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Epidemiological and Etiological Aspects of Acute Renal Failure in the Nephrology and Haemodialysis Department of the Point G University Hospital

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ABSTRACT

Introduction: Acute renal failure (ARF) represents a major public health problem associated with high mortality. The incidence is increasing with the emergence of multiple risk factors. In Mali, there are currently no data on the extent and severity of this condition in either hospital or community settings. The aim of our study was to describe the epidemiological, therapeutic and prognostic aspects of ARF in adults treated at the University Hospital Centre (CHU) of Bamako.

Patients and Methods: This was a retrospective and descriptive study that took place from 1 July 2021 to 30 June 2022 at the CHU du Point G in Bamako. It focused on patients hospitalised and/or followed up on an outpatient basis in the nephrology department during the study period.

Results: The prevalence of acute renal failure was 11.55% with a sex ratio of 1.49. The mean age was 42.37±20.7 (range 6-88 years). Elevated plasma creatinine was the main reason for consultation. Creatinine levels were above 500µmol/l in 65.21% of cases. High blood pressure was the main presenting condition in 33.7% of cases. Acute renal failure was organic, obstructive and functional in 72.8%, 15.2% and 12% respectively. Rehydratation was used in 97.8% of cases. Dialysis was indicated in 40% of cases. Age over 60 years was a major risk factor for ARF. The outcome was favourable in 81.5% of cases.

Conclusion: Mortality in dialysis patients with ARF remains high. Several factors influence the prognosis of these patients, including the severity of ARF and pre-existing comorbidity.

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Introduction

The definition of acute renal failure (ARF) is consensual and universal since 2012 according to KDIGO: any recent (48H) increase of 0.3 mg/dl or 26.5 µmol/l in creatinine levels and/or when urine volume is <0.5 mL/kg/h during the previous 6 hours [1]. Acute renal failure (ARF) is a major public health problem, the incidence of which has been increasing in developed countries over the last ten years or so [2-3]. Our developing country is not spared, especially as it is in the midst of an epidemiological transition, with an influx of new diseases, in particular the coronavirus (COVID-19) and dengue fever, and in a situation of security and economic crisis since 2012. ARI is a diagnostic and therapeutic emergency.

However, there is little data on the current profile of acute renal failure in Mali. The aim of the present study was to describe the epidemiological, clinical, paraclinical and prognostic aspects of AKI at the CHU du point G (Bamako).

Patients and Method

This was a retrospective, descriptive study that ran from 1 July 2021 to 30 June 2022. We included all patients hospitalised and/or

followed up on an outpatient basis in the nephrology department during the study period. AKI was defined according to the KDIGO 2012 criteria:

- Increase in serum creatinine ≥ 3 mg/l (26.5 µmol/L) in 48 hours
- Or increase in serum creatinine of more than 1.5 times the baseline value;
- Or urine volume is <0.5 ml/kg/h during the previous 6 hours.

Patients' clinical, paraclinical and prognostic data were collected using a questionnaire and then analysed using SPSS 20.0 software

Results

The prevalence of acute renal failure was 11.55% with a sex ratio of 1.49. The mean age was 42.37±20.7 with extremes of 6 and 88 years (Table I). Elevated plasma creatinine was the main reason for consultation. Vomiting was found in 91% of cases, diarrhoea in 72.7% of cases, and hypertension in 33.7% of cases. Hypertension was observed in 28.3% of cases, of which 46.15% were grade 1. Systolo-diastolic hypertension was observed in 76.92% of cases. Medication was the cause in 45.4% of cases. Creatinine levels were above 500µmol/l in 65.21% of cases. Dehydration and antibiotics were the risk factors most frequently found in 49 cases (53.26%) and 41 cases (44.56%) respectively (Table II). Acute renal failure was organic, obstructive and functional in 72.8%, 15.2% and 12% respectively (Table III). According to KDIGO 2012 acute renal failure was stage I (6.52%), stage II (13.04%), stage III (80.44%) of cases (Figure 1). Among the causes of parenchymal AKI, acute tubular necrosis predominated (44.77%), followed by acute glomerular nephropathy (38.8%), acute interstitial nephritis (11.9%) and acute vascular nephropathy (4.8%). In functional ARF, dehydration was present in all patients. In obstructive ARF, benign prostatic hypertrophy (35.7%), urolithiasis (28.4%) and pelvic tumours (14.2%) were predominant. Infectious causes accounted for 17.39% of cases of parenchymal ARF (Table V). Management included rehydration in 97.8% of cases, combined with treatment of the aetiology. Age >60 years was a major risk factor for AKI (Table VI). Dialysis was indicated in 40% of cases. Clinical outcome was favourable in 81.5% of cases. The evolution of renal function was marked by complete recovery in 80.52%, partial recovery in 16.88% and the onset of chronic renal failure in 2.6% of cases. Death occurred in 12% of patients, mainly due to septic shock and cardiac arrest on dialysis.

