

The Epidemiology of Acute Kidney Injury in a Tertiary Hospital in Cameroon: A 13 Months Review

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Received date: April 20, 2016; Accepted date: May 21, 2016; Publication date: May 31, 2016

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Abstract

Background: The etiologies and outcome of Acute Kidney injury (AKI) in resource-limited countries are largely related to poverty. Outcome is marred by limited access to renal replacement therapy. Recently, partial government funding for hemodialysis in Cameroon and the SYL program have increased access to RRT for AKI in Cameroon. Data on AKI is sparse in Cameroon. We sought to describe the epidemiology of diagnosed AKI amongst patients in a tertiary hospital.

Method: We retrospectively reviewed records of patients seen by the nephrology department for AKI over a 13 months period in a tertiary Hospital in Cameroon. Diagnostic of AKI was done using usual criteria. We evaluated access to dialysis, renal recovery at hospital discharge and at 3 months and patient survival at hospital discharge.

Results: A total of 108 (61 males, 12 children) patients with AKI were identified among 303 nephrology in-patient consults or admissions during the study period. The mean age was 45.65 ± 21.23 years. Community acquired AKI was most common (70.4%). Pre-renal, renal and obstructive causes accounted for 26.9%, 62% and 11.1% patients respectively. Infections ($n=36$, 33.34 %) and toxins ($n=21$, 19.4 %) were most frequent causes. AKI was pregnancy related in 12 (11%), and malaria-related in 10 (10 %) cases. AKI was multifactorial in 21.3% of patient. Dialysis was indicated in 55 (50.9%) patients but only 30 (27.8%) patients effectively underwent the therapy. Reasons for no access to dialysis were lack of appropriate material and lack of funds. At 3 months, 34 (31.5%) were known dead, 41 (38%) complete renal recovery, 25 (23%) partial recovery and 8 (7.5%) loss to follow-up. No patient was dialysis-dependent.

Conclusion: Infection and nephrotoxins are the main etiologic factor of AKI. Its prognostic is severe: half of patients need dialysis and third die.

Keywords: AKI; Developing country, Infection-nephrotoxin

Abbreviations:

AIN: Acute Interstitial Nephritis; AKI: Acute Kidney Injury; ATN: Acute Tubular Necrosis; CKD: Chronic kidney disease; ECI: Enzyme Conversion Inhibitor; ESRD: End Stage Renal Disease; eGFR: Estimated Glomerular Filtration Rate; GN: Glomerulopathy; ISN: International Society of Nephrology; MAKI: Malaria Related Acute Kidney Injury; NSAID: Non-Steroidal Anti-Inflammatory Drug; RRT: Renal Replacement Therapy; SYL: Saving Young Lives Program

Introduction

Acute kidney injury (AKI) is a sudden aggression of kidney structures which can lead to an abrupt decline of renal function, resulting in retention of nitrogenous waste products and disturbance of water and electrolytes homeostasis. It is a challenging condition because it typically has a silent clinical onset difficult to study, the huge burden of the disease and its high morbidity and mortality. The recent 0 by 25 initiative of the International Society of Nephrology (ISN) has drawn attention to the raising awareness of the global

burden of AKI. The epidemiology of AKI varies amount developed and resource-limited regions. AKI in developed countries is a disease of elderly persons with a high comorbidity burden and mainly hospital-acquired, access to various modalities of renal replacement therapy (RRT) and mortality is high dependent on comorbid conditions. In Africa, community-acquired preventable infections, toxic herbs, diarrheal diseases and pregnancy-related complications account for the bulk of AKI [1]. Young people are mainly affected and mortality is high due to limited access to renal replacement therapy. However, there is no reliable statistic on the epidemiology of AKI in Africa due to the lack of renal registries in most countries. Based on sporadic regional publications the incidence is estimated at 150 pmp [2] and the mortality rate varies between 20-50%. RRT is estimated to be inaccessible in most sub-Saharan African countries. Cameroon is a low medium income country with hemodialysis services widely available in the country. Hemodialysis is partially funded by the state for both AKI and ESRD. In addition The Saving Young Lives (SYL) program of the ISN is also providing peritoneal dialysis for children and women with AKI in one faith-based hospital in the North-West region. Our aim was to describe the epidemiology of AKI in a tertiary Hospital in Cameroon.

