A131 Radiographic Age Estimation of the Knee in Young Children

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After attending this presentation, attendees will be offered practical statistics to transform a single skeletal age estimate into a probable chronological age range that is wide enough to reflect the scope of normal variation, yet narrow enough for the estimate to be of value.

This presentation will impact the forensic science community by providing tighter age intervals to assist with radiographic age estimation of young children between the ages of zero to six years. The reported intervals will at the same time be wide enough to reflect normal variation in developmental timings, thus offering a practical resource to forensic practitioners.

One of the more challenging aspects of forensic age estimation is the balance between producing an estimate that is wide enough to cover the full extent of normal human variation, yet narrow enough for the estimate to be of value. While narrow estimates are optimum in theory, an interval that is too small leads to false exclusion of possible ages, which may potentially compromise identification efforts. In an effort to optimize this balance, predicted age ranges often vary in their reported widths depending on the overall life period of the individual. Generally speaking, the younger the individual, the narrower the estimate that can be provided. One of the more useful methods of estimating age in children includes the radiographic atlas technique.[1] This technique considers the morphological changes that epiphyses within a specific joint region undergo from appearance to full maturity, and thus provides a method that has utility throughout the entire juvenile time period. Radiographic atlases have been published for various joint regions; however, these atlases are known for estimating a single skeletal age rather than a range that includes variable rates of developmental timing. Hackman and Black have recently offered a solution to this conundrum for the joint regions of the knee by offering standard deviations documenting variation in developmental timings, then suggesting that two standard deviations can be added and subtracted from an estimated skeletal age to offer an age interval that transforms the method into a robust technique for estimating age.[2] This provides a single standard deviation for each of the sexes, regardless of the overall maturity level of the juvenile. The standard deviations reported result in an estimate that is nearly four years in width. While there is no doubt that the window of developmental variation is wide-ranging during the teenage years, is it possible that a tighter estimate can be offered for infants and young children? The sample from which the original standard deviations were calculated is extremely limited in individuals younger than seven years, so does not reflect the more cohesive development that occurs during this time period.

This presentation considers the above question by examining rates of development in young American children as assessed through use of Pyle's and Hoerr's radiographic atlas of the knee. Radiographs from 217 children (107 females and 110 males) between the ages of zero to six years were collected via the juvenile radiographic database developed by Mercyhurst University. Standard deviations representing the difference between skeletal age and chronological age were then calculated according to three general time periods, including the first year, second year, and third through sixth year. As expected, variation was observed to decrease with receding maturity, resulting in the creation of significantly narrower ranges when predicting age. Reported standard deviations ranged between 2.7 months and 6.7 months for females and 2.4 months and 8.0 months for males.

References:

1. Pyle SI, Hoerr NL (1969) A Radiographic Standard of Reference for the Growing Knee. 1st edn. Charles C. Thomas, Springfield
2. Hackman L, Black S (2013) Age Estimation from Radiographic Images of the Knee. *J Forensic Sci* 58 (3):732-737. doi:10.1111/1556-4029.12077

Age Estimation, Developmental Osteology, Radiographs