Acute Kidney Injury – Clinical Outcome in Hospitalised Patients

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ABSTRACT

Introduction: Acute Kidney Injury is a global problem and it is frequently encountered in medical, surgical, gynecological and oncology wards of hospitals. AKI is a predictor of immediate and long-term adverse outcomes. The present study highlights the clinical outcome of AKI in the hospitalized patients.

Methods: The study was an observational prospective study conducted in medical ward, Lok Nayak Hospital, Delhi from 1st October 2014 to 30th September 2015. One hundred patients diagnosed with AKI were included in the study and were assessed for the outcome of AKI in terms of recovery of kidney functions (complete, partial or no recovery), or mortality.

Results: The mean age of patients in the study was 43.8 ±16.03 years. Among 100 patients causes of AKI were - pre renal AKI (40%), renal AKI (58%), sepsis being the most common cause in this group and post renal AKI (2%).The study showed 73% patients - complete recovery, 7 % - partial recovery, 5% had no recovery of kidney functions during the follow up period and 15% died during the course of study. During hospitalization 15(15%) patients required dialysis 5(33.3%) of them died during hospitalization.

Conclusion: Irrespective of the cause of AKI, presence of AKI is one of the worst predictor for the outcome of hospitalized patients. Sepsis is most common cause of AKI among hospitalized patients and also carried the highest in hospital mortality in this study. Early diagnosis and timely interventions can improve outcome of AKI in hospitalized patients.

Keywords: Acute Kidney Injury (AKI), Uremic Encephalopathy, RIFLE Criteria

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INTRODUCTION

Acute kidney injury (AKI) is a syndrome characterized by rapid decline in glomerular filtration rate and accumulation of nitrogenous waste products such as blood urea, nitrogen and creatinine.[1,2]The burden of AKI may be most significant in developing countries, with limited resources for the care of these patients once the disease progresses to kidney failure necessitating Renal Replacement Therapy.AKI is more prevalent in (and a significant risk factor for) patients with chronic kidney disease (CKD). Individuals with CKD are especially susceptible to AKI which in turn, may act as a promoter of progression of the underlying CKD.

The detection of AKI in its early stage can be of paramount importance as early therapeutic intervention may prevent its progression to kidney failure. Management of acute kidney injury requiring dialysis adds additional financial burden especially on the health budget of developing countries.[3.4]

A major limitation to assess the outcomes of AKI has been the lack of common standards for diagnosis and classification of the condition. Recognizing that, a group of representing members of the Acute Dialysis Quality Initiative, and nephrology and critical care societies,

has recently established the Acute Kidney Injury Network (AKIN). The fundamental goal of AKIN is to ensure the best outcomes for patients with and those at risk of developing AKI.
The incidence of AKI in unselected patients has been estimated to be 0.4% to 18% depending on the definition used and AKI accounts for 1% to 4 % of all hospital admissions. It has been estimated that 3% to 7% of hospitalized patients and 25% to 30% of patients in the intensive care unit, develop AKI and 5 % to 6% ICU patients require renal replacement therapy during hospitalization.[5-8]
N.Pawankumar Reddy et al performed a prospective observational study, in a tertiary hospital ICU on 240 adult patients admitted during the period between 1 January 2009 to 31 July 2009 (7-month study duration), When the AKIN criteria were applied, AKI was seen in 45.9% (111/242) patients. Mortality at 28 days was significantly higher in the AKI group compared to patients without AKI (23.4% vs. 3.1% p50.001).[9]
However there is paucity of data on clinical outcome of AKI in hospitalized patients(medical wards) especially in developing country, like India.

METHODS

This was an observational prospective study conducted in the medical ward, Lok Nayak Hospital from 1st October 2014 to 30th September 2015 . One hundred and thirteen patients diagnosed as AKI according to the AKIN criteria were enrolled in the study but finally only 100 cases could be included in the study as 11 patients were lost to follow up and another two patient died during the course of follow up due to unrelated illness. The study was conducted after obtaining ethical clearance.

DIAGNOSTIC CRITERIA FOR AKI (AKIN)

An abrupt reduction in kidney function defined as an absolute increase in serum creatinine level of $\geq$ 26.4 μmol/l (0.3 mg/dl) within 48 hours

OR

a percentage increase in serum creatinine level of $\geq$50% (1.5-fold from baseline) within 7 days

OR

a reduction in urine output (documented oliguria of < 0.5 ml/kg/h for > 6 h).

