ORIGINAL ARTICLE

Bali Medical Journal (*Bali Med J*) 2019, Volume 8, Number 2: 408-413
P-ISSN.2089-1180, E-ISSN.2302-2914

Published by DiscoverSys

The role of serum albumin level within the first 24-hours of hospitalization to the mortality risk in burn patients at Dr. Hasan Sadikin General Hospital, Bandung, Indonesia

Ummi Muthiah,[1*] Tiene Rostini,[2] Nina Tristina[2]

ABSTRACT

Introduction: Serum albumin level may predict the mortality risk in burn patients. This study aimed to determine the mortality risk in burn patients based on serum albumin level within the first 24 hours of hospitalization.
Method: A cross sectional study was conducted reprostecively to the patient's medical records. The subjects were burned patients who were hospitalized in Dr. Hasan Sadikin General Hospital Bandung during January-December 2017. The subjects were divided into two groups, which were dead and survived at the end of hospitalization. The mortality risk based on serum albumin level within the first 24 hours of admission was assessed using the odds ratio (OR) of two groups. Data were analyzed using SPSS version 17 for windows.
Result: The subjects were 47 patients, consisted of 9 dead subjects and 38 survived subjects. Males were predominant in both groups such as 12.8% in dead subjects and 70.2% in survived subjects. The OR value based on serum albumin level <2 g/dL within the first 24 hours of hospitalization was 14.40 (p=0.009; CI:2.1–100).
Conclusion: The subjects with serum albumin level <2 g/dL within 24 hours of hospitalization has 14 times higher mortality risk compared to the subjects with serum albumin level >2 g/dL. Therefore, burn patients need to be examined for serum albumin level within the first 24 hours of hospitalization.

Keywords: burn, mortality risk, serum albumin level.
Cite this Article: Muthiah, U., Rostini, T., Tristina, N. 2019. The role of serum albumin level within the first 24-hours of hospitalization to the mortality risk in burn patients at Dr. Hasan Sadikin General Hospital, Bandung, Indonesia. *Bali Medical Journal* 8(2): 408-413. DOI:10.15562/bmj.v8i2.1402

[1]Resident of Clinical Pathology Department, Faculty of Medicine, Padjadjaran University, Dr. Hasan Sadikin General Hospital, Bandung, Indonesia
[2]Department of Clinical Pathology, Faculty of Medicine, Padjadjaran University, Dr. Hasan Sadikin General Hospital, Bandung, Indonesia.

[*]Correspondence to: Ummi Muthiah, Resident of Clinical Pathology Department, Faculty of Medicine, Padjadjaran University, Dr. Hasan Sadikin General Hospital, Bandung, Indonesia
ummi.muthiah@gmail.com

Received: 2018-11-28
Accepted: 2019-04-06
Published: 2019-08-01

INTRODUCTION

Burn injury is one of the global health issues that causes approximately 180,000 death cases per year in the world. The death cases of burn injury notably occur in low- and middle-income countries. About two-thirds of the case occurs in Africa and South-East Asia region.[1]

Indonesia Basic Health Research 2013 showed that burn injury took the sixth place as the cause of injury in Indonesia, with the prevalence is 0.7% from all injury cases. The mortality caused by burn injury in Indonesia is still high, which is about 24-34%. The prevalence of burn injury in West Java Province is 0.9%, slightly higher compared to the national prevalence of burn injury.[2,3]

Identification of factors related to mortality risk among burn patients will lead to a the well management of these patients and become more intensive. The serum albumin level is one of the elements that can be used to predict the mortality risk in burn patients. Several studies have studied about serum albumin level in burn patients, however with different serum albumin level cut-off value.[4-7] Based on such background, the authors wanted to know the mortality risk based on serum albumin level within the first 24 hours of hospitalization in burn patients that were hospitalized in Dr. Hasan Sadikin General Hospital Bandung.

