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## Original Research Article

# Pattern of flame burn injury in Dibrugarh district of Assam: An autopsy based analysis

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## ABSTRACT

**Background:** Burn injuries are the second major cause of trauma-related deaths only exceeded by motor vehicular accidents, both in the developing and developed world. Burn due to flame or fire is common in this region.

**Aims:** To find out epidemiological patterns and cause of death in the flame burn as data on it is not available even though the most common cause of burn in this region.

**Settings and Design:** This cross-sectional observational study was carried out at the Department of Forensic Medicine, Assam Medical College, Dibrugarh from 1st July 2014 to 30th June 2015.

**Methods and Materials:** A total of 224 cases died of flame burn brought for autopsy were taken for study. A thorough post-mortem examination was done on every case following standard procedure. Data were recorded in the proforma especially prepared for this purpose.

**Results:** Out of 1436 medico-legal deaths, 224 (15.60%) was due to flame burn. The majority of victims were female 186 (83.03%), married, and belong to 21-30 years of age group. Victims were mostly from rural areas, unemployed, and literates. Kitchen 129 (57.60%) was the main place of occurrence. The majority suffered more than 80% burns of TBSA and died within 24 hours 92 (41.07%). The hypovolemic shock was the most common cause of death.

**Conclusions:** Until the economic condition is improved and lifestyle changes among the people, the fire-related problem must rise in countries like India.

**Key Messages:** Young age groups and unemployed were most among victims. Burn incidents decrease with increasing education level. Economic improvement and change of lifestyles will help in reducing burn-related problems.

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## 1. Introduction

Burn injuries are the second major cause of trauma-related deaths only exceeded by motor vehicular accidents, both in the developing and developed world.<sup>1</sup> Fire or flame is a common cause of burn in this region. Like other trauma, burn causes significant morbidity and mortality all over the world. As per the report of the Indian National Crime Records Bureau of 2014, out of 316828 unnatural accidental deaths, 19513 (4.3%) were due to fire accidents.<sup>2</sup> This study was conducted to find out epidemiological patterns and

cause of death in the flame burn as data on it is not available even though the most common cause of burn in this region.

## 2. Materials and Methods

A total of 224 cases of flame burns were taken from the medico-legal autopsies performed in the Department of Forensic Medicine, Assam Medical College, Dibrugarh during the period from 1<sup>st</sup> July 2014 to 30<sup>th</sup> June 2015 out of 1436 medico-legal autopsies. The various detailed data of all cases were collected from police inquest papers or investigating officers, hospital papers, family members, friends available, persons present at the time of incidence,

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or accompanying the victim. A thorough post-mortem examination was done on every case and total body surface area (TBSA) was calculated according to Wallace's rule of nine. Data of all 224 cases were recorded in the pre-validated proforma especially prepared for this purpose. These were carefully compiled, tabulated, and analyzed using Microsoft excel.

### 3. Observations and Results

Out of a total of 1436 autopsies, 224 cases were death due to flame burns which are 15.60% of the total.

#### 3.1. Age-sex distribution

[Table 1 ] The highest number of cases observed in the 21-30 years of age group and 11-40 years of age group constitutes 188 (83.94%) of cases. Considering the sex, 186 cases were female and 38 were male which makes the male: female ratio 1:4.9.

#### 3.2. Marital status

[Table 2] Most of the victims were married [182; 81.25%] and widows were the least numbers of total cases. Out of the married cases, 153 (68.30%) were females. Male cases were significantly high in victims married for more than 7 years. Out of the married female 6 (3.92%) cases were found pregnant in the present study.

#### 3.3. Religion

The majority cases 211 (94.20%) were Hindu, then Muslim 9(4.01%), followed by Christian 3 (1.34%) and Sikh 1 (0.45%) respectively. Muslim cases were female.

#### 3.4. Locality

It was observed that rural cases [186; 83.03%] both in males and females outnumbered the semi-urban [20; 8.93] and urban [18; 8.04] among victims.

