

## PREVALENCE OF ACUTE KIDNEY INJURY IN ICU PATIENTS

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### Summary

*Acute kidney injury (AKI) is common in the intensive care unit (ICU) and is associated with significant morbidity and mortality. This study is aimed to estimate the prevalence of AKI in ICU and assess its relation with different indication of ICU admission and duration of hospital stay. It was a cross sectional study done in the Intensive Care Unit (ICU) of Chittagong Medical College Hospital (CMCH), in the period of six months from 08/07/2012 to 07/01/2013. Hundred consecutive admitted patients in the ICU were taken as study subject and Acute Kidney Injury Network (AKIN) criteria was applied to evaluate the acute kidney injury among the admitted patients. The total number of ICU patients taken in the study were 100. Among them, 62 (62%) patients were male and 38(38%) of the patients were female. Male to female ratio was 1.6:1. 52(52%) came from urban areas and 48(48%) came from rural areas. Regarding the age distribution of total 100 patients age range was 22 to 81 years. The mean  $\pm$  SD was  $53.90 \pm 14.502$  years. Among the 100 patients majority were illiterate to primary level educated which were 42(42%). Maximum were in the income group 10,000-20,000 TK/month which is 45(45%). Among all patients housewives were found in 28(28%) cases, followed by retired from service, service holder and businessman in 20(20%), 12(12%) and 16(16%) cases respectively. Regarding analysis of causes of ICU admission respiratory failure was 31% which was highest, then 13% cases were stroke, 12% were septic shock and accidental injury each, postoperative complications were 8%, poisoning was 7%, GBS was 5%, hepatic encephalopathy was 7% and others was 5%. Among the 100 ICU patients, 28(28%) were found to have AKI.*

*Among them, most of the patients (21.4%) of respiratory failure had AKI, next to it was accidental injury (17.8%), postoperative patients(14.2%), septic shock (14.4%), hepatic encephalopathy(10.7%), poisoning (7.2%) and stroke (3.6%). Regarding the renal function tests the mean  $\pm$  SD of blood urea was  $46.64 \pm 18.19$  mg/dl and it was  $2.38 \pm 1.7$ mg/dl for serum creatinine. Out of 100 patients 57(57%) were ventilated and 43(43%) were not ventilated. Among the 57 ventilated patients 23(40.4%) had AKI and among the 43 non ventilated patients 4(11.6%) had AKI. Distribution was statistically significant ( $p < 0.05$ ). Among the 100 patients who stayed less than 5 days in the hospital( $n=29$ ) had AKI 24.1% of patients, who stayed 5-10 days( $n=41$ ) had AKI among 29.4% patients and who stayed  $>10$  days( $n=20$ ) had AKI 30% of patients. Distribution of the AKI according to different duration of hospital stay was statistically significant ( $p < 0.05$ ) The prevalence of AKI in the ICU CMCH, according to AKIN criteria is 28%. Early intervention is essential to overcome the development of overt renal failure.*

### Key words

Acute kidney injury; ICU; ventilation.

### Introduction

The care of critically ill patients in the intensive care unit (ICU) is a primary component of modern medicine. ICUs create potential for recovery in patients who otherwise may not have survived. However, they may suffer from problems associated with nosocomial infections, different organ failure like kidney, liver, heart and brain [1].

Deterioration of renal function like acute kidney injury (AKI) previously called ARF is a relatively common complications of hospitalized ICU patients and is associated with a high morbidity and mortality [1,2]. AKI is a syndrome of multiple etiologies, usually approached diagnostically as pre-renal, post-renal, or intrinsic AKI. Implicitly, AKI is a measurable decline in renal function occurring over a short period of time, often during the course of a hospitalization [2]. There is, however, no universally accepted definition of AKI, making it difficult to compare different studies of therapy or outcome [3].

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Numerous recent studies of relatively severe, usually intrinsic, AKI primarily due to some form of acute tubular necrosis, have documented that outcomes are related both to severity of AKI and also to the severity of co-morbid conditions [4,5]. A variety of illness stratification systems have been employed to analyze the impact of overall co-morbidity on outcome of severe AKI and it is clear that co-morbidity has a major, possibly overriding, influence on mortality in severe AKI [6,7]. For example, isolated AKI, in or out of the intensive care unit (ICU), has a much better prognosis than AKI associated with multiple organ failure [8].

