INFLUENCE OF ADMISSION SERUM ALBUMIN LEVEL ON OUTCOMES OF ADULT PATIENTS WITH SEVERE BURNS

Nguyen Nhu Lam[1], Phan Quoc Khanh[2], Nguyen Hai An[1], Le Quang Thao[1]

[1]Le Huu Trac National Burn Hospital
[2]Region 4 Military Medical Hospital

SUMMARY

This study aimed to detect the impact of serum albumin level at admission on the outcome of severely adult burn patients who were admitted to the Intensive care unit (ICU) within 72h after burn. The result indicated that the serum albumin level significantly reduced at admission (31.1 ± 1.1g/l). Of 62 studied patients, 10 (16.1%) patients had albumin level < 25g/l at admission. Plasma albumin level was significantly lower in patients with deep burn area ≥ 20% total body surface area, in patients who developed multiple organs failure or died (p < 0.05) and was not affected by gender, age, burn size and inhalation injury. In addition, a remarkably higher rate of multiple organ failure and death was recorded in patients with admission albumin level < 25g/l (p < 0.05). There was an insignificant relationship between admission albumin level and length of stay in the ICU, healing time of partial burn as well as a donor site.

Keywords: *Serum albumin, adult burn, outcomes.*

1. INTRODUCTION

The loss of plasma due to a higher vascular permeability in the burn wounds is considered as the main cause of the reduction in blood protein, albumin and circulatory volume, which lead to burning shock and impaired organ functions. Hypoalbuminemia is a common clinical deficiency in burn patients. Burns affecting from 20% of total body surface area (TBSA) can cause significant loss of extracellular fluids, leading to shock by increasing vascular permeability and reducing plasma albumin from the wound exudations. Reduced plasma albumin levels may also cause complications related to increasing extravascular fluids, including edema, abnormalities in healing, and increased susceptibility to sepsis [1],[2].

In this study, we evaluated the characteristics, relating factors and the prognostic value of admission serum albumin level in severe adult burn patients treated at the National Burn Hospital.

2. PATIENTS AND METHODS

A prospective study was conducted on 62 adult burn patients with a burning extent ≥ 20% total body surface area (TBSA), without comorbidities or combined injury, admitted within 72 hours postburn to the Intensive care

[1] Corresponding author: Nguyen Nhu Lam, National Burn Hospital
Email: lamnguyenau@yahoo.com

unit (ICU), National Burn Hospital from June 2016 to August 2018. All patients received the same treatment regime including fluid resuscitation as Parkland formula, early nutrition, daily dressing change, necrosis excision and skin graft. Serum albumin level was determined immediately after admission. The relationship between admission albumin level and patient characteristics, burn size, deep burn area, inhalation injury, length of stay in the ICU, the healing time of burn wounds and donor sites, rate of complications and death were analyzed by using Intercooled Stata 14.0 software. P-value < 0.05 was consider as significant level.

3. RESULTS

Table 1. Patient characteristics (n = 62)

Criteria	Mean	Min - Max
Age (year)	35.2 ± 10.9	19 - 58
Gender (Male/Female)	46/16	
Admission time (hour)	7.6 ± 8.4	1 - 50
Burn size (% TBSA)	50.9 ± 17.4	20 - 95
Full thickness burn area (% TBSA)	19.3 ± 16.4	0 - 69
Inhalation injury, n (%)	8 (12.9)	
Death, n (%)	11 (17.7)	
Admission albumin level (g/l)	31.1 ± 1.1	6.7 - 48.2
Admission albumin < 25g/l (n,%)	10 (16.1)	

**: TBSA: Total body surface area*

Table 1 indicates that the mean age of patients was 35.2 years with a burn size of 50.9% TBSA and a full-thickness burn area of 19.3% TBSA. There were 8 (12.9%) patients who suffered from inhalation injury. The overall mortality rate was 17.7%. The serum albumin level significantly decreased on admission (31.1g/l) and 16.13% of patients had serum albumin level < 25g/l.

Table 2. Relationship between admission albumin level and burn features

Parameter	Group	Albumin (g/l)	p
Gender	Female (n=16)	29.51 ± 10.41	0.37
	Male (n = 46)	31.72 ± 7.83	
Age (year)	16 - 40 (n = 40)	32.55 ± 7.42	0.34
	41 - 60 (n = 22)	30.37 ± 9.08	
Burn extent, % TBSA	< 50% (n = 32)	31.75 ± 7.05	0.57
	≥ 50% (n = 30)	30.51 ± 9.97	
Deep burn, % TBSA	< 20% (n = 38)	33.64 ± 7.13	0.003
	≥ 20% (n = 24)	27.20 ± 9.22	
Inhalation injury	no (n = 54)	31.96 ± 8.58	0.051
	yes (n = 8)	25.67 ± 6.17	

As can be seen from Table 2, admission serum albumin level was not statistically different between subgroups of age, gender, burn size and inhalation injury (p > 0.05). It is noted that serum albumin level was significantly lower in patients with deep burn area ≥ 20% TBSA (27.20 ± 9.22 g/l vs. 33.64 ± 7.13g/l, p < 0.05).

