

## Sexual Dimorphism of Human Hip Bone With Respect To Chilotic Line Index in Saurashtra Region

Vijay Kanjariya\*, Balkrishna Thummar\*, Mital Patel\*\*\*, Dilip Gohil\*\*

\*Assistant Professor, \*\*Associate Professor, \*\*\*Professor & Head,  
Department of Anatomy, M.P.Shah Govt. Medical College, Jamnagar, Gujarat

**Abstract:** Aims and Objectives: To study the sexual dimorphism of dried human hip bone with respect to chilotic line and chilotic line index (CI) and finding a cut off value for the chilotic line index that will be accurate for identification of sex in the human hip bone. Materials and Methods: The study was undertaken with a sample size of 116 adult human dried hip bones from the department of Anatomy, Shri M.P.Shah Government Medical College, Jamnagar. Gujarat. The Chilotic line (pelvic segment and sacral segment) was measured using a Vernier caliper and chilotic line index was calculated. All the observations were tabulated and analyzed statistically further. All the parameters are statistically significant. All the values obtained for various parameters were compared with the previous studies. Results: We defined a demarking point for chilotic line index for male is 157.14 and for female 98.11, thus the hip bones having chilotic line index more than 157.14 are definitely of male and hip bones having chilotic line index less than 98.11 are definitely of female. This finding is very statistically significant with  $P < 0.0001$ ,  $t = 2.872$ . Conclusion: "Demarking point" method identified 22.64% of male hip bones and 10% of female hip bone. So, the sex of the hip bone can be assessed up to about 99.99% confidence with the help of chilotic line index [Kanjariya V Natl J Integr Res Med, 2019; 10(3):16-19]

**Key Words:** Sexual Dimorphism, Hip bone, Chilotic Line Index

**Author for correspondence:** Dr. Balkrishna R. Thummar, Department of Anatomy, Shri MP Shah Medical College, Jamnagar. Mail id: bk\_thummar2000@yahoo.com

**Introduction:** Sexual dimorphism refers to the difference between male and female in regard to their size and appearance. The identification of sex from skeletal remains is of great medicolegal and anthropological importance. In forensic and human anthropology biological sex determination remains challenging. Hip bone is highly dimorphic and in this regard therefore gains importance. Hip bone is considered as the most reliable sex indicator in the human skeleton<sup>1</sup>. Hip bone is an ideal bone for sex determination because not only reflects the general differences between the two sexes but also the special adaptation of female hip bone for child bearing.<sup>2</sup> The Sexual differences in adults are divisible into metrical and non-metrical features, of which the metrical values of a bone are highly accurate.<sup>3</sup> there is no standard formula for a metrical data because bones are gender-specific and population-specific. Moreover, different population further differs with regard to body built of a person and degree of sexual dimorphism and therefore a single data cannot be applied universally. Therefore with this study an attempt was made to calculate a cut off value for the chilotic line that will be accurate for identification of sex from a hip bone in any given population<sup>4</sup> Various metrical parameters in the hip bones of the Indian population which would help the forensic experts, orthopedicians and anthropologists. According to Derry "chilotic line and chilotic line index" are very important tool

for which can be used effectively in sexual dimorphism of hip bone, but as the work progresses it becomes evident that the influence of race had such an important bearing on the question that it was impossible to ignore it<sup>5</sup>. Chilotic indices display reciprocal values in the sexes: the pelvic part of the chilotic line is predominant in females, and the sacral part in males.<sup>6</sup> The main objective of the present study is to do the morphometry of 116 adult dry human hip bones in the saurashtra population of Gujarat state to evaluate various parameters of the hip bone

**Materials and Methods:** For this study a sample of 116 adult human dried hip bones (106 male and 10 female) were taken from the Department of Anatomy, M.P.shah Government Medical College, and Jamnagar. Gujarat.

**Inclusion criteria:**

1. Undamaged bones
2. Bones with complete ossification.
3. Bones with no pathological deformity.

**Exclusion criteria:**

1. Damaged bones
2. Bones having artifacts.
3. Bones of infants and children.
4. Bones with congenital anomalies.

All bones were assessed for the metrical parameters like chilotic line and chilotic line

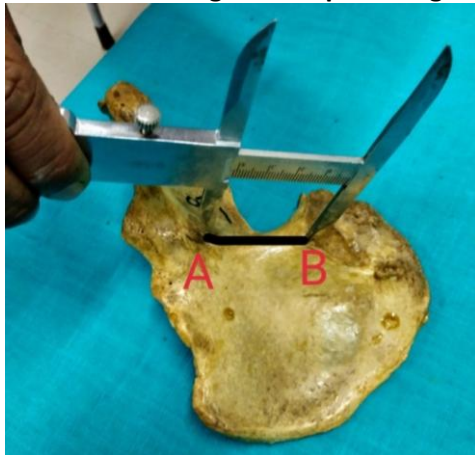
index. Chilotic line consists of two components i.e. the line extending from iliopubic eminence to the nearest point in the anterior auricular margin is the pelvic segment and the line from the anterior auricular margin to the iliac crest is the sacral segment. They were recorded with the help of vernier caliper in mms (Figure1 A & B).

