

Forensic Characterization of Electrical Contact Lesions in Asian Elephants Using Histopathology and Histochemistry

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Abstract

Background: Suspected electrocution is a recurring cause of mortality in wild Asian elephants (*Elephas maximus*) inhabiting agricultural areas adjacent to forest habitats in Thailand, particularly in regions affected by ongoing human–elephant conflict. Confirmation of electrocution can be challenging, as gross lesions may resemble other types of cutaneous injury. Electrical contact lesions may exhibit characteristic histopathological features, and metal transfer from electrical conductors to the skin may occur during contact. Histochemical techniques targeting collagen alteration and iron deposition may provide additional diagnostic evidence in suspected electrical contact lesions.

Objectives: To characterize the histopathological features of suspected electrical contact lesions in elephants and to assess collagen alterations and iron deposition as supportive forensic evidence of electrocution.

Methods: During 2020–2025, skin samples from burn-like lesions in Asian elephants suspected of electrocution were submitted by field officers from the Department of National Parks, Wildlife and Plant Conservation to the National Institute of Animal Health for histopathological examination to confirm electrical contact injury. Tissue samples from suspected electrical contact sites were fixed in 10% neutral buffered formalin, routinely processed, embedded in paraffin, sectioned, and stained with hematoxylin and eosin for histopathological examination. Masson's trichrome and Prussian blue histochemical stains were performed to assess collagen alterations and detect ferric iron (Fe^{3+}) deposits, respectively.

Results: Gross examination revealed focal burn-like skin lesions at suspected electrical contact sites in all cases ($n = 4$). Histopathological examination revealed consistent epidermal and dermal alterations, including coagulative necrosis of the epidermis, intraepidermal separation, and nuclear streaming. Dermal changes included collagen homogenization and hemorrhage. Histochemical staining with Masson's trichrome staining highlighted collagen alterations characterized by homogenization and loss of normal collagen architecture in the dermis. Prussian blue staining demonstrated ferric iron-positive particulate material within the stratum corneum in all cases.

Conclusion: The combined histopathological and histochemical findings support the diagnosis of electrical contact injury in elephants. The persistence of ferric iron-positive particulate material within the stratum corneum following routine histologic processing is suggestive of metallization associated with electrical contact, rather than superficial contamination. These findings highlight the potential value of histopathology and histochemistry as complementary diagnostic tools in the forensic investigation of suspected elephant electrocution.

Keywords: Asian elephant, Electrocution, Forensic pathology, Electrical contact lesion, Histochemistry, Metallization

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