



G106 Sensitivity of Autopsy and Radiological Examination in Detecting Bone Fractures in an Animal Model: Implications for the Assessment of Fatal Child Physical Abuse

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After attending this presentation, attendees will come to realize the limits of the radiological CT scan and autopsy assessment in the detection of antemortem bone fractures in cases of fatal child abuse, and that direct osteological assessment of certain anatomical areas (particularly the rib cage) is advisable.

This presentation will impact the forensic community and/or humanity by demonstrating how the osteological assessment of certain anatomic areas upon autopsy of infants is advisable, since radiology, autopsy, and CT scans may miss fractures.

Skeletal injuries are often strong indicators of child abuse and their detection is crucial. Regardless of whether one is referring to the living or the dead, bone fractures are perhaps the most important and problematic issue as far as detectability is concerned. According to some authors, skeletal injuries occur in 36-50% of abused children. Whereas external and internal soft tissue traumatic injuries will eventually show up at a thorough clinical examination or at the autopsy table, the presence of bone fractures whose distribution, number and age are crucial is not easy to detect, particularly if very recent or if inflicted in the circumstances of a lethal event and therefore just barely antemortem. In cases in which the child dies immediately after infliction of trauma, the signs may consist of very subtle soft tissue lesions and especially bone fractures – the latter being at times, particularly difficult to detect when healing processes (and therefore callus formation) have not taken place. Furthermore, hemorrhaging of soft tissues may be slight and barely visible upon autopsy, particularly in the paravertebral and posterior vertebral regions, or may be hidden by initial decomposition processes. Thus autopsy and radiological assessment are crucial.

However it is not really known how sensitive such procedures are. Although several studies have been performed, little research has been done on the actual sensitivity of radiology, CT scan, and autopsy on control cases. In order to do this in fact, it is necessary to verify, after radiological assessment and autopsy, all fractures, which are actually present on the bone by studying the cleaned skeleton.

The aim of this study was to compare the sensitivity of three diagnostic approaches of autopsy, traditional (conventional) radiology, and computed tomography on “battered” piglets, in order to verify the sensitivity of each method, with respect to the true number of bone fractures assessed once the piglet was skeletonized (osteological control).

Four newborn cadaver piglets that had died from natural causes were severely beaten postmortem in every district of the body. Traditional radiography, computed tomography (CT) and autopsy were performed. The piglet was then macerated until skeletonized and the number of all fractures present recorded (osteological control).

On the cranium, traditional radiology revealed only 35% circa of actual fractures, autopsy detected only 31% ($P < 0.01$ for both comparisons vs. osteological control), whereas CT imaging detected all fractures actually present. For ribs, radiology detected only 47% of all fractures present, and autopsy 65% circa ($P > 0.05$ for both comparisons vs. osteological control), while CT scans detected 34% ($P < 0.01$).

In suspected cases of fatal child abuse, the authors suggest that the bones of specific districts be directly analyzed either at autopsy or by collecting specific diagnostic sites, such as parts of the rib cage, and subjecting them to maceration. The removed areas could be replaced with artificial material for cosmetic purposes. These findings stress the importance of combined radiological, CT scan, autopsy, and osteological survey in the detection of perimortem bone fractures. This study confirms the possibly low sensitivity of autopsy and radiological analysis particularly in the detection of hairline fractures of head and thoracic osseous elements if fractures are perimortem and show no healing. According to the authors, in cases of suspected fatal child physical abuse, the bones of specific anatomic regions should be directly analyzed.

Child Physical Abuse, Bone Fractures, Radiology