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Epidemiology of pediatric burn in southern Taiwan

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Abstract

A 5-year retrospective review of 157 pediatric patients admitted to burn center of Kaohsiung Medical University Hospital (Kaohsiung, Taiwan) was undertaken to identify the incidence, mechanism, and agents of pediatric burn. The highest incidence of pediatric burn was in children aged 1–6 years (57.3%), followed by age group 6–14 years (31.8%). Scald burn (75.2%) made up the major cause of this injury and was dominant in each age group compared to non-scald burn. The kitchen/dining area (57.3%) and living room (29.9%) accounted for the most frequent places where pediatric burns occurred. Among the agents of scald burn, hot drink (49.2%) and soup (32.2%) were the two leading causes. There were more pediatric burns reported in colder seasons (38.2% and 33.1% in winter and fall respectively) and during dining time (19.7% in 11 a.m.–1 p.m. and 35.0% in 5 p.m.–8 p.m.). The results of this report may be closely related to special culinary habits (use of chafing-dish and making hot tea) in the south of Taiwan.

Keywords: Children; Scald; Culinary habit

1. Introduction

Epidemiology analyses have shown that scald burn is the leading cause of burn injury in children either in western or eastern world [1–5]. Fukunishi et al. have reported that bath scald (47.9%) was more common than non-bath related scald (32.9%) in children's burn injuries in Osaka, Japan [5]. However, hot liquid and drinks (non-bath related scald) have higher incidence among scald burns in two study groups in France and Iceland [3,6]. Whether different culture and life style may influence the mechanism of pediatric burns remains to be explored.

Epidemiological data on childhood burn injuries provide vital information for developing strategies aimed at reducing the frequency of burns. There is a need for data on the settings in which pediatric burns are most likely to occur. Epidemiological data on children burn injuries in Taiwan are scant and antiquated, especially in southern Taiwan [7–9].

In the present study, the characteristics of burn injuries in children who were hospitalized at Burn Center of Kaohsiung Medical University Hospital, Kaohsiung, Taiwan, were investigated in order to identify the etiology of burns, mechanism of injury, and the relationship to life style and specific culinary habits.

2. Materials and methods

The subjects consisted of burn victims age 14 and younger who were hospitalized in our Burn Center between July 1996 and August 2002. Three age groups: 0–12 months; 1–6 years and 6–14 years, were distinguished based on the children's predominant activity and behavior with modification of earlier reports [2,4,5].

0–12 months: Most infants in this group are totally dependent on their parents or caregivers for daily living. Motion activity is limited.

1–6 years: In this group, children are capable of self-motion. They begin to learn how to use some tableware for food. Out of curiosity to the environment, they often touch

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Table 1
Characteristics of the population (n = 157)

		0–12 months	1–6 years	6–14 years
Male	82 (52.2%)	12 (7.6%)	44 (28.0%)	26 (16.5%)
Female	75 (47.8%)	5 (3.2%)	46 (29.3%)	24 (15.3%)
Total	157 (100%)	17 (10.8%)	90 (57.3%)	50 (31.8%)

Table 2
Scald and non-scald burn in different age group (n = 157)

		0–12 months	1–6 years	6–14 years
Scald	118 (75.2%)	15 (9.6%)	72 (45.9%)	31 (19.7%)
Non-scald	39 (24.8%)	2 (1.2%)	18 (11.5%)	19 (12.1%)

everything they can find, but they have scanty knowledge about the potentially risky environment and still need the protection of adults.

6–14 years: Taiwanese children start school at 6 years old and in this age group they have more ideas about the environment. They always try to engage in new events and activities.

Information on the patients, including age, sex, time/month of injury, cause/agent of burn, place of the accident and the site of injury were all recorded. Total body surface area (TBSA) was used to represent extent of burn.

3. Results

One hundred and fifty-seven children with burn injuries were hospitalized in our Burn Center during the study period. They made up 26.1% (157/602) of all burn victims hospitalized in our Burn Center during the same period.

