



## Study of the Morphological Features of Human Hip Bone to Determine the Sex in Gujarat State

**Dr. Vijay P. Kanjariya** Tutor, Department of Anatomy, M P Shah medical college, Jamnagar

**Dr. Dilip V. Gohil** Associated Professor, Department of Anatomy, M P Shah medical college, Jamnagar

**Dr. Mital M. Patel** professor, Department of Anatomy, M P Shah medical college, Jamnagar

**Dr. S. P. Rathod** Professor & Head, Department of Anatomy, P D U Medical college, Rajkot

**Dr. Dhaval Talsaniya** Tutor, Department of Anatomy, M P Shah medical college, Jamnagar

**Dr. Mohit V Changani** Tutor, Department of Anatomy, M P Shah medical college, Jamnagar

### ABSTRACT

*Sex determination by using a human skeleton or parts of human skeleton remains are very important for medicolegal as well as anatomist & anthropological studies. So, many bones of human skeleton are used for sex determination. Most important bones are hip bone, skull and sacrum etc. Out of this, so many studies are done on the basis of different indicators of hip bone to determine the sex. In present study, we have tried to determine sex of adult human hip bone by using morphological features. There are so many morphological features to identify sex, but out of these only five most important features are selected for study as these features shows higher percentage of identification. These features are (1). greater sciatic notch (2). ischiopubic ramus (3). iliac crest (4). acetabulum direction and (5). obturator foramen. Material for the study consists of 102 adult hip bones (51 right side and 51 left side) and concluded that multiple morphological features can identify a sex.*

**KEYWORDS : Morphological features, Sex determination and Hip bone.**

### INTRODUCTION:

Examination of skeleton remains by forensic experts assumes a great medicolegal application. Scores of research works are fascinated by studies of sexual differences from bones based on morphological or anatomical parameters. In present study we have observed following morphological features.

**Greater sciatic notch :** In male greater sciatic notch is smaller, closer and deeper while in female it is larger, wider and shallower<sup>1</sup>. In male angle is 50.5° approximately while in female it is 74.5° approximately<sup>2</sup>. In a massive male pelvis its outline resembles hairpin band. Massive bone and extensive sacro-iliac articulation tend to depress the posterior part of the upper margin of the notch and the posterior inferior iliac spine, and a sacrum with its lower end tilted in has a similar effect on the margin of the notch<sup>3</sup>. The greater female values for angle and width are associated with increase backward sacral tilt and greater anteroposterior pelvic diameter, especially at lower levels<sup>4</sup>.

The dimensions of the greater sciatic notch have importance in parturition (5, 6). Upper part of the greater sciatic notch was a reliable marker in sex determination since it was not affected even in pathologically deformed conditions of the hip bones<sup>7</sup>.

According to Derry (1923) in comparing typical male and female hip-bones it will be noticed that the great sciatic, or ilio-sciatic notch as it is better termed, differs markedly in the two sexes. In the man the margins of the notch enclose a relatively deep and narrow excavation: in the woman the posterior margin slopes backwards in such a way as to form a wide shallow arch in striking contrast to that in the male. This difference in shape is associated with a difference in the position of the articular surface for the sacrum, and therefore of the sacrum itself, such that it stands further back in the pelvic cavity in the woman thus increasing the antero-posterior diameter of the pelvis<sup>5</sup>. A wide, shallow greater sciatic notch is considered to be a female characteristic<sup>8</sup> as is the greater width of the ala of the sacrum compared to the width of the body<sup>9</sup>. Female sciatic notches are wider than those of males, and there are also shape differences between the sexes. In males, the greater sciatic notch tends to be narrow and U shaped. In females, it is comparatively open, with lower width to depth ratio<sup>10</sup>.

**Acetabulum:** In male acetabulum is large, directed laterally while in female it is small, directed anterolaterally<sup>11</sup>. The acetabula in female are

farther apart and are smaller, especially relatively, for the femoral head is small and hip bone is large<sup>3</sup>.

**Ischiopubic ramus:** In male Ischiopubic ramus is thick and everted while in female it is thin and not much everted<sup>2</sup>. In male ischiopubic rami are more everted for attachment of the penile crura, the corresponding attachment for the clitoris being poorly developed<sup>4</sup>.

