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Frequency, Etiology and Risk Factors of Infant Burn Injuries

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ABSTRACT

Background: Pediatric population in Pakistan is exposed to alarming consequences of burn injuries. Infants have a higher risk of fatality from burns than adolescents and adults. Merely few burn centers across the country are equipped with the resources and trained doctors/paramedical staff who can cater well to the neonatal and infant burn patients. We studied the frequency, etiology and risk factors of infant burn injuries to call attention and bring in public policy for its prevention and awareness among public. **Methods:** This was a cross-sectional study conducted in the Department of Pediatric Surgery and Pediatric Burn Unit, Mayo Hospital, Lahore, Pakistan from September 2023 to August 2024. All patients being admitted with burn injuries who were 12 months old or younger were included in the study. A structured questionnaire was filled by the duty doctor after interviewing the parents/guardians. **Results:** Total 2638 children presented with burns. Out of 867 admissions 75 were infants with male predominance. Mean age was 9.4+3.4 months ranging from 11 days to 12 months. 62 were scalds, 12 flame burns and one electric burn. Mothers were primary caretakers in 89% cases and 97% mothers were house wives. 71% lived in nuclear families. 64 out of 75 were kitchen accidents. All families faced major disruption in natural gas supply in their homes. Majority accidents occurred in winters and 62.6% in January and February alone. **Conclusion:** Infant burns can be prevented by close surveillance, keeping infants away from kitchen, support system for mothers at home and keeping stove and hot items on shelves away from reach. Provision of hot running water and infrastructure for adequate power and gas supply along with awareness/prevention campaigns by government bodies are needed to save vulnerable infants from this adversity.

INTRODUCTION

Pediatric burns are a grim entity worldwide especially in developing nations like Pakistan. It is reported to be on number five among the commonest known deadly pediatric injuries. [1] Infants because of their curiosity, impulsiveness and poor supervision are most vulnerable to dangerous accidents like burns as compared to older children and adults. Most studies reveal that hot liquids are the leading cause of burns in children followed by other causes of thermal injury.[2] In Pakistan disability in children who faced burns is as high as 18%.[3] Despite these facts there is scarcity of specialized pediatric burn facilities in the country causing the existing centers to be overburdened. Majority of existing burn facilities lack neonatal intensive care infrastructure and human resource.

Pediatric patients have up to three times more total body surface area to body mass ratio as compared to adult counterparts thus resulting in more and more fluid loss and difficult resuscitation.[4] Furthermore an infant being more prone to hypothermia, hypoglycemia, metabolic derangements, fluid overload and sepsis makes it more difficult for the caregivers to save the child

from mortality and morbidity. Many of these adversities occur at home and some studies have demonstrated factors in the living environment that were increasing the risk of such accidents.[5]

There is hardly any published research work dedicated solely to infant burns in Pakistan. Despite being an avertable entity there is no planning on national level or large-scale awareness programs to prevent burns in infants and children.[6] Mortality risk due to burn is significantly more in younger children than adults. [7] This factor makes it paramount to devise preventive measures to avoid burns in the vulnerable infants. Pakistan lacks implementation of strict regulations regarding fire prevention while construction of buildings and no material checks on children's clothing for its flammability. The power sector in the country is unregulated in taking general safety and precautionary measures for the population especially in rainy season. Poor infrastructure of a necessity like electricity causes fires at both domestic and commercial level. Natural gas shortage and its unannounced load shedding have been responsible for many unfortunate events related to burns. Moreover, lack of education and awareness in the general population leads to poor first aid management and often unhygienic items to be used as first aid for burn wounds and thus later present as complicated cases.

With this study we went deep in the setting and circumstances that cause the calamity of burn in order to point out the causative and potential risk factors for the burn injuries. These facts and figures will help us formulate pre-emptive measures to save the infant population from burn injuries and their aftermath hence decreasing burden on the overworked burn units.

MATERIAL AND METHODS

This was a prospective cross-sectional study conducted in the Department of Paediatric Surgery and Paediatric Burn Unit, Mayo Hospital, Lahore for 1 year from September 2023 to August 2024 after taking ethical approval from the Institutional Review Board. Informed consent was obtained from all parents/guardians and ethical standards were maintained. All children of 12 months of age or younger admitted with any kind of burn injuries were included in this study. Infants whose parents/guardians did not know the circumstances related to the burn event were excluded from the study. A structured questionnaire was filled by the duty doctor after interviewing the parents/guardians. Data regarding demographics, living conditions and circumstances related to the burn accident were recorded. Data was analyzed using SPSS 27. Results were calculated as frequencies, means and proportions.

