

Elderly burns; Our clinical experiences

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Abstract

Background: Though mortality rates have decreased with better understanding of burns' pathophysiology and advanced monitoring, elderly burn patients are still a challenging health problem. The elderly population is increasing worldwide. The aim of this study is to investigate the outcomes of burns for elderly patients and increase medical, public and governmental awareness of the issue. Elderly people should be trained in preventive measures to diminish the number of burn accidents.

Methods: Hospitalized patients between 2011 and 2019 were retrospectively studied. Age, gender, burned total body surface area (TBSA), burn agent, comorbidities, location of the burn injury, whether a house fire accompanied, and mortality rates were compared between adult patients (18 to 64 years old) and those who were elderly (65 years or older).

Results: Of the 2258 patients, 285 (12.6%) were aged 65 or older. The burned TBSAs of the adult patients were larger than those of the elderly patients ($p=0.019$). Scalding and contact burns were more frequent among the elderly than the adults ($p=0.001$). The elderly had greater co-morbidities, were mostly burned at home and more house fires accompanied their injuries than those of the adults ($p<0.001$). Despite having lesser burned TBSAs, mortality rates were significantly higher in the elderly ($p<0.001$).

Conclusions: As the elderly population increases worldwide, burn treatment facilities should be prepared for their increase in numbers and co-morbidities. To enforce preventive measures, awareness of the growing issue should be raised and public authorities should be alerted to their need to act.

Keywords: Burns, Elderly, Mortality, Co-morbidity.

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INTRODUCTION

'Elderly' is defined as 65 years old or older and 'advanced elderly' as 80 years old or older. The elderly age group is the most rapidly growing segment of Turkey's population (1). As the elderly population increases, so does the number of elderly patients, and many branches of medicine purport to deal with the health problems of this sensitive group. In particular, it is inevitable that more elderly patients will require treatment for burns in the future. Limited mobility, sight and hearing disorders and slowed reflexes make elderly people more prone to burns and burn-related injuries (2). Elderly burn patients often live alone and may have inadequate social and family support, which is the frequent reason for late admission to health care services after injury. Burn treatment outcomes are worse for the elderly than for adults aged under 65 years (3).

Almost 8% of physical traumas experienced by the elderly occur via burning (4). Failures in burn treatment for the elderly are attributable to factors such as skin atrophy, changes in the wound healing cascade, concomitant diseases, failure to adapt to stressful conditions, immobilization, digestive disorders and protein energy malnutrition and mental regression (5). Skin atrophy is the thinning of the skin. It causes difficulty in depth estimation, diminished graft take-rate, delayed donor site healing, longer length of hospital stays and higher hospital-related infection risk (6). All of these factors contribute to elderly mortality. At the site of the wound, inflammation slows, collagen synthesis decreases and epithelialization is delayed. Concomitant systemic diseases, such as diabetes-related neuropathy and atherosclerotic plaque formation resulting in insufficient perioperative perfusion and oxygenation, complicate burn management (7).

The fragile physical and systemic conditions of elderly people also complicate the treatment of burn shock and the provision of maintenance treatment. All known formulas and protocols should be revised individually, considering the patient's systemic health status; close, meticulous monitoring is a must.

Ankara City Hospital Burn Treatment Center is located at the capital city of Turkey and is a third referral center with eighteen ward beds, six intensive care beds and two operating theaters. Our study aimed to see the etiologic and demographic differences between the elderly and adults, aged under 65 years and treatment outcomes among them

at our hospitalized patient population and prepare the Turkish healthcare system for dealing with an increasing number of elderly burn victims.

The study was carried out after obtaining approval from the Ethics Committee (E1) of Ankara City Hospital (Date: 17.03.2021, Approval No: 2021/E1-21-1607).

MATERIALS AND METHODS

All hospitalized patients aged 18 years and older between 2011 and 2019 were included in our retrospective study. Data were retrieved from the patients' files. The following data were recorded: age; gender; burned total body surface area (TBSA); burn agent; comorbidities; location of the burn injury; whether a house fire accompanied; and mortality rates. The patients were divided into two groups: adult and elderly. The adult group patients were between 18 and 64 years old. The elderly group patients were aged 65 years or older. Statistical analysis was presented with percentages (%), mean \pm standard deviations, Chi-square testing and Mann-Whitney U testing. A p-value less than 0.05 is determined statistically significant.

RESULTS

Of the 2258 inpatients, 1973 (87.4%) were aged between 18 and 64 years (mean 36 ± 12) and composed the adult group. The remaining 285 (12.6%) were 65 years old or over (mean 74 ± 7) and composed the elderly group. The burned TBSAs of the adult patients were significantly larger than those of the elderly patients (18.65 ± 21.02 and 15.52 ± 20.82 , respectively; $p=0.019$). Although there was no significant difference between groups third-degree burns were more prevalent in the elderly group (43.9% compared to 39.4% in the adult group [$p=0.087$]); however, fourth-degree burns were more frequent in the adult group (9.4% compared to 7.0% in the elderly group [$p=0.116$]).

