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Decoding Acute Kidney Injury: A KDIGO-Based Outcome Study in a Rural South Indian Tertiary Intensive Care Unit

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Abstract: ***Acute Kidney Injury (AKI) is a common complication among critically ill patients and is associated with significant morbidity and mortality. Data on AKI in rural, low-resource settings remains limited. This study aimed to evaluate the causes, severity (based on KDIGO criteria), management, and outcomes of AKI in ICU patients at a rural tertiary care hospital in South India. Methods: A prospective observational study was conducted over 18 months having a sample of 100 ICU patients diagnosed with AKI. Patients with Chronic Kidney Disease and those discharged against medical advice were excluded. Various parameters including Clinical features, Laboratory parameters, KDIGO staging, Treatment modalities provided (dialysis, inotropes, ventilation) and the outcomes were recorded and analyzed using SPSS Version 29. Prognosis was categorized as "Good" (shifted to ward or discharged) or "Poor" (deteriorated or expired). Results: The majority of patients were male (65%) and above 50 years of age (63%). Sepsis was the most common etiology (46.4%), followed by cardiac causes (29.5%) among non-infective cases. Based on KDIGO classification, 41% were Stage 1, 24% Stage 2, and 35% Stage 3. Dialysis was required in 29% of patients, 47% needed invasive ventilation, and 54% required inotropes. The mortality rate was 36%. Poor outcomes were significantly associated with advanced KDIGO stages, anuria, mechanical ventilation, and dialysis requirement. Conclusion: Sepsis remains a leading cause of AKI in rural ICUs. Early recognition and aggressive management, particularly in higher KDIGO stages, are crucial to improving outcomes in resource-limited settings.***

Keywords: Sepsis, Acute kidney injury (AKI), Critical care, Dialysis, Intensive Care Unit (ICU), Inotropes, Kidney Disease Improving Global Outcomes (KDIGO), Serum Creatinine, Urine output

1. Introduction

Acute kidney injury (AKI) describes the sudden loss of kidney function that is determined by increased serum creatinine levels and reduced urine output.

It is common worldwide and it is seen in 7-18% of hospital inpatients and 30-70 % of critically ill patients [(1)]. AKI is reported as community acquired in low resource settings or hospital acquired in high income settings.

One of the common etiology in a rural areas is sepsis and toxins due to snake bite. As there is limited data on the AKI in a rural setting, this study was conducted in a rural tertiary care teaching hospital in South India to determine the prevalence, the commonest etiology, stratify these patients based on Kidney Disease Improving Global Outcomes (KDIGO) classification and the intervention for AKI in ICU patients

2. Methodology

A prospective observational study conducted over a period of 18 months from October 2022 to March 2024 in a rural tertiary care teaching hospital in South India. All patients admitted with AKI during the study period were included. Those patients who were discharged against medical advice & with Chronic Kidney Disease (CKD) were excluded. Sample size was calculated as 100 based on a prospective study by Priyamvada et al [(2)]. This study was conducted after obtaining Institutional Ethics Committee clearance (IEC No. -PESIMSR/IHEC/C-135/2022) and Informed Written Consent was taken from all the patients in the sample size.

The baseline characteristics, clinical symptoms and signs were recorded and were followed up till they were shifted from ICU to ward or discharged from ICU or mortality. During their stay in ICU, the etiology for AKI, the details of management and outcome were also recorded. Those patients getting shifted from ICU to ward or discharged from ICU were considered "GOOD" Prognosis and those who deteriorated or expired were considered as "BAD" Prognosis.

The data collected was analysed using IBM SPSS Statistics for Windows- Version 29.0 (Armonk, Ny:IBM Corp). The p-value of <0.05 was considered as statistically significant.

3. Results

The data recorded from all 100 patients were analysed. The baseline characteristics of the study population is depicted in Table 1

Table 1: Baseline Characteristics

AGE (Years)	**%**
≤ 30	8
31-50	29
51-70	37
> 70	26
Gender	**%**
Male	65
Female	35
Co Morbids	**%**
Hypertension	37
Diabetes Mellitus (DM)	34
Coronary Artery Disease (CAD)	2
Chronic Obstructive Pulomary Disease (COPD)	10
CNS (Seizure Disorder)	1
No Comorbids	14

Among the infective etiology, Sepsis was the most common (46.4%) and Cardiac cause (29.5%) was commonest among Non-infective etiology. (Table-2)

