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Acute Kidney Injury in the Nephrology Department of the Brazzaville University Hospital: Epidemiological, Clinical and Evolutionary Aspects

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Abstract

Introduction: Acute kidney injury (AKI) is defined as a sudden and reversible deterioration in renal function. It is a life-threatening condition in hospitalized patients. Our objectives were to determine the prevalence of AKI in a nephrology department, list the causes, describe the evolutionary profile and identify the factors associated with death. **Patients and Methods:** We reviewed the records of patients hospitalised between 1 January 2016 and 31 October 2020 in the nephrology department of Brazzaville University Hospital. We included patients aged at least 18 years whose discharge diagnosis included the item "AKI". Study variables were socio-demographic data, clinical and paraclinical signs, stage and type of AKI, etiology and evolutionary profile. **Results:** Of the 1823 patients hospitalised, 244 (13.38%) were hospitalised for AKI. Of these, 60.2% were boys and 39.8% girls, with an average age of 47 ± 19 years. The average consultation time was 10 ± 6.5 days. AKI was stage 3 in 69.57% of cases. It was functional, organic and obstructive in the order of 55.28%, 36.02% and 8.69%. Dialysis was indicated in 62 patients (38.51%) and performed in 24 patients (14.9%). In-hospital mortality was 27.95%, with an average hospital stay of 9.6 ± 5.8 days. Metabolic acidosis and anemia were the main causes of death in 14.28% and 4.35% of patients respectively. Factors associated with death were male sex, socioeconomic level, coma, indication for dialysis and absence of dialysis, with a $p < 0.05$. **Conclusion:** AKI is more common in young adult males. Mortality is relatively low. Improving prognosis requires early management and access to dialysis.

Keywords

AKI, Epidemiology, Diagnosis, Evolution, Brazzaville

1. Introduction

Acute Kidney Injury (AKI) is defined as a sudden and potentially reversible deterioration in renal function resulting in a rise in plasma creatinine, due to the kidney's inability to eliminate waste products from nitrogen metabolism and maintain the body's fluid and electrolyte balance [1]. It can occur in people with normal renal function or in patients with pre-existing chronic kidney disease [2] [3]. It is a life-threatening diagnostic and therapeutic emergency [4]. The problem with AKI is not its recognition, which is made easier by the contribution of biology, but rather the search for its etiology, which determines the way it is managed. It is one of the causes of in-hospital morbidity and mortality [5] [6]. However, little is known about its incidence in hospitals, due to a contradictory definition, which is the corollary of the variability of diagnostic criteria, and an abundant and discordant literature [5] [7] [8]. In Europe and North America, its incidence in hospitals is estimated at between 200 and 400 cases per million population [9]. In the United Kingdom, according to Racha and Challiner, the incidence of AKI is 25.4%, two-thirds of which develop in hospitals [10]. In the United States, in a national multicenter survey carried out in 2006 in nearly 500 hospitals, the incidence of AKI was 1.9% [11].

In Asia, specifically in China, it was 31.6% in 2009 [12].

In Africa, the studies available on AKI are often hospital-based and single center. In Rabat, Morocco, for example, the hospital incidence rate was 20% [13]. In Burkina Faso, it was 18.4% [14], and 52% in Mali and the Democratic Republic of Congo [15]. In the Republic of Congo, studies of AKI in adults are rare, although a study carried out in intensive care units in Pointe Noire and Brazzaville reported a prevalence of AKI of 20%, with a case fatality rate of 37% [16]. With the aim of contributing to the improvement of the management of AKI in hospitalised patients, we carried out this study with the general objective of determining the epidemiological, diagnostic, therapeutic and evolutionary aspects of AKI in the nephrology department of the CHU-B and more specifically to determine: the frequency of AKI in nephrology, its aetiologies, the evolutionary profile and to identify the factors associated with death.

2. Patients and Methods

2.1. Type and Period of Study

This is a retrospective study. It covered the period from 01 January 2016 to 31 October 2020, *i.e.* 04 years and 10 months. Our study was carried out in the nephrology and dialysis department of the Brazzaville University Hospital Centre (B-UHC).

2.2. Study Population

The study population consisted of all patients hospitalised on the ward during the study period. We included all patients over 18 years of age hospitalised on the ward whose discharge diagnosis included the item ARF. We excluded patients with chronic renal failure (CRF), and patients whose records were absent and/or unusable.

2.3. Sampling

The sampling method was exhaustive. Our data sources were hospital registers and inpatient medical records. The variables studied were: sociodemographic (age, sex, socioeconomic level*, occupation) clinical (reason for hospitalization, time to consultation, history, type of AKI: pre-renal, renal, post-renal), biological (creatininaemia, urea, kalaemia, natremia, calcaemia, phosphaemia), diagnostic (stage of AKI according to the KDIGO 2012 classification**, type of AKI and its etiology), therapeutic (indications for dialysis) and evolutionary (recovery of renal function, death, chronicity). AKI was staged according to the 2012 classification of AKI by KDIGO (Kidney Disease international Global Outcomes), reported in Table 1.

The socio-economic level was classified into three groups based on professional status:

1) High socio-economic level: senior executives of the State or the private sector, import-export traders, army officers;

2) Average socio-economic level: made up of agents of the State or the private sector with a level of education equivalent to secondary school, traders, army non-commissioned officers;

3) Low socio-economic level: made up of workers, laborers, farmers, soldiers and the unemployed.

Table 1. KDIGO 2012 classification of acute renal failure [17].

State	Creatinine	Urinary volume
1	>0.3 mgl dl. 1.5 - 1.9 times basal creatinine	<0.5 ml/kg/h for 6 - 12 h
2	2.0 - 2.9 times basal creatinine	<0 - 5 ml/kg/h for >12 h.
3	3.0 times basal creatinine Creatinine greater than 4.0 mg l dl Start TRR. Less than 18 years old TFG <35 ml/min/1.73 m^2	<0.3 ml/kg/h for >24 h. Anuria for >12 h.

KDIGO Clinical Practice Guideline for Acute Kidney Injury. *Kidney Int.* 2012; 2(1): 1-138.

2.4. Ethical Considerations

Our study was retrospective, so data were collected with respect for patient anonymity and confidentiality.

2.5. Statistical Analysis

The data were entered using Microsoft Excel 2016 and analysed using R version 2016 and Microsoft Excel 2016. Statistical indices were calculated, including those for central tendency (numbers, percentages) and dispersion (arithmetic mean, standard deviation). The quantitative data are presented in the form of mean± standard deviation. We began by carrying out a descriptive study of the different variables associated with AKI, followed by a univariate study to identify the risk factors for death. To do this, the Odd Ratio (OR) and its confidence interval (CI) were calculated. The significance threshold was set at 95%. Confounding factors were identified. In order to identify confounding factors, the results were adjusted using the logit method, with significance at $p < 0.05$.

