

Frequency and Causes of Hospital Re-Admissions among Post-Kidney Transplant Recipients at Specialized Centers in Khartoum, Sudan: A Cross-Sectional Study

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Abstract

Background: Hospital readmissions after kidney transplantation are common and may predict future adverse outcomes. Previous studies using claims data have been limited. A better understanding of the risk factors associated with readmissions is necessary to develop accurate predictive models. **Objective and Rationale:** To determine the frequency, causes, and duration of hospital readmissions among post-kidney transplant recipients in specialized centers in Khartoum State, Sudan. **Study Design:** A descriptive, cross-sectional study. **Setting and Participants:** Three hundred post-kidney transplant recipients at Ahmed Gasim and Ibn Sina centers were enrolled in this study. Data on recipient, donor, and transplantation characteristics were collected. Readmission frequency, duration, causes, sites, and length of hospital stay were recorded using structured questionnaires and medical record reviews. **Results:** The hospital readmission rate was 39% (n = 117). Of these, 72.6% (n = 85) were readmitted only once, and infection was the leading cause of readmissions. Recipient male gender (P-value = 0.031), high body mass index (P-value = 0.014), chronic lung diseases and diabetes mellitus among comorbidities (P-value = 0.000), prior dialysis before kidney transplantation, especially peritoneal dialysis and peritoneal combined hemodialysis (P-value = 0.003), missed post-transplantation follow-up (P-value = 0.000), older-aged donor above 60 years (P-value = 0.003), kidney transplantation from second-degree related donors

(P-value = 0.034), and intermediate & high immunological risks (P-value = 0.000) were major predisposing factors for hospital readmission post kidney transplantation. **Conclusion:** The hospital readmission rate after kidney transplantation among Sudanese recipients was high and mainly due to infection; a specific preventive program based on infection prevention and graft function monitoring should be established.

Keywords

Post-Kidney Transplant Recipients, Hospital Readmission, Sudan

1. Introduction

Chronic kidney disease (CKD) is a common and serious condition worldwide. It can progress to end-stage renal disease. Aging, diabetes mellitus, hypertension, and cardiovascular disease are common and significant risk factors. Because severe renal failure is incompatible with life, renal replacement therapy with hemodialysis, peritoneal dialysis, or kidney transplantation should be initiated at this stage [1].

Kidney transplantation is the renal replacement therapy of choice for the growing number of patients with end-stage renal disease (ESRD). Tremendous progress in immunosuppressive treatment has improved renal graft survival rates, while at the same time making infectious complications even more common in the kidney transplant population, with the urinary tract being the most common infection site [1].

Although kidney transplantation is recognized as the best treatment option for most patients with end-stage renal disease (ESRD) to improve both life expectancy and quality of life, it remains a complex option for the nearly 200,000 patients in the United States who have a functioning graft [2].

Among the many challenges faced by patients and health providers after kidney transplantation is the burden of hospital readmission. Around 30% of kidney transplant patients are readmitted within the first 30 days after discharge from the hospital post-transplant [3]-[6]. This rate is substantially higher than that for patients undergoing other surgeries (4% - 15%) [7]. Early hospital readmission among kidney transplant recipients is associated with a twofold increase in graft failure, a threefold increase in further readmissions, and a 50% - 75% increase in patient mortality. Furthermore, post-transplant admissions are costly (average cost, >\$10,000), representing 20% of all Medicare payments for transplantation. Moreover, research suggests that up to 50% of these readmissions could be preventable. Early intervention after discharge in kidney transplant recipients has been shown to reduce early readmission; thus, reliable tools to predict hospital readmission after kidney transplantation are needed [8]. One of the most common causes of early hospital readmission is infection, and kidney transplant recipients have a cumulative incidence of infections of over 75% in the first year. The high incidence of infections is multifactorial and related in part to the surgical procedure, immunosuppressive

drugs, exposure to nosocomial pathogens, and the need for devices such as urinary catheters and intravascular lines [9].

