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Epidemiology of Burns in Pediatric and Adolescent Patients of Fars Province between 2017 and 2018

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ABSTRACT

Objective: According to the reports of the World Health Organization approximately 300,000 deaths occur yearly worldwide due to burns or burn-associated injuries. This study aims to review the epidemiology of burns in pediatrics and adolescents in Fars province between 2017 and 2018.

Methods: This is a cross-sectional study that investigated all people ≤18 years old who suffered from burn injuries in Fars province between 2017 and 2018. We use data from the file of burn patients which was provided by pre-hospital emergency services of Fars province. This data comprises demographic information (age and gender), burn-related information (type, degree, and severity of burns), mode of transfer (outpatient surgery or transfer to hospital) and the outcome of the disease (death before arrival to the hospital or alive).

Results: The average age of the subjects of this study was 5.8±8.9. We also categorized the subjects into four age groups, 1-4, 5-8, 9-13 and 15-18 years. The number of boys who suffered from burn injuries is significantly more than the girls (p=0.011). Also, there is a remarkable correlation between burn with age (p<0.001) and burn with disease outcome (p=0.01). The Most common cause of burns in boys was nonchemical hot objects and liquids (28.5%). Likewise, the possibility of mortality in burn patients who faced an electric shock was 22.66%. ([95%CI=2.32-220.63], p<0.001 OR=22.66).

Conclusion: This study shows that pediatrics and adolescents ≤ 4 have the most burn injuries, and boys have twice as many burn events as girls. More importantly, the most common cause of burns in both genders was burning with non-chemical hot objects and liquids, in particular, in the age group of 1-4 years, in which event happens at home.

Keywords: Burn; Pediatrics and adolescents; Epidemiology; Pre-hospital emergency.

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Introduction

According to the definition of the international society of burn injuries, burn, is damage to the skin or other organs of the body, which is mainly caused by contact with hot liquids and solids or flame in which we have partial or complete destruction of tissue cells [1]. According to the world health organization (WHO) reports there are about 300,000 deaths due to burns or burn-associated injuries worldwide every year [2, 3]. Out of this death rate, intentional burns, such as suicide attempts and harming others include about 2 to 5 percent of injuries and the rest are unintentional burns [3, 4].

The epidemiology of burns is highly dependent on age, gender, lifestyle, geographical and industrial conditions, and family status in different societies. In developed countries such as the United States, burns rank fourth in injuries, after traffic accidents, falls from a height, and interpersonal violence [5]. According to global statistics, the incidence of burns and burns-related injuries in less developed countries is significantly higher than in more developed countries. Comorbidities such as uncontrolled seizures, peripheral neuropathies, and mental and motor disabilities are important risk factors in burn injuries. Other causes of burns include radioactive rays, electricity, and contact with chemicals [5, 6].

The mortality rate of burn patients in Iran is estimated at 10-20%, the majority of which are pediatrics and teenagers. Burns not only cause physical problems, mental and psychological issues, breathing problems, anxiety and weakening of self-confidence in pediatrics and adolescents but it also imposes significant costs on the health system [7, 8]. Therefore, epidemiological studies can be effective in providing preventive strategies and principles of burns for the care of pediatrics and adolescents [9]. Various studies have been conducted in our country, including in Shiraz, regarding the epidemiology of burns. Considering that knowing the epidemiology and pattern of burns in different geographical conditions is the most effective way to prevent burns, especially in the population of pediatrics and adolescents, these studies conducted have dealt with specific types of burns that have been over a considerable period [10, 11]; the purpose of this study is to investigate the epidemiology of burns in pediatrics and adolescents around Fars province during the years of 2017 and 2018 which is performed for the first time.

Methods

This study is a cross-sectional study in which 226 individuals who are 18 years or younger facing burn injuries from 2017 to 2018 in Fars province are included the study. Age equal to or less than 18 years of burn victims and report of burn event to pre-hospital emergency service are determined as the inclusion criteria of this study, and those patients not fulfilling these criteria and the patients having underlying diseases were excluded.

Data was collected from patient files provided by the pre-hospital emergency services of Fars province according to the case report form. This form includes information regarding demographic information (age, gender), burn related information (cause, severity, and degree of burn), hospital transfer (outpatient surgery or hospital transfer) and the outcome of the disease (death before reaching to the hospital or alive).

Degree of burns: It classifies into 4 degrees. Depth and intensity of burn lesion increase from 1st to 4th degree. In First-degree or superficial burns, only the epidermis is involved. In second-degree or semi-deep burns, a part of the dermis is involved as well. In third-degree or deep burns, the entire dermis is destroyed and often the underlying subcutaneous tissue is also affected. Finally, in fourth-degree burns, the underlying tissues such as muscles or bones are also affected.

Determination of degree of burn: For determination of the degree of burns, the rule of nine was used, which is attached below [12]. The rule of nine is more applicable to adults. Head, both upper limbs, both lower limbs, anterior and posterior of the trunk are equivalent to 9,9,18 and 18 percent of the body area respectively.

