International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

Morphometry of the Posterior Border of the Hip Bone

Lakshmi TA[1], Jose A[2], Nisha T[2], Pallavi S[2]

[1]Assistant Professor, Department of Anatomy, St. John's Medical College, Sarjapur Road, Bangalore, India.
[2]Intern, St. John's Medical College, Bangalore.

Corresponding Author: Lakshmi TA

Received: 31/01//2014 *Revised: 19/02/2014* *Accepted: 20/02/2014*

ABSTRACT

Introduction: The morphology of the hip bone stimulates interest from an anatomical, anthropometric and forensic point of view. Few studies have concentrated on the posterior border of the hip bone, and the possible influence of sexual dimorphism or side on its morphometry, hence this study was taken up.
Materials and methods: The study was done on 122 (70 right and 52 left) dry human hipbones. The following parameters were observed & measured with a scale, digital vernier callipers and inextensible thread. The mean and the standard deviation for each were calculated.
1. PSIS-IT - Distance from posterior superior iliac spine to superior border of ischial tuberosity
2. PSIS-IS - Distance from posterior superior iliac spine to ischial spine
3. PSIS-PIIS - Distance from posterior superior iliac spine to posterior inferior iliac spine
4. PIIS-IS - Distance from posterior inferior iliac spine to ischial spine
5. PIIS-IT - Distance from posterior inferior iliac spine to superior border of the ischial tuberosity
6. Arch PIN - Length of border between the posterior superior iliac spine and posterior inferior iliac spine
7. Arch PIIS- IS - Length of the notch between posterior inferior iliac spine and ischial spine
8. Arch PB - Length of the border between posterior superior iliac spine and superior border of the ischial tuberosity.

Results: The measurement of PSIS-IT, Arch PIIS-IS and Arch PB could be used to determine the side of the hip bone. The measurement of PSIS-IT, PSIS-PIIS, PIIS-IS, Arch PB and Arch PIN can be used to determine the sex of the bone.
Conclusion: From the above parameters it would be possible to determine the side and up to some extent the sex of human skeletal remains from an undamaged posterior border of the hip bone.
Key words: Hip bone, posterior border, gender difference, dimorphism.

INTRODUCTION

The hip bone is a large, irregular, centrally constricted bone that is expanded above and below. The posterior border is irregularly curved and descends from the posterior superior iliac spine. It initially forms a small concavity that ends in the posterior inferior iliac spine. There after the border shows a deep concavity forming the greater sciatic notch that ends at the ischial spine. A less deep lesser sciatic notch followed by the ischial tuberosity completes this border. [1]

The morphology of the hip bone stimulates interest from an anatomical, anthropometric and forensic point of view.

There are a number of studies on the inferior border, sciatic notch and the acetabulum, but few studies have concentrated on the posterior border of the hip bone and the possible influence of sexual dimorphism or side on its morphometry, hence this study was taken up. As commonly accepted, anthropological measurements vary among different populations. [2] The authors have, thus attempted to create a data base of measurements of the posterior border of the hip bone of a South Indian population. The main aims of the present study were-

1) To measure various parameters of the posterior border of the hip bone by osteometric methods.
2) To study the influence of sexual dimorphism on morphometry.

MATERIALS AND METHODS

Undamaged hip bones from the department of Anatomy, St. John's Medical College were used for this study. The total number of the bones was 122 of which, 52 were left and 70 were right. For each hip bone the following parameters of the posterior border were measured.

1. PSIS-IT - Distance from the posterior superior iliac spine to the superior border of the ischial tuberosity
2. PSIS-IS - Distance from the posterior superior iliac spine to the ischial spine
3. PSIS-PIIS - Distance from posterior superior iliac spine to the posterior inferior iliac spine
4. PIIS-IS - Distance from the posterior inferior iliac spine to the ischial spine
5. PIIS-IT - Distance from the posterior inferior iliac spine to the superior border of the ischial tuberosity
6. Arch PIN - Length of the border between the posterior superior iliac spine and the posterior inferior iliac spine
7. Arch PIIS- IS - Length of the notch between the posterior inferior iliac spine and the ischial spine
8. Arch PB - Length of the border between the posterior superior iliac spine and the superior border of the ischial tuberosity.

