

Evaluation of ABSI Score for the Prognosis and Length of Hospitalization of Burn Patients

Nihan Turhan^{1*}, Abdulkadir Ciğer²

¹Martyr Prof. Dr. İlhan Varank Sancaktepe Training and Research Hospital, İstanbul, Turkey

²Kabramanmaraş Necip Fazıl City Hospital, Kabramanmaraş, Turkey

ABSTRACT

The Abbreviated Burn Severity Index (ABSI) score is a scoring system that has been used for many years to determine the mortality risk of burn patients. Today, with modern burn treatment, a decrease in burn-related mortality rates has been observed in the last two decades, and the ABSI scoring system gives a mortality risk higher than expected. The aim of our study is to investigate the usability of the ABSI score in predicting the prognosis and length of hospital stay of the patients. In our study, the data of burn patients who were hospitalized and treated in our burn units between January 2018 and December 2020 were evaluated retrospectively by examining the file data. The effects of burn agent and the factors that make up the ABSI score on the prognosis and length of hospital stay of the patients were investigated.

In our study, 331 burn patients were evaluated. It was found that the percentage of total burn surface area, presence of full-thickness burn and inhalation injury, among the variables constituting the ABSI score, were significantly higher in the burn non survivor group ($p<0.001$). Mortality risk of the patients were increased with the increase in the ABSI score ($p<0.001$).

When the effects of the ABSI score on the length of hospital stay were evaluated, it was found that the higher the ABSI score, the longer the hospitalization duration ($p<0.001$).

The hospitalization duration of the patients with flame and electrical burns were significantly longer than other kinds of burns ($p<0.001$).

We think that a new scoring system that includes the percentage of burn area, presence of full-thickness burn, inhalation damage, which are components of the ABSI score and patient groups with difficult burn recovery as well as the burn agent, will be more effective in determining mortality, prognosis and hospital stay of burn patients.

Keywords: ABSI score, burns, mortality, prognosis, hospitalization

Introduction

Burn is a trauma that can be encountered by people of all ages throughout their lives, and its treatment is quite costly (1). As a result of current developments in burn treatment, attention has been focused on ensuring patients' survival as well as providing patients' functions and minimizing health expenditures. It has been reported that, when the hospitalization duration of burn patients increases, financial costs, infection rate, morbidities, functional and aesthetic problems increase. Therefore, early discharge is very important for the treatment of burn patients (2). Reducing the length of hospital stay is considered among the indicators that show the quality of treatment (3).

It has been suggested that scales showing burn severity and mortality risk of burn patients, can be used to estimate the hospitalization day (4).

ABSI score, which has been used to predict mortality risks of burn patients worldwide for years. The effects of the ABSI score of the burn patients on the prognosis and length of hospital stay were evaluated in this study.

Materials and Methods

The data of the patients who were hospitalized in our burn units between January 2018 and December 2020 were evaluated retrospectively. Patients were evaluated according to age, gender, burn etiology, ABSI score, survival-death status and hospitalization duration. ABSI scores were calculated on the day of hospitalization by an experienced burn surgeon. ABSI score is calculated according to five variables: gender, age, TBSA, presence of full-thickness burn, and inhalation injury. According to this, patients get 1 point for female gender, increase by one point for each 20 years of age, up to 5 points, increase by

*Corresponding Author: Nihan Turhan, Department of General Surgery, Martyr Prof. Dr. İlhan Varank Sancaktepe Training and Research Hospital, İstanbul, Turkey

E-mail: drnihanturhan@yahoo.com, Phone: +90 216 606 33 00

ORCID ID: Nihan Turhan: 0000-0002-8672-3853, Abdulkadir Ciğer: 0000-0003-3235-4244

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Table 1: Abbreviated Burn Severity Index (ABSI)

Variable	Patient Characteristics	Score
Sex	Female	1
	Male	0
Age	0-20	1
	21-40	2
	41-60	3
	61-80	4
	81-100	5
Inhalation injury	No	0
	Yes	1
Full thickness burn	No	0
	Yes	1
TBSA (%)	1-10	1
	11-20	2
	21-30	3
	31-40	4
	41-50	5
	51-60	6
	61-70	7
	71-80	8
	81-90	9
	91-100	10
Total Burn Score	Threat to life	Probability of survival
2-3	Very low	99%
4-5	Moderate	98%
6-7	Moderately severe	90%
8-9	Serious	70%

