

## Original Article

# Epidemiological and socio-cultural study of burn patients in M. Y. Hospital, Indore, India

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## ABSTRACT

**Background:** Developing countries have a high incidence of burn injuries, creating a formidable public health problem. The exact number of cases is difficult to determine: however in a country like India, with a population of over 1 billion, we would estimate 700,000 to 800,000 burn admissions annually. **Objective:** The study was done to investigate the epidemiology of various causations and their outcomes in terms of morbidity and mortality. Also, the effect of social stigma and cultural issues associated with burns on the victim and his family was assessed. **Materials and Methods:** All burn cases (n=412) admitted to the burns unit of M. Y. Hospital, Indore over a period of one year (2005-2006) were investigated. The data regarding sex, age predisposition, geographical origin, mode and nature of injury were obtained by questionnaire-interview with the patient themselves. Clinical assessment was done in the form of depth and extent of injury and complications. In case of mortality, again various factors like age, sex and cause of death were analyzed. The data was analyzed by SPSS 11.0 version. The interrelationship between various factors was studied using multivariate logistic regression analysis. **Results:** Burns were found more commonly in middle-aged groups. The incidence was more in females as an absolute number (70.3%) as well as when stratified by age. Most burns were domestic, with cooking being the most prevalent activity. Flame (80.3%) was the most common agent. Most of the cases of burn were accidental (67.7%). 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 septicaemia and disseminated intravascular coagulation (35.4%) 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:** This series provides an overview of the most important aspects of burn injuries for hospital and non-hospital healthcare workers. The majority of deep burns are accidental, seen in middle-aged housewives as a result of flame burns, and lead to death. So measures should be taken to provide proper education to prevent these accidents and ensure safety.

## KEY WORDS

Burn, total body surface area, epidemiology

## INTRODUCTION

Injuries represent one of the most important public health problems faced by both developing and industrialized nations today. Injuries may be

intentional or non-intentional but intent is sometimes difficult to determine for injuries such as burns.

Burns represent an extremely stressful experience for both the burn victims as well as their families. An

extensive burn profoundly affects the patient's physique, psyche, financial situation and family. Patients who suffer from extensive burn injuries frequently die, while others suffer from painful physical recovery. In addition to their dramatic physical effects, burn injuries frequently cause deleterious psychological complications.

In different communities the aetiological factor of burn injuries varies considerably, hence a careful analysis of the epidemiological factors in every community is needed before the planning and implementation of a sound prevention program. This study was conducted to identify the demographic and socio-cultural aspects of burn patients, to investigate the factors affecting outcome and mortality of burns and to determine the magnitude of the problem of burn among all injuries admitted to the M. Y. Hospital over a period of one year (2005-2006).

## MATERIALS AND METHODS

All burn cases admitted to the burns unit of M. Y. Hospital, Indore over a period of one year (n = 412) were subjected to a questionnaire-interview to obtain the following data:

*Registration data:* age, sex, residence, level of education, occupation, marital status, geographical location and income.

*Circumstances of the injury:* place and time, brief description of the event, agent, associated burning of clothes, patient's and attendants' reaction, first-aid measures taken.

*Clinical assessment of the wound:* site, affected body surface area, degree, depth, severity, complications.

*Chronological data:* dates of admission and discharge.

The data was obtained by questionnaire-interview with the patients themselves, while in case of children or patients who were not well enough as a result of severe injury, the data was obtained from relatives who attended the unit. For defining the extent of burns we used Wallace's rule of nine and for the paediatrics age group the Lynch and Bolcker (1963) method was applied in which they have differentiated between infants and children. In case of infants, the head, front and back of trunk all represent 20% of the total body surface area, while each upper

limb is 10%; when assessing children, they modified the formula: head, lower limbs and posterior trunk is 15% of the total body surface area, the anterior trunk 20% and the upper limbs each rated 10% of the total body surface area. Depth of burns was divided into first, second and third-degree burns. Burns which involved outer layer of skin along with predominant vascular reaction such as dilatation of arterioles and capillaries which resulted in red, swollen and painful skin without formation of blisters were considered as first-degree burns. Second-degree burns resulted in detachment of epidermis from dermis. This typically shows blistering with upper layers destroyed or dying epidermis evident, sometimes with central necrotic area surrounded by zone of hyperaemia or blister formation. While those burns which involved entire skin epidermis and dermis with massive necrosis with stiffened yellowish brown and leathery areas with prominent or dried blood vessels in its floor were taken under third-degree burns.