**Iliac crest:** In male general bony frame work is massive, rougher, marked muscular site, while in female it is less massive, slender, smoother<sup>11</sup>. Since male are more muscular and therefore heavily built, markings for muscles and ligaments more pronounced and general architecture heavier<sup>4</sup>. As a general rule male bones are more massive and heavier than female ones<sup>12</sup>. The crests ridges, tuberosities and lines of attachment of muscles and ligaments are more strongly marked in males. In male iliac crest is more rugged and more acutely curved while in female it is smoother and less curved<sup>13</sup>. The iliac crest has a steeper anterior and posterior slope in males<sup>14</sup>.

### Obturator foramen:

In male obturator foramen is large, oval with base upward while in female it is small, triangular with apex downward<sup>11</sup>. The male obturator foramen being oval in shape, and the female triangular, but this depends on the breadth of the ischio-pubic region and is not constant<sup>15</sup>. The height of the female symphysis and adjoining parts of the pubis and ischium, which form the anterior pelvic wall, are also absolutely less, producing a somewhat triangular obturator foramen, which is more ovoid in males<sup>4</sup>.

### MATERIALS & METHODS:

Total 102 (M: 86, F: 16) hip bones of adults belongs to Gujarat state of known sex were include for present study. Study of the bones was conducted in department of anatomy. M.P.Shah medical college, Jamnagar, Gujarat. All the bones were examined for above morphological features irrespective of sides. Then individual features were identified and combination of three most features are identified and result obtained. Morphological features of bones are classified as M-type & F-type according to above description. Then bones are compared with original sex record of department.

**Keep photograph here.**  
**OBSERVATIONS**

**Table I: showing the percentage of morphological features**

Morphological features	Male% (n=86)	Female% (n=16)
I	83.72(n=72)	50.00(n=08)
II	81.39(n=70)	75.00(n=12)
III	73.25(n=63)	62.50(n=10)
IV	72.09(n=62)	62.50(n=10)
V	69.76(n=60)	25.00(n=04)
I+II	66.27(n=57)	43.75(n=07)
I+II+III	58.13(n=50)	37.50(n=06)
I+II+III+IV	43.02(n=37)	31.25(n=05)
I+II+III+V	37.20(n=32)	00.00(n=00)
I+II+III+IV+V	30.23(n=26)	06.25(n=01)

Abbreviations: I(greater sciatic notch), II(ischiopubic ramus),III(ilic crest), IV(acetabulum) and V(obturator foramen).

Observation table indicate numbers of bones having morphological features of individual as well as combination of 2 or more than 2 features.

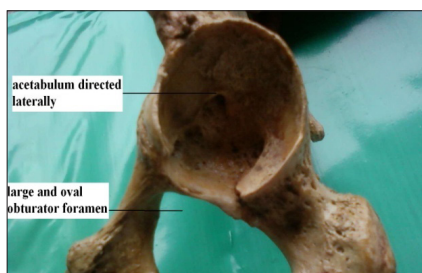
**DISCUSSION:** As per finding of table I in present study out of 86 Male hip bones, Greater sciatic notch is male type in 83.72 % (n=72) type and out of 16 female hip bones female type in 50%(n=8).

Second most important feature is ischiopubic ramus. Out of 86 male hip bone 81.72%(n=70) are male type and out of 16 female hip bones 75%(n=12) are female type.Third feature is iliac crest. Male hip bones show 73.25%(n=63) and female hip bones show 62.50% (n=10) characteristic features.Obturator foramen in 69.76%(n=60) of hip bone showing male type features in male group and 25%(n=4) of hip bones show female type features in female group.

Lastly, result of three most important morphological features like greater sciatic notch, ischiopubic ramus and iliac crst are observed in single bone to identify a sex, it shows that 58.13% bones in male group and 37.50% hip bones of female group having all three morphological features.

**CONCLUSION:** Present study shows that only morphological criteria of bones are also very important tool to diagnose a sex of a given bone. In present study, we have used multiple morphological features to identifying a sex of an individual bone, while most of studies are carried by using single index to that particular group. Percentages of identifying bones are very much as compare to traditional demarking point (D.P.) method. Because in D.P. method, bones identified are situated beyond calculated range. So, numbers of correctly identifying bones are few.This is the newer approach to identify a sex from morphological features. Present study is also needed more observation & application in other region of population.