The above mentioned parameters were measured with the help of a digital vernier calliper accurate up to 0.01 mm, scale and inextensible string. The straight distance between the mentioned points was measured. This was done to avoid error when measuring vertical distances with the points marked on a grid board.

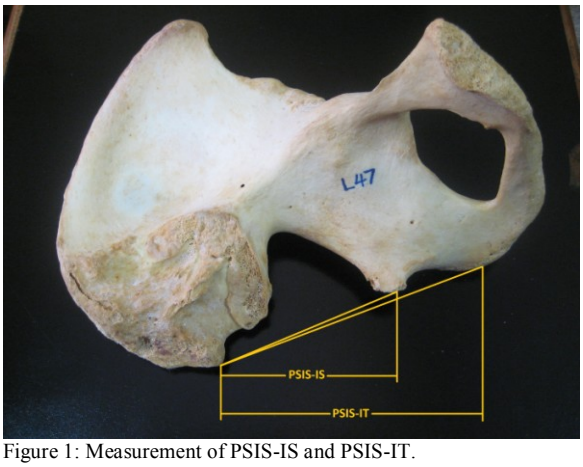

Figure 1: Measurement of PSIS-IS and PSIS-IT.

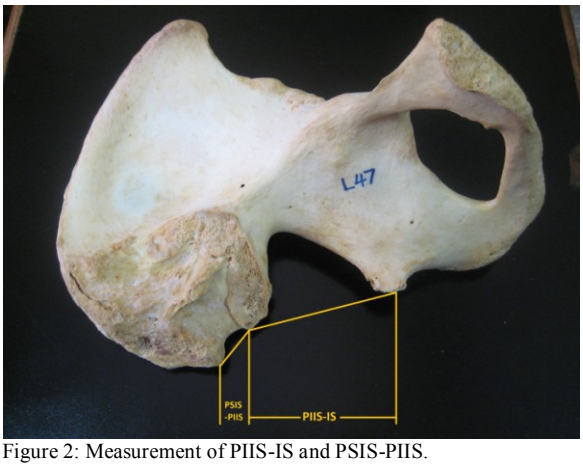

Figure 2: Measurement of PIIS-IS and PSIS-PIIS.

Figure 3: Measurement of PIIS-IT.

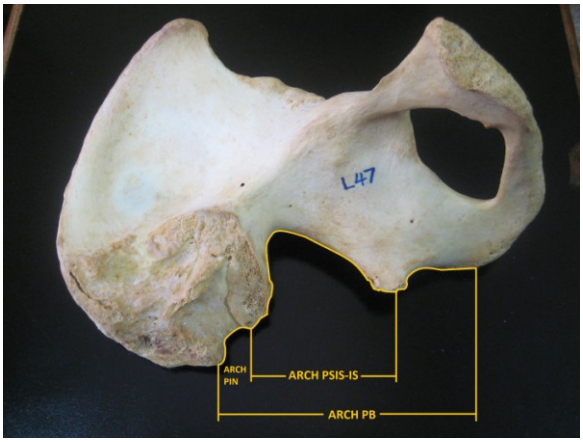

Figure 4: Measurement of Arch PIN, Arch PSIS-IS, Arch PB.

The objectives of this study were:

1) To estimate the values of the above mentioned parameters in the collection of hip bones.
2) To estimate the difference in the above mentioned values between left and right side
3) To estimate the difference in the above mentioned values between male and female bones

The sexing of the hip bones was based on the Bruzek's method. This method yields an accuracy rate close to 98 %. [3]

Statistical analysis was done using SPSS version 16.Themean, standard deviation (SD) standard error of mean (SE), 95% confidence interval (CI) was computed for all the mentioned variables. The independent sample (Student's) t test was employed to compare the means of two independent groups. A p value of greater than 0.05 was considered significant.

