ORIGINAL ARTICLE

Elderly burns: Clinical frailty scale and functional ambulation classification in predicting prognosis

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ABSTRACT

BACKGROUND: The study was to investigate the role of mobility and frailty in predicting the prognosis of elderly burns along with the burn severity.

METHODS: In this retrospective study, 67 patients aged 65 and over who were hospitalized between October 1, 2017, and September 30, 2020 in our burn center are included in the study. The demographic data, etiological data, clinical variables, the percentage of burned total body surface area (TBSA), Abbreviated Burn Severity Index (ABSI), Functional ambulation classification (FAC) scores, and Clinical frailty scale (CFS) scores are evaluated.

RESULTS: Mean age of the study population was 71.58±7.4 years and most of the patients were female (65.7%). The percentage of TBSA was 11.34±12.2. The flame burns were the most common etiology (87.5%) of deaths (n=8), whereas 52.5% of the survivors were scalds. Most of the survived patients were functional ambulatory (93.2%). On the other hand, only 25% of patients who died were functional ambulatory (p<0.001). Also, 83% of the survivors were normal according to CFS scoring, whereas 25% of the patients who did not survive were vulnerable and 75% was frail (p<0.001).

CONCLUSION: The percentage of elderly burns is low, yet the mortality is high in these patients which emphasize the importance of elderly burns. The ABSI is of great help, but ambulation status and comorbid diseases should be taken into consideration in terms of elderly burns. The current study demonstrated that FAC and CFS will be helpful to better predict the outcomes of elderly burn patients along with ABSI.

Keywords: Ambulation; burns; elderly; frailty; prognosis.

INTRODUCTION

The global population aged 60 years and over is more than 1 billion people which represents 13.5% of the world's population in 2020. More than two-thirds of this population lives in high- and middle-income countries. In about 30 years, 1 in 5 people will be 60 years of age or older.[1] An increase in life expectancy might result in increased morbidity and mortality caused by age-related pathophysiological changes such as impaired neurological and motor functions.[2] Burns are among the most devastating forms of trauma worldwide. Although the elderly burns are uncommon in the developing world, they represent about 20% of burns in economically developed countries such as the USA.[3]

The Abbreviated Burn Severity Index (ABSI) is a widely used and simple score to predict mortality after burn injuries. Significant improvements in intensive care management and surgical treatment resulted with an increased survival rate since the creation of ABSI in 1982. On the other hand, the aging population may lead to an increased injury-related mortality rate.[4] Frailty is a geriatric syndrome characterized by the reduction of physiological functions and strength, resulting with increased vulnerability and risk of higher dependency and death.[5,6] The ABSI uses age as a variable, but other factors such as mobility and frailty are not encountered. Therefore, the use of functional ambulation classification (FAC) and clinical frailty scale (CFS) along with the ABSI may be helpful in better predicting the outcomes of elderly burns.

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The study aims to investigate the role of mobility and frailty by the use of relevant scales in predicting the prognosis of elderly burns along with ABSI.

MATERIALS AND METHODS

This study was conducted between October 1, 2017, and September 30, 2020 in our tertiary burn center. A total of 67 patients aged 65 and over who were hospitalized are included in the study. The demographic data, etiological data, and clinical variables such as percentage of burned total body surface area (TBSA), ABSI, hospital stay, infection, and mortality rate as well as FAC scores and CFS scores are evaluated retrospectively from patient files and the hospital registries.

The ABSI is a five-variable scale consisting gender, age, presence of inhalation injury, presence of full-thickness burn, and percentage of TBSA. ABSI assesses burn severity and demonstrates predictive power for classifying patients according to their risk. The age of the patients is divided into groups each representing 20 years. The sum of the scores for each variable gives total burn score which indicates threat to life from very low to maximum and probability of survival.[7] CFS was developed to measure frailty with its nine point measure from "very fit" to "terminally ill."[6] CFS mixes items such as comorbidity, cognitive impairment, and disability with physical frailty. According to CFS, the patients who scored 1-3 were classified as "normal," the patients who scored 4 as "vulnerable" and the patients who scored ≥5 as "frail."[5] The FAC evaluates ambulation in six categories ranging from 0 to 5, where 0 refers to the inability of walking or requirement of at least two assistants for walking and five represents independent walking anywhere. Although the FAC is originally developed for evaluating the ambulation of neurologically impaired patients, it is widely used for other conditions including burn patients.[8,9]

This study was approved by the Local Clinical Research Ethical Committee of our institute (Decision no: 1116/2020).

