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The effect of urinary tract infection on patient and graft survival rate in a group of kidney transplanted patients

Mousa Ghelichi Ghojogh¹, Shaker Salarilak^{2*}, Ali Taghizadeh Afshari³, Hamid Reza Khalkhali⁴,
Mohammad Reza Mohammadi-Fallah³, Khadijeh Makhdoomi⁵

¹School of Medicine, Urmia University of Medical Sciences, Urmia, Iran

²Public Health Department, Tabriz Branch, Islamic Azad University, Tabriz, Iran

³Nephrology, and Kidney Transplant Research Center, Department of Urology, Imam Medical Center, Urmia University of Medical Sciences, Urmia, Iran

⁴Department of Epidemiology and Biostatistics, School of Public Health, Urmia University of Medical Sciences, Urmia, Iran

⁵Nephrology, and Kidney Transplant Research Center, Department of Urology, Imam Medical Center, Urmia University of Medical Sciences, Urmia, Iran

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ABSTRACT

Introduction: Urinary tract infection (UTI) is one of the most common infection following kidney transplant surgery.

Objectives: This study was aimed to evaluate the effect of UTI after transplant on patients and graft survival rate.

Patients and Methods: This study was cross-sectional and the data collected retrospectively. Kaplan-Meier method was used to calculate the survival rate of patients and log-rank test was applied to compare the survival curves. Cox regression model was applied for modeling the factors affecting survival rate. The data were analyzed using SPSS version 19. The level of significance considered less than 0.05.

Results: The mean duration of follow-up in infected and non-infected patients following kidney transplantation surgery were 53.78 ± 24.5 months and 67 ± 40.8 months, respectively. Ten-year survival rate in infected by UTI and in non-infected by UTI were $78 \pm 0.03\%$ and $89 \pm 0.02\%$, respectively. Also, 10-year graft survival rate in infected patients and in non-infected patients were $71 \pm 0.03\%$ and $88 \pm 0.02\%$, respectively. Log-rank test showed a significant difference between infected and non-infected patients regarding graft survival rate ($P < 0.001$).

Conclusion: The results showed that the survival rate of patients was different in infected and non-infected patients. This finding indicated the importance of follow-up in patients with infection following kidney transplant surgery.

Implication for health policy/practice/research/medical education:

Urinary tract infection following kidney transplant is prevalent in patients who their urine culture was positive before transplant. A significant relationship between UTI and kidney survival rate was detected in our study. It should be noted that exact paraclinical evaluation of UTI is necessary before kidney transplant, during follow-up.

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Introduction

Urinary tract infection (UTI) is one of the most common infection after kidney transplant. The rate of bacterial infections after kidney transplant surgery in the urinary tract is 35% to 79%. UTI increases the length of stay in hospital and can occur at any time after kidney transplant

(1,2). UTI is considered as an important issue regarding potential risk factor for kidney transplant recipients (3). Although UTI is the most common infection after kidney transplant surgery in recipients, it can make some complications on kidney transplant patients (4,5). UTI is the leading cause of acute kidney injury (AKI) (3). In the

*Corresponding author: Shaker Salarilak, Email: salari@iaut.ac.ir

study of Pelle et al (6), acute graft pyelonephritis (AGPN) caused by UTI was a risk factor to reduce the kidney function. However, in other studies, this correlation has not been reported (7-9). Although UTI may not affect directly on the survival rate of the kidney transplant patients, it can affect indirectly by bacteremia, acute rejection or cytomegalovirus (CMV).

Objectives

Considering the serious effect of UTI on the survival rate, remission or function of kidney transplant patients, it is important to identify susceptible patients to UTIs, especially in patients with a history of repeated and recurrent infections. The purpose of this study was to evaluate the effect of UTI after kidney transplant on the graft survival rate.

Patients and Methods

Study population

This study was cross-sectional and data collected retrospectively. The sample of study consisted of all kidney transplant recipients during 2001-2011. The data were collected using checklist that completed from available records of graft recipients from nephrology clinic and kidney transplant ward in Imam Khomeini hospital of Urmia, Iran. Transplant recipients were examined regarding the presence of UTI after kidney transplant. Additionally, other variables were included such as age and gender of the kidney donor and recipient, type of dialysis, type of donor (alive and cadaver), length of stay in hospital, causes of death, body mass index (BMI), CMV infection, leading cause of end-stage renal disease (ESRD) and dialysis duration before kidney transplant.

