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Clinical Spectrum and Outcome of Patient with Acute Kidney Injury- A Hospital Based Study from North East India

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Abstract **Original Research Article**

Little is known about the epidemiological character of Acute Kidney Injury (AKI) from North East part of India so this study was carried out to know the epidemiology, clinical characteristics, aetiologies, severity and outcome of the AKI patients. This prospective observational study was conducted at Regional institute of Medical Sciences (RIMS) Hospital, Imphal during September 2015 to August 2017 among the patients admitted with AKI or who developed AKI in-patient in any ward of RIMS Hospital. Patients of 18 years and above, regardless of gender were included in the study. During the study period a total of 304 patients with AKI were found with an incidence of 1.9 % with a male to female ratio of 1.7:1. Mean age of patient was 44.68±13.13 years and the most common age group was 41-50 years (33.5%) in both the sexes. 46.7% of the patient had associated co-morbidities and the most common cause of AKI was sepsis (38.2%). Drugs induced AKI also was common (15.8%) and anti-retroviral therapy (ART) drugs and amino glycoside, were some of offending agents. Intrinsic renal injury was the most common mode of renal injury comprising around 63.2% of the total AKI ($p<0.001$). Based on the RIFLE criteria 42.1% patient landed in Injury (I) category which was closely followed by Failure (F) and Risk(R). Of the total admitted, 21.7% required dialysis while 17.1% expired during the course of illness. 52.6% of the patient recovered completely (<0.001) whereas 30.56% had partial recovery.

Keywords: Acute Kidney Injury, Sepsis, Dialysis, RIFLE criteria, Dialysis.

INTRODUCTION

The incidence of acute kidney injury (AKI) has increased in recent years, both in the community and hospital settings [1, 2]. Seven percent of hospitalised patients and about two-third of patients in intensive care unit develop AKI, often as part of multiple organ dysfunction syndromes [2-4]. It is associated with a high rate of adverse outcomes. Mortality rate range between 25 and 80 percent, depending on the cause and the clinical status of the patient [5, 6]. In India, it is the most common renal emergency and as many as 1.5 percent of hospital admissions are referred to nephrology service for AKI [7, 8].

Geographical, etiological, cultural and economic variations determine the dissimilarities among patterns of AKI in different geographical regions of the world. Detection of the incidence, aetiology and outcome of AKI is important for planning the preventive and therapeutic strategies, identifying patients to avoid renal replacement therapy (RRT) as well as comparison of epidemiological studies for improvement in the clinical decision making[9].

However, literature on AKI is sparse from this North-Eastern part of the country. Hence, this prospective study was conducted at Regional Institute of Medical Sciences (RIMS), Imphal which is one of the largest tertiary care hospitals in the north-eastern region of India catering a large segment of population from neighbouring states and some part of Myanmar to study the clinical profile, aetiology and outcome of patients with AKI considering the limited regional data available, the fallacies of retrospective studies and the regional variations in the profile of AKI.

MATERIALS AND METHODS

This study was conducted after taking institutional ethical approval during the period September 2015 to August 2017 among the patients admitted with AKI or who developed AKI in-patient in any ward of the hospital. Patients of 18 years and above, regardless of gender that fulfilled the RIFLE

criteria of AKI based on creatinine were included in the study [10]. Patients with pre-existing renal disease, acute on chronic kidney disease, AKI in pregnancy and patients who were unwilling to participate in the study were excluded from the study.

Some of working definitions used in the study include

- AKI was defined using the RIFLE classification based on serum creatinine values at or during hospital admission[10].
- 'Volume loss' was defined as any obvious cause of volume depletion (e.g. vomiting, diarrhoea, haemorrhage) with loss of skin turgor with decreased in weight by more than 5%.
- 'Renal hypo-perfusion' was defined as documented decline in blood pressure to <90/60 mm Hg, evidence of congestive heart failure, signs of volume depletion and improvement with appropriate treatment[11].
- 'Sepsis' was defined as two or more of the following as a result of proven or suspected infection: temperature >38 or <36 degrees Celsius, heart rate >90/min, respiratory rate >20/min and total leucocyte count >12,000/mm^3 or <4000/mm^3 or >10% band forms [12].
- 'Nephrotoxic drug' was defined as a drug with known or unknown nephrotoxic potential if received by a patient for a minimum of two days prior to the defined increase in serum creatinine level [7].

