

Study of Significance of Pelvic Brim Chord and Pelvic Brim Depth in Sex Determination of Human Hip Bone



Medical Science

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ABSTRACT

Introduction:- Sex determination of the unknown hip bone either of whole skeleton or any part of its always a field of research not only for anatomist but also for forensic experts, anthropologists and archeologists. Hip bone was considered as ideal bone for sex determination after skull. **Material and Method:-** This study was carried out on 120 dried human hip bones and classified them in to three groups according to nine visual criteria Male, female and Unknown group. Out of 120 hip bones 45% were male, 30% were female and remaining 25% were related with unknown group. Pelvic brim chord and pelvic brim depth were measured and index was calculated. These three parameters were statistically analyzed. **Results:-** Mean values of pelvic brim chord, pelvic brim depth and pelvic brim chord index (PBCX PBD) were higher in female as compared male and unknown sex group hip bones. Difference of the mean of these measurements statistically analyzed and P value >0.133 for pelvic brim chord, P value- 0.001 for pelvic brim depth and pelvic brim chord index was found. **Conclusion:-** After statistical analysis It was found that there was significant difference in the mean value of pelvic brim depth and pelvic brim chord index. And difference in the mean value of pelvic brim chord was not statistically significant.

Introduction:-

Hip bone also known as Os innominatum. Sex determination of the unknown either of whole skeleton or any part of it always a field of research not only for anatomist but also for forensic experts, anthropologists and archeologists. For sex determination of unknown skeleton, skull is the ideal bone. But skull is not always available. In such condition hip bone was considered as ideal bone for sex determination, because there were various morphological changes in female hip bone, to provide a space for fetal skull during birth process. Pelvic brim formed by sacral promontory posteriorly and the lineae terminalis on both sides. Each linea terminalis includes the iliac arcuate line, pectineal line and pubic crest. Pelvic brim forms pelvic inlet.

Hooton^(1 & 2) States that "the determination of sex from post cranial skeleton in adult is easy and certain in about 80% of the cases, difficult but possible in another 10% of cases and quite dubious in remainder."

Many researches have been done on various bones of human skeleton like humerus, femur, clavicle, etc.

There are various methods for sex determination of human Hip bone. One method is by gross morphological anatomy of hip bone like greater sciatic notch, iliac fossa, subpubic arch, inversion of ischiopubic ramus, obturator foramen, preauricular sulcus. Another method is utilizing various measurements of hip bone like total pelvic height, pelvic width, acetabular diameter, pubic length, measurements of greater sciatic notch, measurement of pelvic brim.

In this study measurements of pelvic brim chord, pelvic brim depth and pelvic brim chord index were used to show their significance in sex determination of hip bone.

Material and Methods:-

This study was done on 120 dried adult human hip bones in Department of anatomy of in different medical colleges of Gujarat.

Damaged, deformed hip bones were not considered for the study. All hip bones were separated in male and female and unknown sex group depending on 8 visual criteria of human hip bones. Bone that full fill all these criteria were selected for the study. These criteria were:-

as a depression just inferior to auricular part of sacropelvic surface of ilium. This was present in female and absent in male.

- Greater sciatic notch⁽³⁾:** The greater sciatic notch is present posteriorly, bounded above by the ilium, below by the ilium and ischium. It is formed by turning of the posterior border of hip bone horizontally forwards for about 3cm and then turning down and back to join the posterior ischial border. The width and posterior angle of the notch was observed in the entire bones. Greater sciatic notch wide in female and narrow in male.
- Obturator foramen⁽³⁾:** The shape of obturator foramen present below and slightly anterior to the acetabulum was noted in both the sexes. Obturator foramen oval in male, triangular in female.
- Iliac fossa⁽³⁾:** The depth of iliac fossa i.e. the internal cavity of ilium forming the wall of greater pelvis was compared in both the sexes. Iliac fossa was deep in male and shallow in female.
- Comparison between diameter of acetabulum and the distance of its anterior rim from pubic symphysis⁽³⁾:** This was done to assess the size of acetabulum in both the sexes. Acetabular diameter was more than distance of its anterior rim from pubic symphysis in male as compared to female.
- Ischiopubic ramus eversion⁽³⁾:** Presence or absence of eversion of ischiopubic ramus was looked for in both the sexes. Ischiopubic ramus was everted in male because of attachment of crus of penis. This was not everted in female.
- Subpubic concavity⁽³⁾:** This was seen from the dorsal aspect as a small curve of the ischiopubic ramus, a short distance below the lower margin of pubic symphysis. Subpubic concavity was present in female and absent in male.
- Ventral arc⁽⁴⁾:** Ventral arc was seen as a slightly elevated ridge of bone starting from pubic crest and extending inferiorly across the ventral surface of body of pubis, blending with the medial border of ischiopubic ramus. Ventral arc was seen in female, not in male.

By these criteria hip bones were classified in to three group male, female and unknown sex according to these visual criteria. Hip bone having 7 to 8 female criteria was classified as female, hip bone having 7 to 8 male criteria was classified as male bone, rest of bone had less than these male and female criteria was classified as unknown sex.