Statistical Analysis

Statistical Package for the Social Sciences 22.0 for Windows was used for the analysis of the data. Chi-square test or Mann–Whitney U-test were used to compare the groups. Possible alternative cut-off points for the TBSA, ABSI, and FAC were evaluated using area under ROC curve (AUC) statistics. AUC was found over 0.70 for all parameters. The correlation between continuous variables was analyzed by Spearman correlation test. Logistic regression model was used to estimate the Odds ratios (OR) and 95% confidence interval (CI). The prognostic ability of parameters was evaluated for severe outcome (death or major amputation) in both univariate and multivariable regression models. The values of $p<0.05$ were considered as statistically significant.

RESULTS

A total of 67 elderly patients were hospitalized in the study period. The number of admissions within all ages was 1478 during the same period. Among elderly patients, 57 of them who healed without any sequela or with minor sequela (keloid or contracture) were referred to as Group 1, whereas the remaining ten patients who died (n=8) or had major amputation (n=2) were referred to as Group 2.

Most of the patients in the study population were female (F/M=44/23, 65.7%), but the ratio of male patients was higher in Group 2 (60%). The mean age of the study population was 71.58±7.4 years. The TBSA was 11.34±12.2 and the length of hospital stay was found to be 19.66±18.6 days. With regard to the etiology, scalds (46.4%) and flame burns (38.8%) were most common in our study population. Among the study population, 33 (49.3%) patients were recovered without any sequela, 24 (35.8%) had minor sequela (13 had keloid and 11 had contractures), and 10 (14.9%) patients has severe outcome (eight were died and two had major amputation).

Table 1 includes clinical data, demographic data, and ABSI and FAC scores. Their relationship with the prognosis is also presented. Age and burn degree were found to be associated with prognosis, but gender and comorbidity had no relationship. In total mean±SD and median values for TBSA, ABSI, FAC, and CFS were 11.7±12.1 (8.0), 6.7±1.8 (6.0), 3.9±1.3 (4.0), and 3.0±1.9 (3.0), respectively. The mean values of TBSA, ABSI, FAC, and CFS between two groups were found to be significantly different ($p<0.001$) (Table 1).

A total of 26 (38.8%) patients did not have any comorbid diseases and all of them were from Group 1. Hypertension and diabetes mellitus were the most common comorbid diseases among our patients. In Group 1, 15.25% of patients (n=9) had multiple comorbid diseases, whereas in Group 2, 62.5% of patients (n=5) had multiple comorbidities.

According to correlation analyses, there was a moderate positive correlation between TBSA and ABSI ($r=0.59$, $p=0.001$), no correlation between TBSA and FAC ($r=-0.08$, $p=0.502$), and a weak correlation between TBSA and CFS ($r=0.29$, $p=0.016$). There was a weak negative correlation between ABSI and FAC ($r=-0.25$, $p=0.041$) and a moderate correlation between ABSI and CFS ($r=0.425$, $p<0.001$). There was an excellent negative correlation between FAC and CFS ($r=-0.82$, $p<0.001$). The correlation coefficients between parameters are summarized in Table 2.

Possible alternative cut-off points for the FAC, CFS, TBSA, and ABSI were evaluated using AUC statistics. For FAC and CFS, 3.5 was detected as cut-off point based on receiver operating characteristic (ROC) analysis. For TBSA and ABSI, it was 10.5 and 6.5, respectively. The cut-off values detected by ROC analyses were used for further statistical analyses.

Table 1. Demographic and clinical characteristics of the patients according to groups based on prognosis

	Group 1		Group 2		Total		p
	n	%	n	%	n	%	
Gender							
Male	17	73.9	6	26.1	23	34.3	
Female	40	90.9	4	9.1	44	65.7	0.064
Age group							
65–74	42	91.3	4	8.7	46	68.7	
75+	15	71.4	6	28.6	21	31.3	0.034
Comorbidity							
No	24	92.3	2	7.7	26	38.8	
Yes	33	80.5	8	19.5	41	61.2	0.186
Burn degree							
Second	43	97.7	1	2.3	44	65.7	
Third	14	60.9	9	39.1	23	34.3	0.0001
Etiology							
Scalds	30	96.8	1	3.2	31	46.3	
Flame	19	73.1	7	26.9	26	38.8	
Chemical	1	100.0	0	0	1	1.5	
Electricity	3	75.0	1	25.0	4	6.0	
Contact	4	80.0	1	20.0	5	7.5	–
	Mean±SD / Median (min-max)		Mean±SD Median (min-max)		Mean±SD Median (min-max)		p
Age	70.3±5.9 / 68 (65–84)		78.9±10.7 / 82 (65–91)		71.6±7.4 / 69 (65–91)		0.0001
ICU stay	2.6±11.4 / 0 (0–66)		21.1±20.8 / 16 (0–62)		5.4±14.6 / 0 (0–66)		0.0001
Total stay	18.1±15.7 / 14 (2–84)		25.4±20.3 / 24 (3–62)		19.2±16.5 / 14 (2–84)		0.337
TBSA	8.7±6.4 / 7 (1–40)		28.8±21.0 / 25 (6–64)		11.7±12.1 / 8 (1–64)		0.0001
ABSI	6.3±1.1 / 6 (5–10)		9.1±2.9 / 9 (5–14)		6.7±1.8 / 6 (5–14)		0.0001
FAC	4.2±1.0 / 4 (0–5)		2.3±1.6 / 3 (0–4)		3.9±1.3 / 4 (0–5)		0.0001
CFS	2.5±1.3 / 2 (1–7)		5.8±2.2 / 6.5 (3–9)		3.0±1.9 / 3 (1–9)		0.0001

