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Predictors of Fatal Outcome in Hospitalised Adult Patients with Acute Kidney Injury at Two Tertiary Hospitals in Sub-Saharan Africa

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Abstract

Introduction: Data on mortality in acute kidney injury (AKI) derives from high-income countries where AKI is hospital-acquired and occurs in elderly patients with a high burden of cardiovascular disease. In sub-Saharan Africa (SSA), AKI is community-acquired occurring in healthy young adults. We aimed to identify predictors of fatal outcomes in patients with AKI in two tertiary hospitals in Cameroon. **Methods:** Medical records of adults with confirmed AKI, from January 2018 to March 2020 were retrieved. The outcomes of interest were in-hospital deaths and presumed causes of death. We used multiple logistic regressions modeling to identify predictors of death. The study was approved by the ethics boards of both hospitals. Values were considered significant for a p-value of 0.05. **Results:** We included 285 patient records (37.2% females). The mean (SD) age was 50.1 (19.0) years. Hypertension (n = 97, 34.0%), organ failure (n = 88, 30.9%), and diabetes (n = 60, 21.1%) were the main comorbidities. The majority of patients had community-acquired AKI (78.6%, n = 224), were KDIGO stage 3 (88.8%, n = 253), and needed dialysis (52.6%, n = 150). Up to 16.7% (n = 25) did not receive what was needed. The in-hospital mortality rate was 29.1% (n = 83). Lack of access to dialysis (OR = 27.8; CI: 5.2 - 149.3, p = 0.001), hypotension (OR = 11.8; CI: 1.3 - 24.8; p = 0.001) and ICU admission (OR = 5.7; CI: 1.3 - 24.8, p = 0.001) were predictors of mortality. The presence of co-morbidities or underlying diseases (n = 46, 55%) were the main causes of death. **Conclusions:** In-hospital

AKI mortality is high, as in other low- and middle-income economies. Lack of access to dialysis and the severity of the underlying illness are major predictors of death.

Keywords

Predictors, Fatal Outcome, Acute Kidney Injury, Tertiary Hospital

1. Introduction

Acute kidney injury (AKI), defined as an abrupt decline in glomerular filtration rate (GFR) [1] is common and associated with adverse outcomes. Worldwide, it is estimated that 13.3 million people develop AKI; of these, 85% are in low- and middle-income countries (LMICs) [2]. This clinical condition complicates hospital admission, increasing the length of stay by three days and hospital costs by $7500 [3]. There is increasing evidence that AKI increases the risk of chronic kidney disease and cardiovascular diseases [2] [4]. Despite significant progress in understanding the pathogenesis and care of AKI, mortality remains high. Mortality rates vary from 10.8% to 77% [5] [6] [7] [8]. It is estimated that about 1.7 million people, especially from LMIC, die each year from AKI [2]. In hospitalised patients, AKI multiplies the risk of death by sixfold [3]. In sub-Saharan Africa, mortality rates of 10.9% to 58% have been reported [6] [9] [10]. The reasons for these high mortality rates have been the subject of several studies. Age above 60 years [11] [12], male sex [13] [14], hospital-acquired AKI [15], KDIGO stage 3 AKI [16] [17], ICU admission [8], organ failure [13] [18] [19], and the presence of more than two comorbid conditions [20] have been associated with mortality.

In Cameroon, reported mortality rates in AKI populations range from 10.9% to 36.9% depending on the study design [9] [10] [21] [22] [23]. The available determinants of mortality are pertinent to HICs which differ in characteristics of AKI from LLMICs. Identified risk factors of death in specific populations hinder generalization to all admitted cases of AKI. Reports on AKI in SSA suggest a lack of access to treatment and a paucity of data on risk factors of mortality in hospitalised patients with AKI.

This study aimed to identify the predictors of fatal outcomes in hospitalized patients with AKI. This paper is among the first to address the gap and it would contribute to add to the knowledge on the AKI mortality in Cameroon and may help in designing preventive strategies.

