Section: Anatomy

Original Research Article

SEXUAL DIMORPHISM IN HIP BONE BASED ON METRIC ANALYSIS OF ITS ANTERIOR BORDER: A BOON IN FORENSIC INVESTIGATION OF FRAGMENTED SKELETAL REMAINS

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Abstract

Background: Sexing of bones becomes mandatory in fragmented skeletal remains. Metric method of analysis is very important in determining the sex of skeletal remains. Hip bone is widely used bone for sex determination. This study was done to determine the reliability of anterior border parameters of hip bones for gender confirmation. **Materials and Methods:** In this study we used 87 adult dry human hip bones of which 41 were right sided and 46 left sided, 42 was of male sex and 45 of female sex from bone bank of our institute. Eighteen parameters on anterior border of hip bones were measured by digital verniercaliper and studied for any statistical significant difference in relation to sex or side of the bone. **Results:** Statistically significant differences were found for 3 variables related to sex, which are (1) Straight distance between Anterior inferior iliac spine (AIIS) to Illiopubic eminence(IPE) - Where mean values for male hip bone was 37.48 ± 2.8 mm and for female it was 34.40 ± 3.8mm found (P 0.003) (2) Distance between AIIS to Pubic tubercle(PT) - The mean values of the for males was 78.95±3.1mm and for females 74.03±5.9mm ($P \leq .01$) was obtained. 3) Length of arch between AIIS to IPE – Where mean values of this variable for males was 41.03±2.5mm and for females it was 38.17±5.0mm (P 0.018). **Conclusion:** So it can be stated that anterior border parameters can be utilized for identifying the sex of human hip bone by metric analysis.

INTRODUCTION

Determining the sex utilizing the bone is an important aspect in the field of Anatomy. Its significance further increases when there is need of identifying sex from remains of bone obtained in medico legal cases or during archeological surveys. For determining the age and sex of individual from skeletal remains in medico legal cases opinion is usually obtained by anatomists and forensic experts.[1] Metric analysis is simple and accurate method in determining the sex of skeletal remains.[2] Hip bone biometry after using discriminant analysis rules out observer bias.[3] Hip bone is widely used for sex determination by experts belonging to the field of Anthropology, Forensic Medicine and Toxicology, Anatomy because of its marked sexual dimorphism.[4] In the past research studies have been conducted which indicates sexual dimorphism of hip bone remains dissimilar in different population.[5] Those samples where there is damage to the posterior features of hip bone to hide identification in medico legal cases the role of anterior border features becomes crucial.[6] Many studies have been conducted in the past on different parameters of hip bone, but only few researches have been done on its anterior border. In fact no such study is carried out on hip bones of population belonging to Madhya Pradesh and Chhattisgarh as per our literature search. So this study is conducted with the interest to find out whether the parameters of anterior border of hip bone can be helpful in sex determination.

MATERIALS AND METHODS

Study Design and Setting

This was a cross sectional analytical type of study which was conducted in the department of Anatomy of our institutes. Eighty seven (87) specimens of undamaged dry human hip bone were collected from

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the bone bank of our institutes, of which 41 were right sided and 46 left sided, 42 were of male sex and 45 of female sex. Sex and side of the hip bones was determined by thorough observation and examination by subject experts using standard morphological features.[7] These features are as follows

a. Obturator foramen
b. Ischial spine
c. Greater sciatic notch
d. Ischiopubic ramus

Inclusion Criteria

1. Adult dry human bone
2. Fully ossified bones
3. Intact bones

Exclusion Criteria

1. Bone with pathological changes
2. Deformed and damaged bones
3. Bone with congenital anomalies
4. Malunited bones

Sample Size

Sampling method followed was convenience sampling due to limited availability of hip bones.

Variables

The following 18 parameters were measured on anterior border hip bones (Fig 4-10)