Despite improvements in immunosuppressive therapy and surgical techniques, infectious complications remain a significant cause of morbidity, and these complications, especially urinary tract infections (UTIs), have been associated with an increased risk of graft rejection and generally worse graft outcomes [10].

Although several studies have identified significant risk factors for hospitalization following kidney transplantation, including demographic, socioeconomic, clinical, transplant surgery, and utilization factors, few studies have attempted to predict post-transplant readmission, and those that did reported low accuracy (c-statistics between 0.63 and 0.71) [3] [8]. One potential explanation for this poor accuracy is the variability in the causes and timing of readmission. Indeed, rejection-related or surgical complication-related readmissions are more common early post-transplant. In contrast, infection- and other comorbidity-related readmissions are the most prevalent causes of readmission later post-transplant. Finally, most studies examined the risk of first readmission post-transplantation, although an essential group of transplant recipients experiences multiple readmissions post-kidney transplantation [8].

1.1. Objectives

General Objective

To determine the frequency, causes, and duration of hospital readmissions among post-kidney transplant recipients at specialized centers in Khartoum State, Sudan.

2. Materials and Methods

2.1. Study Design

A descriptive, cross-sectional, hospital-based study.

2.2. Study Area

The study was conducted at two major kidney transplant centers (Ahmed Gasim and Ibn Sina) in Khartoum, Sudan.

2.3. Study Duration

The study was conducted from January 2021 to June 2021.

2.4. Study Population

All kidney transplant recipients underwent follow-up at specialized centers during the study period.

2.4.1. Inclusion Criteria

Adult patients (>18 years).

2.4.2. Exclusion Criteria

Refusal to participate in the study.

2.5. Sample Size

Total coverage of all eligible follow-up patients readmitted to the hospital during the study period. A total of 300 patients were enrolled in the study.

2.6. Data Collection Tools and Methods

The principal researchers conducted data collection. After recruiting study subjects, structured questionnaires were used to collect data. Data on recipient demographics, clinical characteristics, donor demographics and status, and transplantation characteristics (immunological risk according to national protocols and induction therapy) were collected. Readmission frequency, readmission duration after kidney transplantation, causes of readmission, sites of readmission, and length of hospital stay at each readmission were also recorded.

2.7. Study Variables

2.7.1. Independent Variables

Socio-demographic characteristics of participants: age, gender, and body mass index.

Comorbidities.

Causes of end-stage renal disease before kidney transplantation.

Dialysis before and after transplantation.

Follow-up missing.

Location of transplantation.

Donor characteristics: age, gender, body mass index, relationship, type (living or deceased donor), etc.

Transplantation characteristics: immunological risk (according to national protocols), induction with ATG, induction with basiliximab.

2.7.2. Dependent Variables

Readmission time.

Readmission frequency.

Readmission cause.

Length of hospital stay in readmission.

1. Hospital readmission

Defined as any admission to the post-kidney transplantation ward after the first discharge from the hospital after receiving the graft.

2.8. Data Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS, V. 21.0, IBM; Chicago). The analyzed data are presented in tables and figures created in Microsoft Excel 2007. The chi-square test was used as the significance test, and a P-value < 0.05 was considered significant.

The findings are based on unadjusted bivariate associations.

2.9. Ethical Consideration

Ethical clearance is obtained from the Research Ethics Committee of the Educa-

tional Development Center (EDC) of the Sudan Medical Specialization Board (SMSB).

Approval is obtained from the Council of Internal Medicine of the Sudan Medical Specialization Board (SMSB).

Approval is obtained from the Khartoum State Ministry of Health's Research Department.

Approval is obtained from the medical directors of the hospitals, the clinic registrars, and the supervising doctors at the clinics.

The research purpose and objectives are explained to the participant in clear, simple language.

Voluntary, written informed consent is obtained from the participants.

The participant has the right to withdraw at any time without any deprivation.

The participant has the right to be free from harm.

Confidentiality will be preserved through coding.

The participant has the right to benefit from the researcher's expertise.

The researcher fills out the data collection sheet without interrupting the health service provided.

