H42 Patterns of Perimortem Fracture From Military Aircraft Crashes

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After attending this presentation, the attendee will understand the patterns of perimortem fractures of the extremities from fatal military aircraft crashes.

This presentation impacts the forensic community by demonstrating how anthropological analyses of perimortem fractures augment traditional inquires of aviation pathology. This research is discussed within the historical context of aviation pathology, while drawing attention to applications of peri- mortem fracture analyses.

This paper presents fracture pattern analysis among the six antimeric long bones; specifically, the frequency of fractured elements, the location of fractures within these elements, and the distribution of fracture types among the elements are evaluated. The authors hypothesize that given various incident parameters, such as aircraft performance power to weight ratios and seating position, the distribution of fracture types and locations among the six antimeric long bones will enable probability statements for differentiating individuals, thereby aiding identification of passengers from multi-seated aircraft by reducing the list of potential identities associated with specific sets of remains. With regard to seating position, it follows that the location of pilots and crew at the time of impact is important to this study. That stated, the particular activities of pilots and/or crew prior to a crash are not certain; undoubtedly, a pilot attempting to egress during decent will experience different fractures than one who remains at the aircraft controls. However, based on historic documentation we feel that the cases used herein include those representing controlled flights into terrain.

The aircraft accidents reported in this study span a 27 year period from 1942 to 1969 and include incidents from World War II, Korean War, and Vietnam War, with the majority of the samples from WWII. Frequency data are made available due to the efforts of the Joint POW/MIA Accounting Command Central Identification Laboratory (JPAC CIL) in fulfillment of the mission to recover and identify deceased U.S. service members. Therefore, the distribution of fractures discussed herein represents what is expected from non-survivor populations. Evidence-based data are recorded from CIL photographs, analytical notes, identification reports, and/or direct observation of skeletal remains. Fracture frequency data are compiled from 32 individually-identified decedents involved in 18 separate aircraft crashes. For every case each long bone of the upper and lower extremities is divided into fifths and a complete inventory of elements by region is recorded as absent, present, or present with at least one perimortem fracture. If a region contains observable perimortem fractures then the fracture type is recorded as comminuted, oblique, transverse, spiral, and/or longitudinal. Prior to fracture analysis, sample bias is assessed since data are derived from archae- ologically recovered remains. Fracture patterns are established by comparing ratios of fracture presence to total presence of elements and element regions.

Recovery frequency of 85% is determined as a ratio of element regions present to total expected for the 32 individuals, suggesting relatively good preservation and recovery for the samples used in this study. Results of frequency tabulation and fracture pattern analysis are described. The frequency of fractures between right and left elements is equable, suggesting no significant difference among right and left elements for this study. Observations between upper and lower extremity fractures for the 32 casualties are consistent with that previously reported (χ^2= 4.370, df = 1, p-value = 0.037) suggesting that the higher frequency of fracture in the lower extremities (0.61) relative to the upper (0.50) is not by chance alone. Interestingly, stratifying data by natural breaks in aircraft performance power-to-weight ratios the overall fracture distribution between aircraft that have a power-to-weight ratio ≤ 0.056 hp lb^{-1} is significantly different from those that have a ratio ≥ 0.15 hp lb^{-1} (χ^2= 4.841, df = 1, p-value = 0.028). Of particular interest however, is the fracture pattern of pilots compared to non-pilots, regardless of aircraft performance. In this study, pilots display a greater frequency of perimortem fracture (0.63) than non-pilots (0.41) for all elements evaluated; and in fact, pilots are expected to display fractures just over two times that of non-pilots (χ^2 = 14.615, df = 1, p-value = 0.000). Based on the distribution of fracture ratios per element region, pilots experienced midshaft fractures with a greater frequency and consistency than non-pilots, suggesting odds of a pilot with a midshaft fracture is just over two times that of non-pilots. The greatest difference between pilots and non-pilots occurs at the tibia midshaft where odds of fracture are nearly four times that of non-pilots. Of all midshaft fractures (n = 75) 45% are comminuted fractures relative to the other four fracture types recorded.

Demonstrated is the biomechanical response of bone to multiple acute forces and the relationship to the forward seating position through comparison of perimortem fracture frequencies of pilots and non-pilots that did not survive their respective crash incidents. Fractures resulting from multiple forces including longitudinal compression and angular and axial forces are typically displayed at the location of greatest load. As evidenced by the data collected in this study the area of greatest load experienced by bones of the extremities is at midshaft. In this study, discernible patterns of perimortem fracture among bones of the extremities emerge through anthro- pological analyses.

Trauma, Perimortem Fracture, Aircraft Crash