1. Straight distance between anterior superior iliac spine (ASIS) to superior end of symphyseal surface (SS) - Dist. Bet. ASIS to SS
2. Straight distance between anterior superior iliac spine (ASIS) to pubic tubercle(PT) - Dist. Bet. ASIS to PT
3. Straight Distance between anterior superior iliac spine (ASIS) to iliopubic eminence (IPE) - Dist. Bet. ASIS to IPE
4. Straight Distance between anterior superior iliac spine (ASIS) to anterior inferior iliac Spine (AIIS) - Dist. Bet. ASIS to AIIS
5. Straight Distance between anterior inferior iliac spine (AIIS) to the iliopubic eminence (IPE) - Dist. Bet. AIIS to IPE
6. Straight Distance between anterior inferior iliac spine (AIIS) to the pubic tubercle (PT) - Dist. Bet. AIIS to PT
7. Straight Distance between anterior inferior iliac spine (AIIS) to the superior end of symphyseal surface (SS) - Dist. Bet. AIIS to SS
8. Straight Distance between iliopubic eminence (IPE) to pubic tubercle (PT) – Dist. Bet. IPE to PT
9. Straight distance between Iliopubic eminence (IPE) to superior end of symphyseal surface (SS) - Dist. Bet. IPE to SS
10. Straight distance between pubic tubercle (PT) to anterior rim of acetabulum(Ar. Acetabulum) - Dist. Bet. PT to Ar.Acetabulam
11. The length of arch of anterior superior iliac spine to anterior inferior iliac spine - (Arch ASIS to AIIS)
12. The length of arch between anterior inferior iliac spine and iliopubic eminence (Arch AIIS to IPE)
13. The length of arch between iliopubic eminence and superior end of symphyseal Surface – (Arch IPE to SS)
14. The length of arch of anterior inferior iliac spine to the superior end of symphyseal surface (Arch AIIS to SS)
15. The length of arch of anterior border (extending from anterior superior iliac spine to superior end of symphyseal Surface) - Arch Anterior border
16. Depth of anterior border
17. Depth of notch between ASIS and AIIS / Interspinous notch (AIN)
18. Depth of notch between anterior inferior iliac spine and iliopubic eminence – Depth AIIS to IPE

Procedure followed

All the measurement was taken with the help of digital vernier caliper in millimeter. Well defined points were marked on anterior border of hip bones before taking measurements. Each variable was measured three times and average of three was considered as final measurement. Following instruments/tools were used for taking measurement

a. Digital vernier caliper (with an accuracy ± 0.05mm)
b. Inextensible thread
c. Metallic ruler
d. Osteometric board.

Out of total sample size i.e.87, four subsamples were obtained on the basis of the sex and the side to which they belonged. Of which first and second subsamples were 42 males and 45 females, similarly third and fourth subsample were of 41 right sided and 46 left sided bones respectively.

Statistical Analysis

SPSS Version 26 software was used. For each variable following statistical values were measured:-

1. Mean
2. Variance
3. Standard Error of Mean (SEM)
4. Maximum and minimum values
5. 95% confidence limits for mean

The presence of any significant differences in mean values of variables between subsamples related to sex and side respectively were calculated by comparing the equality of variances with Levene's 'F' test followed by student's 't' test. Significant variables as per sex and side were further analyzed with an accuracy of 95% confidence interval (95% CI). Histogram was also plotted for variables having significant differences.

Less than minimal risk i.e. probability of harm and discomfort was involved in this study and it was conducted after obtaining approval from Institutional ethics and review committee.

RESULTS

Table 1 shows the Means, Standard Deviation (SD), Standard Error of Means (SEM) and upper and lower confidence limits of the mean for each

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variable. Table 2 shows statistical values of Means, SD, SEM and P values for significance level obtained from gender related subsamples. Table 3 depicts similar statistical values related to side. Table 4 indicates the further analysis of variables with statistically significant differences of means related to sex including 95% CI with P values for student's 't' test. Table 5 indicates the same for significant variables for the side .

Table 1: Statistical values obtained from total samples (n=87)

S. No.	Variable	Mean	Standard Deviation	Standard Error of Mean	95% CI	
					Upper	Lower
1	Dist.Bet.ASIS to SS	124.2760	3.97414	0.81122	122.6243	125.7217
2	Dist.Bet.ASIS to PT	107.7396	3.83663	0.78315	106.1063	109.3134
3	Dist.Bet. ASIS to IPE	70.8792	4.27808	0.87326	69.1732	72.6021
4	Dist.Bet.ASIS to AIIS	34.7073	3.25212	0.66384	33.4865	35.9010
5	Dist.Bet.AIIS to IPE	36.0938	2.56496	0.52357	35.1524	37.0718
6	Dist.Bet.AIIS to PT	76.4823	3.11714	0.63628	75.1055	77.6415
7	Dist.Bet.AIIS to SS	95.0813	2.89479	0.59090	93.9617	96.1400
8	Dist.Bet. IPE to PT	46.7500	3.00158	0.61269	45.5949	47.9708
9	Dist.Bet. IPE to SS	63.4010	3.02737	0.61796	62.0275	64.4468
10	Dist.Bet.PT to Ar.Acetabulam	44.0917	2.67323	0.54567	43.0303	45.0945
11	Arch ASIS to AIIS	38.5438	2.79811	0.57116	37.4492	39.6104
12	Arch AIIS to IPE	40.0781	2.24261	0.45777	39.2377	40.9948
13	Arch IPE to SS	66.9292	2.90550	0.59308	65.7104	67.9624
14	Arch AIIS to SS	105.6844	3.28421	0.67039	104.3386	107.0832
15	Arch Anterior border	144.1656	4.70795	0.96101	142.3013	146.1458
16	Depth Anterior border	30.2698	3.50237	0.71492	28.8959	31.7187
17	Depth Interspinous notch	6.9677	1.31013	0.26743	6.4970	7.5622
18	Depth AIIS to IPE	8.4167	0.87996	0.17962	8.0678	8.7759

