Death Due to Fatal Accidental Electrocution: A case report

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ABSTRACT
BACKGROUND: Electrocution is an uncommon cause of death and occurs commonly due to accident. Deaths caused by the passage of electric current, irrespective of the source of such current are described as electrocution1. The severity caused due to electrocution could extend from simple to severe shock leading to death of a person. Most of the victims of high-tension electrocution die at the scene or declared dead before treatment. In first case report, deceased having fatal electric shock brought to casualty & declared dead.In second case report, deceased fell down from height due to electric shock & resulting in head injury.

Keywords: electrocution, high voltage electrocution, charring, wound of entry and exit.

INTRODUCTION
Deaths caused by the passage of electric current, irrespective of the source of such current are described as electrocution1. Electrocution is an uncommon cause of death and occurs commonly due to accident2. Electricity has astonishingly very good importance in human’s life. One cannot believe to live without electricity. But we as human being should not overlook the pro’s& con’s of electricity in our life. The endangerment of electricity varies from simple harmless shock to severe muscle contraction, unconsciousness and death. Sometimes the victims may be thrown to ground causing more fatal injuries. The first electrical fatality was recorded in France in 1879 when a stage carpenter was killed by an alternating current (AC) of 250 volts3. In India voltage supply for domestic use electricity is around 220 to 240volts. Electrocution results when a person exposed to fatal amount of electricity and it involves both high voltage (> 600 to 750 V) and low voltage (<600V) currents4. Injuries from high voltage electrocution pose a serious threat to life, increasing the mortality rate. In this case report we are presenting two cases of death due to fatal electrocution which highlights some of the typical features of electrocution due to high voltage such as massive destruction of soft tissue along with exposure of underlying bone.

Case Report no 1:
A 14yrs old boy was brought to casualty with history of electric shock while playing cricket. He was declared dead at casualty before treatment and dead body was sent for post-mortem examination. After receiving accidental death report from investigating agency and history obtained from relatives and eye witnesses, it was prima facie concluded by us that it was a case of death due to electrocution. The deceased was playing cricket in the vicinity of two high tension electric wires. While playing, the ball got entangled on the top portion of a truck. The deceased climbed up the truck to remove the ball. At that time, there occurred physical contact with high voltage wires and he got electrocuted. On external post-mortem examination, we noticed the clothes were burnt, at the site of electrical injuries. Singing of scalp hairs, eyebrows, eyelashes were present. Multiple wounds of electrocution were present over the dead body as follows. 1) Wound of electrocution over face at the level of lower jaw and extending backward covering the right lateral neck region and reaching up to lower border of right scapula. It was bone deep. Gross
charring, blackening, smell of burning and destruction of soft tissues at the site of jaw with exposure of periostium of underlying mandibular bone & teeth with loosening of tooth from socket was seen. Signs of vital reaction were present. 2) Wound of electrocution was present over left forearm on dorso-lateral side extending from lower 1/3rd up to index finger of left hand, it was bone deep and underlying bones were intact. Signs of vital reaction were present. 3) Wound of electrocution was present over left thigh at medial border extending up to scrotum and penis, pubic hairs were singed and both testis exposed to exterior. Signs of vital reactions were present. On internal post-mortem examination organs, hyoid bone, thyroid cartilage, trachea were intact. Petechial hemorrhagic spots were seen on anterior aspect of heart, over both pleurae & meninges. Brain & lungs were edematous and congested. Stomach was empty. So based upon history of the case & post-mortem findings, we gave our opinion as to the cause of death as “death due to electrocution”

Case Report no 2:
42yr old male was brought in dead condition to the casualty with a history of fall from the electric pole to the ground. The deceased was a wireman by occupation and was working on a high voltage electric pole for maintenance work. Suddenly his head got into contact with electric wires; he got electrocuted and fell on the ground. Dead body was sent for post-mortem examination. On external post-mortem examination, we noticed the clothes were intact having blood stains over shirt. Singings of scalp hairs were present. Two injuries were present over the dead body as follows: 1) wound of electrocution (burn area of size 5cm x 3cm, with crater formation at the site of contact) present over right side of scalp at the level of parietal region, situated 2cm lateral to midline; it was extending from right parietal region to frontal region with irregular margins and it was bone deep. Underlying bone was fractured. Signs of vital reaction were present. 2) Lacerated wound present over occipital region of scalp obliquely placed, and was bone deep. Underlying occipital bone was fractured (injury due to fall from height). 3) Lacerated wound present over right elbow posterolaterally with fracture of radius-ulna & lower end of humerus (injury due to fall from height).

