Acute kidney injury in critically ill patients: a comparison between the RIFLE, AKIN, CK and KDIGO classifications

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Abstract

Objective: Compare the incidence of acute kidney injury (AKI) and the ability to predict in-hospital mortality by using RIFLE, AKIN, CK, and KDIGO classifications in critically ill patients.

Methods: A prospective, observational, single-center study conducted over 6 months. We included patients aged ≥18 years, and with an in-hospital stay ≥ 48 hours.

Results: We included 171 patients. The incidence of AKI using the RIFLE, AKIN, CK, and KDIGO criteria were32.16%,46.8%,45%, and 46.8%, respectively. AKIN and KDIGO were similar, and they were more sensitive than RIFLE (46.8% *vs* 32.16%,p<0.001) and CK (46.8% *vs* 45%, p<0.001). In-hospital mortality was significantly higher for AKI patients than for non-AKI patients, regardless of the definition used: RIFLE (17.54% *vs*12.86%, p<0.0001), CK (23.39% *vs*7.01%, p<0.0001), and both KDIGO and AKIN (24.56%*vs*5.84%, p<0.0001). Mortality rate of patients identified as AKI by KDIGO and AKIN was higher than RIFLE (24.56%*vs*17.54%, $p=10^{-3}$), and CK (24.56% *vs* 23.39, $p=10^{-3}$). Compared with RIFLE and CK criteria, both KDIGO and AKIN had greater predictive ability to predict the in-hospital mortality. The area-under-ROC curves for in-hospital mortality for RIFLE, AKIN, CK and KDIGO criteria were: 0.694, 0.761, 0.75, and 0.761 respectively.

Conclusion: KDIGO and AKIN identified more AKI patients and were more predictive for in-hospital mortality than RIFLE and CK.

Keywords: Acute kidney injury; Acute kidney failure; Diagnosis; Incidence, In-hospital mortality

INTRODUCTION

Acute kidney injury (AKI) is a frequent complication in hospitalized patients in the intensive care unit (ICU). It affects one in five hospitalized patients (1) and occurs in up to 25% (2,3). Renal dysfunction is an independent risk factor for mortality, especially in patients treated with renal replacement therapy (RRT) (4). There were about 13.3 million cases of AKI reported worldwide in 2013, with about 85% of cases occurring in low and middle-income countries (5). The effective treatment of AKI is strongly dependent on a timely diagnosis. However, the mean missed diagnosis rate of AKI is reportedly as high as 74.2% (6), which may increase mortality (7). Since 2004, at least four criteria have been used to define and stage AKI. The RIFLE (Risk, Injury, Failure, Loss, and End-stage kidney disease) criteria was the first consensus definition (8). The Acute Kidney Injury Network (AKIN) criteria (9) modified RIFLE by incorporating an absolute increase in creatinine after the finding that small increases in serum creatinine (SCr) were of prognostic significance (10). In 2009, Waikar and Bonventre proposed a creatinine kinetics (CK)–based definition of AKI using absolute changes in SCr over 24 hours or 48 hours (11). Finally, in 2012, the Kidney Disease Improving Global Outcomes (KDIGO) Work Group proposed another definition that builds upon the AKIN definition (12). Few studies have compared these four criteria to determine the incidence of AKI in critically ill patients.

Our study aimed to compare the incidence of AKI and the ability to predict in-hospital mortality by using RIFLE, AKIN, CK, and KDIGO classifications in critically ill patients.

METHODS

Setting: A prospective, observational, single-center study conducted over 6 months (January 2018 to June 2018) in a 22-bed intensive care unit (ICU) of the Habib Bourguiba University Hospital, Sfax, Tunisia. We included all patients admitted to the ICU during the study period, aged ≥18 years, and with an in-hospital stay of at least 48 hours. AKI was defined according to SCr-based criteria per RIFLE, AKIN, CK, and KDIGO; urine output data were not available. Patients aged <18 years, with end-stage chronic kidney disease (CKD) already undergoing hemodialysis, with CKD without baseline serum creatinine information, and/or with an in-hospital stay of less than 48 hours were not included.

