

Epidemiological study of burn injury with special reference to its prevention- A Nine-year retrospective study from a tertiary care hospital of West Bengal, India

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ABSTRACT

Aims and Objectives: We conducted a retrospective analysis among 1984 burn patients to study the incidence, prevalence of burn injury, its various types and modes (actual event behind the burn injury), risk factors and to find out the preventive measures. **Materials and Methods:** The retrospective study was carried out among 1984 patients having burn injuries, admitted in a tertiary care hospital of West Bengal, India over a period of nine years. The sources of information were the admission registers and the patients' folders from the medical records department. The Ethical clearance was taken from the Institutional Ethical Committee. The information obtained included age, sex, whether accidental or suicidal, etiology of burn injury and particularly the mechanism of injury. **Results:** Females were mostly affected (83%) in comparison to males. Among the study population, most of the burn patients were in the age group of 21-30 yrs i.e. 35.3%. The number of burn patients were less in number in the age group of 11-20 yrs i.e. 7.3%. Most of the burn injuries (87%) were accidental. Suicidal burns occurred in 10% cases. Of which about 1/3rd of the cases were due to dowry related issues. A significant number of teenagers also attempted suicides due to trivial reasons (e.g. failure in examination, quarrelling with parents). Gas oven related injuries occurred in 2.7% cases. Oil lamps ('kupi'), candles and hurricane-lanterns, diyas were also responsible to some extent in rural India for flame burns (5%). Smoking related burn injuries occurred in 1.7% cases. Scald injuries occurred in 14% cases. Chemical injuries (0.3%) were due to spillage of unlabelled bottles of acid/alkali. Electrical burn injury occurred in 4.9% cases. **Conclusion:** Burn injury prevention is not easy, but to avoid the significant morbidity and mortality following injury we have to prevent it by any means. A coordinated and dedicated approach among social workers, medical and paramedical personnel, administrators can only minimize the incidence of burn.

Key words: Mechanism of burn, Preventive measures, Incidence of burn, Types of burn, Burn in females

INTRODUCTION

Burn injuries, generally have continued to attract the attention of researchers all over the world. Burn injuries rank among the most severe types of injuries suffered by the human body with an attendant high mortality and morbidity rate.¹

Developing countries have a high incidence of burn injuries, creating a formidable public health problem. High population density, illiteracy, and poverty are the main demographic factors associated with a high risk of burn injury. The exact number of burn injury is difficult to determine. Judicious extrapolation suggests that in India, with a population of over 1 billion, 700 000 to

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800 000 patients are being admitted with burn injury annually. This high incidence makes burn injury an endemic health hazard.²

The worldwide incidence of fire-related injuries in 2004 was estimated to be 1.1 per 100,000 population, with the highest rate in Southeast Asia and the lowest in the America. The incidence of burn injury, in low and moderate income countries (LMIC) is 1.3 per 100,000 population whereas it is 0.14 per 100,000 population in high income countries.³

Globally in 2004, the incidence of burn injury, severe enough to require medical attention, was nearly 11 million people and ranked fourth among all injuries, higher than the combined incidence of tuberculosis and HIV infections. Fortunately, although burns and fires account for over 300,000 deaths each year throughout the world, the vast majority of burn injuries are not fatal. Nonetheless, fire-related burns are also among the leading causes of disability-adjusted life years (DALYs) lost in low- and middle-income countries (LMIC).⁴

Burn profile closely follows the socioeconomic flux of a country. Economically developed nations with sound prevention policy, organized dwelling and safe kitchen technology and fuel have brought down burn incidence drastically. However, in developing nations, burn injury continues to be endemic because of massive slum dwelling and large scale use of unsafe stoves and fuel.⁵

MATERIALS AND METHODS

The retrospective study was carried out among 1984 patients having burn injuries, admitted in a tertiary care hospital of West Bengal, India over a period of nine years. The sources of information were the admission registers and the patients' folders from the medical records department. The Ethical clearance was taken from the Institutional Ethical Committee. The information obtained included age, sex, whether accidental or suicidal, etiology of burn injury and particularly the mechanism of injury.

RESULTS

Females were mostly affected (83%) in comparison to males. This distribution is presented graphically in Figure 1. Among the study population, most of the burn patients were in the age group of 21-30 yrs i.e. 35.3%. The number of burn patient was least in the age group of 11-20 yrs i.e. 7.3%. This distribution is presented in Table 1.

Most of the burn injuries (87%) were accidental. Suicidal burns occurred in 10% cases. Of which about 33% of the

cases were due to dowry related issues. A significant number of teenagers also attempted suicides due to trivial reasons (e.g., failure in examination, quarrelling with parents). This distribution is graphically represented in Figure 2.

