Original Research Article

Assessment of serum renal markers and its association with outcome of acute kidney injury-A cross sectional study

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Abstract

Introduction- Acute kidney injury shows an elevation in the blood urea nitrogen (BUN) level and /or an elevation in plasma or serum creatinine (SCr) concentration, often associated with decrease in urine volume. Acute Kidney Injury is associated with increased length of hospital stay and in turn leads to higher treatment cost. Levels of serum urea and creatinine directly affect the outcome of disease. **Aims and objectives-**

1) To assess serum level of urea, creatinine and K^+ in patients with acute kidney injury.
2) To predict outcome of acute kidney injury patients in our hospital during the study period.
3) To assess association of levels of urea and creatinine with outcome of Acute kidney disease.

Material and methods- After taking proper history and informed consent of the patient, clinical examination was done. Serum level of urea, creatinine and K^+ was assessed. Glomerular Filtration Rate(GFR) was calculated. The patients were managed either conservatively or on hemodialysis. The outcome of patients were noted as full recovery, partial recovery and death. The outcome of patient was compared with serum urea levels, serum creatinine levels. **Results-** 55.29% patients had serum urea level upto 100 mg/dl, 54.7% had creatinine between 2-4mg/dl. 62.94% had serum potassium in normal range. Mean GFR was 24.41±11.47. 66.47% were managed conservatively and 33.52% were given hemodialysis. 50% fully recovered. Deaths were found in 15.88%. Increase in level of urea and creatinine suggested need of hemodialysis. **Conclusion-** Elevated levels of urea and creatinine suggested unfavourable outcome and need of hemodialysis. Early diagnosis, early referral, proper treatment is must for the favourable outcome.

Key words: Acute kidney injury, creatinine, hemodialysis, outcome, urea

Introduction

Acute kidney injury means impairment of kidney filtration and excretory function over days to weeks, resulting in retention of nitrogenous and other waste products normally cleared by the kidneys. The global burden of Acute Kidney Injury is estimated at 13.3 million cases per year, with 85% from low- and middle-income countries[1,2]. Acute kidney injury is divided in three categories pre renal azotemia, renal azotemia and post renal azotemia[3]. The poor prognostic factors of acute kidney injury are age >65 years, acute respiratory failure, cardiac failure, multi organ dysfunction syndrome[4,5]. The common symptoms of Acute Kidney injury are- oedema, oliguria- urine output less than 400ml/day, anuria- urine output less than 100ml/day, convulsion, breathlessness, obstructive urinary symptoms, nausea, vomiting, weakness and hiccups[6]. The classification includes three grades of severity of Acute Kidney Injury (risk, injury, and failure) according to relative changes in serum creatinine and urine output and two outcomes (loss of kidney function and end-stage kidney disease, or ESKD). Although recovery of renal function occurs in most of patients surviving an episode of Acute Kidney Injury, many patients remain dialysis dependant or/are left with severe renal impairment.

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Aims and objectives

This study was mainly done to assess-

1) To assess the serum level of urea, creatinine and K^+ in patients with acute kidney injury.
2) To predict the outcome of acute kidney injury patients in our hospital during the study period.
3) To assess the association of levels of urea and creatinine with outcome of Acute kidney disease.

Material and methods

Type of Study
Cross sectional Study
Sample size
170
Duration of study
18 Months
Age group
More than 12 Years
Inclusion criteria
Cases fulfilling the following criteria's 1. Increase in serum creatinine by ≥0.3mg/dl (≥26.5µmol/l) within 48hours. 2. Increase in serum creatinine to ≥1.5 time's baseline which is known or presumed to have occurred within the previous seven days. 3. Urine volume <0.5mg/kg/hr for more than 6 hours 4. Patients above 12 years
Exclusion criteria

1. Trauma and accidental case
2. Patients with diabetes mellitus
3. Patients with Chronic kidney disease
4. Patients aged below 12 years

Procedure

Present and past history of all the patients was noted. After taking informed consent, clinical examination of every patient was done and Vitals were recorded. The day the Acute Kidney Injury criteria were fulfilled according to serum creatinine was noted as day 1. We used either the rise in serum creatinine of ≥ 0.3 mg/dl or ≥ 150 to 200 % from baseline to diagnose Acute Kidney Injury. Also the duration of stay in hospital was noted. Fully automated random access clinical chemistry analyzer ERBA model EM-360 with computer unit used for Renal function test (RFT/KFT), Liver function test (LFT) and random blood sugar. GFR was also measured by the following formula, GFR = U*V / P, where U is the concentration of the substance in urine P is the concentration of the substance in plasma V is urine flow rate. Urine analysis, urine microscopy and urine dipstick test was done. Ultrasonography was done. The patients were managed either conservatively or on hemodialysis. The outcome of patients were noted as full recovery, partial recovery and death. The outcome of patient was compared with serum urea levels, serum creatinine levels.

