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Case Report

Death by Lightning Strike

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Abstract

Lightning is a massive electrostatic discharge between the electrically charged regions within clouds or between a cloud and the surface of a planet. The charged regions within the atmosphere temporarily equalize themselves through a lightning flash, commonly referred to as a *strike* if it hits an object on the ground. Humans or animals struck by lightning may suffer severe injuries or even death due to internal organ and nervous system damage. A lightning strike can cause death or various injuries to one or several persons. The mechanism of injury is unique, and the manifestations differ from those of other electrical injuries. The case described in this report illustrate diverse injuries and circumstances in which death is attributable to lightning can occur and how to proceed during autopsy examination in cases of suspected death by lightning.

Keywords:Lightning;Electrostatic discharge;Planet.

Introduction

Lightning is common in tropical and subtropical countries and even in higher altitude, occasional tragedies occur where number of people are killed or injured in single episode.[1] Lightning can strike or injure humans in four different ways: Direct strike: In a *direct hit*, the electrical charge strikes the person first. *Splash* hits occur when lightning jumps to a person (lower resistance path) from a nearby object that has more resistance, striking the person on its way to the ground. In *ground* strikes, the bolt lands near the person and is conducted by a connection to the ground (usually the feet), due to the voltage gradient in the earth. This can still cause substantial injury.

Injuries caused by lightning is from three factors: a) electrical damage b) intense heat and c) the mechanical energy which these generate.

Electricity

Counter intuitively, lightning current flowing through the victim's body resistance may develop a high voltage sufficient to *flash* around the skin or clothing to the ground in a *direct strike*, resulting in a surprisingly benign outcome.

The lightning often leaves skin burns in characteristic Lichtenberg figures, sometimes called *lightning flowers*; they may persist for hours or days, and are a useful indicator for medical examiners when trying to determine the cause of death. They are thought to be caused by the rupture of small capillaries under the skin, either from the lightning current or from the mechanical shock wave. The intense electrical current can cause a loss of consciousness; it is also speculated that the EMP created by a nearby lightning strike can cause cardiac arrest.

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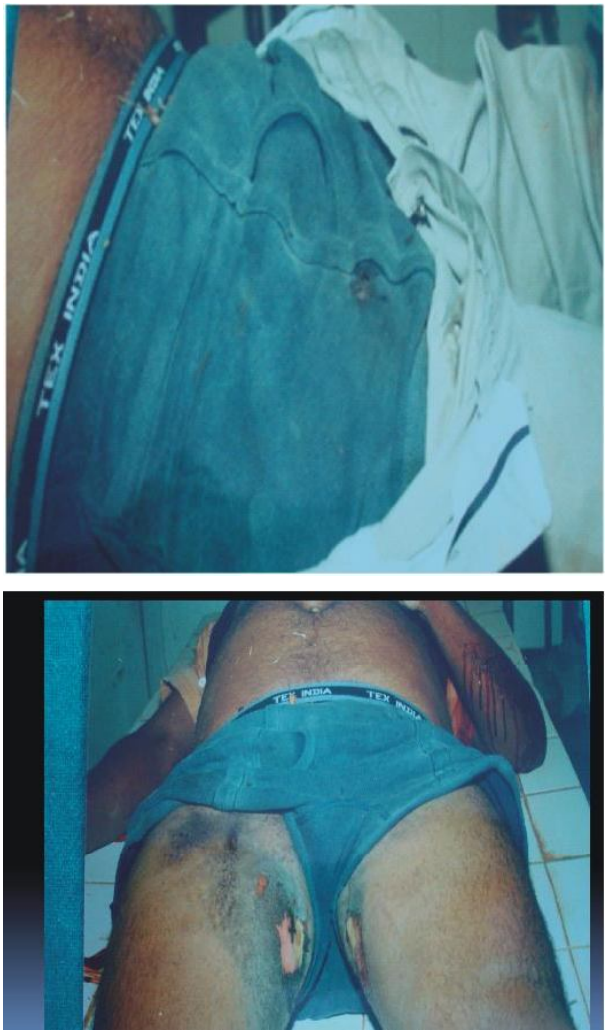
Figure I: Picture Showing Trouser and Underwear were Burnt Including the Inner Aspect of Thighs and Buttocks