### Materials and method

**Study design:** This was a cross sectional study done in the department of ICU and Department of Biochemistry of CMCH in a six month period from 08/07/2012 to 07/01/2013. Patients admitted in the ICU during the study period and fulfilling the inclusion and exclusion criteria provided given informed written consent. Purposive sampling was done and a total of 100 consecutive cases admitted in the ICU were enrolled in this study

#### Selection criteria

##### Inclusion criteria

1. Patients admitted in ICU.
2. ICU stay should be more than 48 hours
3. Serum creatinine normal at ICU admission

##### Exclusion criteria

1. Patients having known documented renal disease.

#### Operational definition

**1. ICU [9] :** An Intensive Care Unit (ICU) are staffed and equipped to allow management of the sickest patients who require invasive ventilation, multimodal monitoring and multiorgan system support.

**2. Acute Kidney Injury [2] :** An abrupt(within 48 hours) decline in kidney function defined as

- An absolute increase in serum creatinine of 26.4 mol/l(0.3mg/dl).
- A percentage increase in serum creatinine of 50%(1.5 fold from base line).
- A reduction in urine output(Documented oliguria of <0.5ml/kg for >6 consecutive hours.

#### Procedure of the study

All patients who admitted in ICU were primarily screened for exclusion and inclusion criteria. Then patients or attendants of the patients were asked to give written consent and after getting it they were primarily enrolled in the study. From all eligible subjects clinical history was taken and clinical examination was done to elicit findings related to kidney and its complication. 5 ml of venous blood was collected and sent for analysis of serum creatinine, blood urea. Test were done by autoanalyzer (HUMANA) by Kinetic methods.

Fresh urine sample was also collected from all patients for analysis which was mid stream clean catch. Those who had Foley Catheter in situ urine was collected after putting a test tube in the distal catheter end to avoid contamination error. Urine output was also observed. All investigation was done in the Department of Biochemistry and Department of Clinical Pathology of Chittagong Medical College Hospital. All relevant data were noted in the pre tested data sheet. All data were checked and rechecked to avoid error. Data was collected by the researcher himself.

#### Informed consent

Informed consent was taken from the patients or eligible attendants.

#### Ethical clearance

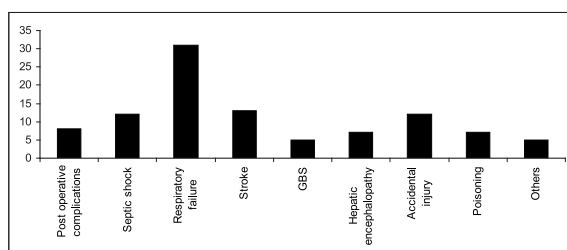
1. The study was approved by the Departmental committee.
2. Informed written consent was taken from the study participants or their legal guardian .
3. Confidentiality of all given information were ensured.
4. The study would not cause any harm or involve any additional burden to the respondents except their time.

#### Results

Among the 100 study patients results were found as shown below

**Table I:** Sociodemographic data.

Variables	Frequency	Percentage
Sex		
Male	62	62%
Female	38	38%
Age Group*		
<20	2	2%
20-40	21	21%
40-60	23	23%
60-80	45	45%
>80	9	9%
Locality		
Rural	48	48%
Urban	52	52%
Educational qualification		
Illiterate to primary	42	42%
Secondary	28	28%
Higher secondary	24	24%
Graduate and above	6	6%
Monthly income		
<5,000/-	12	12%
5,000-10,000/-	26	26%
10,000-20000/-	45	45%
>20,000/-	17	17%
Occupation		
House wife	28	28%
Service holder	12	12%
Business	16	16%
Cultivation	6	6%
Day labor	6	6%
Student	4	4%
Unemployed	8	8%
Retired person	20	20%



**Fig I :** Indications of ICU admission.

**Table II :** Distribution of AKI according to type of disease (n=100).

Type of disease	AKI(n)	Percent
Postoperative patients	4	14.2%
Respiratory failure	6	21.4%
Septic shock	4	14.2%
Stroke	1	3.6%
GBS	0	0%
Hepatic encephalopathy	3	10.7%
Poisoning	2	7.2%
Accidental injury	5	17.8%
Others	3	10.7%

**Table III :** Mode of treatment and AKI.

Mode of treatment	AKI	No AKI	Total**
Ventilated	23	34	57(57%)
Non ventilated	5	38	43(43%)
Total	28(28%)	72(72%)	100(100%)

\*\* P<0.05, Results are statistically significant (Chi-square test)

**Table IV :** Relation of AKI with hospital stay.

AKI	Duration of hospital stay**		
	<5 days(%)	5-10 days(%)	>10 days(%)
Present	7(24.1%)	15(29.4%)	6(30%)
Absent	22(75.9%)	36(70.6%)	14(70%)

\*\* P<0.05, Results are statistically significant (Chi-square test)

## Discussion

AKI in the ICU is common, increasing in incidence and is associated with a substantial increase in morbidity and mortality. So we sought to estimate the prevalence of AKI in ICU in a tertiary care hospital situated in the southern part of Bangladesh.

