

Epidemiology of End-Stage Renal Disease in Mogadishu, Somalia: First Report at a Tertiary Care Hospital

Abdikarim Hussein Mohamed ¹, Mohamed Osman Omar Jeele ²

¹Urology Department, Mogadishu Somalia Turkish Training and Research Hospital, Mogadishu, Somalia; ²Internal Medicine Department, Mogadishu Somalia Turkish Training and Research Hospital, Mogadishu, Somalia

Correspondence: Abdikarim Hussein Mohamed, Mogadishu Somalia Turkish Training and Research Hospital, Mogadishu, Somalia, Tel +252 61 516 7182, Email abdikarimgabeyre@gmail.com

Background: End-stage renal disease (ESRD) in Somalia remains unexamined due to a lack of a national registry system, and the impact of the disease in the country is not estimated yet. The present study is the first report that aims to evaluate the epidemiological characteristics, causes, and dialysis-related factors associated with readmissions in ESRD patients who were going to routine hemodialysis.

Patients and methods: This cross-sectional observational study enrolled 208 patients with ESRD. Also, this study investigated patients readmitted to the hospital (n=135) after they enrolled in hemodialysis. The sociodemographic characteristics, risk factors, and comorbidities associated with these patients were reviewed. Admission site, length of hospital stay, outcome, and dialysis-related factors associated with readmissions in the first six months after being on a regular hemodialysis program were also assessed.

Results: The mean age of the patients was 52.7±15.0 years, 43.3% were >60 years, and 61.5% were male. The most common cause was diabetes at 39.4%, followed by hypertension (35.6%) and 12.5% for postrenal obstruction. The prevalence of 6-month hospital readmissions was 65%. The most common dialysis-related factor associated with readmissions was uremic complications due to missed hemodialysis sessions (40%), vascular access/catheter infection (20%), and anemia (17.8%) (95% CI: 0.825–5.357, OR: 3.017, p<0.04). Female cases were more vulnerable to vascular catheter site infection, anemia, and hyponatremia (p<0.001). 27.5% of the patients were admitted to the intensive care unit (ICU), and the most common reason for ICU admissions was pulmonary edema (53.8%), sepsis (42.8%), and uremia due to hemodialysis skip (26.4%) (95% CI: 1.507–13.632, OR: 2.08, p=0.01). The mortality rate was 5.2%.

Conclusion: The prevalence of unplanned hospital readmissions within six months was very high, and a missed hemodialysis session was identified as the leading cause. Inadequate knowledge, wrong social beliefs about the concept of dialysis and a lack of a health insurance system that covers the higher costs of each dialysis session are believed to be the causes of missed dialysis occasions.

Keywords: end-stage renal disease, Sub-Saharan Africa, hemodialysis

Introduction

End-stage renal disease (ESRD) is defined as a significant reduction in the kidney's ability to function properly, as well as a glomerular filtration rate of less than 15mL/min.¹ Even though the prevalence of chronic kidney disease (CKD) in Somalia was not examined before, CKD in sub-Saharan Africa was found to be 6.8% in 2020, as reported by Muir et al.²

CKD is becoming the leading cause of mortality, associated with increased cardiovascular morbidity and mortality.³ The mortality rate of ESRD is very high, with about 20 to 50% deaths in the first 24 months. Cardiovascular disease is considered the most common cause of death in CKD patients.⁴

Well-established risk factors for CKD include diabetes, hypertension, metabolic syndrome, and obesity.³

Patients with end-stage renal disease going to routine hemodialysis (HD) programs are often more vulnerable to being hospitalized and readmitted than the general population.⁵ It is said that in 2018, 34% of patients going to hemodialysis in the United States were readmitted to the hospital in just 30 days.^{6,7}

The hospital readmissions will impact the quality of life of the patients negatively and will increase the morbidity and mortality of ESRD patients.⁷⁻⁹ Also, these readmissions burden the emplaced health system as they will increase the annual cost of ESRD patient care worldwide.¹⁰ Hence, reducing the possibility of readmissions in HD patients became an essential part of the patients' management for the clinicians and the policymakers.¹¹

In Somalia, a country that has a long history of civil war, there is a lack of a health insurance system that covers and monitors the annual cost of ESRD patients.¹² Needless to say, decreasing the readmission possibilities will not only improve their quality of life but also manage the financial burden of the patients.