2.10. Patient and Public Involvement Statement

Patients' involvement in this study is based on their willingness to participate; they believe that they will benefit from the results, which will improve the health services they receive.

3. Results

3.1. Characteristics of Participants

A total of 300 renal transplant recipients participated in this study; 75% (n = 225) were male, and 25% (n = 75) were female. The majority were aged 40 to 59 years (49.3%, n = 148), and 54.7% were overweight (n = 164) (**Table 1**).

Table 1. Association between hospital readmissions and recipients' demographic characteristics (N = 300).

	Readmission		P-value
	Yes	No	
Gender			
Male	95	130	0.031
	42.2%	57.5%	
Female	22	53	
	29.3%	70.7%	
Age (yrs.)			
18 - 39	56	81	0.289
	40.9%	59.1%	

Continued

40 - 59	58 39.2%	90 60.8%	0.014
60 and above	3 20%	12 80%	
Body Mass Index			
Underweight: less than 18.5	2 100%	0 0%	
Normal (18.5 - 24.9)	36 38.7%	57 61.3%	
Overweight (25 - 29.9)	69 42.1%	95 57.9%	
Obese 1 (30 - 34.9)	8 20.5%	31 79.5%	
Obese 2 (35 - 39.9)	2 100%	0 0%	

3.2. Comorbidities

Regarding comorbidities, hypertension (48.3%, n = 145) and hypertension with diabetes mellitus (16.3%, n = 49) were the most common conditions (**Table 2**).

Table 2. Association between hospital readmissions and recipients' comorbidities (N = 300).

	Readmission		P-value
	Yes	No	
Comorbidities			0.000
Hypertension	40	105	
	27.6%	72.4%	
Diabetes mellitus	6	4	
	60%	40%	
Diabetes mellitus & hypertension	22	27	
	44.9%	55.1%	
Chronic lung disease	3	0	
	100%	0%	
Cardiac diseases	0	2	
	0%	100%	
Stroke	0	3	
	0%	100%	
None	46	42	
	52.3%	47.7%	

Continued

	Smoking		
	Yes	No	
	11 47.8%	12 52.2%	
Ex-smoker	7 28%	18 72%	0.362
No	99 39.3%	153 60.7%	

3.3. The Etiology of Chronic Kidney Disease (CKD)

Hypertension in 48.7% (n = 146) of patients, renal stones in 17.7% (n = 53) of patients, glomerulonephritis in 10% (n = 31) of patients, diabetes mellitus in 5.7% (n = 17) of patients, and unknown in 21.7% (n = 65) of patients (**Table 3**).

Table 3. Association between hospital re-admissions and CKD etiologies of recipients (N not equal 300 because one patient may have several causes of CKD).

	Readmission		P-value
	Yes	No	
Diabetes mellitus	4 3.4%	13 7.1%	0.137
Hypertension	56 47.9%	90 49.2%	0.459
Glomerulonephritis	7 6%	24 13.1%	0.121
Congenital renal disease	12 10.3%	10 5.5%	0.094
Tumor	1 0.9%	0 0.0%	0.390
Renal Stone	17 14.5%	36 19.7%	0.163
Other	16 13.7%	24 13.1%	0.510
Unknown	32 27.4%	33 18%	0.071

3.4. Dialysis Characteristics

Regarding dialysis characteristics, the type of dialysis before renal transplantation was most commonly hemodialysis in 92% (n = 276) of patients. Most patients, 43.3% (n = 130), underwent dialysis for less than one year before renal transplantation. Only two (0.7%) patients required dialysis after renal transplantation (**Table 4**).

Table 4. Association between hospital readmissions and pre-transplant dialysis modality (N = 300).

