SERUM ALBUMIN LEVELS AS PROGNOSTIC MARKER IN PATIENTS ADMITTED IN ICU

Editorial note –

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ABSTRACT

Serum albumin has been the subject of extensive studies as a prognostic marker in various contexts. This study aimed to estimate the role of serial serum albumin estimation as a prognostic marker in critically ill patients who were admitted in the ICU

INTRODUCTION

Albumin is an abundant serum proteins in humans. It has numerous important properties and functions in healthy and diseased people. [1] It transports a large range of exogenous and endogenous substances and thus it can affect the metabolism and elimination of many drugs. In healthy persons, serum albumin is accountable for 75 to 80% of the plasma osmotic pressure and plays a crucial role in the distribution of fluid between extracellular compartments. Antiplatelet properties are also possessed by serum Albumin 5,[2] and have important role in the elimination of oxygen free radicals6,7 [3,4] and also play role in maintaining vascular integrity8.[5] As compared to other colloids, albumin appears to decrease capillary fluid permeability9 [6] and has no adverse effect on the viscosity of blood10.[7] Anti-inflammatory activity possessed by serum albumin has a beneficial effect in patients with sepsis11,12 [8,9]

Serum Albumin act as an important prognostic tool. Its use as a prognostic tool has been studied in severely diseased patients. Increase in ICU stay and death and admission to hospital after discharge, frequently associated with low serum albumin concentration. Daily monitoring of albumin level can help identify the weaning capability of patients who need ventilation support. Investigators use serum albumin as an important marker to assess the metabolic and nutritional status of patients. Deceased serum albumin is shown to be an independent and strong indicator of to predict the outcome of the patient. [1] [10]

It is essential to recognize the patients who may have poor prognosis and increased risk of complications so that immediate intensive management of patient can be undertaken. An efficient, cost effective and simple tool is needed to forecast the chances of mortality in theses patients' level of albumin in serum serves as an important marker of the clinical condition of severely ill patients. Concentration of serum albumin is reduced often

dramatically early in the course of illness, as it is a negative acute phase reactant and often does start rising till recovery starts.3 [11] Increased mortality, increased hospital stay and a higher rate of complication are associated with a decrease in the level of serum albumin..4-6 [12-14] Increase in morbidity by 89%, mortality by 137%, hospital stay by 71%, prolonged intensive care unit stay by 28% and increased resource utilization by 66% observed after each 10 g/L reduction in serum albumin (SA) concentration.7. [15] In general, population, decreased serum albumin has been described as a risk factor which is associated with poor outcomes in critically ill patients. [18] [16] It has been observed that serum albumin level at the time of admission is an important risk factor related to the duration of stay, death, and re-admission to the hospital. [17]

Given the above facts, this study intends to determine the changes in the serum albumin level after admitting patients to ICU and to assess the usefulness of Sequential estimation of Serum Albumin concentration as an important marker of the outcome of patients.

MATERIALS & METHODOLOGY

STUDY DESIGN:-Observational cross-sectional study

STUDY SETTING:-The present study was conducted on the patients admitted to ICU in the Department of Medicine at Dr. D.Y. Patil Medical College, Hospital and Research Centre, Pimpri, Pune.

STUDY DURATION:-Study Duration was 24 months, from October 2020 to September 2022.

STUDY POPULATION:-The present study was conducted on all patients admitted to ICU of the department of Medicine at Dr. D.Y. Patil Medical College, Hospital and Research Centre, Pimpri, Pune.

SAMPLE SIZE:- The sample size for the present study was 100.

SAMPLING TECHNIQUE (SAMPLING METHOD):- A total of 100 patients who were satisfying the inclusion and exclusion criteria were selected in the present study.

SELECTION CRITERIA:-

Inclusion Criteria:-

- All patients with acute illness admitted to MICU
- Age more than 18 years

Exclusion Criteria:-

- Chronic Illness- Chronic liver failure, Nephrotic syndrome
- Protein-losing enteropathy, Chronic malnutrition.
- Recurrent admissions
- Any patient who dies within 5 days of admission to the ICU
- History of Albumin Infusion

METHODOLOGY OF STUDY:

The present study was conducted among the patients admitted to the MICU of the study institute. Before the commencement of the study, ethical clearance were obtained from the institutional review board. The pre-tested, semi-structured questionnaire was developed and used for data collection. Written informed consent had been taken from the patients/relatives prior data collection was done. Clinical and demographic information, such as age, sex, smoking status, and history were collected at the time of admission to the medical ICU. Information regarding chronic diseases like hypertension, diabetes, and chronic obstructive pulmonary diseases was also evaluated. A complete clinical examination was performed after taking a careful and detailed history.