Methodology

Study setting

The General hospital of Douala is located in the economic capital of country and serving the littoral region with a population estimated around 3 million. It has 320 beds, well-equipped laboratory, radiology services and it is as teaching hospital of two Universities. It is also the nephrology and oncology reference center of the region and the only public facility with RRT (Conventional hemodialysis) for AKI. No pediatric nephrologists are available and children are managed in adult unit, which is held by 2 nephrologists. Bicarbonate dialysate with polysulfone dialyzers are used. Serum creatinine assay are not routine for all patients admitted in the hospital. SYL project with peritoneal dialysis for children is more than 365 km away.

We retrospectively reviewed the medical records of all patients admitted into the hospital and who had a nephrology consult or received nephrology care from June 2013 to June 2014 at the Douala General Hospital. All records with a diagnosis of AKI were retrieved and analyzed. Records with insufficient data for the diagnosis of AKI were excluded. The diagnostic of AKI was based on the following criteria:

Increase of at least 3 mg/l of creatinine when the creatinine baseline was known.

Reduction of at least 25% of the eGFR, or increase of at least 50% of the baseline creatinine for people with known chronic renal failure

Urine output of less than 0.5 ml/kh/h for more than 6 hours

Increase of creatinine with unknown creatinine or eGFR baseline and sign in favor of acute renal disease (risk factor, normal size of kidney)

Decrease in serum creatinine of more than 3 mg/dl in patients with a raised serum creatinine whose baseline creatinine is unknown.

The KDIGO 2012 classification was used to stage the severity of AKI. Renal and patient outcomes were evaluated on hospital discharge and at 3 months.. Renal outcomes were reported only for survivors at hospital discharge. Complete renal recovery was definite as normalization of serum creatinine within 12 weeks; partial recovery as persistence of renal failure without need of dialysis in those who were receiving dialysis or decrease and stabilization of serum creatinine between 1.2-1.5 times baseline. The following definitions were used:

Acute tubular necrosis was diagnosed based on history, presence of risk factors, urine indices when they were available and recovery with a polyuric phase.

Pre-renal AKI was diagnosed based on history, presence of risk factor, urea and creatinine ratio of more than 20 and urine indices when they were available.

Nephrotoxins AKI was diagnosed based on an history of ingestion of know nephrotoxic drug (NSAI, ECI, cisplatin, aminoside, iodine contrast...) or herbal concoction.

Analysis of the data was performed using SPSS version 20. Continuous data was summarized as mean or median as appropriate, while categorical data was presented as percentages. The study was approved by the hospital ethics committee.

Results

A total of 108 (61 males) patients with AKI were identified out of the 303 nephrology in-patient consults or admissions done during the study period. Six patients with renal failure but insufficient data to discriminate acute from chronic disease were excluded. The median age was 51 years (range 7 months to 86 years) with the 45-60 years range most represented (35.2%) and 12 (11.1%) were age below 15 years (Figures 1-3).

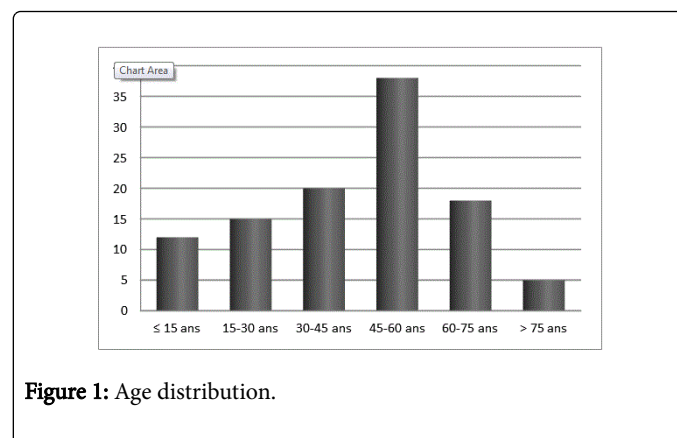


Figure 1: Age distribution.