Cause and type of burns: Heat damage (boiling water and direct contact with hot objects, petrol, flame, gas cylinder explosion, gas heaters or cylinder stoves, fire and Incendiary explosion), electrical and chemical burns (acid, base, caustics)

Statistical analysis: Statistical analysis was done using SPSS software 25.0 version, and data was presented as mean±standard deviation. The Chi-square test was performed for comparing categorical data. t-test and ANOVA were also used to compare the average of two and more than two groups. Statistical data ≤0.05 was considered significant.

Results

Totally 226 patients who were less than or equal to 18 years old were included in this study. The average age of the population was 8.9±5.8 years. With regard to the age group, the study population was divided into 4 age groups: 1-4 years, 5 to 9 years, 10 to 14 years and 15 to 18 years, most of whom 80 pediatrics and adolescents (35%) being under 4 years old. 71.2% of this population were boys and 28.8% were girls, which there was not any significant age difference between them (p=0.41). Table 1 shows the distribution of age and gender of the patients.

Data obtained from burn victims of these two years indicated that the cause of burns in 35.4% of patients was non-chemical hot bodies and liquids, it also indicated that 94 (41.6%) patients had 2nd degree burns with moderate severity and burns-related

Table 1. Age and gender distribution of burn patients in Fars province in 2017 and 2018

Age group	Frequency of boys (%)	Frequency of girls (%)	Total frequency (%)
1-4	52 (23)	28 (12.4)	80 (35.4)
5-9	32 (14.2)	10 (4.4)	42 (18.6)
10-14	40 (17.7)	9 (3.9)	49 (21.6)
15-18	37 (16.4)	18 (8)	55 (24.4)
Age (Mean±SD)*	4.9±5.6	6.2±9.7	8.9±5.8

Age vs gender: * p value=0.41

Table 2. Demographic information, cause, degree and severity of burns, hospitalization, and outcome in burn patients in Fars province in 2017 and 2018

Variable		Frequency (%)
Age (Year)	1-4	80 (35.4)
	5-9	42 (18.6)
	10-14	49 (21.6)
	15-18	55 (24.4)
Gender	Boy	161 (71.2)
	Girl	65 (28.8)
Cause of burn	Hot objects & liquids	80 (35.4)
	Petrol	12 (5.3)
	Gas explosion	23 (10.2)
	Flame	38 (16.8)
	Chemical	8 (3.5)
	Electric shock	46 (20.3)
	Other	19 (8.5)
Burn degree	1	82 (36.3)
	2	94 (41.6)
	3	17 (7.5)
	Unknown	33 (14.6)
Burn severity	Minor	52 (23)
	Moderate	94 (41.6)
	Major	437 (16.4)
	Unknown	43 (19)
Hospitalization	Hospitalized	132 (58.4)
	Outpatient	85 (37.6)
Outcome	Alive	217 (96)
	Death	9 (4)

death in 9 (4%) patients. In Table 2, demographic information, cause of the burn, degree of burn, the severity of a burn, mode of transfer and outcome are mentioned in detail.

Table 3 indicates a significant relationship between the cause of burn with gender (p=0.011), age (p<0.001) and its outcome (p=0.01). As mentioned earlier, in this study, 4% of patients died due to burn events, of which 2.2% were due to electric shock.

The most common type of burn in boys is non-chemical hot objects and liquids (28.5%). Flame (20.5%) is the second leading cause of burn in pediatrics and adolescents. Likewise, burns with non-chemical hot objects and liquids were the most common cause of burns in girls (49.3%). Burns with non-chemical hot liquid and objects, explosions and burns with flame are the most common causes of burns in the age group of 1-4 and 10-14 years old, with an incidence rate of 53.75% and 42.9%, respectively.

Among the death-determining factors of burns in patients listed in Table 4, patients with electric shock burns were 22.66 times more likely to die. ([95%CI=2.32-220.63], p<0.001 OR=22.66).

Discussion

Burns and burn-associated injuries are one of the most important causes of death in Iran [13]. Although most of the burn cases improve, the mortality rate of burn patients in Iran is still estimated to be similar to other less developed countries whose target population is pediatrics and adolescents [14, 15].

The mean age of pediatrics and adolescents in this study was 8.9 which is different from other studies in Iran, America, and Serbia [11, 14, 16-18], which is due to the difference in the selected age group in this study (1-18 years) with other mentioned studies are (1-14 years). However, like other studies, the current study shows that about 35% of burns occurred in pediatrics and adolescents under the age of 4 years, which is consistent with the results

Table 3. Distribution of burn patients in Fars province in 2017-2018 according to gender, age group, and cause of the burn