All patients were followed up till the time of discharge or death whichever was earlier. Patients were classified into one of the RIFLE class based on peak serum creatinine level. Renal replacement therapy (RRT) was instituted according to case specific clinical and laboratory indications. Renal biopsy was done wherever necessary. Outcomes in this study were measured in terms of: (1) length of hospital stays (LOS) – defined as the number of days from admission to discharge, death or left against medical advice from hospital, and (2) treatment outcome: dead or discharged with improved renal function. Complete recovery was defined as coming down of the serum creatinine to <1.5 mg/dl along with improvement in urine output during the hospital stay. On the other hand, partial recovery of renal function was defined as the improvement in renal function (as determined by an increase in urine output and a decrease in serum creatinine) but serum creatinine levels still >1.5mg/dl at the time of discharge from the hospital.

Variables were reported as mean ± SD. Statistical calculation was done using Analysis of Variance (ANOVA),Chi-square test etc. wherever appropriate . $P < 0.05$ was considered significant. All the calculations were carried out with the help of software SPSS16 version.

RESULT

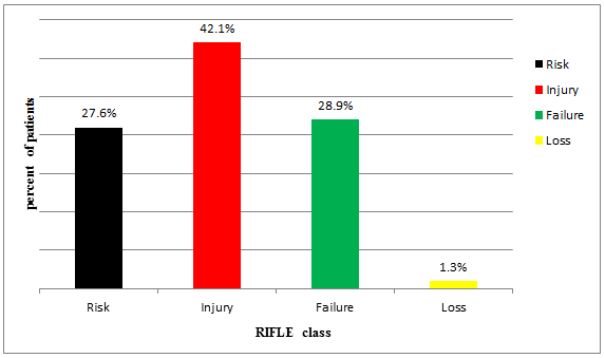
During the study period a total of 304 patients with AKI were identified giving an incidence of 1.9 %.

Table -1 shows the demographic profile of the study population. Of the total 304 patients, 63.15% were male and 36.84% were female with a male to female ratio of 1.7:1 but that was statically not significant (p<0.143). The age of the study population ranged from 18 to 76 years with a mean age of 44.68±13.13 years and median age of 46 years. The most common age group was 41-50 years (33.5%) in both the sexes. 46.7% of the patient had associated co-morbidities of which diabetes and chronic liver disease (CLD) were the commonest (Table-2).4.6 % of patient had chronic obstructive airway disease(COAD), congestive cardiac failure (CCF) and hypertension (HTN) each. Collagen vascular disease like systemic lupus erythromatosis (SLE), rheumatoid arthritis etc. also were present as comorbidities in 1.3% of patients. The cause of AKI was multiple in many cases but the most common cause was sepsis (38.2) (Table-3). Among the causes of sepsis lower respiratory tract (32%) and genitor-urinary tract (30%) infection were the most common sources of infection. Acute gastroenteritis (AGE) leading to volume loss and AKI was found in 7.5% of patient. Other causes of volume loss AKI were gastro-intestinal (GIT) bleeding, burn, post obstructive diuresis etc. (7.0%). Infection with scrub typhus and leptospirosis was also found in 2.3 % each of the patient whereas malarial AKI was not found in this study. Poisoning associated AKI was found in 1.5% of the study population. Drugs induced AKI also was very common (15.8%) and anti-retroviral (ART) drugs, amino-glycoside, and contrast agents were some of offending agents. Among the ART tenofovir was the most common drug (33.3%) which precipitates AKI. Intrinsic renal injury was the most common mode of renal injury comprising around 63.2% of the total AKI (p<0.001) followed by pre-renal and post renal respectively. Out of the intrinsic renal injury acute tubular necrosis (ATN) was the most common type of intrinsic injury (85%) followed by acute interstitial nephritis (AIN) (8%). Most of the patient in pre renal conditions includes AGE, patients with hepatorenal syndrome and traumatic patient etc. The most common cause of post renal cause of AKI was renal calculus related (90%) followed by prostatic and cervical growth.

Based on the RIFLE criteria 42.1% patient landed in Injury(I) category which was closely followed by Failure(F) and Risk(R) (Figure -1)(Table-4).

Of the total admitted patients, 21.7% required dialysis but significant number of patient recovered without dialysis (p<0.001) and significant number of patients (68.42%) (p<0.001) were discharged from hospital in less than 10 days while 17.1% expired during the course of illness (Table-5). 52.6% of the

patient recovered completely (<0.001) whereas 30.56% had partial recovery means recovering and not requiring dialysis at the time of discharge.



