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Research Article

Prevalence and Prognosis of Acute Kidney Injury in Cameroonian Intensive Care Units: A Retrospective Bicentric Study in Yaounde

Prévalence et Pronostic de l'Insuffisance Rénale Aiguë en Milieu de Réanimation Camerounaise : Une Étude Rétrospective Bicentrique à Yaoundé

Maimouna Mahamat[1,2] , Amengle Albert L[3,4], Nzana Bandolo Victorine[1,5], Zake Gornet C[3], Jemea Bonaventure[3,5], Kaze Folefack François[1,5], Ze Minkande Jacqueline[3,4]

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Affiliations

1. Department of Internal Medicine and Specialties, Faculty of Medicine and Biomedical Sciences, The University of Yaoundé 1, Yaoundé, Cameroon
2. Haemodialysis Unit, Yaoundé General Hospital, Yaoundé, Cameroon
3. Department of Surgery and Specialties, Faculty of Medicine and Biomedical Sciences, The University of Yaoundé 1, Yaoundé, Cameroon
4. Resuscitation and Intensive Care Department, Yaoundé Gyneco-Obstetric Hospital, Yaoundé, Cameroon
5. Hemodialysis Department, Yaoundé University Teaching Hospital, Yaoundé, Cameroon

Corresponding Author
Maimouna Mahamat
Email : m_mahamat@yahoo.fr

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ABSTRACT

Introduction. Acute kidney injury (AKI) is a dreaded complication in intensive care, but Cameroonian data remain scarce. This study describes the prevalence, clinical profile, and hospital outcomes of AKI in two adult intensive care units (ICUs) in Yaoundé. **Methods**. Our retrospective descriptive and analytical study included all patients over 18 years of age admitted to the ICUs between January 2020 and December 2021 who developed AKI (KDIGO criteria). Data were analyzed using SPSS 22.0. **Results**. Among 601 admissions, 125 patients had AKI (prevalence 20.8%). Mean age was 60.4 years (sex ratio 1.66). Coma was the main reason for admission (35.2%), and 54.4% of patients had at least two organ failures. AKI was organic in 59.2% of cases, and 56.8% of patients were KDIGO stage 3. Renal replacement therapy (RRT) was initiated in 28.8% of patients. Mortality was very high (69.6%), and only 24.8% of survivors recovered normal renal function by discharge. In bivariate analysis, female sex, presence of ≥ 2 organ failures, stage 3 AKI, need for mechanical ventilation, vasopressors, and RRT were associated with increased mortality. In multivariate analysis, neurological failure (OR = 3.84), mechanical ventilation (OR = 3.12), and stage 3 AKI (OR = 2.45) remained independently associated with death. **Conclusion**. AKI in Cameroonian ICUs affects one in five patients and is associated with a mortality rate of nearly 70%. Only one-quarter of survivors recover normal renal function by discharge. Severity of renal injury and multiple organ failures are major prognostic factors.

RESUME

Introduction. L'insuffisance rénale aiguë (IRA) est une complication redoutable en réanimation, mais les données camerounaises restent limitées. Cette étude a décrit la prévalence, le profil clinique et l'évolution hospitalière de l'IRA dans deux unités de réanimation adulte de Yaoundé. **Méthodes**. Notre étude rétrospective descriptive et analytique a inclus tous les patients âgés de plus de 18 ans, admis en réanimation entre janvier 2020 et décembre 2021, et ayant présenté une IRA (critères KDIGO). Les données ont été analysées avec SPSS 22.0. **Résultats**. Sur 601 admissions, 125 patients présentaient une IRA (prévalence 20,8 %). L'âge moyen était de 60,4 ans (sex-ratio 1,66). Le coma était le motif d'admission principal (35,2 %) et 54,4 % des patients avaient au moins deux défaillances viscérales. L'IRA était organique dans 59,2 % des cas, et 56,8 % des patients étaient au stade 3 KDIGO. Une épuration extrarénale a été initiée chez 28,8 % des patients. La mortalité était très élevée (69,6 %) et seulement 24,8 % des survivants ont récupéré une fonction rénale normale à la sortie. En analyse bivariée, le sexe féminin, la présence de ≥ 2 défaillances viscérales, le stade 3 de l'IRA, le recours à la ventilation mécanique, aux vasopresseurs et à l'épuration extrarénale étaient associés à une mortalité accrue. En analyse multivariée, le déficit neurologique (OR = 3,84), la ventilation mécanique (OR = 3,12) et le stade 3 de l'IRA (OR = 2,45) restaient indépendamment associés au décès. **Conclusion**. L'IRA en réanimation au Cameroun concerne un patient sur cinq et s'accompagne d'une mortalité de près de 70 %. Seul un quart des survivants récupèrent une fonction rénale normale à la sortie. La sévérité de l'atteinte rénale et la présence de défaillances viscérales multiples sont des facteurs pronostiques majeurs.

