Clinical characteristics of acute kidney injury diagnosed by decreasing serum creatinine criteria

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Introduction

KDIGO 2012 defines acute kidney injury (AKI) as an increase in serum creatinine or a decrease in urine output, and a decrease in serum creatinine has not been considered as AKI. However, community-acquired AKI or AKIs in resolving process could be presented in the intensive care unit (ICU) with a decreasing trend of serum creatinine. This study aims to show the clinical significance of decreasing serum creatinine defined- AKI in critically ill patients admitted to the ICU.

Methods

This is a single-center retrospective study based on the consecutively collected data of ICU-admitted patients. AKI was detected by the electronic medical record system using the following criteria; increase in serum creatinine ≥0.3mg/dL within 48 hours (I-Scr), decrease in urine output <0.5cc/kg/hr sustained more than 6 hours (Oliguria), or decrease in serum creatinine ≥0.3mg/dL within 48 hours (D-Scr). We grouped patients by the AKI defining criteria (Oliguria, I-Scr, D-Scr, and no AKI).

Results

Between August 2023 and December 2024, 4553 patients were admitted to the ICU. In all, 27.9% were older than 75 years, 63.9% were male, and 24.9% met AKI during the ICU stay. Among the 1134 patients with AKI, Oliguria, I-Scr, and D-Scr criteria were used in 193 (17.0%), 314(27.7%), and 627(55.3%) of the patients. D-Scr-defined AKI patients had more comorbidities, higher APACHE II score, and more frequent ventilator, vasopressor, or kidney replacement therapy utilization than no AKI.

Table 1. Baseline characteristics

Number	AKI Oliguria N=193(4.2)	AKI I-Scr N=314(11.1)	AKI D-Scr N=627(13.8)	No AKI N=3419(75.1)	P-value
Demographics					
Age	62.45±21.83	67.26±15.07	63.63±17.05	63.06±17.05	
≥75 years	65(33.7)	112(35.7)	186(29.7)	906(26.5)	<0.001
Male	130(67.4)	215(68.5)	452(72.1)	2113(61.8)	<0.001
ICU					
Surgical	100(51.8)	208(66.2)	382(60.9)	2386(69.8)	<0.001
Medical	93(48.2)	100(33.8)	245(39.1)	1033(30.2)	
Comorbidities					
DM	82(42.5)	155(49.4)	273(43.5)	1231(36.0)	<0.001
HT	69(35.8)	187(59.6)	320(51.0)	1583(46.3)	<0.001
Pre dialysis CKD	31(16.1)	46(14.6)	45(7.2)	165(4.8)	<0.001
CHF	54(28.0)	105(33.4)	184(29.3)	693(20.3)	<0.001
MI	29(15.0)	57(18.2)	79(12.6)	353(10.3)	<0.001
Lung Disease	33(17.1)	114(36.3)	187(29.8)	1109(32.4)	<0.001
Liver Disease	21(10.9)	26(8.3)	51(8.1)	110(3.2)	<0.001
Stroke	23(11.9)	59(18.8)	85(13.6)	297(8.7)	<0.001
Cancer	25(13.0)	95(30.3)	124(19.8)	1007(29.5)	<0.001
Disease severity at ICU admission					
APACHE II	24.13±8.18	22.91±8.05	18.71±6.52	16.24±6.92	<0.001
Sepsis	9(4.7)	32(10.5)	55(9.3)	92(3.2)	<0.001
Life supporting device utilization during ICU stay					
Ventilator	90(47.1)	169(55.4)	173(29.3)	502(17.4)	<0.001
Vasopressor	71(37.2)	106(34.8)	104(17.6)	205(7.1)	<0.001
CRRT or HD	62(32.1)	67(21.3)	0	0	<0.001
Lab findings at admission					
WBC	11.67±6.45	12.07±11.92	13.71±11.65	11.77±6.79	<0.001
Hb	11.54±2.97	10.98±2.64	11.15±2.73	11.88±2.29	<0.001
PLT	187.66±96.68	166.84±106.93	190.43±99.12	205.69±88.02	<0.001
Total protein	5.94±1.02	5.66±1.03	5.82±1.02	6.03±0.89	<0.001
Albumin	3.45±0.73	3.29±0.68	3.46±0.68	3.68±0.61	<0.001
BUN	33.89±27.27	30.65±22.86	28.06±20.64	19.83±16.10	<0.001
Creatinine	2.24±2.45	1.57±1.37	1.46±1.07	1.13±1.34	<0.001
Na	136.79±6.61	137.67±6.36	137.55±6.05	138.08±4.71	0.002
K	4.32±1.03	4.16±0.75	4.18±0.74	4.06±0.63	<0.001
Cl	101.60±7.26	103.27±6.70	102.79±6.44	103.50±5.16	<0.001

D-Scr-defined AKI patients required longer ICU or hospital stay, higher death, and AKD progression rate at hospital discharge than patients with no AKI (Table 2). Kaplan-Meier curve showed a clear separation of in-hospital mortality between patients with D-Scr-defined AKI and no AKI (Figure 1).

