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## DECIPHERING THE MYSTERIES OF THE NECK: CASE SERIES REVIEW ON DETERMINING THE CAUSE OF DEATH

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### Abstract

**Background:** Forensic pathologists encounter significant challenges during neck examinations owing to anatomical complexities, the presence of overlapping injury patterns, and the critical need to distinguish between injuries sustained before death and those resulting from postmortem changes. These challenges underscore the importance of developing more refined diagnostic techniques to determine the cause of death accurately.

**Methodology:** In this case series, the author describes three cases in which postmortem findings revealed unique characteristics. Case No. 1: The discovery of an unidentified male body near a farm exhibited signs of injury, such as abrasions and muscle-deep lacerations on the fingers, in addition to postmortem changes, such as greenish discoloration. Internal examination revealed diffuse blood extravasation in the neck muscles. Investigative findings at the scene, including disturbed ground and mud-covered electrical equipment, and histopathological findings, led to the determination of electrocution as the cause of death. Case No. 2: A 40-year-old male who died following an alleged assault presented with sutured facial wounds and neck contusions. Internal examination revealed significant neck blood extravasation, a fractured mandible, and tracheal blood accumulation. These

findings indicated death due to blood inhalation secondary to mandibular fracture. Case No. 3: Examination of a 56-year-old male, retrieved from a canal with suspected foul play revealed external antemortem lacerations and abrasions on the face. Internally, contusions on the neck muscles and symptoms consistent with drowning were observed, confirming drowning as the cause of death.

**Discussion:** This case series underscores the complexity of diagnosing neck bleeding in scenarios beyond asphyxiation or traumatic death, highlighting the need for meticulous evaluation to prevent misinterpretation. **Conclusion:** This study emphasizes the importance of enhancing forensic pathology practices through detailed case studies and systematic research, aiming to refine the approach for interpreting neck-related autopsy findings.

### Introduction

Forensic pathologists face notable challenges when examining the neck for two primary reasons. First, anatomical variations and characteristics within the anterior neck region make it difficult to differentiate between artifacts and genuine pathological findings. Second, a wide range of injuries complicate the diagnosis of strangulation and other forms of external neck compression. Hemorrhagic lesions from neck compression often resemble artifacts, posing diagnostic difficulties for pathologists in identifying neck-related injuries (Pollanen MS., 2009; Lambe A., 2008; Abrahams N et al., 2017).

A fundamental principle in forensic medicine posits that autopsies serve as a critical tool for identifying injuries, especially in cases of unnatural deaths such as homicides (Abrahams N et al., 2017). This principle is based on the premise that detecting hemorrhage within the interstitial spaces of tissue indicates that force is applied to the tissues. Simultaneously, the individual was alive, leading to vascular damage and blood leakage into interstitial spaces, manifesting as bruising (Abrahams N et al., 2017; Fieguth A. et al., 2003). However, this assumption does not hold universally, affecting the accuracy of injury diagnosis during autopsies. The reliability of this premise is affected by various factors encountered during postmortem examinations, such as the presence of triticeous cartilage, migratory bruising, postmortem hypostatic hemorrhage, thyroid cartilage anatomy, and injuries from resuscitation. These complexities underscore the importance of meticulous evaluation and expertise in forensic medicine for accurate injury assessment during postmortem examinations (Pollanen M., 2016).

Differentiating between antemortem injuries and postmortem alterations is of

paramount importance. This distinction is vital because of the various changes that occur after death, and accurate differentiation is essential for correctly assessing the cause of death (Warushahennadi J., 2017). This highlights the intricate nature of forensic pathology, where understanding the nuances of injury mechanisms and the effects of postmortem changes is crucial for the accurate determination of death causes. We present three deaths not due to strangulation that all had at least one feature which could be concerning for strangulation with the goal of making forensic pathologists and death investigators aware of these potential artifacts."

### Case Reports:

#### Case No.1: Electrocution Near a Farm

An unidentified male was found near a farm in the prone position, leading to a detailed postmortem analysis. External examination revealed greenish discoloration of the abdomen, various abrasions and contusions across the face and limbs, and significant lacerations on the left-hand fingers, all indicative of antemortem injuries [Fig. 1, 2].



