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Department of Forensic Medicine & Toxicology, Third Floor, Library Building, Seth G S Medical College & KEM Hospital, Parel, Mumbai-400 012. Email id: mlameditor@gmail.com Phone: 022-24107620 Mobile No. +91-9423016325

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Case Report

Unusual Case of Suicidal High-voltage Electrocution

Venkatesh J[a], Chaudhari VA[b], Satish K[c], Suraj Sundaragiri[d]

[a]Senior Resident, Department of Forensic Medicine and Toxicology, All India Institute of Medical Sciences, New Delhi, India.
[b]Associate professor, Department of Forensic Medicine and Toxicology, Jawaharlal Institute of Postgraduate Medical Education & Research, Puducherry, India. . Pin-605006
[c]Assistant Professor, Department of Forensic Medicine and Toxicology, Shri Sathya Sai Medical College & Research Institute, Ammapettai, Chengalpet, India.
[d]Civil Assistant Surgeon Specialist Forensic Medicine, Community Health Centre, Kodad, Suryapet, Telangana, India.

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Abstract

High-voltage electrocution is usually accidental seen at the workplace. These are always associated with electrical entry wounds because of direct contact or arching of the current. Twenty-two-year-old male admitted with history of homicidal thermal burns in emergency department. He survived for two days of treatment. During the dying declaration deceased revealed the same history. On autopsy, the death was due to flash burns and Joule burns caused by high-voltage electrocution. After a meticulous autopsy, crime scene investigation, histological examination, laboratory investigation and Police inquiry helped to conclude the manner of death as suicidal in nature.

1. Introduction

Electrocution is defined as "the passage of substantial electric current through tissue produces the skin lesion, organ damage, and death".[1] The death in electrocution mainly depends upon the high-voltage currents are more than 1000 volts and low voltage currents are less than 1000 volts.[2] High-voltage electrocution is caused either by direct contact or arching through the air.[3] High-voltage electric current will jump an arc through the air. Air is the bad conductor of electric current and the high-voltage is needed to the arc for some distance. For example, the electric current of 100 kilovolts can jump for 35 cm distance. This will leads to a heat production of about 4000 degree Celsius.[4] The most commonly involving the fatality of high-voltage electrocution is arching or flashing through the air. In flash burns, intense heat may be produced from flashover resembling thermal burns (exogenous burns). Brief contact may not produce burns.

High-voltage burns may be severe with charring of the body. Multiple, small, distinct, pitted burns may be caused by arcing from conductor to the body without direct contact in case of high tension electrical current.[5] An enormous amount of heat may be generated during the arching that causes crocodile flash burns and also the ignition of clothes may possible that leads to secondary burns.[6] High-voltage electrocution is usually accidental as compared to suicidal nature. Suicidal high-voltage electrocution is very rarely reported in the literature.[7]

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***Corresponding author:** Dr. Vinod Ashok Chaudhari, Associate Professor, Department of Forensic Medicine and Toxicology, Jawaharlal Institute of Postgraduate Medical Education & Research, Puducherry, India. Pin-605006 Email: drvinodchaudhari@gmail.com (M): +918940483914.

Hence we are reporting a case with unusual history of homicidal burns. In this case, how meticulous autopsy, crime scene investigation, histo-pathological examination and investigation by Police were helpful for detection of cause and manner of death has been discussed.

2. Case report

A twenty-two-year-old male was admitted to emergency medical services with an alleged history of fastened to the electric post and inflicted thermal burns by pouring kerosene by an unknown person. He was died on after two days of treatment. During the dying declaration deceased revealed the same history. After all the legal formalities body was subjected to postmortem examination. A body was naked, moderately build and brown complexion. Rigor mortis passed off in the upper limb and neck. Livor mortis is present and fixed over the back except over an area of contact and burns.

Superficial burns involving the head and neck (5%), right upper limb (7%), left upper limb (8%), front of trunk (12%), back of trunk (16%), right lower limb (10%), left lower limb(7%) and genital region (1%). Base and margins are reddish. Crocodile flash burns (skin appearance) noted over the left side of the lower half of face, left arm, left shoulder, and bilateral inguinal region (**Fig.1A, 1B& 1C**). Atotal of 66% of total body surface area burns was involved. These were evidence of flash burns.

