

Original Research Paper

Profile and Analysis of Lightning Victims Brought to MGH, Khammam; Telangana State

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Abstract

When there is discharge of electricity between clouds lightning occurs. This study was aimed to study the profile and analysis of lightning victims and pattern of injuries. Thirty Eight victims of lightning fatalities were identified from emergency Dept. of MGH, Dept. of Forensic Medicine, for a period of 3 years. Middle aged males, married, illiterates from rural region, belongs to low socioeconomic group, Hindu community are the most common victims when working as farmers in the open field afternoon time on Saturdays with peak incidence in monsoon season. The pattern of injuries is noted as burns over body in 36 (94.73%) cases with maximum cases having Lichtenberg figures 26 (68.42%), followed by linear burns 8 (21.05%). Magnetization of the metal worn noted. Maximum cases 34 (89.47%) were brought dead, post-mortem findings were nonspecific, petechial hemorrhage seen in the brain and the spinal cord.

Cardiopulmonary arrest following lightning was most common in 28 (77.77%) cases. High incidence of lightning strikes in this region and requires a more systemic and detailed investigative protocol in lightning related deaths. Such deaths are unpredictable but preventable with better public education, rural health care.

Key Words: Lightning, Victims, Pattern of injuries, Incidence, death

Introduction:

When there is discharge of electricity between clouds lightning occurs, when the charge jumps between cloud and earth, it is called Lightning strike. During thunderstorm the lightning stroke discharges many current peaks varying from 10,000-200,000 Amp occurring in fraction of a second affecting an area of about 30 m distance.

In lightning, the discharge may be from cloud or from cloud to the earth through some object, usually the tallest object in contact with the earth. Cloud to ground lightning accounts for 25% of lightning globally, not distributed evenly around the planet and about 70% of fatalities occurs on land in the tropics where most thunderstorms occurs.

The injuries with or without the burns on the body associated with tearing off of the wearing apparels, may closely resemble those produced by criminal violence.

But the history of thunderstorm in the locality, effects of lightning with characteristic burns on the body and the vicinity, fusion or magnetization of metallic objects on the body or nearby, will all suggest death due to lightning stroke. Lightning causes human injury by four distinct mechanisms: the direct effect of electric current, burning by superheated air, effects of expanded and repelled air around flash and the sledge hammer blow death by compressed air pushed before the current.

As doubts may be raised of foul play because of bizarre extent, distribution of injuries and torn clothing, the diagnosis of death may be active by carefully considering the history of thunderstorm in the locality, evidence of the effects of lightning in the vicinity of the scene of death, bursting open of the body, tears scorched, imparted smell of singeing, boots, belt also burst open, characteristic nature and distribution of burns, which are usually superficial due to very brief duration of flash [1]

An estimated 24,000 people are killed by lightning strikes around the world each year and about 240,000 are injured.

Estimated death rate is 0.3 per 1 lac people per year in developed nations and 6 per 1 lac people per year in developing nations.

In India, according to NCRB lightning fatalities accounted for 2550 (0.7%) in 2011,

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2263(0.6%) for 2012 and 2833 (7%) in 2013 respectively. The incidence rate is 0.2. [2]

Aims and Objectives:

- To study and analysis the profile of lightning victims and pattern of injuries
- To study the prevalence of lightning fatalities.
- To determine the various conditions associated with deaths due to lightening

Material and Methods:

The present study was carried out from June 2013 to May 2015 in the Dept. of Forensic Medicine at Mamata Medical College & Hospital, Khammam; Telangana. Proforma specially designed for this purpose was used and filled in each case after examination.

Detailed data collected from victims, relatives accompanied deceased, hospital records, inquest, autopsy reports etc.

Observations and Results:

A total of 38 cases of lightening were recorded during 3 year period of study from 2013-2015 with maximum incidence 16 cases in 2015. Most of the cases occurred during the months of May to September with peak incidence during June– July (76.31%).

Out of total 2262 autopsies done during the study period, 38 victims died due to lightning. The incidence of lightening has increased every year from 2013 10 cases (1.39%) to 2014, 12 cases (1.59%) and 16 cases (2.02%) in 2015.

Maximum number of cases 16 (47.52%) were from 31-40 years age group, followed by 12 cases (31.57%) in 21-30 years, 5 cases (13.15%) in 41-50. The minimum age of the victim is 13 years and maximum was 60 years.

In our study male 30 (78.94%) victims were predominated females 08 (21.05%) and Female: Male is being 26:66. (Table 1)

Majority of victims were from Hindu community 28 (73.68%) followed by Christian 6 (15.78%) and least were from Muslim community 4 (10.52%). In this study Majority of victims 29 (76.31%) were from rural population.

In present study married victims 31 (81.57%) outnumbered unmarried 07 (18.42%). As per educational status, most of the victims were illiterates 20 (52.63%).