	Readmission		P-value
	Yes	No	
Type of Dialysis before Transplant			
Haemodialysis	100	176	0.003
	36.2%	63.8%	
Peritoneal Dialysis	2	0	
	100%	0.0%	
Haemodialysis and Peritoneal Dialysis	4	0	
	100.0%	0.0%	
Preemptive transplant	11	7	
	61.1%	38.9%	
Dialysis Duration before Transplant			
Less than one year	55	75	0.069
	42.3%	57.7%	
1 - 2 years	23	54	
	29.9%	70.1%	
More than two years	28	47	
	37.3%	62.7%	
Preemptive transplant	11	7	
	61.1%	38.9%	

3.5. Adherence to Regular Follow-Up

88.7% (n = 266) of patients did not miss their post-kidney transplant follow-up. 9.7% (n = 29) missed < 25% of follow-up, and 1.7% (n = 5) missed < 50% of follow-up (**Table 5**). 98.3% (n = 295) of patients underwent kidney transplantation in Sudan, and 1.7% (n = 5) underwent renal transplantation abroad (**Table 5**).

Table 5. Association between recipient hospital re-admissions and adherence with follow-up (N = 300).

	Readmission		P-value
	Yes	No	
Follow-Up			
Not missed	91	175	0.000
	34.2%	65.8%	
Missed less than 25%.	21	8	
	72.4%	27.6%	
Missed less than 50%.	5	0	
	100.0%	0.0%	

3.6. Donor Characteristics

Regarding donor characteristics, 51.7% (n = 155) were male, and 48.3% (n = 145) were female. Most donors were between 18 and 39 years old (77.7%, n = 233), and 65.3% (n = 196) were overweight. 67.7% (n = 203) of donor-recipient relationships were first-degree relatives. Almost all donors were alive, 99.3% (n = 298) (**Table 6**).

Table 6. Association between recipients' hospital readmissions and donor characteristics (N = 300).

	Readmission		P-value
	Yes	No	
Gender			
Male	64	91	0.253
	41.3%	58.7%	
Female	53	92	
	36.6%	63.4%	
Age (years)			
18 - 39	79	158	0.003
	33.3%	66.7%	
40 - 59	35	25	
	58.3%	41.7%	
More than 60	3	0	
	100.0%	0.0%	
Body Mass Index			
Underweight (less than 18.5)	0	2	0.064
	0.0%	100.0%	
Normal (18.5 - 24.9)	15	35	
	30.0%	70.0%	
Overweight (25 - 29.9)	76	120	
	38.8%	61.2%	
Obese 1 (30 - 34.9)	24	23	
	51.1%	48.9%	
Obese 2 (35 - 39.9)	0	3	
	0.0%	100.0%	
Obese 3 (35 - 39.9)	2	0	
	100.0%	0.0%	
Donor Relationship			
1st degree	82	121	0.034
	40.4%	59.6%	

Continued

2nd degree	10	85	0.371
	55.0%	45.0%	
Unrelated	2	0	
	25.0%	75.0%	
Donor Type			
Living	117	181	
	39.3%	60.7%	
Deceased Expanded Criteria Donor (ECD)	0	2	
	0.0%	100.0%	

3.7. Transplantation Characteristics

According to transplantation characteristics, 228 subjects (76%) had missing immunological risk data, 58 subjects (19.3%) had low immunological risk, and 13 subjects (4.3%) had intermediate or high immunological risk. Ten percent (n = 30) of patients received induction with Anti-Thymo-Globulin, and 4.7% (n = 14) received induction with basiliximab. In 267 (89%) patients, the donated kidney was predominantly the left kidney (**Table 7**).

Table 7. Association between hospital readmissions and recipients' transplantation characteristics (N = 300).

Transplant characteristics	Readmission		P-value	
	Yes	No		
Immunological Risk				
Missed data	67	161	0.000	
	29.4%	70.6%		
Low	38	20		
	65.5%	34.5%		
Intermediate	11	2		
	84.6%	15.4%		
High	1	0		
	100.0%	0.0%		
Induction with anti-thymocyte globulin (ATG)	14	16		0.237
	12.0%	8.7%		
Induction with basiliximab	4	10	0.301	
	3.4%	5.5%		

