H95 Microscopic and Macroscopic Changes to Peri-Mortem Pediatric Trauma Following Burial

Donna C. Boyd, PhD, Radford University, Forensic Science Institute, PO Box 6939, Radford, VA 24142; Cliff Boyd, PhD, and Lucy A. Hochstein, BS, Radford University, Department of Anthropological Sciences, Radford, VA 24142*

The goal of this presentation is to examine the effect of burial on peri-mortem (blunt force and sharp/blunt force) pediatric trauma. This is accomplished by documenting taphonomic changes in the microscopic and macroscopic signatures of traumatized bone in a sample of frozen stillborn pigs undergoing trauma immediately after thawing and burial immediately following trauma. After attending this presentation, attendees will have a clearer understanding of the microscopic and macroscopic temporal changes affecting traumatized subadult remains undergoing burial.

This presentation will impact the forensic science community by enhancing attendee's ability to recognize and interpret peri-mortem trauma in remains subjected to extended burial and the ability to differentiate this trauma from postmortem damage.

This poster is the first in a series of research projects exploring the relationship between time and the microscopic and macroscopic signatures of pediatric trauma. This study examines the effects of extended burial on subadult remains undergoing peri-mortem trauma. SWGANTH guidelines for trauma analysis (www.swganth.org) have called attention to the need for great caution when identifying peri-mortem blunt and sharp force trauma altered by postmortem processes.[1] This characterization is important not only for understanding the effects of taphonomic variables on peri-mortem trauma, but for differentiating peri-mortem and postmortem processes. A previous study by Calce and Rogers found significant alterations in peri-mortem (blunt force) trauma signatures in adult pig skulls in a surface environment in Canada over a period of 12 months, primarily due to the freeze/thaw cycle of this region.[2] The effects of a varied postmortem environment (e.g., burial rather than surface, more temperate climates) on peri-mortem trauma are not known, particularly with regard to subadult remains.

The current study examines the effect of burial over extended periods of time on peri-mortem blunt force and blunt/sharp force traumatized subadult remains. Eleven (unprocessed) stillborn pigs (*Sus scrofa*), frozen at death, were used in the study. Eight of the 11 pigs were subjected to trauma after thawing for 24 hours. Four of these eight pigs underwent blunt force trauma by means of a standardized drop-force mechanism using a concrete cylinder weighing 1,109g. Pigs were placed on a hard substrate (a metal plate which measured impact force) and impacted by the concrete cylinder on both their left and right sides. Right side impacts (two per pig—one focused on the lateral cranium, the other, the lateral shoulder) were delivered via a drop mechanism through a stabilized 50cm long PVC pipe. Similarly, two impacts on the same areas (cranium, shoulder) on the left side were dropped through a 108cm long PVC pipe. The remaining four traumatized pigs were similarly treated, although the impact tool was a sharpened steel wedge (simulating both sharp and blunt force trauma) weighing 2,100g. The final three pigs underwent no trauma.

Within 24 hours after trauma, nine of the eleven pigs (both traumatized and non-traumatized) were individually buried supine in 40cm deep burial pits at a decay facility in the spring season. After four months, six pigs (representing all three treatment categories) were exhumed; after seven months, the remaining three pigs (again, representing all three treatment categories) were exhumed. All exhumed pigs were skeletonized. The final two pigs (one traumatized with blunt force trauma, the other with blunt/sharp force trauma) were not buried, but processed immediately, serving as controls.

Comparisons were made across the buried and non-buried, traumatized and non-traumatized bone by means of a Keyence VHX 1000 Microscope (using 5 – 50x and 20 – 200x lenses) as well as through visual examination. Variables examined included: number, type, pattern, and dimensions of fractures and fracture lines, fracture surface morphology (e.g., smooth vs. jagged) and angle (e.g., obtuse, right), presence of color differential, hematoma staining, hinging, and inbending/outbending.

Although observed taphonomic damage included microfractures, root etchings, erosion, and split and frayed bone ends, bone samples from pigs undergoing burial after four and seven months retained the characteristic signatures of peri-mortem blunt force trauma, including presence of identifiable inbending/outbending, hinging, radiating fracture lines, and sharp, irregular fracture outlines. Analysis of samples under light microscopy enhanced the identification of these signatures, particularly in samples buried for seven months. Low power magnification of fracture outlines in the extended (seven month) buried samples revealed feathering and serration of fracture edges, making their edges more irregular compared to the non-buried samples (although still recognizable as peri-mortem fractures). Similarly, pigs with blunt force/sharp force trauma retained characteristic signatures of this trauma after seven months of burial.

These comparisons suggest that although microscopic and macroscopic alteration of bone occurs after periods of extended burial, characteristic signatures of blunt force and blunt/sharp force pediatric trauma may not be erased. It is recommended that light microscopy be utilized to examine subadult bone suspected of peri-mortem trauma.

References:

1. Scientific Working Group for Forensic Anthropology (SWGANTH). www.swganth.org

2. Calce SE, Rogers TL. Taphonomic changes to blunt force trauma: a preliminary study. J Forensic Sci 2007;52(3):519-527.

Pediatric Peri-Mortem Trauma, Blunt/Sharp Force Trauma, Burial