Morphometric study of greater sciatic notch of dry human hip bone in Gujarat region

Dr. Shaival Shah*, Dr. Ankur Zalawadia*, Dr. Srushti Ruparelia*, Dr. Shailesh Patel, Dr. S. P. Rathod***, Dr. S. V. Patel******

*Assistant Professor, **Associate Professor, ***Professor and Head, Department of Anatomy, Medical College, Bhavnagar; ****Dean, GMERS, Medical College, Gandhinagar

Abstract : The distinctive morphology of human skeleton and its clear sexual dimorphism make it of interests from anatomical, forensic, obstetrical, radiological and anthropological point of view. 100 known sex normal dry human hip bones obtained from Medical College Bhavnagar, 168 known sex normal dry human hip bones from BJ Medical College, Ahmedabad and Smt. NHL Municipal Medical College, Ahmedabad were studied the year of 2005-06. The posterior segment of Greater Sciatic Notch, Genoves' sciatic notch index and posterior angle are found to be significant by t test ($P < 0.001$). The posterior angle of greater sciatic notch was found to be highly significant for determination of sex of hip bone.

Key-words: Greater sciatic notch, hip bone, Sexual dimorphism

Corresponding Author: Dr. Shaival Shah, C-20, Doctors quarters, Sir T. Hospital Bhavnagar - 364001, Gujarat. E-mail: shaivalshah007@yahoo.com

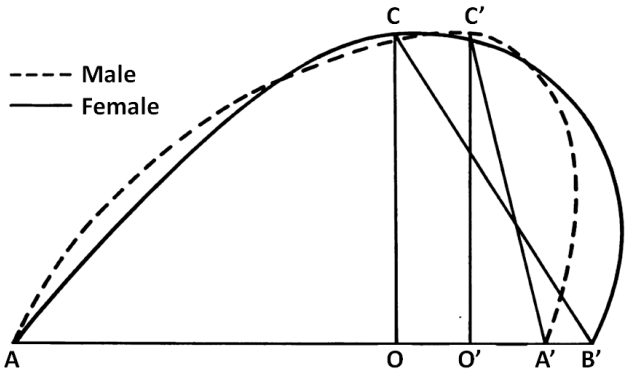
INTRODUCTION: The identification of sex from skeletal remains is of great medico-legal and anthropological importance. Hip bone is an ideal bone for sex determination because it not only reflects the general differences between the two sexes but also the special adaptation of female hip bone for child bearing. In the past, many workers have evolved various metrical parameters and indices for sexing of hip bone, Derry[1], Sraus[2], Washburn[3], Davivong[4], Jovanovic and Zivanovic[5], Jovanovic et al[6], Singh and Potturi[7], Schulter Ellis[8], Turner[9], Pal et al[10]. Those authors who have studied this bone by osteometric method have paid attention either to features relating to its total size or to those of various components such as its inferior border, the symphyseal surface the acetabulum the obturator foramen and arcuate line, chelotic line.

The present study establishes the impact of the 'sex factor' on the morphometry of the greater sciatic notch of hip bone.

MATERIAL AND METHODS: Material of the study consisted of 174 male (87 of right and 87 of left side) and 94 female (47 right & 47 of left side) hip bones. All the bones were fully ossified (adult) bones and free from any pathological or congenital defect. The bones were obtained from Medical College Bhavnagar, BJ Medical College, Ahmedabad and Smt. NHL Municipal Medical College, Ahmedabad.

The following measurements of greater sciatic notch were taken by using a osteometric board & scale as shown in Figure 1.

Figure-1 Measurements of greater sciatic notch



(Interrupted curve shows greater sciatic notch of male & Continuous curve shows greater sciatic notch of female)

(1) **Maximal width**: i.e. the distance between the tubercle of pyriformis muscle and the tip of the ischial spine (AB). (2) **Maximal depth**: i.e. perpendicular to the width (OC). (3) **Posterior segment of the width**: (OB). (4) **Index I**: depth (OC) x 100/width (AB). (5) **Index II**: Posterior segment (OB) x 100 / Width (AB). (6) **Total angle**: After

construction (on paper) of the triangle ABC and depth OC from the above measurements, < ACB denoted the total angle. (7) **Posterior angle**: < BCO.(8) **Genoves' sciatic notch index (GSI)** = Breadth of Greater Sciatic notch ×100 / Length of posterior segment of sciatic notch

All linear measurements were made in millimeters on the intact parts of normal bones. All measurements were repeated twice by two independent observers to identify any intra and inter-observer variability of these techniques. Data collected was tabulated according to gender and sides and statistically analyzed.

