Original Research Paper

Volume - 11 | Issue - 04 | April - 2021 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Anatomy

COMPARISION OF VARIOUS PARAMETERS USED TO DETERMINE SEX OF HIP BONE USING GREATER SCIATIC NOTCH

Vijay Kumar Dayma*	M.Sc.(Med)Anatomy,Department of Anatomy, S.P. Medical College, Bikaner, Rajasthan, India. *Corresponding Author
Dr Geeta	Assistant Professor, Department of Anatomy, S.P. Medical College, Bikaner, Rajasthan, India.
Dr Eva Marker	B.D.S, M.Sc.(Med)Anatomy,Department of Anatomy, S.P. Medical College, Bikaner, Rajasthan, India.

ABSTRACT The hip bone is considered as an ideal bone for sex determination as it provides the highest accuracy levels. The present study was done with an aim to compare various parameters of greater sciatic notch used to determine the sex of hip bone**.** For this purpose, 100 dry hip bones were collected from the Department of Anatomy, S.P. Medical College, Bikaner, Rajasthan, India. seven different parameters of the greater sciatic notch were used for the study: Maximum width, Maximum depth, Posterior segment, Index I, Index II, Total angle and Posterior angle. Among all the parameters only posterior segment, posterior angle and index II were found to be highly indicative of sex hip bone by t- test ($p<0.005$) and the depth of greater sciatic notch was found least indicative.

KEYWORDS : Bone, Greater sciatic notch, Posterior segment, Posterior angle and Index II.

INTRODUCTION

Determining the sex of skeletal remains is a very important part in any forensic examination or anthropological studies. Therefore, the study of sexual dimorphism of a bone in a group of population is a matter of interest not only for an anatomist but also for a forensic expert and an anthropologist. Nearly every region and element of the skeleton has been used to develop methods for sex estimation with varying degrees of success. The general anatomical regions used for sex determination are the pelvic girdle, the skull, and long bones, as well as other bones have also been utilized.[1-3]

The pelvic girdle is the most accurate area to determine sex and methods using it for sex determination tend to make successful predictions in 90 to 95 percent of individuals. Sexual dimorphism in this area is mainly due to the changes that occur during adolescence to meet the requirements of childbirth in females.[4-5]

Sexing of the hip bone is based on the measurements or objective techniques. These include measurements like ischio-pubic index, pubic angle, pubic length, inter-pubic breadth and inter-obturator breadth. [6]

There are many sex estimation methods that can be applied to human remains. Methods vary from visual assessments to metric analyses of sexually dimorphic traits, but the accuracy depends on the parameters used to determine the sex. So, in the present study an attempt has been made to to compare various parameters of greater sciatic notch used to determine the sex of hip bone**.**

MATERIALS AND METHOD

This was a cross sectional study conducted in the Department of Anatomy, S. P. Medical College,Bikaner. The study was conducted on 100 dry hip bones from skeleton of known sex from the department, 57 hip bones were of male and 43 were female type. Adult human hip bones taken for the study were fully ossified, not broken and not having any deformities with intact greater sciatic notch. Deformed, Malformed bones, bones with congenital anomalies were excluded from the study.

The following parameters were measured with the help of sliding caliper, protractor and scale.

Sampling procedure:

The sex of the hip bones was confirmed on the basis of certain morphological features. A sex was assigned only when there was anonymity of atleast 4 out of 5 morphological features.[(1)]

The morphological features used here were:

- Acetabular diameter
- Obturator foramen
- Ischiopubic ramus
- Ischial tuberosity
- Pre- auricular sulcus

In the present study, in addition to its depth, width & various indices, the total angle and posterior angles of the of the greater sciatic notch were also studied as parameters. The measurements were taken with the help of a sliding caliper.

Point A - Ischial spine
Point B - Piriformis tubercle
Point C- Deepest point on greater sciatic notch.
AB - Maximum Width of greater sciatic notch.
OB - Posterior segment of greater sciatic notch.
OC - Maximum Depth of greater sciatic notch.
Index I = Depth OC/ width AB X 100
Index II = Posterior segment OB/ Width AB X 100
Total angle =ACB
Posterior angle =BCO

With the help of a scale, the maximum depth (OC) was calculated between the base line (AB) and the deepest point (C) of the greater sciatic notch.

