

Epidemiology of burn injuries in the Burn Center

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ABSTRACT

Objective: The aim of the present study is to determine the epidemiology of burns by assessing demographic features, etiology, findings and burn-related factors in burn-injured patients followed-up in a burn center located in the Marmara Region, the most densely populated and industrialized geographical area of Turkey.

Methods: Medical records of 630 in-patients were examined in the burn treatment center. The data relating to the demographic characteristics of patients, burn etiology, percentage of the burned total body surface area, burn degree, burn site, burn agent, place of occurrence, etc. were evaluated.

Results: The mean age of 630 in-patients was 27.5±2.18 years. 29.8% of the patients were female, 70.2% were male. The most common causes of burns were respectively; scald (hot water, tea, milk) (37.2%), flame (31.9%), electrical (18.4%) and scald + flame + chemical (11.7%). The average percentage of burned area in the patients was found to be 23.3%. Inhalation burn was reported in 54 cases (8.9%) and co-morbid multiple trauma was reported in 31 cases.

Conclusion: Burn is a trauma with serious physical and psychological consequences. Although considerable progress has been achieved in burn therapy, attempts for preventing burns and focusing on raising awareness of individuals seem to be more efficient and cheaper.

INTRODUCTION

Burn injuries are an important public health issue that may affect all age groups and are common in economically developed and developing countries, as well as in all geographical regions.^[1-3] According to WHO (World Health Organization), burns constitute a major public health problem, especially in low- and middle-income countries where more than 95% of all burn deaths occur. Fire-related burns are the leading cause of deaths (300.000 deaths per year), more than scalding, electrical, chemical burns and death from other types of burns. However, death is not the only problem with burns; many more patients have lifelong disabilities and deformities.^[4] Burn injury is one of

the most devastating injuries, which can lead to pain, disability, serious somatic and psychological complications as well as economic and social problems.^[1,2,5,6]

Epidemiologic data provide useful information for designing strategies to prevent injuries and identifying effective methods in burn treatment.^[7,8] The etiological factors of burns vary among countries. Burn patients are a heterogeneous population, where burns affect a wide age range of patients with different damage mechanisms, burn depth and location.^[9] Epidemiologic data provide valuable information for the planning a prevention program to reduce the incidence of injury frequency of injuries and for designing methods to determine an effective clinical procedure in burn therapy.^[3,5]

The aim of this retrospective cohort study is to determine the burn epidemiology by assessing the demographic features, etiology, findings, and burn-related factors of patients with burn injuries followed-up in a burn center located in the Marmara region, the most densely populated and industrialized geographical regional of Turkey. In our opinion, the definition of epidemiology would benefit in terms of determining risk factors and developing an effective prevention program for the prevention of burns.

MATERIALS AND METHODS

This study was performed with the Institutional Review Board in University of Health Sciences, Derince Training and Research Hospital, Department of Burn Treatment Center between 2008–2013. In this study, demographic characteristics of 630 in-patients and retrospective analysis of their burn etiology were evaluated.

Burn center is located within the training and research hospital in the Marmara region, which is the most densely populated and industrialized geographical region of Turkey. This reference burn center accepts patients not only from the Marmara region but also from all over Turkey. The burn center, which is designed as a completely separate section from the other patients in the hospital campus, as well as the operating room, intensive care, and inpatient services are located within this center. Patients receive standard therapy with a professional team specialized in burn and injury treatment in this center.

Patient files and medical records of in-patients with burns were examined retrospectively in this study. The data regarding demographic characteristics, burn etiology, percentage of the burned total body surface area, burn degree, burn site, burn agent, place of occurrence, in addition to the presence of comorbid diseases, inhalation burns, suicide attempt, and multiple traumas were recorded. All patients hospitalized in the burn center were included in the study. Out-patient burn patients were excluded from the study.

Statistical analysis

All the data were analyzed with SPSS (Statistical Package for the Social Sciences) software for Windows Version 20.0. Descriptive statistical methods (mean, standard deviation) as well as the comparison of quantitative data and comparisons of normal distribution parameters between two groups were performed with Student's t-tests. The Whitney U test was used to compare the parameters that were not normally distributed between the two groups. Comparison of qualitative variables performed with the Chi-Square Test. Logistic regression analysis was used for multivariate analysis. P-values of <0.05 were considered statistically significant.