Results

Total 170 patients presented with complaints of acute renal failure. Out of 170, males were 65.9% and females were 34.1%. Mean age was 51.76±18.68. Maximum patients were from more than 60 years age group(38.23%). Oligourea, vomiting and oedema were most common complaints found in 44%, 34% and 45% respectively. 44.11% had decrease in urine output. 53.52% had pre renal failure, 41.17% had renal failure and 5.29% had post renal failure.

Table 1: Serum urea level

UREA (mg/dl)	Frequency	Percentage
UPTO 100	**94**	**55.29**
100-150	37	21.76
151-200	24	14.11
201-250	12	7.0
>250	03	1.76
TOTAL	170	100

Table 2: Serum creatinine level

Creatinine(mg/dl)	Frequency	Precentage
<2.0	08	4.7
2.0-4.0	**93**	**54.7**
4.1-6.0	32	18.82
6.1-8.0	22	12.94
>8.0	15	8.82
TOTAL	170	100

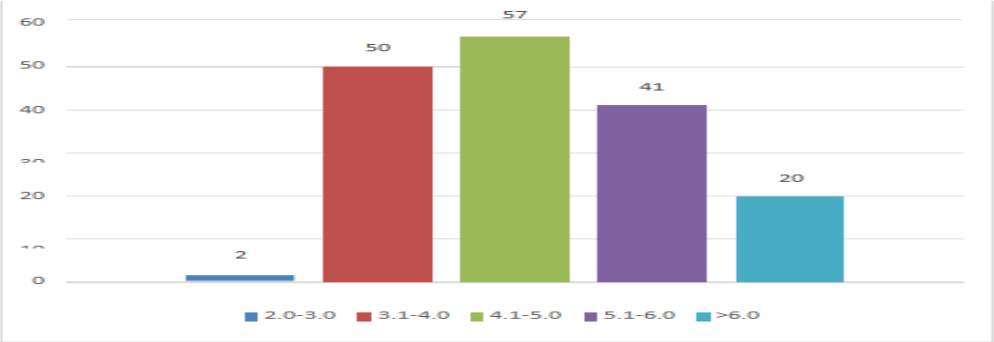

Fig 1: Serum Potassium

62.94% of patients in present study had serum potassium level normal in range & only 35.87% patients had serum potassium level more than 5mEq/lit.

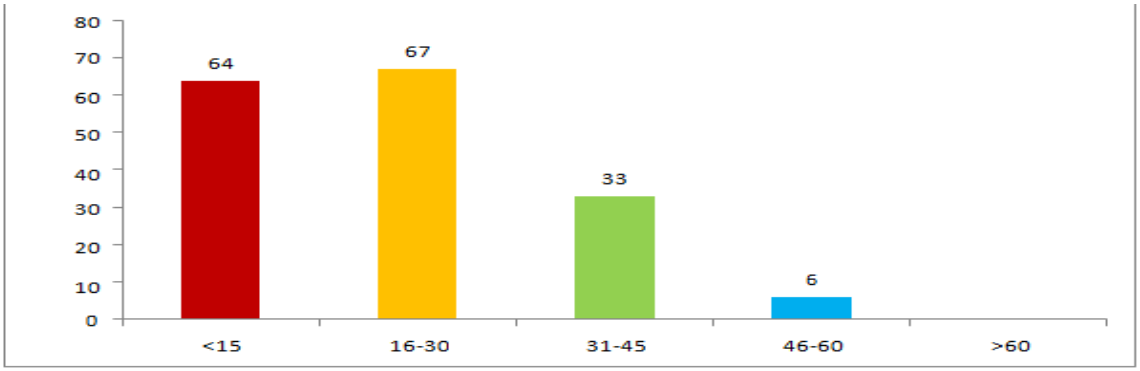

Fig. 2: Patient distribution according to EGFR

Out of 170 patient 57 patients went under Hemodialysis treatment and 113 patients did not undergo Hemodialysis treatment and management with conservative treatment.

In present study out of 170 patients, 27(15.55%) patients died, 85 (50%) patients had full recovery and 59(34.11%) had partial recovery.

Table 3: Comaparison of urea level with outcome

Outcome	Mean	Std. Deviation	95% Confidence Intervalfor Mean		F(2,167)	P Value
			LowerBound	UpperBound		
Death	141.70	64.979	116.00	167.41	7.87	**<0.001**
Partial recovery	115.14	55.731	100.48	129.79		
Recovery	94.68	52.051	83.46	105.91		
Total	109.13	57.712	100.39	117.87		

There was a statistically significant difference in the serum urea level at the p value <0.05 for the all three conditions. Post Hoc comparisons using the Bonferroni test indicated that the mean urea level for the death as the outcome (141.70 ± 64.979mg/dl) was significantly higher than those in recovered phase (94.68 ± 52.051 mg/dl). This Suggest that increase in Serum Urea will lead to bad prognosis from Recovery to Death.

