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Original article

Laboratory profile and its association with outcome of acute kidney injury among female patients: Our experience from a tertiary care centre

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Abstract

Background: All patients presenting with AKI warrant a comprehensive metabolic panel.Although creatinine is the most commonly used serum chemistry to evaluate for AKI, there is evidence that other biomarkers may be more sensitive and may be elevated earlier in the course of AKI compared to creatinine. **Objectives:** To study the clinical and laboratory profile of acute kidney injury among female cases. **Methodology:** This prospective observational study was conducted at the Vilasrao Deshmukh Government Medical College and Hospital Latur, involving 510 AKI patients as per KDIGO criteria. **Results:** Most commonly affected age group in present study was more than 60 years (38.23%).In present study out of 510 patients255 patients had full recovery i.e. 50% and 174 had partial recovery i.e. 34.1%. We also observed that 81 patients (15.9%) died.In our study, 364 patients i.e. 69.4% had serum potassium level above 4 mEq/L, 228 (44.63%) had serum urea above 100 mg/dl and 486 (95.8%) had serum creatinine level above 2 mg/dl.Mortality rate in our study 15.9%. **Conclusion:** Our study concluded that 50% of the patients were fully recovered and 31.4% were partially recovered. Serum urea and creatinine were significantly increased in patients with mortality. Mortality rate in our study 15.9%.

Key words: Acute kidney injury, laboratory profile

Introduction

Acute kidney injury (AKI), previously called acute renal failure (ARF), denotes a sudden and often reversible reduction in kidney function, as measured by glomerular filtration rate (GFR).[1,2,3] However, immediately after a renal insult, blood urea nitrogen (BUN) or creatinine (Cr) levels may be within the normal range, and the only sign of AKI may be a decline in urine output. AKI can lead to the accumulation of water, sodium, and other metabolic products. AKI can also result in other electrolyte disturbances. AKI is a prevalent condition, especially among hospitalized patients, and can be seen in up to 7% of hospital admissions and 30% of ICU admissions. Several criteria have been used to identify AKI, such as RIFLE, AKIN (Acute Kidney Injury Network), and KDIGO (kidney disease: Improving Global

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Outcomes) criteria. Among these, KDIGO is the most recent and most commonly used tool. According to KDIGO, AKI is the presence of any of the following:[4]

1. Increase in serum creatinine by 0.3 mg/dL or more (26.5 µmol/L or more) within 48 hours
2. Increase in serum creatinine to 1.5 times or more than the baseline of the prior 7 days
3. Urine volume less than 0.5 mL/kg/h for at least 6 hours

The RIFLE criteria define 3 categories of impairment—risk, injury, and failure—and 2 categories of long-term renal outcomes—loss and end-stage renal disease (ESRD). Whichever criterion shows the most impairment is used for classification. When baseline Cr is unknown, a baseline GFR between 75 and 100 mL/min is assumed, or the Modification of Diet in Renal Disease (MDRD) equation can be used to calculate an estimated baseline Cr.[4,5]

1. Risk: Cr ↑ of 1.5x baseline, GFR ↓ of 25%, or urine output <0.5mL/kg/h for 6 h
2. Injury: Cr ↑ of 2x baseline, GFR ↓ of 50%, or urine output <0.5mL/kg/h for 12 h
3. Failure: Cr ↑ of 3x baseline, GFR ↓ of 75 %, Cr ≥4.0, or urine output <0.5mL/kg/h for 12 h
4. Loss: Loss of kidney function for over 4 weeks
5. ESRD: Loss of kidney function for over 3 months

The AKIN criteria are based on the RIFLE criteria and are also called the "modified RIFLE" criteria. While the RIFLE and KDIGO systems have higher sensitivity than AKIN, all 3 have similar predictive abilities for in-hospital mortality.[4]

All patients presenting with AKI warrant a comprehensive metabolic panel. Urine electrolytes can also help suggest an etiology of the AKI. Urine studies should be checked for electrolytes, protein, osmolality, and albumin-to-creatinine ratios. Older patients may warrant serum and urine protein electrophoresis (SPEP and UPEP) to rule out monoclonal gammopathy and multiple myeloma. Renal ultrasound can be helpful if obstructive causes are suspected. CT scans are another important radiographic modality and can be used to look for nephrolithiasis or urolithiasis. Urine microscopy can also provide important clues about the etiology, such as muddy brown casts seen in ATN or white blood cell casts sometimes seen in AIN. Sterile pyuria is the most specific sign of acute interstitial nephritis.[5,6]