2. Materials and Methods

2.1. Study Design and Setting

This was a retrospective cross-sectional study conducted in two government-funded and tertiary health institutions with advanced facilities such as an imaging unit,

a haemodialysis centre, and an ICU. These hospitals are located in Yaoundé, the capital city of Cameroon, where 4 million people live. At the haemodialysis centres, the only modality of dialysis is intermittent haemodialysis. The government subsidises the cost of haemodialysis sessions, such that out-of-pocket payment is 5000 XFA (10 US dollars) per session of dialysis per patient; however, patients pay for vascular access and other health facilities needed for dialysis. These institutions also serve as teaching hospitals for both undergraduate and postgraduate students from various medical schools. Additionally, they are referral hospitals for all regions in Cameroon, as they have specialists in various disciplines, including internal medicine. There are three nephrologists in the Yaounde General Hospital (YGH) and two in the Yaounde Unuiversity Teaching Hospital (YUTH).

2.2. Ethical Consideration

Ethical clearance was obtained from the Faculty of Health Sciences, University of Buea (FHS), and its Institutional Review Board (Ref: 2020/938-01/UB/SG/FHS/IRB). To maintain participants' confidentiality, codes rather than names were used on questionnaires. As this was a retrospective study, participant consent was waived by the Ethics Unit (Institutional Review Board, Faculty of Health Science, University of Buea).

2.3. Data Collection and Management

Case notes of all hospitalised patients treated for AKI and seen by a nephrologist from the 1st of January 2018 to the 31st of March 2020 were reviewed. All files of patients aged over 16 years with confirmed AKI by a nephrologist were included. Files with missing outcome data, such as patients who left against medical advice or had insufficient evidence to differentiate AKI from CKD, were excluded. From the records, we obtained sociodemographic data at diagnosis, clinical factors, laboratory factors, and complications of AKI at diagnosis and during admission. The outcome of interest was determined at the time of discharge: death or alive. Each hospital admission was considered a single event. The aetiology of AKI and the causes of death were obtained after discussion with the nephrologists in charge of the case. Multiple causes of AKI were possible in the same patient.

All methods were performed in accordance with the relevant guidelines and regulations.

Definition of acute kidney injury

AKI was diagnosed and staged according to the Kidney Diseases Improving Global Outcomes (KDIGO) definition [24].

Type of AKI: Acute kidney injury was considered community-acquired if the patient presented to the hospital with risk factors for acute kidney injury. A hospital-acquired acute kidney injury was retained if they developed risk factors for acute kidney injury during their hospital stay.

Severity, mechanism, and cause of AKI: As stated in the medical records and confirmed by a nephrologist. In cases of discrepancy, the decision after consulting with the nephrologist was retained, and severity classification was done according to the KDIGO classification [24].

Community-acquired AKI (CA-AKI): Presence of risk factors for AKI on admission

Hospital-acquired AKI (HA-AKI): Presence of risk factors for AKI developed during hospital admission

Nephrotoxic AKI: History of consumption of known nephrotoxic drug(s) such as NSAIDs, tenofovir, atazanavir, phytotherapy, cytotoxic drugs, radiocontrast, and aminoglycosides.

Definition of outcomes

Need for dialysis: Participants with an indication for dialysis according to KDIGO recommendations [23] were considered to have needed dialysis. The reasons for no dialysis despite an indication for it were noted in the medical records.

Baseline serum creatinine: Obtained using the reverse modification of diet in renal disease Study (MDRD) [24].

Hypotension: Arterial blood pressure with systolic < 90 and diastolic < 60 mmHg.

Volume depletion or hypovolemia: Signs and symptoms of dehydration and or hypotension.

Anaemia: Hemoglobin level of <12 g/dl.

Organ failure: Presence of one or more of the following: Heart failure, liver failure, central nervous system failure and respiratory failure.