The prevalence, causes, and reasons associated with unplanned readmission of ESRD patients in Somalia remain unexamined. Therefore, the present study is the first report that aims to evaluate the epidemiological characteristics, causes, and dialysis-related factors associated with readmissions in ESRD patients who were going to routine hemodialysis.

Method

This cross-sectional observational study enrolled all end-stage renal disease patients in the maintenance hemodialysis program at Mogadishu Somalia Turkish Training and Research Hospital (the only referral dialysis center in Mogadishu) from 1 July 2021 to 1 January 2022. A total of 208 patients with ESRD who are going on routine hemodialysis programs were included in the study. Also, this study investigated patients readmitted to the hospital (n=135) after enrolling in the hemodialysis program for any reason, regardless of age and sex, to include in this study. Acute renal failure, those patients with chronic renal failure not needing renal replacement therapy, and patients with missed data were excluded from the study.

The sociodemographic and clinical characteristics of the patients (age, gender, hemodialysis duration and sessions per week, hemodialysis site (fistula, graft, and hemodialysis catheter), hemodialysis compliance of the cases either regular or skip, defined of hemodialysis miss of \geq two times per month, hemodialysis cost funding, quality of life, diet and medication compliance), risk factors and comorbidities associated with ESRD recruited from electronic medical records on hospital information system (HIS) were studied among the patients at hemodialysis program. Patients were grouped into four categories: <18 years, 19–39 years, 40–59 years, and >60 years old. The authors recognized a poor quality of life in patients with ESRD who lost their preceded work due to chronicity of the disease, work absenteeism, lack of public awareness of the disease and the hemodialysis itself, discrimination, and social pressure on the patients.

Risk factors for ESRD assessed were included diabetes, hypertension, postrenal obstruction (Stone, cancers, and others), glomerular diseases based on the presence of proteinuria and absence of other identifiable causes, medications (analgesics use), cystic renal disease (polycystic kidney disease), and idiopathic etiology.

Regarding assessment for reasons associated with readmissions; admission site, duration of hospital stay, cost of hospital stay, outcome (recovered, not improved, and death), and dialysis-related factors associated with readmissions in the first six months after being on routine hemodialysis program were among the extracted data from HIS using date and ICD-10 codes. The definition of not improved was taken as the patients who did not die during the study and did not improve to the level of discharging them from the hospital. If a patient were readmitted multiple times, we counted his first unplanned readmission.

This study was carried out according to the Helsinki Declaration and was approved by Mogadishu Somalia Turkish Training and Research Hospital's ethical committee (REF. MSTH-6745). The study's objective was explained in detail to the participants, all patients, and the parents of the patients under 18 years obtained and signed written informed consent. Statistical analyses were used in the Statistical Package for Social Sciences ((SPSS v23, IBM, Armonk, NY, USA)) software. The frequencies and proportions were presented as point estimates in categorical variables, while the mean \pm SD was employed in quantitative variables. A bivariate analysis was performed to assess the association between independent and dependent variables. A p-value of <0.05 was considered statistically significant. The odds ratios (ORs) and their

95% confidence intervals (CIs) were calculated. The multivariate logistic regression model exhibited variables that showed statistical significance under the bivariate analysis.

Results

This study included 270 patients going to regular hemodialysis at Mogadishu Somali Turkish Research and Training Hospital. A final number of 208 patients who did not have any missing data and gave their consent to participate in the study were examined.

The epidemiological characteristics of the patients were evaluated; the mean age was 52.7 ± 15.0 years, with a range of 14–86 years old. Most cases were elderly (>60 years), accounting for 43.3%, and 128 cases were male, representing 61.5% of the patients. The hemodialysis status of the patients was as follows; 37.5% of the cases were on a hemodialysis program for 2–3 years, 28.8% for >3 years, 74.5% had arteriovenous fistula, and 21.2% had hemodialysis catheter. One hundred fifty-eight patients (76%) underwent two sessions of hemodialysis per week. Regarding hemodialysis compliance of the patients, 93.3% of the cases had good compliance since 57, 7% of the funding themselves, without health insurance, although 94.2% living with poor quality of life. Nearly two-thirds of the cases had no regular diet control (eating a salt and sugar diet), though more than two-thirds had good medication compliance. Table 1 summarizes the sociodemographic and clinical characteristics of the patients.