Total angle and posterior angle were measured after construction of a triangle on a paper from the above measurements in case of each bone.

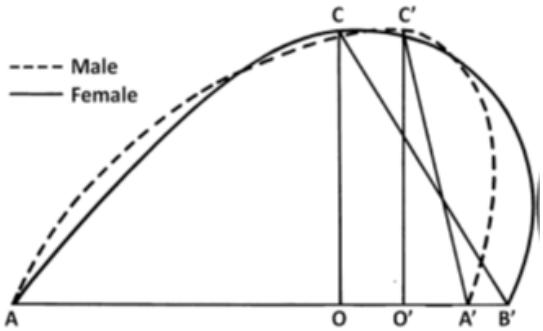

Fig1. Measurements of greater sciatic notch (continuous line for female and dotted line for male)

Measurements of greater sciatic notch -

For this, first pyriformis tubercle[(16)] was defined. It is the pyramidal projection located at termination of the posterior border of greater sciatic notch and designated as point 'B'. It was taken as the posterior point of the width (AB) while the tip of ischial spine was taken as the anterior point as 'A' of width. The curvature of greater sciatic notch was then plotted on paper. From the deepest point (C) of sciatic notch, a perpendicular line was drawn to the baseline (AB) which meets at 'O'. (OB) was designated as the posterior segment. ABC was constructed

on paper.[16] After obtaining confirmation of assigned sex the following parameters were used to compare bones of each sex.

DATA ANALYSIS:
Data thus collected was entered into Microsoft Excel spreadsheet and was presented in the form of tables, figures, graphs, diagrams. Appropriate statistical tests (t- test) wherever necessary were applied using suitable statistical software (EPI- Info.).

Observation
Hundred dry hip bones from skeleton of known sex were studied out of which 57 hip bones were of male and 43 were female type. There was a significant difference seen between male and female bones in all parameters. But the difference was found to be very significant for length of posterior segment of greater sciatic notch and posterior angle of greater sciatic notch, so these parameters can be considered as better indicator of sex as compared to other parameters.

The data obtained on different parameters were tabulated as follows [Tables 1-7]

Table 1 : Comparison of Mean Width (mm) of male and female hip bones of right and left side

Variable	Sex	N	mean	SD	P value
Width (right)	Male	35	41.11	6.126	0.000
	Female	25	46.00	6.148	
Width (left)	Male	22	38.14	2.833	p<0.05
	Female	18	46.33	4.572	

Table 2: Comparison of Mean Depth (mm) of male and female hip bones of right and left sides.

Variable	Sex	n	mean	SD	P value
Depth (right)	Male	35	33.34	5.358	p>0.05
	Female	25	32.28	2.816	
Depth (left)	Male	22	30.73	5.329	0.121
	Female	18	32.61	4.202	

Table 3: Comparison of Posterior segment of male and female hip bones of right and left sides

Variable	Sex	n	Mean	SD	P value
Posterior segment(right)	Male	35	12.40	2.720	p<0.05
	Female	25	20.92	4.736	
Posterior segment(left)	Male	22	12.00	3.929	0.000
	Female	18	20.67	5.322	

Table 4: Comparison of Mean Total angle of male and female hip bones of right and left sides

Variable	sex	n	mean	SD	P value
Total angle(right)	Male	35	61.94	6.811	0.000
	Female	25	73.00	6.252	
Total angle (left)	Male	22	59.77	5.597	0.000
	Female	18	69.28	6.332	

Table 5: Comparison of Mean Posterior angle of male and female hip bones of right and left sides

Variable	Sex	n	Mean	SD	P value
Posterior angle (right)	Male	35	18.17	4.239	0.000
	Female	25	35.32	5.047	
Posterior angle (left)	Male	22	20.41	6.529	0.000
	Female	18	32.89	5.312	

Table 6: Comparison of Mean of Index I of male and female hip bones of right and left sides

