

Can a Postmortem Skin Biopsy Predict Cause of Death?

Deepti Sukheeja, Janani Shanmugam¹, Arulselvi Subramanian, Sanjeev Lalwani¹

Departments of Laboratory Medicine and ¹Forensic Medicine, Jai Prakash Narayan Apex Trauma Centre, All India Institute of Medical Sciences, New Delhi, India

Address for correspondence: Dr. Arulselvi Subramanian, E-mail: arulselvi.jpnatc@gmail.com

ABSTRACT

Electrocution continues to be a major cause of death among workers because they and their employers do not recognize the importance of safety training and implementing safe practices. Part of the reason is that at home and on the job we take electricity for granted. Relying on the benefits of electricity, we may forget its hazards. Death due to electrocution can occur without any marks on body. Skin biopsy of an autopsy case of a male, plumber by occupation, who was brought dead to the hospital, was examined to find out the cause of death. Electrical marks were observed on his palm during autopsy and were supposedly thought to be the cause of death. The histopathology of skin lesion confirmed the diagnosis. We, hereby, report this case as the histopathology in electrocution has rarely been discussed in papers and it can aid in investigations to know the cause of death in unknown cases.

Key words: Electrocution, postmortem, skin biopsy

INTRODUCTION

Electrical hazards represent a serious, widespread occupational danger; practically all members of the workforce are exposed to electrical energy during the performance of their daily duties, and electrocutions occur to workers in various job categories. Many workers are not aware regarding potential electrical hazards present in their work environment, which makes them more vulnerable to the danger of electrocution. Electricity is a ubiquitous energy agent to which many workers in different occupations and industries are exposed daily in the performance of their duties. Many workers know that the principal danger from electricity is that of electrocution, but few really understand just how minute a quantity of electrical energy is required for electrocution. Electrocution should be considered in any unusual death in the home or factory. Electrical injuries are ranked as the fifth most common cause of

occupational fatalities. About two-thirds of electrical injuries occur in persons between 10 and 40 years of age. The effect of an electric current is enhanced by moisture on the skin or a damp environment plus good earthing. In the case of high-tension current extensive burns and charring of the tissues may occur. Electricity may cause burns at both entrance and exit from the body, but characteristically the marks seen at the point of entry, although occasionally no mark or burn can be seen on the skin. Knowledge of microscopic features in electrical marks can help us knowing the cause of death. Hence, our case report discusses its histopathology. To the best of our knowledge, there are very few papers in literature documenting on histopathological features.

CASE REPORT

A 28-year-old male, plumber by occupation, was brought dead to casualty by an attendant. He was last seen alive working on a motor that pumps water out of a well. On postmortem cause of death could not be identified except an electric mark on palm. It was a circular raised pale lesion measuring 2 × 1 cm on the left hand palmar aspect, firm in consistency without surrounding inflammation. Inquest also ruled out foul play. Viscera were sent for chemical analysis which ruled

Access this article online	
Quick Response Code: 	Website: www.jlponline.org
	DOI: 10.4103/0974-2727.119865

out poisoning and intoxication. The biopsy of the skin lesion was sent for histopathology to find out whether the death was due to electrocution. Formalin-fixed tissue comprising of skin and subcutaneous tissue measuring $2 \times 1 \times 1$ cm was received and was processed entirely. Care was taken to avoid autolysis in microscopic sections and to include the epidermis in the sections. Routine hematoxylin and eosin stain and Von Gieson stain was done. On microscopy, intraepidermal separation and focal necrosis within epidermis was seen [Figure 1]. There were nuclear elongation, pyknosis, and palisading (spindle-shaped nuclei in the epidermis arranged parallel to each other) seen in the basal layers epidermis indicative of electrocutive changes [Figure 2].

DISCUSSION

Gupta *et al.*,^[1] conducted a study on deaths due to electrocution and concluded that most deaths are accidental, mostly occurring in rainy season and most of the deaths were preventable. The number of people who believe that normal household current is not lethal or that powerlines are insulated and do not pose a hazard is alarming. Electrocutations may result from contact with an object as seemingly innocuous as a broken light bulb or as lethal as an overhead powerline and have affected workers. Due to scarcity of typical autopsy findings in electrocution and unclear circumstances of death, many a times cause of death remains undiagnosed. According to a study done by Rautji *et al.*,^[2] the electrocution cases represented approximately 1.98% of all autopsy cases received from South Delhi at the All India Institute of Medical Sciences, New Delhi (India) during the period 1996-2001. It is known that changes such as nuclear elongation, pyknosis, and palisading appear in electrical lesions and intraepidermal separation is most frequent in electric lesions.^[3] Jellinek, called

as founder of electropathology is famous for his work on histopathology of electrocution, thought that the nuclear elongation is attributable to an electric polarization effect, as seen in our case.^[4] However, studies have shown that similar nuclear elongations may occur in thermal burns, blunt traumatic skin injuries, cauterization, drying, and freezing, and around blisters due to barbiturate poisoning. In a study, skin specimens obtained at autopsies were exposed to electricity of various voltages. No subepidermal separation was observed in the specimens exposed to electricity at 4, 12, 18, 24, and 36 V, but varying degrees of separation occurred in the specimens exposed to electricity at 48 V and higher.^[5] A case reported by Anders *et al.*,^[6] where death of an old man by stun gun, which generates electric current, shows streaming-like pattern of the elongated epidermal nuclei and coagulative changes of the subepidermal tissue. Fineschi *et al.*,^[7] reported that death due to cardiovascular complications in electrocution shows vacuolization between the endothelium and the internal elastic membrane of myocardium and squaring of myocardial nuclei. Lungs may show pulmonary congestion, edema, hemorrhage, and intralveolar exudates.^[8]

The electrical shock may strike the victim's central nervous system, the cardiovascular apparatus, the skeletal muscular tissue, the lungs, the skin and other internal organs.^[9] In our case since postmortem could not rule out the cause of death, the microscopy of skin lesion helped. Fatal arrhythmias arising due to electrocution can cause instant or late deaths,^[9,10] which could be probable cause of death in our case.