RESULTS

The results are tabulated in tables 1,2 and 3. Table 1 shows the mean, SD, SE and 95% CI of the total sample. Table 2 shows mean and SD of the left (n=52) and right(n=70) sided hip bones and the p value to show if there is a significant difference between the sides for that particular parameter. Table 3 shows similar values with respect to gender.

Table 1: Measured parameters (n =122, combined)(all measurements in mm)

Parameter	Mean	SD	Median	95% CI Lower	Upper	SE
PSIS-IT	103.78	8.7	102.67	102.22	105.34	0.78
PSIS-IS	82.69	7.65	82.60	81.32	84.07	0.69
PSIS-PIIS	28.84	6.8	28.39	27.62	30.06	0.61
PIIS-IS	55.96	7.25	55.43	54.66	57.26	0.65
PIIS-IT	76.59	8.24	76.59	74.64	77.59	0.74
Arch PIN	38.55	9.69	37.86	36.81	40.28	0.87
Arch PIIS-IS	95.81	8.85	95.42	94.18	97.45	0.82
Arch PB	155.23	11.78	154.20	153.12	157.34	1.06

Table 2: Comparison of left and right side hip bones (all measurements in mm).

Parameter	Right (n=70) Mean ± SD	Left (n=52) Mean ± SD	P value
PSIS-IT	105.41± 9.14	101.59 ±7.6	0.01
PSIS-IS	83.43 ± 8.24	81.71 ± 6.7	0.22
PSIS-PIIS	29.43 ± 6.7	28.05 ± 6.8	0.26
PIIS-IS	56.09 ± 7.16	55.78 ± 7.44	0.81
PIIS-IT	76.72 ± 7.9	75.31 ± 8.6	0.35
Arch PIN	39.86 ± 8.67	36.78 ± 10.07	0.08
Arch PIIS-IS	96.82 ± 8.6	90.14 ± 13.5	0.00
Arch PB	157.16 ± 11.78	152.64 ± 11.37	0.03

Table 3: Comparison of male and female hip bones (all measurements in mm)

Parameter	Male (n=50) Mean ± SD	Female (n=54) Mean ± SD	P value
PSIS-IT	106.06 ± 8.83	102.3 ± 7.43	0.02
PSIS-IS	83.12 ± 8.03	82.28 ± 7.18	0.57
PSIS-PIIS	31.56 ± 6.9	26.28 ± 6.1	0.00
PIIS-IS	53.27 ± 6.4	58.24 ± 6.9	0.00
PIIS-IT	75.36 ± 7.46	77.76 ± 7.82	0.11
Arch PIN	41.4 ± 12.1	35.8 ± 6.32	0.00
Arch PIIS-IS	97.63± 8.7	94.67 ± 9.2	0.10
Arch PB	161.6 ± 11.29	149.7 ± 9.5	0.00

Table 4: Comparison of present study with Margam study.

	PSIS-IT		PIIS-IT	
	Male Mean ± SD	Female Mean ± SD	Male Mean ± SD	Female Mean ± SD
Study by Margam et al (2013)	115.07 ± 8.62 (n=100)	116.19 ±11.57 (n=100)	82.96 ± 7.15 (n=100)	85.99 ± 8.7 (n=100)
Present study	106.06 ± 8.83 (n=50)	102.3 ± 7.43 (n=54)	75.36 ± 7.46 (n=50)	77.76 ± 7.82 (n=54)

DISCUSSION

The best method for determining sex of adult skeletal remains is from the hip bone. It presents a number of gender related differences that can be successfully used to ascertain the sex of the individual. [4-6] Current opinion regards the hip bone as the most reliable sex indicator because it is the most dimorphic bone, particularly in adult individuals. [7, 8] The major problem that has been encountered so far is that the recovered hip bones are often incomplete or damaged. Sometimes all that is recovered of a person are fragments of hip bones. Forensically they may be all that is available to identify the person. It has been noticed that the posterior part of the hip bone is usually well preserved due to its hardness; hence the present study gains its importance. [9]

From the above tables it is clear that there is a significant difference in the values of Arch PB, Arch PIIS-IS and PSIS-IT between the left and right sides. A somewhat similar study done by Isaac [10] also found a significant difference between sides with respect to Arch PIISIS and Arch PB. The authors suggest that these two values could be used for side determination.

