

# Pattern of Lightning Related Injuries to Human in Bangladesh

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## Abstract

**Introduction:** In recent past, the incident of lightning strikes and related injuries has increased significantly which is the detrimental consequence of climate change. Therefore, it is recognized as one of the cause of weather related death in Bangladesh.

**Objective:** To present the pattern of lightning related injuries in Bangladesh.

**Methods:** A cross sectional study carried out on September 2021 among 40 people who were victim of lightning on the way to attend a wedding reception in Shibganj upazila of Chapainawabganj on 4 August 2021. Detail information was received from one relative of each 16 deceased family and 24 survivors. Further, data were collected from the doctors and nurses of Chapainawabganj Government Hospital.

**Results:** In addition to the two fatalities on the route to the hospital, 14 individuals died on the spot. Further, among 24 survivors, 16 people survived with moderate and rest 8 survivors had mild injuries. 45% lightning victims were dead and 35% were survived with major injuries by lightning and 20% victims survived with minor injuries. Majority (35%) of death were due to direct strike which is followed by ground strike (30%). Injury to nervous and cardiovascular system is the usual site of injury for human organ where percentage of injury is 35% and 30% respectively. The victims remain admitted to hospital in varying range and survivors had multiple symptoms of minor injuries. Among them, majority victims (9 people) 40.91% left hospital after initial observation.

**Conclusion:** Lightning kills few hundred and injures several thousand people in our country every year. However, lightning survivors should be taken to hospital for further investigation and treatment. Field management is very important for a patient to survive. For this, lightning education will immensely help not only to minimize the death cases but also help them to manage the lightning victims on the spot.

**Key-words:** Lightning, Lightning fatalities & injury, Nervous system, Cardiovascular system, Cardiopulmonary resuscitation.

## Introduction

According to World Risk Report 2015, Bangladesh is ranked 6th as highly disastrous countries of the globe.<sup>1</sup> Bangladesh is small and highly populated country located in tropical regions. So far there is dearth of data regarding lightning to consider it as a natural disaster in Bangladesh. But following the death toll of 81 persons in two days in 2016, Bangladesh government declared lightning as disaster.<sup>1</sup> The American Association for the Advancement of Science (AAAS) study (2014) represented that for one degree Celsius increase in temperature will increase 12% frequency of lightning strike.<sup>2</sup> Lightning is considered as the most beautiful exhibition of discharge of electricity between the electrically charged regions of the cloud. It transfers a huge amount of electrical charge over a fraction of a millisecond. It is a natural phenomenon which is responsible for not only damage to the assets but also cause death or injury to people and animals. From several research papers, it is evident that around 10% lightning patients die and as many as 90% survive with different permanent disabilities due to lightning strikes.<sup>3</sup> Lightning strikes are likely to cause minor injury to severe injury including death.

Lightning cannot be stopped but can be minimized the potential damages. It is advisable to shift the victim to a safe shelter before applying first aid. It is to mention that statistics of lightning injuries are seldom available as people hardly seek treatment from government hospital.<sup>4</sup> This paper aims to present the pattern of lightning related injuries to human in a remote area of Bangladesh.

## Materials and Methods

A cross sectional study was carried out on September 2021 among 40 people who were victim of lightning on the way to attend a wedding reception in Shibganj upazila of Chapainawabganj on 4 August 2021. Detail information was received from one relative of each 16 deceased family

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and 24 survivors where 16 were men and 8 were women. Further, data were collected from the doctors and nurses of Chapainawabganj Government Hospital. The questionnaire survey was on types of injuries, treatment received after injuries, types of strikes, number of days victims were hospitalized etc. After confirming of data by two or three sources, results were compiled.

**Results**

The victims are of different ages which ranges from 20 to 70 years. However, the survivors had multiple injuries in their bodies. From the study, it is evident that the neurological system is regarded common site of lightning injury followed by the cardiovascular system. No rescuer had physical injury due to lightning. But after observing large number of dead, 3 persons had psychologically affect which was recovered after subsequent treatment.