95 % CI= 95 % confidence Intervals of the mean

Table 2: Values obtained from subsamples related to sex (Male [n=42], Female [n=45])

S.No.	Variable	Gender	Mean	Standard. Deviation	Standard Error of Mean	Levene's test for equality of variances. (P-value)	T-test for difference in mean (P-value)
1.	Dist.Bet.ASIS to SS	Male	124.6333	6.49613	1.32602	0.818	0.694
		Female	123.8935	6.3456	1.32315		
2.	Dist.Bet.ASIS to PT	Male	109.0417	6.02056	1.22894	0.784	0.124
		Female	106.2826	6.03551	1.25849		
3.	Dist.Bet. ASIS to IPE	Male	71.4458	4.77755	0.97521	0.017	0.052
		Female	66.7609	10.07998	2.10182		
4.	Dist.Bet.ASIS to AIIS	Male	34.6125	4.99529	1.01966	0.264	0.978
		Female	34.5761	3.71052	0.77370		
5.	Dist.Bet.AIIS to IPE	Male	37.4875	2.89115	0.59015	0.307	0.003*
		Female	34.4043	3.85896	0.80465		
6.	Dist.Bet.AIIS to PT	Male	78.9563	3.15627	0.64427	0.19	≤ 0.01*
		Female	74.0304	5.96901	1.24462		
7.	Dist.Bet.AIIS to SS	Male	95.8083	4.38921	0.89594	0.265	0.266
		Female	94.5217	3.33973	0.69638		
8.	Dist.Bet. IPE to PT	Male	47.9021	3.70668	0.75662	0.229	0.178
		Female	46.2326	4.62463	0.9643		
9.	Dist.Bet. IPE to SS	Male	63.8604	4.76267	0.97218	0.468	0.897
		Female	63.6783	4.83679	1.00854		
10.	Dist.Bet.PT to Ar.Acetabulam	Male	43.7958	4.19443	0.85618	0.629	0.607
		Female	44.3826	3.53272	0.73662		
11.	Arch ASIS to AIIS	Male	38.2167	4.06407	0.82957	0.488	0.733
		Female	38.6261	4.10249	0.85543		
12.	Arch AIIS to IPE	Male	41.0333	2.58951	0.52858	0.075	0.018**
		Female	38.1717	5.06227	1.05556		
13.	Arch IPE to SS	Male	66.5146	4.88067	0.99626	0.742	0.346
		Female	67.7935	4.29959	0.89653		
14.	Arch AIIS to SS	Male	106.9438	4.56364	0.93155	0.704	0.137
		Female	104.9217	4.58946	0.95697		
15.	Arch Anterior border	Male	144.9313	6.60219	1.34767	0.271	0.808
		Female	144.5043	5.2763	1.10018		
16.	Depth Anterior border	Male	30.7688	5.64916	1.15313	0.093	0.364
		Female	29.587	2.53956	0.52953		
17.	Depth Inter- spinous notch	Male	7.175	1.98883	0.40597	0.024	0.403
		Female	6.7935	0.93909	0.19581		
18.	Depth AIIS to IPE	Male	8.3667	1.25937	0.25707	0.733	0.717

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		Female	8.5087	1.40516	0.293		

** Significant at P ≤ 0.01; ** significant at P ≤ 0.05.*

Table 3: Values obtained from subsamples related to side, (Right [n=41], Left [n=46])

