

ORIGINAL ARTICLE

ACCIDENTAL FATAL BURNS AMONG THE ELDERLY IN A METRO CITY OF INDIA - A RETROSPECTIVE SINGLE-CENTRE STUDY

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ABSTRACT

Introduction: In recent years, the increase in life expectancy and the disintegration of nuclear families have been a global phenomenon. These socio-dynamic changes and the rise in life expectancy have compelled the elderly population to live by themselves, despite their age-related decline in physical and mental abilities. This has made them vulnerable to accidents, including burns. In this background, a study to assess fatal accidental burns among the elderly in a metro city of India has been planned.

Objectives: This study aims to elucidate the circumstances surrounding the incidence, extent of burn injury, period of survival after sustaining burns, and cause of death, and to suggest preventive measures.

Methods: This descriptive, cross-sectional study was conducted at an autopsy centre in Kolkata, India, over a year. Data were obtained from reports of post-mortem examinations and police inquests, compiled in Microsoft Excel, and analysed by using frequency and percentage.

Results: In the study population, 84% were females. Incidents of burns have occurred between 8 am and 8 pm in 86% of the reported cases. Burns occurred from “Diya” (pious lamp) or candle while performing “Puja” (a ritual of worship among different religions) in 55% of the cases, and during cooking in 30% of the cases. 16% of the study population died within a day of the accident, suffering an average of 77% of total body surface area burns. 82% of the study population died due to septicaemia and multi-organ dysfunction syndrome.

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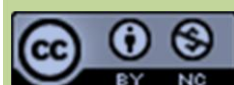
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Conclusions: In this study, 85% of the deceased sustained burns either while performing “Puja” or during cooking due to exposure to open flame. Containment of the flame during “Puja” and the use of a flameless heating system during cooking can substantially reduce fatal accidental burns among the elderly.

Keywords: *Body surface area; burns; Diya; elderly population; Puja*

INTRODUCTION

Control of fire by man is a major milestone in human civilisation. It provided ancient man with a source of warmth and light. The use of fire enabled them to protect themselves from wild animals, make more advanced tools, and cook food. Despite all its advantages, fire also causes burns, which may even lead to death. Presently, injuries and death due to burns are a major global public health problem. Worldwide, an estimated 300,000 people die every year due to burns, and the estimated annual fatal burn injuries are 140,000 in India¹. In recent years, a significant change has taken place in demography worldwide, particularly in developing countries like India, i.e., a change in the composition of the population. In the last century, life expectancy increased steadily due to the advancement of medical sciences, particularly the control, elimination, and eradication of many infectious diseases, which were the major killers of mankind. The number and proportion of people aged 60 years and older in the population are increasing. Globally, in the first decade of the 21st century, people aged 60 years and above numbered 673 million, and by 2050, it is expected to increase to 2 billion². In 1951, the life expectancy of an Indian male was 32.45 years, and that of an Indian female was 31.66 years. In the past 70 years, it has steadily increased up to 70 years³. This change contributed to both the increase in the proportion and the absolute number of the elderly population in this country. In 2020, people aged 60 years and above accounted for 8.1% of the population, totalling approximately 11 million³. At the same time, in society, more and more people are living in nuclear families instead of joint families. In a nuclear or elementary family, there is only one married couple along with their dependent children. But in a joint or extended family, there is more than one married couple of different age groups, young and old. The orthodox Hindu family in India is a joint family. It provides economic and social security to the old³. At the all-India level, 50% of the 318 million households were nuclear in 2022, compared to 37% of households in 2008, according to the available data⁴. Due to these changes, the elderly population, with age-

related decline in physical and mental abilities, has to live by themselves, not adequately assisted or supported in their day-to-day activities. This makes them vulnerable to accidents, including burns. Studies suggest that, as elderly people, who are a medically challenging group, have to live independently for a long time, burn injuries among them will be more⁵. In this scenario, the present study has been planned.

METHODS

This was an observational, descriptive study, cross-sectional in design. The study was conducted at the Department of Forensic and State Medicine, Institute of Postgraduate Medical Education & Research (IPGME&R), Kolkata, West Bengal, for one year, from 1st January 2021 to 31st December 2021. Permission was obtained from the relevant authority before the commencement of this study. Data was then collected, maintaining anonymity. The sources of data were the postmortem reports and reports of police inquests, which include a summary of the incident, the "Injury Report", the report of recording the medicolegal cases, and the "Medical Certification of the Cause of Death (MCCD)". The study population consisted of individuals aged 60 years and above who died due to burns; the manner of death was accidental. The sampling technique was complete enumeration. Ethical clearance was obtained from the Institutional Ethics Committee and the Research Advisory Committee of the Institute after giving an undertaking that the identity of the deceased would not be revealed in any form. During the study period, a total of 2686 postmortem examinations were conducted in the Autopsy Centre. Among them, 638 deceased subjects were aged 60 years and above.

