ABSTRACT

Background: Burn injury remains one of the biggest health concerns in the developing world and is a formidable public health issue in terms of mortality, morbidity, and permanent disability.

Aims and objectives: To study the epidemiological aspects of burn admission in a tertiary care burn centre of Bihar.

Materials and Methods: This study is a retrospective hospital based observational study, being conducted at Patna Medical College Hospital (PMCH), Patna from 1.1.2018 to 31.12.2018. All burn patients (n = 1431) admitted during this period were included in this study.

Results: In our region, burn admissions showed 2 seasonal peaks (April, May) & (Nov, Dec). Females of age 20-39 years were most commonly affected. Accidental injuries were more common than suicidal & homicidal cases. Flame burn leaded the cause followed by electric burn. Most burn victims belonged to rural background & low socio-economic strata. Kitchen was the most common place & kerosene oil most common agent causing burn. Majority of patients presented late to our hospital i.e. after 4 hours. In our scenario, mortality of burn patients with total body surface area (TBSA) > 60% was 95%.

Conclusion: Young females of rural background & low socio-economic strata are the commonest victim of burn injuries. Majority of cases are accidental thermal burn. Mortality rate is high in patients with TBSA > 60%. Appropriate preventive & therapeutic measures need to be taken in terms of social education & provision of quality healthcare to reduce the incidence & improve the survival outcome of burn patients.

Keywords: Bihar, burn, epidemiology, India

INTRODUCTION

The solution to any problem lies in understanding its genesis. Same is the case with burn, which continues to challenge human efforts of “positive health” since the beginning of civilization. Burn injury remains one of the biggest health concerns in the developing world and is a formidable public health issue in terms of mortality, morbidity, and permanent disability. Ninety percent of the burns are reported from low- and middle-income countries, of which 50% are from South and Southeast Asian countries.[1] India has vast geographical dimensions and has wide disparities in terms of climate, demography, resources, socioeconomic strata, culture, habits, beliefs, and psychological behavior. Several efforts have been made in India to study the epidemiology of burn, but still many more are needed.

This study was conducted at a tertiary burn care center of Bihar, India, which has as its catchment area whole of Bihar and Jharkhand, adjoining areas of Uttar Pradesh (Gorakhpur, Balia), West Bengal (Asansol, Bardhaman), and Nepal (Janakpur, Dharan, Biratnagar, Birganj) and covers a population of about 150 million, about 15% of total Indian population.

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MATERIALS AND METHODS

Retrospective data of all the burn patients admitted to the burn ward in Patna Medical College, Patna, Bihar, India, from January 2018 to December 2018 were collected from the hospital management system as well as the burn ward records and were analyzed. Brought dead patients were excluded from the study. In total, 1431 burn patients were admitted in this period.

The burn care unit in Patna Medical College and Hospital, Patna, Bihar, India, is a centrally air-conditioned unit with 8 rooms with 6 beds in each room with monitoring devices and wall-mounted gas pipelines along the circumference and the nurses’ station in the center and a separate 6-bedded intensive care unit. During the study period, the number of beds was 54 and the unit was managed by 16 doctors trained in burns. Along with the doctors, 32 staff nurses, 5 technician-cum-dressers, and 14 hospital attendants manned the unit. On admission, general consent regarding treatment in the hospital is obtained from the patient/patient’s attendants. Specific consent for surgery, blood transfusion, restraint, etc., is taken on a patient-to-patient basis. Burn patients are received in the resuscitation room where saline bath is given. Urinary catheter and peripheral line are introduced. Fluid resuscitation is started with Ringer’s lactate according to the Parkland’s formula. The detailed history is taken and noted and burn evaluation is done with respect to total body surface area (TBSA) and depth. The Lund and Browder chart is marked. Dressing is done in the dressing room with silver sulfadiazine/framycetin, and the wound is covered with Gamgee pads and bandages. Injectable antibiotics, proton pump inhibitors, and analgesics are started as initial drug therapy. Patients are taken up for surgery as the situation demands, which ranges from early excision and grafting, debridement and dressing, escharotomy, fasciotomy, and amputations. Emphasis is laid on the nutrition of the patients and Curreri formula is used to calculate the calorie requirement of each patient. Hospital dietician is responsible to give the calculated calorie in the form of various food items. Ryle’s tube feeding is started if the patient is unable to take an adequate amount of feed orally. Enteral nutrition is given preference over parenteral nutrition. Physiotherapy is advised for all the patients and is done by the hospital physiotherapist who is assisted by the staff nurses of the unit. Special emphasis is laid on chest physiotherapy, spirometry, limb movements, and early mobilization. Patients are discharged when they are stable, after grafting has been done, or when there is minimal raw area remaining. They are followed up in the plastic surgery outpatient department, which runs daily.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.2

