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High-Voltage Suicidal Electrocution With Multiple Exit Wounds

Siddhartha Das, MD, Ambika Prasad Patra, MD,* Kusa Kumar Shaha, MD,* Sarath Chandra Sistla, MS,† and Manoj Kumar Jena, MD‡*

Abstract: Poisoning, hanging, and burning are the usual methods adopted by people to commit suicide. Suicide by electrocution and that too high voltage is one of the rarest methods adopted for the purpose. We report the case of a young man who committed suicide by climbing up a 25-ft-high electric pole. The deceased was a regular alcoholic and was under severe depression for a long time because of his personal problems. He survived for more than 2 days after the incident. His serum urea and creatinine levels were elevated, so were the creatine kinase total and creatine kinase-MB level. The method adopted and the findings make this case a rare scientific report. Moreover, to the best of our knowledge, this is the first reported case in an English scientific literature of a high-voltage suicidal electrocution with multiple exit wounds. The circumstances surrounding the manner of electrocution and the features of electric injuries are presented and discussed.

Key Words: suicide, high-voltage electrocution, multiple exit wounds

(*Am J Forensic Med Pathol* 2013;34: 34–37)

Although it requires no profound knowledge of electricity and electrical wiring to commit suicide by electrocution and the requisite materials are easy to acquire, suicide by electrocution is still uncommon.[1] Majority and in some studies all of such deaths in India,[2–6] and those reported from abroad,[7–10] are found to be accidental in nature. Suicidal electrocution has been reported from the Western countries,[11–13] and Australia.[14]

In most of the cases of suicidal electrocution, low-voltage current has been used. Direct contact with live electrical cables and electrical device immersed in bath tubs are the usual methods adopted by the deceased.[11,14,15] However, Toro et al[12] reported a very interesting case of suicidal hanging on a high-voltage line pylon, hanging being the planned suicidal method which was associated with unintentional electrocution injuries. Indian authors have reported cases of suicidal electrocution quoting either the newspapers or western incidents.[2,4] Recently, Khandekar et al[16] and Gupta et al[17] both from India, reported cases of suicidal electrocution with high and low voltage respectively.

Injury by high-tension electric currents occurs either by direct contact or by indirect results of arcing or flash over. The high-tension injuries are usually seen in linemen working on the grid systems and occasionally in thieves stealing wires from high-voltage overhead lines.[4] Our case highlights the plight of a severely depressed individual who was neither a lineman nor a thief, and who chose a very rare method to end his life.

Manuscript received March 17, 2012; accepted October 23, 2012.

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The authors report no conflict of interest.

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ISSN: 0195-7910/13/3401–0034
DOI: 10.1097/PAF.0b013e31828167a7

CASE REPORT

The body of a 32-year-old man was brought to our mortuary with a history of death from alleged electrocution. On external examination, the deceased was found to be moderately built of body length 159 cm and weight 60 kg. Scalp hairs were shaven. Natural orifices were free. Lividity was present on the back of body. Electrical burn injuries were present on the face, front, and back of neck, upper scapular region, chest, upper abdomen, left upper limb, right arm, lower part of right leg, and dorsum of right feet. There was charring as well as coagulation of muscles and other tissues underneath the burnt areas with singeing of axillary and chest hairs. Multiple electric burn injuries were present on the sole of right foot of sizes varying from 0.7 × 0.5 to 2 × 1.3 cm over an area of size 14 × 6 cm. They were in the form of craters with pale base and occasional congestion, elevated indurate margins with carbonization at many places (Figs. 1 and 2A). Multiple electric burn injuries were also present on the sole of left foot of sizes varying from 0.5 × 0.5 to 1.5 × 1.2 cm over an area of size 8 × 3 cm. They were in the form of craters with pale base and occasional congestion, elevated indurate margins with carbonization at many places (Fig. 2B). On opening the thoracic cavity, right and left lung weighed 430 and 370 g, respectively, and were found to be congested. The pericardial sac contained approximately 30 mL of straw yellow-colored fluid. Heart had a normal tone, weighed 220 g with normal appearance of walls, valves, and patent coronaries. Internal examination of the rest of the viscera was unremarkable except for the presence of congestion. Stomach and proximal small intestine with their contents, one half of each kidney, a portion of the liver and 20 mL of blood were sent for chemical analysis which returned negative result for alcohol and other substances of abuse. Histopathological examination of the viscera had normal findings except for features of acute tubular necrosis of kidney.

