H18 The Analysis of Head Injury in the Evaluation of Manner of Death: A Forensic Case Series and a Review of the Literature

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Learning Overview: After attending this presentation, attendees will be able to describe the role of a head injury pattern.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating how head injuries show typical patterns according to the mode of death.

Head injuries are very common in forensic pathology. Injuries are classified by mechanism, morphology, and severity. According to mechanism, the injuries are open or closed. According to morphology, there are concussions, hematomas, contusions, and cerebral hemorrhages. Severity is assessed through the symptoms. In forensic pathology, head injuries are important in determining the cause and manner of death. They may differ in cases of murder, accident, work-related, or natural deaths; the pattern shows typical features according to the manner. Further, in each case, the analysis of head injuries provides useful information. Described herein are the patterns of head injuries that occurred in four forensic cases.

A woman was found murdered. The autopsy showed 20 different open head injuries. Each injury had indented edges with rounded and convex features. The lesions were overlapped, with depressed skull fractures. The morphology of the edges suggested that the perpetrator hit the woman's head repeatedly using a circular metallic tube. This dynamic was confirmed by the murderer.

In the second case, a man of about 50 years of age fell from a height during work. There were multiple bruises on his head. The autopsy showed major head injury with cerebral hemorrhage, subarachnoid hemorrhage, and multiple right frontal-parietal-temporal region fracture lines. The man was not wearing either a helmet or body harness.

In the third case, a man died in a road traffic accident as a passenger. The man was found outside the car with a large head injury and exposure of the brain. Head trauma was characterized by a large parietal fracture and laceration of the skin. The car had a broken window (point of impact), and the encephalon residues were also found on the guardrail. The autopsy showed that the man was not wearing a seat belt.

In the last case, a man was found dead in the countryside. The man had a bruise on the left parietal region, with red lividity on the thorax and neck. The autopsy revealed no fractures nor brain injuries and proved that the man died from heart failure.

According to a literature review, 39% of deaths related to head injuries are accidents, 43% are homicides, and 17% are undetermined. In work-related deaths, head injuries are the most common finding. There are no data about natural deaths.

The review showed that multiple overlapping injuries with subdural hemorrhage and depressed skull fractures are a typical pattern seen in homicide by blunt trauma. Analysis of wound edges is crucial for determining the weapon, while the evidence of skull fractures and brain injury is useful for estimating the strength of the strokes inflicted. The dynamics can be reproduced using experimental models, then compared with the suspects' witnesses.[1,2]

In cases of accidents, it is common to find multiple, extended, comminuted cranial fractures involving the base of the skull, with Le Fort fractures of frontal facial bones. These findings must be compared with the data collected on judicial inspection and by analyzing the role of the victim (driver, passenger, pedestrian). Also in accidents, injuries are crucial for reconstructing the dynamics of the impact.

In work-related deaths, head injuries are, in most cases, a consequence of fatal falls from a height. Therefore, the severity depends on the height. Head injury pattern can prove the lack of adequate safety measures. In the case reported, the autopsy findings proved the worker did not wear a helmet or body harness. The head injury pattern was subsequently reviewed/utilized in court proceedings.

In literature, there are no data about natural deaths. In the case reported, only bruises related to a fall were found, with no signs of cranial fracture or brain injury. In cases of unilateral, single, and minor head injuries, investigating for typical signs of natural events, such as red hypostasis on the neck and thorax, is suggested. Autopsy can solve the doubtful cases and establish the cause of death.

This study underlines that head injuries are relevant forensic evidence. The pattern changes depending on the case, but it shows recurring features depending on the mode of death. Therefore, this study proposes always performing an accurate investigation of the pattern. The circumstantial data and autopsy are necessary for a precise reconstruction of the event.

Reference(s):

1. Wing R., James C. Pediatric head injury and concussion. *Emerg Med Clin North Am*. 2013 Aug;31(3):653-75.
2. Sempere L., Rodríguez-Rodríguez A., Boyero L., Egea-Guerrero J.J. Experimental models in traumatic brain injury: From animal models to *in vitro* assays. *Med Intensiva*. 2018 Jul 25.

Forensic Sciences, Head Injury, Pattern

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