

**ORIGINAL PAPER****Etiology of Burn Injuries Among 0-6 Aged Children in One University Hospital Burn Unit, Bursa, Turkey****Neriman Akansel, PhD, RN**

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**Abstract**

**Background;** Children whose verbal communications are not fully developed are the ones at risk for burn injuries. Causes of burn injuries vary among different age groups and scald injuries are the common cause of burn injuries among children. The majority of burns result from contact with thermal agents such as flame, hot surfaces, or hot liquids.

**Aim:** The aim of this study was to determine etiologic factors of the burn injured children

**Methods:** Data were collected for burn injured children treated in Uludag University Medical Hospital Burn Unit between January 2001 – December 2008. Patients' demographic variables, etiology of burn injury, TBSA (total body surface area), degree of the burn injury, duration of hospitalization was detected from medical records of the hospitalized patients.

**Results:** The mean age of the children was  $2.5\pm 1.5$  (median=2). Although 4.6 % of burned patients were under one year of age, most of the children (67.8%) were between 1-3 years. All of the patients were burned as a result of accident and house environment was the place where the burn incident occurred. Burn injuries occurred mostly during summer (29.9%) and spring (28.7%). Scald injuries (75.3%) were mostly seen burn injury types all among other burn injuries.

**Conclusions:** Lack of supervision and observation are usually the most common causes of burn injuries in children. Statistical differences were found among age groups according to their burn etiology ( $p<0.05$ ). An effect of TBSA on patient survival was statistically significant ( $p<0.000$ ) and also statistically significant results were seen among age groups according to their TBSA's ( $p<0.005$ ).

**Key Words:** Burn Injuries, Etiology, Children

## Introduction

Burn injuries represent one of the most severe traumas a body can sustain (Hockenberry & Wilson 2007; Wong, 1995). Burn injuries are usually attributed to extreme heat sources but may also result from exposure to cold, chemicals, electricity or radiation. Most burns are relatively minor and do not require definitive medical treatment. However burns involving a large surface area, critical body parts, or geriatric or pediatric population often benefit from treatment in specialized burn centers (Hockenberry & Wilson, 2007). The incidence of burn injuries in the United States has declined significantly in the past two decades. As of the early 1990's, the rate of reportable burn injuries in the United States had declined from 10 in 10000 to 4.2 in 10000 (Ignatavicius & Workman, 2006). According to Turkish National Statistical Report in 2004, 7851 patients were hospitalized due to burn injuries and 173 of them died (Turkish National Statistics, 2004). Burns are an important health problem in Turkey, since widespread hazardous equipments are used in and around the house. Teapots used for traditional tea bereaving, indoor liquid gas heaters, open fires, grills that are used for every day life are some of the risks for burn injuries in home environment (Haberal et al. 1995). Many of the burn victims are children, and approximately 75% of these burns are preventable. It is estimated that 35% of all burn injuries occur in pediatric age-groups (Wong, 1995). In one retrospective study done in Turkey by Inanç et al. (2008), children aged 0-14 years group primarily affected by traffic accidents followed by falls, burns and other injuries. Injuries are a major cause of death during infancy, especially for children 6-12 months. Causes of burn injuries vary among different age groups and scald injuries are the common cause of burn injuries in children aged under 5 (Ignatavicius & Workman, 2006). The leading causes of injury to infants are falls, ingestion injuries and burns. Toddlers (12-36 months) are also the risk groups for burn injuries. Burns rank second to motor vehicle injuries among girls and third among boys in toddlers as a cause of accidental death. Toddlers' ability to climb, stretch, and reach objects above their heads

