H14 Evaluating Methods for Measuring the Ischiopubic Index for Determining Sex and Ancestry From the Human Skeleton

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After attending this presentation, attendees will better understand the validity and utility of recently proposed measurement techniques for both the ischium and pubis that differ from Washburn's original method, including several new measurements of the coxa designed by the authors.

This presentation will impact the forensic science community by helping to improve the way that the Ischio-Pubic (IP) Index is used in the determination of sex and ancestry of unidentified skeletal remains. Furthermore, it will illustrate the importance of carefully examining the sources of variance in a skeletal sample to tease out potential environmental effects.

Osteometric techniques employed in studies of the human pelvis are firmly rooted in the defining work of a few individuals, such as Washburn.[1] Unfortunately, Washburn's widely-used pubis and ischium lengths have increased potential for intra- and inter-observer measurement error because the fusion point of the three major elements of the os coxa (ischium, ilium, and pubis), from which ischial and pubic lengths are taken in adults, is often ambiguous. Few studies have attempted to alleviate this problem and those that have, such as Patriquin's recent work, lack validation.[2] Furthermore, few have simultaneously addressed ancestral variation in the anterior pelvis that could confuse the issue. The current research addresses these problems and suggests that a shift to a more precise method for calculating the IP index is warranted.

Six measurements consisting of three pairs of corresponding pubic and ischial lengths were taken using Washburn's, Patriquin's, and a newly developed technique that uses the very center of the acetabulum (the "acetabular point").[1,2] A sample of 220 identified skeletons was drawn from the collections at the University of Pretoria in South Africa and the University of Tennessee at Knoxville. Measurements were taken from males and females of "Black" and "White" ancestry born in both North America and Africa. "White" and "Black" are used in this context in the traditional sense, referring to individuals whose ancestors were previously derived from either indigenous European or indigenous African populations, respectively. All individuals were adults between the ages of 18 and 99 and free of pathological conditions and postmortem degradation.

Each index was calculated using the traditional formula ((pubis length/ischium length) x 100). A fully-factorial univariate Analysis of Covariance (ANCOVA) was applied to each of the three indices to determine whether any of the independent variables (sex, ancestry, age at death, and continent of origin) or their interactions have a significant effect on the variance of each index. Then the accuracy of each index was assessed by generating separate discriminant functions for sex and ancestry and resubstituting the entire sample into each equation, producing percentages of individuals correctly assigned by each method.

The results indicate that all three indices are significantly affected by sex, two are affected by ancestry, and none are affected by age at death. The newly-developed acetabular index has the best accuracy when predicting sex (87% correct) but the worst accuracy when predicting ancestry (53%), suggesting that its lack of sensitivity to ancestral variation allows it to hone in on sex differences more effectively. Patriquin's index had the best accuracy for predicting ancestry (64% correct) but the worst accuracy for predicting sex (78%). Continent of origin appears to have an independent influence on anterior pelvis morphology beyond the effects of sex or ancestry, suggesting that the environment is an important factor irrespective of genetics.

References:

1. Washburn SL. Sex differences in the pubic bone. Am J Phys Anthropol 1948;6:199–207.
2. Patriquin M, Steyn M, Loth SR. Metric assessment of race from the pelvis in South Africans. Forensic Sci Int 2002;127:104-13.

Ischio-Pubic Index, Sex Determination, Predicting Ancestry

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