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Prevalence and factors associated with restless legs syndrome among haemodialysis patients in Tanzania

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ABSTRACT

Background: Restless legs syndrome (RLS) is a common motor-sensory disorder among chronic kidney disease patients on haemodialysis (HD), significantly affecting quality of life. While its prevalence varies widely, there is limited research on the condition among African haemodialysis patients. This study addressed this gap by assessing the prevalence, severity and associated factors of RLS in patients undergoing HD at Muhimbili National Hospital (MNH) in Tanzania.

Methods: A six-month cross-sectional study was conducted among end-stage kidney disease (ESKD) patients aged ≥18 years. RLS was diagnosed using the 2012 revised International Restless Legs Syndrome Study Group (IRLSSG) questionnaire, with severity assessed via the IRLSSG severity rating scale.

Results: A total of 348 ESKD patients on HD were recruited, with a median age of 50 ± 12 years; 244 (70%) were male. RLS prevalence was 10.1%, and 91% had moderate to severe RLS, with a mean score of 18 ± 5. Multivariate analysis identified age ≥60 years, lower body mass index (BMI), HIV infection, HD inadequacy (URR < 65%), and higher pre-dialysis blood urea nitrogen (BUN) levels as independent factors associated with RLS ($P < 0.05$).

Conclusions: RLS is common among our haemodialysis patients and is independently associated with age >60 years, lower BMI, HIV infection, inadequate dialysis, and elevated pre-dialysis BUN. These findings underscore the importance of routine screening and targeted management to improve patient outcomes.

Keywords: restless legs syndrome; haemodialysis; Tanzania.

BACKGROUND

Restless legs syndrome (RLS), also known as Willis–Ekbom disease, is a chronic motor-sensory disorder characterised by an overwhelming urge to move the legs, often accompanied by unpleasant sensations [1]. This condition frequently disrupts sleep and significantly reduces quality of life [2]. Among patients with chronic kidney disease undergoing haemodialysis, RLS is more prevalent than in the general population, with a reported global burden ranging from 6% to 80% [3]. Similar trends are observed in African settings, where prevalence rates vary from 5.9% in Nigeria and 6% in South Africa to as high as 56.4% in Egypt [4]. Beyond sleep disturbances, RLS can exacerbate anxiety, depression, increased cardiovascular risk and mental well-being, further compounding the burden for patients [5].

While the global burden of the disoder among haemodialysis patients is recognised, its true prevalence remains unclear due to regional differences in diagnostic criteria and population characteristics [3]. In addition, in African contexts including Tanzania, there is a notable scarcity of studies, with many attributing sensory-motor disorders primarily to uremia [4]. This oversight can adversely affect both the physical and mental health of patients, leading to a reduced quality of life [6]. Additionally, factors such as long dialysis duration, uremia, presence of diabetes mellitus, increased body mass index (BMI), and

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female gender have been associated with RLS, though results are inconsistent [(7]. Consequently, there is a critical need for more comprehensive research to elucidate the prevalence and associated factors of the disease in these settings.

The overarching goal of the study reported here was to determine the prevalence, severity, and associated factors of RLS among haemodialysis patients at Muhimbili National Hospital (MNH) in Dar es Salaam, Tanzania. By addressing the gaps in current knowledge, this work aims to provide a clearer understanding of the burden of the disorder in this population. Specifically, it explores the clinical and demographic factors contributing to RLS occurrence and its effect on patient well-being. The findings will help inform strategies to improve the management of RLS and enhance the quality of life of patients undergoing chronic haemodialysis in Tanzania and similar settings.

METHODS

This hospital-based cross-sectional study was conducted over six months, from 1 September 2023 to 30 January 2024, at the haemodialysis unit of Muhimbili National Hospital, which is a tertiary-level public health facility with a 1,500-bed capacity and operates 50 haemodialysis machines, providing dialysis therapy to approximately 400 chronic kidney disease (CKD) patients. These patients have a personalised dialysis schedule lasting for four hours per session, conducted at either one, two or three weekly sessions.

