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Epidemiology of pediatric burn injuries in Istanbul, Turkey

İstanbul'daki pediatrik yanıklı hastaların epidemiyolojisi

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BACKGROUND
Many burns that occur in the first two decades of life are accidental and preventable. The aim of this study was to determine the demographic features, mortality, and other factors associated with pediatric burns in Istanbul, Turkey.

METHODS
Our retrospective study included 375 hospitalized pediatric patients (225 male, 150 female; mean age 4.07±3.79; range 0.2 to 16 years) aged 16 years or less admitted between January 2005 and January 2009. Each child's medical record was reviewed and demographic features, mechanism of burn, place of residence, total body surface area (TBSA), surgical treatment, duration of hospital stay and mortality rates were analyzed.

RESULTS
Scalding was the predominant cause among all pediatric age groups. There were no differences between the age groups with respect to mean TBSA. Length of hospital stay in infants and toddler age group was significantly lower than in other age groups ($p<0.005$). Sixteen (4.3%) patients died during the study period. Mortality rates associated with scalding, flame and electrical burns were 3.1%, 13.9% and 10%, respectively. Electrical burns and flame resulted in significantly higher mortality rates than scalding ($p<0.05$).

CONCLUSION
Scalding was found to be the most important cause of burns and flame-related mechanisms resulted in the highest mortality rate among children. Only a specific preventive program for changing the traditional habits of Turkish parents would reduce burn injuries among children.

Key Words: Burn; children; epidemiology of pediatric burn.

AMAÇ
Yaşamın ilk yirmi yılında meydana gelen yanıklar önlenebilir kazalardır. Bu çalışmada İstanbul'daki pediatrik yanıklarda demografik özellikler ve mortalite oranlarının değerlendirilmesi amaçlandı.

GEREÇ VE YÖNTEM
Ocak 2005 - Ocak 2009 tarihleri arasında 16 yaş ve altı hastaneye yatırılan 375 pediatrik yanıklı hasta (225 erkek, 150 kız; ort. yaş 4,07±3,79; dağılım 0.2-16 yaş) geriye dönük incelenmek üzere çalışmaya alındı. Her hastanın tıbbi kayıtları incelenerek, demografik özellikler, yanık mekanizması, hastanın yaşadığı bölge, tüm vücut yanık yüzdesi (TVYY), cerrahi tedavi, hastane yatış süresi ve mortalite oranları değerlendirildi.

BULGULAR
Tüm pediatrik yaş gruplarında haşlanma en sık yanık nedeni idi. Ortalama TVYY ve yaş grupları arasında anlamlı bir fark bulunmadı. Yenidoğan ve yürümeye başlayan çocuk yaş grubunda hastanede kalış süresi diğer yaş gruplarına göre anlamlı olarak düşüktü ($p<0,005$). Onaltı (%4,3) hasta çalışma dönemi sırasında öldü. Mortalite oranları sırasıyla haşlanma, alev ve elektrik yanıklarında %3,1, %13,9 ve %10 idi. Mortalite oranı elektrik ve alev yanıklarında, haşlanma yanıklarına göre istatistiksel olarak anlamlı derecede daha fazla olduğu görüldü ($p<0,05$).

SONUÇ
Haşlanma önlenebilir yanık kazların ensık nedeni ve alev yanığı da en fazla mortalite nedenidir. Türk ailelerde, sadece geleneksel alışkanlıkları değiştirecek eğitici programların ortaya konması, pediatrik yaş grubunda çoğu yanık kazaları önleyebilir.

Anahtar Sözcükler: Çocuklar; yanıklar; yanık epidemiolojisi.

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Many burns that occur in the first two decades of life are accidental and preventable. However, severe burn is a leading cause of morbidity and mortality in children, and burns are the major cause of injury-related death in this group.[1] Epidemiological data on burns provides information useful in designing strategies to reduce the frequency of injuries and establishing effective methods for burn management. Programs for aimed at reducing domestic accidents could prevent many of the deaths caused by burns among children.[2]

The aim of this study was to provide more information regarding burn trauma in children and to determine the factors and demographic features and mortality associated with pediatric burns in Istanbul, Turkey.

MATERIALS AND METHODS

This study was carried out at the Department of Plastic, Reconstructive and Aesthetic Surgery and Burn Unit, Cerrahpaşa Medical School, Istanbul University, Istanbul, Turkey. Our retrospective study included all children aged 16 years or less admitted between January 2005 and January 2009. In this period, a total of 1590 burn patients attended the outpatient burn clinic, including 975 children of whom 375 were hospitalized. All hospitalized pediatric patients were categorized into three groups: infants and toddlers (0-2 years of age), early childhood (3-6 years of age), and late childhood (7-16 years of age).

