

## Epidemiology and outcome of burn injuries- A prospective study

Jitendra Tomar<sup>1</sup>, Pradeep Kumar Mishra<sup>2</sup>, Mandar R. Sane<sup>3,\*</sup>, Divyesh Saxena<sup>4</sup>, Abhishek Varun<sup>5</sup>

<sup>1</sup>Assistant Professor, <sup>2</sup>Professor, <sup>5</sup>Resident Doctor, SAMC & PGI, Indore, Madhya Pradesh, <sup>3</sup>Assistant Professor, Govt. Medical College & Hospital, Chandigarh, Punjab, <sup>4</sup>Senior Resident, Dept. of Forensic Medicine, Dr. Yashwant Singh Parmar Medical College, Nahan, Himachal Pradesh

**\*Corresponding Author:**

Email: mandarsane@rediffmail.com

### Abstract

Burns are injuries produced by application of dry heat such as flame, radiant heat or some heated solid substance like metal or glass to the body. Local injury to the body by heat may result from dry heat, application of hot bodies, licking by flames resulting in simple burns, moist heat leading to scalds, corrosive poisons resulting in corrosive burns. This was a prospective study carried out at Sri Aurobindo Medical College and Post Graduate Institute, Indore during March 2014 to June 2015 involving all cases admitted in burn ward and post mortem examination done in Department of Forensic Medicine and Toxicology. A total number of 120 cases were taken which included 88 patients who died and a detailed post mortem examination was done. Females outnumbered males as there were 66 (55.0%) females and 54 (45.0%) males. Maximum incidence was in the young adults between the age group of 21-40 years, comprising of 89 (74.17%) cases. Dowry deaths, curse to our so-called modern society are still prevalent, in spite of stringent laws and amendments in the acts. Accidental burn injuries can be reduced by bringing about regulations to develop safer cooking appliances, promoting less inflammable fabrics to be worn at home and educating the community especially women.

**Keywords:** Burn, Autopsy, Inquest, Accidental, Homicidal Burn, Housewives

### Introduction

Among all discoveries made by men, only a few, such as cultivation of soil, speech and writing, have borne such eventful developments as has finding out how to make fire. It took man a long time to understand, appreciate, and reproduce these occurrences, it took him no time at all to realize that fire can hurt and hurt badly. The majority of fire related deaths are accidental and there is typically abundant collateral evidence, from police and fire brigade investigations, to exclude suicide or homicide. Alcoholics and other individuals under the influence of drink or drugs are at risk. Occasionally a natural disease such as epilepsy or a myocardial infarction may cause the victim to collapse onto a heater, starting a fire; the same natural disease may explain failure to escape the fire.

Local injury from heat occurs when an external source of heat raises the temperature of tissue above approximately 44.0 degree centigrade for long enough to damage the tissue. Extremes of age are more vulnerable to such injuries. However in India, it is most commonly seen in younger age group and is most common in female as against in developed countries where it is most common in males as is true with any form of trauma.

### Materials and Methods

This was a prospective study carried out at SAMC & PGI, Indore during March 2014 to June 2015 involving all cases admitted in burn ward and post mortem examination done in Department of Forensic Medicine and Toxicology. A total number of 120 cases

were taken which included 88 patients who died and a detailed post mortem examination was done. Specially prepared proforma was filled by information obtained from the case sheet of patient admitted in burn unit, history taken from the patient and attendants, police inquest and postmortem examination. The information was compiled, tabulated and analyzed.

### Observation

During the study period females outnumbered males as males were 54 (45.0%) and females were 66 (55.0%), and male: female ratio was 1:1.22 (Table 1). Maximum incidence of burn injuries in males were noted in the age group of 21-30 years i.e. 21 (17.5%) and minimum in the age group of 1-10 years i.e. 1 (0.83%). The maximum incidence in females was noted in the age group of 21-30 years i.e. 39 (32.5%). The minimum age to suffer burns was 5 years which was a male child and maximum age was 100 years which was a male patient (Table 1). Most of the victims 90 (75%) were married and 27 (22.5%) were unmarried with married-unmarried ratio of 2.6:1 and most of the victims belong to the Hindu community comprising 108 (90%) and the rest 12 (10%) were from Muslim community. Majority of victims were literate (75.84%), most of which had primary and secondary level education (47.5%). Uneducated victims were accounting for 24.16% of the burn victims.

