

# Post-mortem Analysis of Burn Injury Cases in Forensic Medicine: A Medicolegal Perspective

Md. Syedur Rahaman Sumon<sup>1\*</sup>, Rowshon Ara Begum<sup>2</sup>, Jannatul Ferdous<sup>3</sup>, Nazia Sharmin<sup>4</sup>, Md. Belayet Hossain Khan<sup>5</sup>

<sup>1</sup>Professor (CC), Department of Forensic Medicine, Bashundhara Ad-din Medical College, Bangladesh.

<sup>2</sup>Assistant Professor, Department of Forensic Medicine, Khwaja Yunus Ali Medical College, Bangladesh.

<sup>3</sup>Assistant Professor, Department of Forensic Medicine, Bashundhara Ad-din Medical College, Bangladesh.

<sup>4</sup>Assistant Professor, Department of Forensic Medicine, Shaheed Monsur Ali Medical College, Bangladesh.

<sup>5</sup>Professor & Head, Department of Forensic Medicine, Sir Salimullah Medical College, Bangladesh.

## ABSTRACT

Even before the primitive man learnt to use fire, he had been a victim of it. Our study was carried out for 1 year, starting from 1st January 2019 to 31st December 2019 at Sir Salimullah Medical College & Hospital, Dhaka, Bangladesh, on burn deaths. The aim and objective of the study were to know the demographic pattern, cause of death and relation of the body surface involved.

The rate of burn death was 7.63% of the total autopsies. Male victims outnumbered female victims with a female to male ratio of approximately 2.1:1. The Majority of the cases belong to the adolescent and young adult (21- 30 years) age group. The maximum no. of victims was married. In most of the fatal period was within 6 hours. Most of the deaths occurred when >50% of TBSA is involved. Most of the victims died within 1 to 3 days. The major cause of death in burns was septicemia.

**Keywords:** Burn, demography, cause of death, body surface involved

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## INTRODUCTION

Fire, a groundbreaking discovery in early human history, has significantly advanced our development, yet it remains a source of both progress and peril. Throughout the ages, different cultures have intermittently revered it as sacred or divine.<sup>1</sup> Burn is a tissue injury due to application of heat in various forms (flame, moist heat, chemicals, radiation, or electric spark) to the external or internal body surface.<sup>2</sup> Forensic pathologists frequently encounter burn cases to distinguish whether the injury is antemortem or post-mortem.<sup>3</sup> An estimated 180,000 burn-related deaths were recorded worldwide each year, and 8.4 million new cases were identified in 2019. Among the top causes, burn injuries are the major contributor to the loss of disability-adjusted life years (DALYs) in low- and middle-income countries.<sup>4</sup> Thus, burn constitutes the fourth notable cause of trauma globally following traffic accidents, falls and interpersonal violence.<sup>5</sup> Each year, burn injuries affect roughly 450,000 people, necessitating treatment, with about 30,000 requiring care in burn units. Approximately 3,400 individuals succumb to burns or related complications such as inhalation injuries, toxic exposure, organ dysfunction, or infection.<sup>6</sup> In Bangladesh, it is statistically seen that more than 3000 people die annually due to burns, with a mortality of 2.2 per 100,000 population.<sup>7</sup> Dhaka, being the capital of Bangladesh, has a staggering density of population density, presiding over 23.9 million, according to the most recently published statistics.<sup>8</sup>

Accidental causes accounted for most burn cases, whether they originated in domestic settings, occupational contexts, or

**Corresponding Author:** Md. Syedur Rahaman Sumon, Professor (CC), Department of Forensic Medicine, Bashundhara Ad-din Medical College, Bangladesh e-mail: drsumonadib@gmail.com

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vehicular situations. Death also occurs while escaping from a burning building or the collapse of walls in a building, or collapse in fire incidents. Worse burn cases are from flame ignited to garments in contact with coal, gas, or a kerosene oil stove.<sup>9</sup>

Mortality rates remain elevated due to delayed healthcare access and public unawareness of emergency protocols. Additionally, self-inflicted burns linked to socio-economic stressors—such as family disputes, academic failures, mental health challenges, or chronic illnesses—are rising. Criminal acts, including attempts to conceal crimes like homicide or assault through post-mortem burns, further complicate the issue. Rapid industrialisation and fire-related disasters amplify the burden on Bangladesh's healthcare infrastructure.

