



Physical Anthropology Section – 2009

H39 And a Little Child Shall Lead Them....

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After attending this presentation, attendees will recognize the limitations of presently available skeletal aging standards for infants and young children. Attendees will also be made aware of some of the approaches utilized in assessing abuse in immature skeletal remains.

This presentation will impact the forensic community by emphasizing the need for caution when applying currently available immature skeletal age standards to contemporary forensic cases, and hopefully, encourage the acquisition of more appropriate skeletal data from present day populations of varying ancestry and socioeconomic backgrounds.

In past cases involving child abuse, the authors' primary focus has been on analyzing trauma. The chronological age of the victim at death has always been known. In 2007, a request was made for a determination of age at death, as well as a review of the remains for possible trauma. The parents of the dead infant gave conflicting stories in regard to when the child had died. Relatives were similarly uncertain.

Examination of the dentition provided a dental developmental age estimate of 12-20 months. While attempting to establish a skeletal developmental age, the paucity of data for this portion of the life cycle was noted (see Scheuer and Black 2005 for a summary of the little that is available). Based on the available data, the skeletal developmental age estimate for this child appeared to be 12-24 months. Although the estimated skeletal developmental age was consistent with the dental developmental age, it was apparent that the data used for the age estimate were from children of an earlier time, as well as different ancestry and socioeconomic status.

These concerns regarding the lack of appropriate data were further emphasized upon attempting to use long bone diaphyseal length age data to confirm the dental and skeletal developmental age estimates. Most available dry bone data were based on archaeological individuals whose so-called "known age" was based on dental developmental age estimate. A few were from historic cemetery collections with ages from cemetery records. Radiographic bone length data from immature living individuals of known age at death were scarce and from inappropriate populations ("white", "middle class"). The child in this case was "black" and "lower class."

For example, the radial and tibial diaphyseal lengths, when compared with the tables in Gindhart (1973 AJPA 39: 41-48) are consistent with those of a much younger child (radius: 8-12 months, tibia: 6 months). The Gindhart series consists of males and females of a mainly white middle class background from the Fels Research Institute Longitudinal Growth Study in Yellow Springs, Ohio that began in 1929. The time period for Gindhart's sample is 1930-1967. Comparison with tables in Ruff (2007 AJPA 133:698-716) yielded ages at the lower end of the range for 12 months (humerus, radius, tibia) and under the range for 12 months (femur). Ruff utilized Denver Growth Study data collected from a primarily white middle/upper middle class. It should be noted that more recent and appropriate samples are not available.

The observed secular increase in stature during recent years magnifies the significance of the comparative "shortness." Given the above limitations, the long bone lengths of this individual, lagging well behind skeletal and dental developmental age, are suggestive of growth deficiency due to malnutrition and/or disease.

The possibility of malnutrition and disease was further reinforced by the radiographic presence of multiple lines of increased density ("growth arrest," or "Harris" lines) at the growing ends of several long bone shafts (distal tibia, femur, fibula, radius). Growth arrest lines represent a cumulative deposition of bone salts laid down during periods of protein deficiency as growth of metaphyseal cartilage is reduced. Causative factors may include malnutrition and/or disease and/or abuse.

Traumatic child abuse was specifically suggested by the discovery of healed "bucket handle" (or "corner") fractures of the distal tibiae, visible only in radiographs. These fractures, which differ from "normal" toddler injuries, are strongly associated with child abuse.

Technical Note: Because full body standard x-ray equipment was not immediately available (the office uses fluoroscopy), a portable, digital dental x-ray unit routinely used by forensic odontologists provided excellent radiographs. This machine has also been used in child abuse cases involving rib fractures. The resulting digital radiographs of these small and often difficult to image bones are easily acquired and of very high quality.

There is a great need to gather more appropriate contemporary immature skeletal data. Due to continuing concern regarding x-ray dosage in the living, it would be helpful if forensic practitioners would obtain and share x-ray studies of immature individuals whose chronological age at death is known. Warren (1999), for instance, has done so for fetuses and stillborns. This approach should be extended into early



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childhood.

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