

Targeting burn prevention in the paediatric population: a prospective study of children's burns in the Lausanne area

Julia Natterer, Anthony de Buys Roessingh, Olivier Reinberg, Judith Hoblfield

Department of Paediatric Surgery, University Hospital Center of the Canton of Vaud (CHUV), Lausanne, Switzerland

Summary

Question under study: Domestic accidents are an important problem in paediatric medicine. This study was designed to gain a better understanding of burn mechanisms and target prevention.

Methods: Children treated for burn lesions in the Department of Paediatric Surgery between August 2004 and August 2005 were included in this prospective study. The burn mechanisms, the children's ages and the circumstances in which children were burned as well as their home environment variables were analyzed.

Results: The current study included eighty-nine patients, aged between 2 months and 15 years. Seventy-eight percent were less than 5

years old. More than half were boys. Hot liquid scalding was the most frequent mechanism. There does not seem to be an increased risk in the immigrant population or in low economic status families. In most cases, an adult person was present at time of injury.

Conclusions: If we were to describe the highest "at risk" candidate for a burn in our region, it would be a boy aged 15 months to 5 years who is burned by a cup of hot liquid on his hand, at home, around mealtime, in the presence of one or both parents. Reduced attention in the safe domestic setting is probably responsible.

Key words: burn; child; environment

Introduction

Domestic accidents are an important problem in paediatric medicine. A study performed in 1993 showed that, in the Lausanne area, trauma emergency cases had increased in a linear fashion since the 1970's [1]. Falls were the principle cause (66%) motivating an emergency consultation, followed by burns (8%). This initial study was motivated by the notion that accidents can be prevented if the underlying mechanism is understood. Suzanne Gallagher, director of the prevention campaign concerning children's domestic accidents in Massachusetts USA, wrote: "The most important limitation in the improvement of control of children's trauma is the belief we all hold that accidents happen and cannot be foreseen. Use of the term accident implies unpredictability when in fact accidents are no less predictable than illness." [2, 3]

Based on this notion and in order to gain a better understanding and promote burn prevention, this prospective study was designed, which

analyzes the burn mechanism, the age and circumstances in which children are burned, as well as their home environment variables. Studies have shown that burn mechanisms vary considerably with different cultures and living habits. The population of the Lausanne area has become increasingly diverse over the past 15 years due to increased immigration from Balkan, African and South American countries, and the authors were interested in determining if there existed a target population for prevention counselling. The study was based on information collected concerning children and adolescents (0–16 years) consulting for burn treatment at the Centre Hospitalier Universitaire Vaudois and at the Hôpital de l'Enfance, the two locations of the Department of Paediatric Surgery between August 15, 2004 and August 14, 2005.

We wanted to find out who the children are who get burned in the Lausanne region, to be able to target burn prevention more effectively.

No conflict of interest.

Methods

Eighty-nine children were included in this study. Data were collected at the children's hospital in Lausanne (Hôpital de l'Enfance) which receives minor emergencies and in the University Hospital (CHUV) which has the only paediatric intensive care unit and burn centre in the region. These two centres cover the population of the Lausanne area. Inclusion criteria were children and adolescents between 0 and 16 years old presenting cutaneous burn between August 14, 2004 and August 14, 2005. Electrocution and inhalation injuries without cutaneous burns were excluded, as were sunburns. The children were grouped into 4 age groups as a function of their activity and level of risk comprehension. Group I: 0 to 15 months, minimal mobility, entirely dependent on an adult; group II: 15 months to 5 years, mobile but not mature enough to protect themselves or anticipate the danger of hot objects; group III: 5 to 12 years of age defined as school age and group IV: adolescents who are totally

autonomous and sometimes experiment with risk taking. A closed-end questionnaire was filled out by the parents with the help of the attending doctor, after informed consent. A written explanation concerning the aims of the study was provided to the parents, and the study was approved by the local Ethics Committee. Epidemiological information, geographical residential information by noting the postal code, as well as details concerning the accident were collected. From determining the different places in town and by knowing the social differences between the districts, we tried to find out if there is a link between the incidence of burns in different areas of the town. The quality of the housing was also used to evaluate the socioeconomic state. A questionnaire was also sent to 67 paediatricians in Lausanne and the Lausanne area to inform them of the study and to also try to estimate the proportion of children that were not seen at the hospital but were cared for in the paediatrician's practice.

Results

Demographics

89 patients were included in the study aged from 2 months to 15 years (fig. 1). Fifty patients (56%) were boys. Forty-five (50%) were Swiss na-

tionalities, 10 with dual nationality. No child died during the time of this study.

