Section: Anatomy

Original Research Article

IDENTIFICATION OF SEX FROM SACRUM IN NORTH KARNATAKA POPULATION

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ABSTRACT

Background: The sacrum is a component of the axial skeleton. Its contribution to the pelvic cavity differs in both sexes; hence, the morphometric parameter in both sexes varies. **Materials and Methods:** 25 adult male and 25 adult female sacrums were selected for study. Each sacrum was put in an anatomical position. The length and breadth of the scrum were measured with a vernier caliper. The obtained values were compared statistically. **Result:** The mean value of height 104.42 (± 0.27) in males, 89.28 (±0.14) in female, t test 24.9 and p<0.001. In comparison of width of sacrum 98.30 (± 0.42) in males, 111.04 (± 0.5) in females, t test was 9.75 and p<0.001. **Conclusion:** This metrical study of sexual dimorphism will be useful to medico-legal experts, anatomists, and anthropologists because the morphometric values of mesodermal derivatives are uncertain.

INTRODUCTION

The sacrum is a large triangular bone formed by the fusion of five sacral vertebrae. It is articulated in the pelvis, and it forms the posterior boundary of the pelvic cavity.[1] The function of the pelvic cavity is bearing children and locomotion. It has great interest to the anatomist, medico-legal expert, and anthropologist to differentiate male and female sacrum because it is believed that the sacrum is the last bone to get perished when buried.[2] Hence, it is named as sacrum (sacrum means sacred).

Sexual dimorphism ascertains the biological and behavioral factors that affect the bony elements. Since the skeleton is a dynamic system that undergoes growth and development through the individual life span.[3] It is also evaluated that mineral content is carried out to assess sex differences in adult males and females.

As the sacrum is a component of the axial skeleton and because of its contribution to the pelvic girdle and, in turn, to the functional differences in the region between sexes, it has importance in anatomy, medico-legal, and anthropology.

Secondary centers of ossification almost all appear after birth. The date of their appearance varies considerably from one bone to another.[4] They were precocious in females. The factors that determine the time of ossification are obscure; hence, there will be variation in morphometric parameters of bone. Therefore, an attempt is made to study the sexual dimorphism of the sacrum.

MATERIALS AND METHODS

25 male and 25 female sacrum bones available in the anatomy and forensic department of Navoday Medical College, Raichur, Karnataka-584103, were studied.

Inclusion Criteria

Non-pathological, dried adult sacrums of both sexes were selected for study.

Exclusion Criteria

Broken, pathological sacrum was excluded from the study.

Method: Each sacrum was put in anatomical position. The length and breadth were measured by vernier caliper.

The duration of the study was from April 2024 to May 2025.

Statistical Analysis: Obtained values from various parameters were studied by using the t-test. The statistical analysis was carried out using SPSS software.

RESULTS

[Table 1] Comparison of Height of sacrum in both sexes mean value of male sacrum 104.42 (± 0.27), 89.28 (± 24.9) in female, t test was 24.9 and p<0.001.

[Table 2] Comparison of width of sacrum in both sexes: 98.30 (± 0.42) in male, 111.04 (± 0.5) in female, t test was 9.75 and p<0.001.

[Table 3] Male sacral Index is 94.13 and female sacral index is 124.3

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Table 1: Comparison of Height of sacrum in both sexes

Height (length)	Male sacrum (25)	Female sacrum (25)	t test value	p value
Mean Value (±SD)	104.42 (±0.27)	89.28 (±0.14)	24.9	P<0.001

Table 2: Comparison of Width of sacrum in both sexes

Width	Male sacrum (25)	Female sacrum (25)	t test value	p value
Mean Value (±SD)	98.30 (±0.42)	112.02 (±0.5)	9.75	P<0.001

Table 3: Sacral Index of both sexes

Male - mean values height / width of X 100

$$\frac{98.30}{104.42} x100 = 94.13 \qquad \frac{\text{Sacrum}}{\textit{Mean Value of Height Sacrum}}$$

Female - mean values height / width of X 100

$$\frac{111.04}{89.28} x100 = 124.3 \qquad \frac{\text{Sacrum}}{\textit{Mean Value of Height Sacrum}}$$