Heat

A bolt of lightning can reach temperatures approaching 28,000° Celsius (50,000° Fahrenheit) in a split second. This is about five times hotter than the surface of the sun.[4] Spectacular and unconventional lightning damage can be caused by thermal effects of lightning. *Hot lightning* (high-current lightning) which lasts for more than a second can deposit immense energy, melting or carbonizing large objects. The intense heat generated by a lightning strike can burn tissue, and cause lung damage, and the chest can be damaged by the mechanical force of rapidly expanding heated air.

Concussive Injury

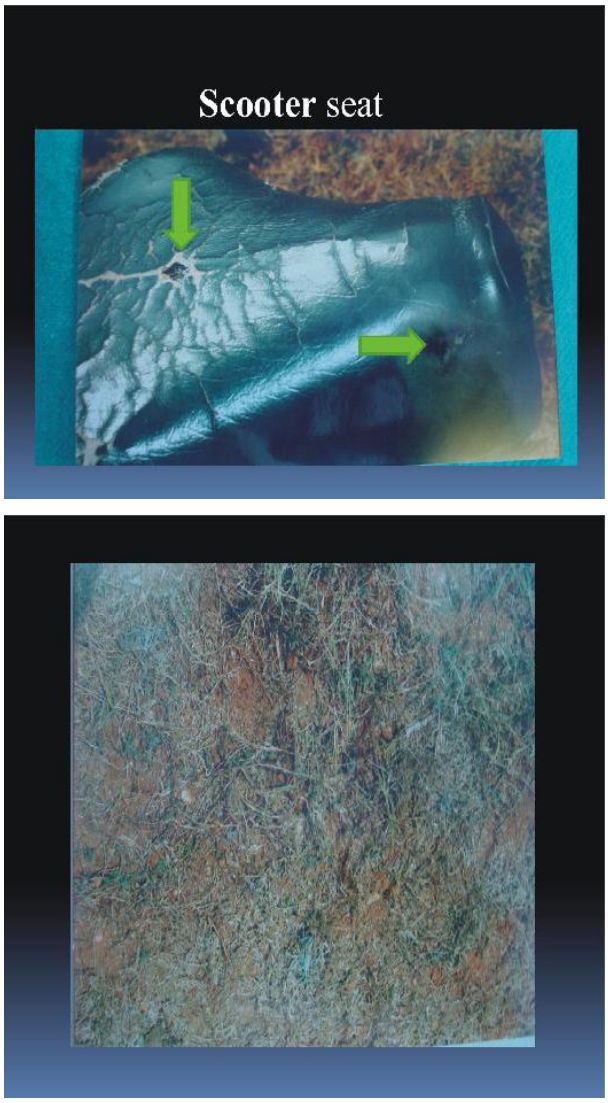
Just as heat can cause expanding air in the lungs, the explosive shock wave created by lightning (the cause of "thunder") can cause concussive and auditory injury at extremely close range. Other physical injury can be caused by objects damaged or thrown by the lightning strike. For example, lightning striking a nearby tree may vaporize sap, and the steam explosion often causes bark and wood fragments to be explosively ejected.

Case Report

According to the police, a 35 yr old male, while returning home on his scooter on a stormy night was found dead on the road with multiple injuries on the body, at the outskirts of city Suspected to be a case of RTA booked under section 279, 304(A) IPC. The

Figure II: Picture Showing the Abrasions and Singeing of the Hairs over Chest and Abdomen

Figure III: Picture Showing the Burnt Scooter Seat and Scene of Crime



body was brought to mortuary to conduct the autopsy.