The data were entered using Microsoft Excel 2016 and analysed using R software version 4.0.3. Statistical indices were calculated, including those for central tendency (numbers, percentages) and dispersion (arithmetic mean, standard deviation). Quantitative data are presented in the form of mean ± standard deviation, and qualitative data in the form of numbers and percentages. A univariate study was used to identify the risk factors associated with death. To do this, Odds Ratios (OR) and their confidence intervals (CI) were calculated. An adjustment for sex was made in the multivariate analysis by integrating the factors associated with death. The significance threshold for comparisons was set at $p < 0.05$.

In total, we consulted 1823 patient files. Figure 1 shows the flow chart for selecting the files selected for the study.

3. Results

3.1. Socio-Demographic Characteristics

3.1.1. Frequency

A total of 1823 patients were hospitalised in the nephrology department during the study period, 244 of them for AKI, representing a hospital frequency of 13.4%.

3.1.2. Age, Sex, Socio-Economic Level

The mean age was 47 ± 19 years, with extremes of 18 and 91 years. The distribution of patients by age group is shown in Table 2.

There were 97 men (60.2%) and 64 women (39.8%), giving a sex ratio of 1.51.

Male patients had a mean age of 48±18.6 years and female patients had a mean age of 45 ± 18.5 years.

There were 104 single patients (64.58%), 37 married patients (23%), 19 widowed patients (11.8%) and one divorced patient (0.62%).

The Table 3 présents the socio-economic level of the patients.

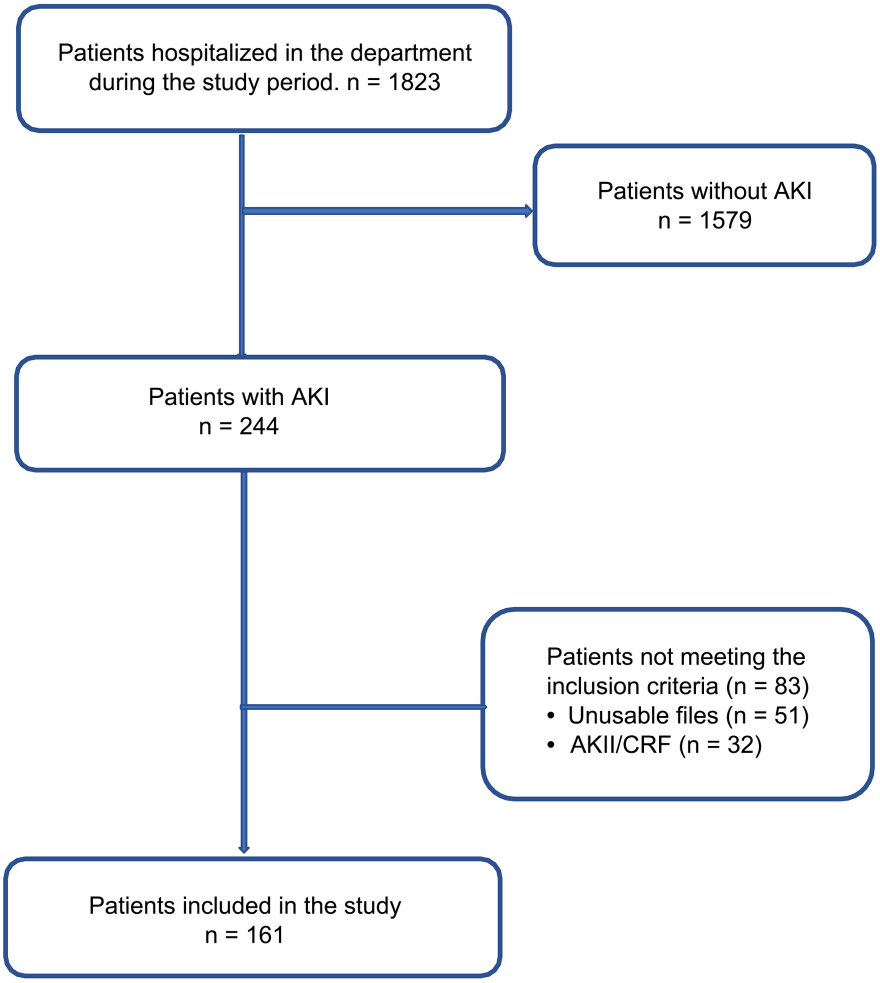

Figure 1. Patient flow chart.

Table 2. Breakdown of patients by age group (in years).

	n	%
[18 - 30]	**42**	**26.1**
[31 - 45]	39	24.2
[46 - 60]	34	21.1
[61 - 75]	37	23
>75	9	5.6

Table 3. Distribution of socio-economic level.

	n	%
Low socio-economic level	**94**	**58.4**
Average socioeconomic level	57	35.4
High socio-economic level	10	6.2

3.2. Clinical Features

3.2.1. Reason for Hospitalisation

The reasons for hospitalisation are shown in Table 4.

3.2.2. Consultation Period

The average time elapsed between the onset of symptoms and hospitalization was 10 ± 6.5 days, with extremes of 1 and 30 days.

3.2.3. Background

The background is shown in Table 5.

3.2.4. Diuresis

Diuresis was preserved in 86 patients (53.4%) and oligoanuria was noted in 75 patients (46.6%).

3.3. Biological Characteristics

3.3.1. Serum Creatinine and Urea

The mean serum creatinine was 701 ± 564 µmol/l (range 147 and 3397 µmol/l). Figure 2 illustrates the distribution of patients according to serum creatinine levels.

The mean azotemia level was 1.8 ± 1.4 g/l (range 0.1 to 5.5 g/l). Azotemia was noted in 53 cases (34%).

Table 4. Breakdown by reason for hospitalization.

	n	%
Consciousness disorders	28	17.4
Edema	20	12.4
Vomiting	17	10.4
Convulsive seizures	16	10.1
Diarrhoea	11	6.8
Anuria	11	6.8
Fever	9	5.6
Lumbar fossa pain	8	5
Abdominal pain	7	4.3
Haematuria	4	2.5
Hoquet	3	1.8
Physical asthenia	3	1.8
Urinary irritation syndrome	3	1.8
Severe anaemia	2	1.2
Joint pain	1	0.6
Digestive haemorrhage	1	0.6

Table 5. Medical history.

	n	%
HBP	47	29.2
Diabetes mellitus	26	16.2
Long-term use of NSAIDs	24	15
HIV	12	7.5
Heart disease	5	3.1
Stroke	5	3.1
Tuberculosis	4	2.5
Cirrhosis of the liver	3	1.86
Benign tumours	3	1.86
Homozygous sickle cell disease	1	0.62
Other	11	6.8

*Poly Blood transfusion (4); systemic lupus erythematosus (2); treatment with injectable aminoglycosides (2); Kaposi's sarcoma (1); nephrotic syndrome (1).

