

Retrospective evaluation of the factors influencing the mortalities of geriatric patients in a burn intensive care unit

Bir yanık yoğun bakım ünitesinde geriatrik hastaların mortalitelerini etkileyen faktörlerin retrospektif olarak değerlendirilmesi

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ABSTRACT

Objectives: This study aims to evaluate the geriatric patients hospitalized in our burn unit in terms of the changes in demographic distributions and treatment outcomes.

Materials and methods: We evaluated 101 geriatric patients (74 males, 27 females; mean age 66.6 years; range, 65 to 89 years) followed-up between January 2015 and December 2017 at University of Health Sciences Kartal Dr. Lütfi Kırdar Training and Research Hospital Burn Intensive Care Unit (BICU), whose data were correctly available, according to years, age, gender, cause and extent of burn, burn degree, month, season, place of residence, first referred health center, interval from injury to arrival at our burn center, treatment modality, treatment outcomes, and mortality reasons.

Results: The mean total body surface area burned was 21%. The most common etiology was scald burn. The most common etiology of mortalities was flame burn. Mortality rate was 20.3% with a statistically significant decrease over the years. The most common mortality reason was sepsis. Deaths due to acute renal failure or gastrointestinal hemorrhage also decreased over the years.

Conclusion: Our findings demonstrated that age, burn percentage, or presence of inhalation injury increased mortality in geriatric patients. The Abbreviated Burn Severity Index and Acute Physiology And Chronic Health Evaluation II scores at the start of treatment in the BICU were directly proportional to mortality.

Keywords: Burn, burn etiology, geriatric, mortality, risk factor.

ÖZ

Amaç: Bu çalışmada yanık ünitemizde yatan geriatrik hastalar demografik dağılımlardaki değişiklikler ve tedavi sonuçları açısından değerlendirildi.

Gereç ve yöntemler: Sağlık Bilimleri Üniversitesi Kartal Dr. Lütfi Kırdar Eğitim ve Araştırma Hastanesi Yanık Yođun Bakım Ünitesinde Ocak 2015 ve Aralık 2017 tarihleri arasında takip edilen, verileri dođru şekilde bulunabilen 101 geriatrik hasta (74 erkek, 27 kadın; ort. yaş 66.6 yıl; dağılım, 65-89 yıl) yıllar, yaş, cinsiyet, yanık nedeni ve boyutu, yanık derecesi, ay, mevsim, ikamet yeri, başvuru ilk sağlık merkezi, yaralanma ile yanık merkezimize geliř arasındaki süre, tedavi yöntemi, tedavi sonuçları ve mortalite nedenlerine göre değerlendirildi.

Bulgular: Yanmış toplam beden yüzeyi alanı ortalama %21 idi. En yaygın etyoloji hařlanma yanıđı idi. Mortalitenin en yaygın etyolojisi alev yanıđı idi. Mortalite oranı yıllar içinde istatistiksel olarak anlamlı bir azalma ile %20.3 idi. En yaygın mortalite nedeni sepsis idi. Akut böbrek yetmezliđi veya gastrointestinal kanamaya bađlı ölümler de yıllar içinde azaldı.

Sonuç: Bulgularımız geriatrik hastalarda yařın, yanık yüzdesinin veya solunum yaralanması varlıđının mortaliteyi artırdıđını gösterdi. Yanık Yođun Bakım Ünitesinde tedavi bařlangıcındaki Kısaltılmış Yanık Şiddet İndeksi ve Akut Fizyoloji ve Kronik Sağlık Deđerlendirmesi II skorları mortalite ile dođrudan orantılı idi.

Anahtar sözcükler: Yanık, yanık etyolojisi, geriatrik, mortalite, risk faktörü.

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Burns are defined as a form of injury that occurs in contact with hot or cold materials, burning chemical substances, electrical currents, or radioactive rays due to their temperature.^[1] Burns are known to be one of the most frequently observed traumas in developing countries.^[2]

Increased quality and duration of life brings with it increased populations. According to the World Health Organization, the exact age limit for the definition of elderly is 65 years.^[3] Burns that occur in this age group are important traumas that should be considered differently from other age groups. Increasing elderly populations around the world are an indication that more burn patients with older age will be treated in the future.

