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# A Study of Microalbuminuria as an Indicator of Sepsis and Mortality Predictor in ICU Patients

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**Abstract:** ***Background: Sepsis is an important healthcare concern in India as well as globally. This study demonstrates how the mortality of patients with and without sepsis is predicted by the degree of microalbuminuria. Methods: In this study total 150 patients of which 75 patients belonging to each sepsis and non-sepsis group, with age >15 years admitted in Intensive Care Unit (ICU). We have analysed Microalbuminuria levels at the time of admission and after 24 hours of admission. Results: Compared to non-septic patients, patients with sepsis had noticeably higher levels of microalbuminuria. Compared to APACHE II and SOFA scores, microalbuminuria has the highest sensitivity (90%) and specificity (98%) for differentiating between sepsis and non-sepsis. Conclusion: Sequential monitoring of urine albumin-creatinine measurements at the bedside may aid in the early detection of sepsis patients in need of early targeted therapy. In addition to predicting ICU survival, the 24-hour ACR evaluation may be used to track the effectiveness of therapeutic measures administered, including fluid resuscitation, the right antibiotics, vasopressors, and ionotropes that impact the endothelium.***

**Keywords:** Microalbuminuria, Sepsis, APACHE II, SOFA

## 1. Introduction

Sepsis is still an important healthcare concern in India as well as globally, despite all the advances that have been made in medical therapeutics.[1,2] Because of frequent delay in diagnosis, targeted therapies do not remain as effective. [3,4] there is no standard method to diagnose sepsis early in patients who are critically ill. Sepsis is characterized by host defense response in which a variety of inflammatory mediators are released in the circulation.[5] Increased capillary permeability leading to loss of barrier function is an important early event.[6] In the kidneys, this is manifested by the glomeruli in the form of increased albuminuria.7 This study was conducted with the objective of assessing the difference between levels of microalbuminuria in sepsis and non sepsis patients. The change in the levels in the first 24 hours were also compared with two scores of sepsis i.e. APACHE II (Acute physiology and chronic health evaluation) and SOFA (Sequential Organ Failure Assessment) scores for the prediction of morbidity and mortality.

## 2. Material and Methods

75 patients of sepsis and 75 patients of non-sepsis admitted in ICU of SMS hospital were taken for study after applying inclusion and exclusion criteria.

**Inclusion Criteria**

- Patient admitted in Medical Intensive Care Unit (ICU) with age >15 years.

**Exclusion Criteria**

- Patient with anuria, macroscopic hematuria
- History of preexisting Chronic Kidney Disease (CKD) (patients on long-term renal replacement therapy, and/or sonologic features of chronic damage and/or history of glomerular filtration rate of <30 ml/min)
- Female patients with menstruation or pregnancy
- Patients with macroalbuminuria [more than 1+ protein on dipstick] due to renal and post renal causes, for example urinary tract infection
- New infection after 48 hours of ICU admission, i.e., nosocomial infection will be excluded. Known case of diabetes and hypertension
- Comparison of SOFA score and APACHE score with Microalbuminuria within 6 hour of admission (ACR1), Micro albuminuria at 24 hour of admission (ACR2) and ΔACR (ACR1- ACR2) was done between sepsis and non-sepsis group

## 3. Results

We enrolled total 150 patients of which 75 patients belonged to sepsis group (Group A) and 75 in non-sepsis group (Group B). Mean age of group A was 50.90 ± 13.32 year and mean age of group B was 47.37 ± 14.37 year. In group A, there were 28 female and 47 male patients, mean SOFA score and mean APACHE II was 7.97 ± 3.802 and 14.53 ± 6.98 respectively. In group B, there were 24 females and 51 male patients and mean SOFA score and mean APACHE II was 5.23 ± 2.84 and 8.71 ± 5.18 respectively (Table 1).

Regarding mortality, out of 75 patients , 24 died in group A comparing with group B in which only 15 patients were succumbed to death. Microalbuminuria at 24 hour of admission (ACR2) and ΔACR (ACR1- ACR2) between sepsis and non-sepsis group. In sepsis group mean SOFA score was 7.97 ± 3.802 and in non sepsis group was 5.23 ± 2.84 and it was statistically significant (p value = 0.0001). In sepsis group mean APACHE II score was 14.53 ± 6.98 and in non sepsis group was 8.71 ± 5.18 and it was statistically significant (p value = 0.0001).