### Data analysis

The data was analyzed by SPSS 11.0 version. Results are expressed in percentage with respect to sex ratio. The relationship between various factors was studied using multivariate logistic regression analysis.

## RESULTS

### Socio-demographic characteristics

The age of the burn patients ranged from one to 60 years (mean  $23.95 \pm 16.7$  years); most of the cases (31.5%) were between 21 to 30 years of age. In our study out of a total of 412 patients, females (70.3%) outnumbered males (29.7%). Out of these 68.2% were Hindus, 21.8% were Muslims and the rest belonged to different communities. The majority of the patients belonged to low socioeconomic status (69.6%), while 21.8% were middle class and only 8.6% were of high socioeconomic status. Out of 122 males 42.6% belonged to an urban area while the rest were from rural areas; while considering the total 290 females, 32.7% belonged to urban areas and the rest 67.3% were from the rural area. Arrival time to hospital after the incidence was variable among all patients, only few patients (9.7%) arrived within 6h of the incidence. The majority (61.8%) reached the hospital between 6-24h, those reaching the hospital after 24h were near about 28.5% [Tables 1 and 2].

### Circumstances of the injury

The majority of burn injuries i.e. more than 85%

**Table 1: Demographic profile**

<b>Variables</b>	<b>Male</b>	<b>Female</b>
Number	122 (29.7)	290 (70.3)
Origin		
Urban	52 (42.6)	95 (32.7)
Rural	70 (57.4)	195 (62.3)
Cause		
Accidental	88 (72.1)	191 (65.8)
Suicidal	25 (20.4)	53 (18.2)
Homicidal	9 (7.5)	46 (16)
Mode of injury		
Flame burn	76 (62.3)	255 (87.9)
Stove bursting	42	103
Chimney	22	69
LPG	12	83
Scald	10 (8.2)	19 (6.6)
Chemical*	11 (9.0)	1 (0.4)
Electrical	25 (20.5)	15 (5.1)
Depth		
1 <sup>st</sup> Degree	10 (8.1)	16 (5.5)
2 <sup>nd</sup> Degree	18 (16.3)	100 (34.3)
3 <sup>rd</sup> Degree	92 (75.6)	174 (60.2)
Extent		
0-20%	10 (8.1)	12 (4.1)
21-40%	19 (15.5)	24 (8.2)
41-60%	25 (20.4)	60 (20.6)
> 60%	68 (56)	194 (67.1)
Mortality		
0-20%	0	0
21-40%	2 (3.0)	1 (0.5)
41-60%	5 (7.6)	15 (7.8)
> 60%	59 (89.4)	175 (91.7)

\*In our study out of 11 male patients six had homicidal burn caused by HCl, three patients had accidental burn as a result of HNO<sub>3</sub> or battery acids at their workplace while two patients had chemical burns by unknown acid. In case of females it was homicidal and nature of acid was HCl. Figures in parentheses are in percentage

**Table 2: Age predisposition**

<b>Age (Years)</b>	<b>Total</b>	<b>Percentage</b>
0-1	5	1.2
1-10	40	9.7
11-20	57	13.8
21-30	130	31.5
31-40	110	26.6
41-50	46	5.1
> 50	24	6.1

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 (75.1%) and showed a tendency to affect more females. Among the flame burns, kerosene stoves were the most common source affecting 55.2% females and 40.4% males. Chimney and LPG burns rank the second most common source of flame injuries accounting for 29% males and 27.1% females in chimney

and 15.8% males and 32.5% females in LPG cases. The occurrences of scalds, chemical and electrical burns were 8.2%, 9% and 20.5% in males and 6.6%, 0.4% and 5.1% females respectively [Table 1].