RESULTS

The mean age of 630 patients hospitalized in the burn center was 27.5 ± 2.18 (Range: 0–91) years. The range of 0–18 age

group was 226 (35.9%), 18–65 age range was 365 (57.9%), and over 65 age group was 39 (6.2%). The highest burn incidence was observed in the 0–10 age group, and the lowest in the 61–70 age group (a sample chi-square test $p=0.000$).

Of the patients, 188 (29.8%) were female, 442 (70.2%) were male, and the female/male ratio was 1/2.3. Male dominance was observed between the ages of 11–50. Statistically significant differences were found in the 11–20, 21–30, 31–40, 41–50 age groups according to female/male ratio, and burns were the most common in men in this age group (a sample chi-square test $p=0.000$) (Fig. 1).

The most common causes of burns were respectively; scald (hot water, tea, milk) (232 cases -37.2%), flame (199 cases -31.9%), electricity (115 cases -18.4%) and scald + flame + chemical (73 cases -11.7%).

The causes of burns were also examined according to age. Scald with hot water was reported most frequently in the 0-10 age group (77.5%), scald with tea-milk was reported most frequently in the 0–10 age group (55.5%), and electrical burn was reported most frequently in the 21–30 age group (32.1%), burns usually caused by an explosion in heavy industry, the scald + flame + chemicals, were reported in the 31–40 age group (35.6%). 86.3% of the scald burns were observed in the 0–30 age group, 58.3% of the flame burns were in the 11–50 age group, and 89.6% of the electrical burns were in the 11–50 age group.

The average percentage of the burned area was found as 23.3% in the total number of patients. 471 (77.2%) of the patients were reported to have less than 30% total burned body surface, whereas 75 (12.3%) patients had a burned area of 31–50%, 40 (6.6%) had a burned area of 51–70%, 20 (3.3%) patients had it of 71–90% and 4 (0.7%) patients had it of 91–100% (Table 1).

The patients were divided into 12 regions in terms of scalp, face-neck, trunk, extremities, genital area and combinations of these 5 groups according to the burned body parts. The most frequent burned body parts were the extremities (38.9%), followed by the trunk (20.5%), face-neck (18.3%), and genital area (5.0%). The rate of scalp burns in patients were reported as 1.9%, and burns of other sites consisting of a combination of these areas were reported as 4.15% (Table 2, Fig. 2).

A total of 319 (51.9%) incidents occurred at the houses, 206 (33.5%) were at work and 90 (14.6%) elsewhere according to the evaluation of the place of occurrence. Scald burns (hot water, tea, milk) were most common at homes

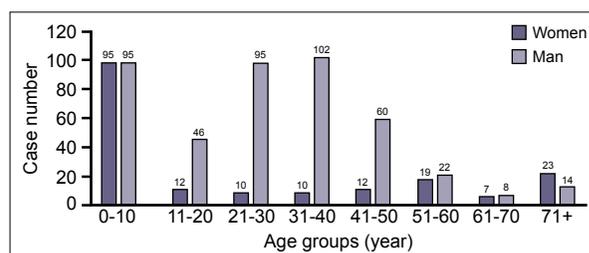


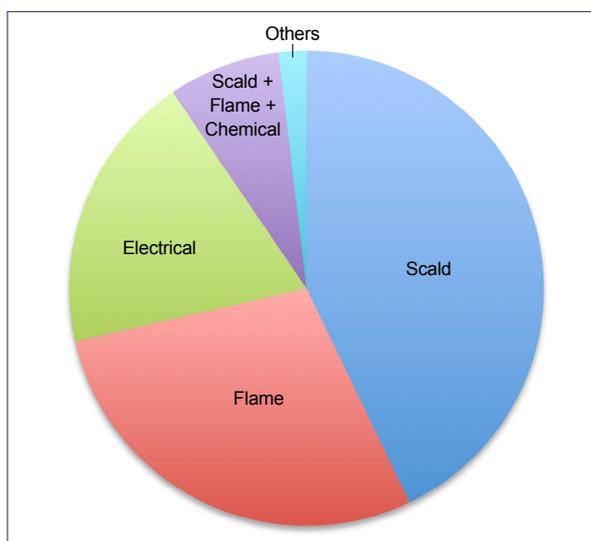
Figure 1. Distribution of burn cases according to age and gender.

