

Factors Predicting Hospitalization among end Stage Renal Disease Patients Undergoing Hemodialysis in Sudan

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ABSTRACT

Anemia is a common complication of End Stage Renal Disease (ESRD). The factors affecting hospitalization among patients undergoing Hemodialysis (HD) in Sudan were not extensively explored. This study was carried out to determine factors predicting hospitalization among patients undergoing HD. Twelve HD centers in Khartoum State were stratified and a total of (1015) adult ESRD HD patient were recruited. A prospective observational study was conducted from 1st August 2012 to 31st July 2013. A standardized data collection form was used and the factors affecting hospitalization were evaluated. A total of 481 patients were excluded from the analysis, which comprised of 194 (19.1%) patients were transferred to other centers, 165 (16.3%) were deceased, 84 (8.3%) lost to follow-up and 38 (3.7%) underwent renal transplantation. Five hundred and thirty-four (52.6%) patients were included in the analysis, with a hemoglobin level of <12 g/dL. Three hundred and seven (57.5%) were males and the mean age was 48.7 ± 16.1 years. From logistic regression analysis factors significantly predicting hospitalization were; patients age '≥ 65' years, (OR=5.01, (3.09–8.13)), hypertension, (OR=1.55, (1.03–2.32)), obstructive uropathy, (OR=2.19, (1.29–3.71)) and pyelonephritis, (OR = 2.24, (1.10–4.56)). Thus, elderly ESRD HD patients with hypertension, obstructive uropathy and pyelonephritis were at higher risk for hospitalization during dialysis period. These findings provide an important insight for Sudanese ESRD HD patients that need further consideration to decrease hospitalization risk.

INTRODUCTION

Anemia is a severe complication among End Stage Renal Disease (ESRD) patients. Hospitalization was common among ESRD patients undergoing Haemodialysis (HD). Higher hospitalization rate among the Dialysis Outcomes and Practice Patterns Study (DOPPS) 1 countries (0.6%-1.7%). Additionally, hospitalization rate in ESRD patients on haemodialysis was documented in Saudi Arabia and Egypt as 65.4% and 49%, respectively.

Several factors contributing to hospitalization in HD patients. Higher association between Hb levels and hospitalization among HD patients. Advanced age was a modifiable risk factor for high rate of hospitalization among anaemic ESRD patients. Risk of hospitalization was increased among the Euro-DOPPS countries and associated with previous peritoneal dialysis treatment, Diabetes Mellitus (DM), cancer, and Cardiovascular Diseases (CVD) [1]. Smokers had infection-related morbidity among HD patients. Infections and access related complications were contributed to higher hospitalization rate. The factors influencing higher risk of hospitalization among HD patients in Sudan are not well-known [2]. This study aimed to determine the factors predicting hospitalization in ESRD patients undergoing HD.

MATERIALS AND METHODS

Patients

The study was carried as a prospective observational in 1015 HD patients from twelve stratified governmental HD centres in Khartoum State. Adult's patients (≥ 18 years old) who were dialyzed at least 4 months and enrolled from August 1, 2012 to July 31, 2013, were included in the study. All patients were included after agreed by written informed consent. Patients who had malignancy or rheumatoid arthritis were excluded from the study.

Patient's soci-demographic, clinical, laboratory data and outcomes

Patient registration records were reviewed to identify patient's data and a standardized data collection form was used. Patients' socio-demographic information such as age, gender, race, height and dry weight were identified. Social factors, including education level, insurance status, employment status, monthly income, and marital status were recognized, along with smoking habit. Medical records were used for patients' clinical data, including comorbidities, the etiology of ESRD, and laboratory data. In addition to, data regarding anemia medications and other concomitant drugs.

For each patient, the Body Mass Index (BMI) was computed as weight in kilograms divided by the square of height in meters, and categorized into five standard groups based on the World Health Organization (WHO). The Glomerular Filtration Rates (eGFR) was estimated by using the Modification of Diet in Renal Diseases (MDRD) equation ($\text{ml}/\text{min}/1.73 \text{ m}^2 = 186 \times (\text{S}_{\text{cr}})^{-1.154} \times (\text{Age})^{0.203} \times (0.742 \text{ if female}) \times (1.210 \text{ if African-American})$).

In this study, anemia was defined as Hemoglobin (Hb) level $<13.0 \text{ g/dL}$ ($<130 \text{ g/L}$) in males and $<12.0 \text{ g/dL}$ ($<120 \text{ g/L}$) in females. Patients were followed until renal transplantation, loss to follow-up, transfer to other centers, and the end of the study or death. The hospitalization rates were recorded from the patient medical records which were

performed during the monthly follow-up. Other clinical outcomes including cardiovascular events and mortality rates were determined.

The study was approved by the national centre for kidney diseases and surgery, ministry of health, republic of Sudan and other approvals from the HD centres for patient enrolment were obtained.