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HIGHLIGHTS FOR READERS IN A HURRY

What is already known on this topic. Acute kidney injury in the ICU is associated with high mortality and an increased risk of chronic kidney disease. In sub-Saharan Africa, epidemiological and prognostic data remain very limited.

The question this study addressed. This retrospective study evaluated the prevalence, clinical characteristics, and hospital outcomes of AKI among 125 patients admitted to ICUs in two referral hospitals in Yaoundé (Cameroon) between 2020 and 2021.

What this study adds. AKI affects 20.8% of ICU patients. Nearly 60% of cases are organic (acute tubular necrosis), and 57% are KDIGO stage 3. Mortality reaches 69.6%; only 24.8% of survivors recover normal renal function by discharge. Independent factors for mortality are neurological failure (OR = 3.84), mechanical ventilation (OR = 3.12), and stage 3 AKI (OR = 2.45).

How this is relevant to clinical practice. These findings call for systematic AKI screening upon ICU admission, early management of organ failures, and improved access to renal replacement therapy. They also highlight the need for post-discharge nephrology follow-up to prevent progression to chronic kidney disease.

INTRODUCTION

Acute Renal Injury (AKI) is defined as the abrupt (a few hours to a few days), sustained and potentially reversible decrease in the renal filtration rate at the origin of the retention of nitrogenous and hydroelectrolyte products. It results in the onset of acute uremic syndrome, made up of a constellation of clinical and biological abnormalities whose intensity directly defines the therapeutic urgency. In intensive care, AKI affect nearly one in 2 patients with an overall incidence varying from 2.5% to 92.2%. AKI is the prerogative in intensive care for subjects with diabetes mellitus, heart failure, obesity, pre-existing kidney disease but also frequent in the context of sepsis or use of nephrotoxins [1,2]. This impact also varies with the level of economic development. In developing countries, AKI is considered a preventable condition based on its etiologies but in the absence of specific biomarkers (expensive and not available in our communities) and the clinical expression of the causative pathology, the diagnosis is frequently delayed, thus lengthening the time to treatment and worsening the prognosis. A Cameroonian single-center prospective study found an annual incidence of 15/100 patients in intensive care and medicine with a majority of patients at stage 3 KDIGO at diagnosis, sepsis as an etiology in one case out of 2 and a mortality of 36.9% [3]. The prognosis depends on the causative condition, the duration and severity of the AKI, and baseline renal function [4]. Mortality ranges from 5 to 80% to 100% in patients undergoing extra-renal cleansing therapy (ERR) [5,6]. This excess mortality is explained by the alteration of innate immunity linked to uremia and independent of the level of development [4,5]. More recently in 2020, Nono et al found in a cohort of subjects hospitalized in the Internal Medicine Unit, that ICU admission was a factor in mortality during AKI [7]. Also, in our context, there are few data on AKI in intensive care where the clinical severity could increase the prevalence of kidney injury. To this end, we will describe in this article the extent and profile of AKI in the intensive care unit and determine the hospital course.

