Original Article

ISSN (O): 2663-8290; ISSN (P): 2663-8282

# A study on the causes of Acute Kidney Injury in ICU in a Tertiary care centre and comparison of prognostic scoring systems (SOFA score and APACHE score) to predict mortality and renal outcome

**Jose Peumpillil Paul**[1], **Nageswara Reddy Pamidi**[2], **G. Suresh Kumar**[3], **K. Sharath Kumar Reddy**[4]

[1]Assistant Professor, Department of Nephrology, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India, [2]Assistant Professor, Department of Nephrology, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India, [3]Assistant Professor, Department of Nephrology, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India, [4]Assistant Professor, Department of Nephrology, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India.

## Abstract

**Introduction:** Acute kidney injury (AKI) is a complex clinical disorder that is associated with severe morbidity and mortality, which in spite of technological advances in Renal replacement therapy (RRT), continues to be associated with poor outcomes. AKI is a syndrome of sudden loss of kidney's excretory function, often associated with oliguria, occurring over hours to days seen commonly in hospitalised patients who are critically ill. **Subjects and Methods:** A prospective and observational study was conducted at Sapthagiri Institute of Medical Sciences & Research Centre from January 2020 to December 2020. Patients with Acute Kidney Injury satisfying inclusion and exclusion criteria, admitted in the medical Intensive care unit (ICU), were selected after obtaining informed consent. **Results:** The mean age of the population was 64.51 ± 14.29 years. 65% patients were males. Most common age group was older age group (65 to 75 years) for both males and females. In the younger age group (18-44 years) most of them were males. In the elderly age group (85- 100 years) females exceeded males. The mean duration of hospital stay was 10.78 ± 8.39 days and the median duration of hospital stay was 9 days. The mean duration of ICU stay was 6.15 ± 5.31days and the median duration of ICU stay was 4 days. In our study some patients had AKI on day 1 of ICU admission and the others developed AKI later during the course of ICU stay. The median day of ICU admission on which patients presented with AKI in our study was on the day 1. RRT was initiated in majority of the patients (53%) on the $1^{st}$ day of ICU admission itself. Remaining patients (25.6%) received RRT on day 2 of ICU admission. Only a few patients (21%) received RRT after 2 days. **Conclusion:** Elderly males are at higher risk for developing AKI. Sepsis with pneumonia is the leading cause of AKI in ICU. Pre-existing Chronic Kidney disease (CKD )has worse renal outcome. Kidney Disease Improving Global outcomes(KDIGO) staging is an independent predictor of ICU mortality, RRT requirement and ventilatory support. In the setting of acute kidney injury, Acute Physiology and Chronic Health Evaluation (APACHE) III is superior to Sequential Organ Failure Assessment (SOFA) and APACHE II for predicting in-hospital mortality. Patients with AKI have 2.33 times more risk of mortality compared to those without AKI. AKI is an independent predictor of mortality in ICU.

**Keywords:** Acute kidney injury, SOFA score, APACHE score, Renal outcome

**Corresponding Author:** Nageswara Reddy Pamidi, Assistant Professor, Department of Nephrology, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India.
E-mail: pnraddy@gmail.com

**Received: 04 January 2021** **Revised: 15 January 2021** **Accepted: 21 January 2021** **Published: 17 June 2021**

## Introduction

Acute kidney injury (AKI) is a complex clinical disorder that is associated with severe morbidity and mortality, which in spite of technological advances in RRT, continues to be associated with poor outcomes. AKI is a syndrome of sudden loss of kidney's excretory function, often associated with oliguria, occurring over hours to days, commonly in hospitalised patients who are critically ill.[1] It can range from mild loss of kidney function to complete kidney failure. AKI usually occurs as a complication of another serious illness.[2] It has only been in the past few years that moderate decline in kidney function has been recognized as potentially important risk factor for mortality, in the critically ill,[3] and in studies on contrast induced nephropathy(4).Acute Kidney Injury continues to remain a significant problem in hospitalized patients and has a high mortality rate. Furthermore, the

incidence of AKI continues to increase and currently there is no definitive therapy for it.

