H16 Thoracic and First Two Lumbar Vertebral Ring Epiphyseal Union in Skeletal Age Estimation: Testing a Revised Method of Documenting the Maturation Process

A. Midori Albert, PhD*, University of NC Wilmington, Dept of Anthropology, 601 S College Road, Wilmington, NC 28403-5907

After attending this presentation, attendees will gain an understanding of the use of a revised method of documenting stages of epiphyseal union for the thoracic and first two lumbar vertebral centra to better comprehend the pattern, sequence, and timing of maturation of this skeletal age indicator and its utility in forensic casework.

This presentation will impact the forensic science community by introducing a revised method of estimating vertebral ring epiphyseal union for the determination of skeletal age-at-death of adolescents and young adults. When this method is used with other skeletal age indicators, it may improve the accuracy of age estimation in human identification.

The progress of epiphyseal union was documented for the annular rings (epiphyses or secondary ossification centers) of the vertebral centra, both superior and inferior, including the twelve thoracic vertebrae (T1-T12) and the first two lumbar vertebrae (L1-L2) when available, for an existing autopsy sample of 46 individuals (14 females, 32 males) ranging in age from 11 to 31 years at death, housed at the Human Osteology Laboratory at the University of North Carolina Wilmington.

The progress of epiphyseal union was noted in stages (stages 0-4) representing no union through completed union. The stages were as follows: Stage 0, ring absent, centrum unfused; Stage 1, partially fused ring, sections of centrum fused and unfused, presence of gaps; Stage 2, complete fusion, clear demarcation between ring and centrum, no gaps but there may be a groove, no remodeling; Stage 3, complete fusion, ring edges are melded with centrum leaving no clear demarcation in portions of the centrum, a slight groove may be seen in some areas but centrum is fully remodeled in other areas; and, Stage 4, complete fusion, ring edges are melded with centrum leaving no clear demarcation in portions of the centrum, bone is remodeled with no grooves. This modified scoring method included five stages of union and differs from the previously studied four-stage method in that a greater distinction was made between varying appearances of complete union, specifically those instances with complete union having a groove present and complete union without a groove.

Results of using this modified scoring method with five stages indicated that thoracic and first two lumbar vertebral ring union correlated rather well with age-at-death, $r = 0.81$, $p<0.05$. This correlation was higher than previously reported findings for vertebral ring union and age-at-death using four stages to record vertebral ring maturation. Males showed a higher correlation ($r = 0.82$) when compared to females ($r = 0.77$); however, there was no statistically significant difference in vertebral ring union mean values between females and males. Raw data observations showed that females generally matured at earlier ages than males. Regarding the sequence of union, there was a tendency for epiphyses to unite either from cranially oriented and caudally-oriented epiphyses before those toward and in the middle of the vertebral column, or for more caudally oriented epiphyses to unite in a cranial direction.

Findings from this study may be considered in forensic cases of unknown identity, mainly for corroborating information from other skeletal age indicators, as multiple lines of evidence from various skeletal age indicators are preferred. Further, if only vertebrae are recovered in forensic cases, use of this method may provide a general age range at death.

Vertebral Maturation, Age Estimation, Epiphyseal Union