makes any hot surface a potential source of danger. The majority of burns result from contact with thermal agents such as flame, hot surfaces, or hot liquids (Hockenberry & Wilson, 2007). Especially children aged under three are mostly the victims of scald injuries and hot water is the most frequent burning agent, followed by grease. Pulling over containers of hot liquids or appliances, use of alternative heating devices such as heaters and wood-burning stoves increases the risk of contact burns in all age groups (Wong, 1995). Especially hot liquids in the kitchen account for 50% of the in children under age two. Scald injury is a significant cause of morbidity and mortality in children (American Burn Association, National Burn Repository, 2009). According to the literature, the causes of burn injuries among children were scalds (Smith, 1969; Torabian & Saba, 2009; Wong, 1995; Elisdottir et al. 1999; Inanç et al. 2008). Most contact burns are non-work related accidents (71%), and 72% of these injuries occur in the home (American Burn Association, National Burn Repository 2009). Kitchen is usually the place where burn incidents occur (Smith, 1969; Petridou et al. 1998; Elisdottir et al. 1999; Ngyuen et al. 2008). Although burn injuries among children usually reported as accidents, problems of cause and control of injury can not be separated from the overall social and economic problems of the family (Smith, 1969). Low economic status has been associated with a higher risk of unintentional injuries (Edelman, 2007). Accidents play an important role in etiology of burn injuries; however it is known that 6-20% of the burn injuries occur as a result of neglect (Reed, 2005). Recognizing the signs of neglect is an important issue for all health practitioners and needs to be handled properly (Zor, et al. 2007). Ongoing efforts towards education, burn prevention, safer home and work environments and new methods of firefighting have significantly decreased burn injuries (National Safe Kids Campaign, 2001).

## Methods

The aim of this study was to determine etiologic factors of the burn injured children treated in

Uludag University Medical Hospital Burn Unit during January 2001 – December 2008. There were 677 patients admitted to burn unit due to burn injuries and 174 of them were children aged 0-6 years. The data were collected from medical records of the patients by using a special form designed for this study. This form included two parts;

1. Patients' demographic variables (age, gender etc.)

2. Etiology of burn injury, TBSA (total burn surface area), degree of the burn injury, duration of hospitalization

Data collections were done by three of authors (NA, NA, and SY) from medical records of the patients treated in burn unit, in a retrospectively designed study.

### Statistical Analysis

Statistical analysis was done by using the statistical program SPSS 17.0. Results are provided in numbers and percentages.  $\chi^2$  test, pearson  $\chi^2$ , Mann-Whitney U test and Kruskal Wallis tests were used for statistical analysis.

### Results

#### Demographic variables of the children

Mean age of the children is  $2.5 \pm 1.5$  (median=2). Although 4.6 % of burned patients were under one year of age, most of the children were (67.8%) between 1-3 years. 27.6 % of the patients were 4-6 years of age. Distribution of the burn injured children according to their ages was presented in Figure 1. Although female / male ratio was 1/1.4 in burned children, no statistical difference was found between two genders ( $p > 0.05$ ) (Table 1). The female/male ratio was 1/1.4 in patients aged 0-3 years, 1/1.8 in patients aged 4-6 years. Eighty one point six percent (81.6%) of the patients were from urban areas. All of the patients were burned as a result of accident and house environment was the place where the burn incident occurred. Duration of the hospitalization ranges from 1-102 days ( $17.9 \pm 16.3$ ; median=14 days). Burn injuries occurred mostly during summer (29.9%) and spring (28.7%) followed by autumn (25.3%) and winter (16.1%) Hospitalization due to burn injuries were high during April (12.6%), September (12.1%), and June (10.9%). Between

the years of 2001-2008 hospitalization due to burn injuries were the highest in 2008 with 32 patients aged 0-6 years.