At the time of admission, serum albumin (SA), total blood counts, renal functions, and liver functions were also noted. An arterial blood gas analysis and chest X-ray were acquired. For each patient, the number of days spent on the ventilator, in the intensive care unit, and the hospital was noted

.Serum albumin estimation was performed on patients who were included in the study on the day of admission, as well as on days three, five, and ten of their hospital stay. The automated bromocresol purple (BCP) specific dye binding method was used to measure serum albumin. The observations were graphically depicted and with the help of tables and conclusions were drawn based on observations and discussion. The data obtained were compiled in tabular form and analyzed. Descriptive statistics were used to present data in tabular and graphical forms and suitable statistical tests were applied for results.

STATISTICAL METHODS

DATA ANALYSIS: Data analysis includes the following steps.

Step I: All responses were tabulated by the investigator using Microsoft Excel 200 Software. Graphical representations were made wherever necessary.

Step II: Data analyzed by using SPSS software version 26.0 Statistical tools used were proportions & percentages & other appropriate Statistical tests of significance.

RESULTS

It was observed that the mean age of the study participants was 56.41±21.82. Out of the total study participants 60(60) were males & 40(40) were females. Out of 100 study participants, 69(69) survived and 31(31) died during the treatment. Among the survivors most of the participants 21(30.43) were in the age group of 51-60 years followed by 18 (26.09) participants in the age group of 41-50 years, 13 (18.84) participants in the age group of 61-70 years, 9 (13.04) participants in the age group of 71-80 years, 5 (7.25) participants above the age of 80 years, 2 (2.90) participants in the age group of 31-40 years and 1 (1.45) participants in the age group of ≤30 years. Among the 69 survivors, 42 (60.87) were male and 27 (39.13) were female participants. Among the 69 survivors, most of the participants i.e. 32(46.38) diagnosed with stroke followed by 13(18.84) participants diagnosed with diabetic foot, 10 (14.49) participants diagnosed with trauma, 11(15.94) participants were diagnosed with COPDI.

Among the survivors mean albumin level on day 1 was 3.83±0.28, on day 3 was 3.42±0.25, on day 5 was 2.93±0.23 and on day 10 was 3.21± 0.22. Among the non-survivors mean albumin level on day1, day 3, day 3 & day 10 was 3.09±0.24, 2.83±0.17, 2.74±0.14 and 2.98±0.24. The difference observed on day 1, day 3, day 5 & day 10 was statistically significant. Among the survivors mean APACHE II score was 18.35±9.4 and among non-survivors mean APACHE II score was28.7±8.7. The difference observed was statistically significant. Among the survivor's duration of ICU stay was 5-7 days in 4(5.80) participants, 8-10 days in 31(44.93) participants, 11-13 days in 20(28.99) participants, more than 13 days in 14 (20.29) participants. Among the non-survivors duration of ICU stay was 8-10 days in 3 (9.68) participants, 11-13 days in 15(48.39) participants, and more than 13 days in 13(41.94) participants It was observed that among the survivor's duration of hospital stay was 5-10 days in 6(8.70) participants, 11-15 days in 34(49.28) participants, 16-20 days in 16(23.19) participants, more than 20 days in 13 (18.84) participants. Among the non-survivors duration of hospital stay was 5-10 days in 3 (9.68) participants, 11-15 days in 23(74.19) participants, 16-20 days in 3 (9.68) participants, and more than 20 days in 2 (6.45) participants.

Table 1: Distribution of patients according to serum albumin level

Day	**Survivor (Mean±SD)**	**Non Survivor (Mean±SD)**	**P value**
Day 1	3.86±0.30	3.07±0.36	<0.001
Day 3	3.26±0.40	2.80±0.31	<0.001

Day 5	2.92±0.47	2.75±0.31	<0.001
Day 10	3.47± 0.46	2.99±0.36	<0.001

Table 2: Distribution of patients according to etiological diagnosis,

Diagnosis	**Survivor**	**Non Survivor**	**Total**
Stroke	32(46.38)	15 (48.39)	47(47)
Snake bites	1(1.45)	0 (0.00)	1(1)
OP poisoning	2(2.90)	1 (3.23)	3(3)
COPD	11(15.94)	5 (16.13)	16(16)
Diabetic foot	13(18.84)	7 (22.58)	20(20)
Trauma	10(14.49)	3 (9.68)	13(13)
Total	69 (100)	31 (100)	100(100)

Table 3: Comparison of APACHE II Score with the outcome

Day	**Survivor (Mean±SD)**	**Non Survivor (Mean±SD)**	**P value**
APACHE II score	18.46±5.82	28.81±9.15	<0.001