Assessing outcomes for burn patients is critical for optimising care, including diagnostic approaches, surgical interventions, and rehabilitation. Identifying hidden prognostic factors can enhance treatment strategies and resource allocation, ultimately improving survival and recovery in vulnerable populations.

## AIM AND OBJECTIVES

- To analyse the demographic profile of individuals affected by burn injuries.
- To investigate the primary causes of mortality associated with burn-related trauma.
- To evaluate the correlation between survival outcomes and the extent of total body surface area affected by burns.

## MATERIALS AND METHODS

This retrospective study was conducted at Sir Salimullah Medical College & Hospital, Dhaka, Bangladesh, from January 2019 to December 2019. The research included all burn injury cases admitted to the Central Morgue at SSMCH, irrespective of the reported circumstances of injury. Data were collected from multiple sources: medical records of the Burn Unit, interviews with family members of deceased individuals, accompanying law enforcement personnel, inquest reports, and official documentation provided during autopsies. Additional details such as treatment histories, laboratory test results, autopsy findings, and available circumstantial evidence were systematically reviewed and cross-referenced to ensure comprehensive analysis.

### Exclusion Criteria

Cases involving instantaneous fatalities due to severe burns (e.g., extensive charring, muscle or bone involvement) or those displaying post-mortem burn characteristics were excluded. Pediatric burn patients treated in the Department of Paediatrics at Sir Salimullah Medical College & Hospital were also excluded from the study cohort.

## RESULT

A total of 1792 cases of unnatural deaths were autopsied during the study period in the SSMC morgue, of which 137(7.63%) cases were deaths due to burn cases (Table 1).

Among the total burn cases, Flame burn was the commonest cause, 104 (75.92%), out of the other causative factors, followed by moist burn from chemical burn & scald, 25 (18.24%) (Table 2)

The highest incidence of burn was found among the 21 to 30 years age group, 54 (39.42%), followed by 33 (24.08%) in the 31 to 40 years age group & 21 (15.33%) in the 41 to 50 years age group (Table 3).

Table 4 presents the sex wise distribution of the burn cases; 93 (67.88%) out of 137 cases were male, and 44 (32.14%) were female, with male-to-female ratio being 2.1:1.

**Table 1:** Prevalence of Burn cases among total autopsy cases (N = 1796)

Nature of death	Frequency	Percentage (%)
Burn	137	7.63
Other cases	1659	92.37
Total	1796	100

**Table 2:** Distribution of Type of burn among the burn cases (n = 137)

Type of Burn	Frequency	Percentage (%)
Flame burn	104	75.92
Electric burn	8	5.84
Scald & Chemical burn	25	18.24
Total	137	100

**Table 3:** Age distribution of burn cases (n = 137)

Age group in year	Frequency	Percentage (%)
0-10	2	1.46
11-20	14	10.22
21-30	54	39.42
31-40	33	24.08
41-50	21	15.33
51-60	9	6.57
61-70	3	2.18
>71	1	0.74
Total	137	100

**Table 4:** Distribution of death by sex among the Burn Cases (n=137) [Ratio M: F = 2.1:1]

Sex	Frequency	Percentage (%)
Male	93	67.88
Female	44	32.12
Total	137	100

Maximum cases of death due to burns occurred in work workplace 79 (57.67%), followed by home 33 (24.08%) and outdoor 25 (18.25%) shown in Table 5.

Table 6 depicts the marital status of the sufferers, showing maximum victims, 69 (50.36%), were married & followed by 64 (46.72%) victims who were unmarried.