3.8. Hospital Readmission

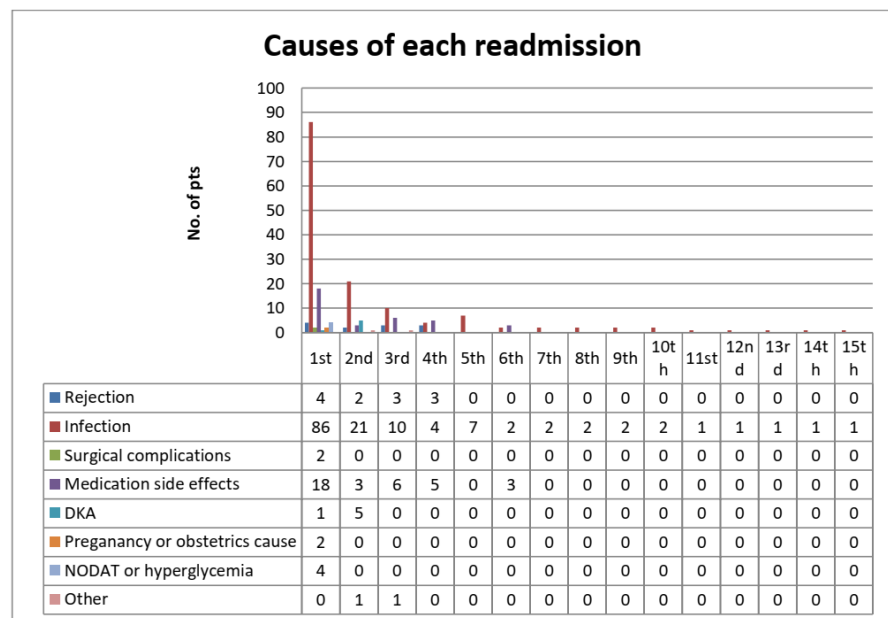
Hospital readmission occurred in 117 (39%) patients, and the remaining 183 (61%) patients were not readmitted.

Among readmitted patients (n = 117), 72.6% (n = 85) were readmitted once.

Most of the patients were admitted during the period of 2 - 6 months after renal transplantation, with 40.2% (n = 47) at the 1st, 12.8% (n = 15) at the 2nd, 6.8% (n = 8) at the 3rd, 4.1% (n = 6) at the 4th, 2.6% (n = 6) at the 5th, and from the 7th to the 15th admissions were admitted > 5 years after renal transplantation.

Infection was the leading cause of readmission for the 1st (73.5%, n = 86), 2nd (17.9%, n = 21), 3rd (8.5%, n = 10), 5th (5.9%, n = 7), and 7th through 15th readmissions. Medication side effects were the leading cause of readmission for the 4th (4.3%, n = 5) and 6th (2.6%, n = 3) readmissions. The medical ward was the most common type of admission at all times of readmission (from the 1st to the 15th).

The mean length of hospital stay was 6.2 days for the 1st readmission, 7.5 days for the 2nd readmission, 5.7 days for the 3rd readmission, 8.1 days for the 4th readmission, 8 days for the 5th readmission, 9.8 days for the 6th readmission, and 7 days for the 7th through the 15th readmissions (**Figure 1**).



DKA: Diabetic Ketoacidosis. NODAT: New-Onset Diabetes After Transplantation.

Figure 1. The causes of each readmission among recipients (N = 300).

3.9. The Association between Hospital Readmission and Recipient Demographic Characteristics

Readmission was significantly more frequent among males than females (42.2% vs 29.3%; P-value = 0.031) (**Table 1**).

Readmission was also significantly more common among underweight, type-II obese, and overweight patients than among others (P-value = 0.014). Recipient age was not significantly associated with hospital readmission (P-value = 0.289) (**Table 1**).

3.10. The Association between Hospital Readmission and Comorbidities

Readmission was common among those with chronic lung diseases and diabetes mellitus, 60% (n = 6), more than among others (P-value = 0.000). Smoking was not significantly associated with hospital readmission (P-value = 0.362) (**Table 2**).

