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Research Article

Acute Kidney Injury and Ad Hoc Consultancy Opinions of Nephrology Consultants in the Ivory Coast: Epidemiological, Diagnostic, and Prognostic Aspects

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Summary

Context: Acute kidney injury is a serious and frequently encountered condition in hospital settings, with an increasing incidence. Given the increasing number of evidence reporting the benefits of specialized and early nephrology care, the Ad Hoc Consultancy Opinion regains a crucial interest in the nephrology care pathway. In the Ivory Coast, data concerning this activity are rare. The objective of this study was therefore to evaluate the Ad Hoc Consultancy Opinion impacts under our practice conditions.

Methods: Our study will focus on all patients of the CHU Treicheville without a history of kidney disease seen in the Ad Hoc Consultancy Opinion by the nephrology team of said center over the period from October 1, 2022, to March 31, 2023.

Results: The consultative nephrology service involved 106 patients with an average age of 45.1 +/- 21.1 years. The average delay for requesting the consultation was 2.6 +/- 2.5 days. Acute kidney injury was at stage 3 of the KDIGO classification in 73.6% (n = 78). Emergency hemodialysis accounted for 59.4% of the indications. The mortality was 22.6%, and the risk of death was associated with coma (p = 0.014), left heart failure (p = 0.009), ARDS (p = 0.035), the severity of AKI (p = 0.024), and the Ad Hoc Consultancy Opinion delay > 3 days (p = 0.010).

Conclusion: Our study adds weight to the claims that early specialized management of kidney disease affects the nephrological outcome and survival of patients.

Introduction

Acute kidney injury (AKI) is a serious and frequently encountered condition in hospital settings, with an increasing incidence [1]. It is responsible for significant morbidity and mortality, including a four-fold increase in the risk of in-hospital mortality [1,2]. Given the growing evidence reporting the benefits of specialized and early nephrology care particularly regarding the slowing of disease progression, the reduction of hospitalization duration, and decreased mortality the Kidney Disease Improving Global Outcomes (KDIGO) organization established reference criteria for nephrology practice in 2012 [3-7]. As the health workforce represents the cornerstone of any healthcare system, the Ad Hoc Consultancy Opinion (AHCO) holds paramount importance within the nephrology care pathway, as it serves

to fulfill a key objective: optimizing access to care. In the Ivory Coast, however, data on this activity remain scarce or altogether absent. The aim of this study was therefore to provide insights into AKI among patients evaluated through AHCO. The working hypothesis is that early management of kidney diseases improves patient survival and their renal prognosis.

Methods

Patients

We conducted an analytical cross-sectional study with prospective data collection on a consecutive cohort of patients treated for AKI between October 1, 2022 and March 31, 2023 at the Treichville University Hospital Center (CHU).

Methods

This was an exhaustive sampling, including patients without a history of kidney disease seen in AHCO and followed for AKI over the duration of hospitalization by the nephrology team of the said center. Data were collected using a standardized electronic form deployed on the KoBoToolbox platform, alongside the clinical hospitalization records. The database was cleaned and analyzed using R software (version 4.3.1).

The parameters studied included socio-demographic, anamnestic, diagnostic, therapeutic, and evolutionary data. Qualitative variables were presented according to their frequencies and proportions, and quantitative variables according to their means, standard deviations, medians, and interquartile ranges. For the comparison of proportions, the Chi-square and Fisher's exact tests were used according to their validity conditions. To compare means and medians, normality of distribution was first assessed using the Shapiro-Wilk test, after which nonparametric tests (Kruskal-Wallis and Mann-Whitney) were applied. The significance threshold was set at $p < 0.05$.

