ORIGINAL ARTICLE

Early mortality in patients with kidney failure starting chronic dialysis in Zambia: a retrospective cohort analysis

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ABSTRACT

Introduction: Dialysis is the primary kidney replacement therapy for patients with kidney failure in sub-Saharan Africa. We assessed the rates and predictors of early mortality in Zambian patients starting chronic dialysis.
Methods: This retrospective study included all patients who started chronic haemodialysis (HD) or peritoneal dialysis (PD) between 1 January 2017 and 31 August 2020 at the three largest public dialysis centres in Zambia. Data on clinical, laboratory and dialysis characteristics were extracted from medical records. The primary outcome of interest was the mortality rate at 90 days.
Results: A total of 154 patients were included in the study; 43.5% were female and 32% were 50 years or older. The main causes of kidney failure were hypertension (59%), glomerulonephritis (10%), HIV/AIDS (10%) and unknown (8%). The mortality rate at 90 days was 12.3%. Of these, 42% were cardiovascular-related mortalities and 32% died of infection related to central venous catheters. The lymphocyte percentage of total white blood cells was lower in patients who died compared to survivors (12.7 vs 20.8%) and was an independent predictor of early mortality (OR 0.914, 95% CI 0.850–0.983; P = 0.015).
Conclusions: Early mortality was high in Zambian patients starting dialysis, and a low lymphocyte percentage was a predictor of mortality.

Keywords: dialysis; kidney replacement therapy; mortality; Zambia.

INTRODUCTION

Dialysis is the main form of kidney replacement therapy (KRT) in patients with kidney failure in sub-Saharan Africa (SSA) [1,2]. Despite the therapeutic advances in chronic dialysis, the mortality rate among patients on this treatment is eight times higher than for the general population [3] and deaths in the first 90 days after the start of dialysis contribute importantly to the overall deaths [4-6].

Previous studies have reported early dialysis mortality rates that range from 4% to 40% [3,7]. Studies in low- and middle-income countries have consistently demonstrated an elevated early mortality rate [2,3]. In Tunisa, Gmar-Bouraoui et al. studied 345 incident dialysis patients and reported a 90-day mortality rate of 17% [7]; in Cameroon, Halle et al. reported a 34% mortality rate in 661 patients [1]. In contrast, the mortality rates at 90 days after the start of chronic dialysis were 3.1%, 8.6%, 6.6% and 5.5% in China, the USA, Canada and Europe, respectively [4,8,9]. A meta-analysis that included 32 studies reported an 8% mortality rate at 90 days [10]. The early mortality rates were higher in African countries than in developed nations (41 vs 18 per 100 person-years, respectively) [10].

Cardiovascular diseases and infections are the leading causes of hospitalisation and early mortality in patients on dialysis [10,11]. Greater age, the use of temporary catheters, female sex and nutritional status have been

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associated with early death [6]. In SSA, dialysis costs which are borne by patients and families are a major cause of dialysis being suspended and early mortality [12].

There are few studies from Africa on early dialysis outcomes. African dialysis populations are young compared to those of high-income countries and might be expected to have improved survival [1,13]. This study assessed early dialysis mortality rate and associated factors in Zambian patients.

METHODS

This retrospective cohort study was conducted at the three largest public nephrology centres in Zambia: University Teaching Hospital, Lusaka, Ndola Teaching Hospital and Kitwe Teaching Hospital. The centres are the main providers of dialysis in the public sector and offer both haemodialysis (HD) and peritoneal dialysis (PD). All patients on HD receive thrice-weekly sessions lasting four hours, whereas those on continuous ambulatory peritoneal dialysis are all offered four daily exchanges. An average of 140 HD and 10 PD patients access treatment at University Teaching Hospital and an average of 65 HD and 5 PD patients access treatments at Ndola and Kitwe teaching hospitals. Chronic dialysis is funded by the Zambian government and recently also by the National Health Insurance Scheme; however, patients pay for laboratory tests and medications. There is no kidney transplant programme; some patients seek treatment abroad, mainly in India, at their own expense.