Table I: Breakdown by age group

Age group in years	Numbers	Percentages
< 20	16	17,4
20-40	37	40,2
40-60	16	17,4
60-80	22	23,9
80 et plus	1	1,1
Total	92	100

Table II: Distribution according to renal stress factors

Factors of acute renal aggression	Workforce	Percentages
Dehydration	49	53,26
Antibiotics	41	44,56
Anti-malarial	26	28,26
Urinary tract infection	17	18,47
Phytotherapy	13	14,1
ACE inhibitor	8	8,7
Otolaryngology Infection	4	5,5
NSAIDS	2	2,2
ARV	1	1,1
Contrast media	1	1,1

NSAIDS = Non-steroidal anti-inflammatory drug, ARV = anti-retrovirals

Table III: Distribution by type of ARF

Diagnosis	Workforce	Percentages
Organic ARF	67	72,8
Obstructive ARF	14	15,2
Functional ARF	11	12
Total	92	100

ARF = acute renal failure

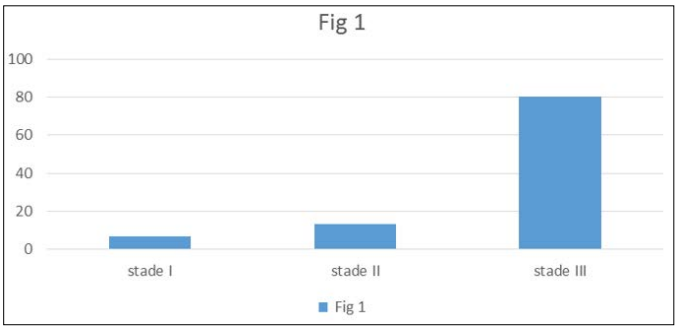

Figure 1: Distribution according to KDIGO 2012 classification

Table V: Breakdown by aetiology of AKI

Etiologies		Workforce	Percentages
Infections		16	17.39 %
Toxic	Phytotherapy	13	15.21 %
	Contrast product	1	
Obstructive	HRP	5	15.21 %
	Urolithiasis	4	
	Obstacle not visible	3	
	Tumor process	2	
Shocks Hemorrhage	Postpartum	6	13.04 %
	Post cesarean	4	
	Epistaxis	2	
Vomiting + diarrhea		10	10.86%
Drugs		10	10.86 %
Malaria		9	9.78%
Diabetes		3	3.26%
HTA		3	3.26%
Lupus		1	1.08%
Total		92	100%

HTA = Hypertension, HRP = retroplacental hematoma

Table VI: Relationship between type of AKI and age

AGE	ORGANIC ARF	OBSTRUCTIVE ARF	Functional IRA	Total
<60	59	1	9	69
60 – 80	8	12	2	22
>80	-	1	-	1
TOTAL	67	14	11	92

Kh^2 =42.287 P=0.001

Discussion

In sub-Saharan Africa, environmental (infectious, risk of dehydration), socio-cultural and economic factors expose patients to a higher risk of developing ARI than in developed countries, but also to a different epidemiological profile. Low socio-economic status and limited access to specialist care make it difficult to treat patients under optimal conditions. In this context, the more severe the ARF, the more dramatic it is, putting the immediate vital prognosis at risk. In our practice, overall mortality during ARF is around 37% [4].

In the literature, the mortality associated with ARF is high, at around 50%, and even 70% in cases where extrarenal purification is required. This high mortality rate is linked to the patient's condition (the elderly, co-morbidities, etc.), the pathologies (septic shock, etc.) in which the ARF occurs and the consequences of the ARF itself [5].

The incidence of acute renal failure rises sharply in the elderly. This incidence is estimated at 950 cases per million inhabitants in France [6]. One third of patients with acute renal failure are aged over 70 [7].