Ethical issues

1) The research followed the tenets of the declaration of Helsinki. 2) Informed consent was obtained. 3) This study was approved by the Ethics Committee of Urmia University of Medical Sciences (#1200-40-01-92).

Statistical analysis

To calculate the graft survival rate, the transplant date was considered as the first event (initial event) and kidney transplant failure date that led to dialysis and in some cases led to death was considered as the last event (end point event). Kaplan-Meier method was used to calculate the patient survival rate as well as log-rank test was applied to compare the survival curves. Cox regression model was used for modeling the factors affecting survival rate. Mann-Whitney U test was applied to compare the continuous variables and χ^2 test was applied to compare classified data. Additionally, all relations were presented by odds ratios and 95% confidence intervals. The data were analyzed using SPSS version 19. The level of significance was considered less than 0.05.

Results

The total population of transplanted patients in our center during 10 years were 1268 patients who 991 patients of them were successfully followed up. In this study, 462 patients had the history of UTI. The incidence rate of UTI was 47%. A total of 149 patients who had kidney transplant rejection suffered from UTI. Among non-infected patients, kidney transplant rejection occurred in 44 patients. A total of 120 deaths occurred, so that 38 patients (31.6%) had UTI and 82 patients (68.4%) had not UTI. The cause of death in infected patients were infection in 10 patients (25.6%), cardiovascular disease in 20 patients (51.3%), cerebrovascular disease in one patient (2.6%), ischemic heart disease in one patient (2.6%), liver disease in 2 patients (5.1%), cancer in 4 patients (10.3%) and other cause in one patient (2.6%). The cause of death in non-infected patients were infection in 19 patients (23.5%), cardiovascular disease in 45 patients (55.6%), cerebrovascular disease in 3 patients (3.7%), ischemic heart disease in 3 patient (3.7%), liver disease in one patients (1.2%), cancers in 7 patients (8.6%), sudden death in 2 patients (2.5%) and Other cause in one patient (1.2%). The most common cause of ESRD in infected patients was hypertension (36.4%) and in non-infected patients was chronic glomerulonephritis (30%). According to Table 1, the mean length of stay in hospital in infected and non-infected patients by UTI in kidney recipients were 23.47 ± 11.24 and 23.83 ± 11.34 days, respectively. Also mean duration of dialysis before kidney transplant surgery in infected and non-infected patients to UTI were 18.24 ± 18 and 16.52 ± 12.6 months, respectively. Regarding gender, 60.2% of kidney recipients and 92.2% of donors among infected patients were male and 39.8% of kidney recipients and 7.8% of donors among infected patients were female. As well as 60.3% of kidney recipients and 94.5% of donors among non-infected patients were male and 39.7% of kidney recipients and 5.5% of donors among non-infected patients were female. Regarding diabetes, 25% of recipients with diabetic had less than 40 years old and 75% of them had more than 40 years old. While in non-diabetic patients, 55% of recipients had less than 40 year-old and 45% of them had more than 40 year-old. The mean duration of follow-up in infected and non-infected patients after kidney transplant was 53.78 ± 24.5 and 67 ± 40.8 months, respectively. Survival rates of the patients with infection after kidney transplant were $93 \pm 0.01\%$, $89 \pm 0.02\%$, $86 \pm 0.02\%$, $84.42 \pm 0.02\%$ and $78 \pm 0.03\%$ at 1, 3, 5, 7 and 10 years, respectively and in patients without infection were $97 \pm 0.01\%$, $93 \pm 0.01\%$, $90.25 \pm 0.14\%$, $89 \pm 0.02\%$ and $89 \pm 0.02\%$, respectively (Figures 1 and 2). Log-rank test indicated a significant difference between the groups with and without infection regarding survival rate ($P = 0.026$). Also graft survival rates of patients with infection after surgery were $92 \pm 0.01\%$, $84 \pm 0.01\%$, $80 \pm 0.01\%$, $77 \pm 0.02\%$ and $71 \pm 0.03\%$ at 1, 3, 5, 7 and 10 years, respectively and in patients without