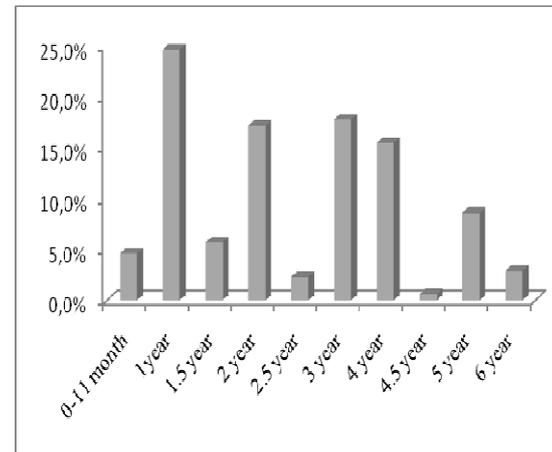


Figure 1. Ages of burned children

#### TBSA %, Etiology, and degree of burn injuries

The overall mean total burn surface area (TBSA) was  $18.9 \pm 13.7$  (median=15) and ranged 2-88% (Figure 2). Most of the burn injuries (67.3%) have TBSA under 20%. Scald injuries (75.3%) were mostly seen burn injury types all among other burn injuries. Etiology of other burn injuries were flame (1.7 %), electrical burns (2.9%), contact burns (1.7%), and others (2.3%) (Figure 3). Scald injuries were mostly seen in children aged between 0-3 years. The children of the same age group were also the ones who are mostly affected by burn injuries (67.8%) all among others. Statistical differences were found among age groups according to their burn etiology ( $p < 0.05$ ). Upper extremities (71.8%), lower extremities (54.4%), trunk (45.6%) and back (32%) were the mostly affected parts of the body in burn injured children. Most of the burn injured patients (93.7%) were discharged from the hospital after receiving treatment. However 6.3% (n=11) of the patients died due to burn injury, 4 of them were burned with flame the others (n=7) were scald injuries. Exitus were mostly seen in second degree (n=2), second+third degree (n=1), full thickness burns (third degree burns, n=8). No exitus was seen in patients with first + second degree burns. There is no effect of burn degree on patients' duration of hospital stay ( $p > 0.05$ , Mann Whitney U)

(Table 3). Most of the patients (n=10) who died due o burn injury had TBSA less than 20% and only one child had TBSA 0-9%. TBSA was calculated as more than 30% on exitus patients (72.7 %, n=8). An effect of TBSA on patient

survival was statistically significant ( $p < 0.000$ ) (Table 2) and also statistically significant results were seen among age groups according to their TBSA's ( $p < 0.005$ ) ( Table 1).

**Table 1. Effects of gender, etiology of burn injury, TBSA% on age grops in burn injured children**

	Age Group		Value/test
	0-3years	4 -6 years	Probability level
<b>Gender</b>			
Girl	55 (44%)	17 (35%)	X <sup>2</sup> =0.662, df=1 Chi- square test, p>0.05
Boy	71 (56%)	31 (65%)	
<b>Etiology of burn injury</b>			
Electrical injury	2 (1.6%)	3 (6.3%)	X <sup>2</sup> =16.928, df=4 Chi-square test, p<0.05
Flame	15 (11.9%)	16 (33.3%)	
Scald	104 (82.5%)	27 (56.2%)	
Hot objects	3 (2.4%)	0 (0%)	
Other	2 (1.6%)	2 (4.2%)	
<b>TBSA%</b>			
0-9 %	45 (35.7%)	8 (16.7%)	X <sup>2</sup> =18.518 , df=5 Chi-square test p<0.005
10-19 %	47 (37.3%)	17 (35.4%)	
20-29 %	18 (14.4%)	8 (16.7%)	
30-39 %	8 (6.3%)	10 (20.8%)	
40-49%	8 (6.3%)	2 (4.1%)	
>50%	0 (0%)	3 (6.3%)	
<b>TOTAL</b>	<b>126 (%100)</b>	<b>48 (%100)</b>	

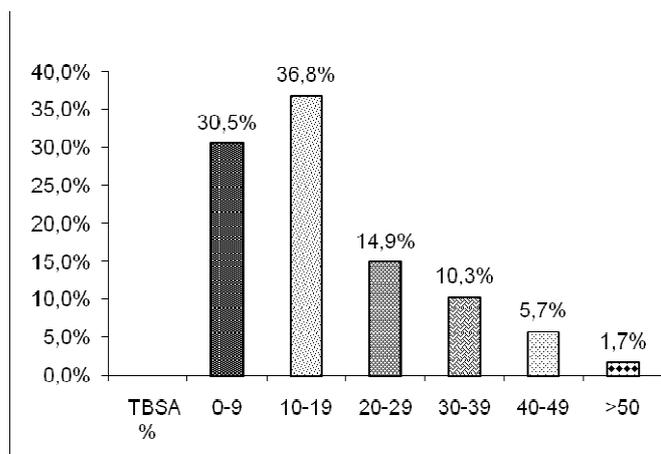


Figure 2. TBSA % of burned patients

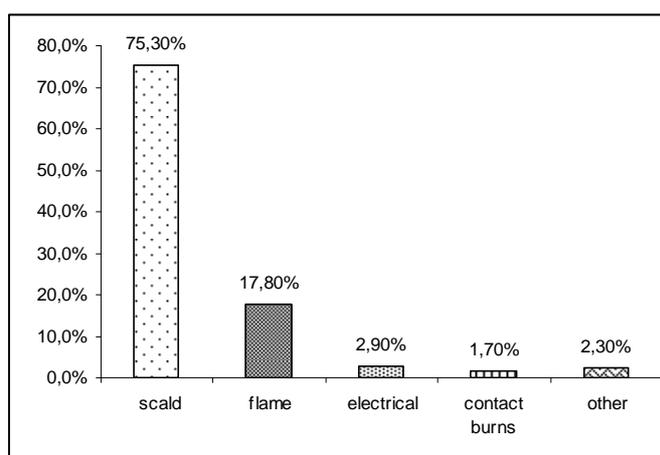


Figure 3. Etiology of burn injuries among children

Table 2. Effects of TBSA on survival rate among burned patients

Survival rate	Mean TBSA%		Value/test
	N	Mean Rank	Probability level
Discharged	163	83.60	U=260.000, Z=-3.939 Mann Whitney U Test P<0.000
Exitus	11	145.36	

