, the main renal artery is revascularized first. Then, the vascular clamps are released and the kidney is partially revascularized. The other artery is anastomosed to a convenient site, maintaining perfusion of the kidney by the main artery. Even though an aortic patch theoretically should make the vascular anastomosis easier and prevent stenosis, the presence of a patch did not decrease the incidence of renal artery stenosis for grafts with a single artery. The

other complications are posttransplant hypertension, rejection, urologic complications, such as ureteral necrosis or calyceal cutaneous fistulas related with delayed graft function.

Therefore, kidneys with multiple arteries should be implanted, using the technique that best fits a particular situation and with which the individual transplant surgeon feels most comfortable.

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