Our study included CKD patients on haemodialysis therapy aged 18 years and above. We excluded the patients with any of the following: pregnancy, bilateral lower limb amputation, current use of antidepressants or antipsychotics, and a diagnosis or treatment for Parkinson's disease. Patients were consecutively enrolled until the target sample size was reached, which was estimated using the Kish and Leslie formula, assuming a 28% prevalence of RLS, a 95% confidence level (Z = 1.96), 80% power, and a 5% margin of error, yielding a minimum required sample size of 346 participants [7]

Data were collected using an interviewer-administered, pre-tested structured questionnaire to capture socio-demographic characteristics, clinical information, and laboratory results as key predictors. Pre- and post-dialysis blood urea nitrogen (BUN) levels from the three months preceding study enrollment were used to calculate the average urea reduction rate (URR). Data on serum iron stores and vitamin B12 levels were not collected, as these investigations were not routinely available for all patients during the study period.

The diagnosis of RLS was established using the revised 2012 International Restless Legs Syndrome Study Group (IRLSSG) criteria. Participants who met the diagnostic criteria were further assessed for RLS severity using the IRLSSG severity rating scale. The main outcome variable was the presence of RLS, defined by meeting all five diagnostic criteria set by the revised IRLSSG. Severity of the condition was categorised into four levels: mild (1–10 points), moderate (11–20 points), severe (21–30 points), and very severe (31–40 points).

Data analysis

Data entry, cleaning and analysis were conducted using SPSS version 23. Categorical variables were summarised as frequencies and percentages, whereas continuous variables were presented as means with standard deviations or medians with interquartile ranges. Data distribution was assessed using the Shapiro–Wilk test and visual inspection. The prevalence of RLS was expressed as a proportion of the study participants. Associations between independent and dependent variables were assessed using chi-squared or Fisher's exact tests. Univariate and multivariate analyses were performed using logistic regression models to determine associations between independent variables and outcomes. Independent variables were first analysed in a univariate model to calculate odds ratios (OR), 95% confidence intervals (CI), and P values. Variables with $P < 0.2$ in the univariate analysis were included in the multivariate model, with statistical significance set at $P < 0.05$.

Ethical consideration

Ethical approval was obtained from the MUHAS Research, Publications, and Ethical Committee (ref. no. DA.282/298/01.C/, MUHAS-REC-08-2023-1863), with additional permission from the MNH administration. Participation was voluntary, and patients diagnosed with RLS were referred for appropriate care according to hospital protocols.

RESULTS

A total of 348 patients with ESKD undergoing haemodialysis at MNH were included in this study. Their median age was 50 ±12 years, with the majority (70%) being male. Their median BMI was 22.8 kg/m² (IQR: 20.7–25.9). Hypertension was the most common comorbidity, affecting 95% of participants, followed by diabetes mellitus (16%). An arteriovenous fistula (AVF) was the most frequently used (41%) vascular access. Approximately 63% had been on haemodialysis for more than two years, and 83% underwent three dialysis sessions per week. Dialysis adequacy, defined as URR ≥65% was achieved in 90% of patients.

Anaemia was prevalent in 98%, and hypocalcaemia was observed in 90% of cases. The median pre-dialysis BUN level was 17.5 mg/dL, while median pre-dialysis serum creatinine was 897.4 µmol/L (Table 1).

Of the 348 patients recruited into the study, 35 were diagnosed with RLS, making the prevalence of the condition in ESKD patients on haemodialysis at MNH to be 10.1%.

Severity of restless legs syndrome

Of the ESKD patients undergoing haemodialysis at MNH diagnosed with RLS, 9%, 57% and 34% had the condition in mild, moderate and severe form, respectively. Those with moderate to severe RLS had a mean RLS score of 18 ± 5.

Factors associated with RLS among patients with ESKD on haemodialysis

In the univariate analysis, advanced age (≥60 years), HIV infection, inadequate dialysis (URR < 65%), and elevated pre-dialysis BUN levels were significantly associated with the presence of RLS ($P < 0.05$). Other factors, including gender, smoking and alcohol history, hypertension, diabetes mellitus, dialysis duration, number of sessions per week and since initiation, haemoglobin levels, total calcium levels, and pre-dialysis serum creatinine, were not significantly associated with RLS ($P > 0.05$) (Table 2).

These factors were then assessed using binary logistic regression in terms of univariate and multivariate analysis. All variables with $P < 0.2$ in univariate analysis were then included in multivariate analysis, which revealed that age ≥60 years, underweight status, HIV infection, HD inadequacy (based on URR) and higher pre-dialysis BUN levels were independently associated with RLS, all with $P < 0.05$ (Table 3).

