BANTAO Journal 2026; 24(1): 38-41

BJ
BANTAO Journal

Original article

Post-Transplant Infectious Complications Within a Five-Year Period: A Single-Center Experience

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Abstract

Introduction. Kidney transplant recipients (KTRs) are particularly vulnerable to post-transplant infectious complications. Immunosuppressive (IS) therapy prevents allograft rejection but also increases susceptibility to infections. Although infection rates have declined over recent decades, infections remain an important cause of mortality after kidney transplantation (KT), only after the cardiovascular disease. Infectious episodes may impair renal allograft function and contribute to chronic graft injury, potentially leading to graft failure and a return to renal replacement therapy (RRT). This study aimed to describe infections among KTRs followed at our center.

Methods. This retrospective observational study was conducted at the Department of Nephrology and Renal Replacement Therapy, Clinical Center, University of Sarajevo, between 2020 and 2025. Electronic health records were reviewed for 100 KTRs attending regular follow-up visits. All patients received induction therapy with anti-thymocyte globulin (ATG) or basiliximab, followed by triple maintenance IS therapy consisting of corticosteroids, mycophenolic acid, and a calcineurin inhibitor (CNI; tacrolimus or cyclosporine A).

Results. The mean patient age was 47.42±12.56 years, and 73% were male. Post-transplant complications were reported in 61.8% of patients, and 85% of these complications were described as infectious. Urinary tract infections (UTIs) were reported in 31% of patients with *Escherichia coli* as leading identified pathogen (11%). No statistically significant associations were observed between infectious complications and hypertension, diabetes mellitus, or anemia. The frequency of infectious complications did not differ significantly between living- and deceased-donor transplant recipients. Patients receiving tacrolimus had a higher reported risk of infectious complications compared to those receiving cyclosporine (relative risk [RR] 14.286, 95% confidence interval [CI] 1.41-178.8; p=0.01). Delayed graft function (DGF) was associated with overall complications (p=0.026), but not with infectious complications when analyzed separately. The duration of pre-transplant RRT (p=0.005) and lower estimated glomerular filtration rate (eGFR; p=0.018) were associated with overall complications that was not observed for infectious complications alone. Infectious complications were documented in all five patients who died during follow-up.

Conclusion. Our study concluded that infectious complications are frequently reported among KTRs, with UTIs representing the most commonly described infection. Individualized IS management and regular monitoring may support early detection and treatment and help improve patient and allograft outcomes.

Keywords: kidney transplantation, Infectious complications, Urinary tract infection

Introduction

Kidney transplant recipients (KTRs) are particularly vulnerable to infectious complications because the immunosuppressive (IS) therapy, while essential for preventing allograft rejection, increases susceptibility to a broad range of infections. Despite improvements in prevention and management, infections remain an important cause of mortality after kidney transplantation (KT), only after the cardiovascular disease. Previous infectious episodes may impair allograft function and contribute to chronic graft injury, potentially leading to graft failure and the need to resume renal replacement therapy (RRT) [1]. Treating infections in transplant recipients can be challenging because some antimicrobial agents are nephrotoxic, and interactions with IS drugs may increase treatment-related toxicity. When planning living-donor KT, particular attention should be also paid to latent infections that may reactivate during IS. Hence, an appropriate donor and recipient screening, together with preventive measures, may reduce the risk of post-transplant infectious complications [2-4].

Material and methods

This retrospective observational study was conducted at the Department of Nephrology and Renal Replace–ment Therapy, University Clinical Center of Sarajevo. The study included 100 KTRs who attended regular follow-up visits between December 2020 and December 2025, including recipients transplanted before the start of the study period. Data, including pre-transplant hyper–tension (HTA), diabetes mellitus (DM), and hemo–globin (Hb) levels, were obtained from electronic health records. Anemia was defined as an Hb level below 110 g/L. All patients received induction therapy with anti-thymocyte globulin (ATG) or basiliximab, followed by triple maintenance IS therapy consisting of corticosteroids, mycophenolic acid, and a calci–neurin inhibitor (CNI; tacrolimus or cyclosporine A). The primary aim was to describe post-transplant infectious complications at our center and assess their associations with selected risk factors and allograft function. Collected variables included the underlying kidney disease, type and duration of pre-transplant RRT, HTA, DM, and anemia, CNI use, donor type (living or deceased), delayed graft function (DGF), post-transplant complications, including infections, mortality, and renal allograft function. Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS), version 26. Continuous variables were expressed as mean ± standard deviation (SD) and compared using Student's t-test or the Mann–Whitney U test, as appropriate. Categorical variables were compared using the chi-square or Fisher's exact test. A p-value below 0.05 was considered statistically significant.

