

Original Article

An epidemiological study of 500 paediatric burn patients in Mumbai, India

S. S. Verma, S. Srinivasan, A. M. Vartak

Department of Paediatric Burns and Plastic Surgery, BJ Wadia Hospital for Children, Parel, Mumbai, India

Address for correspondence: Dr. SS Verma, 08, Rajwada Chowk, Indore - 452 004, MP, India. E-mail: dr_sachinverma@rediffmail.com

ABSTRACT

Aim: To study the epidemiological data of paediatric burn patients to determine the role of demographic distribution and epidemiological parameters for assessment of mortality rate and development of burn prevention strategy. **Materials and Methods:** Epidemiological data of 500 patients admitted to the Burns and Plastic Surgery Unit of B.J. Wadia Hospital, Mumbai over a period of six years (2000-2005) was reviewed from medical records. Age, sex, demographic distribution, seasonal variation, total body surface area (TBSA) involved, type and place of burn injury, parental occupation, family size, first aid and mortality rate were studied. **Result:** Median age group for patient was 3.44 years (range one month to 14 years). The majority (24%) of burns occurred in children between the one to two years age group. Male to female sex ratio was 1.38:1. Most of the patients were from the defined demographic region served by the hospital. A significant number of patients however were from outside this region. Burn injury occurred predominantly during winter. Most common type of burn was scalds which occurred mainly in domestic circumstances. In the majority of patients, less than 10% TBSA was involved. All patients were managed as per the unit protocol. Mortality rate was 10.4%. Mortality rate was high in patients having more than 40% TBSA involvement. Seventy-three per cent of the total deaths occurred in the patients coming from regions outside the demographic region served by the hospital. Parental occupation, family size and the first aid did not affect the mortality rate. **Conclusion:** Availability of a burn care unit in the vicinity can decrease the mortality rates in the paediatric burn patients. An intense and focused burn prevention campaign to educate the general population about dangerous aetiological factors will decrease the incidence of paediatric burns.

KEY WORDS

Burns prevention, epidemiology, paediatric burns

Burn injuries are complex cutaneous traumas managed by many plastic surgeons. Burn injuries represent an extremely stressful experience and constitute a major concern in the paediatric age group with respect to morbidity and mortality. Morbidity in paediatric burns is considerable; such disfigured and disabled children are denied social acceptance and are unable to lead a productive life. Although burn injuries

are common in children, most of the accidents happen at home and are largely preventable. Epidemiological studies of burn injuries have highlighted risk factors that have led to the establishment of effective preventive programs.^[1] It is important to educate parents, make them aware of the potential danger of the home environment and how to prevent common burn accidents.

MATERIALS AND METHODS

The Burns Unit of B. J. Wadia Hospital in Parel, Mumbai is the major regional referral centre for all paediatric burn injuries. The unit receives most of its patients from the population residing in the area under the Municipal Corporation of Greater Mumbai (MCGM). It also receives a large number of patients from the jurisdiction of Thane Municipal Corporation (TMC), which is on the outskirts of MCGM. Few patients come from the rest of Maharashtra state (ROM) and other states. In our study, we included 500 acute burn injury patients admitted to our unit between the age group of one month to 14 years. Medical records of all the patients were reviewed retrospectively. Data regarding age, sex, demographic distribution, seasonal variation, total body surface area (TBSA) involved, type and place of burn injury, parental occupation, family size, first aid and mortality rate were registered on the computer and observations made.

Management protocol

All patients were managed by the strict protocol followed in the unit for the past many years. As soon as the patient is sent from the casualty to the burns unit, the attending doctor measures the weight of the child and estimates the percentage of burn (TBSA) involved. Intravenous fluid is given to patients involving more than 10% of total body surface area. Urinary catheterization and Ryle's tube insertion is done immediately. Ringer lactate is given by the formula:

Fluid requirement (ml per h): $\text{Weight} \times \text{TBSA} / 4$.

