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A Case of Fatal Electrocution in Rural Nepal

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ABSTRACT

Although preventable, electrocutions have claimed many lives in Nepal. People of low socio-economic background from remote villages in Nepal who visit jungle to tend cattle, collect firewood and cattle fodder are vulnerable to electrocution when the foliage are in contact with the power lines. We present a case of a 11-year-old boy who was found suspended over three naked high-tension electric wires approximately 30 feet above the ground in rural Nepal. This article describes a case of fatal electrocution and attempts to explain a reasons for such mishaps in Nepal through consideration of topography and socioeconomic factors. This article further discusses the death scene investigation in such cases.

Keywords: Death scene investigation; fatal electrocution; high-tension transmission

INTRODUCTION

Electrical injuries are mostly accidental, yet preventable injuries which are commonly associated with high morbidity and mortality. In a classical electrical injury, the current passes through the individual making him/her a part of the circuit. Wounds of entry and exit are commonly seen in classical electrical injuries.¹ When the electricity passes through the body, it alters the membrane potential of the cell membrane and also causes muscle tetany. The other mechanisms of tissue destruction in electrical injuries are; conversion of electrical energy into thermal energy causing massive tissue destruction and coagulative necrosis.²

Although electrocution is a preventable mishap, statistics show that it is one of the leading causes of unnatural deaths after road traffic accidents.³ Nepal Police recorded 518 electrical accidents of which 289 succumbed to death during April-December 2018.⁴ However, there is sparse reporting of these fatal accidents in the scientific literature.

CASE PRESENTATION

A 11-year-old boy was found suspended over three naked high-tension electric wires approximately 30 feet above the ground. The body was located near the upper end of an electric pole in between two 'Sal' trees (*Shorea robusta*). One of the three wires was in direct contact with one of the trees (Figure 1). As per the inquest report, the boy had gone to the jungle in the afternoon

to collect cattle fodder.



Figure 1. The scene of crime showing the victim being suspended on high tension electric wires.

The body was found at about five o'clock in the evening. An autopsy was performed approximately 42h later. On external examination, the deceased was found to be of moderate built. Nasal orifices were stained with mucous discharge. Other natural orifices were unremarkable. There were multiple electrical burns over the lower back and both the legs. The largest bone deep injury was present over the left lower back near the lumbar region measuring 19 x 7 cm exposing the lumber vertebrae

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(Figure 2). An injury measuring 7 x 5 cm was present over the right popliteal region exposing the underlying fascia. A 4 x 3 cm bone deep injury was present on the medial aspect of the right foot. All injuries were greyish white and charred and the base of the injuries was coagulated and pale. Large part of the back was involved by burn and skin piled up in the injured area. The classic I-shaped incision was used during autopsy and the Virchow's technique was followed for evisceration of the organs. On internal examination, blood was found to be in a fluid state, petechiae were noted on the surfaces of the heart and lungs, and venous congestion of the internal organs was noted. Death scene report, history from the relatives and circumstantial evidence were suggestive of the manner of death being accidental in nature.

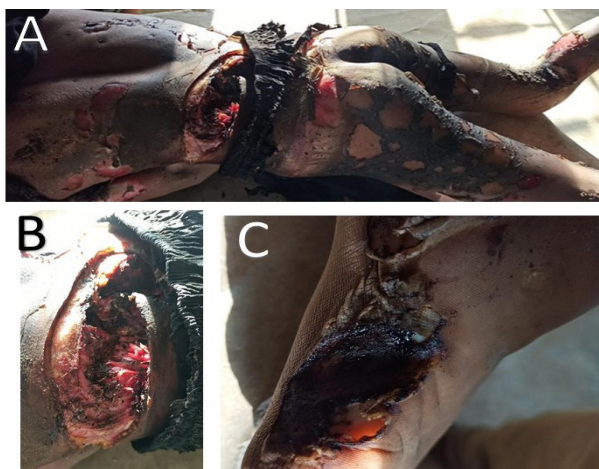


Figure 2. A- The body of the victim. B- Close view of the entry wound. C-The exit wound.

DISCUSSION

Topographically Nepal faces a lot of problems to maintain the electric cables in hilly and mountainous regions. In addition, broken cables, low hanging cables, culture of throwing waste or pasting advertisement on the electric poles, electrical transmitters without any caution and fencing are common findings here.

