






## Case Report

# High-Voltage Electrocutation Injuries: A Case Series with Forensic Implications

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### Abstract:

High-voltage electrocution, while uncommon, is a lethal cause of accidental death, often associated with unique external and internal injuries. This case series details four fatalities involving male individuals aged 12, 13, 30, and 16 years, each experiencing accidental contact with high-tension electrical wires. Postmortem examinations revealed dermo-epidermal burns involving 35% to 88% of total body surface area. Characteristic features such as crocodile flash burns, electric splits, singed hair, charring effects, and burnt clothing were observed. One case demonstrated arc-related contact burns without direct wire contact. Internal examinations showed subdural and subarachnoid haemorrhages, skull fractures, and signs consistent with cardio-respiratory failure. These cases highlight the importance of detailed forensic evaluation in electrocution deaths and underscore the urgent need for preventive strategies such as proper insulation of high-tension lines, underground cabling, and enhanced public safety education.

**Keywords:** Electrocutation, High-Voltage Injury, Flash Burns, Crocodile Skin, Autopsy findings.

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### Introduction:

Virtually all electrocution are accidents, with suicides rare and homicides even rarer [1]. Deaths virtually always involve alternating currents, because direct current is used less. In addition, humans are four to six times as sensitive to alternating currents as to direct. Alternating currents between 39 and 150 cycles/s have the greatest lethality [1]. Residential voltage in India is 220 to 240 volts, alternating at 50 cycles (Hertz) per second [2]. Electrocutation is rare at less than 100 volts, and most deaths occur at more than 200 volts [2]. The flow of

current through the body is great, if the voltage is high (more than 1000 volts) or if the resistance is low [2]. Amperage, or the amount of current flow, is the most important factor in electrocution. It is directly related to the voltage and inversely related to the resistance [1]. In high voltage incidents, direct contact with the wire is not necessary. As the body approaches the high-voltage line, an electric current (arc) may jump from the line to the body. Electrocutation from these lines occurs when they break, fall to the ground and are touched, or when an intact or “live” line is touched by a tall metal object such as a ladder, pole or crane with which a person is in contact [1].

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### Case Report: 01

A case of electrocution involving a 12-year-old uneducated male shepherd was brought to our institute's mortuary. As reported by the family and investigating team, he was herding cattle near an earthed electric pole. During an electricity board checkup, current was accidentally passed through the earthing wire. The child unknowingly touched the live wire and sustained fatal electrocution. Postmortem examination revealed both eyes to be blackened, tongue clenched between teeth, crusted blood present over face at places, fluid blood oozing out from both nostrils, rigor mortis all over the body and hypostasis cannot be appreciated due to burn. Dermo-epidermal burn present all over body except left forearm and right leg and foot area, blackish reddish discoloration present over burnt area at places, splitting of skin present over front of the chest, right inguinal region, inner side of left thigh and over anteromedial aspect of right thigh, underlying subcutaneous tissue found exposed [Fig.1,2]. The percentage of burn was about 60-70 percent of the total body surface area. Multiple punched out lesion (Crocodile flash burns) were seen over lower half of back of the body and over gluteal region [Fig.3]. Diaphragm found uplifted up to 5<sup>th</sup> to 6<sup>th</sup> intercostal space. Scalp found contused over right frontal area, outer table of skull was intact and dura was found tensed. A linear, oblique fracture measuring 8.0 cm in length extends transversely from the right side of anterior cranial fossa to the floor of left side [Fig.4], and subdural hemorrhage present over right parietal region of brain. All other internal organs were congested and grossly normal. Trachea was found empty. Based on the autopsy findings, it was opined that the death was due to cardio-respiratory failure as a result of electrocution. Evidence of electrocution present over body. Evidence of head injury present. Duration of death was within 24 hours since post-mortem examination.