Among literates 10 (26.31%), primary education 4 (10.52%), secondary education 2 (5.26%) and intermediate and graduate accounts for one case each. In our study maximum victims belong to low socioeconomic 31(81.57%) group followed by middle class six (15.78%) and one (2.63%) case from high class.

Farmers were top among the occupations, 28 cases (73.68%) followed by

laborers 06 (15.78%) and students 03 (7.89%). (Fig. 2)

Maximum lightening cases (94.73%) occurred during June to September months of monsoon and minimum 2 (5.26%) cases are encountered in May. (Fig. 3)

Regarding day of incidents, most cases 18 (50.00%) occurred on Saturday followed by 13 (34.21%) on Sunday and 2 (5.63%) on Wednesday. (Table 2) Most of the cases 24 (63.15%) occurred in the afternoon hours between 12noon and 3 pm. About 10 incidents had occurred in the late afternoon and evening between 3pm and 6pm. (Fig. 6)

Open field is the most vulnerable place for lightning strikes accounting for 27(71.05%) cases. Persons standing beneath a tree or under a shade comprised 9 (23.68%) and 2 (5.26%) cases were recorded near house. (Fig. 1)

In this study maximum cases 34(89.47%) were brought dead and did not receive the treatment, followed by Two cases (5.26%), who died after one day and 2(5.26%) victims were survived after hospitalization. (Table 3) The pattern of injuries were noted as burns over body in 36 (94.73%) cases with maximum cases having arborescent burns or filigree burns 26 (68.42%), followed by linear burns 8(21.05%), surface burns two (5.26%) cases and burns injuries are not seen in two cases. (Fig. 4)

In present study majority of 17(44.73%) victims had burns over the thorax, front and back, followed by both upper limbs 8 (21.05%), front and back of abdomen, both lower limbs 6 (15.78%). Face and head are involved in only 2 (5.21%) cases. (Fig. 5) Majority of the burn injuries 26 (68.42%) were superficial burns.

Magnetization of the metal worn noted in 15 (39.47%) cases. Metallic objects marks such as tooth fillings, spectacles, belts, buckles and coins were observed. Singed hair was noted in 18 (47.36%) cases. There was often a smell of singeing or burning of the body and clothing, observed in 12 (34.28%) cases.

We also observed head injury, caused either by the lightning strike itself or by falling to ground in 10 (28.57%) cases in our study. In 16 (42.0%) cases bleeding was noted either from one or both ears. Evidence of blast effect was also found in 11 (31.42%) cases.

Post-mortem findings were nonspecific and majority showed evidence of severe congestion of all internal organs and pulmonary edema was also common. Petechial hemorrhages were seen in the brain and the spinal cord. In present study cardiopulmonary arrest following lightning was most common in

28 (77.77%) cases which leads to immediate death of the victim followed by burns six (16.66%) and one (2.77%) cases each by head injury and pulmonary infarct. (Table 4)

Discussion:

The incidence of lightening has increased from 2013 10 cases (1.39%) to 2015 16 cases (2.02%). This was evident that the incidence of lightening and the fatalities are much higher in this region.

Maximum number of cases 16 (47.52%) were from 31- 40 years age group, followed by 12 cases (31.57%) in 21-30 years, 5 cases (13.15%) in 41-50 and no cases at both extremes of the age. These were consistent with other author's findings. [2, 5] This was due to fact that adults are involved in outdoor activities in spite of bad weather and working class people belong to this age group.

In our study 30 cases (78.94. %) were of males whereas females amounted to 08 [21.05%] and ratio of female to male is being 26:66. Males were involved in outdoor activities and hence more prone for lightening. Similar findings are observed by other studies. [1, 3]

Majority of victims were from Hindu community followed by Christian and least were from Muslim community. These were similar with Indian studies. This could be due to most of the population in India is Hindu community.

Majority of victims (76.31%) were from rural population and (23.68%) cases were from urban population. These are consistent with other studies. [4, 5] This might be due to victims were working at open field even during high risk period of lightening; primary occupation is agriculture which is rain dependent.

In present study married victims (81.57%) outnumbered unmarried (18.42%). [3, 6] The married population actively involves in work for earning of money for maintainance of their families. As per educational status, most of the victims were illiterates and literates include literates (26.31%), primary education (10.52%), secondary education (5.26%) and graduate, consistent with other authors. [1, 4]

This is due to the lack of education there are mainly depending on agriculture based works for source of income. Majority victims were belongs to low socioeconomic group followed by medium and one case from high class. [1, 4]

This could be explained that the low socioeconomic group more exposed for lightning fatalities due to lack of permanent source of income as job, poor living standards, illiteracy, agricultural daily activities in open fields even during thundering.

