

Epidemiology, Clinical Pattern and Management Outcome of Paediatric Burn Injuries in Nepal

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ABSTRACT

Introduction: Burn injuries are third commonest type of injury in Nepal and 61% of burn victims are children. This represents a significant morbidity and mortality burden for patients and families. This study was carried out to describe epidemiology, clinical pattern and therapeutic outcome of children with burn.

Methods: It is a retrospective observational study of routinely collected data of children up to 14 years admitted to the Burns Ward at Kanti Children's Hospital, Kathmandu, Nepal, from July 2016 to July 2019. Statistical analysis was done on the collected data.

Results: Total 935 patients were admitted with an average of 311.7 per year, among which 63% were males and 83.0% were aged five years or under. Patients travelled from all over Nepal for treatment at this hospital. 50.6% of patients presented with fresh burns < 24 hours after injury. Scald burn was the commonest (82.6%). Children under five were more likely to have scald burns, whereas older children more likely to have flame or electric burns. Majority of cases (70%) were of mild burns < 10% TBSA and only 3.2% TBSA > 30%. 68.5% were managed conservatively and 18.4% required debridement and skin grafting. Mean length of stay was 15 days. Overall mortality was 1.0%. In children with > 30% burns mortality was 12.9%.

Conclusions: Scald burn was the commonest while proportion of flame burn increases with age. Majority of burns occur in male under five years of age. Most cases presented with < 10% TBSA and were managed conservatively.

Key words: burn; flame; scald; total body surface area



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INTRODUCTION

Injuries, especially unintentional injuries, are leading cause of death among children and a serious public health problem around the world.^{1,2} Children are considered to be more vulnerable because of their curiosity to explore and experiment their surroundings, their small stature, and their physical and physiological immaturity to perceive danger.^{3,4}

World Health Organization (WHO) reported burns to be the second biggest cause of paediatric unintentional injury after motor accidents. Morbidity and mortality is high, with burn injuries causing 250,000 deaths and loss of 18 million disability associated life years (DALYs).⁵ Burns result in long term social, psychological, economical complications for patients and their families as well as complications of scarring, contracture and limb amputation.⁶ Ninety percent burn deaths occur in low income countries due to inconsistent quality of care and lack of preventive programmes.⁷

There is dearth of literature in regards to burn injuries in our part of the world. Hence this study was conceptualised to describe the epidemiology, clinical characteristics, management and outcome of the paediatric burns in Kanti Children's Hospital (KCH), Kathmandu, Nepal.

METHODS

This is a retrospective observational study based on routinely collected patient information from the Burns Ward of Kanti Children's Hospital, Kathmandu, Nepal. Data was collected from July 2016 to July 2019 and analyzed using SPSS version 16. Permission for the study was obtained from the Institutional Review Board.

After the database was created, patient characteristics were grouped and coded for analysis. Patient's addresses were searched using Google Maps and distance travelled was calculated. Total body surface area (TBSA) was initially a continuous variable that was categorized to allow analysis and comparison with other studies. Length

of stay in days was used as a continuous variable to get minimum, maximum and mean, then categorized into groups for further analysis.

Data was entered in SPSS. Descriptive statistics were used to analyze the numbers and percentages of total pediatric burn patient population by year, age, sex, TBSA, distance travelled, time until arrival, cause of burn, management, length of stay, discharge status and mortality.

Chi square test of association was used to determine if there was an association between selected categorical variables (age, sex, time until arrival, distance travelled, TBSA) and adverse outcomes, such as length of stay and mortality. $P < 0.05$ was considered statistically significant.

RESULTS

A total of 935 patients were admitted into the burn ward between July 2016 and July 2019. The total from July 2016 - 17 was 321, from July 2017-18 was 329 and July 2018 - 19 was 285. The average number per year was 311.7. There was a male predominance; 63% of total patients were males (590) compared to 37% females (345). This was consistent across all three years; 59%, 65% and 64% males consecutively. Incidence of burns varied by age with younger than five years being affected mostly and decreasing with age.

Contact addresses were available for 89.2% children. Patients were recorded having travelled from all over Nepal to attend KCH; up to a distance of 850 km. 38.2% (358) travelled over 100 km from their home address while 311 (33.2%) lived within 100 km of Kathmandu and 160 patients (17.11%) were from Kathmandu city. There was significant association between time until presentation and distance travelled on Chi squared test of association ($p < 0.001$) as shown in table 1.