The following metric parameters were taken and statistical calculation was done:

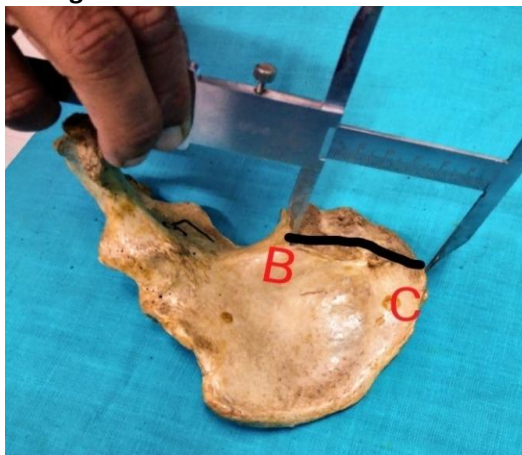
1. Pelvic segment of the chilotic line.,
2. Sacral segment of the chilotic line
3. Chilotic index [CI] = sacral segment/ pelvic segment x 100
4. Mean.
5. Standard deviation.
6. t-test calculation and p-value was also done to establish the significance of the study.
7. Cut-off value (demarking point) for the chilotic line.

All measurements were recorded in millimeter and entered in the MS Excel work-sheet.

**Fig. 1 A:** Showing chilotic line and its two components AB= The line extending from iliopubic eminence to the nearest point in the anterior auricular margin is the pelvic segment



**Fig. 1 B:** Showing chilotic line and its two components BC= The line extending from the anterior auricular margin to the iliac crest is the sacral segment.



**Results :** The pelvic segment of male hip bones fall in the range of 36 mm- 58 mm, with the mean value of 47.78 mm whereas the pelvic segment of female hip bones ranges between of 42-62 mm with mean value of 51.8 mm (shown in Table 1) .The sacral segment of male hipbones fall in the range of 49-83 mm,with the mean value of 67.58 whereas as the sacral segment of female hip bones lies in the range of 56-72 with the mean value of 63 (Table 2).

**Table 1: Comparison of Pelvic segment of chilotic line in male and female hip bone**

Group	Males	Females
Number of bones	106	10
Range	36-58	42-62
Mean	47.78	51.8
SD	5.06	5.92
P< 0.001, t=2.2498		

**Table 2: Comparison of Sacral segment of chilotic line in male and female hip bone**

Group	Males	Females
Number of bones	106	10
Range	49-83	56-72
Mean	67.58	63
SD	5.86	5.54
p < 0.001, t=2.3151		

The chilotic index in male hip bones fall in the range of 98.11- 195.24 mm, with the mean value of 142.42 and in females it lies in the range of 90.32-157.14 with the mean value of 123.74. This finding is very statistically significant with P<0.0001, t=2.872 (table -3)

**Table 3: Comparison of Chilotic line Index in male and female hip bone**

Group	Males	Females
Number of bones	106	10
Range	98.11-195.24	90.32-157.14
Mean	142.42	123.74
SD	19.37	20.72
Mean ± 3SD	84.31-200.53	61.58-185.90
Demarking point	> 157.14	< 98.11
Percentage beyond demarking point	(n=24) 22.64%	(n=1) 10%
P<0.0001, t=2.872		

**Table: 4 Regional variations of chilotic line index in India**

Sr. no.	Name of the author	Pelvic part of chilotic line		Sacral part of chilotic line		Chilotic line index		No. of bones
		Male	Female	Male	Female	Male	Female	
1	Vivek k Nirmale et al <sup>5</sup>	56.8	62.8	67.4	60.7	120.22	97.58	178
2	Ahmed et al <sup>6</sup>	54.14	63.31	62.98	49.45	117.86	79.88	50
3	Charanalia <sup>7</sup>	47.14	59.90	65.72	56.74	140.52	95.23	
4	MP Sarangee <sup>8</sup>	54.3	60	62	50.35	114.94	84.50	120
7	Gupta et al <sup>9</sup>	R49.52	54.57	66.76	61.62	135.98	114.22	100
		L51.28	53.92	66.87	62.64	131.54	116.90	
8	Present study)	47.78	51.8	67.58	63	142.42	123.74	106

