A67 Standardized Descriptive Method for the Anthropological Evaluation of Fractures of the Adult Neurocranium

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The goal of this presentation is to provide case-example illustrations of a novel method developed for the standardized description of adult neurocranial fractures.

This presentation will impact the forensic science community by describing a method that is designed for use by anthropologists in the description of adult neurocranial fractures which circumvents the confounding effects of the inappropriate application of clinical fracture descriptions in the forensic context.

The system is a modification of the system recently presented for use with pediatric cases.[1] The presentation will: (1) describe the method; (2) place the method within the context of the existing skull fracture literature; and; (3) describe a validation study based on the application of the method to forensic casework examined at the Harris County Institute of Forensic Sciences (HCIFS).

Interpretation of head trauma is an important component of the forensic autopsy that benefits from thorough detection, standardized description, and appropriate interpretation of skull fractures. The majority of the literature pertaining to skull fracture is clinically based and thus motivated by the need for effective assessment of both fracture characteristics (type, frequency, location, and mechanics) and context (severity of injury, associated soft tissue damage, and patient prognosis). Much of the data pertaining to adult skull fractures is drawn from studies of traumatic brain injury. This clinical perspective is reflected in the significant array of skull fracture classification systems that exist. Most clinical schema identify some variation of the following fracture categories: simple, complex, compound, comminuted/composite, depressed, basilar, stellate, and diastatic. From a strictly descriptive standpoint, these categories are not mutually exclusive but instead represent overlapping levels of detail in fracture description that are useful in the clinical setting but confound the non-clinical description of fractures in the forensic context. For this reason, application of these schema in the forensic anthropological interpretation of skull fractures, as manifest on the bone itself rather than imaging/associated clinical findings, is inappropriate.

It is argued that forensic anthropological interpretation of adult neurocranial fractures requires a standard classification system that reflects fracture morphology alone; thus, a three-step classification system which conveys increasing detail with each additional step is suggested. The first, and most basic step is the fracture *category* of which four variations exist: simple, complex, comminuted, and hyper-fragmented. The second step describes the fracture *pattern*, e.g., linear, curvilinear, and stellate. The third step adds the fracture *descriptors*, e.g., depressed. Thus, the proposed system utilizes the fracture characteristics that covary with, but are not independent of, the basic fracture categories, as modifiers rather than additional fracture categories.

The proposed schema was applied retrospectively to evaluate its applicability and repeatability. The study sample included all HCIFS adults autopsied between January 1, 2011, and August 15, 2013, and who had the terms "fracture" and "cranium" or "skull" in the cause of death. Thirty-nine cases met the sampling criteria and were included in the study. For each case, four doctoral-level forensic anthropologists examined photographs taken during the autopsy and photographs of processed bone, when available. Each analyst described each fracture following the proposed schema. Intra-observer disagreement was evaluated.

The study was intended to: (1) statistically evaluate the effectiveness of the schema in capturing the variation in neurocranial fractures seen at the HCIFS; and, (2) to identify the potential for inter-observer error in the application of the schema. Forty-four fractures were found in the 39 cases. Application of the method demonstrated that the proposed schema adequately documented fracture variation in each of the cases and validated the effectiveness of the schema in describing fractures of the adult cranial vault. There was 100% agreement between the four anthropologists in the assignment of the fracture category. The fracture patterns assigned to each fracture were also highly consistent among the analysts, with only six of 156 discordant entries (3% error rate) between observers.

This study illustrates the value of the proposed schema for the standardization of the anthropological description of adult neurocranial fractures and the effective distinction of fracture description and clinical implication. The system is adequate for the anthropological classification of the majority of skull fractures observed during medicolegal autopsies of adults.

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