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Original Research Article

Analysis of the Prognostic Significance of Serum Albumin Level Serial Estimation in Sepsis Patients: A Hospital Based Study

Rahul Kumar Bharti[1], Sanket Raj[2], Obaid Ali[3]

[1]Senior Resident, Department of Medicine, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar.

[2]Senior Resident, Department of Medicine, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar.

[3]Associate Professor, Department of Medicine, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar.

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Corresponding author: Dr. Sanket Raj

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Abstract

Background: Sepsis is a disease characterized by a dysregulated host response to infection. The severity ranges from sepsis to septic shock. Although figures vary widely and depend on the group under study, it has been demonstrated that mortality rates in shock cases range from 10% to 40%. The primary goals of the study are to determine whether there is a quantitative relationship between blood albumin levels and mortality risk and to investigate the effect of serial serum albumin level monitoring as a predictor of mortality and morbidity in sepsis patients admitted to the intensive care unit.

Method: 140 sepsis patients admitted to the Medicine ICU at Jawaharlal Nehru Medical College and Hospital in Bhagalpur, Bihar, between March 2025 and August 2025 were included in this hospital-based descriptive study. On the first day after being diagnosed with sepsis, all of the chosen patients underwent a thorough evaluation; on days three and five, their serum albumin levels were assessed. Throughout their hospital stay, patients were monitored, and their outcomes—that is, whether they survived or not—were documented. Statistical Product and Service Solutions (SPSS) version 18 was used to analyze data entered into an MS Excel spreadsheet.

Results: Two groups of 140 patients were chosen for the study: those who survived and those who did not. The mean serum albumin level on day one was 3.72 g/dl (±0.278) for the survivor group and 3.11 g/dl (±0.247) for the non-survivor group. On day three, the mean serum albumin levels were 3.17 g/dl (±0.248) for the survivor group and 2.65 g/dl (±0.172) for the non-survivor group. On day five, the mean blood albumin levels were 2.72 g/dl (±0.25) in the survivor group and 2.32 g/dl (±0.144) in the non-survivor group. An unpaired t test revealed that the change in mean blood albumin on days 1, 3, and 5 was statistically significant, with a p value ≤0.001. From day one to day five, survivors' mean blood albumin levels decreased from 3.72 g/dl to 2.72 g/dl. It ranges from 3.11 g/dl to 2.32 g/dl in non-survivors.

Conclusion: This study demonstrated a direct association between a blood albumin level of less than 3.5 gm/dl on all three days and the prognosis of a sepsis patient. Serum albumin levels in both the survivor and non-survivor groups gradually decreased starting on day 1, but a decrease below 3.0 gm/dl was linked to a greater death rate. It implies that the mortality prognosis of the sepsis patient is influenced by the rate at which serum albumin drops below the normal threshold. Serum albumin testing is less expensive and can aid in clinical evaluation; patients with sepsis are at risk for a poor prognosis even in areas with limited resources.

Keywords: Serum albumin, Sepsis, Intensive care unit.

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Introduction

Only the liver is capable of producing albumin, a necessary protein. The most prevalent protein in plasma, albumin, is released into the blood at a rate of 10–15 g per day (3.5 g/dL to 5 g/dL). There are several physiological uses for albumin. The most significant modifier of the oncotic pressure in plasma is human albumin. Consequently, it stops fluid from seeping into the extravascular areas. Additionally, albumin affects how certain molecules move. Serum albumin contains both foreign substances like medications and endogenous substances including fatty acids, ions,

and bilirubin. Furthermore, albumin is a hormone transporter that carries cortisol, thyroxine, and testosterone while binding at least 40% of the calcium in the blood. Furosemide, warfarin, methadone, thiopental, methotrexate, propranolol, and many other medications are carried by albumin. Acting as a plasmatic buffer is one way albumin contributes to the preservation of acid-base equilibrium.[1-3]

Burns, sepsis, nephrotic syndrome, chronic kidney failure, liver failure, and protein-losing enteropathy can all cause a decrease in albumin levels in plasma. Mortality is one of the numerous issues that individuals with low albumin deal with. Although the factors that induce hypoalbuminemia are more prevalent as people age, it is not a physiological consequence of aging. Therefore, older persons may be more susceptible to hypoalbuminemia and its consequences.[4]

Sepsis is associated with altered albumin distribution between intravascular and extravascular compartments due to increased capillary leakage and vascular permeability. Additionally, albumin production is reduced and albumin breakdown is elevated in sepsis patients. Hypoalbuminemia is a risk factor for death in sepsis patients due to several pathophysiological pathways.[5]

This study aims to ascertain whether serum albumin levels and mortality risk are quantitatively related. It also aims to ascertain if serial monitoring of serum albumin levels is helpful in predicting mortality and morbidity in sepsis patients admitted to the intensive care unit.

