Health Sciences & Disease
The Journal of Medicine and Biomedical Sciences

Original Article

Epidemiology, Clinical Presentation and Outcome of Acute Kidney Injury in the City of Bobo-Dioulasso (Burkina Faso)

Profil épidémiologique, clinique et évolutif de l'insuffisance rénale aiguë à Bobo-Dioulasso (Burkina Faso)

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HIGHLIGHTS

What is already known on this topic
Acute kidney injury (AKI) is common but its picture varies from region to region depending on the sociodemographic profile of patients, the etiologies and the health system. So it is necessary to get local data.

What question this study addressed
Local data concerning epidemiology, clinical presentation, etiologies and outcome of AKI in Faso.

What this study adds to our knowledge
AKI is common in Faso and has a relatively high letality rate The main etiologies are dehydration, infections such as malaria and toxics. These causes are preventable.

How this is relevant to practice, policy or further research.
There is a need to initiate actions targeting the avoidable causes ok AKI.

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Keywords : AKI, incidence, profile, Bobo-Dioulasso

Mots clés : IRA, incidence, profil, Bobo-Dioulasso

ABSTRACT

Introduction. Acute kidney injury (AKI) is a serious public health issue. Our study aimed to describe the epidemiology, the clinical presentation and the outcome of acute kidney injury in the City of Bobo-Dioulasso (Burkina Faso). **Methods.** This retrospective, descriptive study from January 1st to December 31, 2018, in the nephrology-dialysis department of CHUSS included all patients with AKI according to KDIGO 2012 definition.. **Results.** The incidence of AKI was 29.94% (109/364) among hospitalized patients, accounting for 31.50% (109/346) of all renal failures. The mean age of patients was 40.63 ± 21.49 years, and the sex ratio (male/female) was 1.32. The main symptoms were vomiting (45.87%), dehydration (41.28%) and oligoanuria (40.36%). The mean serum creatinine, urea and hemoglobin were respectively 935.65 ± 568.32 µmol/L, 32.82 ± 18.75 mmol/L and 8.69 ± 3.21 g/dL. AKI's main etiologies were dehydration (43.12%), infections (14.67%) such as malaria (11.92%) and toxic (11.92%). AKI was respectively organic and functional in 50 (45.87%) and 47 (43.12%) cases. Red cells transfusion was performed in 55 patients (50.46%). Hemodialysis indicated for 18 patients (16.51%), was effective in 10 cases (55.55%). The proportion of patinets who recovered completely their renal function was 69.72% (76/109). The lethality rate was 11.92% and seemed to be higher among women (p=0.04). **Conclusion.** AKI is common and has a poor prognosis in the nephrology-dialysis department of CHUSS. There is a need to develop initiatives to control preventable AKI's causes.

RÉSUMÉ

Introduction. L'insuffisance rénale aigue (IRA) est un problème de santé publique. Notre objectif était de decrire les aspects épidémio-cliniques, étiologiques et évolutifs de l'IRA afin d'améliorer sa prise en charge au CHUSS. **Méthodologie.** Cette étude rétrospective du 1er janvier au 31 décembre 2018 dans le service de néphrologie-dialyse du CHUSS, a inclus tous les patients hospitalisés pour IRA selon les KDIGO 2012. Des facteurs pronostiques ont été recherchés par des anlyses uni et bivariée ($p < 0,05$). **Résultats.** L'incidence de l'IRA était de 29,94 % (109/364) soit 31,50 % (109/346) des cas d'insuffisance rénale. L'âge moyen était de 40,63 ± 21,49 ans et le sex-ratio de 1,32. Les principaux symptomes étaient les vomissements (45,87 %), la déshydratation (41,28 %) et l'oligo-anurie (40,36 %). La créatininémie, l'azotémie et le taux d'hémoglobine moyens étaient de 935,65 ± 568,32 µmol/L, 32,82 ± 18,75 mmol/L et 8,69 ± 3,21 g/dL. L'IRA était organique et fonctionnelle dans 50 (45,87%) et 47 (43,12%) cas. Ses étiologies étaient dominées par la déshydratation (43,12%), les infections (14,67%), dont le paludisme (11,92%) et toxiques (11,92%). Une transfusion a éte réalisée chez 55 patients (50,46%). L'hémodialyse a été effective dans 10 cas sur les 18 cas indiqués (55,55%). La fonction rénale a totalement récupéré chez 76 patients (69,72%). La létalité était de 11,92% et semblait plus élevée chez les femmes ($p = 0,04$). **Conclusion.** L'IRA est fréquente et de mauvais pronostic dans le service de néphrologie-dialyse du CHUSS, d'où la nécessité d'inititier des actions ciblant ses causes évitables.

