H34 Retrospective Study of Skull Fractures Observed Following Terminal Falls

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The goals of this presentation are to review the current literature of skull fracture biomechanics and to evaluate the variation in skull fracture patterns observed in the medical examiner population.

This presentation will impact the forensic science community by increasing the general knowledge of skull fracture types associated with terminal falls.

Skull fractures are common in the medical examiner population. At times, the circumstances surrounding the death are unknown and skull fracture pattern interpretation plays a significant role in the manner of death classification. When faced with a complex skull fracture pattern, pathologists often look to forensic anthropologists for guidance in fracture pattern interpretation.

Recent research has focused on blunt force trauma to the head and associated fractures. For example, Hamel et al. developed a multibody study using finite elemental modeling to identify the parameters that influence the mechanism of skull fractures.[1] They concluded that two fall parameters, impact velocity and impact surface, and two biological parameters, cortical thickness and cortical rigidity, had the greatest influence on the mechanism of skull fractures. Additionally, Kremer and Sauvageau evaluated the relationship between three criteria Hat Brim Line (HBL) rule, side lateralization, and number of scalp lacerations) and the mechanism of injury.[2] Also, they evaluated the predictability of the mechanism of injury by combining the criteria. The authors conducted a six-year retrospective study of autopsy cases with skull fractures. They found that fractures resulting from falls tended to be within or below the HBL, on the right side, and have three or less scalp lacerations. Fractures resulting from homicidal blows tended to be above the HBL, on the left side, and have more than three scalp lacerations. When combining two criteria in favor of a fall, the predictive value of the mechanism was 65.9%. When combining two criteria in favor of a homicidal blow, the predictive value was 100%. The predictive value increased to 83.3% when three criteria in favor of a fall were combined.

Although the research has furthered the understanding of skull fracture dynamics, one feature of a skull fracture is being overlooked: fracture type. In children, fracture type has been used to differentiate between accidental and inflicted trauma.[3] Similar research investigating the correlation between fracture type and cause of injury needs to be performed in adults. As a result, the Harris County Institute of Forensic Sciences conducted a retrospective pilot study of skull fracture types observed in accidental deaths. The study included five years of records.

During the study period, 192 deaths were classified as accidental with fracture listed in the cause of death. Of these, 57 cases were autopsied and 46 cases had skull fractures documented during the autopsy. Thirty cases had skull fractures that resulted from terminal falls at or near a standing height. Reviewing autopsy photographs of these cases, the fracture types were coded as linear in 23 cases and as stellate or comminuted in seven cases. In comparison, 12 cases involved a fall from a significant height, such as a fall from a roof; again using autopsy photographs, ten of these fractures were coded as comminuted and two as linear. The occurrence of skull fracture types for the two groups, standing height falls and significant height falls, was shown to be significantly different using a Mann-Whitney test (p=.000). Although the sample size was small, the results indicate that fracture type may be an important variable in differentiating terminal falls from a standing height and other mechanisms of injury.

References:

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2. Kremer C, Sauvageau A. Discrimination of falls and blows in blunt head trauma: assessment of predictability through combined criteria. *J Forensic Sci* 2009;54(4):923-6.
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