Causes of ESRD were assessed; the most common cause was diabetes in 39.4% ($n=82$), followed by hypertension ($n=74$, 35.6%), 12.5% for postrenal obstruction (Stone=17, cancers=9), glomerular disease in 4.8%, medications and cystic renal disease in 1% each, and 5.7% for unknown cause. Diabetes was the leading cause of ESRD in all age categories and gender groups (except those younger than 18 years old). Table 2 shows the distribution of causes associated with ESRD.

As illustrated in Figure 1, the most common comorbidity associated with these patients was hypertension in 56.7%, heart failure in 27.9%, dyslipidemia in 26%, diabetes in 17.3%, ischemic heart disease in 11.5% and 1.5% had cerebrovascular disease.

A total of 135 cases were readmitted, of which 54.8% ($n=74$) were male and 45.2% ($n=61$) were female (95% CI: 0.89–1.58, OR: 1.03, $p=0.36$). There was a statistically significant variation in age among readmitted patients, 48.9% of them ($n=66$) were aged 60, and over, 28.1% ($n=38$) were between 40 and 59 years old (95% CI: 1.01–1.58, OR: 1.23, $p<0.02$). This result indicates that an increase in the patient's age will increase the possibility of readmission (Table 3).

Throughout the study; dialysis-related factors associated with readmission were examined, and found that 40% ($n=54$) of the cases had uremic complications (ie, confusion, pericarditis) due to missed hemodialysis session, 20% ($n=27$) had vascular access/catheter infection, 17.8% ($n=24$) had anemia, 10.4% ($n=14$) had pulmonary edema, and 5.9% ($n=8$) had hyponatremia (95% CI: 0.825–5.357, OR: 3.017, $p<0.04$). As shown in Figure 2, Female cases were more vulnerable to vascular catheter site infection (15/27), anemia (13/23), and hyponatremia (6/8) (95% CI: 1.234–9.648, OR: 3.26, $p<0.001$).

Concerning the admission site, 72.5% of the cases were admitted in the inpatient ward and 27.5% in the ICU. The most common reason for ICU admission was pulmonary edema (53.8%), sepsis (42.8%), uremic complications due to hemodialysis skip (26.4%), anemia (13%), and vascular catheter site infection in 12.5% (95% CI: 1.507–13.632, OR: 2.08, $p=0.01$).

The mean hospital stay in our study was 7.04 ± 4.75 days with a medium range of 2 to 26 days. Half of the patients (54.8%) stayed in the hospital for 3–7 days, 25.9% for >8 days, and 19.3% in 1–3 days. The hospital stay of the patients who followed up in the intensive care unit was statistically significantly higher than the inpatient clinic patients, 40% vs 16% in >8 days (95% CI: 0.94–2.53, 1.83, $p=0.004$). Also, a statistically significant difference was found between the hemodialysis duration of the cases according to the length of hospital stay, >8 days hospital stay in 32% for hemodialysis duration >2 years ($p=0.010$). There was no statistically significant association between risk factors for readmission and length of hospital stay ($p=0.074$).

Regarding the outcome of the patients; 91.8% of the patients were recovered successfully, four patients were not improved, and the mortality rate of our study was 5.2% of the cases ($n=7$), three patients had sepsis, two patients with skip dialysis, one with pulmonary edema, and patient with vascular catheter site infection were those who passed away (95% CI: 1.12–2.44, OR: 1.46, $p<0.001$).

The hospital costs of the cases ranged from 103 to 3050 dollars, averaging 465.10 ± 407.01 dollars.