INTRODUCTION

AKI is a complex condition associated with significant hospital mortality **[1,2].** Epidemiology of AKI differs across world. This difference depends on the sociodemographic profile of patients, the etiologies and context of AKI occurrence, as well as treatment accessibility and prognosis [**3**]. Approximately 10 to 20% of patients would develop AKI during hospitalization [**4].** In 2013, a meta-analysis noted that it's incidences varied between 13.8% and 21.6%, respectively, among children and adults in developed countries [**5].** Hospital studies noted a frequency of 20% and 18.4% of AKI respectively in Ethiopia and Ouagadougou [**6,7].** In severe forms of AKI, early and adequate management is necessary to improve the prognosis [**8**]. However, mortality related to AKI remains high despite its decline in recent decades [**9**]. AKI has been identified by the International Society of Nephrology (ISN) as a major preventable cause of death worldwide. The ISN has therefore set itself the goal of "eliminating preventable deaths from AKI worldwide by 2025" [**10,11**] with the launch of its "0 by 2025" initiative. Our study aimed to improve knowledge on the epidemiology, clinic, etiologies and evolution of AKI in our context in order to better management.

METHODS

This was a retrospective and descriptive study, which took place from January 1 to December 31, 2018, in the Nephrology-Dialysis department of the Bobo Dioulasso University Hospital in Burkina Faso. All patients hospitalized during the study period, consenting to participate, and who presented with an AKI according to KDIGO 2012 were included.

The informations collected were:

- Socio-demographic data including age, gender, place of residence and occupation;
- Pathological history and comorbidities;
- Clinical data such as blood pressure, diuresis, hydration status;
- Paraclinical data: plasma urea, serum creatinine, hemoglobin level, alkaline reserve, C-reactive protein (CRP) and in some cases ultrasound;
- Treatments received.

For the purpose of the study, we adopted the following operational definitions:

AKI was defined according to KDIGO 2012. In cases where we do not have previous serum creatinine, we have considered as a case of AKI a patient with normal-sized kidneys with good cortico-medullar differentiation and / or in whom renal function has ulteriorly recovered.

According to pathophysiological classification renal biopsy missing context, AKI was classified into:

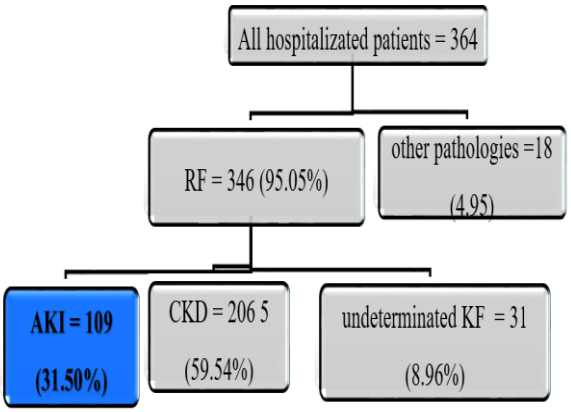
- Functional AKI when we have renal hypoperfusion factor (diarrhea, vomiting, low cardiac output) and/or dehydration without another identified factor;
- Obstructive AKI in presence of pyelocaliceal cavities dilation and/or obstruction on the urine's tracts;
- Organic AKI after exclusion of functional and obstructive AKI.

The criteria for emergency hemodialysis were acute lung edema resistant to diuretics, hyperkaliemia ≥ 6.5 mmol / L, anuria of more than 48 hours, alkaline reserve < 15 mmol / L, very high urea values over 40 mmol / L or the presence of uremic complications (pericarditis, coma, hemorrhagic syndrome).

Collected data was analyzed using the software and SPSS (Statistics Package Social Sciences) in its version 20. A significance level $p < 0.05$ was retained.

RESULTS

The annual incidence of AKI among hospitalized patients was 29.94% (109/364) and represented 31.50% (109/346) of kidney failure cases (Figure 1).