Data collection: SCr was recorded for 10 days or until discharge from the ICU. Complete recovery or loss of renal function, the need for renal replacement therapy (RRT) was also recorded. Age, gender, co-morbidities, primary diagnosis, the need for mechanical ventilation, PaO2/FiO2 ratio, the use of catecholamine drugs, in-hospital mortality, length of mechanical ventilation, length of stay in ICU, and pneumonia acquired under mechanical ventilation (PAMV) were noted. Severity was assessed by APACHE II score (13) (Acute Physiology and Chronic Health Evaluation)

and SOFA (14) (Sequential Organ Failure Assessment). Patients were divided into two groups: those who had AKI according to the most sensitive classification (AKI) group, and those who did not have AKI (No-AKI) group.

Definition of acute kidney injury: AKI was defined by using RIFLE, AKIN, CK, and KDIGO criteria. Patients were categorized according to serum creatinine (SCr) and not urine output. We used the lowest known SCr value during the previous 3 months as the baseline creatinine. For patients without a known baseline SCr, we used an estimated baseline. The baseline creatinine was estimated using the simplified modification of diet in renal disease (MDRD) formula, assuming a GFR of 75 mL/min per 1.73 m (2 15,16).

In 2004, the ADQI (Acute Dialysis Quality Initiative) collective (8) developed a system to define and classify AKI by RIFLE (acronym indicating Risk of renal dysfunction; Injury to the kidney; Failure of kidney function, Loss of kidney function, and End-stage kidney disease) criteria. AKI was defined as a 1.5 threshold increase in baseline SCr (≥50%) within 7 days. In 2007, AKIN (Acute Kidney Injury Network) (9) adopted the severity criteria of the RIFLE classification with a modification of stage 1 and therefore of the definition which then defined AKI by the abrupt onset (in 48 hours) of a reduction in renal function defined by an increase in blood creatinine ≥ 0.3 mg/dl (≥ 26.5µmol/L) or ≥ 50% of its base value within 48 h or to 1.5 to 1.9 times baseline. Waikar and Bonventre published in 2009 (11) a new classification based on creatinine kinetics (CK). It defines AKI as an increase in creatinine ≥ 0.3 mg/dl (≥ 26.5µmol/L) over 24 hours or 0.5 mg/dl (44µmol/L) within 48 hours. The KDIGO group classification (Kidney Disease Improving Global Outcomes) was established in 2012 and represents an optimized synthesis of the three previous classifications to define an AKI by the presence of at least 1 of the following 3 diagnostic criteria: increased plasma creatinine ≥ 0.3 mg/dl (≥ 26.5 µmol/L) within 48 hours or increase in serum creatinine ≥ 1.5-1.9 times the baseline value within 7 days (≥ 50%)[12]. In AKIN and KDIGO stage-3 criteria were not only defined by an increase of baseline SCr ≥ 3 times, but also by initiation of RRT (17).

Renal prognosis was classified as complete recovery or loss of renal function based on the SCr level at discharge compared to that at baseline. Complete recovery of kidney function was defined as a SCr level of no more than 0.5 mg/dL (44µmol/L) greater than the baseline value. Loss of renal function was defined as a continuously increasing SCr value or the need for RRT (18).

Statistical analysis: The categorical data were reported as proportions and compared by using Fisher's exact test or the Pearson Chi-square test. Continuous variables were presented as the mean ± standard deviation, median (IQL), and compared by Student's t-test or by the non-parametric Mann-Whitney U test in case of non-normal distribution. Receiver operating

curves ROC by calculating the area under the curve (AUC) were used to compare the predictive ability for mortality. Logistic regression analysis was used in calculating odds ratios and 95% confidence intervals. A p-value ≤ 0.05 was significant.

RESULTS

Demographic Characteristics, Clinical and Biological Findings

During the study period, 428 patients were admitted. After checking the exclusion criteria, 171 patients were included (Figure 1).

