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Incidence and Risk Factors of AKI in Patients of Emergency and Surgical Intensive Care Units

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Abstract

Background:*Acute kidney injury is a common medical complication in all patients especially ICU patients. AKI is a common cause of increased mortality and morbidity rate among ICU patients. The aim was toidentify the incidence and risk factors for acute kidney injury development in patients of emergency and surgical intensive care units.* ***Methods:****This study was carried out at emergency and surgical intensive care units of Zagazig University Hospitals over a period of 6 months. Data collection were: Peak of serum creatinine level. 2: Peak of decreased urine output. 3: At the peak of AKI: AKIN score (Acute Kidney Injury Network).* ***And*** *some risk factors.****Results:****incidence of AKI in was 7.015% according to AKIN score. sepsis, Noradrenaline, dehydration and contrast were significantly associated with AKI with significant relative risk each****Conclusion:*** *incidence rate of developing AKI in patients of emergency and post-operative critical care units along the period of 6 months started from October 2018 till the end of march 2019 according to the inclusion criteria and AKIN score is 7.015 %.age and sex weren't risk factors for AKI.The common risk factors which associated with developing AKI in ICU are sepsis (71.2%), dehydration (18.6%), D.M (44.1%), HTN (23.7%), dehydration (18.6%), contrast induced nephropathy (11.9%) and HCV with (6.8%).*

Key words: *Acute kidney injury –incidence- risk factors.*

I. Introduction:

Acute kidney injury (AKI) is defined as an abrupt or rapid decline in renal filtration function. **(1).**

Acute kidney injury is a common medical complication in all patients especially ICU patients. AKI is a common cause of increased mortality and morbidity rate among ICU patients and is a leading cause of CKD and ESRD which need either medical treatment or renal replacement therapy RRT.**(2)**

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Incidence of AKI among ICU patients increasing and differs according to data collected and classification used. There are multiple classifications for AKI to define and stage as RIFLE score, AKIN score and KDIGO score.[3]

AKI is a common and devastating condition associated with significant morbidity and mortality. [4].

Risk factors for AKI in patients with severe illnesses are often multiple rather than single. These features can be grouped into several categories: certain underlying background predisposes patients to the development of AKI. Aged patients tend to acquire AKI more frequently than their younger counterparts, owing to the physiologic ageing of kidneys, multiple morbidities, and impaired renal recoverability [5].

The incidence of AKI in **Koeze*et al.,*** [6]was (7.8%) using the RIFLE based on serum creatinine and (28%) based on urine output during the first week of ICU admission. The incidence according to AKIN was (12%) based on serum creatinine and (28%) based on urine output during the first week of ICU admission. The incidence according to KDIGO was (11%) based on serum creatinine and (28%) based on urine output during the first week of admission.

The study aimed toidentify the incidence and analyze the risk factors (age and sex) for acute kidney injury development in patients of emergency and surgical intensive care units.

II. Patients and Methods

Technical design:

*This r*etrospective cohort study *was* carried out at emergency and surgical intensive care units of Zagazig University Hospitals over a period of 6 months. All patients that had been admitted in emergency and surgical intensive care units of Zagazig University Hospitals over a period of 6 months that started at October 2018 and ended at March 2019 are included in this study.

Inclusion criteria:

The study included the patients meeting the following inclusion criteria:

1: Patients with no history of chronic kidney disease and normal serum creatinine at time of admission in ICU but develop increase in serum creatinine level > 1.2 mg/dl later.

2: Patients with no history of chronic kidney disease and normal urine output at time of admission in ICU but develop decrease in urine output < 0.5 ml / kg /hour for > 6 hours later.

3: Patients with history of other medical diseases as hypertension, diabetes mellitus, chronic liver disease, hypo or hyperthyroidism and cerebrovascular stroke either controlled on treatment or not.

Exclusion criteria:

1: Patients with history of chronic kidney disease.

2: End stage renal disease patients on regular dialysis.

3: Patients with history of renal congenital anomalies as polycystic kidney or absent kidney.

Methods:

Quantitative data collection:

1: Peak of serum creatinine level.

2: Peak of decreased urine output.

3: At the peak of AKI: AKIN score (Acute Kidney Injury Network).

Table 1.Acute Kidney Injury Network Classification/Staging System for AKI [7].