Operational definition

- The Ad Hoc Consultancy Opinion is defined as an opinion provided by a specialist physician (referred to as the corresponding physician) at the explicit request of the attending physician.
- AKI was defined and classified according to KDIGO recommendations, based on serum creatinine values determined during the inpatient stay [8].AKI is considered functional in the presence of a renal hypoperfusion factor (diarrhea, vomiting, low cardiac output) or in the presence of signs of extracellular dehydration. It is considered obstructive in the presence of AKI associated with bilateral dilation of the pyelocaliceal cavities on ultrasound . [8]
- The kidney biopsy having not been performed; acute tubular necrosis was suspected in the presence of AKI associated with proteinuria of less than 1g/24 hours, with or without oliguria. Acute glomerulonephritis (AGN) was retained in the presence of edema, arterial hypertension, positive albuminuria, and a decrease in the C3 fraction of complement. Acute interstitial nephritis was suspected in the presence of AKI with positive leukocyturia and preserved diuresis (1 to 2 liters per day), or in the presence of AKI with retained diuresis in the context of proven drug intake. Vascular nephropathy was retained in the presence of severe hypertension, proteinuria of less than 1 g/24 hours, and the absence of edema in the lower limbs [8].
- Oliguria was defined as a diuresis of less than 500 mL/24 hours. [8]
- Anemia was defined as a hemoglobin level below 12 g/dL and was considered severe when below 8 g/dL [9].
- Dialysis urgency was defined by the presence of any of the following: uremic encephalopathy, diuretic-resistant acute pulmonary edema (APE), threatening hyperkalemia, metabolic acidosis, severe uremia, or anuria lasting more than 24 hours. [10].
- Severe uremia was defined by a serum urea level ≥ 2 g/L with clinical signs of intolerance, including tremors of the extremities, hiccups, nausea, vomiting, somnolence, or coma [10].
- Sepsis was diagnosed in accordance with the consensus guidelines of the American College of Chest Physicians and the Society of Critical Care Medicine [11].
- Complete recovery was defined as a serum creatinine level below 15 mg/L at discharge and/or after 3 months of follow-up.
- Partial recovery was defined as a decrease in serum creatinine with a lower KDIGO stage, without reaching a creatinine level below 15 mg/L after 3 months of follow-up.
- Clinical evolution was considered favorable when partial or complete recovery was documented.
- Clinical evolution was considered unfavorable when stagnation or an increase in serum creatinine was documented, with progression to a higher KDIGO stage.

Results

Epidemiological data

During the study period, the nephrology department received 106 consultation requests for acute kidney injury,

including 54 men, with a sex ratio of 1.04. The mean age of the patients was 45.1 ± 21.1 years, with a range of 2 to 82 years. The most affected age group was 45–54 years (24.5%) (Figure 1).

The mean time to AHCO after identification of nephrological abnormalities or symptoms was 2.6 ± 2.5 days. The departments that most frequently requested nephrology consultations were infectious diseases (24.5%) and medical emergencies (20.8%) (Figure 2).

Clinical and paraclinical data

The reason for consultation request was renal function impairment in 100% of cases. Regarding medical history, there were 23 cases of arterial hypertension (21.7%), 18 cases of diabetes mellitus (17.0%), 15 cases of human immunodeficiency virus (HIV) infection (14.2%), and one case of scleroderma (0.9%). The main findings on clinical examination were conjunctival pallor (69.8%), fever (58.5%), and oligoanuria (53.8%).

On biological assessment, anemia was present in 86.8% (n=92) of cases, with a mean hemoglobin level of 8.6 ± 2.7 g/dL (range: 3.0 to 13.8 g/dL). The mean serum creatinine was 98 ± 88.2 mg/L (range: 16 to 438 mg/L) and the mean serum urea was 1.8 ± 1.1 g/L (range: 0.5 to 4.9 g/L). Blood ionogram analysis revealed 83 cases of hyponatremia and 33 cases of hyperkalemia. The infectious workup identified 37 cases of malaria, 5 cases of urinary tract infection, and 5 cases of amicrobial leukocyturia out of 13 urine cytobacteriological examination (UCBE) samples performed, as well as 4 cases of streptococcal infection (ASLO positive) out of 8 samples tested.

Diagnostic and prognostic data

AKI was at stage 3 of the KDIGO classification in 73.6% of cases (n = 78). Based on the clinical circumstances and the pathophysiological factors identified, renal involvement was parenchymal in 67.0% of cases (Table 1). Regarding toxic or drug-related causes, polypharmacy (combination of antimalarial agents and ciprofloxacin) was identified in one case, and phytotherapy in 3 cases.

Emergency dialysis was indicated in 32 patients and initiated in 19, representing 59.4% of indications. The indications for emergency dialysis were uremic encephalopathy (22.6%), severe uremia (17.9%), and anuria lasting more than 48 hours (17.0%), hyperkalemia (4.7%), and acute pulmonary edema (APE) (4.7%).

Clinical evolution was favorable in 52.8% of cases, with complete recovery in 28.3% and partial recovery in 24.5%. The dialysis weaning rate was 63.2% among dialyzed patients (n = 12), and mortality was 22.6% during the study period. The risk of death was significantly associated with coma (p = 0.014), left heart failure (p = 0.009), acute respiratory distress syndrome (ARDS) (p = 0.035), severity of AKI (p = 0.024), and delay in seeking nephrology consultation (p = 0.010) (Table 2).