To classify patients according to different stage of AKI as given by the AKIN and KDIGO guidelines, baseline and peak serum creatinine values were collected from the patient's case sheet. Baseline serum creatinine was the serum creatinine value at the time of admission and peak value was the highest creatinine value during hospital admission.[2]
Patients were followed daily till the time of discharge and weekly for first 6 weeks and monthly till the end of three months after discharge.Serial records of urine output and serum creatinine were maintained and patients were assessed for any deterioration or improvement of renal functions . Detailed clinical history, general physical examination and systemic examination was done. Treatment given and requirement of dialysis for the patients enrolled under study was noted.
Based on this information patients were classified in to various etiologies of AKI

- Pre renal (acute gastroenteritis, pancreatitis,upper gastro intestinal bleed, dengue , shock)[10-15]
- Renal (sepsis, malaria, obstetrical causes,lupus nephritis,FSGS, interstitial nephritis, poisoning)[16-25]
- Post renal (obstructive uropathy)

INCLUSION CRITERIA

1. Patients with AKI as per the AKIN criteria, admitted in medical wards of Lok Nayak Hospital.
2. Age >14 yrs.
3. Patients who are willing to participate in the study and voluntarily giving the consent. For cases aged > 18 years informed consent and in cases aged 14 – 18 years informed ascent forms were obtained.

EXCLUSION CRITERIA

1. Patients with AKI in ICU settings

PRIMARY END POINT

To study the outcome of acute kidney injury in hospitalized patients in terms of

- Complete recovery: serum creatinine fell to the baseline or below.
- Partial recovery: serum creatinine remained above the baseline but no need of renal replacement therapy
- No recovery**:** serum creatinine remained above the baseline with requirement of renal replacement therapy.
- Mortality

SECONDARY END POINT

To study the etiology and stage of AKIand their impact on outcome. Additional data was obtained regarding the co morbid illness and their relationship with the outcome in these patients.

STASTICAL ANALYSIS

Discrete data elements are presented as frequencies, as proportion of individuals within each classification. Stastical significance was studied using Chi square test or Fischer's exact test for discrete variables and ANNOVA for continous variables depending on the frequency. Differences were considered significant if the p value was less than 0.05 and highly significant if the p value less than 0.001.All the analysis was done using SPSS 20.0 software.

RESULTS

The mean age of patients in the study was 43.8± 16.03years. Maximum number of patients belong to the age group 31 to 45 years(32%).The Males (55%) were more than females in the study.

OUTCOME OF AKI: At the time of discharge(N=100) 53% patients showed complete recovery of renal functions, 23% had partial recovery,10% had no recovery and 14% died during hospitalisation.86 patients (86%) who survived and discharged from the hospital were followed for a period of three months and at the end of three months out of 86 patients 73(84.8%) showed complete recovery and 7 (8.1%)patients had partial recovery ,5 (5.8%) patients required dialysis and 1(1.1%) patient died due to hyperkalemia and uremic encephalopathy during subsequent follow up. (Table no.1)

On analyzing the results from the time of hospitalization to the end of three months follow up, out of 100 patients 15% died,5 % were dialysis dependent , 7 % were partial recovery without requirement of dialysis and 73 % patients had complete recovery of kidney functions. After discharge from hospital to three months follow up, additional 20 patients (20 %) patients had shown complete recovery of renal functions.(figure no.1)

Among the different etiologies of AKI, 40% patients were of pre renal AKI, 58% were of renal AKI and 2% were of post renal AKI(figure 1). Pre renal causes included (acute gastroenteritis, cardiogenic shock, upper gastrointestinal bleeding in chronic liver disease, pancreatitis and

dengue).Out of 4 dengue patients 1 also had concomitant malaria and 1 presented with chest infection and sepsis. Among 58(58%) patients of renal causes of AKI, malaria 11(18.9%), obstetrical cases- post partum sepsis 6(10.3%), lupus nephritis 3(5.1%), FSGS 2 (3.4%), interstitial nephritis 1(1.7%), acute tubular necrosis 1(1.7%) and Urinary tract infection 11(18.9%) , liver abscess 4(6.8%), acute on Chronic Kidney Disease 9 (15.5%).Rest 10 patients were dengue with malaria and Chronic lung disease patients with chest infection and sepsis. Sepsis was leading factor responsible for AKI in renal AKI etiologies(Table no.2) .