Table 1. Distribution of the cases according to the total burned body surface area (%) and age groups (years)

Total body surface area burned (%)	Age groups							Total	
	0–10	11–20	21–30	31–40	41–50	51–60	61–70		71+
1–30	171	37	68	81	46	32	12	24	471
31–50	11	14	15	16	10	3	2	4	75
51–70	4	4	11	6	8	2	0	5	40
71–90	1	3	3	4	6	0	1	2	20
91+	1	0	2	0	0	1	0	0	4
Total	188	58	99	107	70	38	15	35	610

Table 2. The distribution of burn cases according to burned area

Burn area	n	%
Scalp	12	1.9
Extremity	243	38.9
Body	128	20.5
Face + Neck	114	18.3
Genital	31	5.0
Extremity + Body	30	4.8
Extremity + Body + Face	48	7.7
Extremity + Face	8	1.3
Extremity + Body + Genital Region	4	0.6
Extremity + Face + Neck	2	0.3
Extremity + Face	1	0.2
Extremity + Genital Region	3	0.5

**Figure 2.** Percentage distribution according to causes of burn cases.

(87.8%), electrical burns were most frequently observed at workplaces (71.1%). Flame burns were almost similar (50.0%) at the home and workplace. Besides scald burns with only due to tea and milk occurred with the rate of 92.6% at home. When assessing the place of occurrence

according to age group, 92.6% of the patients in the 0–10 age group, 86.7% of the patients aged 61–70 years, and 71.4% of the 71+ patients were reported to be exposed to burns at home. In addition, the place of burn was found to be workplaces for 62.5% of patients in 21–30 age group, 66.1% of patients in 31–40 age group, 46.4% of patients in 41–50 age group.

It was reported that 2 (0.3%) patients in burn centers had first-degree burns, 507 (82%) second-degree burns, and 108 (17.7%) third-degree burns. Inhalation burns were reported in 54 cases (8.9%), and comorbid multiple trauma was reported in 31 cases (5.0%) in this study. Abuse/intentional use was reported in 19 cases (3%) and suicide attempt was reported in 14 cases (2.3%).

DISCUSSION

Millions of people worldwide are affected by burns each year. Burn injuries may result in acute and chronic sequelae as well as death. Burn injuries are serious traumas that cause permanent damage, contracture, tissue loss, distracting scars on the skin, and psycho-social disorders in patients.^[10] Burn injury requires long-term rehabilitation and repetitive operations for the treatment of physical and psychological sequelae. Additionally, the treatment of burn patients causes great economic losses due to the requirement of a special intensive care environment and trained staff.^[11]

Our burn center is located in the Marmara region, which is the most densely populated and industrialized geographical region of Turkey. It is also one of the two burn centers in the region. There are seven burn centers throughout Turkey. In addition to being a reference center for the region, it accepts patients from all over Turkey. However, there is no published epidemiological research on this center yet. In our opinion, our data roughly reflect the etiology of the region and country related to burn injuries.

In our study, the incidence of burn injuries was found to be quite high in the 0–10 age group. Approximately 36% of the patients were under the age of 18. The lowest rate was obtained from the 61–70 age group. The most frequently affected age groups vary by country. Burn injuries are more prevalent among children in Angola, Scotland, and Jordan. Additionally, the highest incidence was obtained in Iran between the ages of 16–25 years and in India between

the ages of 20–49. Besides, 61.5% of burned patients are above the age of 40 in Spain.^[6,12–16]

Of the patients, 188 (29.8%) were female, 442 (70.2%) were male, and the female/male ratio was 1/2.3. Although no gender differences were obtained under 10 years and over 50 years of age, male exposure between the 11–50 was significantly higher. In our study, male prevalence results were similar to a burn center in the Southeastern Anatolia Region of Turkey and in Argentina, Thailand, Uruguay, Saudi Arabia.^[17–19] The incidence of burn injuries in females were reported to be higher in relation to social customs and traditions of countries such as India, Iran, Bangladesh in some studies.^[3,20] In our study, the rate of young and male patients may be higher in many business sectors, with more participation of young men in industrial jobs and exposure to flame and electrical burns.

