

Clinical outcome of pediatric hand burns and evaluation of neglect as a leading cause: A retrospective study

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ABSTRACT

BACKGROUND: Majority of the pediatric burns happen when an adult is nearby the child. This suggests the role of adult carelessness or neglect as a cause of burns. The aim of this study is to provide clinical data on pediatric hand burns and to draw attention to the role of neglect in pediatric burn injuries.

METHODS: Children admitted to a tertiary burn center between September 2017 and October 2018 were included in the study. Epidemiological data including age, sex, etiology and place of injury, presence of caregiver nearby, physical signs of neglect or abuse, clinical outcomes including burned total body surface area, length of admittance, and complications were recorded.

RESULTS: A total of 335 pediatric burns were admitted to the burn center. Among them 89 patients with hand involvement were included in the study. Most of the patients were under the age of 6 (79.8%) and 88.8% of the burn accidents occurred indoors. Scalding was the main mechanism for hand burns. There was an adult nearby in 71.9% of the patients. Among patients with hand involvement, 19 (21.35%) were considered as neglect. All the neglect cases were under the age of 6.

CONCLUSION: Pediatric burn accidents occurred mainly at home, mostly with an adult around. Habits of drinking hot beverages, dangerous cooking practices and lack of awareness are some important issues leading to burn accident. Neglect is found in 21.35% of hand burns as the etiology. In addition to general preventive measures special attention should be paid to the signs of neglect in the evaluation of patients. These burns should also be reported to official services, as they may reflect inadequate supervision or neglect by the caregiver.

Keywords: Accident; hand; neglect; pediatric burns.

INTRODUCTION

Burn injury can lead to significant morbidity and mortality, including both physical and psychological sequelae, associated with considerable health-economic impact. In European hospitals, children are reported to account for nearly half of all burns and scalds.^[1] Almost 25% of all patients hospitalized due to thermal injuries are children between 0 and 4 years.^[2] The upper extremity or hand is involved in at least 80% of patients admitted to burn centers. The American Burn Association classifies hand burn as a major injury, emphasizing the specialized care these patients need. Special considerations are required in the diagnosis, treatment, and management of pediatric upper extremity and hand burns.^[3]

The hand is important for our ability to evaluate the environment and protect ourselves from injury. Hand burns are particularly common in the pediatric population, as children explore their surroundings frequently by touching and feeling. When motor skill development outpaces cognitive development, disaster may result.^[4] Hand burns in the pediatric population differ in terms of etiology. Dorsal hand burns are frequently scald injuries from hot liquids, whereas burns to the palm usually result from direct contact with a hot surface such as a radiator or iron.^[5]

Although burn injury generally results from an accident, in 6–20% of the cases there may be neglect. Neglect is the failure of a parent or caregiver to provide the resources nec-

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essary for the child to grow and thrive. During childhood detection of neglect is quite difficult. As the patient is not fully able to explain himself, the event is easily misdiagnosed as an accident. Physical abuse is harm or threatened harm to the health or welfare of a child through non-accidental physical injury.^[4,6,7] The possibility of abuse for every injured child should be kept in mind. Abused children are, on average, between 2 and 4 years of age, more commonly are boys and come from low-socioeconomic households of two or more children, with most often the abused child being the youngest.^[4,8,9]

Pediatric hand burn is considered as a major injury and admittance to a burn ward is recommended.^[10,11] Although circumferential burns are common because of the anatomical structure of wrist and hands, well-demarcated circumferential burns involving the entire hand may be a sign of forced hand submersion into hot liquid and thereby raise suspicion of child abuse.^[12,13]

Majority of the childhood burns happen when an adult is nearby and in most cases, carelessness or neglect of the adult is the suspected cause of burn. The aim of this study was to provide data on pediatric hand burns and draw attention on neglect.