Death due to natural causes, i.e., disease, debility, and old age, was seen among 182 subjects. The unnatural causes of death in this age group, i.e., death due to suicide, alleged homicide, and accidents, were seen among 456 subjects. Among them, 56 individuals died due to accidental burn injuries. They constitute the population of this study (Fig. 1).

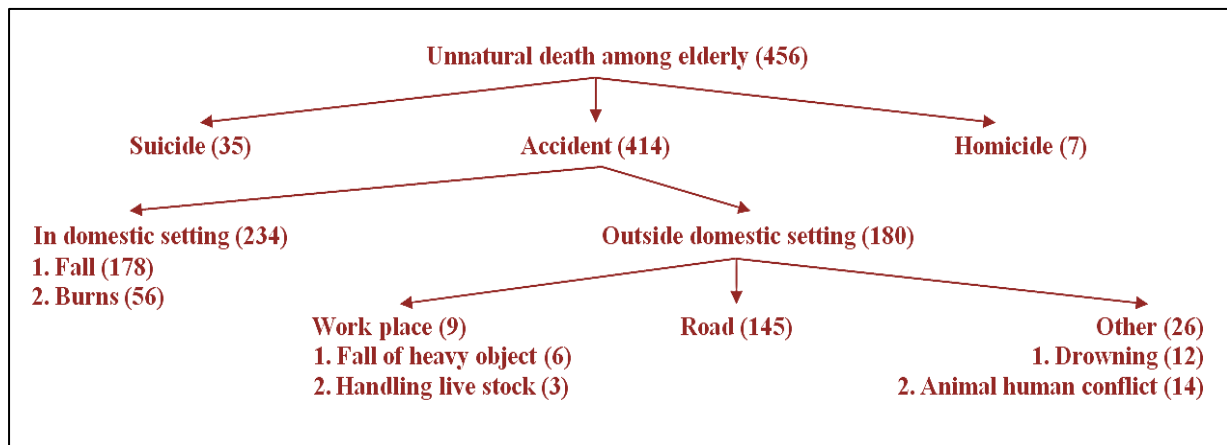


Figure 1: Cause and manner of unnatural death among the elderly.

STATISTICAL ANALYSIS

The compilation of the data was done in Microsoft Excel and then analysed by Simple Table, using frequency and percentage.

RESULTS

The total number of study subjects in this period was 56 (Table 1). It showed that 84% of the deceased are female in gender.

Table 1: Gender-wise distribution of fatal accidental burns among the elderly (n=56)

Gender	Frequency	Percentage (%)
Male	9	16
Female	47	84

It has been revealed from the police inquest that 30% of the fatal accidental burns among the elderly occurred during morning hours (0800–1159 hours) of the day, while another 30% occurred during the afternoon (1200–1559 hours). 26% of the fatal accidental burns among the elderly occurred during evening hours (1600-1959 hours) of the day (Table 2).

Table 2: Time of occurrence of fatal accidental burns among the elderly (n = 54*)

Time of occurrence	Frequency	Percentage (%)
Midnight (0000–0359 hours)	1	2
Early morning (0400-0759 hours)	2	4
Morning hours (0800 - 1159 hours)	16	30
Afternoon (1200–1559 hours)	16	30
Evening (1600-1959 hours)	14	26
Night (2000-2359 hours)	5	9

*One charred body, one readmission

From the report of the police inquest, it has been revealed that burns occurred from “diya” or candles while performing “Puja”- a worship ritual of Hindus, in 55% of the cases, and during cooking in 30% of the cases (Table 3).

Table 3: Circumstances leading to fatal accidental burns among the elderly (n=56)

Circumstances	Frequency	Percentage (%)
From Diya during “Puja”	31	55
During cooking, using an open flame	17	30
Other (electric/burning of waste/firecracker/lighting Bidi*/fireplace)	8	15

*“Bidi” is an indigenous mini cigarette smoked in the Indian subcontinent. It is made from unprocessed tobacco wrapped in “Tendu leaf” (leaf of *Piliostigma racemosum*), and tied by a string.

The study revealed that 16% of the study population died within a day (24 hours) after sustaining a burn injury, while another 41% of the study population died within a week, and another 36% within a month. 7% of the study population survived more than 30 days (Table 4).

