

## Uncommon Parameters for Hip bone sexing

Dr Yuvaraj J Bhosale\*, Dr Kishor D Khushale\*\*, Dr K Shyamkishore\*\*\*

\*Additional Professor, Department of Anatomy, Seth G S Medical College, Mumbai - 400012

**Abstract:** Background- It is very difficult to determine sex of skeleton when pieces of skeletal bones are exhumed  
Objectives- Thus our study aims at: 1. Finding accuracy of the previously set criteria for sexing of hip bone. 2. To find the validity of other criteria in sexing of hip bone by which sex of the skeleton can be determined from small portion of hip bone. Methods- 200 hip bones of known sex (100 male and 100 females) were studied from various medical colleges. Results and Interpretation- Unpaired 't' test was found to be highly significant when values of true pelvic height in males and females were compared. Similarly, 'p' value was found significant in comparing mid-pubic width in males and females. Mean of distance from ischial tuberosity to farthest rim of acetabulum in males was found to be more than that of the females. Very significant differences were observed in the mean of pubic length and acetabular diameter in females. The index mentioned by Maclaughline and Bruce in 1985 was calculated in males and females. The index showed a value of 100.226 in males and 126.944 in female. Conclusion- Apart from the previously mentioned criteria in hip bone sexing, the study helped to prove the importance of following criteria in hip bone sexing : 1.True pelvic height 2.Mid-pubic width 3.Distance from ischial tuberosity to farthest rim of acetabulum 4.Index mentioned by Maclaughline and Bruce 5.Distance from anterior superior iliac spine to pubic tubercle 6.Distance from anterior superior iliac to iliopubic eminence [Dr Yuvaraj J NJIRM 2016; 7(4):14-16]

**Key Words:** Hip bone, Sex determination, Anthropology

**Author for correspondence:** Dr Yuvaraj J Bhosale, Department of Anatomy, , Seth G S Medical College Medical College, Mumbai – 400012. e- mail: dryuvaraj@gmail.com

**Introduction:** Many unclaimed decomposed bodies are sent to the anatomy and forensic departments for identifying sex from its bones. Sometimes bodies are exhumed and sex of the skeleton is to be identified. According to forensic anthropology, the most reliable part of human skeleton for assessment of sex is pelvis.<sup>1</sup> The present study aims at finding out the parameters by which the sex of a skeleton can be determined, even if a part of hip bone remains are exhumed.

**Methods:** : 200 hip bones of known sex (100 male and 100 females) were studied from various medical colleges. All these bones were dry, without congenital anomalies and bones with fractures were excluded from the study. All the distances were measured by vernier caliper.

STEP I) A total of 17 distances were measured on each hip bone.

1. Pelvic width, measure from the anterior superior iliac spine to posterior superior iliac spine<sup>2</sup>
2. Distance from anterior superior iliac spine (ASIS) to public tubercle (PT)<sup>3</sup>
3. Distance from anterior inferior iliac spine to iliopubic eminence<sup>3</sup>
4. Distance from anterior inferior iliac spine to pubic tubercle<sup>3</sup>
5. Mid-pubic width. (The shortest distance from the middle of the pubic symphysis to the obturator foramen)<sup>2</sup>
6. Pubic length. (The nearest horizontal distance from the pubic symphyseal surface to acetabular rim)<sup>4</sup>

7. Length of pubic crest<sup>5</sup>
8. Distance from public tubercle to acetabulum<sup>4</sup>
9. Acetabular diameter<sup>4</sup>
10. Distance from ischial tuberosity to farthest rim of acetabulum.<sup>4</sup>
11. Maximum pelvic height (From the highest point on the iliac crest to the lowest point on the ischial tuberosity)<sup>6</sup>
12. Total pelvic height - (The distance measured from the ischiopubic ramus to the iliac crest measured on osteometric board)<sup>4</sup>
13. Width of sciatic notch.<sup>4</sup>
14. True pubic height (From the lowest point on the medical margin of the ischial tuberosity to the arcuate line anterior to iliopectineal eminence)<sup>6</sup>
15. Distance from anterior superior iliac spine to iliopectineal eminence.<sup>3</sup>
16. Chilotic line - pelvic part (Distance from ilio-pubic eminence to nearest point on the anterior margin of auricular surface of ilium)<sup>5</sup>
17. Chilotic line - sacral part. (Distance from anterior margin of auricular surface of ilium to iliac crest)<sup>5</sup>

STEP II) Mean and standard deviation of all the above distances were calculated.