We included 154 patients aged at least 15 years, who started chronic dialysis between 1 January 2017 and 31 August 2020 (Figure 1). All consecutive patients were included. We excluded patients who were already on dialysis, those who had been transplanted and patients with acute kidney injury. The study was approved by the Tropical Diseases Research Centre Ethics Review Committee (reference no.TRC/C4/10/2020) and the National Health Research Authority of Zambia. Medical records were reviewed for demographic, clinical and treatment-related data. The initial laboratory results were considered as baseline parameters. Kt/V was available for only 29% of the participants and therefore not included in the analysis.

The primary outcome was early mortality, defined as death within 90 days of starting dialysis. Factors potentially associated with mortality were also studied. Data capture and analysis used Microsoft Excel® and Stata version 13. Continuous variables were summarised using means with standard deviations and medians with interquartile ranges

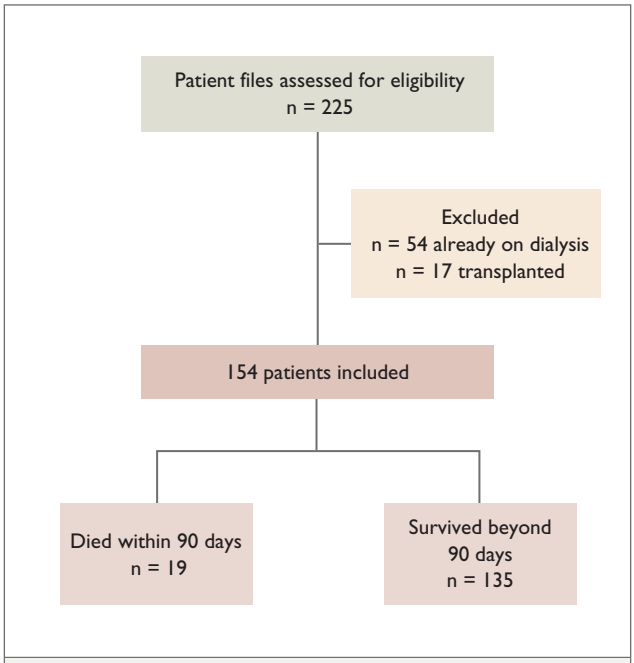

Figure 1. Participants' flow chart.

(IQR); categorical variables were reported using counts and proportions. For comparisons, Fisher's exact and Mann–Whitney U tests were used; a P value of <0.05 was considered statistically significant. Magnitudes of associations were estimated using odds ratios (OR) and their 95% confidence intervals (CI).

RESULTS

A total of 154 patients were included (Figure 1), whose baseline characteristics are described in Tables 1 and 2. One-third of the participants were ≥50 years of age and 56% were male. Hypertension (59%) was by far the most common reported cause of kidney failure (Table 3). HD was the predominant treatment modality (94% of the study population). Most HD patients were using a tunnelled catheter at the start of KRT and only 8.3% were using an arteriovenous fistula (AVF).

There were 19 deaths (12%) within 90 days, 18 of these patients on HD. The cause of death was cardiovascular disease in 42% and catheter-related infection in 32%. There were no deaths among patients using an AVF (not statistically significant). The median lymphocyte percentage was significantly lower in those who died compared to the survivors (12.7 vs 20.8%). After adjusting for age, educational status and platelet levels, low lymphocyte percentage was independently associated with early mortality (OR 0.914, 95% CI 0.850–0.983; P = 0.015).

Table 1. Baseline characteristics of 154 patients in the study population.

