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Pattern of urinary tract and surgical site infection in allograft renal recipient during early postoperative period

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Article Info

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Received : 25 December 2021
Accepted : 10 March 2022
Available Online : 15 May 2022

ISSN: 2224-7750 (Online)
2074-2908 (Print)

DOI: https://doi.org/10.3329/bsmmuj.v15i2.60868

Keywords: Renal allograft recipient, Urinary tract infection (UTI), surgical site infection (SSI)

Cite this article:
Saha BK, Rahman MH, Hossain TMS, Hossain F, Ghosh KC. Pattern of urinary tract and surgical site infection in allograft renal recipient during early postoperative period Bangabandhu Sheikh Mujib Med Univ J. 2022; 15(2): 127-131.

Available at:
www.banglajol.info

A Journal of Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

Abstract

A kidney transplant (KT) offers a significant survival benefit and is the only curative treatment for patients with ESRD. Infectious complications are still a leading cause of morbidity and death among transplant patients. This study aimed to assess the organisms and risk factors responsible for urinary tract and surgical site infection in allograft live-related renal transplant recipients during the early post-transplant period. This observational follow-up study was conducted among 20 purposively selected patients who underwent renal allograft transplant surgery from July 2019 to December 2020 in the Department of Urology, BSMMU, Dhaka. Patients with a history of renal transplant recipients or congenital renal anomalies and any urological malignancy were excluded from the study. After kidney transplant, UTI developed in 6 (30%) renal transplant recipients where all were complicated types and occurred between 10 to 14 days postoperatively. UTI was caused by E. coli in 3 (15%) patients, while Klebsiella and Enterococci were causative organisms for 1 (5%) and 2 (10.0%) patients, respectively. SSI developed in 3 (15%) renal transplant recipients where two were superficial, and one was deep. SSI occurred between 5-8 days postoperatively. SSI was caused by S. aureus in 2 (10%) patients and Pseudomonas in 1 (5%) patient. UTI was significantly more in older patients and the patients with a longer duration of catheterization. Older patients and overweight patients had significantly higher rates of SSI. In total, 33% of the recipient during the early hospital stay developed UTIs, all of which were complicated types. SSI developed in 15%, where 2/3rd was superficial and 1/3rd was deep. Older age with a longer duration of catheterization and DJ stent was found to be associated with the occurrence of UTI, while older age and high BMI were related to the event of SSI.

Introduction

Renal transplant is the most frequent solid organ transplantation.[1] Currently, around 100,000 solid organ transplantations are performed yearly worldwide, where 68,250 kidneys have been transplanted (68.2%).[2] Due to chronic medical conditions, the surgical process and immunosuppressive medication after transplantation, patients with kidney transplants (KT) are at an increased risk of infection.[3]

Some nosocomial infectious conditions are encountered in renal transplant recipients during a postoperative hospital stay. Among these, urinary tract infection (UTI) and various patterns of surgical site infection (SSI) are the most common.[4]

The global prevalence of post kidney transplant (KT) UTI varies between 6% to 86%, and SSI, considered a clean-contaminated surgery, varies between 0% to 11% and 2% to 7.5% with or without antibiotic prophylaxis, respectively.[5-7] The UTI may be uncomplicated or complicated, and the SSI may be superficial or deep.

Despite advances in surgical techniques, antimicrobial prophylaxis, new immunosuppressive therapy schemes, and hygiene measures in the management of organ transplant patients, infectious complications continue to be a major cause of morbidity and mortality in solid organ transplant (SOT) patients.[8] The most common pathogens isolated in urine culture were Escherichia, Enterococcus, Staphylococcus, and Klebsiella.[4] Female sex, age, changes in the morphology of the urinary system, initial kidney illness, surgical manipulation during transplantation, as well as the amount, severity, and duration of immunosuppression were all linked to the development of UTI.[9]