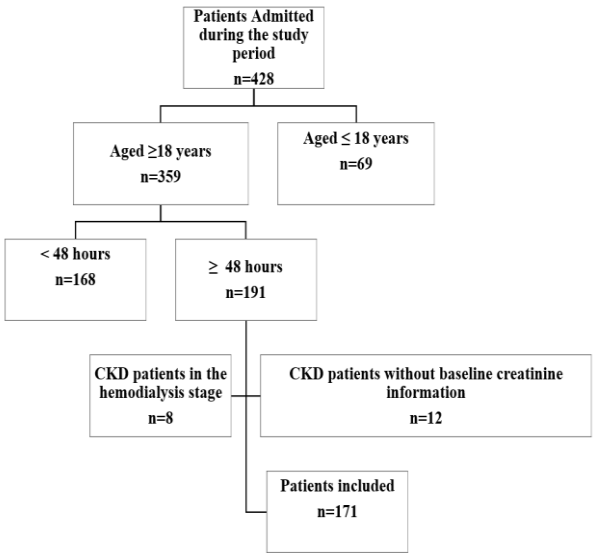

Figure 1 : Flow Chart of study

CKD: end-stage chronic kidney disease

The mean age of patients was 49.26 ± 19.86 years, ranging from 18 to 88 years. 113 (66.08%) were men with a sex ratio of 1.94. Mean APACHE II (SD) 15.1±7.5. Mean SOFA (SD) 6.7 ± 2.9. Mean SCr (SD) at admission was 148.65±19.95 µmol/L. The previous SCr value was found in only 15.2%. The mean baseline SCr (SD) estimated by MDRD was 92.34 ± 13.52 µmol/L. The characteristics of the whole patient population are detailed in Table 1.

Table 1 : Clinical characteristics of patients on admission

	All patients	No-AKI (n=91)	AKI (n=80)	*p*
Age (mean±SD)	49.26 ± 19.86	42.66±19	56.69±18.2	0.000
Male (gender), n (%)	113 (66.08)	62 (36.25)	51 (29.82)	0.6
APACHE II (mean±SD)	15.1±7.5	12.9±6.6	17.49±7.7	0.000
SOFA (mean±SD)	6.7±2.9	5.99±2.6	7.48±3.01	0.001
HBP, n (%)	44(25.7)	14 (67.4)	29 (32.6)	0.002
Diabetes, n (%)	32(18.7)	9 (28.1)	23 (71.9)	0.002
Chronic heart failure, n(%)	25(14.6)	6 (24)	19 (76)	0.002
Chronic kidney diseases*, n (%)	2(1.2)			
Chronic lung disease, n(%)	27(15.8)	12 (44.4)	15 (55.6)	0.335
Shock at admission, n (%)	18(10)	3 (16.7%)	15(18.51)	0.001
Polytrauma, n(%)	48(28)	35(72.9)	12 (48%)	0.001
Surgical admission, n (%)	25(15)	13 (52%)	12 (48%)	0.91
Vasopressors, n(%)	96(56.14)	46	50	0.09
Oedema of the lower limbs, n (%)	17(9.9)	5 (29.4%)	12 (70%)	0.04
Mechanical Ventilation, n (%)	151(88.3)	82(47.95)	69(40.35)	0.5
PaO2/FiO2 ratio	251.47	275.95±10	224.67±85	0.001
Length of stay, median (IQR) (days)	10. 5(5-19)	9(5-17)	13(6-20)	0.14
Length of mechanical ventilation, median (IQR) (days)	8(4-13)	6(3-11)	10(4.5-16)	0.036
PAMV), n (%)	82(48%)	32 (39.5%)	49 (60.5%)	0.001
SCr on admission (mean±SD)	148.65± 19.95	64.93±20.76	161.18±142.28	0.000
Serum creatinine (SCr) baseline using MDRD (mean±SD)	92.34±13.52	95.03±14.14	89.24±12.14	0.052
Mortality, n (%)	52(30.4)	10(5.84)	42(24.46)	0.00

AKI: acute kidney injury; HBP: high blood pressure; MDRD: the modification formula of diet in renal disease; SCr: Serum creatinine; APACHE II, Acute Physiology and Chronic Health Evaluation; SOFA: Sequential Organ Failure Assessment; PAMV: Pneumonia Acquired under Mechanical Ventilation

**Chronic renal insufficiency without stage of hemodialysis,*

Comparison of the incidence of acute kidney injury by the different classifications

AKI was diagnosed in 55 patients (32.16%) by using the RIFLE classification: 22 with Risk, 18 with Injury, and 15 with Failure (Table 2).