Table I The Sociodemographic and Clinical Characteristics of the Patients

Variables	No. of Patients	Percentage %
Age	52.7±15 years	
>60Y	90	43.3%
40–59Y	82	39.4%
19–39Y	28	13.5%
<18Y	8	3.8%
Gender		
Male	128	61.5%
Female	80	38.5%
Hemodialysis site		
Fistula	152	74.5%
Catheter	44	21.6%
Graft	10	3.9%
Hemodialysis duration		
<6month	16	7.7%
7–24 months	54	26%
24–48 months	78	37.5%
>48 months	60	28.8%
Hemodialysis sessions		
Once /week	26	12.5%
Twice/ week	158	76%
Three times/week	20	9.6%
Four times/ week	4	2%
Hemodialysis Compliance		
Regular	194	93.3%
Skip	14	6.7%
Hemodialysis cost		
Own	120	57.7%
Help	88	42.3%
Quality of life		
Poor	196	94.2%
Good	12	5.8%
Diet control		
Yes	88	42.3%
No	120	57.7%
Medication compliance		
Yes	150	72.1
No	58	26.9%

Discussion

End-stage renal disease is a public health challenge, particularly in low-income Sub-Saharan African countries. The prevalence, causes, and dialysis-related factors associated with unplanned readmission of ESRD patients in Somalia remain unexamined due to a lack of a national registry system, and the impact of the disease in the country is not estimated yet. The present is the first study aimed at evaluating the epidemiological characteristics, causes, and

Table 2 Distribution of Causes Associated with ESRD

Causes	No. of Patients	Percentage %
Diabetes	82	39.4%
Hypertension	74	35.6%
Postrenal obstruction	26	12.5%
Glomerular disease	10	4.8%
Cystic disease	2	1%
Medications	2	1%
Unknown	12	5.7%

predisposing factors associated with readmissions in ESRD patients who are going to routine hemodialysis at a tertiary hospital in Mogadishu, Somalia.

In our study, the most common cause of ESRD was diabetes in 39.4%, the leading cause of ESRD in all age categories and gender groups, followed by hypertension (35.6%). Analysis of the Taiwan Renal Registry Data System (TWRDS) database from 2005 to 2012 revealed that diabetes was found in up to 47.9% of the cases.¹³ Another study from Egypt involved 1559 patients on routine hemodialysis, unknown etiology, and hypertension were responsible for 25% and 21.4% of ESRD, respectively.¹⁴ Variations of the causes were noticed in a study reported from Mexico; young patients (20–40 years) initiated for RRT were a result of an unknown cause (70%), whereas the elderly group (50–70 years) were a result of diabetes and hypertension in 60%, which coheres with our study findings.¹⁵ A survey of 20 countries in Latin America over ten years declared that diabetes remains the most common cause of ESRD, which coheres with our study findings.¹⁶ Public health awareness, early diagnosis, and management of diabetes and hypertension should include the most crucial steps for ESRD prevention.

Two-thirds of the ESRD cases in our study were male, and a similar male predominance was observed in a large national population-based cohort study from Korea that detected the number of male patients (58.5%) tended to be higher than that of females.¹⁶ A cross-sectional study from Palestine revealed that 57.7% of their cases were male, which supports the results of the current study.¹⁷

