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Correlation of Urine Albumin-Creatinine Ratio with SAPS II Score in A Tertiary Health Care Centre

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Abstract: Sepsis is a medical emergency that describes the body's systemic immunological response to an infectious process that can lead to end-stage organ dysfunction and death. Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection. Sepsis has very high morbidity and mortality, leading to a major healthcare burden worldwide. Though there is far advancement in the therapeutic options, the mortality rate remains high due to the delay in the diagnosis because of the lack of availability of reliable diagnostic methods. This study aimed to observe the utility of Urine Albumin-Creatinine ratio with SAPS II score among patients with sepsis. It is a Hospital based prospective analytical study conducted to study the utility of the correlation of Urine Albumin-Creatinine ratio with SAPS II score in patients with sepsis period was July 2021 to November 2022 at General Medicine Department in Tertiary Care Hospital. Institutional Ethics Committee approved the study. It was observed that most patients were male 34 (56.67%) and female 26 (43.33%). It was observed that most patients were in the age group 41-50 years 14 (23.33%) followed by 51-60 years 12 (20%); the mean age of the patients was 45.1 ± 17.15 years. This study concludes that the Urine Albumin-Creatinine ratio with SAPS II score is useful in sepsis diagnosis. The urinary ACR estimation is an easy, cheap, and non-invasive tool and may be used to identify high-risk sepsis cases in resource settings.

Keywords: (SAPS II), Urine Albumin-Creatinine Ratio (ACR), SIRS, Serum Creatinine, Sepsis.

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1. INTRODUCTION

Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection. Sepsis is a medical emergency that describes the body's systemic immunological response to an infectious process that can lead to end-stage organ dysfunction and death. Sepsis occurs in 1–2% of all hospitalized patients and accounts for as much as 25% of ICU cases.[1] In 1993, Simplified Acute Physiology Score II **(**SAPS II) was developed using logistic regression analysis to select and weigh the variables.[2] The Simplified Acute Physiology Score (SAPS), first developed and validated in 1984 in France, used 13 weighted physiological variables and age to indicate the risk of death for ICU patients.[3] As with the APACHE, the realization that the SAPS II had lost some of its accuracy over time led to attempts to improve its accuracy. An extended version was created and published in 2005, adding 6 admission variables: age, sex, length of pre-ICU hospital stay, patient location before ICU, clinical category, and presence of drug overdose. This model had better calibration, discrimination, and uniformity of fit than the original SAPS II. Using a regional score potentially enables better comparison with other ICUs in the same geographic region, although it also reduces the accuracy of comparison with ICUs in different geographical zones. The SAPS II score has been shown to exhibit satisfactory discrimination, calibration, and goodness of fit.[4] In various studies, microalbuminuria has been correlated with rapid changes in vascular integrity.[5] Microalbuminuria, defined as 30–300 mg/day of albumin excretion in the urine, occurs rapidly after an acute inflammatory insult such as sepsis and persists in patients with complications. It is a common finding in critically ill patients, where it has shown promise not only as a predictor of organ failure and vasopressor requirement but also of mortality.[6,7] However, as yet, no simple test exists, and thus the role of urinary albumin-creatinine ratios (ACR) as a simple predictor for the development of postoperative complications is worthy of investigation. Urinary ACR measures the glomerular permeability of the kidney to albumin. Under normal conditions, albuminuria should not occur, as any albumin crossing the glomerulus should be reabsorbed. However, these reabsorption mechanisms work at near maximal capacity under normal conditions, so even small increases in the glomerular load of albumin will saturate the transport mechanisms, leading to albuminuria.[8,9] Traditionally, the measurement of ACR has been used as an investigative tool by nephrologists and diabetologists in the assessment of renal function, and in particular, in screening for diabetic nephropathy. However, since the systemic inflammatory response is known to affect glomerular permeability, ACR has more recently been used as a marker of renal function in sepsis and after inflammatory states, where microalbuminuria occurs as part of the inflammatory response secondary to increased vascular permeability.[10] Therefore, the aim of this study was to observe the utility of Urine Albumin-Creatinine ratio with SAPS II score among patients with sepsis. The great focus on this disease in contemporary research is fully justified because it may be useful in the clinical assessment of critically ill patients at risk of worse prognosis, even in resource-poor areas.

