

Kidney transplantation from living donors with multiple renal arteries

Multiple renal arterlere sahip canlı donörlerden böbrek nakli

Gökhan Ertuğrul¹, Çağatay Aydın¹

¹ Organ Transplantation Center, Medipol University, Faculty of Medicine, Istanbul, Turkey

ORCID ID of the author(s)

GE:0000-0002-8351-4220

ÇA: 0000-0002-7216-1079

Abstract

Aim: Although better outcomes have been reported recently due to advances in surgical techniques, kidney artery variations are still important for good clinical results in transplantation. The aim of our study was to compare the clinical outcomes of grafts with one and two or more arteries.

Methods: Between April 2014 and January 2019, 117 patients with live kidney transplantations were evaluated retrospectively with two groups. Group 1 consisted with one artery grafts and Group 2: two or more arteries. We were evaluated clinical outcomes between groups.

Results: Among 117 recipients, there were two or more arteries in 13 cases (11.1 %). There was no significant deference between these two groups in terms of clinical outcomes during a median 27 (1-60) months of follow-up ($P=0.62$).

Conclusion: It appears that the presence of renal grafts with two or more arteries may not be counted as a relative contraindication for renal transplantation.

Keywords: Kidney transplantation, Multiple arteries

Öz

Amaç: Son zamanlarda cerrahi tekniklerdeki gelişmelere bağlı olarak böbrek naklinde daha iyi sonuçlar alınmasına rağmen, böbrek arter varyasyonları iyi klinik sonuçlar için halen önemlidir. Çalışmamızın amacı, bir ve iki veya daha fazla arterli greftlerin klinik sonuçlarını karşılaştırmaktır.

Yöntemler: Nisan 2014 ile Ocak 2019 arasında, canlı vericili böbrek nakli yapılan 117 hasta retrospektif olarak iki grupta değerlendirildi. Grup 1 bir arterli greft ve Grup 2 iki veya daha fazla arterli greftten oluşuyordu. Bu iki grup arasındaki klinik sonuçları değerlendirildi.

Bulgular: 117 alıcı arasında 13 (%11,1) olguda iki veya daha fazla arterli greft vardı. Ortalama 27 (1-60) aylık takip süresinde bu iki grup arasında klinik sonuçlar açısından anlamlı bir farklılık saptanmadı ($P=0,62$).

Sonuç: İki veya daha fazla arterli böbrek grefti kullanımının, böbrek nakli için göreceli bir kontrendikasyon olmadığı anlaşılmaktadır.

Anahtar kelimeler: Böbrek nakli, Multiple arter

Corresponding author / Sorumlu yazar:

Gökhan Ertuğrul

Address / Adres: Organ Nakli Merkezi, Medipol Üniversitesi, Tıp Fakültesi, TEM Avrupa Otoyolu Göztepe Çıkışı No: 1, 34214, Bağcılar, İstanbul, Türkiye

e-Mail: mdgertugrul@gmail.com

Ethics Committee Approval: Ethics committee approval was not received for this study because of the retrospective design of the study.

Etik Kurul Onayı: Etik kurul onayı çalışmanın retrospektif doğasından dolayı alınmamıştır.

Conflict of Interest: No conflict of interest was declared by the authors.

Çıkar Çatışması: Yazarlar çıkar çatışması bildirmemişlerdir.

Financial Disclosure: The authors declared that this study has received no financial support.

Finansal Destek: Yazarlar bu çalışma için finansal destek almadıklarını beyan etmişlerdir.

Published: 4/18/2019

Yayın Tarihi: 18.04.2019

Copyright © 2019 The Author(s)

Published by JOSAM

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives License 4.0 (CC BY-NC-ND 4.0) where it is permissible to download, share, remix, transform, and build upon the work provided it is properly cited. The work cannot be used commercially without permission from the journal.



Introduction

Kidney transplantation is the treatment of choice in patients with end-stage renal disease when compared with chronic dialysis therapy in relevant to patient survival and quality of life [1].

Good outcomes due to advances at surgical techniques in last years but kidney artery variations are currently very important for clinical results in transplantation.

Variations in the number of renal arteries are common, with the reported frequency ranging between 9% and 76% [2,3].

The presence of renal artery variations in the donor kidney substantially increases the risk of complications, given the technical difficulties and longer anastomosis time [4-6].

The aim of our study was to evaluate the clinical outcomes and graft loss rates, grafts with one and two or more arteries.

Materials and methods

Between April 2014 and April 2019 at Medipol University Medical Faculty Hospital Organ Transplantation Department, Istanbul, Turkey, 117 patients with living donor kidney transplantation were studied retrospectively.

Patients were divided into two groups: Group I was formed by recipients with single renal artery grafts and Group II with multiple renal arteries. For each of these groups, the age, sex, body mass index, preoperative creatinine level, postoperative fifth days creatinine level, induction therapy with anti-thymocyte globulin (ATG), warm ischemia time, cold ischemia time, acute rejection and graft loss were compared.

Warm ischemia time was defined as the time from clamping of the renal artery to extraction of the organ from the donor's abdomen and its placement on ice. Cold ischemia time was defined as the time from placement on ice to finish the anastomosis and open the renal artery clamps.