In our study there were 40 pre renal cases of AKI ,among them 36 (90%) patients had complete recovery,1 had partial recovery, 1 had no recovery and 2 patients died during hospitalization. During hospitalization 1 patient of pre renal AKI (case of known hypertension who presented with acute gastroenteritis)was dialysed who had complete recovery of renal functions after discharge.(figure no.3)

Out of 58 patients of renal AKI 37 (63.7%) patients had complete recovery of renal functions, 6 had partial recovery, 3 had no recovery and 12 patients died during hospitalisation. Sepsis leading to renal AKI was the most common cause for dialysis among admitted patients.Among 2 patients of post renal AKI 1 of them died and other had no recovery of renal function, both of them were dialyzed during hospitalization. Renal causes of AKI are associated with the worst outcome, with 12% mortality. Pre renal AKI is associated with the best outcome.

In our study 34% patients were of stage1 AKI , 21% were of stage 2 AKI and 45% were of stage 3 AKI. Out of 34 patients with stage 1 AKI all of them had complete recovery of renal functions after 3 months. Out of 21 patients with stage 2 AKI, 18 patients showed complete recovery, 2 patients had partial recovery and 1 patient died during hospitalization. There were 45 patients with stage 3 AKI, among them 21 had complete recovery, 5 had partial recovery, 5 patients showed no recovery and 14 patients died.

During hospitalization 15% patients were dialyzed with 5(33.3%) of them died during hospitalization, and 4 (26.6%) of them were dialysis dependent even after three months of discharge.

Among 74patients who had chronic diseases 41 (55.5%) had renal diseases (diabetes 20, hypertension 12,CKD 9) 2 patients of CKD were on dialysis prior to the presentation to the hospital. Out of 9 patients of CKD, 5 of them required dialysis during hospitalisation and 6 of them died.

41 % of hypertensive patients with AKI died as compared to 11.3% of non hypertensive patients with AKI which is stastically significant with a p value <0.05.Out of 12 patients(hypertensive) 4 patients required dialysis even after three months.

CONCLUSION

Our study was aimed at evaluating the clinical outcome of AKI in hospitalized patients and these patients were subsequently followed. In our study Renal AKI (58%) was the most common cause of AKI. This finding is quite different from other studies where the most common etiology of AKI was pre renal AKI (55-60%).[10 -12]

In our study most common cause of AKI was sepsis (45%) followed by cardiogenicshock (17%) followed by diarrhea (13%) and malaria (11%).In a retrospective study conducted in 2005 by Kaul et al most common cause of CAAKI was medical (77.2%) most common cause being diarrhea (29%),followed by malaria (18.8%),sepsis (13.9%).[26]

In a comparative study conducted by Singh et al in 2009 incidence of AKI in medical wards was (o.54%)(p value < 0.0001).They had used the RIFLE criteria for defining AKI. Most common etiology of HAAKI in medical wards was drug induced (39.2%) whereas in surgical and ICU unit was (34%) and (35.2%) cause of AKI being sepsis. Mortality in medical wards with AKI was (37.2%) p value = 0.003[27]

AKI occurs as a complex interaction between the risk and the susceptibilities of an individual. Patients with chronic disease are prone to develop AKI as compared to normal patients

The reasons for underlying the increase in incidence of AKI have not been determined but are likely to related to increasing patient age and and a higher burden of comorbidity including CKD. Although these studies showed a decrease in the attributable mortality over time ,AKI survivors had prolonged hospital length of stay and a greater requirement of post hospitalization care.[2,28]

Patients with CKD are more prone to develop AKI .Strong association with baseline renal functions is suggestive of the fact that development of AKI is more common in the subgroup with already impaired renal function .In a normal individual , nephrons and overall kidneys have a high functional reserve, but patients with CKD have limited number of nephrons ,even a minor episode of insult is associated with AKI in these functionally compromised patients.

In our study 9 patients of AKI had underlying CKD with baseline eGFR <30 ml/min/m^2. 5 of them were dialysed during hospitalization and 6 of them died.In a population based cohort study on CKD patients performed by Hsu CY et al during 1996 to 2003,in Northern California, U.S. After hospitalization with an AKI episode,a graded relationship was observed between the risk of in hospital death and pre hospitalization eGFR[29]

Diabetes and hypertension came out to be the most associated risk factor for the development of AKI as around 20% patients were diabetic and 12 % patients were hypertensiveAny literature of the previous studies failed to identify an association between the incidence of AKI in hypertensive patients and their clinical outcome.In our study 41% hypertensive patients died compared to the 11% mortality of non hypertensive patients with AKI.