2. MATERIALS AND METHODS

It is a hospital-based prospective analytical study conducted to study the utility of the correlation of Urine Albumin-Creatinine ratio with SAPS II score in patients with sepsis period was July 2021 to November 2022 at the General Medicine Department in Tertiary Care Hospital. In this study consecutive sampling technique was used to recruit a sample of size 60 patients to diagnose sepsis; the sample size was calculated using the correlation of urine albumin with ACS. A urine sample was collected after 24 hours of admission and tested for Urine Albumin and Urine Creatinine, and urine albumin: urine creatinine ratio was calculated at 24 hours of admission. Detailed history, clinical examination, and relevant laboratory examination were assessed. The severity of sepsis was calculated using SIRS and SAPS II Score. This study was conducted after clearance by the Institutional Ethical Committee.

2.1 Ethical Statement

The study was conducted after approval by the institutional ethical committee (Approval No. MC/Ethics/2022/58 dated 14/03/2022), and written informed consent was obtained from the patients who participated.

2.2 Inclusion criteria

Patients of age more than 18 years presenting with sepsis and willing to undergo subsequent laboratory assessment.

2.3 Exclusion criteria

1. Patients receiving nephrotoxic drugs
2. Patients with pre-existing urinary tract infection
3. Patients with urologic trauma resulting in frank haematuria or urinary infection
4. Patients with pre-existing chronic kidney disease (serum creatinine level ≥ 2.0mg/dL)
5. Pregnant women
6. Patients with Anuria
7. Patients who don't give consent.

3. STATISTICAL ANALYSIS

Data were double-entered using Microsoft Excel 2016 and analyzed using SPSS version 22. Data were summarized in frequency, pie chart, and histogram. Categorical variables were reported as a proportion. Continuous data were described as means (standard deviation) or medians (interquartile range) depending on the data distribution. The T-test was applied in the following results whenever necessary. The correlation between urinary protein creatinine ratio SAPS II score was assessed using the Pearson correlation coefficient. The accuracy of the urinary protein creatinine ratio to use sensitivity & specificity was evaluated using the Receiver Operating Characteristic Curve, i.e., the ROC curve. [Difference between areas under the curve at different stages according to sepsis was assessed] The level of significance criteria was selected at $P<0.05$.

4. RESULTS

During the study period, 60 patients with sepsis were recruited in the study and had an age ranging from 18 to 82. The below table shows the majority of the patients were chest infection 38 (63.3%), followed by peritonitis 11 (18.3%), wound infection 6 (10.0%) & infected bed sores 5 (8.3%).

Table No. 1: Source of Sepsis in the study subjects.	
Source of Sepsis	**No. of Patients (%)**
Chest Infection	38 (68.3%)
Peritonitis	11 (18.3%)
Wound Infection	6 (10.0%)
Infected bed sores	5 (8.3%)

The below table and Figure 1 show the distribution of patients according to age. It was observed that most patients were in the age group 41-50 years 14 (23.33%) followed by 51-60 years 12 (20%). The mean age of the patients was 45.1 ±17.15 years. It was observed that the majority of patients were male, 34 (56.67%), and females 26 (43.33%). It was observed that most patients had hypertension 15 (25%) followed by diabetes mellitus 12 (20%). The CVA was observed among 04 (6.67%) patients, tuberculosis 1 (1.67%), CVD 1 (1.67%), and others 9 (15%). It was observed that the majority of patients had fever 43 (71.67%) followed by breathlessness 32 (53.33%), abdominal distension 21 (35%), abdominal pain 19 (31.67%), altered sensorium 8 (13.33%) and convulsion 3 (5%).

Table 2: Distribution according to hematological examination		
Parameters	**Mean**	**Standard Deviation**
Haemoglobin (g/dl)	9.29	1.86
WBC Count (mcL)	20361	12295
Platelets (mcL)	206.71	80.52
SGOT (mg/dl)	102.9	11.54
SGPT (mg/dl)	93.55	13.4
Total bilirubin (mg/dl)	2.98	1.72
Direct bilirubin (mg/dl)	1.34	1.11
Blood urea (mg/dl)	30.17	12.11
Serum Creatinine (mg/dl)	1.29	0.43