Sepsis: Proven or suspected microbial infection in the presence of at least 2 of the following symptoms of Systemic Inflammatory Response Syndrome: Temperature > 38˚C or <36˚C, Respiratory rate > 24 breaths/min, Pulse > 90 beats/min, WBC count > 12,000 cells/mm^3 or <4000 cells/mm^3.

Cause of death: Clinical and laboratory clues to the cause of Deaths were identified for each case:

- In patients with an indication for dialysis, the said indication was retained as a cause of death if no session of dialysis was received.
- In the presence of severe comorbid conditions, the cause of death was attributed to the said condition when dialysis access was restricted due to the comorbid condition.
- In patients with no indication for dialysis, the underlying disease condition was retained as the cause of death.

2.4. Data Management and Analysis

Data was entered into an electronic data set in CS Pro version 7.1, which was coded and stored on a computer. This data was then analysed using the Statistical Package for Social Sciences (SPSS) version 22. Categorical variables were expressed as frequencies and their proportions, and continuous variables were ex-

pressed as means (with standard deviation) or medians (and the 25th - 75th percentile). The chi-squared test was used to compare the proportions of qualitative data, the Student's t-test was used to compare the means of quantitative data, and the Mann-Whitney test was used to compare medians. Determinants of mortality were identified using logistic regression.

3. Results

A total of 303 files were reviewed during the study period; 18 were excluded from the analysis (10 for incomplete data, 8 with insufficient evidence for AKI), and 285 were retained for analysis.

- **Demographic and clinical characteristics of the study population**

Out of the 285 participants, 179 (62.8%) were male. The mean (SD) age was 50.1 (19.0) years, with 46% (n = 131) aged 50 years and below.

A total of 207 (73.6%) participants had at least one comorbidity, with hypertension (n = 97, 34%), diabetes (n = 60, 21%), and HIV/AIDS (n = 60, 21%) being the most prevalent. In all, 88 (30.8%) of patients had at least one organ failure, with comas being the most common (Table 1).

- **Characteristics of AKI**

Community-acquired AKI accounted for 78.6% (n = 224), and over 85% (n = 253) of the participants were in KDIGO stage 3. Infections (43.9%), volume depletion (29.8%), and nephrotoxins (18.2%) were the main causes of AKI, and over half of them required dialysis (n = 150, 52.6%). Of those who needed dialysis, 16.7% (n = 25) did not have access (Table 2).

1) Fatality rate

A total of 83 deaths were recorded, giving a fatality rate of 29.1%. The fatality rate was comparable between males and females (26.8% versus 33.0%, p = 0.154), see Figure 1.

And fatality increased with the severity of acute kidney injury (Figure 2).

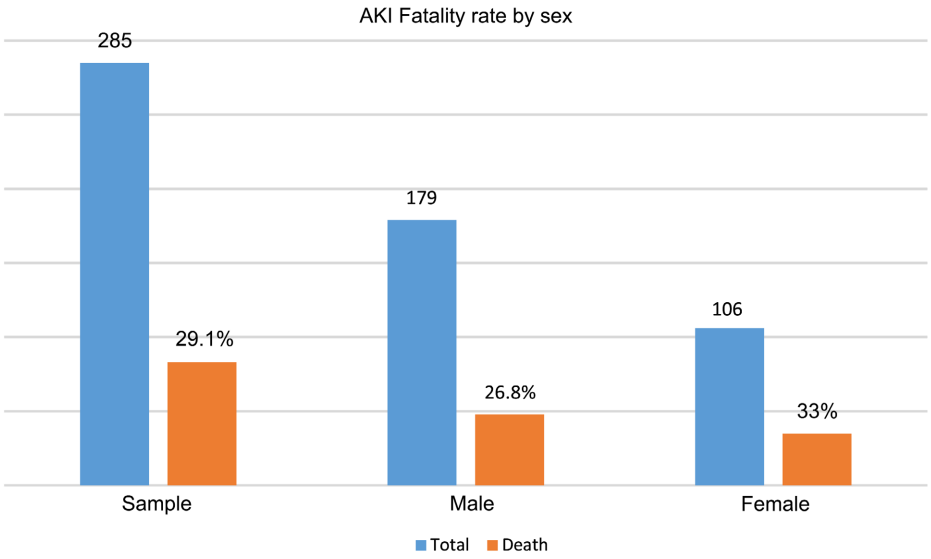

Figure 1. Fatality rate according to sex (N = 285).