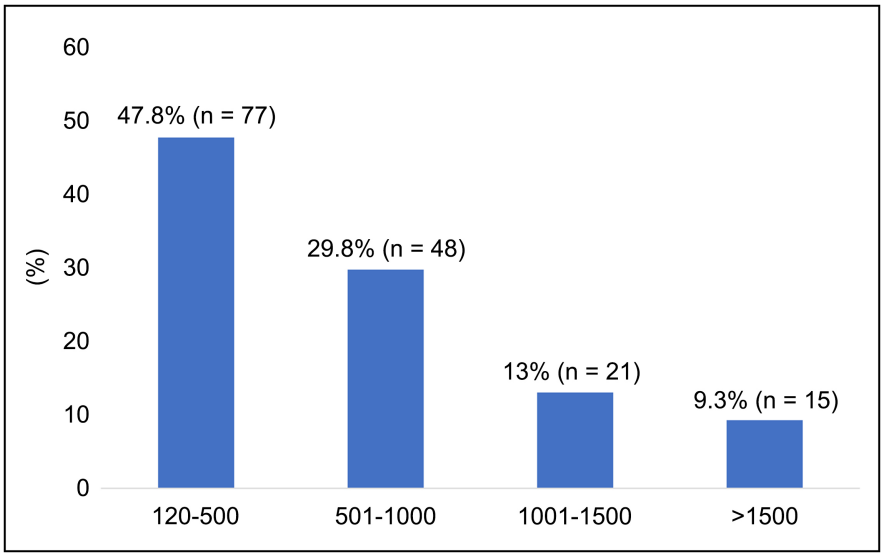

Figure 2. Distribution of patients according to serum creatinine levels (in umol/l).

3.3.2. Electrolytic Disorders

The blood ionogram revealed: a mean natraemia of 139 ± 6.6 meq/l (extremes: 130 and 158 meq/l). Hyponatremia was found in 51 cases (31.7%) and hypernatremia in 21 cases (13%); mean kalaemia was 3.8 ± 1.3 meq/l with extremes of 0.74 and 7 mEq/l. Hypokalaemia was noted in 69 patients (42.8%), moderate hyperkalaemia in 28 cases (17.4%) and threatening hyperkalaemia in 2 cases (1.2%).

The mean calcaemia was 99 ± 4.4 mg/l with extremes of 80 and 110 mg/l.

Hypocalcaemia was noted in 2 cases (1.2%) and hypercalcaemia (n = 1, 0.6%).

The mean serum phosphorus level was 34 ± 4.7 mg/l, with extremes ranging from 29 to 40 mg/l. Four of the patients had normal blood phosphorus levels.

3.3.3. HIV infection

Twenty-three patients (14.3%) were HIV-positive, of whom 12 (7.6%) knew their HIV-positive status and 11 were diagnosed during hospitalization.

3.4. Staging of Acute Renal Failure (KDIGO 2012)

The distribution of patients by stage of renal failure is shown in Figure 3.

3.5. Type of Acute Renal Failure

The distribution of the type of acute renal failure is illustrated in Figure 4.

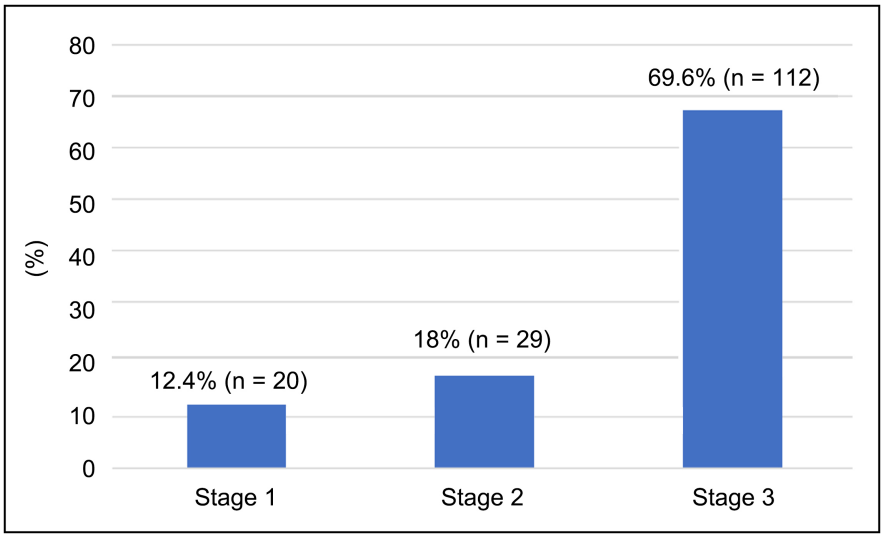

Figure 3. Distribution of AKI according to the KDIGO 2012 staging.

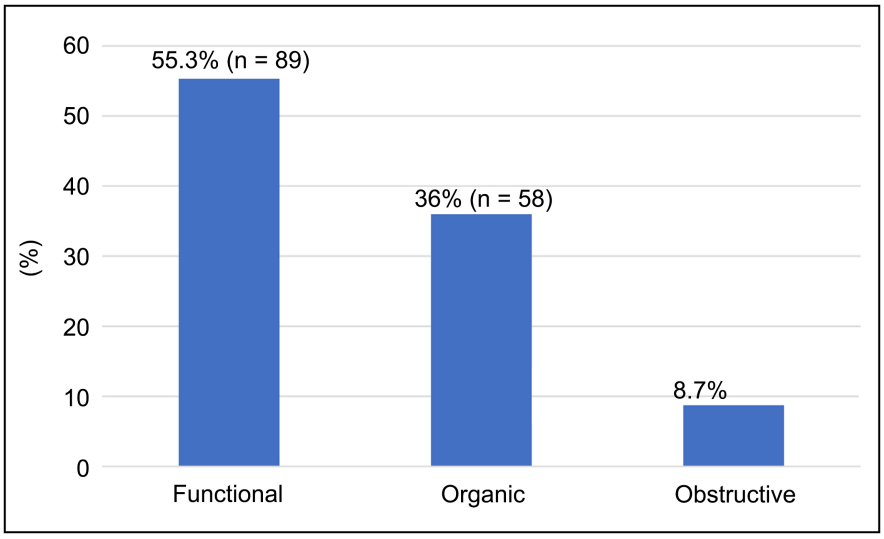

Figure 4. Breakdown of patients by type of acute renal failure.