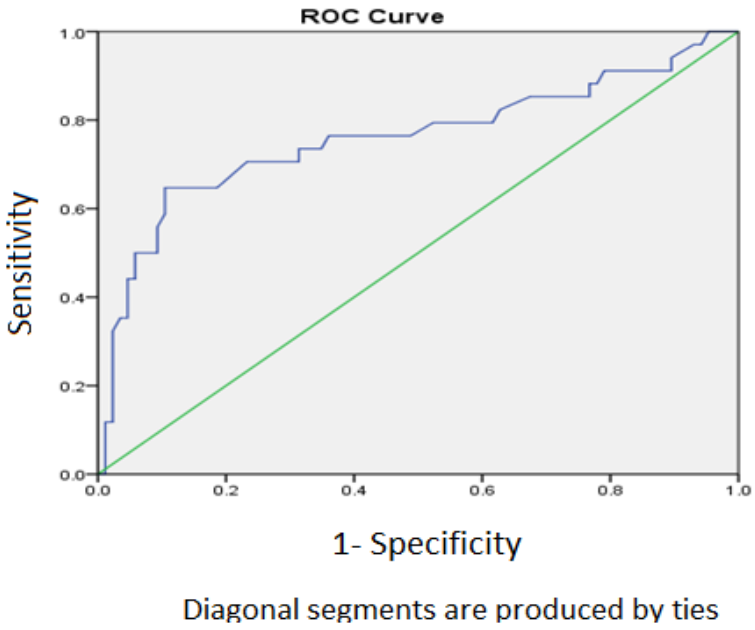
The above table 2 shows hematological parameters. The mean hemoglobin among patients was 9.29 ±1.86 g/dl. The mean blood urea was 30.17 ±12.11 mg/dl. The mean serum creatinine was 1.29 ±0.43 mg/dl. The mean WBC count was 20.361 ±12.295 ($x10^9$/L). The mean SGOT was 102.9 ±11.54 mg/dl. The mean SGPT was 93.55 ±13.4 mg/dl. The mean total bilirubin was 2.98 ±1.72 mg/dl. The mean direct bilirubin was 1.34 ±1.11 mg/dl. The mean platelet was 206.71 ±80.52 ($x10^9$/L).

Table 3: Correlation of Urine Albumin-Creatinine ratio and SAPS II score		
Correlation	**Pearson's coefficient (r)**	**P value**
UACR & SAPS II score	0.63	<0.00001 (S)

The above table 3 shows the correlation between the Urine Albumin-Creatinine ratio and the SAPS II score. The SAPS II score increases as UACR increases with a positive correlation (0.63) and a statistically significant difference. (P<0.001).

Table 4: Correlation of SIRS Criteria and SAPS II score		
Correlation	**Pearson's coefficient (r)**	**P value**
SIRS & SAPS II score	0.59	<0.00001 (S)

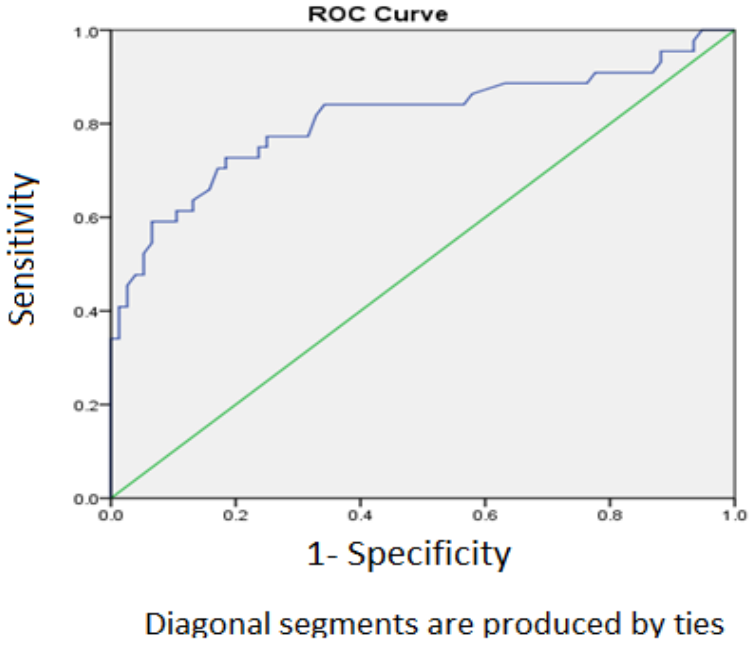
The above table 4 of the SIRS criteria and SAPS II score. The SAPS II score increases as SIRS criteria increase with positive correlation (r=0.59) and statistically significant difference. (P<0.001).



AUC	95% Confidence Interval	Std. Error	P Value
0.76	0.65 – 0.87	0.056	< 0.001

Fig 1: ROC Curve: SAPS II to predict sepsis

The area under the curve was 0.76; there was a significant correlation between the baseline SAPS II and sepsis. ($p < 0.001$). SAPS II criteria had a sensitivity of 71%, specificity of 69%, PPV of 68%, and NPV of 69% to predict sepsis.



AUC	95% Confidence Interval	Std. Error	P Value
0.81	0.72 – 0.90	0.046	< 0.001

Fig 2: ROC Curve: UACR to predict sepsis

The area under the curve was 0.81; there was a significant correlation between the baseline UACR and sepsis. ($p < 0.001$). UACR had a sensitivity of 83% and specificity of 76%, PPV of 74%, and NPV of 70% to predict sepsis.