MATERIALS AND METHODS

Children up to 17 years old admitted to our tertiary burn center between September 2017 and October 2018 were included in the study. Epidemiological data including age and sex, place of injury, presence of an adult nearby, the etiology of burns, depth of injury, burned total body surface area (TBSA), length of hospital stay, and treatment outcomes were evaluated retrospectively from the medical records and the burn treatment registry. The case is considered as “neglect” or “abuse” according to the records concerning history and physical findings as follows: (1) Delay in admittance to a health care specialist, discrepancy between the medical history and physical findings, (2) different lesions at various healing stages or at unusual localizations like the tongue, pubic area or lips, (3) hostile behaviors of the parents and abnormal relationship between the child and the parents, (4) the insensitive response of the child to painful stimulus, (5) any attempts to hide lesion, and (6) presence of cigarette burns, ecchymosis or unusual scars.^[4,8–10,14]

Statistical Analysis

Statistical Package for the Social Sciences 20.0 for Windows was used for the analysis of the data. Normality tests were used to check distribution of the variables. Since the data were not distributed normally, Kruskal–Wallis test was used for analysis of continuous variables. Chi-square test was used for analysis of categorical variables. The results were expressed as mean±SD and median (IQR), n and percent (%).

The values of $p < 0.05$ were considered as statistically significant.

This study was approved by the local Clinical Research Ethical Committee of our Hospital (Decision no: 2018/362).

RESULTS

A total of 335 pediatric burn injury patients were admitted to our burn center during the study period. Among them 89 (26.57%) patients with hand involvement were included in the study. The median age of our patients was 2.5 years. Males ($n=52$) were injured more than females ($n=37$). On admittance, right hand was burned in 36 patients, left hand in 29, and both hands in 24.

The demographic and clinical data were analyzed according to three age groups: Infants and toddlers (0–2 years) (Group 1), early childhood (3–6 years) (Group 2), and late childhood (7–17 years) (Group 3). A total of five patients had comorbid diseases. Among them, three were in Group 1 (2 epilepsy and 1 cerebral palsy patient), one in Group 2, and one in Group 3 (both were asthma patients). Educational status of the parents is given in Table 1. No statistically significant difference was detected between groups considering educational status of the parents regarding age groups (Table 1).

The etiology of pediatric hand burns is given in Figure 1. As seen in the figure, 75% of the burns ($n=67$) were scalds, among them water being the most common reason. For further analysis, the etiology was categorized into four main groups: scalding (water, tea/coffee, soup/food, milk, and frying oil), flame, electric, and contact burns. The mean age of the patients was significantly different according to the etiology groups ($p=0.000$). In Groups 1 and 2, scalding was the predominant cause (88.4% and 85.7%, respectively) whereas in Group 3 flame burns (38.9%) was more common than scalding and electric burns (27.8% each). The TBSA of three age groups were significantly different ($p < 0.001$). The length of hospital stay was also significantly different between the

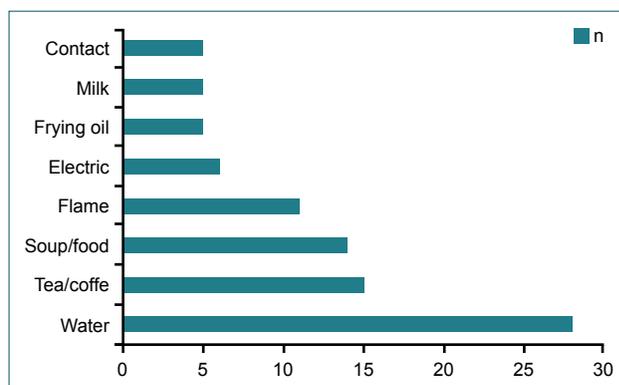


Figure 1. The etiology of pediatric hand burns. 75% of the burns ($n=67$) were scalds (water, tea/coffee, soup/food, milk, and frying oil), among them water being the most common reason ($n=28$).

