

# Study of Acute Kidney Injury

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## ABSTRACT

**Introduction:** AKI is a protean syndrome of varied severity. Detection of the incidence, aetiological profile and outcome of AKI is important for commencement of preventive and therapeutic strategies. Considering the limited data available on AKI in India, the present study was undertaken. Study aimed to determine the incidence, age and gender ratio, etiopathogenesis, complications including mortality and role of dialysis in Acute Kidney Injury(AKI).

**Material and Methods:** It was a prospective study between 2012 to 2015 at vydehi hospital on 261 patients with AKI.

**Results:** Age group between 51-60yrs was most affected (21.8%). Males were affected more (64%). Sepsis was most common cause (69.7%), hemodialysis was required in 13.8%, Intensive care unit(ICU) care was required in 55.2% (Table 2). Renal biopsy was done in 14 patients (5.4%). Myeloma cast nephropathy was the most common histopathologic finding in 5 (1.9%) patients. MODS was present in 41.8%, mortality was noted in 2.3%. In total, 93% recovered from renal failure. Renal not-recovered group had higher incidence of proven myeloma(29.4%), GIT bleed (35.3%) deaths(35.3%), vasopressor support(35%), ventilator support(35%).

**Conclusion:** Sepsis was the most common cause of AKI with majority showing improvement, especially when they received prompt early intervention.

**Keywords:** Acute Kidney Injury, Sepsis, Hemodialysis.

## INTRODUCTION

Acute Kidney Injury (AKI) is defined as a sudden decline in renal function (within 48hrs) defined as an absolute rise in serum creatinine of >0.3mg/dl or decline in urine output (<0.5ml/kg/hr for more than 6 hrs).<sup>1</sup> AKI is a protean syndrome of varied severity. It is characterized by a rapid (hours to weeks) decline in the glomerular filtration rate (GFR) and hence, leading to blood urea nitrogen and creatinine retention.<sup>2-5</sup> Detection of the incidence, aetiological profile and outcome of AKI is important for commencement of preventive and therapeutic strategies. Considering the limited data available on AKI in India, the present study was undertaken. Study aimed to determine the incidence, age and gender ratio, etiopathogenesis, complications including mortality and role of dialysis in Acute Kidney Injury (AKI).

## MATERIAL AND METHODS

Present study was a prospective study between 2012 to 2015 on 261 patients with AKI, selected among 5011 total patients needing acute care presented to the hospital.

**Selection of cases:** Patients with acute rise in serum creatinine >1.2mg% or who showed 50% improvement in GFR upon treatment were considered. Patients with chronic kidney disease were excluded. Patients were grouped according to age and

gender. All patients were studied for the pattern of AKI and their outcome including factors influencing prognosis, complications, death rates and role of renal replacement therapy in clinical outcome. Consent was taken, wherever invasive testing or procedure were carried along with appropriate hospital authority permission.

**Methods:** Diagnostic work-up included history taking, clinical examination and investigations. Investigations included urine analysis, blood urea nitrogen, serum creatinine, serum electrolytes, x-ray chest, ultrasound abdomen for kidney size. Investigations included hematocrit, reticulocyte count, complete blood count, Renal function test and ANA titres were done in glomerulonephritis. Work-up for infection like cultures of blood, urine, widal test, malaria and Dengue serology were done as per cases. Kidney biopsy was considered in case unexplained renal failure persisted, if otherwise not acute tubular necrosis (ATN). Glomerular disease was considered in presence of hypertension, hematuria, proteinuria, low levels of complements and elevated ASLO titre. ATN was considered depending upon initial clinical picture and exclusion of other etiology. Management included correction of etiological factors, fluid, electrolyte, acid-base imbalance, control of hypertension. Incidentally, none of them required peritoneal dialysis.

## STATISTICAL ANALYSIS

Student t test (two tailed, independent) which was used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters. Chi-square/ Fisher Exact test was used to find the significance of study parameters on categorical scale between two or more groups. The Statistical software namely SPSS 15 were used for the analysis.

## RESULTS

Age group between 51-60yrs was most affected (21.8%). Males were affected more(64%). Sepsis was most common cause (69.7%) (Table 1). Oligo-anuria was the commonest presentation in the present study. Next common was fever from septicaemia. Blood culture was positive in 32% with Acinetobacter being more common, urine culture was positive in 24% for proteus being more common, complicated Malaria was in 7.3%, GIT bleed was found in 2.3%, NSAIDS related renal failure was noticed in 73%, contrast related nephropathy was noted in 12.6 %, alternative medication related was noted

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in 34.1%, diuretic related was noted in 62.5%, urinary tract obstruction was noted in 19.5%, all of whom required surgical intervention. Diabetes mellitus was present in 39.8%, Liver involvement was seen in 44.4%, hemodialysis was required in 13.8%, ICU care was required in 55.2% (Table 2). Renal failure recovery was noticed in 57.1 % with average time being <6weeks. In total 93% recovered from renal failure with P-value <0.001. Renal biopsy was done in 14 patients (5.4%) among which renal recovery noted in 2.4%. Myeloma cast nephropathy was the most common histopathologic finding in 5 (1.9%) patients. Multiple organ dysfunction syndrome (MODS) was present in 41.8%, mortality was noted in 2.3%, and patients with myeloma, hypotension showed no renal recovery.