Table 1. Patients characteristics (N = 285).

Variable		Frequency (n)	Percentage (%)
Sex	Male	179	62.8
	Female	106	37.2
Age ranges	[17 - 35]	70	24.6
	[35 - 50]	61	21.4
	[51 - 65]	89	31.4
	>65	65	22.8
Unit of admission	Nephrology	194	68.1
	Intensive care unit	41	14.4
	Internal medicine*	35	12.3
	OB/GYN	10	3.5
	Surgery	5	1.8
Hypertension		97	34.0
Diabetes		60	21.0
HIV		60	21.0
Malignancy		23	11.1
Chronic kidney disease		12	4.2
Organ failure		88	30.8
Number of organ	1	71	20.2
	≥2	17	6.0
Type of organ	CNS (coma)	46	16.1
	Liver failure	27	9.4
	Heart failure	26	9.1
	Respiratory failure	6	2.1
Catecholamine use		26	9.1

CKD = Chronic Kidney Disease, CNS = Central Nervous System, OB/GYN = Obstetrics and Gynaecology, HIV/AIDS = Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome. *Non-nephrology.

Table 2. Characteristic and aetiologies of acute kidney injury (N = 285).

Variable		Frequency	Percentage
Diagnostic criteria	Based on Serum creatinine	263	92.3
	Based on both	22	7.7
Type of AKI	Community acquired	224	78.6
	Hospital acquired	61	21.4

Continued

Severity of AKI	Stage 1	13	4.6
	Stage 2	19	6.7
	Stage 3	253	88.8
Type of renal lesion	Pre-renal	75	26.3
	Acute tubular necrosis	129	67.5
	Acute interstitial nephritis	32	16.8
	Thrombotic microangiopathy	28	14.7
	RPGN	2	1.0
	Post renal	20	7.0
Etiology	Infection	125	43.9
	Volume depletion	83	29.8
	Drugs and nephrotoxins	52	18.2
	Malignancies	29	10.2
	Vascular causes	22	7.7
	Obstetric complications	10	3.5
Dialysis	Need for dialysis	150	52.6
	Dialyzed	125	83.3
	Indicated but not dialyzed	25	16.7
Indications for dialysis	Oligo/anuria > 12 + urea > 1.2 g/l	140	93.3
	Uremia	56	37.3
	Metabolic acidosis	44	29.3
	Refractory hyperkalemia	27	18.0
	Acute pulmonary edema	24	16.0
	Normal UO + urea >1.8 g/l	23	15.3

AKI = Acute Kidney Injury, RPGN = Rapidly Progressing Glomerulonephritis, UO = Urine Output, KDIGO = Kidney Disease: Improving Global Outcome.

2) Factors associated with mortality

On bivariate analysis (Table 3), factors associated with mortality were: older age (p = 0012), ICU admission (OR: 18.1, p < 0.001), presence of comorbidity (OR: 5.0, p < 0.001), presence of a organ failure (OR: 5.2, p = 0.001), lack of dialysis access when needed (OR: 25.4, p < 0.001), hypotension (OR: 8.7, p < 0.001), GI bleeding (OR: 2.9, p < 0.001) and hypernatremia (OR: 2.4, p = 0.006). After adjustment, lack of hemodialysis access (p = 0.001, AOR: 27.8), hypotension (p = 0.007, AOR: 11.8) and ICU admission (p = 0.001, AOR: 5.7) were predictors of mortality (Table 4).