Variable	Sex	N	Mean	SD	P value
Index I(right)	Male	35	81.93	12.57	P<0.05
	Female	25	68.14	6.307	
Index I(left)	Male	22	78.15	10.01	0.012
	Female	18	72.30	8.384	

Table 7: Comparison of Mean Index II of male and female hip bones of right and left sides

Variable	Sex	N	mean	SD	P value
IndexII (right)	Male	35	28.90	7.853	0.000
	Female	25	46.64	7.193	
Index II (left)	Male	22	28.62	9.817	0.000
	Female	18	45.52	8.462	

GSN- Greater sciatic notch , S.D.- Standard deviation ,
P = Probability of the difference between two means by chance.

P value < 0.001, *** statistically highly significant. P value <0.05, *statistically significant

These results were then compared for the sex determination. After the statistical analysis, it was found that all the parameters especially posterior segment, total angle, posterior angle and index II were found to be highly indicative of sex (p>0.05) of unknown hip bone except depth.

DISCUSSION
The present cross sectional study was done to determine the sex by using greater sciatic notch of hip bone and was conducted at Department of Anatomy, S.P. Medical College, Bikaner, after obtaining permission from institutional ethical committee.

In our study 100 dry adult hip bones were included which were then classified subjectively and also using various parameters of greater sciatic notch into male and female hip bones, so it was observed that there were 57 male and 43 female hip bones included in the study. A similar study was done in Turkey by Ilknur Ari, provides quantification of the features of greater sciatic notch in os coxae that should be of value in forensic and archeological analyses, especially when dealing with fragmentary bones [9]. A similar study was done in Japan by Hideo Takahashi using 164 bones (104 males and 60 females). They found that posterior angle is best discriminating variable with an accuracy of 91% and sex was determined correctly in 88% of cases [10]. In the present study also statistical difference was found to be highly significant (P>0.0001) between the mean values of posterior angle of greater sciatic notch of male and female hip bones for both right and left sides.

Sex determination was attempted by Rajangam et.al on 140 hip bones of unknown sex of Karnataka origin. 87.7% of hip bones could be accurately classified. The total pelvic height, sciatic notch height and the acetabular height were the most useful indicators in sexing of hip bones [11]. In the present study also statistical difference was found to be highly significant (P>0.0001) between the mean values of width of male and female hip bones. Jovanovic et al. reported the reliability of parameters like posterior segment, Index II, and the posterior angle as good sex discriminant factors and stressed the importance of the upper segment of the greater sciatic notch in sex determination [12].

A Nigerian study was done by Akpan et al. using greater sciatic notch to determine the sex in 150 hip bones, the width, depth, total angle and index I were insignificant in determination of sex. Posterior angle and index II were found to be most useful in assigning sex with an accuracy of 75-90% [13]. In the present study, it was found that all the parameters (especially posterior segment, total angle, posterior angle and index II) were found to be highly indicative of sex (p>0.05) of unknown hip bone except depth.

Patriquin et al. found the maximal width, maximal depth, and posterior segment of the greater sciatic notch to be 43.03 mm(in whites) and 36.96 mm (in blacks); 26.55 mm (in whites) and 22.68 mm (in blacks); 15.56 mm(in whites) and 9.31 mm (in blacks) for males respectively. They reported that the depth of the greater sciatic notch is more in males, but wider in females and that there is significant sex differences among both South African males and females and whites and blacks [14, 15]. In the present study, the mean value of width of GSN of female right hip bone is more than the right male hip bone by 6.89mm. And that on the left side, female hip bone is more by 8.19mm which is statistically highly significant (p>0.0001). Present study shows, the mean depth of GSN of male right hip bone is more than the right female hip bone by about1 cm where as in left male hip bone it is less than left female hip bone by 1.88mm which is statistically non-significant.

In a study of sexing of hip bones done by Singh and Potturi, the length of posterior segment of greater sciatic notch assigned sex to a higher percentage of hip bones especially female bones (95-97%) which suggests that widening of greater sciatic notch found in females has occurred primarily in the posterior segment [12]. In the present study, the mean value of posterior segment of GSN of female right hip bone is more than the right male hip bone by 10.52mm and that on the left side, female hip bone is more by 11.67mm which is statistically significant (p<0.0001).

