H41 Differentiating Impact and Heat-Related Skeletal Fractures From a Small Plane Crash

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After attending this presentation, attendees will have a better understanding of skeletal trauma resulting from thermal damage and/or a rapid deceleration event.

This presentation will impact the forensic science community by outlining the differences between skeletal fractures induced by heat and those related to rapid deceleration events. In a medicolegal context, it is important to distinguish the cause of fractures encountered during autopsy. Because heat-related and peri-mortem fractures can be difficult to distinguish, this information will serve to better inform the medicolegal community and increase the accuracy and speed of trauma identification in similar scenarios.

To illustrate differences in skeletal trauma sustained from fire or impact events, this presentation will present a case study of remains recovered from a plane crash. In November 2016, a fixed-wing air ambulance carrying four passengers crashed in Elko, NV. The plane subsequently caught fire, leading to both impact fracturing of the skeletal remains as well as burning and heat-related fractures. The main goal of this investigation was to identify the respective trauma patterns on each decedent and attribute them to the impact or to thermal causes.

Fracture type, location, and cause were documented on each individual and digital photographs were taken in the medical examiner setting, without extensive anthropological preparation. The majority of the fractures were found to result from the impact as evinced by unburned tissue surrounding the trauma sites. Further, these fractures were in the mid-shaft of many long bones, which is also commonly seen in high-velocity impact trauma. Heat-related fractures were seen in areas of charring and burning of the skeletal and soft tissues. The standard pugilistic posture, so-named due to its similarity to a boxer's stance, was observed in two individuals, with associated heat fractures of the bones of the hand and wrist. Pugilistic posture results from protein coagulation and shortening of the muscle fibers in the extremities and torso due to thermal effect; thermal fractures are also commonly present in the extremities, and these fractures are due to heat rather than occurring as a result of any mechanical force of the thermal contracture of the muscles. Several fractures exhibit limited charring (i.e., evidence of thermal damage does not extend across the entirety of the fractured surface) and are likely related to the impact event.

Overall, fractures that exhibit no or incomplete heat damage (i.e., lack charring and/or calcination) can be related to other forces (in this case, a rapid deceleration event). Because heat fractures lack the kinetic energy required to extend into unburned areas, any fracture located in an area unaffected by thermal change can be attributed to the impact event. Fractures related to fire exposure will exhibit fire damage; heat fractures result when heat breaks down the connective tissue, thereby exposing more of the bone to thermal destruction.[1] When fractures exhibit full or incomplete charring/calcination, careful examination is required to determine whether they are due to heat exposure or were sustained from other forces before exposure to the fire. The location and suspected cause of trauma can aid in making this determination, as this case study highlights. Furthermore, such examinations can be made in the typical medical examiner's office setting with some forethought to consider the differential diagnosis for these types of trauma.

This report presents a case study of four individuals from a plane crash and outlines the impact and heat-related skeletal trauma. The means to differentiate the two is also discussed, which includes a careful consideration of the morphology of the fractures and the unique events of the case.

Reference(s):

1. Symes, Steven A., Christopher W. Rainwater, Erin N. Chapman, Desina R. Gipson, and Andrea L. Piper. Patterned Thermal Destruction in a Forensic Setting. Chap. 2 In *The Analysis of Burned Human Remains*, edited by Christopher W. Schmidt and Steven A. Symes, 17-59. San Diego, CA: Elsevier, 2015.

Thermal Fractures, Blunt Force Injury, Plane Crash

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