## H19 Age Determination From the Medial and Lateral Clavicle: A Re-Evaluation of Present Scoring Systems

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After attending this presentation, attendees will become aware of the differences between various scoring systems used to determine age from the medial clavicle and will understand the usefulness of applying a transition analysis to this aging method. Additionally, this presentation will explore the lateral clavicle as a useful aging tool.

This presentation will impact the forensic community and/or humanity by demonstrating the necessity for continual updating of the samples from which standards are developed and a re-evaluation of methods, updating of samples and using modern data to assess age of modern skeletons.

The *Daubert* decision has made rigorous testing and evaluation of forensic methods essential in all fields of the forensic sciences. In forensic anthropology, the documentation of secular change in human skeletal dimensions necessitates continual updating of the samples from which standards are developed. This research answers the call for the re- evaluation of methods and updating of samples.

**Background:** The medial end of the clavicle is the last epiphysis to fuse in the human skeleton. This epiphysis remains unfused into adulthood, sometimes into the late twenties. Furthermore, whereas limb bone epiphyses can fuse in as little as 1 year, union of the medial clavicle takes at least 2 to 3 years[1] . Consequently, the medial clavicle can provide accurate age estimates of young adults.

Early attempts at developing a scoring system include those of Stevenson[2] and Todd and D'Errico[1] . Today, most anthropologists rely on McKern and Stewart's[3] system developed using the Korean War sample of American males, Webb and Suchey's[4] system developed using an autopsy sample from Los Angeles county, and/or Black and Scheuer's[5] system developed using 18th, 19th, and 20th century skeletons from three European collections.

Typically, transition analysis is used to analyze senescent changes in bone[6], but the medial clavicle is a good candidate for such an analysis because the extended development of this epiphysis is represented in a series of stages. In this study, transition analysis shows the average age at which an individual transitions from one stage to the next.

**Methodology:** This study's sample is a subset of the University of Tennessee's William F. McCormick Clavicle Collection, a modern autopsy collection assembled between 1986 and 1998. The sample consists of 563 individuals born between 1962 and 1983 (424 males and 139 females). The individuals were between the ages of 12 and 33 at the time of death. Ninety-five percent of the sample is Caucasian, 4% is African American, and the remaining 1% are Asian, Latino, and Indian.

The lateral clavicular epiphysis was scored as "not fused", "fusing", or "fused". The medial clavicles were scored with Todd and D'Errico[1] , McKern and Stewart[3], Webb and Suchey[4], and Black and Scheuer[5]. The McKern and Stewart system was found to be the most comprehensive in estimating stage of union. This scoring system utilizes 5 phases: 0=no closure, 1=beginning union, 2=active union, 3=recent union with scar, and 4=complete union with no scar. The other systems were either lacking an important phase or included phases that could not be evaluated on this skeletal sample. Consequently, a transition analysis was performed on the McCormick clavicle sample using this scoring system, as well as on McKern and Stewart's data for the medial clavicle. Additionally, a transition analysis was performed on the McCormick data for the lateral clavicle using the 3 stages mentioned earlier.

**Results and Discussion:** According to the transition analysis of the lateral epiphysis, the average age at which an individual goes from "no fusion" to "fusing" is 17 years. The average age at which an individual proceeds from "fusing" to "fused" is 19 years. There were no significant differences between males and females. The earliest age at which fusion began was 17 years. All individuals were fused by age 23.

The transition analysis produced the following results for the medial clavicle:

| Transition | McKern and Stewart | McCormick Males | McCormick Males Females |
|---|---|---|---|
| Phase 0 to Phase 1 | 19.81 ± 0.22 | 16.95 ± 0.34 | 14.77 ± 0.65 |
| Phase 1 to Phase 2 | 21.82 ± 0.22 | 20.42 ± 0.27 | 19.07 ± 0.48 |
| Phase 2 to Phase 3 | 23.59 ± 0.26 | 24.28 ± 0.25 | 23.28 ± 0.47 |
| Phase 3 to Phase 4 | 26.23 ± 0.32 | 27.21 ± 0.22 | 27.06 ± 0.40 |

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These results show that differences exist between males and females concerning the average age at which fusion commences (Phase 0 to Phase 1); specifically, fusion begins earlier in females. Furthermore, the McKern and Stewart sample and the McCormick sample show differences in the first two transitions. The McCormick individuals begin fusion earlier than the Korean War males. This difference could be due to secular change in growth. Therefore, these results show the importance of modern data to assess age of modern skeletons.

**References:**


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3 McKern TW, Stewart TD. Skeletal age changes in young American males: analyzed from the standpoint of age identification. Natick, Massachusetts: Quartermaster Research and Development Center, Environmental Protection Research Division; 1957. Report No.: EP-45.

4 Webb PAO, Suchey JM. Epiphyseal union of the anterior iliac crest and medial clavicle in a modern multiracial sample of American males and females. Am J Phys Anthropol 1985;68:457-66.

5 Black S, Scheuer L. Age changes in the clavicle: from the early neonatal period to skeletal maturity. Int J Osteoarchaeology 1996;6: 425-34.

6 Boldsen JL, Milner GR, Konigsberg LW, Wood JW. Transition analysis: a new method for estimating age from skeletons. In: Hoppa RD, Vaupel JW, editors. Paleodemography: age distributions from skeletal samples. Cambridge: Cambridge University Press, 2002; 73-106.


**Age Estimation, Medial Clavicle, Transition Analysis**

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