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Analysis of vascular complications requiring surgical intervention after kidney transplantation

Böbrek nakli sonrası cerrahi girişim gerektiren vasküler komplikasyonların analizi

Cem TUĞMEN[1], İsmail SERT[1], Sait Murat DOĞAN[2], Eyüp KEBAPCI[1], Hülya COLAK[3], Sibel ERSAN[3], Mustafa ÖLMEZ[1], Cezmi KARACA[1]

[1]Tepecik Eğitim ve Araştırma Hastanesi, Genel Cerrahi ve Organ Nakli Kliniği, İzmir
[2]İnönü Üniversitesi, Tıp Fakültesi, Genel Cerrahi Anabilim Dalı, Malatya
[3]Tepecik Eğitim ve Araştırma Hastanesi, Nefroloji ve Organ Nakli Kliniği, İzmir

ABSTRACT

Objective: Vascular complications seen after kidney transplantation may unfavorably effect patient and graft prognosis. The aim of the study was to analyze the severe vascular complications requiring surgical intervention after renal transplantation.
Method: The data of 462 patients who were reoperated following kidney transplantations from living and deceased donors because of development vascular complications were retrospectively analyzed. Only 13 patients requiring surgical interventions because of grade 3b and 4 vascular complications in early post-transplant period were included in this study.
Results: Because of fifteen vascular complications; 13 (2.8%) kidney recipients underwent re-operation. Median occurrence time of vascular complications was 12±19 days (min: 1 day, max: 72 days). The most common causes of vascular complication were hematoma followed by renal vein thrombosis, dehiscence of arterial anastomosis , arterial kinking, infected hematoma and renal artery thrombosis. Graft nephrectomy was performed in 5 (38.5%) patients due to uncontrolled vascular complications. One year patient and graft survival rates were 90.9% and 61.5% in patients who underwent re-operations due to vascular complications, respectively. Two year patient and graft survival rates were 90.9% and 46.2%, respectively.
Conclusion: The rates of vascular complications after kidney transplantation demonstrate the safety and feasibility of the kidney transplantation. The graft survival rates in patients requiring re-operation owing to severe vascular complications are at acceptable levels.

Key words: Vascular complication, kidney transplantation, re-operation, graft survival, patient survival

ÖZ

Amaç: Böbrek nakli sonrası görülen vasküler komplikasyonların, hasta ve greft prognozu üzerine olumsuz etkisi olabilmektedir. Bu çalışmanın amacı böbrek nakli sonrası, cerrahi müdahale gerektiren ciddi vasküler komplikasyonları analiz etmektir.
Yöntem: Kadavradan ve canlı böbrek nakli yapılmış 462 hastadan vasküler komplikasyonlar nedeniyle reoperasyon geçirenlerin verileri retrospektif olarak incelendi. Grade 3b ve 4 Vasküler komplikasyon nedeniyle re-operasyon geçiren 13 hastanın verileri analiz edildi.
Bulgular: On beş vasküler komplikasyon nedeniyle 13 (2.8%) hastaya re-operayon yapıldı. Ortanca vasküler komplikasyonların görülme zamanı 12±19 gün olarak saptandı (min: 1, maksimum: 72 gün). Reoperasyonların nedenleri; hematom, renal ven trombozu, arter anostomozunda ayrılma, arterial katlanma, enfekte hematom, renal arter trombozu olarak bulundu. Greft nefrektomi, kontrol edilemeyen vasküler komplikasyon nedeniyle 5 hastaya (%38.5) yapıldı. Birinci yıl hasta ve greft sağ kalımı sırasıyla; %90.9 ve %61.5 iken ikici yıl hasta ve greft sağ kalımı sırasıyla; %90.9 ve % 46.2 olarak saptandı.
Sonuç: Böbrek nakli sonrası vasküler komplikasyonlar oranları, böbrek naklinin güvenli ve uygulanabilir olduğunu göstermektedir. Böbrek nakli sonrası gelişen ve cerrahi müdahale gerktiren vasküler komplikasyonlar gelişen hastalarda greft sağ kalımı kabul edilebilir seviyelerdedir.