Acute Kidney Injury (AKI) affects over 13 million people per year globally, and results in 1.7 million deaths.[4–6] AKI is diagnosed in up to 20% of hospitalized patients and in 30–60% of critically ill patients.[7–10] It is the most frequent cause of organ dysfunction in intensive care units (ICUs) and the occurrence of even mild AKI is associated with a 50% higher risk of death.[11] AKI results in a significant burden for the society in terms of health resource use during the acute phase, and the potential long-term sequelae including development of chronic kidney disease (CKD) and kidney failure.[12–14] The effect of AKI on an individual patient and the resulting social burden that ensues from the long-term effects of the disease, including development of chronic kidney disease (CKD) and end-stage renal disease (ESRD), is attracting increasing scrutiny.

Acute Kidney Injury is not a single disease but rather a syndrome comprising multiple clinical conditions. Outcomes from AKI depend on the underlying disease, the severity and duration of renal impairment, and the patient's baseline renal function. The development of AKI is the consequence of complex interactions between the actual insult and subsequent activation of inflammation and coagulation. AKI can also lead to problems that are not readily appreciated at the bedside and can extend well beyond the ICU stay, including progression of CKD and impaired innate immunity. Experimental and small observational studies provide evidence that AKI impairs innate immunity and is associated with higher infection rates.[9]

Multiple definitions of AKI has led to great disparity in the reported incidence of AKI making it difficult to compare various published studies focusing on AKI.[12,15–19] In 2011 the KDIGO work group combined the RIFLE and AKIN classifications of AKI to establish one classification of AKI for practice, research and public health. Due to the rising incidence and mortality in patients with AKI, it is important to evaluate the causes of acute kidney injury. There have been several studies concentrating on the prediction of mortality in critically ill patients using several scoring systems like SOFA score, APACHE score, MODS score, SAP score etc. Literatures on classification and prognostication of AKI in critically ill based on KDIGO guidelines in Indian population are limited . Also studies on predicting mortality in critically ill patients with acute kidney injury using APACHE III is also limited.

This study is done to determine the causes of acute kidney injury in critically ill patients and to predict their mortality using SOFA score, APACHE II and APACHE III scoring systems.

## Subjects and Methods

A prospective and observational study conducted at Sapthagiri Institute of Medical Sciences & Research Centrefrom January 2020 to December 2020. Patients with Acute Kidney Injury satisfying inclusion and exclusion criteria, admitted in the medical ICU, were selected after obtaining informed consent.

**Sample size:** The sample size was calculated assuming the expected proportion of any particular cause of AKI as 34.25% as per the study by Chih-Hsiang Chang et al. The other parameters considered for sample size calculation were 95% confidence level and 5% precision. As per the previous year statistics, the monthly ICU admission is about 250 patients per month. Hence, the total number of ICU admissions expected is about 3000 during 12-month data collection period. Considering the reported proportion of AKI is about 30% by various studies, a total of about 900 AKI subjects are likely to get admitted during data collection period. Hence a finite population correction factor for 900 subjects was added in sample size calculation.

### Inclusion criteria

1. Patients with Acute Kidney Injury diagnosed based on the KDIGO guidelines.
2. Patients aged more than 18 years.

### Exclusion criteria

1. Patients with End Stage Renal Disease (ESRD) on maintenance Renal Replacement Therapy.
2. Patients aged less than 18 years.
3. Patients who underwent renal transplantation.

### Statistical Methods

The data was entered in Excel and the software used for statistical analysis was SPSS version 22 (Statistical Package for Social Science).

Descriptive analysis: Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Data was also represented using appropriate diagrams like bar diagram, pie diagram and box plots.

The association between categorical explanatory variables and quantitative outcome was assessed by comparing the mean values, Independent t test, ANOVA was used to assess statistical significance. The association between explanatory variables and categorical outcomes was assessed by cross tabulation and comparison of percentages. Chi square test was used to test statistical significance.

## Results

During the study period, 218 patients diagnosed to have acute kidney injury (KDIGO criteria ), fulfilling the inclusion and exclusion criteria were admitted in the medical ICU. Their data was collected and analysed. Another 100 patients without kidney injury admitted to the ICU was studied for comparison with the AKI patients**.** Results of this study are as follows:

**Demographic Data of the Study Population**

There were 218 patients recruited for study. Age group taken was adults more than 18 years of age. The mean age of the population was 64.51 ± 14.29 years. 65% patients were males. Most common age group was older age group (65 to 75 years) for both males and females. In the younger age group (18-44 years) most of them were males. In the elderly age group (85-100 years) females exceeded males.