While males were more frequently burned in the adult group (73.4% compared to 26.6% females), the distribution of the burns by gender was almost equal in the elderly (50.5% males and 49.5% females) ($p<0.001$, Table 1).

Scalding was the most frequent cause of burns among the elderly, followed by flame burns (43.5% and 36.8%, respectively); however, flames were the leading cause of burns among adults, followed by scalding (44.2% and 28.5%, respectively). While electrical burns were the third most common cause of burns among adults, contact burns were the third etiology among the elderly, (12.6%). There was a significant difference between adults and elderly (Table 1).

Table 1. Patients Characteristics and Demographics

	Age		Total	p
	18-64	>65		
Gender				
Female	525 (26.6%)	144 (50.5%)	669 (29.6%)	<0.001
Male	1448 (73.4%)	141 (49.5%)	1589 (70.4%)	
Etiology				
Scald	563 (28.5%)	124 (43.5%)	687 (30.4%)	
Contact	102 (5.2%)	36 (12.6%)	138 (6.1%)	
Flame	873 (44.2%)	105 (36.8%)	978 (43.3%)	<0.001
Electrical	319 (16.2%)	9 (3.2%)	328 (14.5%)	
Chemical	83 (4.2%)	7 (2.5%)	90 (4.0%)	
Frost bite	6 (0.3%)	0	6 (0.3%)	
Others	27(1.3 %)	4(1.4%)	21 (1.4 %)	
Burn place				
Home	989 (50.5%)	241 (85.8%)	1230 (54.9%)	
Workplace	474 (24.2%)	1 (0.4%)	475 (21.2%)	<0.001
Open place	447 (22.8%)	34 (2.1%)	481 (21.5%)	
House Fire				
No	1425(95.9%)	203 (90.6%)	1628 (95.2%)	<0.001
Yes	61(4.1%)	21 (9.4%)	82 (4.8%)	
Mortality⁸				
No	1774(89.9%)	231(81.1%)	2005(88.8%)	<0.001
Yes	199(10.1%)	54(18.9%)	253(11.2%)	
Total	1973	285	2258	

Table 2: Co-morbidities in 2258 patients

		Age (years)		p
		18-64 (n, %)	>65 (n, %)	
Epilepsy	No	1885 (95, 5%)	279 (97, 9%)	0.036
	Yes	88 (4, 5%)	6 (2, 1%)	
Diabetes Mellitus	No	1897 (96, 2%)	224 (78, 6%)	<0.001
	Yes	75 (3, 8%)	61 (21, 4%)	
COPD	No	1967 (99, 7%)	280 (98, 2%)	0.007
	Yes	6 (0, 3%)	5 (1, 8%)	
CVD	No	1950 (98, 8%)	262 (91, 9%)	<0.001
	Yes	23 (1, 2%)	23 (8, 1%)	

COPD= Chronic Obstructive Pulmonary Disease; CVD= Cardiovascular Diseases

The prevalence of co-morbidities was higher in the elderly group (109/285, 38.2%) than in the adult group (206/1973, 10.4%) (p<0.001). Diabetes mellitus, chronic obstructive pulmonary disease (COPD) and cardiovascular disease (CVD) rates were significantly higher among the elderly; however, epilepsy was significantly more common in

adult patients (Table 2). When the effects of comorbidities on the burn depth were analyzed, patients with epilepsy were found to have significantly higher rates of third- and fourth-degree burns; no significant effect of other comorbidities was found (Table 3).

Table 3: Fourth and third degree burns and epilepsy correlation regarding to age groups.

Epilepsy						
Age	Burn Depth		No	Yes	Total	p
			N (%)	N (%)	N (%)	
18-64	3 th degree	No	1158 (61.9%)	37 (36.3%)	1195 (60.6%)	0.000
		Yes	713 (38.1%)	65 (63.7%)	778 (39.4%)	
	Total	n	1871	102	1973	
>65	3 th degree	No	152 (57.4%)	8 (40.0%)	160 (56.1%)	0.102
		Yes	113 (42.6%)	12 (60.0%)	125 (43.9%)	
	Total	n	265	20	285	
Total	3 th degree	No	1310 (61.3%)	45 (36.9%)	1355 (60.0%)	0.000
		Yes	826 (38.7%)	77 (63.1%)	903 (40.0%)	
	Total	n	2136	122	2258	
18-64	4 th degree	No	1703 (91.0%)	85 (83.3%)	1787 (90.6%)	0.012
		Yes	168 (9.0%)	17 (16.7%)	185 (9.4%)	
	Total	n	1871	102	1973	
>65	4 th degree	No	249 (94.0%)	16 (80.0%)	265 (93.0%)	0.041
		Yes	16 (6.0%)	4 (20.0%)	20 (7.0%)	
	Total	n	265	20	285	
Total	4 th degree	No	1951 (91.4%)	101 (82.8%)	2052 (90.9%)	0.002
		Yes	184 (8.6%)	21 (17.2%)	205 (9.1%)	
	Total	n	2136	122	2258	

