



Original Research

Hospitalization Pattern and Mortality of Patients on Maintenance Hemodialysis in a Low Resources Setting

Causes d'Hospitalisation et de Mortalité en Hémodialyse Chronique dans un Pays à Ressources Limitées

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ABSTRACT

Background. Haemodialysis (HD) treatment is challenging in developing countries and could be associated with higher morbidity and mortality. The aim of this study was to describe causes of hospital admission in patients on maintenance HD and factors associated with fatal outcomes. **Methods.** This cross-sectional, study was conducted in a tertiary care hospital in Cameroon during from 1st January 2018 to 31st March 2020. We used files of all patients on maintenance HD admitted during the study period to collect sociodemographic, clinical and paraclinical data. **Results.** we included 77 patients (77.7% male) with a mean age of 48.7 ± 15.6 years and a median [IQR] dialysis vintage of 30.38 months [3-96]. Vascular access was mainly permanent (72.7%). Hypertension (84.4%) was the most common comorbidity. Hypertension (28.6%), Chronic Glomerulonephritis (27.3%) and diabetes (24.7%) were the main baseline nephropathies. The main causes of hospitalization were infectious (67.5%), neurovascular (18.2%) and digestive (10.4%) diseases. Infectious state was dominated by vascular access infection (25.9%), pneumonia (13%) and malaria (17.3%). Fatality rate was 14.3% due to a sepsis in 90.9%. Out nephrology service admission (RR= 28.34; $p=0,041$) and use of temporary catheter vascular access (RR = 5.98; $p = 0,038$) were associated with mortality. **Conclusion.** Infectious diseases are common in HD patients in this setting and associated with a high risk of mortality. A temporary catheter is associated with a poor outcome.

RÉSUMÉ

Introduction. L'hémodialyse (HD) reste un véritable challenge en Afrique Subsaharienne où la mortalité est élevée. Le but de cette étude était d'évaluer les motifs d'hospitalisation et le devenir des patients en HD chronique. **Methodes:** Il s'agissait d'une étude rétrospective monocentrique conduite du 1er janvier 2018 au 31 mars 2020 dans un service d'hémodialyse spécialisé de la capitale politique Camerounaise. Ont été inclus les dossiers des patients adultes en hémodialyse depuis plus de 3 mois et admis en hospitalisation durant la période d'étude. Les données sociodémographiques, cliniques et paracliniques d'intérêt ont été colligées. Les considérations éthiques ont été respectées. Un seuil de significativité $p < 0,05$ était considéré comme statistiquement significatif. **Résultats.** Au total, 77 patients ont été inclus (77,7% sexe masculin) ayant un âge moyen de $48,7 \pm 15,6$ ans et une durée médiane [IIQ] en dialyse de 30,38 months [3-96]. La majorité des participants (72,7%) avaient un abord vasculaire permanent. L'hypertension artérielle (84,4%) était la principale comorbidité. Les principales causes d'hospitalisations étaient infectieuses (67,5%), neurovasculaires (18,2%) et digestives (10,4%). Les infections incluaient celles des abords vasculaires (38,5%), la pneumonie (19,2%) et le paludisme (17,3%). Le taux de mortalité était de 14,3%, lié au sepsis dans 90,9%. L'admission hors service de néphrologie (RR= 28,34; $p=0,041$) et l'utilisation d'un cathéter central temporaire (RR = 5,98; $p=0,038$) étaient associées au décès. **Conclusion.** La promotion d'un abord vasculaire permanent en HD chronique et une prise en charge multidisciplinaire axée sur les particularités des patients en HD sont à implémenter en vue d'améliorer le pronostic.

KEY RESULTS**What question this study addressed**

Causes of hospital admission in patients on maintenance HD and factors associated with fatal outcomes in Cameroon

Key findings

- Hypertension was the most common comorbidity.
- Hypertension, chronic glomerulonephritis and diabetes were the main baseline nephropathies.
- The main causes of hospitalization were infectious (67.5%), neurovascular (18.2%) and digestive (10.4%) diseases.
- The leading infectious conditions were vascular access infection, pneumonia and malaria.
- Fatality rate was 14.3% due to a sepsis in 90.9% of cases.
- Out nephrology service admission and use of temporary catheter vascular access were associated with high mortality.