Burns seen in the elderly are important because of significantly increased morbidity, requirement of hospitalization, and invasive interventions resulting in permanent psychological trauma. Elderly patients have a number of risk factors that increase their mortality and morbidity after burn injury.

Systemic problems such as chronic diseases including adult diabetes, cardiovascular diseases, aging of lung reserves, decrease of body mass index, deterioration of nutritional status, and deterioration of endogenous anabolic hormones increase the risk of mortality after burn injury.^[4] Burn, in elderly patients, is characterized by a hypermetabolic response involving massive protein and lipid catabolism, total body protein loss, muscle destruction, peripheral insulin resistance, increased energy expenditure, and increased synthesis of acute phase proteins.^[5] Therefore, in this study, we aimed to evaluate the geriatric patients hospitalized in our burn unit in terms of the changes in demographic distributions and treatment outcomes.

MATERIALS AND METHODS

Our study included 101 geriatric patients (74 males, 27 females; mean age 66.6 years; range, 65 to 89 years) hospitalized in Kartal Dr. Lütfi Kırdar Training and Research Hospital Burn and Wound Treatment Center Burn Intensive Care Unit (ICU) between January 2015 and December 2017. The records of patients were retrospectively reviewed and the demographics, burn percentage (BP), presence of inhalation injury, Acute Physiology and Chronic Health

Evaluation (APACHE) II, and Abbreviated Burn Severity Index (ABSI) burn scores were examined. The study protocol was approved by the Kartal Dr. Lütfi Kırdar Training and Research Hospital Ethics Committee. A written informed consent was obtained from each patient. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Statistical analysis

The IBM SPSS Statistics version 22.0 program (IBM Corp., Armonk, NY, USA) was used for the statistical analyses. Student's t-test was used for comparison of the descriptive statistical parameters including mean, standard deviation, and minimum and maximum values between the two groups. One-way analysis of variance test was used for multiple comparisons. Statistical significance was set at $p < 0.05$.

RESULTS

In our study, 88.7% of the patients were males and 11.3% were females. The percentage of patients with burns was 30.6%. Of the patients, 28.5% had additional inhalation damage while 71.5% had no inhalation damage. The mean ABSI score of the patients was 8.3 (Table 1).

The mean duration of hospitalization (HD) in ICU was 15.5 days (range, 1 to 128 days). The mean mechanical ventilation (MV) duration was 7.4 days (range, 1 to 106 days). The number of operations applied was 17. The APACHE II score ranged between 0 and 35 with a mean of 18.3.

The age groups of our geriatric patients were age < 65 , $65 \leq$ age < 75 , and $75 \leq$ age. Mortality change was statistically significant depending on age groups ($p < 0.01$). Accordingly, mortality was found to increase as age increased. Mortality rate was lowest at 16.6% in the group with age < 65 and highest at 89.4% in the group with $75 \leq$ age (Table 2).

The mortality rates of male and female patients were 35.8% and 49.4%, respectively. The mortality difference between male and female patients was not statistically significant (Table 3).

The incidence of burns was evaluated according to the following three groups: $BP < 20$, $20 \leq BP < 50$, and $50 \leq BP$; mortality rates significantly increased as the BP increased (Table 4).

Table 1. Descriptive statistical values (n=101)

	%	Mean±SD	Min-Max
Age (year)		66.6±13.1	65-89
Gender			
Male	88.7		
Female	11.3		
Burn percentage		30.6±21.8	0-100
Abbreviated Burn Severity Index		8.3±3.1	3-15
Burn Intensive Care Unit hospitalization (day)		15.5±13.2	1-128
Mechanical ventilation support (day)		7.4±11.3	0-106
Number of operations		1.9±3.0	0-17
APACHE II		18.3±8.7	0-35
Lactate (mmol/L)		3.4±3.0	0.9-9.4

SD: Standard deviation; APACHE II: Acute Physiology and Chronic Health Evaluation II.

Thirty-one patients had inhalation injury and the mortality rate of these patients was 65.9%. The mortality rate of these patients was significantly higher than patients without inhalation injury (14.3%). Statistically significant mortality changes were observed due to the presence of inhalation injury (Table 5).