The values recorded for PSIS-IT, PSIS-PIIS, PIIS-IS, Arch PIN and Arch PB show a significant difference between male and female hip bone. Thus five out of the eight measurements show significant gender differences. In a similar study done by Isaac [10] and another study by Doshi, [4] the authors have reported that Arch PB showed significant difference with respect to gender. The present study concurs with previous studies with respect to Arch PB. This study cannot be directly compared because the method of measurement used by the authors is slightly different from that used in the present study.

In another study done by Margam et al. [11] the method of measurement was the same as that of the present study and two of the values were comparable as shown in Table 4. The values as determined by Margam et al. seem to be higher than that in the present study. These differences may be because of regional differences in the population.

It is hoped that the present study will provide a data base of measurements of the posterior border of the hip bone that can be used by anatomists, anthropologists, forensic experts and also orthopedicians.

Further studies: The authors would like to use discriminant function analysis to compute a regression equation that would help determine sex from the measurements of posterior border of the hip bone.

CONCLUSION

The morphometry of the posterior border of the hip bone is influenced by gender as well as side. The measurement of PSIS-IT, Arch PIIS-IS and Arch PB could be used to determine the side of the hip bone. The measurement of PSIS-IT, PSIS-PIIS, PIIS-IS, Arch PB and Arch PIN can be used to determine the sex of the bone. Sexing and side determination could be done using the posterior border of the hip bone.

AKNOWLEDGEMENT

The authors would like to thank Dr. Nachiket Shankar, Associate professor, Dept. of Anatomy, St. John's Medical College for his unwavering support throughout this study.

REFERENCES

1. Mahadevan V.Standring S.Pelvic Girdle and lower limb.Gray's Anatomy. 40th edition. Churchill Livingstone Elsevier. 2008, 1352-55.
2. Mall G, Graw M, Gehring K, Hubig M. Determination of sex from femora.Forensic Science International. 2000;113(1-3):315–21.
3. Bruzek J.A method for visual determination of sex, using the human hip bone.Am J PhysAnthropol. 2002 Feb;117(2):157-68.
4. Doshi BD, Joshi HG, Mehta CD. The Sex determination by Posterior Border Of Adult Human Hip Bone. NJIRM. 2011; 2(2): 10-13.
5. Derry DE.On the Sexual and Racial Characters of the Human Ilium. J Anat. 1923 October; 58(Pt 1): 71–83.
6. Duric M, Rakocevic Z, Donic D. The reliability of sex determination of skeletons from forensic context in the Balkans. Forensic Sci Int. 2005 Jan 29;147(2-3):159-64.
7. Gonzalez PN, Bernal V, Perez SI. Geometric morphometric approach to sex estimation of human pelvis.Forensic Sci Int. 2009 Aug 10;189(1-3):68-74.
8. Bytheway JA, Ross AH.A geometric morphometric approach to sex determination of the human adult oscoxa. J Forensic Sci. 2010 Jul;55(4):859-64.
9. Debono L, Mafart B. Sex determination from fragmented hip bones using the Bruzek's method: experience in a historic necropolis in Provence (France). Anthropologie. 2006;XLIV/2:167–172.
10. Isaac B. Biometry of the posterior border of the human hip bone: normal values and their use in sex determination. J Anat. Soc. India. 2002; 51(1) 43-46
11. Margam SR, Doshi MA, Jadhav SD, Patil R, Ambali MP. Sex and side determination of human hip bone by metric parameters of its posterior border. NJCA. 2013; 2(1): 16-21.

How to cite this article: Lakshmi TA, Jose A, Nisha T et. al. Morphometry of the posterior border of the hip bone. Int J Health Sci Res. 2014;4(3):125-129.

****