Table 4: Comparison of serum creatinine level with outcome

Outcome	Mean	Std. Deviation	95% ConfidenceInterval for Mean		F(2,167)	P Value
			LowerBound	UpperBound		
Death	5.989	2.17	5.12	6.84	19.24	<0.001
Partial recovery	4.831	2.18	4.25	5.40		
Recovery	3.429	1.85	3.02	3.83		
Total	4.314	2.23	3.97	4.65		

There was a statistically significant difference in the serum creatinine level at the p value<0.05 for the all three conditions. Post Hoc comparisons using the Bonferroni test indicated that the mean Creatinine level for the death as the outcome was significantly higher than those in recovery. This Suggest that increase in serum Creatinine will lead to bad prognosis from Recovery to Death.

Comparison of sereum urea level and hemodialysis as mode of treatment- There was a statistically significant difference in the mean Serum Urea Level of both groups. Group B (Hemodialysis done) had a mean of 131.55±64.87 mg/dl which was higher than Serum Urea Mean level in which Hemodialysis not used (Group A) i.e. 97.52± 50.11 mg/dl. This Suggest that increase in serum urea level leads to need of Hemodialysis.

Comparison of sereum urea level and hemodialysis as mode of treatment- Group B (Haemodialysis done) had a mean of 5.67+/- 2.65 which was higher than Serum Creatinine Mean level in which Haemodialysis not used (Group B) i.e. 3.61 +/-1.61. There was a statistically significant difference in the mean Serum Creatinine Level of both groups. This Suggest that increase in serum Creatinine level leads to need of Hemodialysis.

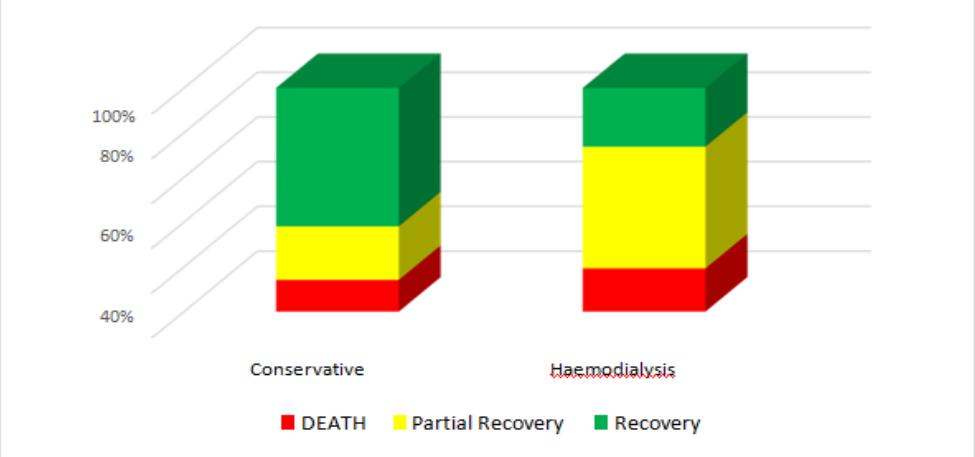

Fig. 3: Comparison of mode of treatment with patirnt's outcome

61.9 % of those received conservative management showed recovery as compared to 26.3% on haemodialysis treatment. Also 14.2% of those received conservative management had death as the Outcome compared to 19.3% received Haemodialysis management. This difference was found to be statistically significant. So death and partial recovery more in patients those received haemodialysis. In the present study good results were obtained with conservative management. Most of our patients who died, had septicemia and associated complications like hypotension, respiratory failure, Multiple Organ Dysfunction Syndrome etc.

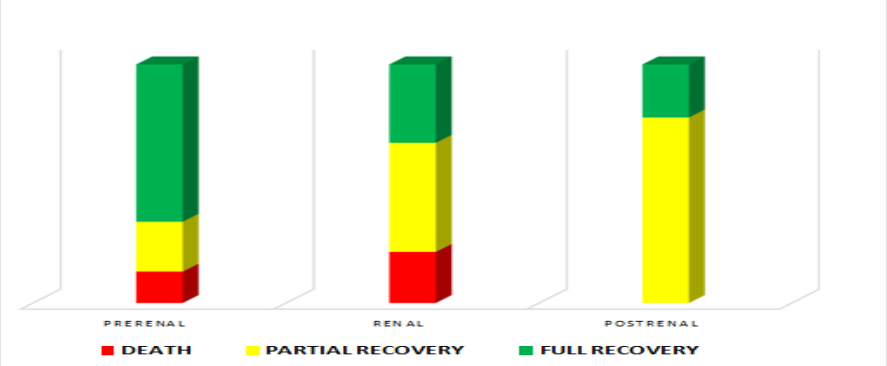

Fig.4: Comparison of recovery based on type of renal failure

65.93% of those who had pre renal failure recovered compared to 32.86% of those with renal failure and 22% with post renal failure. 20.8% who had pre renal failure partially recovered compared to 45.71% with renal and 77.78% with post renal failure. 13.2% with renal failure died compared to 21.43% with renal failure. This difference was found to be statistically significant. This suggest that renal type of acute kidney injury had bad prognosis.