Although creatinine is the most commonly used serum chemistry to evaluate for AKI, there is evidence that other biomarkers may be more sensitive and may be elevated earlier in the course of AKI compared to creatinine. Some of these include neutrophil gelatinase–associated lipocalin (NGAL), which can be measured in the plasma and urine, kidney injury binding protein-1 (KIM-1), retinol-binding protein, cystatin C, α/β microglobulin, and urine uromodulin. The use of these biomarkers is not widely available and has not yet been validated in wide-scale studies.[7,8]

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With this background we planned this study with the objective to evaluate the laboratory profile of female patients with acute kidney injury

Objectives:

To study the clinical and laboratory profile of acute kidney injury among female cases

Materials and Methods

This prospective observational study was conducted at the Vilasrao Deshmukh Government Medical Collegeand Hospital Latur, a high-volume tertiary care hospital in Maharashtra, India, after institutional ethics committee approval. The study was approved by the Institutional Review Board at VDGMC, LATUR and patient consent was obtained.

The study was conducted on patients with more than 18 years of age, and those satisfying AKI as per KDIGO criteria were included if AKI was present at presentation or developed within 48 h of hospital admission, labelling them as AKI.[2]

Inclusion criteria:

Cases fulfill the following criteria-

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 <0.5ml/kg/hr for more than six hours.

4. All female AKI patients aged above 18 years.

5. Pregnancy, Post delivery PNC, ANC. 6.Patient who are willing to be the part of study.

Exclusion criteria:

1. Trauma and accidental case

2. Patients with diabetes mellitusand Hypertension

3. Patients with CKD

4. Patients aged below 18 years

5. Male Patient. 6. Patient not giving consent

7. Post Operative Surgical Patient Post Renal AKI.

Those patients with established CKD, probable CKD with a surrogate marker with imaging showing any structural abnormalities, or bilaterally reduced kidney size less than 8.5 cm or on any form of renal replacement therapy (RRT) were excluded from the study.

The recruitment of patients for the study involved receiving referrals for nephrology consultations from various departments. The inclusion criteria encompassed both out- and

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in-patient cases within the nephrology department, as well as individuals referred from other wards.

Data abstraction checklists and structured proforma were developed. The information about the patient's demographics, diagnosis, and associated comorbidities was collected, and laboratory investigation results (creatinine, urea, electrolytes, complete blood count, and liver function tests) were noted. All patients underwent an ultrasonogram of the kidney to note the size and the structural abnormalities.

All participants were followed up and assessed for the outcomes. The patients' clinical examination findings were noted, including the quantification of urine output by 24-h urinary volume and laboratory parameters, such as serum creatinine. Urine analysis was performed to detect proteinuria and microscopic haematuria.

Statistical analysis plan

The data entry was done in Microsoft Excel, and analysis was done using Epi info software 7.2.2.2. The normality distribution of the data was tested by using the Kolmogorov–Smirnov test. Baseline characteristics and patterns of AKI were presented as numbers and percentages. The quantitative data were presented as means ± SD.

A bar diagram was used to display the pattern of AKI outcomes at each follow-up period. Univariable Cox regression was carried out to evaluate the effects of potential factors on overall survival.

The multivariable analysis included all the variables with a p-value of by univariable Cox regression. Reduced model selection using Akaike's information criterion was done to build a multivariate model. Multinomial logistic regression was used to calculate the adjusted odds ratio (AOR) following univariate analysis of overall patient outcome. For all analyses, the p-value is taken as statistically significant when it is less than 0.05.