**Figure 1:** Muscle deep lacerations over palmer surface of middle and ring fingers



**Figure 2:** Crescent shape abrasion in front of neck

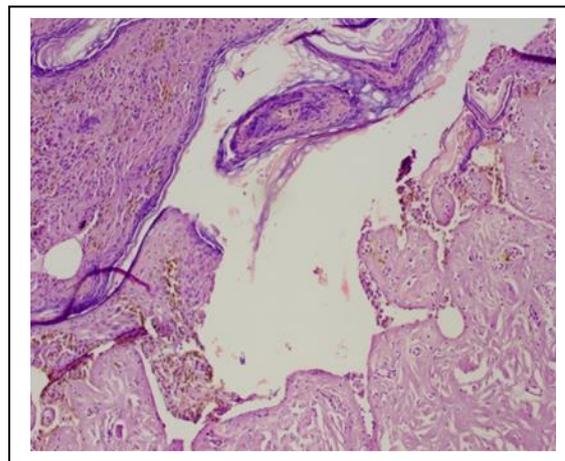
Internally, diffuse blood extravasation was noted in the anterior neck muscles without bone fractures [Fig. 3].



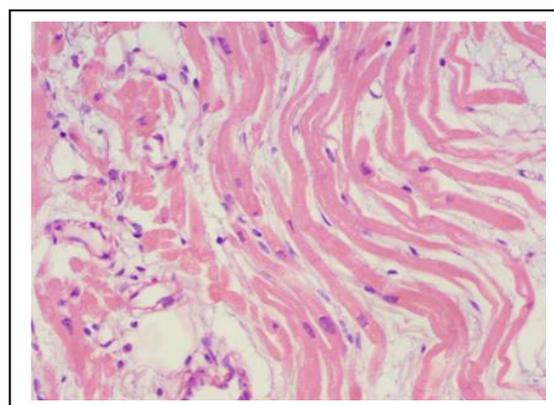
**Figure 3:** Extravasation of blood in front of neck muscles

At the crime scene, evidence suggests the recent removal of electrical installations, hinting at a possible electrocution. Histological examination of the skin lesions showed microblisters with separation of the epidermis and dermis and palisading of the spinous epidermis layer. Heart examination revealed wavy myocardial fibers and squared and elongated

nuclei, and the cause of death was determined to be electrocution [Fig. 4, 5].



**Fig 4:** Histopathological changes in skin in case of electrocution



**figure 5:** Histopathological changes in the heart in case of electrocution

#### Case No. 2: Fatal Assault Post-Mandible Fracture

A 40-year-old male, previously diagnosed with a left-sided mandibular fracture and who had left the hospital against medical advice, was found to have died at home. Initial examination did not reveal any significant external marks. A closer inspection revealed sutured wounds, abrasions, and contusions on the face and neck [Fig. 6].

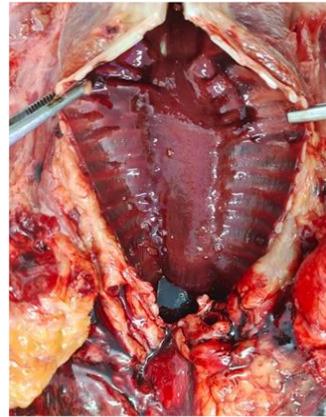


**Fig 6:** Reddish blue contusion over the front and left lateral aspect of the neck

Internal examination revealed extensive blood extravasation in the neck with a clear line of demarcation [Fig. 7] and a linear fracture on the left mandible with surrounding ecchymosis, along with notable tracheal blood accumulation [Fig. 8]



**Fig 7:** Extravasation of blood in front of the neck with a distinct demarcation line



**Figure 8:** Blood in tracheal lumen; above and below the level of bifurcation of trachea

#### Case No. 3: Drowning in a Canal

The body of a 56-year-old male, suspected of foul play by relatives was retrieved from a canal. External examination revealed a well-built individual with postmortem lividity and antemortem injuries including lacerations and abrasions on the face. Internally, contusions and blood extravasation were observed in the neck muscles, and the lungs were edematous, with frothy blood and aquatic plants present in the trachea, indicative of drowning. The cause of death was determined as drowning.

These cases underscore the complexity of forensic examinations, where detailed external and internal analyses coupled with histopathological findings are crucial for accurately determining the causes of death. Each case presents unique challenges and findings that highlight the importance of thorough investigative procedures in forensic pathology.

#### Discussion

In forensic medicine, the core principle is that autopsies can uncover injuries indicative of unnatural death scenarios, such as homicides. These examinations are crucial for identifying hemorrhages within the interstitial tissues, which suggests that force was applied while the individual was still alive. This force can manifest as external abrasions, bruises, or internal vascular damage, leading to blood escaping into the interstitial spaces, commonly

recognized as contusions (**Sharma N., 2018; Bingham-Abujasen K., 2023**). However, it is critical to understand that this principle is not universally applicable and presents significant challenges in accurately diagnosing injuries during autopsies (**Pollanen M., 2016**). Precise differentiation of hemorrhage characteristics is of paramount importance, as it can significantly influence legal outcomes, potentially affecting verdicts in criminal cases.

