H21 Evaluation of Purkait's Triangle Method for Determining Sexual Dimorphism

Robert P. Brown, MFS, 22nd Military Police Battalion (CID), USACIDC, PO Box 331009, Mailstop #84, Fort Lewis, WA 98433; Douglas H. Ubelaker, PhD, Smithsonian Institution's National Museum of Natural History, Department of Anthropology, 10th and Constitution Avenue NW, MRC 112, PO Box 37012, Washington, DC 20013; and Moses S. Schanfield, PhD, The George Washington University, Department of Forensic Sciences, 2036 H Street NW, 102 Samson Hall, Washington, DC 20052*

After attending this presentation, attendees will be briefed on a method for determining sexual dimorphism using measurements from the proximal end of the femur and its comparison and combination with more traditional methods.

This presentation will impact the forensic community and/or humanity by evaluating a relatively new method for determining sexual dimorphism and its application to the Terry collection.

The ability to determine sex from isolated bones and bone fragments is a necessity in medicolegal investigations. Sexual dimorphism in the skeleton is generally based on two factors, size difference with males being generally larger than females, and function related differences, particularly in the pelvis. Differences between the sexes involve varying levels of stress and strain on the bones during development that lead to differences in size and morphology. Traditionally, when the proximal end of the femur is the only portion of bone available for analysis, the maximum vertical diameter of the head is utilized for determining sex. Purkait's (2005) triangle method includes the use of points of muscle insertion that develop and change based on muscle strain.

This study compares the accuracy of Purkait's method in comparison and combination with the maximum vertical diameter of the head when applied to the Terry collection housed at the Smithsonian Institution's National Museum of Natural History. The sample consists of 200 individuals with a balanced number of males and females, and black and white adult subjects. Additionally, another sample of 40 individuals equally balanced was measured. Purkait's method involves measuring a triangle that is projected on the posterior side of the proximal end of the femur. The point projecting most medially on the greater trochanter and the highest point on the lesser trochanter were labeled points 'B' and 'C', respectively. The point on the articular margin of the head dipping most laterally was labeled point 'A'. Measurements of the sides of this triangle (AB, AC, and BC) along with the vertical diameter of the head were taken from each femur.

The data were subjected to discriminant function analysis. The accuracies for determining sex using the single variables of AB and AC (69% and 70.5%, respectively) were much lower than those found in Purkait's study which is reflected in the higher standard deviations found in the Terry collection data. BC was shown to be the best indicator using Purkait's triangle method with an accuracy of 85.5%. The accuracy using the diameter alone was 89%. Combining the diameter and BC raised the accuracy to 90%. Additionally, a jackknife procedure was conducted on the data that reflected nearly identical results for accuracy. The threshold value for separating the larger male values from the smaller female values were 53.0 mm for BC and 45.7 mm for the diameter of the head. When individuals where BC and diameter measurements produced conflicting results using the threshold approach were excluded, the prediction accuracy increased to 94.5%. The 40 additional femora not included in the determination of the threshold values were tested against these threshold values. The accuracy using BC was 80%, diameter was 95%, and the two factors in combination (with exclusion of individuals with conflicting results) were 97.5%. There was no significant difference between the Terry collection white and black samples.

The value of the study is the evaluation of a relatively new sexual dimorphism method in order to determine the population variability between the Terry collection and Purkait's sample, which consisted of middle class Central Indian males. BC was determined to be a valuable measurement in estimating sex using the proximal end of the femur, particularly in combination with the maximum vertical diameter of the head. The measured values in the Terry Collection taken in this study were found to be smaller than those from Purkait's study. More studies should be conducted on different populations using contemporary samples in order to determine proper threshold values based on population variability and to further document human variation in this aspect of the anatomy.

Forensic Anthropology, Sex Determination, Femur

 ** Presenting Author*