S. No.	Variables	Side	Mean	Std. Deviation	Std. Error Mean	Levene's test for equality of variances. (P-value)	T-test for difference in mean (P-value)
1	Dist.Bet. ASIS to SS	Left	123.6125	5.50725	1.12416	0.573	0.527
		Right	124.7196	6.37429	1.32913		
2	Dist.Bet. ASIS to PT	Left	107.4854	4.51838	0.92231	0.066	0.905
		Right	107.6891	6.96284	1.45185		
3	Dist.Bet. ASIS to IPE	Left	67.1667	7.60094	1.55154	0.852	0.035*
		Right	71.7261	6.74046	1.40548		
4	Dist.Bet. ASIS to AIIS	Left	35.1875	3.50783	0.71603	0.219	0.405
		Right	34.1065	5.17877	1.07985		
5	Dist.Bet.AIIS to IPE	Left	35.6333	2.40708	0.49134	0.191	0.417
		Right	36.4043	3.9016	0.81354		
6	Dist.Bet.AIIS to PT	Left	76.4458	4.56708	0.93225	0.848	0.888
		Right	76.237	5.50783	1.14846		
7	Dist.Bet.AIIS to SS	Left	94.3938	4.54828	0.92841	0.013	0.295
		Right	95.5413	2.63920	0.55031		
8	Dist.Bet. IPE to PT	Left	47.1146	4.48956	0.91643	0.991	0.544
		Right	46.3587	3.95272	0.8242		
9	Dist.Bet. IPE to SS	Left	63.8563	3.75017	0.7655	0.477	0.395
		Right	62.8565	4.22157	0.88026		
10	Dist.Bet.PT to Ar. Acetabulam	Left	43.8563	3.19474	0.65212	0.728	0.644
		Right	44.2978	3.32116	0.69251		
11	Arch ASIS to AIIS	Left	38.9458	4.27787	0.87322	0.587	0.374
		Right	37.9304	3.41054	0.71115		
12	Arch AIIS to IPE	Left	39.4229	4.88807	0.99777	0.104	0.644
		Right	39.9391	2.13648	0.44549		
13	Arch IPE to SS	Left	66.5521	4.11819	0.84062	0.058	0.289
		Right	67.6674	2.8748	0.59944		
14	Arch AIIS to SS	Left	106.1	4.9325	1.00684	0.152	0.501
		Right	105.237	3.66191	0.76356		
15	Arch Anterior border	Left	145.5458	7.15384	1.46027	0.174	0.203
		Right	143.1674	5.29808	1.10473		
16	Depth Anterior border	Left	29.8917	3.28225	0.66999	0.86	0.565
		Right	30.6326	5.28094	1.10115		
17	Depth Inter- spinous notch	Left	7.1	1.77139	0.36158	0.18	0.599
		Right	6.8717	1.08898	0.22707		
18	Depth AIIS to IPE	Left	8.4833	1.09084	0.22267	0.683	0.812
		Right	8.4087	1.05148	0.21925		

** Significant at P ≤ 0.05.*

Table 4: Variables with statistically significant differences of means related to sex (Male [n=42], Female [n=45])

Variable		Mean	95 % CI	Difference of Means	Standard Error of the Difference of Means	95 % CI	P-value
Dist. between AIIS to IPE	**Male**	37.4875	36.339 to 38.577	3.0831	0.9918	1.0855 to 5.0807	0.003
	Female	34.4043	33.004 to 35.904				
Dist. Between AIIS to PT	**Male**	78.9563	77.7126 to 80.3076	4.9258	1.38443	2.1374 to 7.7142	≤ 0.01
	Female	74.0304	71.5329 to 76.0539				
Arch AIIS to IPE	**Male**	41.0333	40.0563 to 42.0916	2.86159	1.16557	0.5140 to 5.2091	0.018
	Female	38.1717	36.0241 to 40.0322				

95 % CI= 95 % confidence Intervals of the mean; P – value = P value for Student's t test.

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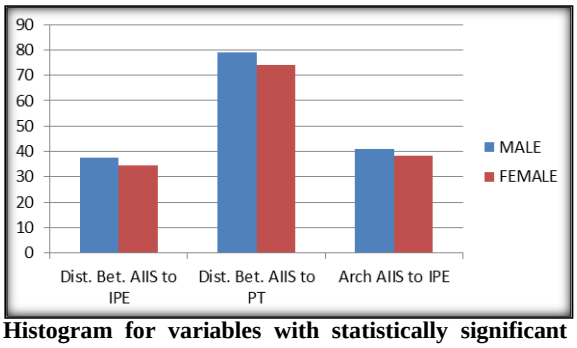
Table 5: Variables with statistically significant differences of means related to side (Right [n=41], Left [n=46])

Variable		Mean	95 % CI	Difference of Means	Standard Error of the Difference of Means	95 % CI	P-value
Dist. between ASIS to IPE	**Left**	67.166	64.1137 to 70.2330	4.55942	2.09300	8.776 to 0.342	0.035
	Right	71.726	69.2578 to 74.3455				

95 % CI= 95 % confidence Intervals of the mean; P – value = P value for Student's t test.