RESULTS

The results were analyzed with regard to month-wise distribution, age, sex, rural/urban distribution, type of burn, percentage of burns, mode of injury, causative agent, time between burn and admission, and mortality rate. Overall 1978 patients were admitted in burn and plastic surgery emergency, of which 1431 were burn patients and were included in the study.

The highest number of patients reported in the months of April and May. In November, December, and January, again the patient inflow increased. June, July, August, September, and October witnessed a relatively less number of admissions [Table 1].

Table 2 shows the incidence of different types of burns as well as sex distribution. Flame burn constituted about 80% of the cases, electric burn 13%, scald burn 5%, and chemical burn 2%. Out of the 1431 burn patients admitted during the study period, a total of 875 females and 556 male patients were admitted with the female-to-male ratio of 1.57:1. However, when seen separately, female-to-male ratio for flame, scald, electric, and chemical burn was found to be 2.26:1, 0.63:1, 0.24:1, and 2:1, respectively [Table 2].

Majority of flame burn patients (58.7%) belonged to the age group of 20–39 years. The age group of 20–29 years had higher incidence (34.6%) than 30–39 years (24%). Patients aged >40 years constituted only 17.8% of total. In all age groups, except <10 years and more than 90 years, the incidence of thermal burn was noted to be higher in females [Figure 1]. Electric and chemical burn chiefly affected 20–39 years age group (>50%) [Figures 2 and 3, respectively]. Majority of scald burns were children <10 years. The incidence in males was higher than that in females [Figure 4]. Lightening-affected patients were males of 45 and 50 years.

| Table 1: Month-wise distribution |
|----------------------------------|
| Jan    | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| 134    | 124 | 134 | 148 | 149 | 109 | 91  | 89  | 95  | 95  | 133 | 130 |
Majority of affected patients belonged to rural background (79%) whereas 21% belonged to the urban areas [Figure 5].

Sixty-three percent of females suffered burns more than 50% total burn surface area (TBSA) in comparison to 36% of male patients suffering burns >50% TBSA. TBSA <30% constituted only 18.6%. 27.3% of patients admitted were with TBSA >80%. Figure 6 shows the distribution of patients according to the total body surface area.

Only 8% of cases reported in the first 4 h after burns. 32% of cases reported between 4 and 24 h after burns. Eighty percent of referred patients were dehydrated at the time of admission. Figure 7 shows the time between burn and admission.

Majority of the flame burns (81.9%) were accidental. Females had higher incidence of suicidal as well as homicidal burns [Figure 8]. Out of 72 scald cases, 67 cases were of accidental burns [Figure 9]. One hundred percent of electric burn cases were accidental [Figure 10]. Out of 28 chemical burn cases, 25 were of vitriolage and 3 cases were accidental [Figure 11].

Forty-nine percent of cases suffered when cooking. The most common cause is kerosene oil pressure stove (18.1%), followed by kerosene oil lamp (17.2%), liquefied petroleum gas (LPG) cylinder (16%), and kachcha chulha (14.9%) [Figure 12]. Suicidal burns constituted 8% of total burn cases. The incidence was higher in females.

| Type of burn    | Total | Female | Male | Ratio (F:M) |
|-----------------|-------|--------|------|-------------|
| Flame           | 1147  | 795    | 352  | 2.26        |
| Scald           | 67    | 26     | 41   | 0.63        |
| Electrical      | 192   | 37     | 155  | 0.24        |
| Chemical        | 28    | 19     | 9    | 2           |
| Lightening      | 2     | 0      | 2    |             |
| Total           | 1436  | 877    | 559  | 1.57        |

Patients who left against medical advice were excluded from study while calculating mortality rate. The overall mortality rate was 63.8%. The mortality was 100% in TBSA >80%, 95% in TBSA 60%–80%, 48% in TBSA 40%–60%, and 15% in TBSA 20%–40%. In TBSA <20, only 2% of patients died [Table 3].