Statistical analysis

The significance variables were taken as $p < 0.05$. The continuous variables were presented as means (\pm SD) and categorical variables were presented as frequencies and percentages. The logistic regression models were used as univariate and backward stepwise multivariate methods to determine factors predicting hospitalization. More than two categorical variables were introduced as dummy variables. All independent variables were introduced in the multivariate models. The p-value of < 0.05 with adjusted Odd Ratio (OR) > 1 was considered as a significant predictor. The Statistical Package for Social Sciences (SPSS) version 22.0 used for all data analysis.

RESULTS

In this study 1015 patients were recruited. Out of them one hundred and ninety-four (19.1%) patients were transferred to other centers, 165 (16.3%) were deceased patients, 84 (8.3%) patients were lost to follow-up and 38 (3.7%) underwent renal transplantation. Five hundred and thirty-four (52.6%) patients were included in the analysis. Male patients were 307 (57.5%). The mean age of the analyzed patients was 48.66 ± 16.05 years. Table 1, shows the baseline characteristics of patients. Hospital admission during study time was determined in 206 (38.6%). The most common cause of hospitalization was catheter infections, CVD and other complications.

Table 1. The baseline characteristics of anemic ESRD hemodialysis patients (534).

Variable	n (%)
Gender	
Male	307 (57.5)
Female	227 (42.5)
Age (years)	
18-44	198 (37.1)
45-64	234 (43.8)
≥ 65	102 (19.1)
^a BMI (kg/m ²)	
Underweight < 18.5	129 (24.2)
Normal weight 18.5-24.9	390 (73.0)
Overweight ≥ 25	15 (2.8)

Race	
Sudanese	528 (98.9)
Others	6 (1.1)
Education level	
≥ Secondary	349 (65.4)
<Secondary	185 (34.6)
Smoking habit	
Current	3 (0.6)
Previous	244 (46.3)
Never	287 (53.7)
Family history of ^b ESRD	
No	450 (84.3)
Yes	84 (15.7)
Comorbidities	
Other diseases	67 (12.5)
Gout	55 (10.3)
No comorbid disease	47 (8.8)
Hyperlipidemia	21 (3.9)
Liver disease	10 (1.9)
Postoperative complication	7 (1.3)
Malnutrition	1 (0.2)
Etiology of ESRD	
Hypertension	297 (55.6)
Diabetes mellitus	135 (25.3)
Obstructive uropathy	79 (14.8)
Other causes	81 (15.2)
Treatment	40 (7.5)
Unknown	37 (6.9)
Chronic glomerulonephritis	37 (6.9)
Pyelonephritis	37 (6.9)
Interstitial nephropathy	6 (1.1)
Hereditary nephropathy	3 (0.6)

Predictors of hospitalization

The significant factors predicting hospitalization in simple and multivariate logistic regression analysis (Table 2).

Table 2. Factors predicting hospitalization among ESRD HD patients (n=534) using simple and multiple regression analysis.

Variable	Simple regression			Multiple regression		
	β	Crude OR (CI 95%)	P	β	Adjusted OR (CI 95%)	P
Age (years)						
18-44	0	1	-	1	1	-
45-64	-0.10	0.90 (0.60, 1.36)	0.628	-	-	-
≥ 65	1.62	5.03 (3.00, 8.43)	<0.001	1.73	5.63 (3.41, 9.30)	<0.001
Education level						
\geq Secondary	0	1	-	-	-	-
<Secondary	0.57	1.78 (1.23, 2.56)	0.002	-	-	-
Comorbidities						
Gout (no/yes)	0.56	1.75 (1.00, 3.07)	0.049	0.60	1.82 (0.97, 3.39)	0.060
Post-operative complication (no/yes)	0.76	2.15 (0.48, 9.68)	0.321	1.74	5.72 (1.17, 27.88)	0.031
Other comorbidities	-0.06	0.94 (0.55, 1.60)	0.820	0.74	2.09 (1.11, 3.93)	0.023
Etiology of ESRD						
Hypertension (no/yes)	0.47	1.60 (1.12, 2.28)	0.010	0.67	1.95 (1.23, 3.09)	0.005
Obstructive uropathy (no/yes)	0.40	1.49 (0.92, 2.41)	0.104	1.01	2.75 (1.56, 4.87)	<0.001
Treatment (no/yes)	-0.83	0.44 (0.20, 0.94)	0.034	-	-	-
Unknown (no/yes)	-0.16	0.85 (0.42, 1.72)	0.656	0.87	2.39 (1.05, 5.40)	0.037
Pyelonephritis (no/yes)	0.44	1.56 (0.80, 3.04)	0.195	1.03	2.81 (1.34, 5.90)	0.006

The result of final model stepwise backward multivariate analysis that the significant predictors for hospitalization among anemic ESRD HD patients were patients' advanced age (≥ 65 years) (OR=5.01), hypertension (OR=1.55), obstructive uropathy (OR=2.19), and pyelonephritis (OR=2.24) (Table 3).

Table 3. Factors significantly predicting hospitalization among ESRD HD patients (n=534) using multiple logistic regression analysis.