PATIENTS AND METHODS

Type of study

We conducted an analytical cross-sectional study

Study period

Study Location

The study was conducted in the 2 reference hospitals in the city of Yaoundé: the Yaoundé University Hospital Center (CHUY) and the Yaoundé Gynecological-Obstetric Hospital (HGOPY). These 2 hospitals are both located in the political capital of Cameroon. The CHUY is a 227-bed public hospital with a large cosmopolitan attendance; it has a hemodialysis unit with a capacity of 15 generators. HGOPY has a capacity of 240 beds and specializes in maternal and child health; it relies mainly on the adjoining Yaoundé General Hospital for dialysis care.

Study population

The study concerned all the files of patients admitted to the multi-purpose intensive care unit of the CHUY and HGOPY from January 1, 2020 to December 31, 2021.

Inclusion criteria

The records of all patients over 18 years of age, admitted to intensive care and who presented with acute kidney injury at admission or during hospitalization, were included.

Non-inclusion criteria

Records of known patients with chronic kidney disease or palliative neoplastic disease as well as records with missing data (reasons for hospitalization, history, serum creatinine, treatment, progression at discharge) were not retained for this study.

Sample size

The sampling was consecutive and exhaustive.

Data collection

Patient recruitment was based on the registers and records of patients admitted to the intensive care units of the CHUY and HGOPY over a period of 24 months. The variables of interest were, among others: age, sex, origin, reason for admission, history, clinical parameters (diuresis, blood pressure), visceral failure, diagnosis made, additional examinations, daily treatment, functional and overall evolution during the duration of hospitalization.

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Data analysis

Data were collected on a pre-tested questionnaire using IBM SPSS Statistics 22.0 software. The tables and figures were prepared using Excel and Word 2016. Quantitative variables were expressed as mean and standard deviation. Qualitative variables were expressed in terms of numbers and percentages. The search for associations between the qualitative variables was done using the Chi-square test. The significance threshold was set for a p-value < 5%. The odds ratio (OR) and risk ratio (RR) with their 95% confidence intervals were calculated to assess the association between the variables.

Ethical considerations

Definition of operational terms

- Acute kidney injury defined according to the KDIGO 2012 criteria by:
- An absolute elevation of baseline serum creatinine ≥ 3 mg/L in ≤ 48 hours and/or
- An increase in serum creatinine ≥ 50% in 1 to 7 days and/or
- An oliguria < 0.5 ml/kg/h for more than 6 hours.

Also, an elevation of serum creatinine > 15mg/L during hospitalization was considered an AKI in the presence of a recent renal aggression factor (hypovolemia, infection, obstruction, nephrotoxic). Baseline serum creatinine was that at hospital admission or less than 3 months prior to hospitalization.

- Visceral failure could be neurological, hemodynamic, respiratory.
- Neurological failure: Glasgow score ≤ to 12 (in the absence of sedation)
- Hemodynamic failure: mean arterial pressure ≤ 50 mmHg; need for filling or vasoactive drugs to maintain systolic blood pressure > 100 mmHg
- Respiratory failure: respiratory rate: ≤ 12 cycles/min, Mechanical ventilation for at least 3 days
- Hepatic failure **:** clinical jaundice**,** ALT > x 2 normal, hepatic encephalopathy
- Haematological failure: haematocrit ≤ 20%; leukocytes≤ 300/mm³; wafers≤ 50,000/mm³; disseminated intravascular coagulation
- Evolution: it could be done around
- Complete recovery: return to baseline and stabilization of serum creatinine prior to discharge.
- Partial recovery: decrease in serum creatinine but no return to normal value.
- Non-recovery**:** Persistence of elevated serum creatinine.
- Death

RESULTS

Prevalence of acute kidney injury

Out of 601 admissions recorded throughout our study period, 125 patients met our inclusion criteria, representing an AKI prevalence of 20.8%.

