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Original Article

Evaluation of the relationship between perioperative urine culture and postoperative urinary tract infections in renal transplant patients

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Abstract

Aim: The aim of the study was to determine the prevalence and risk factors of bacterial urinary tract infection (UTI) in patients undergoing renal transplantation and to evaluate the possible bacterial agents that colonize the bladder in patients with or without micturition beforehand.

Material and Methods: A total of 89 renal transplant patients were included in the study. Demographic characteristics of the patients such as age and gender, as well as the presence of micturition before transplantation, clinical findings, urine culture, and agents that showed growth were all retrospectively analyzed and the relevant data were recorded.

Results: Of the total 89 patients, 17 (19.10%) developed a urinary tract infection within 12 months after transplantation. Eight of these patients required hospitalization for treatment, while four had at least two infection episodes. Escherichia coli and Klebsiella pneumonia were the two most common causative agents. A comparison of the groups with and without UTI revealed that micturition before transplantation was not a factor that affected the development of UTI ($p > 0.05$).

Conclusion: Because UTI represents a severe problem for renal transplant patients, it must be evaluated in all patients. No correlation was found between preoperative micturition and postoperative UTI.

Keywords: Renal transplantation; urinary tract; infections; urination; hospitalization.

INTRODUCTION

Renal transplantation is known to be the most effective treatment for end-stage renal disease. However, urinary tract infections (UTIs) observed in these patients continue to be a significant cause of morbidity and mortality (1,2). The incidence of infection after transplantation increases depending on the donor and recipient characteristics, surgical techniques, and immunosuppressive therapies. For this reason, a variety of infections are observed in approximately 75% of patients undergoing renal transplantation, especially in the first year after transplantation (3,4). These infections may cause acute cellular rejection, impaired allograft function, and graft loss. Renal transplantation-associated recurrent UTI and sepsis are the causes of morbidity and mortality (5). Studies have shown that the most commonly observed infections are bacterial UTIs and that the rate of infection is higher in patients without micturition (6-8).

For patients undergoing renal transplantation, it is necessary to determine the possible risk factors for UTI and to treat these patients more effectively. Doing so will make it possible to increase the postoperative quality of life, to prolong the graft life, and to use community resources more effectively. This study aimed to determine

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the prevalence of bacterial UTIs in patients undergoing renal transplantation in our clinic to evaluate the risk factors for infection development and to identify the possible bacterial agents that colonize the bladder in patients without micturition beforehand.

MATERIAL and METHODS

The study was conducted between June 2017 and January 2019. The prospectively collected data were evaluated retrospectively. The patients in our study were divided into two groups. The first group comprised the patients with micturition (urine output more than 400 ml per a day) before transplantation; the second group comprised those without micturition (complete anuria or urine output less than 400 ml per a day) before transplantation. Patients with micturition (Group 1) underwent a complete urinalysis, and urine culture was performed under sterile conditions before transplantation. In patients without micturition (Group 2), a Foley catheter was inserted under sterile conditions before transplantation, after which the bladder was inflated with 200 cc saline and samples were taken for a complete urinalysis and urine culture. Patients were clinically monitored for UTI in the post-transplant period. In the postoperative period, complete urinalysis, and urine culture were obtained from the patients, and the patients were evaluated for fever, dysuria, frequent urination, abdominal pain, among others. Cases that showed positive culture results and those requiring hospitalization due to UTI were evaluated along with the causative agents of UTI.

All renal transplant patients over 18 years of age were included in the study. Patients who could not be followed up for any reason after transplantation and patients with deceased kidney transplantation were excluded from the study.

All procedures performed in studies involving human participants were following the Helsinki declaration and its later amendments or comparable ethical standards.

The Number Cruncher Statistical System 2007 (Kaysville, Utah, USA) software was used for statistical analysis. Descriptive statistical methods (mean, standard deviation, median, first quartile, third quartile, frequency, percentage, minimum, maximum) were used to evaluate the study data. Shapiro–Wilk test and graphical analysis were used to check the normal distribution of quantitative data. Kruskal–Wallis test was used for the comparisons between more than two groups of quantitative variables that were not normally distributed. Pearson's chi-square test and Fisher–Freeman–Halton exact test were used in comparing the qualitative data. A value of $p < 0.05$ was considered as statistically significant.

RESULTS

Of the total number of cases, 30.33% (n = 27) were female, and 69.67% (n = 62) were male, while the mean age was 44.90 ± 12.53 years. Eight cases were complete anuria and preoperative urine sample was not obtained, one case showed positive preoperative culture result, and 80 cases showed negative preoperative culture results. Two cases showed positive perioperative culture results, while 87 cases showed negative perioperative culture results. Postoperative culture results of 17 cases were positive, while those of 72 cases were negative (Table 1). There was no significant difference between the groups in terms of age ($p > 0.05$), gender ($p > 0.05$), and preoperative culture results ($p < 0.001$). There was no significant difference between the two groups in terms of perioperative and postoperative culture results and hospitalization rates (Table 2) ($p > 0.05$). Eight cases with positive culture results were hospitalized and treated. According to the culture results, Escherichia coli (n: 9) and Klebsiella pneumonia (n: 6) were the top two microorganisms that showed the most growth. Enterobacter cloacae, Pseudomonas aeruginosa, and Proteus mirabilis each showed growth in one culture (Table 3).