54 (45%) cases were housewives, followed by 5 (4.16%) females who were students. In males, maximum cases reported were labourer i.e. 13 (10.83%), followed by farmers i.e. 11 (9.16%) cases (Table 2).

Most of the patients were part of a joint family accounting a total of 96 (80%) patients. In males, 39 (32.5%) cases were a part of joint family while 15 (12.5%) cases were residing as nuclear families. In females, 57 (47.5%) were residing as joint families and 9 (7.5%) as nuclear families.

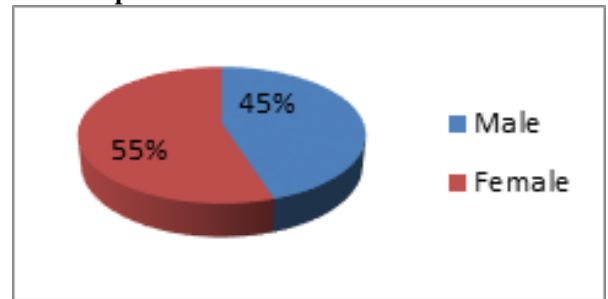
104 (86.67%) victims came from rural (village) area and rest 16 (13.33%) were from urban (city) area. 62 (51.66%) cases were residing in kaccha house (made of soil and wooden material) and remaining 58 (48.33%) were residing in pacca house (cemented house). 64 (53.33%) cases sustained burn injuries during daytime and rest 56 (46.66%) cases in night time. Taking the place of incidence of burn into consideration, 66 (55%) cases occurred in own/rented house which was the maximum among the studied categories while taking sex wise place of incidence, it was maximum among females at in-laws place i.e. 36 (30%), followed by 30 (25%) cases at own/rented house.

Majority of the victims' i.e. 49 (40.83%) cases had burn injuries covering 50 – 80% of the total body surface area (Table 3). Maximum number of burn cases was seen in females' i.e. 15 (12.5%) cases, falling in the category of 70-80% TBSA. In males, maximum number of cases i.e. 11 (9.16%) cases suffered burns to the extent of 30- 40% TBSA. In burnt areas upper extremities were most commonly affected i.e. in 117 (97.5%) cases, followed by head, neck and face in 109 (90.83%) cases (Table 4). Chest & abdomen were involved in 106 (88.33%) cases and genitalia were involved in 24 (20%) cases.

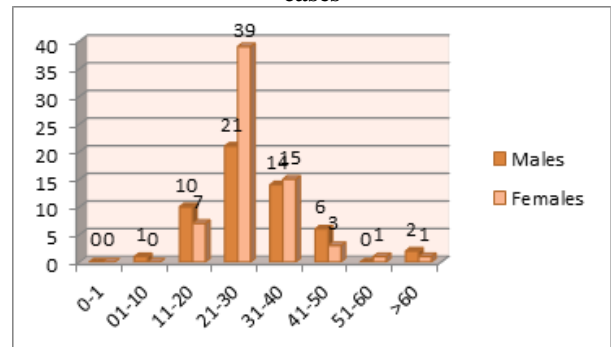
In our study, kerosene lamp/ chimney/ kerosene stove/ pouring of kerosene was the cause of fire in 73 (60.83%) cases, while gas stove/ cylinder was involved in 12 (10%) cases and angithi/ chullha in 8 (6.67%) cases. (Table 5) Overall, the universal source of fire in the household for cooking purposes were responsible for 89 (74.17%) instances of the victims catching fire. Out of total 120 cases, 4 (3.33%) cases were under the influence of alcohol at the time of incidence of burn. All these patients were male and died after hospitalization. Among these 4 deaths, 1 was suicidal and rest 3 were accidental in nature.

During the study period all the cases were hospitalized except one case which was brought dead. Among the patients which were discharged, maximum duration of hospitalization was 76 days and among the patients who died, the maximum duration was 36 days. Majority of patients i.e. 55 (45.83%) had the hospitalization period of more than one week. Soot particles were found in only 5 cases (5.69%). In majority of cases i.e. 68 (77.26%), the cause of death was septicemia, followed by hypovolemic shock in 11 (12.5%) cases and in 1 (1.13%) case which was brought dead, it was neurogenic shock (Table 6).