RESULTS

A total of 2638 children presented with burns during this period. 867 patients were admitted to the Pediatric Burn Unit out of which 75 were infants. 47 of them were male and 28 were female. Mean age was 9·4±3·4 months ranging from 11 days to 12 months. Six among them were neonates. 31 of the patients were 12 months old. 16 out of these 75 infants were first born while 26 had one sibling and 21 had two siblings. 64% families lived in urban areas, 73% of them living in rented homes. 73 out of 75 mothers were housewives. In 71% of the cases the patient lived in a nuclear family and in 89·3% cases mother was the primary caretaker of the infant. Details of other demographic variables are mentioned in Table I.

Table 1

Demographic variables

S. No	Variables		Results (N=75)
1	Maternal Age	less than 20 years	10
		20-25 years	39
		25-30 years	12
		more than 30 years	14
2	Mother's Education	Uneducated	23
		Primary	32
		Secondary	14
		graduate or higher	6
3	Father's Education	Uneducated	10
		Primary	31
		Secondary	28
		graduate or higher	6
4	Occupational status	working father only	69
		working mother only	2
		both parents working	4
5	Family income	less than 30,000 PKR	26
		30,000 to 60,000 PKR	39
		more than 60,000 PKR	10
6	Residence	Urban	48
		Rural	27
7	Ambulatory status of infant	pre-ambulatory	17
		crawling	27
		walking	31

Out of 75 cases, 62 were scalds, 12 were flame burns and one was an electric burn. Among scalds majority were caused by hot water (56·4%), followed by hot milk (20·9%), hot tea (20·9%) and hot gravy (1·6%). These incidents took place by either of the following events; infant falling in a utensil filled with hot liquids placed on floor, infant reaching out for a utensil placed at a height or hot liquid being poured over the infant mostly while they are in lap. Six out of 12 cases of flame burns were ignited by stove followed by five due to gas cylinders and one because of a gas heater. One case of electric burn in an infant was caused by electric heater.

We also recorded data regarding the living conditions (Figure 1) of the family taking into account crowding (more than four people living in one room), whether kitchen was combined with a room or separate, whether kitchen stove was placed on a counter top or on the floor, electricity and gas outage (no supply for more than four hours a day) and whether running hot water was available in the house.

We took into account all the surrounding circumstances at the point when the burn injury occurred. 73 of these cases occurred at home and 64 among them were kitchen accidents followed by 7 occurring in bedroom and 2 in washroom. 80% of these events took place on working days while only 20% occurred on weekends. Only 17 patients got burned at night while rest of the accidents happened at morning and afternoon. In 81·3% cases either one of the parents were present around at the time of mishap. In two cases older siblings and cousins poured hot water on the infant in bathroom trying to bathe.

Two of the families had ongoing domestic disputes among them. One of the family members was involved in substance abuse in 2 cases. An 11 days old baby presented with 90% flame burn due to fire from gas heater as he was left alone for long in a room. That was labeled as a case of neglect and concerned authorities were involved. Maximum number of infants with burns were admitted in the month of January i.e. 25. Admissions in rest of the months are illustrated in Figure 2.

Figure 1

Living conditions of the patients' families

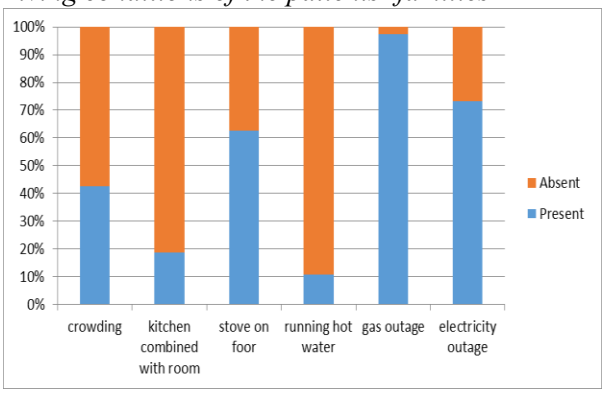
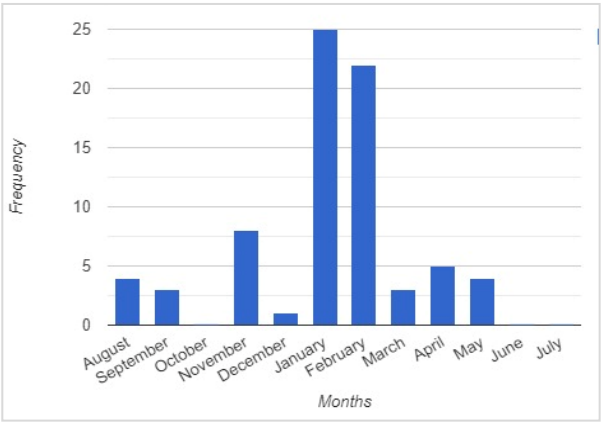


Figure 2

Seasonal variation in number of infant burn admissions.



