H110 An Analysis of Skeletal Trauma in Suspected Child Abuse Fatalities: A Procedure Involving Radiology, Pathology, Histology, and Anthropology

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After attending this presentation, attendees will have a better understanding of the procedures for the analysis of skeletal fractures associated with child abuse cases.

This presentation will impact the forensic science community by describing a multidisciplinary approach to the interpretation of skeletal trauma in child abuse cases.

Thorough documentation and analysis of fractures is critical for the investigation of suspected child abuse fatalities. This presentation details a multidisciplinary procedure involving radiology, pathology, histology, and anthropology for the documentation, analysis, and interpretation of skeletal fractures.

The forensic pathologist has the ultimate responsibility for evaluating all the different pieces of evidence when making his/her eventual determination of cause and manner of death. In addition to the findings at autopsy, the forensic pathologist will also benefit from findings provided through radiology, histology, and anthropology. These modalities can play critical roles in the final certification of pediatric deaths and will also be useful in criminal proceedings if the case is deemed a homicide.

Radiography is a critical first step in the assessment of skeletal fractures. Antemortem radiographic studies may be available from a hospital and will be of obvious importance to the forensic pathologist. A postmortem series should also be completed prior to autopsy. At a minimum, standard two-dimensional X-ray images should be completed, but high-resolution Computed Tomography (CT) scans can also be extremely useful. Any skeletal specimens removed at autopsy should be re-radiographed as visualization of fractures and associated healing (if present) will be improved. In some instances, it may be helpful to have a radiologist interpret the images, especially regarding fractures in various stages of healing.

During autopsy, the forensic pathologist will document and photograph fractures, sites of hemorrhage, and vital reaction. Areas of fracture (or suspected fracture) are removed during autopsy for additional studies, including histology and anthropology. As noted above, it is advantageous to also take radiographs of the harvested specimens prior to initiating any additional examinations.

In order to allow both histological and anthropological analyses to be completed, a sampling procedure has been developed in which "windows" are cut through the fracture locations. It has been found that a hand-held rotary tool with a diamond blade allows for precise sections to be removed through fracture locations. Cutting a window through the fracture allows for the small section to be decalcified and slide mounted for histological evaluation while the larger section can be submitted for maceration and gross anthropological analysis. Through these studies, it is possible to document whether the fractures are acute, subacute, or show remote stages of healing.

The procedure outlined above is similar to recommendations made by Andrew Baker in the 2013 version of his excellent handout titled *Gross and Microscopic Evaluation of Pediatric Fractures at Autopsy* with only slight modifications.[1] One main difference is the role of anthropology in the process. Maceration of specimens (only to be completed after histology sampling) can provide an additional line of documentation and interpretation of fractures that can be useful to the forensic pathologist and which can be very illustrative in court proceedings. In some instances, additional subtle fractures have been observed after maceration that would have been missed on X-ray and during autopsy. The sampling procedure presented in this report allows both histological and anthropological analyses to be completed.

These recommended procedures for the documentation, analysis, and interpretation of skeletal fractures in suspected cases of child abuse have been applied on numerous cases at the New York City Office of Chief Medical Examiner. This presentation will describe the recommended multidisciplinary procedures in detail. In addition, several case examples will be presented, demonstrating how this approach was applied and how the findings proved to be critical in these challenging cases.

Reference(s):

1. Andrew M. Baker et al. Bones and Children: An Interdisciplinary Approach to Forensic Issues. *Proceedings of the American Academy of Forensic Sciences*, 65th Annual Scientific Meeting, Washington, DC. 2013:18-19.

Child Abuse, Pediatric Fractures, Battered Baby Syndrome

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