Results

The mean patient age was 47.42±12.56 years with 73% being males. The cause of end-stage renal disease (ESRD) was unknown in the largest group of patients (Figure 1). Post-transplant complications were identified in 61.8% of patients, and 85% of these complications were reported as infectious. Urinary tract infections (UTIs) were documented in 31% of patients. *Escherichia coli* was the most frequently isolated pathogen (11%), follo–wed by *Klebsiella pneumoniae* (9%) and *Enterobacter cloacae* (4%). Other infectious complications, including cytomegalovirus (CMV) viremia, BK polyomavirus (BK) viremia, and coronavirus disease 2019 (COVID-19), were also documented (Figure 2). No statistically significant association was found between infectious complications and the assessed pre-transplant risk fac–tors, including HTA, DM, and anemia. The occurrence of infectious complications did not differ significantly between living- and deceased-donor transplant recipients. Among patients with infectious complications, 84.3% had received hemodialysis (HD) before KT, 5.9% un–derwent preemptive transplantation, and the remaining patients had received peritoneal dialysis. Patients re–ceiving tacrolimus had a higher reported risk of in–fectious complications compared to those receiving cyclosporine (relative risk [RR] 14.286, 95% confidence interval [CI] 1.41-178.87; p=0.01). DGF was associated with a higher frequency of overall post-transplant com–plications (p=0.026); however, this association was not observed when infectious complications were analyzed separately. Overall post-transplant complications were associated with the duration of pre-transplant RRT (p

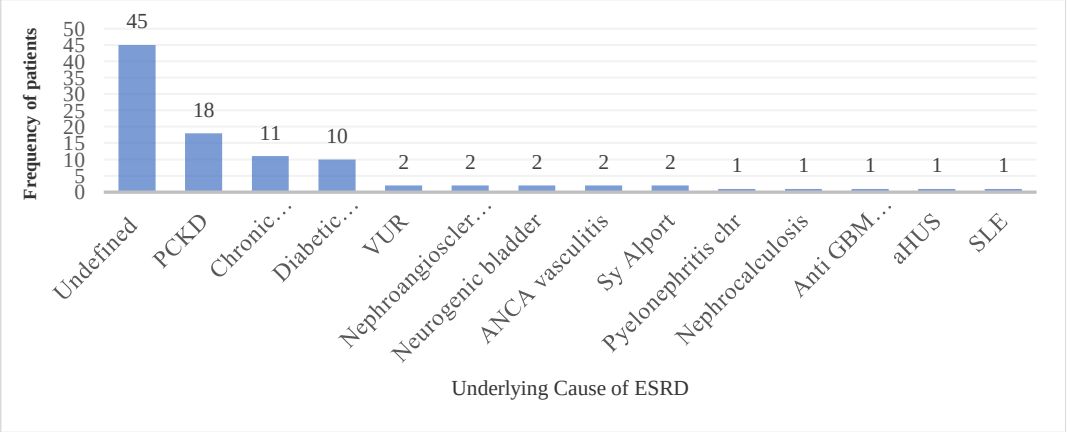


Fig. 1. Underlying causes of end-stage kidney disease in the study population.
Note: Values indicate the number of patients in each category. Abbreviations: ESRD, end-stage renal disease; PCKD, polycystic kidney disease; VUR, vesicoureteral reflux; ANCA, antineutrophil cytoplasmic antibodies; anti-GBM, anti-glomerular basement membrane antibodies; aHUS, atypical hemolytic uremic syndrome; SLE, systemic lupus erythematosus; Sy, syndrome; chr, chronic.

