Burn scenario in a single North-Eastern State of India: A 5-year retrospective study

ABSTRACT
Introduction: The exact figure of burn injuries is still unavailable in many states of India. Some northeast Indian states with their unique social structure, hilly terrain, and practice of shifting (Jhum) cultivation the pattern of burn injuries in these states may be different.

Materials and Methods: The burn records between March 2012 and April 2017 were retrospectively studied from all the district and private hospitals of the state. The demographic profiles, etiologies, delay in admission, percentage, and degrees of burn, hospital days, managements, and outcome on a single hill state of India were reviewed and analyzed.

Results and Observations: The total number of patients studied was 450 with a mean age of 18.94 years. There were 281 male (62.4%), 168 female (37.3%), and one missing sex data, out of which 17 (4.2%) expired. Majority of the admission were in the winter season. The most common etiology was scald burn (55%). Suicidal intent was recorded in 8 patients (1.8%). The mean percentage of burn was 21.72%.

Conclusion: The pattern of burn cases in the state showed marked variance from studies of other larger states of the country. Lifestyle modification, improving living standard, and active NGO participation seem to influence the low incidence of burn in the state.

Keywords: Burn epidemiology, burn injuries, hill state, shifting cultivation, social structure

INTRODUCTION
The epidemiology of burn in the high-income countries shows a decreasing pattern of burn-related injuries and deaths because of better prevention strategies and improved care.[10] However, the impact it has on low-income countries are catastrophically devastating. According to the 2015 Global Health Estimates, 96% of fatal fire-related burns occur in low- and middle-income countries.[21]

Many studies have shown regional variation in the epidemiology of burn injuries. India being a large country with diverse culture and socioeconomic condition the picture may be different for each region. Although many studies and research on the epidemiology of burn injury had been published, studies in the north-eastern states of the country other than Assam are still lacking. A small state like Mizoram in the northeast part of the country with its unique social structure, hilly terrain, and practice of shifting (Jhum) cultivation, the pattern of burn injuries in the state has been a subject of many speculations. According to individual estimates and hospital statistics, the picture may be different from those reported in other larger states of the country.

We conducted this retrospective study within 5 years to find out the epidemiology of burn injuries in all the district hospitals and private nursing home and hospitals throughout the state.

MATERIALS AND METHODS
This is a descriptive analysis using retrospective data from district hospitals and private hospitals of Mizoram state in...
India. Available data were collected from the eight district hospitals and fifteen private hospitals throughout the state. This retrospective study included all admitted burn patients between March 2012 and April 2017. As the state does not yet follow burn registry, data were collected by searching manually the inpatient records and electronically if the hospital follows a computerized registration system. Every government and private hospitals/nursing homes existing inside the state during the study were covered.

The demographic profiles, etiologies, percentage, and degree of burn, hospital days, managements, and outcome were reviewed. The prevalence of burn during the study and incidence of burn-in 2016 was also calculated. “Unknown” refers to unavailable data. Those treated on outpatient basis and those admitted for burn complications such as contracture and scars were excluded from the study. The analysis was done using IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp. and Microsoft Excel 2010. \( P < 0.05 \) was considered as statistically significant. Ethical clearance was obtained from the institute ethical committee.

RESULTS

The total number of patients studied between March 2012 and April 2017 was 450. The prevalence of burn from March 2012 to April 2017 was 38.53 per 100,000 and the incidence of burn-in 2016 was 18.1 per 100,000. There were 281 male (62.4%), 168 female (37.3%), and one missing sex data, with a male to female ratio of 1.7:1. Age ranges from 5 months to 78 years, and the mean age of the study individuals was 18.94 years. The highest proportion of admission was seen in the age group between 0–1 years and 26–35 years constituting about 18.2% and 15.8%, respectively, from the total number of admissions. The age group distribution data are shown in Table 1 and Figure 1.

Monthly distribution of admissions

Studies on seasonal pattern showed that the highest admission was observed during winter season, and the patients admitted in March and January were highest. The lowest average monthly admission was observed during October.

Outcome according to etiology

The burn etiology varied by age. The predominant cause of burns in the adult group was flame burns followed by scald, electric, and chemicals. Scald burns were the most common cause in pediatric group followed by flame and electric [Table 2]. Admission due to contact burn was not recorded during the study. The most prevalent among all age group was scald burn, accounting for 55% of injuries, followed by flame (28.2%), electric (16%), and chemicals (0.95%). Chemical burns were observed in three adult males; all were results of accidental automobile battery burns while the lone female was a victim of acid attack associated with an attempted rape [Table 3].