Table 2: Patient characteristics and survival status

	Survivor	Non-survivor	All patients	p value
Number (n/%)	319 96.37%	12 3.62%	331	
Age (mean±SD)	25.33±22.81	37.33±33.51	25.77±23.32	0.080
Gender (F/M) (n, %)	144/175 45.1%/54.9%	3/9 25.0%/75.0%	147/184 44.4%/55.6%	0.139
Burn percentage (mean±SD)	7.29±7.04	23.00±14.02	7.86±7.93	<0.001
Full thickness burn (n, %)	45 14.1%	10 83.3%	55 16.6%	<0.001
Inhalation injury (n, %)	18 5.6%	3 25.0%	21 6.3%	0.033
ABSI score (mean±SD)	3.79±1.57	6.58±2.27	3.89±1.68	<0.001

n: Number, SD: Standard Deviation

one point for each 10% TBSA, and get a maximum of 10 points, 1 point for full-thickness burns, and one point for inhalation injury. According to the results obtained, the patients are

divided into 6 categories and the mortality risk is determined as a percentage (Table 1).

Statistical Analysis of Data: Normality control of the study was done with Kolmogorov-Smirnov test. Data were given as mean, standard deviation,

Table 3: Relationship Between Absi Score and Length of Hospital Stay

ABSI Score	Comparison Group	Length of Hospitalization	SD	p value
ABSI 2-3		5,036	3,9100	
	ABSI 4-5	8,459	6,0301	0,001
	ABSI 6-7	13,674	12,8688	0,000
	ABSI 8-9	25,400	20,0011	0,000
	ABSI 10-11	6,000	1,4142	1,000
ABSI 4-5		8,459	6,0301	
	ABSI 6-7	13,674	12,8688	0,001
	ABSI 8-9	25,400	20,0011	0,000
	ABSI 10-11	6,000	1,4142	,989
ABSI 6-7		13,674	12,8688	
	ABSI 8-9	25,400	20,0011	0,000
	ABSI 10-11	6,000	1,4142	0,584
ABSI 8-9		25,400	20,0011	
	ABSI 10-11	6,000	1,4142	0,005

*A significant difference p was found below or equal to 0.001 in all subgroup paired comparisons in the post-hoc analysis with anticipated exception of ABSI 10-11 subgroup due to low number of patient in this subgroup (n = 2). SD: standard deviation

Table 4: The Relationship Between Burn Agent and Length of Hospital Stay

Burn Agent		Length of hospitalization (Mean days)	SD	p value
Scald		6,504	6,1210	
	Flame	14,240	12,2467	,000
	Contact	6,591	8,5337	1,000
	Electrical	13,615	13,6903	,013
	Chemical	5,556	4,0761	,988
Flame		14,240	12,2467	
	Contact	6,591	8,5337	,001
	Electrical	13,615	13,6903	,999
	Chemical	5,556	4,0761	,001
Contact		6,591	8,5337	
	Electrical	13,615	13,6903	,079
	Chemical	5,556	4,0761	,994
Electrical		13,615	13,6903	
	Chemical	5,556	4,0761	,039

*Statistically significant difference was found in the comparison of scald-flame, scald-electrical, flame-contact, flame-chemical, electrical-chemical paired comparisons in subgroup analysis SD: standard deviation

frequency and percentage. Normally distributed variables between the two groups were analyzed by Student's t-test for independent groups and by ANOVA test for comparisons with more than two subgroups. Post-hoc analysis was done with the Tukey test. Nominal variables were evaluated with Chi square test and Fisher's exact probability tests. The limit of significance was taken as $p < 0.05$ and bidirectional. Analyzes were performed using SPSS (IBM, Chicago, Illinois, USA) software.

Ethics Committee Approval: Martyr Prof. Dr. İlhan Varank Sancaktepe Training and Research Hospital Clinical Research Ethics Committee granted approval for this study (date: 23.06.2021, number: 2021/169).