Most of the death cases from burns were due to septicaemia 58(42.34%), followed by neurogenic shock 38(27.74%) & hypovolemic shock 29(21.16%) (Table 7).

The majority of the deaths, 46 (33.58%), due to burns, occurred immediately within <6 hours of the incident. Whereas 33(24.08%) deaths occurred within 1 to 3 days, 21(15.33%) deaths within 1 week, 11(8.03%) deaths within 1-2 weeks from the post-injury period, as shown in Table 8.

Considering the fatality of total body surface area involved to be >50% were the larger group 67(48.91%) and maximum number of victims 36(26.27%) were sustained 71 to 90% of total body surface area (TBSA) burns followed by 21(15.33%) victims sustained <50% total body surface area (TBSA) burns (Table 9).

It is observed in Table 10 that accidental deaths were the commonest manner of burn death, accounting for 102 (75.46%), followed by suicidal deaths, which were 26 (18.97%).



**Table 5:** Distribution of burn victims by location (n=137)

Place of incidence	Frequency	Percentage (%)
Workplace	79	57.67
Home	33	24.08
Outdoor	25	18.25
Total	137	100

**Table 6:** Marital status distribution among the burn cases (n=180)

Marital status	Frequency	Percentage (%)
Married	69	50.36
Unmarried	64	46.72
Others (Divorce/ Widow/Single)	4	2.92
Total	137	100

**Table 7:** Cause of death in burn cases (n=137)

Cause of death	Frequency	Percentage (%)
Neurogenic shock	38	27.74
Septicaemia	58	42.34
Hypovolemic shock	29	21.16
Asphyxia	5	3.65
Multi-organ failure	7	5.11
Total	137	100

**Table 8:** Duration of survival of the victims (n=137)

Duration of survival	Frequency	Percentage (%)
<6 hrs	46	33.58
7-24 hrs	18	13.13
1-3 days	33	24.08
4-7 days	21	15.33
1-2 weeks	11	8.03
>2 weeks	8	5.84
Total	137	100

**Table 9:** Distribution of total body surface area (TBSA) (n=137)

TBSA	Frequency	Percentage (%)
<50 %	21	15.33
51-70 %	67	48.91
71-90 %	36	26.27
90 %	13	9.49
Total	137	100

**Table 10:** Manner distribution of burn victims (n=137)

Manner	Frequency	Percentage (%)
Accidental	102	75.46
Suicidal	26	18.97
Homicidal	9	6.57
Total	137	100

## DISCUSSION

The present research indicates that (7.63%) of the total 1796 deaths in the morgue of SSMC during the given period are classified as death by burn. Maximum deaths were principally caused by flame (75.92%), which is consistent with the result of Chowdhury MIB *et al.*, Virendra K *et al.*, Singh D *et al.* and Hilal A *et al.* (96.33, 94.1, 90 and 91%, respectively) of all unnatural death autopsies.<sup>10,11,12,13</sup>

It is observed that the age group mostly encountered death from burn are 21-40 years with peak incidence between 21-30 years (39.42%), which is similar to study of Chowdhury MIB *et al.*, Nayak PK *et al.*, Virendra Ket *al.*, Faizunnahar *et al.* and Singh D *et al.*<sup>10,11,12,13,14</sup> It explains that this specific age group is productive and faces midlife crisis, including family problems, financial problems or the effect of modern life style.<sup>13</sup> But in contrast, K. Soltani *et al.* show peak incidence between the 16-25 years age group, with maximum burn cases being (93%) below 60 years.<sup>15</sup> Whereas a study done by Hilal A. *et al.* found that maximum burn cases were younger age group 0-5 years.<sup>17</sup>