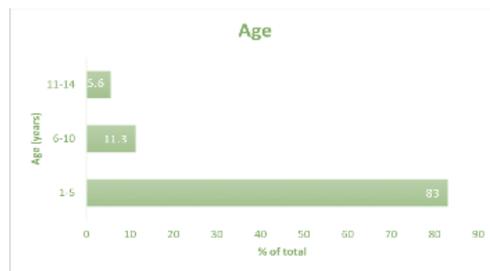
Time to hospital presentation was available for 98.7% of patients. 50.6% (474) presented within 24 hours of the burn injury. Almost half of all patients

Table 1. patient characteristics and their outcome

Patient Characteristics	Outcome
Age (yrs.)	Management (conservative, wound debridement, skin graft, both, amputation)
Sex	Length of stay (< 1 wk, 1 - 2 wk, 2 - 4 wk, 4 - 8 wks, > 8 wks)
Distance Travelled (distance from KTM; KTM city, < 100 km, > 100 km)	Mortality
Time until presentation (< 24 hr, < 1wk, > 1 wk)	Other: referral to another centre, LAMA
% TSBA (1 - 5%, 5 - 10%, 10 - 30%, 30 - 50%, > 50%)	
Type of burn: scald, flame, contact, electric, lightening, acid, chemical	

(48.1%) had delayed presentation and reached hospital more than 24 hours after injury. Three hundred and sixty seven (39.2%) presented after 24 hours but within one week of injury, and 8.9% (83) arrived at hospital more than one week after the burn injury.

Significant association between type of burn and age was found in this study ($P < 0.001$). Scald burns made up 84% of burns in the under five age group, 73.5% of the 6 - 10 and 71% of the 10 - 15 age group. Flame burns made up 11% of the under five years, 19% of the 6 - 10 years and 11.5% of the



Chi squared test of association did not find any association between sex and age of burns patients ($p=0.08$).

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Figure 1. Age distribution

15 age group. Other burn types (Electric including lightning, acid, contact and chemical) made up 3% of the under 5's, 7% of the 6 - 10's and 17% of the 11 - 15 age group. Younger children are more likely to have scald and flame burns while older children more likely to suffer electric, chemical and other types of burn. No significant association was found between sex and type of burn ($P = 0.6$).

TBSA percentage was available for 99.5% of patients. 34.1% (319) had TBSA less than 5%, 34.9% (327) between 5 - 10% TBSA, 27% (254) between 10 - 30% TBSA. Twenty nine (3%) patients had TBSA between 30 and 50%, and two patients (0.2%) had burns that covered > 50%. No statistical significance was found in case of TBSA and various age groups ($P = 0.1$) and also sex ($P = 0.46$).

TBSA was associated with type of burn ($P < 0.01$). Scald burns tended to be minor; they made up 84%

Table 1. Travel time and distance to Kanti Children's Hospital

Time until presentation	Distance travelled		
	Kathmandu	< 100 km	> 100 km
< 24 hours	118 (76%)	167 (55%)	145 (41%)
Delayed (> 24 hours)	38 (24%)	131 (45%)	209 (59%)
Total	156	298	354

Table 2. Types of burn

Types of burn	No of patients	Total %
Scald	773	82.6
Flame	117	12.5
Electric	25	2.7
Chemical	8	0.9
Contact	6	0.6
Lightening	3	0.3
Acid	3	0.3
Total	935	100%

Table 3. Type of burn and age

Type of burn	Age range (Yrs)			Total
	5	6 - 10	11 - 15	
Scald	658 (84.6%)	78 (73.5%)	37 (71.1%)	773
Flame	91 (11%)	20 (19%)	6 (11.5%)	117
Other	28 (3.6%)	8 (7.5%)	9 (17.3%)	45
Total	777	106	52	935

of burns with TBSA < 10%, and only 67.7% of burns TBSA > 30%. Flame burns tend to be more severe; they only made up 9.9% of minor burns with TBSA < 10% but 30.3% of severe burns with TBSA > 30%.

Management of patients were recorded as wound debridement, skin grafting or conservative. The majority of patients 68.5% (641) were managed conservatively. 8.7% (81) received wound debridement alone, 4.5% (42) required skin grafting alone and 18.3% (171) required both wound debridement and skin grafting. Seven patients were also recorded to have limb or digit amputations; four of these had flame burns, two electric burns and one had scald burn.

Length of stay was available for 89% of patients. Mean length of stay was 15 days and range was from one to 120 days. In total, 85.8% of patients stayed less than one month and 64.7% less than two weeks.

Statistically significant association was found between TBSA and length of stay ($p < 0.001$). Most patients who stayed more than four weeks had

Table 5. Treatment modality

Management	No of patients	Percentage
Conservative (dressings)	641	68.5%
Debridement	81	8.7%
Skin graft	42	4.5%
Debridement and graft	171	18.3
Total	935	100%

Table 4. Type of burn with TBSA

Type of burn	TBSA%			Total
	< 10%	- 30%	30%	
Scald	548 (84%)	203 (79.9%)	21 (67.7%)	772
Flame	64 (9.9%)	43 (16.9%)	10 (33.3%)	117
Other	34 (5%)	8 (3.1%)	0 (0%)	42
Total	646	254	31	931

TBSA > 30% (48%), whereas only 5.9% had TBSA < 5%. Conversely, 43.7% of patients who stayed < one week had TBSA 1 - 5%, and only 25.9% had over 30%.