ABSI: Abbreviated burn severity index; CFS: Clinical frailty scale; FAC: Functional ambulation classification; ICU: Intensive care unit; TBSA: Total body surface area; SD: Standard deviation.

Table 2. Correlation coefficients (r) between parameters

		ABSI	FAC	CFS	Age
TBSA	r	0.588	–0.084	0.294	0.116
	P	0.000	0.502	0.016	0.351
ABSI	r		–0.250	0.425	0.266
	P		0.041	0.000	0.030
FAC	r			–0.820	–0.545
	P			0.000	0.000
CFS	r				0.662
	P				0.000

ABSI: Abbreviated burn severity index; CFS: Clinical frailty scale; FAC: Functional ambulation classification; TBSA: Total body surface area.

The most sensitive and specific cut-off values for FAC, CFS, TBSA, and ABSI were detected with ROC curves. Highest AUC (0.90) was found for CFS (sensitivity 80% and specificity 83% for cut-off value 3.5). AUC for FAC was 0.83 (sensitivity 70% and specificity 85% for cut-off value 3.5). AUC for TBSA was 0.86 (sensitivity 80% and specificity 79% for cut-off value 10.5). AUC for ABSI was 0.80 (sensitivity 80% and specificity 67% for cutoff value 6.5). Figure 1 shows ROC curve analysis.

Table 3 shows results of the univariate analyses. Although the CI range of the parameters was found to be wide, TBSA, ABSI, FAC, and CFS scores were found to be significant factors that related with prognosis according to univariate analyses.

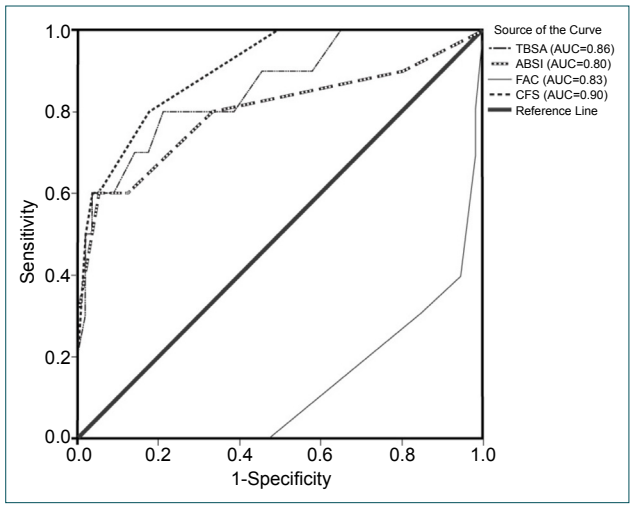

Figure 1. Receiver operating characteristic analysis and area under curve for sensitivity and specificity of parameters. ABSI: Abbreviated burn severity index; CFS: Clinical Frailty scale; FAC: Functional ambulation classification; TBSA: Total body surface area.

Table 4 shows results of the logistic regression analyses. The logistic regression model was obtained with significant parameters detected by univariate analysis and adjusted by gender, age, TBSA, and ABSI. Among these parameters, FAC and CFS were found to be significant independent risk factors for poor prognosis. The CI range of FAC and CFS was found to be wide; however, being non-ambulatory/dependent (OR=13.5; %95 CI=1.1–160.2; p=0.039) and vulnerable/frail (OR=11.4; %95 CI=1.2–112.2; p=0.036) are significantly increasing the poor prognosis.