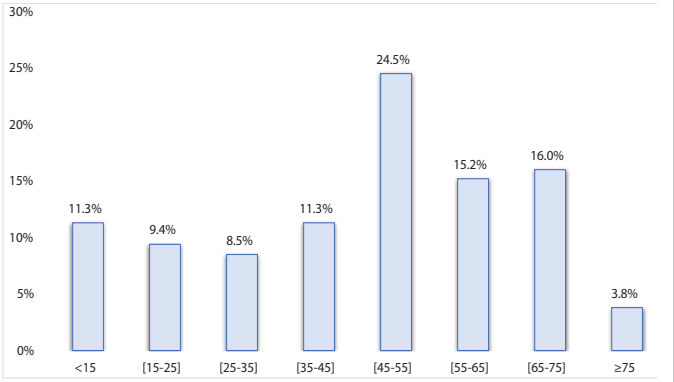

Figure 1: Distribution of patients by age group in years.

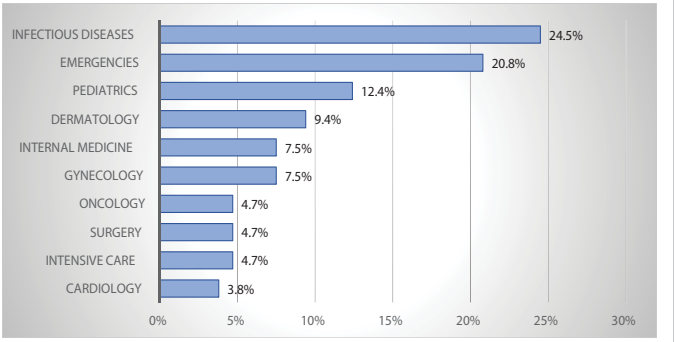

Figure 2: Distribution of patients by inpatient department

Table 1: Summary of the lesional and etiological diagnosis

Lesion diagnosis	Etiological diagnosis	Workforce	Percentage
Pre-renal		20	18,9%
	DEC	11	10,5%
	Low cardiac output	08	07,5%
	Hemorrhagic fibroid	01	00,9%
Parenchymal		71	67,0%
ATN		57	53,7%
	Sepsis	52	49,0%
	Toxic	04	03,8%
	Hemorrhagic	01	00,9%
AGN		05	04,7%
	Post Streptococcal	04	03,8%
	Undetermined	01	00,9%
AVN		05	04,7%
	Pregnancy	03	02,9%
	CRS	01	00,9%
	MNAS	01	00,9%
AIN		04	03,8%
	Infectious pyelonephritis	02	01,9%
	Sepsis	02	01,9%
Postpenal		15	14,2%
	Enlarged prostate	10	09,5%
	Urolithiasis	02	01,9%
	Uterine tumor	02	01,9%
	Bladder tumor	01	00,9%

DEC: Extracellular Dehydration; CRS: Scleroderma Renal Crisis; ATN: Acute Tubular Necrosis; AGN: Acute Glomerulonephritis; AIN: Acute Interstitial Nephritis; AVN: Acute Vasculitis Nephropathy; MNAS: Malignant Nephroangiosclerosis.

Table 2: Factors associated with the risk of death

Variables	N	Deceased, *n* (%)	Alive, *n* (%)	*p* - value
Socio-demographics				
Gender	106			0,6
Female		13 (54,2%)	39 (47,6%)	
Male		11 (45,8%)	43 (52,4%)	
Age	106			0,8
< 60 years		16 (66,7%)	57 (69,5%)	
≥ 60 years old		08 (33,3%)	25 (30,5%)	
Comorbidities				
Diabetes	106	04 (16,7%)	14 (17,1%)	> 0,9
HIV	53	06 (46,2%)	09 (22,5%)	0,2
Clinical				
Fever	106	14 (58,3%)	55 (67,1%)	0,4
Coma	106	14 (58,3%)	23 (28,0%)	0,014
Oligo-anurie	106	11 (45,8%)	46 (56,1%)	0,4
Left heart failure	106	04 (16,7%)	01 (01,2%)	0,009
Right heart failure	106	00 (00,0%)	02 (02,4%)	> 0,9
ARDS	106	08 (33,3%)	11 (13,4%)	0,035
Paraclinic				
Natremia	106			0,2
Normal		07 (29,2%)	14 (17,1%)	
Severe hyponatremia		02 (08,3%)	05 (06,1%)	
Mild to moderate hyponatremia		14 (58,3%)	62 (75,6%)	
Hypernatremia		01 (04,2%)	01 (01,2%)	
Kaliemia	106			0,7
Normal		14 (58,3%)	46 (56,1%)	
Hypokalemia		02 (08,3%)	11 (13,4%)	
Mild to moderate hyperkalemia		08 (33,4%)	21 (25,6%)	
Severe hyperkalémia		00 (00,0%)	04 (04,9%)	
Severe anemia	106	09 (37,5%)	40 (48,8%)	0,3
Other				
Time limit for requesting the opinion	106			0,010
≤ 24 hours		12 (50,0%)	44 (53,7%)	
[1 - 3] days		03 (12,5%)	28 (34,1%)	
> 3 days		09 (37,5%)	10 (12,2%)	
Severity of the IRA	106			0,024
Stage 1		00 (00,0%)	17 (20,7%)	
Stage 2		05 (20,8%)	06 (07,3%)	
Stage 3		19 (79,2%)	59 (72,0%)	