METHOD

A cross-sectional sectional study was conducted retrospectively from the medical record of burn patients. The data used were 1) the serum albumin level within the first 24 hours of hospitalization, 2) the clinical condition of the patients at the end of the hospitalization (dead or survived), and 3) the patient's characteristic in terms of age, gender, etiology/cause of burn injury, and severity of burn injury. This study obtained ethical approval from the Research Ethics Committee of the Dr. Hasan Sadikin General Hospital Bandung (Number LB.04.01/A05/EC/102/IV/2018).

The subjects of this study were burned patients who were hospitalized at Dr. Hasan Sadikin General Hospital Bandung during the period January-December 2017. The inclusion criteria were adult patients (>18 years old) who were examined for serum albumin level in the first 24 hours since they

were admitted to the hospital. Meanwhile, the exclusion criteria were patients with a history of diabetes mellitus, kidney injury, nephrotic syndrome, and chronic liver disease, or patients who returned before the end of the burn injury's critical period (less than 5 days of hospitalization).[8,9]

The subjects were divided into two groups, those who died (A group) and survived (B group) at the end of admission. Subjects from group A and B were then divided based on serum albumin level within the first 24 hours of admission, which consisted of normoalbuminemia (serum albumin level: 3.4–5.0 g/dL), hypoalbuminemia (serum albumin level: 2.0–<3.4 g/dL) and severe hypoalbuminemia (serum albumin level: <2.0 g/dL). After that, the odds ratio (OR) was calculated to assess the serum albumin level within the first 24 hours of hospitalization as a mortality risk factor of burn patients. The sample size was calculated based on the formula to determine OR, which was 8 subjects for each group A and B. Statistical examination was carried out at a statistical confidence level of 95% (α=0.05) and p-value <0.05 was considered as significant. Data were analyzed using SPSS version 17 for windows.

RESULT

The number of adult burn patients hospitalized at Dr. Hasan Sadikin General Hospital Bandung during the period January-December 2017 was 67 patients. Twenty patients were excluded, so that total subjects in this study were 47 patients, consisted of 9 dead subjects and 38 survived subjects. The subject's characteristic data can be seen in Table 1 below.

The subjects in the dead and survived group was then divided based on the serum albumin level within the first 24 hours of hospitalization. The serum albumin level within the early 24 hours of admission of the study subjects can be seen in Figure 1 below.

Figure 1 shows that 2 subjects had normoalbuminemia in the dead subject group and there were

Table 1 Baseline characteristics of respondents

		Dead Subjects Group (n=9)		Survived Subjects Group (n=38)		Total (n=47)	
Parameter	Description	Amount (n)	%	Amount (n)	%	Amount (n)	%
Age	>18-65 years old	9	19.1	38	80.9	47	100
	>65 years old	0	0	0	0	0	0
Gender	Male	6	12.8	33	70.2	39	83.0
	Female	3	6.4	5	10.6	8	17.0
Cause of burn injury	Fire	9	19.1	22	46.8	31	65.9
	Electricity	0	0	14	29.8	14	29.8
	Other cause	0	0	2	4.3	2	4.3
Degree of burn injury	2nd degree	0	0	9	19.1	9	19.1
	2nd–3rd degree	9	19.1	27	57.4	36	76.6
	3rd degree	0	0	2	4.3	2	4.3
Severity of burn injury	Mild	0	0	2	4.3	2	4.3
	Moderate	0	0	8	17.0	8	17.0
	Severe	9	19.1	28	59.6	37	78.7
Total body surface area of burn	<15%	0	0	16	34.0	16	34.0
	15-25%	1	2.1	9	19.1	10	21.3
	>25%	8	17	13	27.7	21	44.7
Onset of burn injury	<48 hours	7	14.9	26	55.3	33	70.2
	48–120 hours	0	0	4	8.5	4	8.5
	>120 hours	2	4.3	8	17.0	10	21.3

Table 2 Characteristic of Dead Subjects with Normoalbuminemia and Survived Subjects with Severe Hypoalbuminemia