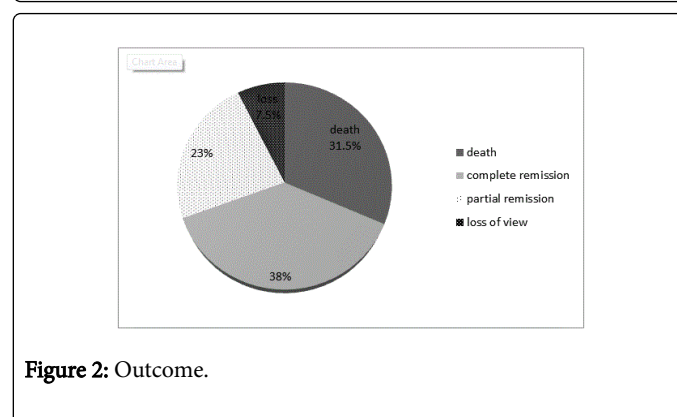


Figure 2: Outcome.

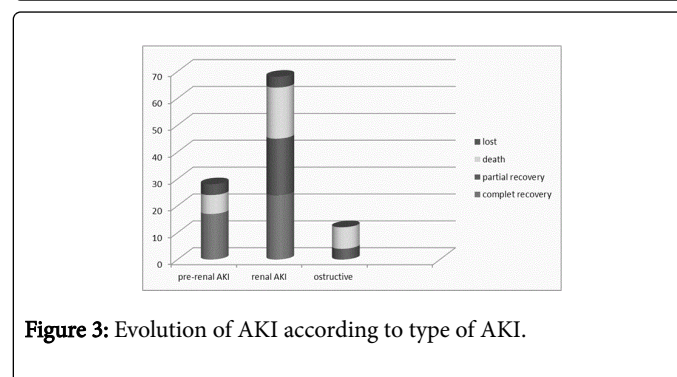


Figure 3: Evolution of AKI according to type of AKI.

Community-acquired AKI was more frequent, involved 76 patients (70.4%) and 77.4% of patients had Stage 3 AKI on diagnosis (Table 1). Renal parenchymal disease accounted for most cases (62%, n=67) with acute tubular necrosis being the main clinical form (39.7%, n=27, Table 1). Sepsis from bacterial infections (n=26, mainly septicemia), nephrotoxicity from drug (n=4 with 2 iodine contrast product, 1 NSAI and 1 cisplatin) and herbal concoctions (n=13) were major causes of renal parenchymal disease. Hypovolemia (n=15 mainly dehydration,

digestive hemorrhage and hypotension) and pelvic solid tumors were the main causes of prerenal and post-renal disease respectively. AKI was multifactorial in 23 (21.3%) patients. Eclampsia was the main cause of pregnancy-related AKI while complicated malaria was the main cause in children (Table 2). Renal replacement therapy was indicated in 55 (50.9%) patients but only 30 (27.8%) effectively underwent the therapy (Table 2). Lack of appropriate technical resources was the main reason for non-access to dialysis (Table 3). In-

hospital mortality was 29.6% (n=32) and 2 other patients died during the 3 months follow up; both with partial remission at discharge. Concerning the 74 survivors at 3 months, recovery of renal function was complete in 41(55.4%), partial in 25 (33.8%), 8 (10.8%) patients were lost to follow-up (all in the partial recovery group at discharge). No patient was dialysis dependent. The 3-month mortality was 34 (31.5%), with comorbidities constituting the main causes of death (Table 4).