Figure 1A: Crocodile flash burns noted over the left side of lower half of face, left shoulder and arm; Figure 1B: Crocodile flash burns noted over the bilateral inguinal region; Figure 1C: Superficial burns present over the back.

A circular electrical entry wound of size 1.5cm diameter present on the hypothenar eminence of the left palm. Another electrical entry wound of size 8cm x 4cm present over the distal part of the thenar eminence and proximal fingers of left palm except for the thumb. The bases of craters were greyish pale present in two electrical entry wound. These injuries were suggestive of Joule burns (**Fig.2**). Multiple reddish-brown abrasions were seen on the posterior and medial aspect of both thighs (**Fig.3A**). Multiple abrasions present on the antero-lateral aspects of the left thigh (**Fig.3B**). These graze abrasions were suggestive of climbing the electric post. The chemical analysis report was negative for toxicological substances.

Figure 2: A arrow showed a circular electrical entry wound of size 1.5cm diameter present on the hypothenar eminence of left palm. B arrow showed electrical entry wound of size 8 cm x 4 cm present over the distal part of thenar eminence and proximal fingers of left palm except for the thumb.

Figure 3A: Multiple reddish brown abrasions were seen on posterior and medial aspect of both thighs. Figure 3B. Multiple abrasions present on the anterolateral aspect of the left thigh.

Histopathological examination of electrical entry wound site revealed that electric current induced changes in the skin are disruption and necrotic epidermal layer and presence of neutrophil infiltrations (Fig.4). These findings were suggestive of Joule burns. Crime investigation showed the evidence of torn thin metallic wire (it holds high tension wire with pole) and partially burnt shirt recovered from the crime scene (Fig.5).

Figure 4: Histopathological examination of electrical entry wound site revealed that electric current induced changes in the skin (H & E 10x). Arrow A showed disruption and necrotic epidermal layer. Arrow B & C showed presence of neutrophil infiltration.

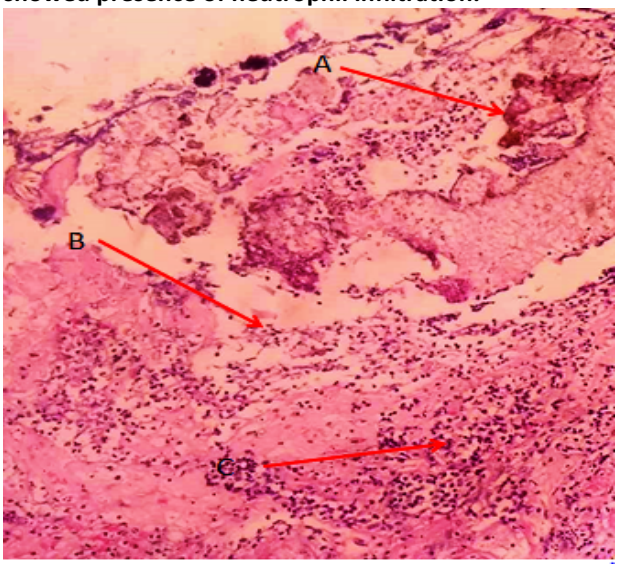

Figure 5A. Crime scene investigation showed the evidence of torn electric wire which was previously connected with high-voltage wire. Figure 5B. A partially burnt shirt recovered from the crime scene.

There was no evidence of kerosene or petrol. But evidence of burnt clothe and burns of the left half and the upper half of the body due to the flash burns due to high-voltage. We ruled out any other injuries due to assault. The cause of death opined based upon the autopsy features and histopathological examination was 66% of burns following high-voltage electrocution. There was evidence of both flash burns and Joule burns. After analysis of autopsy, histopathology, crime scene, chemical analysis report and Police inquiry, we concluded manner of death as suicidal.