- 1. Preauricular sulcus⁽³⁾:** Preauricular sulcus was seen or felt

Table 1:- Summary of hip bones used for study

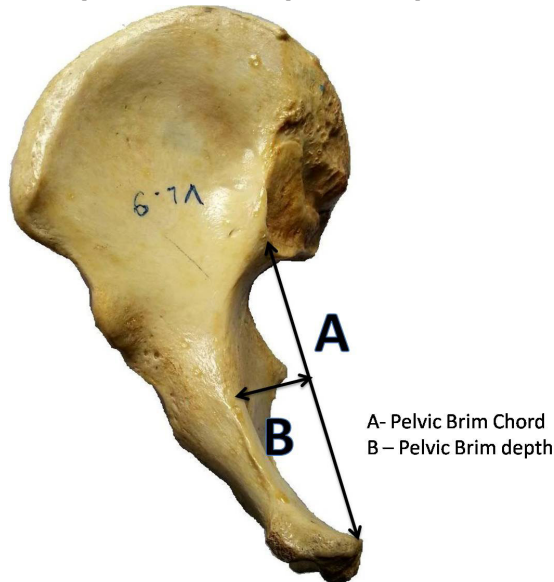
Group	Right side	Left side	Total	% of total hip bones
Male	27	27	54	45 %
Female	19	17	36	30 %
Unknown sex	15	15	30	25 %

Pelvic brim chord and pelvic brim depth was measured in mm with vernier caliper.

Description of measurements

- **Pelvic brim chord (PBC):** Pelvic brim chord was measured as the straight distance from the auricular point (defined as intersection of arcuate line with anterior edge of auricular surface) to the uppermost edge of pubic symphyseal surface.⁵
- **Pelvic brim depth (PBD):** Pelvic brim depth was taken as the perpendicular distance from the midpoint of pelvic brim chord to the pelvic brim.⁵
- **Pelvic brim chord index (PBC x Pelvic brim depth)⁵** was calculated.

Photograph:- Showing bony points and method of measurement of pelvic brim chord and pelvic brim depth



A- Pelvic Brim Chord
B – Pelvic Brim depth

Results:-

All measurements were statistically analyzed and their mean standard deviation was calculated. ANOVA test was applied to find out significance of these differences in male, female and unknown sex hip bones.

In table 2, 3 and 4 results of these measurements were shown.

Table – 2 Summary of measurement of Pelvic brim chord

	Male	Female	Unknown Sex
Mean	106.498	109.244	107.347
Standard Deviation	5.857	5.966	7.176
Minimum	90.800	99.100	95.400
Maximum	118.900	124.700	124.600
P Value	0.133		
F Value	2.055		

Table 2 showed that mean value of pelvic brim chord was higher in female (109.24mm) as compared to male (106.49mm) and in between in unknown sex group (107.347 mm). Difference between the mean of these group was statistically analyzed and found P value was >0.133 that was not significant.

Table 3 - Summary of measurement of Pelvic brim depth

	Male	Female	Unknown Sex
Mean	22.452	25.439	23.363
Standard Deviation	3.038	4.627	3.262
Minimum	17.500	17.300	18.300
Maximum	29.100	37.800	31.900
P Value	0.001		
F Value	7.305		

Table 3 showed that mean value of pelvic brim depth was less in male (22.45mm) as compared to female (25.43mm) and in between in unknown sex group (23.36 mm). Difference between the mean of these group was statistically analyzed and found P value was 0.001 that was significant.

Table 4 - Summary of measurement of Pelvic brim chord index (PBC x PBD)

	Male	Female	Unknown Sex
Mean	2396.183	2788.930	2513.170
Standard Deviation	376.204	588.710	421.499
Minimum	1616.240	1714.430	1897.710
Maximum	3128.250	4713.660	3688.160
P Value	0.001		
F Value	7.742		

Table 4 showed that mean value of pelvic brim chord index was less in male (2396.18) as compared to female (2788.93) and in between in unknown sex group (2513.17). Difference between the mean of these group was statistically analyzed and found P value was 0.001 that was significant.

Discussion:-

Determination of sex of unknown human skeleton is a challenging task for forensic expert and archeologist. Many studies have been done on skeletal material by various researchers for sexing of bone. Hip bone is having great value in sexual dimorphism.

Various techniques have been employed by researches for sex determination of hip bone. These techniques include visual criteria, objective criteria or analytical criteria.

Visual criteria for sex determination of hip bone are having high degree of subjective error and it requires experience. For Objective criteria, no standard charts are available for various parameters and different races.

In this study 120 adult human hip bones of unknown sex were selected. By 8 visual criteria these hip bone were categorized into male, female and unknown sex hip bones. Out of these 120 hip bones, 54 were male and 36 were female and 30 were unknown sex hip bones.

The result of our study showed that mean value of pelvic brim chord was higher in female as compared to other two groups but this difference was not statistically significant.

Mean value of pelvic brim depth and pelvic brim chord index was also higher in female and difference between the mean of these measurements between the groups were statistically significant. These findings were similar to findings of Segebarth

Orban⁶.

Study carried out by Milne had similar findings that pelvic brim chord was not significant but pelvic brim was significant between male and female hip bone.⁵

Our result were similar to the finding of S G Dixit et al. whose study state that pelvic brim depth and index 4(pelvic brim depth X pelvic brim chord) were good discriminator of sex.⁷

Findings of study of Arsuga indicated that larger pelvic inlet in female that included(longer pubic bone, a greater degree of curvature of the iliopectineal line, and relatively more posterior position of the auricular surface.⁸

Conclusion and recommendation:-

This study showed that there were gender differences in measurements of linea terminalis part of pelvic brim. Mean values of pelvic brim chord, pelvic brim depth and pelvic brim chord index was higher in female and less in male. But there was overlapping between the range of total pelvic height and pelvic width in male and female. Pelvic brim depth and pelvic brim chord index were statistically significant. And mean difference of pelvic brim chord was statistically not significant. This study showed that female pelvic inlet wider as compared to male.

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