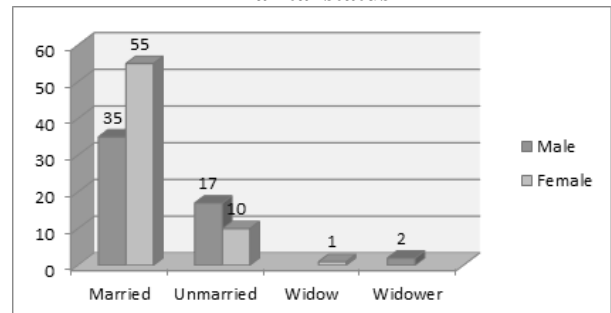
**Graph 1: Sex wise distribution of burns**



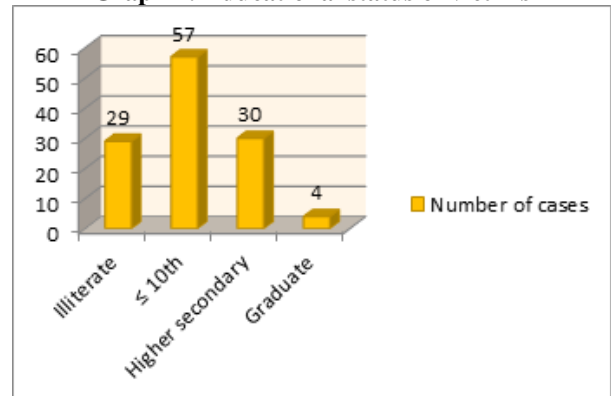
**Graph 2: Age and sex wise distribution of burn cases**



**Graph 3: Distribution of burn in relation to sex and marital status**



**Graph 4: Educational status of victims**



**Table 1: Occupation wise distribution of burn cases (n=120)**

| Occupation            | Male No. (%) | Female No. (%) | Total No. (%) |
|-----------------------|--------------|----------------|---------------|
| Housewife             | -            | 54 (45%)       | 54 (45%)      |
| Laborer               | 13 (10.83%)  | 3 (2.5%)       | 16 (13.33%)   |
| Business              | 4 (3.33%)    | 0              | 4 (3.33%)     |
| Student               | 6 (5%)       | 5 (4.16%)      | 11 (9.17%)    |
| Private Job           | 10 (8.34%)   | 0              | 10 (8.34%)    |
| Farmer                | 11 (9.17%)   | 0              | 11 (9.17%)    |
| Electrician           | 1 (0.83%)    | 0              | 1 (0.83%)     |
| Factory Worker        | 4 (3.33%)    | 0              | 4 (3.33%)     |
| Unemployed/ Dependent | 5 (4.17%)    | 4 (3.33%)      | 9 (7.50%)     |
| Total                 | 54 (45%)     | 66 (55%)       | 120 (100%)    |

**Table 2: Total body surface area of burn (n=120)**

| Body surface Area involved | Male No. (%) | Female No. (%) | Total No. (%) |
|----------------------------|--------------|----------------|---------------|
| 10-20 %                    | 10 (8.33%)   | 1 (0.83%)      | 11 (9.17%)    |
| 20-30 %                    | 5 (4.17%)    | 3 (2.50%)      | 8 (6.67%)     |
| 30-40 %                    | 11 (9.17%)   | 8 (6.67%)      | 19 (15.83%)   |
| 40-50 %                    | 5 (4.17%)    | 7 (5.84%)      | 12 (10%)      |
| 50-60 %                    | 4 (3.33%)    | 10 (8.33%)     | 14 (11.67%)   |
| 60-70 %                    | 9 (7.50%)    | 9 (7.50%)      | 18 (15%)      |
| 70-80 %                    | 2 (1.66%)    | 15 (12.50%)    | 17 (14.17%)   |
| 80-90 %                    | 3 (2.50%)    | 7 (5.83%)      | 10 (8.33%)    |
| 90-100 %                   | 5 (4.17%)    | 6 (5%)         | 11 (9.16%)    |
| Total                      | 54(45%)      | 66 (55%)       | 120 (100%)    |

**Table 3: Distribution of burn injuries on the body (n=120)**

| Area of body burnt  | Total no. of cases | Percentage (%) |
|---------------------|--------------------|----------------|
| Head, neck and face | 109                | 90.83%         |
| Chest and abdomen   | 106                | 88.33%         |
| Back                | 90                 | 75.00%         |
| Upper Extremities   | 117                | 97.50%         |
| Lower Extremities   | 101                | 84.17%         |
| Genitalia           | 24                 | 20.00%         |

