A97 Atypical Skull Injuries and the Biomechanical Continuum

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After attending this presentation, attendees will have an understanding of some limitations to the standard object/weapon-centered classification scheme (sharp force, blunt force, gunshot/high velocity) used in classifying bone trauma.

This presentation will impact the forensic science community by providing a broad interpretive framework for trauma analysis of bone through the examination of examples of atypical injuries of known mechanism whose characteristics contradict or overlap with those usually associated with classic trauma classifications of peri-mortem skeletal fractures.

The goal of trauma analysis in forensic anthropology is to determine the mechanism and timing of bone trauma and to address other related medicolegal problems.[1] By applying principles of biomechanics, bone trauma can often be classified as arising from sharp force, blunt force, or gunshot/high-velocity trauma and in so doing serve an important role in guiding medicolegal death investigations; however, a significant deviation from the expected magnitude or combination of extrinsic factors (e.g., acceleration, surface area, force) involved in fracture production from that which is typically associated with a given mechanism of injury can produce confounding or equivocal wounds. In such instances, an over-reliance on weapon-centric classification can lead to misclassification or over-reaching interpretations and may affect the medicolegal determination of cause and manner of death. Therefore, trauma analysis of skeletal material may be better approached by emphasizing the continuous nature of biomechanical factors that influence wound production.[2,3]

To demonstrate this point, gunshot injuries typically involve high-velocity penetrating injuries with classic entrance/exit defects, beveling, and possibly radiating and concentric fractures; however, in rare circumstances, intermediate targets, unexpected bullet behavior, or similar intervening forces may cause significant deceleration such that a projectile may produce a fracture pattern more typical of blunt force injury. These types of injuries were more commonly seen in the 19th century, but still occur in modern contexts.[4,5] Similarly, blunt-edged objects traveling at sufficiently high velocity are capable of producing internal beveling defects similar to gunshot wounds.[6] This presentation provides four cases of documented injuries that exemplify the biomechanical continuum in that the fracture patterns produced are equivocal, overlap more than one category, or are otherwise atypical of the standard classifications.

Overlapping fracture characteristics or features which "transition" between standard classifications may be observed when objects conveying certain combinations of physical (i.e., size and shape) and dynamic (i.e., velocity) characteristics impact bone. Cases that highlight the problematic nature of applying rigid typology/classification in light of the biomechanical continuum underlying wound production will be presented. While a typological and weapon-centered approach to trauma analysis is often necessary to provide useful information to medicolegal authorities, descriptions of trauma are sufficient when a classification is not forthcoming.[7]

References:

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