Histogram for variables with statistically significant difference of means related to sex (all values are in millimeter)

Numerical values for histogram

1. Dist. Bet. AIIS to IPE – Male (37.48 mm), female (34.40 mm)
2. Dist. Bet. AIIS to PT – Male (78.95 mm), female (74.03 mm)
3. Arch AIIS to IPE – Male (41.03 mm), female (38.17 mm)

Figure legends

1. Straight distance between AIIS to IPE
2. Straight distance between AIIS to PT
3. Length of Arch between AIIS to IPE
4. Variables no. - (1) Dist Bet ASIS to SS (2) Dist Bet ASIS to PT (3) Dist Bet ASIS to IPE (4) Dist Bet ASIS to AIIS
5. Variables no. – (5) Dist Bet AIIS to IPE (6) Dist Bet AIIS to PT (7) Dist Bet AIIS to SS
6. Variables no. – (8) Dist Bet IPE to PT (9) Dist Bet IPE to SS(11) Arch ASIS to AIIS (12) Arch AIIS to IPE (17) Depth Inter spinous notch
7. Variables no. – (10) Dist Bet PT to Ar.Acetabulum
8. Variables no. – (13) Arch IPE to SS
9. Variables no. – (14) Arch AIIS to SS (18) Depth AIIS to IPE
10. Variables no. – (15) Arch Anterior border(16) Depth Anterior border

FIG. 1 Distance between AIIS to IPE

FIG. 2 Distance between AIIS to PT

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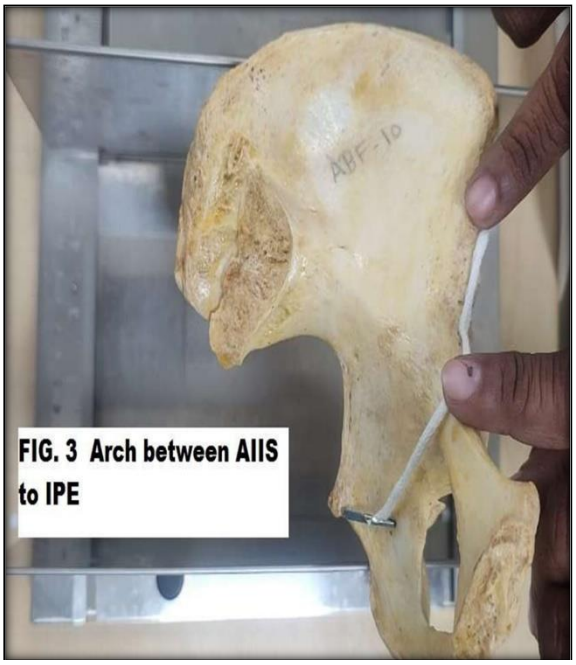

FIG. 3 Arch between AIIS to IPE

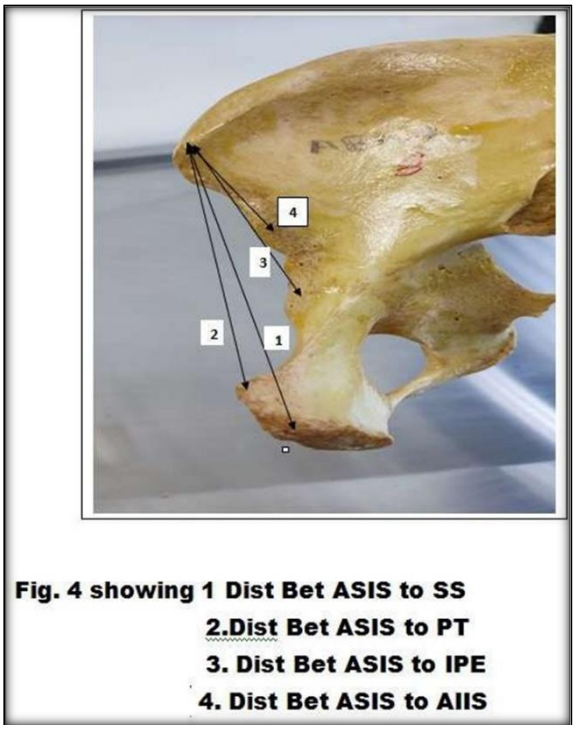

Fig. 4 showing 1 Dist Bet ASIS to SS
2.Dist Bet ASIS to PT
3. Dist Bet ASIS to IPE
4. Dist Bet ASIS to AIIS