DISCUSSION

The number of elderly burn victims grows as the population gets older. The proportion of elderly burns requiring hospitalization is reported to increase for 2.3–4.8% during 6–9 years period in various studies.[10–13] Prediction of burn outcomes has been based traditionally on patient age and the percentage of burned TBSA. Some of the updated models take into account the presence and amount of full thickness burns, inhalation injury, gender, or age-adjusted modifications for calculation in their predictions.[4,14–16] Unfortunately, individuals with the same chronological age vary widely in their health and functional status making age alone a poor predictor of patient outcome.

In our study group, 61.2% of elderly patients had pre-existing medical conditions. Furthermore, multiple comorbidities were evident in the non-survivor group. In a review article by Silva et al.,[17] the prevalence of comorbidities in elderly burn patients is reported to be 53–68% in different articles. There are also numerous articles reporting comorbidities from 35.9% to 82.4% for elderly patients. In these studies far, less percentages are reported for non-elderly.[10,18–21] The common comorbidities among our patients were hypertension, diabetes

Table 3. Relation of clinical features, ambulation and frailty with prognosis

	Group 1		Group 2		Total		OR (95% CI)
	n	%	n	%	n	%	p
TBSA Cutoff							
Low (0–10)	45	93.8	3	6.3	48	71.6	8.7 (1.9–39.0)
High (>10)	12	63.2	7	36.8	19	28.4	0.002
ABSI Cutoff							
Low (0–6)	38	95.0	2	5.0	40	59.7	9.4 (1.8–49.0)
High (>6)	19	70.4	8	29.6	27	40.3	0.006
FAC Cutoff							
High (>3)	48	94.1	3	5.9	51	76.1	12.4 (2.7–57.3)
Low (0–3)	9	56.3	7	43.8	16	23.9	0.0001
CFS							
Normal (CFS:1–3)	47	95.9	2	4.1	49	73.1	18.0 (3.5–102.5)
Cutoff							
Vulnerable–Frail (CFS:4–9)	10	55.6	8	44.4	18	26.9	0.0001
CFS							
Normal (CFS:1–3)	47	95.9	2	4.1	49	73.1	Ref.
Vulnerable (CFS:4)	7	77.8	2	22.2	9	13.4	6.7 (0.8–55.6)
Frail (CFS:5–9)	3	33.3	6	66.7	9	13.4	47.8 (6.5–340.6) 0.0001

ABSI: Abbreviated burn severity index; CFS: Clinical frailty scale; CI: Confidence interval; FAC: Functional ambulation classification; OR: Odds ratio; TBSA: Total body surface area.

Table 4. The results of logistic regression analyses

	B coefficient	OR	95% CI	p
Gender (male)	1.919	4.4	0.5–40.3	0.223
Age gr (>75)	1.604	4.9	0.3–71.8	0.239
TBSA	3.393	29.7	(2.2–389.7)	0.010
ABSI	–0.003	1.0	0.1–32.1	0.998
FAC (non-ambulatory/dependent)	2.601	13.5	(1.1–160.2)	0.039
CFS (vulnerable/frail)	2.438	11.4	(1.2–112.2)	0.036

ABSI: Abbreviated burn severity index; CFS: Clinical frailty scale; CI: Confidence interval; FAC: Functional ambulation classification, OR: Odds ratio; TBSA: Total body surface area.

mellitus, cerebrovascular disease, chronic lung diseases, and dementia. In a study by Lam et al.,[22] the elderly patients were 4.2% of total admissions, of whom 20.9% had pre-existing medical conditions. They claimed that comorbidity was not an independent risk factor for death, but increased age, burn extent, and presence of inhalation injury was. The percentage of comorbidities in their study group is lower than the literature and this may be the reason of not finding comorbidity as an independent risk factor in their study. Contrary to their findings, Tanizaki et al.[23] have studied outpatient elderly burn patients with a mean percentage of 4% burned TBSA and they found that the Charlson comorbidity index for outpatients with delayed healing was higher than that for those without delayed healing. They also claimed that age and burned TBSA was not associated with delayed healing. Their findings support the use of frailty in predicting outcomes of elderly burns.

During the study period, there were 32 deaths among 1,478 hospitalized patients (2.17%) in our burn clinic. The number of deaths among our elderly patients is 8 (11.9%) at the same period. Elderly patients constituted 4.53% of all our patients and 25% of deaths, which emphasizes the importance of elderly burns. In various studies in the literature, the mortality rate has been reported between 7.5% and 54.2%, which is much more higher than younger adults in the same cohort.[10–13,18,24,25] In our study, the ABSI score was significantly higher in Group 2 (p=0.001) as well as FAC and CFS. The significant difference in ABSI score between the groups is predominantly a result of marked difference in burned TBSA. However, the case by case evaluation reveals some different interpretations in terms of ABSI. There were two patients in our mortality group with 9% burned TBSA. Although their ABSI scores predicted 80–98% probability of survival, the patients died. Besides, both patients were non-functional ambulatory and frail. On the other hand, two other patients who were evaluated as functional ambulatory and vulnerable had survival rates less than 10% according to ABSI. Therefore, the combination of ABSI with ambulatory status (FAC) and frailty assessment (CFS) comprehensively explains the mortality in all of our patients.