In our study maximum lightening (94.73%) cases were seen in the rainy season in our region. Minimum (5.26%) cases are occurred during May. [4, 5, 13] The most probable reason might be more reporting of cases during rainfall season.

As per day of incidents, most cases 18[50.00%] occurred on Saturday followed by (34.21%) on Sunday and Wednesday (5.63%). Similar findings occur in other studies also. [4, 12] The most probable reason is that people indulge in more outdoor activities on weekends and holidays. Like other studies in our study also most of the cases occurred in the afternoon between 12-3 pm. [6, 9,11]

This is the time for most of the people engaged in their work more susceptible and also times for most the people to finish their daily work and go back to respective home, hence more susceptible to strike by lightning.

Farmers were top among the occupations [6, 8] because most common outdoor activity carried in our region is farming and they lack proper place to hide during lightening. Open field is the most vulnerable place for lightning strikes accounting for (71.05) cases. Persons standing beneath a tree or under a shade comprised of (23.68%). [8, 9]

The tendency of lightning striking a tall object in an open space and shelter under a tree is by no means safe, particularly if they are carrying or wearing something that may attract lightning. Maximum cases 89.47% were brought dead followed by 5.26% who died after 1 day and 02 were survived after hospitalization. Similar findings were observed by other authors. [8, 9, 13] The reason is after lightening, ventricular arrhythmias are most common effect on the body and this is life threatening condition needs immediate treatment by skilled persons.

We found burns over body in 94.73% cases. These were consistent with authors. [9, 10] A superficial or deep burn marks are the point of discharge from the body to the earth or metal objects may burn the underlying skin or mark the skin due to heat of the electrical arching. The track of the discharge can be traced by these skin burns and damage to the clothing.

The external lesions in lightning mostly take the form of unique arborescent injuries noted in 26 (68.42%) cases. This was due to deposition of copper on the skin as a result of rupture of smaller blood vessels and breaks down of red cells in the skin capillaries along the path of the electric current. [10, 14] The other Pattern of injuries in lightning is linear burns in 21.05% cases.

They are varied from 6-25 mm in width over the victim's body observed. These were found on moist surfaces of the skin, because moist skin offers less resistance than dry skin similar to other studies. [10, 11]

In this study the surface burns were found in 5.26% cases and burns injuries are not seen in 5.26% cases like others. [9, 12] The strike survivors 5.26% were thrown away by the struck of lightning suffered with shock found unconscious condition, after hospitalization recovered with retrograde amnesia. Similar findings were seen in other studies. [10, 12]

In present study 42.10% cases bleeding was noted either from one or both ears. Evidence of blast effect was also found in 31.57% cases. [10, 13] Blast effects observed in the form of tearing of clothing, the effects also observed on the trees showing areas of scorched leaves and vegetation in the vicinity of the scene of death. Metallic objects in the area get fused or become magnetized or nylon underclothing melts and objects at a distance of 100 feet or more struck.

Majority of victims 44.73% found burns over the thorax front & back, right shoulder and right upper limb and least over the face and head consistent with observations of other researchers. [9, 12] This might be due to discharge of high voltage direct electricity bizarre phenomenal presentations of lightning during thundering within the short period.

Majority of the burn injuries 68.42% were superficial burns. [10, 12] This was due to rapid, short period exposure of the body to lightning. Magnetization of the metal was seen 39.47% cases. [12, 13]

Metal objects may burn the underlying skin mark due to heat of electrical arcing which is true burns. This is due to high voltage of direct current and was a usual finding in lightening. Metallic objects marks seen on such as tooth fillings, spectacles, belts, buckles, wrist watches, metal hooks or zip and coins are observed.

Singed hair was noted in 47.36% cases and the clothing got burnt or torn wide apart, observed in 47.36% cases. These were similar to authors. [11, 12] We found head injury, caused either by the lightning strike itself or by falling to ground was observed in 31.57% cases. This was consistent with studies by others. [10, 12]

Post-mortem findings were nonspecific, showed evidence of severe congestion of all internal organs. [13, 14] Cardio-pulmonary arrest following lightning was most common in 77.77% cases, leads to immediate death of the victim followed by burns 16.66% and 2.77% each one

by head injury and pulmonary infarct. Similar findings were observed by other studies. [15, 16]

The initial response of lightning stroke is paralysis of the vital centers, especially respiratory centers, resulting in apnea, ventricular fibrillation or cardiac arrest. Cardiac arrhythmias are very common with lightning strokes.

Conclusion:

The incidence of lightening and the fatalities are much higher in this region. Males, Married, Hindu community from rural area belonging to low socioeconomic, illiterate, encounter during rainy season with peak incidence during June-July farmers at open field, shelter under tree are vulnerable circumstances. Cardiopulmonary arrest following lightning was most common cause of death.