Discussion:

In India, about 9986 deaths in 2015related to the accidental and suicidal death of electrocution as per the National crime bureau record investigation. It contributes to 3 % of death compare to all unnatural cause of death.8Suicide by using electric current is a very rare phenomenon and about 90% was successful. In which mostly the individuals are using the low voltage electric current for committing suicide and more common in males.[7,9]High-voltage electrocutions are usually accidental at the workplace and always associated with electrical entry wounds because of direct contact or arching of the current[10].

The individuals who have committed suicide by electrocution may be linked to psychiatric illness and the electrical profession. Based upon this it can be divided into two groups. In the first group person who has related to electrical works like electrician, electrical engineers, and electrical appliances repairing. They are often dealing with complicated electrical circuits with time and switches. In the second group the person with a psychiatric illness who have more prone to deal with an electric current to terminate the life of an individual like person sits in the bathtub by dropping the hairdryer and lamps into the water.9[,11]

According to Somogyi E et al and Manfredi M suicide by electrocution is again classified into four groups based upon the type of method of commission. **Group 1:** climbing a pylon grasping the wire carrying high-voltage electric current. **Group 2:** fastened the one end of a wire to one of the limbs and throw the other end of wire tied with the heavy object to transmission lines. **Group 3:** winds the electrical wires to a wrist or the waist and switching the current. Group 4: placing the electric wire on the mouth passing the current over the head.7[,12]

Fernando R and Liyanage S reported a case of the thirty-four-year-old male laborer of electricity board found dead inside the locked room. He had two-loop of electric wire encircles the left index

finger. He was a known case of depressive disorders. They came to a conclusion based upon autopsy findings and circumstantial evidence cause of death was ventricular fibrillation due to low voltage electrocution.[11] Bligh-Glover WZ et al reported two cases of suicidal electrocution case one was by using the bare copper wires encircles both wrists with switch control present over the chest and found suicide note revealed warning about the live electrical circuit for the rescuers not to touch his body and another was holding the lamp by the deceased in the bathtub. Both cases are known case of psychiatric disorders. Cause of death arrived as ventricular fibrillation as consequent of low voltage electrocution.[10]

Gupta BD et al reported a case of suicide by electrocution using 'black' and 'red' wires tied on the wrist with un-insulated copper wire. He was an electrician by occupation. They concluded the case died due to electrocution.[13] Chan P et al conducted a study for 10 years in Sydney regarding suicidal electrocution. They found 25 cases in that 20 cases are the direct contact and 5 cases are immersed in the water bathtub with electrical devices. In this majority of the cases are direct contact with electricity and most of the cases are related electrical professions. They found that the high number of bodies in the scene of investigation presences of the active electrical wire. They were investigated with proper electrical professional.[14]

Das S et al reported a case of suicidal electrocution of the thirty-two-year-old men climbing the electric post and grasped the electric wire and having multiple exit electrical wounds over both feet. He was known the case of psychiatric disorder. The cause of death was high-voltage electrocution.[15] Eren B et al and some of a few case reports showed the electrical profession was usually involved in suicide electrocution.[16,17] Lucas J conducted a study for 22 years in North Ireland. They found a total of 9 suicidal electrocutions among these eight were associated with severe depressive disorder.[18] In the present case, the person involved was free of psychiatric disorder and nonelectrical profession who had committed suicide by high-voltage electrocution method.

We observed crocodile flash burns. Heat produced by flash over in high tension wire and arcing resulted in the ignition of clothes responsible for the thermal burns. It was evident by burnt clothes present in the crime scene. The linear and circular electrical entry wounds were typical of a Joule burns with shallow crater due to direct contact with an un-insulated live metallic wire connected with high tension electric wire. This was confirmed with crime scene investigation where torn connecting wire with high tension electric wire in the electric pole and along with the histopathological examination. Joule burns are caused by low-voltage electrocution. But in our case, Joule burns were produced by high-voltage electrocution. In present case combination of flash burns and Joule burns was seen due to suicidal high-voltage electrocution.

Conclusion

As autopsy surgeons, we should not believe the history given by deceased himself in the form of dying declaration or allegation of relatives. We want to the highlight importance of autopsy and ancillary investigation in the form of histopathology. It helped in forming an opinion to cause of death. Further use of crime scene visit and Police inquiry were very much helpful to differentiate homicidal versus suicidal death.

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