3.6. Indication for Dialysis

Haemodialysis was indicated in 62 patients (38.5%) The indications for haemodialysis were:

- Uremic encephalopathy: n = 32 (20%).
- Persistent anuria (>24 hours): n = 11 (6.8%).
- Acute pulmonary Edema (APE) refractory to diuretic treatment: n = 10 (6.2%).
- Severe metabolic acidosis unresponsive to conservative measures in 7 patients (4.35%).
- Severe hyperkalaemia: n = 2 (1.2%).

Only 24 patients (14.9%) were able to undergo dialysis.

3.7. Evolution

The average length of hospital stay was 9.6 ± 5.8 days (extremes: 1 and 28 days). One hundred and four patients were hospitalised for 10 days or less.

Table 6 shows the evolution of patients during hospitalization.

The average age of patients who died was 50 ± 22 years (extremes: 18 and 91 years). The breakdown by cause of death is shown in Table 7.

3.8. Risk Factors for Death

The Table 8 shows in analysis univariate analysis the relationship between the socio-demographic characteristics and death, in univariate analysis.

3.8.1. Relationship between Co-Morbidities and Death

Table 9 shows the relationship between comorbidities and death in univariate analysis.

Table 6. Breakdown by development.

	n	%
Full kidney Function recovery	86	53.4
Deceased	45	27.9
Chronic Kidney Failure	21	13
Unknown (escapees)	9	5.6

Table 7. Breakdown of patients by cause of death.

Cause of death	n	%
Uremic encephalopathy	**23**	**14.3**
Septic shock	16	10
Hypovolaemic shock	3	1.8
APE	3	1.8

APE: Acute Pulmonary Edema.

Table 8. Relationship between socio-demographic characteristics and death.

	Deceased n = 45 n (%)	Living n = 107 n (%)	OR [95% CI]	p-value
Gender				
F	10 (22.2)	50 (46.7)	Ref.	Ref.
M	35 (77.8)	57 (53.3)	3.1 [1.38 - 6.82]	**0.005**
Socio-economic level				
Low	21 (46.7)	70 (65.4)	Ref.	Ref.
Elevated	7 (15.6)	4 (3.74)	5.8 [1.56 - 21.9]	**0.01**
Medium	17 (37.8)	33 (30.8)	1.7 [0.80 - 3.68]	0.172
Admission procedure				
Referral	15 (33.3)	44 (41.1)	Ref.	Ref.
Intra-hospital transfer	30 (66.7)	63 (58.9)	1.4 [0.67 - 2.90]	0.377

Table 9. Relationship between comorbidities and death in univariate analysis.

	Deceased n = 45 n (%)	Living n = 107 n (%)	OR [95% CI]	p-value
HTA				
No	31 (68,9)	77 (72,0)	Ref.	Ref.
Yes	14 (31.1)	30 (28.0)	1.2 [0.54 - 2.48]	0.702
Diabetes mellitus				
No	37 (82.2)	93 (86.9)	Ref.	Ref.
Yes	8 (17.8)	14 (13.1)	1.4 [0.56 - 3.71]	0.461
HIV				
No	43 (95.6)	98 (91.6)	Ref.	Ref.
Yes	2 (4.4)	9 (8.41)	0.5 [0.10 - 2.44]	0.424
Heart disease				
No	45 (100)	102 (95.3)	Ref.	Ref.
Yes	-	5 (4.67)	-	0.168
Cirrhosis of the liver				
No	44 (97.8)	106 (99.1)	Ref.	Ref.
Yes	1 (2.2)	1 (0.9)	2.4 [0.15 - 39.4]	0.592

3.8.2. Multivariate Analytical Study

In multivariate analysis, after adjustment for sex, the factors associated with death are shown in Table 10.

Table 10. Risk factors for death in multivariate analysis.

Dependent: DEATH	OR (multivariable)	p-value
Gender		
F	-	
M	2.5 [1.11 - 6.09]	**0.032**
Socio-economic level		
Low	-	-
Elevated	5.4 [1.41 - 23.69]	**0.016**
Medium	1.7 [0.75 - 3.81]	0.201
Awareness		
Normal	-	-
Coma	3.2 [1.48 - 6.95]	**0.003**
Blood urea		
<2.5	-	
≥2.5	1.1 [0.38 - 2.88]	0.913
Indication for dialysis		
No	-	
Yes	4 [1.54 - 10.19]	**0.005**

4. Discussion

4.1. Analysis of the Methodology

In Congo-Brazzaville, studies of AKI are still rare, despite the problems it poses for vital and functional prognosis in the short and medium term. The available studies are sector-based and do not provide an overall hospital prevalence rate. Ekat MH *et al.* carried out a descriptive and analytical study in 2013 on the prevalence and factors associated with acute renal failure in newly HIV-positive patients in Brazzaville [18]; Missamou A *et al.* carried out a retrospective study on ARF during and after childbirth in 2017 [16] and Moyen E *et al.* carried out a study in 2019 on acute renal failure exclusively in the paediatric wards of the Brazzaville University Hospital [19].

We conducted a retrospective analytical study with the aim of contributing to improving the management of AKI in the nephrology department of B-UHC.

This methodological choice was justified by the need to obtain hospital data on AKI, in particular from a department specialising in the management of kidney disease, thereby supplementing the sectoral data already available.

There are undoubtedly a number of pitfalls in this study. The first relates to the fact that the study was only carried out in a hospital department, which

would obviously reduce the power of the observations and make it difficult to extrapolate the results to the general population. The second relates to the retrospective nature of the study, which generates bias in terms of lost to follow-up and data collection. During data collection, we found a large number of files that could not be used (n = 51). The exclusion of patients with chronic renal failure was justified by the fact that many of these patients do not have regular follow-up, since the diagnosis of AKI on a chronic background is made during post-hospital follow-up [20] [21]. Despite these limitations, we were able to carry out our work within the defined period, and the results obtained were discussed with the data in the literature.

4.2. Socio-Demographic Characteristics

AKI is a major threat to the vital prognosis of hospitalised patients, depending on the circumstances in which it occurs [14]. Our study shows that one in seven hospitalised patients (13.38%) in the nephrology department of Brazzaville University Hospital presented with AKI. Our data are in line with the sub-Saharan literature, which reveals a prevalence in nephrology departments of between 10 and 15%. Samaké M *et al.* in 2018 in Mali found a prevalence of 11.88% in the internal medicine department of the Fousseyni Daou Hospital in Kayes [22]. In Uganda, the prevalence of AKI in the adult medical wards of Mulago National Referral Hospital was 16% in 2013, according to Basagha P *et al* [23]. Our data and others from sub-Saharan Africa are similar to those from Europe such as the French study conducted in 2011 by Lakhal K where the prevalence was 14% [24].