DISCUSSION

There are very few articles in literature concerning exclusively to the attributes of infant burns. Most studies were comparable with our results as male gender being predominant victims in infants.[5,8,9] Some factors related to the infant burns appear to be different for the developing and developed countries. Our data has majority of the cases belonging to a lower socioeconomic class (86·6% having monthly income <60,000 PKR and 34·6 % having <30,000PKR), having poor educational background especially of the mother and maternal age being younger than 25 years, which aligned with the results of a study from India (Lal & Bhatti, 2017) but was contrary to a Finnish article (Laitakari et al., 2015).[5,8] Consequently when these young and ill-informed mothers are the caretakers, they may not be mature enough to judge the hazard in her child's activities and surroundings in order to ward off such calamities. Our study displayed

the crawling and walking infants were more at risk of getting burned as they can reach hot objects themselves thus emphasizing the fact that this group required meticulous supervision from the guardians. Considering this we also advocate keeping hot objects like cups of tea on a height level which couldn't be reached by the infant and turn away handles of utensils to the opposite sides when they are placed on cooking stoves or shelves.

A study from Karachi included 11 neonates and enlisted contact burn from heaters as most common cause for burns in neonates.[10] Three neonatal burn admissions in our ward were due to scalds (two by hot water and one by hot tea spill while being in lap) and three were due to flame burn (one due to fire from stove flame, one from gas cylinder and one due to fire from gas heater)(Figure 3). Following the trend from studies from many developing nations the most common cause of burn in our study was also scald followed by flame burn but contradicting results were found from first world countries. Burlinson et al., 2009 enlisted the frequent causes of burns in Australian infants as scald followed by contact burn, IV site burn due to Total Parentral Nutrition and sunburn.[11] We didn't encountered the last three causes in our study. Laitakari et al., 2015 also mentioned contact burn as the most common cause in Finland.[8]

Power and natural gas supply disruptions for domestic use especially in winters are a predicament for the Pakistani population. Gas load shedding surpasses even 12 hours for some cities in winters and conditions in rural areas are worse. We saw a drastic rise of burns in winter and almost half of the cases presenting in January and February which is logical as in winters there is a peak in gas outage, increased need of hot water, use of gas and electric heaters and high use of hot beverages all being potential risk for burns

The alarming high numbers of scalds due to hot water are certainly due to the unavailability of warm water running in taps. Consequently, the people boil water on stoves for bathing, washing and daily usage where temperature of water can't be controlled automatically like in geysers. Thus become a risk for the defenseless infants. As majority of the household geysers here use gas source and some use electricity, the underlying cause of these scalds is again linked to the long gas and power outages. Boiling milk for consumption instead of pasteurized ones and then putting it aside on approachable locations for cooling culminated in hot milk being 2nd leading cause of scald in our data (Figure 5). Moreover, stove fire being the top reason for flame burn, we found that all cases caused by stove fire had the stove placed on the floor rather than on the kitchen counter. This makes the fire approachable for the small crawling and walking infants who are unaware of the hazards. Gas cylinder was 2nd on our list causing flame burn which is again rooted in the pivotal issue of natural gas shortage, coercing people to buy low quality gas cylinders and hence these catastrophes(Figure 4).

Figure 3a

This neonate accidently fell into a clay stove when mother was cooking while holding him in her lap, causing full thickness burns on scalp and face.

Figure 3b

Same neonate after two debridements of the scalp and now planned for debridement of outer table of skull and management of ectropion

Figure 4
A 3 month old infant brought in with flame burn and inhalational injury due to gas cylinder blast

Figure 5
12 month old boy with gangrene of fingers due to full thickness scald from hot milk

We studied the household conditions and circumstances around the incident in detail and one cardinal precaution appears to be keeping children especially infants away from the kitchen as 64 out of 75 of these accidents occurred in kitchen. We found that most burns in infants occurred on working days in morning or afternoon, families were majorly nuclear and almost all infants were primarily looked after by a house wife. We deduce that these mothers carry the burden of doing household chores while their spouses are at work might causing poor surveillance of their uninhibited infants. Further in all our cases either a parent or guardian was present around at the time of injury shows that these events can be evaded by diligent supervision. We didn't receive any infant burned due to abuse.

CONCLUSION

Keeping children away from kitchen, avoiding floor level stoves, turning away handles of hot utensils, quality check of cylinders, vigilant overseeing especially of the crawling and walking infants, support system for mothers while they are alone busy in household chores and continuous provision natural gas and electricity can prevent these misadventures. These facts should be taken up to relevant authorities and media to bring in laws and legislations to halt and counter these avoidable accidents in homes, schools and public places. We suggest constructing a national action plan for awareness of prevention and proper first aid like that of COVID. All these efforts will ensure a decline in the burden on hospitals and burn units with the high influx of patients and save the infants from significant morbidity and mortality.

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