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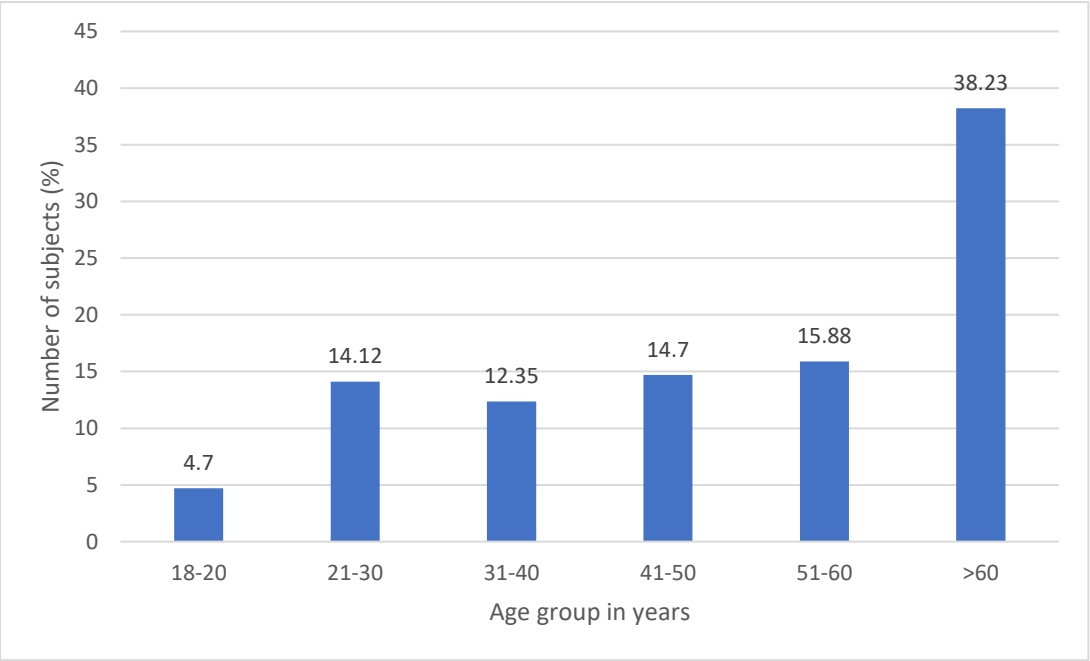
Figure 1: Bar diagram showing distribution of the study population according to age group



Most commonly affected age group in present study was more than 60 years (38.23%) followed by 50-60 years (15.88%). Least affected age group in present study was 18-20 years (4.7%).

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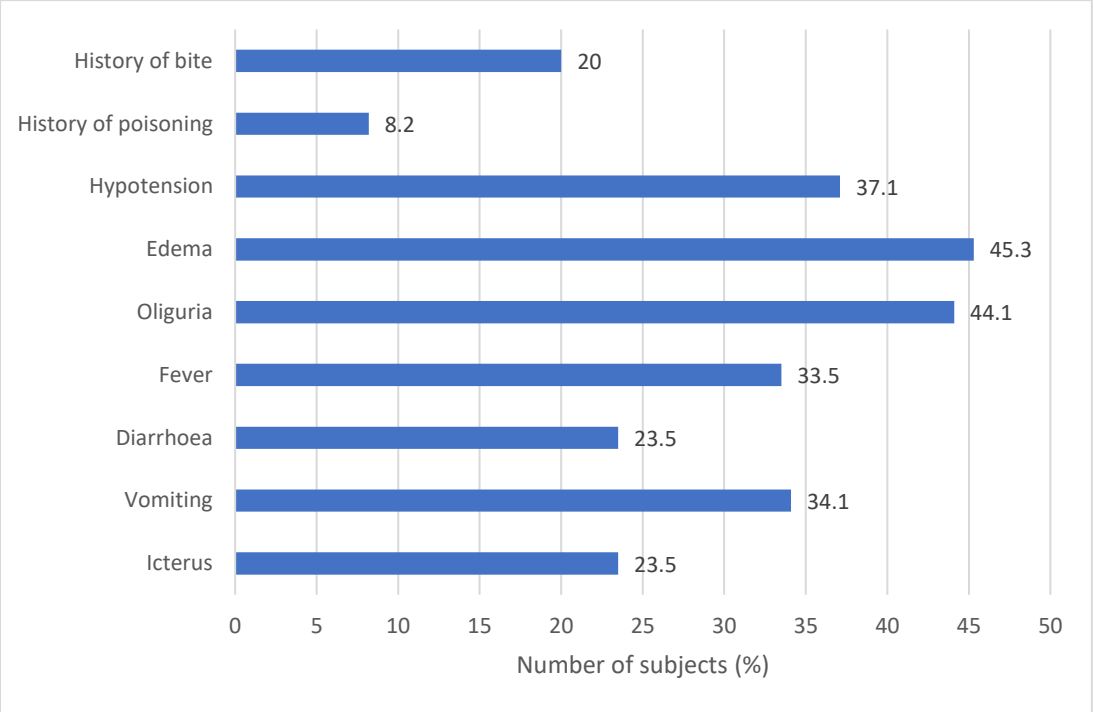
Figure 2: Bar diagram showing distribution of the study population according to clinical features