Table 2: Primary Etiology on Admission to ICU

Etiology	N	%	Etiology	N	%
Infective	56	56	Non - Infective	44	44
Sepsis	26	46.4	Cardiac	13	29.5
GIT	11	19.6	CNS	4	9.1
Respiratory	7	12.5	Surgical	7	15.9
Cardiac	2	3.6	Pregnancy Related	1	2.3
CNS	1	1.8	Poisoining/ Envenomation	8	18.2
UTI	1	1.8	Trauma/RTA	3	6.8
Tropical	6	10.7	Liver	1	2.3
Others	2	3.6	Co Morbid	7	15.9

Table 3: Parameters at Admission

Symptoms	No of patients
Fever	43
Breathlessness	31
Cough	15
Cold	2
Chest Pain	13
Palpitations	0
Vomiting	32
Loose stools	18
Abdominal pain	12
Abdominal distension	8
Constipation	0
Headache	4
Giddiness	5
Involuntary movements of limbs/ Stiffening of limbs / Uprolling of eye balls	7
Deviation of angle of mouth / Inability to talk	3
Loss of consciousness/ Unresponsiveness	5
Burning micturition	5
Pregnancy related	1
Poisoning / envenomation	9
RTA/ Trauma	4
Swelling of lower limbs	9
Generalised body pain	8
Fatiguability	0
Altered sensorium	3
Others	19
Loss of weight	1
Loss of appetite	4
Sweating	3
Chills and rigors	1
Heart Rate (Beats/min)	**N-100**
<60	0
60 - 80	12
81-120	63
>120	25
SBP (mm Hg)	**N-100**
Unrecordable	1
Hypotension (60-90)	33
Normotension (91-140)	58
Hypertension (>140)	8
Respiratory Rate (/MIN)	**N -100**
<18	14
18-22	56
> 22	30

At the time of admission, Fever was the commonest symptom (43%) followed by vomiting (32%), 63 % had heart rate of 81-120 bpm, 58% were normotensive and 70% had normal respiratory rate. (Table-3)

Table 4: Pattern of Urine Output

Urine Output	Admission	Discharge		
		Non-Oliguric	Anuric	Oliguric
Anuric	5	1	4	-
Oliguric	7	7	-	-
Non Oliguric	88	85	2	1

In the study population, at the time of admission, 5 patients had anuria and 4 patients remained anuric at time of discharge. 7 patients were oliguric at time of admission and became non oliguric at time of discharge. 88 patients who were non oliguric at the time of admission, 2 patients became anuric and 1 patient became oliguric at the time of discharge. (Table 4)

Among the laboratory parameters, Anemia (37%), Thrombocytopenia (27%), Abnormal LFT (32%) were observed (Table-5)

Table 5: Laboratory Parameters in ICU

S No	Lab Parameters	N - 100	%
1	**Anemia**		
	Yes	37	37
	No	63	63
2	**Platelet Count**		
	Normal	68	68
	Thrombocytosis	5	5
	Thrombocytopenia	27	27
3	**Liver Function Test**		
	Normal	68	68
	Abnormal	32	32
4	**Sodium**		
	Normal	83	83
	Hyponatremia	15	15
	Hypernatremia	2	2
5	**Potassium**		
	Normal	53	53
	Hypokalemia	21	21
	Hyperkalemia	26	26
6	**Coagulation Profle**		
	Normal	85	85
	Abnormal	15	15
7	**Serum Creatinine** (mg/dL) Mean ±SD	3.03 ± 1.77	

Among the study population, 41% were in KDIGO Critera-1 followed by 35% in KDIGO Criteria-3 and 24% in KDIGO Criteria -2 (Figure-1)

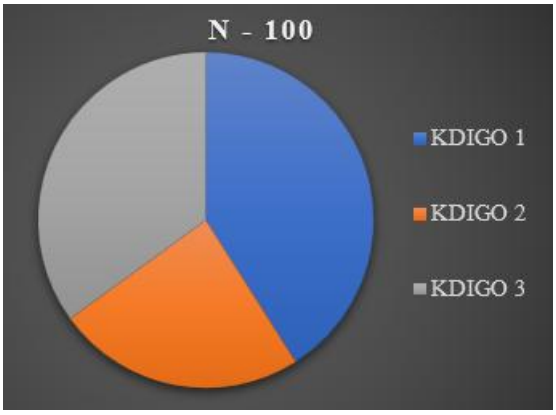

Figure 1: KDIGO Criteria

These AKI Patients required inotropes, dialysis/ RRT and Ventilation for additional management while they were all managed medically. (Table-6)