In sepsis group initial level of microalbuminuria (ACR1) was 152.01 ± 25.62 mg/g which increased to 156.77 ± 58.64 mg/g (ACR2) after 24 hours of admission. Mean ΔACR was -4.76 ± 36.69 mg/g in sepsis group. In non-sepsis group initial level of microalbuminuria (ACR1) was 81.4 ± 18.63 mg/g which decreased to 71.13 ± 28.60 mg/g (ACR2) after 24 hours of admission. Mean ΔACR was 10.27 ± 14.35 mg/g in non-sepsis group. This difference of ACR1, ACR2 and ΔACR was statistically significant (p value = 0.0001, 0.0001, 0.0012 respectively) (Table 2).

**Table 1:** Comparison of SOFA and APACHE score with ACR1, ACR2, ACR

| | Groups | Mean | Std. Deviation | P value |
|---|---|---|---|---|
| SOFA Score | Sepsis<br>Non-sepsis | 7.97<br>5.23 | 3.8<br>2.84 | 0.0001 |
| APACHE II Score | Sepsis<br>Non-sepsis | 14.53<br>8.71 | 6.98<br>5.18 | 0.0001 |
| ACR 1 | Sepsis<br>Non-sepsis | 152.01<br>81.4 | 25.62<br>18.63 | 0.0001 |
| ACR 2 | Sepsis<br>Non-sepsis | 156.77<br>71.13 | 58.64<br>28.6 | 0.0001 |
| ACR | Sepsis<br>Non-sepsis | -4.76<br>10.27 | 36.69<br>14.35 | 0.0012 |

**Table 2:** Comparison of ACR1, ACR2, ACR between sepsis and non-sepsis group.

| | | Median | IQR | Z value |
|---|---|---|---|---|
| ACR1 | Sepsis<br>Non-sepsis | 147<br>85 | 41<br>31 | -10.43 |
| ACR2 | Sepsis<br>Non-sepsis | 128<br>65 | 104<br>35 | -8.86 |
| ACR | Sepsis<br>Non-sepsis | 14<br>14 | 64<br>12 | -1.12 |

## 4. Discussion

It is important to diagnose sepsis early for optimum patient management and early initiation of appropriate lifesaving therapy. There are several markers that have been used conventionally to identify sepsis. Procalcitonin (PCT) has been used as a sensitive and specific marker for systemic infections, but it is also known to increase in other non infectious inflammatory conditions and may remain normal in localized infections.[8, 9] C-Reactive Protein (CRP) is another marker which is used but it is nonspecific, takes time to rise and does not correlate with the severity of the disease.[8-10] As compared to PCT and CRP, levels of microalbuminuria increase within hours of inflammatory injury.[10]

In our study, patients were divided into two groups: Patients without sepsis and patients with sepsis. In both groups, patients were comparable with respect to their demographic parameters. In our study, in sepsis group 24 out of 75 patients died. Low mortality and low median APACHE II score in sepsis group in our study as compared to Bhadade RR et al had mortality and APACHE II score similar to our study.9

In the current study, the mean levels for ACR1 in sepsis group was 152.01 mg/g with standard deviation (SD) of 25.62 and in non-sepsis group mean level of ACR1 was 81.4 mg/g with SD of 18.63. The levels of microalbuminuria were significantly high among the patients with sepsis at admission as compared to those without sepsis. In our study, the microalbuminuria levels after 24 hours (ACR 2) and mean ΔACR levels were found to decrease significantly among the patients with sepsis [ACR2-156.77 ± 58.64 mg/g, ΔACR= -4.76 ± 36.68mg/g] as compared to the patients without sepsis [ACR2-71.13 ± 28.60, ΔACR= 10.26 ± 14.34]. After 24 hours, the decline in microalbuminuria could be attributed to the effect of treatment, protecting the glycocalyx layer and preventing rise in capillary permeability. From these observations one could infer that microalbuminuria can be used as a diagnostic tool as well as to check the efficacy of treatment.

In our study for mortality prediction of sepsis group, ΔACR performed better than SOFA score but not better than APACHE II score. Still, there is no significant difference observed between mortality prediction by APACHE score, SOFA score and ΔACR

## 5. Limitation of study

We have excluded diabetic and hypertensive patient because they have pre-existing microalbuminuria. So our study population is less representative of real life scenario. Further studies will be required to determine effects of illness on pre existing microalbuminuria. Critically ill patients with urinary tract infections and chronic renal insufficiency were excluded from the study, which may be a limitation to the universal applicability of microalbuminuria as a diagnostic tool.

## 6. Conclusion

Sequential monitoring of urine albumin-creatinine measurements at the bedside may aid in the early detection of sepsis patients in need of early targeted therapy. In addition to predicting ICU survival, the 24-hour ACR evaluation may be used to track the effectiveness of therapeutic measures administered, including fluid resuscitation, the right antibiotics, vasopressors, and ionotropes that impact the endothelium.

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