

THE PHARMA INNOVATION

Outcome of burn injury and associated factors among hospitalized patients at a tertiary care teaching hospital

Dr. Ravi Hullamballi Shivaiah

Assistant Professor, Department of Plastic and Reconstructive Surgery, JSS Hospital and Medical College, Mysore, Karnataka, India

Introduction: Burn injuries constitute a major public health problem and account for a significant cause of mortality and morbidity amongst the Indian population. As the etiological factors of burn injuries vary considerably in different communities, careful study of the pattern in every community is needed before a sound prevention program can be planned and implemented. Hence, this study was conducted to assess epidemiological, modes, causes, and risk factors and the microbial profile of burn injuries and to study the outcomes.

Material and Method: This is a prospective and descriptive study conducted in the Department of Plastic Surgery, JSS Medical College, Mysuru over a period of 1 year. The burn unit in tertiary care center has facilities for treatment of all types of major as well as minor burn injuries. Burn unit is having well equipped burn intensive care unit and burn OT with a skin homograft storage facility, capable surgeons and plastic surgeons, intensivists, nursing staff and lab facilities.

Results: Burns were found more commonly in middle-aged groups. The incidence was more in females as an absolute number (71.0%) as well as when stratified by age. Most burns were domestic, with cooking being the most prevalent activity. Flame (89.1%) was the most common agent. Most of the cases of burn were accidental (68.8%). Moreover, the patients had third degree burn that leads to more mortality in our circumstances. Death occurred in more than one-half (62.3%) of cases with septicemia and disseminated intravascular coagulation (35.7%) as the leading causes. When using logistic regression analysis, the outcome of the burn injury was significantly associated with degree, depth, extent, and mode of injury.

Conclusion: The study shows that 21-30 years age group are the most affected group this may be because they are in the active working age group. Safety and safe working environments should be provided at home and workplaces, and promotion of education on burn prevention should be intensified.

Keyword: Burn injuries, microbial profile, total body surface area, scalds

INTRODUCTION: Burn patients have supra-physiological metabolic activities; multi-organ dysfunction; and local and systemic oxidant changes manifested by increased free radical activity and lipid peroxidation, inflammatory cytokines, and acute phase proteins^[1].

Burns account for 1% of the global burden of diseases and cause more than 7.1 million injuries, a loss of almost 18 million disability-adjusted life years (DALYs), and more than 265 000 deaths worldwide annually.^[2] About 7 million burn incidents occur in India each year, making burn injuries the second largest group of injuries after road accidents. The major factors associated with burn injuries are low socioeconomic status, poor living conditions, illiteracy, overcrowding, and floor-level cooking, which are risk factors frequently associated with burns. A study by Sanghavi *et al.*^[3] reported that the average ratio of fire-related deaths of young women to young men was 3:1. Several previous studies have reported that burns are a major public health issue, demonstrating the fact that more women report burns in 21 to 40 years and that the percentage of burns and mortality is higher amongst women.

The treatment of burns and its sequelae is a major drain on the public health system and also a financial burden for the family. The mean cost per patient, including the social and labor costs, was estimated to be as high as US \$1060 to treat burn victims in north India^[4]. The best treatment for burns is, thus, undoubtedly prevention. The approach to burn prevention, to be effective in a particular area, should be based on a sound knowledge of etiological patterns of burn injuries and must take into account the geographical variations and socioeconomic differences in burn epidemiology^[5, 6].

However, very few epidemiology studies are available in south India. So, the study was undertaken at a burns center to understand selected epidemiological variables and out-comes of burn injuries.

Material and Methods

This is a prospective and descriptive study conducted in the Department of Plastic Surgery, JSS Medical College, Mysuru over a period of 1 year. The burn unit in tertiary care center has facilities for treatment of all types of major as well as minor burn injuries. Burn unit is having well equipped burn intensive care unit and burn

OT with capable surgeons and plastic surgeons, intensivists, nursing staff and lab facilities.

Inclusion Criteria

All ages and case records of burns ward in the hospital for seeking treatment for burns as per records were included in the study.

Exclusion Criteria

Case reports from burns ward were studied and cases who did not sustain any burn injuries and incomplete (>20%) records were excluded.

Data was collected with the help of a team consisting of medical officer (1) and nursing staff (3) working in burns ward after training them about the purpose, objectives and about details in data abstraction form.

