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A STUDY OF ETIOLOGY, CLINICAL PROFILE AND PROGRESS IN PATIENTS WITH ACUTE KIDNEY INJURY IN A TERTIARY CARE HOSPITAL, BARABANKI

General Medicine

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ABSTRACT

Background: Acute Kidney Injury (AKI) is a critical condition with diverse etiologies and variable prognoses. This study aims to identify the etiology, clinical profile, and progression of AKI in patients admitted to a tertiary care hospital. **Objectives:** To identify the varied etiology of AKI. To study the prognosis of AKI. To determine the outcomes of AKI correlated with AKIN Stage. **Methods:** A prospective hospital-based study was conducted over 18 months at Dr. KNS Memorial Institute of Medical Science, Barabanki. Forty adult patients (24 males, 16 females) fulfilling AKIN criteria were enrolled. Demographic, biochemical, and clinical profiles were recorded, with serum creatinine measured at admission and follow-ups. Data analysis was performed using SPSS 23.0, applying Chi-square, t-test, and ANOVA, with statistical significance set at $P < 0.05$. **Results:** The study assessed age, sex, type of AKI (pre-renal, renal, post-renal), risk factors, dialysis indications, and outcomes. Correlations between AKIN stages and prognosis were evaluated, showing a significant association with recovery or mortality rates. **Conclusion:** AKI has a multifactorial etiology, with outcomes influenced by AKIN stage and timely intervention. Identifying high-risk patients can aid in early diagnosis and management, improving survival rates. Further large-scale studies are recommended for better understanding and prevention strategies.

KEYWORDS

INTRODUCTION

Acute renal failure (ARF) "is a generic term for a sudden and persistent decrease in renal function leading to retention of nitrogenous (urea, and creatinine) and non-nitrogenous waste products".(1)

Serum creatinine elevations caused by acute renal failure might be quite severe (needing dialysis) or quite mild. New evidence suggests that even modest alterations in renal function are linked to significantly higher mortality rates.(2,3)

In light of this, the acronym AKI now stands for Acute Kidney Injury and encompasses the full range of symptoms seen by patients with this condition, from mild shifts in renal function markers to the need for Renal Replacement Therapy.(4)

In order to quantify and stratify the severity of AKI, the Acute Dialysis and Quality Initiative Group (ADQI) created the RIFLE classification, which stands for Risk, Injury, Failure, Loss of kidney function, and End Stage Kidney Disease.(5)

An updated version of the RIFLE, known as the Acute Kidney Injury Network (AKIN) classification, was introduced to improve the accuracy and precision of AKI diagnoses.(4) Acute kidney injury (AKI) affects 2-7% of inpatients.(6,7)

In a research on acute renal failure that was acquired in a healthcare facility, An episode of renal insufficiency occurred in 7.2% of patients. (8) Acute kidney injury that occurs in a hospital setting is five to ten times more common than AKI that occurs in the community.(9) Aggressive treatment of an ageing population and the effects of novel nephrotoxic drugs and diagnostic methods are both contributing to these rising rates.(6,10)

Nonsteroidal anti-inflammatory medicines (NSAIDS) and nephrotoxic antibiotics, including aminoglycosides, are the most often linked medications to kidney damage in the elderly.(11) The kidneys undergo numerous changes as we age, and one of them is an increased susceptibility to drug-associated renal side effects. (4)

Even while renal failure was not the direct cause of death in AKI patients, it was an independent risk factor for death.(12) Developing nations bear a disproportionate share of the cost of AKI because they lack the infrastructure to treat patients once their condition has advanced to the point where renal failure and RRT are necessary.(13)

Despite the fact that AKI is prevalent, dangerous, curable, and mostly avoidable, there is a dearth of research on the topic originating from India that makes use of different serum creatinine values.(11,14) Hence, we planned to carry out this study to look into the varied etiology of AKI and their outcome using newer AKI definitions. This study aims to identify the etiology, clinical profile, and progression of AKI in patients admitted to a tertiary care hospital.

METHODS

A prospective hospital-based study was conducted over 18 months at Dr. KNS Memorial Institute of Medical Science, Barabanki. Forty adult patients (24 males, 16 females) fulfilling AKIN criteria were enrolled. Demographic, biochemical, and clinical profiles were recorded, with serum creatinine measured at admission and follow-ups. Variables assessed age, sex, type of primary disease (medical or surgical), type of AKI (pre-renal/renal/post-renal), risk factors, indications and type of dialysis and outcomes (recovery/ death/ discharge on dialysis). Data analysis was performed using SPSS 23.0, applying Chi-square, t-test, and ANOVA, with statistical significance set at $P < 0.05$.