Discussion

Out of 170 patients included in the study 112 were males and 58 were females with a mean age of 51.76 years with SD of 18.68, resulting in male: female ratio of 2:1 which is quite similar to study done by Utkarsh Pet al., Kumar R et al. Eswarappa et al[7-9].

We noticed that oliguria, edema and vomiting were most common presenting symptoms comprising of 44%, 45% and 34% respectively. This findings is comparable to studies done by Kumar R. et al., which showed that oliguria and vomiting was seen in 82% and 90% of patients respectively[8], may be due to Diabetes and CKD cases included. Fever is presentation in 33.5% of patients, similar to other study done by Utkarsh R.P. et al.[7], Soren et al.[10], 40% of patients had fever in P.K. Bhattacharya et al.[11], 52% of patients had hypotension in Bernieh et al. study[12]. Loose stools is presentation in 23.5 % in present study is similar to Soren et al[10].

In present study, out of 170 patients, 143 Patients survived and about 27 patients died. Amongst survived, 85 patients had complete recovery & 58 patients had recovered partially. Partial recovery means there is a sign and symptoms of uremia with elevated serum creatinine &/or serum urea level with low urine output even after 4 cycles of haemodialysis & required renal replacement therapy (RRT) at the time of discharge from our hospital. Complete recovery means patient does not having any sign and symptoms of uremia with adequate urine output and normal kidney function test and no need of RRT at the time of discharge. Out of 170 patients, 113 patients were treated conservatively & 57 patients underwent haemodialysis. Conservative management included early detection of the etiology and prompt initiation of treatment includes management of volume, electrolyte and acid-base homeostasis and specific drug management. Out of 113 patients, 66 patients recovered completely and 9 patients died due to other associated co-morbid condition with a mortality of 5.3% rate. In the present study good results were obtained with conservative management. Present study was comparable to the study done by Kaul A et al.[13], where 92.5% of patients were managed conservatively and 7.5% of patients underwent dialysis. Out of 57 patients of haemodialysis, 11 patients died, 31 patients partially recovered and 15 patients recovered completely with normal renal function. Most of our patients who died, had septicemia and associated complications like respiratory failure. The major risk factors affecting prognosis of the patients were presence of multi organ failure, high baseline serum creatinine level and complications developed during the course of illness. In the present study, mortality was seen among the patients who had high serum creatinine at admission as compared to survived patients. Low mortality observed in this study may be due to large number of patients with medical acute renal failure, early diagnosis and treatment. But among the expired individuals, aged >40 years patients were more. The survival rate in present study (84.12%) was comparable with other studies like Utkarsh et al. (81.42%), Eswarappa et al. (85%) and Kumar R. et al.(90%)[7-9]. The mortality in present study (16%) is similar to study done by Utkarsh et al. (18.5%)[7] and Eswarappa et al. (15%)[9], but in variance with other studies conducted by Kumar R et al. (29.2%)[8] and Patil TB et al. (29.8%)[14]. In present study mortality is more in patients on haemodialysis (19.3%) than conservative management (14.2%). This is similar to multi-center SHARF4 study, including 1,303 consecutively admitted Acute Kidney Injury patients, they found significant differences in outcome between patients receiving conservative treatment and those treated with RRT. Prognosis of RRT patients remained worse, after correction for disease severity or limiting the analysis to the most critically ill patients. Center practice of treatment choice was identified as an independent risk factor for mortality, with the higher frequency of RRT treatment associated with higher mortality[15]. Although our results may be due to differences in severity of disease in general and renal failure in particular, no guidelines were available to define this severity more accurately. We also have no arguments to suspect that our results are related to the quality of dialysis treatment on itself. In the present study, due to post renal cause out of 9 patients, 7 had partial recovery due to obstructive cause. Post renal causes of Acute Kidney Injury in present study were less due to study was conducted in only medicine wards severity more accurately.

Conclusion

Our study says that, serum markers for kidney should be properly monitored as they help to assess the mode of treatment and outcome of patient. Increase in level of urea and creatinine, suggest the need of haemodialysis and elevated levels suggest unfavourable outcome. This study may be helpful to physicians to proper management of acute kidney injury patients as well as government to make proper guidelines to decrease mortality of the acute kidney injury patients.

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