**Discussion:** A review of literature showed that not much study is available in the population in context to the metrical data on chilotic line (pelvic and sacral segment) and chilotic line index. Therefore the present study is undertaken to define a cut off value for the above parameter so that bone identification can be easily done even if it is available in fragments<sup>3</sup>. Study by Vivek k Nirmale et showed mean value of pelvic segment was 56.8 mm in males and 62.8 mm in females while the sacral segment was 67.4 mm in males and 60.7 mm in females and Chilotic index was 120.22 in males and 97.58 in females<sup>4</sup>.

Study by Ahmed MM in Karnataka region showed mean value of pelvic segment was 54.14 mm in males and 63.31 mm in females while the sacral segment was 62.98mm in males and 49.45 mm in females and Chilotic index was 117.86 in males and 79.88 in females<sup>6</sup>. Charnalia et al showed in their study found that in the south Indian population the mean value of pelvic segment was 47.14mm in males and 59.90 mm in females while the mean value of sacral segment was 65.72 mm in male and 56.74 mm in females and Chilotic index was 140.52 and 95.23 in males and females respectively<sup>7</sup> Study by MP Sarangee showed mean value of pelvic segment was 54.3 mm in males and 60 mm in females while the sacral segment was 62.0 mm in males and 50.35 mm in females and Chilotic index was 114.94 in males and 84.5 in females<sup>8</sup>. The chilotic index in male hip bones falls in the range of 98.11- 195.24 mm, with the mean value of 142.42 and in females it lies in the range of 90.32-157.14 with the mean value of 123.74.

All of the above studies have discussed only mean and SD of chilotic line index in male and female. They do not give accurate parameter for the identification of male and female hip bone. In our study we have calculated mean $\pm$  3SD,

demarking point and percentage beyond demarking point of chilotic line index. We defined a demarking point for chilotic line index for male is 157.14 and for female 98.11, thus the hip bones having chilotic line index more than 157.14 are definitely of male and hip bones having chilotic line index less than 98.11 are definitely of female. This finding is very statistically significant with  $P < 0.0001$ ,  $t = 2.872$ .

#### Conclusion:

1. Length of pelvic part of chilotic line, Length of sacral part of chilotic line and Chilotic line index are statistically significant parameters.
2. Sacral part of chilotic line is more in males as compared to females. while pelvic part of chilotic line is more in female as compared to males.
3. Various Genetic, Geographical and Hormonal factors are held to be responsible for regional and racial variation of chilotic line index amongWith respect to above results and discussion, 22.64% of male hip bones and 10% of female hip bones have been identified. Thus, the sex of the hip bone can be assessed up to about 99.99 % confidence with the help of chilotic line index by demarking point method.

#### References:

1. Kanabur V. Identification of the sex of human hip bone by metric analysis of its anterior border. Biomedical Research 2012; 23:211-4.
2. Pal G.P., Bose S and Choudhary S. Reliability of criteria used for sexing of hip bones. J.Anat.soc. india.53(2)(2004)
3. Gray's: Anatomy of the human body; 40th Edition. 2011:1359-1360.
4. Jeneeta Baa, P.C.Maharana. chilotic index-A strong determinant in studying sexual dimorphism of dried hip nones in the

- population of north Andhra Pradesh. Int J Anat Res 2018, 6(4:1):5743-46.
5. Vivek K Nirmale, Dhanaji S Jadhav, Shanshank B Vedpathank, Swati Belsare. Regional and racial variations of chilotic line index in human adult hip bones: A comparative study. Med Pulse- International Journal of Anatomy November 2017;4(2):25-28
  6. Ahmed MM, Jeelani M, Tarnum SA. Sexual dimorphism of human hip bone with respect to Chilotic Index in North Karnataka region. Int J Sci Stud 2015; 3:14-7.
  7. Charnalia VM. Sex difference and determination in human sacra in south India. J Anat Soc India 1967; 16:33.
  8. Sarangee MP, Maharana PC, Rao KS, Das S. A study on sexual dimorphism of the human hip bones in respect of chilotic line and chilotic index in the population of Orissa. Indian Anthropol 1992; 22:13-23.
  9. Sanjay Gupta et al measurements of anthropometric parameters of ilium of hundred human hip bones in north Indian region. Int J Anat Res 2017; 5(1): 3648-51.

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