Table 3. Factors associated with mortality.

Variable	Category	Alive n (%) n = 202	Dead n (%) n = 83	OR	95% CI	p-Value
Mean age (SD) years	-	48.3 (18.7)	54.9 (18.8)	-	-	**0.012**
Sex	Male	131 (64.9)	48 (57.8)	0.9	0.4 - 2.1	0.848
	Female	71 (35.1)	35 (42.2)			
Unit of hospitalisation	ICU	7 (3.5)	41 (49.4)	18.1	8.4 - 77.4	**<0.001**
	Others	42 (20.8)	34 (40.9)	0.7	0.3 - 1.6	0.421
	Nephrology*	153 (75.7)	8 (9.6			
Presence of comorbidity	Yes	131 (64.9)	76 (91.6)	5.0	2.0 - 13.0	**<0.001**
	No	71 (35.1)	7 (8.4)			
Diabetes	Yes	42 (20.8)	18 (21.7)	0.7	0.3 - 1.3	0.202
	No	160 (79.2)	65 (79.3)			
Hypertension	Yes	66 (32.7)	31 (37.3)	0.7	0.4 - 1.2	0.183
	No	136 (67.3)	52 (62.7)			
HIV/AIDS	Yes	32 (15.8)	28 (33.7)	1.0	0.0 - 3.0	0.059
	No	170 (84.2)	55 (66.3)			
Organ failure	Yes	36 (17.8)	52 (62.7)	5.2	2.8 - 9.6	**<0.001**
	No	166 (82.2)	31 (37.3)			
Severity of AKI	Stage 3	178 (88.1)	75 (90.4)	1.3	0.5 - 2.9	0.587
	Stages 1 & 2	24 (11.9)	8 (9.6)			
Oligo-anuria	Yes	152 (57.2)	70 (84.3)	1.8	0.9 - 3.5	0.096
	No	50 (24.8	13 (15.7)			
Need for Dialysis	Yes	100 (49.5)	50 (60.2)	1.5	0.9 - 2.6	0.100
	No	102 (50.5)	33 (39.8)			
Dialysed	Yes	97 (97)	28 (56.0)	25.4	7.1 - 91.1	**<0.001**
	No	3 (3)	22 (44.0)			
Sepsis	Yes	81 (40.1)	44 (53.0)	1.7	0.4 - 3.1	**0.0047**
	No	121 (59.9)	36 (47.0)			
Hypotension	Yes	8 (4.0)	22 (26.5)	8.7	3.7 - 20.6	**<0.001**
	No	194 (96.0)	61 (73.5)			
Hypernatremia	Yes	28 (13.9)	23 (27.7)	2.4	1.3 - 4.4	**0.006**
	No	174 (86.1)	60 (72.3)			
GI Bleeding	Yes	7 (3.5)	8 (9.6)	2.9	1.0 - 8.5	**0.042**
	No	195 (96.5)	75 (90.4)			