All burn patients who have attended to the hospital during the study period for seeking opinion or for treatment for burns either on OP basis, inpatient basis or ICU basis.

Total 400 patients attended the hospital during the study period and all were included in the study as all have come under inclusion criteria.

Data was collected from the medical records and reports attached in the file of the patient in the hospital and if any clarification was required information was collected by phone number available in records.

Data abstraction form was prepared to get the information from the records which has 4 parts, 1st part is demographic information like age, gender, religion, education, occupation and comorbidities like hypertension, diabetes or any chronic illness, if present; 2nd part was to collect information regarding etiology of burns, like type, source, time of burn, place of burn, cause of burn; 3rd part was characteristics of burn like percentage of burn surface area, area most affected, grade of burn, average length of stay in hospital and 4th part was data regarding bacterial profile of burn wound.

In the hospital burn surface area was calculated according to the principal of rule of nine and were graded as 10.

First-degree (superficial) burns affect only the outer layer of skin, the epidermis. Second-degree

(partial thickness) burns involve the epidermis and part of the lower layer of skin, the dermis. Third-degree (full thickness) burns destroys the epidermis and dermis. Fourth-degree burns go through both layers of the skin and underlying tissue as well as deeper tissue, possibly involving muscle and bone.

Skin swab and blood sample were taken during first visit and after 1 week if wound does not improve. Length of stay in hospital was considered from day of admission to day of discharge.

Statistical Analysis

All data from the data abstraction form was entered in to excel sheet. From the excel sheet the data was analyzed, using Microsoft excel. Percentages and proportions were calculated and compared with other studies. Chi square test was used to know the association between characteristics of burn and mortality and $p < 0.05$ was considered as statistically significant. Data was presented using tables.

Results

The age of the burn patients ranged from one to 60 years (mean 20.59 ± 13.4 years); most of the cases (29.5%) were between 21 to 30 years of age. In our study out of a total of 400 patients, females (71.0%) outnumbered males (29.0%). Out of these 67.8% were Hindus, 21.0% were Muslims and the rest belonged to different communities. The majority of the patients belonged to low socioeconomic status (71.8%), while 20.1% were middle class and only 8.1% were of high socioeconomic status. Out of 116 males 43.1% belonged to an urban area while the rest were from rural areas; while considering the total 284 females, 32.6% belonged to urban areas and the rest 67.4% were from the rural area. Arrival time to hospital after the incidence was variable among all patients, only few patients (9.1%) arrived within 6h of the incidence. The majority (60.2%) reached the hospital between 6-24h, those reaching the hospital after 24h were near about 30.7% [Tables 1 and 2].

Table 1: Demographic profile

| Variables | Male | | Female | |
|-----------------------|------|--------|--------|--------|
| Number | 116 | (29.0) | 284 | (71.0) |
| Origin | | | | |
| Urban | 50 | (43.1) | 92 | (32.6) |
| Rural | 66 | (56.9) | 192 | (67.4) |
| Cause | | | | |
| Accidental | 86 | (74.2) | 189 | (66.6) |
| Suicidal | 23 | (19.5) | 51 | (17.9) |
| Homicidal | 7 | (6.3) | 44 | (15.5) |
| Mode of injury | | | | |
| Flame burn | 74 | (63.8) | 253 | (89.1) |
| Stove bursting | | 41 | | 102 |
| Chimney | | 21 | | 69 |
| LPG | | 12 | | 82 |
| Scald | 9 | (7.8) | 18 | (6.1) |
| Chemical* | 10 | (8.6) | 1 | (0.3) |
| Electrical | 23 | (19.8) | 13 | (4.5) |
| Depth | | | | |
| 1st Degree | 9 | (7.7) | 14 | (4.9) |
| 2nd Degree | 17 | (14.6) | 98 | (34.5) |
| 3rd Degree | 90 | (77.7) | 172 | (60.5) |
| Extent | | | | |
| 0-20% | 9 | (7.8) | 11 | (3.8) |
| 21-40% | 18 | (15.5) | 23 | (8.1) |
| 41-60% | 23 | (19.8) | 58 | (20.4) |
| > 60% | 66 | (56.9) | 192 | (67.7) |
| Mortality | | | | |
| 0-20% | | 0 | | 0 |
| 21-40% | 1 | (1.7) | 1 | (0.5) |
| 41-60% | 4 | (6.9) | 12 | (6.6) |
| > 60% | 53 | (91.4) | 171 | (92.9) |

Table 2: Age predisposition

| Age (Years) | Total | Percentage |
|-------------|-------|------------|
| 0-1 | 4 | 1.0 |
| 1-10 | 43 | 10.7 |
| 11-20 | 56 | 14.0 |
| 21-30 | 118 | 29.5 |
| 31-40 | 111 | 27.8 |
| 41-50 | 45 | 11.3 |
| > 50 | 23 | 5.7 |

Circumstances of the Injury

The majority of burn injuries i.e., more than 85% occurred at home. The sex of the victim was significantly associated with the site of accident.

