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Etiology incidence and outcome of acute Kidney Injury inthe Intensive Care Unit from a tertiary care center from north India.

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Abstract

Background: Acute kidney injury (AKI) is a frequent clinical condition with a diverse etiological nature. It complicates around 5% of hospital admissions and 30% of hospitalizations to intensive care units (ICU). The present prospective observational study was objectively conducted to find the incidence, etiology and outcome of acute kidney injury in patients admitted in ICU. **Materials and methods:** This prospective observational study was conducted at SMHS, Hospital, an associated hospital of GMC Srinagar after approval by Institutional Ethical Committee. It was a prospective hospital based study of all cases, who developed AKI in ICUs from November (2018)-June (2020). **Results**: We assessed the distribution of AKI patients as per RIFLE scoring and observed that category; R, I and F was evident in 9(14.3%), 34(54%) 20(31.7%) patients respectively. None of the patients were found in L and E category. We observed that majority of patients accounting for 38(60%) had sepsis etiology, followed 20(31.7%) with hypovolemic shock etiology, 3(4.8%) had GN and 2 (3.2%) had drug etiology. **Conclusion:** Acute kidney injury, a major issue in ICUs, significantly affects mortality and morbidity. In our ICU, the incidence of AKI was 9.7%. The present study revealed that pre-renal sepsis (60.3%), hypovolemic shock (31.7%), glomerulonephritis (4.8%), and toxin-induced (3.2%) were the predominant causes of AKI. Incidence of mortality was 41.3%. It was found that higher mortality and a longer length of stay in the ICU were both related to rising AKI severity.

Keywords: acute kidney injury, intensive care unit, dialysis, renal replacement therap

Introduction

The clinical state known as acute kidney injury (AKI) is characterized by a sudden drop in glomerular filtration rate (GFR) that is sufficient to reduce the clearance of nitrogenous waste products (urea and creatinine) and other uremic toxins. In intensive care unit (ICU) patients, the mortality rate of AKI ranges from 50 to 80%, and it has not greatly decreased since the acute dialysis therapy's early notable benefits. AKI independently raises morbidity and mortality, even when multiple system organ failure (MSOF) and other comorbidities contribute to its high mortality rate. Systems for assessing the severity of an illness that are particular to AKI have been proven to predict prognosis in ICU AKI, taking into account both the degree of renal failure and any accompanying MSOF.[1,2] Acute kidney damage (AKI), which affects millions of patients worldwide and increases the chance of developing chronic kidney (CKD) disease, is increasingly recognized as a serious health issue. It is typical in severely ill patients and frequently identified in conjunction with other acute illnesses. AKI plays a significant role since it is closely linked to increased healthcare expenses, unsatisfactory results, and decreased quality of life after discharge. Depending on the degree, AKI has a wide range of effects and prognoses.[3] The simplest approach to define AKI is as a sudden decline in glomerular filtration rate (GFR), which causes metabolic waste products to be retained and the homeostasis of fluid, electrolytes, and acid-base to become dysregulated. Acute parenchymal injury leading to glomerular, interstitial, tubular, or vascular dysfunction, as well as hemodynamic disturbances that impair normal renal perfusion and lower GFR without overt parenchymal injury, are all components of the

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heterogeneous syndrome known as AKI. Over 50% of patients in the ICU are thought to experience AKI at some point during their critical illness, which is regarded to be a significant increase over what was previously thought. AKI and multi-organ failure have been linked to a higher than 50% mortality rate in ICU patients.[4-6] The original injury and subsequent activation of inflammation and coagulation interact intricately to cause the development of AKI. Recent experimental and clinical results contest the common wisdom that renal ischemia-reperfusion is a prerequisite for the onset of AKI. Loss of renal function can happen even in the absence of histology evidence of tubular necrosis or injury. AKI has several negative consequences beyond its conventional, well-known symptoms like fluid excess and electrolyte imbalances. AKI can also result in issues that are difficult to recognize at the bedside and that persist long after the patient leaves the ICU, such as CKD progression and compromised innate immunity. There is evidence from experimental and small observational studies that AKI reduces (innate) immunity and is linked to greater infection rates.

Preventing AKI is the best form of treatment. Cardiovascular function should be improved and intravascular volume deficiencies should be repaired in patients with prerenal azotemia. Treatment for obstructive (postrenal) kidney disease involves mechanical unblocking.

