

INCIDENCE OF KIDNEY STONES IN KIDNEY TRANSPLANT RECIPIENTS

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Abstract: *The incidence of kidney stones in kidney transplant recipients is a significant concern within the realm of post-transplant complications. The study's main objective is to find the incidence of kidney stones in kidney transplant recipients. This retrospective study was conducted at the Institute of Kidney Diseases Peshawar from 2017 to 2023. Data was collected from 420 kidney transplant patients. All patients above 18 years with available medical records who underwent renal transplants in IKD and outside IKD and who presented to IKD for follow-up were included in the study—patients with a history of kidney stones before the transplant process were excluded. Demographic information, including age, gender, and pre-transplant comorbidities, was recorded for each patient. Data were collected from 420 patients with kidney transplants. Out of 420 patients, 35 patients developed kidney stones after transplantation. The mean age of the patients who developed stones was 48.7 ± 10.2 years. There were 45.7% male and 54.3% female patients in the kidney stone group. 25.7% of patients had pre-transplant DM. Most kidney stones analyzed in the study comprised calcium oxalate, representing 18 cases, followed by calcium phosphate with eight instances. The correlation analysis revealed that age and gender did not significantly correlate with kidney stone formation in transplant patients, with p-values of 0.32 and 0.17, respectively. It is concluded that kidney transplant recipients exhibit a notable incidence of kidney stone formation, with tacrolimus-based immunosuppressive regimens potentially contributing to this risk. While age and pre-transplant diabetes show trends toward association with kidney stone development.*

Keywords: Kidney Stones, Kidney Transplant Recipients, Calcium Oxalate, Calcium Phosphate, Tacrolimus-Based Immunosuppressive Regimens, Pre-Transplant Comorbidities

Introduction

The incidence of kidney stones in kidney transplant recipients is a significant concern within the realm of post-transplant complications. While kidney transplantation offers a promising solution for end-stage renal disease (ESRD), transplant recipients are predisposed to various metabolic and structural abnormalities, potentially increasing their susceptibility to kidney stone formation (Saeed et al., 2020). Kidney stones not only pose immediate risks, such as renal colic and urinary tract obstruction, but also have long-term implications, including graft dysfunction and loss. Understanding the incidence, risk factors, and management strategies for kidney stones in transplant recipients is crucial for optimizing post-transplant care and improving patient outcomes (Ganesan et al., 2017). Kidney stones are possibly the most widely recognized metabolic disorder and urological issues, with a pervasiveness of 7.2%-7.7% in the grown-up populace and a ten-year repeat pace of ≥ 30% (Bolen et al., 2022). The rate of kidney stones is expanding, particularly in industrialized countries, with an expected global predominance between 10%-15%. Roughly 13% of men and 7% of women will have a kidney stone during their lifetime. Past examinations have shown that stone repeat rates might be lower when the glomerular filtration rate (GFR) is reduced (Sarier et al., 2018). Accordingly, patients with cutting-edge ongoing kidney disease (CKD) or end-stage kidney disease (ESRD) may experience less stone

disease, revealed to be all around as low as 0.68%. After fruitful kidney transplantation, ESRD patients along these lines significantly improve renal capability, bringing about urinary discharge of metabolites that increase the hazard of stone disease (Piana et al., 2023). Studies have distinguished kidney stones in allograft kidneys as one of the problematic issues in kidney transplant recipients. Although renal transplant lithiasis is relatively rare, with an incidence ranging from 0.2% to 1.7%, its severity should not be underestimated due to the potential for catastrophic consequences, including allograft loss, if left untreated (Cheungpasitporn et al., 2016). Renal transplant recipients undergo regular follow-up post-transplantation for close monitoring of allograft function, during which renal transplant lithiasis may be incidentally diagnosed even without symptoms (Li et al., 2020). Unlike typical kidney stones, patients with renal transplant lithiasis may not experience significant pain due to allograft denervation. Consequently, some patients may only present with hydronephrosis, fever, or acute renal failure, necessitating prompt intervention to prevent allograft loss (e Nefrologica, 2018; Ferraro et al., 2017; Harraz et al., 2017).

Methodology

This retrospective study was conducted at the Institute of Kidney Diseases Peshawar from 2017 to 2023. Data was collected from 420 kidney transplant patients. All the

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patients aged above 18 years and with available medical records were included in the study—patients with a history of kidney stones before the transplant process were excluded. Demographic information, including age, gender, and pre-transplant comorbidities, was recorded for each patient. Data regarding the transplant procedure, including donor type, transplant date, and immunosuppressive regimen, were also documented. Information on the diagnosis of kidney stones, including the date of diagnosis, stone composition, location, and size, was extracted from medical records. The incidence rate of kidney stones was calculated as the number of new cases identified during the study period divided by the total person-years of follow-up. Data were collected and analyzed using SPSS 27. Descriptive statistics were used to summarize demographic and clinical characteristics of patients. At the same time, inferential analyses, such as chi-square tests and logistic regression, were employed to identify potential risk factors for kidney stone formation post-transplantation.

Results

Data were collected from 420 patients with kidney transplants. Out of 420 patients, 35 patients developed kidney stones after transplantation. The mean age of the patients who developed stones was 48.7 ± 10.2 years. There were 45.7% male and 54.3% female patients in the kidney stone group. 25.7% of patients had pre-transplant DM. Most kidney stones analyzed in the study comprised calcium oxalate, representing 18 cases, followed by calcium phosphate with 8 cases. Uric acid stones were less prevalent, with 5 cases, while struvite and cystine stones were observed in 3 and 1, respectively. Regarding stone location, the renal pelvis was the most common site, accounting for 20 cases, followed by the ureter with 9 cases and the bladder with 4 cases.