The HD was divided into two groups as HD <7 days and 7 days ≤ HD. The mortality rates of the two groups were 23.6% and 28.9%, respectively, without a statistically significant difference. Mortality rates were evaluated according to the duration of MV. According to this, MV implementation durations were

Table 2. Age group and mortality relationship

Age	n	Mortality (%)	SD	p
Age <65	40	16.6	27.5	
65≤ age <75	33	25.5	45.1	<0.01
75≤ age	28	89.4	42.3	

SD: Standard deviation; p<0.05: Significant; One-way analysis of variance test was used.

Table 3. Gender and mortality relationship

Gender	n	Mortality (%)	SD	p
Male	74	35.8	43.8	0.35
Female	27	49.4	45.7	

SD: Standard deviation; p<0.05: Significant; Student's t-test was used.

Table 4. Burn percentage and mortality relationship

Burn percentage	n	Mortality (%)	SD	p
BP <20	47	9.3	23.8	
20≤ BP <50	24	19.1	36.5	<0.01
50≤ BP	30	87.4	47.4	

BP: Burn percentage; SD: Standard deviation; p<0.05: Significant; One-way analysis of variance test was used.

Table 5. Inhalation damage and mortality relationship

Inhalation	n	Mortality (%)	SD	p
+	31	65.9	43.1	<0.01
-	70	14.3	37.2	

SD: Standard deviation; p<0.05: Significant; Student's t-test was used.

Table 6. Abbreviated Burn Severity Index and mortality relationship

ABSI	n	Mortality (%)	SD	p
ABSI <9	56	29.1	31.2	<0.01
9≤ ABSI	45	67.5	39.8	

ABSI: Abbreviated Burn Severity Index; SD: Standard deviation; p<0.05: Significant; Student's t-test was used.

Table 7. Acute Physiology and Chronic Health Evaluation II and mortality relationship

Burn percentage	n	Mortality (%)	SD	p
APACHE II <10	36	25.2	22.9	
10≤ APACHE II <20	24	31.1	27.6	<0.01
20≤ APACHE II	41	67.8	27.8	

APACHE II: Acute Physiology And Chronic Health Evaluation II; SD: Standard deviation; p<0.05: Significant; One-way analysis of variance test was used.

considered in three groups as non-MV cases, MV <7 days, and 7 days ≤MV. The mortality rate was 11.3% in cases without MV and this value was lower compared to the other groups. The mortality rates in the other two groups were close to each other without a statistically significant difference.

The patients' ABSI scores were evaluated as ABSI <9 and 9 ≤ ABSI. Mortality rate was 29.1% in the group with ABSI <9 and 67.5% in the group with 9 ≤ ABSI with a statistically significant difference. As the ABSI score increased, mortality increased (Table 6).

The mortality rate was 25.2% in group with APACHE II <10, 31.1% in group with 10 ≤ APACHE II <20, and 67.8% in group with 20 ≤ APACHE II. The mortality rate in group with 20 ≤ APACHE II was significantly higher (Table 7).

DISCUSSION

Burns cause many medical, psychological, social, and economic problems in all societies. The epidemiological and demographic character of burn injury varies from country to country. In this study, a total of 101 patients over 65 years of age were followed-up in the ICU between January 2015 and December 2017. Of these patients, 54 (26.7%) died. Our mortality rate was similar to those reported in the literature for adult burn patients, ranging from 4% to 28.3%.^[6,7]

In recent years, many progresses occurred in the treatment of burn injuries; however, the improvement rate of health outcomes in elderly adults with burn injuries is significantly lower than that of young patients. Chronic diseases present in large numbers in elderly patients, while reduced cardiopulmonary reserve and susceptibility to infection and sepsis tend to complicate the preservation of sensitive balances and are considered to be the main causes of high mortality.^[8]

As with any disease group, age has an important effect on both burn formation as well as treatment outcomes in burn injuries. Elderly are more exposed to burn injuries due to decreased ability to move along with the advancing age, inability to perform fine motor functions, and reduced reflexes.^[9]

