



Research Article

## A MORPHOMETRIC STUDY OF ISCHIUM OF HUMAN HIP BONE AND ITS CLINICAL IMPORTANCE -AN INSTITUTIONAL STUDY

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### ARTICLE INFO ABSTRACT

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**Keywords:**

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**Background:**-Hip bone is one among the bones in the human skeleton that is most sexually dimorphic and provides sufficient evidence for sex determination even if some parts or fragments are available. This bone is of great use for anatomic, medicolegal and anthropological purposes. The present study aims to determine the sexual differences in morphometric diameters of the ischial part of dry hip bone. **Methodology:** The present study is done on 50 undamaged dry human hip bones of known sex and side (M: F=20:30, R: L=23:27) taken from the Department of Anatomy, Government Medical College, Srinagar. The different parameters are (1) Height of ischium (2) of ischium up to the farthest point on the acetabular rim (3) Lower spinal length (4) spinal height. **Results:** In our present study, the parameters we found were longer in males as compared to females. Also, the parameters were longer on the right side in both males and females but the difference was statistically insignificant. The height of ischium in males on the right side is  $7.3 \pm 0.5$  mm and in females  $7.1 \pm 0.33$  mm, in females on the left side is  $6.8 \pm 0.34$  mm. Ischial length up to the farthest point on the acetabulum rim in males on the right side is  $10.3 \pm 0.8$  mm and on the left side  $7.3 \pm 0.32$ . In females on the right side  $10.1 \pm 0.8$  mm and on the left side  $9.9 \pm 0.9$ . The lower spine height in males on the right side is 12.43 mm and on the left side  $12.08 \pm 1.003$  mm, in females on the right side  $12.5 \pm 1.6$  mm and on the left side  $11.8 \pm 1.0$ . The frontal spinal height in males on the right side is  $15.42 \pm 0.7$  mm, on the left side  $15.12 \pm 1.74$  mm, in females on the right side is  $15.3 \pm 1.02$  and on left side  $15.0 \pm 1.0$ . **Conclusion:** The present study gives valuable data about different variants of the hip bone that are important in determining the size and gender of bone. Moreover, our study will add to the existing data of similar studies

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## INTRODUCTION

The hip bone is an irregular-shaped bone that forms the part of the pelvic girdle which is the bony structure that connects the axial skeleton to the lower limb. The hip bone has three parts ilium, ischium and pubis [1]. The ischium forms the posteroinferior part of the hip bone. It contributes  $2/5^{\text{th}}$  of the acetabulum. It has two ends (upper and lower), three borders (anterior, posterior and lateral) and three surfaces (femoral, dorsal and pelvic) [2]. The body contains a prominent spine, known as the ischial spine which serves as the origin of the superior gemellus muscle. The indentation inferior to the spine is a lesser sciatic notch. This is the portion that supports weight while sitting. There is one primary centre of ossification for ischium which occurs in 3<sup>rd</sup> month of intrauterine life and one secondary center for ischial tuberosity. Ossification of the rest of the bone is completed in 20-25 years [3].

The nature and degree of sexual differentiation in the pelvis have long been of interest to anatomists and anthropologists. It

is also of practical importance to obstetricians and forensic experts who would identify skeletal is gaining importance in recent years, due to increasing crime rates worldwide. Thus new and more accurate means of determining the age, sex and race are needed [4].

The determination of sex is statistically the most important criterion, as it immediately excludes approximately half the population, whereas age, stature and race each provide points within a wide range of variables. Obvious sex differences do not become apparent until after puberty, usually in the 15-18 year period, though specialized measurements of the pelvis can indicate sex even in fetal material [5]. The accuracy of sex estimation is difficult. Krogman's scored 100% accuracy, using the whole skeleton, 95% on the pelvis, 92% on the skull, 98% on the pelvis and skull, 80% on long bones and 98% on long bones plus pelvis [6]. The literature contains sufficient evidence that metric and morphological biological differences exist among Caucasoid, Mongoloids and Negroid races [7, 8]. The determination of related indices and angles have been very useful not only in forensic science but also in

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clinical practice mostly in obstetrics and gynaecology and physical Anthropology.

Davivong and Washburn determine the ischiopubic index obtained by dividing the length of the pubis by the length of ischium [9].

According to Udoaka et al, the ischium is longer in males. It was found that the ischial length was more on the right side as compared to the left side in males while in female ischial length are slightly more on the left side as compared to the right side of the hip bone [10].