STEP III) The following distances were compared and their p value and 95% confidence limit was calculated.

- a) True pelvic height in males and females were compared

- b) Mid pubic width in males and mid pubic width in females were compared
- c) Distance from ischial tuberosity to furthest rim of acetabulum in males and females
- d) Pelvic width in males and females
- e) Width of sciatic notch width in males and females were compared
- f) Pubic crest in males and females
- g) Pubic length in female and acetabular diameter in females
- h) Pelvic part of chilotic line and sacral part of chilotic line in females
- i) Distance from anterior superior iliac spine to pubic tubercle
- j) Distance from anterior superior iliac to iliopubic eminence

STEP IV) The following variables were compared:

- 1) Pubic length in male v/s Acetabular diameter in male.
- 2) Pubic length in female v/s Acetabular diameter in female.
- 3) Chilotic line Pelvic part in female v/s Sacral part in female.
- 4) Chilotic line Pelvic part in male v/s Sacral part in male.

STEP V) 1) The following ratio was calculated: Pubic length x 100 / Acetabular diameter as described by Mac laughline and Bruce in 1985. It was calculated in both males and females.

2) Chilotic index was calculated in males and females.

**Results:** Hip bone is one of the important bones in the body useful for sexing a human skeleton. 17 distances were measured in 200 hip bones (100 male and 100 female). Out of the distances measured, the distances that showed significant difference in the mean are seen in the table.

**Discussion:** Unpaired 't' test was found to be highly significant when values of true pelvic height in males and females were compared. It is stated in many standard text books that pelvic cavity in male is longer and more conical and in female it is shorter and more cylindrical.<sup>7</sup> The utility of true pelvic height in hip bone sexing has been mentioned.<sup>6</sup>

Similarly, 'p' value was found significant in comparing mid-pubic width in males and females.(Figure-1) Significance of mid-pubic width in hip bone sexing was

previously confirmed.<sup>2</sup> Since this parameter contributes to greater length of the pubis in females as compared to males, it is merged with the pubic length in the present study.

No.	Parameter	Sex	Mean
1.	True Pelvic Height(graph-1)	M	9.652
		F	8.952
2.	Ischial Tuberosity-Farthest Rim of Acetabulum(graph-2)	M	9.358
		F	8.784
3.	Acetabular Diameter	M	5.277
		F	4.773
4.	Pubic Length (graph -3)	M	5.819
		F	6.059
5.	Anterior Superior Iliac Spine-Pubic Tubercle	M	11.023
		F	10.623
6.	Iliopubic eminence-Anterior Superior Iliac Spine	M	7.104
		F	6.800

Mean of distance from ischial tuberosity to farthest rim of acetabulum in males was found to be more than that of the females. The p value was also found significant proving the utility of this criteria in sexing hip bone also. It is also stated that the acetabular diameter/distance from pubic symphysis to acetabulum and also the distance from ischial tuberosity to further rim of acetabulum is proved to be statistically of greatest discriminating value classifying 97% of the samples.<sup>8</sup>

Unpaired 't' test in case of pelvic width in males and females was not significant. So the pelvic width cannot be used as criteria for sexing hip bone. No reference was noted regarding its utility in hip bone sexing. Very highly significant p values in case of pubic crest and sciatic notch width proved their utility in hipbone sexing. Long pubic crest and wide sciatic notch seen in female hip bones is well known criteria as in mentioned in all standard text books.<sup>5</sup>

Very significant differences were observed in the mean of pubic length in females and acetabular diameter in females. The mean of pubic length was 6.059 cm. and mean of acetabular diameter was 4.773 cm.

