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Original Research Paper

A MORPHOMETRIC STUDY OF THE GREATER SCIATIC NOTCH OF DRY HIP BONE IN RELATION TO SEXUAL DIMORPHISM IN NORTH INDIAN POPULATION

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ABSTRACT:

Background: The hip bone is a big, flattened, asymmetrical bone that is narrowed in the middle and enlarged above and below. Together, they form the sides and anterior wall of the pelvic cavity. It meets its counterpart on the opposing side in the middle line in front. **Aim**: Morphometric study of the greater sciatic notch of dry hip bone in relation to sexual dimorphism in north Indian population. **Materials and Method**: The study is cross sectional. Material for the study consisted of 300 dry hip bones of known gender. Gender was determined using information from the Department of Anatomy Index Medical College Malwanchal University Indore M.P. All the bones are fully ossified and free from any congenital or pathological defects. Deformed and malformed bones are also excluded from the study. Not properly ossified and not paired bones were excluded. **Results and Conclusion**: The maximum width, Index I and II of the greater sciatic notches was found significantly lower in male comparison to that in the female but in Index III of the greater sciatic notch was found insignificant difference.

Key Words: Hip Bone, Sciatic Notches

INTRODUCTION:

The hip bone is a big, flattened, asymmetrical bone that is narrowed in the middle and enlarged above and below. Together, they form the sides and anterior wall of the pelvic cavity. It meets its counterpart on the opposing side in the middle line in front. In a young subject, the ilium, ischium, and pubis are separate from one another; in an adult, they are fused together. The union of the three components occurs in and around the acetabulum, a huge cup-shaped articular cavity that is located close to the middle of the outer surface of the bone. The superior broad and extended section that rises upward from the acetabulum is known as the ilium and is given that name because it supports the flank. The ischium, which extends downward from the acetabulum, expands into a large tuberosity, and then curves forward to form the obturator foramen, a large aperture, is the lowest and strongest part of the bone. The pubis forms the front of the pelvis and supports the external organs of generation as it extends medially forward and downward from the acetabulum and articulates in the middle line with the bone on the opposite side[1].

Prevalence of different shapes of pelvis:

Early studies of human pelvic dissimilarities focused on the occurrence of diverse pelvic shapes in various "races," as well as their ability for pregnancy[2]. Only a small number of populations, including the KhoeSan, Andamanese, and Australians, have a rounder canal, which is regarded to be older and better suited for giving birth. It was believed that the transversally larger shape of European women made them unfit for giving birth. The female pelvis was thought to have a uniform shape regardless of a woman's urge for reproduction, but recent research has disproved this idea. Recent research has revealed that populations differ greatly in the shape of the pelvis[3]. According to the results of this study, it may be possible to distinguish between individuals of "white" and "black" ancestry using a collection of pelvic measurements with an accuracy of more than 80%. Weaver and colleagues20 discovered that present populations varied significantly in overall pelvic form after analysing dissimilarity in the complete articulated pelvis across many human populations using 3D landmark techniques[4]. Many people have come to the same conclusion as Bettiet al. based on the ilium's 3D