3.11. Association between Hospital Readmissions and CKD Etiologies of Recipients

The etiologies of CKD before renal transplantation were not significantly associated with hospital readmission (P-value > 0.05) (**Table 3**).

3.12. Association between Type of Dialysis before Transplantation and Hospital Readmission

Type of dialysis before transplantation was significantly associated with hospital readmission (P-value = 0.003); readmission was frequent among patients who underwent peritoneal dialysis (all patients), peritoneal combined hemodialysis (all patients), and those with preemptive transplant (61.1%). However, dialysis duration was not significantly associated with readmission (P-value = 0.069) (**Table 4**).

Post-transplantation follow-up was significantly associated with hospital readmission (P-value 0.000), as readmission was more frequent among patients with missed follow-up (missed < 50% = 100% and missed < 25% = 72.4%) than among those who did not miss follow-up (**Table 5**).

3.13. The Association between Hospital Readmission and Donors' Demographic Characteristics

Readmission was significantly more frequent among recipients who received kidneys from donors aged > 60 years (100%) and donors aged 40 - 59 years (58.3%) than among recipients who received kidneys from donors aged < 40 years (P-value 0.003) (**Table 6**). In addition, readmission was significantly more frequent among recipients who received kidneys from 2nd-degree related donors than among first-degree relationships (P value 0.034). On the other hand, donor's gender (P value 0.253), body mass index (P value 0.064), and donor type (P-value 0.371) were not significantly associated with hospital readmission (**Table 6**).

3.14. The Association between Transplantation Characteristics and Hospital Readmission

Readmission was recurrent among patients with high and intermediate immunological risks (P-value = 0.00), which is significant (**Table 7**).

4. Discussion

This study confirms the high burden of hospital readmission following kidney transplantation among adult kidney transplant recipients and underscores the

challenge of predicting hospital readmission in this population. This study underlines the need to select potential risk factors in light of each specific study outcome, since the importance of predictors varies based on the timing of readmission and whether we consider the first versus subsequent readmissions.

The majority of participants were male, 75% (n = 225), revealing a sharp gender imbalance that may be explained by males having greater exposure to end-stage renal disease risk factors. These results were comparable to similar studies in Spain [11] and the United States of America [12], which also reported male predominance (60.9% vs. 39.1%) and (61.2% vs. 38.8%), respectively, in patients with chronic kidney disease (CKD). Studies in Ghana [13] and Nigeria [14] also reported male predominance (65% vs. 35%) and (65.3% vs. 34.7%), respectively. This male predominance may reflect the fact that chronic kidney disease and its risk factors, such as hypertension and smoking, are more common in males than in females. Differences in health-seeking behaviors between males and females may also contribute to the observed differences in chronic kidney disease prevalence between the two sexes.

This study found that most patients were in the 40 - 59 age group (49.3%). This reflects a generally younger population, with ESRD and CKD affecting the economically productive young society between the ages of 20 and 50 years. A similar study by Okwuonu C. *et al.* reported a mean age of 43 years, with most patients (53.6%) in the 40 - 60 age group [15].

The present study also demonstrated that hypertension (48.7%) was the most common cause of CKD among our participants. Several studies in Ghana [13] [16] [17] and Nigeria [18] have identified hypertension as the most common cause of CKD. Our study found that the rate of hospital readmission after kidney transplant was 39% (n = 117), and among them, most patients (72.6%, n = 85) were readmitted once. This rate was similar to that reported by the US registry for a cohort of 32,961 kidney transplant recipients treated by the Medicare system from 2000 to 2005; hospital readmission was 31%, ranging from 18% to 47% across transplant centers [3] [19] [20] [21]. Our rate was also comparable to other previous studies, such as McAdams-Demarco MA *et al.* who reported 31% [3], Julien H *et al.* who reported 39% [8], Ostrem J *et al.* who reported 35.7% [22], and Michelle C *et al.* in Ohio who reported 30-day, 90-day, and 1-year HR as 31%, 41%, and 53%, respectively [23]. Although our rate was lower than those reported by Leal R *et al.* (49%) [9], Karima B *et al.* (45.5%) [24], Avila C *et al.* (64.9%) [25], and Jesse D *et al.* (48%) [26].