All 510 patients divided according to common presenting symptoms. We noticed that oliguria, edema and vomiting was most common presenting symptoms comprising of **44%, 45%** and 34% respectively.

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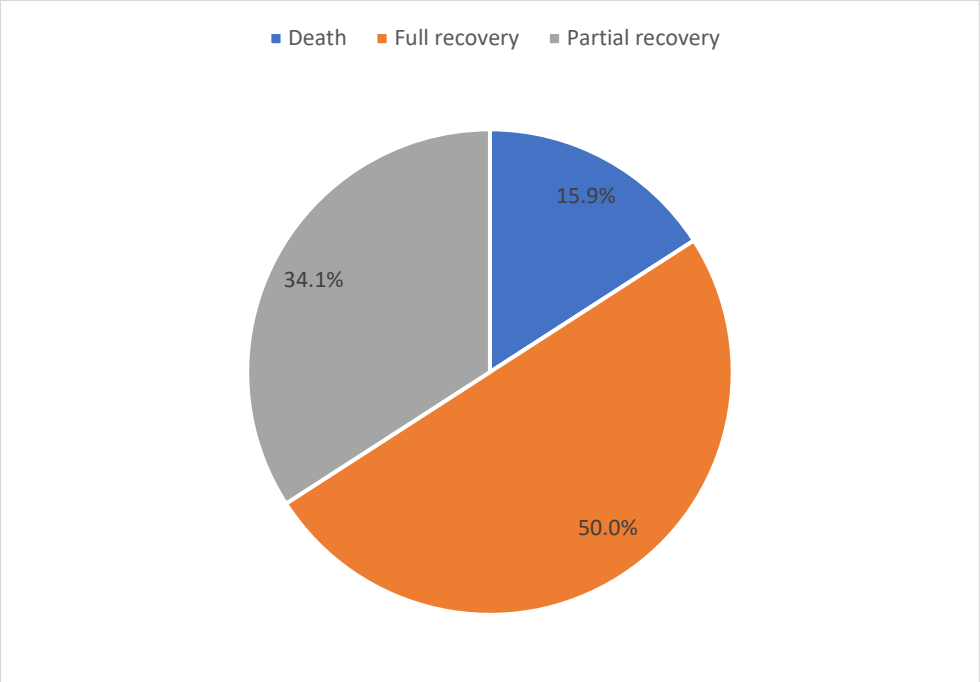
Figure 3: Pie diagram showing distribution of the study population according to outcome



In present study out of 510 patients255 patients had full recovery i.e. 50% and 174 had partial recovery i.e. 34.1%. We also observed that 81 patients (15.9%) died.

Table 1: Laboratory profile of the AKI cases

SERUM K+ LEVEL (mEq/L)	FREQUENCY	PERCENTAGE
2.0-3.0	6	1.17
3.1-4.0	150	29.4
4.1-5.0	171	33.52
5.1-6.0	123	24.11
>6.0	60	11.76
TOTAL	510	100
UREA (mg/dl)	**FREQUENCY**	**PERCENTAGE**
Upto 100	282	55.29
100-150	111	21.76
151-200	72	14.11
201-250	36	7
>250	9	1.76
TOTAL	510	100
CREATININE (mg/dl)	**FREQUENCY**	**PERCENTAGE**
<2.0	24	4.7
2.0-4.0	279	54.7
4.1-6.0	96	18.82
6.1-8.0	66	12.94
>8.0	45	8.82
TOTAL	510	100

In our study, 364 patients i.e. 69.4% had serum potassium level above 4 mEq/L, 228 (44.63%) had serum urea above 100 mg/dl and 486 (95.8%) had serum creatinine level above 2 mg/dl.