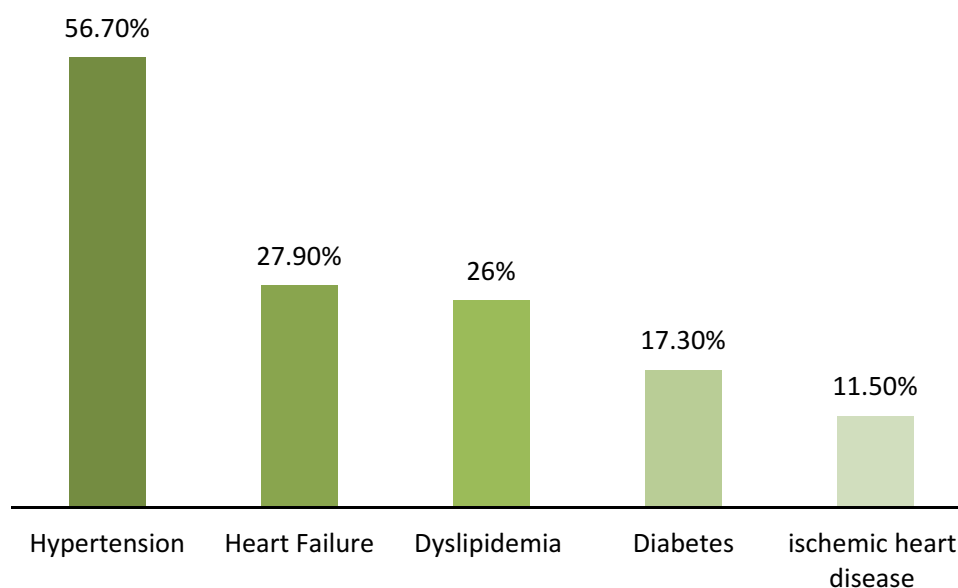
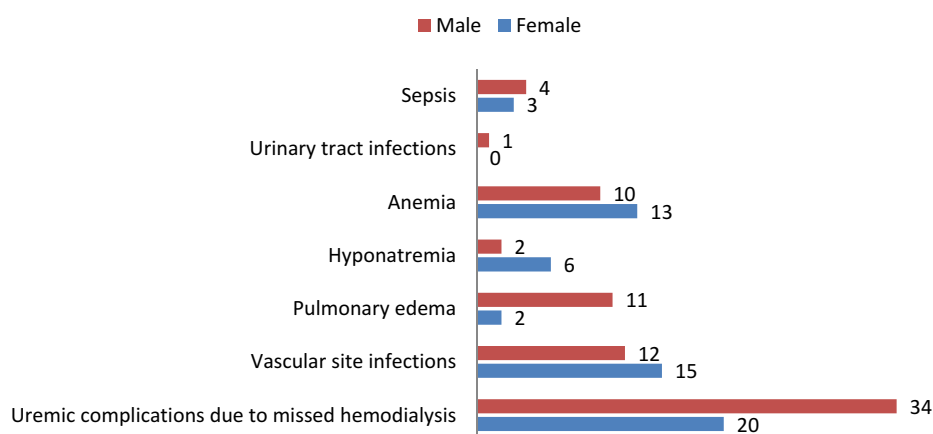
**Figure 1** The most common comorbidities associated with ESRD patients.

Table 3 Characteristics of Readmitted Patients

Variables	No. of Patients	Percentage %	95% CI	OR	P-value
Age			1.01–1.58	1.23	P<0.02
<18 years	13	9.6%			
19–39 years	18	13.4%			
40–59 years	38	48.9%			
>60 years	66	28.1%			
Gender			0.89–1.52	1.03	P<0.36
Male	74	54.8%			
Female	61	45.2%			
Predisposing Factors			0.825–5.357	3.017	p<0.04
Uremia (due to missed hemodialysis sessions)	54	40%			
Vascular access catheter infection	27	20%			
Anemia	24	17.8%			
Pulmonary edema	14	10.4%			
Hyponatremia	8	5.9%			
Sepsis	7	5.2%			
Urinary tract infection	1	0.7%			
Outcome			1.12–2.44	1.46	p<0.001
Recovered	124	91.8%			
Not improved	4	2.9%			
Died	7	5.2%			

Notes: A p-value of <0.05 was considered statistically significant. The odds ratios (ORs) and their 95% confidence intervals (CIs) were calculated.

ESRD is a worldwide concern, resulting in undesirable impacts for patients, their families, and society. Its incidence and prevalence are progressively rising due to the increase in the leading causes of diabetes and hypertension, though they can be prevented. Nearly two-thirds of our cases have no regular diet control (eating salt and sugar daily) without regular exercise. The estimated annual cost of ESRD is \$32.9 billion.¹⁸ Due to limited resources in our country, our center is the sole functional dialysis center available in the whole countryside, where the rest there is no available renal replacement therapy. Patients who were in the dialysis program had to spend the expenses by themselves (58%) or for the help of other charities.