Among the groups with renal recovered and not-recovered (Table 2), both groups had matched aged, gender and baseline serum creatinine levels. Renal not-recovered group had higher incidence of proven myeloma (29.4%), Gastrointestinal (GIT) bleed (35.3%) deaths (35.3%), vasopressor support (35%), ventilator support(35%) (Table 2). Recovered group had higher incidence of MODS (44%), malaria (7.8%), contrast-induced nephropathy(12%), urinary tract obstruction (20%) requiring prompt urological intervention, cellulitis(9.8%), gastroenteritis (36.5%), sepsis (83%), higher episodes of NSAIDS intake (74.6%), high initial blood sugars (29%) and ICU requirement (56.6%).

## DISCUSSION

AKI complicates 5-7% of acute care hospital admissions and up to 30% of admissions to the intensive care unit. In our study, AKI contributed roughly 5.2% of all acute care needing patients, among which near 52% required ICU care, which is slightly more as mentioned in literature. In several series, obstructive uropathy is seen in 2% to 10% of all cases in AKI, though in our study it was 19.5%.

Bernich B et al., in their study of pattern of acute renal failure, found that 58% were males and 36% were females, mean age of these patients was 56.2 years, like in our study, where age group between 51-60yrs are most affected.<sup>4</sup>

We could show that the AKI occurrence is highest in elderly patients. In the elders, there is heightened susceptibility to medication toxicity, probably related to altered drug

pharmacokinetics, pharmacodynamics, higher consumption of medications overall, including nephrotoxic agents, than younger patients.<sup>6</sup> In our study, AKI patients were significantly older.

Sepsis was most common cause (69.7%), like in hungary study. Oligo-anuria was the commonest presentation in the present study, followed by fever due to septicaemia.<sup>6,7</sup>

Renal failure is influenced by duration and weaning from mechanical ventilation. Mechanical ventilation and vasopressor requirements were significantly higher in patients who died than in patients recovered, like in our study which showed in 35%. It has come to know that the inflammatory response and cytokine cascade that occur AKI play a important role in the development of ALI.<sup>8</sup>

Cardiogenic shock with renal ischaemia is strong predictor of AKI. The incidence of AKI IN cardiac illness is reported as 19%-45%. In a study of patients after cardiac arrest, AKI was noted in nearly 50% of cases. It shows that the severity of hypoxia/ischemia may also influence on the onset of AKI. In a study, Marenzi et al found AKI incidence of 55% in the setting of ST-elevation acute myocardial infarction with cardiogenic shock. In our study 12.6% of AKI was related to cardiorenal syndrome/contrast induced nephropathy and IHD, like in other studies.<sup>9</sup> Hypovolemia-associated renal failure was noted in 0.4% of our AKI patients.

Renal failure due to various conditions affecting the kidney, is normally managed in non-ICU settings and has relatively better prognosis and low mortality (5-10%). In contrast, AKI as a part of MODS has 50-70% mortality. In our study the mortality was 2.3%. The higher mortality of AKI in Hungarian ICUs can be explained by factors, such as higher incidence of malignancy and non-uniform treatment principles.

Renal recovered group had more incidence of treatable complications like MODS (44%), urinary tract obstruction (20%) requiring prompt urological intervention, more cellulitis (9.8%), gastroenteritis (36.5%), sepsis (83%), more episodes of NSAIDS intake (74.6%), high initial blood sugars (29%) and more ICU requirement (56.6%), indicating treatable medical conditions and good ICU care instituted in this group.

Renal not-recovered group underwent more kidney biopsy (47%), more proven myeloma (29.4%), more deaths (35.3%), more vasopressor support (35%), more ventilator support (35%)

Cause of renal failure	Gender		Total
	Female	Male	
Sepsis	65(69.9%)	117(69.6%)	182(69.7%)
Contrast induced nephropathy	9(9.7%)	24(14.3%)	33(12.6%)
Complicated malaria	9(9.7%)	10(6%)	19(7.3%)
GIT Bleed	2(2.2%)	4(2.4%)	6(2.3%)
Myeloma cast nephropathy	1(1.1%)	4(2.4%)	5(1.9%)
Preeclampsia	1(1.1%)	3(1.8%)	4(1.5%)
ATN	2(2.2%)	1(0.6%)	3(1.1%)
UT Obstruction, Sepsis	1(1.1%)	2(1.2%)	3(1.1%)
Class 4 Lupus	0(0%)	1(0.6%)	1(0.4%)
FSGS	1(1.1%)	0(0%)	1(0.4%)
MPGN	1(1.1%)	0(0%)	1(0.4%)
Obstructive nephropathy	1(1.1%)	0(0%)	1(0.4%)
Pauci-immune crescentic glomerulonephritis	0(0%)	1(0.6%)	1(0.4%)
Scorpion sting	0(0%)	1(0.6%)	1(0.4%)
Total	93(100%)	168(100%)	261(100%)