**Table-I:** Number of Deceased According to Gender (n=40)

Age	Death Case		Injury Case	
	Male	Female	Male	Female
20-30	6	2	7	2
31-40	3	1	4	2
41-50	3	0	3	1
51-60	1	1	2	0
61-70	1	0	2	1
Total	12	4	18	6

Table-I displays mortality instances by gender, with 12 men and only 4 women. The ratio of male and female of death cases is 3:1 and injury cases also 3:1. The ratio of male to female injury and death cases in this study does not exactly reflect that of previous studies.<sup>4,7-9</sup>

The investigation showed a single hit of lightning injured 40 persons at various ranges; 14 people died on the spot, 02 people died on the way to bring them to hospital, 16 and 8 people survived with moderate and mild injuries respectively. Among 40 victims, nearly one third victim was female. As per Table-II, 45% lightning victims died and 35% were survived with major injuries by lightning and 20% victims survived with minor injuries. Therefore 55% of the survivors had permanent disabilities like burn marks, paresis, hearing loss and cataracts. Nearly all took cover under a tin shed on the river bank due to rain.

The most dangerous strike of lightning is direct strikes which is generally rare. But in our study, majority of death are due to direct strike which is 35% followed by side flash. All direct strike victims are dead. Contact strike victim is only 15%. It is assumed that some victims had been holding the pillars of tin shed and few had been holding metal objects of umbrellas. Side flash is a common occurrence in lightning injuries from a tree,

another person, or other objects whose percentage is 30%. Ground strike is 20%. But according to literature,<sup>10</sup> ground strike is responsible for maximum injury. Different types of lightning strikes which cause death and injuries are summarized in Table-II.

Primarily, nervous system was found to be damaged by lightning, whose percentage is nearly 35% in this study. The second most regular site of injury of human by lightning strike is cardiovascular system which is 30%.<sup>11</sup> Out of 40 victims, there was 8 cardiorespiratory arrest cases where 2 victims died and rest have survived with permanent disabilities. The total death percentage is also 40% in this study. Though severe burns are rare after lightning strikes, yet in this incident two people observed such. Eight victims sustained minor skin damage. Many eye injuries have developed, including cataracts. Few patients suffered from deafness which is regular in lighting strike. However, type of human organ injuries is listed in Table-II.

Twenty four patients had varying injuries including multiple injuries that were experienced with minor injuries. These 24 people were taken to Chapainawabgonj General Hospital for observation and treatment. Among them, majority victims (10 people) 41.67% left hospital after initial observation; 29.16% (7 people) remained admitted for one day, 16.67% (4 victims) for 2 days and rest 12.50% (3 victims) remained admitted to the hospital for more than 2 days (Table-II).

**Table-II:** Number of Injury and death, types of lightning strikes on victims, type of human organ injuries and number of victims admitted at Hospital.

Characteristics	n	%
Number of injury and death		
Spot death	16	40.00
Died on the way to hospital	02	5.00
Survive with moderate injury	14	35.00
Survive with minor injury	08	20.00
Total	40	100.00
Types of lightning strikes on victims		
Direct strike	14	35.00
Contact strike	3	07.50
Side flash	6	15.00
Ground strike	12	30.00
Upward streamer	5	12.50
Total	40	100.00
Type of human organ injuries		
Nervous system	14	35.00
Cardiac	10	25.00
Skin	8	20.00
Ophthalmic	5	12.50
Other organ injuries	3	7.50
Total	40	100.00
Number of victims admitted at hospital		
Initial treatment	10	41.67
Admitted for 1 Day	7	29.16
Admitted for 2 Days	4	16.67
Admitted for more than 2 Days	3	12.50
Total	24	100.00

## Discussion

It is projected that around 10% lightning strike victims are likely to die and the remaining 90% live long lasting disabilities which is principally responsible due to nerve or brain or injury.<sup>3,11</sup> As per different studies, likely principal lightning injuries are brain, heart, skin, eye, ear etc. Some patients present with multisystem involvement, while others show little evidence of injury. Nervous and cardiovascular system injury represented the poor prognostic indicators where mortality rate is higher. Approximately 35% victims suffer some form neurological disorder after being struck by lightning. This figure is relatively low comparing with other studies.<sup>10-12</sup> The cardiovascular system injury represent the second most commonly affected by lightning strikes. It is revealed from Table-II that nearly one fourth victims suffer cardiac related disabilities. But other studies represent higher figure than in this study.<sup>10,11</sup> Cutaneous burns are the third highest injury due to lightning. Skin burns were occurred around 20% victims where deep burns were rare and superficial burns were usual which completely resemble other studies.<sup>10,11</sup>