RESULTS: Table below shows sex related differences amongst various parameters.

Tabel-1 Results of various parameter of greater sciatic notch

Variable	Sex	N	Mean	Std. Deviation	p value
Breadth	Male	174	3.85	0.459	0.0001
	Female	94	4.27	0.481	
Post Segment	Male	174	0.683	0.2848	0.0001
	Female	94	1.248	0.3343	
GSI	Male	174	661.98	289.76	0.0001
	Female	94	367.59	107.52	
Depth	Male	174	2.414	0.3869	0.0001
	Female	94	2.227	0.3541	
Index 1	Male	174	63.48	12.323	0.0001
	Female	94	52.54	8.950	
Index 2	Male	174	17.52	6.446	0.0001
	Female	94	29.14	7.026	
Total Angle	Male	174	69.45	9.290	0.0001
	Female	94	82.85	9.549	
Posterior Angle	Male	174	16.63	6.398	0.0001
	Female	94	29.93	7.661	

DISCUSSION: Though the greater sciatic notch attracted attention as early as 1875, difficulties were encountered in measuring its width. The greater sciatic notch was found to be significantly wider in females than in males irrespective of the side of the bone.

In present study the range of Breadth for male and female are 2.7-5.3 and 3.2-5.3 respectively and breadth mean are 3.85± 0.459 and 4.27± .481 respectively for male and female. So mean value of female is more than male which matches the study of Sing and Potturi[7]. Similar observations have been made earlier by Verneau[11], Thomson[12], Derry[13]. Mean values in my study is almost matches the Sing and Potturi study. The P value is 0.0001 which is significant that matches with previous study.

In present study the range of distance of posterior segment in male is 0.2 - 2.00 and in female is 0.4 - 1.9. The mean values are 0.68 ± 0.28 and 1.24 ± .33 respectively for male and female. The mean length of posterior segment is two times higher in female. So the distance of posterior segment of greater sciatic notch is more in female which support the findings of Davivongs[14]. Probability of occurrence of difference in posterior segment of greater sciatic notch between male and female by chance is less than 0.0001 in present study. The difference is statistically significant. So the distance of posterior segment of greater sciatic notch is more in female compare to male. This findings correlates with that of Sing and Potturi[7] study.

The range of GSI in my study are 205-2150 and 238.89-825 for male and female respectively. The mean values are 661.98± 289.76 and 367.59± 107.52 for male and female respectively. Comparison of observations of present study and previous study are as following. P value is significant which match with that of previous study. Objective sex identification from hip bones utilizing Genoves' Sciatic Notch Index could be achieved with an accuracy of 99.75% in 21.4% of male hip bones by demarking point method.

In present study the range of Depth of Greater Sciatic Notch in male is 1.5-3.7 and in female is 1.4-3 with mean values are 2.414±0.3869 and 2.227±0.3541 for male and female respectively. Sing & Potturi has found the mean value in male 2.56±0.35 and in female 2.49±0.32. Both studies show deeper notch in male. In present study P value of Depth is 0.001 which is significant as in previous study.

In present study range and the mean of INDEX 1 in male are 39.53-108.82 and 63.48+12.323. In female the range is 36.96-76.92 and mean is 52.54+8. So the mean values are almost matching with the previous study , in which the mean value of male is 64.48+12.17 and mean value of female is 53.03+7.28. The P value 0.0001 which is significant which correlate with the previous study. Index I, which depends on depth and width of the greater sciatic notch, was accordingly not much help in the sexing of hip bones. It was found to be higher in males which confirm earlier reports Davivongs[14], Jovanovic and Zivanovic[15].