KF: kidney failure, AKI: acute renal failure, CKD: chronic renal failure

***Figure 1**: Distribution of patients according to pathologies.*

Sociodemographic data of the population

The mean age of patients was 40.63 ± 21.49 years, and the sex ratio (male/female) was 1.32. The age group [30-40[years was the most represented (19.27%) as shown in Figure 2. Most of the patients resided in Bobo-Dioulasso (49.54%).

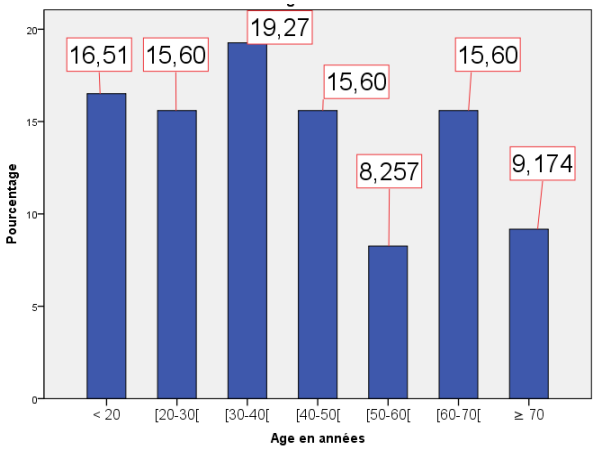


Figure 2: Distribution of 109 patients by age groups

Clinical presentation

Among the history and comorbidities, we noted mainly malaria (19.27%), High Blood Pressure (HBP) (12.84%), preeclampsia or eclampsia (8.5%), as illustrated in Table I.

Table I: Main history and comorbidities (N=109 patients)

Main history and comorbidities	N	%
Malaria	21	19,27
High Blood Pression	14	12,84
HIV-positive serology	5	4,58
Hematuria	5	4,58
Obstructive uropathies	5	4,59
Snakebite or bee stings	5	4,59
Diabetes	4	3,67
Preeclampsia/clampsia (n=47)	4	8,51
Neoplasia	3	2,75
Heart diseases	2	2,75
Toxiderma	1	0,91

HIV: Human Immunodeficiency Virus

We are summarized main clinical signs are in Table II.

Table II: Main clinical signs found in the 109 patients

Main Clinical symptoms	Numbers	%
Vomiting/nausea/diarrhea	62	5 6,8 8
Dehydration	45	41,28
Oligo-anuria	44	40,36
Fever	32	29,36
Asthenia	24	22,02
Headache	24	22,02
Neurologic disorders	17	15,60
Abdominal pain	16	14,68
Edema	13	11,92
HBP	12	11,01
Hemoglobinuria/jaundice	6	5,50
AUR	2	1,83

HBP: High blood pressure, AUR: acute urine retention

Etiologies and probable pathophysiological mechanisms of AKI

The etiologies of AKI were dominated by dehydration (44.04%), infections (14.67%) of which alone malaria accounted for 11.92% and toxic intake (11.92%) (Table III**).** In 18 patients (16.51%), the etiology of AKI was multifactorial or unterminated.

Tableau III: Probable etiologies of AKI in the 109 patients

Etiologies		n	%
Dehydration		48	44,04
Indéterminée/multifactorielle		18	16,51
Infections	Malaria	13	11,93
	Bacteriologic	2	1,83
	VIH	1	0,92
Toxics		13	11,93
Eclampsia/Preeclampsia		4	3,67
Envenomation (snake and bees)		4	3,67
Obstructive		5	4,59
Post-infectious GNA		1	0,92

HIV: Human Immunodeficiency Virus, GNA: Acute Glomerulonephritis.

Depending on the pathophysiological mechanisms, we found respectively 50 cases (45.87%) of organic AKI, 47 cases (43.12%) of functional AKI and 5 cases of obstructive AKI.

Biological data

The mean serum creatinine, plasma urea and hemoglobin were respectively 935.65 ± 568.32 µmol/L, 32.82 ± 18.75 mmol/L and 8.69 ± 3.21 g/dL. Averaged C-Reactive Protein (CRP) at 77.45 ± 66.55 mg/L.

Treatment and evolution

Hemodialysis was indicated in 18 patients (16.51%) and 10 (55.55%) of them benefited from it. Half of the patients (50.46%) were transfused. Most patients were discharged (78.90%) after a mean length of hospitalization of 9.01 ± 6.47 days. The total recovery of renal function rate at discharge or during follow-up was 69.72%. We reported 13 cases of death (11.92%) during hospitalization.