Table 2: Correlation between RIFLE and KDIGO classifications

Definition		RIFLE				
		No-AKI	Stage 1	Stage 2	Stage 3	Total
KDIGO	No-AKI	91(53.2)	0	0	0	91(53.2)
	Stage 1	25(14.6)	22(12.9)	0	0	47(27.5)
	Stage 2	0	0	18(10.5)	0	18(10.5)
	Stage 3	0	0	0	15(8.8)	15(8.8)
	Total	116(67.8)	22(12.9)	18(10.5)	15(8.8)	71(100)

AKI, acute kidney injury; **KDIGO**, Kidney Disease: Improving Global Outcomes; **RIFLE**, Risk, Injury, Failure, Loss of Kidney Function, and End-stage Kidney Disease

The incidence of AKI according to AKIN and KDIGO was identical (Table 3).

Table 3: Correlation between AKIN and KDIGO classifications

Definition		AKIN				
		No-AKI	Stage 1	Stage 2	Stage 3	Total
KDIGO	No-AKI	91(53.2)	0	0	0	91(53.2)
	Stage 1	0	47(27.5)	0	0	47(27.5)
	Stage 2	0	0	18(10.5)	0	18(10.5)
	Stage 3	0	0	0	15(8.8)	15(8.8)
	Total	91(53.2)	47(27.5)	18(10.5)	15(8.8)	171(100)

AKI, acute kidney injury; **AKIN**, Acute Kidney Injury Network; **KDIGO**, Kidney Disease: Improving Global Outcomes.

AKI occurred in 80 patients (46.8%): 47 with stage 1, 18 with stage 2, and 15 with stage 3. When CK criteria were used, AKI occurred in 77 patients (45%): 37 with stage 1, 21 with stage 2, and 19 with stage 3 (Table 4).

Table 4 : Correlation between CK and KDIGO classifications

Definition		CK				
		No-AKI	Stage 1	Stage 2	Stage 3	Total
KDIG	No-AKI	91(53.2)	0	0	0	91(53.2)
	Stage 1	3 (1.7)	35(20.5)	9(5.3)	0	47(27.5)
	Stage 2	0	2(1.16)	12(7)	4(2.34)	18(10.5)
	Stage 3	0	0	0	15(8.8)	15(8.8)
	Total	94(55)	37(21.6)	21(12.3)	19(11.1)	171(100)

AKI, acute kidney injury; **KDIGO,** Kidney Disease: Improving Global Outcomes; **CK**, creatinine kinetics

The KDIGO criteria identified 25 additional patients with AKI than the RIFLE criteria did. They were identified as stage 1 (Table 2).

Compared with the CK criteria, KDIGO diagnosed 3 more patients as having AKI. Two patients were identified as stage 2 by KDIGO and stage 1 by CK. Nine patients were identified as stage 1 by KDIGO and stage 2 by CK. Four patients were identified as stage 2 by KDIGO and stage 3 by CK (Table 4). The KDIGO and AKIN criteria were more sensitive than RIFLE (46.8% versus 32.16 %, p <0.001) and CK (46.8% versus 45%, p <0.001).

A total of 18 patients (10.52%) received renal replacement therapy (RRT) within 10 days after ICU admission. According to the KDIGO and AKIN criteria, these 18 patients were identified as AKI: 4 with stage 1, 2 with stage 2, and 12 with stage 3. Based on the RIFLE criteria, 17 of the 18 patients were identified as AKI: 3 with Risk, 2 with injury, and 12 with failure; the other patient without AKI received RRT for hyperkaliemia. Based on the CK criteria, these 18 patients were identified as AKI: 3 with stage 1, 3 with stage 2, and 12 with stage 3.

Thirty-four patients (42.5%) had complete recovery of renal function, 4 patients needed long-short RRT, and 11 patients (13.5%) lost recovery of renal function and developed chronic kidney failure.