General characteristics of the study population

The mean age of the study population was 60.37±17.9 years with 50.4% (n=63) being between 60 and 80 years old and 78% (n=62.4) of the series being male. The main reason for admission to intensive care was coma (35.2%); patients being admitted from the emergency department (48%) or medical hospitalization services (16.8%). Comorbidities were dominated by arterial hypertension (42.4%) and diabetes (21.6%). Only 10 patients were HIV carriers. The use of nephrotoxicants was reported in 35.2% (n=44), including anti-inflammatory drugs (8%), phytotherapy (8%) and aminoglycosides (2.4%), but also conventional drugs potentially harmful to renal hemodynamics such as renin-angiotensin-aldosterone system blockers (25.6%). All of this is illustrated in Table I.

Table 1. Characteristics of the study population (N= 125)

Variables	N(%)
Average age (SD), years	60.37 (17.9)
Male	78 (62.4)
Reason for admission	
Coma	44 (35.2)
Sepsis	24 (19.2)
Postoperative	18 (14.4)
Hemodynamic shock	17 (13.6)
Respiratory distress	13 (10.4)
Comorbidities	
High blood pressure	53 (42.4)
Diabetes	27 (21.6)
HIV	10 (8)
Risk factors for AKI	
Taking NSAIDs	10 (8)
Phythotherapy	10 (8)
Iodinated contrast agent	4 (3.2)

SD : standard deviation

Clinical, Biological and Etiological Profile of AKI

As summarized in Table II, AKI was primarily organic (59.2%), consistent with acute tubular necrosis in 75.7% of cases occurring in the continuum of hypovolemia (44%) or related to nephrotoxics (35.2%). Digestive loss was the cause of hypovolemia in 6 patients. The mechanism of AKI was unknown in 8.8% of situations. AKI was severe in our series with 56.8% (n=71) of patients at stage 3 KDIGO. The median serum creatinine [interquartile range] was 38.5 [38.5-68] mg/l with extremes ranging from 16 to 209.9mg/l. The median [interquartile range] of the CRP was 48 [3-96] mg/L.

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Renal replacement therapy

Haemodialysis was performed in 28.8% of patients (n=36) with the main indications being severe metabolic acidosis (n=10), acute pulmonary edema (n=8), uremic encephalopathy (n=6) and threatening hyperkalemia (n=6). In addition, respiratory support was required in 64 patients (51.2%) and vasopressor support in 33 patients (26.4%).

Table 2. Characteristics of acute kidney injury

Variables	N=125	%
Mechanisms		
Organic	74	59.2
Acute tubular necrosis	*56*	*75.7*
Acute interstitial nephritis	*12*	*16.2*
Vascular nephropathy	*6*	*8.1*
Functional	43	34.4
Obstructive	8	6.4
Etiologies		
Hypovolemia	55	44
Nephrotoxic	44	35.2
Sepsis	12	9.6
Decompensated heart failure	8	6.4
Prostatic hypertrophy	6	4.8
Severity		
Stage 1	27	21.6
Stage 2	27	21.6
Stage 3	71	56.8
Dialytic treatment indications* (n=36)		
Severe metabolic acidosis	10	27.8
Hydro Sodium Overload	8	22.2
Uremic encephalopathy	6	16.6
Hyperkalemia	6	16.6
Anuria	6	16.6

***More than one indication could be retained in the same patient**

Table 3. Length of hospital stay and evolution of the study population

Variables	N=125	%
Length of hospitalization, days		
Minimun-maximun	2-36	
Median [IQR]	4[3-7]	
Hospital evolution		
Alive	38	30.4
Complete renal recovery	31	24.8
Partial renal recovery	5	4
Deceased	87	69.6
Causes of death (n=87)		
Septic shock	40	45.9
Hypovolemic shock	25	28.7
Acute pulmonary edema	7	8
Respiratory failure	6	6.9
Severe anemia	6	6.9
No access to dialysis	3	3.4

IQR: interquartile range

Evolution

When discharged from the ICU, the complete recovery rate was 24.8%. The mortality rate was 69.6% (n=87) with septic shock as the main cause of death (45.9%, n=40). This is illustrated in Table III. Prognostic factors

Table IV presents the factors associated with the prognosis.