AKI is more frequent in an adult hospital ward; in fact, comparing our data with those of Moyen E *et al.*, the prevalence of AKI in the 4 paediatric wards of B-UHC was 10 times less frequent [19]. However, despite the specialised nature of renal disease management, AKI is less frequent in nephrology than in an intensive care unit, since Missamou *et al.* in 2018 found a prevalence of AKI of 20% in the intensive care units of B-UHC and A Cissé Hospital in Pointe Noire Ciy [16]. In our study, 60.2% of patients were male. The same finding was noted in various studies such as that of Lengani A *et al.* where the predominance of males was 61.98% [14]; and Hatem O *et al.* in Saudi Arabia, who found a male predominance of 62% [25]. At any age, AKI is more frequent in males, since our data also concur with those of Moyen E *et al* [19] who also reported a male predominance in children. In univariate and multivariate analysis, male sex was a risk factor for death from AKI in our study (0.05). This could be explained by hormonal factors.

AKI patients in the nephrology department are young. The age group most affected was between 18 and 30 (26.08%). Elderly patients were very poorly represented, with only 5.6% over 75 years of age. Our data are in line with those of other African studies, where the average age varies between 40 and 55. In Morocco in 2013, Failal I *et al.* found a mean age of 45.8 years [26]. Samaké M *et al* in Mali in 2018 [22] and Masewu A *et al* in the DRC [15] reported an average

age of 51.61 and 51.9 respectively. This can be explained by the fact that the African population, and the Congolese population in particular, is predominantly young. The African population is predominantly young [27]. Our data and those in the African literature differ from those in Europe, where the average age is between 60 and 80, with a peak in the over 75s [28]. In fact, due to better health coverage and better-equipped modern medical facilities, life expectancy in the West is higher than in Africa [29] [30] [31]. Elderly subjects are also at risk of AKI, due to a senile decline in the perception of thirst and higher cardiovascular risk factors [32] [33]. Patients with a low socio-economic level were the most represented (58.39%). The data is similar to that observed in the literature. Lengani A *et al.* reported in 2010 a proportion of 55.4% of patients with a low socio-economic status [14]. This finding is explained by the fact that the majority of the Congolese population is active in the end on their behalf [34].

4.3. Clinical Characteristics

The delay in consultation was 10 ± 6.5 days in our study population. The late recourse to modern health structures is linked to the multiple traditional treatments (herbal medicine) and therapeutic manipulations at the level of secondary health centers [35].

Disturbed consciousness was the main reason for hospitalisation (17.39%). This finding in our study sample is similar to that observed in Algeria by Hanba M *et al* [36] and in the Republic of Congo by Missamou M *et al* [16]. This high frequency of patients hospitalised for disturbance of consciousness may be related to uremic encephalopathy as a result of a delay in consulting specialised facilities, but may also be part of a multivisceral failure.

4.4. Co-Morbidities and AKI

Hypertension was common in our patients (29.19%). This figure was slightly higher than that of Lengani A *et al.* where the proportion of hypertension was 10.7% [14]. Diabetes mellitus was the second most common medical history (**Table 6**). It was observed in 26 patients (16.15%). This finding is similar to that of Hanba M *et al.,* who reported a proportion of diabetic subjects of 11.3% [36]. Hypertension and diabetes mellitus are the world's leading non-transmissible chronic diseases and are the cause of significant morbidity and mortality. Several studies have reported a high incidence of AKI in hypertensive and diabetic patients. However, despite their significant morbidity and mortality, these two diseases did not influence death in our study.

In several studies, such as Lengani's, heart disease was observed in 11% of cases [15]. In our study population, the incidence of heart disease was 3.11%. Stroke was observed in 3.1% of our study population. This result is similar to that reported by Eswarappa in India (2.8%) [37].

Patients with heart disease, particularly those with a collapse of the ventricular ejection fraction, are at risk of AKI [16] [38], as are patients hospitalised for

stroke [16]. In our study, the low frequency of these two comorbidities may be explained by the location of the study: "a nephrology department". Patients hospitalised for heart disease or stroke are managed in other departments. ARF is managed in these departments in collaboration with the nephrologists. A transfer is considered when the AKI is severe.

4.5. Severity of AKI

More than 2/3 of AKI were at stage 3 of the KDIGO 2012 classification; explaining a high mean creatinine level (701 ± 564 µmol/l). This high frequency of severe AKI has also been found in other African studies. Lengani H *et al.* found that 73.33% of AKI were severe [39]. The delay in diagnosis and the limited technical resources could explain the large number of patients seen at stage 3. These data are in contrast to those from Europe and even Eastern Europe, where the frequency of severe AKI is lower, as reported by Yang Li *et al.* (28.6% of severe AKI) in China.

[40] and Conan in France (28.6%) [41], despite the multicenter nature of these studies. The differences observed in the severity of AKI patients admitted to hospital are thought to be linked to the level of the healthcare system.

4.6. AKI and Dialysis

In our study population, the indications for dialysis were high among patients with AKI hospitalised in nephrology (38.51%). However, access to dialysis was poor, with only 24 patients (14.9%) receiving dialysis. Our results are similar to those of Mokoli MV *et al.* in the DRC, who reported a high frequency of dialysis indications of around 45% in 320 patients hospitalised for AKI in nephrology; of these, only 17.8% were able to benefit from dialysis [42]. In 2008, Sayer I *et al.* observed a dialysis frequency of 18% [43] and Ben Ariba Y *et al.* reported a proportion of 8.1% of patients having benefited from dialysis in Tunis in 2017 [44]. The low accessibility to dialysis in our study could be explained by the absence of dialysis generators in the nephrology and dialysis department of Brazzaville University Hospital Center during the period of our study to date [45] [46]. In Brazzaville the

Haemodialysis sessions for hospitalised patients are carried out in private dialysis centres, which create 2 obstacles: on the one hand, the high price of a session which is not affordable for everyone, and on the other, the selection of haemodynamically stable patients who can afford to travel outside hospital. However, results superior to ours have been described in Europe. Lins RL *et al.* reported an accessibility rate of 36.5% for patients requiring dialysis in Belgium in 2004 [47], where renal replacement techniques are more accessible, as in many European countries [48]. The indications for dialysis vary according to the data in the literature, but all authors agree on certain absolute indications [49].

Uremic encephalopathy and persistent anuria resistant to diuretics after 24 hours were the main indications for dialysis in our study series in the order of

19.89% and 6.82%. Elouaer Y *et al.* found t hat severe acidosis, APE and uremic syndrome were the main indications for haemodialysis in 27.4%, 24.3% and 16.5% [50]. This difference in results is due to the clinical severity on admission resulting in a delay in diagnosis, since the average duration between the onset of symptoms and arrival at hospital was high, in the order of 10 ± 6.5 days.