Each child's medical record was reviewed and demographic features, mechanism of burn, place of residence, total body surface area (TBSA), surgical treatment, duration of hospital stay and mortality rates were analyzed.

All data were presented as mean (±) standard deviations (SD). Parametric tests were performed for data analysis. A one-way ANOVA test was performed and post-hoc multiple comparisons were done with least significant difference (Tukey). These differences were considered significant when probability was less than 0.05.

RESULTS

In this period, a total of 1590 burn patients presented to the burn clinic, including 975 (61.3%) of these were children. 375 children were admitted as inpatients. 225 (60%) male and 150 (40%) female pediatric patients were hospitalized. The mean (range) age of the patients was 4.07±3.79 (range, 0.2-16) years. The mean age of the patients with scalds was significantly lower than the age of patients with flame or electrical injury (p=0.000).

The mechanisms of burn injuries were 85.6% (321 cases) scalding, 9.6% (36) flame, 2.66% (10) electric current, 1.88% (7) contact and 0.26% (1) chemical compound (Table 1). Scalding predominated in infancy. Scalding was the predominant cause among all pediatric age groups. However, the proportion of scalds decreased from 96.1% in the 0-2 years age group to 50% in the 7-16 years age group. In addition, the ratio of flame and electrical burns increased from 1.1% and 0% in the 0-2 years age group to 36.3% and 13.6% in the late childhood group, respectively.

As noted, 342 (91.2%) of the 375 inpatient subjects were from urban environments while 33 (8.8%) lived in rural areas.

The mean TBSA burned was 14.1%±10.4 (range 1-86%). There were no differences between the age groups with respect to mean TBSA. However, in flame injuries the mean TBSA was found significantly higher than among scalding injuries (p<0.05) and similar to electrical burns (Table 2). Length of hospital stay was 19.6±12.5 (range 1-117) days. Length of hospital stay in infants and toddler age group was significantly lower than among other age groups (p<0.005).

Table 1. The distribution of patients according to ages

	Ages 0-2 (n=183)		Ages 3-6 (n=126)		Ages 7-16 (n=66)	
	n (%)	Mean±SD	n (%)	Mean±SD	n (%)	Mean±SD
Scald	176 (96.2)		112 (88.9)		33 (50.0)	
Flame	2 (1.1)		10 (7.9)		24 (36.4)	
Electric	–		1 (0.8)		9 (13.6)	
Contact	4 (2.2)		3 (2.4)		–	
Chemical	1 (0.5)		–		–	
TBSA (%)		13.96±9.8		14.38±9.6		15.6±12.9
Operations (n)		0.74±1.26		0.97±1.3		1.04±1.03
Days in hospital		16.8±9.3*		22.09±14.5		22.7±14
Mortality	7 (3.9)		4 (3.3)		5 (7.6)	

TBSA: Total body surface area; * Indicates p<0.01 for 0-2 ages *vs.* 3-6 ages and p<0.01 for 0-2 ages *vs.* 7-16 ages.

Table 2. The distribution of patients according to burn type

	Scalds (n=321) Mean±SD	Flame (n=36) Mean±SD	Electric (n=10) Mean±SD
Age	3.28±2.92[a]	8.91±4.68	11.9±3.5
TBSA (%)	13.52±8.9[b]	21.41±17.29	17.6±12.98
Operations (n)	0.74±1.16[c]	1.8±1.68	1.8±1.75
Days in hospital	18.83±11.6	24.5±15.6	29.7±20.5
Mortality n (%)	10 (3.1)[d]	5 (13.9)	1 (10)

TBSA: Total body surface area. a: Indicates p<0.001 scald *vs.* flame and scald *vs.* electric; b: Indicates p<0.05 scald *vs.* flame; c: Indicates p<0.01 scald *vs.* flame; d: Indicates p<0.05 scald *vs.* flame and scald *vs.* electric.

Conservative treatment was successful in 216 (57.6%) of cases. A total of 325 surgical interventions were carried out for 159 (42.4%) children, including 202 debridement and grafting procedures, 104 grafts later in the hospital stay, 3 amputations and 16 other procedures involving for example, escharotomies, fasciotomies or flaps. The number of surgical interventions per patient was 0.74±1.16 for scalds, 1.8±1.68 for flame burns and 1.8±1.75 for electrical burns. Although patients with flame and electrical burn required more operations than scalding patients, only patients with flame-related burns required significantly more surgical intervention than scalding patients (p<0.05). There were no statistically significant differences between age groups in mean surgical intervention number (p=0.130).