RESULTS

Table 1: Distribution of AKI based on type of AKI

		Count	Column N %
Type Of AKI	Pre-renal	68	68.0%
	Renal	22	22.0%
	Post-Renal	10	10.0%
Total		100	100%

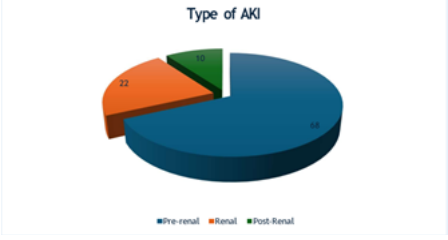

Figure 1: Pie chart showing type of AKI

A total of 100 cases of AKI were enrolled in our study; based on eligibility criteria. Among them 68% were pre-renal; 22% were renal and 10% were post-renal type of AKI.

Table 2 Distribution Of Patients According To Co-morbidities

		Count	Column N %
Co-morbidities	Hypertension	47	47.0%
	IHD	12	12.0%
	CKD	13	13.0%
	CLD	19	19.0%
	Anemia	7	7.0%
	Others	2	2.0%

Distribution according to co- morbidities Hypertension was most common co-morbidty among AKI patients (47%). Other comorbidity like IHD; CKD; CLD anemia and others were also reported.

Table 3: Descriptive characteristics of Hb; TLC and Platelets count

Type Of AKI		Hb	TLC	PLT
Pre-renal	Mean	11.27	9.56	1.36
	SD	1.22	4.69	0.78
Renal	Mean	9.54	9.93	1.90
	SD	1.34	4.41	0.83
Post-Renal	Mean	11.48	10.26	2.08
	SD	1.36	4.52	0.86
Total	Mean	11.50	9.96	1.88
	SD	1.33	4.42	0.847
p-value (one way ANOVA)		0.739	0.912	0.082

Hypertension was most common co-morbidty among AKI patients (47%). Other comorbidity like IHD; CKD; CLD anemia and others were also reported.

Table 4: Description Of Urea Level At Time Of Admission; Day 14 And 3 Months

Urea Level					P-Value (RM-ANOVA)
Type Of AKI		Admission	Day 14	3months	
Post- Renal	Mean	90.68	52.14	30.14	<0.001
	SD	32.80	18.11	7.62	
Pre-renal	Mean	96.70	45.10	27.80	<0.001
	SD	31.31	10.10	5.98	
Renal	Mean	95.34	52.71	31.04	<0.001
	SD	29.22	17.01	7.26	
Total	Mean	94.45	51.82	30.52	<0.001
	SD	29.99	16.73	7.22	

There were significantly gradual decrease in the mean value of urea level from admission to 3 months after discharge (RM<0.001) in all type of AKI.

Table 5: Distribution According To Stage Of AKI

		Count	Column N %
Stage Of AKI	Stage I	0	0
	Stage II	66	66.0%
	Stage III	34	34.0%

66% of cases showed stage II AKI and 34% showed stage III AKI.

Table 6: Distribution According To Need For RRT

		Count	Column N %
Need of RRT	NO	79	79.0%
	YES	21	21.0%

21% cases had need of RRT.

Table 7: Underlying Etiology Of AKI

Diagnosis	Count	%age
Sepsis (with MODS)	30	30.00%
Malaria	13	13.00%
Dengue	13	13.00%
Gastroentritis	15	15.00%
Leptospirosis (with MODS)	1	1.00%
Cellulitis	6	6.00%
CCF	3	3.00%
UTI	4	4.00%
Unknown	2	2.00%
NSAID Induced	2	2.00%
Obstructive uropathy	6	6.00%
Diabetic ketoacidosis	1	1.00%
Enteric fever	1	1.00%
Total	100	100%

Most common etiology was sepsis (30%) followed by malaria (13%); dengue (13%); gastroenteritis (15%); leptospirosis (1%); cellulitis (6%); CCF (3%); UTI (4%); NSAID induced (2%); Obstructive uropathy (6%); diabetes ketoacidosis (1%) and enteric fever (1%) and 2% had unknown cases.