In the elderly group, burn injuries occurred at a significantly higher rate at home (85.8%), whereas in the adult group 50.5% of the injuries occurred at home, 24.2% in the workplace and 22.8% in open spaces (Table 1). The charts of 1710 patients were noted for whether or not there had been a concomitant house fire. Burn injuries were associated with a significantly higher rate of house fires in the elderly group (9.4%) than in the adult group (4.1%) (Table 6). When the house fires were analyzed in relation

to comorbidities, it was found that having a comorbidity increased the rate of house fires for both groups; as such, the rate of house fires was 66.7% for the elderly group (Table 4). Epilepsy, as a comorbidity, was encountered in 6.9% (5/81, p=0.253) of the house fires. However, diabetes mellitus was a significantly effecting comorbidity in 11.9% (13/82, p=0.002) of the house fires, especially among the elderly (Table 4).

Table 4 : House fires regarding the comorbidities and age.

Age	Comorbidity	House Fire		p
		None	Yes	
		N (%)	N (%)	
18-64	None	1275 (89.5%)	47 (77.0%)	
	Yes	150 (10.5%)	14 (23.0%)	0.005
	n	1425	61	
>65	None	146 (71.9%)	7 (33.3%)	
	Yes	57 (28.1%)	14 (66.7%)	0.001
	n	203	21	
Whole	None	1421 (87.3%)	54 (65.9%)	
	Yes	207 (12.7%)	28 (34.1%)	<0.001
	n	1628	82	
	Diabetes Mellitus			
18-64	None	1368 (95.9%)	56 (96.6%)	
	Yes	59 (4.1%)	2 (3.4%)	0.570
	n	1427	58	
>65	None	163 (94.2%)	40 (78.4%)	
	Yes	10 (5.8%)	11 (21.6%)	0.002
	n	173	51	
Whole	None	1531 (95.7%)	96 (88.1%)	
	Yes	69 (4.3%)	13 (11.9%)	0.002
	n	1600	109	

Although mean burned TBSA was lesser in the elderly, this group had a significantly higher mortality rate (Table 1). Having a comorbidity significantly increased mortality in the adult and elderly groups, as well as in both groups, combined ($p < 0.001$, $p < 0.001$, and $p < 0.001$, respectively).

DISCUSSION

Given that age is an increased risk factor for burn injury and that Turkey's elderly population is increasing rapidly, a greater number of elderly burn patients can be expected in the nation's hospitals. 12.6% of our hospitalized burn patients were elderly; this number will be higher in the future.

According to demographic studies, young male patients are significantly more prone to burn injury than female patients. However, our results, consistent with results from the literature, showed that female and male burn victims are similar in proportion among elderly (8).

Although adult patients most commonly have burns caused by fire, followed by scalding; the elderly had significantly more burns from scalding, followed by fire. Electrical burns and contact burns were the third most frequent burn agents among adults and the elderly, respectively.

An analysis of our elderly patients' contact burns and the existence of epilepsy among the patients revealed a significant relationship between epilepsy and third and fourth degree burns, which were the most common type of contact burn.

Mabrouk et al. have found that nearly 80% of elderly patients burn themselves at home, and about 4% in the workplace (9). Concordant with the literature, our study shows the proportions of the accident sites to be more distributed among the adult population, with 50.5% of burns occurring at home, 24.2% in the workplace and 22.8% in open spaces, and the majority of the elderly

patients' burns (85%) occurring at home. Although the majority of our elderly patients burned themselves at home, this may vary among countries, as the retirement age of each country is different. Physical or mental illness, diminished alertness, slower reaction time, reduced mobility and poor eyesight and hearing can result in home accidents, especially in the kitchen and the bathroom (10).

House fires are important events that increase the severity of burn injuries and result in accommodation problems. House fires were accountable for the burn injuries of 9.4% of our elderly patients and 4.1% of our adult patients. Elderly patients who suffer from burn injuries generally live alone and have inadequate social support. Smoking, low income and poor building amenities and conditions (such as cooking over an open flame or with other heating equipment; lack of extinguisher systems) further increase the risk of fire. Fire injury and death commonly occur midmorning and early afternoon (11,12). The use of alcohol and medications such as sleeping pills or tranquilizers is an additional factor in the increased risk of a house fire. According to our results, having a comorbidity also significantly increases the incidence of house fires for all age groups. While the prevalence of epilepsy had no effect on the incidence of house fires, diabetes mellitus was found to significantly increase the incidence of house fires among elderly burn patients.

