

## Original Research Paper

# Study of Fatalities due to Lightning in Nagpur Region of Maharashtra

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### Abstract

In Nagpur region of Maharashtra (India), many deaths were reported due to lightning strikes. In most cases of deaths due to lightning, bodies of deceased persons were found in remote areas with torn clothes and burn injuries. The injuries present over body may apprehend the relatives and raise suspicion of foul play. In this study total 31 cases were studied which were brought for medico legal post-mortem with history of lightning of which 87% were farmers and farm labourers.

Twenty nine percent of cases belonged to the age group of 41-50 years. Most of the cases were found in the months of June, July and October. Filigree burns were found only in 4 cases. Careful examination of victims along with history of thunderstorm in the vicinity will help the autopsy surgeon to confirm the diagnosis of lightning.

**Key Words:** Lightning Deaths, Autopsy, Filigree Burns, Fatalities, Thunderstorm, Victim, Dagnosis

### Introduction:

Lightning is a naturally occurring global phenomenon. It is estimated that a lightning flash occurs approximately 8 million times per day throughout the world [1, 2] As per centre for disaster mitigation and management, Vellore (India), average number of thunderstorm days per year in Nagpur region of Maharashtra state is 45 and it is placed in the category of moderately hazardous zone. [3]

In Vidarbha region of Maharashtra (India), many deaths were reported due to lightning strikes. Figures say, as many as 28 deaths were reported due to lightning in a single day in Vidarbha region. [4] In most cases of deaths due to lightning, bodies of deceased persons were found in remote areas with torn clothes and burn injuries.

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The injuries present over body may apprehend the relatives and raise suspicion of foul play. Absence of visible external injuries in some cases of lightning is an infrequent and interesting finding.

During lightning in the vicinity of striking areas, people try to fabricate the natural deaths as deaths due to lightning for monetary benefits.

Here comes the role of autopsy surgeon to fix the cause and manner of deaths so as to give proper justice to each case. Autopsy surgeon should be careful while dealing with such type of cases because his report can give proper guidance to the investigating authority.

Few studies have been carried out on victims of lightning in the past. But those studies were retrospective studies carried out by just analysing the autopsy records of the victims of lightning. The present study was undertaken to note the pattern and circumstances of injuries in lightning deaths.

### Materials and Methods:

The present study was carried out at Departments of Forensic Medicine and Toxicology, Indira Gandhi Govt. Medical College and Govt. Medical College, Nagpur (Maharashtra, India), from January 2007 to December 2010. In this study total 31 cases of deaths due lightning were studied which were brought for medico-legal post-mortem examination.

A standard proforma was prepared which included all the preliminary data of the

victim including name, age, sex, address, occupation, date and place of incident. Condition of clothes of victim and location and pattern of injuries over body were also noted in standard proforma. Detailed post mortem examination was carried out and internal injuries were noted.

Activity of the deceased during the lightning strike and place of incident were collected from police records and relatives. Other corroborative evidences from the place of incident were also analyzed from spot inquest provided by investigating authority.

### **Results:**

The study consisted of 31 cases comprising 19 males (61.29%) and 12 females (38.71%). Most of the cases belonged to the age group 41-50 years (29.03%) followed by 11-20 years (25.81%). (Table1)

As far as occupation was concerned, 27 (87.10%) victims were farmers. (Table 2) Highest number of cases (n=20, 64.51%) were observed in the month of June. (Fig. 1) Considering the activity of the victim during lightning strike and the place of incident, it was noted that 16 (51.61%) victims had taken shelter under the tree. (Table 3)

In the present study, singeing of hairs was present in 16 cases (51.61%), torn or melted clothes and fabrics was seen in 19 cases (61.29%), blackening and or scorching of skin and clothes was observed in 09 cases (29.03%) and magnetization of metals was seen in 02 cases (6.45%). Bleeding through one or both ears was found in 10 cases (32.26%). Surface burns injuries were present in 29 (93.5%) cases.