**Table 3. Effects of degree of burn injury on duration of hospitalization**

	Mean rank of hospitalization		Value/test
	N	Mean Rank	Probability level
<b>Degree of burn injuries</b>			
Second degree	119	82.65	X <sup>2</sup> =5.872 , df=4 Kruskall Wallis Test p>0.05
Third degree	16	96.35	
First degree + second degree	5	83.50	
Second degree+ third degree	34	96.63	

### Discussion

Lack of supervision and observation and not having preventive measures are usually the most common causes of burn injuries in children. According to the literature, burns are frequently seen in pre-school period (Elisdottir, R., 1999) and children aged between 0-4 years are mostly affected group (Torabian & Saba, 2009; Kut et al. 2006; Odabaşı et al. 2009; Petridou et al., 1998; Verma et al. 2007). While another study represents burns are mostly seen in 1-5 years (Inanç et al. 2008). In this study, 72.4% of the patients were 0-3 years of age group which is congruent with the results of some other studies (Carlsson et al. 2006; den Hertog et al. 2000). Children in this age group have problems with stability and they are curious about their environment and try to discover their surroundings. These factors place them in a high risk group for burn injuries. Constant vigilance, awareness and supervision are essential as the child gains locomotor and manipulative skills that are coupled with insatiable curiosity about the environment (Hockenberry & Wilson 2007). Our entire study group was injured at home and burn incident occurred accidentally. It is reported that especially childhood burn injuries mainly occur in home environment and kitchen is the part of the house where burn injuries are most frequently seen (Petridou et al. 1998; Berber et al. 2009). Children whose verbal communications are not

fully developed are the ones at risk for burn injuries. Because it is hard to determine the reason for burn injuries at this age and also it is hard to prove whether injuries occur as a result of negligence. For this reason, health practitioners have important responsibilities in preventing burn injuries and also educating parents on this important issue. It is known that younger children are the ones at risk for scald injuries (Torabian & Saba 2009). Different studies have shown that scald injuries hold the first place among all other burn causes. Studies were done on children with different age groups that occurrence of scald injuries ranges from 51.2% to 80.4%. While Odabaşı (2009) reported scald injury rate as high as 82%, other studies reported scald injury rates as 80.4% (Magsoudi & Samnia 2005), 77% (Goldman et al. 2006), 72% (Torabian & Saba 2009), 71% (Carlsson, 2006), 68.8% (Aytaç et al. 2004), 60.7% (Petridou et al. 1998) and 51.2% (Berber 2009). Especially hot liquids like tea or water are the major cause of burn injuries. Infants and toddlers are the most commonly injured by hot liquids in the kitchen and bathroom which mostly occur as a result of inadequate supervision. Preventive efforts are targeted at parents and other caregivers; education includes the importance of adequate supervision and the establishment of safety at home (Hockenberry & Wilson, 2007). Scald injuries (75.3%) are the common cause of burn injuries among all other causes in this study and children under the age of

