

Regional and racial variations of chilotic line index in human adult hip bones: A comparative study

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Abstract

Background: As an individual hip bone (os innominate) is the most commonly used bone in determination of sex during medicolegal cases. It is well known that hip bone is by far the most non-population specific indicator for reliable sex determination. Nonmetric methods i.e. observational methods require expertise, simple anthropometric population specific data can be utilised effectively. **Aim:** Present study was carried out to assess the utility value of pelvic and sacral part of chilotic line, and chilotic line index in determination of sex by using hip bone. And to focus on numerous factors contributing for regional and racial difference in these parameters. **Materials and Methods:** For our study hips bones obtained from department of anatomy Government medical college, Aurangabad were used. Out of 178 hip bones 54 are of females and 124 are or males. All the observations were tabulated and analysed statistically further. All the parameters are statistically significant. All the values obtained for various parameters were compared with the previous studies. **Results:** Pelvic part of Chilotic line is more in females as compared to males. In males mean chilotic line index is 120.22 (Range 83.07-151.1) and in females mean is 97.58 (Range 72.3-160.8). chilotic line index is found more in males as compared to females. **Conclusion:** Among the three parts of hip bone, ilium constitutes the important means of sexual dimorphism. It also justifies us in considering a part of hip bone to be of great sexual importance, while other racial factors appear sufficiently to impact their influence.

Key Words: Pelvic part of Chilotic line, Sacral part of Chilotic line and chilotic line index.

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INTRODUCTION

The advantage of studying human skeletal remains is that they are very resistant to be affected by external environmental factors. These bones can be very well examined, observed and measured even after a long time after death of the individual. Hip bone usually displays difference in the morphology independent of the size due

to different sexual and reproductive functions which are influenced by sex hormones. So, study of hip bone morphology and its shape differences in both sexes makes it an interesting anatomically and anthropologically.¹ Hip bone is ideal bone for sex determination because it reflects the general differences between the two sexes providing high accuracy levels of sex determination and it also shows special adaptation of female hip bone for child bearing.² According to Derry (1923)³ “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. In the present study, we obtained data from population of Maharashtra and compared it with different regions of India and with different races across the world. Further we would like to highlight the numerous factors which can be held responsible for regional and racial variations of chilotic line index.

MATERIAL AND METHODS

A total of 178 adult hip bones (54 were of females and 124 were of males) were collected. All the hip bones were obtained from the bone bank of Department of Anatomy, Government medical college, Aurangabad. All the hip bones are fully ossified, unbroken and free from any deformity. The personal record of all the hip bones with respect to race and sex are available at bone bank. The instruments used for measurements are thread, marker pencil and pen. In the present study, we consider the following parameters.

1. Length of pelvic part of chilotic line
2. Length of sacral part of chilotic line
3. Chilotic line index

For our purpose of study, we selected two points. The first one is situated on iliopecteneal line at the site of union of pubis and ilium and called it as pubo-iliac point. The second one is on the anterior margin of the auricular surface where this approaches nearest to the pubo-iliac point and termed as auricular point. Chilotic line extends from pubo-iliac point or ilio-pubic eminence to iliac crest. Auricular point divides the chilotic line into anterior pelvic and posterior sacral part.³

1. **Length of pelvic part of chilotic line:** it is the distance between puboiliac point and auricular point. it was recorded with the help of thread then recorded on scale in mms
2. **Length of pelvic part of chilotic line:** Distance between auricular point to the iliac crest, it is measured by marking the fixed points with marking pencil and running a no elastic thread. The length of the thread then recorded on scale in mms.
3. **Chilotic line index** is calculated by using following formula.

$$\frac{\text{Sacral part of chilotic line}}{\text{Pelvic part of chilotic line}} \times 100$$

OBSERVATIONS AND RESULTS

As a first part of the study for each parameter we calculated range, mean, standard deviation and P value. Demarcating points were calculated from calculated range i.e. mean + standard deviation.⁴ The percentage of bones identified by each D.P. in both sexes were estimated. All the observations were recorded. In the second part of study, we compared our findings with previous studies.

Table 1: Statistical analysis of sacral part of chilotic line

| Details of the measurement | Male (cm) | Female (cm) |
|----------------------------|-----------|-------------|
| Range | 5.4-7.8 | 4.6-7.8 |
| Mean | 6.74 | 6.07 |
| Std. Deviation | 0.499 | 0.736 |
| Mean ± 3 S.D. | 5.24-8.23 | 3.86-8.28 |
| Demarking Points | <3.86 | > 8.23 |
| % of Bones Identified | NIL | NIL |
| P Value | P< 0.001 | |

Table 2: Statistical analysis of pelvic part of chilotic line

| Details of the measurement | Male (cm) | Female (cm) |
|----------------------------|-----------|-------------|
| Range | 4.18-7.1 | 4.6-7.8 |
| Mean | 5.68 | 6.28 |
| Standard Deviation | 0.661 | 0.659 |
| Mean ± 3 S.D. | 3.68-7.68 | 4.3-8.25 |
| Demarking Points | <4.3 | >7.68 |
| % of Hip Bones Identified | 1.6% | 3.7% |
| P Value | P< 0.001 | |

Table 3: Statistical analysis of chilotic line index

| Details of the measurement | Male | Female |
|----------------------------|-------------|------------|
| Range | 83.07-151.1 | 72.3-160.8 |
| Mean | 120.22 | 97.58 |
| Standard Deviation | 14.075 | 15.525 |
| Mean ± 3 S.D. | 78-162.45 | 51-144.15 |
| Demarking Points | >144.15 | < 78 |
| % of Hip Bones Identified | 3.22% | 3.30% |
| P Value | P< 0.001 | |