In male and female the range of the INDEX 2 are 4.65-48.78 and 12.12-41.86 respectively. The mean values are for 17.52± 6.44 male and 29.14+7.02 for female. The mean values almost match with the findings of Sing & Pouttri[7] study. INDEX 2 which depends on both widths and length of the posterior segment is 2 to 2.5 higher in females. These findings confirm to those of Davivongs[14]. The P value is 0.001 which is significant.

The total angle of greater sciatic notch of hip bones are found to be significantly higher in female ($P < 0.01$). For male it ranges from 50° to 90° with an average of 69.45° ±9.29° , while in female it ranges from 48° to 100° with an average of 82.85° ±9.54°. Singh and Pouttri[7] found that the total angle was significantly higher in female ($P < 0.01$). For male it varied from 48° to 78° with an average of 65.73° ±6.98°, while in females it varied from 67° to 97° with an average of 83.55° ±8.01°. The posterior angle of greater sciatic notch , a new measurement not used by workers earlier than Singh and Potturi[7]. They noticed the mean value of male and female hip bones were 13.06° ± 3.16° and 32.15° ± 5.01° respectively. They found mean values for females were more than 2.5 times those of males and showed minimal overlap in their ranges.

In present study, the mean values for male and female are 16.63°±6.39° and 29.92°±7.62° respectively. The mean values of female hip bones almost 2 times more than mean value of male. This matches with the study of Singh and Potturi[7]. The P value in present study is highly significant ($P< 0.001$) which suggest that it is a good indicator for determination of sex of hip bone. It correlates the findings of Singh and Potturi[7] study.

CONCLUSION: The posterior segment of Greater Sciatic Notch, Genoves' sciatic notch index and posterior angle are found to be significant by t test ($P < 0.001$). The posterior angle of greater sciatic notch was found to be highly significant for determination of sex of hip bone.

The Posterior Angle of Greater Sciatic Notch also varied from 7°-32° in male and 10°-41° in female. Our present study has shown that widening of the greater sciatic notch, which makes the pelvis broad in female, have largely occur in the posterior segment of the greater sciatic notch.

The Total angle of greater sciatic notch varied from 50°-90° in male and from 48°-100° in female. So female greater sciatic notch are wider than male. Thus, We can judge sex of unknown hip bone correctly by measuring Posterior Angle of Greater Sciatic Notch .

REFERENCES:

1. Derry De. On sexual and racial characters of human ilium. J Anat 1923;58,71-83.
2. Straus WL. Human ilium: sex and stock. Am J Phy Anthrop 1927;11,1-28.
3. Washburn SL. Sex differences in the pubic bone. Am J Phy Anthrop 1948;6, 199-207.
4. Davivongs V. The pelvic girdle of the Australian aborigine; sex differences and sex determination. Am J Phy Anthrop 1963; 21;444-455.
5. Jovanovic S, Zivanovic S. The establishment of sex by greater sciatic notch. Acta Anat 1965;61:101-7.
6. Jovanovic S, Zivanovic S, Lotric N. The upper part of greater sciatic notch in sex determination of pathologically deformed hip bones. Acta Anat 1968;69,229-238.

7. Singh S, Potturi BR. Greater sciatic notch in sex determination. J Anat 1978;125,619-624.
8. Schulter Ellis FP, Hayek LA, Schimidt OJ, Caraig J. Determination of sex with a discriminanat analysis of new pelvic bone measurement. I J For Sci 1983;28,169-180.
9. Turner W. The index of the pelvic brim as a basis of classification. J Anat 1886;20,125-143.
10. Pal GP, Bose S, Choudhary SM. Sexing of adult hip bone. European Journal of Morphology 2004;2,16-18.
11. Verneau R. Le Bassin dans le Sexes et dans les Races. Paris: Bailliere et Fils 1875.
12. Thomson A. The sexual differences of fetal pelvis. Journal of Anatomy & Physiology 1899;33,359-380.
13. Derry DE. On the sexual and racial characters of human ilium. J Anat 58:71-83,1923-24.
14. Davivongs V. The pelvic girdle of the Australian aborigine; sex differences and sex determination. American Journal of Physical Anthropology 1963;21,444 455.
15. Jovanovic S and Zivanovic S. The establishment of the sex by the greater sciatic notch. Acta Anat 1965;61:101-107.