On retrospective evaluation, history revealed that he had climbed up an electric pole near his house to commit suicide. He got electrocuted from the live wires atop the pole carrying high-voltage current and was thrown to the ground unconscious. After receiving the initial treatment at a local hospital, he was immediately referred to our hospital in a state of unconsciousness. Hospital case records revealed a complaint of pain over the left side of chest and left upper abdomen. No h/o hematuria; vomiting; seizure; ear, nose, and throat bleeding; long bone injury; neck pain; back pain; and loss of movements of limbs. Examinations of the different systems were unremarkable. Urine was normal in color and a gradual decline in urine output level observed during the 2 days. Perusal of his investigation reports showed elevated serum urea and creatinine levels. Creatine kinase total was 4109 IU/L, creatine kinase-MB 587 IU/L, and Troponin T was nonreactive. Rest of the biochemical investigations were within normal limits. Diagnostic procedures like chest x-ray, electrocardiogram (ECG), USG Abdomen, and computed tomographic scan head showed normal findings. On conservative management, he regained consciousness

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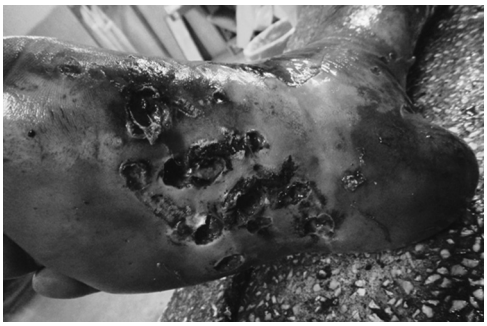

FIGURE 1. Multiple electric exit wounds on the sole of right feet.

briefly but from second day onward developed restlessness, disorientation to time, place, person, and gradually passed on to a stage of coma, after which he was declared dead on the third postelectrocution day.

DISCUSSION

Injury by high-tension current is either by direct contact or, as is not infrequent, an indirect result of arcing or flash over. There is then the risk of grave thermal burns because of the considerable heat generated in the flash and of "knock down" by the sudden and appreciable increase in local atmospheric pressure.[1] The distance between the person and the cable leading to arcing is related to the voltage. The distance an electric arc can jump varies from few millimeters with 1000 V to approximately 35 cm with 100,000 V.[18]

On most of these occasions, survival of the victim implies that the current had passed by and not through the body. It could be that contact with high voltage, even multikilovolt, is not immediately lethal because, in such circumstances, the amperage of the supply, if it passes through the body, could exceed 4 A and, in consequence, ventricular fibrillation would not occur. Survival in these circumstances is to be attributed to high amperage.[1] This could be the possible explanation for the deceased not having an instantaneous death in our case. Moreover, the ECG findings did not reveal any abnormality, thus ruling out arrhythmia, ventricular fibrillation in particular. Mandatory ECG monitoring and cardiac enzyme analysis in an intensive care unit setting for 24 hours after injury is unnecessary in patients with electrical burns, even those resulting from high-voltage current, in patients who have stable cardiac rhythms on admission,[19] and studies have shown that if the ECG is normal on admission, subsequent cardiac dysarrhythmias are rare.[20] The most serious cardiac derangements occur in the first 24 hours after injury.[21] Cardiac troponins are now regarded as the most specific biochemical markers of myocardial injury,[22] and considered as the diagnostic "gold standard" for the diagnosis of myocardial injury.[23] On the basis of a nonreactive cardiac troponin test and normal appearance of the heart in postmortem and histopathological examination, we ruled out myocardial injury.

According to Dokov,[11] the second most common method of committing suicide by electrocution is climbing up and touching high-voltage power transmission line. In our case too, the deceased followed the same procedure. Some of the reported cases of suicidal electrocution showed that the victims were electrician by profession indicating their natural preference for the adapted method.[13–15,17] But, in the instant case, the victim was an agriculturist by profession. One study from Northern Ireland found all the 9 cases of suicidal electrocution to be caused by domestic electric supply and 8 of them had a documented history of depression.[8] The deceased in the present case was also experiencing severe depression as was revealed by his father. But because of his low socioeconomic status and lack of awareness, he could not get professional counseling for his ailing mental condition.

History collected from police and the relatives revealed that the deceased was experiencing mental depression ever since his first wife died 2 years ago. To overcome the void in his life, he remarried, but approximately 7 months back his second wife ran away from him. He was thrown into depression once again and started consuming large amounts of alcohol regularly. Added to this, his financial condition was not so sound. All this factors drove him toward a suicidal state of mind. On that fateful night when all his family members were sleeping, he did not go to sleep and consumed alcohol as a build up to the incident. He climbed up the electric pole from an adjoining tree and squatted on a horizontal bar present on the electric pole itself (Fig. 3). He was slowly rising from the squatting position to touch the overhead high-voltage wires when, suddenly he received electric shock and was thrown to the ground unconscious.