Pathologists develop their diagnostic acumen through extensive case experience, research, and literature reviews, enabling them to distinguish between genuine injuries and artifacts. This expertise is particularly valuable in evaluating phenomena such as livor mortis (lividity or hypostasis), where blood pools and accumulates in body areas owing to gravity (**Bingham-Abujasen K., 2023**). The distinction between postmortem hypostatic hemorrhages, which may occur due to livor mortis and vascular autolysis, and hemorrhages caused by trauma or mishandling of the body poses a complex challenge during autopsy examinations.

Camp and Hunt's research into the causation of postmortem hypostatic hemorrhages suggests that these hemorrhages result from congestion in venous plexuses and loss of vessel integrity due to autolysis or decomposition. This indicates that a prone position could lead to diffuse and superficial hemorrhages in the anterior neck due to livor mortis, based on the Prinsloo-Gordon hemorrhage phenomenon observed in the posterior pharyngeal wall, attributed to a congested and leaky pharyngoesophageal venous plexus (**Vanezis P., 2001**).

Case 1 exemplifies these concepts in our case series, showing extensive blood extravasation in the anterior neck muscles and multiple neck abrasions. Histopathological examinations also revealed signs of electrocution in skin and heart tissues, corroborated by similar findings in studies by Fineschi et al., Cristina Mondello et al., and Mansueto et al. (**Mondello C., 2018; Fineschi V et al., 2006; Mansueto G et al., 2021**). The case further reveals a scenario involving illegal high-voltage electric wiring by a farm owner, leading to fatality and subsequent illegal body movement to obscure the incident.

The formation, absorption, and visual interpretation of bruises add complexity to forensic analyses, with numerous factors influencing these processes. Distinguishing between true bruising and pseudo-bruising, or migratory bruises, is challenging for forensic pathologists, as both perimortem and postmortem blood extravasations can lead to misinterpretation (**Pollanen MS., 2009**).

Case Number 2 involves a mandibular fracture causing ongoing bleeding, resulting in visible skin discoloration and blood accumulation in neck musculature, mirroring phenomena described by Armin E. Good and Rodney V. Pozderac disease involves hemarthrosis, leading to bruise-like manifestations distant from the injury site (**Good AE., 1977**). In addition to the above findings, the immediate cause of death, inhalation of blood due to mandibular fractures, highlights the critical forensic challenge of identifying the specific mechanisms leading to death within the context of blunt trauma. Our analysis aimed to delineate the forensic pathology perspective, particularly emphasizing diagnostic differentiation from strangulation based on the absence of classical markers, such as intramuscular hemorrhage or hyoid/thyroid cartilage fractures.

In Case 3, the presence of oedematous lungs with frothy blood, a hallmark sign of drowning, alongside aquatic plants within the trachea, directly points to the decedent's inhalation of water and underwater vegetation, a process incompatible with postmortem submersion. Additionally, the pattern and distribution of antemortem injuries, such as lacerations and abrasions on the face, could possibly result from natural interactions with the aquatic environment during the struggle to breathe or from the initial fall into the water rather than indicating directed violent actions. These findings, especially the physiological indicators of drowning in the lungs, substantiate the conclusion that the decedent's death resulted from drowning, reinforcing the necessity to comprehensively consider all evidence in the context of the scene and autopsy results.

These cases collectively emphasize the importance of nuanced and meticulous forensic examinations to accurately interpret injury patterns, differentiate between postmortem changes and antemortem injuries, and understand the implications of these findings in legal contexts.

### Conclusion

This collection of cases conclusively demonstrates that the likelihood of homicide can be effectively ruled out, providing critical insights into the occurrence of bleeding in the anterior and lateral regions of the neck in deaths not caused by asphyxiation or trauma. This observation underscores the importance of meticulous evaluation to prevent the misattribution of compressive neck injuries. It is imperative to proceed with the utmost diligence during the autopsy to ascertain the underlying causes and establish diagnoses accurately. Given the pivotal role of the neck in forensic pathology, there is a persistent challenge in accurately diagnosing cases of strangulation and other forms of neck compression.

### Recommendation

It is crucial to enhance the knowledge within this domain by publishing case studies and series that exemplify the vast array of scenarios presented herein. A methodical examination of these cases is essential to develop a robust, evidence-based approach for interpreting findings related to the neck in autopsy practice.

### Declarations

**Ethics approval-** Ethical approval number IEC/BU/2023/Cr. 30/234/2023 dated 09/08/2023. Institutional Ethics Committee DHR Registration Number- EC/NEW/INST/2021/592

**Consent for publication-** Taken

**Availability of data and material-** All the postmortem examinations of the above-mentioned cases were conducted by the Department of Forensic Medicine & Toxicology, Pramukhswami Medical College

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