Out of the 31 cases, surface burn injuries were present in 29 cases (93.55%). Front of trunk was the most common site for surface injury (61.29%) followed by lower limbs (58.06%). (Fig. 2) Filigree burns or fern tree like appearance was found in 04 (12.9%) cases. (Fig. 3) In two cases (6.45%) lacerations of spleen were observed. (Fig. 4)

### **Discussion:**

Lightning causes damage to the body as a result of electrical current passing through the body on the way to the ground. Sometimes it causes burns, as air nearby is heated by passing lightning with clothing being set alight or by explosive effect of the air being heated up to 20000 °c in a fraction of a second.

Approximately thirty to fifty percent of the lightning strikes are fatal.

In this study majority of the victims were males comprising of 61.29% of total cases while rest 38.71% were females. Male to female ratio of 3:2 was observed. This ratio was closely

similar to the one observed by Chattopadhyay S. et al [5], in which it was 3:1. Murty O. P. et al [6] reported that 92.59% cases were males and 07.41% cases were females, in their study conducted in Malaysia. Other studies carried out in U.S., Singapore, England and Wales report the male to female ratio as 4.6:1. [7]

In our study relatively greater involvement of females might be due to the fact that more number of females traditionally being involved in the farm works in this region.

In current study, the age group of victims most affected by lightning was between 41-50 years, comprising of 29.03% of cases, followed by 25.81% of cases from age group of 11-20 years. The victims in the age group of 31-40 years were 16.13%.

Majority of the victims were in the age group of 31-50 years, comprising of 45.16% cases. This finding closely resembles with that of Chattopadhyay S. et al [5] who found 62% of the victims in the age group of 31-50 years.

This corroborates with the fact that the age group of 31-50 years is the one which is mainly involved in earning livelihood for family.

The difference in the findings of our study and the one conducted by Murty O. P. et al [6] in Malaysia, in which the age group 31-40 years consisted of 61.54% cases, might be due to socioeconomic and geographical differences of two countries. In our region at the start of monsoon, the whole family is involved in the farm work, which is reflected in the finding that younger age group of 11-20 years is the second most common affected age group comprising of 25.81% of cases. With 87.10% of total victims being farmers, our study reveals that farmers are the most common victims of lightning strikes.

Chattopadhyay S. et al [5] reported the similar findings of farmers being the victims of lightning in 72.23% of total cases. As farmers work in rainy conditions and stay at farm during rain and thundershowers, which predispose them to major risk of lightning accidents. We also found three students being struck by lightning when they were playing at various places like football ground, terrace and farm.

This represents the fact that population which is involved in recreational activities is also more prone to be hit by lightning strikes.

In this study, most of the cases were reported during the months of May to October with peak incidence being reported in the month of June. June is the month for onset of monsoon in this part of country, which usually is associated with heavy rains, thundershowers and lightning. Chattopadhyay S. et al [5] reported the similar findings of maximum

incidence of lightning accidents during the months of May to September.

In present study majority of victims were taking shelter under the tree during heavy rainfall, comprising of 51.61% of cases, while 29.03% victims were working in field. Similar findings were observed by Murty O. P. et al [6], where most common activity of victims at the time of lightning accident was taking some type of shelter, followed by working. The place of shelter during lightning accidents in our study was nearby the victims' work fields.

As our study consisted mostly of rural population with low socioeconomic status these people are forced to work in conditions of rain and thundershowers and if possible they take shelter nearby. During thunderstorms people take shelter under isolated trees because they believe erroneously that a tree offers protection from lightning.

In our study superficial burn injuries were seen over front of trunk in 61.29% of cases followed by lower limbs (58.06%), head, neck & face (41.93%), upper limbs (22.58%), back of trunk (19.35%) and genitals (12.90%). [6]

Filigree burns or fern tree like appearance or arborescent marks were found only in 04 cases. All the four deceased females were sitting under the tree during thunderstorm and during autopsy no other damage was seen except filigree burns and melted clothes. This finding correlates with that of various authors that the filigree burns are not so common. [8-12]

Bleeding through one or both ears was found in 32.25% cases. This was due to blast effect of lightning which causes rupture of tympanic membrane and hemotympanum.

This finding is similar to the one reported by Murty O. P. et al [6] (29.63%), and Chattopadhyay S. et al [5] (35.18%). In two cases we found magnetization of metals worn by the deceased. This is an important corroborative evidence of lightning.