5. DISCUSSION

The present study observed that most patients were in the age group 41-50 years (23.33%), followed by 51-60 years (20%). The mean age of the patients was 45.1 ±17.15 years. Traynor J et al. [11] assessed morbidity and mortality of patients with multi-organ dysfunction syndrome in sepsis patients and observed age of patients varied from 18 years to 90 years with a mean age of 48.36 years. In a study done by Aditi Jain et al. [12] in predicting outcomes of patients in the Intensive Care Unit (ICU), the observed mean age among patients was 40 ±16 years, with more than 80% of subjects being <55. Stevens et al. [13] evaluated predicting the 1-month outcome of patients in

the emergency department and observed the mean age of patients was 68.36 ±18.62 years. The mean Urine Albumin among patients was 69.15 ±9.82 mg/dl. The mean urine creatinine was 0.21 ±0.12 mg/dl. The mean UACR was 378.67 ±212.18 mg/g. The mean hemoglobin among patients was 9.29 ±1.86 g/dl. The mean blood urea was 30.17 ±12.11 mg/dl. The mean serum creatinine was 1.29 ±0.43 mg/dl. Similarly, Osama Tayeh et al. [14] evaluate the urinary albumin/creatinine ratio (ACR) as a prognostic predictor in sepsis observed Albumin/creatinine ratio (ACR) measured on admission (ACR1) was 113.2 (83.7–163.5) with a range from 29 to 229 mg/g and the 24 h ACR (ACR2) was 136.4 (63.7–195.3) ranging from 21 to 255 mg/g. In the present study, SAPS II criteria had a sensitivity of 71%, specificity of 69%, PPV of 68%, and NPV of 69% to predict sepsis. UACR had a sensitivity of 83% and specificity of 76%, PPV of 74%, and NPV of 70% to predict sepsis. Similarly, Anil Sachdev et al. [15] investigated the association of urinary albumin: creatinine ratio (ACR) with the outcome of sepsis patients and observed a cutoff value of ACR 102.7 mg/g had a sensitivity of 86.2%, specificity of 40.4%, positive predictive value 27.8%, and negative predictive value 91.7%. Also, Osama Tayeh et al. [14] evaluated the urinary albumin/creatinine ratio (ACR) as a prognostic predictor in sepsis. They observed a significant correlation between ACR1 obtained on admission and SOFA or APACHE IV scores. In contrast, ACR2 obtained 24 h later significantly correlated with SOFA score and had a statistically non-significant tendency for correlation with APACHE IV score. In medical /surgical critically ill patients, Basu et al. [16] found that ACR 6 and 24 h after admission were correlated with APACHE II score.[17] This was a uni-center study with a limited sample size, and only those patients who presented to ED were enrolled. Outcomes of only ED-admitted cases were studied. The present study did not follow up with patients who may have been readmitted or died or need a ventilator, vasopressor, or renal replacement therapy after discharge.

6. CONCLUSION

The present study concludes that the Urine Albumin-Creatinine ratio with SAPS II score is useful in sepsis diagnosis. The urinary ACR estimation is an easy, cheap, and non-invasive tool and may be used to identify high-risk sepsis cases in resource settings. Microalbuminuria, including UACR, is an inexpensive and rapid diagnostic tool; serial measurements may be useful in the clinical assessment of critically ill patients at risk of worse prognosis, even in resource-poor areas. The present prospective study was conducted to assess the utility of Urine Albumin-Creatinine ratio with SAPS II score among patients with sepsis in the ICU setting of a tertiary care hospital. Most patients were in the age group 41-50 years (23.33%), followed by 51-60 years (20%). The mean UACR was 378.67 ±212.18 mg/g, and the mean UACR among patients was 289.28 ± 118.76, 328.18 ± 178.22, and 412.19 ±202.19 mg/g for SIRS criteria 2, 3, and 4, respectively. The SAPS II score increases as UACR increases with positive correlation and statistically significant difference. (P<0.001). The SAPS II score increases as SIRS criteria increase with positive correlation and statistically significant difference. (P<0.001)

7. AUTHORS CONTRIBUTION STATEMENT

Dr. Sujay Trivedi gathered the data for this study. Dr. D. P. Lakra and Dr. M. Khande conceptualized, and necessary inputs were given to the study's design. Dr. M. Khande and Dr. Sujay analyzed these data. All authors discussed the methodology and results and contributed to the final manuscript.

8. CONFLICT OF INTEREST

Conflict of interest declared none.

