H39 Sex Differences in Vertebral Centra Height From a Modern Autopsy Sample of Adolescents and Young Adults

A. Midori Albert, PhD, University of North Carolina Wilmington, Department of Anthropology, 601 South College Road, Wilmington, NC 28403-5907*

After attending this presentation, attendees will be introduced to preliminary findings of sex differences in vertebral centra height for purposes of better understanding normal human variability in this region of the skeleton.

This presentation will impact the forensic science community by showing the ways in which vertebral centra height was found to vary in females and males, which may lead to the future development of a sex determination method for use in human identification.

The goal of this study was to examine sex differences in the maximum height of vertebral centra in a sample collected at autopsy for purposes of exploring normal human variability. The sample comprised 42 sets of as many as all 12 thoracic (T1-T12) and the first two lumbar vertebral centra (L1-L2); there were 13 females and 29 males, ranging in age from 12 to 31 years. This was a pre-existing sample, whereby the vertebrae were originally collected for an age estimation study in 1992. For each individual in the sample, a vertebral column "wedge" was cut at autopsy; longitudinal cuts were made on the lateral aspects of the centra with transverse cuts at T1 and L2 enabling a wedge to be removed intact. Once removed, vertebral column wedges were macerated, and each vertebra was labeled. Two researchers independently and blindly (i.e., sex and age were unknown) measured in millimeters the maximum height of each centra at midpoint using GPM sliding calipers, and data were analyzed grossly and statistically. It should be noted that in some cases, the superior portion of T1 and the inferior portion of L2 were cut midway across the centra due to soft tissue obscurity, resulting in the omission of some height measures for these vertebral centra. This was accounted for during data analysis.

Raw data observations revealed that more cranially-situated thoracic vertebral centra were shorter than caudally-situated thoracic and lumbar vertebral centra, an unsurprising finding which supports anecdotal evidence. When considering age, an *F*-Test Two Sample for Variances showed no significant difference in the age ranges between the female and male samples. Mean vertebral centra height values were calculated for each individual in the sample, and these mean values were correlated with known age. Pearson's correlations for age and mean vertebral centra height values showed no clear relationship ($r = -0.45$ for females, and $r = 0.44$ for males). Thus, the variation found in vertebral centra height was thought to be more related to sex rather than skeletal maturation or aging effects. Since stature was unknown, it remains possible that some differences attributed to sex could very well be a function of living height. Nonetheless, when exploring sex differences in centra height, ANOVA tests were highly statistically significant among all vertebral types (T1-L2).

Descriptive statistical results indicated that females and males had similar low and high centra height values: females had a low of 14mm (T1) and a high of 30mm (L1), and males had a low of 14mm (T1 and T2) and a high of 31mm (L2). Although these low and high height values were comparable, the mode in centra height for the different vertebrae showed variation between the sexes. For nearly each vertebra type, the male mode was consistently about 2mm higher than the female mode. Mean height values were calculated for each vertebral centra type (T1-L2) in the female and male sample; and observations of the raw data (i.e., comparing the means visually) showed that males were consistently higher than females for all vertebral types, although these differences were not statistically significant. Yet, when centra height for each vertebral type (T1-L2) for each individual in the female and male samples was compared, Student's t-test results indicated statistically significant ($p\text{-value} < 0.05$) sex differences in all vertebral types except T1, T12, L1, and L2. There was a possible small sample size effect on T1 inasmuch as only 17 out of 42 sets of vertebrae contained T1s that were not cut off superiorly at autopsy when the sample was collected.

For each vertebral centra type (T1-L2), the range of low to high centra height measures was calculated in the female and male samples. For example, the range in height for T1 in the female sample was 14-17mm and in the male sample it was 14-20mm. Next, the magnitude of the ranges was calculated for each vertebral centra type in the female and male samples. Thus, based on the example above, for T1 in the female sample the magnitude of the range was 3mm (14-17mm is a 3mm magnitude of difference) and in the male sample it was 6mm (14-20mm is a 6mm magnitude of difference). Results of a Student's t-test indicated a statistically significant sex difference in the magnitude of the ranges ($p\text{-value} < 0.05$). Gross observations of the raw data showed that the magnitudes of the ranges were wider for males when compared to females for all vertebral types except L1 and L2. This finding seemed to suggest that males exhibit greater variability in vertebral centra height than females, yet with some greater variability becoming apparent in L1 and L2 for females. Moreover, in females, the magnitude of the range of centra height increases from T1-L2 while in males it fluctuates, peaking at T7 and T8 and becoming slightly less than the females at L1 and L2. Findings from this preliminary investigation into sex differences in vertebral centra height provide some initial insight into normal human variability in this area of the skeleton. The goal of this study is that this study will stimulate further research to help explain the reasons for the sex differences in centra height as well as encourage additional studies of the relationship between vertebral centra height and overall stature as linked to sex.

 ** Presenting Author*

Vertebrae, Sex Differences, Human Variation

 ** Presenting Author*