Approximately 20% of patients with AKI require renal replacement therapy [8, 9]. The timing of initiation of dialysis varies enormously depending on the clinical situation of individual patients [10]. Some studies have shown that early initiation of dialysis is beneficial in critical cases of AKI [11, 12]. However, the Artificial Kidney Initiation in Kidney Injury (AKIKI) study showed that mortality at 60 days was comparable, around 48.5% in the early dialysis strategy group compared with 49.7% in the delayed dialysis strategy group [11].

The prognosis of acute renal failure depends on the speed of management and the associated multi-visceral failures [13]. However, it remains remarkably severe, with a high mortality rate and a significant frequency of residual impairment of renal function in survivors. This underlines the importance of renal protection in situations of renal aggression. [6]. In Mali in 2014 in the nephrology department of the CHU Point G Kane M et al found a frequency of 6.89% [14], Samaké et al found a frequency of AKI of 11.88% in Kayes in 2018 [15].

During the study period, 796 patients were hospitalised and monitored in the nephrology and haemodialysis department of the Point G University Hospital, 92 of whom met the inclusion criteria, i.e. a frequency of 11.55%. The frequency of AKI in 2014 by Kane M in the department was 6.89% [14]. ARF is clearly on the rise in the department. The frequency of ARF in the internal medicine department of the Fousseyni Daou Hospital in Kayes, Mali, where a nephrologist practises, Samaké M et al in 2018 found a prevalence of 11.88% [15]. In the intensive care unit of the Gabriel University Hospital in Bamako, Touré M A et al found a prevalence of 12.32% [16]. In sub-Saharan Africa, prevalence in nephrology departments varies between 10 and 15% [17]. In Congo Brazzaville in the nephrology department of the Brazzaville University Hospital, Sinomono et al in February 2021 and in Uganda in the adult medical services of the Mulago National Referral Hospital by Basagha P et al in 2013 the prevalence was 13.38% and 16% respectively [18,19].

In Europe, a French study conducted in 2011 by Lakhal K found a prevalence of 14% [20]. The prevalence of AKI varies from one study to another depending on patient selection criteria and study sites [1].

For all authors, advanced age is a predisposing factor for acute renal failure [21-23]. In our study, 57.6% of patients were under 40 years of age, with an average age of 42.37 years. In Mali, Kane M et al. in the same department in 2014, Coulibaly O in 2017, Toure M A in 2021 reported an average age of 49 years, 26.35 years and 39.5 years respectively [14,16,24]. In Mali, ARI affects young adults [21,24,16].

A predominance of males has been observed in the literature [23-25], with a sex ratio ranging from 1.3 to 2.9. In our study,

60% of cases were male, with a sex ratio (M/F) of 1.49. Male predominance has been reported by Lengani A et al in Burkina Faso and Hatem O et al in Saudi Arabia in 61.98% and 62% respectively [17-25]. At any age, ARF is more frequent in males, as our data also concur with those of Moyen E et al who also reported a male predominance in children [26].

Elevated creatinine was the main reason for hospitalisation, accounting for 95% of cases. Kane M in 2014 and Dembélé M in 2008 reported a frequency of 93.85% [14] and 56.5% respectively in the same department [27].

The condition was dominated by hypertension (33.7%). Toure M A in Mali in intensive care at CHU Gabriel Touré, Lengani A in Burkina Faso and Coulibaly O respectively found 19.2%, 20.7% and 40% hypertension [16,17,21].

Antibiotics (44.6%), antimalarials (28.2%), diuretics and phytotherapies (14.1%), conversion enzyme inhibitors (8.7%) and non-steroidal anti-inflammatory drugs (2.2%) were administered to patients without prior measurement of creatinine levels. In some patients, the nature of the drug was not specified because of self-medication and herbal medicine.