		Hot objects & liquids	Petrol	Gas explosion	Flame	Chemical	Electrical	Other	*p* value
Gender Frequency (%)	Boy	46 (28.5)	12 (7.4)	21 (13)	33 (20.5)	7 (4.5)	13 (8.1)	29 (18)	0.011
	Girl	34 (49.3)	0 (0)	7 (10.7)	0 (0)	1 (1.5)	7 (10.7)	18 (27.7)	
Age group	1-4	43 (53.75)	0 (0)	3 (3.75)	4 (5)	4 (5)	6 (7.5)	20 (25)	<0.001
	5-9	17 (40.4)	5 (11.9)	4 (9.5)	2 (4.7)	1 (2.3)	5 (11.9)	8 (19.2)	
	10-14	7 (14.3)	3 (6.1)	3 (6.1)	20 (42.9)	2 (4)	8 (16.3)	5 (10.2)	
	15-18	13 (23.6)	4 (7.3)	13 (23.6)	8 (14.5)	1 (1.9)	5 (9.1)	11 (20)	
Outcome	Alive	80 (36.8)	12 (5.5)	23 (10.5)	28 (12.9)	8 (3.7)	12 (7.3)	49 (22.6)	0.01
	Death	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (55.5)	4 (44.4)	

Table 4. Death-determining factors among burn patients in Fars province in 2017-2018

Variable		Odds ratio (OR)	95% Confidence-interval (95%CI)	*p value*
Causes of burn	Hot objects & liquids	-	-	<0.001
	Electric shock	22.66	2.32-220.63	

obtained from other research conducted in Iran [7, 16, 19-21], China [22], and Bosnia and Herzegovina [18] correspondingly. The ratio of the boys was 2.4 times higher than the girls, which is higher than similar studies in which can be rooted the number of boys participating in our sample size was more than the girls [14, 16, 23]. However, some studies also reported an almost equal ratio [18], this difference in burn patterns is mainly due to geographical variation [15, 18]. Some factors such as more freedom of action, being alone for a longer period and playing alone and participating in high-risk activities are among the factors contribute to the higher rate of burn injuries in boys than in girls [24, 25].

The results of this study show that the most common cause of burns in both genders is burning with hot objects and non-chemical liquids, especially in the age group of 1-4 years old, which is consistent with the results of other studies. In Iranian families, it is common to use hot kettle for boiling water which is exploited to wash and cook, and a gas heater as a heating system, often pediatrics and adolescents at this age are curious and active at home, so their contact and interaction with these objects are very probable; As a consequence, parental negligence and lack of adequate care can play a very important role in the occurrence of this type of burn events in pediatrics and adolescents, which can be preventable [7, 10, 11]. In addition, it was also observed that burns with flame is the second cause of burn injury in boys and the age group of 10-14 and other studies confirm our findings [15, 16, 26]. The behavioral characteristics of pediatrics and adolescents at this age vary, especially in less developed countries, and their desire for dangerous activities such as performing traditional ceremonies related to the culture of their country increases, which can be the cause of this type of burn pattern in this group and gender [14-16, 18]. Therefore, in addition to educating families, by empowering mothers to monitor their pediatrics and adolescents as much as possible, especially boys, and by educating pediatrics and adolescents in schools, it is possible to reduce burns-related injuries [26]. The findings of this study also showed that about 40% of burned pediatrics and adolescents had second-degree burns with moderate severity, this result is in line with the results of other studies, due to moderate level of damage, most burn patients were alive (96%) [15]. The mortality rate due to burn-related injuries in this study is 4%, all of whom died due to electric shock. This mortality rate in other studies was between 3-10% [26, 27].

This study is the first study conducted around the Fars province, which can be considered a strengthening point of this study. One of the limitations of this study could be its low sample size. With regard to the data collection of this research from the pre-hospital emergency service of Shiraz, some information such as age, occupation, education and literacy level of the parents, the date and time of the event, the number of pediatrics and adolescents in the family, the level of safety of the pediatrics and adolescents' environment inside and outside the house, whether or not the kitchen is separated from the reception, the installation of smoke and fire detectors and the presence of appropriate medical services may have significant relation to burn incidence. Thereby, empowerment of families can reduce the number of burn incidences. For future studies, it is suggested to collect these data in the process of data collection.

Conclusion

This study shows that pediatrics under the age of 4 have the most burn injuries, and boys have twice as many burn events as girls. It was also observed that the most common cause of burns in both genders was burning with non-chemical hot objects and liquids, especially in the age group of 1-4 years, in which event happens at home. As a result, parental negligence and lack of adequate care

can play a very influential role in the occurrence of this type of burn event in pediatrics, which can also be prevented. Therefore, prevention, education, and control measures can significantly reduce burns and their complications. Also, it is helpful to conduct epidemiological studies and investigations and to know the influential factors in the occurrence of this social phenomenon to raise awareness and provide preventive solutions.

Declaration

Ethical approval: This study approved by institutional review board of Shiraz university of medical science (Approval ID: IR.SUMS.MED.REC.1398.478).

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Author's contribution: MY: conceptual and design study, data acquisition, data analysis, drafted and revision paper. PF: contributed to conceiving and design of the study, interpretation of data, commented on drafts, and made significant revisions to the paper. SP: contributed to conceiving and design of the study and interpretation of data MK: contributed to the design of the study, interpretation of data, commented on the draft, and made significant revisions to the paper. MAN: contributed to the design of the study and made significant revisions to the paper.

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