Among readmitted patients, infection was the leading cause of readmission after a kidney transplant. Our findings were consistent with those of Leal R *et al.* and Karima B *et al.* [24], who also reported that infection (mainly urinary tract infection) was the most common cause of readmission after kidney transplant [9]. The current study found that the recipient's male gender (p value = 0.031) and high body mass index (p value = 0.014) were the major predisposing factors for hospital readmission after a kidney transplant. This is in accordance with the study of Avila *et al.*, who reported that hospital readmission was lower for females

compared to males (OR = 0.769, $p = 0.005$) and increased with high body mass index (p value < 0.001) [25].

Also, Leal R *et al.* found that a higher body mass index was a significant risk factor for readmission ($P = 0.03$) [9].

Our study also reported that hospital readmission after kidney transplantation was common among those with chronic lung diseases and diabetes mellitus comorbidities (P -value 0.000). Leal R *et al.* also reported that diabetes mellitus was a predictor of readmission after kidney transplantation ($P = 0.02$) [9].

Another critical risk factor for hospital readmission after kidney transplantation in our study group was dialysis before transplantation, particularly peritoneal dialysis and peritoneal combined hemodialysis ($p = 0.003$). These findings were consistent with those reported by Ostrem J *et al.* in the United States, who found that patients on dialysis before transplant had a readmission rate of 28.2%, compared with 5.6% for those not on dialysis ($p = 0.037$) [22].

Not surprisingly, post-transplantation follow-up was significantly associated with hospital readmission (P -value 0.000). Readmission was more frequent among patients who missed post-transplantation follow-up (Miss < 50% = 100% and Miss < 25% = 72.4%) than among those who did not miss follow-up (P -value 0.000).

This study demonstrated that readmission was significantly more frequent among recipients who received kidneys from older donors (>60 years) than among others (P value 0.003). This finding aligns with the study by Leal *et al.*, which showed that older donors were significantly associated with readmission ($P = 0.007$) [9]. In addition, readmission was significantly more frequent among recipients who received kidneys from 2nd-degree related donors (55%), parent donors (53.8%), and partner donors (husband/wife) (45%) than among other relationships (P value 0.034).

Remarkably, readmission was more frequent among patients with high (100%) and intermediate (84.6%) immunological risks than among those with low immunological risks (P -value 0.000). McAdams-Demarco reported similar findings.

5. Conclusions

This study concludes that the hospital readmission rate after kidney transplantation among Sudanese recipients was high. Hospital readmission was significantly associated with male gender, body mass index, diabetes mellitus, and chronic lung diseases as comorbidities, dialysis before kidney transplant (peritoneal dialysis and peritoneal combined hemodialysis), and missing post-kidney transplantation follow-up among recipients' characteristics.

Among donor characteristics, older-aged donors (>60 years) and 2nd-degree related donors were significant risk factors for hospital readmission. Moreover, among kidney transplant characteristics, hospital readmission was frequent in patients with high and intermediate immunological risk.

6. Strengths and Limitations of This Study

- Relevant and addresses a major concern in Sudan and worldwide.

- Filling a knowledge gap that has the potential to reduce hospital readmissions and improve the prognosis and quality of life for kidney transplant recipients.
- Limited complementary information could be obtained from the records at Sudanese kidney transplant centers.
- The cross-sectional nature of the study revealed significant associations; however, it did not establish causal relationships among the variables.

7. Recommendations

- Hospital readmission was associated with reduced graft and patient survival; thus, highly accurate predictive models of post-transplant readmission are needed to guide the implementation of targeted interventions to reduce the burden of post-transplant readmission after kidney transplantation.
- A specific preventive program, based on infection prevention and graft function monitoring, should be established to prevent and minimize rehospitalizations.
- Prospective multicenter studies with detailed recipient-level data are needed to identify additional recipient factors and modifiable center-level factors that may reduce the rate of rehospitalization in this vulnerable and unique patient population.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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