4.7. Evolution

The outcome of AKI depends on the etiology, the speed with which it is managed and the quality of the technical support available, in particular access to a dialysis unit. Complete recovery of renal function was high in our study (53.4%). Complete recovery of renal function during AKI is a known fact according to various African studies. Ghezaiel H *et al.* in 2012 [51], Samaké M *et al.* in 2020 in Mali [22], Haffane L *et al.* in 2012 in Morocco (Rabat) [52], Lengani A *et al.* in Burkina Faso in 2010 (41.3%) [14] reported a recovery of Renal Function in the order of 63%, 49.3%, 49.5% and 41.3%. The high recovery rate in these studies as in our case can be explained by the fact that extra-renal purification is not indicated in the majority of patients, by the young age of patients, by the low number of cases of polypathology (comorbidities), and by the fact that the main cause of AKI is functional; an origin for which the management consists, among other things, of adequate and early filling, and therefore does not require a special heavy technical platform.

The course of AKI may also be marked by complications, including CKD and death [53]. Progression to CKD was relatively low in this study (13%). This figure is similar to that reported in Morocco by Haffane L *et al.* (18%) [52].

In-hospital mortality was observed in 45 patients (27.9%), including 35 men and 10 women, which is high. The death rate observed in our work is the same as that observed in the African literature. Mokoli MV *et al.* in the DRC found a case fatality rate of 29.4% [42]; Lengani A *et al* reported 24% [14]. Lower mortality rates were reported in Mali by Samaké M *et al.* at 12.4% [22]. This variable mortality rate from one study to another is justified by the severity of the clinical picture on admission, the etiology, associated comorbidities and the need for dialysis.

In the study by Mokoli MV *et al.* in the DRC, septic shock (26.6%), uremic encephalopathy (25.5%), hyperkaliemia (18%) and anemia (10.6%) were the main causes of death [42]. Our study showed that uremic encephalopathy was the main cause of death (14.3%).

We recorded an evasion rate of 5.6%. This choice can be justified on the one hand by a lack of knowledge of the pathology within the population due to a lack of information, and on the other hand by the high cost of dialysis once it is indicated.

4.8. Factors Associated with Death

Among the risk factors associated with death found in univariate analysis were:

coma (p = 0.004), blood urea (p = 0.014) and indication for dialysis (p < 0.001). These risk factors for death have been found in intra-hospital African studies [14] [15] [42].

The literature reports that coma is a risk factor associated with an increase in death in ARF patients. Mokoli MV *et al*., in the Democratic Republic of Congo, found coma to be a risk factor for death (OR = 3.7, p = 0.002) [42]. This result was also found in multivariate analysis in our study, where the proportion of deaths in patients with coma on admission was 45.1% and 21.8% in patients with normal consciousness (p = 0.003). And the risk of death in patients with coma on admission was 3 times greater than in patients with normal consciousness. Blood urea, which is indicative of high protein catabolism, was a risk factor found in univariate analysis in this study (OR = 1.3, p = 0.014). Unlike the study by Mokoli MV *et al.* in which blood urea was a multivariate predictor of death (OR = 1, p = 0.035) [42] and Chertow GM in 2006 in California in the USA [53], our study excluded this factor in the multivariate study (p = 0.913). Blood urea and coma reflect the severity of AKI. Severe AKI accounted for more than 2/3 of our sample. Patients with severe AKI appropriate management. This severity indicates the need for urgent haemodialysis, which is not widely available in our context (only 14.9% of urgent dialysis indications were implemented). Mortality was higher in patients requiring ESRD (56.9%) than in those for whom ESRD was not indicated (12.8%). The risk of death in patients for whom haemodialysis was indicated was multiplied by 3.90 (p = 0.05). Dialysis remains the key to improving vital prognosis in the management of AKI.

In our study, the proportion of deaths in men was 77.8% compared with 22.2% in women, with a statistically significant difference (p = 0.005), and the risk of death in men was 3 times higher than in women. This finding was confirmed in multivariate analysis (OR = 2.52; p = 0.032). Conversely, in most studies, gender does not appear to be associated with death. Masewu A *et al.* reported a non-significant difference in the DRC (p = 0.32). [11] and in East Asia (China), Yang Li *et al.* report a p = 0.80 [40].

Also in our work, the high socio-economic level in multivariate analysis was significantly associated with death (OR = 5.43, p = 0.016). This finding seems to be confirmed in the work of Lengani A *et al.* [14] in Burkina Faso with a significant statistical difference (p = 0.005). This trend in socio-economic level could be explained by the lack of health coverage in our country and by the fact that functional causes are the primary cause of AKI, even though in the study by Lengani *et al*, this cause comes in 2nd place after organic causes. Gastroenteritis, the main cause of AKI in our sample, is a reason for hospitalization, particularly in affluent patients. In middle-class and especially disadvantaged patients, it is often treated by self-medication and simple oral rehydration at home. These patients are more likely to consult a doctor for this symptom if they have an associated co-morbidity, such as HIV, or signs of severity [54].

With the exception of blood urea, multivariate analysis confirmed all the

above risk factors. The failure to confirm blood urea as a risk factor for death from AKI in our study may be explained by the importance of dialysis indications in the risk of death. Whatever the indication for emergency dialysis, because of the presence of severe AKI, blood urea remained high. The mean blood urea level in our study was 1.8 ± 1.4 g/l.

5. Conclusions

AKI is a medical emergency, and its frequency is high in the nephrology department of Brazzaville University Hospital. Young people between the ages of 18 and 30 are the most affected, with males predominating. Etiologies were dominated by functional causes. The severe form (KDIGO 2012 stage 3) was the most common, with a high case fatality rate. The factors associated with death were male gender, socioeconomic level, coma and the need for dialysis.

The problems posed by this condition in the Congo are essentially linked to treatment. Biological and morphological tests, medical treatment and follow-up are expensive. Haemodialysis, which is indicated for severe forms of the disease, is non-existent in hospital departments and expensive in private centres, thus limiting the overall management of patients.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Bellomo, R., Kellum, J.A. and Ronco, C. (2004) Defining Acute Renal Failure: Physilogical Principals. *Intensive Care Medicine*, **30**, 33-37. https://doi.org/10.1007/s00134-003-2078-3

[2] Brady, H.R. and Singer, G.G. (1995) Acute Renal Failure. *The Lancet*, **346**, 1533-1540. https://doi.org/10.1016/S0140-6736(95)92057-9

[3] Van Biensen, W., *et al.* (2006) Defining Acute Renal Failure. RIFLE and Beyond. *Clinical Journal of the American Society of Nephrology*, **1**, 1314-1319. https://doi.org/10.2215/CJN.02070606

[4] Cornet, C., Lsser, M.R. and Jacob, L. (2009) Acute Renal Failure. *Médecine D'urgence*, 25-100-A-30. https://doi.org/10.1016/S1959-5182(10)45566

[5] Valette, X., Terzin, N. and Cheyron, D. (2010) How to Define Acute Kidney Injury in the Intensive Care Unit? *Reanimation*, **19**, 431-440. https://doi.org/10.1016/j.reaurg.2010.04.006

[6] Clec'h, C., Chemouni, F. and Cohen, Y. (2013) Prevention and Management of Acute Renal Failure in Intensive Care. *EMC-Anesthésie Réanimation*, **10**, 1-15.