Table 4: Average days of survival in accidental burns among the elderly (n = 56)

Days of Survival	Frequency	Percentage (%)
0 i.e. < 24 hours	9	16
1-7	23	41
8 - 30	20	36
31 and more	4	7

In this study, it has been found that those who died within 24 hours of the accident had burn injuries affecting, on average, 77% of total body surface area (TBSA). Those who survived beyond 24 hours up to one week suffered burn injuries affecting an average of 67% of TBSA, and for those who survived beyond one week up to one month, the average TBSA affected was 45%, which further reduced to 42% of TBSA for those who survived beyond one month (Fig. 2).

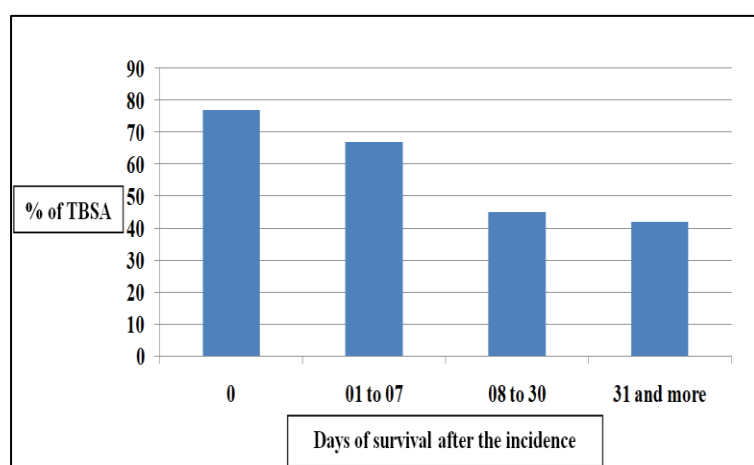


Figure 2: Distribution of study population according to average TBSA affected during fatal accidental burns among the elderly and days of survival thereafter (n=56)

In this study, 82% of the victims of fatal accidental burns among the elderly population died due to septicaemia and Multi-Organ Dysfunction Syndrome (MODS), 11% due to neurogenic shock, and 7% due to hypovolaemic shock (Table 5).

Table 5: Cause of death in accidental burns among the elderly (n = 56)

Cause of death	Frequency	Percentage (%)
Neurogenic shock	6	11
Hypovolemic shock	4	7
Septicaemia and MODS	46	82

DISCUSSION

The National Burns Programme of India, revealed that 65% of those who died due to burns were women. An audit of burn deaths among older adults in North India stated that 58.4% of victims were females⁶. In our study, 84% of the study population (victims of fatal accidental burns among the elderly) were female (n=47). This is considerably more than the results of the two former studies. In our study, it has been found that 55% of these fatal accidental burns were sustained from “Diya” while performing “Puja,” and in another 30% of cases, it happened during cooking. In both situations, there is an open flame as the source of fire. During “Puja”, the images and idols of gods and goddesses are placed upon a throne or pedestal, with offerings of flowers and sweets (Fig. 3).



Figure 3: The “Puja” ritual with the “Diya” (the holy lamp) placed at the centre.

“Diya” is an Indian word meaning a “lamp”, which is a small, cup-shaped oil lamp made from brass or baked clay, having a cotton wick dipped in oil or “ghee” - clarified butter. The lamp is lit during worship and waved, accompanied by singing of devotional hymns to show respect to the Gods. The lighted lamp is considered pious and is an integral part of the act of worship. In every Hindu household the rituals of “Puja” is done at least once daily in which, lighting the “Diya” is mandatory (Fig. 4). In this process, there are chances that the clothes, hair of the person or any inflammable articles kept in the vicinity of the lighted “Diya” may catch fire.



Figure 4: The lighted “Diya” - the holy lamp

In another study conducted in India, “Puja” burns constituted 16% of the total burn cases⁷. In the same study, it has been observed that accidental burns while performing “Puja” happen during the morning hours of the day. In our study, 86% of fatal accidental burns among the elderly occurred between 8 am and 8 pm, evenly distributed throughout that period. Asma et al. observed in their study that 65% of victims died within a week of hospitalisation⁷ while Nayak et al. in their study stated that 74.4% of the victims (n=224) died within 1 week of the incident, out of which 44.5% (n=134) of cases died within 24 hours⁸. In our study, 57% of the deceased (n=32) succumbed to death within seven days of the incident, with 16% (n=9) dying within a day.