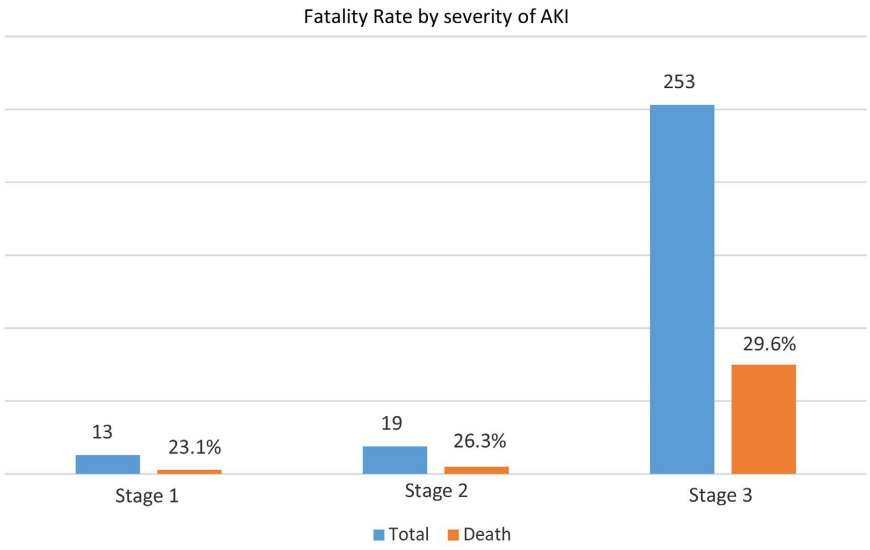

Figure 2. Fatality rate according to severity to AKI (N = 285).

Table 4. Predictors of mortality in acute kidney injury (multivariate analysis).

Variable	OR (96% CI)	AOR	95% CI	Adjusted p-value
No access to dialysis	25.4 (7.1 - 91.1)	27.8	5.2 - 149.3	**<0.001**
Hypotension	8.7 (3.7 - 20.6)	11.8	1.3 - 24.8	**<0.001**
ICU admission	18.1 (8.1 - 77.4)	5.7	1.3 - 24.8	**<0.001**
GI Bleeding	2.9 (1.0 - 8.5)	3.8	0.4 - 173.7	0.374
Presence of comorbidity	5.0 (2.0 - 13.0)	2.1	0.5 - 9.8	0.329
Organ failure	5.2 (2.8 - 9.6)	1.8	0.4 - 6.3	0.374
Age	0.9 (0.96 - 0.99)	1.7	0.6 - 5.2	0.358
Sepsis	11 (0.6 - 1.8)	1.6	0.6 - 4.6	0.369
Hypernatremia	2.4 (1.3 - 4.4)	0.6	0.0 - 7.2	0.508

ICU = Intensive Care Unit, GI = Gastrointestinal, RRT = Renal Replacement Therapy.

3) Presumed causes of death in the study population

Non-dialysis catheter-related septic shock (20.5%), uraemia (10.8%), and HIV/AIDS complications (9.6%) were the main causes of death (Table 5).

4. Discussion

In this study, we sought to identify predictors of fatality in hospitalised patients with acute kidney injury at two referral hospitals with dialysis facilities.

High in-hospital mortality is well known in AKI, with rates of 10.8% to 77% depending on the unit of care and study population. We observed a 29.1% fatality rate in this study, which is close to the 32% in sub-Saharan Africa [1]. Our results also fall within the 23.5% to 33% range from previous observational studies

Table 5. Presumed causes of death in the study population.

Causes of death		Frequency (n)	Percentage (%)
Comorbidities and underlying disease		**46**	**55.4**
	Non catheter related septic shock	17	20.5
	HIV/AIDS complications	8	9.6
	Malignancy	4	4.8
	Cerebrovascular accident	3	3.6
	Liver failure	3	3.6
	Heart failure	3	3.6
	Complications of diabetes	3	3.6
	Pre-eclampsia/Eclampsia	2	2.4
	Bulbar palsy	1	1.2
	Malignant hypertension	1	1.2
	Massive GI bleeding	1	1.2
Complications of AKI		**21**	**25.3**
	Uremia	9	10.8
	Acute pulmonary edema	6	7.2
	Hyperkalemia	6	7.2
Complications of hemodialysis		**8**	**9.6**
	Catheter bleeding	3	3.6
	Disequilibrium syndrome	3	3.6
	Catheter related sepsis	2	2.4
Others		**8**	**9.6**
	Unknown	5	6.0
	Pulmonary embolism	3	3.6

HIV/AIDS = Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome, GI = Gastrointestinal.

in Cameroon [21] [22] [23] [25]. Several factors may explain the high fatality rate in ours and previous studies in Cameroon: the high prevalence of severe AKI (KDIGO stage 3), the high burden of severe comorbid conditions, and the underlying causes of AKI. Studies in both HICS and LLMICs suggest that the presence of two or more comorbidities or severe comorbidities is associated with higher mortality rates [14] [20]. Critical illness and the presence of sepsis result in increased mortality [11] [26]. Higher mortality rates of 36.9% to 77% have been noted in other LLMICs and high-income countries [6] [8] [9] [11]. This

can be explained by the lower proportion of ICU admissions in this study; more so, two studies had a higher mean age of 65.5 years, and others included only patients in the ICU [6] [8]. Mortality in the ICU is usually high, as most of these patients have multiple organ failures [26].