The overall mortality rate was 1%. Cause of mortality was recorded as sepsis in two of these cases, for the remaining seven cases, no cause was recorded.

Statistically significant association between TBSA and mortality was found in this study ($P < 0.001$). Amongst the group with TBSA < 10% mortality was 0, 10 - 30% TBSA mortality was 1.9% (5), 30 - 50% TBSA mortality was 10% (3), and > 50% TBSA mortality was 50% (1).

All cases of mortality occurred in children < five years of age, however in chi squared test of association no significance was found between age group and mortality ($P = 0.39$). Time until presentation was not significantly associated with mortality ($P = 0.2$). Type of burn was not associated with mortality ($P = 0.9$) but amongst nine patients who died, eight had scald burns and one had flame burn. Sex and distance travelled were also non-significant statistically ($P = 0.8$ and 0.5). Thirty

Table 6. Length of hospital stay

Length of stay	Frequency	Percent	Cumulative Percent
<1wk	292	31.8	31.8
1 - 2 wks.	302	32.9	64.7
2 - 4 wks.	194	21.1	85.8
4 - 8 wks.	116	12.6	98.4
> 8 wks.	14	1.5	100

Table 7. Length of stay with TBSA

Length of stay	TBSA%			
	5	5 - 10	10 - 30	30
< 1 week	139 (43.7%)	92 (38.4%)	51 (20.7%)	7 (25.9%)
2 week	107 (33.6%)	129 (39.9%)	64 (26%)	2 (7.4%)
4 week	53 (16.6%)	66 (20.4%)	69 (28%)	5 (18.5%)
> 4 week	19 (5.9%)	36 (11.1%)	62 (25.2%)	13 (48%)
Total	318	323	246	27

three patients (3.4%) were referred to other centers in Kathmandu. Reasons for this were recorded as being for improved management or ICU care. Referral was more likely if patients had high TBSA % ($p < 0.001$). 22% of patients with TBSA $> 30\%$ were referred compared to 5% of those with TBSA 10 - 30% and 1.7% of those with TBSA $< 10\%$. Forty four (4.7%) were recorded as LAMA or requesting early discharge for various reasons.

DISCUSSION

In regards to the prevalence of burn injuries, our yearly average rate is in concordance with Chaudhary et al who had found similar results for the year 2014 - 2015 in KCH.⁸ The male preponderance of paediatric burns seen in this study (63%) is similar to other researchers in the past by Rybarcyk et al, Chaudhary et al, Qian et al and Golshan et al.⁸⁻¹¹ However, girls had higher preponderance in the study conducted by Mathur et al.¹² Similarly, a review of burn injury studies from South Asia also showed female preponderance.⁹ This may be explained by deep-rooted gender-based roles for girls in low and middle income

Table 9. Referral to another center

TBSA%	Referral to another centre		Total
	No	Yes	
< 10	635	11	646
10 - 30	240	14	254
> 30	24	7	31
Total	899	32	931

Table 8. Mortality with TBSA

TBSA%	Survival	Mortality	Total
< 10	646	0	646
10 - 30	249	5	254
30 - 50	26	3	29
50	1	1	2
Total	922	9	931

countries which exposes them to unsafe kitchen or cooking areas.¹³ We found no association between sex and age group ($P = 0.08$). Children less than five years old were the most common age group admitted with burn injuries (83%). This is in agreement with previous studies by Chaudhary et al from the same institute, Golshan et al from South-East Asia, by Rybarcyk et al from Africa and by Balseven- Odabasi et al from Turkey.^{8-10,14}

We noted that scalds were the commonest type of injury comprising 83% in all age group. This may be accounted for by the Nepali culture of boiling milk and water for regular consumption of hot tea. Our data shows an association between type of burn and age ($p < 0.001$). Percentage of burns that were scald was highest in under five years and decreased in older age groups. Children over age five were more often affected by flame burns than the under five age group, and incidence of electrical, lightning, chemical and contact burns was highest in older children aged 10 - 15 years. This trend has also been found in previous study from Nepal.¹⁵ However, Golshan et al reported that electric burns were more common amongst males and flame burns amongst females.⁹

The majority of our patients had minor burns with $< 10\%$ TBSA accounting for 70% of all cases. Similar findings have been reported by Zvizdic et al. who found that TBSA $< 10\%$ accounted for 71.2% of cases and $> 30\%$ for 2.7% of cases.⁶ However, this is in contrary to previous study from our institute by Chaudhary et al. Their study reported only 45.8% of patients having burns $< 10\%$ TBSA and 7% of patients TBSA $> 30\%$.⁸ The recent shift in clinical pattern towards less severe

burns suggests there may be improvements in burn education and prevention in Nepal.