In univariate analysis, mortality was significantly higher among females (p=0.04) (Table IV). On the other hand, in bivariate analysis, female sex was not associated with high mortality (Odd ratio = 3.24; CI = 0.86 -12.17), as it is shown in Table V.

Table IV: Univariate comparison eutic characteristics of living and dead patients.

Parameters	Total	Living	Died	p
Number of patients n (%)	109 (100 %)	96(88,07 %)	13(11,92 %)	
Average age (years)	40,63 ± 21,49	40,97 ±21,37	38,15 ± 23, 09	0,66
Female (%)	43,12	39,58	69,23	0,04
Average hospitalization length (days)	9,01 ± 6,47	9,20 ± 6,52	7,62 ± 6,14	0,41
Oligo-anuria (%)	40,37	41,67	30,77	0,45
Oedema (%)	11,92	10,41	23,07	0,18
Impaired consciousness (%)	15,59	13,54	30,76	0,10
Average SBP (mmHg)	122,06± 28,31	121,94± 29,17	123,10±20,68	0,90
Mean serum creatinine (µmol/L)	935,65±568,82	931,11±581,74	968,84±482,40	0,82
Mean urea (mmol/L)	32,82 ± 18,75	31,89 ± 19,08	39,74 ± 15,06	0,21
Mean Natremia rate (mmol/L)	132,59 ± 10,84	132,32 ± 11,28	133,97 ± 7,50	0,68
Mean kaliemia rate (mmol/L)	3,93 ± 1,10	3,93 ± 1,13	3,94 ± 0,86	0,96
Average alkaline reserve (mmol/L)	15,41 ± 7,62	15,56 ± 7, 80	13,00	0,75
Average CRP (mg/L)	77,45 ± 66,55	70,40 ± 62,00	122,62 ± 84,38	0,10
Mean hemoglobin rate (g/dL)	8,69 ± 3,21	8,91 ± 3,26	7,13 ± 2,62	0,06
Organic AKIN (%)	45,87	43,75	61,53	0,55
Blood transfusion (%)	50,46	50,00	53,85	0,79
hemodialysis indicated (%)	16,51	14,58	30,76	0,14

SBP : systolic blood pressure, CRP : C - reactive protein.

Table V: Comparative bivariate analysis of some data of living and died patients.

Factors	p	OR	IC (95 %)
Female	0,08	3,24	0,86-12,17
Impaired consciousness	0,25	0,42	0,10-1,81
Réserve alcaline <20 mmol/L	0,93	1,09	0,11-10,50
CRP > 100mg/L	0,59	1,57	0,29-8,33
Hb level < 8 g/dL	0,84	1,14	0,29 -4,39
Hospitalization < 10 days	0,40	0,54	0,12-2,32
HD indicated	0,31	2,09	0,48-9,02

HD : Hemodialysis, OR : Odd Ratio, IC: Confiance Intervalle, CRP : C reactive Protein.

DISCUSSION

Epidemiology

The incidence of AKI (29.94%) in hospitalization is slightly higher than the 21.6% incidence found in the **Susantitaphong** meta-analysis [**5**], which involved all continents and included 312 studies. Our patients were young with an average age of 40.63 ± 21.9 years and more than 16% of them were under 20 years old. These results corroborate those found in most developing countries [**12**]. Indeed, **Lengani** in Burkina Faso[**7**], **Bello** in Nigeria[**3**] and **Aylward** in South Africa **[13**] had respectively found an average age of 38.6±16.3; 39.7±16.3 and 43.7±16.8 years. However, in developed countries, the average age during AKI was most often over 70 years **[1 4, 15]**. The young age of the patients could be explained by the fact that Burkinabe population is mostly young. So, more than 77.9% of our country's population is under 35 years old according to the 5th General Population data (RGPH) in 2019 of Burkina Faso[**16**]. In addition, the frequency of infections and pathologies related to pregnancy (pre-eclampsia), causes of AKI, that most often affecting young subjects in our context, could justify this situation.