Raut R et al. (2013)[16] analyzed the adult coxae of unknown sex from the skeletal collection at their department and found the maximal width, maximal depth and posterior width of the greater sciatic notch to be 36.71 mm, 24.96 mm, 7.14 mm, 70.87 and 17.32for males, respectively. They reported that the maximum width was not a good parameter, while posterior segment width and Index II were indeed good parameters for sex determination.

The above studies and our own provides a metric assessment of the morphology of the greater sciatic notch and whereas some studies doubt its role as an indicator of sexual dimorphism. According to some previous studies it was observed that there is some incompatibility related to the validity of the features of the greater sciatic notch in sex determination which could be related to anthropometric differences among populations, the statistical analysis preferred in the different studies, and the ability of the observer.

CONCLUSION

By the present study it was concluded that the width and depth of the greater sciatic notch were a less useful criteria for sexing purposes while the posterior angle was found to be the best parameter, which identified 75 % of left and 88 % of right male hip bones and 92 % of left and 100 % of right female bones. Length of the posterior segment and Index II also assigned sex to a high percentage of hip bones, specially to the female ones (95-97 %), these results suggests that the widening of the greater sciatic notch found in females has occurred mainly in its posterior part.

REFERENCES

1. Dnyanesh S. Study of Greater Sciatic Notch in Sex Determination of Hip Bone by Metric Method. IOSR Journal of Dental and Medical Sciences. 2013;10:18-23.
2. Singh S, Potturi B. Greater sciatic notch in sex determination. Journal of anatomy.1978;125:619-24.
3. S. Shah, A. Zalawadia, S. Ruparelia, S. Patel, S.P. Rathod and S.V. Patel, Morphometric study of greater sciatic notch of dry human hip bone in Gujarat region, NJIRM, April; 2(2), 2011, 27-30.
4. T.W. Phenice, A newly developed visual method of sexing the os pubis, Am. J. of Phys. Anthropology, 30, 297-301.
5. T.A. Black, A new method for assessing the sex of fragmentary skeletal remains: Femoral shaft circumferences. Am J Phys Anthrop.,48, 1978, 27-31
6. G. Singh, S. Singh and S.P. Singh, Identification of sex from tibia. J. Anat Soc India, 24, 1975, 20-24
7. Sex determination from the skeleton. Thieme FP, Schull WJ. Hum Biol. 1957 Sep;29(3):242-73
8. Akpan T, Igiri A, Singh S. Greater sciatic notch in sex determination in Nigeria skeletal sample. Afr.J.Med. Science .1998; 27:43-46.
9. I. Ari, Morphometry of GSN on remains of male Byzantine skeletons from Nicea, Eur J Anat. 9(3), 2005, 161-5.
10. Takahashi, Curvature of GSN in sexing of human pelvis, Anthropological science, 114(3), 2006, 187-91.
11. S. Rajangam, S. Janakiram and I.M. Thomas, Sexing of hip bones of Karnataka origin, J. Anat. Soc. India, 40, 1991, 105-8.
12. S. Javanovic, S. Zivanovic and N. Lotric, The upper part of greater sciatic notch in sex determination of pathologically deformed hip bones, Acta Anat, 69, 1968, 229-38.
13. T.B. Akpan, A.O. Igiri and S.P. Singh, Greater sciatic notch in sex differentiation in Nigerian skeletal samples, African J Med Sci, Mar- Jun; 27 (1-2), 1998, 43-6.
14. M.L. Patriquin, S.R. Loth and M. Steyn, Metric assessment of race from the pelvis in South Africans, Forensic Sci Int, 147, 2005, 104-13.
15. M.L. Patriquin, M. Steyn and S.R. Loth, Metric analysisof sex differences in South African black and white pelves, Forensic Sci Int, 147, 2005, 119-27.
16. Raut R, Hosmani P, Kulkarni P. Role of Greater Sciatic Notch in Sexing Human Hip Bones. International journal of recent trends in science and technology.2013; 7: 2277-2812.