Table 1. Demographic and clinical features of the patients

Variable, n (%)		UTI+ (n=462)	UTI- (n=529)	P
Recipient age (y)	<40	241 (52.2)	272 (51.4)	0.02
	>40	221 (47.8)	257 (48.6)	
Donor age (y)	<40	438 (94.8)	513 (97)	0.083
	>40	24 (5.2)	16 (3)	
Recipient gender	Male	278 (60.2)	319 (30.3)	0.001
	Female	184 (39.8)	210 (39.7)	
Donor gender	Male	426 (92.2)	500 (94.5)	0.143
	Female	36 (7.8)	29 (5.5)	
Type of dialysis before RT	HD	418 (90.5)	479 (90.5)	0.56
	PD	26 (5.6)	24 (4.5)	
	None	18 (3.9)	26 (4.9)	
Type of Donor	LDR	16 (3.5)	37 (7)	0.001
	ULDR	394 (85.3)	459 (86.8)	
	Cadaveric	18 (3.9)	26 (4.9)	
Recipient BMI (kg/m ²)	<18.5	85 (18.4)	82 (15.5)	0.291
	18.5-25	244 (52.8)	304 (57.5)	
	>25	133 (28.8)	143 (27)	
CMV infection	Yes	3 (0.6)	459 (99.4)	0.86
	No	3 (0.6)	526 (99.4)	
Post-transplant hospitalization (day)		23.47± 11.24	23.83± 11.34	0.616
Dialysis time before RT (day)		18.24± 18	16.52± 16.86	0.123

RT: renal transplant; HD: hemodialysis; PD: peritoneal dialysis; CMV: cytomegalovirus; UTI: urinary tract infection; LDR: living related donor; ULDR: unrelated living donor; BMI: body mass index.

infection were $97 \pm 0.01\%$, $91 \pm 0.01\%$, $88 \pm 0.02\%$, $88 \pm 0.02\%$ and $88 \pm 0.02\%$, respectively.

Log-rank test indicated a significant difference between the patients with and without UTI regarding graft survival rate ($P < 0.001$). Based on the results of the Cox regression model (Table 2), age, gender of recipients and ESRD were known as risk factors for UTI infection after kidney transplant. Hence, hazard ratio of infected by UTI in recipients (classification: more than 40 years and less than 40 years) was 1.46 (CI: 1.31-1.65) ($P = 0.002$). Also hazard ratio of infected by UTI in recipients (classification: patients with diabetes and patients with

glomerulonephritis) was 2.9 (CI: 1.36-4.8) ($P = 0.006$) and the hazard ratio of infected to UTI between female and male gender was 1.94 (CI: 1.72-2.1) ($P < 0.001$).

Discussion

The incidence rate of UTI was obtained 47% indicating one of the most common complications after transplant. The reported incidence rate in other studies was different in the range of 36% to 60% (1,7,10). In the study conducted by Golebiewska et al, the incidence rate of UTI was reported 52.9% (11). In several studies, there was a significant relationship between UTI after

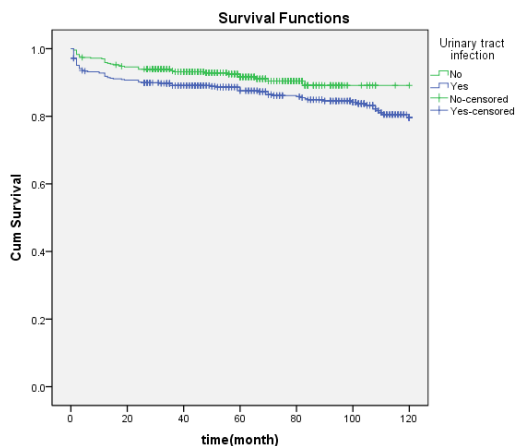


Figure 1. Comparison of the survival rate in patients with UTI following kidney transplant surgery.