Clinical and biological features

Comorbidities such as malaria (19.27%), hypertension (12.84%), preeclampsia (8.5%), HIV infection (4.59%) and diabetes (3.67%) were found by most African authors [**1,3,12**]. In addition to these factors, envenomation mainly by snakebites (4.59%), and in most cases among the rural population during their field work, was a context of occurrence of AKI relatively frequent during our study. AKI was severe in our patients with mean serum creatinine and urea of respectively to 935.65 ± 568.82 µmol/L and 32.82 ± 18.75 mmol/L. This is probably related to either a delay in consultation and/or patient management in structures other nephrologist centers. This would be attributable to the insufficiency or geographical inaccessibility of specialists and/or specialized services of Nephrology in our country. Anemia, considered an unusual sign during AKI, was common and severe in our patients, with more than half of the patients transfused. This frequency of anemia in our patients could be related to hemolysis either of infectious or toxic origin that would aggravate pre-existing martial deficiency due to the low standard of living of our populations. Thus, the renal ischemia maintained by this anemia could partly explain the severity of AKI in our patients.

Etiologies

The etiologies of AKI were dominated by dehydration, infections, toxic intake and preeclampsia, which are generally preventable pathological conditions. The same etiologies have been reported by most authors in our countries **[3,6**]. These causes are also found in developed countries with few cases of tropical diseases and pregnancy-related complications. In addition, while in developing countries the substances implicated in nephrotoxicity are dominated by traditional drugs, in developed countries it is more iodinated contrast agents, antibiotics and anticancer drugs that are often indexed [**14,17,15**]. Infections in general and particularly malaria are common in our countries. They can cause AKI either by direct effect of microorganisms or their antigenic components on the kidney parenchyma or indirectly by complications of infections or drugs used for their treatments. Indeed, these infections are generally treated by self-medication (modern and/or phytotherapy) or with prescriptions combining antimalarials and certain antibiotics. This may be the cause of AKI as shown by **Adu** in Ghana according to which, sepsis and intravascular hemolysis due to antibiotics and traditional drugs were the main causes of AKI among adults in Africa**[12]**. The high proportion of undetermined or multifactorial etiologies of AKI (16.51%) would be explained by the impossibility of performing a renal biopsy for technical reasons, in front of cases of AKI often seen late, cumulating several etiological factors including infectious, sometimes with polymedication both modern and traditional, and mostly dehydrated due to inappropriate use of diuretics in peripheric centers.

Evolution and factors of poor prognosis

Mortality rate was 11.92%. This mortality rate is high but remains low compared to that found by most authors. Indeed, **Bello** in Nigeria, **Lengani** at Ouagadougou in Burkina Faso, **Aylward** in South Africa and **Fang** in China had respectively noted 29.6%, 31.8% and 19.68% of deaths [**3,7,13,14].** Worldwide, mortality related to AKI can be as high as 50% according to some meta-analyses and this mortality may be higher in the absence of hemodialysis [**10**]. The delays in consultation and the financial inaccessibility to extrarenal epuration for all patients despite the partial subsidy of dialysis in our center (55.55% effectiveness of emergency dialysis indicated), could partly explain this poor prognosis of AKI in our context. However, there has been an improvement in access to dialysis for AKI compared to that observed by **Lengani** in Ouagadougou in 2010 (16.70% effectiveness of dialysis indicated) [**7**] at the time when dialysis was entirely paid by the patient.

We found higher mortality among females (p=0.04). But after a bivariate analysis, no female sex or many other factors such as conscious impaired, high CRP level, low alkaline reserve level, low hemoglobin level, length of hospitalization less than 10 days or extra-renal epuration need, cited as factors of poor prognosis during AKI by some authors [**3**, **13,14,18]**, were not statically associated with mortality in our study.

We observed 69.72% total of kidney function recovery at discharge or at follow-up. However, this figure remains to be relativized because some patients have not been seen again after their discharge from hospital. This raises fears of a risk of progression of some of them to chronic renal failure in the long term, when we know that AKI is a risk factor for chronic renal failure.

CONCLUSION

AKI is common in the Nephrology-Dialysis department of the Bobo-Dioulasso University Hospital. It involved young, male-dominated patients who consult with severe AKI. The main etiologies of AKI were preventable causes such as dehydration, infections, taking nephrotoxic substances. Mortality remains high even if it is low compared to that found in the literature. It is therefore necessary to develop initiatives to fit again preventable causes of AKI and, above all, to elaborate preventive measures against infections and the use of both modern and traditional nephrotoxic medicines used by our populations.

Ethics

We obtained authorization from CHUSS officials to carry out this study. The identity and information collected from our patients remained confidential.

Authors' contributions

all authors are contributed study elaboration or draft redaction or revising.

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