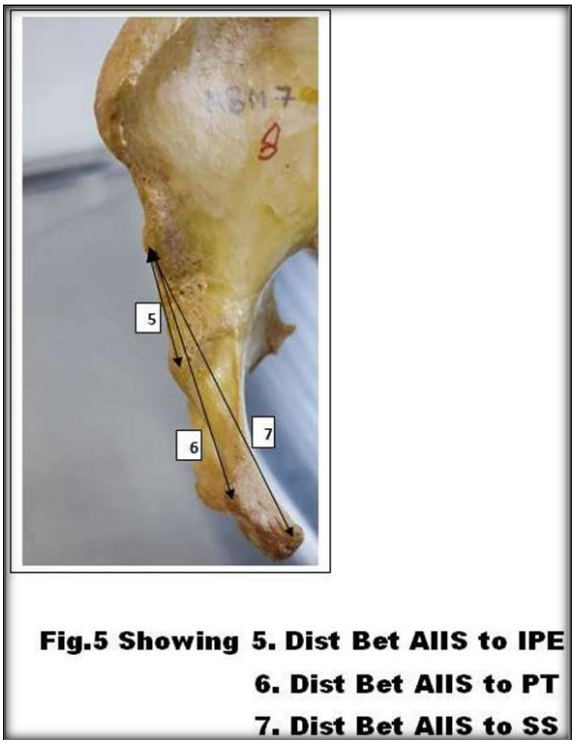

Fig.5 Showing 5. Dist Bet AIIS to IPE
6. Dist Bet AIIS to PT
7. Dist Bet AIIS to SS

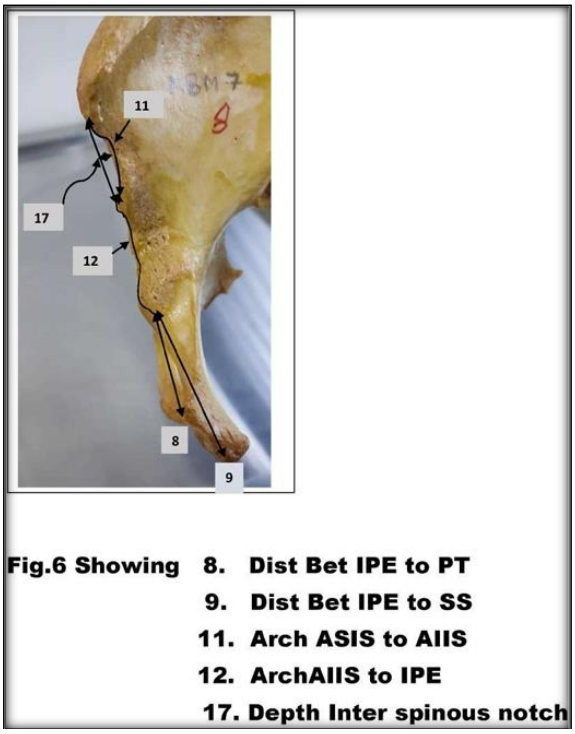

Fig.6 Showing 8. Dist Bet IPE to PT
9. Dist Bet IPE to SS
11. Arch ASIS to AIIS
12. ArchAIIS to IPE
17. Depth Inter spinous notch

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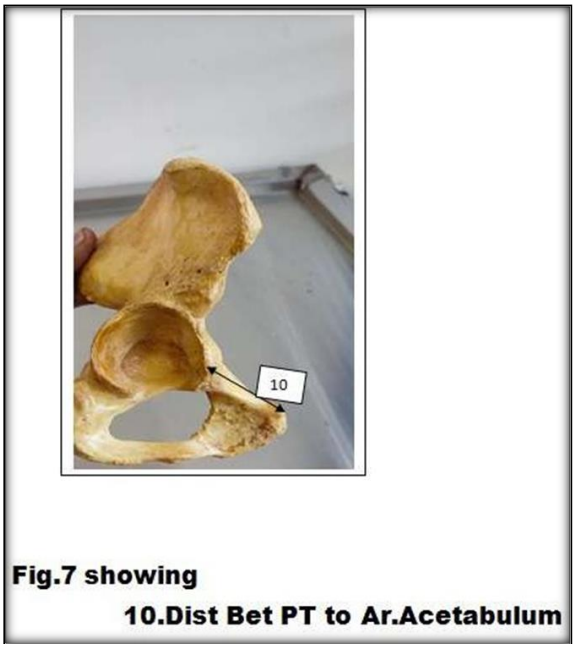