Preoperative assessment of the renal artery, renal vein, and ureters of the donor organ was obtained computed tomographic angiography. Our surgical technique is open donor nephrectomy in multiple renal arteries patients. If there are two or more renal arteries at grafts, all of the renal arteries were anastomosed to external iliac artery separately in an end-to-side manner. Anastomoses were done by using x3.5 surgical loupes. A running suture was used to anastomose main renal artery. In other millimetric sized accessory arteries, first 7/0 or 8/0 sutures were placed separately and then tied one by one.

Statistical analysis

SPSS 22.0 (SPSS for Windows, 2007, Chicago) was used for statistical analysis. Continuous variables which have normal distribution were presented as mean (standard deviation). Statistical analysis for the parametric variables was performed by the Student's T-test. The qualitative variables were given as percent and the correlation between categorical variables was investigated by the chi-square test and Fisher's exact test. Statistical significance level was defined as $P < 0.05$.

Results

The indications for kidney transplantation were; 42 (35.9%) patients had no cause, 37 (31.6%) had diabetes mellitus,

17 (14.5%) had hypertension, 15 (12.8%) had chronic glomerulonephritis, 3 (2.6%) patient had polycystic kidney disease and 3 (2.6%) other causes (Alport syndrome, vesicoureteral reflux, etc.). We used CT angiography for evaluation of the donor renal arteries (Figure 1).

Mean age of the one renal artery group was 37.4 (15.9) years; two or more renal arteries group was 35.6 (16.3) years ($P=0.76$). Sixty nine (66.3%) males and 35 (33.7%) females in one renal artery group, 9 (69.2%) males and 4 (30.8%) females patients in two or more renal arteries group ($P=0.55$).

Mean BMI of the one renal artery group was 25.1 (5.5) kg/m^2 , two or more renal arteries group was 27.2 (9.2) kg/m^2 ($P=0.61$). Mean preoperative creatinine level of the one renal artery group was 8.1 (3.2) mg/dL , two or more renal arteries group was 8.7 (3.7) mg/dL ($P=0.73$). Mean postoperative first month creatinine level of the one renal artery group was 0.88 (0.25) mg/dL , two or more renal arteries group was 0.82 (0.16) mg/dL ($P=0.61$).

Induction therapy with anti-thymocyte globulin (ATG) 82 (78.8 %) patients in one renal artery group, 11 (84.6%) patients in two or more renal arteries group ($P=0.48$).

Mean Warm ischemia time was 90.5 (21-220) second in one renal artery group and 89 (32-120) second in two or more renal arteries group ($P=0.89$). Mean Cold ischemia time was 53.5 (23-120) minutes in one renal artery group and 60 (42-123) minutes in two or more renal arteries group ($P=0.02$) (Figure 2).



Figure 1: Computed tomographic angiography



Figure 2: Graft after revascularization

Acute Rejection Rate is detected in 6 (5.8%) patients in one renal artery group, 1 (7.7%) patients in two or more renal arteries group ($P=0.57$). Graft loss occurred in 4 (3.8%) patients was only with one renal artery group ($P=0.62$) due to acute humoral rejection. Table 1 shows the comparison of demographic and clinical findings.

Table 1: Demographic and clinical data of the two groups

	One renal artery (n=104)	Two or more renal arteries (n=13)	P-value
Age (Years) mean (standard deviation)	37.4 (15.9)	35.6 (16.3)	0.76
Sex (Male /Female) (n%)	69 (66.3)/35 (33.7)	9 (69.2)/4 (30.8)	0.55
Body Mass Index (kg/m ²)	25.1 (5.5)	27.2 (9.2)	0.61
Preoperative creatinine levels (mg/dL)	8.1 (3.2)	8.7 (3.7)	0.73
Postoperative first month creatinine levels (mg/dL)	0.88 (0.25)	0.82 (0.16)	0.61
Induction therapy with anti-thymocyte globulin (ATG) (yes/no) (n%)	82 (78.8)/22 (21.2)	11 (84.6%)/2 (15.4%)	0.48
Warm ischemia time (second)	90.5 (21-220)	89 (32-120)	0.89
Cold ischemia time (minute)	53.5 (23-120)	60 (42-123)	0.02
Acute Rejection Rate (yes/no) (n%)	6 (5.8)/98 (94.2)	1 (7.7)/12 (92.3)	0.57
Graft Loss Rate (yes/no) (n%)	4 (3.8)/100 (96.2)	-/13 (100)	0.62

Discussion

There are several determinative factors which donor will select for transplantation. The most important one of these is anatomic abnormalities and the number of arteries, veins and ureters. Multiple methods are available for preoperative assessment of arterial supply to the kidneys, i.e., computed tomographic (CT) angiography and magnetic resonance imaging (MRI) angiography. CT angiography is reported to have a sensitivity of 91%, a specificity of 98% [7]. In our center, we used CT angiography for evaluation of the donor renal arteries.