Burn mechanism

The study found that 39 cases (45%) were due to scalding, of which 20 were due to a cup of hot tea or coffee left within reach of the child, 42 cases (47%) were due to thermal contact (fig. 2). Other burn mechanisms included lighters, heaters, hot sticks and motorbike mufflers. Burn mechanisms vary according to the age of the children. The burn mechanisms were analyzed with 4 age groups (table 1).

Seventy children (79%) were burned in their homes. Most burns were in direct relation to food preparation (hot drinks, contact with the oven door or burners on the stove) and meal times are the most dangerous with two peaks of burn occurrence between 11 a.m. and 2 p.m. as well as 6 p.m. and 9 p.m., accounting for 51 cases (57%). Fifty-five (62%) burns occurred between September and March.

Percentage of body surface burned

The large majority of our patients presented with minor burns. Sixty-nine percent had less than 5% of body surface burned, 36% had less than 1% of body surface burned. One adolescent with a burn covering over 20% of the body surface was admitted during the trial period (fig. 3).

Figure 1

Age distribution.

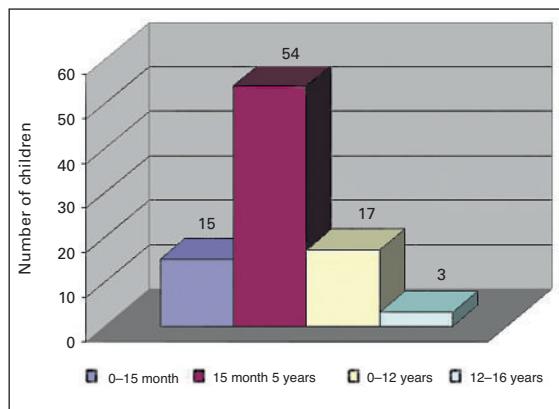


Figure 2

Burn mechanism.

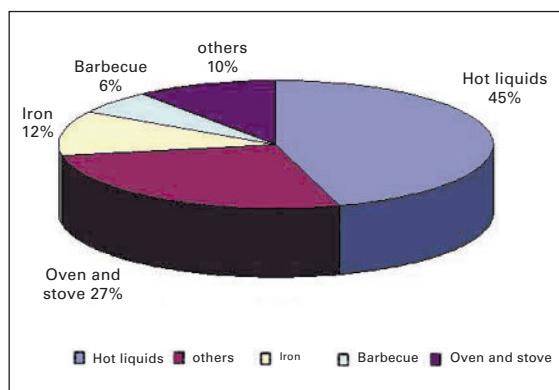


Table 1

Burn mechanisms according to the age groups.

	Group I (0-15 months)	Group II (15 m-5 years)	Group III (5-12 years)	Group IV (12-16 years)
Hot liquids	11 (12%)	22 (24.7%)	5 (5.6%)	1 (1.3%)
Oven and stove	4 (4.4%)	15 (16.9%)	4 (4.4%)	
Iron		9 (10.1%)	1 (1.3%)	
Barbecue		5 (5.6%)		1 (1.3%)
Others		2 (2.2%)	7 (7.9%)	1 (1.3%)

In 5% of the included patients, the surface wasn't evaluated by the attending doctor or the questionnaire was not filled in correctly.

Depth of burns

The majority of children (93%) presented with second degree burns and only 3% suffered from third degree burns.

Figure 3

Body surface burned.

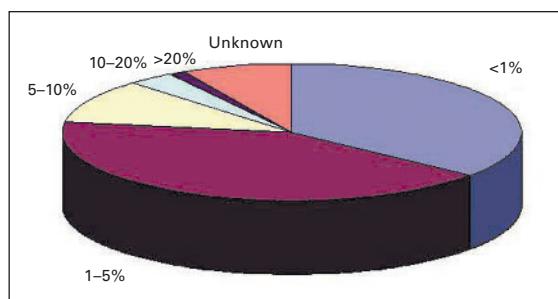


Table 2

Burn location.

Burn location	Number of burns / locations	(%)
Uppelimb (hand)	56	52.3
Hand	43	40
Lower limb	23	5
Trunk	23	21.5
Face	5	4.7

11 patients had burns at multiple locations:
8 patients with 2 locations, 3 patients with 3 locations
and 1 patient with 4 locations.

Table 3

Number of rooms at patients' home.

Number of rooms	number of patients (%)
<2	3 (0.3)
2–3.5	45 (50.6)
4–5	29 (32.6)
>5	12 (13.5)

Burn localization

The majority of the burns were located on the upper limbs (56%). Hands were affected in 40% of all burns. Seventy-seven percent of burns on the upper limbs concerned hands (table 2).