**Figure 2** Dialysis-related factors associated with readmissions regarding gender distribution.

Thirty-day hospital readmission for patients going to the hemodialysis program is about 34%.^{6,7} Several risk factors are associated with increased readmission rates, including anemia, hypoalbuminemia, catheter vascular access malfunctions, comorbidities such as heart failure, and myocardial infarction.¹⁹ S, Yetti K. reported that poor hemodialysis compliance and anemia were significantly correlated with hospital readmission.²⁰ A retrospective study concerning 30-day hospital readmissions of a total of 189 patients by Plantinga LC et al said that 44% of readmissions were due to pulmonary edema.²¹

The prevalence of 6-month dialysis-related hospital readmissions in our study was 65%. The most common predisposing factor was found to be uremic complications due to missed hemodialysis sessions, followed by vascular access/catheter infection, anemia, and pulmonary edema. Renal replacement therapy, including hemodialysis and peritoneal dialysis, is the primary life-saving treatment for ESRD patients. Unfortunately, there is a lack of access to dialysis services for more than 63% of CKD patients in low and lower-middle-income countries. Nearly 7 million ESRD cases die due to a lack of dialysis accessibility.²² Missed hemodialysis sessions were responsible for the overcrowding of our center for receiving many ESRD patients needing regular renal replacement therapy, lack of public awareness of the disease and the hemodialysis itself, discrimination, and social pressure on the patients. In addition to this, inadequate skills of dialysis providers, higher costs belonging to each dialysis session that most of the patients are not affordable (low socioeconomic status), as well as lack of access to the center because of rural and far distance distribution of the cases were also the principal causes of missed dialysis occasions. These hospital readmissions pose an increased financial cost to the patients; the hospital costs of our cohort ranged from 103 to 3050 dollars, with an average of 465.10±407.01 dollars.²³

Besides the advancements in the management of ESRD in the manner of hemodialysis (presently, about 2 million individuals are in maintenance hemodialysis programs worldwide, which represents only 10% of the patients), the mortality rate of these patients is high compared to that of general of the population (from 6% in Morocco, 10.4% in Tunisia, and 12% in Algeria).²⁴ In Sub-Saharan African countries, few studies reported the mortality rate. In a study of a total of 661 hemodialysis patients from Cameroon, the death rate at one year of follow-up was 26.8%.²⁵ The mortality rate among patients varied between the nations. The mortality rate of readmitted patients in our study was 5.2% of the cases (n=7). We recommend the immediate establishment and facilitation of the patients for numerous dialysis centers in the country to properly serve, reduce preventable causes of unplanned readmissions, and improve their quality of life.

This study has several limitations: first, it is a single-center study; there are no capable hemodialysis centers eligible for the patients throughout the country (to date, only our center is the only referral center available which faces overcrowding), and underreporting is probable. The type of glomerular disease was not determined due to the unavailability of biopsies. Peritoneal dialysis and kidney transplantation are not available in Somalia. Besides these limitations, ESRD patients in Somalia remain unexamined due to a lack of a national registry system, and the impact of the disease in the country is not estimated yet. This present is the first study to evaluate the epidemiological characteristics, causes, and dialysis-related factors associated with readmissions in ESRD patients who are going to routine hemodialysis.

Conclusion

The prevalence of unplanned hospital readmissions within six months was higher than in many other Sub-Saharan African countries, and a missed hemodialysis session was identified as the leading cause. Uremic complications due to missed hemodialysis sessions were responsible for 40% of unplanned hospital readmissions in our study. Inadequate knowledge, wrong social beliefs about the concept of dialysis, and lack of a health insurance system that covers the higher costs of each dialysis session are believed to be the causes of missed dialysis occasions. Future studies will identify the exact reasons behind the missed hemodialysis sessions.

Abbreviations

CRF, chronic renal failure; ESRD, End stage renal disease; HD, hemodialysis; HIS, hospital information system; TWRDS, Taiwan Renal Registry Data System.

Institutional Review Board Statement

This study was carried out according to the Helsinki Declaration and was approved by Mogadishu Somalia Turkish Training and Research Hospital's ethical committee (REF. MSTH-6745).

Data Sharing Statement

Data included in the manuscript.

Informed Consent Statement

The objective of the study was explained in detail to the patients and the parents of underage patients and all patients obtained informed consent.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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