Urinary tract infection may result in prolonged inflammation and potential renal scarring,[10] leading to impaired renal function. Several studies have evaluated the clinical association in transplant patients, providing divergent findings. Some report a significant association between UTI and reduced creatinine clearance[11] or lower graft function[12], and others describe no significant effect on long-term graft function. Surgical site infections represent an important cause of morbidity in these patients. Ultimately it may cause increased antibiotic use, health care cost, and prolonged hospital stay.[3] Risk factors associated with post-transplantation SSI in KT recipients include high body mass index (BMI), diabetes mellitus (DM), acute cellular rejection, reoperation, delayed graft function (DGF), sirolimus use, deceased donor, female recipient, recipient age, prolonged cold ischemia time, and urinary fistula.[1,14] The main agents isolated from SSIs are Staphylococcus aureus, coagulase-negative staphylococci, Enterococcus species, Enterobacteriaceae, and Pseudomonas aeruginosa.[15]

There is a wide difference in how frequently UTI & SSI occur after renal transplantation. Takai et al [16] reported that 26% of 363 renal transplant patients followed over a mean period of 4 years developed at least one UTI. However, some studies disagree on the risk factors associated with developing post-transplant UTIs and SSIs, while the significance of UTIs in renal transplant recipients is also debated.[4]

To the best of our knowledge, no such study has been carried out at BSMMU, and there is no specific way to reduce the incidence of UTI & SSI in post-transplant allograft live-related transplant recipients. The present study was designed to determine the pattern of UTIs and SSIs in renal transplant recipient patients during the early postoperative period.

Methods

This observational follow-up study was conducted among 20 purposively selected patients who underwent renal allograft transplant surgery from July 2019 to December 2020 at the Department of Urology of Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka to assess the organisms and risk factors responsible for urinary tract and surgical site infection in allograft live-related renal transplant recipients during the early post-transplant period. Patients with a history of previous allograft live-related renal transplant recipients or congenital renal anomalies and any urological malignancy were excluded from this study.

Routine and regular follow-up was ensured. Drain tube collection and urine output were measured routinely and noted. The intake-output chart was maintained strictly, and the urine color was also checked routinely. As all patients were immune-compromised and catheterized, symptoms of UTI may be less remarkable or absent. So, the diagnosis of UTI, mainly depends on laboratory investigations, like urine routine microscopy examination and culture sensitivity of all the patients in the concerned department of BSMMU. A urine sample was collected invariably from all recipients after two days of catheter removal between the 8th to 12th postoperative days for culture & sensitivity test. Patients with UTI were treated with adequate hydration, proper drainage of the bladder, and specific antibiotics.

During the follow-up period, the condition of the wound was observed daily. Some patients developed some SSI (e.g. superficial incisional, deep incisional, and organ space infection) between the 5th to 8th post-operative day, which were diagnosed by a history-soaked bandage, fever with chills, pain, swelling and purulent discharge from the wound; physical examination- temperature, tenderness, red inflamed the surgical site and relevant investigations like CBC, C-RP and wound swab done in concerned Department of BSMMU. Afterward, the results of this investigation were recorded in the data collection sheet. Treatment of superficial surgical site infection involved opening the incision, exploring the space, drainage, irrigation, and wound debridement with subsequent regular wound care. Deep surgical site infection was managed by returning to the operation theatre for exploration, washout, drainage and debridement followed by secondary closer and intravenous antibiotics according to culture & sensitivity test. The drain was removed within 7 to 10 days, the urethral catheter was removed between 6 to 10th postoperative day, and skin stitches were removed on 10 to 12th postoperative day except in those where post-operative complications like SSI were developed during hospitalization. Post-operative hospital stay was recorded for each patient and on average it was 4 to 6 weeks. Immunosuppressive therapy was initiated before transplantation and continued as maintenance therapy with calcineurin inhibitors (tacrolimus), mycophenolate mofetil, and corticosteroids in all the cases. CBC, C-RP serum creatinine, serum electrolytes, and blood urea were done routinely. X-ray of KUB was done on 4th week to see the position of the DJ stent before removal at 6th week. With aseptic precautions under local anesthesia, the stent was removed after giving one dose of intravenous prophylactic antibiotic as an out-patient department case by rigid cystoscopy, and the tip of the stent was sent for C/S to the department of microbiology of BSMMU.