In consonance with previous reports, we found a lack of dialysis access (OR = 27.4, $p < 0.001$), the presence of hypotension (OR = 11.8, $p < 0.001$) and ICU admission (OR = 5.7, $p < 0.001$) as predictors of mortality.

Lack of dialysis access is a major challenge and cause of mortality in low-income countries, especially SSA, due to limited availability and a lack of funds [1]. In this study, we observed that about one out of four deaths occurred in patients who did not receive dialysis, although it was indicated. Bello *et al.* in Nigeria showed that lack of access to dialysis increases the odds of death by 11-fold [27]. In a recent systematic review of the outcomes of AKI in SSA, the pooled mortality without dialysis when needed was 86% compared to 32% with dialysis [1]. Dialysis is a lifesaving therapy that replaces failed renal function by maintaining homeostasis and removing excess fluids. It is suggested that prompt administration of dialysis when required is associated with a good outcome [28]. Several reasons account for the lack of dialysis access. In HICs where healthcare is accessible to all [29], the lack of access to dialysis in AKI, when needed, is mainly due to the perception or recognition of futility by the healthcare team [15]. In contrast to LLMICs, where the cost of AKI is mostly self-funded and dialysis therapies are unavailable or not equally distributed geographically [29] [30] [31], the Non-availability of dialysis, inability to afford therapy, poor resources (human and infrastructure) of the hospital, and delayed referral account for the reasons for no dialysis [1] [15]. In this study, death before dialysis initiation (n = 11/25), lack of funds (n = 8/25), futility (n = 3/25), and lack of appropriate dialysis material (n = 3/25) were the reasons for no dialysis. Late presentation and delay in management due to delay in sourcing funds for therapy could explain the high proportion of deaths before the institution of dialysis [1] [15]. Despite government subsidies, lack of funds continues to be a cause of inaccessibility to dialysis [21] [25]. However, there is a lower proportion of those without access compared to studies in Nigeria, where dialysis is completely paid out of pocket [27] [31]. In countries where dialysis is completely funded at the point of care, lack of dialysis is not associated with mortality [16].

Similar reports in LLMICs and HICs have identified the presence of hypotension [8] [32] and a history of hypotension [33] as determinants of mortality. The presence of hypotension has been suggested to be a predictor of mortality when used in a scoring model, increasing the odds of death by about threefold [18]. This can be a reflection of the severity of the underlying disease, such as sepsis and volume depletion, which were the main causes of AKI in this study.

We found ICU admission to be a determinant of mortality. This is similar to a study in India, where critical illness was a determinant of mortality [11]. Another study in Nigeria found an association between ICU admission and mortality on univariate analysis only [27]. Patients admitted to the ICU are generally crit-

ically ill with organ failure and, hence, at higher risk of death. However, very few countries in LLMICs have identified ICU admission as a predictor of mortality. In HICs, being monitored in the ICU increased the risk of dying by threefold [8] [12]. However, studies in China found no association [17].

Contrary to other studies, we did not find advanced age, multi-organ failure, the presence of more than two comorbidities, KDIGO stage three AKI, sepsis-related AKI, oliguria, or the need for dialysis to be predictors of mortality [11] [12] [13] [14] [18] [19] [20].

In most HICs, age above 60 is a predictor of death [12] [17] [34]. We observed that survivors were significantly younger than non-survivors; however, only 21.6% of the study population were above 60 years, unlike in HICs where over two-thirds of participants were above 60 years [12] [17].