Socio-economic factors

Twenty-seven (30%) of mothers were career homemakers and 4 were unemployed at the time of the accident. Seventy (79%) couples of parents were married, and only 2 were single mothers living alone.

Only eleven patients (12%) were alone at the time of the accident. In the majority of cases (79%) one or both parents were present. Two children were burned while under the responsibility of professional educators. No child was burned while at day-care, kindergarten or with a day-mother.

In order to determine the impact of socio-economic status of the families, it was noted that 45 children (50.6%) lived in a 2–3.5-room apartment and 29 (32.6%) in 4–5 rooms (table 3). The number of rooms per inhabitant was calculated and only 5.6% lived in crowded conditions with more than 2 persons per room (table 4).

Table 4

Number of rooms per persons living at patients' home

Rooms/persons	number fo cases (%)
<0.49	5 (5.6)
0.5–0.99	34 (38)
1–2	41 (46)
>2	4 (4.5)
Unknown	5 (5.6)

Discussion

The results found that the majority of the children included in this study were less than 5 years old. Scalding and thermal contact were the most frequent burn mechanisms. A relationship was found between burns and food. This is shown by the mechanisms and by the fact that most burns happen around mealtimes.

When a child is burned there are significant repercussions not only on the child but on the family as well. Although the vast majority of the burns treated in our hospital are small in surface and can be treated as outpatients, there is suffering for the child and often substantial guilt for the family. Since multiple dressing changes and consultations are necessary, considerable time must be invested by the parents, as well as a part of the family budget. In order to reduce the incidence of

burns among children, it is important to understand the mechanisms and target the prevention.

The age and gender factor: In the current study, 78% of the children included were less than 5 years old. In another study, Elisdottir et al showed that 72% of 290 children included were younger than 5 years old [4], which is comparable to the current results. This age distribution is found in almost all studies [5–10]. Boys are more frequently victims of burns. In the current study, 54% of the children were males. El-Balawy and Mabrouk found a similar proportion of boys (53.7%) [11], but most studies have found an even greater proportion of 60 to 75% boys [12–15]. It is interesting to see that in adult population the proportion is inverted with more women being burned than men [16–17].

Mechanisms and conditions: Children were analyzed by developmental stages in order to easily delineate the mechanisms of injury. Similar to several studies [18–20], it was found that in small children less than 5 years old, burns by scalding were by far the most frequent (49%). Mukerji et al. showed that in India, out of 60 scald burns, 53 (82%) were associated with drinks or food preparation [19]. The current study had similar findings, as 35 (90%) of scalding burns were associated with drinks or meal preparation despite cooking habits being very different in Switzerland. Even if there were patients of different cultures presenting in our study, a difference was not found in the burn mechanisms. Also, in the current study only one child was burned in a bathtub, probably due to limitations on the temperature of water available in apartment faucets in Switzerland. Thermal contact is the second cause of burns in small children, with a great amount of oven and stove involvement (68%). In group II (15 m–5 years), of mobile children, thermal contact was as frequent as scalding. The small amount of adolescents involved in the current study makes it impossible to conclude anything specific about this age group. The fact that the age group of older children seems to be underrepresented is probably because adolescents do not consult for minor burns. Only one life-threatening burn accident was registered, that affected an adolescent and was due to liquid fire lighter thrown over a barbecue.

The most dangerous time is around mealtimes and our findings corroborate those found in numerous studies [4, 21, 23]. In the current study no child was burned by grabbing the handle of a cooking pot on a stove. Unfortunately, oven doors are not always equipped with thermally isolated doors and are often at the level of small children. It was found that 62% of the burns occurred between September and March. Some studies found comparable results, such as El-Balawy and Mabrouk who showed that nearly 70% of their population was burned in winter and spring [11]. Other studies showed more burns in the summer [23].

Care-taking context: Initially the fact that in the majority (78%) of cases one or both parents were present at the time of the accident was surprising. Den Hertog et al. found the same proportion of 78% of children under supervision of one or both parents [23]. In the current study, in 39 cases (44%) one adult was present, in 26 two were present, and in 9 cases there were more than 2 adults in the same room. It seems important to note that only 2 children were burned when under professional surveillance and none when under the responsibility of a day-mother or day-care.