Fig.7 showing
10.Dist Bet PT to Ar.Acetabulum

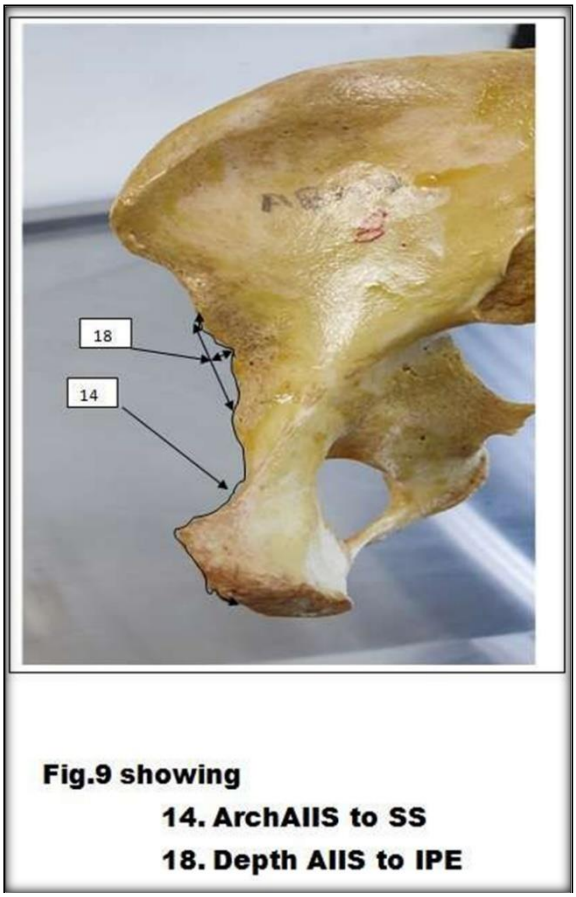

Fig.9 showing
14. ArchAIIS to SS
18. Depth AIIS to IPE

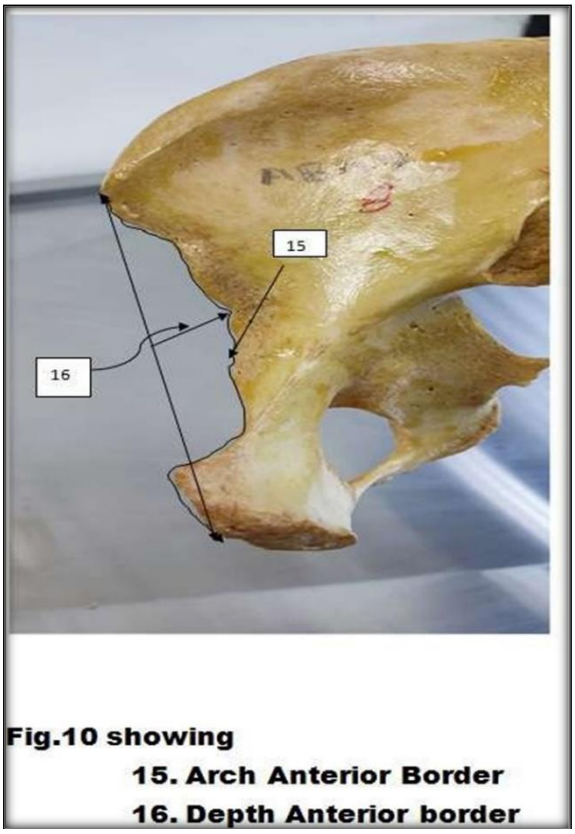

Fig.10 showing
15. Arch Anterior Border
16. Depth Anterior border

DISCUSSION

After meticulous observation of table no. 4 statistically significant differences have been observed for 3 variables related to sex, which are as under

1. Straight distance between Anterior inferior iliac spine (AIIS) to Illio-pubic eminence (IPE) (Fig 1)
2. Straight distance between AIIS to Pubic tubercle (PT) (Fig 2)
3. Length of arch between AIIS to IPE (Fig 3)

On comparing the values obtained for these 3 variables in similar studies done in past we found

1. Straight distance between AIIS to IPE – In our study the mean values for male hip bone was 37.48 ± 2.8 mm and for female it was 34.40 ± 3.8 was found (P 0.003), which is highly significant. Similar variable was studied by L. Gomez Pellico et al in 1992 where the values were 40.19 ± 3.89 in males and 35.54 ± 3.96 in females (P 0.0007) was obtained.[8] In another study done by Mitesh Shah et al (2013) values for same variable was 36.96 ± 4.15 in males and 33.57±3.96 (P ≤ 0.001) was obtained.[9] Results of both the studies are in concordance with our study.
2. Straight distance between AIIS to PT – In our study mean values of the distance between AIIS to PT for males was 78.95±3.1 and for females 74.03±5.9 (P ≤ .01) was obtained. Similar variable was studied by other researchers and its values were found to be as follows