Characteristic	Dead Subjects with Normoalbuminemia	Survived Subjects with Severe Hypoalbuminemia
Degree of burn injury	2nd – 3rd degree	2nd – 3rd degree
Total body surface area	25%; 45%	14.5%; 21.5%
Body area exposed by burning	Not the area requiring special attention	Not the area requiring special attention
The severity of burn injury	Severe	Severe
The onset of burn injury	5 hours; 5 hours	168 hours; 47 hours

Table 3 The mortality risk of subjects based on serum albumin level

Variables			Outcome at the end of hospitalization: Dead (n = 9)	Outcome at the end of hospitalization: Survived (n = 38)	Total	P	OR (95%CI)
Serum albumin level	<2.0 g/dL	N	4 (8.5%)	2 (4.3%)	6 (12.8%)	0.009	14.400
	2.0–5.0g/dL	N	5 (10.6%)	36 (76.6%)	41 (87.2%)		(2.073–100.012)

Description: p-value based on the Fisher's Exact test where statistically significant if less than 0.05; OR: Odds Ratio; CI: Confidence Interval.

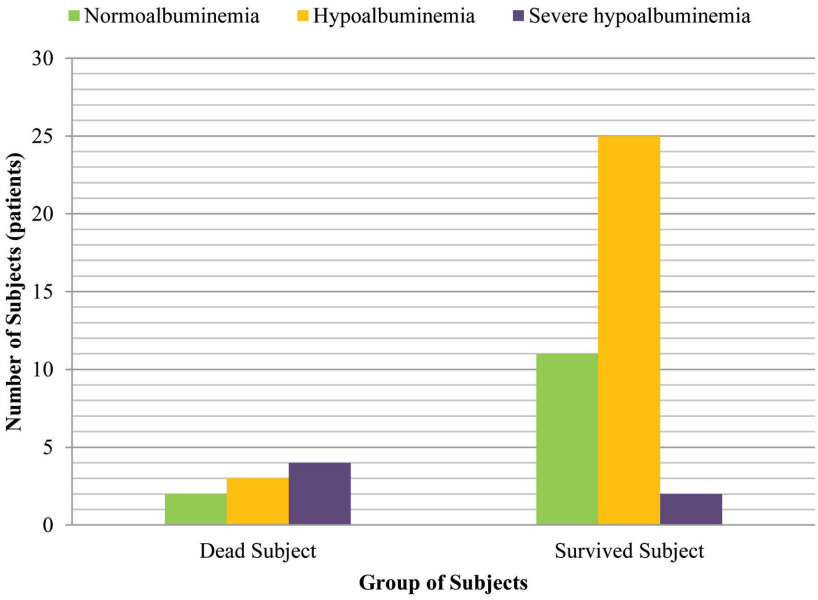

Figure 1 Serum Albumin Level within the First 24 Hours of Hospitalization

2 subjects who had severe hypoalbuminemia in the survived subject group. The characteristic of the dead and survived subjects can be seen further in Table 2 below.

To assess serum albumin level within the first 24 hours of hospitalization as mortality risk in burn patients, OR calculations were carried out between subjects who died and survived. The result of the OR calculation can be seen in Table 3 below. The result suggested that the subjects with severe hypoalbuminemia within the first 24 hours of hospitalization had higher significant mortality risk until 14 times compared to the subjects with hypoalbuminemia (OR: 14.4; 95% CI: 2.073-100.012; P: 009)

DISCUSSION

The subjects of this study were mostly men, with the ratio between men and women of 4.8:1. This study obtained a similar result with the previous study from Wardhana et al. in Cipto Mangunkusumo General Hospital, Jakarta, Indonesia, towards 304 burn patients, consisted of 67% men and 33% women. Another study by Li et al. towards 6,235 burn patients in China also obtained the ratio of 2:1 between men and women. Men are more prone to have burn injury rather than women because they are more active.[2,10,11]

