



Physical Anthropology Section - 2014

H13 Study of the Sexual Dimorphism of the Postcranial Base With MSCT

Sarah Blicq, Service de Médecine Légale, Hopital Rangueil, 1, avenue du professeur Jean Poulhès, TSA 50032, 31059 Toulouse Cedex 9, FRANCE; Frederic Savall, Service de médecine légale, Hopital de Rangueil, 1 avenue Professeur Jean Poulhès, Toulouse Cedex 9 31059, FRANCE; Fabrice F. Dedouit, 1 Avenue Du Professeur Jean Poulhes, Toulouse Cedex 9, FRANCE; Hervé Rousseau, PhD, 1 Avenue Professeur Jean Poulhès, Toulouse 31059, FRANCE; Daniel Rouge, MD, Service de Medecine Legale, Centre Hospitalier Univ Rangueil, Avenue du Professeur Jean Poulhes, Toulouse Cedex 4 31403, FRANCE; and Norbert Telmon, MD, PhD, Service Medico-Judiciare, CHU Rangueil, 1 Avenue Jean Poulhes, Toulouse F-31054, FRANCE*

The goal of this presentation is to evaluate the sexual dimorphism of the foramen magnum and the occipital condyles using geometric morphometrics on Multislice Computed Tomography (MSCT).

This presentation will impact the forensic science community by providing an example of an anthropological application of the Multislice Computed Tomography in forensic sciences.

MSCT is uncommonly used in forensic anthropology. MSCT allows more precision than metric and scopic methods, which can be helpful for sex determination.

The technique: 120 angio CT scans from the radiology department of the university hospital of Toulouse (France) with a sixteen-detector row MSCT (Sensation 16, Siemens) were selected. For each angio CT scan, size and shape of the postcranial base were studied.

To study the size of the postcranial base, 20 landmarks, based on literature data, were positioned on Amira[®] 5.2.2: four landmarks on the foramen magnum to appreciate length and width; four landmarks on each occipital condyle to appreciate length and width; four landmarks on the Frankfort plan; and four landmarks on the maximum length and width of the skull to appreciate the ratio between foramen magnum and skull measurements.

To study the shape, outlines of the foramen magnum were obtained using ImageJ[®] from snapshots of each foramen magnum realized on Amira[®] 5.2.2. With each outline, two processes were used: Fourier analysis to obtain 3D statistical shape models, using geometric morphometrics, via R 2.1.5 software, and shape descriptors using form factors (perimeter, area, roundness, compacity, aspect ratio, and circularity). For each measurement (size and shape) with R 2.1.5 software, mean, standard deviation, median, maximum and minimum data were calculated using boxplots. The sample studied consisted of 60 males and 60 females.

Study of Size: The width of the foramen magnum was higher for men than women, as noted in literature, but it was not a statistically significant result, as previous studies showed. The length of the foramen magnum was higher for men and it is a statistically significant result. Men have higher occipital condyles than women, whether it is the left or the right condyle, which is statistically significant. There is no statistically significant difference between men and women concerning the angle formed by the foramen magnum and the Frankfort plan, as shown on literature data. There is no statistically significant difference between men and women concerning a ratio between the length of the foramen magnum and the maximum length of the skull. The width ratio between the foramen magnum and the skull is higher for women, which is a statistically significant result.

Study of Shape: From the Fourier analysis, there is a superposition of the points concerning men and women on the PCA, which proves an absence of clear discrimination between men and women. The results are statistically significant for only two shape descriptors (area and perimeter).

This study is the third study performed on MSCT about foramen magnum sexual dimorphism; the most previous studies concerned dry bone. The length of the foramen magnum is a statistically significant measurement, but not its width. This information is new and differs from the literature, which shows the opposite. The right occipital condyle (using length and width) is discriminant, as shown in the literature, but this study shows that the left occipital condyle is discriminant too. Other new information was obtained by studying the ratio between measurements of the foramen magnum and those of the skull. It was shown that women have higher ratio between width of the foramen magnum and the maximum width of the skull than men. This unpublished result is statistically significant and shows the existence of a morphological criterion.

Generally, there is no sexual dimorphism for the shape of the foramen magnum. Shape descriptors are not a pertinent tool to study foramen magnum sexual dimorphism. This study shows a robustness criterion (length) because of a sexual dimorphism on the size of the foramen magnum and a morphological criterion (width ratio between foramen magnum and skull), but no shape effect.

Anthropology, Sexual Dimorphism, Tomography