Patients come from all over Nepal for treatment at our unit. 38.2% travelled distances over 100 km, 33% lived outside KTM city but within 100 km, and only 17.1% of patients came from within KTM city. Nepal is a mountainous country with poor roads. Many rural communities are not linked by roads and 100 km on road can take between nine and 15 hours by public transport; these distances travelled can represent journeys taking multiple days. KCH has the only paediatric burns unit in the country and lack of access to care is one of the top three barriers to health care in Nepal.¹⁵ It was therefore unsurprising to find a correlation between distance travelled and time until presentation ($P < 0.001$); almost 60% of patients living > 100 km away from KTM presented with burns > 24 hrs whereas only 24% of patients living in KTM presented with burns > 24 hrs. We found that over half of patients presented with fresh burns, < 24 hours of injury (50.6%) and 48.1% presented after 24 hrs; 39.2% within 1 week and 8.9% after a week. Shrestha's study of paediatric burn patients at Patan Hospital, Lalitpur, Nepal in 2006 found that 54% presented < 24 hours of injury.¹⁶ However, Chaudhary et al had found that more than half presented after 24 hours of injury (52.23%).⁸ As many patients come travelling long distances, this slight reduction in time could reflect improved road and public transport infrastructure.

Our findings that the majority (68.5%) of patients were managed conservatively agrees with literature in the past.^{6,8} 18% of our population required wound debridement and graft, similar to Zvizdic et al from Bosnia Herzegovina,⁶ Ozotrun et al from Turkey¹⁷ and Chaudhary et al from our institute.⁸ 0.7% patients in our study required limb or digit amputations. This is in keeping with Ozotrune et al¹⁷ who found that 0.4% of patients had amputations with majority due to electric burns, however in our population four out of the seven patients with amputation had flame burns, two had electric burns and one had scald burn.⁸

Our patients stayed in hospital on average of 15 days. This is in keeping with Zvizdic et al's average hospital stay of 16 days⁶ and Chaudhary et al's for

up to two weeks.⁸ The association between increased TBSA % and length of stay in our study is supported by other studies too.^{6,17}

Studies of paediatric burn injuries in low and middle income countries show a vast range in overall mortality rates with 1.31% from Oztorun et al to 19.68% from Gupta et al.^{17,18} Our overall mortality rate of 1% is lower than Chaudhary et al's data from KCH in 2014 - 15, which had an overall mortality of 4.78%.⁸ This improvement in mortality could represent improvements in standards of care in the paediatric burn unit of KCH. Low mortality rate compared to data from other centers may be because the more serious patients were transferred out of unit either to PICU in KCH, which was not recorded, or referred to other centers where higher standards of critical care were available. This is proven by the fact that 22% of patients with burns TBSA $> 30\%$ were referred to other centers, compared to 5% of burns with TBSA 10 - 30% and only 1.7% of burns $< 10\%$. The fact that patients with high TBSA were more likely to be referred to private centers is in keeping with the survey findings that 63% of Nepalese use private healthcare for acute illness and injury, regardless of socioeconomic status.²¹ This may be due to lack of trust in Government facilities. Mortality was up to 100% in patients with TBSA $> 40\%$ in Nepal in the study done by Gupta et al.¹⁹ Type of burn was not associated with mortality ($P = 0.9$) in our study. However, one study from Nepal by Tripathee et al found flame burns responsible for 95% of deaths.²⁰

The percentage of patients with LAMA was high (4.7%) in our study. Reasons for this could be due further distance from home, fear or mistrust of modern health care, financial constraints, wishing to seek alternative treatments and a lack of understanding of care requirements. Gupta et al reported that one of the major barriers to burn care in Nepal is fear and lack of trust.¹⁹

Although our study is comprehensive, it is retrospective in nature, and is single centric. In addition to this ethnicity, parental occupation or level of education or any other marker of socioeconomic status was not available for this study. Anatomical site and depth of burn were also not included. This may not reflect the in depth

picture of the entire population. However, we expect that further more robust prospective studies in the future would further analyse and contribute in improving the outcome in pediatric burn injuries in the country.

CONCLUSIONS

Burns are a significant cause of injury amongst the paediatric population of Nepal. Kanti Children's Hospital's specialist burn unit receives on average 311.7 cases per year. The clinical pattern of burn injury was found to be predominantly scald burns (83%) affecting boys (63%) and children under five

years of age (83%). Most cases were of burns affecting < 10% TBSA (69%) and were managed conservatively (68.5%), staying on average 15 days. Overall mortality rate was low at 1%.

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