H40 Cervical Vertebral Centra Epiphyseal Union as an Age Estimation Method in Teenage and Young Adult Skeletons

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After attending this presentation, attendees will gain an understanding of the pattern, sequence, and timing of maturation of cervical vertebral centra and how it may be used to estimate skeletal age at death.

This presentation will impact the forensic science community by introducing a supplemental method of estimating skeletal age-at-death of teenagers and young adults, which when used with other skeletal age indicators may improve the accuracy of age estimation in human identification.

This study examined epiphyseal union of the inferior centrum of the second cervical vertebra (C2 or the axis), and the superior and inferior centra of the third though seventh cervical vertebrae, C3-C7. The sample comprised 55 individuals of known sex, ethnicity, and age at death. There were 23 females (2 American European, 21 African American) and 32 males (5 European American, 27 African American), aged 14 to 27 years from the Robert J. Terry Skeletal Collection housed at the National Museum of Natural History, Smithsonian Institution, Washington, DC.

A four stage method was used to code the progress of epiphyseal union of the vertebral centra or "ring epiphyses". Stage 0 represented the absence of any epiphyseal union activity. Vertebral centra in Stage 0 were completely bare with no epiphyseal attachment. Stage 1 signified beginning union or union in progress. Beginning union was characterized by the slightest adherence of any portion of the epiphyses, and union in progress included partial to full epiphyseal rings present with gaps—adhesion in some areas and open spaces in other areas along the surfaces of the vertebral centra. Stage 2 denoted epiphyses that were almost completely united or recently united. Beginning union and union in progress were consolidated into one stage, Stage 1, and almost complete union and recent union were also consolidated into one stage, Stage 2, since the timing of fusion seemed to occur over the course of only a few months. Stage 3 corresponded to epiphyses that were fully fused for some time. The distinction between recently united epiphyses (Stage 2) and fusion that had been complete for some time (Stage 3) was important in that noting recent union allowed for more age information to be extracted from the sample and may yield greater accuracy in estimating age at death. That an individual may skeletally show signs of youth in adulthood (recently completed union, Stage 2) is more informative than simply recognizing an individual as adult (complete union, Stage 3) since that adult skeletal status could have occurred many years ago.

Results indicated that: (1) females matured at an earlier age than males; (2) there was no identifiable sequence of union—various ring epiphyses of C2-C7 fused in seemingly random order; and, (3) cervical vertebral ring epiphyseal union correlated with known age-at-death moderately well (r=0.63). Thoracic and first two lumbar vertebral ring epiphyseal union data for the same sample, however, yielded a higher correlation with known age-at-death (r=0.70) probably due to there being more data for thoracic and lumbar centra—28 epiphyses—versus 11 epiphyses for the cervical vertebrae. Cervical vertebral ring union data correlated rather poorly with thoracic and first two lumbar vertebral ring union data for the same sample (r=0.41). While these results may not fare as well as other skeletal age estimation methods as a stand alone method, cervical vertebral ring epiphyseal union is still a viable option inasmuch as it may be used to corroborate findings from other skeletal age indicators and or it can provide a general idea of an age range if cervical vertebrae are the only bones available for analysis.

Age Estimation, Epiphyeal Union, Cervical Vertebrae

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