form. Based on research into bone measurements and in vivo pelvic measurements, Wells et al. discovered that birth canals varied greatly among populations[5]. Different populations' pelvic breadths have been recognised and discussed by a number of authors, including Holliday and Hilton. Bi-iliac breadth differences between residents of higher and lower latitudes suggest that climate may be a factor in the differences. The results suggest that people in various climates appear to have varying body proportions[6]. Measuring the pubis and sciatic notch typically reveals the genuine sex differences in adult hip bones. The pubic bone is one of the most potent morphological discriminators of sex in the human hipbone, and the indices and angles of the greater sciatic notch are renowned for their sexual dimorphism[7]. For those who are known to be significantly sexually dimorphic, many indices have been developed. Several techniques have been used in the past and have proved successful, including the sciatic notch index, ischio-pubic index, and a modified version of that index[8]. The acetabulum-pubis index (A-Pindex) can reliably identify a person's gender more than 90% of the time. Geometric morphometric and three-dimensional quantitative methods have become more widely used in recent decades. In sexual analysis, measurements, collections of landmarks, exterior surface curves, and roundness can all be used[9]. Following cross validation, this method was used to the French population, and 90.3% of the people were correctly assessed. The most accurate sex indication is the hip bone, which is the most heterogeneous bone in the human body[10]. There is a sex difference in the hip bones starting in the foetal stage. Anthropologists have already pondered a lot about the greater sciatic notch[11]. For the first time, Verneau observed that the large sciatic notch in females was shallow and wide. Derry, Caldwell, and Moloy claim that a broad and shallow notch for women is essential for childbirth. Long acknowledged as a key factor in determining sex is the pelvic girdle, or hip bone[10]. As a result, no research has been done on the north Indian population, despite the fact that it is frequently thought to be one of the bones for sex identification that is most accurate. There is sexual dimorphism in the pelvis, with the male pelvis growing larger and the difference fading later in childhood. In comparison to the male sacrum, the female sacrum is bigger, more compact, somewhat curved, and located further back. Men's pelvises are longer and narrower than women's, and their pelvic cavity is larger. Ebraheim and Biyani's study found that elderly men have a somewhat greater SIJ area than older women [12]. Men's average auricular surface area is 22.3 cm, compared to women's standard range of 10.7 to 14.2 cm and higher, with a maximum of 18 cm. because sexual dimorphism with the pelvis is more reliable. The pelvis was selected as the area of sexual dimorphism in this experiment[13]. It is one of the most useful bones for determining age and sex in the entire skeleton. By looking at the hip bone, it is possible to identify the sex. A unique adaptation in females for childbearing is the sexual dimorphism of hip bones. Therefore, being aware of the typical hip bone size in both sexes were aid forensic professionals in detecting sex in disputed cases. If the skeleton's sex is accurately obtained, following research is likely to be more precise, and separate male and female standards may then be utilized to calculate age. Normal anatomical variance exists within each sex to establish norms. Additional influences on these variances include genetic, ethnic, environmental, and cultural ones. The determination of sex can be aided by a number of metric factors and non-metric variances in skeletal component between groups[14]. Aim of the study a morphometric study of the greater sciatic notch of dry hip bone in relation to sexual dimorphism in north Indian population.

MATWERIAL AND METHODS:

The study is cross sectional. Material for the study consisted of 300 dry hip bones of known gender. Gender was determined using information from the Department of Anatomy Index Medical College Malwanchal University Indore M.P. All the bones are fully ossified and free from any congenital or pathological defects. Deformed and malformed bones are also excluded from the study. Not properly ossified and not paired bones were excluded.

The metric parameters were:

Maximum width of the greater sciatic notch: The maximal width of the posterior border of greater sciatic notch (PSIS-IT) in cm - measured from the Posterior superior iliac spine (PSIS) to superior border of ischial tuberosity (IT)

Index of the greater sciatic notch: - Out of these three parameters, depth and width will be measured with the help of sliding vernier caliper while the third parameter will be calculated with the help of these two parameters by using the formula (depth/width) x 100.

RESULT AND DISCUSSION:

Table 1 shows statistical analyzes projected that the maximum width of the greater sciatic notch found to be significantly. This was observed that the average (Mean ± SD) was found in male 43.42 ± 4.30 and in female 47.26 ± 5.61. The maximum width of the greater sciatic notch was found significantly lower in male comparison to that in the female, with a p value of < 0.001. These findings were in line with the findings of prior research conducted by Thomas et al., (2019)[15] and Jain et al., (2013)[16] suggested that the bigger sciatic notch was significant in classifying the sexes and they were found a statistically significant difference in the width, depth, anterior segment, posterior segment, three indices, posterior angle, and

total angle of the greater sciatic notch in males and females.