HIV: Human Immunodeficiency Virus; ARDS: Acute Respiratory Distress Syndrome

Discussion

Epidemiological data

In our study, the patients were predominantly young adults. This is consistent with the findings of Failal, et al. in Morocco (2020), Konan, et al. in Ivory Coast (2021), and Samake, et al. in Mali (2022) [12–14]. However, these results diverge from data reported in developed countries, where the mean age was generally above 60 years [15,16]. This discrepancy may be explained by demographic characteristics, notably the relatively young age structure of African populations compared to the increasingly aging populations of developed countries.

Male predominance has been reported in numerous African and Western studies, consistent with the findings of the present study [12,14,15]. However, in Ivory Coast, Yao, et al. (2017) and Guei, et al. (2019) reported female predominance in their studies conducted among HIV-infected patients [17,18]. This finding may be attributed to the higher prevalence of HIV infection among women in this population [19].

Renal function impairment was the sole indication for AHCO in all cases. Consistent with studies on initial and follow-up nephrology consultations conducted in Senegal, Australia, and Great Britain, renal function impairment represented the primary reason for referral to nephrology expertise [20–22]. It is worth noting, however, that in our region, the indications for nephrology referral are considerably less varied compared to those reported in developed countries. Indeed, the diagnosis of kidney disease typically arises in two distinct clinical situations: on the one hand, during the follow-up of patients at risk, such as those with hypertension,

diabetes mellitus, or autoimmune disease; and on the other hand, in the presence of clinical signs suggestive of kidney injury. In both situations, the need for referral to specialized nephrology care should be systematically assessed in accordance with the recommendations of learned societies [10,23].

Diagnostic and prognostic data

The majority of patients (73.6%) presented at stage 3 of the KDIGO classification, with a considerable proportion requiring emergency dialysis (30.2%). These findings are consistent with those reported by Guei ,et al. (61.6% at stage 3), and suggest late diagnosis and/or delayed management of patients [18]. Favre, in a study on the timing of nephrology consultation requests, recommends a referral delay of less than 2 hours to avoid missing a vital emergency; yet in the present series, the mean time to specialist consultation request was 2.6 ± 2.5 days [24]. These data highlight a significant weakness in our healthcare system, namely the delayed response of healthcare staff to clinical deterioration.

Complete recovery was recorded in 28.3% of cases and partial recovery in 24.5%. Lengani et al. reported higher rates in Burkina Faso, with complete recovery in 41.3% and partial recovery in 36.4% of cases [25]. According to the literature, approximately 63% of patients regained their baseline renal function following an episode of AKI, with a lower proportion observed among patients with pre-existing chronic kidney disease (CKD) [26]. The dialysis withdrawal rate of 63.2% observed in the present study is consistent with data from the literature, which reports rates ranging from 40% to 70% [27–29].

The mortality rate in the present study was 22.6%. With an estimated 1.7 million deaths attributed to acute kidney disease annually worldwide, the close association between AKI and mortality is well established [30].

In numerous studies on AKI, the risk of mortality has been correlated with the severity of renal impairment and associated vital organ failures [26,28]. The findings of the present study are consistent with these observations, identifying a significantly increased risk of death associated not only with coma ($p = 0.014$), left heart failure ($p = 0.009$), and acute respiratory distress syndrome (ARDS) ($p = 0.035$), but also with the severity of AKI ($p = 0.024$) and a delay in requesting nephrology consultation exceeding 3 days ($p = 0.010$). The latter finding further supports the growing body of evidence suggesting that early specialized nephrology care is associated with a reduction in mortality [6,31–33].

Conclusion

Our working hypothesis is confirmed with a risk of death associated with the severity of kidney damage and a delay in requesting consultation of more than 3 days. AKI in our countries predominantly affects young adult males, with infectious etiologies representing the leading cause. Despite the advent of renal replacement therapy, which has substantially transformed the management of severe renal failure, mortality rates remain unacceptably high, largely attributable to delayed diagnosis and referral to specialized care. These findings highlight the critical importance of a comprehensive and coordinated approach, encompassing public awareness campaigns, improved access to nephrology care, and the continuous training of healthcare personnel on the clinical benefits of early specialized nephrology intervention. Further prospective multicenter studies are warranted to better characterize the epidemiological and clinical profile of AKI in our countries and to inform evidence-based nephrology care policies.

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