Among the AKI patients, the risk of death was the lowest in D-Scr-defined AKI compared to those defined by I-Scr or Oliguria (Table 3).

Table 2. Patient outcomes by AKI diagnosis criteria

	AKI Oliguria N=193(4.2)	AKI I-Scr N=314(11.1)	AKI D-Scr N=627(13.8)	No AKI N=3419(75.1)	P-value
Patient Outcomes					
LOS at ICU	5.0(2.0-14.5)	10.0(4.0-24.0)	8.0(4.0-20.0)	2.0(1.0-6.0)	<0.001
LOS at hospital	10.0(3.0-25.0)	23.5(11.0-43.5)	26(13.0-49.0)	12.0(6.0-23.0)	<0.001
In-hospital mortality	103(53.4)	135(43.0)	84(13.4)	298(8.7)	<0.001
AKD at discharge	40(20.7)	96(30.6)	33(5.3)	58(1.7)	<0.001

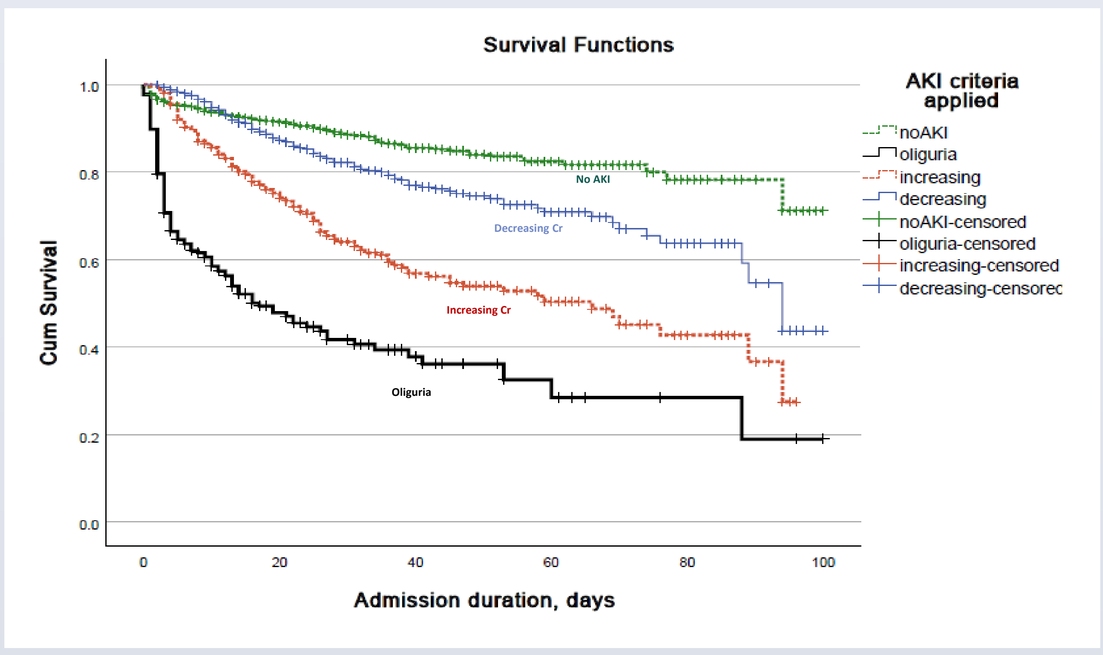

Figure 1. In-hospital mortality rate by AKI diagnosis criteria, Log rank <0.05

Table 3. Multivariable cox proportional hazard model for the risk of death in all patients and AKI patients

In All patients			
	HR	**95%CO**	**P-value**
Age, year	1.025	1.018-1.032	<0.001
Serum Albumin	0.768	0.664-0.888	0.001
APACHE II score	1.088	1.077-1.099	<0.001
AKI	1.386	1.171-1.640	<0.001

In AKI patients			
Age, year	1.011	1.002-1.020	0.018
APACHE II score	1.084	1.067-1.102	<0.001
Predialysis CKD	0.599	0.375-0.957	0.032
AKI diagnosis criteria			
Decreasing cr	Reference		
Increasing cr	2.757	2.009-3.785	<0.001
Oliguria	5.449	3.843-7.725	<0.001

Conclusion

More than half of the ICU patients were defined as AKI by D-Scr criteria. D-Scr-defined AKI shares unique characteristics of AKI, requiring special attention.