



### **G107 Histopathology of Antemortem Infant Bone Fractures: Estimation of Time Since Insult**

*Murray K. Marks, PhD\*, University of Tennessee, Department of Anthropology, 250 South Stadium Hall, Knoxville, TN 37996-0720; and Darinka X. Mileusnic, MD, PhD, Regional Forensic Center, University of Tennessee Medical Center, 1924 Alcoa Highway, Knoxville, TN 37920*

After attending this presentation, attendees will understand the gross, radiologic and histological signatures of antemortem (chronic) and perimortem (acute) infant bone fractures associated with child abuse and apply a general timetable to better estimate “time since insult” for wounds.

This presentation will impact the forensic community and/or humanity by providing a means of accurately dating antemortem fracture times, the pathologist and investigating team serving the pathologist can better pinpoint the association of a victim to suspect. This association (or lack thereof) will provide a date line to when wounds may have been received prior to death and help establish a history and pattern of abuse.

Autopsy protocols that allow only macroscopic and radiological evidence fail to provide adequate information about wound diagnosis and time since insult. The obvious importance of recognizing and evaluating evidence of this violence in cases of suspected child abuse is necessary to gain an appreciation a clear understanding of vulnerable bone, fracture site biomechanics and wound healing processes crucial to causation and response. Klotzbach and coworkers (2003) first qualified the radiological and histological signatures relevant to “time since insult” indicators and this research follows that protocol and the procedures of Marks and coworkers (2005) by expanding those diagnostic criteria of for microscopically qualifying and quantifying osseous apposition rates at various postmortem intervals. The rich cellular osteogenic environment characteristic of growing bone demonstrates a unique response when compared with static adult bone, regardless of location.

Twenty antemortem “healing” and five perimortem occult (hidden) and acute fractures from ribs and various appendicular bones from four infant victims were radiographically and histologically assessed for degree of bony response. The specimens were seized at autopsy and represent various stages of healing. All were prepared as undecalcified dry thin sections using normal petrographic methods. Both dissecting and light microscopy and SEM were utilized to document, diagnose/qualify and quantify defects.

Longitudinal and cross sections taken through wound sites reveal telltale structural remodeling correlating to chronology. These include the location and degree of woven “blastic” bone proliferation during conversion and obliteration of the comminuted byproducts of the hematoma soon after trauma, subsequent manifestation of the transformation of the initial solid callus into bone and finally, full mineralization and “clastic” remodeling of the callus. Besides recognition of these qualitative events, the ability to recognize, document and radiograph the wound at autopsy are described with a method for harvesting, processing for histology and the manner of embedding and sectioning for light and scanning electron microscopy. Finally, while validation of these results was performed using light and SEM, utilization is made by dissecting microscopy.

Like previous research, this study demonstrated a detailed continuum of bone healing in rib and diaphyseal fracture calluses and among diaphyseal surface woven bone proliferation. These data may imply one of three isolated or correlated scenarios: differential inter-bone response to similar forces causing breakage/trauma, differential wounding forces or chronological specificity in wound appearance.

**Histology, Child Abuse, Bone Fracture**