H51 Sexual Dimorphism of Immature Pubis Bone: A Multislice Computed Tomography Study by Geometric Morphometrics

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The goal of this presentation is to study pubis morphology during ontogeny, specifically examining size and shape dimorphism independently.

This presentation will impact the forensic science community by: (1) demonstrating pubis ontogeny in order to develop new methodology for sexing pubis bone in juveniles; (2) showing the potential of Three-Dimensional (3D) Multislice Computed Tomodensitometry (MSCT) reconstructions for future anthropological research; and, (3) showing the potential of using clinical MSCT investigations for anthropological purposes, rendering the concept of virtual anthropology more concrete.

Purpose: Recent developments in geometric morphometrics open new research avenues in biological anthropology. Difficulty in sex estimation of juveniles is frequently encountered in forensic medicine. Contrary to adult remains, few studies have been conducted to evaluate sex differences of immature coxal bone and, when studied, the results are often contradictory. The objectives of this study are to analyze the ontogeny of size and shape sexual dimorphism in the pubis.

Materials and Methods: A retrospective study to evaluate sexual dimorphism observed in the pubis was conducted. A combination of landmark-based geometric morphometric analyses using 3D reconstructions of MSCT were performed to evaluate the ontogeny of pelvic shape and size dimorphism. Specifically, the analyses were designed to examine differences between age groups and rates of change. Five osteometric landmarks were targeted. The study population consisted of 188 children (95 boys, 93 girls), ranging in age from 1 to 18 years. The subjects were of diverse ancestry and lived in the area of Toulouse, southern France. Data were collected by two observers following a data collection protocol. Briefly, PCA was used as an exploratory step. Two-way MANOVA and Goodall's F-test were used to test differences between the sexes and among age groups. Linear regression was used to compare rates of shape change. The authors analyzed sexual dimorphism in size (centroid size) and shape (Procrustes residuals) and patterns of shape change with age (development) and size change with age (growth). MorphoJ and R2.2.0 software was used to perform the statistical tests.

Results: The maximum intra- and inter-observer error was 3%. The results of the PCA analysis demonstrated that the ontogenetic trajectories of shape change were different for males and females. Two-way MANOVAs of shape variables, with sex and age as factors, revealed statistically significant differences ($p<0.001$) between the sexes and age groups. The pubis shape became significantly sexually dimorphic at 13-years-old, although visible shape differences were observed as early as 9-years-old. Also, the size was statistically significant between the sexes. Trajectories of shape (development) and size (growth) differed between sexes throughout ontogeny. Mean shape superimpositions between sexes for each age group showed that shape differences between sexes occurred gradually with age.

Conclusion: Immature pubis bone sexual dimorphism is an age-dependent phenomenon, both manifesting by size and shape differences. The immature pubis presents sexual dimorphism in both size and shape. In ontogeny, pubis growth and pubis development are separate phenomena.

Geometric Morphometric, Ontogeny, Pubis

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