Scald were observed in all age groups in this study; especially it was the most frequent burn cause in children age group. Scald burns with hot water were reported most frequently in the 0–10 age group (77.5%) and with hot tea-milk in the 0–10 age group (55.5%). This rate was consistent with the data of burn etiology obtained from the Southeastern Region of Turkey. Scald burns are constituted 76.5% of all burns in this region.^[21] The main source of scald was hot liquids such as hot water, tea and milk. The majority of burns in children are caused by inadequate adult supervision. Especially, the overlapping of two cups filled with hot water and traditional tea service is peculiar to Turkey.^[22] Using a kettle (electric water heater) and serving far from children may prevent scald burns instead of traditional practice. Children should not be allowed to play by the stove, and an elevated platform should be built to cook and keep the casseroles out of reach of children in the kitchen.^[7] Scald burns with hot milk usually occur when making cheese from milk in the countryside. Although traditional cheese-making is a barely practiced method, we think that the production process of cheese can reduce scald injuries due to milk.

Although scalding is the most common cause of burns in all age groups, in our study, as in developed countries, the causes of scalding are turning into fires and electrical burn injuries are due to aging.^[23,24]

In our study, fire and flame-induced burns were the second most common cause of burn injuries. Flame burns often occur as a result of the ignition of flammable liquids. It is necessary to prevent illegal sales of flammable liquids and increase occupational safety training in Turkey.

Nursal et al.^[25] have reported that approximately 25% of the total hospitalized burned patients (children and adults) were caused by electrical burns. In our study, electrical burns accounted for 18.4% of all burn injuries. Electrical burns were caused by the high-voltage power lines in the workplace and outdoors. In order to reduce electricity burns in Turkey, it is necessary to take safety measures in the industry, to provide the electricity infrastructure, and to urbanize regularly and safely.

The most frequently reported place of occurrence were houses, followed by the workplace in our study. When evaluated according to the causes of burns at the scene, scalding and thinner-induced flame burns were most frequently reported at homes, electrical burns were most frequently reported at workplaces, and flame burns were reported at a similar rate both at home and at work. These results were consistent with the findings of published data.^[6,26,27] Assessing the places of occurrence according to the age group; patients aged 0–20 years and patients over 60 years old had burns in their homes. In addition, the place of occurrence for the patients in the 20–60 age group was noted as a workplace. Generally, children and the elderly were exposed to scalding burns at home, while the young and middle-aged group were mostly in the workplace.

Han et al.^[28] defined burn injuries involving more than two body parts as multiple burns and reported the rate of multiple burns as 74%. The majority of burned body parts were isolated in our cases. The most frequent burned body parts were extremities (38.9%) and (20.5%) trunk. The burnt body parts were reported as 30.8% head, 52.8% trunk, 44.4% upper extremities, 59.9% lower extremities, and 7.9% perineum in a study conducted in Ankara (Turkey).^[29] Similarly, Hudson et al.^[30] obtained the rate of head burns as 27%, body and upper extremities 50%, lower extremities, and perineum 23% in South Africa. In another study, Li and Liu have found the rates of head-neck burns to be 33%, trunk 41%, upper extremities 55%, lower extremities 70% and perineum 8% in China.^[31] In our opinion, the differences in the localization of burns were related to the individual's lifestyle, traditions, measures of protection, country's economic development, and industrial development.

The average percentage of the TBSA burn was found to be 23.3% in our study. 77.2% of the patients were reported to have a total burnt body surface area of less than 30%. This rate was lower than the studies originating from Iran.^[3,5,32] An association between the injury types and TBSA % was found in our study. Patients affected with flame and explosion had a higher average TBSA than patients with scalding burns.

Skin burns and inhalation injuries occur in the case of fire by inhaling toxic smokes, vapors and volatile chemicals. The presence of inhalation injury generally causes pulmonary complications and results in respiratory impairment.^[33,34] Inhalation burns were reported in 54 cases (8.9%) in our study, and the majority of patients with inhalation injury were supported by mechanical ventilators in the intensive care unit.

30.4% of our patients were treated successfully with conservative treatment. Surgical intervention was performed in 69.2% of the patients. The most frequent surgical intervention was debridement followed by eschar excision, fasciotomy, escharotomy, and amputation.

In our study, comorbid multiple trauma was reported in 31 cases (5.0%). Multi-trauma patients were usually observed

in scalding and flame burns, which were commonly caused by explosions in the workplace.