The main treatment for acute interstitial nephritis is to stop using the trigger. Renal replacement treatment (RRT) is now more commonly used as a support system than only as a life-saving intervention. Even though each modality has advantages, indications, and contraindications of its own, continuous approaches are preferred when treating critically ill patients. The present prospective observational study was objectively conducted to find the incidence, etiology and outcome of acute kidney injury in patients admitted in ICU

Material and methods

After receiving institutional ethical committee approval, this prospective observational study was carried out at SMHS Hospital, an associated hospital of GMC Srinagar. All cases who experienced AKI in ICUs between November 2018 and June 2020 were included in this study. The workup included a thorough history and physical examination of the patients, as well as their

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informed permission. At the time of admission and throughout their stay in the ICU, patients' vital statistics, including GCS, HR, BP, CVP, and MAP, were recorded. The following baseline tests were completed: ABG, CBC, KFT, LFT, ECG, and X-ray chest. Blood, urine, and endotracheal tube tip cultures were provided as part of the septic profile. Demographic information, information on co-existing diseases, and parameters to assess sequential data regarding the supportive measures given were also recorded. The following inclusion and exclusion criteria were strictly adopted to eliminate the possibility of heterogeneity and bias thereof.

Inclusion Criteria:

1. All patients who were admitted to the ICU, whether or not they had AKI.

Exclusion criteria

1. Dialysis patients with chronic kidney disease (CKD).
2. People who have had kidney transplants.

Results

There were 648 total admissions to the ICU, of which 63 patients developed AKI. The incidence of AKI was 9.7%. The distribution of age groups was taken between <30 up to ≥ 60. The Mean ± SD (Range) was 46.7±15.62 (21-80) years, with ten patients in the age group < 30, 16 patients in 30-39 age group, 7 patients in 40-49 age group, 19 patients in 50-59 age group and 11 patients beyond 60 years of age with corresponding percentage of 15.9%, 25.4%, 11.1%, 30.2% and17.5%. There were 63 AKI patients in total, with 31 males and 32 females, representing 49.2% and 50.8% of the total. Hypertension, diabetes, and hypothyroidism were existing comorbidities in AKI patients. However, there were 27, 18, and 10 individuals who acquired hypertension, hypotension, diabetes mellitus, and hypothyroidism, respectively, with corresponding incidence rates of 42.9%, (54%), 28.6%, and 15.9%. Out of 63 patients with AKI 19 (30.2%) patients had IUDs with sepsis, 18 (28.6%) had head injuries from RTAs, 12 (19%) had previously undergone surgery for CNS tumors', 8 (12.7%) had intestinal obstructions, and 6 (9.5%) had pancreatitis. Out of 63 AKI patients 40 (63.5%) needed ventilator support, and 58/63 (92.1%) had pre-renal pathology and 5 (7.9%) had renal pathology.

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Table 1: Distribution of AKI patients as per RIFLE category

RIFLE Category	No. of Patients	Percentage
R	9	14.3
I	34	54.0
F	20	31.7
L	0	0.0
E	0	0.0
Total	63	100

We assessed the distribution of AKI patients as per RIFLE scoring and observed that category; R, I and F was evident in 9(14.3%), 34(54%) 20(31.7%) patients respectively. None of the patients were found in L and E category.

Table 2: Distribution of study patients as per etiology of AKI

Etiology	No. of Patients	Percentage
Sepsis	38	60.3
Hypovolemic Shock	20	31.7
GN	3	4.8
Drug	2	3.2
Total	63	100

The etiology of the studied patients was evaluated, and it was evident that majority of patients accounting for 38(60%) had sepsis etiology, followed 20(31.7%) with hypovolemic shock etiology, 3(4.8%) had GN and 2 (3.2%) had drug etiology.

Out of 63 patients, 26 (41.3%) expired and rest of the patients 37(58.7%) were discharged. Dialysis was needed in (43/63, 68.3%).

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Table 3: Distribution of outcome of study patients as per etiology of RIFLE classification

Outcome	Risk, n=9		Injury, n=34		Failure, n=20		P-value
	No.	%age	No.	%age	No.	%age	
RRT	0	0	25	73.5	18	90	<0.0001*
Mortality	1	11.1	8	23.5	17	85	<0.0001*

Table No. 3 reflects that there were 9 patients in the Risk category, 34 in the Injury category, and 20 in the Failure category. Around 25 (73.5%) patients in the Injury category and 18 patients (90%) in the failure category needed renal replacement therapy. None of the patients who fell into the risk category needed renal replacement treatment. According to RIFLE criteria, death was seen in the Risk category at 11.1%, in the Injury category at 23.5%, and in the Failure category at 85%.

Table 4: Showing total duration of ICU stay among AKI patients with respect RIFLE classification

Outcome	Risk, n=9		Injury, n=34		Failure, n=20		P-value
	No.	%age	No.	%age	No.	%age	
<7 days	7	77.8	6	17.6	0	0	<0.0001*
7-14 days	2	22.2	28	82.4	2	10	
> 14 days	0	0	0	0	18	90	

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There were 7 (77.8%) patients in the Risk category, 6 (17.6%) in the Injury category, and none in the Failure category who had an ICU stay of fewer than 7 days. Patients with 7 – 14 days stay in Risk Category were 2 in number, in Injury category were 28 in number and in Failure category were 2 in number. Patients with more than 14days stay were only seen in Failure category, with a number of 18 (90%) patients.