DISCUSSION

Our study offers valuable insights into the prevalence and associated factors of restless legs syndrome among Tanzanian patients with chronic kidney disease undergoing haemodialysis therapy. We found that about one in 10 patients with chronic kidney disease on haemodialysis experienced the condition. Significant factors associated with RLS included older age, HIV infection, inadequate haemodialysis, and elevated pre-dialysis blood urea nitrogen levels. These findings are consistent with previous research conducted in similar settings, highlighting the importance of addressing these risk factors to improve patient care and outcomes in CKD patients on haemodialysis [8].

Our study found a 10.1% prevalence of RLS among ESKD patients undergoing HD, consistent with global rates, ranging from 6% to 62% [(9]. Across continents, prevalence

Table 1. Socio-demographic, clinical and laboratory characteristics of the study participants (N = 348).

Variable	Frequency (n)	Percent
Age group (years)		
<60	269	77
≥60	79	23
Median age in years (IQR)	50 (42–58)	
Sex		
Male	244	70
Female	104	30
History of smoking		
Yes	32	9
No	316	91
History of alcohol use		
Yes	144	41
No	204	59
BMI category (kg/m²)		
Reduced BMI (BMI < 18.5)	28	8
Normal weight (BMI 18.5–24.9)	212	61
Overweight (BMI 25.0–29.9)	84	24
Obese (BMI ≥ 30)	24	7
Median BMI (IQR)	22.8 (20.7–25.9)	
Comorbidity		
Hypertension	330	95
Diabetes mellitus	56	16
HIV	17	5
Hepatitis B	6	2
Others	19	6
Vascular access for HD		
AV fistula	142	41
Temporary catheter	73	21
Duration of HD (years)		
≤2	128	37
>2	220	63
Total number of HD sessions since start		
≤400	193	55
>400	155	45
Number of HD sessions per week		
<3	59	17
3	289	83
HD adequacy based on URR		
URR < 65%	34	10
URR ≥ 65%	314	90
Haemoglobin levels		
No anaemia	6	2
Anaemia	342	98
Total calcium levels		
Normal	34	10
Hypocalcaemia	314	90
Median pre-dialysis blood urea (mg/dL)(IQR)	17.5 (11.5–22.1)	
Median pre-dialysis creatinine level (µmol/L)(IQR)	897.4 (670–1201)	

Abbreviations: AV, arteriovenous; BMI, body mass index; ESKD, end-stage kidney disease; HD, haemodialysis, IQR, interquartile range; HIV, human immunodeficiency virus; RLS, restless legs syndrome; URR, urea reduction rate; anaemia: Hb <11 g/dL; hypocalcaemia: total calcium <2.1 mmol/L.

Table 2. Socio-demographic factors associated with RLS among patients with ESKD undergoing haemodialysis.

	Restless legs syndrome		
Variable	Yes (%)	No (%)	P value
Age group (years)			
<60	22 (8)	247 (92)	0.032*
≥60	13 (17)	66 (84)	
Sex			
Male	26 (11)	218 (89)	0.570
Female	9 (9)	95 (91)	
History of smoking			
Yes	3 (9)	29 (91)	1.000
No	32 (10)	284 (90)	
History of alcohol intake			
Yes	15 (10)	129 (90)	0.852
No	20 (10)	184 (90)	
BMI (kg/m²)			
Underweight (<18.5)	6 (21)	22 (79)	
Healthy weight (18.5–24.9)	19 (9)	193 (91)	0.252
Overweight (25.0–29.9)	8 (10)	76 (91)	
Obese (≥30)	2 (8)	22 (92)	
Comorbidity			
Hypertension			
Yes	31 (9)	299 (91)	0.094
No	4 (22)	14 (78)	
Diabetes			
Yes	7 (13)	49 (88)	0.507
No	28 (10)	264 (90)	
HIV			
Yes	5 (29)	12 (71)	0.020*
No	30 (9)	301 (91)	
Duration of HD (years)			
≤2	9 (7)	119 (93)	0.152
>2	26 (12)	194 (88)	
Number of HD sessions since start			
≤400	14 (7)	179 (93)	0.052
>400	21 (14)	134 (87)	
Number of HD sessions/week			
<3	6 (10)	53 (90)	0.975
3	29 (10.0)	260 (90.0)	
HD adequacy based on URR			
URR < 65%	11 (33)	22 (67)	< 0.001*
URR ≥ 65%	23 (8)	285 (93)	
Haemoglobin levels			
No anaemia	1 (17)	5 (83)	0.473
Anaemia	34 (10)	308 (90)	
Total calcium levels			
Hypocalcaemia	33 (11)	281 (90)	
Normal	2 (6)	32 (94)	
Median BUN (mm/L) (IQR)	21.6 (17.6–28.0)	16.7 (11.2–22.0)	0.002*
Median creatinine (µmol/L) (IQR)**	1078.0 (648.0–1302.8)	895.4 (671.2–1187.8)	0.189

Abbreviations: BMI, body mass index; BUN, blood urea nitrogen; HD, haemodialysis; HIV, human Immunodeficiency virus; URR, urea reduction rate; IQR, Interquartile range.
*Statistical significance P value < 0.05; **pre-haemodialysis blood urea nitrogen and creatinine.