The vast majority of occupational and street burns occurred among males while more than half the females were because of domestic reasons. Cooking was most often responsible for burn in domestic setup. Flames represented the most common agent of burn injuries (89.1%) and showed a tendency to affect more females. Among the flame burns, kerosene stoves were the most common source affecting 35.9% females and 35.3% males. Chimney and LPG burns rank the second most common source of flame injuries accounting for 28.3% males and 27.3% females in chimney and 16.2% males and 32.4% females in LPG cases. The occurrences of scalds, chemical and electrical burns were 7.8%, 8.6% and 19.8% in males and 6.1%, 0.3% and 4.5% females respectively [Table 1].

Out of total burn patients 68.8% were accidental, which was the most common cause, while the rest of them were homicidal (12.8%) and suicidal (18.5%). In terms of sex distribution, 74.5%, 19.5%, 6.3% males and 66.6%, 17.9%, 15.5% females suffered from accidental, homicidal and suicidal burns respectively [Table 1].

Clinical Assessment of the Burn Wound

The majority of the cases belonged to third-degree burns (65.5%), while the rest (34.5%) were first and second degree. When first, second and third-degree burns were analyzed with respect to sex, 7.7%, 14.6%, 77.7% males and 4.9%, 34.5%, 60.5% females were affected respectively. The causative agent was significantly associated with the degree, depth and severity of burn; flame burns tend to cause mixed second and third degree. Thorax and abdomen (65.2%) were the most common areas involved in all types of burns, while the head and neck, upper extremity and lower extremity were involved in 32.4%, 53.4% and 42.3% respectively. We also observed that the extent of burns varied with the sex of the victims. The extent of burns was classified as 0-20%, 21- 40%, 41- 60% and > 60% of body surface area and corresponded to 7.8%, 15.5%, 19.8% and 56.9% in males and 3.8%, 8.1%, 20.4% and 67.7% in females respectively [Table 1].

Outcome

In our study, the case fatality rate was 60.2%. The mortality was more in females (70.6%) than in males (29.4%). The mortality rate was more in patients who suffered extensive burns i.e., out of total mortality, 92.9% females (184), females and 91.3% (58) males had burn more than >60% body surface area [Table 1]. The major causes of death among patients were septicemia and disseminated intravascular coagulation (35.7%). aspiration pneumonia in 12.5% while combined causes were responsible for 14.5% of deaths [Table 3]. Similarly, septicemia and disseminated intravascular coagulation were the major complications in the post-resuscitation phase (52.0%) while aspiration pneumonia, hematemesis and gastric dilation were seen in 17.0%, 10.0% and 2.0% patients respectively [Table 3]. As far as late outcome is concerned hypertrophic scar (22.5%) is the most common outcome [Table 4]. Rest is alopecia (21.2%), contractures (17.5%) and amputation (1.8%). Mortality was significantly associated with the age and sex of the burn victim, TBSA, agent, degree, depth and severity of the burn wound, delay in seeking medical care and occurrence of inhalation burns. When logistic regression analysis was applied, it was found that age, sex, body surface area and degree and depth of burn were significantly associated with mortality.

Table 3: Mortality with respect to complication

| Variable | Complication (%) | Mortality (%) |
|----------------------|------------------|---------------|
| Septicemia+DIC | 208 (52.0) | 143 (35.7) |
| Aspiration pneumonia | 68 (17.0) | 50 (12.5) |
| Both | 76 (19.0) | 58 (14.5) |
| Hematemesis | 40 (10.0) | 0 |
| Gastric dilation* | 8 (2.0) | 0 |

Table 4: Outcome

| Sequelae | Number | Percentage |
|-------------------|--------|------------|
| Mortality | 245 | 61.2 |
| Hypertrophic scar | 90 | 22.5 |
| Contractures | 70 | 17.5 |
| Amputation | 7 | 1.8 |
| Alopecia | 85 | 21.2 |

Discussion

The current study reveals a predominance of burns in females. Similar findings have been reported in various studies. This may be due to the fact that women are engaged more in cooking activity compared to males. Previous studies have showed a greater number of burns in females compared to males. The current study revealed 21-30 years as the group most prone to burn injury. The high prevalence rate of burn injuries in this age group could be attributed to the fact that they are involved in active day to day work. The current study also revealed that most of the burns took place in the domestic setting, especially in the kitchen, where cooking occurs.