#### 3.5. Occupation

[Table 3] The highest cases were unemployed [129; 57.59%] of which housewife constitutes the largest group with 108 (48.21%) cases of the total, followed by daily wagger [61; 27.23%], and least semi-government employee with 1 (0.45%) case. Children, students included in other categories of unemployed persons.

#### 3.6. Education

Illiterate [61; 27.23%] and Primary level [61; 27.23%] constitutes the highest cases, and numbers of cases were declining with an increase in the education level.[Table 4]

#### 3.7. Place of incident

Maximum place of occurrence is in the kitchen with 129 (57.60%) cases. Inside house [198; 88.40%] is the place where incident mostly occurs. [Table 5]

#### 3.8. Seasonal distribution

Highest 71 (31.70%) cases observed in winter (November-February), followed by 67 (29.91%) in Rainy (June-September), 64 (28.57%) in Spring (March-May), and least 22 (9.82%) cases in autumn (October). The season division is as per the Assam state weather calendar.

#### 3.9. Body surface area

Maximum of 98 (43.76%) cases had burn injuries involving >80% of TBSA and only 20 (8.93%) cases were found with <40% of TBSA. No case was found with burns involving <10% of TBSA. (Figure 1)

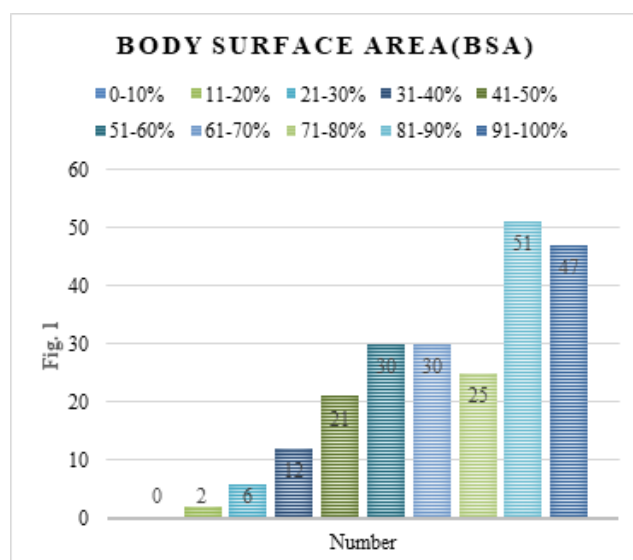


Fig. 1: Body surface area

#### 3.10. Survival period

[Table 6] It was observed that most of the victims [44; 19.64%] survived 8-14 days, and at least 10 (4.46%) cases survived 4-6 hours of duration. Altogether, the highest 92 (41.07%) cases died within 24 hours period. Comparison between TBSA involvement and Survival period shown in Table 7.

#### 3.11. Cause of death

Most of the cases [107; 47.76%] died due to hypovolemic shock, and septicemic shock was the second most common cause of death with 99 (44.20%) cases.(Figure 2)

**Table 1:** Age-sex distribution

Age (in years)	Male	Female	Total	Percentage
0-10	2	1	3	1.34
11-20	4	37	41	18.30
21-30	9	91	100	44.64
31-40	14	33	47	21.00
41-50	3	15	18	8.03
51-60	3	6	9	4.01
61-70	3	3	6	2.68
<b>Sum</b>	<b>38</b>	<b>186</b>	<b>224</b>	<b>100</b>

**Table 2:** Marital status and time since marriage

Marital status	Male	Female	Total	Percentage
Widow	0	8	8	3.57
Unmarried	9	25	34	15.18
Married	<7years	7	74	81.25
	>7years	22	79	
<b>Sum</b>	<b>38</b>	<b>186</b>	<b>224</b>	<b>100</b>

**Table 3:** Occupation of victims

Occupation	Number	Percentage	
Unemployed	Housewife	108	48.21
	Others	21	9.38
Daily Wager	61	27.23	
Farmer	2	0.89	
Business	6	2.68	
Self-employee	3	1.34	
Private employee	14	6.25	
Semi-Govt. employee	1	0.45	
Govt. employee	8	3.57	
<b>Sum</b>	<b>224</b>	<b>100</b>	

