G33 Recognizing Classic Metaphyseal Lesions in Child Abuse: An Autopsy Technique

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The educational objectives of this presentation are to review the difficulties associated with recognizing classic metaphyseal lesions in infants and to present a new autopsy technique which enables the visualization and documentation of these fractures.

This presentation will impact the forensic community by introducing a new autopsy technique developed to improve the recognition and documentation of injury pattern in child abuse.

Complete recognition and documentation of injury pattern is key in the diagnosis of child abuse. Classic metaphyseal lesions (CML) in infants are highly suggestive of child abuse but difficult to recognize. A CML is a planar fracture through the most immature portion of the metaphyseal primary spongiosa. It may occur as a partial or complete fracture and results in the epiphyseal cap separating from the metaphysis. In infants the primary spongiosa or newly formed trabecular bone at the chondro-osseous junction (COJ) is the weakest point of the long bone. The rapid rate at which the growing bone lengthens generates relatively thin and weak metaphyseal trabeculae. With age the growth rate decreases and the metaphyseal trabeculae become thicker and stronger. CML is typically the result of torsional and tractional forces applied in a direction perpendicular to the long axis of the bone as an infant is pulled or twisted by a limb, also by the acceleration and deceleration as an infant is shaken (Kleinman 1998).

A CML is difficult to recognize both in radiographs and at autopsy. Radiographically, a CML may appear as a radiolucency in the sub-physeal region of the metaphysis. However, it may not be visible in all views or if the trabecular disruption is insufficient (Kleinman 1998). Crawford and Al-Sayyad (2003) note that most distal tibia metaphyseal fractures are diagnosed as ankle sprains or strains on initial radiographs because no definite fracture can be identified. Furthermore, CML rarely causes hemorrhage at the fracture site or in the surrounding tissue. Subperiosteal new bone formation is not prominent at a healing fracture site. Histologically, a CML appears as a series of microfractures at the mineralized regions of the distal zone of hypertrophic chondrocytes of the physis and a thin portion of the metaphyseal primary spongiosa, a difficult section to read (Kleinman 1998). In the healing bone, the CML may appear with chondrocytes deeper than expected within the primary spongiosa or as a broad region of thickened hypertrophic zone (Kleinman 1998).

As a result of the difficulty to recognize a CML, a new autopsy technique has been developed. The first step is to expose and visually examine the COJ of the long bones by cutting the muscle from the long bone ends and reflecting the periosteum. An acute CML appears as either an open fracture or a slight line of hemorrhage. A healing fracture may appear as an oddly shaped COJ. When a fracture is suspected but not obvious, the end of the long bone is removed and processed by soaking it in a water soap bath at a steady but elevated temperature (~60C) for 24 hours. The result is a metaphysis without the epiphyseal cartilage or periosteum. Partial and complete CMLs are completely visible grossly. This technique is far more invasive and time intensive than standard flaying of the dermis but yields excellent results and eliminates any question about the presence of a CML. This technique is recommended for all infant deaths in which a non- accidental traumatic cause of death is suspected.

Classic Metaphyseal Fractures, Child Abuse, Autopsy Techniques

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