We believe that to prevent burn injuries, measures should be taken regarding the burn epidemiology and burn-related factors should be further improved within the existing prevention procedure in Turkey. For this purpose; traditional hot tea serving, cooking and boiling water should not be done close to children and children should not be allowed to play around stove, and parents should be made aware of these risk factors to prevent scalding burns in children.

In rural areas, completely substituting the traditional cheese-making method into a manufacturing process may decrease the scalding injuries from hot milk in adults. Moreover, solar energy systems should take place instead of fire and flame-based hot water supply for personal cleaning, and those living in rural areas should be supported in this regard.

Illegal sale of flammable liquids should be prohibited to prevent flame burn injuries due to the ignition of flammable liquids in Turkey. An occupational health and safety training program with a supervision procedure can provide permanent benefits for both employers and employees in the prevention of burns caused by electricity and flammable liquids in the Turkish industry. Moreover, in order to reduce non-industrial electricity burns in Turkey, it is necessary to prevent illegal electricity use, provide electricity infrastructure, and ensure regular and safe urbanization.

CONCLUSION

Burn injuries are traumas that have serious physical and psychological consequences in both acute and chronic periods. Although considerable progress has been made in burn therapy, it seems more efficient and cheaper to focus on preventing burns and raising awareness of individuals, so that material and moral losses will be reduced obviously. Consequently, further researches with larger study groups should be performed to obtain more reliable results.

Ethics Committee Approval

This study approved by the Kocaeli University Faculty of Medicine Clinical Research Ethics Committee (Date: 22.02.2014, Decision No: 3/1).

Informed Consent

Retrospective study.

Peer-review

Internally peer-reviewed.

Authorship Contributions

Concept: O.E., A.Ç., M.C.H.; Design: O.E., M.G., A.Y., H.T.T., Ç.T., M.B.Y., M.C.H., A.Ç.; Supervision: O.E., M.G., M.B.Y.; Fundings: O.E., M.G., A.Y., H.T.T., Ç.T., M.B.Y., M.C.H., A.Ç.; Materials: O.E., M.B.Y., A.Y.; Data: O.E., M.G., A.Y., H.T.T., Ç.T., M.B.Y., M.C.H., A.Ç.; Analysis: O.E., H.K.E.; Literature search: O.E., H.K.E., M.G.; Writing: O.E., H.K.E., A.Y.; Critical revision: O.E., M.B.Y.

Conflict of Interest

None declared.

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Yanık Merkezindeki Yanık Yaralanmalarının Epidemiyolojisi

Amaç: Bu çalışmanın amacı, Türkiye'nin en yoğun nüfuslu ve sanayileşmiş coğrafi bölgesi olan Marmara bölgesinde yer alan bir yanık merkezinde takip edilen yanık hastalarının demografik özelliklerini, etiyojisini, bulgularını ve yanık ile ilişkili faktörleri değerlendirerek yanık epidemiyolojisini belirlemektir.

Gereç ve Yöntem: Yanık tedavi merkezinde takip edilen 630 hastanın tıbbi kayıtları incelendi. Hastaların demografik özellikleri, yanık etiyojisi, yanık toplam vücut yüzey alanı yüzdesi, yanık derecesi, yanık yeri, yanık ajanı, yanık yeri vb. ile ilgili veriler değerlendirildi.

Bulgular: Yatarak tedavi gören 630 hastanın ortalama yaşı 27.5±2.18 yıl idi. Hastaların %29.8'i kadın, %70.2'si erkekti. En sık görülen yanık nedenleri sırasıyla; haşlanma (sıcak su, çay, süt) (%37.2), alev (%31.9), elektrik (%18.4) ve haşlanma + alev + kimyasal (%11.7) idi. Hastalarda ortalama yanık alanı yüzdesi %23.3 olarak bulundu. Elli dört olguda (%8.9) inhalasyon yanığı ve 31 olguda eşlik eden çoklu travma tespit edildi.

Sonuç: Yanık, ciddi fiziksel ve psikolojik sonuçları olan bir travmadır. Yanık tedavisinde önemli ilerlemeler kaydedilmesine rağmen, yanık oluşumunun önlenmesi ve bireylerin bilinçlendirilmesine odaklanmak daha etkili ve daha verimli görünmektedir.

Anahtar Sözcükler: Türkiye; yanık epidemiyolojisi; yanık merkezi.