Characteristics	Total (154) n (%)	Male (87) n (%)	Female (67) n (%)
Age (years), mean (SD)	43 (14.0)	45 (15.0)	40 (13.0)
Age (years)			
≥50	49 (31.8)	34 (69.4)	15 (30.6)
<50	105 (68.2)	53 (50.5)	52 (49.5)
Education status			
Primary/secondary	35 (36.8)	23 (65.7)	15 (34.3)
Tertiary	60 (63.2)	41 (68.3)	19 (31.7)
Marital status			
Married	110 (78)	64 (58)	46 (42)
Not married	31 (22)	16 (52)	15 (48)
Dialysis modality			
Haemodialysis	110 (93.5)	80 (55.6)	64 (44.4)
Peritoneal dialysis	10 (6.5)	7 (70.0)	3 (30.0)
Dialysis duration (days), median (IQR)	210 (90–365)	210 (60–365)	195 (90–365)
Haemodialysis vascular access			
Arteriovenous fistula	12 (8.3)	9 (75.0)	3 (25.0)
Tunnelled catheter	97 (67.4)	54 (55.7	43 (44.3)
Temporary central venous catheter	35 (24.3)	17 (48.6)	18 (51.4)
HBV status			
Positive	12 (7.8)	8 (66.7)	4 (33.3)
Negative or immune	142 (92.2)	79 (55.6)	63 (44.4)
HIV status			
Positive	46 (29.9)	22 (47.8)	24 (52.2)
Negative	108 (70.1)	65 (60.2)	43 (39.8)
Cardiac disease			
Yes	80 (52)	42 (53)	38 (48)
No	74 (48)	45 (61)	29 (39)
WCC (10^9/L), median (IQR)	6.1 (4.2–8.1)	6.6 (4.3–8.3)	5.8 (4.0–7.6)
Platelets (10^9/L), median (IQR)	212 (160–299)	212 (160–319)	211 (154–288)
Haemoglobin (g/dL), median (IQR)	8.0 (6.7–9.5)	8.1 (6.6–9.4)	8.0 (6.7–9.5)
Urea (mmol/L), median (IQR)	26.7 (16.0–38.0)	30.7 (19.6–42.7)	22.3 (14.6–34.9)
Creatinine (μmol/L), median (IQR)	969 (686–1471)	1057 (713–1600)	896 (613–1332)
% Lymphocytes, median (IQR)	19.6 (12.4–28.2)	18.0 (11.3–25.8)	21.6 (15.0–29.9)
% Neutrophils, median (IQR)	68.8 (58.3–78.7)	70.9 (60.8–79.9)	64.6 (56.0–76.1)
NLR, median (IQR)	3.5 (2.0–6.3)	3.8 (2.4–6.8)	2.9 (1.9–4.8)
ALT (IU/L), median (IQR)	19.2 (11.7–30.7	23.2 (12.6–34.5)	17.0 (9.4–25.4)
SBP (mmHg), mean (SD)	153 (30.0)	152 (31.0)	154 (29.0)
DBP (mmHg), mean (SD)	92 (20.0)	92 (20.0)	93 (20.0)

Abbreviations: WCC, white cell count; HBV, hepatitis B virus; HIV, human immunodeficiency virus; ALT, alanine aminotransferase; SBP, systolic blood pressure; DBP, diastolic blood pressure; NLR, neutrophil lymphocyte ratio; IQR, interquartile range.

DISCUSSION

The main finding of this study is the high mortality rate of 12.3% at 90 days after starting dialysis, at least twice as high as in many high-income countries [14]. Comparable rates were 6%, 6.7% and 6.3% in studies from the USA, Singapore and Canada, respectively [4,13,15]. Renal registries in high-income countries reported similar mortality rates. The United States Renal Data System reported a 90-day mortality rate of 8.6%, the Canadian Organ Replacement Register 5.6%, and the European Renal Association and European Dialysis and Transplant Association registry reported a rate of 6.6% from 29 European countries [9]. A study conducted in Peru reported a 9.3% mortality rate [6].

The high mortality rate in our study may have several causes including high usage of central venous catheters for vascular access and limited availability of routine laboratory tests such as those for mineral and bone disease, and dialysis adequacy.

Table 2. Baseline characteristics of survivors and non-surviving patients.