INTRODUCTION

Haemodialysis (HD) is the only kidney replacement therapy (KRT) in many developing countries and remained non affordable for all patients with Kidney Failure (KF) [1]. When available, HD adequacy is then not always achieved in this setting. This could lead to recurrent hospitalizations and increase mortality which are favoured by late referral of patients for KRT and the type of vascular access [2,3]. In Cameroon, there is an increase incidence and prevalence of patient with KF due to the dual burden of infectious and non-communicable disease [4]. This leads to an increase number of patients on maintenance HD who is partially subsidized by the Government. Despite technical advances, mortality remains high in HD; the main causes are sepsis secondary to vascular access, cardiovascular diseases, and anaemia [5,6]. With the absence of data on in-hospital morbidity, we carried out this study aiming to access the causes of hospitalizations and its outcomes in one of the most active government funded HD facility.

PATIENTS AND METHODS**Study design and setting**

This was a hospital-based retrospective study carried from 1st December 2018 to 31st May 2020 (30 months) at the Yaounde General Hospital (YGH). YGH is one of the reference teaching hospitals for the country host the first and biggest haemodialysis centre of the region. The HD center is equipped with 15 functional 5008S Fresenius Medical Care Generators for an average of 120 patients. Each patient received two dialysis sessions of 04 hours per week. Each patient paid the equivalent of 10 US Dollars per session. HD patients are admitted in various units depending of the illness and the severity coming from the outpatient consultation, the emergency or the HD unit. Each HD patient admitted is reviewed within 24 hours by a team of nephrology. Socio-demographic, clinical and paraclinical data were collected from dialysis and hospitalisations files, hospitalisation profile is recorded

using paper-based files. A patient can have multiple files (one for each admission).

Data collection and analysis

Files of all patients on maintenance haemodialysis admitted during the study period were reviewed. We included all patients on HD for at least 3 months with complete data on hospitalisation diagnosis and outcomes. We excluded patients with incomplete file (admission diagnosis and in hospital evolution). Socio-demographic (age, gender), clinical [baseline nephropathy, comorbidities (hypertension, diabetes, HIV, hepatitis B and c, gout...), cause of admission and deaths] and paraclinical (Hemoglobin) data were collected from dialysis and hospitalisations files for this study, we used the following definitions:

- Maintenance haemodialysis patient was defined as patient who has been on haemodialysis for greater than 3months indicated for end stage kidney failure
- Vascular access infections were defined as local signs (pus or redness) at the vascular access site or a positive blood culture with no known source other than the vascular access
- Sepsis was defined as the presence of proven or suspected microbial infection in the presence of at least two of the following: temperatures $> 38^{\circ}\text{C}$ or $< 36^{\circ}\text{C}$, pulse at $> 90/\text{minute}$, respiratory rate $> 24/\text{cycles/minute}$, white cell count of $> 12,000/\text{cells}/\text{mm}^3$ or $< 4000/\text{cells}/\text{mm}^3$.

Data were exported and analysed using the statistical package for social sciences (SPSS) version 26. Chi-square statistical test, student t-test, and logistic regression were used for analysed associations between different predictor variables and death. A p-value < 0.05 was considered statistically significant.

Ethical considerations.

Ethical approval was obtained from the institutional review board of the Faculty of Medicine and Biomedical Sciences (N°277/UY1/FMSB/VDRC/CSD) and administrative authorization was gain from the Director of the YGH. Confidentiality and anonymity were respected during all the study procedure.

RESULTS

During the study period, 193 patients were on maintenance HD among with 153 (79.3%) where hospitalized. Only 77 (50.3%) files were included for analysis with 72.7% males. As showed in Table 1, high blood pressure (28.6%), Chronic Glomerulonephritis (27.3%) and diabetes (24.7%) were the main baseline nephropathies. High blood pressure (84.4%) diabetes (31.2%) and viral hepatitis C (19.5%) were the main comorbidities. Median [IQR] dialysis vintage was 21 [7-40] months. A permanent vascular access was present in 72.7% patients. Patients were mostly admitted in the nephrology unit (96.1%) and in an unplanned condition (98.7%).



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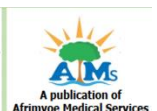


Table 1: General characteristics of HD patients in hospitalisation

	Patients (N=77)	%
Mean age \pm SD, years	48,7 \pm 15,6	
Male sex	56	72.7
Comorbidities		
Hypertension	65	84.4
Diabetes	24	31.2
hepatitis C virus	15	19.5
HIV	8	10.4
hepatitis B Virus	4	5.2
Baseline nephropathy		
Hypertensive nephropathy	22	28.6
Chronic glomerular nephritis	21	27.3
Diabetes nephropathy	19	24.7
Chronic tubulo-interstitial nephritis	7	9.1
Others*	8	
Dialysis vintage [IQR], months	21 [7-40]	
Vascular access		
AVF	56	72.7
Temporary catheter	21	27.3
Service of admission		
Nephrology	74	96.1
ICU and surgery	3	3.9
Admission modality		
Emergency	76	98.7
Unplanned	1	1.3
Mean length of hospitalisation \pm SD (minimum-maximum), days	5.64 \pm 1.37 (1-17)	
Mean Hemoglobin, g/dl	8 \pm 1.9	
Anemia	52	67.5