Table 1. Demographic and clinical variables of the patients according to age groups

	0–2 years (n=43)	3–6 years (n=28)	7–17 years (n=18)	p-value
Gender (male/female)	26/17	13/15	13/5	0.208
Comorbidity (yes/no)	3/40	1/27	1/17	
Parental education status (mother/father)				
Illiterate/Literate	12/7	8/7	4/1	0.771/0.689
Primary	11/14	12/9	7/7	
Secondary	15/10	6/7	5/6	
High school/University	5/12	2/5	2/4	
Burned Total Body Surface Area (%)	7.77±7.3	12.61±15.9	21.22±15.2	0.003
	5.0 (9)	7.0 (7)	20.5 (33)	
Hospital Stay (day)	9.63±6.8	12.36±12.2	27.67±23.1	0.004
	8.0 (8)	9.0 (7)	20.5 (31)	
Complications				
Contracture only	4	2	1	
Hypertrophic scar only	6	4	2	
Contracture and hypertrophic scar	5	3	1	
Contracture and hypertrophic scar and amputation	0	0	1	

Table 2. Comparison of demographic and clinical variables of the patients according to burn etiology

	Scalding n=67 (75.3%)	Flame n=11 (12.4%)	Electric n=6 (6.7%)	Contact n=5 (5.6%)	p-value
Gender (male/female)	36/31	8/3	5/1	3/2	0.381
Age (years)	2.79±2.27	9.50±5.49	12.08±4.71	1.90±0.22	0.000
	2.0 (1.0)	7.0 (10.0)	12.75 (7.8)	2.0 (0.3)	
Burned Total Body Surface Area (%)	11.09±12.23	20.18±15.48	15.00±18.72	2.8±0.84	0.012
	7.0 (9)	16.0 (34)	4.5 (37)	3.0 (2)	
Hospital stay (day)	10.45±7.81	33.73±26.78	22.83±19.63	10.00±11.00	0.025
	8.0 (7)	36.0 (51)	21.5 (38)	5.0 (17)	

three age groups ($p < 0.001$) (Table 1). TBSA was higher in flame and electric burns, whereas lower in contact burns ($p = 0.012$). Hospital stay was longest in flame burns and the difference between groups according to the burn etiology was also statistically significant ($p = 0.025$) (Table 2).

Most of the burn incident occurred indoors (85.4%). Almost all of the burns in Groups 1 and 2 were indoor burns. In Group 2, only one patient was burned outdoors. In Group 3, 12 patients were injured outdoors. Electric burns in this group mainly took place at the roof of the houses (one low voltage case occurred indoors, three high voltage, and a flash injury case took place on the roof). The diagnosis of neglect was based on medical history and physical examination. There were 19 neglect cases (21.35%) among our patients

and all of them were under 6 years of age. No abuse was detected among the patients (Table 3).

Most of the hand burns were second-degree (84.3%) and the remaining were third-degree (15.7%). Fasciotomy was performed in circumferential hand burns involving the wrist ($n = 5$). The incision began from the dorsal side of the hand and extended to the forearm. Escharotomy was performed in six patients. Proper debridement and wound dressing regarding the anatomical position was applied to all patients during hospitalization. No wound infection was detected. A full or split-thickness skin grafting was needed in patients who underwent fasciotomy or escharotomy. One patient with second-degree burn needed additional grafting. Flap was not required in any of our cases. Twenty-nine patients

Table 3. The distribution of burn place, accompanying care provider, and neglect according to age groups

	0–2 years n=43	3–6 years n=28	7–17 years n=18
Burn place			
Indoors	43	27	6
Outdoors	0	1	12
Accompanying care provider			
An adult nearby	40	19	5
Alone	3	9	13
Neglect cases n (%) [*]	13 (30.23)	6 (21.43)	0 (0)

*Percentage of neglect is calculated as cases per number of patients in each age group. Neglect cases are diagnosed by positive history, physical findings, behavioral observation of parents and/or repeat cases.

healed with sequelae (32.6%) including 17 contractures, 22 hypertrophic scars, and one amputation. Nineteen patients had either contractures or hypertrophic scars, whereas nine patients had both. One patient with flame burn underwent amputation of three fingers also developed contracture and hypertrophic scar.

DISCUSSION

Burns are among significant cause of morbidity and mortality in children. Most burns are minor and can be managed as outpatient.^[15] Hand burns have great impact on long-term functional outcome and quality of life. Optimal treatment of hand burns should focus on the prevention of contractures.^[16]

In the current study, 335 inpatient pediatric burn cases were evaluated, among them 89 had burns involving hands (26.6%). D'Souza et al.^[17] reported that among pediatric burn patients treated in emergency departments, 36% of the injured body parts were the hands/fingers. Extremity injuries were commonly treated in the outpatient settings and this may be an explanation of the higher percentage compared to our study.