In the present study 100 consecutive patients of critically ill patients admitted in the ICU was taken as study subject. Male patients were 62% and female were 38%. Male to female ratio was 1.6:1. A study done by Lopes et al. found in their study that male patients were 59.2%. As female patients has less access to the hospital care in Bangladesh due to cost of ICU and socio cultural factors so the number is less in the present study.

Regarding the age group of patients where most of the patients included were 60-80 years of age. The Mean  $\pm$  S D of age of the patients in our study was  $53.90 \pm 14.502$  years. The findings are consistent with the study done previously by Lopes et al and Kellum [9,10]. As most of the critically ill patients admitted in ICU are adult and also there are no ventilator support for neonate or younger children such age distribution was found in the present study.

Most of the patients (45%) came from average socioeconomic status(10,00-20,000) taka per month). In ICU of CMCH patients have to pay but that is affordable to the middle class population so such socioeconomic status is acceptable in the present study. Regarding analysis of occupation various classes were found service to farmer and house wife to students. and literacy rate was low among the study population. This scenario represent the socio-demographic status of Bangladesh though it might not be the actual one, as sample size was small and sampling technique was purposive.

The prevalence of AKI in the ICU was found 28%, classified by AKIN criteria. Out of 100 patients 57(57%) were ventilated and 43(43%) were not ventilated. Among the 57 ventilated patients 23(40.4%) had AKI and among the 43 non ventilated patients 4(11.6%) had AKI. Distribution was statistically significant (p<0.05). Nearly similar results obtained by Bagshaw et al who reported that AKI occurred in 36.1% of ICU patients [11]. Their study was done in 57 ICUs across Australia during a 5 year period and this may explain the slight difference in comparison to the current study. Also Ostermann et al. study reported the prevalence of AKI in 41, 972 ICU patients was 35.80% [12].

In contrary to our results Thakar et al. study found that the overall prevalence of AKI among patients admitted to Veterans Affairs ICUs including 71,486 patients the prevalence of AKI was 22%, however this difference can be explained by the fact that they studied patients who complicated by AKI during their stay in the intensive care unit [13]. The lowest prevalence of the AKI in ICU reported by Brevet et al. was 7%, their study focused on the AKI occurring in the ICU in a 20 center, prospective 6 months performed in France in 1991, but this old study was carried for a short period and did not depend on RIFLE criteria for diagnosis of AKI [7]. This low prevalence may explore the higher sensitivity of the RIFLE criteria for diagnosis of AKI and suggesting that the incidence of detectable AKI is annually increasing and much higher than previously appreciated.

The highest prevalence was reported by Hoste et al was 67%, they constructed a retrospective cohort study in seven ICUs serving medical, surgical, neurological, trauma and solid organ transplant patients during a 12 month period, this can be explained by the fact that their study was carried on different ICUs including surgical, neurological, trauma and solid organ transplant patients, expected to include high risk patients after surgery, trauma, hence they are more prone to AKI [14].

In the present study AKI was found mostly among the patients of respiratory failure(21.4%), next to it was accidental injury(17.8%), postoperative patients(14.2%), septic shock(14.4%), hepatic encephalopathy (10.7%), poisoning (7.2%) and stroke(3.6%). A study done by Kellum revealed that, etiology of AKI was ATN (acute tubular necrosis) in 50% of cases with no specific determined cause [10]. The next most common etiologies included nephrotoxin administration (26%), cardiac disease (20%) including myocardial infarction, cardiogenic shock, and congestive heart failure. Regarding analysis of hospital stay and its relation with AKI, 24.1% AKI was found among patients who stayed <5days in the hospital, whereas 29.4% and 30% were found among patients who stayed 5-10 days and >10days respectively ( $p < 0.05$ ). In a previous study the mean  $\pm$  SD of hospital stay was found  $8.2 \pm 6.5$  days and distribution of AKI in relation with duration of hospital stay was similar with the present study [9].

### Conclusion

AKI in the ICU setting is common and it is multifactorial. In the present study prevalence of AKI in the ICU was found 28%. Significantly raised AKI was found among the ICU patients who were ventilated. Hospital stay also had an influence in the development of AKI. Among the primary diagnosis of diseases, respiratory failure was found to common disease causing AKI, next to it was accidental injury, postoperative patients, septic shock, hepatic encephalopathy, poisoning and stroke.

### Disclosure

All the authors declared no competing interest.

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