Sixteen (4.3%) patients died during the study period. There were no differences between the age groups with respect to mortality rates. Ratios of these patients according to age groups were 3.8%, 3.2% and 7.6% for infants and toddlers, early childhood, and late childhood, respectively. Mortality rates associated with scalding, flame and electrical burns were 3.1%, 13.9% and 10%, respectively. Thus electrical burns and flame burns resulted in significantly higher mortality rates than scalding injuries (p<0.05).

DISCUSSION

Istanbul is the biggest city in Turkey, with a greater population (more than 11 million people) than most European cities and countries. Until 2008, our burn unit was the only referral center in Istanbul. Therefore the patients presenting to this unit are generally from almost all regions of Turkey, at the crossroads between Asia and Europe. Thus, we believe that our data roughly reflect the national situation as regards burn injuries.

In this study, scalding was the predominant cause of burn injury among all pediatric age groups, similar to previous reports from our country and elsewhere.[3-7] In our study, the mean age at the time of scalding was 3.2 years and scalding accounted for 85.6% of our pediatric inpatient group. The main source of scalding is hot liquid, especially the hot water used for making tea, a traditional practice in our country.[7] Specific to Turkey is the use of two containers with narrow bases on top of each other to make tea.[4,7] This practice is inherently unstable, and kettles have been advocated instead for increased stability. Children should not be allowed to play near fireplaces, and an elevated platform should be constructed for cooking and keeping hot pots out of reach of children in the kitchen. We believe that an effective and preventive program for the education of parents would prevent many of the scalding injuries occurring among children in our country.

Children become more prone to flame and electrical burns at older ages through industrial work, in some sectors, or playing games outdoors. Even though scalding was the predominant cause of burns in all age groups, a clear shift from scalding to flame and electrical burns with increasing age was found in our data set. This has been observed similarly in developed countries.[6,8,9]

Flame burn was the second most common cause of burn injuries. Childhood flame burns usually occurred outdoors, often as a result of the ignition of flammable liquids. In Turkey, public education to prevent the illegal sale of these products to children is required.

Electrical burn injury is a major problem. Electrical burn injury accounts for approximately 25% of all hospitalized burn patients (both adults and children) in Turkey.[10] Electrical burns accounted for 2.4% of our inpatient group of children. Most electrical injuries in our study group occurred outdoors through contact with overhead high-voltage lines, in contrast to the international literature, in which most injuries occur in domestic environments.[11] In Turkey, due to both a rapid urbanization trend since the 1950s and differences between geographic regions, population and investments have accumulated in certain regions, while disordered and unhealthy urban areas have expanded in others. Most of the patients in our study live in these unreliable urban areas called “gecekondu”.

The "gecekondu" is officially defined as a dwelling unit on land not owned by or rented to the occupant, usually built near high voltage lines without obtaining approval of the landowner and built in a way that is not approved by the general legal provisions for building and construction. Therefore to decrease the incidence of high voltage electrical burns among children in Turkey, major legislative changes are required in order to establish a more comprehensive and rational basis for the implementation of urban regeneration, rehabilitation and transformation projects.

Our data also showed, that flame and electrical burns required longer hospital stays, more surgery and increased incidence of permanent complications potentially necessitating lifelong physical and psychological rehabilitation and support, in agreement with previous studies.[9,10]

In our series, conservative treatment succeeded in 57.6% of the inpatient children. A total of 325 operations were carried out, involving 42.4% (159) of cases. Electrical and flame burns led to significantly more surgical interventions in comparison to scalds ($p<0.05$). Our results and those of others suggest electrical and flame burns cause significantly more histopathological damage which, in turn, leads to additional surgical interventions.[8,9]

In our study, all the major amputations were carried out among children injured by electricity, among whom the amputation rate was 30%. Yowler et al.[12] reported that upper extremities were affected with high frequency among 51 victims of high-voltage electrical injury, similar to our results. As inaccurate diagnosis and delay in escharotomy or fasciotomy will lead to amputation, electrical and flame burns should be transferred promptly to an experienced centre where appropriate management is possible.[12]

In this study, the total mortality rate was 4.3%, which could be expected.[13,14] Although electrical burn was associated with higher amputation rates and more operative interventions, flame burns had the highest associated mortality (13.9%).[7,10] In our investigation, a larger proportion of the total body surface area was affected among flame burn victims and consequently these individuals were more prone to mortal complications such as burn shock, acute renal failure and sepsis.

In conclusion, burns, as one of the most devastating injuries in children, require more consideration than that given to other types of trauma. In our study, scalding was found to be the most important cause of burns and flame-related burns had the highest mortality rate in children. In our opinion, only a specific preventive program for changing the traditional habits of Turkish parents would decrease burn injuries among children.

Conflict-of-interest issues regarding the authorship or article: None declared.

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