*ischemic nephropathy (3); HIV associated nephropathy (2); Polycystic disease (2); unknown (1). SD: Standard Deviation; IQR: Inter Quartile Range, AVF: arterio-veinous fistula; HIV: Human Immunodeficiency Virus; ICU: Intensive Care Unit

The causes of admission were dominated by infection (67.5%), mostly from vascular access (38.5%) and respiratory tract (19.2%). Non-infectious causes were cerebrovascular (19.5%) and digestive (10.4%). The cerebrovascular were leading by hypertensive encephalopathy (40%), stroke (26.8%) and heart failure (20%) (Table 2).

Table 2: causes of hospitalisation (N=77)

	N	%
Infections		
Vascular access infection	20	38.5
- catheter related sepsis	18	
- AVF infection	2	
Pneumonia	10	19.2
Severe malaria	9	17.3
Suppuration*	8	15.4
Febrile diarrhoea	5	9.6
Cerebro-vascular diseases	15	19.5
Hypertensive encephalopathy	6	40
Stroke	4	26.8
Heart failure	3	20
Epilepsy	1	6.6
Depression	1	6.6
Digestive diseases	8	10.4
Digestive haemorrhage	5	62.5
Acute gastritis	3	37.5
Others	2	2.6
Adrenal insufficiency	1	50
Severe hyperkalaemia	1	50

* Septic arthritis (3), cutaneous abscess, diabetic foot, pelviperitonitis, spondylodiscitis, acute pyelonephritis.

We recorded 11 deaths giving a mortality rate of 14.3%. They were due to sepsis (90.9%) and severe denutrition (9.1%). Although not statistically significant, mortality was more frequent in patient hospitalized out of the nephrology service (Table 3).

Table 3: Factors associated with in hospital outcome (univariate analysis)

	Alive (%) (n=66)	Death (%) (n=11)	OR (95% IC)	p
Mean age \pm SD, years	48.03 \pm 15.8	52.91 \pm 14.4	0.42 (0.10-1.73)	0.34
Male sex	48 (7.7)	8 (72.7)	1.0 (0.23-4.19)	1.00
Out Nephrology service admission	1 (1.5)	2 (18.2)	14.4 (1.18-166.6)	0.05
Hypertension	55 (83.3)	10 (90.9)	2 (0.23-17.25)	1.00
Diabetes	21 (31.8)	3 (27.3)	0.8 (0.19-3.33)	1.00
Hepatitis C	12 (18.2)	3 (27.27)	1.68 (0.38-7.31)	0.44
HIV	2 (3)	6 (54.54)	2.22 (0.38-12.74)	0.32
Hypertensive nephropathy	21 (31.8)	6 (54.54)	0.38 (0.10-1.42)	0.14
Diabetic nephropathy	19 (28.8)	3 (27.27)	1.07 (0.25-4.50)	0.61
CGN	18 (27.3)	3 (27.27)	1.00 (0.23-4.19)	1.00
Mean hemoglobin level \pm SD, g/dl	8.06 \pm 1.89	7.96 \pm 1.98	0.77 (0.2-2.9)	0.86
Catheter use	23(41.1)	8 (72.72)	4.94 (1.20-20.83)	0.02
Vascular access infection	15 (26.8)	5 (45.5)	0.31 (0.06-1.47)	0.13
Community Acquired pneumonia	8 (14.3)	2 (18.2)	0.66 (0.11-3.93)	0.64
Malaria	9 (100)	0	1.22 (1.06-1.41)	0.32
Digestive haemorrhage	5 (8.9)	3 (27.3)	1.19 (1.07-1.31)	0.59

HIV: Human Immunodeficiency Virus; CGN: Chronic Glomerulonephritis

The admission outside the nephrology service and the use of catheter were associated with deaths (Table 4).