DISCUSSION

In the present study out of 100 study participants, 69(69) survived & discharged from hospital and 31(31) died during the treatment. A study conducted by Sanket Mahajan et al(2)revealed that 31 (62%) and 19 (38) patients were discharged and died respectively. A study conducted by Blunt MC et al(4) reported 54% survivors and 46% non-survivors. A study conducted by Altaf Ahmed et al(5) revealed out of 100 patients, 39 patients were discharged from hospital (survivors) and 61 patients expired in the hospital (nonsurvivors). Shobha Kumar et al(7) revealed that out of 70 patients included in the study, 43 (61.42%)

patients were discharged from the hospital (survivors) and 27 (38.57%) died in the hospital (non-survivors). A study conducted by A Pal et al (8) observed that out of total of 117 patients, 70 patients (59.8%) recovered and 47 patients (40.17%) succumbed to their illness. Santosh Gosavi et al(9) observed that out of 300 patients included in the study, 152 (50.7 %) and 148 (49.3) patients were discharged and died respectively. In the present study among the survivors mean albumin level on day 1 was 3.83±0.28, on day 3 was 3.42±0.25, on day 5 was 2.93±0.23 and on day 10 was 3.21± 0.22. Among the non-survivors mean albumin level on day1, day 3, day 3 & day 10 was 3.09±0.24, 2.83±0.17, 2.74±0.14 and 2.98±0.24 respectively. The difference observed on day 1, day 3, day 5 & day 10 was statistically significant. Most of the non-survivors were having decreased levels of serum Albumin at the time of admission than survivors, thus low serum albumin at the time of admission indicates a poor prognosis.

Gosavi et al(9) observed that the mean S. albumin on the day of admission in patients who survived and not-survived was 3.06 gm% (+/-0.54) and 2.45 gm% (+/-0.50) ($p< 0.01$) respectively. A study conducted by Sanket Mahajan et al(2) revealed that serum albumin level on day one was 3.3 g/dl (±0.4 g/dl). In survivors and non- survivors mean serum albumin level recorded as 3.43 g/dl (±0.41 g/dl) and 3.12 g/dl (±0.19 g/dl) respectively. On day three level of serum albumin recorded was 2.9 g/dl (±0.4 g/dl). Serum albumin level was 3.04 g/dl (±0.51 g/dl) and 2.75 g/dl (±0.22 g/dl) among those who survived and died respectively. A study by Dubois MJ et al(10)conclude that hypoalbuminemia was potent, dose-dependent independent indicator of poor outcome. Banga A et al(11) revealed the mean level of serum albumin on day one and day three were reported to be 3.2 g/dl (± 0.7 g/dl) and 2.9 g/dl (± 0.6 g/dl) respectively. A study conducted by Yap FM et al(12) revealed survivors had higher level of serum albumin (2.57 g/dl vs 2.10 g/dl, $p<0.005$) than non-survivors at the time of admission.

In the present study among the survivors mean APACHE II score was 18.35±9.4 and among non-survivors mean APACHE II score was28.7±8.7. The difference observed was statistically significant.

A study conducted by Phuping Akavipat et al[15] revealed APACHE II score among survivors and non-survivors was 16.56 (95% CI, 15.84-17.29) and 19.08 (95% CI, 15.40-22.76) respectively. A study conducted by G. Giangiuliani et al(16) revealed that mean APACHE II score in those who survived and not survived was 14.2 and 22.4 respectively. Bashu Dev Parajuli et al(17) revealed mean APACHE II score among survivors and non-survivors was 22.08 & 16.39 respectively, with statistically significant differences observed in the two groups. Santosh Gosavi et al(9) observed that the mean APACHE II score in survivors and non-survivors was 11.7 (+/- 5.65) and 19.18 (+/- 6.76) respectively. A study by Rajnish Gupta & V.K. Arora,(18) found the mean APACHE II score in survivors and non-survivors as 11.34 ± 6.75 and 23.09 ± 10.01 respectively ($p < 0.01$). A study conducted by Amr Elhadidy et al(19) found that the APACHE II score is good indicator of mortality.

CONCLUSION

From the present study, it can be concluded that there is a significant decrease in the level of serum albumin in non-survivors compared to the survivors. Estimation of serum albumin level at regular intervals after admission of the patient to the hospital, helps to forecast outcome. In addition to this APACHE II score was significantly lower in non-survivors compared to the survivors. APACHE II score is also used as a prognostic indicator in critically ill patients admitted to ICU. Thus both serum albumin and APACHE II score are good screening parameters for predicating outcome of patients.

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