8: Correlation between outcome and AKI stage

		AKI stage			
		Stage II		Stage III	
		Count	Column N %	Count	Column N %
Outcomes	DEATH	5	7.6%	13	38.2%
	RECOVERED	61	92.4%	21	61.8%
P<0.001					

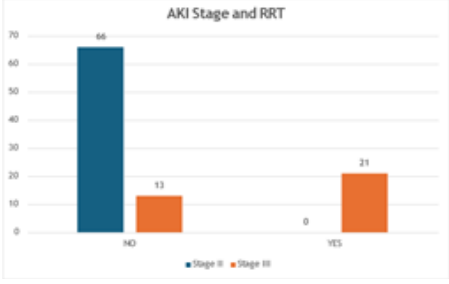

Figure 2: Bar diagram showing correlation between outcome and AKI stage There was significant association between mortality and advanced stage of AKI stage (7.6% v/s 38.2%; p<0.001).

Table 9: Correlation between AKI stage and RRT.

		AKI stage			
		Stage II		Stage III	
		Count	Column N %	Count	Column N %
RRT	NO	66	100.0%	13	38.2%
	YES	0	0.0%	21	61.8%
P<0.001					

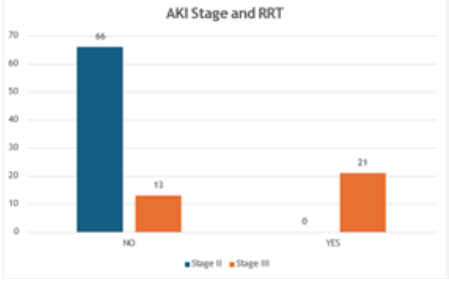

Figure 3: Bar diagram showing correlation between need of RRT and AKI stage

There was significant association between need of RRTand advanced stage of AKI stage (0.0 % v/s 38.2%; p<0.001).

Table 10: Comparison of eGFR in different type of AKI

eGFR					P- Value
Type Of AKI		Admission	Day 14	3months	(RM-ANOVA)
Pre-renal	Mean	10.77	29.96	46.78	<0.001
	SD	2.8	8.11	7.62	
Renal	Mean	7.31	14.79	19.43	<0.001
	SD	3.31	10.1	5.98	
Post-Renal	Mean	8.64	30.71	34.68	<0.001
	SD	2.22	7.01	7.26	

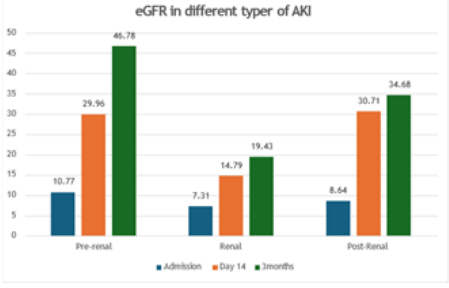

Figure 4: Bar diagram showing comparison of eGFR in different type of AKI

The mean value of eGFR was significantly improved in all type of AKI from day of admission to 3 months after discharge (P<0.001).

DISCUSSION

Pre-renal AKI was most common type of AKI.AKI was more observed at above 50 years of age in present study. Male preponderance was seen.Most common etiologies were Sepsis and Malaria.Renal function parameter like urea; creatinine and e GFR were improved with treatment.Mortality and need of RRT was significantly associated with advanced stage of AKI. Overall mortality observed was 18% mainly in ICU setting.

Epidemiology Of AKI

The average age that was recorded by HS Kohli et al. it was 67.9 ± 7.6 years. (15) In the present study, there were 64% males and 36% females with M: F ratio of 1.77:1. There were more men than women in the study conducted by Kohli et al., Jha et al., and other authors.(2,8,15-17)

Investigations

In our study; the mean value of creatinine and urea level showed significant improvement from admission to 3 months follow up ($p<0.001$). eGFR also improved on treatment from admission to 3 months ($p<0.001$). In a study, Bouchard et al. found that 47% of patients regained normal renal functions upon discharge from the hospital, and that the average S. creatinine level upon admission was 2.5 mg%. Complete recovery of renal function was documented in 38.5 percent of patients by Nash et al., 86.3 percent by HS Kohli et al., and 45.5 percent by Anupama Kaul.(8, 18, 15,19, 20)

Urine Albumin was present in 10 % patients while pus cells and RBC was present in 42 % and 18% patients. Albumin is the protein of choice for the urine. Diabetes, various glomerular disorders, and hypertensive nephrosclerosis all lead to chronic kidney disease (CKD), the first sign of which is an increase in albumin excretion in the urine. Albuminuria can be a symptom of polycystic kidney disease, tubulointerstitial disease, or kidney disease in those who have recently received a kidney transplant.(21)

