

Original Research Article

C-reactive protein/albumin ratio as a predictor of 28 day mortality in patients with sepsis

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ABSTRACT

Background: Sepsis is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection. Sepsis remains a major cause of morbidity and mortality worldwide. Important biomarkers that can be used as prognostic markers in sepsis are C Reactive Protein (CRP) and serum Albumin levels. CRP levels markedly elevate in response to infection whereas albumin levels decrease in response to acute phase infection. We want to ascertain the value of CRP/albumin ratio as an independent predictor of 28-day mortality in sepsis patients.

Methods: A prospective study was conducted including 150 patients satisfying the criteria for sepsis according to SOFA score of more than 2. Initial CRP/Albumin ratio was assessed to determine its significance in assessing the 28-day mortality, primary end point of our study. Secondary end points assessed were length of ICU stay, need for inotropic support, need for ventilator support and renal replacement therapy.

Results: In the analysis of CRP/Albumin ratio as a predictor of 28-day mortality, patients were followed up from day of admission till 28 days to assess primary outcome. Among study subjects survivors were 92 in whom mean CRP/ALB ratio was 0.1197 and non survivors were 58 patients with mean CRP/ALB ratio was 0.0426. p-value <0.001, there was statistically significant difference found between survivor and Non-Survivor with respect to CRP/Albumin ratio. In assessing secondary outcome statistically significant association was found for need for ventilator and inotropic support, whereas it was insignificant in assessing need for dialysis and length of ICU stay.

Conclusions: CRP/albumin ratio, which indicates the extent of residual inflammation, could be used as a prognostic marker in predicting mortality in patients with sepsis and septic shock.

Keywords: Albumin, C reactive protein, CRP/Albumin ratio, Mortality in sepsis, Sepsis, Sofa score

INTRODUCTION

Sepsis is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection.¹ Sepsis remains a major cause of morbidity and mortality worldwide. The mortality rate of severe sepsis is 20-30%, accounting for about 30-50% of hospital deaths¹. Similar to polytrauma, acute myocardial infarction, or stroke, early identification and appropriate management in the initial hours after sepsis develops improves outcomes.^{1,2} Recently the mortality rate of sepsis has decreased markedly since the

introduction of Early Goal-Directed Therapy (EGDT), survivors are still at increased risk of death.³

Sepsis, a syndrome of physiologic, pathologic, and biochemical abnormalities induced by infection.¹ Hospital mortality and 28-day mortality of severe sepsis in India are 59.3% and 57.6% respectively. Furthermore, there is increasing awareness that patients who survive sepsis often have long term physical, psychological, and cognitive disabilities with significant health care and social implications.⁴ Septic shock being the most common

cause for hospitalization in the ICU around the world, patients are often hospitalized for extended periods of up to 2-3 weeks.⁵

The inflammatory response is important in the pathophysiology of sepsis, higher degree of inflammation can worsen chronic illness, which is a major determinant of adverse, long term outcomes.⁶ important biomarkers that can be used as prognostic markers in sepsis are C Reactive protein (CRP) and serum Albumin levels. CRP levels markedly elevate in response to infection whereas albumin levels decrease in response to acute phase infection.⁷

Authors want to ascertain the value of CRP/albumin ratio as an independent predictor of 28-day mortality in sepsis patients. Objective of the study is to measure admission C Reactive Protein and serum Albumin levels in patients with sepsis, to estimate CRP to Albumin Ratio and to correlate between CRP to Albumin Ratio with prognosis among sepsis patients.

METHODS

A prospective study was conducted including 150 patients satisfying the criteria for sepsis according to SOFA score of more than 2 (According to surviving sepsis campaign 3) who were admitted to medicine department of R L Jalappa hospital, Tamaka, Kolar.

Inclusion criteria

- Patients admitted to medicine department with sepsis. (According to the third international sepsis criteria: that is patients with SOFA score of >2)
- Age more than 18 yrs.

Exclusion criteria

- Patients with pre-existing organ dysfunction prior to infection (chronic kidney disease, decompensated liver disease)

The primary end point of study was 28-day mortality from day of admission. The secondary end point was vasopressor use, the need for mechanical ventilation, need for renal replacement therapy and length of ICU stay during the hospital stay. This study was conducted in RL Jalappa hospital for a period of 1 year 9 months from November 2107 - August 2019

Statistical analysis

Data was entered into Microsoft excel data sheet and was analysed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions.

Chi-square test or Fischer’s exact test (for 2x2 tables only) was used as test of significance for qualitative data.

Continuous data was represented as mean and standard deviation. Independent t-test was used as test of significance to identify the mean difference between two quantitative variables.

Graphical representation of data

MS Excel and MS word was used to obtain various types of graphs

p-value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Statistical software

MS Excel, SPSS version 22 (IBM SPSS Statistics, Somers NY, USA) was used to analyse data.