Elderly patients frequently have coexisting or premorbid conditions such as diabetes and cardiovascular disease. Mabrouk et al. showed an incidence of premorbid conditions of 54.6% in patients aged 60 years older (9). These pre-existing medical conditions render elderly people more susceptible to various complications after burn injury (13). In our study, diabetes and cardiovascular diseases were the most common co-morbid diseases in the elderly (21.4% and 8.1%, respectively), and epilepsy was the most common co-morbid disease in adult burn patients (4.5%). According to these results, the types of co-morbid diseases in elderly burn patients in Turkey (a developing country) and developed countries are similar, and living conditions, awareness and preventive measurements should be improved at this group.

Elderly diabetic patients are more likely to sustain burns during home accidents, especially due to neuropathy and diminished motor activity. Furthermore, the incidence of complications among diabetic burn patients

is significantly higher due to the patients' triads of vasculopathy, neuropathy and immunopathy (14). According to population-based studies of diabetes and risk characteristics of diabetes in Turkey (TURDEP I and II), diabetes is moderately common in Turkey by international standards. The incidence of Diabetes in Turkey had increased by 90% over the last 12 years (from 2002 to 2013). The prevalence of diagnosed diabetes was 16.5% (15,16). In our study, diabetes was common among the elderly (21.4%), and house fires were frequently accountable for the burns of diabetic patients. To our finding, increased diabetic burn victim numbers with concomitant house fires will be more frequent health and social problem for Turkey and may be for all countries.

Epileptic patients most commonly have accidents and sustain injuries at home. These accidents are correlated with the patient's neurologic impairment and number of seizures. Burns affecting epileptic patients are severe and deeper due to the patient's loss of consciousness during seizures (17). Epileptic seizures were found to lead to a higher proportion of third- and fourth-degree burns in our adult and elderly patient groups.

Many scoring systems have been used in order to quantify the severity of burns and predict the mortality of burn patients. Baux Score, defined as the sum of the age in years and the burned percentage of the body, has been used by generations of clinicians to predict the probability of mortality following burn trauma (18). Over the past three decades, via the advancements in burn treatment, the Lethal Dose 50 (LD50) burn size has been increased. The mortality rate for adult burn patients has decreased to 5.5%. On the other hand, mortality among elderly burn patients still ranges from 7.4 to 66%, with an average of 30% (19).

Farinas et al. suggest a high conversion rate from partial to full thickness burns in the elderly; clinically, this is understood to be a deepening of the burn wound, as it makes the burn wound dynamic (20). Similar to previous studies, our clinical experiences showed that, although their TBSA was significantly smaller, the elderly group had a significantly higher mortality rate (18.9%). Elderly skin tissue undergoes significant physiological changes, such as decreased epidermal turnover, decreased skin appendages, thinning of the dermis, decreased dermal vasculature, decreased collagen and matrix and impaired

neurosensory perception (6). Therefore, elderly burn patients face deeper wounds and a longer healing time than adults with similar TBSA (7). Prolonged healing time results in longer hospital stays and a higher risk of hospital-acquired infections.

The physiological changes brought about by aging; age associated immune dysfunction; immunosenescence and pre-existing medical problems; malnutrition; and hypermetabolism all contribute to poorer outcomes for elderly burn patients (5).

Improvements in burn management and a reduction in mortality lead to more elderly patients being discharged from acute care hospitals alive. Rehabilitation, social reintegration and long-term survival are important goals for burn treatment. According to previous research, 90% of adults with a major burn return to a home environment within a year, compared to approximately 50% of elderly patients (19). As long-term disability is much greater among the elderly, aggressive rehabilitation to avoid early loss of function and muscle strength is very important (21).

In order to provide more reliable data on burn trauma and its consequences faced by the elderly population in our country, multicenter studies with large series including outpatients and inpatients are needed throughout the country.

Elderly burn patients face a significantly higher risk of mortality. Natural aging processes lead to delayed burn wound healing and increased morbidity and mortality. Pre-existing co-morbid conditions and impaired inflammatory responses are indicators of poor outcomes for the elderly. The elderly's impaired reflexes impede actions such as extinguishing the fire and cooling the burned site by applying tap water, and cause delays in seeking medical advice (which results in delayed treatment and deeper wounds). Elderly people should be trained in preventive measures to diminish the number of burn accidents. As most elderly burn injuries are preventable, passive and active prevention strategies should be encouraged.

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Declarations

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