**Table 4:** Education status

Education	Male	Female	Percentage
Illiterate	11(4.91)	50(22.31)	27.23
Primary	11(4.91)	50(22.31)	27.23
Middle + High school	11(4.91)	49(21.87)	26.79
Higher secondary	2(0.89)	23(10.27)	11.16
Undergraduate	2(0.89)	8(3.57)	4.46
Graduate	1(0.45)	5(2.23)	2.68
Post-graduate		1(0.45)	0.45
<b>Sum</b>	<b>16.97</b>	<b>83.03</b>	<b>100</b>

**Table 5:** Place of incident

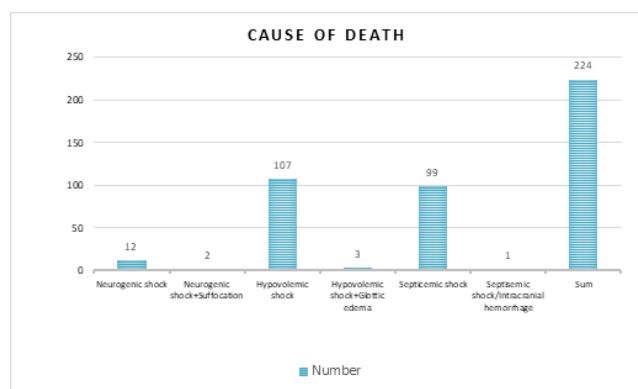
Place of Incident	Male	Female	Number	Percentage
Inside House	Kitchen	10	119	57.60
	Other room	19	50	30.80
Outside house	9	17	26	11.60
<b>Sum</b>	<b>38</b>	<b>186</b>	<b>224</b>	<b>100</b>

**Table 6:** Survival period

Survival Period	Number	Percentage
0-3hours	14	6.25
4-6hours	10	4.46
7-12hours	29	12.95
13-24hours	39	17.41
2-3days	23	10.27
4-7days	39	17.41
8-14days	44	19.64
15days-1month	15	6.70
>1month	11	4.91
<b>Sum</b>	<b>224</b>	<b>100</b>

**Table 7:** TBSA involvement and Survival period comparison

Survival period	0-10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	91-100%	Total
0-3 hours	0	0	1	0	0	0	1	1	5	6	14
4-6 hours	0	0	0	0	0	0	1	0	0	9	10
7-12 hours	0	0	0	0	1	0	3	3	5	17	29
13-24 hours	0	0	1	1	3	4	7	4	13	6	39
2-3 days	0	2	1	1	2	3	2	1	7	4	23
4-7 days	0	0	0	0	4	12	7	6	7	3	39
8-14 days	0	0	1	5	7	6	5	7	11	2	44
15days-1 month	0	0	0	1	2	4	4	1	3	0	15
>1 month	0	0	2	4	2	1	0	2	0	0	11
<b>Sum</b>	<b>0</b>	<b>2</b>	<b>6</b>	<b>12</b>	<b>21</b>	<b>30</b>	<b>30</b>	<b>25</b>	<b>51</b>	<b>47</b>	<b>224</b>

**Fig. 2:** Cause of Death

#### 4. Discussion

Out of the total 1436 autopsies, 224 (15.60%) cases died from flame burn injuries. Previous studies reported 16.70%,<sup>3</sup> and 19.4%<sup>4</sup> cases died of burn which is comparable with present observation.