This literature shows that males have outnumbered the females with the ratio being 2.1:1, which is quite similar to a study done by Chowdhury MIB *et al.* and Faizunnahar *et al.* (2.03:1 and 2.3:1, respectively).<sup>10,13</sup> The commonest cause of male predominance is considered as due to more involvement

in risky work, both indoor to outdoor, professionally.<sup>13</sup> Gupta R *et al.* have also compiled data on male victim prevalence over females in burn cases.<sup>19</sup> However, Nayak PK *et al.*, Singh D *et al.*, Hilal A. *et al.*, and Vipul NA study found females are more prone to burn explaining because their chores are mainly in the kitchen.<sup>11,14,16,17</sup> While engaged in cooking, women usually dress in loose traditional attire and remain distracted due to family life stress, frequently owing to a lack of awareness, which renders them more susceptible to burns.

The current study reveals that (57.67%) cases were reported as death from burn incidence in the workplace rather than indoor (24.08%) or outdoor (18.25%). This result is close to the study conducted by Faizunnahar *et al.* (44.01%).<sup>13</sup> but a study by Chowdhury MIB *et al.* reported that the highest burn incidences were (64.91%) at home, followed by the workplace, ranked second (27.06%).<sup>10</sup> Workplace incidents often involve burn injuries caused by thermal, chemical, electrical, and gas explosions affecting various professions like labourers, electricians, restaurant staff or industrial workers, as well as individuals at home. Here, men make up the majority of the workforce. Gas cylinder explosions have become a significant safety concern following recent incidents both at home and at workplaces, which involve both men and women.<sup>18</sup> As for the marital status of the victims in our study, the maximum sufferers (50.36%) were found to be married, and 46.72% were

unmarried in both sexes, which is consistent with the findings of the study by Nayak PK *et al.*<sup>11</sup>

The leading cause of death from burns in our study was septicemia (42.34%), followed by Neurogenic shock (27.74%) and Hypovolemic shock (21.16%). Similar findings were also observed by Nayak PK *et al.*, Virendra K *et al.*, Singh D *et al.*, Gupta R *et al.* and Chawla R *et al.*<sup>11,12,14,19,20</sup> Instantaneous death due to Neurogenic shock in burn cases has been found by Chowdhury MIB *et al.* as the major cause of death, which is dissimilar compared to our study.<sup>10</sup>

The fatal period in most of the cases (33.58%) is within 24 hours, and the studies conducted by Chowdhury MIB *et al.*, Nayak PK *et al.* and Chawla R *et al.* reported similar findings to ours.<sup>10,11,20</sup> But in contrast to our study, Virendra K *et al.* & Singh D *et al.* differ on it, showing the majority of the deaths being within 1 week.<sup>12,14</sup>

In the present study, the majority of cases (84.67%) were >50% TBSA, indicating reduced life expectancy even if medical attention has been received. Findings by Chowdhury MIB *et al.* and Gupta R *et al.* are similar to our study.<sup>10,19</sup> Nayak PK *et al.* and Virendra K *et al.* found maximum cases >40% TBSA, which is also quite similar to the current study.<sup>11,12</sup>

Though the majority of the incidents are accidental (75.46%), suicidal and homicidal cases were also observed. Chowdhury MIB *et al.*, Faizunnahar *et al.*, Singh D *et al.*, A.K. Batra *et al.*, Buchade D *et al.* and Chakraborty S *et al.* noted the similar finding.<sup>19,21,22,23</sup>

## CONCLUSION

This study highlights the significant burden of burn injuries in the forensic and medicolegal context, emphasising that most burn-related deaths occur among young adult males, predominantly due to flame burns in domestic and occupational settings. The findings underscore the crucial need for targeted preventive measures, public awareness campaigns, and improved emergency response protocols to reduce mortality and morbidity associated with burn injuries. Additionally, the data on the distribution of causes and survival periods can aid clinicians, forensic experts, and policymakers in devising strategies for better management, timely intervention, and effective resource allocation. Continued research and implementation of safety regulations are imperative to mitigate the incidence of burn injuries and save lives in vulnerable populations.

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