Table 6: Management of AKI patients

S. No	Management	N - 100	%
1	**Inotropes**		
	Yes	54	54
	No	46	46
2	**Dialysis/Rrt**		
	Yes	29	29
	No	71	71
3	**Ventilation**		
	NIV	24	24
	Invasive Ventilation	47	47
	No Ventilation	29	29

With regards to outcome, 58 % had "GOOD" Prognosis while the remaining 42% had "BAD" Prognosis. (Table-7)

Table 7: Outcome

Outcome	N - 100	%
Shifted To Ward	52	52
Discharged	6	6
Deterioration	6	6
Mortality	36	36

4. Discussion

AKI is one of the commonest complications among ICU admission. This is associated with poor short term and long term complications like prolonged hospital stay, cost and progression to CKD and cardiovascular events. There is limited knowledge about the incidence, etiology and outcome of AKI in low resource countries and hence this study was conducted in a rural tertiary care centre in South India with referrals.

We observed the incidence of AKI among all age groups with 63% of them being more than 50 years. However there is a change in trend in low and middle resource countries with decline in mean age to below 50 years.[3] This can be due to increase in comorbidities among the younger age group due to change in lifestyle. We also observed a decrease in the median age among the patients with KDIGO criteria 3 (59 years) Unlike in KDIGO criteria 2 (59 years) and KDIGO criteria 1 (65 years).

It is observed that the males are more commonly affected (65%). This can be due to the testosterone which can increase the susceptibility to ischemia or reperfusion of kidney injury.[4]

In our study, sepsis was the commonest etiology (46.4%) which is higher than other Indian studies. [2,5] This might be due to the lower socio-economic strata of the population catered in a tertiary care teaching hospital.

Among the non- infective etiology, cardiac events like infective endocarditis and rheumatic heart disease were common (29.5%) Unlike other Indian studies[2,5], where hypovolemia and acute pancreatitis where the commonest etiologies.

There is growing evidence of association of AKI with comorbidities. This is observed in our study population and also in Eswarappa et al. study[6]

At the time of admission, we observed majority of patients having stable vital parameters. Among the study subjects, 5 were anuric at the time of admission and 4 of them were in poor prognosis group and also there was significantly more number of non oliguria patients in good prognosis group.

The mortality rate in our study was 36% unlike in Priyamvada et al. study[2] of 52.4% & Korula et al. study of 49.5%[7]. This can be due to longer duration of follow up of 28 days in their studies and we followed them up only for 7 days and this is one of the limitation of our study.

Dialysis is one of the important treatment modalities for AKI patients. This is indicated in patients with volume overload, hyperkalemia, severe acidosis and severe azotemia [8]. In our study coma patients requiring dialysis had a significantly poorer outcome (19% versus 42.9%). The other factors for higher mortality are advanced age, mechanical ventilation, hypertension and those requiring inotropic support.

In AKI, 39.1% of patients require dialysis[7]. Even though dialysis is a critical supportive measure, it can increase the risk of short- term mortality and long- term risk of ESRD, cardiovascular events and death [8]

Non-invasive ventilation is commonly preferred in AKI patients, but its impact on outcome is not well established. The need for invasive ventilation was significantly more (90.2%) in "Poor" prognosis group and 67.6% of patients with KDIGO criteria 3 required invasive ventilation. A similar observation was made in Vemuri et al. study [9], but in Asmus et al. study [5], mechanical ventilation was required in only 27.3% of patients. This might be due to higher plateau pressures, lower respiratory system compliance and poor oxygenation which contributes to poor outcome. It is also influenced by fluid balance, use of vasopressors and underlying cardiac function.

The requirement of inotropes was higher (54%) in our study population unlike in Asmus et al. study (31%) [5]. This difference might be due to difference in selection criteria as they included patients with CKD who are excluded in our study.

The strength of our study is the inclusion of AKI patients with different etiologies and was conducted in a rural tertiary care teaching hospital. The other strengths are selection based on latest KDIGO criteria and their outcome is analysed under good prognosis and poor prognosis. The limitations being a single centric study and short duration of follow up.

5. Conclusion

Sepsis is a leading cause of AKI and frequent cause for ICU admission. AKI patients with poor prognosis require dialysis and mechanical ventilation. The regional differences in the disease pattern should be considered in formulating the policies

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