In this study, 11-40 years of age group constitutes a maximum of cases [188; 83.94%] with a female predominance (male: female ratio 1:4.9). Other studies in India have reported similar findings with maximum

cases between 11-40 years of age group and female predominance.<sup>3,5-10</sup> It is because people of this age group are actively involved in both indoor and outdoor work. Family disharmony and stress also gives them social trauma and propel them to commit suicide. On contrary, in western countries, children and the elderly, and males were more in burn injuries.<sup>11,12</sup> The early marriage in females and involvement in kitchen work even at an early age in India make them susceptible to an accident. Bride burn for the sake of dowry is also a reason women suffer burn. The present study shows maximum cases were married females [153; 68.30%] of which 74 (48.36%) cases were within 7 years of active marriage life. Several other studies also have shown married female predominance.<sup>3,10,13-16</sup>

Most of the victims were from the rural area [186; 83.04%] and Hindu by religion [211; 94.20%] in this study, and consistent with other studies.<sup>13,17-19</sup> This may be due to low income, lifestyle, and being Hindu majority area. A study also showed more in urban than the rural area and those urban migratory people who belong to poor socio-economic categories still use stoves for daily cooking work.<sup>8</sup>

Though overall literates are more than illiterates as per education, maximum victims were educated up to primary level only which constitute 61 (27.23%) cases out of total

victims. A decline in the number of cases with an increase in education level observed. Many studies also observed more in literates,<sup>10,18,20,21</sup> and others in illiterates.<sup>13,14,22–25</sup> It might be due fact that education improves the confidence of a person and economic status increases awareness and safety in handling inflammable substances. In low economic class Chula and Kerosene stoves for cooking, and use of Lamp, Chaki, Dia, Candle for light in absence of electricity increase the fire-related incidence more commonly as these materials are cheaper and easily available which fit their budgets.

The majority of the victims were housewives followed by daily wagers. Other studies also found housewives were highest among victims.<sup>8,20,22</sup> Burn injuries occurred mostly in the kitchen,<sup>9,18,20</sup> that is similar to this study. Overall inside house occurrence and unemployed are highest. This high incidence in housewives may be due to regular exposure to fire during cooking in the kitchen, inexperience in handling the unsafe cooking appliances, and too much pressure in work leading to accidents. The loose clothing like saree used by females in India and synthetic or mixed fabrics used by the poor also make them susceptible. Bonfire and open Chula are made for warming and cooking in winter increases the risk of fire accidents. The kitchen is the place where inflammable substances like kerosene and match sticks are stored and easily available to use for self-immolation.

Burn injuries > 80% of TBSA comprises the highest victims in the present study. Other studies also have similar,<sup>6,7,16</sup> and different observations.<sup>5,26,27</sup> Grossly though with a decrease in the involvement of TBSA, the period of survival increases but that didn't hold in all cases. Some cases with lesser TBSA involvement died early than those with higher. It implies that the period of survival or fatality of burn injuries depends on various factors other than the extent of the burn. Thus interpretation from the data is that chances of survival increased when burns involvement is less than 30% of total body surface area in this area.

Victims died most within 24 hours after the incident [92; 41.07%]. Many studies observed similar results,<sup>6,26,27</sup> and others found the majority died between 1-7 days after the incident.<sup>3,5,7</sup> Most of the death occurred due to shock, out of which the majority were from hypovolemic shock. Shock also observed as a major cause of death in existing studies<sup>6,28</sup> and other observed septicemia or septicemic shock.<sup>5,15,16,18,26</sup>

## 5. Conclusion

Burn incidents are seen more prevalent among women, unemployed, less educated, and in the kitchen. The low literacy rate and socio-economic status of the people are the major causes of accidental burns. These again lead to family disharmony, increases stress, and propel them to do

suicide by burning. Schemes like the distribution of safe cooking appliances and awareness programs regarding the safe handling of fire-related appliances by the government will be a great help. Women should be given equal status in society. Women empowerment gives economic freedom, independent life, and helps economic upliftment to their family. As the fire-related injury is a major problem in India, till the economic condition is improved and lifestyle changes, the fire-related problem must rise. Psychiatric consultation should be available for tackling mental distress that usually develops due to day to day life experiences which is also a propelling factor for suicide.

## 6. Source of Funding

None.

## 7. Conflict of Interest

The authors declare no conflict of interest.

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### Author biography

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