Material and Methods

Between March 2025 and August 2025, 140 sepsis patients were admitted to the medicine intensive care unit (ICU) of Jawaharlal Nehru Medical College and Hospital in Bhagalpur, Bihar, for this hospital based descriptive study. A confirmed case of sepsis by culture, an abnormal white blood cell count (>12,000/μL or <4,000/μL), a temperature that was either higher than 380°F (100.40°F) or lower than 360°F (96.80°F), an arterial carbon dioxide tension (PaC02) of less than thirty-two millimeters of mercury, or a respiratory rate. This study excluded patients with protein-losing enteropathy, chronic liver disease, chronic renal disease with proteinuria, malnutrition, and those who passed away within five days of admission.

Blood albumin levels were compared by phone on the 28th day following the diagnosis with the clinical outcome (survivor/non-survivor) at the time of sepsis diagnosis, as well as on days 3 and 5, following a thorough review of each chosen patient. On the first day of the sepsis diagnosis, as well as on days three and five, about two milliliters of blood were venepunctured. A disposable syringe and antiseptic were utilized. Patients with sepsis symptoms from all causes who were intubated and placed on mechanical ventilation were included in the study. The treating physician made the decision to adopt mechanical ventilation. Along with a thorough and thorough history recording, a thorough clinical examination was conducted. Total blood counts, renal and hepatic functions, serum albumin (SA), serum electrolytes, and other tests carried out at the time of admission were also recorded.

Sensitivity, blood culture, and arterial blood gas analysis were acquired. Each patient's days spent in the hospital, in the intensive care unit, and on a ventilator were recorded. The data was imported into Microsoft Excel and then analyzed using SPSS version 18. All quantitative variables are represented by the mean, median, mode, and standard deviation.

Percentages and frequencies are used to express categorical variables. Qualitative data was analyzed using chi-square tests, while quantitative data was analyzed using the Mann-Whitney test if the "normality test" was successful. The unpaired t-test was employed in all other cases. P values less than 0.05 were considered statistically significant.

Results

140 sepsis patients who were admitted to a medical intensive care unit were chosen for this study. Of the 140 admitted patients that were the subject of this investigation, 86 (61.42%) were released from the hospital after being declared survivors, and 54 (38.57%) passed away there (non survivors).

Two groups of patients were created: survivors and non-survivors. The nonsurvivor group's mean age was 38.85 (10.53), while the survivor group's mean age was 37.53 (10.48). The non-survivor group had minimum and maximum ages of 21 and 61, respectively, while the survivor group had lowest and maximum ages of 21 and 60. Within the survivor group, there were 30.2 percent (n=13) females and 69.8% males (n=30). Within the non-survivor group, there were 21 male (77.8%) and 6 female (22.2%).

In the survivor group, 16.3% of patients experienced a stroke, 11.6% snake bites, 9.3% OP poisoning, and 9.3% COPD patients, according to the etiological diagnosis. Of the patients in the non-survivor group, 25.9% had a stroke, 14.8% had COPD, 11.1% had diabetic foot, and 14.8% had OP poisoning. Causative organisms included pseudomonas in 48.57% of patients, E. Coli in 28.58%, MRSA in 10%, streptococci in 8.58%, klebsiella in 3.85%, and anaerobes in 1% of patients.In our study, the proportion of patients with normal blood albumin levels on day 1 (g/dl) in

the survivor group was 72.10%, while the non-survivor group had just 3.7% of normal levels. Day 1 mean serum albumin levels were 3.72 g/dl (±0.278) in the survivor group and 3.11 g/dl (±0.247) in the nonsurvivor group. Using an unpaired t test, the difference in mean serum albumin on day 1 was shown to be statistically significant with a t value of 9.28, df of 68, and p value <0.001.Compared to 100% in the non-survivor group, 88.40% of patients in the survivor group had blood albumin levels <3.5 (g/dl) on day 3. Eleven percent of patients in the survivor group and zero percent in the nonsurvivor group had normal blood albumin levels (>3.5 g/dl). Day 3 mean serum albumin levels were 2.65 g/dl (±0.172) in the non-survivor group and 3.17 g/dl (±0.248) in the survivor group. Using an unpaired t test, the difference in mean serum albumin on day three was shown to be statistically significant with a t value of 9.496, df of 68, and p value <0.001.In this current investigation, on day 5, 95.30% of patients in the survivor group had serum albumin levels < 3.5 (g/dl), compared to 100% in the nonsurvivor group. The proportion of patients with normal blood albumin levels (>3.5 g/dl) was identified in 4.70% of the survivor group and 0% of the non-survivor group. Day 5 mean blood albumin levels were 2.72 g/dl (±0.25) in the survivor group and 2.32 g/dl (±0.144) in the non-survivor group. By using an unpaired t test, the difference in mean serum albumin on day 5 was shown to be statistically significant, with a t value of 7.43, df 68, and p value <0.001. The mean blood albumin level of survivors in our study decreased from 3.72 g/dl to 2.72 g/dl between days 1 and 5. It ranges from 3.11 to 2.32 g/dl in nonsurvivors.