Table 1.General distribution of variables

Age (year)	Min-Max	14-67
	Mean±SD	44.90 ± 12.53
Gender; n(%)	Female	27 (30.34)
	Male	62 (69.66)
Urine output; n(%)	Unavailable	33 (37.08)
	Available	56 (62.92)
Preoperative culture; n(%)	Unavailable	8 (8.99)
	Positive	1 (1)
	Negative	80 (89.89)
Peroperative culture; n(%)	Positive	2 (2.25)
	Negative	87 (97.75)
Postoperative culture; n(%)	Positive	17 (19.10)
	Negative	72 (80.90)
Re-hospitalization due to UTI; n(%)		8 (8.3)

UTI: Uriner Tract Infection

Table 2. Comparisons between groups

		Group 1 (n=56)	Group 2 (n=33)	p
Age; medyan(Q1,Q3)		46 (34. 55)	44 (37. 57)	[a]0.783
Gender; n(%)	Female	20 (35.7)	7 (21.2)	[b]0.384
	Male	36 (64.3)	26 (78.8)	
Preoperative culture; n(%)	Unavailable	0 (0)	8 (24.2)	[b]<0.001**
	Positive	1 (1.8)	0 (0)	
	Negative	55 (98.2)	25 (75.8)	
Peroperative culture; n(%)	Positive	2 (3.6)	0 (0)	[b]0.595
	Negative	54 (96.4)	33 (100)	
Postperative culture; n(%)	Positive	12 (21.4)	5 (15.2)	[c]0.728
	Negative	44 (78.6)	28 (84.8)	
Re-hospitalization due to UTI; n(%)	Positive	5 (8.3)	3 (9.1)	>0.05
	Negative	51 (91.7)	30 (90.9)	

[a]Kruskal-Wallis test , [b]Fisher-Freeman-Halton exact test, [c]Pearson ki-kare test, *(p > 0.05), **p<0.01
Q1: First quartile, Q3: Third quartile, UTI: Uriner Tract Infection

Table 3. According to the results of culture, the most reproducing microorganisms

Culture results	n	%
Escherichia coli	9	50
Klebsiella pneumoniae	6	33.33
Pseudomonas aeruginosa	1	5.55
Proteus mirabilis	1	5.55
Enterobacter cloacae	1	5.55

DISCUSSION

Renal transplantation is the best treatment modality for end-stage renal disease worldwide. Despite kidney transplantation improving the patient's quality of life and reducing the risk of mortality compared with dialysis, it is known that the patients' immune resistance to various diseases (infections, cardiovascular diseases, and various organ cancers) decreases due to the immunosuppressive drugs that they are prescribed (9).

Infections are a significant cause of mortality after kidney transplantation (10). Patients undergoing kidney transplantation are susceptible to both common and opportunistic infections. UTIs are among the most commonly observed bacterial infections in kidney transplant recipients (11). Post-transplant UTI is associated with acute cellular rejection, impaired graft function, and graft loss. Thus, the follow-up of patients after kidney transplantation and the early diagnosis and treatment of UTIs become even more critical.

The risk of infection varies depending on various factors (12). UTIs occur in 25% of recipients in the first year after transplantation and account for 45% of all infectious complications (13). In our study, the incidence of post-transplant UTI in the first year was 18.8%, while the rate of UTI cases requiring hospitalization was 8.3%. Although this rate appears to be lower than that reported in the literature, three patients were hospitalized and treated at least twice because of recurrent resistant UTI.

Uropathogenic bacteria that move from the urinary tract to the bladder are mainly responsible for the pathogenesis of post-transplant UTI (14). Virulence of bacteria and immunosuppressive drugs also facilitate the emergence of this situation. Also, the absence of a natural sphincter in ureteroneocystostomy and the ureteral stents that are used in such procedures may contribute to this condition. However, in some cases, the infection can also be caused by the abnormal blood flow in the kidney and surgical site infections (15).

Gram-negative bacteria mainly cause Post-transplant UTI, and the predominant microorganism is E. coli in approximately 70% of cases (11,16,17). Other common gram-negative pathogens include P. aeruginosa, Enterobacter, and Klebsiella species. Fungi and viruses may also cause UTI, although they are less commonly observed than bacteria. In a study by Parasuraman R et al., the isolated post-transplant UTI agents were listed as E. coli (59.1%), Klebsiella spp (16.9%), Enterococcus spp (6.5%), Enterobacter spp (6.5%), P. aeruginosa (4.0%), Proteus spp (4.0%), Citrobacter spp (0.8%), Acinetobacter baumannii (0.8%), Staphylococcus spp (1.6%), and Serratia marcescens (0.8%) (18,19). In our study, E. coli was the most common agent observed in 50% of the cases, followed by K. pneumonia in 33.3% of the cases. To a lesser extent, P. aeruginosa, P. mirabilis, and E. cloacae were other microorganisms that showed growth. In one patient with resistant UTI who required recurrent hospitalization, both A. baumannii and P. mirabilis growth were observed.

In our study, no difference was found between the groups in terms of age and gender (p > 0.05 for both).

There was also no significant difference between the groups in terms of preoperative, perioperative, and postoperative culture results ($p < 0.001$). In the study conducted by Abbott et al., no difference was found between the genders in UTI cases that developed within six months after transplantation (20). Various studies have reported that the rate of UTI is higher in kidneys obtained from deceased donors (21,22). Urine culture and complete urinalysis are tests that can be safely used in the diagnosis of symptomatic UTI (21). However, there are ongoing discussions about the cost-effectiveness of routine culture examination. Nevertheless, urine culture is recommended within the first few months in patients undergoing renal transplantation because of their hypersensitivity to UTI and along with an antibiogram that can help surgeons to provide the most appropriate treatment. In our study, we found no clear benefit of performing routine urine culture examination during surgery.

CONCLUSION

Renal transplantation is the most successful method for the treatment of end-stage renal failure. However, post-transplant UTI continues to be a significant problem in these patients. In our case series, the prevalence of UTI was 18.8% in patients who underwent renal transplantation, and it was found that preoperative micturition and perioperative routine urine culture showed no effect on postoperative UTI.

Competing interests: The authors declare that they have no competing interest.

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