Fig.1 Distribution of dermo-epidermal burns and electric split over the anterior surface of the body



Fig.2 Electric split over right inguinal region



Fig.3 Crocodile skin over back and gluteal region

### Case Report: 02

A case of electrocution involving a 13-year-old school-going boy was brought to our institute's mortuary. As per information provided by the relatives and the investigating team, the child was playing on the terrace when he noticed a pigeon perched on a high-tension electric cable.



**Fig.4 Fracture of anterior cranial fossa**

In an attempt to rescue the bird, he raised a pole to scare it away. The pole accidentally touched the live wire, leading to fatal electrocution. Postmortem examination revealed dermo-epidermal burns over both lower limbs, including the dorsal aspects of both feet, the penis, scrotum, and pubic region [Fig.5,6]. Additional burn patches were noted on the lower abdomen, dorsal surfaces of the proximal phalanges of all fingers, and the distal metacarpal region of the left hand [Fig.7]. The skin over the lower abdomen, anterior upper thighs, inguinal regions, and left hand appeared thickened and hardened in places. Burns on the left hand showed sharp demarcation at proximal and distal margins, with erythematous borders. Partial singeing of pubic hair was noted. The total burn surface area was estimated at 35–40%, ranging from superficial to deep burns. The scalp and skull were intact; the brain and all internal organs were congested but grossly unremarkable. The trachea was empty. Based on the overall findings, the cause of death was concluded to be cardio-respiratory failure secondary to electrocution. The presence of both flame and flash burn patterns correlated with the reported circumstances of the incident. The postmortem interval was estimated to be within 24 hours.



**Fig.5 Distribution of dermo epidermal burn over anterior surface of lower limb**



**Fig.6 Flash burns over thighs, inguinal region and lower abdomen**



**Fig.7 Flash burns over dorsal aspect of left hand**

### Case Report:03

A case of electrocution involving a 30-year-old male manual laborer was brought to our institute's mortuary. As per information from the deceased's family and the investigating team, the victim was working on a concrete project on a building rooftop when he slipped. A high-tension wire was located above the terrace, and during the fall, he accidentally came into contact with it, resulting in electrocution and subsequent

fall from the building. Postmortem examination revealed socks present on right foot and other wearing found burnt all over and remaining burnt cloth pieces present over body in situ [Fig.8-9]. Scalp hairs were singed [Fig.10]. Dermo-epidermal burn present over face, both hands, chest, abdomen, both lower limbs up to knee [Fig.8,9]. Percentage of burn is 85% of total body surface area. Yellowish reddish discoloration seen over burnt area at places. Scalp found ecchymosed internally all over and lacerated wound of size 3.0 x 0.8 cm x bone deep present over right frontal area of scalp, multiple fractures were observed in the underlying skull bones [Fig.11], dura found torn on frontal area, SDH and SAH present all over brain at places [Fig.12], brain found pale. All other organs were grossly normal and pale. Based on the autopsy findings, it was opined that the death was due to cardio-respiratory failure. Evidence of burn present over body. Evidence of head injury caused by surface impact present. Duration of death was within 24 hours since post-mortem examination.



**Fig.10 Singed of scalp hairs**



**Fig.11 Multiple fractures over the skull**



**Fig.12 Subarachnoid and subdural hemorrhage all over the brain surface**



**Fig.8 Distribution of dermo epidermal burns over anterior surface of the body with burnt clothes (yellow circled)**



**Fig.9 Distribution of dermo epidermal burns over posterior surface of the body with burnt clothes (yellow circled)**

#### **Case Report:04**

A case of electrocution involving a 16-year-old male was brought to our institute's mortuary. As per information from the deceased's family and the investigating team, the victim was attempting to retrieve a piece of clothing that had blown onto a high-tension electric line while drying on