Variable	β^a	Adjusted OR (95% CI) ^b	p-value
Age groups (years)			
18-44	0	1	
≥ 65	1.61	5.01 (3.09, 8.13)	<0.001
Other comorbid diseases (no/yes)	0.52	1.68 (0.93, 3.03)	0.086
Hypertension (no/yes)	0.44	1.55 (1.03, 2.32)	0.035
Obstructive uropathy (no/yes)	0.78	2.19 (1.29, 3.71)	0.004
Pyelonephritis (no/yes)	0.81	2.24 (1.10, 4.56)	0.027

DISCUSSION

The current study revealed that prevalence of hospitalization during the study was 39%, for different conditions. In the US the rate of hospitalization among patients undergoing HD in 2014 was 1.7 per patient. However, it was higher in Canada 73.9%. Lower prevalence of hospitalization was reported among HD patients in Korea as 37%. The present study finding was higher than those documented in Saudi Arabia 23.7%. These discrepancies explain by the differences in the methodology and population [3-7]. Nevertheless, advanced aged patients with hypertension, obstructive uropathy and pyelonephritis as baseline causes of ESRD were identified as factors associated with increased risk of hospitalization among HD patients.

The current research found that patients aged 65 years or older, increased risk of hospitalization among study patients compared to younger patients. This is in agreement with several previous studies findings. However, this study showed that patients hospitalized during the study time were fivefold more likely to be older than ('18-44' years). Contrary, advanced age was found not to be associated with hospitalization for non-access-related causes. However, older age was found as significant risk factor associated with serious infections contributes to hospitalization among hemodialysis ESRD patients [8-15]. The present study finding partially disagree with those of the DOPPS study which found that age was not associated with hospitalization rate among most Euro-DOPPS countries. Except in UK, where advanced age (≥ 65 years) was associated with increased risk of hospital admission, this may have related to increased catheters use in UK than in other countries. This may explain by the reductions in estimated GFR contributed to increase of prevalence of all Chronic Kidney Disease (CKD)-related complications even in geriatric patients regardless of age. In addition, age relating functional and structural changes may affect all organ systems and reduce homeostatic capacity and increases vulnerability, which lead to more complications in the presence of CKD-related anemia.

It was found that hypertension was independently associated with hospitalization. It was present in 55% as a leading cause of ESRD among these study patients. This compare to 14.3% and 43% the rate of hypertension range in Sudan reported in previous studies. The current study results in agreement with finding in Egyptian HD patients found that hypertension as a comorbid disease increased risk of hospitalization [16-19]. In addition, patients with

unchanged or higher Systolic Blood Pressure (SBP) were found at a higher risk of hospitalization than patients with lower SBP for causes other than access complications. Likewise, elevation of SBP may increase the comorbidities and contribute to a higher risk of complications. However, the pathophysiology of this hemodynamic outcome was not determined. A study conducted in HD patients documented that 24% were hospitalized and 15% of them due to hypertension [20-23]. Similarly, hypertension and CVD have been documented to be major causes of hospitalization. Conversely, previous study showed that hospitalization of dialysis patients with advanced CKD was related to CVD and infectious diseases rather than hypertension. These variations may relate to differences in geographical regions, population, and methodology.

In the present study the analysis showed that obstructive uropathy was significantly increased rate of hospitalization as a baseline cause of ESRD [24]. Other studies agreement with this study finding was reported that patients with obstructing calculi were at higher risk for worsen of renal function and hospitalization. In other hand, several studies have reported that nephrolithiasis was associated with CVD. Notably, CVD including coronary artery disease, silent myocardial ischemia, ventricular arrhythmias, atrial fibrillation, Left Ventricular Hypertrophy (LVH), aorta and mitral valve calcification, were found as the most common cause of hospital stay among HD patients. As well as the CVD risk factors were contributed to increased morbidity rates among these patients [25-29]. A study reported that the duration and frequency of hospitalization has been found to be associated with uncontrolled anemia and cardiovascular events.

This research also showed that pyelonephritis as a cause of ESRD may associate with increase hospitalization among HD patients. Currently, relatively little is known about the prevalence of acute pyelonephritis related hospitalization among HD patients [30]. However, this study result was consistent with previous studies finding showing that higher rate of pyelonephritis related hospitalization among general population in the US. The present study was also in agreement with a study showing that 9.96% of women and 1.18% of men were hospitalized for pyelonephritis [31].

CONCLUSION

This study has several limitations. First, the observational nature of the study not improves the causal association of the predictors with hospitalization rate. Second, the frequency of hospitalization identified from the patient's medical records in dialysis centers which may sometimes the information unavailable. However, the study also has some strength that it was used longitudinal prospective data for substantial number of HD patients including all ranges of the demographic and laboratory data from multi dialysis centers across the town. The hospitalization rate was higher among these study patients. Hospitalization risk increased with patients advanced age, hypertension, obstructive uropathy and pyelonephritis. These findings significantly contribute to the clinical practice considering quality of life of hemodialysis patients in Sudan.

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