[7] Ponte, B. and Saudan, P. (2008) L'Insuffisance Rénale Aigue en 2008. *Revue Médicale Suisse*, **147**, 568-575. https://doi.org/10.53738/REVMED.2008.4.147.0568

[8] Jacobs, F.M. and Brivet, F.G. (2005) Epidemiology and Prognosis of Acute Renal Failure in Intensive Care. *Reanimation*, **14**, 472-482. https://doi.org/10.1016/j.reaurg.2005.09.011

[9] Perladi, M.-N. (2014) Nephrology and Electrolyte Disorders. Elsevier Masson SAS,

Paris.

[10] Challiner, R., James, P.R., *et al.* (2014) Incidence and Consequence of Acute Kidney Injury in Unselected Emergency Admissions to a Large Acute UK Hospital Trust. *BMC Nephrology*, **15**, Article 84. https://doi.org/10.1186/1471-2369-15-84

[11] Liangos, O., Wald, R., O'Bell, J.W., Price, L., Pereira, B.J. and Jaber, B.L. (2006) Epidemiology and Outcomes of Acute Renal Failure in Hospitalised Patients: A National Survey. *Clinical Journal of the American Society of Nephrology*, **1**, 43-51. https://doi.org/10.2215/CJN.00220605

[12] Wen, Y., Jiang, L., *et al.* (2013) Prevalence, Risk Factors, Clinical Course, and Outcome of Acute Kidney Injury in Chinese Intensive Care Units: A Prospective Cohort Study. *Chinese Medical Journal*, **126**, 4409-4416.

[13] Bentaleb, I., Errami, Z., Bel Mokhtar, S., Flayou, K., Benamar, L., Zaittouni, F., *et al.* (2013) Profile of Acute Renal Failure at the Ibn-Sina University Hospital of Rabat I. Poster. *Nephrology & Therapeutics*, **9**, 372. https://doi.org/10.1016/j.nephro.2013.07.335

[14] Lengani, A., *et al.* (2010) Acute Renal Failure in Burkina Faso. *Nephrology and Therapeutics*, **6**, 28-34. https://doi.org/10.1016/j.nephro.2009.07.013

[15] Masewu, A., Makulo, J.R., Lepira, F. and Bibonge, A.E. (2016) Acute Kidney Injury Is a Strong Independent Predictor of Mortality in Critically Ill Patients: A Multicentre Prospective Cohort Study from Kinshasa, Democratic Republic of Congo. *BMC Nephrology*, **17**, Article No. 118. https://doi.org/10.1186/s12882-016-0333-4

[16] Missamou, A., Eyeni Sinomono, D.T., Elombila, M., Loumingou, R., *et al.* (2018) Pre- and Immediate Postpartum Acute Renal Failure in the Congo: Prevalence, Aetiologies and Current Management. *Nephrology & Therapeutics*, **14**, 335-402.

[17] Honoré, S., *et al.* (2018) Chapter 55: Treatment of Renal Failure. In: Whittlesea, C. and Hodson, K., Eds., *Clinical and Therapeutic Pharmacy*, Elsevier Masson SAS, Paris, 977-993.

[18] Ekat, M.H., Courpotin, C., Diafouka, M., Akolbout, M., *et al.* (2013) Prevalence and Factors Associated with Renal Disease among Patients with Newly Diagnoses of HIV in Brazzaville, Republic of Congo. *Tropical Medicine and Health*, **23**, 176-180. https://doi.org/10.1684/mst.2013.0170

[19] Moyen, E., Bomelefa-Bomel, V., Ekouya, B.G., Eyeni Sinomono, D.T., *et al.* (2019) Acute Renal Failure in Chidren at the University Hospital of Brazzaville. *Open Journal of Pediatrics*, **9**, 253-272. https://doi.org/10.4236/ojped.2019.93024

[20] Bataille, A. and Legrand, M. (2018) Recovery after Acute Renal Failure. *Anesthésie & Réanimation*, **4**, 406-414.

[21] Eftekhari, P. (2014) Evaluation of Acute Kidney Injury in the Hospital Setting. *Primary Care: Clinics in office Practice*, **41**, 779-802. https://doi.org/10.1016/j.pop.2014.08.005

[22] Samaké, M., Sy, S., Yattara, H., Fofana, A.S., Coulibaly, M., Diallo, D., *et al.* (2020) Prevalence and Prognosis of Acute Renal Failure at the Fousseyni Daou Hospital in Kayes. *Health Sciences and Disease*, **21**, 5-20.

[23] Basagha, P., Frederick, N. and Arthur, K. (2015) Acute Kidney Injury among Adult Patients with Sepsis in a Low-Income Country: Clinical Patterns and Short-Term Outcomes. *BMC Nephrology*, **16**, Article No. 4. https://doi.org/10.1186/1471-2369-16-4

[24] Lakhal, K., Ehrmann, S., Chaari, A., *et al.* (2011) Acute Kidney Injury Network Definition of Contrast-Induced Nephropathy in the Critically Ill: Incidence and Out-

come. *Journal of Critical Care*, **26**, 593-599.

[25] Qutub, H.O., *et al.* (2001) Acute Renal Failure in an Intensive Care Unit. *Saudi Medical Journal*, **22**, 999-1003. https://doi.org/10.1159/000060077

[26] Failal, I., Ezzaki, S., Mtioui, N., Elkayat, S.S., Zamed, M., Ramdani, B., *et al.* (2020) Acute Renal Failure: Epidemiological, Aetiological, Therapeutic and Evolutionary Profile. *Nephrology and Therapeutics*, **16**, 326. https://doi.org/10.1016/j.nephro.2020.07.203

[27] Soudan, F. (2009) Dossier <<Un Milliard D'Afrique>>. Jeune Afrique, No. 2550, 24-31.

[28] Kleinecknecht, D., *et al.* (1994) Epidemiology and Prognosis of Acute Renal Failure. *Nephrology*, **15**, 281-288.

[29] Hsu, C.Y. (2007) Community-Based Incidence of Acute Renal Failure. *Kidney International*, **72**, 208-212.