Patients were followed up from admission to discharge/ death from the hospital. The mean duration of hospital stay was 10.78 ± 8.39 days and the median duration of hospital stay was 9 days. The mean duration of ICU stay was 6.15 ± 5.31days and the median duration of ICU stay was 4 days. In our study some patients had AKI on day 1 of ICU admission and the others developed AKI later during the course of ICU stay. The median day of ICU admission on which patients presented with AKI in our study was on the day 1.

RRT was initiated in majority of the patients (53%) on the $1^{st}$ day of ICU admission itself. Remaining patients (25.6%) received RRT on day 2 of ICU admission. Only a few patients (21%) received RRT after 2 days.

[Table 7] The mean SOFA score in the study population was 7.04 ± 3.83. The mean APACHE II and APACHE III scores in the study population were 20.96 ± 7.65. and73.02 ± 25.1 respectively.

All the 218 patients were followed up until discharge from the hospital or in hospital death. For all the patients who survived following AKI, status at discharge was assessed by recording serum creatinine at discharge and this was compared with the baseline creatinine and degree of recovery was assessed. 33% patients recovered completely; 35% expired during the course of treatment and 1% patients became dialysis dependent. Of the remaining patients who survived 21% recovered only partially and 8% patients did not recover at all.

## Discussion

AKI is common in ICUs and has been associated with increased mortality, length of ICU stay, and medical costs for critically ill patients. Reliable and comparable data about the clinical spectrum of AKI is necessary for optimizing management. This study is done to describe the etiologies of AKI, prognostication and outcome of AKI. In our study we recruited 218 patients in ICU who presented with Acute Kidney Injury and those who developed AKI during the course of ICU stay. The KDIGO guidelines were applied to diagnose AKI. The baseline serum creatinine value of the patients was collected. In those patients whose baseline creatinine was not known serum creatinine on the day of admission to the hospital was taken as baseline. We also grouped the patients according to the severity of Acute Kidney Injury based on the KDIGO severity staging. Mortality in critically ill patients was usually due to multisystem involvement, and renal failure plays a very important role in prognosis. Mortality prediction for patients in intensive care units (ICU) remains an important challenge. Many severity scores are used but none of these individually outperform all others regardless of the context. In this study we tried to predict mortality in patients admitted to the ICU using three scoring systems (SOFA, APACHE II, APACHE III scores) and to find out which score had the maximum ability to predicted mortality.

Until recently AKI had several definitions, in several literatures AKI was still diagnosed based on old definitions (RIFLE criteria, AKIN classification). Though the KDIGO group put forward the KDIGO guidelines for diagnosis and staging of AKI in 2011, literatures on KDIGO criteria were limited. So we used the KDIGO guidelines to diagnose and assess the severity of AKI in our study population.

In our study there were 42(19.3%) patients with pre-existing CKD and 172(78.8%) had AKI without pre-existing renal impairment. On analysis we have found that there was statistically significant increase in age for CKD patients (p=0.05). There was no significant difference in the duration of hospital stay between these two groups. Analysis of our data showed the prevalence of diabetes, hypertension and coronary artery disease is significantly higher in CKD when compared to patients with AKI without pre-existing CKD (p< 0.05).

In our study mean duration of ICU stay was 6.15±5.31 days which was in concordance with the study done by Eswarappa et al where mean duration of ICU stay was 5.6 days and median ICU length of 7 days as in study of Piccini et al.[20,21] The mean duration of hospital stay was 10.78 ±8.39 days. In our study, we observed the day of ICU admission on which the patient developed AKI. In this the minimum was on day 1 of ICU admission and maximum was 16 days after ICU admission. The median day of ICU admission on which AKI occurred was on Day 1.

In the AKI population (218 patients), three prognostic scoring systems SOFA, APACHE II, APACHE III scores were calculated within 24 hours of ICU admission and were compared to find which score had the best ability to predict mortality. The mean SOFA score was 7.04 ± 3.83. Mean APACHE II and APACHE III were20.96 ± 7.65 and 73.02 ±25.1 respectively.

