MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi:

Significance of Serum Proteins and Serum Lipids as a Prognostic Mortality Indicator in Burn Patients

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ABSTRACT

Severe burn is the leading cause mortality because of the higher metabolic and physiological abnormalities Hypoalbuminemia is a common clinical deficiency in burn patients and is associated with complications related to increased extravascular fluid, including edema, abnormal healing and susceptibility to sepsis. This study aimed to find whether serum albumin, globulin, total protein, cholesterol and triglyceride levels are clinically relevant to determine the mortality of a burn patient and thereby the patient's outcome. This cross-sectional observational was conducted in the in the Department of Surgery in collaboration with Department of Biochemistry, in a tertiary care hospital, central India. All patients who were admitted to the burn unit during the study period were enrolled in our study. detailed history and clinical examination were recorded. Serum albumin, globulin, total proteins and serum cholesterol were estimated on alternate days starting from day of admission till discharge or death. Out of total 255 burn patients, 208 (81.6%) were survivors and 47 (18.4%) patients expired during the course of treatment. Majority of the patients was female (56.9%), second grade burn cases were 54.5%, most of them were thermal burn (84.3%). Sepsis was the most common (34.1%) complication in burn patients. Majority of patients showed an involvement of 31-40% TBSA with 45.2% of survivor patients, whereas among non survivor 51-60% TBSA in 61.7% cases. Serum albumin, globulin, total serum protein and scrum cholesterol significantly associated with the mortality of burn patients. The increase in values of albumin, globulin, total protein and cholesterol during the clinical course reduces mortality with serum albumin acting as the best predictor and cholesterol the least.

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Key Words
Albumin, globulin, total protein, serum cholesterol, burns, prognosis

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Received:
Accepted: 08 September, 2023
Published:

Citation: Vidyanand Pandit, Soobia Karim Ansari and Dharmveer Sharma, 2023. Significance of Serum Proteins and Serum Lipids as a Prognostic Mortality Indicator in Burn Patients. Res. J. Med. Sci., XX: 00-00, doi:

INTRODUCTION

An injury to the skin and underlying tissues that are predominantly brought on by heat, electricity, friction, or chemical contact is referred to as a "burn"[1]. However, systemic symptoms may occur if the burn surface area exceeds 15% of the total body surface area (TBSA)[2]. Burn mortality is more due to its metabolic and physiological derangements than due to the injury. Many burn mortality prediction models have been developed over time, which are important for quality control, assessment, planning of treatment, explaining prognosis and as research tools to compare efficacy of different therapeutic modalities. Virtually, all burn mortality models include three variables: Age, percentage TBSA burn and inhalation injury in their analysis of burn outcomes. Although, metabolic derangements are the cause of both morbidity and mortality in burns, most prognostic scoring systems do not include any of the biochemical parameters[3,4]. Severe burn injury is followed by a profound systemic response that persists till the wounds heal[5]. These metabolic and physiological reactions include hepatic dysfunction, increase in vascular permeability, catabolism and heightened inflammatory response[6-8]. These ultimately affect serum protein and lipid levels in burn patients. The physiological and metabolic derangements in burns are dynamic over the clinical course. Hypoalbuminemia is common in critically ill patients, particularly in burn patients[9]. Even when burns cover <10% of the body surface, important metabolic changes occur. Burns produce hypermetabolic and hypercatabolic responses, which are related to the extent and depth of the injuries[10]. Burns affecting >20% of the body surface cause a major loss of extracellular fluids, thereby inducing shock by increasing vascular permeability and reducing plasma albumin from the wound exudations. Hypoalbuminemia also causes complications related to increasing extravascular fluids, including edema, abnormalities in healing and increased susceptibility to sepsis[11].

The present study will evaluate the association of serum albumin, globulin, serum total proteins and serum cholesterol with the burn patient mortality.