Due to high sensitivity of nervous tissues to lightning strike, it is most vulnerable organ. It has the characteristics of low electrical resistance.<sup>6,7,12,13</sup> In the study, maximum injuries of the victims are related to nervous system. Approximately 40% of the victims in this study suffered from various neurological symptoms like headache, loss of consciousness, weakness, amnesia, nausea, vomiting, confusion, memory loss, cognitive impairment etc. Similar results found in other studies also.<sup>6-8,10,14-17</sup> Victims have suffered different ranges of paralysis and paresthesia without permanent damage.<sup>8</sup>

After nervous system, cardiac system is the most affected organ of human body. According to this study, around 25% victims are suffered from heart related symptoms like hypertension, tachycardia, variety of arrhythmias, cardiac arrest, nonspecific ECG changes etc. where other studies presented little higher primary cardiac arrest than this finding.<sup>10,11</sup> Few victims struck by lightning had instant cardiac arrest; 75% of those who die as a result of electrification by lightning are thought to have suffered secondary arrest.<sup>11,18</sup>

Lightning warrants burns. In this study, out of 40 victims 8 persons have burn mark on head, neck, arm and leg. Among 8 victims of burn patients, 5 victims have the incidence of multiple burns. It is to mention that all burns victims have superficial burn from lightning strikes and no deep burn was marked from the study which is similar to the study.<sup>6,11,19</sup>

Ocular injuries are common after lightning strike. Eye injury usually offers instant ocular problems or delayed cataract formation. It is likely to emerge from months to years after being struck by lightning.<sup>11,19-22</sup> Approximately 5% of patients are likely to suffer<sup>11</sup> eye related injury but this study showed 12.50% which is little higher than other studies. In other research papers, retinal detachment, iritis, vitreous hemorrhage and optic nerve injury were vivid<sup>22,23</sup> which was not reflected in this study.

Tympanic membrane rupture is considered the most usually experienced injury associated with lightning strike.<sup>24-26</sup> Besides that temporary hearing impairment is also very regular in case of lightning strike victims<sup>14</sup> which is similar to other study.<sup>11,26</sup> Further, victims have the evidence of suffering tinnitus, vertigo, or facial nerve paralysis/injury as seen in other study.<sup>26</sup> Renal failure is also observed in this study due to massive muscular contraction of lightning strike.<sup>14,15</sup>

## Treatment and Prevention

Prevention is the best treatment of lightning injuries. It is advisable to shift the victim to a safe shelter before applying first aid. The physicians will instruct for some useful tests depending on the record of the lightning strike and the observation of initial check. However, head and heart injury indicated by different types of abnormalities should be treated in hospital by observations, clinical tests and medicines. Neurologist will take care of nerve injury patients. Burn victims with abnormal ECG, cranial or leg burns, chest pain need to be treated and monitored. Electrolyte imbalance needs to be treated with crystalloid fluid and transfusion of blood or blood products (if necessary). Ocular function and auditory function along with tympanic membrane rupture should examine thoroughly. Complete blood count, urinalysis, and measurement of electrolytes, blood urea nitrogen, creatinine and cardiac isoenzymes, chest X-ray, ECG, ultrasonography should be checked.

Lightning fatalities and injuries can be cured by following the lightning safety precautions and guidelines. The importance of lightning education and awareness cannot deny preventing lightning injuries. Individuals should strictly pay attention to the meteorological forewarn before moving out for routine jobs especially for outdoor jobs. If it is obvious for a person to work at open areas, then he/she must have a contingency plan to escape from lightning strikes. Worldwide “30–30” rule is suggested for lightning safety. Once the last lightning is witnessed by individual, he is recommended to remain inside for 30 minutes before individual is stepping out for outdoor jobs. Again, if lightning is seen, one should take shelter and if thunder is heard, one should terminate outdoor activities. Elevated areas, like hills, mountains etc

and tall objects, open areas, holding or carrying metal objects etc. to be avoided while one is at outdoor. During lightning, if one does not find shelters at open areas, one is recommended to crouch down in a catcher's posture. More so, people are suggested to protect ear against the damage from thunder by placing fingers on each ear. Individuals are suggested not to touch land line telephone and electrical gadgets, metal substances, shut down all doors and windows and remain apart from them, disconnect all electronic gadgets prior to lightning when he/she stay inside the building.

## Conclusion

In recent past, the incident of lightning strikes and related injuries has increased significantly. However, lightning survivors should be taken to hospital for further investigation and treatment. A multifaceted management is of foremost significance and the psychological consequences of a lightning victim are required to be assessed early. Field management is very important for a patient to survive. For this, lightning education will immensely help not only to minimize the death cases but also help them to manage the lightning victims on the spot.

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