Anahtar kelimeler: Vasküler komplikasyon, böbrek nakli, reoperasyon, greft sağkalımı, hasta sağkalımı

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Yazışma adresi: Uzm. Dr. Cem Tuğmen, Tepecik Eğitim ve Araştırma Hastanesi, Organ Nakli Kliniği, İzmir
e-mail: cemtugmen@gmail.com

INTRODUCTION

Kidney transplantation is the gold standard treatment in patients with End Stage Renal Disease (ESRD). As compared to hemodialysis and peritoneal dialysis, it is superior in terms of quality of life, morbidity, mortality and cost of the treatment. Like all surgical interventions, kidney transplantation too has the risk for surgical complications. Most of these were treated medically or with minimal interventions under radiological guidance. But in some cases, reoperation was indispensable and patient's health was first priority next to preservation of graft function in these cases. In this study, we evaluated the vascular complications requiring reoperation in early post-transplant period. Graft and patient survival were analyzed.

MATERIAL and METHODS

The data of 462 patients who underwent kidney transplantation from living and deceased donors from 2003 to 2013 was analyzed retrospectively. Only 13 patients requiring surgical intervention due to grade 3b and 4 vascular complications in early post-transplant period were included in this study. Grade of vascular complications were defined according to Clavien classification of surgical complications [(1)].

Prior to transplantation, donor and recipient tissue typing was performed using the Polymerase Chain Reaction (PCR) method. Before 2011, tissue typing was performed by Compliment Depended Cytotoxicity (CDC), and after 2011 both CDC and flow cytometry crossmatch tests were used.

Arterial anastomosis was performed in end to side fashion to the external iliac artery or end to end fashion to the internal iliac artery by using 6/0 or 7/0 polypropylene suture. Venous anastomosis was performed in end to side fashion with the external iliac artery by using 6/0 or 7/0 polypropylene suture. Artery anastomosis were completed by running or interrupted suture technique and venous anastomosis was performed using running suture technique. Urinary anastomosis was done according to Lich-Gregoir ureteroneocystostomy technique by using 5/0 or 6/0 PDS suture. Bladder catheterization was routinely performed in all the patients and the catheter was removed at 5th post-operative (PO) day. In all cases, retroperitoneal suction drain was introduced. Cefazolin 1g twice daily for 5 days was used for antibiotic therapy. Metilprednisolone 10 mg/kg and Antithymocyte globulin 2-3 mg/ kg was used as induction therapy in transplantation with deceased donors. In kidney recipients from living donors Metilprednisolone 10 mg/kg and basiliximab 20 mg – at 0 and 4 day were used. In case of delayed graft function, Antithymocyte globulin with induction dose were maintained by monitoring the serum CD3 levels. For maintenance therapy; triple agents (steroids, mycofenolic acid and calcineurin inhibitors) were preferred. Kidney functions were monitored every day.

Term 'graft dysfunction' was defined as primary non-functioning graft or graft that was functioning after transplant but now required dialysis or when the serum creatinine levels did not drop down to desired levels i.e. less than 30% decrease in serum creatinine than baseline level or serum creatinine level of more than 3 mg/dl at P.O. day 5.

Definition of marginal deceased donor were established according to UNOS (United network for organ Sharing) criteria; A marginal donor was defined with an age over 60 or between 50 and 59 with one of the following criteria; hypertension with serum creatinine level of more than 1.5 mg/dl or death from a cerebrovascular event. For live donors following criteria were applied; age over 60 years with atherosclerotic retinopathy, GFR < 60 ml/min, diabetes mellitus and presence of proteinuria.

Statistical analysis was performed using SPSS 15.0 software. Data was expressed as mean ± standard deviation. Patient and graft survival analysis was performed by using Kaplan-Meier Method.

Table 1. Recipient demographic data.