Acute kidney injury usually complicates several disease conditions; hence, causes of death vary widely, resulting from the severity of comorbid diseases, complications of AKI or its therapy, and/or the underlying diseases. In this study, we found that comorbidity and underlying disease conditions account for about 55% of deaths, with septic shock, complications of HIV, and complications of malignancy being the main causes. In consonance, other reports worldwide show that sepsis and its complications are the main causes of death [25] [35] [36] [37] [38]. A higher mortality rate is reported to occur in septic patients due to respiratory failure, metabolic acidosis, and oliguria [39]. In this study, about 20% of the participants were HIV positive, and over half were not on c-ART. Higher incidences of 58.8% and 59% in patients with AKI have been reported in other LLMICs. Non-compliance with therapy leads to progression of the disease, poorer immunity, and consequent complications. Hubert *et al.*, in a population of patients with HIV/AIDS, found that mortality increased with a higher stage of the disease [40]. Contrary to previous studies suggesting that AKI in LLMICs occurs in previously healthy individuals, 39% of deaths related to comorbidities and underlying disease conditions were due to non-communicable diseases. In line with studies in Cameroon and Turkey [25] [36], complications of AKI were one of the main causes of death. In this study, we found that uraemia, acute pulmonary oedema, and hyperkalaemia accounted for about 25% of deaths, probably as a result of a lack of dialysis. We observed that complications of RRT such as dialysis catheter bleeding, disequilibrium syndrome, and dialysis catheter sepsis were other causes of mortality. Dialysis catheter-related complications are known causes of death in AKI worldwide [41].

5. Study Limitations

With the retrospective nature of the study, 3.3% of patient records were not explored because data was missing. More so, laboratory data shown in the literature to be associated with mortality could not be assessed.

Laboratory data was obtained from several laboratories, which may not have been very accurate; we studied only patients seen by the nephrologist, hence we may have missed other admitted cases that were not brought to the nephrolo-

gist's attention.

For each death, we attributed only one cause, hence, we could have likely missed other causes of death, which could have influenced our results. However, the nephrologists consulted for the causes of death are the same nephrologists who had been running the nephrology unit for the past two years.

6. Conclusion

At the end of this study, in which we sought to identify predictors of fatal outcomes in hospitalised patients with acute kidney injury, we concluded that the fatality rate is high, with predictors of mortality in these patients being lack of access to dialysis, the presence of hypotension, and ICU admission. Health system organisations, severity of comorbidity, and underlying disease conditions.

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Not applicable.

Ethics Approval and Consent to Participate

Ethical clearance was obtained from the Faculty of Health Sciences, University of Buea (FHS), and its Institutional Review Board (Ref: 2019/938-01/UB/SG/FHS/IRB). Administrative clearance was obtained from hospital authorities. The consent to participate and the informed consent were waived by the ethics committee (Intuitional Review Board, Faculty of Health Sciences, and University of Buea). All methods were carried out following relevant guidelines and regulations.

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 upon reasonable request.

Conflicts of Interest

The authors declare that they have no competing interests.

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Authors' Contributions

DGT, FEJ, and GA were entirely responsible for the conception and design of the study. DGT, FEJ, MLT, MM and AG designed data collection tools, collected

and monitored data collection for the whole trial, cleaned, analysed, and interpreted the data, and drafted the manuscript. FKF, EANT, DGT, and GA revised the paper and had the final manuscript. All authors read and approved the final manuscript.

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List of Abbreviations

AKI: Acute Kidney Injury
CKD: Chronic Kidney Disease
FHS: Faculty of Health Sciences
GFR: Glomerular Filtration Rate
ICU: Intensive Care Unit
KDIGO: Kidney Diseases Improving Global Outcomes
LLMICs: Low- and Middle-Income Countries
YUTH: Yaoundé University Teaching Hospital
YGH: Yaoundé General Hospital