Stage	Serum creatinine criteria	Urine output criteria
1	• Increase in serum creatinine of more than or equal to 0.3 mg/dl or • increase to more than or equal to 150% to 200% from base line	• Less than 0.5 ml/kg per hour for more than 6 hours.
2	• Increase in serum creatinine to more than 200% to 300% from baseline	• Less than 0.5 ml/kg per hour for more than 12 hours.
3	• Increase in serum creatinine to more than 300% from baseline or • serum creatinine of more than or equal to 4.0 mg/dl with acute increase of at least 0.5 mg/dl	• Less than 0.3 ml/kg per hour for 24 hours or • anuria for 12 hours.

Qualitative data collection:

1: Age.

2: Gender.

3: Admission cause.

Statistical analysis

Data collected throughout history, basic clinical examination, laboratory investigations and outcome measures coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) **(**Statistical Package for the Social Sciences) software for analysis. According to the type of data qualitative represent as number and percentage, quantitative continues group represent by mean ± SD, the following tests were used to test differences for significance. difference and association of qualitative variable by Chi square test (X^2), risk assessment by relative risk RR. Differences

between quantitative independent groups by t test. P value was set at <0.05 for significant results &<0.001 for high significant result.

III. Results:

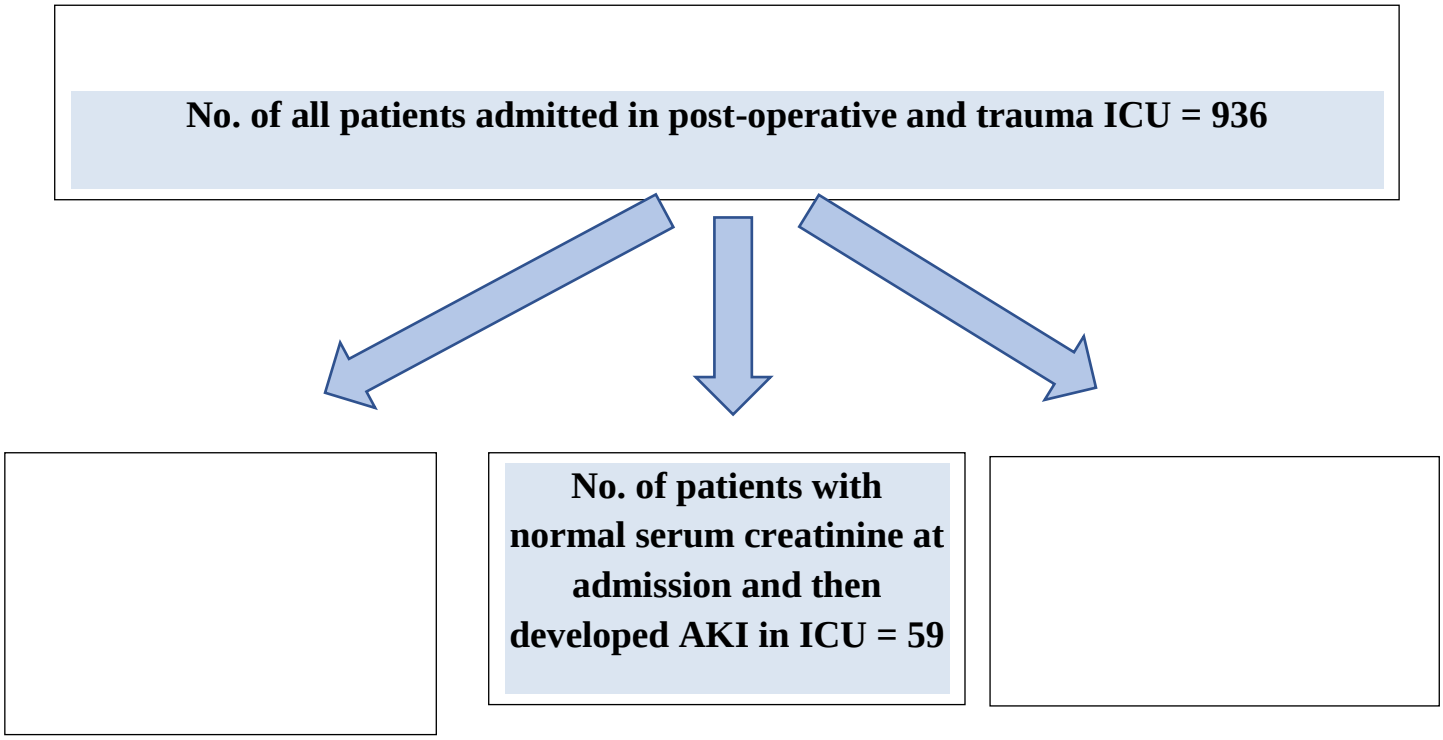

Table (1): Sex and age distribution between AKI and Non-AKI cases:

Group			Non-AKI	AKI	t-test	P-value
Age (year)			50.24±17.64	50.62±15.89	-0.16	0.87
Gender	**Female**	N	411	34		
		%	52.6%	57.6%		
	Male	N	371	25		
		%	47.4%	42.4%		
Total		N	782	59	0.56	0.45

	%	100.0%	100.0%		

(AKI= acute kidney injury, N= number, % = percentage)

The data in this table expressed by t-test and use of P-value to assess the significant difference.

There was no significant difference between groups regard age or sex as age was distributed as 50.24 year ±17.64 and 50.62 year ±15.89 between Non-AKI and AKI respectively and female were more than half of more groups.

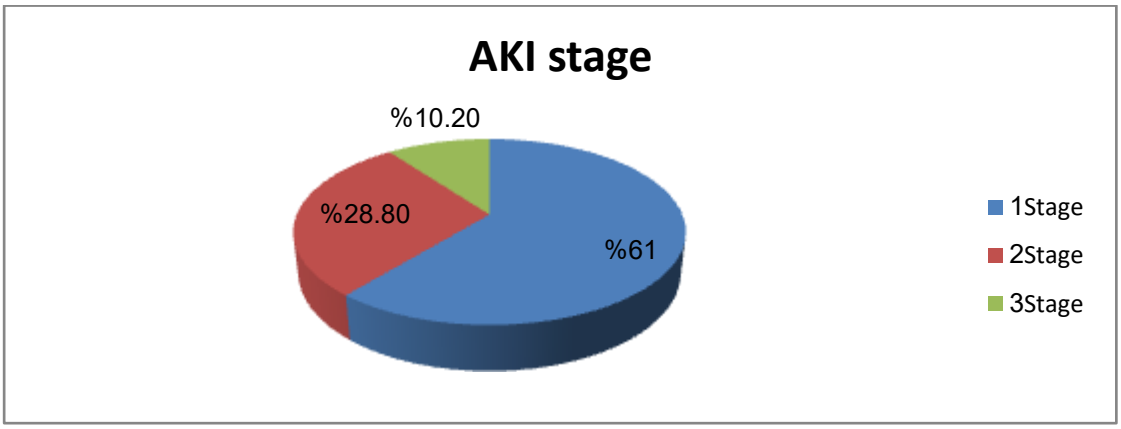

Figure (1): Pie chart showing AKI staging according to AKIN score.

Majority was stage 1 (61%) followed by stage 2 (28.8%) and stage 3 (10.2%)

Table (2): Risk factors distribution between groups:

Risk factors			**Groups**		**Total**	**X^2**	**P**	
			Non-AKI	**AKI**				
Sepsis	**-VE**	**N**	**691**	**17**	**708**			
		%	**88.4%**	**28.8%**	**84.2%**			**RR= 13.4**
	+VE	**N**	**91**	**42**	**133**	**146.12**	**0.00****	**CI 95% (7.7-22.3)***
		%	**11.6%**	**71.2%**	**15.8%**			

NE	**-VE**	**N**	**763**	**46**	**809**			
		%	**97.6%**	**78.0%**	**96.2%**			
	+VE	**N**	**19**	**13**	**32**	**57.6**	**0.00****	**RR =7.14**
		%	**2.4%**	**22.0%**	**3.8%**			**CI 95% (4.5-11.78)***
DM	**-VE**	**N**	**421**	**33**	**454**			
		%	**53.8%**	**55.9%**	**54.0%**			
	+VE	**N**	**361**	**26**	**387**	**0.097**	**0.75**	
		%	**46.2%**	**44.1%**	**46.0%**			
HTN	**-VE**	**N**	**593**	**45**	**638**			
		%	**75.8%**	**76.3%**	**75.9%**			
	+VE	**N**	**189**	**14**	**203**	**0.006**	**0.93**	
		%	**24.2%**	**23.7%**	**24.1%**			
HCV	**-VE**	**N**	**697**	**55**	**752**			
		%	**89.1%**	**93.2%**	**89.4%**			
	+VE	**N**	**85**	**4**	**89**	**0.97**	**0.32**	
		%	**10.9%**	**6.8%**	**10.6%**			
AF	**-VE**	**N**	**739**	**58**	**797**			