Table 4: Factors associated with in hospital outcome (multivariate analysis)

Variables	Adjusted OR (95%)	Adjusted
Out nephrology hospitalisation	0,31 (0,001-1,40)	0,044
Catheter use	0,08 (0,01-0,75)	0,027

DISCUSSION

This study gives an overview of indication for hospitalisation and factors associated with fatal outcomes among HD patient in low-resources settings. We reported that nearly 8 out of 10 HD patients were hospitalized among which more than two- third secondary to an infection mainly from vascular access. The mortality rate was 14.3% and associated factors were the admission outside the nephrology service and the use of catheter.

We observed a higher rate of compare to general population which can be explained by the high burden of comorbidities and immunodepression due to uremic condition [1]. Quinn et al, had describe a similar trend of hospitalisation [2]. In a recent study elsewhere in Cameroon, Teuwafeu et al found that 4 patients out of 5 were admitted at least once during a 5 years period [3]. However, our hospitalisation rate is greater than 16% observed by Coulibaly which could be explained by the difference in the hospital admission criteria and the higher frequency of catheter use in our study [4]. The mean age (48.7 ± 15.6 years) of our cohort is superposable to those of Mikou et al (46.7 ± 20 years) and Coulibaly et al (46 years) with a similar male trends [4,5].

The infections were the main causes of hospitalisation in this study as observed by Fouda, teuwafeu et Coulibaly in similar settings. These result differed from developed countries where cardiovascular disease lead the admission causes [3,5,6] [6,7]. The infections were dominated by the vascular access infections as reported by Hassanien et al who showed that the use of catheter increase by 2.5-fold the rate of hospital admissions compared to AVF [8]. The reason why catheters are associated with higher hospitalization may be due to direct results of catheter-related bloodstream infections, access site infections, thrombosis, bleeding and hematoma and catheter dysfunction. Pneumonia rates were higher in HD than expected from general population [9] because of the impairment of immunological response due to uremic internal milieu with impaired chemotaxis, adherence, reactive oxygen species production, and phagocytosis and accelerated apoptosis of granulocytes. Like in our study, it is know that about 20% of infections in ESKF patients are attributable to pulmonary causes and it is suggested that episodes of pneumonia are associated with particularly high morbidity and mortality in this population [10]. Anemia was less frequent in our cohort than the 30.7% reported by Teuwafeu et al [3] or the 79% in the 2015 cohort of Kaze et al [11]; this may be due to the better access to erythropoiesis-stimulating agents (ESA) for anemia treatment in our hospital. Non-infectious cause of hospitalisation was dominated by hypertensive encephalopathy and digestive haemorrhage. Hypertension is a risk factor for mortality in HD patients [12]. Non-infectious diseases are frequent cause of

admission in developed countries where neurovascular diseases are frequent in concordance with cardiovascular risks factors and atherosclerotic risk associated to population aging. Our population is young with less diabetes and no coronary heart disease diagnosed.

The mortality rate was high reaching 14.3% similar to reported valour from previous studies [13,14]. Early mortality was reported in 25.5% of HD patient in two publics HD centre in Cameroon [13]. Ashuntantang et al in a sub-saharian systematic review, reported a mortality rate of 16% among adults on HD [15]. There is a trend of mortality rate reduction with time in HD: 57.5% in 2005 [16] and 44.9% in 2012 [3,17]. The dialysis catheter use was associated with higher mortality and increased hospitalization rates compared with AV access [18]. Site of insertion, duration of use, poor personal hygiene, use of occlusive transparent dressing, and accumulation of moisture influence the rate of infection in general [19]. Despite the fact that only 27.3% of patients had a temporary vascular access, this study demonstrated that patients who use catheter showed a risk for bad outcome (OR 0.08 (0.01-0.75); $p=0.027$).

LIMITATIONS

The sample size of the study and the exclusion of incomplete files are main limitation of this study. Efforts are needed to improve the archives system in our hospital.

CONCLUSION

Patients receiving maintenance HD are commonly admitted with infectious conditions. Vascular access infection and acute acquired pneumonia are most common cause of infection. Treatment and preventive measures should be taken to reduce burden of the disease such as promoting early arterio-vascular fistula creation. Result of this study should be considered with finding of other studies as this was a single-center study with limited subjects.

DECLARATIONS

Consent for publication

Not applicable

Availability of data and materials

The materials described in the manuscript, including all relevant raw data, will be freely available to any scientist wishing to use them for non-commercial purposes. The data that support the findings of this study are then available from the corresponding author.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

- Conceptualization: AG, FF, MM. Data curation: MM, KFF.
- Formal analysis: MM, FH, KFF. Investigation: MMa, MM.
- Project administration: KFF, MM. Supervision: KFF, AG.
- Validation: MM, TDG, MTA.
- Writing – review & editing: MM, TDG, KFF, AG.

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