In two cases lacerations of spleen were found, which are rarely reported in lightning accidents. This might be the result of mechanical trauma due to blast effect of lightning.

In our study we found one incidence in which five females along with one bullock were struck by lightning while they were taking shelter under a solitary tree. In another incidence a person was struck by lightning while he was swimming in a pond.

These two incidences show that taking shelter under a solitary tree and swimming in a pond are risk factors for lightning strikes in conditions of thunderstorms.

## Conclusion:

Though lightning accidents are unpredictable, the deaths and the casualties resulting from the same can be prevented by some simple precautionary measures, like staying indoors during thunderstorms and taking shelter under a safe and strong solid structure. Various vulnerable circumstances, such as being in an open field, on top of a building, under a solitary tree, swimming in a pond, predispose a person to the lightning strikes.

Such circumstances should be avoided during thunderstorms. In urban areas lightning protection devices for buildings are used which along with protection provided by tall buildings, may be the reason for low incidence of lightning accidents in urban areas.

There is a need for development of similar lightning protection devices which can be effective in the fields, from where we encounter most of the cases of lightning deaths. General awareness of common man along with some precautionary measures is the key in prevention of lightning accidents.

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**Table 1: Demographic data of Lightning Victims**

Age grps (yrs)	Victims			Percentage
	Male	Female	Total	
0-10	01	01	02	6.45
11-20	04	04	08	25.81
21-30	02	01	03	9.68
31-40	04	01	05	16.13
41-50	06	03	09	29.03
51-60	02	02	04	12.9
Total	19 (61.29%)	12 (38.71%)	31	100

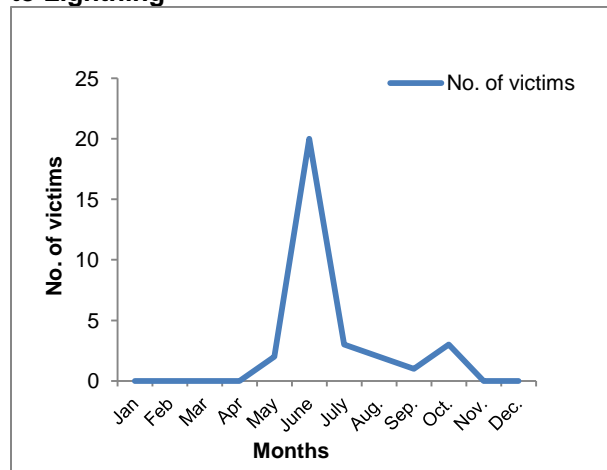
**Table 2: Occupation of Victims**

Occupation	Victims	Percentage
Farmer/farm labourer	27	87.10
Construction worker	01	03.22
Student	03	09.68
Total	31	100

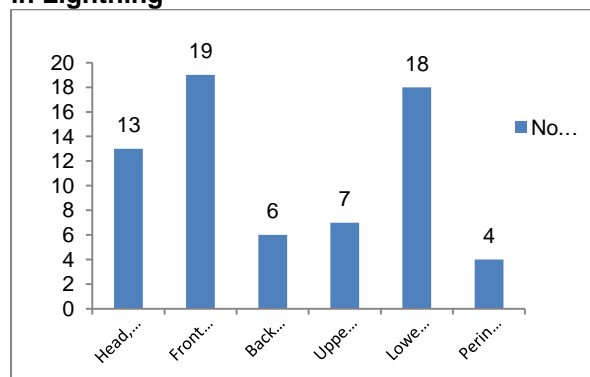
**Table 3: Place of Incidence and Activity of Victim at the time of Lightning**

Activity of Deceased/Place of Incidence	Victims	Percentage
Standing /sitting under tree	16	51.61
Working in field	09	29.03
Playing in open space	03	9.68
Walking on road	02	6.45
Swimming in pond	01	3.23
Total	31	100

**Fig. 1: Month wise Incidence of Deaths due to Lightning**



**Fig. 2: Distribution of Surface Burn Injuries in Lightning**



**Fig. 3: Filigree Burns due to Lightning Stroke**



**Fig. 4: Rupture of Spleen due to Blast Effect of Lightning**