9. REFERENCES

1. Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, et al. The third international consensus definitions for sepsis and septic shock (Sepsis-3). JAMA. 2016 23 Feb;315(8):801-10. doi: 10.1001/jama.2016.0287. PMID: 26903338.
2. Raith EP, Udy AA, Bailey M, McGloughlin S, MacIsaac C, Bellomo R, et al. Predictive accuracy of the SOFA score, SIRS criteria, and qSOFA score for in-hospital mortality among adults with suspected infection admitted to the intensive care unit. JAMA. 2017;317(3):290-300. doi: 10.1001/jama.2016.20328. PMID: 28114553.
3. World Health Organization. Operations manual for the integrated disease surveillance program: India. New Delhi: WHO; 2002.
4. Cowen JS, Kelley MA. Errors and bias in using predictive scoring systems. Crit Care Clin. 1994;10(1):53-72. doi: 10.1016/S0749-0704(18)30144-1. PMID: 8118733.
5. Le Gall JR, Lemeshow S, Saulnier F. A new simplified acute physiology score (SAPS II) based on a European/North American multicenter study. JAMA. 1993;270(24):2957-63. doi: 10.1001/jama.270.24.2957. PMID: 8254858.
6. Gosling P. Microalbuminuria: A marker of systemic disease. Br J Hosp Med. 1995 20 Sep-Oct 3;54(6):285-90. PMID: 8542177.
7. Abid O, Sun Q, Sugimoto K, Mercan D, Vincent JL. Predictive value of microalbuminuria in medical ICU patients: results of a pilot study. Chest. 2001 Dec;120(6):1984-8. doi: 10.1378/chest.120.6.1984. PMID: 11742932.
8. Gosling P, Brudney S, McGrath L, Riseboro S, Manji M. Mortality prediction at admission to intensive care: A comparison of microalbuminuria with acute physiology scores after 24 hours. Crit Care Med. 2003 Jan;31(1):98-103. doi: 10.1097/00003246-200301000-00016. PMID: 12545001.
9. Rudd KE, Johnson SC, Agesa KM, Shackelford KA, Tsoi D, Kievlan DR, et al. Global, regional, and national sepsis incidence and mortality, 1990-2017: analysis for the Global Burden of Disease Study. Lancet. 2020;395(10219):200-11. doi: 10.1016/S0140-6736(19)32989-7. PMID: 31954465.
10. Abid O, Sun Q, Sugimoto K, Mercan D, Vincent JL. Predictive value of microalbuminuria in medical ICU patients: results of a pilot study. Chest. 2001 Dec;120(6):1984-8. doi: 10.1378/chest.120.6.1984. PMID: 11742932.
11. Traynor J, Mactier R, Geddes CC, Fox JG. How to measure renal function in clinical practice. BMJ. 2006;333(7571):733-7. doi: 10.1136/bmj.38975.390370.7C. PMID: 17023465.

12. Jain A, Palta S, Saroa R, Palta A, Sama S, Gombar S. Sequential organ failure assessment scoring and prediction of patient's outcome in Intensive Care Unit of a tertiary care hospital Anaesthesiol. Clin Pharmacol. 2016 Jul-Sep;32(3):364-8.
13. Stevens LA, Levey AS. Measurement of kidney function. Med Clin North Am. 2005;89(3):457-73. doi: 10.1016/j.mcna.2004.11.009. PMID: 15755462.
14. Tayeh O, Taema KM, Eldesouky MI, Omara AA. Urinary albumin/creatinine ratio as an early predictor of outcome in critically ill septic patients. The Egyptian Journal of Critical Care Medicine. 2016;4(2):47-55. doi: 10.1016/j.ejccm.2016.03.002.
15. Sachdev A, Raheja K, Gupta N, Chugh P. Association of urinary albumin:creatinine ratio with outcome of children with sepsis. Indian J Crit Care Med. 2020 Jun;24(6):465-72. doi: 10.5005/jp-journals-10071-23463. PMID: 32863641. PMCID: PMC7435108.
16. Basu S, Bhattacharya M, Chatterjee TK, Chaudhuri S, Todi SK, Majumdar A. Microalbuminuria: A novel biomarker of sepsis. Indian J Crit Care Med. 2010 Jan;14(1):22-8. doi: 10.4103/0972-5229.63034. PMID: 20606905.
17. Moran JL, Graham PL, Rockliff S, Bersten AD. Updating the evidence for the role of corticosteroids in severe sepsis and septic shock: a Bayesian meta-analytic perspective. Crit Care. 2010;14(4):R134. doi: 10.1186/cc9182. PMID: 20626892.