The result of this study showed that the prominent cause of burn injury was fire. This result was similar with the study from Wardhana et al. The origin of burn injury in this study were mostly fired that deriving from the explosion of liquefied petroleum gas (LPG), it happened to 29 subjects from 31 subjects (93.55%). Liquefied petroleum gas is a fuel that is commonly used in households and industries in Indonesia today. The fire caused by the LPG was due to the lack of knowledge from the society on the use of LPG and the use of improper equipment related to it, such as tube, regulator, and hose under adequate standard.[12]

All of the dead subjects were suffering from severe burn injury in 2nd–3rd degree with total body surface area (TBSA) of burn injury >25%. Most of the survived subjects were also suffering from severe burn injury in 2nd–3rd degree, however with TBSA <25%. Burn injury severity is determined based on the depth of burn, the burned surface area, and the involved body area. The depth of burn injury is distinguished based on the affected skin

layer. It can be separated into the first degree, where the epidermis layer is still intact, only erythema; the second degree, where the integrity of the epidermis layer is damaged, and the injury is limited to the upper layer of the dermis; the third degree, which affects all layers of the dermis; and the fourth degree, which affects the skin and tissue below. The burned surface area can be measured using the 'rule of nines' and stated in percentage (%). Several areas of the body require special attention to burn injuries, such as the eyes, ears, face, hands, feet, and genitalia.[13,14]

Burn injury cause injury to the skin, which damages blood vessels and releases inflammatory mediators. Both, causing increase of vascular permeability, which triggers plasma and protein in the blood to leak out of the intravascular compartment into the interstitial compartment, and causes a decrease of blood protein particularly albumin. Hypoalbuminemia causes extravasation of plasma and protein into the interstitial compartment, further causing intravascular hypovolemia, systemic hypotension, organ hypoperfusion, and death. Hypoalbuminemia also decreases the ability of drug binding so that inflammation continues and increases the mortality risk in burn patients.[15,16]

Several studies have discussed the serum albumin level in burn patients. A study from Aguayo-Beccera O et al. showed that burn patients with serum albumin level <2 g/dL within the 24 hours after the onset of burn had a mortality risk of >80% with the sensitivity of 84% and specificity of 83%. A study from Kim G.H. et al. (2003) showed that burn patients with serum albumin level <2.5 g/dL had a greater mortality risk of 2.7 times compared to burn patients with serum albumin level >2.5 g/dL. While a study from Eljaiek and Dubois in 2013 showed that burn patients with serum albumin level <3 g/dL within the first 24 hours of admission was associated with a two-fold increase in organ dysfunction.[4-6]

The study showed that most of the dead subjects suffered from severe hypoalbuminemia and most of the survived subjects suffered from hypoalbuminemia. Nonetheless, some subjects were dead regardless that they had normoalbuminemia, while some other subjects with severe hypoalbuminemia were survived instead. The result showed that there was another factor besides the serum albumin level that increases the mortality risk of the subjects.

Our findings suggested that the dead subjects with normoalbuminemia were suffering from burn injury with the TBSA 25% and 45% (>25%) while the survived subject with severe hypoalbuminemia was suffering from burn injury with the TBSA of 14.5% and 21.5% (<25%). The result showed the possibility of the TBSA >25% took the role in increasing the mortality risk of subjects. The study from Banshali et al. (2017) showed that the larger of TBSA, then the greater the mortality risk would become. The study reported mortality rate of the burn patients with various TBSA were 37%, 66%, 97% and 99.8% for TBSA <30%, 30-52%, 52-81%, and >81% respectively.[8]

There were 21 burn patients with the TBSA >25% in this study, consisted of 8 dead subjects and 13 survived subjects. All subjects with the TBSA >25% and suffering from severe hypoalbuminemia were dead. Most of the burn patients with the TBSA >25% with hypoalbuminemia were survived. The results showed that serum albumin level and TBSA of burn injury hold the important roles in increasing the mortality risk in burn patients.