Every hour, the fluid requirement is titrated to keep the urine output $> 1\text{-}2$ cc/kg. Empirical third generation cephalosporin and sulbactam combination is started. Frequent Ryle's tube feeding of water followed by Butter Milk Diet (BMD) is started as soon as the bowel sounds appear and gradually intravenous fluid is stopped. Butter Milk Diet has been developed in our unit as a cheap high-calorie, high-protein diet for the purpose of tube feed. It consists of the following ingredients:

1. Curd: 250 g.
2. One green peeled ripe banana.
3. One hen's egg.
4. One tablespoon full of sugar.

Daily bath and dressing is done under sterile conditions in the Operation Theatre using silver sulfadiazine and

highly absorbent nonwoven cotton with polyethylene backing (Tenabed). Tenabed is moisture-retaining which makes it nonadherent, this facilitates dressing change in a painless fashion and obviates the need for analgesia or anaesthesia. Swab collections are done twice a week for bacterial culture and sensitivity testing by our microbiologist. Antibiotics are changed strictly as per the sensitivity pattern. Monitoring of the patient is done clinically and by routine laboratory haematological and biochemical investigations and evidence-based management protocols are instituted e.g.: anaemia is corrected with blood transfusion; hypoalbuminaemia necessitates fresh frozen plasma and albumin infusion, etc. This has a significant bearing on the final outcome.

RESULTS

In our study, the maximum numbers of patients were in the age group one to two years. The eldest patient was 14 years old and youngest was one month old. The average age was 3.44 years. Males outnumbered females in our series. Male: Female ratio was 290:210.

Within the MCGM territory 242 patients were from within 5 km of the unit and 133 were from the catchment area outside the 5 km zone [Table 1]. One hundred and fourteen patients were from the nearby TMC territory. Nine patients were from the rest of Maharashtra and two patients were from other states.

The maximum number of patients was seen during winter (179) and less numbers of patients were seen during the summer and rainy season (321).

The majority of the patients sustained less than 10% of burn [Table 2]. Maximum and minimum TBSA involved was 95% and $\frac{1}{4}\%$ respectively. Average TBSA involved was 16.35%.

Scalds were the main cause of burn in the majority of patients [Table 3]. Flame burn is the second most common

Table 1: Demographic data

Demographic region	Total
Within 5 km (MCGM territory)	242
Outside 5 km (MCGM territory)	133
TMC	114
ROM	9
Other states	2
Total	500

MCGM - Municipal Corporation of Greater Mumbai, TMC - Thane Municipal Corporation, ROM - Rest of Maharashtra

Table 2: Extent of burns

<i>TBSA</i>	<i>Number of cases</i>	
<10%	232	
11-20%	124	
21-30%	70	
31-40%	27	
41-50%	29	
51-60%	14	
>70%	4	
Total	<10% to >70%	500

TBSA - Total body surface area involved

Table 3: Aetiology of burns

<i>Type</i>	<i>Number of cases</i>
Scalds	409
Flame	54
Fireworks	12
Electric	12
Contact	13
Total	500

cause of paediatric burn injury. Fire cracker injuries were observed during the Deepawali festival. Electric burn and contact burn were also seen. All burns were accidental burns. We have not had any inhalation burns. We did not come across any cases of suicide or child abuse.

Domestic burns resulted in 468 injuries followed by 32 injuries outside the house. None of the patients sustained burns at school.

Average size of the family of patients was five [Table 4]. One patient was living with 14 other members of the family and one patient had only one parent. In larger families the incidence appeared to be lower, probably due to presence of more persons in accident prone areas.

The majority of the fathers were manual labourers (59%) followed by clerical jobs, factory workers and businessmen. Ninety-five per cent of the mothers were housewives.

Water was used as first aid in 77.8% of patients followed

Table 4: Family size

<i>Family size</i>	<i>Number of cases</i>	
<3	79	
4	84	
5	65	
6	33	
7	26	
8	17	
>8	25	
Data not available	171	
Total	3-8	500

by use of ointments, oil etc. Fifteen per cent patients did not use any first aid. Ink, kerosene, henna, egg, salt, Colgate tooth paste etc. were some exotic first aid measures used, to name a few.

Overall mortality rate was 10.4% [Tables 5-7]. The maximum number of deaths occurred in the age group of one to two years. Mortality rate was maximum (18%) in the age group < 1 year and 10-11 years. Female mortality rate (12%) was higher than male mortality rate (9%). Fifty-four per cent of total deaths occurred in patients having more than 40% TBSA involvement. Following observations were made with respect to demographic distribution and mortality.

- 5.79% mortality rate within 5 km of our unit.
- 15% mortality rate (73% of total deaths) outside 5 km of our unit.
- Three deaths (7% of total deaths) in patients with 11-20% burns were from the region outside the 5 km zone but within MCGM territory.
- Zero mortality in patients from rest of Maharashtra and other states.