Ward et al.[16] have demonstrated that the frailty score can be used to predict in-hospital mortality for thermal burns of any size in the elderly patients. They also suggest the use of frailty score in combination with the modified Baux score to improve the prediction of mortality. In the present study, the univariate analyses revealed that TBSA, ABSI, FAC, and CFS scores were significant factors related with prognosis. Among these factors, FAC and CFS are found to be significant independent risk factors for poor prognosis according to the logistic regression model. As a consequence being non-functional and frail is significantly increasing the poor prognosis.

There are some limitations of the present study. First, the number of elderly patients was relatively small compared to all of our hospitalized patients during the study period. Second, due to low severe outcome (mortality and amputation), the number of patients in Group 2 was also small. Nevertheless, we recommend the use of FAC and CFS together with ABSI in the elderly patients.

Conclusion

The percentage of elderly burns is low, yet the mortality is high in these patients which emphasize the seriousness of elderly burns. The ABSI or other age adjusted models are of great help but elderly patients form a heterogeneous group due to their decreased mobility and various comorbidities. In elderly patients, there is need of support to models like ABSI in terms of ambulation status and frailty. The present study demonstrated that FAC and CFS are good independent parameters to predict the outcome of elderly burn patients along with TBSA and ABSI.

Ethics Committee Approval: This study was approved by the Adana City Training and Research Hospital Clinical Research Ethics Committee (Date: 04.11.2020, Decision No: 1116).

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Conflict of Interest: None declared.

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ORİJİNAL ÇALIŞMA - *ÖZ*

Yaşlı yanıkları: Prognozun öngörülmesinde klinik kırılganlık ölçeği ve fonksiyonel ambulasyon sınıflandırması kullanımı

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AMAÇ: Bu çalışmanın amacı, yaşlı yanıklarında prognozu öngörmede yanık şiddeti ile birlikte mobilite ve kırılganlığın rolünü araştırmaktır.
GEREÇ VE YÖNTEM: Bu çalışmaya 1 Ekim 2017–30 Eylül 2020 tarihleri arasında yanık merkezimizde yatarak tedavi gören 65 yaş ve üzeri 67 hasta dahil edildi. Demografik veriler, etiyolojik veriler, hastaların prognoz verileri, yanık toplam vücut yüzey alanı yüzdesi (TVYA), kısaltılmış yanık şiddet indeksi, fonksiyonel ambulasyon sınıflandırması ve klinik kırılganlık ölçeği ile değerlendirme sonuçları geriye dönük olarak incelendi.
BULGULAR: Çalışma popülasyonunun yaş ortalaması 71.58±7.4 yıldı ve hastaların çoğu (%65.7) kadındı. Yanık TVYA yüzdesi 11.34±12.2 idi. Ölen hastaların %87.5'inde alev yanıkları (n=8 hasta) etiyolojik faktör iken, hayatta kalan hastaların %52.5'i haşlanma yanığı idi. Hayatta kalan hastaların çoğu fonksiyonel yürüyebilen iken (%93.2), ölen hastaların sadece %25'i fonksiyonel yürüyebilen idi (p<0.001). Ayrıca, klinik kırılganlık ölçeği değerlendirmesine göre hayatta kalan hastaların %83'ü normal iken, ölen hastaların %25'i incinmeye yatkın ve %75'i kırılgan idi (p<0.001).
TARTIŞMA: Yaşlı hastalarda yanık oranı düşüktür ancak bu hastalarda mortalite yüksektir. Bu durum yaşlı yanıklarını önemli kılmaktadır. Prognozu belirlemede kısaltılmış yanık şiddet indeksi çok faydalıdır ancak yaşlı yanıklarında ambulasyon durumu ve kırılganlık açısından eşlik eden hastalıklar da göz önünde bulundurulmalıdır. Mevcut çalışma, fonksiyonel ambulasyon sınıflandırması ve klinik kırılganlık ölçeğinin kısaltılmış yanık şiddet indeksi ile birlikte kullanılmasının yaşlı yanık hastalarının prognozunu öngörmede daha iyi bir belirleyiciliği olacağını göstermiştir.
Anahtar sözcükler: Ambulasyon; kırılganlık; prognoz; yanık; yaşlı hastalar.

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