Type		N (%)
Severity (KDIGO)	Community acquired AKI	76 (70.4%)
	Hospital acquired AKI	32 (26.6%)
	Stage I	8 (7.3%)
	Stage II	17 (15.7%)
	Stage III	83 (77%)
Mechanism	Prerenal	29 (26.9%)
	Renal	67 (62%)
	ATN	27
	Vascular	5
	AIN	3
	GN	3
	unknown	29
	obstructive	12 (11.1%)
Etiologic factors	Bacterial infection*	36
	Drug/herbal medicine	21
	Volume depletion	17
	obstetrical	12
	Pelvic tumors#	12
	Malaria-related	10
	Hematologic malignancy	6
	Heart failure	4
	Malignant HTN/HUS	4
	Hepato-renal syndrome	2
	Blood transfusion reaction	2
	HIVAN	1
	Acute GN	1
Lithiasis	1	

Table 1: AKI type, severity and etiologies. ATN acute tubular necrosis, AIN acute interstitial nephritis, GN glomerulonephritis, HIVAN HIV associated nephropathy, HTN hypertensive nephropathy, HUS hemolytic and uremic syndrome * bacterial infection included 12 septicemia, 9 urinary tract infection, 5 gastroenteritis, 3 pulmonary infection, 3 meningitis 2 cholecystitis and 2 endometritis # pelvic cancer included 5 prostate cancer, 6 cervix cancer and 1 psoas carcinoma.

Obstetrical AKI	N	Percentage	Pediatric AKI	N	Percentage
Preeclampsia/ eclampsia	6	50%	Malaria-related	8	66.80%
Postpartum infection*	2	16.40%	Bacterial infection #	2	16.40%
Urinary tract infection	1	8.40%	HUS	1	8.40%
Hyperemesis gravidarum	1	8.40%	Acute post infection Glomerulonephritis	1	8.40%
Acute fatty liver	1	8.40%			
Postpartum hemorrhage	1	8.40%			
Total	12			12	100

Table 2: Etiologies of obstetrical and pediatric AKI. * 2 post partum endometritis and 1 per gravidarum urinary tract infection. # 1 bacterial meningoenzephalitis and 1 urinary tract infection, HUS hemolytic and uremic syndrome.

	N	Percentage
Dialysis indicated	55	50.9%*
Dialysis received	30	27.8%*
Dialysis acces ratio	30/55	54.50%
Reason for no dialysis		
Lack of appropriate material	18	72%
Financial constraints	7	28%
Total	25	100%

Table 3: Access to dialysis. *N=108.

	N (%)	
Comorbidity (N=23)	Cancer	11 (31.5%)
	Myeloma/lymphoma	4 (12%)
	Fulminant toxic Hepatitis	3 (9%)
	Cardiac failure	2 (6%)
	Cirrhosis	1 (3%)
	Eclampsia	1 (3%)
	Digestive Hemorrhage	1 (3%)
Septic choc	7 (20.5%)	
Complication of AKI	3 (9%)	
Post transfusion reaction	1 (3%)	
Total	34	

Table 4: Causes of death.

Discussion

In consonance with previous studies in sub-Saharan Africa (SSA), AKI is predominantly community- acquired occurring in young

persons. Infections including malaria, nephrotoxic agents and pregnancy related causes are frequent. However in contrast to other SSA, affordability is a less frequent cause of lack of access. Like most reports worldwide, mortality remains high. Renal recovery is good in survivors albeit a high rate of loss to follow up.

In contrast to developed country, AKI in developing area mainly affect young people as in our study. More than 75% of our patient was less than 60 years old, which is comparable to what found by Chijiokie and al in Nigeria [3] with 80% of their patients less than 40 years. The mean age of our patients was 45.65 years, corresponding to the mean age range of 37-47 years describe in tropical area [4].

In developed countries, AKI usually occurs as a part of multi organ involvement in already hospitalized elderly patient. This is quite different in developing countries, where patient with AKI are young and typical present to hospital with already kidney impairment due to factors encountered in their environment [4]. So, community acquired AKI is a hallmark of AKI in developing country, as illustrated in our study with 70.4% community acquired AKI. In the same way, most of our patient present late with 77.4% in stage 3 of AKIN, like describe by other authors [3,4].