Comparison of outcomes

In-hospital mortality

In-hospital mortality was significantly higher for AKI patients than for non-AKI patients,

regardless of the definition used (Table 1): RIFLE (17.54% versus 12.86%, p<0.0001), CK (23.39% versus 7.01%, p<0.0001) and both KDIGO and AKIN (24.56% versus 5.84%, p<0.0001) criteria (table 5).

Table 5: In-hospital mortality according to AKI stratified by the RIFLE, AKIN, and KDIGO classification schemes

Category	RIFLE	AKIN	CK	KDIGO
None (%)	22(12.86)	10(5.84)	12(7.01)	10(5.84)
Risk/Stage 1 (%)	11(6.43)	23(13.45)	17(9.94)	23(13.45)
Injury/Stage 2 (%)	8(4.68)	8(4.68)	10(5.84)	8(4.68)
Failure/Stage 3 (%)	11(6.43)	11(6.43)	13(7.6)	11(6.43)
Any category (%)	30(17.54)	42(24.56)	40(23.39)	42(24.56)

AKI: acute kidney injury; **KDIGO**: Kidney Disease: Improving Global Outcomes; **RIFLE**: Risk: Injury: Failure: Loss of Kidney Function: and End-stage kidney disease; **CK:** creatinine kinetics

It is worth mentioning that the AKIN and KDIGO classifications have similar results. Mortality rate of patients identified as AKI by KDIGO and AKIN was higher than RIFLE (24.56% versus 17.54%, p=0.000) or CK (24.56% versus 23.39, p=0.000).

Length of stays in the intensive care unit

In our study, the ICU-length of stay was greater in patients with AKI than in those without AKI; however, it was not a significant difference (p=0.14) (Table 1).

Predictive ability for mortality

AKI was associated with in-hospital mortality regardless of the definition used.

We found high Odds ratios for stage 3 of the AKIN-KDIGO and CK classifications of 22.28 and 14.806, respectively. The odds ratio for stage 3 was only 3.4 in the RIFLE classification. The odds ratio increases from stage 1 to stage 3 for AKIN-KDIGO and CK classifications. But the odds ratio for stage 1 was higher than for stage 3 and stage 2 according to the RIFLE classification (Table 6).

Table 6: Association of different acute kidney injury categories with mortality by multivariable logistic regression models

Criteria	Odds ratio	*p*	95% CI
RIFLE			
Stage 1	4.7	0.002	1.774 - 12.449
Stage 2	1.2	0.020	1.209 - 9.662
Stage 3	3.4	0.000	3.418 - 40.398
AKIN			
Stage 1	8.1	0.000	3.377 - 19.431
Stage 2	6.48	0.001	2.076 - 20.229
Stage 3	22.28	0.000	5.953 - 83.346
KDIGO			
Stage 1	8.1	0.000	3.377 - 19.431
Stage 2	6.48	0.001	2.076 - 20.229
Stage 3	22.28	0.000	5.953 - 83.346
CK			
Stage 1	5.808	0.000	2.395 - 14.088
Stage 2	6.833	0.000	2.354 - 19.832
Stage 3	14.806	0.000	4.729 - 46.357

CI: confidence interval, **AKI:** acute kidney injury; **AKIN:** Acute Kidney Injury Network; **KDIGO:** Kidney Disease: Improving Global Outcomes; **CK:** creatinine kinetics; **RIFLE:** Risk, Injury, Failure, Loss of Kidney Function, and End-stage Kidney Disease

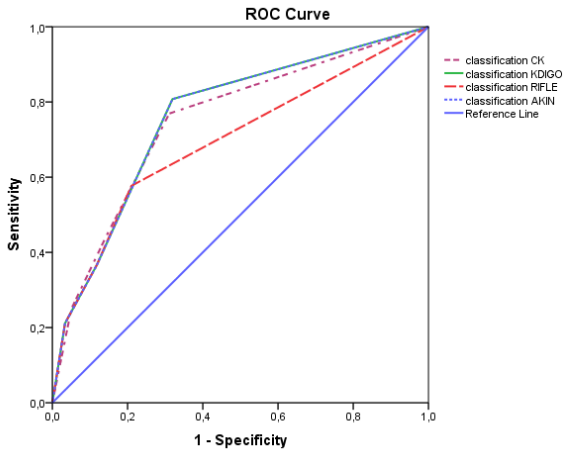

Figure 2: Area under the curves for RIFLE, AKIN, CK and KDIGO classification schemes comparing the predictive ability of RIFLE, AKIN, CK and KDIGO classification schemes for in-hospital mortality.