DISCUSSION

Burn is the second major cause of trauma-related deaths after road traffic accidents. According to the WHO fact sheet April 2014, over 1,000,000 people are moderately or severely burnt every year in India. For clear understanding of its incidence, nature, course, complications, and clinical outcome, various studies in different parts of India have been done. Each population seems to have its own epidemiological characteristics, and knowledge of the epidemiology of burns is needed to select target groups for preventive action. Although the incidence of burn injuries is found all over the country, detailed epidemiological studies from the eastern part of the country are sparse. This effort has been made for a better understanding of burn accidents in our scenario, so that appropriate preventive and curative measures could be taken to reduce the incidence and improve the outcome.

Burns most commonly occurred in April and May (21%) and winter seasons of November to January (27.4%). This is in accordance with the mega-study made by Othman and Kendrick which found winter as the most common season for burn accidents. However, the studies made in Chandigarh by Singh and Dasari which found maximum cases in February and the studies made by Aslam et al. in Peshawar found maximum patients in June. These differences may be explained on geographical and cultural differences. Winter is the cold season in the region and in countries which do not have a regular supply of electricity or where electricity is less affordable than other means; households are likely to use kerosene devices for space heating and also for heating water and making hot drinks. Household members are also likely to spend a greater
proportion of their time indoors in cold weather, which may help explain the winter excess of burn injuries.

Flame was the most common cause of burn injury (80%), followed by electrical current (13%), scald (5%), and chemical burn (2%). Hot liquid was the most common burning agent in children ≤10 years whereas flame was the most common in adults. Our observations are at par with other authors.[10-12] However, this is in contrast with studies made by Aslam et al.[9] where scald burns formed the majority of burn patients.

In our study, 877/1436 (60%) patients were female with a female: male ratio of 1.57:1. Comparing data regarding the gender preponderance, our observations are in agreement with other authors.[11-15] However, this is at variance with epidemiological studies of other authors where females outnumber males as burn victims.[5,9,16,17] Reason for this could be that the typical Indian burn patient is usually a female whose loose clothes catch fire while cooking on the floor-level kerosene stove. Furthermore, dowry-related
deaths are more prevalent in this gender group as they find burning themselves as an easy task to get rid of these issues.\[5\]

Majority of flame burn patients (58.7%) belonged to the age group of 20–39 years. In all age groups, except <10 years and more than 90 years, the incidence of thermal burn was noted to be higher in females. This is in accordance with the studies made in Delhi,\[13\] Indore,\[11\] Bhopal,\[12\] Ahmedabad,\[10\] and Madurai,\[18\] where the peak age of incidence is reported to be in adolescence and adulthood. However, it differs from the studies made in Kashmir,\[5\] where <10 years’ age group is mostly affected.

Electric burn chiefly affected 20–39 years’ age group (>50%) and males were affected more than females. Similar findings have been reported by various studies,\[9,14,19,20\] This finding can be explained with the fact that adult males, being involved in outdoor activities, are affected more.

Chemical burn chiefly affected 20–39 years’ age group and females were affected more than males. This in contrast with various studies\[9,11,14,21-23\] made in India and other countries where involved persons were predominantly males of active working age. This vast difference in data shows the existing problem of vitriolation in our region, of which females are usual victim. The leading causes of the chemical burns were sulfuric acid and nitric acid. Majority of chemical burns at our center involved <10% TBSA. There was a predominance of burns (73.5%) involving deep partial-thickness and full-thickness skin loss which necessitated operative treatment.

Majority of scald burns were children <10 years. The incidence in males was higher than that in females. This is in accordance with studies in Peshawar,\[9\] Bhopal,\[14\] Ethiopia,\[15\] Kuwait,\[24\] and Australia.\[25\] However, studies at Indore\[11\] showed that scald burn affected females more than males. The pattern of scald injuries in children is consistent internationally, both in developed and developing nations. The main causes of scalds involve pulling down receptacles from table and bench tops or overturning containers of heated liquid. Scald injuries occur most frequently in the family kitchen with at least one parent present or from hot tap water in the bathroom or kitchen.\[25\]