Severity of burn injuries

Second degree burn was documented in more than half of the study patients (\( n = 250, 61.6% \)). The next most common was the first-degree burn (\( n = 101, 24.9% \)). The severity of burn based on the total body surface area (TBSA) burn ranges from 5% to 80% TBSA with a mean of 21.72%. There were six deaths from the 11 patients admitted due to burns with TBSA above 60% [Table 4].

Mode of injury and their outcome

Of the total of 450 individuals studied, the circumstance of burn was accidental in 81.1%. The suicidal burn was documented in eight patients (1.8%) and homicidal in three

Table 1: Age group distribution of admission

| Years | Frequency, \( n \) (%) | Valid (%) |
|-------|------------------------|-----------|
| 0-1   | 82 (18.2)              | 18.3      |
| 2-5   | 81 (18)                | 18.1      |
| 6-13  | 45 (10)                | 10        |
| 14-18 | 27 (6)                 | 6         |
| 19-25 | 62 (13.8)              | 13.8      |
| 26-35 | 71 (15.8)              | 15.8      |
| 36-50 | 56 (12.4)              | 12.5      |
| 51-65 | 18 (4)                 | 4         |
| 66-80 | 6 (1.3)                | 1.3       |
| Unknown | 2 (0.4)              |           |
| Total | 450 (100)              |           |

Table 2: Types of burn across age group

| Age group | Flame burn | Scalding burn | Electric burn | Acid/chemical burn | Unknown |
|-----------|------------|---------------|---------------|--------------------|---------|
| 0-1       | 4          | 77            | 1             | 0                  | 0       |
| 2-5       | 5          | 71            | 5             | 0                  | 0       |
| 6-13      | 13         | 23            | 9             | 0                  | 0       |
| 14-18     | 11         | 9             | 6             | 0                  | 1       |
| 19-25     | 21         | 20            | 18            | 2                  | 1       |
| 26-35     | 34         | 20            | 17            | 0                  | 0       |
| 36-50     | 25         | 18            | 10            | 1                  | 2       |
| 51-65     | 9          | 2             | 5             | 1                  | 1       |
| 66-80     | 2          | 4             | 0             | 0                  | 0       |

Table 3: Types of burn across sex

| Sex       | Flame burn | Scalding burn | Electric burn | Acid/chemical burn | Unknown |
|-----------|------------|---------------|---------------|--------------------|---------|
| Female    | 45         | 111           | 9             | 1                  | 2       |
| Male      | 80         | 133           | 62            | 3                  | 3       |
patients (0.7%). Eight deaths were recorded out of the total 327 accidental burn cases. There were four deaths among the eight suicidal cases (50%) and one death from among the three homicidal burn cases (33.3%) [Table 5].

**Management**

More than two-thirds of the study patients were managed conservatively (82.7%) with regular occlusive dressings. The most common cause of burn; scald burns resulted in mostly superficial burns which requires only conservative treatment. Among those surgically treated 11.8% underwent debridement or tangential excision followed by split-thickness skin graft (STSG) while debridement only was recorded in 2.4%.

**Duration of hospital stay**

The average length of hospital stay was 13.63 days. The longest average duration of hospital stay was observed in those admitted due to electric burns (19 days) followed by flame (18 days), scald burns (10 days), and chemical burn (12 days).

**Mortality: Whole State and District wise**

The overall mortality rate for admitted burn patients in the whole state was 3.8%. The individual mortality rate for Civil Hospital Aizawl, the main referral center of the state was 11.59%. Among the districts, mortality was highest in Kolasib (6.5%), the northern-most district bordering Assam, followed by Lunglei (5.2%) the second most populated district and then Aizawl (3.8%) which has the highest population.

**DISCUSSION**

Accurate data on the epidemiology of burns covering a single whole north-eastern state of the country is still lacking. The total number of admitted burn patient in our study between March 2012 and April 2017 was 450. In our study, males (62.4%) outnumbered female (37.3%) with a male to female ratio of 1.7:1. This is different from most of the other studies of the surrounding areas.

The low number of female burn patients in the study might be due to fewer records of accidental kitchen fire-related burns. One of the risk factor, a synthetic, long and loose traditional clothes are not commonly worn by women of the study area. The use of kerosene stoves which is considered to be the most common form of cooking in rural areas of the country resulted in the high occurrence of accidental kitchen fire.[4] However, this form of cooking is not popularly practiced in this part of the country. A shifting trends toward improved living standard resulted in a shift from primitive cooking practices to liquid petroleum gas in both urban and rural population. This may partly explain the low incidence of cooking-related fire in the state.