Table 2 shows Statistical analyzes projected that the Index I, II and III of the greater sciatic notches found to be significantly. This was observed that the average (Mean ± SD) was found in male 71.68 ± 11.33, 19.03 ± 6.87, and 63.56 ± 10.96 and in female 70.46 ± 9.50, 34.62 ± 8.83 and 72.42 ± 11.82. The Index I and II of the greater sciatic notches was found significantly lower in male comparison to that in the female, with a p value of < 0.001 but in Index III of the greater sciatic notch was found insignificant difference. These findings were in line with the findings of prior research conducted by Thomas et al., (2019)[15], Sandhya K et al., (2019)[17] and Jain et al., (2013)[16] compared that the different factors of larger sciatic notches for sexual dimorphism. The larger sciatic notches of males and females were significantly different in both index-I and index-II, and it was determined that index-I is also very important in determining sex.

Table-1 Comparison of maximum width of the greater sciatic notch

Variable	Male (mm)	Female (mm)	p – Value
	Mean ± SD	Mean ± SD	
Maximum width of the greater sciatic notch	43.42 ± 4.30	47.26 ± 5.61	0.001

SD = Standard deviation

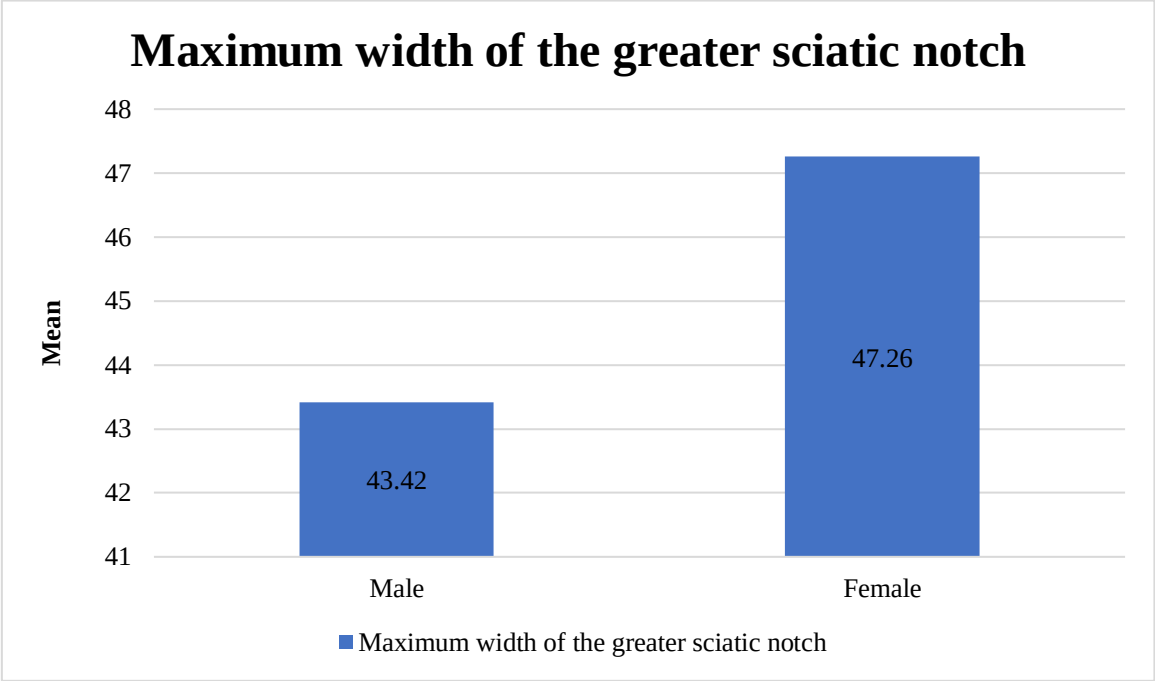

Figure:1 represents the maximum width of the greater sciatic notch

Table-2 Comparison of Index of the greater sciatic notch

Variable	Male (mm)	Female (mm)	p – Value
	Mean ± SD	Mean ± SD	
Index I of the greater sciatic notch	71.68 ± 11.33	70.46 ± 9.50	>0.05
Index II of the greater sciatic notch	19.03 ± 6.87	34.62 ± 8.83	0.001
Index III of the greater sciatic notch	63.56 ± 10.96	72.42 ± 11.82	0.001

