H167 Heat-Induced Changes in Charred Human Remains

Antonina Argo, PhD, University of Palermo, Palermo 90100, ITALY; Giuseppe F. Lo Re, MD, University of Palermo, Palermo, ITALY; Donatella Piscionieri, University of Palermo, Palermo 90127, ITALY; Ginevra Malta, MD, University of Palermo, Palermo 90100, ITALY; Alessia Vinci, MD, University of Palermo, Palermo 90127, ITALY; Agata Crapanzano, MD, University of Palermo, Palermo 90100, ITALY; Sergio Salerno, University of Palermo, Palermo 90100, ITALY*

Learning Overview: After attending this presentation, attendees will better understand how heat induces changes on human charred bodies and the possibility of distinguishing peri-mortem and postmortem bone fractures, taphonomic modification, and heat-induced bone changes by macroscopic observation and Postmortem Computed Tomography (PMCT).

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing results of an observed case (January 2019) of charred human remains in an area (prolonged exposure of the human body to fire) that is very challenging to distinguish peri- mortem and postmortem fractures and by interpreting taphonomic modification and heat-induced bone changes.

Burned human remains in crime scenes are typically difficult to identify, recover, and manage.[1] All of the burned material at the scene, including body tissues, is often modified to a similar appearance. In particular, even though bone is certainly the most resistant to high-temperature exposure, at temperatures above 700°C, it will undergo complete combustion of the organic substances with incineration and recrystallization of the inorganic matter; this phenomenon is termed "calcination." A charred or calcinated bone is known to be more fragile. The added peri-mortem or postmortem fracture lesion, fragmentation, and bone loss resulting from recovery techniques adds to the difficult task of autopsy and laboratory analysis of burned human remains. This is especially problematic for bone trauma analysis, as its most immediate goal is to distinguish peri-mortem trauma from postmortem alterations and shape lesions from heat-related traumatic lesions. With regard to burning-related changes such as shrinkage, the literature reports that low temperatures (i.e., less than 800°C) of minimal duration produce minimal shrinkage.[2] The characteristics of severely heat-damaged areas of tissue are usually obvious and well-known in forensic practice, but fractures may be challenging to interpret. In cases involving extreme exposure to fire, burned skeletal elements typically exhibit severe fragmentation and fracturing, limiting interpretation and distinction of peri-mortem and postmortem trauma.

In this study, a criminal case occurring on January 2019 and classified as Glassman and Crow level 4/5 male human remains is presented.[3] Color changes, fracturing pattern, bending, shortening, and cracking of all recovered bones by both visual examination and PMCT were analyzed. PMTC allowed for better recognition of cortical thinning and loss of matter, smoothing of the sharp edges, assessment of various alterations of bone marrow density associated with the presence of air, and recognition of thumbnail fractures as an exclusive sign of the burning of bones with soft tissues.[4] Preliminary statistical testing found a significant relationship (p-value <0.005) between the supposed temperature of combustion of analyzed bones within the Shipman color scale and the Hounsfield Units (HU) of bones on PMCT scan. Taphonomic modifications of the human remains were verified after four months and under controlled conditions before burial and are here illustrated.

Reference(s):

1. Ubelaker D. The forensic evaluation of burned skeletal remains: A synthesis. *For Sci Int* (2009)1-5.
2. Thompson T.J.U. Heat-induced dimensional changes in bone and their consequences for forensic anthropology. *J Forensic Sci* 2005;50(5):1–8.
3. Glassmann D.M., Crow R.M. Standardization Model for Describing the Extent of Burn Injury to Human Remains. *J Forensic Sci* 1996 (41): pp. 152-154.
4. Gonçalves D., Thompson T.J.U., Cunha E. Implications of heat-induced changes in bone on the interpretation of funerary behaviour and practice. *J Arch Sci* 2011 (38): 1308e1313.

Charred Body, Heat Fractures, Incineration

*Presenting Author