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Biometric Study of Anterior Border of Hipbone and Its Application for Sex Determination.

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ABSTRACT

Hipbone is the reliable bone to determine the sex. Sex determination of individual is greatly useful in Anatomy, Archeology, Anthropology, Radiology, and forensic departments. But the authors who have done the previous studies by using the hip bones have paid attention to study the sex determination on following parameters. Acetabulum, Obturator foramen, Greater sciatic notch, Ischio pubic rami, chelotic index, Arcuate index and body of pubis. However we were unable to find any studies that set out to establish the measurement of particular parameters of anterior border of hip bone by osteometric method. We therefore decided to undertake the present study, which forms the part of a larger systematic analysis of the construction of the human hip bone. To determine the sex of the human hipbones by using different metric parameters of anterior border of hip bone. The present study was conducted in 100 dry adult human hip bones without any pathological changes (56 female and 44 male) from the department of anatomy, SRM medical college, Chennai. In our study we found that the length of the border between anterior superior iliac spine to anterior inferior iliac spine (Arch AIN) was $3.655 \pm 0.5563\text{cm}$ in male and $3.618 \pm 0.5615\text{cm}$ (SD) in female. The depth of the anterior interspinous notch (depth AIN) was $0.627 \pm 0.177\text{cm}$ in male and $0.557 \pm 0.1962\text{cm}$ (SD) in female. The length of the border between anterior superior iliac spine and superior end of the symphyseal surface (Arch AB) was $14.909 \pm 1.1262\text{cm}$ (SD) in male and $14.413 \pm 0.9425\text{cm}$ (SD). The depth of the anterior border (depth AB) was $3.018 \pm 0.4848\text{cm}$ (SD) in male and $2.902 \pm 0.4376\text{cm}$ (SD) in female. To conclude that, the biometric study of anterior border of hip bone is useful for carrying out medico legal examination, cephalopelvic disproportions in obstetric cases and anthropological examination.

Keywords: Hipbone, Anterior superior iliac spine, Sex determination.

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INTRODUCTION

Accurate sex determination is an important issue in both forensic and bioarcheology. The distinct morphology of human hip bone and its clear sexual dimorphism of hip bone make it interesting from anatomical, anthropological, and forensic point of view.[13, 14]The skeletons often investigated for this purpose are the pelvis and skull. The current opinion regarding hipbone as the most reliable sex indicator because it has long been recognized as the most dimorphic bone particularly in adult individuals [1]. Identification of sex and side from the skeletal remains is very critical challenge, not only for anatomist but also for forensic experts, anthropologist and archeologist [1, 2, and 3]. The hip bone innominate bone or coxal bone is a large flattened shaped bone, constricted in the centre and expanded above and below. The shape of the Greater sciatic notch and subpubic angle [10] of hip bone was widely used in assessment of sex from skeleton remains (MacLaughlin,et.,al 1986[7], & Gray's 35th edition)[12]. Therefore, the hipbone has been the most frequently used bone for sexing of the human skeleton and also provides the higher accuracy levels for sex determination [5, 6, 7, and 8]. According to Krogman et al [4], a reliability of 95% can be obtained from sex determination by the hip bone. Numerous techniques of sex determination have been proposed, based on visual assessment or recording of linear variables of the hip bone. Measurements on hip bone radiologically can also be of valuable aid to orthopedic surgeons especially in pelvic surgery, hip bone replacement etc. In this study, various parameters of anterior border of hip bone were measured to decide the sex.

MATERIALS AND METHOD

This study was conducted in 100 dried adult human hip bones, (56 females and 44 males) collected from the department of Anatomy, SRM medical college and Research centre, Kattankulathur, Chennai. All the hip bones were free from pathological changes and damages. Their sex were identified by keeping standard sex determine by experts. For measurements sliding caliper, inextensible thread, metallic ruler and pencil were used [9]. All the findings were tabulated and analyzed statistically using student's t test.

Parameters :

1. The length of the border between anterior superior iliac spine and the anterior inferior iliac spine (Arch AIN).
2. The depth of the anterior interspinous notch (Depth AIN).
3. The length of the border between anterior superior iliac spine and superior end of the symphyseal surface (Arch AB).
4. The depth of the Anterior border (Depth AB).

RESULTS

**The length of the border between anterior superior iliac spine and the anterior inferior iliac spine (Arch AIN)
Fig (1):**



Figure 1: The length of the border between anterior superior iliac Spine and the anterior inferior iliac spine (Arch AIN).

The statistical analysis showed that there is a significant difference between the male and female with regard to the length of the border between anterior superior iliac spine and the anterior inferior iliac spine (Arch AIN). The mean length from anterior superior iliac spine to anterior inferior iliac spine in male was $3.655 \pm 0.5563\text{cm}$ (SD) and in female was $3.618 \pm 0.5615\text{cm}$ (SD) [Table1].

The depth of the Anterior interspinous notch (Depth AIN) Fig (2):

The statistical analysis showed that there is a significant difference between the male and female with regard to the depth of anterior interspinous notch (Depth AIN). The mean depth of anterior interspinous notch in male was $0.62 \pm 0.17\text{cm}$ (SD) and in female was $0.55 \pm 0.19\text{cm}$ (SD) [Table1].