Characteristics	Died (19) n (%)	Survived (135) n (%)	P value
Age (years)			
≥50	5 (10.2)	44 (89.8)	
<50	14 (13.3)	91 (86.7)	0.774
Sex			
Male	11 (12.6)	76 (87.4)	1.000
Female	8 (11.9)	59 (38.1)	
Marital status			
Married	14 (13)	96 (87)	1.000
Not married	4 (13)	27 (87)	
Education level			
Primary/secondary	6 (17.1)	29 (82.9)	0.071
Tertiary level	3 (5.0)	57 (95.0)	
Dialysis modality			
Haemodialysis	18 (12.5)	126 (87.5)	1.000
Peritoneal dialysis	1 (10.0)	9 (90.0)	
Haemodialysis vascular access			
Arteriovenous fistula	0 (0.0)	12 (100.0)	0.363*
Tunnelled catheter	10 (10.3)	87 (89.7)	
Temporary central venous catheter	8 (22.9)	27 (77.1)	
HBV status			
Positive	1 (8)	11 (92)	1.000
Negative or immune	18 (13)	124 (87)	
HIV status			
Positive	5 (10.9)	41 (89.1)	0.925
Negative	14 (13.0)	94 (87.0)	
Cardiac disease			
Yes	7 (9)	73 (91)	0.245
No	12 (16)	62 (84)	
WCC (10^9/L), median (IQR)	7.4 (3.8–13.0)	6.0 (4.3–7.9)	0.207
Platelets (10^9/L), median (IQR)	305 (177–379)	210 (158–288)	0.100
Haemoglobin (g/dL), median (IQR)	7.2 (5.8–8.6)	8.0 (6.7–9.6)	0.195
Urea (mmol/L), median (IQR)	32.3 (20.5–50.7)	25.2 (15.6–37.0))	0.173
Creatinine (µmol/L), median (IQR)	1220 (703–1617)	922 (683–1451)	0.418
% Lymphocytes, median (IQR)	12.7 (8.4–20.8)	20.8 (12.7–29.0)	0.015
% Neutrophils, median (IQR)	72.5 (70.3–82.3)	67.5 (58–77.8)	0.107
NLR, median (IQR)	4.8 (3.3–9.8)	3.3 (2.0–6.0)	0.077
ALT (IU/L), median (IQR)	25.6 (20.6–34.0)	18.7 (10.9–29.0)	0.014
SBP (mmHg), mean (SD)	149 (40.0)	153 (29.0)	0.640
DBP (mmHg), mean (SD)	87.0 (25.0)	93 (20.0)	0.229

Abbreviations: HIV, human immunodeficiency virus; ALT, alanine aminotransferase; WCC, white cell count; SBP, systolic blood pressure; DBP, diastolic blood pressure; NLR, neutrophil lymphocyte ratio; IQR, interquartile range.

Table 3. Causes of kidney failure (n = 154).

	Frequency	Percentage
Hypertension	91	59
HIV	16	10
Glomerulonephritis	16	10
Unknown	12	8
Diabetes mellitus	8	5
Obstructive uropathy	8	5
Adult polycystic kidney disease	3	2

Our study revealed that low lymphocyte percentage was a poor prognostic marker, a finding consistent with previous studies [16,17]. Kuwae et al. found that it predicted hospitalisation and mortality in patients on maintenance HD [16]. Low lymphocyte percentage may be a marker of the malnutrition and inflammation complex [16], a common finding in patients on dialysis [18-20].

Previous studies have shown that delayed placement of an AVF, cardiovascular diseases and infections were con-

tributing factors to early mortality [4,21]. It is interesting that there were no deaths among the few patients using an AVF in our study. In an investigation conducted in the United States, early provision of an AVF was associated with 72% less mortality at six months compared to using central venous catheters [21]. Patients with kidney failure are immunocompromised and infection is a leading cause of early mortality [4,19,22]. In our study, 32% of the deaths were related to central venous catheter infection and 42% to cardiovascular disease.

The finding that hypertension was reported as the most common cause of kidney failure, followed by glomerulonephritis and HIV/AIDS, is in line with the few other studies from SSA [23-25]. The high rates of hypertensive kidney disease might represent an overdiagnosis as hypertension is a common finding in patients with CKD.

Our study has some limitations, partly because of its retrospective nature. There were missing data, limited laboratory tests of potentially prognostic biomarkers and the sample size was relatively small.

CONCLUSIONS

The survival of patients starting chronic dialysis in Zambia remains poor in the first 90 days, with catheter-related infection and cardiovascular disease responsible for three-quarters of deaths. Low lymphocyte percentage predicts mortality. Greater efforts should be made to ensure the early provision of an AVF, to reduce the rates of catheter-related infections.

Conflicts of interest

No conflicts of interest to declare.

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