The ischial spine is a landmark for pudendal nerve block as the pudendal nerve is situated close to the ischial spine. The upper portion of ischium forms a major part of the concave portion of the pelvis that forms the hip. As part of the hip joint, this bone plays an important role in leg mobility, balance, standing up and lifting tasks [11]. Clinically speaking the ischium is associated with hip osteoarthritis, a common ailment characterized by erosion of necessary cartilage and there wear and tear of hip joint [12].

For obstetricians to assess the progress of labour, presenting the fetal part in the birth canal is done in relation to the ischial spine. If the fetal head is present below the ischial spines it is denoted as + like +1,+2,+3,+4,+5 [13].

After a detailed review and considering the facts that there were many morphologic biologic differences amongst populations globally, decision to conduct present study was carried out to provide reliable data on the population of this part of the country (Kashmir).

## MATERIAL AND METHODS

A set of 50 undamaged adult human hip bones of known sex (20F and 30M) and side were chosen out of which 23 bones are on the right side and 27 that on the left side from the collection of anatomy laboratory, Government Medical College, Srinagar. All the bones that were fully ossified and free from any pathological defects were included. The bones which were deformed and malformed were excluded from our study. All the measurement of bones were done by using verniercalipers. On each hip bone, the following four parameters were measured:

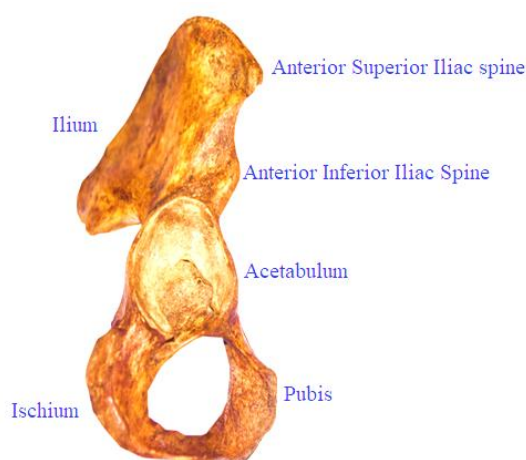


Fig 1 A diagram showing parts of Hip Bone of right side

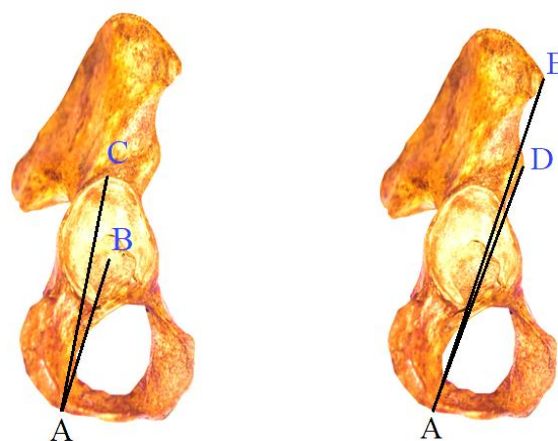


Fig 2 A diagram of right-sided hip bone showing measurement points of ischial parameters.

A-B: Height of Ischium

A-C: Length of Ischium up to the farthest point at acetabular rim

A-D: Lower spinal height

A-E: Front spinal height

### Height of Ischium

It was termed as the length of ischium by Davivongs. Seidler described it as the greatest distance between the central point of the acetabulum and the farthest point on the distance between the ischial tuberosity and anterior inferior iliac spine. It was measured with Vernier Caliper. The inferior aspect of ischial tuberosity is known as the ischial point by theme.

### Ischium length up to the farthest point on the acetabular rim

It is measured with from the ischial point to the farthest point on the rim of the acetabulum.

### Lower spinal height

It is the distance between the ischial tuberosity and anterior inferior iliac spine.

### Front spinal height

It was measured by as the distance between the ischial tuberosity and anterior superior iliac spine



Fig 2 A diagram of the Right Hip Bone showing the height of ischium

### Data analysis

The values of the measurements were recorded then tabulated and statistically analyzed using the statistical package for social science (SPSS) version 25.0. The mean, standard

deviation, and student t method were used to analyze the data and a p-value <0.05 was considered statistically significant.