Table 1: Serum Albumin Levels in Survivor and non-survivor groups

S. albumin in g/dl	Survivors(n=86)	Non-survivors (n=54)	Total (n=140)
Day 1			
• <3.5	24(27.9%)	52(96.3%)	76(54.28%)
• >3.5	62(72.1%)	2(3.7%)	64(45.71%)
Day 3			
• <3.5	76(88.4%)	54(100%)	130(92.85%)
• >3.5	10(11.6%)	0(0%)	10(7.14%)
Day 5			
• <3.5	82(95.3%)	54(100%)	136(97.14%)
• >3.5	4(4.7%)	0(0%)	4(2.85%)

Table 2: Comparing mean (SD) serum albumin in g/dl

S. albumin in g/dl	Mean (SD)		t-value	df	p-value
	Survivor	Non-survivor			
Day 1	3.72(±0.278)	3.11(±0.247)	9.28	68	<0.001
Day 3	3.17(±0.248)	2.65(±0.172)	9.49	68	<0.001
Day 5	2.72(±0.250)	2.32(±0.144)	7.43	68	<0.001

Discussion

Seventy sepsis patients who were admitted to a medical intensive care unit were chosen for this investigation. Patients were separated into two categories: survivors and non-survivors.

Day 1 serum albumin levels were 3.72 g/dl (± 0.278) for the survivor group and 3.11 g/dl (± 0.247) for the non-survivor group. An unpaired t test revealed a statistically significant difference in mean blood albumin on day 1, with a t value of 9.28, df of 68, and p value <0.001.

However, the difference was not statistically significant. Survivors had slightly higher serum albumin on day 1 (3.46 ± 0.25 vs. 3.44 ± 0.30) than nonsurvivors, according to a study by Nirmala et al.[6]The research group's mean blood albumin level on Day 1 (of admission) was 3.3 g/dl (± 0.4 g/dl), according to a study by Sanket Mahajan et al. It was 3.4 g/dl (±0.4 g/dl) in survivors and 3.1 g/dl (±0.19 g/dl) in nonsurvivors. Among those who did not survive, it was much lower (p = 0.003).[7]According to a study by Gosavi et al., the average blood albumin levels on the day of admission were 2.45 gm% (±0.50) for survivors and 3.06 gm% (+/-0.54) for non-survivors (p<0.01).[8]On day three, the survivor group's mean serum albumin levels were 3.17 g/dl (±0.248), while the nonsurvivor groups were 2.65 g/dl (±0.172). An unpaired t test revealed that the change in mean serum albumin on day three was statistically significant, with a t value of 9.496, df of 68, and p value <0.001. A study by Nirmala et al. found a significant correlation between a drop in serum albumin on day three (S - 3.46 ±0.29/NS - 2.83 ± 0.51) and death among critically ill patients. According to Mahajan et al., the best indicator of a patient's prognosis is their serum albumin level on day three (S - 3.04 ± 0.51/NS - 2.75 ± 0.22).[6, 7]

The survivor group's mean blood albumin level on day five was 2.72 g/dl (± 0.25), while the nonsurvivor group's was 2.32 g/dl (± 0.144). The

change in mean serum albumin on day five was shown to be statistically significant using an unpaired t test, with a t value of 7.43, df 68, and p value <0.001. A study by Pal. A. et al. found that individuals who recovered to a higher mean albumin value on day five had a higher chance of surviving. Participants with blood albumin levels higher than 3.5 g/dl did not experience any mortality on day 5. Seventy percent of people died if their serum albumin level was below 2.5 g/dl.

Therefore, a poor prognosis is indicated by any serum albumin concentration below 2.5 g/dl on day 5, while those who recover to a mean value of >3.0 g/dl have a much better prognosis with regard to death.[9]Between days 1 and 5, the survivors' mean blood albumin level dropped from 3.72 g/dl to 2.72 g/dl. In non-survivors, it varies between 3.11 and 2.32 g/dl. The results show that both groups' blood albumin levels gradually declined, however the reduction in non-survivors was more noticeable than in survivors. It suggests that the rate at which serum albumin declines affects the patient's mortality prognosis. A decline in serum albumin levels indicates a poor prognosis. According to a study by Mahajan et al., the survivors' serum albumin dropped by 0.86 g/dl between the time of admission and day 10. In non-survivors, it is 1.09 g/dl over a ten-day period.[7]

Conclusion

The prognosis of a sepsis patient was found to be directly correlated with a blood albumin level of less than 3.5 gm/dl on all three days. Serum albumin levels in both the survivor and non-survivor groups gradually decreased starting on day 1, but a decrease below 3.0 gm/dl was related to a higher death rate. It implies that the mortality prognosis of the sepsis patient is influenced by the rate at which serum albumin drops below the normal threshold. Serum albumin testing is less costly, and its serial measurement may help with the clinical assessment of sepsis patients, who are at risk for a poor prognosis even in areas with limited resources. Patients with severe sepsis may have higher survival chances if aggressive care is started early.

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