Brett reports an incidence between 1 and 25% of child abuse in admissions for burns [25]. In the current population, there was only one slight suspicion of child abuse. Mercier and Blond

reported 1.7% among their population in France [13]. It is possible that some cases were missed, but none of the children included presented with typical burn patterns like glove- or stocking-like burns to the hand or the feet, burns of the buttocks, bilateral lower extremity burns or burns located at perineum or in the back. Parents were asked how exactly the accident happened. None of the history was doubtful or not compatible with the lesions. Additionally none of the children registered came twice to consultation for burns or had a history of multiple consultations for trauma. Although eleven patients were alone at the time of the accident, no small child was alone at home. In most cases, parents or adults were in the next room. Four older children and adolescents were burned while cooking or playing without supervision. No child showed other signs of abuse or neglect.

The percentage of body surface burned as well as the depth of the burn is the major criteria determining the choice of treatment and the need to hospitalize the patient. Outpatient care is preferred and 80 patients (89%) remained outpatients even if their dressings and debridement needed anaesthesia.

Social context: The current study shows that there was an equal number of Swiss and non-Swiss patients (which is the same distribution of emergency consultations in the hospital), showing that there does not seem to be an increased risk in the immigrant population. Seventy (79%) parents were married, 5 were co-parental families but unmarried and only 10 children lived with only one parent at home. Twenty-seven percent of the mothers were homemakers. Analysis of these numbers proved inconclusive. It is difficult to find other studies, with comparable populations. Mercier and Blond did not find a relationship between the age or the activity of the parents and the risk of burns [13]. Our attempt at evaluation of the socio-economic level of the families using the number of rooms available per person showed that over half (56%) the patients lived in a relatively spacious environment with at least 1 room per person and only 4.5% in an apartment with 2 or more persons per room. The analysis of these results did not permit us to establish any relationship between the level of economic well-being and the risk of burns which could be shown in some studies [26–28].

Conscious of the fact that certain patients consult their paediatrician and so are not included in the current study, a questionnaire was sent to all the paediatricians in the region. Of 67 paediatricians, 25 (37%) answered. In general, the results showed that most paediatricians treat few burns in their practices, and these are only small surface areas and what are described as minor burns, first degree and very small surface intermediate second degree burns at worst. As the response rate was low and the questionnaires were not fully completed, no further analyses were

done on these results. It seems then that the majority of patients in the region are seen at our hospital. It was of interest to determine whether or not certain neighbourhoods were represented,

but the analysis of the results was inconclusive, except for the fact that more children came from neighbourhoods close to the hospital, the rest being distributed evenly in the Lausanne region.

Conclusion

Although the number of children included in the current study was small, the results concur with those found in larger populations.

In the Lausanne region, particular attention should be paid to little boys, aged between 15 months and 5 years, and responsible adults should be more careful with cups of hot liquid and cooking devices. Prevention information should be addressed directly to the parents, all nationalities and socio-economic levels combined so that they will become aware of the daily dangers in their home environment. It is important to inform parents about the danger in their home every day and not only at a barbecue party. At each check-up paediatricians should inform parents about domestic accidents emphasizing the dangers associated with cups of hot coffee, oven doors and stove burners (even when recently turned off) which are

everyday objects that warrant constant surveillance, and then paediatric burns could be largely prevented. Giving parents the details of mechanisms at each age could target a little more the prevention. Informing them that most burn accidents occur in the kitchen could help them to anticipate the danger. Oven doors should be better isolated. Advice concerning the cooking space exists and can be useful, but the best prevention is to keep children away from the place while cooking.

Correspondence:

*Dr Julia Natterer
Service de Pédiatrie
Rue du Bugnon 46
CH-1011 Lausanne
E-Mail: julia.natterer@chuv.ch*