MATERIALS AND METHODS

This cross-sectional observational was conducted in the in the Department of Burns and Plastic Surgery in collaboration with Department of Biochemistry, in a tertiary care hospital, central India. All patients who were admitted to the burn unit during the study period were enrolled in our study,

Inclusion criteria:

- Patients aged 18-60 years with both gender
- Patients admitted within 24 hrs of the burn injury
- Percentage of TBSA involved should be 15-60%.
- Patients who provide written informed consent for the study

Exclusion criteria:

- Children <18 years of age
- Patients who had comorbidities such as chronic liver disease, chronic renal disease, diabetes, hypertension, hypothyroidism and septicemia
- Patients not provide consent for the study

Complete history was obtained from the patients (if conscious) or the accompanying attendees. Blood samples were collected and sent for hematological and biochemical investigations immediately. The patient's serum albumin, globulin, total protein, cholesterol and TG levels on the day of admission followed by every 72 h were recorded.

Normal serum concentration, which will be taken as a reference value will be as follows[12]:

- **Serum total protein:** 6.7-8.2 g dL^{-1}
- **Serum albumin:** 3.2-5.5 g dL^{-1}
- **Serum globulin:** 1.8-3.4 g dL^{-1}

RESULTS

A total of 255 burn patients were analysed and followed up in our study among them, 208 (81.6%) were survivors who were discharged/DOR in stable condition and 47 (18.4%) patients expired during the course of treatment. Majority of the patients was female (56.9%), second grade burn cases were 54.5%, most of them were thermal burn (84.3%). Sepsis was the most common (34.1%) complication in burn patients (Table 1).

In the present study, among the survivors, the highest number of patients belonged to the age group of 31-40 years with 44.2% followed by 18-30 years with 37.5% of survivor cases. Among the non-survivors, the highest number of patients belonged to the age group of 51-60 years with 55.3% of total non-survivor cases followed by 41-50 years with 31.9% of non-survivor cases (Table 2).

Table 1: Demographic and clinical characteristics of burn patients

Variable	Frequency	Percentage
Gender		
Male	110	43.1
Female	145	56.9
Burn grade		
Two	139	54.5
Three	13	5.1
Four	0	0
Two and three	93	36.5
Three and four	10	3.9
Type of burn		
Inhalation	20	7.8
Electrocution	16	6.3
Chemical	4	1.6
Thermal	215	84.3
Complications		
Pulmonary infection	48	18.8
Sepsis	87	34.1
Renal failure	27	10.6

Table 2: Age distribution among burn survivors and non survivors

	Survivors		Non-survivors	
Age group (years)	Frequency	Percentage	Frequency	Percentage
18-30	78	37.5	-	-
31-40	92	44.2	6	12.8
41-50	23	11.1	15	31.9
51-60	15	7.2	26	55.3
Total	208	100.0	47	100.0

Table 3: TBSA distribution (TBSA%) among survivors and non survivors patients

	Survivors		Non-survivors	
TBSA (%)	Frequency	Percentage	Frequency	Percentage
15-20	5	2.4	-	-
21-30	60	28.9	-	-
31-40	94	45.2	-	-
41-50	29	13.9	18	38.3
51-60	20	9.6	29	61.7
Total	208	100.0	47	100.0

TBSA: Total body surface area

Table 4: Assessment of Serum albumin and serum globulin values among survivors and non survivors patients

	Survivors		Non survivors		
Days	Serum albumin	Serum globulin	Serum albumin	Serum globulin	p-value
3	2.67±0.23	2.52±0.22	1.96±0.17	1.84±0.10	<0.001
6	2.73±0.22	2.58±0.20	1.83±0.15	1.75±0.12	<0.001
9	2.82±0.21	2.61±0.19	1.74±0.16	1.64±0.11	<0.001
12	2.90±0.22	2.63±0.23	1.60±0.12	1.55±0.09	<0.001
15	3.02±0.20	2.67±0.21	1.52±0.13	1.49±0.10	<0.001