Immediately after the burn injury, the metabolism will decrease, called the ebb phase. The ebb phase happens in a short time, but it can stays for as long as 24 hours or 48 hours after the burn injury. Afterward, the metabolism will gradually increase, called the flow phase. In the flow phase, there is a decrease in protein synthesis and lipogenesis and an increase in protein catabolism. The flow phase will stay until the plateau phase is reached, which is about 120 hours (5 days) after the onset of burn injury. After entering the plateau phase, the critical period of the burn injury shall be ended.[8,9,17]

There were two subjects who normoalbuminemia and dead in this study. They were examined for serum albumin level within 5 hours after the burn onset so that the condition of normoalbuminemia might be due to patients still in the ebb phase when analyzed for serum albumin level. However, the result of serum albumin level examination after 48 hours of burn onset in both subjects showed severe hypoalbuminemia, which was 1.4 g/dL and 1.5 g/dL respectively.

The analysis of serum albumin level within the first 24 hours of hospitalization against the burn onset, showed that subjects with normoalbuminemia were examined for serum albumin level <6 hours, >6–12 hours, >18–24 hours, and >48 hours after burn onset as much as 69%, 8%, 8%, and 15% respectively. Subjects with hypoalbuminemia were examined for serum albumin level <6 hours, >6–12 hours, >12–18 hours, >18–24 hours, >24–48 hours and >48 hours after burn onset as much as 11%, 11%, 3%, 7%, 36%, and 32% respectively. Meanwhile, subjects with severe hypoalbuminemia were examined for serum albumin level >12–18 hours, >18–24 hours, >24–48 hours and >48 hours after burn onset as much as 17%, 17%, 33%, and 33% respectively.

The analysis of mortality risk based on serum albumin level between subjects with severe hypoalbuminemia and hypoalbuminemia as can be seen in Table 3.3, showed that the p-value was 0.009 (<0.05) which means, there was a significant difference of mortality risk between patients with severe hypoalbuminemia and hypoalbuminemia. The odds ratio (OR) as much as 14.4 showed that the subjects with severe hypoalbuminemia within the first 24 hours of hospitalization had higher mortality risk until 14 times compared to the subjects with hypoalbuminemia. The limitation of this study was that serum albumin level of patients before the incidence of burn injury were unknown, and there was limited amount of subjects.

CONCLUSION

The result of this study indicates that burn patients who suffer from severe hypoalbuminemia within 24 hours of hospitalization have a mortality risk 14 times higher than burn patients who do not suffer from severe hypoalbuminemia. Another risk factor that might play a role in increasing the mortality risk in burn patients is the total body surface area (TBSA) of burn injury.

Based on the result of this study, we suggest that burn patients need to be examined for serum albumin level within the first 24 hours of hospitalization, in order to estimate their mortality risk. The examination of serum albumin level in burn patients should pay attention to the onset of burn injury. Further study is needed in order to determine the mortality risk in burn patients based on serum albumin level, TBSA of burn injury, and the presence or absence of infection.

CONFLICTS OF INTEREST

The authors did not have conflicts of interest with any party.

ETHICAL CLEARANCE

This study obtained ethical approval from the Research Ethics Committee of the Dr. Hasan Sadikin General Hospital Bandung (Number LB.04.01/A05/EC/102/IV/2018).

FUNDING

The authors are responsible for the study funding without the involvement of grant, scholarship, or any other resource of funding.

AUTHORS CONTRIBUTIONS

Ummi Muthiah was the first author in this study. Tiene Rostini and Nina Tristina were the advisers as well as second authors in this study.

ACKNOWLEDGMENTS

This study used the funding entirely borne by the first author. The authors would like to thank the Head of Department of Clinical Pathology, Faculty of Medicine, Padjadjaran University; the Head of Clinical Pathology Installation of Dr. Hasan Sadikin General Hospital Bandung, and the Head of the Specialist Medical Education Study Program of Department Clinical Pathology, Faculty of Medicine, Padjadjaran University, who have been supporting in this study.