Concerning etiologic factor of AKI in tropic, sepsis and toxic are still top of list. Infection was the main etiologic factor in our study as reported by Chijiokie in Nigeria [3] and Jai P in India [5]. Toxic, mainly herbal remedies, is also a common cause of AKI in tropic [4,6-8], we found it in 21 patients (19.5%) with 13 due to herbal concoction. Common nephrotoxic find in Africa included impila (*callilepis laureola*), violet tree (*securidaca longepedunculata*) and cap aloes [4,6-8]. In our practice, identify the herbal toxic is difficult because many people don't confess their used and when they do; identification of the plant is difficult. Another problem is the lack of botanic and toxicology laboratory to identify the plant and confirm the nephrotoxicity.

Malaria related AKI (MAKI) was frequent in our cohort (n=10), especially among pediatric (8/12 pediatric AKI) and *plasmodium falciparum* was noted in all the case. AKI is found in 1-4% of patient with *P. falciparum* infection and incidence can increase to 60% in severe malaria [9-11]. As noted in our series (9 patients/10), need of dialysis is frequent (50-80%) in MAKI [12]. Patient with high parasitemia, children under 5 years, pregnant women, HIV patient are risk population [13]. Mortality of MAKI vary between 15-50% [13],

but early antimalarial treatment and dialysis is associated with improved survival and recovery of renal function [14,15], these could probably explain the good outcome of our patient (none die and complete renal recovery was usual). Black water fever was the main clinical form (n=7) of MAKI in our cohort. It is a particular form *P. falciparum* malaria, characterized by acute intravascular hemolysis after administration of quinine or some other anti-malaria treatment (eg amodiaquine, mefloquine). It can be associated to glucose-6 phosphate dehydrogenase deficit (which is highly found in black African) or not. AKI is frequent, result from hemolysis and renal histology shown acute tubular necrosis [1]. Passage of dark urine followed by oliguria is the typical presentation.

Obstetrical AKI was found in 11.1% of patient, corresponding to finding of Chijioje in Nigeria (10.5%) [3], Randeree in South Africa (16%) [9] and Jai P in India (8-10%) [5]. Incidence of obstetrical AKI shown a bimodal distribution, the first peak is noted in late first trimester and due to hyperemesis gravidarum and septic abortion, whereas the second peak appear in third trimester and accounted for preeclampsia/ eclampsia, abruption placenta, postpartum hemorrhage and puerperal sepsis [4]. Although its incidence has decrease, obstetrical AKI continues encountered in tropic mostly as a consequence of suboptimal antenatal care, out of hospital childbearing and unsafe abortion practice [4]. Preeclampsia/ eclampsia, puerperal sepsis and postpartum hemorrhage are the main cause of obstetrical AKI describe in tropic [16] as illustrate in our series.

Most of our patients need dialysis (61%) but less than the third benefited of it. Limited technical resource and finance are the main reason of non-dialysis as generally describe in developing country [4, 6]. This could partially explain high mortality associated with AKI in tropic. Other reason included late presentation, etiologic factor (septic choc, multi organ involvement due to nephrotoxic). We found an overall mortality rate of 31.5%, within the range of 10-50% found in tropic literature [3,5,17-19]. Half of patient who die need dialysis but could not benefited of renal replacement therapy, suggest the impact of limited resources on survival. While complete recovery was frequent, 5.6% (n=6) of our patients keep abnormal kidney function after 3 month, underling the CKD risk associated with AKI. However, most patients with partial recovery were loss of view, indicated renal sequels could be more prevalent in our population.

Conclusion

In conclusion, AKI in our milieu is frequent and affect young people. Pre-renal and ATN are the principal type of AKI. Infection, toxic and malaria are the main etiologic factors. Its prognostic is severe: half needs dialysis and third die.

Limits of the Study

This study was retrospective and tried to describe the epidemiology of AKI in a Tropical setting. Indeed it has all the limits of retrospective

studies. For example, we could not evaluate the incidence of the disease in our center; there were lacking data (e.g. urinary output) and the etiology of renal AKI could not be found in 43% of renal AKI.

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