Ethical clearance was taken from the Institutional Review Board of BSMMU. Informed written consent was taken from all the patients after an adequate explanation of the purpose of the study. They were assured of the protection of their autonomy, privacy, and confidentiality.

Results

Age distribution of the patients shows that 14 (70.0%) patients were from the 26-35 years age group, and 4 (20.0%) patients were from the >35 years age group. The patients' mean (sd) age was 31.9 (7.6) years, ranging from 25-55 years. Among the

patients, 16 (80.0%) were male and 4 (20.0%) were female. Out of 20 patients, 14 (70.0%) had normal body weight and 6 (30.0%) had overweight (Table - I).

Table--I

Distribution of patients by baseline characteristics (n=20)

Baseline characteristics	Frequency	Percentage
Age (in years)		
Up to 25	2	10.0
26-35	14	70.0
>35	4	20.0
Mean ±SD	31.9 ±7.6	
Sex		
Male	16	80.0
Female	4	20.0
Body Mass Index		
Normal	14	70.0
Overweight	6	30.0

SD=Standard Deviation

Nine (45%) patients had catheterization for >7 days, while the mean (sd) duration of catheterization was 7.7 (1.5) days. Again, 14 (70%) patients had DJ stent in situ for ≤ 5 weeks, while the mean (sd) duration of catheterization was 4.9(0.8) days. Moreover, 14 (70.0%) had a hospital stay for ≤ 5 weeks, while the mean (sd) duration of hospital stay was 5.0 (0.7) weeks (Table - II).

Table-II

Distribution of patients by duration of catheterization, DJ stent in situ, and hospital stay (n=20)

Duration	Frequency	Percentage
Catheterization (in days)		
≤ 7	11	55.0
> 7	9	45.0
Mean ±SD (range)	7.7±1.5 (6.0-10.0)	
DJ stent in situ (in weeks)		
≤ 5	14	70.0
> 5	6	30.0
Mean ±SD (range)	4.9±0.8 (4.0-6.0)	
Hospital stay (in weeks)		
≤ 5	14	70.0
> 5	6	30.0
Mean ±SD (range)	5.0± 0.7 (4.0-6.0)	

Footnote: SD=Standard Deviation

After kidney transplant, urinary tract infection (UTI) developed in 6 (30.0%) allograft renal recipients during the early postoperative period, while 14 (70.0%) patients had no UTI. Again, Surgical Site Infection (SSI) developed in 3 (15.0%) renal allograft recipients during the early postoperative period, while 17 (85.0%) patients had no SSI (Figure-1).

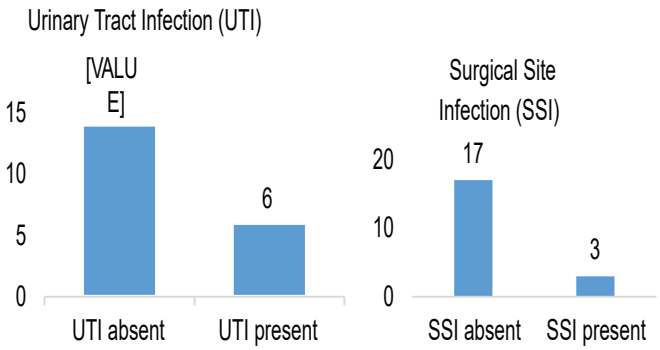

Figure -I: Frequency of patients by Urinary Tract Infection

Discussion

The mean age of the patients was 31.9 ±7.6 years and majority of the patients were from the 26-35 years age group. Tekkarışmaz et al[17] identified possible donor/recipient-based risk factors and found the mean age of patients was 35.2 ±12.4 years, similar to the present study. Sorto et al[18] identified the risk factors associated with its development and found the mean age of patients was 37 ±12 years. Among the 20 patients, majority were male which was inconsistent with other studies.6, 15, 17, 18 Out of 20 patients, 14 (70%) had normal body weight and 6 (30%) had overweight. Harris et al[7] observed that 42% of renal transplant patients were obese.