Lack of vigilance of power supply transmitters as well as cables have resulted in many electrical accidents and fatalities. Six people were electrocuted when a passenger bus touched a low hanging 11,000-volt transmission line during January 2019.⁴

Short-circuit due to power fluctuation in summer have destroyed lots of resources both in terms of money and lives. During January 2020, Khotang district witnessed a destruction of properties worth rupees 4.8 million; however, no casualties were reported.⁵

Children being fragile are prone to injury. In remote areas of Nepal there are many families with low socioeconomic condition who cannot even afford slippers for their children. Wet feet decrease the resistance of the skin. Children are sent alone to the forest to rear buffaloes and goats instead of school. While playing in the jungle they may accidentally come across raw cables. No helping hand will be available for resuscitation in remote jungles. Survival and complete recovery is possible if the person in cardiac arrest from electrocution is resuscitated immediately.⁶

FORENSIC INVESTIGATION IN FATAL ELECTROCUTION

Death scene investigation in all cases of fatal electrocution is essential to discover and know the circumstances of how the death occurred. Photography of the scene from various angles and corners should be done. However, the scene may not be safe and the source of electricity/live wire might still be there being capable of fatal electrocution.⁷ During the scene visit, forensic experts and investigators must be cautious and should not touch the dead body as the body may be electrified.^{7,8} The investigators should lookout for the possibility of electrocution. A team of experienced electric workers accompanying the investigators should first disconnect or turn off the electric current. Only then the death scene investigation should be carried out.

For electrocution to occur the human body has to become a part of an active electrical circuit. When sufficient electricity with enough voltage overcomes the resistance offered by the skin and enters the human body fatal electrocution ensues. When the voltage is high, death can occur even if the duration of contact is only for a few seconds or less. Signs of wetness/dampness are to be observed. Signs of burns are found on the clothes of the victim. When an individual is exposed to a high-voltage electrical energy, a specific pattern of injury is produced.^{8,9} The injury is deep with extensive tissue damage. At the point of contact, also known as 'entry point' or 'entry wound' typical injuries like charring, metallization, and singeing of hair pertaining to the electrical burn can be seen. Death scene photographs, police inquest report and the autopsy findings firmly ascertain that the body of the victim was in contact with the live electric cable at the level of the hip which was the point of entry of the electric current. Fatality can result even if the victim is not in contact with the source of high-voltage because electricity is believed to jump, break through the air to the victim known as current arching, which could generate intense heat with temperatures reaching up to 3000 °C.^{8,9}

The mechanism of death in electrocution primarily depends upon the path taken by the current through the body. In the majority of the cases, electricity passes through the heart causing disruption of cardiac conduction activity leading to a fatal arrhythmia.^{6,8} Paralysis of the diaphragm and other respiratory muscles causing asphyxia can also occur. The current can also disrupt the conduction activity of the brain and spinal cord leading to paralysis of the central nervous system. Severe electro-thermal injuries in high-voltage electrocutions can also result in death. In cases of instantaneous death, sudden electrocution provides the stimulus to the production of fibrinolysin.¹⁰ The fibrinolysin activity possibly retained fluidity of the blood in the present case.

The exit wounds are usually present on the feet. Careful examination of the shoes and feet needs to be done in all cases of electrocution. In high-voltage electrocution, apart from entry and exit wounds, there may be superficial injuries due to arching. The skin may show blisters. In the present case, more damage to the tissue was seen on the right foot with deep charring with skin splits forming ridges which were most likely the exit wounds. Fracture and dislocation of bones and joints may also occur as a result of fall from height or violent muscle contractions.⁹ The diagnosis of electrocution is primarily based upon the history, circumstantial evidence from death scene investigation and the pattern of injuries present on the body. With advanced forensic techniques, like the use of scanning electron microscope (SEM), to see the extent of damage of the blood vessels; histological examination of myofibrils, biochemical analysis of cardiac enzymes; SEM equipped with energy dispersive X-ray microanalyzer; or atomic absorption spectroscopy for metallization of entry wounds; a detailed evaluation in cases of electrocution can be made.^{6,7,8,11}

The victim in the present case had climbed a *Sal* tree. *Sal* trees are strong, robust, and usually attain a height of 30 meters. The green leaves in these trees are usually situated in the upper part of the trunk. The leaves are used not only for cattle fodder but also as temporary plates. The victim who was unaware of the high-tension line touching the tree might have climbed near the tree top, where he was arched by the electric current and thrown away, ended up landing on the top of one of the naked wires resulting in fatality.

CONCLUSIONS

In the present case, one of the high-tension electric cable was in contact with the tree on which the victim had

climbed to collect cattle fodder. Any tree or vegetation growing in close proximity to power lines are hazardous and pose safety risk which might lead to fires, blackouts or power surges. Had the powerlines been cleared from foliage and branches by the concerned authority, the mishap could have been prevented in the present case.

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