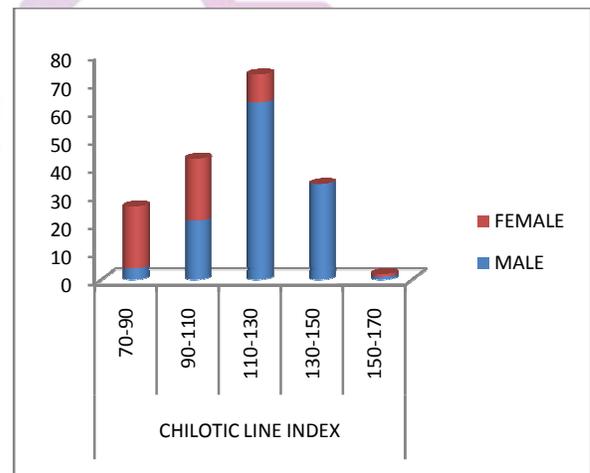


Figure 1: Chilotic line index



Figure 2: Measuring pelvic part of Chilotic line

DISCUSSION

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 |
|--------|---|------------------------------|-------|------------------------------|-------|---------------------|--------|-------------|
| | | M | F | M | F | M | F | |
| 1 | Charanalia (1966) ⁵ | 47.14 | 59.90 | 65.72 | 56.74 | 140.52 | 95.23 | ---- |
| 2 | MP Sarangee (1992) ⁶ | 54.3 | 60 | 62 | 50.35 | 114.94 | 84.50 | 120 |
| 3 | Sharma Gopal (2013) ⁷ | R 61.1 | 65.7 | 65.7 | 60.8 | ---- | ---- | 200 |
| | | L 62.1 | 67.8 | 66.6 | 61.2 | ---- | ---- | |
| 4 | Sachdeva (2014) ⁸ | 54.6 | 59.1 | 68.3 | 60.8 | ---- | ---- | 100 |
| 5 | Ahmed <i>et al</i> (2015) ⁹ | 54.14 | 63.31 | 62.98 | 49.45 | 117.86 | 79.88 | 50 |
| 6 | Gupta <i>et al</i> (2017) ¹⁰ | R 49.52 | 54.57 | 66.76 | 61.62 | 135.98 | 114.22 | 100 |
| | | L 51.28 | 53.92 | 66.87 | 62.64 | 131.54 | 116.9 | |
| 7 | Present study (2017) | 56.8 | 62.8 | 67.4 | 60.7 | 120.22 | 97.58 | 178 |

From the above table, we can conclude that range of various parameters is much large and our findings are nearly in the middle as highest reading shown by Charanalia (1966)⁵ in south Indian population and the lowest one by MP Sarangee (1992)⁶ in Orissa population. Our findings are matching with findings of Ahmed *et al*

(2015)⁹ whose study population belonging to state of Karnataka (South India). Even though all the previous studies were carried out in different Indian populations, reasons for such variability can be attributed to sexual and hormonal factors, in the background of various genetic and geographical factors.

Table 5: Racial Variations of Chilotic line Index

| Sr. No | Pelvic part of Chilotic line | | Sacral part of Chilotic line | | Chilotic line index | | No of bones | |
|--|---|------|------------------------------|------|---------------------|-------|-------------|----|
| | M | F | M | F | M | F | | |
| 1. DERRY'S readings(1923) ³ | English | 52.8 | 55.7 | 71.2 | 61.3 | 136.1 | 110.8 | 95 |
| | 5 th -12 th Dynastics | 55 | 62.9 | 68.4 | 56.5 | 125.9 | 90.7 | 74 |
| | Predynastic | 54.5 | 59 | 67.7 | 63.1 | 125.6 | 107.1 | 66 |
| | Kerma | 55.5 | 60.9 | 68.4 | 62.1 | 125.2 | 103.2 | 40 |
| 2. Devivong (1963) ¹¹ | 49.8 | 58.2 | 60.1 | 56.7 | 129.2 | 98.1 | ---- | |
| 3. Present study | 56.8 | 62.8 | 67.4 | 60.7 | 120.2 | 97.58 | 178 | |

As will be seen in the accompanying Table no.5, the total length of the Chilotic line in the men is practically identical in three out of the four groups examined. There is in fact no sensible difference in the actual size of the bone in these races. But a remarkable difference is apparent in the English men as compared with the other three groups when the Chilotic line is divided into its two component parts Pelvic and Sacral. In this case the

English are found to have the shortest Pelvic Chilotic line (52.8) as against an average of 55-0 in the remaining groups, but they have at the same time the longest Sacral Chilotic line (71.2) so that the Chilotic Index for this race rises to 136.1. In the women, the total length of the Chilotic Line varies from 117-0 in the English to 123-0 in the Kerma group. But although the Pelvic portion of the line is again shorter in the English women than in the

women of the other groups, in all of them it exceeds the length of the same line in the men of their respective races. This is of course only another way of demonstrating the greater antero-posterior diameter of the pelvis in women. When, however, we come to examine the Sacral Chilotic line in this sex we find it to be consistently smaller than in the men, both as well as in relation to the total length, so that the Chilotic Index falls towards the figure already suggested as the boundary line between men and women, i.e. 100, and in the VIth-XIIth Dynasty Egyptian women reaches as low as 90-7. It is instructive to note, however, that as in the case of the English men, the White chapel women have the highest Chilotic Index.

CONCLUSION

Finally, to summarise

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. In males mean chilotic line index is 120.22 (Range 83.07-151.1) and in females mean is 97.58 (Range 72.3-160.8). chilotic line index is found more in males as compared to females.
3. Various Genetic, Geographical and Hormonal factors are held to be responsible for regional and racial variation of chilotic line index among different population groups.

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