**Fig 3** A diagram of the right hip bone showing the length of ischium up to the farthest point at the acetabular rim.



**Fig 4** A diagram of the right hip showing the lower spinal height.



**Fig 5** A diagram of the right hip showing the front spinal height.

## RESULTS

All the measured parameters, mean, standard deviation and standard error of mean were calculated. To this the independent student's t-test for equality of means was applied and 't' and 'p'-values were calculated to find out the consequence of the dissimilarity between the means for the two sexes. The results have been tabulated in Table 1. On elucidation, it can be seen that all four parameters i.e.; the height of ischium, length of ischium up to the farthest point on the acetabular rim, lower spinal height, and front spinal height show conspicuous differences between the two sexes, being larger in males. Also, when two sides are compared, all the measurements are longer on the right side as compared to the left side in both sexes, although no significant difference could be found in either sex.

## DISCUSSION

The human pelvis is different in males and females which is well studied in different literatures and various studies have been done on this human pelvis by anatomists, anthropologists and obstetricians. In females, the hormonal action of estrogens on bones has been shown to inhibit osteoblast apoptosis and increase osteoblastic life span thereby increasing the functional capacity of each osteoblastic. This leads to different growth in females for reproductive purposes.

### Height of ischium

The present study shows that ischium was significantly longer in males as compared to females. Regarding sides, the height of ischium is slightly longer on the right side in both males and females. A comparison of the data with other studies is given in Table 2.

### Ischium length to the farthest point on the acetabular rim:

In our present study, it was found that this variable was statistically longer in males than that in females. As far as the side was concerned, the right side showed longer on both males and females. A comparison of the data with other studies is given in Table 2.

### Lower spinal Height

The present study showed the mean value of this parameter was significantly longer in males and slightly more on the right side in males and females. A comparison of the data with other studies is given in Table 2.

### Front spinal Height

Statistically Front spinal height was found longer in males and as far as the side is concerned it was more towards the right side in both males and females. A comparison of the data with other studies is given in Table 2.

**Table 1** Mean values, standard deviation, Range and P-value for various measurements studied in both sexes on both sides.

Sr. no	Parameter	Male(N=20) Mean±S.D		Female Mean±S.D (N=30)		P-value	Side
		Right	Left	Right	Left		
1	Height of ischium	7.3±0.5mm	7.1±0.33mm	7.1±0.6mm	6.8±0.34mm	0.037	0.548
2	Ischial length up to the farthest point on the acetabular rim	10.3±0.8mm	7.3±0.32mm	10.1±0.8mm	9.9±0.9mm	0.112	0.757
3	Lower spinal height	12.43±0.8mm	12.08±1.003mm	12.5±1.6mm	11.8±1.0mm	0.034	0.668
4	Frontal spinal height	15.42±0.7mm	15.12±1.74mm	15.3±1.02mm	15.0±1.0mm	0.062	0.844

**Table 2** Comparison of ischial height/length in different population.

Authors	Race	MEAN ± S.D	MEAN ± S.D
		MALE	FEMALE
Kimura (1982) <sup>14</sup>	Japanese	10.8 ± 3.78	9.82 ± 3.98
Kimura (1982) <sup>14</sup>	American whites	11.6 ± 6.38	10.17 ± 5.18
Kimura (1982) <sup>14</sup>	American blacks	11.17 ± 0.58	10.68 ± 0.58
Theresa (2014) <sup>15</sup>	Lagos	6.89 ± 0.58	6.69 ± 8.47
Kumari & Singh (2016) <sup>16</sup>	Jharkhand	10.68 ± 0.58	10.68 ± 0.58
Gupta et al (2017) <sup>17</sup>	North Indian	7.024 ± 4.58 (R)	6.526 ± 3.78(R)
		6.992 ± 4.71 (L)	6.50 ± 3.73(L)
Mostafa et al (2017) <sup>18</sup>	Egyptian	9.58 ± 4.1 (R)	8.49 ± 3.5 (R)
		9.61 ± 3.9 (L)	8.53 ± 3.4 (L)
Sachdeva et al (2020) <sup>19</sup>	North Indians	8.07 ± 0.567	7.31 ± 0.781
Present study (2023)	Kashmiri population	7.3 ± 0.5 (R)	7.1 ± 0.6 (R)
		7.1 ± 0.33 (L)	6.8 ± 0.34 (L)

## CONCLUSION

Hip bone is the most reliable indicator of sexual dimorphism in adults, which varies geographically. However, there are no diagnostic criteria that can be transferred from one population to another. Thus, we as anatomists are trying to develop population-specific standards that can be used for the identification of human skeletal remains

The present study gives valuable data about different morphometric variants of Hip bone that are important in determining the size and gender of bone. Moreover, our study will add to the existing data of similar studies.

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