In elderly patients, burn is one of the most frequent causes of death and is ranked at fourth place among deaths due to injuries.^[9] Elderly individuals are more vulnerable to burn injuries because of their limited mobility that prevent them from reacting quickly and reaching a safe area when they are in danger. Mabrouk et al.^[10] reported that 23.7% of such individuals were unable to act at the scene, and that this increased the severity of injuries in the hospital. In this group of patients, mortality rate compared to burn site is significantly higher than that for younger patients. In young adults, 80% of the total body surface area (TBSA) burns cause 50% mortality, while 35% of the TBSA burns between ages 60 and 70 years cause the same mortality rate.^[11] The relationship between age and mortality was examined in geriatric patients admitted to ICU, and mortality was found to increase with increasing age. In the literature, older age was associated with increased mortality rate with reports indicating a mortality rate of 45% in elderly patients.^[12] Our study revealed similar findings.

In terms of the relationship between gender and mortality, one study^[13] reported the ratio of males to females in burn patients as 2.6:1 in adults. In that study, 83.2% of the patients were males while 16.8% were females. The mortality rates of male and female patients were 20.2% and 29.4%, respectively, with no significant difference.

In elderly patients, it is necessary to plan burn treatment immediately by starting fluid treatment in those with burns greater than 5-10% of body surface and any size of inhalation damage. An examination of age and extent of burn reveals that a patient with a burning width of over 50% is not alive. There is consensus in the literature on increased mortality with increased size of the total burn area.^[13]

In a study of Kurtoglu et al.,^[14] BPs were classified as 30-50%, 50-75%, and 75%; while their mortality rates were determined as 66%, 95%, and 100%. In our study, mortality rate was found to be the lowest with 5.1% in the group with TBSA <20, whereas it increased to 69.2% in the group with 50% TBSA according to the literature. These rates are low compared to children and adolescents, and although there are many important developments in burn treatment, it is an important indication that we still fail to treat elderly burn patients.

In this study, when burn types were examined, thermal burns ranked first with 62.8%, electrical burns ranked second with 28.2%, chemical burns ranked third with 4.9%, and toxic epidermal necrolysis (TEN) burns ranked fourth with 3.9%. A review of the association of burn types with mortality showed the lowest mortality in patients with electrical burns (5.3%), while patients with TEN burns had the highest mortality (50.0%).

The incidence of burn injury and inhalation injury increases with elderly patients due to decreased reaction time. In this age group, reduced seeing, hearing, and reaction time with occasional impairment of reasoning ability are often the main factors in the occurrence of accidents and injuries. We think that the low mortality in electrical burns is due to keeping our patients at follow-up for 24 hours even if they have low grade burns. We also believe that in TEN, even if the burn grade is low, mortality increases with the presence of additional diseases.

An examination of the relationship between inhalation injury and mortality of geriatric patients in the burn ICU demonstrated that mortality was significantly increased in patients with inhalation injury. Of hospitalized burn patients, 30% have inhalation injury while the presence of an inhalation injury, which is seen in 48-56% of burn patients with pneumonia, has been reported to cause a two-fold increase in the risk of pneumonia.^[15]

In our study, 27.7% of patients had inhalation damage and 55.4% of these patients died. The mortality rate was found to be significantly increased in cases with inhalation injury. In addition, elderly burn patients have lower threshold that is reached more quickly for MV support during treatment due to reduced lung reserve and earlier fatigue. Heavy-burn geriatric patients may require MV due to many reasons such as inhalation injury, respiratory tract obstruction, pneumonia, acute respiratory distress syndrome, or pulmonary edema.

Studies conducted on the ABSI scores showed that the results were consistent with the scores in full-thickness burns and mortality rates, while low-burn-rate mortality was determined by the duration of hospitalization rather than ABSI. In advanced-age patients with ABSI, higher

scores may be noted if age is an important parameter.^[16,17] In our study, mortality was significantly increased in patients with high ABSI scores. The mortality rate was 67.5% in patients with $9 \leq \text{ABSI}$.

The major limitation was the small number of patients included in this study.

In conclusion, the geriatric age group with the highest mortality rate among burn patients require special treatment and follow-up due to the negative effects of burn as well as accompanying diseases and aging on the entire body system. We suggest careful follow-up and a multidisciplinary treatment approach to reduce mortality and morbidity in geriatric burn patients.

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