Scalds and flame burns were the most common type among pediatric hand burn patients, admitted to our burn center. The common sources of hot water in our study were two-piece teapots in the kitchen, hot water in the bathtub and solar water heating systems. Habit of drinking hot beverages also contributes to scalds. Scalds consisted 75.3% of our hand burn patients. Battle et al.^[1] declared that, scalds and contact burns were the most common reported thermal injury in children aged <16 years (median age 2 years). The median age of our patient group was 2.5 years. The results of numerous studies in the literature and our study confirm that most pediatric burns occur at ages 1–3, commonly caused by hot liquids and indoors.^[1,11,18]

The etiology of burn injury differs during late childhood. Only 27.8% of cases were scald burns over 6 years of age. Solar heating systems constructed on the flat roof could present as a burn etiology for children over 6 years of age as they enjoy playing around these systems. We had three such cases among our patients. There are similar results in the literature supporting our findings.^[11,18,19]

Considering all anatomic locations, Birchenough et al.^[3] stated that scalds and contact burns, account for the largest percentage of accidental pediatric burns in children up to 10 years old. However, they found that flame burns (47%), predominate over scald (22%), and contact burns (20%) assessing young children with hand burn involvement. Due to traditional unsafe habit of cooking and dining on the floor, scalds were dominantly the most common cause among all age groups in our study. Flame burns, on the other hand, were the predominant leading etiology over 6 years of age.

The initial evaluation of hand burn injury is extremely important and determines the future course of therapy. Main points in this respect are the mechanism of the injury, the type of the causative agent, the temperature and duration of contact, and verification of the presence of adequate perfusion of the burned hand.^[20] As a consequence of wrist and hand anatomy, circumferential burns are common. Fasciotomy or escharotomy is often needed in circumferential burns and we performed these procedures in eleven patients. Despite all our efforts, 29 of our patients healed with sequelae (32.6%). Our complication rate was similar to those in the literature.^[21,22]

Recently, there is a growing interest around non-accidental burn etiology in pediatric patients. Distinguishing a non-accidental burn from an accidental one may be quite complicated. In a recent systematic review, it is reported that the estimated incidence of non-accidental burns vary between 1% and 25% in children, but available data regarding burns as a result of neglect is scarce.^[13]

Andronicus et al.^[14] classified 9% of burned TBSA as an evidence of accidental burns, whereas those reaching as high as 16% may be due to abuse/neglect. Therefore, they suggested that a TBSA score more than 10% would be more likely to reflect abuse/neglect. Percentage of neglect was highest in our 0–2 year old patient group, reflecting a burned TBSA score lower than 10% (7.77±7.3, median 5.0). Therefore, our results may support the probability of neglect, with much lower burned TBSA percentages. Neglect and/or abuse are often difficult to diagnose, even by experienced health care professionals. In our study, we evaluated neglect according to positive history, physical findings, and behavioral observation of parents and/or presence of repeat cases. Neglect has been shown in some cases to be a precursor to abuse.^[8] As the patient is not fully able to explain himself, the case is easily misdiagnosed as an accident. The localization and the characteristics of the burn injury will help us to differentiate accident from neglect as an

etiology. The presence of a healed scar or repeat case may be an evidence of neglect or abuse. In our study there were three repeat cases among 0–2 years old group. These cases were regarded as neglect after thorough history and physical examination. When an evidence of neglect is determined, the responsibilities of the health-care providers increase. In such cases judicial procedures are required.^[6] Furthermore, Aliustaoglu et al.^[23] suggested that evaluation of all burn cases in children should be approached as a case of neglect or abuse in clinical forensic practice. Yasti et al.^[24] conducted a study to emphasize underdiagnosed neglect cases considered as accident among burn patients. The clinical forensic scientist claimed that one-third of cases diagnosed as “accidental” by the clinician was instead a “neglected” case in their study. There were nineteen cases of neglect (21.35%) among our patients under 6 years of age and no abuse was detected. Among five cases with comorbid diseases, two in Group 1 and one in Group 2 were considered as neglect. Lower maternal age may be related to neglect, but none of the mothers were under the age 18 in our study group. The parental educational status of the children with neglect was not statistically different from the remaining.