**Table 1: S ex distribution**

| Gender | Frequency | Percentages |
|---|---|---|
| Male | 142 | 65.10% |
| Females | 76 | 34.90% |

**Table 2: Sex distribution in different age groups.**

| Age group | Females | Males |
|---|---|---|
| 15-24 | 0 | 3 |
| 25-34 | 0 | 6 |
| 35-44 | 2 | 7 |
| 45-54 | 8 | 24 |
| 55-64 | 16 | 31 |
| 65-74 | 23 | 38 |
| 75-84 | 17 | 27 |
| 85-94 | 10 | 5 |
| 95-104 | 0 | 1 |

**Table 3: Age characteristics**

| Parameter | Mean ± SD | Median | Min | Max | 95% C.I | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| AGE | 64.51 ± 14.29 | 66.50 | 18.00 | 99.00 | 62.60 | 66.42 |

**Table 4: Length of hospital stay/ length of ICU stay/ day of occurrence of AKI in ICU (n=218)**

| Parameter | Mean ± SD | Median | Min | Max | 95% C.I | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| Number of days in hospital | 10.78 ± 8.39 | 9.00 | 1.00 | 53.00 | 9.66 | 11.90 |
| No of days in ICU | 6.15 ± 5.31 | 4.00 | 1.00 | 38.00 | 5.44 | 6.86 |
| AKI on day of ICU | 1.43 ± 1.62 | 1.00 | 1.00 | 16.00 | 1.21 | 1.64 |

**Table 5: Day of ICU stay on which RRT was started (n=43)**

| ICU Day | Frequency (%) |
|---|---|
| 1st | 23 (53%) |
| 2nd | 11 (25.6%) |
| 3rd | 2 (4.6%) |
| 4th | 2 (4.6%) |
| >5 Days | 5 (12%) |

**Table 6: Survival outcome**

| Characteristics | Alive (n=140) | Dead (78) | p value (independent t test) |
|---|---|---|---|
| SOFA score | 5.71±3.087 | 9.42±3.890 | 0.279* |
| APACHE II score | 18.27±6.287 | 25.78±7.529 | 0.0001 |
| APACHE III score | 62.62±19.302 | 91.68±23.530 | 0.0001 |
| Age | 63.46±15.110 | 66.40±12.568 | 0.146 |
| Days in ICU | 5.91±5.181 | 6.59±5.551 | 0.964* |
| Days in hospital | 12.63±8.736 | 7.46±6.570 | 0.0001* |
| GCS | 13.84±2.585 | 11.74±3.812 | 0.0001 |
| MAP | 89.90±27.208 | 76.64±27.901 | 0.001 |
| Creatinine | 3.44±2.696 | 3.72±2.357 | 0.036* |
| HCO3 | 19.59±8.421 | 17.64±6.892 | 0.082* |
| Potassium | 4.38±.917 | 4.58±.905 | 0.126 |
| Sodium | 132.50±6.873 | 134.04±9.004 | 0.159 |
| Sugar- RBS | 203.92±127.635 | 185.87±113.741 | 0.290* |
| Albumin | 3.12±.754 | 2.87±.745 | 0.019 |
| Haemoglobin | 11.24±2.518 | 11.54±2.891 | 0.421 |
| Platelets | 205.89±122.416 | 202.60±140.046 | 0.606* |
| No of patients required rrt | 19 | 31 | 0.0001$ |
| No of patient required ventilation | 17 | 35 | 0.0001$ |
| No of patient on inotropes | 28 | 39 | 0.0001$ |

*Mann whitney u test, $ chi-square test To assess the factors affecting mortality the above mentioned characteristics were compared in survivors and non survivors. There was statistically significant difference in the APACHE II and III scores between these two groups (p=0.0001) with higher scores in non survivors. There was no significant difference in SOFA score. There was statistically significant increase in duration of hospital stay, requirement of RRT, inotropic support and mechanical ventilation among non survivors (p=0.001).Among the non survivors there was significant decreased in GCS, albumin, mean arterial pressure and increase in creatinine levels($p<0.05$).

**Table 7: ICU scoring systems with mean value.**

| Parameter | Mean ± SD | Median | Min | Max | 95% C.I | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| **Sofa** | 7.04 ± 3.83 | 6.00 | 1.00 | 21.00 | 6.53 | 7.55 |
| **Apache II** | 20.96 ± 7.65 | 20.00 | 6.00 | 45.00 | 19.94 | 21.98 |
| **Apache III** | 73.02 ± 25.1 | 68.50 | 20.00 | 166.00 | 69.67 | 76.37 |

**Table 8: Renal outcome**

| Renal outcome | Frequency | Percent |
|---|---|---|
| Complete recovery | 71 | 32.50% |
| Partial recovery | 46 | 21.10% |
| No recovery | 17 | 8% |
| Dialysis dependent | 2 | 1% |
| Death | 78 | 35.7% |
| Discharge against advice | 4 | 2% |

There was statistically significant difference in the SOFA, APACHE II and APACHE III scores between the 3 stages of AKI (0.0001), with maximum scores in patients belonging to KDIGO stage 3. When comparing AKI versus AKI with CKD, it was found that only APACHE II has a statistically significant difference, with higher scores in CKD.