The distribution of different mechanisms of injury is presented in Table 2 and graphically represented in Figure 3.

A lot of accidents occurred at home and in the kitchen. Pump stoves (Kerosene) are used commonly for cooking purposes. Stove related injuries occurred in 39.5% cases. The mechanisms most commonly found in these injuries were due to explosion of stoves after excessive pumping, filling of fuel while the stove was on.

Gas oven related injuries occurred in 2.7% cases. These type of accidents occurred when someone forgot to switch off the cylinder valve, use of damaged pipe leading to leakage and the explosion following lighting in a closed kitchen.

Oil lamps ('kupi'), candles and hurricane-lanterns, diyas (clay baked earthen oil lamps) were also responsible to

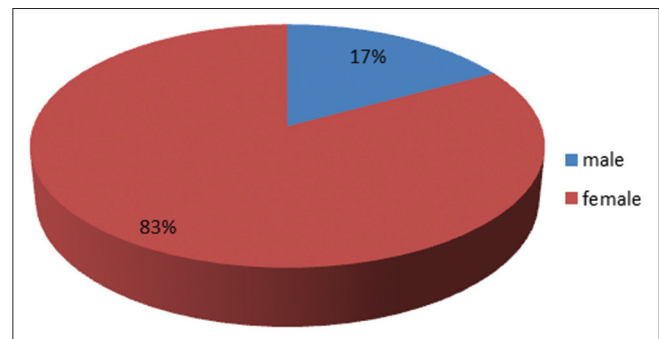


Figure 1: Sex wise distribution of study population

Table 1: Age wise distribution of study population

Age group (years)	No. of patients	Percentage
1-10 yrs	321	16.2
11-20 yrs	145	7.3
21-30 yrs	700	35.3
31-40 yrs	407	20.5
41-50 yrs	191	9.6
>50 yrs	220	11.1

Table 2: Different mechanisms of burn injuries

Mechanism of burn injury	No. of patients	Percentage
Pump stoves	784	39.5
Gas oven	54	2.7
Oil lamps('Kupi'), candles, hurricanes	99	5
Others (irrespective of burners)	632	31.9
Smoking related	34	1.7
Scald	278	14
Electrical burn	97	4.9
Chemical burn	6	0.3

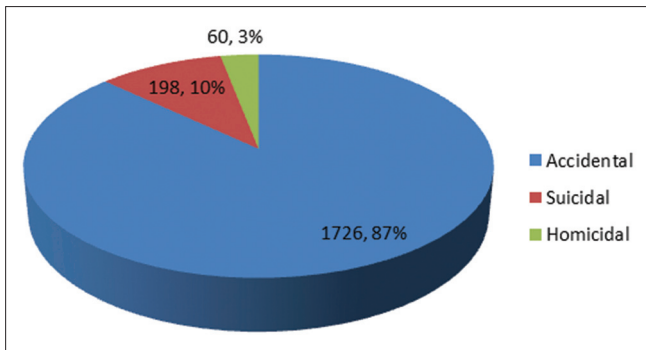


Figure 2: Different modes of burn injury

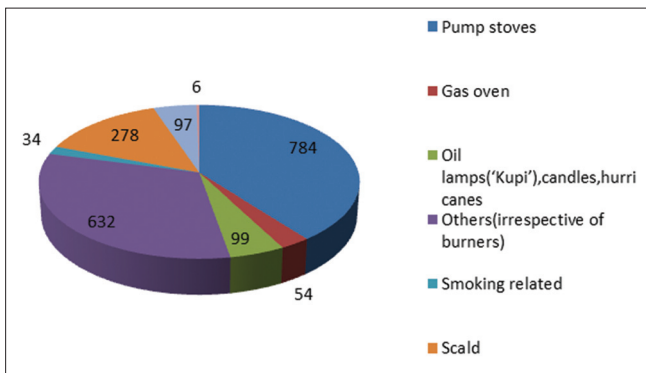


Figure 3: Different mechanisms of burn injury

some extent in rural India for flame burns (5%). Taking light-sources inside the mosquito, accidental fall of candles, during evening prayer with diyas were mainly responsible for these injuries. All accidents were happened due to human mistake.

Irrespective of fuel/burners, both flame burns and scald occurred in kitchen. Many of the flame burns happened when someone cooking, wearing clothes with long loose ends (aanchal/dupatta). Transport of hot soups by holding with defective pincers was responsible for some scald and contact burns. Accidental fall over the containers filled with hot soup caused scald injuries in paediatric population. In outdoor, carelessness while handling fireworks caused injuries particularly in children and teenagers. Scalds due to falling into large vats used for boiling grains responsible for scald injury in children of rural population. In winter, mostly the elderly were victims of flame burn during camp-firing. Scald injuries occurred in 14% cases. Most of the victims were in paediatric age group. Most of the injuries happened in the kitchen due to spilling of hot liquids.