Post Mortem Examination

Cloth examination showed the trouser and underwear were burnt over the inner aspect of thighs and buttocks. Dead body was that of a male measuring 174cms, moderately built and nourished. Rigor mortis present all over the body. Post mortem staining present over the back of the body and is fixed. Multiple Abrasions of varying sizes were present all over the body. The abrasions are bright red in color.

Superficial flash burns were noted over the inner aspect of both thighs corresponding to the burnt clothing. Body hairs over front of chest, abdomen and pubic hairs are partially burnt and shows singeing. Internal findings on opening the body showed all viscera intact and congested. Blood was sent to FSL for chemical analysis and the skin sample from the burn site was sent for histo-pathological examination. Chemical analysis proved positive for the presence of alcohol in blood. quantum of ethyl alcohol 39.23 mg/dl of blood. Histo-pathological study showed typical features of elongated nuclei, pallisading pattern of cells and dermis showed few congested blood vessels. Cause of Death: Shock due to lightning strike was proved by autopsy study. Early suspicion of RTA and assault was disproved.

The importance of collecting history and visiting scene of incidence is once again highlighted in this case.

Discussion

Injuries and death occurring due to lightning strike are reported frequently.[2] The physical damage in fatal cases can vary from virtually nil to gross burning, fractures and tissue destruction. In lightning injury, cardiac damage or arrest may be caused by either electrical shock or induced vascular spasm. [3,4] Deep burns occur in fewer than 5% of lightning injuries.[5,6] Patients may exhibit one or more of four types of superficial burns or skin changes that do not reflect actual burn injury: linear, punctate, feathering, or thermal burns.[5,6]

Linear burns tend to occur in areas where sweat or water accumulate, such as under the arms or down the chest. These are superficial burns that appear to be caused by steam production from the flashover phenomenon. Punctate burns appear as multiple, small cigarette-like burns, often with a heavier central concentration in a rosette-like pattern. [7] They range from a few millimeters to a

centimeter in diameter. Feathering burns are not true burns because there is no damage to the skin itself. They seem to be caused by electron showers induced by the lightning that make a fern pattern on the skin.[8] These transient lesions are pathognomonic for lightning injury and require no therapy. Thermal burns occur if the clothing is ignited or may be caused by metal that the person is wearing or carrying during the flashover.[9] Pulmonary contusion and haemorrhage are reported with lightning injury.[10] Blunt abdominal injuries and often with head injury caused either by the lightning strike itself or by falling to the ground.

Early recognition of lightning injury of cases and management of complications will have better outcomes.[11] It is important to understand risk factors for lightning development, consequences and medical treatment if struck, and most importantly, how not to be a victim. Lightning strike results in death in 20%-30% of the injuries and the most common cause of death is Cardio pulmonary arrest.[12]

The most critical injuries are to the circulatory system, the lungs, and the central nervous system but injuries also occur to other body systems. Some victims suffer immediate cardiac arrest and will not survive without prompt emergency care.[13] It is safe to administer care immediately, because the victim will not retain any electrical charge after the lightning has struck. Other victims may suffer myocardial infarction and various cardiac arrhythmias most of which can be rapidly fatal as well.

Conclusion

Lightning injuries affect 800 to 1000 persons per year. Cardiac arrest is the main cause of death, burns tend to be superficial. From time and again individuals die as a result of injuries being struck by lightning and the possibility of such a death is overlooked unless certain practical factors like A) Examination of clothes is done. B) Histo-pathological specimens to be collected. C) Visiting/ photographs of scene of incidence. D) History of thunderstorm and evidence of effects of lightening should be considered. To prevent from the injuries and death from lightning safety precautions should be taken. When there is thunderstorm, avoid being in an open field, outdoors and under a tree. Electric equipments should be avoided or turned off. Improved warning systems, increased public education about safety regarding lightning, and improved medical care will reduce the incidences of injury and death caused by lightening.

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