Table 5: Assessment of Serum total protein and serum cholesterol values among survivors and non survivors patients

	Survivors		Non survivors		
Days	Total serum protein	Serum cholesterol	Total serum protein	Serum cholesterol	p-value
3	5.02±0.24	119.80±8.20	3.83±0.14	109.50±12.20	<0.001
6	4.93±0.22	138.12±14.09	3.76±0.12	90.10±9.20	<0.001
9	4.87±0.20	159.30±25.16	3.68±0.10	82.30±6.16	<0.001
12	4.82±0.21	181.51±22.14	3.62±0.11	71.50±7.14	<0.001
15	4.80±0.18	202.66±20.23	3.55±0.08	63.90±5.23	<0.001

In the present study, among the survivors, the highest number of patients showed an involvement of 31-40% TBSA with 45.2% of survivor patients followed by 21-30% of TBSA in 28.9% of survivor cases, whereas among non survivor 51-60% TBSA in 61.7% cases followed by 41-50% of TBSA in 38.3% of non survivor patients (Table 3).

DISCUSSIONS

Metabolic parameters are expected to reflect the status of pathology and ultimately the prognosis of burn patients. However, none of the existing burn prognostic scales included any metabolic parameter. In extensive burns, the response is characterized by increased metabolic rates, hypercatabolism, insulin resistance, multiorgan dysfunction, muscle protein degradation and increased risk for infection[6].

In the present study, a total of 255 burn patients were studied and followed up. Among them, 81.6% of total patients were survivors who were discharged/DOR in stable condition and 18.4% of total patients expired during the course of treatment, our results were similar to a study conducted by Gupta *et al*.[13] and Bandeira *et al*.[14], lower rate of survivors may be due higher chances of secondary infections, high degree of burn and septicemia.

Chances of mortality in burns are also governed by many physiological and metabolic derangements which happen during the clinical course of the patients.

In the present study, among the survivors, the highest number of patients showed involvement of 31-40% TBSA and among the non-survivors, maximum number of patients showed TBSA between 51-60%. The results significantly showed that an increase in burn size and higher percentage of TBSA are associated with higher risk of death, finding are comparable with the Maile *et al*.[15] and Kim *et al*.[7].

Serum albumin is a poor nutritional marker but it is a good prognostic marker correlating with morbidity and mortality in hospitalized patients. For that reason, it is hardly surprising that hypoalbuminemia is associated with increased mortality and prolonged length of stay in ICU. We agree with these statements since our results show an association between hypoalbuminemia with higher morbidity, consistent to many other studies conducted by Kamolz *et al*.[16], Vanek[17] and Romero[18].

Current study found serum globulin also a prognostic marker of mortality in burn patients, significantly association of serum globulin and mortality were reported, accordance to Pruthviraj *et al*.[19].

Comparing albumin and globulin, it was seen that day 1 value of albumin was a better predictor than globulin but both could be used in prognostication.

We are also examined the relationships between mortality and the levels of total serum proteins and serum cholesterol level, statistically significant association between serum total protein and serum cholesterol level with the mortality in burn patients were seen in present study, correlated to many other literature[12,20,21].

It was observed in our study that there were a significant positive trend of serial serum albumin, globulin, total protein and cholesterol levels in patients who survived and a gradual negative trend in patients who expired.

The sensitivity and specificity of total serum proteins, globulin, the albumin/globulin ratio, cholesterol and TG were inferior to those of albumin in predicting mortality.

CONCLUSION

The study showed a significant relationship of serum albumin, serum globulin, serum total protein, serum cholesterol and TGs in prognosis of burn patients. The most important prognostic parameter was found to be serum albumin. It could be statistically inferred that the increase in values of albumin, globulin, total protein and cholesterol during the clinical course reduces mortality with serum albumin acting as the best predictor and cholesterol the least

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