Table 4. Prognostic factors for AKI in intensive care (bivariate analysis)

Variables	Total (N=125)	Alive (%) n= 38	Deaths (%) n=87	p	RR	IC (95%)
Gender						
Male	78 (62.4)	32(41)	46(59)	0.001	0.210	1.193-1.834
Female	47 (37.6)	6(12.8)	41(87.2)			
Number of failures						
<2	57 (45.6)	30(52.6)	27(47.4)	0.002		
≥2	68 (54.4)	8(11.7)	60(88.2)			
Assisted ventilation	64 (51.2)	14(21.9)	50(78.1)	0.003		
Type of failure						
Neurological	68 (54.4)	9(13.2)	59(86.8)	0.00	0.349	0.194-0.629
Hemodynamics	54 (43.2)	8(14.8)	46(85.2)	0.001	0.398	0.209-0.760
Respiratory	64 (51.2)	11(17.2)	53(82.8)	0.001	0.475	0.281-0.804
AKI Severity						
Stage 1	27 (21)	16(59.3)	11(40.7)	0.000		
Stage 2	27 (21)	11(40.7)	16(59.3)			
Stage 3	71 (58)	11(15.5)	60(84.5)			
Hemodialysis	36 (28.8)	6(16.7)	30(83.3)	0.033	0.458	0.208-1.008

Table 5. Prognostic factors for *AKI* in intensive care (*multivariate* analysis*)*

Variable	Adjusted OR (	CI (95%)	P-value
Neurological deficit	3,84	[1,72 - 8,56]	0,001
Assisted ventilation	3,12	[1,45 - 6,71]	0,004
Severity Stage (3)	2,45	[1,02 - 5,90]	0,045
Hemodynamic Deficiency	1,92	[0,88 - 4,20]	0,102 (NS)

The most frequently observed visceral failure in AKI was neurological failure (54.4%), followed by respiratory failure (51.2%) and hemodynamic failure (43.2%). More than 2 disorders were present in 54.4%

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(n=68). Female sex, failure of more than 2 systems, namely neurological, hemodynamic and respiratory, were factors significantly associated with death. Similarly, stage 3 of AKI and the need for dialysis were predictive factors for an unfavourable outcome.

DISCUSSION

At the end of this study conducted in 2 intensive care units over a period of 4 months, it emerged that: AKI is common in intensive care (20.8%); the causes of AKI in intensive care are dominated by sepsis, hypovolemia, nephrotoxic drugs; the majority of AKI cases in intensive care are severe from the outset (stage 3); The progressive modalities are: complete recovery (24.8%), partial recovery (4%) and death (69.6%); The mortality factors are: female sex, the existence of more than two visceral failures (neurological, hemodynamic and respiratory in particular), the use of vasoactive amines, respiratory support, stage 3 AKI and dialytic treatment.

The prevalence of AKI in our series is superimposed on that reported by White et al on a prospective cohort of patients admitted to 12 ICU units in Australia [8]. It is close to the 22.3% of Halle et al in Cameroon and the 19.21% of Bouchard et al [3,9]. A prospective study conducted at the Gabriel Touré University Hospital in Bamako reported a prevalence of AKI of 12.32%, mostly women (61.5%), with an average age younger than ours and hypovolemia (61.5%) and infections as etiologies [10]. AKI is common and generally affects young people in resource-limited settings like ours, unlike in developed countries [11]. However, in intensive care, AKI is mainly found in elderly subjects (average age in our series of 60.37 years) explained by the functional and structural changes of the kidney with age and by the renal impact of many chronic diseases such as diabetes, high blood pressure and obstructive pathologies of the urinary tree, the incidence of which increases with age [12]. It is also important to highlight the growing share of iatrogeny as a risk factor for AKI in the elderly, who are frequently exposed to polymedication. Women were less affected, as in most studies [13]. Male subjects are the most affected, as in our series.