**Table 4: Alleged causes of burn (n=120)**

| Alleged Causes                                      | Male No. (%) | Female No. (%) | Total No. (%) |
|---|--------------|----------------|---------------|
| Stove burst   | 1 (0.83%)    | 8 (6.67%)      | 9 (7.50%)     |
| Cylinder burst                                      | 4 (3.34%)    | 0              | 4 (3.33%)     |
| Clothes caught fire while working on gas            | 2 (1.67%)    | 3 (2.50%)      | 5 (4.17%)     |
| Clothes caught fire while working on kerosene stove | 5 (4.17%)    | 22 (18.30%)    | 27 (22.50%)   |
| Clothes caught fire while working on chulha         | 0 (0)        | 8 (6.67%)      | 8 (6.67%)     |
| Fall of kerosene lamp (chimney)                     | 10 (8.33%)   | 21 (17.50%)    | 31 (25.83%)   |
| Pouring of kerosene                                 | 3 (2.50%)    | 3 (2.50%)      | 6 (5.00%)     |
| Electric spark burn                                 | 14 (11.67%)  | 0              | 14 (11.67%)   |
| Petrol  | 1 (0.83%)    | 0              | 1 (0.83%)     |
| Fire at work place                                  | 7 (5.83%)    | 0              | 7 (5.83%)     |
| Gas leakage   | 2 (1.67%)    | 1 (0.86%)      | 3 (2.50%)     |

|                                    |           |          |            |
|------------------------------------|-----------|----------|------------|
| Burn while saving victim           | 3 (2.50%) | 0        | 3 (2.50%)  |
| Bed caught fire while smoking bidi | 1 (0.83%) | 0        | 1 (0.83%)  |
| Diesel                             | 1 (0.83%) | 0        | 1 (0.84%)  |
| Total                              | 54 (45%)  | 66 (55%) | 120 (100%) |

**Table 5: Cause of death (n=88)**

| Duration of survival | No. of cases | Percentage | Cause of death    |
|----------------------|--------------|------------|-------------------|
| Brought dead         | 1            | 1.13%      | Neurogenic shock  |
| 1-2 days             | 11           | 12.50%     | Hypovolumic shock |
| 3-7 days             | 50           | 56.81%     | Septicemia        |
| >7 days              | 18           | 20.46%     | Septicemia        |

## Discussion

Female preponderance was noted during the study which is similar with the finding of other studies.<sup>(1,2,3)</sup> Females were more prone to the burn incidences because of their domestic activities which required an association with fire sources. This is in contrast to other studies where slight male preponderance was observed.<sup>(4,5)</sup>

Maximum incidence of burn injury was noted in females and males in the age group of 21-30 years i.e. 39 (32.5%) females and were 21(17.5%). Also observed in other studies.<sup>(3,4,6,7,8)</sup> The age group 21-30 years is the young adult group and is the most common age for marriage in this area of study.

90 (75%) victims were married and 27 (22.5%) were unmarried. Of the females 55 (45.83) were married and 10 (8.33%) were unmarried in contrast to males 35 (29.16%) were married and 17 (14.16%) were unmarried. Other studies also reported similar finding,<sup>(1,2,3,9)</sup> this is because of their marital maladjustment and bride burning cases in recently married females.

It was observed that 54 (45%) cases who suffered burn injuries were housewives followed by 5 (4.16%) females which were students. In males, maximum cases which were reported were labourer by occupation accounting to be 15 (12.5%). The present study was in consistence with studies of Harish D et al<sup>(3)</sup> and Chawla R et al<sup>(7)</sup> due to involvement of females in the kitchen work.

In the present study majority of the victims i.e. 104 (86.66%) came from rural (village) area and rest 16 (13.33%) were from urban (city) area. Sri Aurobindo Medical College is located in the outskirts of Indore city and surrounded by villages on one side. Ghaffar UB et al<sup>(9)</sup> in their study also noted maximum number of victims were from rural area (68.4%) than from urban area (31.6%).

