H57 Osseous Traumata Caused by a Fall From a Height: A Case Study

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The goal of this presentation is to present a case study concerning the effects of a fall from a height on the skeleton.

This presentation will impact the forensic community and/or humanity by detailing analysis of skeletal remains from an individual who fell from a height.

The remains of an incomplete and fragmentary human skeleton were found in the Grand Canyon at the bottom of a four hundred foot cliff when authorities went into the canyon to recover an unrelated witnessed suicide jumper. At the time, information on sex, age, race, stature, pathology, and trauma was requested. The individual was later identified as a white male, age forty-five, and of European ancestry.

The remains were completely skeletonized and had minimal associated desiccated soft tissue. The skeletal elements were badly fragmented with evidence of carnivore activity and differential exposure to the weather and sun. Only seven cranial fragments and four teeth were recovered. A rough estimate of one to five years was given for elapsed time since death.

The pattern of perimortem trauma in this case, and the location where the remains were found suggest that the individual fell approximately four hundred feet from the cliff edge above. The manner of death, whether accident, suicide, or homicide could not be determined from the skeletal remains. Evidence indicating a fall from a height from the cranium, humeri, ribs, vertebrae, pelvis, femora, and tibiae is discussed in the sections below.

Both humeri sustained injuries that appear to be perimortem in nature. The diaphysis of the left humerus was obliquely fractured in a manner consistent with spiral oblique fractures in fresh bone. Also, the right humeral head was separated from the shaft at the anatomical neck in a clean transverse fracture. Fractures were present at the sternal ends of at least two ribs, and perhaps a third. The trauma to the ribs appears to have occurred in fresh bone because the bone was depressed in a linear fashion, as if it were bent inwards in a “greenstick” type of fracture. Not all of the vertebrae of this individual were recovered. A careful examination of the vertebrae present led to the discovery of one small fracture on the transverse process of the fifth lumbar vertebra. The fracture line is visible and a piece is displaced, but it was not broken off, suggesting that the bone was fractured perimortem.

The pelvis displayed several fractures indicative of impact after free fall. There is a fracture on the left iliac blade that is depressed, suggesting that the fracture was created in green bone. The fracture line itself is depressed and a fragment on the edge of the line is pushed inwards. A fracture is also noted at the edge of the left acetabulum where bone is bent in with a visible fracture line and displaced fragments. The ischial fractures present may or may not be postmortem in nature and cannot be accurately used to support the idea that this individual fell from a height while still alive.

In the femora, fractures requiring a great deal of force were noted. Both the right and left femoral heads were sheared off at the neck. The fractures of the femoral necks are not typical of carnivore damage. Animal activity does affect the proximal and distal ends of long bones, but usually involves chewing, tearing, and gnawing. No tooth marks or signs of gnawing were found at the proximal ends of the femora. The damage is more consistent with perimortem shearing trauma than postmortem damage.

The right tibia was badly fractured longitudinally into at least five pieces. Part of the lateral tibial plateau is cracked longitudinally, which may or may not be perimortem damage. The edge of the medial aspect of the tibial plateau and the medial malleolus on the left tibia appears to be sheared off as well. The right and left fibulae are both fragmentary.

The osseous traumata visible in this individual found at the bottom of the Grand Canyon suggests that he either jumped or fell four hundred feet, impacted a slope, and then probably rolled or bounced for an unknown distance. Primary impact was likely with the feet, but secondary impacts probably occurred as his body continued down slope from the primary impact point. The shearing fractures of both femoral heads from the necks and the longitudinal fracturing of the tibiae strongly support the hypothesis that the individual landed feet first. However, in the vertebrae that were present, there were no compression fractures, which are common in feet and buttock primary impacts. Furthermore, few tarsals and metatarsals were recovered, and those that were did not show any signs of impact trauma. The fact that very little of the cranium was recovered suggests that it was fractured into many pieces either from direct contact with the ground surface in a secondary impact, or from the force of the vertebral column bursting through the base of the skull upon primary feet impact. Fragments of the occipital were not found, making it impossible to determine if a ring fracture was present. The remaining fractures of the humeri, ribs, pelvis, and vertebrae can be attributed to secondary impacts after the body struck the slope initially at a depth of approximately four hundred feet and continued to bounce further down slope.

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