The presence of renal artery variations in the donor kidney substantially increases the risk of complications and given the technical difficulties [8-10]. Transplanting a kidney with multiple arteries has several theoretical disadvantages. It may prolong the warm- cold ischemia time, increase the incidence of ATN and rejection episodes, decrease graft function and prolong hospitalization. Multiple renal arteries reportedly have been associated with a higher rate of vascular complications (thrombosis-stenosis), infarction, infection, and urologic complications [11,12].

Several techniques are for bench reconstruction of multiple renal arteries. The smaller artery usually is anastomosed in an end to-side fashion to the main artery. If both renal arteries are of similar size, the ends of the two vessels can be sutured together side to side or not was done reconstruction, anastomosis are one by one and end to side an external iliac artery [13,14].

In our clinic, we prefer to perform a left nephrectomy in nearly almost all living donations.

We was not done bench reconstruction of multiple renal arteries, anastomosis are one by one, end - side to external iliac artery. With polar arteries, our approach has been to anastomosis in arteries directed to the lower pole of the kidney regardless of the size because these arteries potentially the blood supply of the ureter.

In this study, there was no difference in warm ischemia times between the two groups. The duration of cold ischemia was more in two or more arteries group, but this condition did not affect acute rejection and graft loss. According to our experience, grafts with two or more arteries were not a relative contraindication for renal transplantation.

Our study has several limitations. First, this study was retrospective. Second, the number of cases was small.

Conclusion

Despite the limitations described in the Discussion section, it appears that the presence of renal grafts with two or more arteries may not be counted as a relative contraindication for renal transplantation.

References

1. Tonelli M, Wiebe N, Knoll G, Bello A, Browne S, Jadhav D, Klarenbach S, Gill J. Systematic review: kidney transplantation compared with dialysis in clinically relevant outcomes. *Am J Transplant.* 2011 Oct;11(10):2093-109. doi: 10.1111/j.1600-6143.2011.03686.x.
2. Satyapal KS, Haffjee AA, Singh B, Ramsaroop L, Robbs JV, Kalideen JM. Additional renal arteries incidence and morphometry. *Surg Radiol Anat.* 2001;23:33-8.
3. Khamanarong K, Prachaney P, Utraravichien A, Tong-un T, Sriporaya K. Anatomy of renal arterial supply. *Clin Anat.* 2004;17:334-6.
4. Shoja MM, Tubbs RS, Shakeri A, et al. Peri-hilar branching patterns and morphologies of the renal artery: A review and anatomical study. *Surg Radiol Anat.* 2008;30:375-82.
5. Al-Saeed O, Ismail M, Sheikh M, Al-Moosawi M, Al-Khawari H. Contrast-enhanced three-dimensional fastspoiled gradient magnetic resonance angiography of the renal arteries for potential living renal transplant donors: A comparative study with digital subtraction angiography. *Australas Radiol.* 2005;49:214-7.
6. Vazquez R, Garcia L, Morales-Buenrostro L, et al. Renal grafts with multiple arteries: A relative contraindication for a renal transplant? *Transplant Proc.* 2010;42:2369-71.
7. Bhatti AA, Chugtai A, Haslam P, Talbot D, Rix DA, Soomro NA. Prospective study comparing three-dimensional computed tomography and magnetic resonance imaging for evaluating the renal vascular anatomy in potential living renal donors. *BJU Int.* 2005;96:1105-8.
8. Khanam A, Alam MR, Ahmed AH, Khan SA. The outcome of kidney transplants with multiple renal arteries. *Mymensingh Med J.* 2011;20:88-92.
9. Makiyama K, Tanabe K, Ishida H, et al. Successful renovascular reconstruction for renal allografts with multiple renal arteries. *Transplantation.* 2003;75:828-32.
10. Hung CJ, Lin YJ, Chang SS, Chou TC, Lee PC. Kidney grafts with multiple renal arteries is no longer a relative contraindication with advance in surgical techniques of laparoscopic donor nephrectomy. *Transplant Proc.* 2012;44:36-8.
11. Breda A, Veale J, Liao J, Schulam PG. Complications of laparoscopic living donor nephrectomy and their management: the UCLA experience. *Urology.* 2007;69:49-52.
12. Saidi R, Kawai T, Kennealey P, et al: Living donor kidney transplantation with multiple arteries: recent increase in modern era of laparoscopic donor nephrectomy. *Arch Surg.* 2009;144:472-5.
13. Kadotani Y, Okamoto M, Akioka K, et al: Management and outcome of living kidney grafts with multiple arteries. *Surg Today.* 2005;35:459-66.
14. Keller JE, Dolce CJ, Griffin D, et al. Maximizing the donor pool: use of right kidneys and kidneys with multiple arteries for live donor transplantation. *Surg Endosc.* 2009;23:2327-31.

The National Library of Medicine (NLM) citation style guide is used in this paper.

Suggested citation: Patrias K. Citing medicine: the NLM style guide for authors, editors, and publishers [Internet]. 2nd ed. Wendling DL, technical editor. Bethesda (MD): National Library of Medicine (US); 2007-[updated 2015 Oct 2; cited Year Month Day]. Available from: <http://www.nlm.nih.gov/citingmedicine>