The AKI, as in the other cohorts, was organic and severe from the outset associated with sepsis and the use of nephrotoxicants. The use of traditional pharmacopoeia drugs had been described as frequent during AKI in an earlier Cameroonian publication. Also, Halle et al already highlighted in their cohort the frequency of hypovolemia (31.6%) as a cause of AKI. Thus, AKI in our context remains potentially predictable through early recognition, correct evaluation and preventive management.

In our study, hemodialysis (HD) was indicated in 36 patients (28.8%) and the main indication was metabolic acidosis. Halle et al and Dos Santos et al reported lower rates of HD use, 10.1% and 13% respectively [3,14]. This may be related to the severity of the clinical condition of our patients in intensive care, but also to greater accessibility to locum therapy in line with the "0 by 25" initiative [15].

Complete renal recovery was observed in less than one in 4 patients despite the low proportion of polymorbid subjects. This poor renal evolution may be due to the systemic and renal inflammatory state supported by sepsis, the main cause of AKI in our study.

The mortality of patients with AKI remains very high, especially in cases of need for extrarenal purification and particularly in intensive care compared to other inpatient departments [16,17]. The prognosis for AKI is unfavourable in intensive care regardless of the geographical area [18]. There is excess female mortality, possibly related to the low access to care in this category. The same is true in the series Asiatique by Jiang et al, which found a low risk of death in intensive care in male subjects [19]. The AKI was mostly at stage 3 in our context, referring to late consultation or referral in our environment, itself associated with a poor prognosis [20].

The analysis of mortality within our intensive care cohort in Yaoundé highlights a high prevalence of death, influenced by factors of clinical severity and the need for organic replacement. Our results underline the importance of neurological and ventilatory prognosis in determining the fatal outcome. In our study, neurological deficit (ORa = 3.84) was the main independent factor in death. This finding is consistent with the work of Balti et al. in sub-Saharan Africa, who show that a low initial Glasgow score is a poor survival marker, often linked to longer delays in care before admission to intensive care. Unlike hemodynamic deficit, which can be transiently stabilized by amines, severe neurological lesions often reflect irreversible systemic damage in the context of limited resources. Assisted ventilation (ORa = 3.12) is strongly correlated with death in our series. While this technique is vital, it is also associated with an increased risk of nosocomial complications. A study conducted in tertiary intensive care units in Cameroon has already highlighted that ventilator-related mortality is often aggravated by lack of continuous monitoring and difficulties in ventilatory weaning [21]. Our results confirm that the need for invasive respiratory support identifies a population at very high risk of mortality in Yaoundé.

Stage 3 of the KDIGO classification appeared to be a significant risk factor ($p = 0.011$). The association of ERA with death in bivariate analysis (OR = 2.67) reflects a classic selection bias in intensive care: only the most severe patients benefit from this technique [4]. The lack of significance of the ERA in multivariate analysis suggests that the risk is carried by the severity of the kidney damage (stage 3) rather than by the procedure itself. As underlined in the KDIGO recommendations, the initiation of ERA must be early to hope to bend the mortality curve, which remains a logistical challenge in our context [5].

CONCLUSION

Acute kidney injury is common in the intensive care unit in our context and is associated with a poor functional and overall prognosis. Biomarkers for early diagnosis are not available in routine practice and therefore the identification of risk groups is vital for the reduction of morbidity and mortality. Inexpensive strategies such as

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the elimination of nephrotoxic drugs and the optimization of the hemodynamic state should be systematic in the intensive care unit.

DECLARATIONS

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Conflicts of interest

The authors declare no conflict of interest.

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The work was carried out with own funds.

Ethical considerations

All stages of the work were carried out in compliance with the Declaration of Helsinki. The approval of the institutional ethics committee was obtained prior to the start of the study. This work did not involve any experimentation on humans or animals and it does not contain any personal information that could identify the patients

Data availability

Data is available on reasonable request from the principal author.

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