After kidney transplants, urinary tract infections developed in 30% of renal allograft recipients during the early postoperative period. Uncomplicated UTI occurs in otherwise healthy patients with structurally & functionally normal genitourinary tract. As all patients in this study had anatomically & functionally alternation of the genitourinary tract and were in an immune-compromised state, these UTI were complicated. Among Turkish kidney recipients, the rate of UTI was reported at 37.9% during the first year after transplant.[17] A study conducted in Bhutan reported the incidence of UTI as 10.3%[3], while a study conducted in the United States of America reported the incidence of UTI in KT recipients as 14.5%.[19] Another study in the United States of America found that 43% of patients developed one or more post-transplant UTIs over a mean follow-up period of 42 months.[4] A study performed in Mexico reported a 35.8% incidence of UTI[18], while a study done in Brazil found that 44.8% of renal transplant patients had UTI.[1]

All the patients who had UTI had catheterization> 7 days. It is

indicated that the long duration of catheterization increased the rate of UTI. Sorto et al[18] demonstrated that days of bladder catheterization were an independent risk factor for UTI development. Dantas et al[1] and Rabkin et al[20] also identified risk factors for UTI as the duration of the urinary bladder catheterization.

After kidney transplants, surgical site infection (SSI) developed in 15.0% of renal allograft recipients during the early postoperative period. Among these SSI patients, 66.7% had superficial and 33.3% had deep SSI. Among the three patients, two had Diabetes mellitus. The retrospective cohort study of Harris et al[7] reported that 15% of renal transplantation patients developed SSI where 47% were superficial-incisional and 53% were deep-incisional SSI. Wszola et al[15] assessed the incidence of SSI in patients after kidney transplant and identified risk factors for SSI where SSIs were diagnosed in 7.3% of patients. The prospective cohort study of Dantas et al[1] diagnosed SSI in 15.1% of kidney recipients.

Surgical site infection (SSI) occurred between 5 to 8th days postoperatively, whereas the meantime of occurrence of SSI was 6.7± 1.5 days. The only deep SSI occurred at the 8th POD. A Brazilian study of Freire et al[21] observed the median time from transplantation to infection was 20 days.

For maintenance therapy, most patients received one of the following three regimens: (a) a calcineurin inhibitor (cyclosporine or tacrolimus) + Mycophenolate Mofetil (MMF) + corticosteroids; (b) a calcineurin inhibitor + sirolimus + corticosteroids; and (c) sirolimus + MMF + corticosteroids. Using sirolimus as maintenance therapy in kidney recipients is associated with a higher risk of surgical site infection. So, the most frequently used maintenance regimen is calcineurin inhibitor + MMF + corticosteroids.[22] All the patients in the present study were under a calcineurin inhibitor (cyclosporine or tacrolimus) +MMF+ corticosteroids regimen. As all patients were on the same regimen, the role of immunosuppressive drugs in developing UTI and SSI was not considered for discussion.

Conclusion

As many as 33% of the renal allograft recipient during the early hospital stay developed urinary tract infections, all of which were complicated types. Surgical site infection developed in 15% of patients where two-thirds were superficial and one-third was deep. Older age and delayed removal of the catheter and DJ stent were found to be associated with the occurrence of urinary tract infection, while older age, DM, and high body mass index were related to the event of surgical site infection. Early removal of the urethral catheter and DJ stent is recommended to reduce the risk of urinary tract infections

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