In this study, we found scald burn to be the most common cause of burn injuries (55%) when we consider all the age groups. The second-most common cause was flame (28.2%) similar to the findings by Duci et al.[5] and Kitara et al.[6]

In pediatric population, accidental hot liquid scald burn appears to be the single most common etiology in this study which is comparable to other studies.[7-9] The predominant mode of burn in the pediatric patients is accidental spillage of hot liquid at the kitchen or bathroom due to the unavailability of water heating appliances/geyser in the rural households. However, Sankar et al. in their study reported kerosene to be the single most common agent causing burn injuries in the pediatric patients.[10]

One of our objectives was to study the association between jhum-farm burning and the incidence of burn injuries. Jhum cultivation (Slash-and-burn type of cultivation) commonly practiced in this part of the country is a form of primitive cultivation where a farmer burns his farmland after clearing. The local government is yet to fully abolished this practice which falls between the late February and March every year [Table 6].

**Table 5: Mode of injuries and outcome**

| Mode      | Frequency (n) | Valid (%) | Among death, n (%) | Among recovered |
|-----------|---------------|-----------|--------------------|-----------------|
| Accidental| 368           | 81.1      | 8 (2.2)            | 360             |
| Suicidal  | 8             | 1.8       | 4 (50)             | 4               |
| Homicidal | 3             | 0.7       | 1 (33.3)           | 2               |
| Unknown   | 71            | 15.8      | 3 (4.2)            | 68              |
| Total     | 450           | 100       | 16 (3.6)           | 434             |
The remaining one third were surgically managed by debridement/tangential excision with STSG (11.8%) and debridement only (2.4%).

Overall mortality in our study was 3.8% comparable to studies from China\cite{10} and Europe.\cite{9,13,14} The recorded mortality rate of Civil Hospital Aizawl was 11.5% which is lower than those reported from other hospital studies of the region [Table 7]. Karki et al.\cite{15} reported 19.4% mortality in their study at Nepal Cleft and Burn Centre of Kirtipur Hospital, Kathmandu.

**Limitations of the study**

This study was conducted by manually searching the patient’s files from the record sections of each hospital. Most private hospitals do not have a proper record and statistic section, so some cases were missing from the study. Detail history of some variables studied was missing as majority of the hospitals did not maintain a well-documented history records.

**CONCLUSION**

The pattern of burn cases in the state showed marked variance from other studies in the country. Lifestyle modification, improving living standard, and active NGO participation seems to influence the low incidence of burn in the state. The high number of electric burn cases in the state calls for better prevention strategies and proper training to prevent such accidents.

**Financial support and sponsorship**

Nil.

---

**Table 6: District wise distribution of burn cases and deaths**

| District      | Aizawl | Champhai | Kolasib | Lawngtlai | Lunglei | Mamit | Serchhip | Siaha | Others | Total |
|---------------|--------|----------|---------|-----------|---------|-------|----------|-------|--------|-------|
| Cases         | 212    | 46       | 31      | 22        | 58      | 25    | 29       | 19    | 8      | 450   |
| Death (%)     | 8 (3.8)| 1 (2.2)  | 2 (6.5) | 0 (0)     | 3 (5.2) | 0 (0) | 1 (3.4)  | 0 (0) | 1 (12.5)| 16 (3.6)|

**Table 7: Comparisons between Aizawl district hospital with other institutions**

| Institutions                                      | Time period (years) | Total patients | Mean age | Male:female ratio | TBSA (mean) (%) | Flame burn (%) | Scald burn (%) | Electrical burn (%) | Length of hospital stay | Overall mortality (%) |
|---------------------------------------------------|---------------------|----------------|----------|------------------|-----------------|----------------|-----------------|----------------------|------------------------|----------------------|
| SN Medical College, Belgaum Karnataka\cite{3}      | 2 (April 2004-March 2005) | 240            | -        | 0.8:1            | -               | 83.75          | 10              | 4.58                 | -                      | 37.50                |
| Sri-Kashmir Institute of Medical Sciences\cite{16} | 2 (January 2010-December 2011) | 110            | 24.2     | 1.5:1            | -               | 43.64          | 25.42           | 27.27                | 24.7                   | 11.8                |
| Govt. Medical College, Srinagar\cite{17}          | 2 (January 2013-December 2015) | 698            | 31       | 1:1.5            | 34              | 57.44          | 18.62           | 4.87                 | 19 days for <15% TBSA | 36.82                |
| Tata Main Hospital, Jamshedpur\cite{11}           | 5 (January 2009-December 2013) | 1975           | 29.16    | 1:1.05           | 42.5            | 65.16          | 15.80           | 10.37                | 6.64 days              | 40.80                |
| Civil Hospital, Aizawl\cite{11}                   | 5 (March 2012-April 2017) | -              | 24.01    | 1.8:1            | 28.1            | 33.8           | 36.4            | 25.6                 | 16 days                | 11.5                |

TBSA: Total body surface area"
Conflicts of interest
There are no conflicts of interest.