Pediatric burns often take place indoors.^[11,19,21,25] In accordance, 85.4% of our patients were burned indoors and in 71.9% of cases there was an accompanying care provider. Obligation to protect children and ensuring their safety is the primary responsibility of every social community. Therefore, we made notification to legal offices in all patients <6 years of age, whether it was an accident or not. We believe, this may aid the parents to understand the importance of care they provide for their children and avoid such incidences.

Conclusions

Neglect is found in 21.35% of our burn patients with hand involvement and is more common among patients under 6 years of age. Our results suggest that possibility of neglect cannot be ruled out in burns with lower TBSA. Distinguishing accidental burns from neglect is important for prevention of future injuries. Therefore, we recommend a thorough history, a detailed clinical examination and a broader consideration of social and historical background. We recommend hospitalization regardless of burn size, in case of possible neglect or abuse. Support from social services and education programs focusing on primary prevention, addressing family members are required in these patients.

Ethics Committee Approval: This study was approved by the Adana City Training and Research Hospital Clinical Research Ethics Committee (Approval number: 2018/362, date: 19.12.2018).

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Conflict of Interest: None declared.

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ORİJİNAL ÇALIŞMA - ÖZ

Pedriatrik el yanıklarının klinik sonuçları ve başlıca neden olarak çocuk ihmalinin değerlendirilmesi: Geriye dönük bir çalışma

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AMAÇ: Çocuk yanıklarının çoğu yakınında bir yetişkin varken meydana gelmektedir. Bu durum yanık nedeni olarak yetişkin dikkatsizliği veya ihmalinin rolünü düşündürmektedir. Bu çalışmanın amacı pediatrik el yanıkları hakkında klinik veriler sağlamak ve çocuklarda yanık yaralanmalarında ihmalin rolüne dikkat çekmektir.

GEREÇ VE YÖNTEM: Çalışmaya Eylül 2017–Ekim 2018 tarihleri arasında üçüncü basamak yanık merkezinde yatarak tedavi edilen çocuklar dahil edildi. Yaş, cinsiyet, yanık etiolojisi, olay yeri, yakınlardaki erişkin varlığı, fiziksel istismar veya ihmal varlığı, yanık toplam vücut yüzey alanı, yatış süresi ve komplikasyonlar kaydedildi.

BULGULAR: Yanık merkezinde yatarak tedavi edilen 335 pediatrik yanık hastası arasında el yanığı olan 89 hasta çalışmaya alındı. Hastaların %79.8'i 6 yaş altındaydı. Yanık kazalarının %88.8'i iç mekanlarda meydana gelmişti. El yanıklarının çoğu haşlanma yanığı idi. Hastaların %71.9'unda yanık yaralanması esnasında yakınlarda bir yetişkin vardı. El yanığı olan hastaların 19'u (%21.35) ihmal olarak değerlendirildi. Tüm ihmal olguları altı yaşın altındaydı.

TARTIŞMA: Pediatrik yanıklar çoğunlukla ev içerisinde ve yakınlarda bir yetişkin varken meydana gelmiştir. Sıcak içecek tüketme alışkanlıkları, mutfakta tehlikeli pişirme uygulamaları ve farkındalık eksikliği yanık kazasına yol açan bazı önemli konulardır. Etiyolojik bir neden olarak ihmal el yanıklarının %21.35'inde tespit edilmiştir. Tekrarlanan yanık yaralanmalarının önlenmesi için genel önlemlerin yanı sıra hastaların değerlendirilmesinde ihmal bulgularına özellikle dikkat edilmesi gerekmektedir. Ebeveynin yetersiz denetim veya ihmali düşünüldüğünde resmi makamlara bildirimde bulunulmalıdır.

Anahtar sözcükler: El; ihmal; kaza; pediatrik yanıklar.

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