What we presume is that somehow he managed to climb up the pole to the horizontal bar and was squatting there. When he tried to straighten himself up from that position, either his head or the back may have come in contact with the wires and he was thrown to the ground. Autopsy examination of the scalp did not show any linear shaped burn injury as would be expected in case of contact with wires. Similarly no linear shaped burn injury was noted anywhere on the body. It is a well-known fact that arcing occurs with high-voltage current. Rarely, the current passes through the head and neck, usually in circumstances

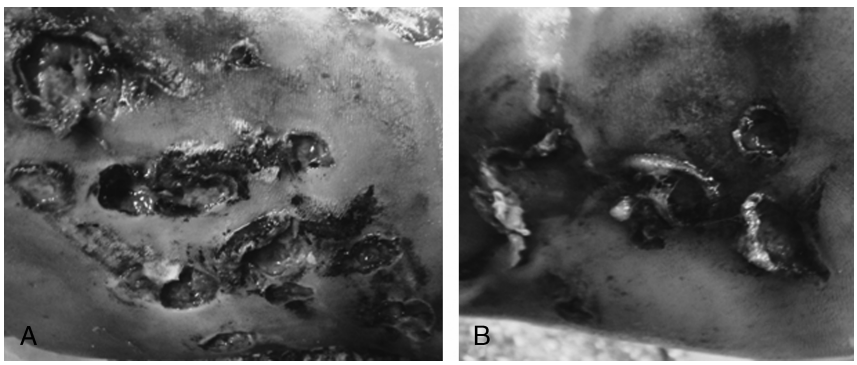

FIGURE 2. Close up image of the sole of (A) right and (B) left feet.

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FIGURE 3. Scene of the incident. Red arrow pointing the horizontal bar on which he was squatting and the white oval, the spot where he was found lying unconscious.

when the head of a worker on overhead power lines comes into contact with the conductor. In such instances, there may be a direct effect on the brainstem so that cardiac or respiratory centers are paralyzed.[24] But in the present case, clinical and laboratory examination of the respiratory and cardiovascular system were normal. Hence, a possibility of the head coming in contact with the wires was excluded. Extremely high voltage, such as those encountered in power transmission systems and in electronic equipment, may paradoxically be safer on some occasions, as the shock may physically fling the subject off the conductor, thus reducing the contact time below the threshold for cardiac damage.[24] In the present case, ECG was normal and Troponin T was nonreactive indicating the absence of a cardiac damage. Keeping in view the previously mentioned facts and, also after reviewing the scene of the incident, we arrived at the provisional conclusion that when the person tried to stand up from the squatting position, his scapular region and not the head may have come in contact with the overhead lines, which were approximately 4 ft from the horizontal bar on which he was squatting. The absence in the body of a contact wound in the form of a linear electric burn may be because of the clothes that he was wearing. But Polson et al[1] theorizes that the electric mark can be produced beneath intact clothing and also undamaged by thermal heat. So a greater possibility in this case according to us is the phenomenon of arcing or flash over, which explains the absence of a linear electric burn on the back and also the distribution of the burn injuries sustained in different parts of the body.

The pathway of the current will depend mainly on the relative resistance of various potential exit points and tends to take the shortest route between entry and best exit, irrespective of the varying conductivity of different internal tissue. As far as resistance of the skin to the flow of electric current is concerned, dryness or dampness has a very potent role. Although dry palm skin may have a resistance of the order of 1,000,000 Ω, when wetted this may fall to only 1200 Ω. When the current begins to pass, there is a further marked drop in resistance, because of electrolytic changes in the skin, which may fall to only 380 Ω. The resultant current will be far greater if the skin is wet from sweating or external moisture.[24] In this case, the incident occurred at predawn when dews accumulate in the trees, especially the leaves. Because the person climbed the electric pole from an adjoining tree, his skin resistance might have decreased considerably because of the presence of these dews and, which possibly led to arcing injuries over his body. Moreover, the horizontal bar on which he was squatting was metallic which, acted as a good conductor of electricity and thus the earthing point. This also explains the multiple exit wounds of various sizes found on the soles of both feet. Saukko and Knight[24] in their illustrious book on *Forensic Pathology* mention the case of a workman who pushed a metal wheelbarrow over a live cable lying in a pool of water. In that case also, the electrical burns were found on the soles of both feet.

One interesting observation can be made from this case. The electric burn wounds on the soles of both feet are more concentrated on the concavity of the soles of both feet and not the toes, balls of the toes or the heel which are the usual point of contact with the ground or the surface on which a person is standing. This can be explained by the small width of the horizontal bar on which the deceased was squatting.

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