Lightening-affected patients were males of 45 and 50 years.
As per this study, females suffered a greater percentage TBSA burns than males, which could be because of their flowing dressing style. This is in accordance with studies made in Delhi.[13] However, in contrast with other studies[5] (Kashmir) where TBSA <20% constituted majority of cases, we found that TBSA <30% constituted only 18.6%. It may be because of lesser awareness among our population about burn, who believes that, in these cases, no consultation will be needed and will heal on its own. 27.3% of patients admitted were with TBSA >80%. This high percentage is due to referral of these patients from different centers and even private hospitals try to avoid these patients. These data were in accordance with the findings (29.6%) of studies of Delhi.[13]

Majority were late-presenting patients. Sixty percent of patients reported 24 h after burns. This delay may be explained as our institute is a tertiary burn care center and patients come from a large geographical area. Other causes of delay include overcoming the state of panic, primary health care consultation, making arrangement for money, transportation, and lack of understanding the severity of the burn. This is in contrast with various studies[10,11,13] where majority of patients report within 24 h. However, it is in accordance with studies made in Nigeria.[26]

Majority of referred patients were dehydrated at the time of admission, which shows unawareness or unwillingness of medical professionals working at referral centers to follow a valid fluid resuscitation protocol in burn patients.

Majority of the flame burns were accidental. Females had higher incidence of suicidal as well as homicidal burns. This is in accordance with earlier studies.[5,10,11,13,18] All cases of electric burns were accidental. Usual causes are loose and bare high-voltage wiring, travelling on roof of rails and buses, climbing electrical poles for repair, and accidents during electricity theft. Majority of cases of chemical burns were of vitriolage and only three cases were accidental.

Flame burn was mostly due to kerosene oil pressure stove (18.1%), followed by kerosene oil lamp (17.2%), LPG cylinder (16%), and kachcha chulha (14.9%). Other than the studies made in Delhi[13] and Kashmir,[5] kerosene oil stove had been found to be the most common cause of domestic accidental flame burn[11,18,14] and is in accordance with our studies.

Majority of our population is of rural background and has an agriculture-based economy. Cooking in most of the homes in villages is done on kerosene oil stoves and kachcha chulha. Cooking on dry wood (jalaawan) and paddy is economical and that is why they cook on it, even if they have LPG cylinders. These kachcha chulhas expose the families not only to increased risk of burn but also to toxic effects of smoke and fumes. Lack of electricity forces the family to use kerosene oil lamps (Dhibri) and these constitute 17.2% of cases. Suicidal burns constitute 8% of total burn cases. The incidence is higher in females because of emotional fragility and dowry-related problems. Suicidal burns in males are often the result of unemployment, psychiatric problems, and alcohol abuse. While homicidal burns in female result from dowry issues and vitriolage, in males, they occur due to property-related disputes.

The mortality rate of 63.8% may be explained with the fact that most of our patients were from far off places, inadequately managed at the primary care centers, and had very extensive burns. This mortality rate was higher than Ahmedabad[10] (50.94%) and Madurai[18] (57.3%). It was comparable to observations made in Delhi[13] (65.4%) and Indore[11] (62.4%) and lower than the observations of Puri (90.2%) in Mumbai, Maharashtra.[27]

Studies involving all burns and all age groups have reported variable in-hospital mortality rates including 2% in Australia,[28] 4% in the United States,[29] 6% in the UK,[30] 20% in Iran,[31] 27% in Sri Lanka,[32] and 52% in India.[33] These data showed the vast scope of improvement in health services and public awareness in developing countries.

CONCLUSION

Flame burn leads the cause followed by electric, scald, and chemical burn. Most of the burn victims belong to rural background and low socioeconomic status. Most of the cases were accidental, with kitchen being the most common place and kerosene oil being the most common agent for thermal burn in our locality. Most of the patients present late to our institution due to lack of burn care centers in a large locality, long distance coverage, and inability to understand the graveness of scenario.

Burn accidents in urban areas can be prevented by the implementation of smoke detectors and housing codes that assure safety of electrical wiring and awareness regarding safe use of LPG cylinders. However, in rural areas and among the urban poor, the epidemiologic pattern of burns differs markedly and thus very different strategies are going to be required. In this regard, some of the factors that are of prime concern include use of cooking pots on ground level, use of open wood fires, use of kerosene stoves and lamps, and wearing of loose-fitting cotton clothing which can ignite when cooking on an open fire.
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Conflicts of interest
There are no conflicts of interest.

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