REFERENCES

1. World Health Organization (WHO). World Health Organization Burns. 2018. [Accessed 24 December 2018]. Available on http://www.who.int/en/news-room/fact-sheets/detail/burns
2. Wardhana A, Basuki A, Prameswara ADH, Rizkita DN, Andarie AA, Canintika AF. The epidemiology of burn in Indonesia's National refferal burn center from 2013 to 2015. Burns Open. 2017; 1:67-73.
3. Indonesian Ministry of Health. Report of National Basic Health Research (RISKESDAS) 2013. Jakarta: 2014.
4. Aguayo-Becerra OA, Torres-Garibay C, Macias-AmezcuaMD, Fuentes-Orozco C, Chaves-Tostado MdG, Andalon-Duenas E, et al. Serum albumin level as a risk factor for mortality in burn patients. Clinics. 2013; 68(7):940-5.
5. Kim GH, Oh KH, Yoon JW, Koo JR, Kim HJ, Chae DW et al. Impact of burn size and initial serum albumin level on acute renal failure occuring in major burn. Am J Nephrol. 2003; 23(1):55-60.
6. Eljajek R, Dubois M. Hypoalbuminemia in the first 24h of admission is associated with organ dysfunction in burned patients. Burns. 2013; 39(1):113-8.
7. Deepthi S, Narayan GAR. Evaluation of serum albumin levels and its relation to burn size in burn patients. World Journal of Pharmacy and Pharmaceuttical Sciences. 2015;4(8):1461-5.
8. Bhansali CA, Gandhi G, Sahastrabudhe P, Panse N. Epidemiological study of burn injuries and its mortality risk factors in a tertiary care hospital. Indian J Burns. 2017;25:62-6.
9. Jeschke MG, Gauglitz GG, Kulp GA, Finnerty CC, Williams FN, Kraft R et al. Long-term persistance of the pathophysiologic response to severe burn injury. PLoS ONE. 2011;6(7):e21245.
10. Karlie J, Wardhana A. External validation of belgian outcome of burn injury score on burned patient in burn unit Cipto Mangunkusumo general hospital. New Ropanasuri J Surg. 2017;2(1):e90.
11. Li H, Yao Z, Tan J, Zhou J, Li Y, Wu Y et al. Epidemiology and outcome analysis of 6325 burn patients: a five-year retrospective study in a major burn center in southwest china. Sci Rep. 2017; 7:46066.
12. Burhan AS, Muljono, Syamsuddin E. Alat Pencegahan Kebakaran yang Disebabkan Kebocoran Liquefied Petroleum Gas (LPG). TESLA. 2013; 15(2):153-64.

13. Yasti AC, Senel E, Saydam M, Ozok G, Coruh A, Yorganci K. Guideline and treatment algorithm for burn injuries. Ulus Travma Acil Cerrahi Derg. 2015; 21(2):79-89
14. Iftimia N, Ferguson RD, Mujat M, Patel AH, Zhang EZ, Fox W et al. Combined reflectance confocal microscopy/optical coherence tomography imaging for skin burn assessment. Biomedical Opt Express. 2013; 4(5):680-95
15. Udy AA, Roberts JA, Lipman J, Blot S. The effects of major burn related pathophysiological changes on the pharmacokinetics and pharmacodynamics of drug use: An appraisal utilizing antibiotics. Adv Drug Deliv Rev. 2018; 123:65-74
16. Lopez ON, Cambiaso-Daniel J, Branski LK, Norbury WB, Herndon DN. Predicting and managing sepsis in burn patients: current perspectives. Ther Clin Risk Manag. 2017; 13:1107-1117
17. Clark A, Imran J, Madni T, Wolf SE. Nutrition and metabolism in burn patients. Burns Trauma. 2017; 5(11):1-12.