In present study conducted for 510 patients, mean level of Sr. Urea was 109.13 ± 57.71 mg/di with minimum value of 31 .00 mg/di and maximum value of 310.00 mg/ dl.In present study conducted for 510 patients, meanlevel of Serum Creatinine was 4.31 ± 2.23 mg/dl with minimum value of 1.90 mg/dl and maximum value of 11.90 mg/dl.In the study conducted for 510 patients, mean level of Serum K+ was 4.74 ±0.98mEq/L with minimum value of 2.80mEq/L and maximum value of 7.30mEq/L.

Table2: Comparison of urea level with outcome

OUTCOME	Mean	Std. Deviatio	95% Confidence Interval for Mean	F	P Value

		n	Lower Bound	Upper Bound		
RECOVERY	94.7	52.05	83.46	105.91	7.87	<0.001, Highly significant
PARTIAL RECOVERY	115	55.73	100.48	129.79		
DEATH	142	64.98	116	167.41		
TOTAL	109	57.71	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.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/di). This Suggest that increase in Serum Urea will lead to bad prognosis from Recovery to Death.

Table3: Comparison of serum creatininelevel with outcome

OUTCOME	**Mean**	**Std. Deviation**	**95% Confidence Interval for Mean**		**F**	**P Value**
			Lower Bound	Upper Bound		
RECOVERY	3.43	1.85	3.02	3.83	19.24	0.0001, Highly significant
PARTIAL RECOVERY	4.83	2.18	4.25	5.3		
DEATH	5.99	2.17	5.12	6.84		
TOTAL	4.31	2.23	3.97	4.65		

There was a statistically significant difference in the serum creatinine level at the pvalue<0.05 for the all three conditions.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.

Discussion

The course of stay in hospital and outcome of these patients with acute kidney injury is variable. In the present study out of 510 patients, 429 Patients survived and about 81 patients expired. Among the survived 255 patients had complete recovery & 174 patients had recovered partially. Partial recovery means there is a sign and symptoms of uraemia 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 uraemia with adequate urine output and normal kidney function test and no need of RRT at the time of discharge.

Out of 510 patients, 339 patients were treated conservatively & 171 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 339 patients, 198 patients recovered completely and 27 patients died due to other associated comorbid 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[9], where 92.5% of patients were managed conservatively and 7.5% of patients underwent dialysis.

Out of 171 patients of haemodialysis, 33 patients died, 93 patients partially recovered and 45 patients recovered completely with normal renal function. Most of our patients who died, had septicaemia and associated complications like respiratoryfailure. 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[7] (81.42%), Eswarappa et al[10] (85%) and Kumar R. et al[11] (90%).

The mortality in present study (16%) is similar to study done by Utkarsh et al[12] (18.5%) and Eswarappa et al[10] (15%), but in variance with other studies conducted by Kumar R et al[11] (29.2%) and Patil TB et al[13](29.8%).

Ibrahim A. et al[14] in their study reported that nearly all of the patients had mild anaemia onadmission, and had an average drop of 2 g/dl of haemoglobin at discharge. The mean levelsof creatinine at admission and discharge were 10.18 ± 5.19 and 4.97 ± 3.54 mg/dl respectively and for potassium the value was 5.03 ± 1.35 and 4.06 ± 1.02 mEq/L at admission and discharge respectively.

Conclusion:

Our study concluded that 50% of the patients were fully recovered and 31.4% were partially recovered. Mortality rate in our study 15.9%. Serum urea and creatinine were significantly increased in patients with mortality. In our study, 364 patients i.e. 69.4% had serum potassium level above 4 mEq/L, 228 (44.63%) had serum urea above 100 mg/dl and 486 (95.8%) had serum creatinine level above 2 mg/dl. Our study also concluded that rise in Urea and creatininelevel lead to bad prognosis from recovery to death.

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