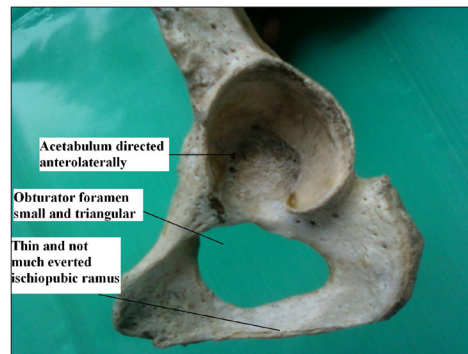
**Photograph 1: Male left side hip bone (Anteroposterior view)**



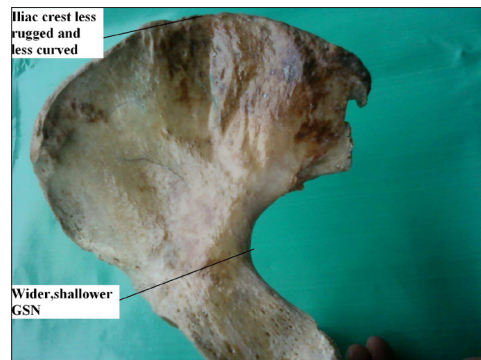
**Photograph 2: Male left side hip bone ( Posterolateral view)**



**Photograph 3: Female left side hip bone (Anteroposterior view)**



**Photograph 4: Female left side hip bone ( Posterolateral view)**



**REFERENCES**

1. Krogman WM, Iscan MY. The human skeleton in forensic medicine, 2nd Edn. Charles C. Thomas, Springfield IL. 1986 :209. | 2. Datta AK. Essentials of human anatomy, thorax, abdomen and pelvis. Vol.1, 8th Edn. . Current Books International ,Kolkata. 2008;381. | 3. Romanes GJ. Cunningham's textbook of anatomy, 10th Edn. Oxford Medical Publication, London. 1964;178. | 4. Standing S. Gray's anatomy-the anatomical basis of clinical practice, 39th Edn. Elsevier Churchill Livingstone, Edinburgh, London, . 2005;1431. | | 5. Derry DE. On sexual and racial characters of human ilium. J. Anat. 1923;58,71-83. | | 6. Caldwell WE, Moloy HC. Sexual variations in pelvis. Science. 1932;76,37-40. Cited by Singh S, Potturi BR. Greater sciatic notch in sex determination, J. Anal. 1978;125: 619-624. | | 7. Jovanovic S, Zivanovic S, Lotric N. The upper part of greater sciatic notch in sex determination of pathologically deformed hip bones. Acta Anatomica. 1968; 69:229-238. Cited by Singh S, Potturi BR. Greater sciatic notch in sex determination, J. Anat. 1978;125:619-624. | | 8. Hager LD. Sex differences in the sciatic notch of great apes and modern humans. Am J Phys Anthropol. 1996;99:287-300. Cited by Scheuer L. Application of osteology to forensic medicine . Clinical Anatomy. 2002; 15:297-312. | 9. Kimura K. A base wing index for sexing the sacrum. J. Anthropol Soc Nippon 90(Suppl) 1982;153-162. Cited By Scheuer L. Application of osteology to forensic medicine . Clinical Anatomy . 2002;15:297-312. | 10. Walker PL. Greater sciatic notch morphology: sex, age and population differences. Am J Phys Anthropol. 2005;127:385-391. | 11. Reddy KSN. The essentials of forensic medicine and toxicology. 20th Edn. Medical Book Company, Hyderabad. 2001; 51,54,55. | | 12. Davivongs V. The Pelvic Girdle Of The Australian Aborigine: Sex Differences And Sex Determination . Am J Phys Anthropol. 1963;21:444-455. | 13. Chaurasia BD. Human Osteology, 1st Edn., CBS Publisher And Distributers, Delhi. 1984; 102. | 14. Straus('27) Cited by Krogman WM, Iscan MY. The human skeleton in forensic medicine, 2nd Edn. Charles C. Thomas, Springfield IL. 1986 . | 15. Breathnach AS. Frazer's anatomy of the human skeleton, 6th Edn. J.&A. Churchill Lt. London. 1965; 117. |