All the 218 AKI patients were followed up until discharge or in hospital death. Renal outcome was assessed based on the serum creatinine at discharge. Out of 218 AKI patients, 32.5% recovered completely, 35.7% patients expired, 1% became dialysis dependent at discharge, 21% had partial recovery while 8% had no recovery at the time of discharge. In study by Yang et al the recovery rate was 21% and the mortality rate was 19.6%.[22–25] The scores were also used to predict the renal outcome. Patients with higher ICU scores did not have complete recovery, they either had no recovery or they expired. There was statistically significant difference in the SOFA, APACHE II, APACHE III scores of patients who completely recovered and those who died during treatment or those without complete recovery. (p,0.05) Higher the scores of SOFA, APACHE II and APACHE III, poorer the renal outcome. So high scores are an indicator of poor renal outcome or mortality.

## Conclusion

Elderly males are at higher risk for developing AKI. Sepsis with pneumonia is the leading cause of AKI in ICU. Pre-existing CKD has poorer renal outcome. KDIGO staging is an independent predictor of ICU mortality, RRT requirement and ventilatory support. In the setting of acute kidney injury, APACHE III is superior to SOFA and APACHE II for predicting in-hospital mortality. Patients with AKI have 2.33 times more risk of mortality compared to those without AKI. AKI is an independent predictor of mortality in ICU.

## References


1. Koza Y. Acute kidney injury: current concepts and new insights. J Inj Violence Res. 2016;8(1):58–62. Available from: https://doi.org/10.5249/jivr.v8i1.610.
2. ;. Available from: https://www.nhs.uk/conditions/acute-kidney-injury/.
3. Hoste EA, Clermont G, Kersten A, Venkataraman R, Angus DC, Bacquer D. RIFLE criteria for acute kidney injury are associated with hospital mortality in critically ill patients: a cohort analysis. Crit Care. 2006;10(3):73–73. Available from: https://dx.doi.org/10.1186/cc4915.
4. Levy EM, Viscoli CM, Horwitz RI, Rich GF. The Effect of Acute Renal Failure on Mortality. Sur Anesthesiol. 1997;41(5):310. Available from: https://dx.doi.org/10.1097/00132586-199710000-00065.
5. Lameire NH, Bagga A, Cruz D, Maeseneer JD, Endre Z, Kellum JA, et al. Acute kidney injury: an increasing global concern. Lancet. 2013;382(9887):170–179. Available from: https://dx.doi.org/10.1016/s0140-6736(13)60647-9.
6. Lewington AJP, Cerdá J, Mehta RL. Raising awareness of acute kidney injury: a global perspective of a silent killer. Kidney Int. 2013;84(3):457–467. Available from: https://dx.doi.org/10.1038/ki.2013.153.
7. Susantitaphong P, Cruz DN, Cerda J, Abulfaraj M, Alqahtani F, Koulouridis I, et al. World Incidence of AKI: A Meta-Analysis. Clin J Am Soc Nephrol. 2013;8(9):1482–1493. Available from: https://dx.doi.org/10.2215/cjn.00710113.
8. Hoste EA, Kellum JA. Acute kidney injury: epidemiology and diagnostic criteria. Curr Opin Crit Care. 2006;12(6):531–537. Available from: https://dx.doi.org/10.1097/mcc.0b013e3280102af7.
9. Singbartl K, Kellum JA. AKI in the ICU: definition, epidemiology, risk stratification, and outcomes. Kidney Inte. 2012;81:819–825. Available from: https://dx.doi.org/10.1038/ki.2011.339.
10. Santos PR, Monteiro D. Acute kidney injury in an intensive care unit of a general hospital with emergency room specializing in trauma: an observational prospective study. BMC Nephrol. 2015;16:30. Available from: https://dx.doi.org/10.1186/s12882-015-0026-4.
11. Linder A, Fjell C, Levin A, Walley KR, Russell JA, Boyd JH. Small Acute Increases in Serum Creatinine Are Associated with Decreased Long-Term Survival in the Critically Ill. Am J Respir Crit Care Med. 2014;189(9):1075–1081. Available from: https://dx.doi.org/10.1164/rccm.201311-2097oc.
12. Chertow GM, Burdick E, Honour M, Bonventre JV, Bates DW. Acute Kidney Injury, Mortality, Length of Stay, and Costs in Hospitalized Patients. J Am Soc Nephrol. 2005;16(11):3365–3370. Available from: https://dx.doi.org/10.1681/asn.2004090740.
13. Bellomo R, Ronco C, Kellum JA, Mehta RL, Palevsky P. Acute renal failure - definition, outcome measures, animal models, fluid therapy and information technology needs. Crit Care. 2004;8:204–212. Available from: https://doi.org/10.1186/cc2872.
14. Chawla LS, Eggers PW, Star RA, Kimmel PL. Acute kidney injury and chronic kidney disease as interconnected syndromes. N Engl J Med. 2014;3(1):58–66. Available from: https://doi.org/10.1056/nejmra1214243.
15. Brivet FG, Kleinknecht DJ, Loirat P, Landais PJM. Acute renal failure in intensive care units–Causes, outcome, and prognostic factors of hospital mortality. Crit Care Med. 1996;24(2):192–198. Available from: https://dx.doi.org/10.1097/00003246-199602000-00003.
16. Liaño F, Pascual J, Group TMARFS. Epidemiology of acute renal failure: A prospective, multicenter, community-based study. Kidney Int. 1996;50(3):811–818. Available from: https://dx.doi.org/10.1038/ki.1996.380.
17. Lopes JA, Jorge S. The RIFLE and AKIN classifications for acute kidney injury: a critical and comprehensive review. Clin Kidney J. 2013;6(1):8–14. Available from: https://dx.doi.org/10.1093/ckj/sfs160.
18. Schaefer JH, Jochimsen F, Keller F, Wegscheider K, Distler A. Outcome prediction of acute renal failure in medical intensive