[30] Uchino, S., Bellomo, R., Goldsmith, D., *et al.* (2006) An Assessment of the RIFLE Criteria for Acute Renal Failure in Hospitalized Patients. *Critical Care Medicine*, **34**, 1913-1917. https://doi.org/10.1097/01.CCM.0000224227.70642.4F

[31] Ehrich, J.H.H. and Eke, F.U. (2007) Malaria-Induced Renal Damage: Facts and Myths. *Pediatric Nephrology*, **22**, 626-637. https://doi.org/10.1007/s00467-006-0332-y

[32] Commereurc, M., *et al.* (2014) Acute Renal Failure in the Elderly: Diagnostic and Therapeutic Aspects. *La Presse Médicale*, **43**, 341-347. https://doi.org/10.1016/j.lpm.2013.07.030

[33] Musso, C.G., Liakopoulos, V., Loannidis, I., *et al.* (2006) Acute Renal Failure in the Elerdy: Particular Characteristics. *International Urology and Nephrology*, **38**, 787-793. https://doi.org/10.1007/s11255-006-0084-4

[34] Republic of Congo (2017) Employment and Main Sources of Income. Report on Poverty Analysis. http://documents1.worldbank.org/curated/en/359991503510903731/pdf/114706-FRENCH-v2- Republic-of- Congo-FRE-7-17-17-M3.pdf

[35] Gold, C.H. (1980) Acute Renal Failure from Herbal and Patent Remedies in Blacks. *Journal of Clinical Nephrology*, **14**, 128-134.

[36] Hanba, M., Himmi, K., Benhadj, A., Benmahdi, L., Ghbalou, A. and Ahmed Fouatih, Z. (2019) Epidemiological Profile of Acute Renal Failure in Adults at the Hôpital Militaire Régional Universitaire D'Oran. *La Revue Médicale de l'HMRUO*, **6**, 848-858.

[37] Eswarappa, M., *et al.* (2014) Spectrum of Acute Kidney Injury in Critically Ill Patients: A Single Centre Study from South India. *Indian Journal of Nephrology*, **24**, 280-285. https://doi.org/10.4103/0971-4065.132991

[38] Rasmussen, H.H., Pitt, E.A., Ibles, L.S. and Mc Neil, D.R. (1985) Prediction of Outcome in Acute Renal Failure by Discriminant Analysis of Clinical Variables. *Archives of Internal Medicine*, **145**, 2015-2018. https://doi.org/10.1001/archinte.1985.00360110085020

[39] Lengani, H., Dibri, D.B., Zoeyinga, P., Kadio, S.A., *et al.* (2018) Evolutionary Profile of AKI during Dingue in Patients Followed in the Nephrology and Haemodialysis Department of the CHU Yalgado Ouédraogo in Ouagadougou (Burkina Faso). *Nephrology and Therapeutics*, **14**, 360. https://doi.org/10.1016/j.nephro.2018.07.249

[40] Li, Y., Xing, G., Wang, L., Wu, Y., Li, S., Xu, G., *et al.* (2015) Acute Kidney Injury in China: A Cross-Sectional Survey. *The Lancet*, **386**, 1465-1471.

https://doi.org/10.1016/S0140-6736(15)00344-X

[41] Ghezaiel, H., Hamouda, M., Akremi, S., *et al.* (2012) Postpartum Acute Renal Failure. *Nephrology and Therapeutics*, **8**, 341-342. https://doi.org/10.1016/j.nephro.2012.07.108

[42] Mokoli, M.V., *et al.* (2008) Prognostic Factors of ARI at the University Clinics of Kinshasa. *Annales Africaines de Médecine*, **1**, 34-44.

[43] Al-Azzam, S.I., Al-Husein, B.A., *et al.* (2008) Etiologies of Acute Renal Failure in a Sample of Hospitalized Jordanian Patients. *Renal Failure*, **30**, 373-376. https://doi.org/10.1080/08860220801947371

[44] Ben Ariba, Y., *et al.* (2017) Acute Renal Failure in the Medical Setting: What Risk Factors for Unfavourable Outcome? *Journal of Medicine*, **38**, A109-A248.

[45] Conan, P., *et al.* (2019) Short-Term Prognosis of Acute Renal Failure Associated with Severe Malaria in Travellers: Results of a Multicentre Retrospective Study. 20*es Journées Nationales d'Infectiologie| Médecine et Maladies Infectieuses*, **49**, S118-S128.

[46] Eyeni Sinomono, D.T., Gassongo Koumou, G.C., Loumingou, R., *et al.* (2017) Epidemiological Profile of Chronic Renal Failure at the Brazzaville University Hospital in 2016. *Nephrology and Therapeutics*, **13**, 396. https://doi.org/10.1016/j.nephro.2017.08.302

[47] Douniama, P.W. (2021) Agence d'Information d'Afrique Centrale: World Kidney Day: Kidney Failure Remains a Problem in Congo. http://www.adiac-congo.com/content/world-kidney-day-renal-failure-a-great-public-health-problem-in-the-congo

[48] Lins, R.L., Elseviers, M.M., Daelemans, R., Arnouts, P., Billiouw, J.M., *et al.* (2004) Reassessment and Modification of the Stuivenberg Hospital Acute Renal Failure Scoring System (SHARF) for the Prognosis of Acute Renal Failure: An Independent Multicentre Prospective Study. *Nephrology Dialysis Transplantation*, **19**, 2282-2288. https://doi.org/10.1093/ndt/gfh364

[49] Stengel, B., Couchoud, C., Helmer, C., Loos-Ayav, G., *et al.* (2007) Epidemiology of Renal Failure in France. *La Press Médicale*, **36**, 1811-1821. https://doi.org/10.1016/j.lpm.2007.04.039

[50] Klouche, K., Sandapa, D., Barrau, H. and Jonquet, O. (2011) Acute Renal Failure in Intensive Care-Prevention and Treatment. *Reanimation*, **20**, 552-559. https://doi.org/10.1007/s13546-010-0030-4

[51] Haffane, L., Bezzaz, A., Elouazzan, H., *et al.* (2012) Acute Renal Failure: Epidemiology and Prognostic Factors. *Néphrologie & Thérapeutique*, **8**, 340-3341. https://doi.org/10.1016/j.nephro.2012.07.106

[52] Haffane, L., Bezzaz, A., Elouazzan, H., *et al.* (2012) Insuffisance rénale aigue: Épidémiologie et facteurs pronostiques. *Néphrologie et Thérapeutiquetique*, **8**, 338-337.

[53] Chertow, G.M. (2006) Mortality after Acute Renal Failure Models for Prognostic Stratification and Risk Adjustment. *Kidney International*, **70**, 1120-1126. https://doi.org/10.1038/sj.ki.5001579

[54] Monlet, C., Sidibé, G., Wognin, A., Konan, S.D., *et al.* (2019) Evolutionary Profile of Acute Renal Failure in People Living with HIV in Abidjan, Cote d'Ivoire from 1 January 2014 to 31 December 2017. *The Pan African Medical Journal*, **34**, 1-9.