It has been observed in our study that individuals affected with a greater percentage of TBSA burns survived for fewer days. Those who died within 24 hours of the accident had burn injuries affecting an average of 77% of TBSA. Those who survived beyond 24 hours up to one week suffered from burn injuries affecting an average of 67% of TBSA, and for those who survived beyond one week up to one month, the average TBSA affected was 45%, which further reduced to 42% of TBSA for those who survived beyond one month. This finding corroborates the findings of other similar studies. Nayak et al., in their study, observed that most fatalities occurred when greater than 40% of TBSA is involved, and with an increase in the percentage of burn surface area, the duration of survival decreases⁸. Kumar et al., in their study, observed that 82.5% of the victims had more than 50% of total body surface area (TBSA) burns, which is incompatible with life⁶. In our study, 82% of the victims of fatal accidental burns among the elderly population died due to septicaemia and MODS, 11% due to neurogenic shock, and 7% due to hypovolaemic shock. Lam et al. reported that the most common complications among elderly burn patients in the National Burn Hospital, Hanoi, Vietnam were multiple organ failure (4.1%), pneumonia (4.1%), and septic shock (2.9%)⁹. The incidence of MODS in the study of Alam et al. was 63.3%¹⁰. The findings of both studies are different from our study.

CONCLUSIONS

Accidents are preventable, and so are accidental burns. Fatal accidental burns are the tip of the iceberg of the problem related to accidental burns, with the huge, submerged portion representing the morbidity due to the non-fatal cases. Burns are a leading cause of loss of disability-adjusted life-years (DALYs) in low- and middle-income countries. The World Health Organization (WHO) also recommends the enclosure of fires and limiting the height of open flames in the domestic environment. They promote the use of safer cooking devices and less hazardous fuels, generate awareness, and motivate people to adopt safe practices¹¹.

In this study, it has been found that 85% of the fatal accidental burns among the elderly are sustained while performing “Puja” and cooking. Both of these activities cause burns from open flame (flame burns). If the use of open flame during “Puja” and cooking can be replaced by suitable alternatives, these fatal accidental burns can be prevented. The use of open flame while performing “Puja” is an age-old mandatory custom in Hindu and other religions. A device can be designed, like a miniature hurricane lantern/lamp, with an ignition facility operated with a switch. This will provide safety during ignition and during burning by providing a barrier to the flame (Fig. 5).

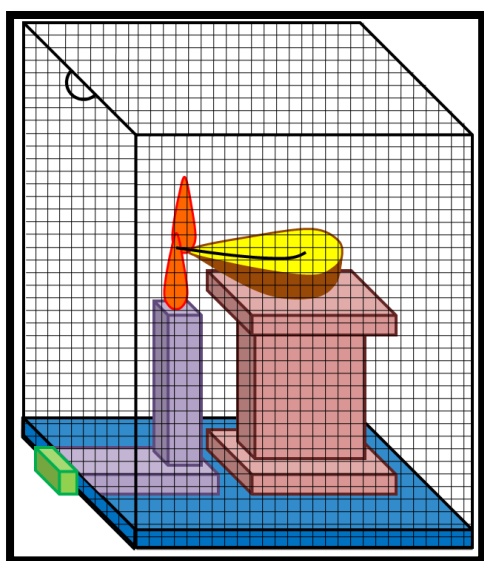


Figure 5: “Safe Diya”. Switch (green) operated gas lighter (purple), lighting the cotton wick (black) of “Diya” (brown), filled with oil/ghee

(yellow) and kept on a stand (pink). The whole assembly is enclosed in a wire cage, providing a barrier to the flame. Conceptualised and designed by author K. Bag.

Recently, the use of electric induction heaters as an alternative to gas burners is gaining popularity. This may be encouraged by providing subsidies or waiving taxes during the purchase of the appliances by senior citizens.

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CONFLICTS OF INTEREST

The authors declared no conflicts of interest.

ETHICAL ISSUES

Ethical clearance was obtained from the IPGME&R Research Oversight Committee (Institutional Ethics Committee), Institute of Post Graduate Medical Education and Research, Kolkata, West Bengal, India (IPGME&R/IEC/2021/531, Date: 25/09/2021).

SOURCES OF SUPPORT

None

AUTHOR CONTRIBUTIONS

ID: Conception of the work; the acquisition, analysis, and interpretation of data for the work; revising the work critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **KB:** Design of the work; drafting the work and revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **CKJ:** Acquisition, analysis, and interpretation of data for the work; revising the work critically for important intellectual content; final approval of the version to be published; agreement to be accountable

for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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