Recipient Sex	Mean±SD	Min-max	Percentage
Female	6/13		46%
Male	7/13		54%
Recipient Age (yr)	33±12	16-53	
Time on dialysis(months)	54±31	12-168	
Occurrence of the vascular complications (days)	12±19	1-72	
Cause of ESRF			
Glomerulonephritis	n:2		15%
Hypertension	n:3		23%
Polycystic disease	n:1		8%
Pyelonephritis	n:1		8%
Unknown	n:6		46%
HLA mismatch			
≤ 3	n:6		46%
>3	n:7		54%
Venous Anostomosis			
External iliac vein	n:13		100%
Arterial anostomosis			
Internal iliac artery	n:4		30.8%
External iliac artery	n:9		69.2%
Cross-match (+)	Non		
Preemptive	Non		

ESRF: End stage renal failure

RESULTS

A total of fifteen vascular complications were observed; 13 (2.8%) kidney recipients underwent re-operation. Two patients underwent surgical intervention twice. Median time of occurrence of vascular complication was 12±19 days (1-72 days). Donor and recipient characteristics are described in Table 1 and 2.

The causes of the re-operations were as follows; hematoma, renal vein thrombosis, artery anastomosis disruption, arterial kinking, infected hematoma and renal artery thrombosis (Table 3). Hematoma and infected hematoma were treated with drainage. Repair of the anastomosis was performed in artery anastomosis disruption. Revision of the anastomosis was performed in artery kinking. Graft nephrectomy was performed in all patients with renal infarcts secondary to renal artery or venous thrombosis.

Graft nephrectomy was performed in five patients (38.5%) due to uncontrolled vascular complications. These patients had seven re-operation procedures. In these patients, renal vein or arterial thrombosis was the main causes. The histopathological findings of patients who underwent graft nephrectomy was collected and correlated with the intraoperative findings. Laparoscopic donor nephrectomy was performed in three donors, with the median warm ischemia time of 6.49 minute.

In case of graft dysfunction, the first choice of imaging method was doppler ultrasonography. In two patients; conventional angiography, and in one patient; dynamic kidney syntigraphy was additionally utilized.

Median follow up of the patients was 54 months (15-121 months). One patient died with functioned graft during plasmapharesis procedure because of recurrent glomrulonephritis at month 21.Total number of 7 (46.6%) patients returned to the dialysis. One patient underwent re-transplantation at first month after graft nephrectomy and his follow up is uneventful. Six patients still live with functioning graft.

One year patient and graft survival were % 90.9 and 61.5% in patients who had re-operations due to vascular complications, respectively. Two year patient and graft survival were 90.9% and 46.2%, respectively.

Table 2. Donor demographic data.

Donor Sex	Mean	Min-max	Percentage
Female	n=5		38.5%
Male	n=8		61.5%
Donor age (yr)	40±16	18-76	
CIT (min)			
Living donors	76±14	60-100	
Deceased donors	706±410	270-1180	61.5%
Donor type			38.5%
Living	n:8		
Deceased	n:5		
Multiple arteries	n:1		
Multiple veins	n:2		50%
Donor nephrectomy			50%
Laparoscopic	n:4		15%
Open	n:4		
Marginal donors	n:2		

CIT: Cold Ischemia Time

Table 3. The causes of the re-operation.

	Percentage (number)	Requiring Graft Nephrectomy
Hematoma	33.3% (n:5)	Non
Infected hematoma	13.3% (n:2)	Non
Renal vein trombosis	20% (n:3)	Yes (n:3)
Renal artery trombosis	13.3% (n:2)	Yes (n:2)
Arterial anostomosis disruption	13.3% (n:2)	Non
Arterial Kinking	6.6% (n:1)	Non

DISCUSSION

Vascular complications are still an important cause of mortality and morbidity in kidney transplantation, in spite of the advancement in surgical technique and patient management. Vascular complications are noted in 3-15% of the kidney transplantations [2]. The most common causes of vascular complications are renal artery or renal vein thrombosis in early period and renal artery stenosis, arterio-venous fistulas and pseudo aneurysms in late period [3]. In some cases, endovascular approaches are the treatment of choice but others require surgical interventions. In this study, the rate of vascular complications requiring surgical intervention was 2.8%. As we included patients with Grade 3b and 4 vascular complications, we experienced this low rate.