Out of total burn patients 67.7% were accidental, which was the most common cause, while the rest of them were homicidal (13.4%) and suicidal (18.9%). In terms of sex distribution, 72.1%, 7.5%, 20.4% males and 65.8%, 15.9%, 18.3% 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 (64.6 %), while the rest (35.4%) were first and second degree. When first, second and third-degree burns were analyzed with respect to sex, 8.1%, 16.3%, 75.6% males and 5.5%, 34.3%, 60.2% 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 (67.9%) were the most common areas involved in all types of burns, while the head and neck, upper extremity and lower extremity were involved in 34.9%, 55.1% and 44.9% respectively. We also observed that the extent of burns varied with the sex of the victims. The extent of burns were classified as 0-20%, 21- 40%, 41- 60% and > 60% of body surface area and corresponded to 8.1 %, 15.5 %, 20.4 % and 56 % in males and 4.1%, 8.2 %, 20.6% and 67.1% in females respectively [Table 1].

### Outcome

In our study the case fatality rate was 62.4%. The mortality was more in females (73.3%) than in males (24.7%). The mortality rate was more in patients who suffered extensive burns i.e. out of total mortality, 91.6% females (191), females and 89.4%(66) males had burn more than >60 % body surface area [Table 1]. The major causes of death among patients were septicaemia and disseminated intravascular coagulation (35.4%). aspiration pneumonia in 12.6% while combined causes were responsible for 14.0% of deaths [Table 3]. Similarly, septicaemia and disseminated intravascular coagulation were the major complications in the post-resuscitation phase (51.4%) while aspiration pneumonia, haematemesis and gastric dilation were seen in 16.9%, 10.1% and 2.7% patients respectively [Table 3]. As far as late outcome is concerned hypertrophic scar (62.3%) is the most common outcome [Table 4]. Rest are alopecia (22.1%), contractures (18.2%) and amputation (2.4%). Mortality was significantly

**Table 3: Mortality with respect to complication**

Variable	Complication (%)	Mortality (%)
Septicaemia	212 (51.4)	146 (35.4)
Aspiration pneumonia	70 (16.9)	52 (12.6)
Both	78 (18.9)	59 (14.0)
Haematemesis	42 (10.1)	0
Gastric dilation*	10 (2.7)	0

\*Gastric dilation was assessed clinically by nausea, vomiting, epigastric distension and drainage of more than 1000ml gastric content on nasogastric tube aspiration

**Table 4: Outcome**

Sequelae	Number	Percentage
Mortality	257	62.3
Hypertrophic scar	99	24.0
Contractures	75	18.2
Amputation	10	2.4
Alopecia	92	22.1

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 [Table 5]. 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 5].

## DISCUSSION

Burn injuries and their related morbidity, disability and mortality represent a public health problem of increasing importance in developing countries. Economic development coupled with a remarkable decrease in the rate of infectious disease has decreased the morbidity, disability and mortality in such countries.<sup>[1]</sup> Epidemiological studies of morbidity are a prerequisite for effective burn prevention programs because each population seems to have its own epidemiological characteristics and knowledge of the epidemiology of burns is needed to select target groups for preventive actions.

Age and sex are important epidemiological determinants for burn injuries. The present study revealed that more than half the cases were aged between 21-40 years, while

those aged 40 years and over represented 10.2% of the cases. The age distribution revealed by the present study is similar to that found in other studies.<sup>[2,3]</sup> However, the discrepancy between the relatively low percentage of old people in the present study and the higher percentage (16.7%) reported in a previous study<sup>[4]</sup> might be explained by the social structure in our setup as older members usually live within the family, thus decreasing their exposure to hazardous situations.

This pattern means that burns tend to occur more in certain age groups reflecting the particular developmental or behavioural patterns associated with age. In children, the lack of coordination and unawareness of dangerous substances play an important role in the occurrence of burns. High incidence among young adults may be explained by the fact that they are generally active and exposed to hazardous situations both at home and at work.

As regards sex distribution, the female preponderance in the age group 20-40 years concurs with other reports from developing countries such as India<sup>[5]</sup> and Jordan<sup>[6]</sup> as well as other Egyptian studies<sup>[7,8]</sup> and might be explained by the involvement of females in domestic activities and also dowry deaths. Socio-cultural factors are among the major causes of different sex predisposition of burn injury in developing countries like India compared to other developed nations. On the other hand, the male predominance in the younger age group (5-10 years) might be explained by the inquisitive and exploring nature of boys of this age. This finding concurs with other reports from different countries.<sup>[5,8-12]</sup> With respect to the place where the burn injury occurred, the majority of burns (91.4%) occurred in the home. This figure is comparable to other reports from developing countries.<sup>[13-15]</sup> However, figures from industrialized countries are clearly lower than those reported from developing countries. This may be due to the relatively higher percentage of occupational and recreational burns or due to better home safety with safer cooking and heating devices in industrialized countries.<sup>[16-18]</sup>

