H116 The Burning Question: A Case Analysis of Peri-Mortem Trauma vs. Post Fire Damage

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After this presentation, attendees will be able to: (1) observe the progression of the pugilistic posture in remains exhibiting perimortem trauma, (2) identify the characteristic features that may indicate pre- existing blunt force trauma in burned long bones, and (3) identify the important points of analysis when investigating perimortem trauma in burned remains.

This presentation will impact the forensic community by outlining points of analysis for the investigation of blunt force trauma to burned remains that will positively assist anthropologists in the correct identification of pre-fire blunt force trauma.

Correctly recognizing and identifying pre-existing perimortem trauma in burned human remains can be challenging especially when soft tissues and bone are destroyed. Despite the damage, it is critical to remember that the distinct characteristics of perimortem trauma can and do survive varying degrees of thermal destruction. Forensic anthropologists must work to correctly separate pre-fire perimortem trauma from thermal damages caused both during and after fire processes. The ability to do these tasks successfully may be compromised by transport of remains to forensic facilities during which time the friability of remains can lead to dramatic fragmentation. Using a recently adjudicated case and a recent case experiment, this presentation will investigate the telltale signs of pre-fire blunt force trauma.

During November of 2007, the Forensic Osteological Investigation Laboratory at the University of California Santa Cruz was called in for blunt force trauma analysis of burned human remains. Of specific concern was the timing of a fracture to the right ulna associated with extensive thermal damage. The posterior portion of the ulnar shaft was completely destroyed and the remaining anterior mid-shaft demonstrated a fracture that extended into unburned bone. In this case, the ulna was analyzed for several categories critical to trauma timing:

1. Fracture Refit
2. Direction of Force
3. Fracture Margin Deformation
4. Color Change

During analysis of these categories, several important features were noted. First, no disarticulation artifacts were noted which suggested that any pre-fire blunt force trauma to the body occurred while the bones were in anatomical relation to each other. Given this fact, the fracture suggested a direction of impact initiating within the interosseous crest which would have been difficult to sustain prior to burning. Second, microscopic analysis of the fracture indicated a close refit of the two fractured sections. Third, the fracture margins lacked deformation which contributed to their close reapproximation. In addition, the changes in coloration due to the thermal damage passed over the fracture line and did not extend into the fractured surface. Given the sum of these determinations it was determined that the defect may have been sustained after the fire due to the fragility of the materials.

Shortly after the completion of the case trial, the opportunity arose to analyze a similar situation experimentally. In June of 2008, the San Luis Obispo country Fire Science Training Program held a forensic fire death investigation course. The course utilized in-class training and burn exercises to teach fire investigators proper fire death investigation techniques. Burn scene 4 consisted of a single adult male cadaver to which perimortem blunt force trauma was delivered to the left radius and left tibia. The fractures were retained completely within the tissue. The burn was recorded via video and thermocoupler for data consistency.

During the course of the burn, the powerful contraction of the arm muscles caused the left radius to pull apart like a hinge, resulting in a stacking of the fractured ends. The complete and unfractured ulna eventually lost articulation with the radial fragments. In the lower limbs, both feet and muscles of the legs flexed completely into the pugilistic posture despite the complete fracture of the left tibia. The right and left distal tibia along with the feet were highly fragmented upon completion of the fire.

Upon examination of the radius it was noted that:

1. If a burned body in the pugilistic pose also shows hinging at a fracture site in the forearm, pre-fire trauma is indicated.
2. Both fractured ends of the radius demonstrated thermal damage and warping and, as a result, the refit was poor.
3. The thermal damage present on the fracture margin extended into the fracture as a result of its exposure to heat from the pugilistic movement.

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4. The direction of force required to cause a pre-fire fracture could be readily interpreted by anatomical association of the bones.

This experimental situation reaffirmed the importance of analyzing areas of suspected blunt force trauma in burned remains for quality of fracture refit, suspected direction of force, fracture margin deformation, color change and, if possible, the position of bones and soft tissue following the pugilistic posture. Utilizing these categories as points of analysis during the investigation of blunt force trauma to burned remains will positively assist anthropologists in the correct identification of pre- fire blunt force trauma.

Fire, Blunt Force Trauma, Trauma Timing

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