**Table-1:** Causes of renal failure

	Renal Failure		Total(n=266)
	Not recovered (n=17)	Recovered (n=244)	
Cause of renal failure:			
Sepsis	1(5.9%)	181(74.2%)	182(69.7%)
Contrast induced nephropathy	1(5.9%)	32(13.1%)	33(12.6%)
Complicated malaria	0(0%)	19(7.8%)	19(7.3%)
GIT Bleed	6(35.3%)	0(0%)	6(2.3%)
Myeloma cast nephropathy	5(29.4%)	0(0%)	5(1.9%)
Preeclampsia	0(0%)	4(1.6%)	4(1.5%)
ATN	0(0%)	3(1.2%)	3(1.1%)
UT Obstruction, Sepsis	1(5.9%)	2(0.8%)	3(1.1%)
Class 4 Lupus	0(0%)	1(0.4%)	1(0.4%)
FSGS	1(5.9%)	0(0%)	1(0.4%)
MPGN	1(5.9%)	0(0%)	1(0.4%)
Obstructive nephropathy	0(0%)	1(0.4%)	1(0.4%)
Pauciimmune crescentic glomerulonephritis	1(5.9%)	0(0%)	1(0.4%)
Scorpion sting	0(0%)	1(0.4%)	1(0.4%)
Vasopressor support/Ventilator support/SLED in relation to Renal failure:			
Vasopressor support	6(35.3%)	26(10.7%)	32(12.3%)
Ventilator Support	6(35.3%)	25(10.2%)	31(11.9%)
SLED	0(0%)	2(0.8%)	2(0.8%)
Death:			
No	11(64.7%)	244(100%)	255(97.7%)
Yes	6(35.3%)	0(0%)	6(2.3%)
ICU Care:			
No	11(64.7%)	106(43.4%)	117(44.8%)
Yes	6(35.3%)	138(56.6%)	144(55.2%)
MODS:			
No	16(94.1%)	136(55.7%)	152(58.2%)
Yes	1(5.9%)	108(44.3%)	109(41.8%)
Urinary tract obstruction:			
No	16(94.1%)	194(79.5%)	210(80.5%)
Yes	1(5.9%)	50(20.5%)	51(19.5%)
Renal Biopsy done:			
No	9(52.9%)	238(97.5%)	247(94.6%)
Yes	8(47.1%)	6(2.5%)	14(5.4%)
Liver dysfunction:			
No	10(58.8%)	135(55.3%)	145(55.6%)
Yes	7(41.2%)	109(44.7%)	116(44.4%)
Renal failure recovery:			
No	17(100%)	0(0%)	17(6.5%)
Yes	0(0%)	244(100%)	244(93.5%)
Renal replacement therapy requirement:			
No	16(94.1%)	209(85.7%)	225(86.2%)
Yes	1(5.9%)	35(14.3%)	36(13.8%)

**Table-2:** Characters in patients studied in relation to renal failure recovered or not recovered

indicating more critical condition of patients in this group.

Prognostic factors:

Age: Mortality of 2.3% (6 patients) was found with average age of 59.5yrs. But whether older age has an impact on prognosis of AKI and mortality needs more studies.<sup>10</sup>

Complications: Among 6 (2.3%) mortality cases, 3 patients (50%) had myeloma cast nephropathy, 2 had GI bleed/shock and 1 had urinary tract obstruction and urosepsis. It was noticed that survival was better when there was primary renal lesion and poor when AKI was precipitated by an underlying illness, suggesting need of early treatment of etiological factors to avoid AKI, and early initiation of dialysis if required. It was also noted that AKI recovery was significantly more in urinary obstruction

with sepsis. This can be explained by the fact that our hospital being tertiary referral center, patients got immediate appropriate treatment leading to early recovery as shown in other study.<sup>11</sup>

**The limitations of study:** Our ICU hasn't uniform protocol for AKI treatment, so we couldn't compare with other ICUs.

## CONCLUSION

This is a prospective study on AKI occurring in intensive care settings. The results of the present study states higher incidence of AKI and deaths. AKI prolongs patient's admission stay. The independent risk factors for incidence of AKI were serum creatinine, sepsis and vasopressor treatment. Age, sepsis, need

of vasopressor treatment, mechanical ventilation and AKI were significant risk factors for the mortality.

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