Mortality rate was higher in flame burns followed by electric injury and scalds. There was no significant variation in the mortality pattern as per the change in parental occupation. The ultimate mortality rate was unaffected by first aid measures used.

Table 5: Age group and mortality rate

<i>S. No.</i>	<i>Age group In years</i>	<i>Number of deaths</i>	<i>Number of cases</i>	<i>Mortality rate (%)</i>
1	< 1	11	61	18
2	1-2	16	119	13
3	2-3	8	94	9
4	3-4	3	53	6
5	4-5	5	48	10
6	5-6	0	36	0
7	6-7	2	15	13
8	7-8	0	20	0
9	8-9	1	6	17
10	9-10	2	15	13
11	10-11	2	11	18
12	11-12	2	13	15
13	12-13	0	7	0
14	13-14	0	2	0
Total	0-14	52	500	10.4

Mortality rate is calculated as percentage of number of deaths in age group and total number of patients in that age group

Table 6: Demographic data and mortality

Demographic region	<10% TBSA	11-20% TBSA	21-40% TBSA	>40% TBSA	Total deaths
Within 5 km (MCGM Territory)	0	0	7	7	14 (27)
Outside 5 km (MCGM Territory)	0	3	6	11	20 (38)
TMC	0	0	7	11	18 (35)
ROM	0	0	0	0	0
Other states	0	0	0	0	0
Total	0	3 (7)	20 (39)	28 (54)	52 (100)

Figures in brackets indicate the percentage of total deaths in each demographic region

Table 7: Demographic data and mortality rate

Demographic region	Number of patients	Total deaths	Mortality rate (%)
Within 5 km (MCGM territory)	242	14	5.78
Outside 5 km (MCGM Territory)	133	20	15.04
TMC	114	18	15.79
ROM	9	0	0
Other states	2	0	0
Total	500	52	10.4

DISCUSSION

Burns are important preventable causes of injury in children. This study was carried out on 500 paediatric burn patients with an objective to analyze demographic and epidemiological features of patients in our area so as to determine the predisposing factors and those preventive measures that can be implemented through public education.^[2]

Analysis of age and sex records in our study showed that maximum patients were less than three to four years of age and our observations conform to published reports.^[3-8] The overall male predominance is also in agreement with the study of other authors.^[3-5,7-12]

The average TBSA involved was 16.35%, which is in accordance with the work of some reporters^[8] and in discordance with the reports of some others.^[10] Seasonal variation showed increased number of admissions during winter season.^[10-13] Most burns occurred in domestic circumstances.^[3,5,7,10-12] Scalds are the commonest cause of burn injury.^[3,5,6,8,9,11,14,15] Prevalence of scalds can be attributed to the fact that children are often left unattended at home and they are too small to understand the dangers of being in the vicinity of injurious agents.

Overall mortality rate was 10.4% and mortality rate in the

demographic region within 5km of the unit was 5.79%, this conforms to findings reported in other studies.^[8,13,14] Zeitlin *et al.*^[6] and Ying *et al.*^[10] reported a mortality rate of 0.2% which can be attributed to the less number of patients with extensive and severe burns, in their series. Reports of paediatric burn studies from India suggest a significantly higher mortality rate than observed in our unit.^[11,12] Higher mortality in the patients from the area outside 5km of our unit suggests the need for early resuscitation. Significant mortality in patients with 11-20% TBSA involvement from the region outside the 5 km of the unit suggests the role of golden hours lost during transportation of these patients and the lack of primary resuscitation. Zero mortality among the patients from other districts of Maharashtra and other States suggests that patients were stabilized before shifting. Large burn size (>40% TBSA) is a strong predictor of mortality.^[8,15] Mortality rate was higher in flame burns followed by electric injury and scalds. There was no significant variation in the mortality pattern as per the change in parental occupation. Similarly, first aid measures used did not affect the ultimate mortality rate.

Mortality rates in our unit are low and acceptable in comparison with the international data and credit goes to the management protocol of our unit. We follow a simple and easily reproducible regime. The structure of the unit is simple. It comprises a ward and small operation theatre with trolley and hand shower for bathing. A dedicated burn Intensive Care Unit (ICU) is not available in our institution. However, critically ill patients are managed in the paediatric ICU by valuable input from paediatric intensivist. Our staff consists of head of the department, two senior consultants, three resident doctors, microbiologist, dedicated nurses and other workers. This basic structure is described so as to guide other centres which are interested in establishing a simple unit.