100% mortality was seen in the victims having > 50% TBSA. Maximum percentage of burns was seen in females as compared to males in 15 (12.5%) cases falling in the category of 70-80% TBSA. In males, maximum 11 (9.16%) cases, suffered burns to the extent of 30-40% TBSA. Memchoubi and H.

Nabachandra<sup>(4)</sup> observed in about 73.84% cases, >80% body surface area was involved. Mazumder A and Patowary A<sup>(6)</sup> observed in most of the victims the burn injury covers 90-100% of the total body surface area followed closely by 50-60% of the total body surface area involvement.

In present study upper extremities were most commonly affected in 117 (97.5%) cases, followed by head, neck and face in 109 (90.83%). Cases in which percentage of burn (TBSA) was above 95% died within 24 hrs. Similar findings were observed in the study done by Chawla R et al<sup>(7)</sup> and Ande JD et al<sup>(8)</sup> with most of the cases involving upper limbs (93.5%), followed by chest and abdomen (86.11%), lower limbs (63.8%) and genitalia (14.81%). In contrast to the present study, Buchade D et al<sup>(2)</sup> found that Head, face & neck region was most commonly affected in 206 (86.91%) cases, followed by chest in 174 (73.41%) cases.

In present study the source of fire was kerosene (lamp (chimney)/ kerosene stove/ pouring of kerosene) in 73 (60.83%) cases, while gas (stove/ cylinder) was involved in 12 (10%) cases and anghiti/ chullha in 8 (6.67%). Kerosene lamp (chimney) is very widely used in rural areas for lighting purpose. The observations of this study that flame is in agreement with other studies.<sup>(10,11)</sup> In present study, commonest method of committing suicide in 6 (5.00%) out of 7 (5.83%) cases was by sprinkling kerosene oil over the body and then setting fire. This observation was in concordance with the study conducted by Aggarwal BBL and Chandra J.<sup>(12)</sup>

Cases under the influence of alcohol at the time of incidence were 4 (3.33%) out of total 120 cases. All the patients were male and died after hospitalization. Among these 4 deaths 1 was suicidal and rest 3 was accidental in nature. This was consistent with the study conducted by Buchade D et al<sup>(2)</sup> who studied 237 burn cases brought for autopsy and observed total 18 (7.59%) victims were under the influence of alcohol at the time of incidence. Hence alcohol intoxicated victims had 100% mortality. Consumption of alcohol leads to delayed reflex.

Majority of patients i.e. 55 (45.83%) cases had the hospitalization period of more than one week. 27 (22.50%) cases survived up to 5 days. 17 (14.16%) cases had survival up to 1 week, whereas 7 (5.83%) cases succumbed to death in less than 24 hours. Harish D et al<sup>(3)</sup> had similar observation of majority of patients i.e. 102 (24%) surviving for more than a week before succumbing to the death.

In 68 (77.26%) cases the cause of death was septicemia, followed by hypovolemic shock in 11 (12.5%) cases and in 1 (1.13%) case which was brought dead it was neurogenic shock. The infection usually is airborne and less often hematogenous from wound infection. Septicemia was common in victims who survive more than 3 days. Renal failure and Acute Respiratory Distress Syndrome (ARDS) were other complications arising out of septicemia. Similar observation with septicemia as cause of death in majority of cases was found in the study of Harish D et al<sup>(3)</sup> on 381 burn cases. Mazumdar A and Patowary A<sup>(6)</sup> and Mishra PK et al<sup>(14)</sup> observed shock as the most common cause of death. Mangal HM et al<sup>(1)</sup> observed maximum percentage of victims 166 (55.33%) died within first 24 hours due to hypovolumic shock (burns-shock). In all cases that died after 36 hours the cause of death was given as septicemia.

### Conclusion

Despite the modernization, the domestic fire is the major cause of burns with maximum involvement of female. Strict implementation of the Anti-dowry Act would go a long way in bringing down the incidence of these 'accidents'. The government along with various working groups and the NGOs, including the doctors need to put in more sincere effort. The government must appoint more doctors in the burn units.

Following the safety instructions like putting the lights off while going out, wearing tight and cotton cloths while cooking, not leaving a fire source unattended etc. will definitely help to reduce the incidence of burn injuries, as we feel most of the accidental burn cases are preventable. The present study is concluded with the hope that the given suggestions will help in reducing the number of burn injuries.

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**Conflict of interest:** None to declare.

**Ethical clearance:** Taken

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