Results

A total of 340 burn patients were treated by hospitalization in our burn units during the

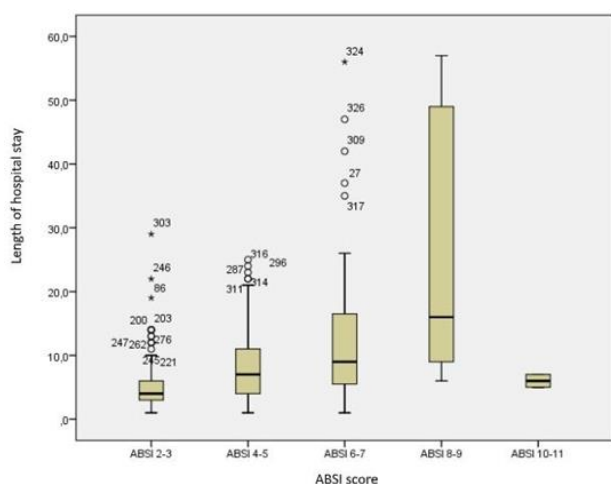


Fig. 1. Relationship Between ABSI Score and Length of Hospitalization Days

specified time period. Nine patients, who died during the first resuscitation phase were excluded from the study, and a total of 331 patients were included in the study.

Of the patients, 147 were female and 184 were male. The age distribution of the patients ranged from 0 to 91. The number of pediatric patients (<18 years) was 146 (44.10%), and the number of elderly patients (>65 years) was 28 (21.37%).

The number of patients with a mortal course was 12. When these patients were compared with the survivors, there was no statistically significant difference between the mean age ($p=0.080$) and gender distributions ($p=0.139$). TBSA (23.00%) of the patients who died was found to be significantly higher than (7.29%) the patients who survived ($p<0.01$). The number of patients with full-thickness burns in the non-survivor group ($n=10$, 83.3%) was significantly higher than the number of patients in the survivor group ($n=45$, 14.1%) ($p<0.001$). Inhalation injury was more common in the non-survivor group ($n=3$, 25%) than in the survivor group ($n=18$, 5.6%) ($p=0.033$). When the ABSI score was evaluated, the mean ABSI value was 6.58 in the non-survivor group and 3.79 in the survivor patient group, significantly higher in the non-survivor patient group ($p<0.001$) (Table 2).

There were 167 patients with ABSI score of 2-3, 109 patients with 4-5, 43 patients with 6-7, 10 patients with 8-9 and 2 patients with 10-11. Nine patients with an ABSI score of 12-13 were not included in the study because they died during the first resuscitation phase. Two patients with an ABSI score of 10-11 died during the treatment, the mean length of hospital stay was found to be 6.00 days for those patients.

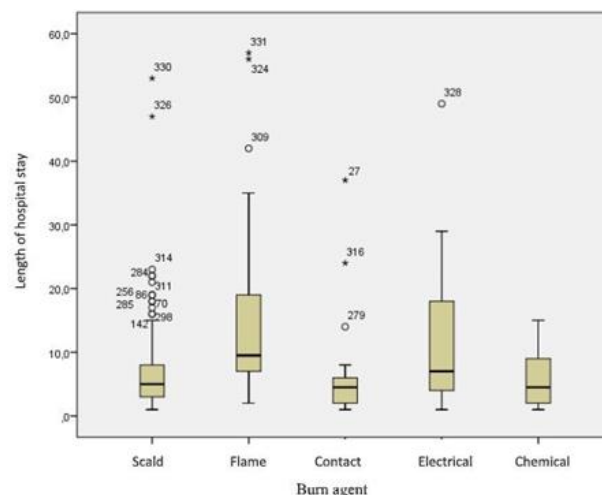


Fig. 2. The Relationship Between Burn Agent and Length of Hospitalization Days

When the relationship between ABSI scores and length of hospital stay was evaluated, the shortest mean hospitalization was seen in the group with an ABSI score of 2-3 with 5.04 days. The longest hospitalization was seen in the group with an ABSI score of 8-9 with 25.40 days ($p<0.001$). A statistically significant difference was found between ABSI score and length of hospitalization day in all subgroup comparisons ($p<0.001$; Table 3, Figure 1).

When the distribution of the patients according to the burn etiology was examined, it was seen that the most common cause of burns was scald ($n=228$, 68.88%).

When the relationship between hospitalization day and burn agent was evaluated, it was calculated that the mean hospitalization period of 50 patients with flame burns was 14.24 days and 13.62 days for 13 patients with electrical burns. The mean hospital stay was found to be significantly higher in patients with flame and electrical burns ($p<0.001$; Table 4, Figure 2).

Discussion

Burns are one of the most common causes of injury and accident related death. In recent years, especially in developed countries, due to raising awareness about prevention of burns and early surgical debridement and grafting, a decrease in burn mortality rates has been observed (5). However, burns continue to be a very important health problem for the whole world, especially for underdeveloped and developing countries, due to high cost treatments and morbidities in patients (1, 6-8).