3.1. Age and sex

The mean age of the children was 4.03 ± 3.62 years. The male to female ratio was 1.1 (82/75), as listed in Table 1. The greatest number of pediatric burns is indicated in Fig. 1 as occurring in the age group 1–6 years old (57.3%), followed by age 6–14 years (31.8%) and then age 0–12 months (10.8%).

3.2. Causes

Scald burn, accounting for 75.2%, made up the major cause of burn injuries in the study as compared with non-scald burn (24.8%) (Table 2). Scald burn was found to have higher incidence than non-scald burn in each age group. Among the scald injuries, 89.8% (67.5% of all pediatric burns) were caused by non-bath related causes, and only 10.2% (7.6% of all pediatric burns) resulted from hot baths (Table 3). Hot drinks (49.2%) and hot soup (32.2%) were the two leading causes in non-bath scald followed by rice porridge (8.5). Flame burn (89.7%) accounted for the highest incidence in non-scald burn; others were electric (5.1%) and chemical burn (5.1%).

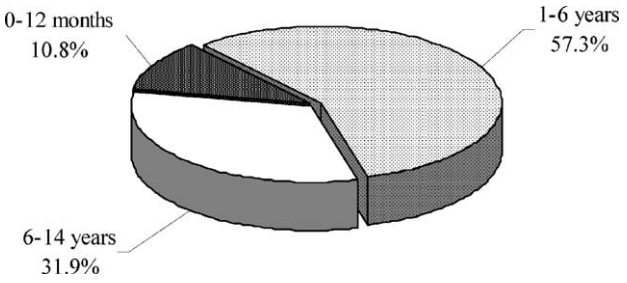

Fig. 1. Age distribution of the study subjects.

3.3. Place of injury

Most of the burn injuries happened in the home (93.0%) (Table 4). There were 57.3% in kitchen/dining area (kitchen and dining area are not usually separated in southern Taiwan), 30.0% in the living room and 5.7% in the bathroom. Only 7.0% of pediatric burns occurred outside the home.

3.4. Burn extent

The mean total body surface area burned was 12.4% in group 0–12 month, 16.3% in group 1–6 years, and 14.0% in group 6–14 years (Fig. 2). The overall TBSA in all pediatric was 15.4%. TBSA burned for female in group 1–6 years was higher but not statistically significant different.

3.5. Site of injury

The trunk was affected in 78.6% of all patients studied. The head and neck area, which was the second frequently burned site, was affected in 68.2% all patients. The upper and lower extremities were involved in 60.3% and 42.9% respectively (Table 5). It is interesting to find trunk, head and neck areas and upper extremities were the sites most

Table 3
Agents of burn (n = 157)

	Scald Burn (n = 118)				Non-scald Burn (n = 39)		
	Non-Bath, 106 (89.8%)			Bath, 12 (10.2%)	Flame	Electric burn	Chemical burn
	Hot soup	Hot drinks	Rice porridge				
Number	38	58	10	12	35	2	2
Percentage	32.2%	49.2%	8.5%	10.3%	89.7%	5.1%	5.1%

Table 4
Place where the burn injury occurred in different age group (n = 157)

	0–12 months	1–6 years	6–14 years
Kitchen/Dining area	90 (57.3%)	11 (64.7%)	44 (48.9%)	35 (70.0%)
Living room	47 (30.0%)	6 (35.3%)	35 (38.9%)	6 (12.0%)
Bathroom	9 (5.7%)	0 (0.0%)	4 (4.4%)	5 (10.0%)
Outside the home	11 (7.0%)	0 (0.0%)	7 (7.8%)	4 (8.0%)

involved among non-bath related scalds, while in bath scald, lower extremities, trunk and buttock and genitalia were frequently burned sites. Head and neck areas, by far, were the most affected site in flame burn.