ACKNOWLEDGMENT

We would like to sincerely thank Meenakshi, Lian, and Pawan Kumar for the technical support.

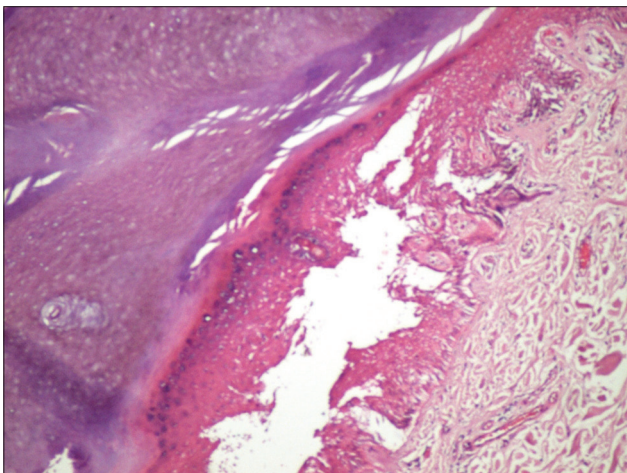


Figure 1: Hematoxylin and eosin-stained section (×10) showing intraepidermal separation

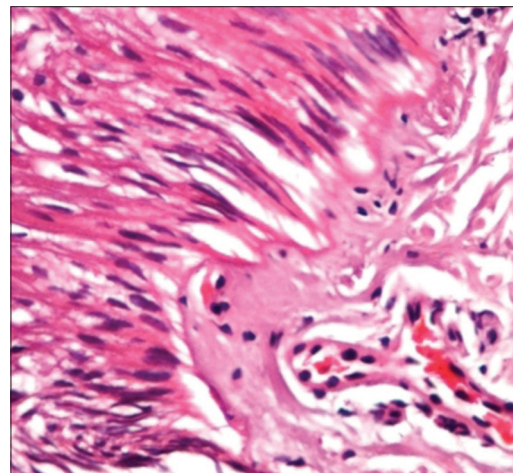


Figure 2: Hematoxylin and eosin-stained section (×40) showing elongation and pyknosis of nuclei in the basal layer

REFERENCES

1. Gupta BD, Mehta RA, Trangadia MM. Profile of deaths due to electrocution: A retrospective study. *J Indian Acad Forensic Med* 2012;34:13-5.
2. Rautji R, Rudra A, Behera C, Dogra TD. Electrocution in south Delhi: A retrospective study. *Med Sci Law* 2003;43:350-2.
3. Uzün I, Akyildiz E, Inanici MA. Histopathological differentiation of skin lesions caused by electrocution, flame burns and abrasion. *Forensic Sci Int* 2008;178:157-61.
4. Aggrawal A. Histopathological changes in electrocution. *Anil aggrawal's Internet Journal of Forensic Medicine and Toxicology* 2002;3:1.
5. Oehmichen M, Cröpelin A. Temporal course of intravital and postmortem proliferation of epidermal cells after mechanical injury. An immunohistochemical study using bromodeoxyuridine in rats. *Int J Legal Med* 1995;107:257-62.
6. Anders S, Junge M, Schulz F, Püschel K. Cutaneous current marks due to a stun gun injury. *J Forensic Sci* 2003;48:640-2.
7. Fineschi V, Di Donato S, Mondillo S, Turillazzi E. Electric shock: Cardiac effects relative to non fatal injuries and post-mortem findings in fatal cases. *Int J Cardiol* 2006;111:6-11.
8. Michiue T, Ishikawa T, Zhao D, Kamikodai Y, Zhu BL, Maeda H. Pathological and biochemical analysis of the pathophysiology of fatal electrocution in five autopsy cases. *Leg Med (Tokyo)* 2009;11: S549-52.
9. Fish R. Electric shock: Part I. Physics and pathophysiology. *J Emerg Med* 1993;11:309-12.
10. Mathiharan K, Patnaik AK. *Modi's Medical Jurisprudence and Toxicology*. 23rd ed. New Delhi: Lexis Nexis; 2006. p. 651.

How to cite this article: Sukheeja D, Shanmugam J, Subramanian A, Lalwani S. Can a postmortem skin biopsy predict cause of death?. *J Lab Physicians* 2013;5:121-3.

Source of Support: Nil. **Conflict of Interest:** None declared.

Staying in touch with the journal

1) Table of Contents (TOC) email alert

Receive an email alert containing the TOC when a new complete issue of the journal is made available online. To register for TOC alerts go to www.jlponline.org/signup.asp.

2) RSS feeds

Really Simple Syndication (RSS) helps you to get alerts on new publication right on your desktop without going to the journal's website. You need a software (e.g. RSSReader, Feed Demon, FeedReader, My Yahoo!, NewsGator and NewzCrawler) to get advantage of this tool. RSS feeds can also be read through FireFox or Microsoft Outlook 2007. Once any of these small (and mostly free) software is installed, add www.jlponline.org/rssfeed.asp as one of the feeds.