H76 Investigation of Second, Fourth, and Eighth Sternal Rib End Variation Related to Age Estimation

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After attending this presentation, attendees will better understand the impact of variation throughout the rib series on age estimation. This will be achieved by explaining how the right, second and eighth sternal rib ends will be aged (i.e., under- or over-aged) with the most commonly utilized methods for estimating age at death with rib ends.

This presentation will impact the forensic community by demonstrating the necessity for continual re-analysis and updating of forensic anthro- pology's most commonly utilized methods for age estimation.

Estimating age at death accurately can be invaluable in answering important questions on forensic anthropology. Sternal rib ends have received a great deal of research attention as an area that uniformly changes with age. The *Daubert* decision has made rigorous testing and evaluation of forensic sciences' most commonly used methods essential, and thus, forensic anthro- pologists must understand the timing differences in terms of age character- istics between ribs.

Background: The most popular methods utilizing this area were developed by Iscan and coworkers[1, 2] using the right fourth rib from an autopsy population in Broward County, Florida. However, the accuracy of this method has been called into question, particularly on ribs other than the fourth and on ancestral populations other than European American. Yoder et al.[3] analyzed ribs two through ten in order to see if there was a significant difference between phase placements for rib four and all other ribs. Although most did not have significance in terms of differing phase placements, the authors did note that the percentage of differences were high for some ribs. This demonstrates that differences in terms of timing of degenerative changes are present in the rib series.

Methodology: The right second, fourth and eighth sternal rib ends from the William M. Bass Donated Collection were examined using the methodology described by Iscan et al. The pictures, casts and phase descriptions developed by these authors were used in order to determine phase placement. A total of 156 individuals (113 males and 43 females) of different ancestry were investigated. Eighty-five percent of the sample is Caucasian, 13% is African American and 2% is Latino. A Wilcoxon signed rank test was performed in order to determine if there was intra-observer error present in this study. Additional Wilcoxon signed rank tests were completed to demonstrate if a significant difference is present in the phase placements between the right, fourth rib and the right, second and eighth ribs. In order to better understand these differences, a transition analysis was performed for all ribs under investigation. Estimated transition ages were produced for the Iscan et al.[1] phases for comparison purposes using a means test. A last statistical procedure, t-tests, were performed in order to determine if there was significance between the transitions produced in this analysis and the transitions estimated from Iscan et al.[1]

Results and Discussion: The Wilcoxon signed rank test demonstrated that there was no significant intra-observer error in this analysis. However, significance was found between the phase placements of the standard fourth rib and both the second and the eighth ribs for the male and total sample. No significant difference was found between phase placements in the female sample. Thus, the transition analysis was only performed on the male sample. This analysis showed that the second rib when aged with the Iscan et al. methods will significantly over-age individuals, while the eighth rib will consistently under-age specimens, although in some cases not significantly (significance was determined through the t-tests). Differential levels of stress within the rib series, which are produced by numerous factors, are the most likely cause of these dissimilarities found between phase placements for the second, fourth and eighth rib.

References:

1 Iscan MY, Loth SR, Wright RK. Age estimation from the rib by phase analysis: White males. *Journal of Forensic Sciences* 1984; 29: 1094-1104.

2 Iscan MY, Loth SR, Wright RK. Age estimation from the rib by phase analysis: White females. *Journal of Forensic Sciences* 30: 853-863.

3 Yoder C, Ubelaker DH, Powell JF. Examination of variation in sternal rib end morphology relevant to age assessment. *Journal of Forensic Sciences* 46(2): 223-227.

Sternal Rib Ends, Transition Analysis, Age Estimation

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