care. Intensive Care Med. 1991;17(1):19–24. Available from: https://dx.doi.org/10.1007/bf01708404.
19. Silvester W, Bellomo R, Cole L. Epidemiology, management, and outcome of severe acute renal failure of critical illness in Australia. Crit Care Med. 2001;29(10):1910–1915. Available from: https://dx.doi.org/10.1097/00003246-200110000-00010.
20. Sitprija V, Losuwanrak K, Kanjanabuch T. Leptospiral Nephropathy. Seminars in Nephrology. 2003;23(1):42–48. Available from: https://dx.doi.org/10.1053/snep.2003.50004.
21. Daher E, Abreu K, De JS, Da GB. Leptospirosis-associated acute kidney injury. Braz J Nephrol. 2010;32(4):408–423.
22. Dos MSL, Da SM, Dos MSL, Da SM. Mechanical ventilation and acute kidney injury in patients in the intensive care unit. Acta Paul Enferm. 2015;28(2):146–51. Available from: https://doi.org/10.1590/1982-0194201500025.
23. Levi TM, Souza SPD, Magalhães JGD, Carvalho MSD, Cunha A, Dantas J, et al. Comparison of the RIFLE, AKIN and KDIGO criteria to predict mortality in critically ill patients. Rev Bras Ter Intensiva. 2013;25(4):290–296.
24. Masewu A, Makulo JR, Lepira F, Amisi EB, Sumaili EK, Bukabau J. Acute kidney injury is a powerful independent predictor of mortality in critically ill patients: a multicenter prospective cohort study from Kinshasa, the Democratic Republic of Congo. BMC Nephrol. 201624;17(1):118–118. Available from: https://doi.org/10.1186/s12882-016-0333-4.
25. Bucuvic EM, Ponce D, Balbi AL. Fatores de risco para mortalidade na lesão renal aguda. Rev Assoc Med Bras. 2011;57:158–163. Available from: https://dx.doi.org/10.1590/s0104-42302011000200012.



**How to cite this article:** Paul JP, Pamidi NR, Kumar GS, Reddy KSK. A study on the causes of Acute Kidney Injury in ICU in a Tertiary care centre and comparison of prognostic scoring systems (SOFA score and APACHE score) to predict mortality and renal outcome. Acad. J Med. 2021;4(1):41-47.

DOI: dx.doi.org/10.47008/ajm.2021.4.1.8

**Source of Support:** Nil, **Conflict of Interest:** None declared.