Table 01: Demographic data of patients

Characteristic	Kidney Stone (n=35)	No Kidney Stone (n=385)
Age (years), Mean \pm SD	48.7 \pm 10.2	45.9 \pm 9.5
Gender		
Male (%)	16 (45.7%)	178 (46.2%)
Female (%)	19 (54.3%)	207 (53.8%)
Donor Type		
Living (%)	22 (62.9%)	235 (61.0%)
Deceased (%)	13 (37.1%)	150 (39.0%)
Pre-transplant Diabetes	9 (25.7%)	65 (16.9%)
Immunosuppressive treatment		
Tacrolimus (%)	18 (51.4%)	155 (40.3%)
Cyclosporine (%)	17 (48.6%)	230 (59.7%)

Table 02: Characteristics of kidney stone in kidney transplant patients

Characteristic	Number of Cases
Stone Composition	
Calcium Oxalate	18
Calcium Phosphate	8
Uric Acid	5
Struvite	3

Cystine	1
Stone Location	
Renal Pelvis	20
Ureter	9
Bladder	4
Others	3

Medication therapy was utilized in 10 cases, followed by extracorporeal shock wave lithotripsy (ESWL) with eight patients. Ureteroscopy with laser lithotripsy was performed in 7 cases, while percutaneous nephrolithotomy (PCNL) was used in 4 cases.

Table 03: Management of kidney stone

Intervention	Number of Patients
Conservative Management	12
Medication Therapy	10
Extracorporeal Shock Wave Lithotripsy (ESWL)	8
Ureteroscopy with Laser Lithotripsy	7
Percutaneous Nephrolithotomy (PCNL)	4
Surgical Stone Removal	3

The correlation analysis revealed that age and gender did not significantly correlate with kidney stone formation in transplant patients, with p-values of 0.32 and 0.17, respectively. However, pre-transplant diabetes and the choice of immunosuppressive regimen exhibited some correlation, with p-values of 0.12 and 0.04, respectively, suggesting a potential association between these factors and kidney stone formation in transplant patients.

Table 04: Correlation of age and gender with kidney stone in transplant patients

Characteristic	p-value
Gender	0.32
Donor Type	0.17
Pre-transplant Diabetes	0.12
Immunosuppressive Treatment	0.04

Discussion

Our study observed an incidence rate of kidney stones in kidney transplant recipients of 12.2% per 100 person-years, which aligns with previous literature suggesting an increased risk of kidney stone formation in this population compared to the general population. The higher incidence rate underscores the importance of vigilance in monitoring kidney transplant recipients for this potential complication. One notable finding was the association between an immunosuppressive regimen and kidney stone development, with more patients receiving tacrolimus experiencing kidney stones than those receiving cyclosporine (Emiliani et al., 2018).

Urolithiasis, characterized by the formation of urinary tract stones, is a complex disorder influenced by multiple genetic and environmental factors, with a global prevalence ranging from 2% to 20%. It has emerged as a significant health concern, ranking as the third most common urinary tract

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ailment, surpassing both urinary tract infections (UTI) and prostatic pathology (Branchereau et al., 2018). The prevalence of urolithiasis has shown an increasing trend in recent years, with rates varying regionally: approximately 1-5% in Asia, 7-13% in North America, and 5-9% in Europe (Boissier et al., 2023). A study conducted in Pakistan reported a 3% prevalence of urolithiasis and a 5% probability of asymptomatic stones within the general population (Mohammadi et al., 2021).

Calcium-based stones, including calcium oxalate (CaOx) and calcium phosphate (CaP) stones, prevail as the most frequent kidney stone types among both the general population and kidney transplant recipients, as evidenced by our meta-analysis findings (Bolen et al., 2022). Interestingly, struvite stones, also known as "infection stones," exhibit a higher prevalence among kidney transplant recipients (20%) compared to the general population (10%-15%). This disparity underscores the importance of recognizing the association between struvite stones and urea-splitting bacterial infections (Murad et al., 2021). Given the distinct treatment approach required for struvite stones, emphasizing the removal of all stone fragments and employing antibiotics, this insight holds significance for future research endeavors aimed at preventing and managing kidney stones post-kidney transplantation (Bessede et al., 2021; Tatapudi et al., 2020).

Conclusion

It is concluded that kidney transplant recipients exhibit a notable incidence of kidney stone formation, with tacrolimus-based immunosuppressive regimens potentially contributing to this risk. At the same time, age and pre-transplant diabetes show trends towards association with kidney stone development.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned.

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

FAZL E MANAN (Specialist Registrar)

Conception of Study, Final approval of manuscript
Coordination of collaborative efforts.

KHALIL UR REHMAN (Specialist Registrar)

Coordination of collaborative efforts.

Study Design, Review of Literature

Conception of Study, Development of Research Methodology Design, Study Design,, Review of manuscript, final approval of manuscript

IKRAM ULLAH (Associate Professor)

Data entry and Data analysis, drafting article

Conception of Study, Final approval of manuscript

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Data acquisition and analysis.

Manuscript drafting.

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