On USG, normal kidneys was observed in over half of the patients (47%) while grade I and II Renal parenchymal Changes (RPC) with normal sized kidneys was observed in 31% and 5% patients. Other findings included Cystitis, Pyelonephritis, Prostatomegaly and obstructive uropathy. Pulmonary odema on X-ray was observed in 20 % patients. Abnormal echo findings were observed in 7% patients. 3% had dilated cardiomyopathy and 4% had LVH diastolic dysfunction.

In present study deranged SGPT and SGOT was observed in 43% and 53% respectively in patients of Acute Kidney Injury.

As many as 27 percent of those diagnosed with Acute Kidney Injury exhibited abnormal liver functions, according to research by Bouchard et al.(22)

Etiology

Most common etiology for AKI was Sepsis (30%) and Malaria infection (13%) followed by Dengue, Gastroenteritis (15%) and Leptospirosis (1%). Other diagnosis included cellulitis (3%), CCF (3%), and UTI (4%), NSAID induced and obstructive uropathy (2%), diabetic ketoacidosis (1%) and enteric fever (1%). Etiology was unknown among 2% cases.

When blood cultures come back positive, about 19% of patients with mild sepsis, 23% with severe sepsis, and 51% with septic shock get acute renal failure. Patients with acute renal failure alone have a death rate of 45%, but when sepsis is also present, that number rises to 70%. So, a very dangerous medical issue is the coexistence of sepsis with acute renal failure. Twelve to forty-eight percent of individuals with sepsis develop acute kidney injury (AKI), according to previous research. (23)

While 28% of AKI cases were attributed to sepsis in one study, 22% to Bouchard et al., and 28% to Ravindra et al. In contrast to earlier investigations, V. Jha et al. found 26%.(15,16,19)

The world's most important zoonosis is leptospirosis. The majority of patients are young males. Acute kidney injury (AKI) in leptospirosis can be caused by a number of things, such as the leptospira's direct nephrotoxic effect, high blood bilirubin levels, muscle breakdown, and low blood volume. Acute kidney damage (AKI) caused by leptospirosis is rare in industrialized nations. But leptospirosis is a major cause of AKI in tropical nations where it is endemic. From 10% to 60% of patients of leptospirosis experience AKI.

This study's 2.9% rate of AKI due to UTI is comparable to that of Hou et al. and Nash et al. (50,58), which similarly found 2.3% and 2.1% of UTIs, respectively, related with UTIs.(24,25)

AKIN Staging, Dialysis And Outcome

In present study out of total patients, 66% had stage II AKI, while 34% had stage III AKI according to AKIN staging. No age and gender difference were observed in the distribution of patients according to AKI stage ($p>0.05$). Mortality was significantly associated with advance stage of AKI (7.6% v/s 38.2%, $p<0.001$)

A prospective study was conducted by Neveu et al. with 345 patients who were diagnosed with acute renal failure. Patients with sepsis had significantly higher mortality (74.5 percent vs. 45.2 percent, $P<0.001$) and an increased need for mechanical ventilation (70 percent vs. 47 percent, $P=0.001$). Ravindra et al. found that individuals with AKI caused by sepsis had a higher mortality rate (48% vs. 21%; $p< 0.01$) compared to patients without sepsis. Dialyzing patients with sepsis was more common than in patients without sepsis (70 vs. 50%; $p<0.01$).(19,26)

Using the AKIN criteria for AKI patient staging, we discovered that the death rate increased as AKI severity increased. The mortality rate in our group was 2.2% for AKIN stage 2 and 8.7% for AKIN stage 3. In stages I, II, and III, respectively, Anupama Kaul discovered a mortality rate of 8.75%, 19.3%, and 21.2%. According to Hoste et al., the mortality rates were 8.8%, 11.4%, and 26.3%. In their study, Yi Fang et al. found that 7% of patients with AKIN stage 1, 49.5% with stage 2, and 66.7% with stage 3 died.(19,27,28)

CONCLUSION

AKI has a multifactorial etiology, with outcomes influenced by AKIN stage and timely intervention. Identifying high-risk patients can aid in early diagnosis and management, improving survival rates. Further large-scale studies are recommended for better understanding and prevention strategies

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