Direct relationship was observed between the stage of AKI and the clinical outcome. Stage 3 AKI was associated with the worst outcome with 93% mortality seen in stage 3 and rest in stage 2. Stage 1 AKI had the best outcome

Direct association was seen with type of AKI and clinical outcome. Prerenal azotemia reverses rapidly if kidney perfusion is restored.

Sepsis was the worst predictor for causation of AKI as well as outcome of AKI in our study. A study by Levy et al. examined outcomes for over 1000 patients enrolled in the control arms of two large sepsis double-blind sepsis trials .This study suggests that outcomes for patients with severe sepsis in the ICU are closely related to early resolution of AKI[30]

FIGURES AND TABLES

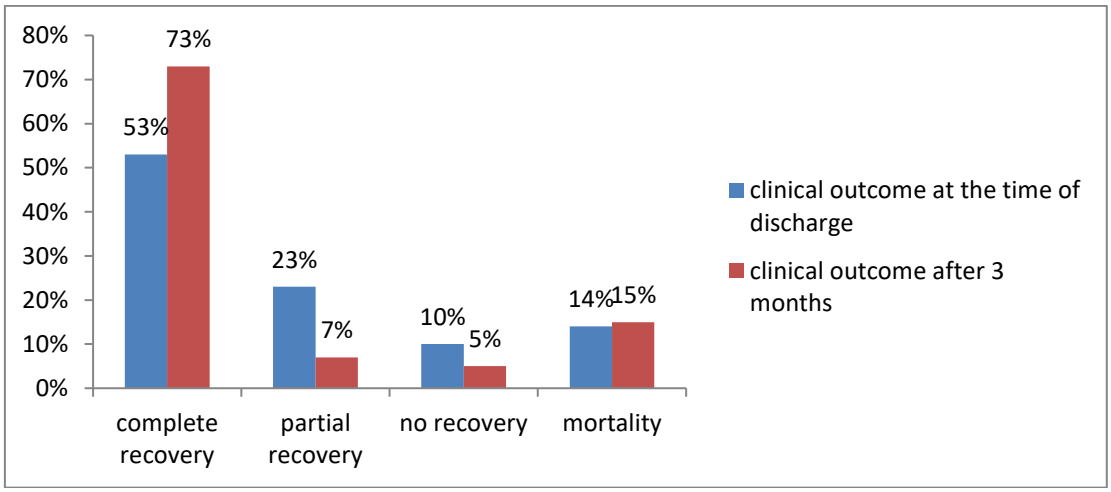

Figure no.1 clinical outcome of AKI

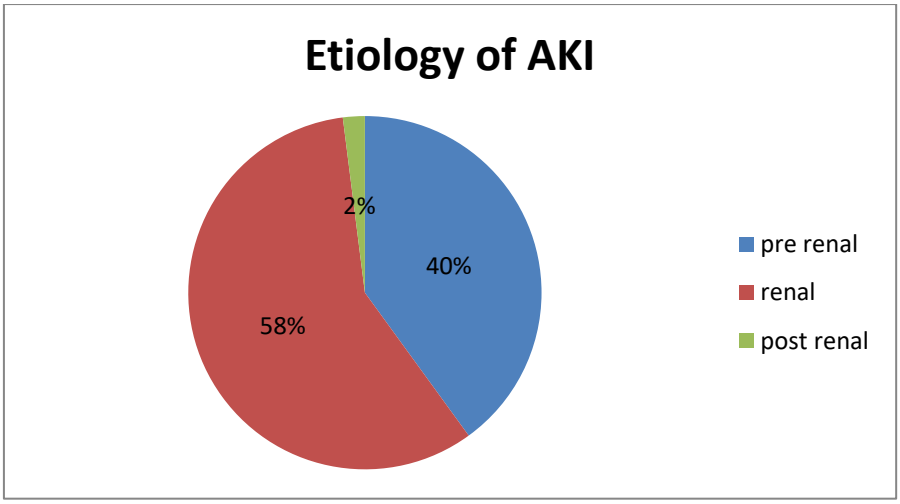

Figure no.2 distribution of AKI according to etiologies

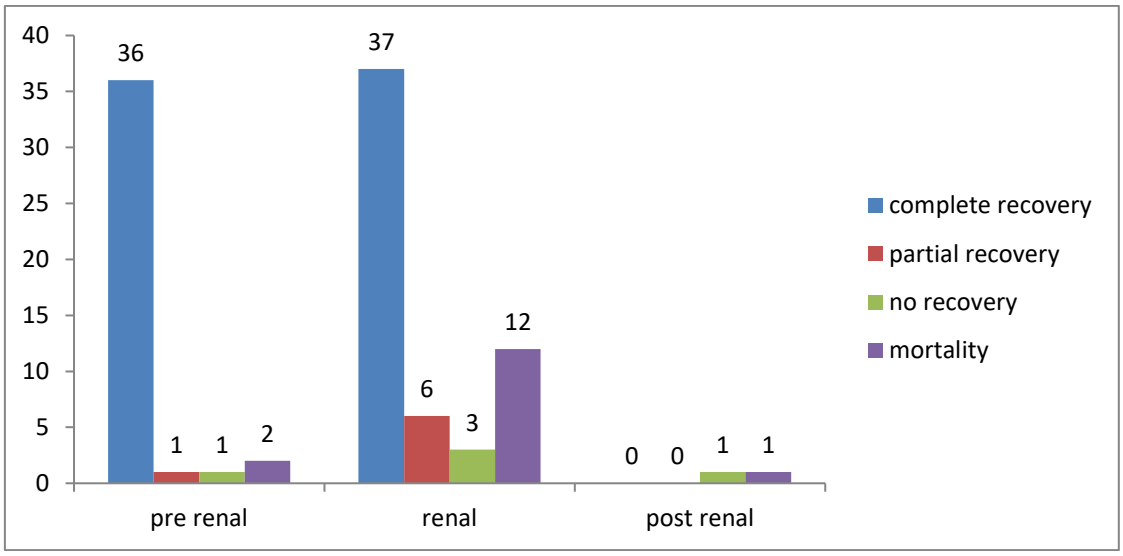