RESULTS

Among 150 study participants, the subjects in the age group of 20-39 years was 16%, between 40-59 years was 38%, between 60-79 years was 33.35, between 80-99 years was 12.7%. (Table 1). In the study 58% were male and 42% were female (Figure 1).

Table 1: Distribution of subjects according to age group.

Age group	Frequency	Percent
20-39 yrs	24	16.0
40-59 yrs	57	38.0
60-79 yrs	50	33.3
80-99 yrs	19	12.7
Total	150	100.0

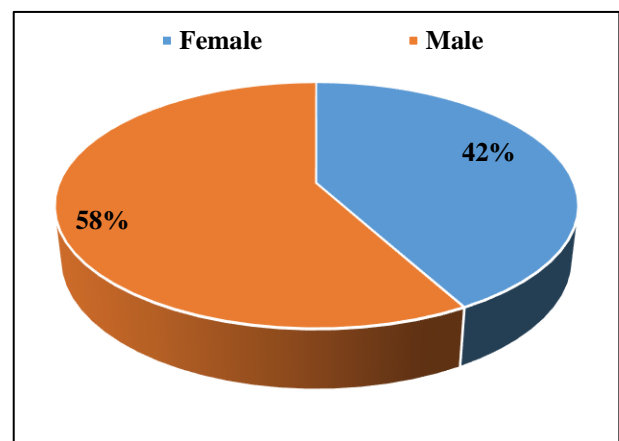


Figure 1: Distribution of subjects according to sex.

In the presenting complaints most common complaint was fever, seen in 115(76.7%) followed by altered sensorium, breathlessness and cough, other symptoms were as noted in Figure 2 and 3.

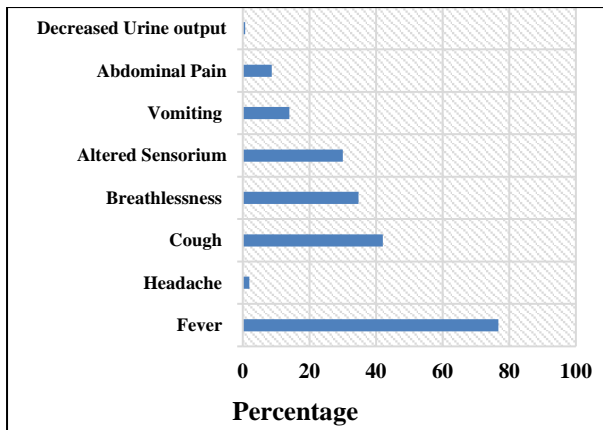


Figure 2: Frequency distribution of symptom.

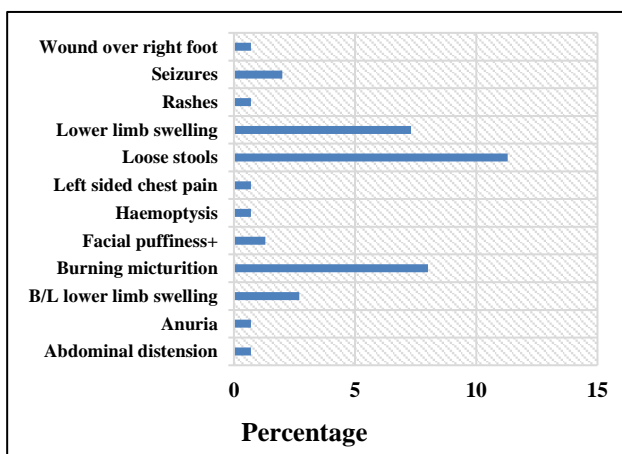


Figure 3: Frequency distribution of other symptoms.

Among patients past medical history, most common comorbidity associated was diabetes in 56% followed by hypertension in 32.67%, other comorbidity profile is as shown in Table 2.

Table 2: Frequency distribution of co morbidities.

	Frequency	Percent
None	22	14.66
Bronchial asthma	7	4.66
COPD	9	6
TB	6	4
Hypertension	49	32.67
DM	84	56
Epilepsy	3	2.0
CAD.	9	6
Hypothyroidism	5	3.3
IHD	5	3.3

In the study population, most common diagnosis was lower respiratory tract infection seen in 71(47.3%) patients, among whom 17(11.3%) patients developed ARDS. Urosepsis was seen in 22(14.7%) patients, Acute gastroenteritis was seen in 15(10%) patients, soft tissue

infection with cellulitis was seen in 13(8.7%) patients, Neuroinfection was noted in 12(8%) (Table 3).

Table 3: Distribution of subjects of according to diagnosis.