Discussion

In the present study, the incidence of AKI in ICU was 9.7%. The age ranges of (30-39) and (50-59) years saw the highest incidence. In a likewise study by Cruz DN et al, the authors reported the incidence of AKI patients as 10.8%, which is exactly same to what the present study found.[7] Another cohort study due to Gammelager H et al, the incidence of likewise patients was reported as 15.6%, which in consonance with our study.[8] Bagshaw et al in a multi-centric study evaluated the early acute kidney injury among critically ill trauma patients and found the incidence of AKI patients as 18.1% which is almost twice to what we observed. [9]According to studies, the incidence of AKI in ICU patients ranges from 2% to 92%. The implementation of varied classifications, including RIFLE, AKIN, and KDIGO, can be attributed for the diverse incidence rates. In our study, pre-renal disease accounted for 92.1% and renal disease accounted for 7.9% of the patients who developed AKI in the intensive care unit. Sepsis (60.3%), hypovolemic shock (31.7%), glomerulonephritis (4.8%), and toxin-induced (3.2%) were identified as the causes in our investigation. In a similar kind of study by Mohsenin V et al, the researchers came to the conclusion that prerenal conditions like fluid volume deficit, sepsis, or acute tubular injury account for the majority of cases of AKI.[10] Prerenal causes (38.0%) and sepsis (25.6%) were found to be the two most often mentioned causes of AKI in a research of a similar nature conducted by Cruz DN et al. in 2007.[11] In their study, Eswarappa M et al found that sepsis, followed by respiratory infections and diabetic foot, was the most common cause of AKI while the most common source of sepsis was a urinary tract infection.[12] In their investigation, gastroenteritis ranked as the second most typical cause of AKI while as surgery, hepatitis, and cardiac disease made up the other three main causes of AKI.[12] In a related study, Jiang L et al came to the conclusion that the top three reasons were poor cardiac output (20.5%), sepsis upon ICU admission (22.2%), and hypovolemia (25.4%).[13]In our study, 68.3% of patients needed dialysis, while 63.5% of patients needed ventilatory assistance. 90% of patients in the Failure

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class of RIFLE and 73.5% of those in the Injury class of RIFLE both required dialysis. Mortality overall was 41.3%. Mortality was found to be 11.1% in the RIFLE's Risk class, 23.5% in its Injury class, and 85% in its Failure class. Mortality was found to be 11.1% in the RIFLE's Risk class, 23.5% in its Injury class, and 85% in its Failure class. For predicting outcome in critically ill patients, Chang CH et colleagues examined the AKIN and RIFLE classifications.[11] A total mortality rate of 60.8% (177/291) was discovered. Based on the severity of the AKIN and RIFLE categorization, the increased mortality was progressive and considerable. Their study's mortality directly relates to the findings of our investigation.[11] According to a study by Hoste EAJ titled "RIFLE criteria for acute renal injury are linked with hospital mortality in critically sick patients," Renal replacement therapy was only given to less than 1% of patients with maximum RIFLE class Injury and 14.2% of patients with maximum RIFLE class Failure. [14] Hospital mortality rates for patients with the highest RIFLE classes of Risk, Injury, and Failure were 8.8%, 11.4%, and 26.3%, respectively, compared to 5.5% for patients without acute renal injury.[14] In a likewise study by Hashemian SMR et al, the authors concluded that although there was an average ICU death rate of 7% over the study period, patients who had AKI had a mortality rate of 19.8%.[15] Their investigation found a substantial correlation between AKI and ICU mortality, which was in line with other studies' findings. They reported an excellent (93% sensitivity) correlation between AKI and death. It is challenging to compare our findings to those from other research that employed various standards, which highlights the demand for a consistent diagnosis of AKI that can precisely predict patient outcomes. It is challenging to compare our findings with those of other research that employed different standards, which highlights the necessity for a consistent diagnosis of AKI that can precisely predict patient outcomes

Conclusion

Acute kidney injury, a major issue in ICUs, significantly affects mortality and morbidity. In our ICU, the incidence of AKI was 9.7%. According to studies, the incidence of AKI in ICU patients ranges from 2% to 92%. Prior to the establishment of the RIFLE and AKIN classifications, AKI in the ICU had been challenging to investigate due to inconsistent definitional criteria. The progressive rise in the prevalence of AKI may be partially attributed to better detection. Furthermore, the incidence of AKI is typically underestimated by doctors due to the sensitivity of the AKI definitional criteria. The present study revealed that pre-renal sepsis (60.3%),

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hypovolemic shock (31.7%), glomerulonephritis (4.8%), and toxin-induced (3.2%) were the predominant causes of AKI. Incidence of mortality was 41.3%. It was found that higher mortality and a longer length of stay in the ICU were both related to rising AKI severity. Injury and failure of the maximum RIFLE class were both linked to greater mortality. Evidently, he mortality was unaffected by coexisting diabetes and hypertension.

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