A138 Evaluating Non-Accidental Injury and Comorbidity in Elderly Decedents Through Macroscopic and Microscopic Patterning of Fracture and Fracture Repair

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Learning Overview: The goal of this presentation is to investigate patterning in fracture and fracture repair in elderly decedents suspected of Non-Accidental Injury (NAI). Antemortem and acute fractures from elderly individuals with suspected NAI are macroscopically and microscopically compared to enhance assessments of diagnostic fracture patterns and fracture healing typical of fatal elder abuse and neglect.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing a greater understanding of a number of key comorbidity factors influencing fracture pattern and fracture healing in the elderly. This will ultimately provide evidence (and strengthen court testimony) relating to the determination of accidental vs. non-accidental etiology and timing for fractures in forensic death investigations involving suspicions of elderly abuse and neglect.

Research regarding fracture pattern and fracture repair has not commonly been applied to investigations of suspicious elderly deaths. As with suspicious pediatric deaths, diagnoses of elderly NAI typically rely on fracture type, fracture distribution pattern, evidence of repetitive injury, and inconsistencies between injury pattern and the reported traumatic event.[1] For the elderly, suspicious fracture patterns include long bone, thoracic, and maxillofacial fractures, derived from hitting, grasping, or forcibly restraining these regions.[2,3] However, unlike pediatric NAI determinations, a number of comorbidity factors influence and potentially confuse or conflate NAI in the elderly, leading to difficulty in adjudicating these cases in a forensic setting. Although it is widely recognized, for example, that age-related osteoporosis can significantly increase risk for fracture and post-fracture mortality as well as delay the fracture healing process, the influence of this and other age-related factors on elderly skeletal fracture has not been fully described or documented from a forensic anthropological perspective.[4]

This study presents microscopic and macroscopic evidence for fracture pattern, fracture repair, and factors influencing fracture repair in bone derived from four Radford University Forensic Science Institute (RUFSI) and District of Columbia Office of Chief Medical Examiner (DC OCME) elderly decedents exhibiting suspected NAI. The decedents (both male and female) range in age from 62 to 81 years and exhibit a total of 61 fractures. These fractures are documented through case reports as well as more than 650 micrographs depicting the progression of bone healing and age-related bone disease. These data allow investigation of fracture patterning and repair progression in elderly bone.

Results support the patterning of injury in elderly NAI—the elderly decedents examined here exhibit injuries primarily to their thorax (ribs) and appendages; compromised, delayed, and non-union of antemortem fractures are common and relate to a bone model of anabolic osteoblastic deficiency in the elderly skeleton.[1] Osteoporosis, osteomalacia, and other age-related pathologies are observed as comorbidity factors affecting bone fracture, healing, and post-fracture mortality. Observed fractures differ significantly in their healing morphology, process, and timetable compared to adult and pediatric fractures; for this reason, estimates of time since injury for elderly fractures using current adult fracture stages are inaccurate.[1] Fracture morphology is often indistinguishable across accidental and non-accidental as well as abuse and neglect etiologies; therefore, a consideration of injury patterning, repetition, and context is critical for differential diagnoses of elderly abuse and neglect. Microscopic evaluation of bone fracture morphology is recommended as an integral method for evaluation of these cases.

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Non-Accidental Injury, Elder Abuse, Elder Neglect