Diagnosis	Frequency	Percent
Acute GE	15	10.0
Cellulitis	13	8.7
LRTI	71	47.3
LRTI, ARDS	17	11.3
Neuro infection and meningitis	12	8
Urosepsis	22	14.7
Total	150	100.0

Primary outcome

In the analysis of CRP/Albumin ratio as a predictor of 28 day mortality, patients were followed up from day of admission till 28 days to assess primary outcome. Among study participants survivors were 92(61.3%) among whom mean admission CRP/ALB ratio was 0.1197 with standard deviation of 0.1093. Non survivors were 58(38.7%) patients with mean CRP/ALB ratio was 0.0426 with standard deviation of 0.0191. p value <0.001, there was statistically significant difference found between survivor and Non-Survivor with respect to CRP/Albumin ratio (Table 4).

Table 4: Comparison of mean CRP/Albumin ratio between survivor and Non-Survivor.

Survived	Frequency (percentage)	Mean CRP/ALB	Std. deviation
No	58 (38.7%)	0.1197	0.1093
Yes	92 (61.3%)	0.0426	0.0191
Total	100	0.0724	0.0788

Secondary outcome

To identify the role of CRP/Albumin ratio in assessing morbidity, analysis of need for ventilator support, length of ICU stays, vasopressor support, need for renal replacement therapy was done. Among study population 86 patients required ventilator support accounting to 57.3%, the p value <0.001, there was statistically significant difference found between Ventilator Support and CRP/ALB ratio (Table 5). Need for inotropic support was seen in 104 patients, the p value 0.025, there was statistically significant difference found between inotropic support and CRP/ALB ratio (Table 6). Due to sepsis induced acute kidney injury 20(13.4%) patients required renal replacement therapy, the p value 0.586, there was no statistically significant difference found between Renal replacement therapy and CRP/ALB ratio (Table 7). Based on the length of ICU stay patients were assessed, 138 patients required up to 5 days of ICU Stay, remaining 12 patients required even prolonged duration of ICU stay, the p value 0.484, there was no statistically

significant difference found between ICU Stay and CRP/ALB ratio (Table 8).

Table 5: Comparison of mean CRP/Albumin ratio among ventilator support.

Ventilat or support	Frequency	%	Mean CRP/ALB	Std. deviation
No	64	42.7	0.0448	0.0224
Yes	86	57.3	0.0930	0.0975
Total	150	100.0	0.0724	0.07885

Table 6: Comparison of mean CRP/Albumin ratio among inotropic support.

Inotropic support	Frequency	%	Mean CRP/ALB	Std. deviation
No	46	30.7	0.0507	0.0254
Yes	104	69.3	0.0820	0.0916
Total	150	100.0	0.0724	0.0788

Table 7: Comparison of mean CRP/Albumin ratio among Renal replacement therapy.

Renal replacement therapy	Frequency	%	Mean CRP/ALB	Std. deviation
NO	130	86.6	0.0738	0.0833
YES	20	13.4	0.0635	0.0389
Total	150	100.0	0.0724	0.0788

Table 8: Comparison of mean CRP/Albumin ratio among ICU Stay.

ICU Stay	Frequency	%	Mean CRP/ALB	Std. deviation
1-5days	138	92.0	0.074198	0.0830
>5days	12	8.0	0.060579	0.03912
Total	150	100.0	0.0724	0.0788

DISCUSSION

In hospitalized patients with sepsis, the initial value of CRP/Albumin ratio was strongly and independently associated with 28 day mortality, for predicting need for ventilator support and inotropic support CRP/Albumin ratio was independently associated, whereas p value was not significant with respect to assessment of length of ICU stay and need for renal replacement therapy.

Accurate prognostication is especially important in critically ill patients, and many biochemical markers could reflect the severity of diseases. Albumin levels are associated with the chronic nature of disease, and represent the inflammatory status.⁸ The value of albumin levels in predicting outcomes in chronic and inflammatory disease is also well known.⁹ In patients with community-acquired blood stream infections, with severe sepsis or septic shock, hypoalbuminemia is the

strongest predictor of mortality.¹⁰ However, in the context of this study, hypoalbuminemia is likely to be the result of infection rather than previous illness. As such, when evaluating patients with varying underlying conditions, this marker alone can create bias because albumin levels are affected by both the chronic nutritional and inflammatory status.

It is generally believed that the worsening of a chronic illness with an ongoing infection represents a major determinant of an adverse long-term outcome in severe sepsis and septic shock patients. Thus, rather than an analysis of each single factor on its own, CRP and albumin were combined. The combination of these markers enabled inflammatory and nutritional factors to be merged, both of which strongly influence prognosis. In this study, the CRP/albumin ratio at admission was positively correlated with the prognosis in severe sepsis and septic shock

CRP/albumin ratio, which indicates the extent of residual inflammation, could be used as a prognostic marker in predicting mortality in patients with sepsis and septic shock.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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