SD = Standard deviation

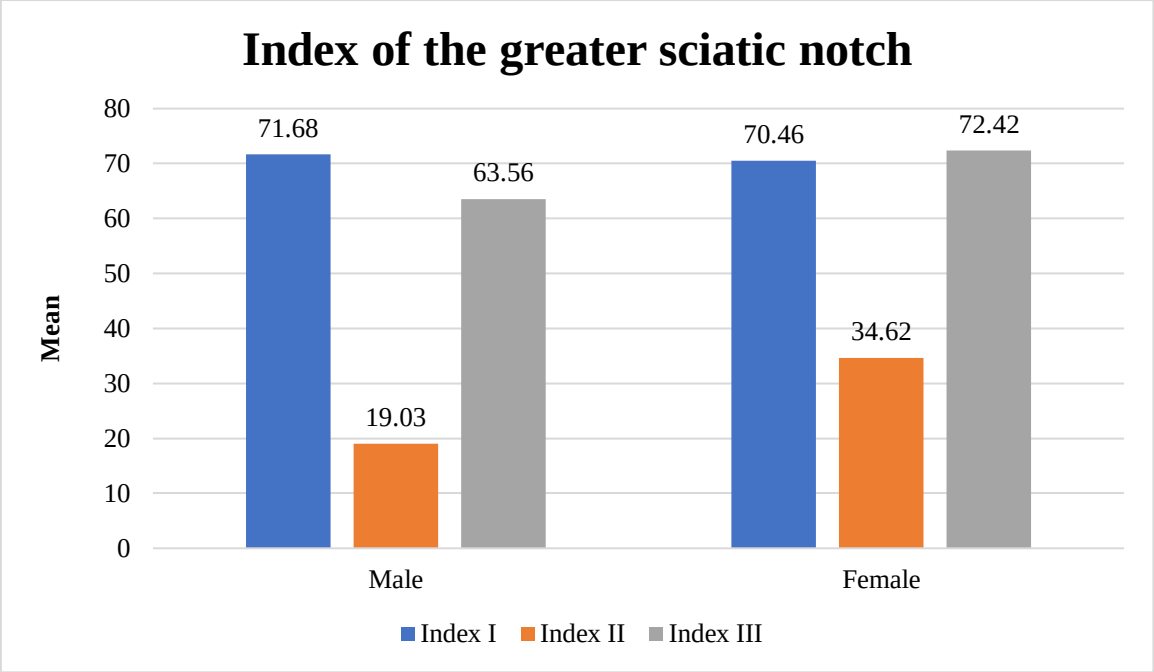

Figure:2 represents the Index of the greater sciatic notch

CONCLUSION:

The findings of this investigation clearly demonstrate the hip bone considerable sexual dimorphism. The current study shows that all statistical methodologies are useful in determining sex, both individually and collectively. The accuracy of categorization improves as the number of parameters grows. Furthermore, the study's demarcating and limiting results can be used to establish baseline criteria for sex determination in the north Indian population.

The present study showed the following main findings:

1. The maximum width of the greater sciatic notch was found significantly lower in male comparison to that in the female, with a p value of < 0.001.
2. The Index I and II of the greater sciatic notches was found significantly lower in male comparison to that in the female, with a p value of < 0.001 but in Index III of the greater sciatic notch was found insignificant difference.
3. This research highlights the need of population-specific methodologies not only for medicolegal investigations, but also for the study of population affinities and variables influencing bone shapes. When other human remains suitable for sex determination are unavailable, the study's findings may aid in predicting sex from the hip bone in Indians.

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