In the present study, most burns were accidental. In the causes of burn injury, flame was the most common agent affecting more than two-thirds of cases, followed by electrical, scald and chemical burns. Similar results have been reported from Egypt<sup>[8,13]</sup> and Jordan.<sup>[19]</sup> As regards the source of flame, portable pressure kerosene stoves

**Table 5: P values**

Variable	Mode	Cause	Depth	Extent	Mortality
Mode	-	0.239	0.028 <sup>a</sup>	0.001 <sup>b</sup>	0.492
Cause	0.239	-	0.004 <sup>a</sup>	0.127	0.490
Depth	0.028 <sup>a</sup>	0.004 <sup>a</sup>	-	0.001 <sup>b</sup>	0.031 <sup>a</sup>
Extent	0.001 <sup>b</sup>	0.127	0.001 <sup>b</sup>	-	0.001
Mortality	0.492	0.490	0.031 <sup>a</sup>	0.001 <sup>b</sup>	-

<sup>a</sup> -  $P < 0.05$ , <sup>b</sup> -  $P < 0.01$



were the most common source and were responsible for slightly more than half the cases. This is consistent with the findings of previous studies in developing countries,<sup>[14,15]</sup> as well as in Egypt.<sup>[7,8]</sup> On the other hand, the picture reported from industrialized countries differs, where flammable liquids and gas stoves were the most common source of flame burns.<sup>[18,20]</sup> Burn agents are highly individualized in each country, largely depending on the standard of living and lifestyle. In spite of the finding that scalds were responsible for only 7% burn injuries in this sample, they were found to be the most frequent agent of burn injuries in reports from Japan<sup>[21]</sup> and Nigeria,<sup>[22]</sup> in which they represented 40-78%. The difference in the ranking of different agents could be attributed to the developmental stage of the country, the age composition of the sample and whether outpatients were included or not.

In the present study, a significant association was found between age and agent of burn injury. Most scald and electrical burns occurred in children <10 years, while in the older age groups flame was the most common agent. These results are in agreement with previous studies.<sup>[7,8,11,13]</sup> Associated clothing ignition was identified in 83% of flame cases. Clothing ignition has been identified as a major cause of burns in both industrialized and developing countries. However, in industrialized countries, a change to more closely fitting styles of clothing, together with decreased fabric flammability has resulted in a significant decrease in deaths from clothing ignition, which represented only 5% of all burn deaths in the USA.<sup>[23]</sup>

Mortality is the most important and most readily quantifiable outcome in burn patients. In the present study, the case fatality rate was 62.4%. The mortality rate is quite high as compared to one of the studies reported in USA.<sup>[23]</sup> This difference may be because of less equipped emergency and intensive care units in our country, as also due to lack of experienced hospital staff and lack of awareness among the general people. When univariate analysis was used, a higher case fatality rate was observed with factors like young age groups, with flame agent, especially if clothing was ignited, larger body surface area, deep burns, higher degree and if the patients delayed seeking hospital admission. These results are consistent with other reports.<sup>[24,25]</sup>

When applying logistic regression analysis to a model of 10 variables, which were significantly associated with

mortality, five factors were found to be significantly different between the survivors and those who died. These variables were mode, sex, body surface area, degree and depth of burn. The depth and degree were significant in these models but they were used in conjugation with TBSA, presenting it as percentage full thickness burn and percentage partial thickness burn. The variability of these results may indicate differences in treatment protocols, which influence ultimate mortality.<sup>[24]</sup>

Although burn patients may appear numerically few, they comprise a patient group often requiring considerable resources because of the need for repeated grafting procedures, hygienic precautions, treatment of infections and supportive care to patients and their families.

## CONCLUSION

This series provides an overview of the most important aspects of burn injuries for hospital and non-hospital healthcare workers. The majority of deep burns are accidental, seen in middle-aged housewives as a result of flame burns and lead to death. So measures should be taken to provide proper education to prevent these accidents and ensure safety.

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

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