On internal post-mortem examination, under scalp hemotoma was present over left fronto-parieto-temporal region with subdural hemotoma over left cerebral hemisphere at parieto-temporal region. Subarachnoid hemorrhage was noted all over the brain surface. 3rd, 4th, 5th ribs were fractured on right side with multiple lacerations to right lung. Multiple contusions were present left lung. Thoracic cavity contained 500ml of blood & blood clots. Petechial hemorrhagic spots were seen on anterior aspect of heart. Other internal organs were intact & stomach was empty. So based upon history of the case & post-mortem findings, we gave our opinion as to the cause of death as “death due to intracranial hemorrhage due to head injury following electrocution”

DISCUSSION

Diagram: 1 Distribution of electricity (reference no4)

Photograph of Case report 1: Showing typical burn injury due to fatal electrocution

Photograph of Case report 1: Showing burn injury extending up to scapula
The laws of physics demand that circuit be completed for a flow of electrons to occur. It is this flow of electrons that constitutes electric current. The quantum of electrons constitutes the amperage, whereas the force or potential difference between the two ends of circuit constitutes the voltage. The effects upon a body depend on both the amperage as well as the voltage of electric current. The amount of current that will flow through or over the body may be determined by the formula $A = \frac{V}{R}$, where $A$ is current in amperes, $V$ is potential difference in volts and $R$ is the resistance of the body in ohms. The flow of current through the body is great, if the voltage is high (more than 1000 volts) or if the resistance is low.

Most fatalities occur with the domestic voltage between 110 & 380 volts, which is the voltage range of houses & industrial electricity. The transmission (over 13800 volt) & distribution (fewer than 13800 volt) lines typically carry the high voltages. Most of deaths in fatal electrocutions is asystole, ventricular fibrillation or respiratory arrest secondary to tetanic contraction of respiratory muscles or damage to central respiratory control. Most of the victims of high-tension electrocution die at the scene or declared dead before treatment and not all the cases show typical entrance & exit wounds, which is similar with this case. Charring of the skin is frequently present as seen in this case. The electrostatic forces are responsible for the gross mechanical effects on the body and its clothing which occur in high voltage injuries.

In case report no 1, entry & exit wound of electrocution is difficult to appreciate due to multiple fatal burn wounds, charring at the site of tissue & gross damage as extremely high voltage current causes gross destruction & charring of soft tissues along with exposure of underlying bone. Our finding is consistent with author who mentioned that in case of high voltage electrocution there may be extensive burning or even charring of the body. In case report no 2, we could appreciate wound of entry of electrocution but wound of exit was not present & associated external & internal injuries due to fall from height following electrocution were noted. Electrocution continues to be responsible for a significant number of deaths in adult population. Deaths are often are accidental, associated with work place injury. Almost all Indian workers were forced to work in the most dangerous jobs without effective safety measures. Many workers are unaware of the potential electrical hazards present in their work environment, which makes them more vulnerable to the dangers of electrocution. Thus, it seems that the high rate of work related electrocution mortality in our country can be due to low safety training for workers and their employers. In case of death due to electrocution unfortunately in most of the cases there are no pathognomic features, so determination of the cause of death relies heavily on the circumstances of death and the findings of typical electric burn at autopsy. The most appropriate steps to take in minimizing the chances of childhood electrical injuries and fatalities are to keep electric appliances in child proof cabinets, particularly in the bathroom where there is access to water. Most of the electrocution deaths are preventable in nature and they can be prevented by implementing proper education programs to the society including the electricity board workers with regards to the usage of safety appliances and insulators.
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REFERENCES