Graph-1: Showing the different categories of AKI in RIFLE criteria

AKI=Acute Kidney Injury

Table-1: Age and sex distribution of AKI patients (n=304)

Age group	Male No. (%)	Female No. (%)	Total No. (%)	P-value
<30	30(9.86)	20(6.57)	50(16.4)	P<0.14
31-40	34(11.18)	26(8.55)	60(19.7)	
41-50	60(19.73)	42(13.81)	102(33.5)	
51-60	44(14.47)	18(5.92)	62(20.4)	
61-70	14(4.60)	2(0.65)	16(5.3)	
71>	10(3.28)	4(1.31)	14(4.6)	
Total	192(63.15)	112(36.84)	304(100)	

AKI=Acute kidney injury

Table-2: Comorbidities pattern in AKI

Co-morbidities	No.	%
Hypertension	14	4.6
Diabetes mellitus	40	13.2
Hypertension+ Diabetes mellitus	12	3.9
Collagen vascular disease	4	1.3
COAD	14	4.6
CCF	14	4.6
CLD	30	9.9
CVA	8	2.6
Malignancies	6	2.0
No –comorbidities	162	53.3

AKI=Acute kidney injury, COAD=Chronic Obstructive Airways Disease: CCF= Congestive cardiac failure: CLD= Chronic liver disease: CVA=Cerebrovascular accident

Table- 3: Characteristics of AKI (n=304)

Causes of AKI	No.	%	
Sepsis	116	38.2	
Volume loss	44	14.47	
Drugs	48	15.8	
Hypo-perfusion	38	12.5	
Glomerulonephritis	10	3.28	
Obstructive cause	30	9.8	
Miscellaneous	18	5.9	
Mechanism of injury			
Pre-Renal	82	27	P<0.001
Intrinsic renal	192	63.2	
Post Renal	30	9.9	

AKI=Acute kidney injury

Table-4: AKI Based on RIFLE criteria (n=304)

RIFLE-Categories	No.	%
Risk	84	27.6
Injury	128	42.1
Failure	88	28.9
Loss	4	1.3
ESRD	0	0

AKI=Acute kidney injury: ESRD=End Stage Renal Disease

Table- 5: Treatment given and outcome of AKI patients. (n=304)

Parameters	No.	%	p-value
Dialysed	66	21.7	P<0.001
Not dialyzed	238	78.27	
Complete recovery	160	52.6	P<.001
Partial recovery	92	30.56	
Dead	52	17.10	
< 10 days of hospital stay	208	68.42	P<0.001
>10 days of hospital stay	96	31.57	

DISCUSSION

AKI is a very important public health problem with great impact on mortality and morbidity of the patients. The epidemiological characteristics of AKI are different depending on the various local and regional factors as well as the status of the health care facilities available.

In the study we found that the incidence of AKI was 1.9% which was much higher than other studies like Jha *et al.* [13] (0.64%) and Noronha *et al.* (0.79%) [14]. But our finding was quite comparable to other studies where incidence was between 2.38-2.5% [15-17]. This variation in incidence may be due to the difference in the definition used, cohort of the study population and other local factors like status of health care facilities, educational status of the people etc. In this study we took the data only form hospitalized patient whereas many patients with AKI doesn't required hospitalisation.

In this study incidence of the AKI was more in male compared to female (63.15% vs 36.84%)though it was not statistically significant (p<0.143). Our finding is in accordance with the other studies [18, 19]. This higher incidence in male could be due social factor like

male dominancy in society which makes more likely to expose to adverse environments, more treatment seeking attitude of male gender and a bit of neglected attitude by the society towards female gender by not encouraging or giving proper guidance to get proper medical care. It is true especially for our social structure and low rate of literacy and other social taboo.

We also found that the incidence of the AKI was more common in the younger age group (41-50) with a mean age of 46 year as in other studies [20, 21] reflecting the Indian data in contrast to studies from developed countries where mean age of the patient were more than 60 years of age as shown by other studies [2, 6]. This difference between the our finding and those studies in developed countries may be explained by the fact that with improvement in life expectancy in developed countries, total share of elder population in society have been significantly increased. These older people have lower reserved kidney function and more likely to undergo diagnostic intervention like angiography which make them more prone to AKI.

We found a high burden of comorbidities in our patients. More than 46% of our patient already have comorbid condition out of which diabetic (13.2%), CLD (9.9%), hypertension (8.5%) were the main conditions. This burden of comorbidities was also noted in other studies [22, 23], but high incidence of CLD (mostly alcohol related) in our study was not reported in other studies. This high burden of comorbidities may be a reflection of socio-cultural habits of the society and the epidemiological transition from communicable to non-communicable diseases.