It has been shown in the study conducted by Kishawi et al. that, the prolongation of the hospitalization day and increase in total burn area have negative effect on the patient's quality of life (9). Reducing the length of hospital stay in burn patients is an accepted view for both effective use of financial resources and reduction of possible morbidities (3, 10).

The idea of using the parameters used to determine the risk of mortality in burn patients to predict the patient's quality of life and length of hospital stay has led to new studies.

There are many evaluation scales defined to determine the prognosis and mortality risks of burn patients. Although some scoring systems have high accuracy, they are not clinically useful because they are difficult to calculate (11). The Abbreviated Burn Severity Index (ABSI) scoring, defined in 1982, is an easy-to-calculate assessment method used to estimate the severity of the burn and the patient's life expectancy (12). ABSI scoring is based on gender, age, presence of full-thickness burn, inhalation damage and total body surface area burned (TBSA). The mortality risk of burn patients is stated according to the total score obtained (Table 1). The ABSI score is widely used around the world to estimate the risk of burn mortality and the need for intensive care. However, there are also studies showing that the ABSI score has some shortcomings (13).

Bartels et al., in their study on 14,984 patients, reported that the ABSI score was insufficient to determine the mortality risk of pediatric, pregnant and elderly patients. They suggested that these patients should be specified as the risky patient group. On the other hand, they stated that gender, one of the ABSI criteria, had no effect on the mortality risk (14). Similarly, El Soud et al. evaluated the data of 1233 patients retrospectively, 420 of them were pediatric patients. They suggested that mortality risk is higher especially in pediatric patients under the age of 10 and pregnant patients, and it would be more appropriate to rearrange the ABSI score criteria for these patients (15). According to N.N. Sheppard et al. the main variables affecting the prognosis among the parameters of the ABSI score are age, TBSA and inhalation injury (11).

In our study, a significant increase was found between the increase in the ABSI score and the increase in the mortality rate. However, when the parameters of the ABSI score were evaluated one by one, age and gender were not associated with mortality risk. TBSA, inhalation injury and

presence of full-thickness burn were shown to be determinants of increased mortality risk.

In a study conducted by Berntson et al. on 83 pediatric burn patients to evaluate the effects of the ABSI score on the length of hospital stay, it was shown that the ABSI score was associated with the length of hospital stay and the duration of being connected to the ventilator. They stated that the ABSI score could be used in the planning of intensive care unit use (16).

Similarly, Gravante et al. investigated the relationship between Roi index, Baux score, UBS (Unit Burn Standard) and ABSI score and length of hospital stay in a study on 233 patients. Similar to ABSI score, age, gender, TBSA and presence of full-thickness burn are evaluated in the Roi index. As a result, it was shown in the study that ABSI score and Roi index were strongly associated with length of hospital stay (4).

In the study of Andel et al. and in the review by Hussain et al., it has been shown that TBSA and age, are associated with the length of hospitalization (17, 18). Krob et al. emphasized that duration of hospitalization and morbidities increased in the elderly patients due to the difficulty of wound healing (19).

In our study, relationship between the duration of hospitalization and ABSI scores of burned patients were evaluated. It was observed that the hospitalization duration was significantly higher in the groups with high ABSI scores.

Another factor that is effective in prolonging burn treatment is the etiology of the burn injury. Başaran et al. reported that the treatment of electrical burns was difficult. TBSA and ABSI scores were insufficient in determining the prognosis in patients with electrical burns. (20). Li et al. reported that there was an increase in the number of operations in burn patients due to high-voltage electric current, and that these burns were a major risk factor for prolonging hospitalization (21).

In our study, the mean hospitalization days in flame and electrical burns compared to other burn causes were significantly higher in the subgroup analysis.

The low number of patients with high ABSI scores is among the limiting factors of our study. Larger studies are needed in which pediatric, pregnant and elderly burn patients are evaluated in more detail. It would be more appropriate to conduct multicenter studies with a large number of patients. Burn percentages calculated during the initial assessment of electrical burns may not

reflect the actual TBSA. Therefore, the ABSI score calculated in these patients will be lower than expected. This possible margin of error in the ABSI score may have an impact on the results of our study. This is another limitation of our study.

As a result, we think that ABSI score is not enough for prediction of prognosis and hospitalization duration of burn patients. It is necessary to create a modified ABSI score, in which burn etiology and risky patient groups are evaluated.

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