In an attempt to plan preventive strategies, we studied the factors leading to paediatric burn injury. It is the child's natural curiosity and inability to understand that certain things are dangerous to them, which leads to burn injury. These factors are further substantiated by the lack of supervision, lack of awareness about injurious agents and carelessness on part of parents. If dangerous objects are kept out of the reach of children, these injuries can be avoided. Greater awareness and parental education will help in preventing paediatric burn injury. Preventive campaign starts with identifying the high-risk population in the community and exploring the ways and means of reaching and educating these people. Mass education by showing how actual accidents occur with the aid of video tapes and colour drawings can be rewarding. Help of the media like television, radio and press etc is required, but is expensive. It was found that the average family size was five, this means that apart from parents, other members of the family were also living at home. Mother, elder siblings and other family members should be targeted for implementing prevention protocol and that too during spring season. Elder siblings can be taught to take care of their younger ones by education at school.^[2] After admission, the neighbours should be called and educated so that similar incidents will not occur again in that locality. Although use of water as first aid does not affect the mortality rate, it definitely decreases the morbidity by decreasing the extent and depth of burn and therefore hospital stay. Burn prevention campaign should aim for the elimination of paediatric burn injuries from our society.

CONCLUSION

This study provides a comprehensive overview of the epidemiology of paediatric burn patients. The management protocol followed in our unit is simple and can be easily followed in a country like India where cost of burn management is prohibitively expensive. Almost all of these burn injuries can be avoided if simple prevention measures are taken. The most important step

is public education and availability of good burn care facilities in all public institutions as near to the place of accident as possible. Early and adequate resuscitation improves the final outcome. Prevention is more cost-effective than treatment. Good and effective burn care does not necessarily imply expensive burn care.

REFERENCES

1. Bouter LM, Knipschild PG, van Rijn JL, Meertens RM. How to study the etiology of burn injury: The epidemiological approach. *Burns* 1989;15:162-6.
2. Keswani MH. The prevention of burning injury. *Burns Incl Therm Inj* 1986;12:533-9.
3. Cheng JC, Leung KS, Lam ZC, Leung PC. An analysis of 1704 burn injuries in Hong Kong children. *Burns* 1990;16:182-4.
4. Chapman JC, Sarhadi NS, Watson AC. Declining incidence of paediatric burns in Scotland: A review of 1114 children with burns treated as inpatients and outpatients in a regional centre. *Burns* 1994;20:106-10.
5. Elísóttir R, Lúdvígsson P, Einarsson O, Thorgrímsson S, Haraldsson A. Paediatric burns in Iceland. Hospital admissions 1982-1995, a populations based study. *Burns* 1999;25:149-51.
6. Zeitlin R, Somppi E, Jarnberg J. Paediatric burns in central Finland between the 1960s and the 1980s. *Burns* 1993;19:418-22.
7. Ryan CA, Shankowsky HA, Tredget EE. Profile of the paediatric burn patient in a Canadian burn centre. *Burns* 1992;18:267-72.
8. Morrow SE, Smith DL, Cairns BA, Howell PD, Nakayama DK, Peterson HD. Etiology and outcome of pediatric burns. *J Pediatr Surg* 1996;31:329-33.
9. Mercier C, Blond MH. Epidemiological survey of childhood burn injuries in France. *Burns* 1996;22:29-34.
10. Ying SY, Ho WS. An analysis of 550 hospitalized pediatric burn patients in Hong Kong. *J Burn Care Rehabil* 2001;22:228-31.
11. Gupta M, Gupta OK, Goil P. Paediatric burns in Jaipur, India: An epidemiological study. *Burns* 1992;18:63-7.
12. Mukerji G, Chamania S, Patidar GP, Gupta S. Epidemiology of paediatric burns in Indore, India. *Burns* 2001;27:33-8.
13. Iregbulem LM, Nnabuko BE. Epidemiology of childhood thermal injuries in Enugu, Nigeria. *Burns* 1993;19:223-6.
14. Enescu D, Davidescu I, Enescu M. Paediatric burns in Bucharest, Romania: 4327 cases over a 5-year period. *Burns* 1994;20:154-6.
15. Ramakrishnan KM, Sankar J, Venkatraman J. Profile of pediatric burns Indian experience in a tertiary care burn unit. *Burns* 2005;31:351-3.

Source of Support: Nil, **Conflict of Interest:** None declared.