H39 The Influence of Behavior on Free Fall Injury Patterns: Possible Implications for Forensic Anthropological Investigations

Angi M. Christensen, MA, Department of Anthropology, The University of Tennessee, 250 South Stadium Hall, Knoxville, TN*

The goal of this presentation is to present the forensic community the results of an investigation into the influence of behavioral response (or lack thereof) on skeletal injury patterns in cases of falls from heights.

Victims of falls from heights tend to sustain a pattern of injury that is predictably different from injuries associated with other types of blunt trauma. Many studies have examined resulting injury patterns (particularly skeletal fractures) in attempts to reveal relationships between these patterns and various other factors such as body position, height of the fall, age, pre-existing medical conditions, etc. However, few have pondered the possibility of an association between skeletal injury pattern and cause or motivation of the fall.

Motivation or circumstances of a fall from a height can be a key piece of information in forensic contexts where it may be useful in assessing whether a victim's death resulted from a suicide, an accidental fall, a homicidal push, or whether death occurred prior to the fall. The patterns of skeletal injury may be of particular importance in cases where bodies are not discovered until some later time and soft tissue injuries are no longer observable, leaving a skeletal trauma analysis the only means of arriving at clues regarding the manner of death.

A key difference in these cases is the mental state of the deceased before and during the fall and their resulting behavioral response (or lack thereof). Victims of accidental falls and homicidal pushes do not consciously want the falling action to occur and will spontaneously, as a defense mechanism, attempt to interfere with and manipulate the physical forces acting upon them. They will attempt to protect their heads from impact with the ground, and/or extend appendages to brace themselves for impact. Suicidal persons, on the other hand, initiate purposeful action and may actually enjoy and welcome the fall, resulting in less preparation for impact. Studies indicate, in fact, that suicidal, psychotic, and inebriated individuals (who have been termed "abnormally relaxed") have a disproportionate survival rate among free falls of extreme distances as a result of their relaxed state. Similarly, severely incapacitated individuals or dead bodies (the extreme cases of "abnormally relaxed") would have no defensive response to the fall and impending impact. They are thus subject exclusively to the physical forces acting upon them.

This study examines the effect of these mechanical forces on the human body form in free fall in the absence of interference by human behavioral response. The hypothesis is that "abnormally relaxed" individuals will fall in a predictably different fashion than alert individuals due to the absence of a behavioral defense response, and that this will result in a distinct pattern of orientation at impact. Indeed, a review of case studies of free fall injuries indicated that most falls from heights result in lower extremity, pelvic and vertebral fractures, due largely to the fact victims of accidental falls tend to land in a feet-first orientation, a pattern that is notably different from studies of suicidal jumpers in which horizontal impacts and associated thoracic injuries and rib fractures are predominant. The investigation was undertaken by observing experimental free fall drops of an anthropomorphic dummy (representing the "abnormally relaxed" state) from a height of about 75 feet. Nine total drops were performed, using three different starting orientations; three falls began in a feet-first orientation, three began in a horizontal orientation, and three began in a headfirst orientation. All nine drops resulted in impact orientations that were roughly horizontal. Even over this relatively short fall, there was a distinct tendency for the dummy to rotate toward (or maintain) a horizontal orientation.

These results suggest that in the absence of a behavioral response, physical laws naturally orient the human form horizontally, probably because this is more stable position, maximizing drag forces. In light of these results, a review of a case study of a possible suicidal jump from 100 feet investigated by the University of Tennessee Forensic Anthropology Center was reanalyzed in an attempt to elucidate the possible circumstances of the fall. The pattern of skeletal injuries, which were primarily thoracic and axial, suggests a victim in a relaxed state at the time of the fall, lending support to suspicions that the victim was suicidal. The pattern of feet first injuries so pronounced in case studies could therefore be a result of the instinctive reaction of conscious humans to attempt to prepare for or resist impact. This information could be applied in forensic contexts by providing potential insight into the circumstances of a fall, particularly where skeletal fracture patterns are among the only clues.

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 ** Presenting Author*