Figure no.3 clinical outcome of AKI in different etiologies of AK

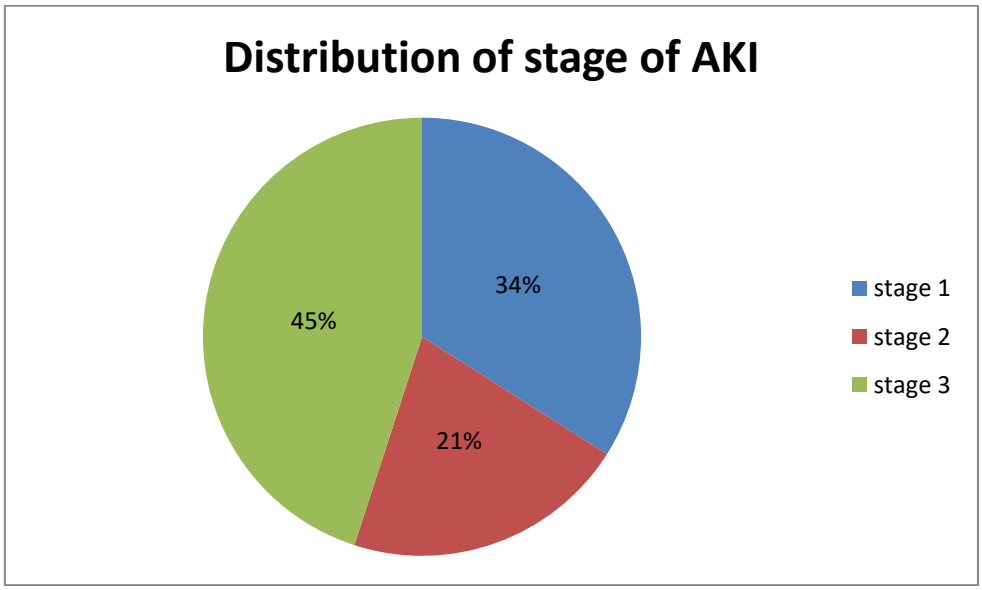

Figure no.4 distribution of AKI according to various stage

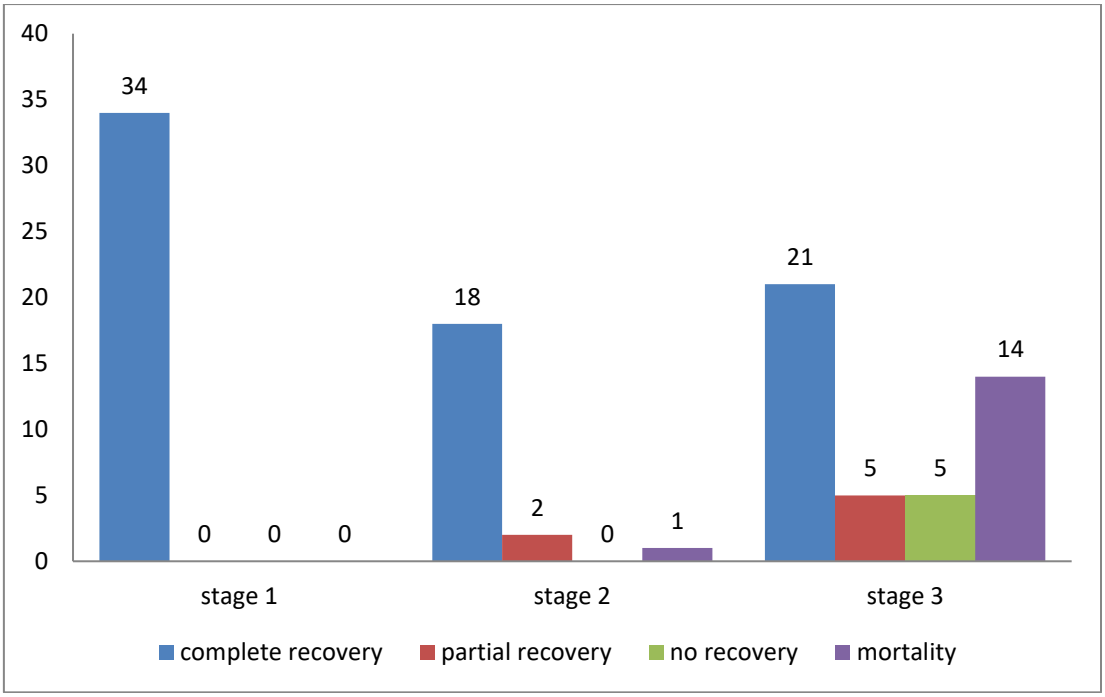

Figure no.5 clinical outcome of AKI in various stages of AKI

Table no.1 clinical outcome of AKI

	No. of patients at the time of discharge(N = 100)	**No. of patients after 3 months (N = 100)**
Complete recovery	53	73
Partial recovery	23	7
No recovery	10	5
Mortality	14	15

Table no.2 Clinical outcome of AKI and need for dialysis in relation with diagnosis of the patients.

Clinical Outcome Of Aki After Three Months N = No. Of Patients (Total =100)						**No. Of Patients Dialysed**	
Diagnosis (N)	C	P	N	M	P value	D	p value
Sepsis (45)	30	3	3	9	0.516	7	0.888
Cardiogenic shock (17)	14	0	1	2	0.603	0	0.057
Acute gastroenteritis (13)	12	1	0	0	0.288	1	0.429
Acute on CKD (9)	0	0	3	6	0.000	5	0.000
Malaria (11)	7	2	0	2	0.710	4	0.097
Urinary tract infections(11)	6	3	0	2	0.036	1	0.560
Obstetrical causes (6)	3	1	1	1	0.382	3	0.013