3.6. Time of injury

Dining periods (especially dinner, 5 p.m.–8 p.m., and lunch time 11 a.m. to 1 p.m. in Taiwanese society) had overtly the higher number of accidents (Fig. 3). Thirty-five percent of all pediatric burns happened at dinner time and 19.7% occurred at lunch time. There were fewer accidents in the early morning from 2 a.m. to 6 a.m.

3.7. Season distribution

Fig. 4 depicts the monthly fluctuation of pediatric burn, coinciding with the Taiwanese seasons of spring (March–May), summer (June–August), autumn (September–November), and winter (December–February). There were more pediatric burns in the colder months (38.2% in winter and 33.1% in autumn) (Fig. 4).

4. Discussion

The culture of food habits is quite different between eastern and western worlds. In Taiwan, members of an extended family always gather for meals. Most adults (parents or caregivers) are used to taking care of young children while they are cooking or eating. Other special culinary habits are common in Taiwanese society such as making hot tea on top of table and eating foods from a chafing-dish, a kind of portable grate heated with charcoal or electricity and used for cooking or keeping food warm. The chafing-dish is also used for cooking various dainty dishes at table. The employment of this special utensil has been largely restored in modern cookery in Taiwan. All these special kinds of food culture, especial in southern Taiwan, make their children susceptible to scald burn. For example, the extended family members often cause the kitchen/dining area to be crowded. In such circumstances, children are frequently in contact with cooking utensils such as teapots, tea sets, bowls, and dishes which are heating and serving for making hot tea, water, drink, soup, or cooking on the chafing-dish. As a result, the hot tea/drink/water, or soup along with hot tea-leaf or hot foods, is easily spilled out over the body of the child victim. These risky environmental factors make the children more susceptible to burns, especially non-bath related scald.

Table 5
Site of injury stratified by causes of burns

	Percentage of cases				
	Non-bath scald	Bath	Flame	Others	Totals
Head and Neck	82.7	28.1	71.4	2.5	68.2
Trunk	92.5	54.0	34.4	1.3	78.6
Buttock and Genitalia	10.0	67.2	2.0	0.0	18.6
Upper extremities	78.4	37.0	55.4	2.5	60.3
Lower extremities	44.0	80.0	18.5	1.3	42.9

Scald burn is predominant over non-scald in each age group in our study, which complies with earlier reports [1–2,10–13]. In younger age groups (0–12 months and 1–6 years), there was much more scald than non-scald burn (7.5 times and 4 times increases respectively) (Table 2). The further analysis showed non-bath related scald prevailing over bath related scald (Table 3). Hot soup and hot drinks (including water, milk, tea, and coffee) brought the most

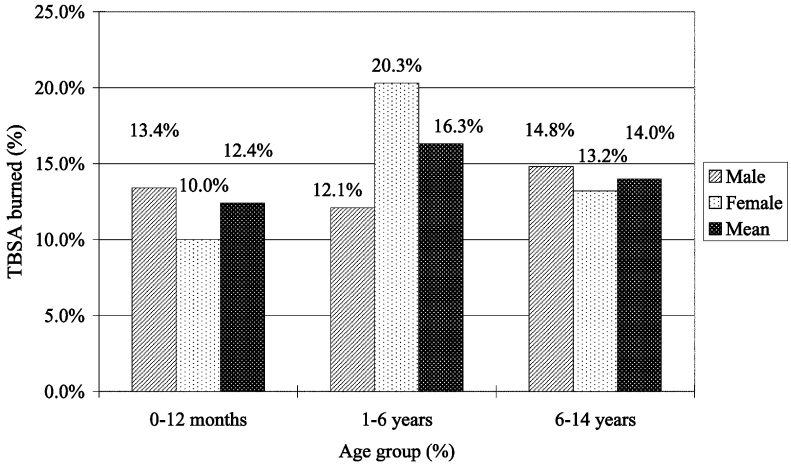

Fig. 2. The area of burned in different age group.