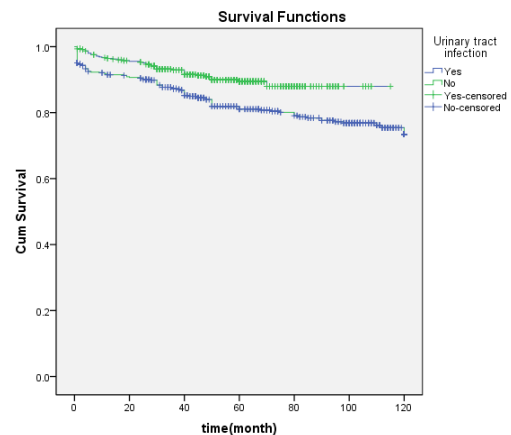


Figure 2. Comparison of the survival rate in patients with UTI following kidney transplant surgery.

Table 2. Cox regression analysis of factors independently associated with UTI after kidney transplant

Variables	Adjusted odds ratio for UTI in Cox regression	P
Recipient age (y)		
<40	--	0.002
>40	1.46 (1.31, 1.65)	
Recipient gender		
Male	--	0.001
Female	1.94 (1.72, 2.1)	
Cause of ESRD		
Chronic glomerulonephritis	--	
PKD	2.5 (2.1, 3.2)	0.001
Diabetes	2.9 (1.36, 4.8)	0.006
Nephropathy	3.1 (2.6, 4.5)	0.001
Renal stone	2.5 (1.54, 3.8)	0.004

ESRD: end-stage renal disease; PKD: polycystic kidney disease.

kidney transplant and graft survival rate (11-15) that these results were consistent with the results of our study. Therefore, in our study hazard ratio of rejection of graft in multivariate analysis in patients who had UTI was more than 1. However, in the study of Fiorante et al (7) and Ariza-Heredia et al (16), they reported UTI as a factor affecting the graft survival rate. The incidence of UTI was common after kidney transplant in patients that had a positive urine culture before transplant. There was a significant relationship between UTI and graft survival rate that indicated the need of exact examination in patients regarding UTI before kidney transplant and also the need of follow-up after kidney transplant. In general, some variables such as low-dose medication, increasing the mobility of patients after surgery and removal of the catheter can be effective in reducing the severity of UTI after kidney transplant. In multivariate analysis, UTI was not known as an effective factor on the survival rate of patients that was consistent with the study of Rizvi et al (17) and Kosmadaki et al (18). In other studies UTI has been reported as a factor affecting the survival rate of patients (14,15) and female gender was a strong risk factor in developing UTI that our results confirmed it (19-21). In this study, the hazard ratio of UTI in patients who their cause of ESRD were diabetes, was highly similar to other studies (15,22), which indicated the need of special care and tests related to UTI after kidney transplant. There was a significant relationship between gender of recipients ($P=0.02$) and age of recipients ($P<0.001$) with status of patients regarding UTI, which was consistent with the studies conducted by Camargo et al (23) and Golebiewska et al (11). While in the study of Silva et al (22), no significant relationship between age and gender of recipients with UTI was detected. Additionally, in the study of Abbott et al (15), there was a significant relationship between type of donor and status of UTI ($P<0.001$). However, in our study, there was no significant relationship between types of dialysis, dialysis duration before surgery, CMV infection and BMI recipients with UTI. Additionally, the

results of other studies (7,11,23) were consistent with our results.

Conclusion

The results showed that UTI infection after kidney transplantation is one of the most common problems that its incidence rate was 47%. In this study gender (female) and age of recipients were risk factors for UTI infection after kidney transplant. There was a significant difference between infected and non-infected patients regarding survival rate. This finding indicated the importance of follow-up and treatment of patients with an infection after kidney transplant.

Limitations of the study

The main limitation of the present study was lack of availability to patients' data due to low registry.

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Authors' contribution

SS; study design and manuscript drafting. MGG; study design, data collection and statistical analysis. KM; study design and manuscript reviewing. HRK; statistical analysis. ATA and MMF contributed to the development of the study.

Conflicts of interest

The authors declare no conflict of interest.

Ethical considerations

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

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