The most common cause of burn admission was flame. This could be the result of their highly active nature, and hence will be vulnerable to flame burns.

Burns are associated with hospitalization of the patient for management. The extent of burn injuries and prognosis may determine how long the patient will be hospitalized. From the current study, the highest mean length of stay was 9.7 days. An average length of hospital stay of 18 days was reported by Chien *et al.* [6] in a study on burn patients in Taiwan. Akerlund *et al.* [7] also reported 3 days as a median length of hospital stay in Sweden.

The highest mean% TBSA for the current study was more than 64.5%. TBSA has been reported as a risk factor for mortality. TBSA is also an important indicator on how a patient is to be managed, especially in children and the elderly, and could possibly influence the management strategy of burn victims [8].

Most of the burns that occurred in the current study were unintentional except a single acid assault case that was caused intentionally. Assault-related burns caused by the use of acids and bases are a common occurrence in some settings around the globe. Psychologically, these burn survivors grow up developing a negative self-image of themselves, are stigmatized, and sometimes may not even be employed or married [9].

Mortality has been reported as a complication of burn injury. Olaitan and Jiburum [10] reported a

burn mortality of 20% out of 285 burn patients at a burn center in Nigeria in a retrospective study from January 1996 to December 2000. Ibran *et al.*, reported a mortality of 36.12% in a 2-year prospective cross-sectional study conducted in Karachi, Pakistan.

A burn injury, depending on the severity, may require the patient to undergo a series of surgical procedures, such as excision and grafting. In other circumstances, amputation may be suggested as a modality in the management of the victim. Surgical procedures are quite expensive, especially plastic surgery, reconstructive procedures, and cosmetic procedures. Strict supervision of children is important for the prevention of burn injury. Public education on burn prevention and use of fire alarm systems should be encouraged.

Haddon's theory on conceptualization, which is focused on prevention, was adopted. At the workplace, standard operating guidelines and safety rules should be enforced to prevent burn occurrences.

Conclusion

The study shows that 21-30 years age group are the most affected group; this may be because they are in the active working age group. Safety and safe working environments should be provided at home and workplaces, and promotion of education on burn prevention should be intensified.

References

1. Gupta JL, Makhija LK, Bajaj SP. National program for prevention of burn injuries. *Indian J Plast Surg.* 2010;43:S6-10.
2. Haberal M, Sakallioglu Abali AE, Karakayali H. Fluid management in major burn injuries. *Indian J Plast Surg.* 2010;43:S29-36.
3. Sanghavi P, Bhalla K, Das V. Fire-related deaths in India in 2001: a retrospective analysis of data. *Lancet* 2009;373(9671):1282-8.
4. Shankar G, Naik VA, Powar R. Epidemiological study of burn injuries admitted in two hospitals of North Karnataka.

- Indian J Community Med. 2010;35(4):509-12.
5. Williams FN, Herndon DN, Jeschke MG. The hypermetabolic response to burn injury and interventions to modify this response. *Clin Plast Surg.* 2009;36(4):583-96.
 6. Othman N, Kendrick D. Epidemiology of burn injuries in the East Mediterranean Region: a systematic review. *BMC Public Health.* 2010;10:83.
 7. Chien WC, Pai L, Lin CC, *et al.* Epidemiology of hospitalized burns patients in Taiwan. *Burns.* 2003;29(6):582-8.
 8. Akerlund E, Huss FR, Sjöberg F. Burns in Sweden: an analysis of 24,538 cases during the period 1987-2004. *Burns.* 2007;33(1):31-6.
 9. Balseven-Odabasi A, Tümer AR, Keten A, *et al.* Burn injuries among children aged up to seven years. *Turk J Pediatr.* 2009;51(4):328-35.
 10. Olaitan PB, Jiburum BC. Analysis of burn mortality in a burns center. *Ann Burns Fire Disasters.* 2006;19(2):59-62.