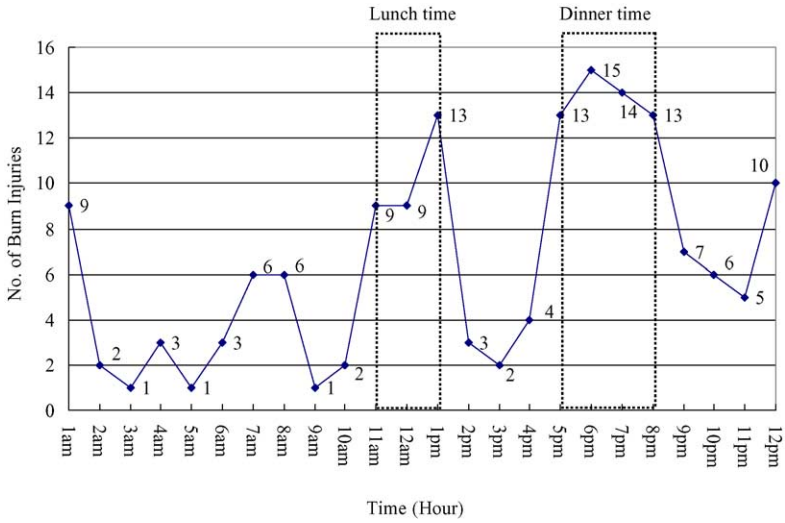

Fig. 3. Time of Injury.

cases of non-bath related scald. Hot rice porridge, which most Taiwanese use to feed their young children and infants, could not be overlooked as a cause in non-bath scalds. The pattern of the pediatric burns in this study is different from Fukunishi's report in Japan in which bath scald was more commonly seen than non-bath scald. The sites of injury in non-bath scald were commonly seen in trunk (92.5%), head and neck (82.7%) then upper extremities (78.4%) (Table 5). Meaningfully, when non-bath related scald (caused by hot soup, hot drinks, or hot rice porridge) occurred, the upper body was found to be easily involved. However, the lower body areas (lower extremities 80.0%, buttock and genitalia 67.2%) accounted for the two frequent sites of injury seen in bath scald. The explanation might be due to hot tub immersing which made children more frequently involved in lower body areas when accident happened. In such mechanism, the upper body areas (28.1% in head and neck and 37.0% in upper extremities) were comparatively less involved.

Ninety-three percent of pediatric burn took place at home. In the age group 0–12 months, all burn injuries happened in the home (Table 4). Relative limitation of daily activity in this age might explain. Kitchen/dining area and living room, which are usually adjacent because of limitation of space in most Taiwanese homes, were the two frequent places in pediatric burns. Whether over-crowding in living space is relevant in pediatric burns remains to be surveyed.

In this study, gender was almost equally affected and somewhat different from other reports (male predominant, male/female varies from 1.5 to 2.6) [2,3,5,7,12]. Adversely, Kumar et al. have reported a high female/male ratio 3:1 [4]. The determinant of gender in pediatric burns remains to be further investigated. The majority of pediatric burns in this study is found in age group 1–6 years, which agrees with most reports [1–6,10–15]. The overall TBSA burned in all pediatric patients was 15.4%. Other reports demonstrated a variation from 6.4% to 25% [3,5,12,14].

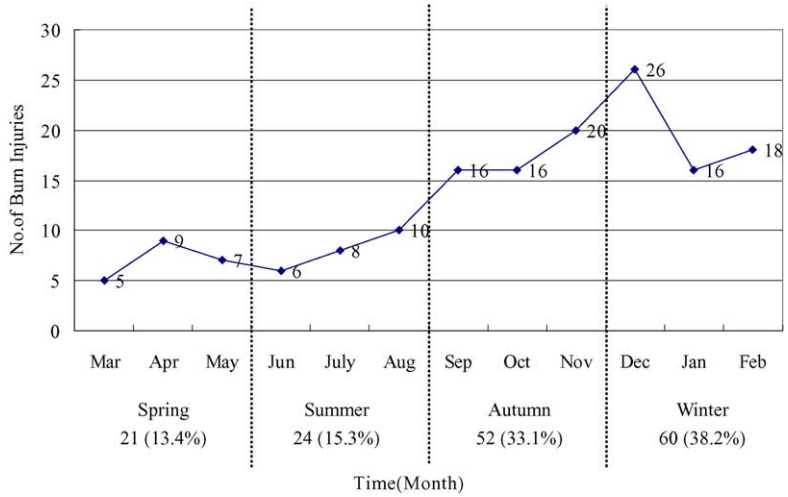

Fig. 4. Season distribution.