the terrace. He used a pole to get it down, which accidentally came into contact with the live wire, resulting in fatal electrocution. Postmortem examination revealed the presence of burnt clothes over the body, both arms found internally rotated, both elbows found flexed, right fist found clenched [Fig.13] with plantar flexion of both feet. Dermo epidermal burn present over right side of face, right ear, bilateral region of neck, right arm, left arm and over right lateral side of back. The left forearm is found charred with underlying muscles and bones found exposed. Distal one third part of the left forearm along with the left hand found missing [Fig.14]. The right forearm, dorsolateral and palmar aspect of the right hand found charred with underlying structures found exposed. Right index finger, palmar aspect of proximal phalanx of right thumb, palmar aspect of proximal and middle phalanx of right middle finger found missing with charring effect over the surrounding structures and metacarpal bones. Both side of chest and upper part of abdomen found charred with underlying structures found exposed [Fig.15]. Patches of burn area were seen over left anterior superior iliac spine and over anterior aspects of both thighs found hard and thickened. Dermo epidermal burn present over scrotum and over the shaft of penis. Scalp hairs were signed. Scalp found internally ecchymosed over the right parieto-occipital region. Diaphragm found uplifted. All other internal organs found grossly normal and congested. Based on the autopsy findings, it was opined that the death was due to cardiorespiratory failure as a result of electrocution.



Fig.13 Burnt clothes with internally rotated arms, flexed elbows, clenched right fist



Fig.14 Both forearms found charred with missing of distal part of left forearm and left hand



Fig.15 Both side of chest and upper part of abdomen found charred with underlying structures found exposed

#### Discussion:

Flash or spark burns seen on postmortem examination of case report: 1, occurs from high-voltage currents when sparking happens between a conductor and the victim, producing exogenous burns. Multiple lesions are found in the region of flexures of upper and lower limb where the current has passed across the joints. The wide area of skin shown yellowish grey discoloration due to heat and metallization. High-tension grid cables can produce multiple spark lesions across many centimeters, creating a "crocodile-skin" appearance with punched-out lesions over lower half of back of the body and left

gluteal region. These burns cause keratin to melt and solidify into brownish nodules resembling crocodile skin. Electric burn splits over the chest, abdomen, and thighs appeared dry, firm, and linear with ragged edges. Superficial skin shedding is typical, and aseptic necrosis may extend beyond visible burns, leading to sloughing. The victim was thrown away by high tension current sustaining a skull fracture and subdural hemorrhage from a contrecoup injury. Based on the postmortem examination of case report:2, the findings such as thickened and hardened burn patches over lower abdomen, anterior aspect of both upper thighs, both inguinal regions and over left hand were suggestive of flash burns. The burn injuries over both lower limbs including dorsal aspect of both feet, dorsal aspect of penis, over scrotum, over pubic region were suggestive of thermal burn resulted from the flame effects from his clothes. Based on the postmortem examination of case report:3, findings such as burnt clothes, singed hairs and dermo epidermal burn over face, both hands, chest, abdomen, both lower limbs up to knee were suggestive of thermal burn resulted from the flame effects from his clothes. Other findings such as fracture of the skull, subdural haemorrhage and sub arachnoid haemorrhage would have resulted from the surface impact during his fall from the building. Based on the postmortem examination of case report:04, the findings such as internally rotated arms, flexed elbows, clenched right fist and extended feet were suggestive of violent muscular contraction which happens due to contact with high voltage current. However, the grasping will be continued by the individuals after the contact with high voltage current. Evidence such as missing of the left hand and distal part of the left forearm, the presence of confluent areas of third degree burns over the chest and abdomen helps us in determining that the pole would have been held in the left hand. The burns seen over the face, both upper

limb, chest, and abdomen were suggestive of high voltage electrical burns. Patches of burn over left anterior superior iliac spine and over anterior aspect of both thighs were suggestive of flash burns.

### **Conclusion:**

The fatalities observed in these cases are primarily attributed to insufficient public awareness and inadequate management by the relevant electricity authorities. These tragic events highlight the pressing need for the implementation of underground electrical cables or the proper insulation of high-voltage wires as preventive measures. The enforcement of stringent electrical safety regulations must be made mandatory, alongside public education initiatives aimed at promoting awareness of safety protocols. Strategic placement of clear signage, along with educational materials outlining safety do's and don'ts, would significantly contribute to mitigating the occurrence of similar incidents in the future.

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