Table 3. The relationship between the albumin level (mmol/l) outcomes

Criteria	Subgroup	Albumin (g/l)	p	Albumin		
				< 25g/l	≥ 25g/l	p
ARDS	No (n = 57)	31.71 ± 8.32	0.07	8 (80)	49 (94.2)	0.13
	Yes (n = 5)	24.7 ± 9.32		2 (20)	3 (5.8)	
Septic shock	No (n = 53)	31.93 ± 8.37	0.08	7 (70)	46 (88.5)	0.12
	Yes (n = 9)	26.57 ± 8.54		3 (30)	6 (11.5)	
MOF	No (n = 52)	32.26 ± 8.2	0.017	6 (60)	46 (88.5)	0.025
	Yes (n = 10)	25.33 ± 8.2		4 (40)	6 (11.5)	
Death	No (n = 51)	32.63 ± 7.85	0.003	5 (50)	6 (11.5)	0.004
	Yes (n = 11)	24.26 ± 8.55		5 (50)	46 (88.5)	

**ARDS: Acute Respiratory Distress Syndrome; MOF: Multiple Organ Failure*

Serum albumin level at admission was insignificantly different between patient developed ARDS and septic shock (Table 3). Meanwhile, patients who developed MOF or died have significantly lower albumin concentration (p < 0.05). In addition, the MOF and mortality rates were remarkably higher among patients with admission albumin level < 25g/l (p < 0.05).

Table 4. Relationship between admission serum albumin level and length of stay in ICU wound healing duration

Duration, day	Admission albumin level		p
	Albumin < 25g/l	Albumin ≥ 25g/l	
Stay in ICU	17.1 ± 6.7	19.2 ± 11.7	0.58
Healing of superficial dermal burn	17 ± 4.2	15.9 ± 1.9	0.31
Healing of deep dermal burn	25 ± 5.3	25.1 ± 5.2	0.96
Healing of donor sites	14.5 ± 5.9	12.7 ± 2.5	0.36

Length of stay in the ICU, completely healing time for partial burns ad donor sites was not statistically significant between patients with or without serum albumin level < 25g/l (Table 4).

4. DISCUSSION

Albumin is synthesized in the liver, then transported in systemic circulation to tissues including muscle, skin, intestines and other organs. Normally, there is only 5% of albumin leaking from vessels per hour [1]. Severe burn injuries lead to escaping plasma including albumin from a vessel into intercellular space. This phenomenon occurs not only at the burn wounds but also systematically causing edema in the first days and cachexia and lack nutrients for the wound healing process in the later stage [2]. The plasma leakage occurs early at 5 minutes after burn, reaches to the highest level at 8 - 12 hours and can last for 72 hours postburn in case of extensive burns causing a decrease in serum protein and albumin level.

Our result was in accordance with the above statement. The serum albumin level decreased immediately after hospitalization, in which, there was 16.1% of patients had albumin level < 25g/l.

Most studies found that the albumin level was related to the burn size [3]. Our results showed that the patients with the full thickness burn area ≥ 20% TBSA had a significantly lower serum albumin concentration ($p < 0.05$), but burn extent and inhalation injury did not affect admission albumin level in our study.

In burn patients, a reduction of admission serum albumin level was considered as a predictor of an increased rate of complications and mortality. In 2013, the study by Aguayo-Becerra OA and colleagues found that patients with albumin concentration < 20g/l had a mortality rate > 80% with 84% sensitivity and 83% specificity [4].

Kim GH et. al indicated that a decrease in admission serum albumin level was related to an increase in the risk of acute renal failure and mortality [5]. Gong MN and coworkers reported that a higher rate of ARDS developed in patients with serum albumin levels < 23g/l in the first 24 hours [8]. The study by Gupta S et. al also showed a similar result [6], [8].

In our study, the admission albumin level decreased and the patients with albumin concentration < 25g/l had a statistically higher rate of multiple organs failure and death.

5. CONCLUSION

Admission serum albumin level decreased in a severely adult burn, particularly in patients with deep burn ≥ 20% TBSA. In addition, multiple organs failure and mortality rates were remarkably higher in the patients with the admission serum albumin level < 25g/l as compared to remain patients.

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