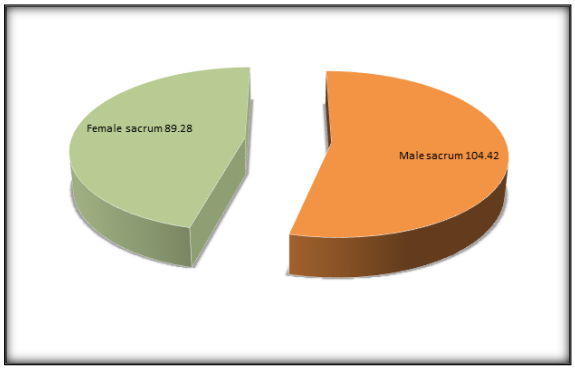

Figure 1: Comparison of Height of sacrum in both sexes

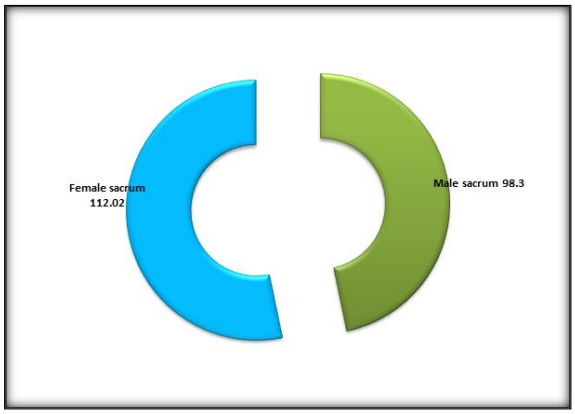

Figure 2: Comparison of Width of sacrum in both sexes

DISCUSSION

In the present study of identification of gender from the sacrum. The height of the sacrum is 105.42 (± 0.27) in males and 89.28 (± 0.14) in females; the t-test was 21.2, and the p-value was highly significant ($p<0.001$) (Table 1). The width of the sacrum is 98.30 (± 0.42) in males, 111.04 (± 0.5) in females, t test was 9.75 and p value was highly significant ($p<0.001$) (Table 2). The sacrum index in males was 94.13 and in females 124.3 (Table 3). These findings are more or less in agreement with previous studies.[5-7]

It is observed that the female sacrum is wider and flatter than that of the male, permitting a greater outlet of the birth canal.[8] The gender differences in the sacrum are due to factors like age, height, weight of stature, nutrition, heredity, climate, race, disease, and sex.[9] In the present study the sacral index of the male sacrum was 93.21, which falls under the dolichoheiric group (narrow sacrum), and the female sacral index was 125.4, which falls under the plathyhieric group. Those findings are also more or less in agreement in the Bengali sacrum and Jammu Stage region.[10] It confirms that there is drifting of population from West Bengal and Jammu to Maharashtra. Moreover, the present sacral indexes are also in agreement with abroad studies.[11]

In the evolution, the quadruped vertebral column was like a cantilever bridge, which modified into a pillar to transmit the body weight of erect posture; hence, there is a reorientation of the morphometry of the sacrum because the cantilever bridge modified into a pillar.[12] The modified sacrum may cause obstetrical problems, which were unknown to quadrupeds. Hence, due to the adaptation of erect posture against gravity stress, the sacrum of both sexes has adapted its functional and biomechanical status to facilitate locomotion and parturition as well.

In addition to this, the secretion of calcitonin from the thyroid gland plays a vital role in the stature of the human skeleton, like in giantism and dwarfism. Moreover, the process of ossification is associated with the appearance of a local enzyme called phosphatase.[13] Hence, hormones also play a vital role in the morphometric values of the sacrum.

CONCLUSION

The present study of identification of gender from the sacrum will be useful to medico-legal experts, anthropologists, and anatomists to differentiate the gender. But this demands further genetic, embryological, nutritional, hormonal, and biomechanical studies because exact morphometric values of mesoderm are still uncertain.

Limitation of study: Owing to remote location of research centre, small number of bones lack of latest techniques we have limited finding and results.

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