		%	94.5%	98.3%	94.8%			
	+VE	N	43	1	44	1.6	0.206	
		%	5.5%	1.7%	5.2%			
Dehydration	-VE	N	740	48	788			
		%	94.6%	81.4%	93.7%			
	+VE	N	42	11	53	16.36	0.00**	RR =3.0
		%	5.4%	18.6%	6.3%			CI 95% (1.7-5.3)*
Cardiomyopathy	-VE	N	768	57	825			
		%	98.2%	96.6%	98.1%			
	+VE	N	14	2	16	0.75	0.38	
		%	1.8%	3.4%	1.9%			
IHD	-VE	N	691	55	746			
		%	88.4%	93.2%	88.7%			
	+VE	N	91	4	95	1.29	0.25	
		%	11.6%	6.8%	11.3%			
leukemia	-VE	N	740	58	798			
		%	94.6%	98.3%	94.9%			

	+VE	N	42	1	43	1.52	0.21	
		%	5.4%	1.7%	5.1%			
Contrast	-VE	N	757	52	809			
		%	96.8%	88.1%	96.2%			
	+VE	N	25	7	32	11.26	0.001**	RR =3.21
		%	3.2%	11.9%	3.8%			CI 95% (1.59-6.5)*
Hemorrhage	-VE	N	712	58	770			
		%	91.0%	98.3%	91.6%			
	+VE	N	70	1	71	3.73	0.053	
		%	9.0%	1.7%	8.4%			
Hyperbilirubiuria	-VE	N	753	58	811			
		%	96.3%	98.3%	96.4%			
	+VE	N	29	1	30	0.64	0.42	
		%	3.7%	1.7%	3.6%			
Myoglobinuria	-VE	N	738	58	796			
		%	94.4%	98.3%	94.6%			
	+VE	N	44	1	45	1.67	0.19	

		%	5.6%	1.7%	5.4%			
Total		N	782	59	841			
		%	100.0 %	100.0 %	100.0 %			

(X^2 = chi square test, P= P-value, RR= relative risk, CI= confidence interval,

N= number, NE= Noradrenaline, DM= Diabetes Miletus, HTN = hypertension, HCV= hepatitis c virus, A.F = atrial fibrillation, IHD= ischemic heart disease)

The data in this table is expressed by chi square test to assess the significant risk factors.

This table shows that sepsis, Noradrenaline, dehydration and contrast were significantly associated with AKI with significant relative risk each.

IV. Discussion

In our study the incidence rate of developing AKI in patients met the inclusion criteria and according to AKIN score was 7.015 % which is near to the incidence rate of AKI which reported in**Ali *et al.*, [(8)]** which held at hospitals of Grampian region of Scotland over a period of 6 months and use the rise of serum creatinine or fall in GFR to assign a category in RIFLE classification and did not use urine output as a criterion for classification and the incidence rate of AKI according to RIFLE score and was 8.90 % by 474 patients of total 5321 patients**.**

Our study differs from**Koeze *et al.*, [(6)]** which included all patients admitted in ICU from January 1st 2014 till June 11th 2014 and use serum creatinine and urine output according to RIFLE , AKIN and KDIGO classification. The incidence of AKI in **Koeze *et al.*, [(6)]**was (7.8%) using the RIFLE based on serum creatinine and (28%) based on urine output during the first week of ICU admission. The incidence according to AKIN was (12%) based on serum creatinine and (28%) based on urine output during the first week of ICU admission. The incidence according to KDIGO was (11%) based on serum creatinine and (28%) based on urine output during the first week of admission. Most probably cause of difference between our study and that study **Koeze *et al.*, [(6)]**is that study held on medical, post-operative and emergency critical units and didn't exclude CKD patients and using different classification to define and stage AKI**.**

