A72 Validation of the Acetabulum as a Skeletal Indicator of Age at Death

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After attending this presentation, attendees will better understand the biology underlying progressive acetabular changes.

This presentation will impact the forensic science community by demonstrating the utility of the acetabulum for age estimation; the changes occurring in this joint could prove particularly relevant to the development of future multifactorial aging methods.

This research investigated the nature of progressive changes in the acetabulum, with the goal of determining whether they are metamorphic or degenerative and ascertaining whether they are valid indicators of age at death.

The acetabulum has been a focus of age-estimation research during the past decade, and several acetabulum-based aging methods have become available to the forensic anthropological practitioner; however, the nature of the progressive changes that occur in the acetabulum remains poorly understood. These changes may constitute skeletal metamorphoses (akin to the formation of the ventral rampart of the pubic symphysis), which forensic anthropologists generally believe to be tightly linked with age. Alternately, acetabular changes may represent skeletal degeneration (osteoarthritis or OA) — generally viewed as less strongly correlated with age and more influenced by factors such as physical activity and obesity. If the former proves true, this would lend support for the use of acetabular changes in skeletal age-at-death estimation. If the latter proves true, this would suggest that use of the acetabulum for age estimation should be reevaluated.

In order to investigate these problems, acetabular changes and OA were analyzed in a sample of 409 European-American skeletal individuals from the W.M. Bass Donated Skeletal Collection (University of Tennessee, Knoxville). Acetabular changes were observed and scored.[1] In all major appendicular joints, OA was observed and scored.[2] These data were then compared with documented demographic data for the 409 individuals. In addition to age, sex, height, and weight (used to calculate Body Mass Index (BMI)), demographic data also included self-reported habitual and occupational activities, which were assigned values representing their Metabolic Intensity Level (MET) using a system developed for the coding of physical activity survey data.[3] Statistical tests assessed potential associations between acetabular scores and OA scores, ages at death, BMI, and MET values. Non-parametric tests and visualization techniques (e.g., Spearman's rank-order correlation, box-and-whisker plots) were used to assess associations between ordinal data such as acetabular and OA scores. Parametric tests and visualization techniques (e.g., linear regression, scatterplots) were used to assess associations between continuous data such as ages at death, BMI, and MET values. The alpha-level was set at 0.05, and the Bonferroni correction was applied in cases of multiple test iterations.

Acetabular changes were found to correlate statistically significantly positively with OA in all joints and body regions. This indicates that the changes occurring in the acetabulum are degenerative rather than metamorphic; however, these acetabular changes also correlated statistically significantly positively with age, indicating that they are still useful for age estimation. In contrast, acetabular changes showed no associations with BMI or MET values, indicating that these changes are resistant to the effects of obesity and habitual and occupational activities. This finding also supports their use in aging.

In summary, the degenerative changes of the acetabulum are valid skeletal age indicators that are relatively resistant to the effects of lifestyle variables (i.e., obesity, physical activity) in European-Americans. The strong age correlations of degenerative acetabular changes suggest that the metamorphic-degenerative dichotomy of skeletal age change is in need of revision. Further, the lack of association between acetabular degeneration and physical activity indicates that the oft-cited anthropological paradigm of activity-induced joint degeneration is overly simplistic. In a field where *science matters*, it is important not only to test and refine age-estimation methods but also to understand the biology underlying method success or failure. These findings advance an understanding of skeletal aging that can improve both identifications of the dead and health outcomes for the living.

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Reference(s):

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