Surprisingly, there are scanty reports about the time of day in pediatric burns. Surveying general hospitalized burn patients, Chien et al. have demonstrated that about 23% of burns occurred between 10:00 and 12:00 (lunch time) and a relatively high incidence was found between 16:00 and 18:00 [16]. In the present study, two periods of dining time (especially 11:00 a.m.–1:00 p.m. and 5:00 p.m.–8:00 p.m.) were identified to be high-risk times for pediatric burns (35.0% and 19.7% at dinner and lunch time respectively) (Fig. 3). These two peak incidences in time of injury are similar but in our study (focusing in pediatric burn) dinner time was higher than lunch time which was the frequent injury time in Chien's report.

In consideration of month fluctuation, our present study shows higher incidence of pediatric burns (33.1% in fall and 38.2% in winter) appeared in colder months. Cronin et al. have demonstrated a similar report indicating more pediatric burns during the colder winter months in Ireland [2]. In South Africa, Van Niekerk et al. have reported that most childhood burns occurred over April through to October [13]. Colder months had more pediatric burns in these two studies [2,14], but the higher incidence of pediatric burns in winter and autumn in our study may not be explained simply by the climate. More pediatric burns in winter and autumn found in our study may also be connected to specific culinary habits (such as making hot tea and more often eating food from chafing-dish in colder seasons).

5. Conclusions

Burn was ranked the top two causes of child death in Taiwan, according to the statistics in 1987, in which year accident was the number one reason [17]. Most of the burned children came from lower socio-economic families and usually could not afford the high medical cost before the implementation of the Bureau of National Health Insurance (BNHI) in 1995. Very often the child victim has to give up the medical care with subsequent disastrous results. The incidence and severity of burn injury in children were decreased significantly over the past decade which has seen the reformation of BNHI and participation of public welfare and foundations (such as the Childhood Burn Foundation in Taiwan, founded in 1988 and the Sunshine Foundation, founded in 1981) [18]. Similar improvements in the management and prevention of pediatric burn were reported in UK [19], Japan [5], Hong Kong [14], Iceland [6], India [4,10], Vietnam [11], Iran [12], and South Africa [13].

An unforgettable, easy to learn campaign for first aid for burns"FLUSH, REMOVE, LOOSEN, COVER, SEND" was presented and well accepted by Taiwanese even in young children [17]. Various education programs were input through schools, public media and the internet. All these preventive and first aid procedures are beneficial to pediatric burns and advocated in some reports [4–6,10–14,19]. Such campaign and education programs work well in most pediatric burn injuries. Careful monitoring of activities of young children as well as avoidance of unnecessary contact with hot utensils may be beneficial for reducing the possibility of pediatric burns.

In this study, scald (75.2%) was the most common injury in pediatric burns. Among them, non-bath related scalds (67.5% of all pediatric burns) accounted for the majority (89.8%). The colder seasons (winter and autumn in Taiwan) and dining time (11:00 a.m.–1:00 p.m. and 5:00–8:00 p.m.) are two factors which need to be watched for. Special southern culinary habits in Taiwanese culture, eating food from chafing-dishes and making hot tea at dining time, are closely related to these results of our study.

The issue of specific culinary habits in southern Taiwan in relation to pediatric burns is discussed in this study. More educational programs are needed to highlight the prevention of such injuries, which may result in physical or psychological morbidity in children. Eventually, we hope further medical assistance, burn prevention movement, dissemination, and public education should be set up and conducted properly to prevent pediatric burns.

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