***AKIN**, Acute Kidney Injury Network; **KDIGO**, Kidney Disease: Improving Global Outcomes; **RIFLE**, Risk, Injury, Failure, Loss of Kidney Function, and End-stage Kidney Disease; **ROC**, receiver operating characteristic. **RIFLE**: AUC 0.694 (95% CI 0.603-0.785, p< 0.001). **AKIN**: AUC 0.761 (95% CI 0.682-0.84, p < 0.001). **CK**: AUC 0.75 (95% CI 0.668-0.831, p < 0.001). **KDIGO**: AUC 0.761 (95% CI 0.682-0.84, p< 0.001.*

The area-under-ROC curves for in-hospital mortality for RIFLE, AKIN, CK, and KDIGO criteria ware: 0.694 ($p<0.001$, $CI_{95\%}$ [0.603-0.785]), 0.761 ($p<0.001$, $CI_{95\%}$[0.682-0.84]), 0.75 ($p<0.001$, $CI_{95\%}$[0.668-0.831]) and 0.761 ($p<0.001$, $CI_{95\%}$ [0.682- 0.84]) respectively. AKIN and KDIGO were identical. Compared with RIFLE and CK criteria, KDIGO and AKIN had greater predictive ability for in-hospital mortality ($p<0.001$) (Figure 2).

DISCUSSION

Incidence of acute kidney injury

Our study compared the four criteria and showed that KDIGO and AKIN identified more patients as AKI than RIFLE and CK. Both KDIGO and AKIN criteria identified 25 more patients with AKI than the RIFLE criteria did categorize as stage 1. Compared with the CK criteria, both KDIGO and AKIN diagnosed 3 more patients with AKI. In the literature, a few studies have compared these four criteria in critically ill patients (19–21). Consistent with our results, most of these studies confirmed that KDIGO is the most sensitive criterion and identifies more AKI (17, 18). Zhou et al. compared the four criteria and found the incidences of AKI of 26.4% by RIFLE, 34.1% by AKIN, 37.8% by KDIGO, and 36.1 % by Cys-C criteria (22). This finding was comparable to our results. Xiaoxi et al. compared the four definition criteria and found that AKI incidence was the highest with the KDIGO definition (18.3%), followed by the AKIN (16.6%), RIFLE (16.1%), and CK (7%) definitions. AKI incidence appeared markedly higher in those with low baseline serum creatinine according to the KDIGO, AKIN, and RIFLE definitions, in which AKI may be defined by a 50% increase over baseline (17). Emilio et al. compared the four criteria in patients with sepsis and found that the AKI rate was 74.3% for RIFLE, 81.7% for AKIN, 81.7% for KDIGO, and 77.5% for CK (21). In our sample, higher rates may be explained by the severity of patients on admission, compared to those reported in previous studies. In a large multicenter study conducted in China, Luo et al. compared only 3 criteria (RIFLE, AKIN, and KDIGO), and found that the highest incidence of AKI was diagnosed with the KDIGO criteria (51%), followed by RIFLE (46.9%) and AKIN (38.4%) (23). Another research compared only the RIFLE and the AKIN classifications (24). The reported incidence of AKI differed across the various diagnostic criteria. The incidence of AKI according to the KDIGO definition is the highest due to the addition of an absolute increase criterion (≥0.3 mg/dl over 48 hours) to the RIFLE definition and expansion of the time limit for percentage increase (≥ 50%) in the AKIN and CK definition from 48 hours to 7 days (17). Furthermore, without a baseline SCr to serve as a reference point, it is difficult to accurately identify acute SCr elevations and evaluate patient recovery (20). Koeze et al. compared RIFLE, AKIN or KDIGO. They found that AKI incidence rates were respectively 15%, 21%, and 20%, using SCr of RIFLE, AKIN, and KDIGO criteria. Adding

urine output criteria increased AKI incidence rates to 35, 38, and 38% using RIFLE, AKIN, and KDIGO definitions (20). Compared with our study, we used only SCr; we would have found a higher incidence of AKI if we had added urine output. KDIGO and AKIN have similar results, allegedly because most of our patients developed AKI within admission and 48 hours. Moreover, KDIGO and AKIN identify more AKI at stage 3 because they include the need for RRT in the definition of stage 3.