These cases are Unpredictable but preventable with proper precautions and with better public education, arrange lightening protection devices, awareness of common people.

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Table 1: Age & Gender wise Distribution of Victims

Age grps (Yrs.)	Males	Females	Total (%)
0-10	0	0	0(00)
11-20	1	0	1(2.63)
21-30	11	3	14(36.84)
31-40	16	5	21(47.52)
41-50	1	0	1(2.63)
Total	30	8	0(100)

Table 2: According to Days in Week

Day	Cases	%
Monday	0	00
Tuesday	0	00
Wednesday	2	5.63
Thurs day	0	00
Friday	0	00
Saturday	18	50.00
Sunday	13	34.21

Table 3: Survival Period

Survival period	Cases	%
Brought dead	34	89.47
<1 hour	2	5.26
1-24 hours	2	5.26
>24hours	0	00
Total	38	100

Table 4: Cause of Death in Lightning

Cause	Cases	%
Cardio-pulmonary arrest	28	77.77
Burns	6	16.66
Head injury	1	2.77
Pulmonary infarct	1	2.77
Total	36	

Fig. 1: Place of Incidence

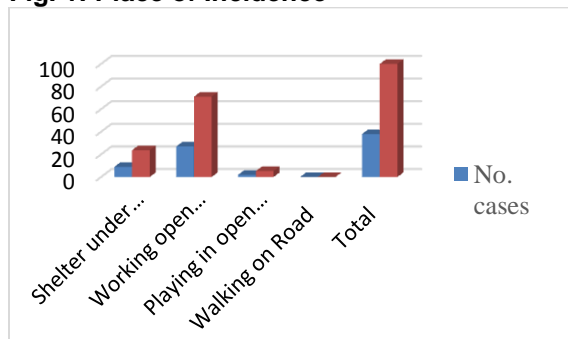


Fig. 2: Occupation wise Distribution

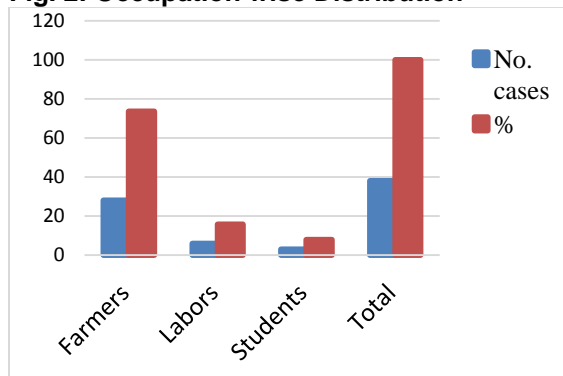


Fig. 3: Month Wise Incidence of Lightning Victims

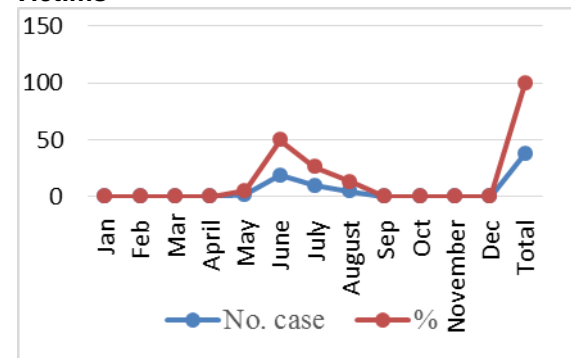


Fig. 4: Pattern Distribution of Injuries in Lightning

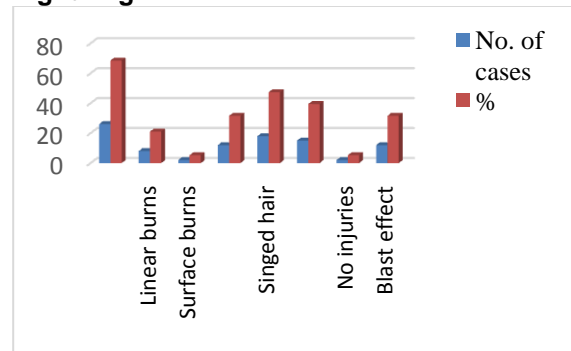


Fig. 5: Surface Burn Injuries in Victims

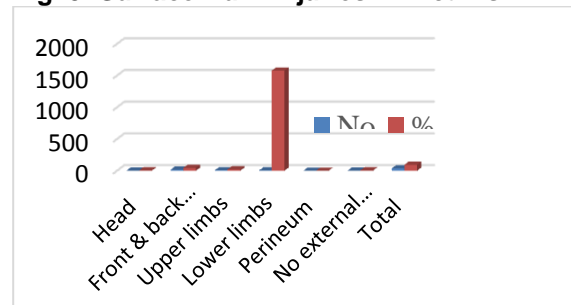


Fig. 6: Time of Incidence