In our study distribution of AKI was more among female patients by (57.6%) where the mean of age was (50.62±15.89) With no agreement with **Hoste *et al.*,[(9)]** study as the mean of age was 65.0 and more among male patients by percentage was 63.0 % and the cause is that study **Hoste *et al.*, [(9)]**exclude all patients under 18 years old**.**

In our study and according to AKIN SCORE the majority of patients were stage 1 by (61%) followed by stage 2 by (28.8%) then stage 3 by (10.2%), Peak of decreased UOP was distributed at the mean of

(0.55±0.15) and Creatinine distribution was distributed at the mean of (2.19±0.78), while in this study**Koeze *et al.*, [(6)]** and also according to AKIN score with UOP criteria : stage 1 incidence was 20 % and stage 2 incidence was 9.2 % and stage 3 was 7.9 %.

In our study there were multiple causes of AKI as sepsis and septic shock (71.2 %) followed by hypovolemia and dehydration (18.6 %) then contrast induced nephropathy (11.9 %) and multiple risk factors and comorbidity as D.M (44.2%), HTN (23.7 %) and use of Noradrenaline (22.0 %).

Our study differs from**Hoste *et al.*, [(9)]** study as in their study causes of AKI were sepsis (40.7%), hypovolemia (34.1 %) and drug related (14.4 %) and multiple risk factors as diuretic treatment (32.4%), NSAIDs administration (11.9%) and invasive mechanical ventilation (27.8%)**.**

Finally, our study agree with other studies that AKI is a common complication in all patients especially critical care patients and may cause serious complications as long live dialysis even may cause death.

V. Conclusion:

Our results reported that incidence rate of developing AKI in patients of emergency and post-operative critical care units along the period of 6 months started from October 2018 till the end of March 2019 according to the inclusion criteria and AKIN score is 7.015 %.age and sex weren't risk factors for AKI.The common risk factors which associated with developing AKI in ICU are sepsis (71.2%), dehydration (18.6%), D.M (44.1%), HTN (23.7%), dehydration (18.6%), contrast induced nephropathy (11.9%) and HCV with (6.8%).

References:

1. **Schrier RW, Wang W, Poole B, Mitra A.** Acute renal failure: definitions, diagnosis, pathogenesis, and therapy. J Clin Invest. 2004 Jul;114(1):5–14.
2. **Waikar SS, Bonventre J V**. Creatinine kinetics and the definition of acute kidney injury. J Am SocNephrol. 2009 Mar;20(3):672–9.
3. **Lameire NH, Bagga A, Cruz D, De Maeseneer J, Endre Z, Kellum JA, et al.** Acute kidney injury: an increasing global concern. Lancet (London, England). 2013 Jul;382(9887):170–9.
4. **Vaidya VS, Ferguson MA, Bonventre J V.** Biomarkers of acute kidney injury. Annu Rev PharmacolToxicol. 2008;48:463–93.
5. **Chao C-T, Wu V-C, Lai C-F, Shiao C-C, Huang T-M, Wu P-C, et al.** Advanced age affects the outcome-predictive power of RIFLE classification in geriatric patients with acute kidney injury. Kidney Int. 2012 Oct;82(8):920–7.
6. **Koeze J, Keus F, Dieperink W, Van der Horst ICC, Zijlstra JG, Van Meurs M.** Incidence, timing and outcome of AKI in critically ill patients varies with the definition used and the addition of urine output criteria. BMC Nephrol. 2017;18(1):1–9.

7. **Tsigou E, Psallida V, Demponeras C, Boutzouka E, Baltopoulos G.** Role of New Biomarkers: Functional and Structural Damage. Crit Care Res Pract. 2013;2013:361078.

8. **Ali TZ, Khan I, Simpson W, Prescott G, Townend J, Smith W, et al.** Incidence and outcomes in acute kidney injury: A comprehensive population-based study. J Am SocNephrol. 2007;18(4):1292–8.

9. **Hoste EAJ, Bagshaw SM, Bellomo R, Cely CM, Colman R, Cruz DN, et al.** Epidemiology of acute kidney injury in critically ill patients: the multinational AKI-EPI study. Intensive Care Med. 2015;41(8):1411–23.