Smoking related burn injuries occurred in 1.7% cases and were due to smoking in bed within nylon mosquito, dozing with lighted cigarette, and careless discarding of lighted cigarettes butts. Chemical injuries (0.3%) were due to

spillage of unlabelled bottles of acid/alkali. Electrical burn injury occurred in 4.9% cases. Power outlets of electrical appliances are often placed at a lower level.

In 13 cases (all children), injury occurred when they inserted fingers into the plug. Contact with torn high tension wires caused injury in 23 cases. In urban areas, contact with high tension wires while digging for pipes/ other constructions caused injury in 6 cases. Contact with high tension wires while hooking caused injury in 32 cases. Injury also occurred when someone placed wet clothing over a metal string that accidentally made contact with an electrical wire.

Alarmingly, only 23 patients (1.16%) received any form of primary management. Those who had attended primary health-care facilities mostly did not receive standard care.

DISCUSSION

Burns are responsible for significant morbidity and mortality worldwide and are among the most devastating of all injuries, with outcomes spanning the spectrum from physical impairments and disabilities to emotional and mental consequences. Management of burns and their sequel even in well-equipped, modern burn units of advanced affluent societies remains demanding and costly. Undoubtedly, in most low and middle income countries (LMICs) with limited resources and inaccessibility to sophisticated skills and technologies, the same standard of care is obviously not possible.⁶

In preventing burn injuries, it is essential to know how they occur and which population groups, environments and heating appliances can be targeted for prevention work.⁷

In the present study, 83% of the patients were females. This finding is similar to studies undertaken in various parts of India.^{1,2} This high female to male ratio can be explained due to our male dominant society and more engagement of females in kitchen works. In a study in Nigeria,⁸ the ratio was almost reverse most likely due to increased handling of petroleum and related product in workplace.

“No one is immune from thermal injury, though demographic analysis shows four high-risk groups to be the predominant victims of severe burn injuries. They include the very young, the very old, the very unlucky (National Burn Information Exchange data indicate that 21% of burn victims are innocent bystanders), and the very

careless (fully three-fourths of burn injuries result from the victim's own action).⁹

About 66% of patients were in the age group of 21-50 yrs, which is the most productive age group in our country and more susceptible to injuries both in home and in workplace. This type of age distribution is similar to other studies in India and outside.^{10,11} About 16% of patients were in the age group of 1-10 yrs. Age group 11-20 yrs were found least susceptible to burn injuries likely due to minimal engagement in household activities and more engagement in studies. Burns are an important cause of injury to young children, being the third most frequent cause of injury resulting in death behind motor vehicle accidents and drowning. The majority of burn injuries in children are scald injuries resulting from hot liquids, occurring most commonly in children aged 0-4 years. Mechanisms of injury are often unique to children and involve exploratory behaviour without the requisite comprehension of the dangers in their environment.¹⁶ Children over 10 years of age account for approximately 36% of burns seen in Accident and Emergency (A&E) departments of United Kingdom.¹²

Alleged accidental burn accounted for 87%. These were mostly due to flame (80.8%), similar to other studies in India¹³⁻¹⁵ and mostly due to the carelessness of individuals and malfunctioning of appliances. As regards the source of flame, cooking appliances (pump stoves, gas ovens) were the most common cause (42.2%). These kerosene pump stoves are without any safety features.

'Kupi' and candle related burns accounted for 5% cases. In a study conducted in Bangladesh, 'Kupi' was the major cause of flame burn in children.¹⁷ Scald injuries most commonly affects the pediatric age group. In one study conducted in Arizona Burn Centre, USA, main etiologies of scald burns included hot water (25%), soup (24%), and coffee or tea (21%). Most common child behaviours were pulling hot substance from stove (24%), from countertop (13%), and having liquid spilled on them (13%) typically while caregiver was cooking.¹⁸ In one study conducted in Nigeria,⁸ of all children aged below 16 yrs, the majority (74.3%) had scalds, mainly due to hot water meant for beverages or bathwater that was being kept in a kettle or bowl awaiting mixing with cold water or because of children bumping into adults carrying hot fluids.

In the developing world, the incidence of electrical burn injuries has increased in the past few years. In one study conducted in Nagpur, India,¹⁹ the most frequently affected age group was in the second decade of life (33.3%). Contact with live wire or contact with an object that was in contact

with a live wire (secondary contact) accounted for 43 of 84 cases (51%). Home was the most common location where injury occurred (51.2%).