Figure 2: The depth of the anterior interspinous notch (Depth AIN).

The length of the border between Anterior superior iliac spine and superior end of the symphyseal surface (Arch AB) Fig (3):

The statistical analysis showed that there is a significant difference between the male and female with regard to the length of the border between anterior superior iliac spine and the superior end of the symphyseal surface (Arch AB). The mean length from anterior superior iliac spine to the superior end of the symphyseal surface in male was $14.9 \pm 1.12\text{cm}$ (SD) and female was $14.4 \pm 0.94\text{cm}$ (SD) [Table1].



Figure 3: The length of the border between anterior superior iliac Spine and superior end of the symphyseal surface (Arch AB).

The depth of the Anterior border (Depth AB) Fig (4):

The statistical analysis showed that there is a significant difference between the male and female with regard to the depth of the anterior border (Depth AB). The mean depth of the anterior border in male was $3.01 \pm 0.48\text{cm}$ (SD) and in female was $2.9 \pm 0.43\text{cm}$ (SD) [Table1].



Figure 4: The depth of the anterior border (Depth AB).

Male & Female n= 100	Male			Female		
	Mean	±SD	P Value	Mean	±SD	P Value
Arch AIN	3.655	0.55	0.74	3.61	0.56	0.74
Depth AIN	0.627	0.17	0.06	0.55	0.19	0.06
Arch AB	14.90	1.12	0.01	14.1	0.94	0.01
Depth AB	3.01	0.48	0.21	2.90	0.413	0.21

Table 1: Student -t test and P-value for male and female

DISCUSSION

As per the results we got one variable arch AB which was significant ($p \leq 0.01$) for sex determination. While in the study of L.Gomez pellico et al., (1992), [9] statistically there is no significant difference between mean related to sex were detected. This variable could be used for sex determination of human hip bone. There is no significance of three measurements, the length of the border between anterior superior iliac spine and the anterior inferior iliac spine (Arch AIN); the depth of the anterior interspinous notch (depth AIN); the depth of the anterior border (Depth AB). We cannot determine the sex of the human hip bone from these variables.

L.Gomez pellico et al., (1992), [9] stated that the mean value of Arch AIN in male was $45.7 \pm 6.30\text{cm}$ (SD) and in female was $47.17 \pm 7.73\text{cm}$ (SD). In the present study, the mean value of Arch AIN in male was $3.65 \pm 0.55\text{cm}$ (SD) and in female was $3.61 \pm 0.56\text{cm}$ (SD). L.Gomez pellico et al., (1992),[9] reported that the mean value of Depth AIN in male was $7.03 \pm 1.58\text{cm}$ (SD) and in female was $6.43 \pm 1.44\text{cm}$ (SD). According to Mitesh shah et.al, (2013), [11] stated that the mean value of Depth AIN in male was $7.1 \pm 1.74\text{cm}$ (SD) and in female was $6.52 \pm 1.58\text{cm}$ (SD).

Leena Raichandani et.al, (2015) [10] reported that, statistically there was a significance in above mentioned parameter. L.Gomez pellico et al., (1992), [9] found that the mean value of Arch AB in male was $157.80 \pm 9.29\text{cm}$ (SD) and in female was $156.7 \pm 12.56\text{cm}$ (SD). In the present study, the mean value of Arch AB in male was $14.90 \pm 1.12\text{cm}$ (SD) and in female was $14.41 \pm 0.94\text{cm}$ (SD). Mitesh shah et.al. (2013) [11] reported that the mean value of Depth AB in male was $28.36 \pm 4.61\text{cm}$ (SD) and in female was $28.32 \pm 3.44\text{cm}$ (SD). According to L.Gomez pellico et al., (1992), [9] stated that the mean value of Depth AB in male was $32.9 \pm 4.08\text{cm}$ (SD) and in female was $34.8 \pm 6.34\text{cm}$ (SD). In the present study, the mean value of Depth AB in male was $3.01 \pm 0.48\text{cm}$ (SD) and in female was $2.90 \pm 0.43\text{cm}$ (SD).

CONCLUSION

In the present study four parameters were used to measure the anterior border of human hip bone. The parameters used were Arch AIN, Depth AIN, Arch AB, and Depth AB. After the statistical analysis of all four parameters, Arch AB showed a statistical significance. Hence I conclude that the parameter arch AB is the most useful parameter to determine the sex of the human hip bone, instead of taking other parameters. This study is useful for carrying out medico legal examination of bones, cephalopelvic disproportion in obstetric cases, Anthropological examination of skeleton, Radiological study of pelvis, Orthopedic surgeons especially in pelvic surgery, hip bone replacement and also for archaeological examination of skeleton.

ABBREVIATION:

Arch AIN: The length of the border between anterior superior iliac spine and the anterior inferior iliac spine.

Depth AIN: The depth of anterior interspinous notch.

Arch AB: The length of the border between anterior superior iliac spine and the superior end of the symphyseal surface.

Depth AB: The depth of the anterior border.

SD: Standard Deviation.

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