Table 3. Univariable and multivariable analysis of factors associated with RLS.

		Univariable analysis			Multivariable analysis		
Variable	Category	cOR	95% CI	P value	aOR	95% CI	P value
Age group (years)	≥60	2.21	1.06–4.62	0.035	4.98	1.85–13.39	< 0.001*
	<60	Ref					
Sex	Female	0.79	0.36–1.76	0.570			
	Male	Ref					
Smoking	Yes	0.92	0.26–3.18	0.893			
	No	Ref					
Alcohol intake	Yes	1.07	0.53–2.17	0.852			
	No	Ref					
BMI	Underweight	2.77	1.00–7.67	0.050	4.79	1.37–16.94	0.015*
	Overweight	1.07	0.45–2.55	0.880	0.66	0.24–1.79	0.415
	Obese	0.92	0.20–4.23	0.918	1.12	0.20–6.22	0.894
	Health weight	Ref					
Hypertension	Yes	0.36	0.11–1.17	0.090	0.78	0.17–3.62	0.751
	No	Ref					
Diabetes mellitus	Yes	1.35	0.56–3.26	0.508			
	No	Ref					
HIV	Yes	4.18	1.38–12.6	0.011	9.94	2.13–46.40	0.003*
	No	Ref					
Duration of HD (years)	>2	1.77	0.80–3.91	0.157	3.36	0.79–14.07	0.099
	≤2	Ref					
Number of HD since start	>400	2.00	0.98–4.08	0.056	1.45	0.42–5.05	0.557
	≤400	Ref					
Number of HD sessions/week	<3	1.02	0.40–2.56	0.975			
	3	Ref					
HD adequacy (URR)	<65%	6.20	2.68–14.3	< 0.001	10.98	3.83–31.51	< 0.001*
	≥65%	Ref					
Haemoglobin	Anaemia	0.55	0.06–4.86	0.592			
	No anaemia	Ref					
Total calcium level	Hypocalcaemia	1.79	0.41–7.86	0.436			
	Normal	Ref					
Pre BUN level		1.07	1.03–1.12	< 0.001	1.14	1.07–1.20	< 0.001*
Pre-creatinine level		1.00	0.99–1.01	0.455			

Abbreviations: BMI, body mass index; BUN, blood urea nitrogen; HD, haemodialysis; HIV, human immunodeficiency virus; URR, urea reduction rate; anaemia: Hb <11 g/dL; hypocalcaemia: total calcium <2.1 mmol/L; cOR, crude odds ratio; aOR, adjusted odds ratio; Ref, reference category.
*Statistical significance P value < 0.05.

rates vary, with African studies reporting those from 5.3% to 56.4%. For instance, research conducted in Nigeria in 2008 reported a prevalence of 5.3%, whereas a study in Kenya in 2020 found a much higher rate of 35.8% [10,11]. Similarly, investigations in Egypt revealed prevalence rates of 42% and 56.4%, indicating significant regional disparities in RLS burden among haemodialysis patients [4,12]. Discrepancies in prevalence have been attributed to variations in the populations studied, in terms of ethnicity, culture, socio-economic status, health-seeking behaviour, access to medical services, the methodology employed in studies, methodological restrictions (such as limited sample size), and differences in diagnostic criteria used [13].

The severity of RLS symptoms also varies among the populations studied, with milder symptoms in the general population but moderate to severe symptoms among ESKD patients. Our study showed that nine out of 10 patients diagnosed with RLS had moderate to severe RLS with a mean score of 18 ± 5. Our findings are consistent with a study conducted in Saudi Arabia, which reported that most haemodialysis patients with RLS experienced moderate to severe symptoms [14]. Studies by Sabry et al. [(12] and Zhang LY et al. [(15] also reported a higher severity of RLS with more than 65% of haemodialysis patients with RLS having moderate or severe levels of the condition. The severity of RLS is notably higher among HD patients due

to various interrelated factors but mainly it is linked to chronic inflammation, iron deficiency anaemia, and inadequate haemodialysis in this particular group.