Like other injury mechanisms, the prevention of burns requires adequate knowledge of the epidemiological characteristics and associated risk factors. Hence it is important to define clearly the social, cultural and economic factors, which contribute to burn injuries. While much has been accomplished in the areas of primary and secondary prevention of fires and burns in many developed or high-income countries (HICs) such as the United States due to sustained research on the epidemiology and risk factors, the same cannot be said for many LMICs. Many health authorities, agencies, corporations and even medical personnel in LMICs consider injury prevention to have a much lower priority than disease prevention for understandable reasons. Prevention programmes need to be executed with patience, persistence, and precision, targeting high-risk groups.⁶

The development of strategies for burn injury prevention needs to consider both active and passive approaches. Active action implies changes in individual lifestyles and includes health education for injury prevention and family planning. Passive action seems to be better accepted, because of the possible short-term results.⁸ The main risk factors are poverty, poor housing condition and poor education.

Looking closely at our series, we can see that most of the flame burns and scalds occurred in the kitchen. These were mostly due to defective cooking appliances and human errors. To prevent these, following measures can be taken:

- a) Avoid filling of fuel while the stove is on and excessive pumping.
- b) Strict regulation regarding selling of safe kerosene stoves.
- c) Checking of regulator of cylinder and burner after cooking, opening of windows before igniting burners, periodic check up of pipes and burner.
- d) Public awareness programme in newspaper and electronic media regarding safety measures of gas oven use.
- e) Wearing proper fitting clothes while in kitchen, avoid clothes with loose fitting long sleeves (churni/aanchal), not allowing too young or too old to cook.
- f) Not to leave the hot liquids in kitchen unattended, not to carry hot liquids while holding a child in other hand.

Many flame burns also occurred in living room. They occurred from kupi, candles and burning cigarettes. To avoid these, following measures can be taken:

- a) Avoid smoking in bed particularly within mosquito-net.
- b) Never leave burning bidi or cigarette unattended,
- c) Don't forget to put out the candle or kupa before sleeping.
- d) Encourage to use the solar lanterns.

A few flame burns and scald occurred in outdoors. These were due to unsupervised use of fireworks by the children during festivals, sudden explosion of fireworks during manufacturing, camp-firing in winter in villages, falling over the large vats for boiling grains.

These can be prevented by:

- Proper supervision during lighting of fireworks.
- Strict regulation in production of safe fireworks.
- Being alert when children and elderly people are near the fire or hot liquids.

Regarding prevention of electrical burn injuries, these measures can be helpful:

- a) Placing of plug points beyond the reach of children.
- b) To be careful when using electrical appliances.
- c) Maintenance workers must be trained about the safety measures.
- d) 'Hooking' should be strictly prohibited.

Regarding approach from the health-care system, all doctors, paramedical workers and health workers from primary level to tertiary level must be trained about preventive aspects as well as basic treatments of burn injuries. Government should initiate National level preventive programme like communicable diseases.

Burn injuries are a serious public health problem with alarmingly high mortality and morbidity. These injuries are preventable through design and promotion of more aggressive prevention programmes, especially for flame injuries occurring in the home environment.

Hence, relevant, cost-effective, culture-specific, and sustainable interventions should be developed for burn injury prevention and control. The interventions can be translated into action through the four Es of injury prevention and control namely; Education, Engineering, Enforcement, and Emergency care.¹

Depending on the population of the country, burn injury prevention could be a national programme. This can ensure availability of sufficient funds and leads to proper coordination among district, regional, and tertiary care centres. It could also provide for compulsory reporting of all burn admissions to a central registry, and these data could be used to evaluate strategies and prevention

programmes that should be directed at behavioural and environmental changes which can be easily adopted into lifestyle.⁶

CONCLUSION

Burn injury prevention is not easy, but to avoid the significant morbidity and mortality following injury we have to prevent it by any means. A coordinated and dedicated approach among social workers, medical and paramedical personnel, administrators can only minimize the incidence of burn.

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Authors Contribution:

SSK - Conception and design, analysis and interpretation of data, critical revision of article, revising it critically for important intellectual content, and final approval of the version to be published; **BCG** - Acquisition of data, critical revision of article, analysis and interpretation of data, final approval of the version to be published; **NM** - Conception and design, analysis and interpretation of data; **MMN** - Acquisition of data, critical revision of article; **TKS** - Conception and design, critical revision of article; **GG** - Critical revision of article, revising it critically for important intellectual content, final approval of the version to be published.

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