REFERENCES

1. Forjuoh SN. Burns in low – And middle-income countries: A review of available literature on descriptive epidemiology, risk factors, treatment, and prevention. Burns 2006;32:529-37.
2. World Health Organization. Burns. Violence and Injury Prevention. Geneva: World Health Organization. Available from: http://www.who.int/violence_injury_prevention/other_injury/burns/en/. [Last accessed on 2018 Jul 22].
3. Sankar G, Naik VA, Powar R. Epidemiological study of burn patients admitted in a district hospital of North Karnataka, India. Indian J Burns 2014;22:1.
4. Suri MP, Agarwal A, Goyal R, Basra BK, Amin H, Shaik MF, et al. Kitchen related burn injuries: An epidemiological study. Indian J Burns 2011;19:56-7.
5. Ducib SB, Arifi HM, Selmani ME, Mekaj Ayu, Hoxha ET, et al. A retrospective study of 69 patients admitted at the intensive care unit university clinical center of Kosova during the period 2008-2012. Indian J Burns 2014;22:88-92.
6. Kitara DL, Aloyo J, Oboi JH, Anywar DA. Epidemiology of burn injuries: A basis for prevention in a post-conflict, Gulu, Northern Uganda: A cross-sectional descriptive study design. J Med Sci 2011;2:990-6. Available from: http://www.interesjournals.org/abstract/epidemiology-of-burn-injuries-a-basis-for-prevention-in-a-postconflict-gulu-northern-uganda-a-crosssectional-descriptive-2543.html. [Last accessed on 2018 Jun 08].
7. Chakraborty AK, Ahmed SS. Paediatric burn injuries in burn unit, Dhaka medical college hospital-an overview. Indian J Burns 2010;18:14-20.
8. Wardhana A, Basuki A, Prameswara AD, Rizkita DA, Andarie AA, Canintika AF. The Epidemiology of burns in Indonesia’s national referral burn center from 2013 to 2015. Burn Open 2017;1:67-73. Available from: http://dx.doi.org/10.1016/j.burnso.2017.08.002. [Last accessed on 2018 Jun 08].
9. Buja Z, Hoxha E. Burns in Kosovo: Epidemiological and therapeutic aspects of burns treated in university clinical center of Kosovo during the period 2003-2012. Burns Open 2018;2:66-70. Available from: https://doi.org/10.1016/j.burnso.2017.11.004. [Last accessed on 2018 Jun 08].
10. Cheng W, Wanf S, Shen C, Zhao D, Li D, Shang Y. Epidemiology of hospitalized patients in China: A systematic review. Available from: https://doi.org/10.1016/j.burnso.2017.10.003. [Last accessed on 2018 Jun 08].
11. Goswami P, Singodia P, Sinha AK, Tudu T. Five-year epidemiological study of burn patients admitted in burns care unit, Tata Main Hospital, Jamshedpur, Jharkhand, India. Indian J Burns 2016;24:41-6.
12. Oh H, Boo S. Burns in South Korea: An analysis of nationwide data from the health insurance review and assessment service. Burns 2016;42:675-81.
13. Harats M, Peleg K, Givon A, Kornhaber R, Goder M, Jaeger M, et al. Burns in Israel, comparative study: Demographic, etiologic and clinical trends 1997-2003 vs 2004-2010. Burns 2016;42:500-7.
14. Santos JV, Oliveira A, Costa-Pereira A, Amarante J, Freitas A. Burden of burns in Portugal, 2000-2013: A clinical and economic analysis of 26,447 hospitalisations. Burns 2016;42:891-900.
15. Karki B, Rai SM, Nakarmi KK, Basnet SJ, Magar MG, Nagarkoti KK, et al. Clinical epidemiology of acute burn injuries at Nepal cleft and burn centre, Kathmandu, Nepal. Ann Plast Surg 2018;80:S95-S97.
16. Khan TS, Wani AH, Darzi MA, Bijli AH. Epidemiology of burn patients in a tertiary care hospital in Kashmir: A prospective study. Indian J Burns 2014;22:98-103.
17. Wani M, Mir MA, Mir SA, Banotra A, Ahmad WY. Epidemiology of burns in teaching hospital of Northern India. Indian J Burns 2016;24:47-52.