Our study revealed that individuals aged 60 years and above exhibited about fivefold increased odds of developing RLS compared to their younger counterparts. This is in keeping with findings from other research that reported that RLS more commonly affects older people than younger [16]. It is suggested that the neurodegenerative process linked to disturbance in dopamine transmissions of pain impulses may be a key factor in RLS [17,18]. RLS is also related to the way of life of elderly individuals and their corresponding age-related alterations, which include cardiovascular and metabolic changes [19]. Nevertheless, research from India and the United Kingdom found no association between age and RLS [20,21].

Previous studies on the link between BMI and RLS in ESKD patients report conflicting results [22]. Our work found that being underweight was linked to a higher likelihood of developing the syndrome, with underweight patients having significantly increased odds of RLS compared to those with normal BMI. This contrasts with earlier studies that suggested a higher BMI was associated with increased RLS risk, possibly due to reduced dopamine receptor density in obese individuals [23]. However, other surveys have not found a clear association between BMI and RLS [10,24]. It is possible that underweight individuals may experience higher inflammation and malnutrition, which could worsen RLS symptoms due to deficiencies in essential nutrients like iron and vitamins [25].

Previous studies have shown also that HIV-infected patients show a significantly higher prevalence rate for RLS than the general population [26]. Our study revealed that HIV was strongly associated with RLS among ESKD on haemodialysis. Patients with HIV were almost 10 times more likely to develop the syndrome than those without. Our findings are similar to a 2007 study conducted in Germany, in which RLS prevalence and severity were much higher in HIV-positive than in HIV-negative patients [26]. The mechanism by which HIV infection predisposes a person to RLS is still unclear, but it is thought to be related to HIV-associated neurodegeneration in central nervous system (CNS) sensory-motor modulating areas (for example, basal ganglia), accelerated brain atrophy, active and chronic CNS inflammatory processes, CNS iron deficiency, and loss of myelin integrity [27].

Haemodialysis inadequacy has been strongly associated with RLS. Notably, patients with a URR below 65% were found to be 10 times more likely to develop the condition than those with a rate above 65%. Our findings align with a 2006 study from Taiwan, which also identified a link between RLS severity and inadequate haemodialysis [28]. However, other research has found no significant relationship between RLS risk and dialysis adequacy [7,29]. Dialysis inadequacy, however, marked by ineffective waste and fluid removal, contributes to the syndrome through several mechanisms. Uremia directly affects the CNS, while electrolyte imbalances, particularly in calcium and potassium, worsen RLS and exacerbate its symptoms [28].

Our study found also that elevated pre-dialysis BUN levels are independently linked to RLS, which may indicate inadequate haemodialysis. This finding is consistent with a South Korean report by Kim et al., which showed a significant correlation between pre-dialysis BUN levels and RLS severity [24]. Uremia, associated with disturbances in neurotransmitter balance, oxidative stress, and inflammation, is believed to contribute to RLS by affecting motor and sensory pathways, and potentially causing nerve damage that exacerbates symptoms of the condition [24].

CONCLUSION

Approximately one in every 10 patients with ESKD undergoing haemodialysis at MNH experienced RLS, with most reporting moderate to severe symptoms. Advanced age, being underweight, HIV infection, inadequate haemodialysis, and elevated pre-dialysis urea levels were independently associated with the disease. These findings highlight the need for routine screening and early detection of RLS in dialysis settings, not only to alleviate distressing symptoms but also to improve sleep quality, reduce cardiovascular risk, and enhance overall quality of life. Although key micronutrient data such as vitamin B12 and serum iron were not assessed, limiting our ability to fully explore all potential contributors, the study reported here highlights the importance of addressing modifiable risk factors. A coordinated, multidisciplinary approach involving nephrologists, nutritionists, and other healthcare professionals is essential to optimise care and outcomes in this high-risk population.

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Authors' contributions

SM conceptualised the study, wrote the proposal, collected the data and wrote the initial draft of the manuscript. DM conceptualised the methods and reviewed the first draft of the manuscript. JM, JS and PJ equally conceptualised the methods and reviewed the results and final draft.

Consent for publication

Not applicable.

Conflict of interest

The authors have no conflicts of interest to declare.

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