References

- 1 Reinberg O. Les accidents d'enfants et d'adolescents: de l'analyse à la prévention. Revue médicales de la suisse romande. 1995;115: 863-7.
- 2 Guyer B, Gallagher SS, Chang BH, Azzara CV, Cupples LA, Colton T. Prevention of childhood injuries: evaluation of the statewide childhood injury prevention programm (SCIPP). Am J Public Health. 1989;79(11):1521-7.
- 3 Gallagher SS, Finison K, Guyer B, Goodenough S. The incidence of injuries among 87,000 Massachusetts children ant adolescents: results of the 1980-81 stateside childhood injury prevention program surveillance system. Am J Public Health. 1984; 74:1340-7.
- 4 Elisdottir R, Ludvigsson P, Einarsson O, Thorgrímsson S, Haraldsson A. Pediatric burns in Iceland. Hospital admissions 1982-1995, a population based study. Burns. 1999;25:149-51.
- 5 Calder F. Four years of burn injuries in a red cross hospital in Afghanistan. Burns. 2002;28:563-8.
- 6 Werneck GL, Reichenheim ME. Paediatric burns and associated risk factors in Rio de Janeiro, Brazil. Burns. 1997;23:478-83.
- 7 Dedovic Z, Brychta P, Koupilova I, Suchanek I. Epidemiology of childhood burns in the burn center of Brno, Czech Republic. Burns. 1996;22:125-9.
- 8 Phillips BJ, Kassar A, Anderson B, Schiller W. Recreational-outdoor burns: the impact and severity-A retrospective review of 107 patients. Burns. 1998;24:559-61.
- 9 Haberal M, Ucar N, Bilgin N. Epidemiological survey of burns treated in Ankara, Turkey and desirable burn prevention strategies. Burns. 1995;21:601-6.
- 10 Lari AR, Rastegar A, Talei AR, Rossignol AM, Alaghehbandan R. Epidemiology of childhood burn injury in Fars Province, Iran. Journal of Burn Care & Rehabilitation. 2002;23(1):39-45.
- 11 El-Balawy A, Mabrouk AR. Epidemiology of childhood burns in the burn unit of Ain Shams University in Cairo, Egypt. Burns. 1998;24:728-32.
- 12 Coruh A, Gunay GK, Esmaoglu A. A seven-year burn unit experience in Kayseri, Turkey: 1996 to 2002. J Burn Care Rehabil. 2005;26(1):79-84.
- 13 Mercier C, Blond MH. Enquête épidémiologique française sur la brûlure de l'enfant de 0 à 5 ans. Arch Pédiatr. 1995;2:949-56.
- 14 Daisy S, Mostaque AK, Bari TS, Karim S, Quamruzzaman Q. Socioeconomic and cultural influence in the causation of burns in the urban children of Bangladesh. J Burn Care Rehabil. 2001;22(4):269-73.
- 15 Song C, Chua A. Epidemiology of burn injuries in Singapore from 1997 to 2003. Burns. 2005;31S:S18-S26.
- 16 Laloe V. Epidemiology and mortality of burns in a general hospital of eastern Sri Lanka. Burns. 2002;28:778-81.
- 17 Panjesahin MR, Lari AR, Talei AR, Shamsnia J, Alaghehbandan R. Epidemiology and mortality of burns in the southern west of Iran. Burns. 2001;27:219-26.
- 18 Pedriou E, Trichopoulos D, Mera E, Papadatos Y, Papazoglou K, Marantos A, et al. Risk factor for childhood burn injuries: a case-control study from Greece. Burns. 1998;24:123-8.
- 19 Mukerji G, Chamaania S, Patidar GP, Gupta S. Epidemiology of paediatric burns in Indore, India. Burns. 2001;27:33-8.
- 20 Nguyen D, Tabin S, Dickson WA, Potokart. Infants under 1 year of age have significant risk of burn injury. Burns. 2008;34(6): 863-7.
- 21 Lin TM, Wang KH, Lai CS, Lin SD. Epidemiology of pediatric burn in southern Taiwan. Burns. 2005;31:182-7.
- 22 Wibbenmeyer LA, Amelon MJ, Torner CT, Morgan LJ, Robinson BK, Chang PX, et al. Population based Assessment of burn injury in southern Iowa: Identification of children and younger-adult at-risk groups and behaviour. J Burn Care Rehabil. 2003;24(4):192-202.
- 23 Tung KY, Chen ML, Wang HJ, Chen GS, Peck M, Yang J, et al. A seven-year epidemiology study of 12,381 admitted burn patients in Taiwan - using the internet registration system of the childhood burn foundation. Burns. 2005;31S:S12-S17.
- 24 Den Hertog PC, Blankendaal F, Ten Hag SM. Burn injury in the Netherlands. Accid Anal Prev. 2000;32:355-64.
- 25 Brett D. Patient and injury characteristics, mortality risk, and length of stay related to child abuse by burning. Ann Surg. 2008;247:519-23.
- 26 Van Niekerk A, Rode H, Laflamme L. Incidence and pattern of childhood burn injuries in the Western Cape, South Africa. Burns. 2004;30:341-7.
- 27 Cronin KJ, Butler PE, McHugh M, Edwards G. A 1-year prospective study in an Irish paediatric burn unit. Burns. 2006; 22:221-4.
- 28 Palmieri TL, Alderson TS, Ison D, O'Mara MA, Sharma R, Bubba A, et al. Pediatric soup scald burn injury: etiology and prevention. J Burn Care Rehabil. 2008;29(1):114-8.