According to the KDIGO 2012, acute renal failure was stage I (6.52%), stage II (13.04%) or stage III (80.44%) in some cases. This high frequency of severe ARF has also been found in other African studies, including Sinomono from Brazzaville University Hospital in 2021 and Lengani H et al, who found 2/3 of ARF at stage 3 of the KDIGO 2012 classification, explaining the high mean creatinine level (701±564 µmol/l) and 73.33% of ARF at the severe stage [18, 28-32]. 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 the East, where the frequency of severe ARF is lower, as reported by Yang Li et al (28.6% of severe ARF) in China and Conan in France (28.6%) [33,34]. The differences observed in the severity of ARF in patients admitted to hospital may be linked to the level of the healthcare system. Sepsis, cardiogenic shock and hypovolaemic shock are the main causes of ARF in the literature. [26]

The ARF was, in order of frequency, parenchymal (organic or per-renal) 72.8%, obstructive (post-renal) 15.2% and functional (pre-renal) 12%. In 2014, in the same department, Kane et al reported less parenchymal ARF (62%), more pre-renal ARF (23%), and 15% obstructive ARF and that of Lengani A. et al in Burkina Faso which found a prevalence of 47.1%, 35.5% and 12.4% respectively, in the majority of studies parenchymal ARF predominates [17,26].

In parenchymal ARF, acute tubular necrosis predominates (44.77%), followed by acute glomerular nephropathy (38.8%), acute interstitial nephritis (11.9%) and acute vascular nephropathy (4.8%), As reported in the literature, the primary cause of parenchymal ARF is parenchymal nephropathy. Several studies are similar to ours: Sinomono et al at the Brazzaville University Hospital, Lins RL et al, Missamou et al, Payen et al reported 25.5% ATN, 44.5% ATN, 78% ATN , 82% ATN [18,34-37]. Lengani et al also found ATN to be the main cause of organic AKI in a nephrology department, with lower proportions (17.35%) , as in our study. In intensive care, the main mechanism of ATN was ischaemic [16,17].

-In functional ARF, dehydration was present in 100% of cases, sometimes associated with other mechanisms. Vomiting was present in 91% of cases, diarrhoea in 72.7% and drug-induced vomiting in 45.4%.

In obstructive ARF, benign prostatic hypertrophy was predominant in 35.7%, urolithiasis in 28.4%, non-visible urolithiasis in 21.4%, and tumour processes in 14.2%. Kane et al found 60% urolithiasis and 30% prostatic pathology [21]. Sinomono et al found obstructive ARF with prostatic hypertrophy as the main cause [18].

Management consisted of hydrosodium intake in 97.8% of cases, antimalarial drugs in 92.4%, antibiotics in 91.3%, antihypertensive drugs in 50%, urethral catheterisation in 41.3%, other treatments in 10.9%, and nephrotomy in 4.34%. Extra renal purification was used in 36 patients (40%). The indications were anuria (24 cases), hyperkalaemia (11 cases) and acute lung oedema (1 case). It concerned parenchymal and obstructive ARF in 84% and 16% respectively. Kane M et al found parenchymal and obstructive ARF in 76.92% and 23.08% respectively [21].

The outcome was favourable in 81.5% of cases with total recovery of renal function in 67.39%, partial recovery in 14.13%, the mortality rate was 11.95%, 4.35% of patients were discharged against medical advice, lost to follow-up and the transition to chronicity occurred in 2.17% of our patients. Kane M et al found a favourable outcome in 30.76% of cases, with recovery of renal function being complete in 38.46%, and the transition to chronicity occurring in 16.92%, showing a clear improvement in the prognosis of AKI between 2014 and 2022 [21]. Farota A et al found full recovery of renal function in 67% of cases [38-40]. Heritiana J L C et al found that 58.82% had normalised their renal function. Nine patients with AKI died, i.e. 17.64% [40]. The range of mor2ality in the literature is 20 to 50% [38]. Mortality from AKI remains high at around 50% in developed countries, where these are intensive care patients with multi-visceral damage. Thus advanced age, sepsis and the severity of AKI were factors with a poor prognosis. However, the combination of sepsis and ARF is associated with a higher mortality rate than ARF alone. [41,42].

Conclusion

AKI in the nephrology department of the Point G University Hospital is a rapidly growing condition with a prevalence of that almost doubled between 2014 and 2022. The patients concerned are young and predominantly male. Stage 3 of the KDIGO 2012 classification is the most common at the time of diagnosis. The mechanisms of onset are dominated by organic causes, in particular NTA of ischaemic origin. Functional causes, the main aetiologies of which were dehydration and vomiting. Obstructive causes, the main aetiologies of which were benign prostatic hypertrophy. Mortality remained high even in patients who had received dialysis. Several factors influence the prognosis of these patients, including the severity of the clinical picture and the presence of pre-existing co-morbidity. The emphasis must therefore be placed on prevention, as well as on facilitating access to healthcare for the population and education on the controlled use of traditional medicines.

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