Upper gastrointestinal bleed (5)	5	0	0	0	0.584	0	0.335
Dengue (4)	3	0	0	1	0.854	1	0.560
Liver abscess (4)	4	0	0	0	0.673	0	0.391
Pancreatitis(3)	3	0	0	0	0.766	0	0.460
Lupus nephritis(3)	2	1	0	0	0.000	0	0.256
FSGS (2)	0	2	0	0	0.000	0	0.256
Obstructive uropathy(2)	0	0	1	1	0.009	2	0.001
Interstitial nephritis(1)	1	0	0	0	0.000	0	0.256

Hair dye poisoning (1)	1	0	0	0	0.946	0	0.673

C: complete recovery P: partial recovery N: no recovery M: mortality D: number of patients who were dialysed

Table no.3 Cross table analysis of hypertension and clinical outcome of AKI

Clinical outcome	No. of Hypertensive patients (N =12)	No. of normotensive patients(N = 88)
Complete recovery	3 (25%)	70 (79.5%)
Partial recovery	0	7 (7.9%)
No recovery	4 (33.3%)	1 (1.1%)
Mortality	5 (41.66%)	10 (11.3%)

The Chi square analysis of hypertension with clinical outcome suggest a poor prognosis in hypertensive patients(.p value 0.000)

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