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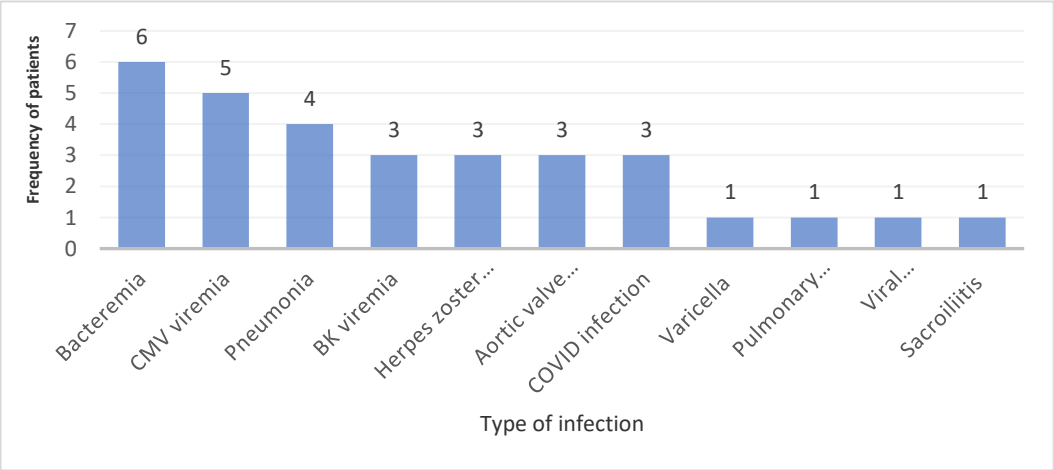


Fig. 2. Distribution of infectious complications other than urinary tract infections.
Note: Values indicate the number of patients with each reported infection. Abbreviations: CMV, cytomegalovirus, BK, BK polyomavirus, COVID, coronavirus disease 2019 (COVID-19).

=0.005) and a decrease in estimated glomerular filtration rate (eGFR) after complications (p=0.018). Neither association was statistically significant when infectious complications were analyzed separately. No significant association was found between time since KT and overall post-transplant complications. Five patients who died during the follow-up period, had experienced infectious complications. No statistically significant association was observed between mortality and overall post-transplant complications. In all five patients, infectious complications occurred within the first six months after KT. Two of these patients experienced both surgical and infectious complications: one presented with renal artery stenosis and a pulmonary infection, while the other had an urinoma and a UTI.

Discussion

In this retrospective single-center study, infectious constituted a high proportion of reported post-transplant complications (85%), with UTIs being the most frequently described type. This is consistent with previous retrospective studies in which UTIs were among the most common infections after KT [2]. Although all five patients who died in our study had experienced infectious complications, no statistically significant association with mortality was found. Alotaibi *et al.*, similarly reported no significant difference in mortality between patients with infections and controls [2]. Infections may impair allograft function through a direct tissue injury, inflammatory responses, acute or chronic rejection, antimicrobial nephrotoxicity, interactions affecting IS drug levels, and reactivation of latent viral infections. Severe systemic infections and sepsis may further compromise graft function through hemodynamic instability and acute kidney injury. In our study, previous infectious complications were not significantly associated with serum creatinine or eGFR when analyzed separately. An association with graft function was observed only when infectious, vascular, and surgical complications were combined. In contrast, Kaouiri *et al.*, (2025) reported persistent renal dysfunction after infection in 46% of patients and graft failure requiring a return to dialysis in 14.6% [5]. Differences in patient characteristics, infection type and severity, follow-up duration, IS regimens, and sample size may partly explain the discrepancy. This study was limited by its retrospective design, with potential selection bias, incomplete data, and residual confounding. The small sample size limited statistical power for analyses of allograft function, while the small number of deaths restricted the assessment of mortality. Further prospective multicenter studies are needed to confirm these findings and inform standardized infection-prevention strategies for KTRs.

Conclusion

Infectious complications represented a substantial proportion of post-transplant complications in this single-center cohort, with UTIs being the most frequently reported type. Individualized IS management, regular monitoring, early recognition of infection, and timely, appropriate antimicrobial treatment remain important components of post-transplant care. A multidisciplinary approach may help to improve patient and allograft outcomes.

Conflict of interest statement. None declared.

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