3 were the mostly affected group. Results of our study are congruent with the results of the den Hertog et.al's (2000) study. Although no differences were found with respect to gender ( $p > 0.05$ ), more than half of the patients (58.6%) treated in burn unit were boys in our study. This result is also associated with risk taking behaviors of young boys (Hockenberry & Wilson, 2007). Scald injuries were mostly seen in boys ( $n=76$ ) which is compatible with previous studies (Kut et al., 2006; Carlsson, 2006; Torabian & Saba, 2009; Magsoudi & Samnia, 2005, Petridou et al., 1998, Verma et al., 2007; Odabaşı et al., 2009; Berber et al., 2009; Elisdottir, R., 1999). Only one study reported that scald injuries are mostly seen in girls compared to boys (Torabian & Saba 2009). Cold winter months reported as high risk periods for occurrence of burn injuries. During winter time people exposed to various risks for burn injury at home environment (Smith, 1969; Bölükbaşı et al. 2009). According to different studies no statistical differences were found between seasons in terms of burn injuries (Torabian & Saba's 2009; Kut at al.2006). Prevalence of burn injures increase during summer (Al et al. 2005) which is similar to our study. The possible reason for increase in burn incidence in summer might be the preparation of preserves (like tomato paste, jam etc.) at home for winter besides lack of supervision. In Turkey since outside heaters that are used for food preparation are very close to ground, children may easily pull the boiling pans and spill hot liquids which may result in serious burn injuries. Meanwhile, hot tea is one of the most prevalent drinks in Turkey. Traditional tea brewers have two pots, one on the top of the other, which can be easily toppled by children and this is known as a quite common reason for burn injuries among young children. In villages where there are no natural gas supply, stoves and small LPG (liquid petroleum gas) canisters are used for cooking and these devices and the hot containers placed on them may be prevalent causes of burn injuries. For this reason, it is important to have places for cooking where high enough to prevent children from reaching easily. The physiologic responses, therapy, prognosis and disposition of the injured child are directly related to the amount of tissue destroyed; therefore, the severity of the burn injury is

assessed on the basis of the percentage of body surface burned and the depth of the burn (Ignatavicious & Workman, 2006). When determining the seriousness of injury, the important factors are the location of the wound, the age of the child, general health level, the causative agent, respiratory involvement (Ignatavicious & Workman, 2006; Hockenberry & Wilson, 2007). Superficial (first degree) burns are usually minor significance. In our study the percentage of the second degree burns (68.5%) was higher than other burn degrees. This result is also similar to Petridou et al.'s (1997) study. The reason of this may be that patients who have the first degree burns might have been treated in primary health care settings. Odabaşı (2009) also reported that patients with first degree burn injuries are not hospitalized and not treated in hospital settings. However, second degree burns (partial thickness) involve the epidermis, and varying degrees of dermis. There is often a latent period followed by erythema. Tissue damage is minimal, the protective functions of the skin remain intact and systemic effects are rare (Hockenberry & Wilson, 2007). TBSA % affected due to burn injury is an important factor in determination of the seriousness of the burn injury. In children under 10 years of age, a TBSA (total body surface area) less than 10 % is named as a minor burn and may require 1-2 days of hospitalization but usually treated at outpatient basis. Burns which have 10-20 % of TBSA are classified as moderate and burns more than 20% of TBSA are named as major burns. Major burns require an admission to a burn center (Wong, 1995; Black & Jacobs, 1997). According to 2009 NBR (American Burn Association, National Burn Repository,) annual report, increase in burn size also causes fatality or risk of death. In some different studies it has been reported that TBSA % is important in mortality (Maghsoudi & Samina,2005), Al et al., 2005; Torabian & Saba, 2009). Mortality mostly was seen in patient who had TBSA's around 40% in two different studies (Al,2005; Verma at al,2007). In our study mortality rate was 6.3 %. Some other studies reported mortality as 3.5% (Torabian& Saba, 2009), 6.4% (Maghsoudi & Samina (2005) and 10.4% (Verma et al., 2007). In this study it is seen that mean of TBSA has great influence on mortality. Ten out of eleven patients who died

due to burn injury had TBSA more than 20%. In one study, the ratio of TBSA under 20 % was calculated 76.5% (Torabian & Saba (2009). In our study, burned children who had TBSA under 20 % were 67.3 %. Mean of TBSA % was  $18.9 \pm 13.7$  (median=15). This result shows that patient who treated in burn care center had serious burn injuries. Children younger than 2 years of age have significantly higher mortality rates than older children with burns of a similar magnitude (Hockenberry & Wilson, 2007). In our study, two children under the age of 2 died due to burn injury. The other children (n=9) who died because of burn injury were over the age of two. There is a growing recognition that trauma affects not only the victim but also those closest to the child. It is the family, particularly the parents, who are the most significant person in the child's life. Psychological stress related to physical trauma experienced by care givers and children after burn injuries should be taken in to account and needs further assistance from health care providers.

### Conclusion

Burn prevention is the responsibility of all members of the community. Nurses have an obligation to participate in educational efforts directed at parents, children, and others regarding the prevention of burn injuries and fire related deaths. Since the best cure is prevention, increasing knowledge of parents on this issue can play an important role in preventing burn injuries.

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