The p value was also found to be significant. Also a difference was noted in mean pubic length in male (5.81 cm) and female (6.05 cm). In case of chilotic line the mean of pelvic part (7.33 cm) was more than of

sacral part (6.62 cm) in females. All the above criteria are mentioned in Gray's Anatomy.<sup>5</sup>

The index mentioned by Maclaughline and Bruce in 1985 was calculated in males and females. The index showed a value of 100.226 in males and 126.944 in female. The significant difference shows the utility of this index in hip bone sexing as was already mentioned.<sup>2</sup>

The difference was noted in the mean of distance from anterior superior iliac spine to pubic tubercle in male (11.022 cm) and female (10.228 cm). So this parameter can be used in hip bone sexing.

Statistically significant differences were detected between means of 4 variables of the 16 different variables studied in 42 human hip bones. 1) Distance from the anterior superior iliac spine to the pubic tubercle. 2) Distance from the anterior inferior iliac spine to iliopubic eminence. 3) Distance from the anterior inferior iliac spine to pubic tubercle. 4) Length of the notch between the anterior inferior iliac spine and iliopubic eminence.<sup>3</sup>

In our study, the difference was also noted in means of the second parameter in male (7.104 cm) and female (6.800 cm). So the distance from anterior superior iliac spine to iliopubic eminence can be used as a parameter for hip bone sexing as the unpaired 't' test was significant in both the cases.

**Conclusion:** The study was carried out to find the significance of some parameters in hip bone sexing. These criteria are useful in medicolegal cases to determine sex in case of exhumed bodies. 17 different distances were measured on each hip bone. Unpaired 't' test was applied to some of these parameters. The unpaired 't' test was significant in case of following criteria pubic crest, chilotic line (pelvic/sacral part), acetabular diameter and pubic length. Thus these results matched with the sexing criteria mentioned in standard text-books. The results matched with the results mentioned in some journal articles as mentioned in the discussion. Similarly, indices like chilotic index was calculated along with an index mentioned by Maclaughline and Bruce.

The values in the case of above mentioned indices differ significantly in males and females. Thus apart from the previously mentioned criteria in hip bone

sexing, the study helped to prove the importance of following criteria in hip bone sexing :

- (1) True pelvic height
- (2) Mid-pubic width
- (3) Distance from ischial tuberosity to farthest rim of acetabulum
- (4) Index mentioned by Maclaughline and Bruce
- (5) Distance from anterior superior iliac spine to pubic tubercle
- (6) Distance from anterior superior iliac to iliopubic eminence

**Acknowledgment:** Dr Alka Patankar, Ex Professor, Dept of anatomy, Grant Medical College and JJ Hospital, Mumbai-8 Dr Pritha Bhuiyan, Professor and Head, Department of Anatomy, Seth G S Medical College and KEM Hospital, Mumbai-12

#### References:

1. Naggar EL, Textbook of Forensic Anthropology, 1<sup>st</sup> Edition, p.125
2. Miline N, Journal of Anatomy and Human Biology, Oct 1990 (Great Britain) , Journal No. 172, p. 221-226
3. Gomez PL. Fernandez CS, Journal of Anatomy, England, December 1992, p.417-422.
4. Schultor E, Schmidt DJ, Hayek LA, Craig J, Journal of Forensic Sciences (1983), 28 (I) p. 169-180.
5. Warwick R, Willaims PL, Gray's Anatomy, 35<sup>th</sup> Edition, Saunders 1975, p -355-356
6. Ashley MF ,Textbook of Anthropometry, 1<sup>st</sup> edition, p. 75
7. Dutta A K, Essentials of Human Anatomy, 4<sup>th</sup> edition, Current Books International, p. 316- 320.
8. Schultor E, Hayek LA, Schmidt DJ, Journal of Forensic Science, Jan 1985, 30(1) p. 171-185.

Conflict of interest: None
Funding: None
Cite this Article as: Bhosale YJ, Khushale KD, Shyamkishore K. Uncommon Parameters for Hip bone sexing. Natl J Integ Res Med 2016; 7(4): 14-16