Renal artery and renal vein thrombosis is often encountered in the first and second week. The rate of renal artery and vein thrombosis is reported as 0.2-7.5% and 0.1-8.2%, respectively [4]. Renal vein thrombosis is seen more often than the arterial thrombosis. In general, arterial thrombosis is asymptomatic. The only symptom may be sudden onset anuria. However patient with venous thrombosis may present with pain, tenderness, oliguria or hematuria. The risk factors for vascular thrombosis are defined as donor of age younger than 6 years or older than 60 years, a cold ischemia time of more than 24 hours, atherosclerosis of the renal vessels, recipient on peritoneal dialysis, diabetes, history of thrombosis, hemodynamic instability and delayed graft function. Warm ischemia time, multiple vessels and right kidney graft are still controversial risk factors for vascular thrombosis [4]. Besides these risk factors, hyper coagulation and immune mechanisms may be the cause of vascular events, as well [5-7]. Of the risk factors mentioned above, marginal donor (n:2), long warm ischemia time (n:3), surgical technique (n:3) and delayed graft function (n:4) were observed in our study. The problems in surgical technique observed were arterial anastomosis disruption and arterial kinking.

Hemotoma is another vascular complication of the kidney transplantation. Generally, minor hemorrhage is seen due to inattentive dissection of the graft hilum. Although, major hemorrhage is encountered because of main vascular structures. Surgical technique accounts as a the main reason of the minor and major hemorrhages. Active bleeding, graft dysfunction, vascular collapse and pain are the possible symptoms of the hematoma and hemorrhage [8]. In our study, 46.6% of the vascular complications requiring the surgical intervention were owing to hematoma. None of these patients underwent graft nephrectomy.

Doppler ultrasonography (US) was the first imaging technique utilized in patients have vascular complications. The sensitivity and specificity of doppler ultrasonography to determine the vascular lesions is 88% and 85 % respectively [9]. Almost, graft dysfunction is observed in all patients with vascular complications and Doppler US should be performed at fre-

quent intervals. Magnetic resonance and computed tomography angiography are other imaging methods to define the diagnosis. Conventional angiography may be used for both the diagnosis and treatment of the complications in selective cases [10,11]. In our study, conventional angiography was performed in 2 patients. Because of the active bleeding and inadequate perfusion, these two patients were later treated surgically. Dynamic perfusion scintigraphy was used for only one patient.

Although with the advancement in diagnostic tools available for detecting the presence of vascular complications in early period, graft damage is frequently observed due to prolonged warm ischemia, thrombosis and infarction.

Although advanced diagnostic tools are available for detecting the presence of vascular complications, irreversible damage to graft is frequently observed and graft nephrectomy was required in patients for their survival. Five of thirteen patients required the graft nephrectomy in our study. The rate of graft nephrectomy due to complications has been reported between 2.7% and 4.8%, in literature [12,13]. In our study the incidence of graft nephrectomy following vascular complication was found to be 1%.

A number of reports are available stating the data of vascular complications in early post-transplant period. They include all kind of complications from surgical side infection to urological complications. But few of them focus on the severe vascular complications, especially requiring the surgical intervention. Some reports suggest that the occurrence of vascular complications in early post-transplant period has negative effect on graft survival [14-16]. Survival rates of patients undergoing repeat surgery (not limited to vascular complications) in early period was reported to be 69% at 3 years [15]. In our study this rates was 90.2% at 3 year. The three year graft survival rate of the patients having vein thrombosis has been reported as 54% [15]. In our study, it was 42.6%. But here, we would like to emphasize that this study includes only patients requiring re-operation owing to severe vascular complications in early post-transplant period.

CONCLUSION

We present the vascular complications requiring surgical treatment in early post-transplant period and their follow up data in details. The rate of vascular complications after kidney transplantation shows the safety and feasibility of the kidney transplantation. The graft survival rates in patients requiring re-operation owing to severe vascular complications are in acceptable levels.

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