In our study the most common cause of AKI was sepsis (38.2%) followed by drugs 15.8 % as in other studies [24-26]. Sepsis does not spare any section of human being and any geographical region. In the studies by Bouchard J, *et al.* [27] and Hoste EA *et al.* [28] also found that sepsis, hypovolemia, drugs and ischemia are the most common causes for AKI in high-income countries also and was often associated with other acute organ failures. In our set up among the drugs causing AKI, ART drug is the most frequent offender reflecting the high prevalence of HIV in our society. However in a study by Anvar MI *et al*. [29] another study from India found hypovolemia due to gastroenteritis as the most common cause of AKI whereas another study by Nash *et al*. [2] found decreased renal perfusion because of CCF, cardiac arrest and volume contraction as the most common cause of AKI. This variation in the etiological factors may be due to difference in the cohort of study patients, public health care delivery system status, socioeconomic status etc.

Intrinsic renal injury mostly in the form of ATN was the most common pathological changes ($p<0.001$). A similar result was reported by Said R [30] in a study of 215 patients with AKI in which intrinsic renal injury was responsible for 58% of cases followed by pre-renal factors (28%) and post-renal obstruction (14%). Kapadia MP *et al*. [25] also reported similar results in which 66% of AKI were due to intrinsic renal insult, 26% due to pre-renal factors and rest 8% were due to post-renal obstruction. In a study by Al-Homrany also found ATN as the most common reason for AKI in 62.5% [31].

Based on the RIFLE criteria majority of the patients were in RIFLE-Injury class (42.1%) followed by RIFLE-Failure class (28.9%) and RIFLE-Risk class (27.6%). 4 patients in our study could not recover and went into RIFLE-Loss class with persistent renal dysfunction for more than 4 weeks. A previous study by Kapadia *et al*. observed contrasting results in which RIFLE-Risk class formed the majority (58%) and lesser patients in RIFLE-Injury class (17%) but RIFLE-Failure class had a comparable number of patients (23%) [25]. This could be explained by the fact that our patients perhaps presented to the hospital at a late and more advanced stage of the primary disease because of lack of proper transport system and other local factors like inadequate health services at peripheral area as mostly are hilly area.

In this study a significant number of patient recovered without dialysis (78.24 %, $p<0.001$). This finding was in accordance with many previous studies where conservative treatment was sufficient in 60- 83% of cases [25, 29, 30, 32]. However in a study by Gullipali P *et al*. [26] in female AKI patients found around 96% patient needed dialysis. Similarly in an observational cohort study carried out by Daher EF *et al*. [33] to investigate the differences in community acquired AKI, hospital acquired AKI and intensive care-acquired AKI in patients found that intermittent haemodialysis was required in 68% of cases. These variation in the incidence explained that the need for RRT depend on the composition of study cohort, the origin of AKI, the hospital setting, and local or institutional criteria for dialysis in addition to the standard criteria for initiation of dialysis.

In our study the recovery of kidney function was complete in majority (52.6%) and in a significant number ($p<0.001$) and most of the patient was discharged in less than 10 days ($p<0.001$). It is similar with that of other studies like Goswami *et al*. [34] and Biradar V *et al*. [35] where recovery was found in around 59% of patients.

A mortality rate of 17.1% was observed in this study which is comparable with other studies where mortality rate ranges from 7% -21% [25, 32, 36, 37]. In contrast, in a study by AL Homrany [31] found a mortality of 40% and another study by Effa EE *et al*. [24] also found a higher mortality rate (31%). T his variation in mortality can be explained by the fact that

most of mortality are related to the underlying basic disease, presence or absence of co-morbidity, nature of study cohort and status of health facility though it is influenced by the presence of AKI.

CONCLUSION

AKI is an increasingly common and potentially serious complication in hospitalized as well as in community acquired AKI patients and it is common in this part of the country also. It is more common in the middle-aged group who had associated medical co-morbidities. Sepsis as a result of lower respiratory and urinary tract infection formed majority of the cases followed by ART induced AKI in this region. Though not all the patients required dialysis and most of the patients recovered, presence of AKI definitely increases mortality and morbidity of the patient. Frequent epidemiological studies are needed to devise preventive and management strategies for this condition to limit the risks to susceptible individuals. Early recognition and timely nephrology intervention of AKI can lead to a better outcome.

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