In-hospital mortality

Our results showed that patients diagnosed as AKI had significantly higher in-hospital mortality than non-AKI patients, regardless of the diagnostic criteria used. Actually, AKI is associated with significantly increased mortality, which was related directly to the severity of AKI (10,17,19,20). Furthermore, patients in our sample had very high SOFA and SAPSII scores. Luo et al. (23) demonstrated that in-hospital mortality was significantly higher for patients diagnosed with AKI compared to those without, across all evaluated criteria: RIFLE (27.8% vs. 7%, $p<0.001$), AKIN (32.2% vs. 7.1%, $p<0.001$), and KDIGO (27.4% vs. 5.6%, $p<0.001$). This was attributed to the KDIGO and AKIN criteria identifying more patients with AKI than the alternative definitions. Our result was comparable (26). Conversely, a study by Ülger et al. (27) evaluating in-hospital mortality among critically ill trauma patients showed that first-day ICU mortality did not significantly differ between AKI and non-AKI groups when applying the RIFLE ($p=0.565$), AKIN ($p=0.362$), and KDIGO ($p=0.362$) definitions. A significant increase in first-day mortality was only observed when AKI was defined by the CK criteria ($p=0.045$).

Length of stays in the intensive care unit

In our study, ICU length of stay was longer for patients with AKI than for those without AKI, this difference was not significant. Similar findings are reported in the literature regardless of the criteria used (19,22,27).

Mortality prediction

AKI was a heavy global burden that was associated with both short and long-term mortality (7). In our study, KDIGO and AKIN were more predictive of in-hospital mortality than RIFLE and CK. As shown in our results, most studies found that predicted in-hospital mortality increases from stage 1 to stage 3 (19,21,23,26,27). Luo et al. found that compared with the RIFLE criteria, KDIGO was more predictive of in-hospital mortality (AUC 0.757; $p<0.001$), but there was no significant difference between AKIN and KDIGO (23). In a retrospective analysis of 457 critically ill patients with severe sepsis or septic shock, Pereira et al. (29) found that AKI defined by the AKIN and KDIGO criteria was associated with in-hospital mortality, whereas AKI defined by RIFLE was not—a finding consistent with our own results. Nevertheless, the AUC for in-hospital mortality was comparable across all three classifications: RIFLE (0.652), AKIN (0.686), and KDIGO (0.658), with $p < 0.001$ for

all. Conversely, a separate prospective cohort study (26) demonstrated that the RIFLE, AKIN, and KDIGO criteria were all effective predictors of mortality in critically ill patients, with no significant differences among them. In that study, the AUC was 0.735 for RIFLE, 0.740 for AKIN, and 0.733 for KDIGO ($p < 0.001$ for all).

Limits: There are some limitations to our study. First, we used the simplified MDRD formula as a baseline for patients without known baseline creatinine. Second, we used only serum creatinine to define AKI without considering urine output; this may underestimate the incidence of AKI. Third, the sample size is small, and we have not calculated the power. Even so, this study is one of the few studies conducted in Africa that compares the four criteria of AKI.

CONCLUSION

In conclusion, the KDIGO and AKIN criteria identified a greater number of AKI cases than the RIFLE and CK classifications. Regardless of the definition applied, patients diagnosed with AKI experienced significantly higher in-hospital mortality than those without the condition. Furthermore, KDIGO and AKIN demonstrated superior predictive value for in-hospital mortality compared to RIFLE and CK. Given the high acuity of the emergency setting, utilizing these sensitive and highly predictive criteria is critical for early risk stratification, enabling clinicians to implement timely interventions and potentially improve patient outcomes.

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