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a. L. Gomez Pellico et al found it to be 87.22±6.7 in males and in females it was 80.82±5.01 (P 0.0028).[8]
b. Mitesh Shah et al found it to be 81.40±7.4 for males and 78.58±6.3 for females (P 0.001).[9]
c. KanikaSachdeva et al (2011) in their study too found significantly higher values in males than females for straight distance between AIIS to PT.[10]

So results of these studies for above cited variable are similar with our study.

3. Length of arch between AIIS to IPE – the mean values for this variable in our study for males was 41.03±2.5 and for females it was 38.17±5.0 (P 0.018) was found. These values are comparable with the values obtained in some similar studies done in the past which are mentioned below:-

a. Study by L. Gomez Pellico et al in which the values for male was found to be 44.69±4.14 and in females it was 40.02±4.38 (P 0.0014).[8]
b. Mitesh Shah et al found it to be 42.52±4.63 for males and 38.11±4.60 for females ($P \leq 0.001$).[9]
c. Similarly KanikaSachdeva et al (2011) found significantly higher values in males than females for the same variable.[10]

There are ten variables in our study for which we couldn't find any statistically significant difference between male and female bones, though other researchers found results differing from ours, which are described below

1. Straight distance between Anterior superior iliac spine (ASIS) to Superior end of Symphyseal surface (SS) - Mitesh Shah et al, KanikaSachdeva et al, VijayeendraKanabur andLeenaRaichandani et al have found statistically significant higher mean value for male bone compared to female hip bones.[9,10,11,12]
2. Straight distance between Anterior superior iliac spine (ASIS) to Pubic tubercle(PT) - L. Gomez Pellico et al, Mitesh Shah et al, KanikaSachdeva et al and VijayeendraKanabur found this variable having significantly higher values in males than females.[8,9,10,11]
3. Straight distance between ASIS to IPE – VijayeendraKanabur in his study found mean value of this variable significantly higher in male than female.[11]
4. Straight distance between AIIS to SS - KanikaSachdeva et al found this variable having significantly higher values in males than females.[10]
5. Straight distance between IPE to PT – Rajasekhar et al found the mean value for this variable significantly higher in female bones in comparison to male bones.[6]
6. Straight distance between PT to Anterior rim of Acetabulum (Ar. Acetabulum) – Mean value of this variable also was found higher in female than male bones in the study done by Rajasekharet al.[6]
7. Length of arch between ASIS to AIIS - KanikaSachdeva et al in their study found this variable having significantly higher mean values in male bones than female ones.[10]
8. Length of Arch of Anterior border - KanikaSachdeva et al and V Nithya et al (2016) are the two researchers who got their mean values for this variable significantly higher in male bones.[10,13]
9. Depth of Anterior Interspinous notch (AIN) - In the study done by Mitesh Shah et al it was found that mean value of this variable is significantly higher in male bones than female bones.[9]
10. Depth of notch between AIIS and IPE – Only the studies done by Mitesh Shah et al and KanikaSachdeva et al as per our literature search it was observed that the mean values for this variable is higher in males than females.[9,10]

For remaining five variables viz. Straight distance between ASIS to AIIS, Straight distance between IPE to SS, Length of arch between IPE to SS, Length of arch between AIIS to SS and Depth of Anterior border, we couldn't find any statistically significant difference between male and female bones nor was it found in other studies we came across.

After critical analysis of table no. 5 we detected statistically significant difference between means related to side (left v/s right) for straight distance between ASIS to IPE in which mean value for left side was 67.16±7.6 and for right side it was 71.71±6.7 (P 0.035). L. Gomez Pellico et al and Mitesh Shah et al who did analytical study on anterior border of hip bone for side related differences on 42 and 306 bones respectively, where they didn't find any statistically significant difference.[8,9]

CONCLUSION

Of all the variables we studied statistically significant differences related to sex were found in mean values of only three variables which are (I) Straight distance between AIIS to IPE (II) Straight distance between AIIS to PT (III) Length of arch between AIIS to IPE where they were higher for male hip bone in comparison to female bones. Out of these three variables, the most significant parameter is straight distance between AIIS to IPE based on considerable statistical difference (P 0.003) related to sex. So it can be the best variable which can be utilized for identifying the sex of human hip bone by metric analysis of its anterior border. The other two variables mentioned above may also be considered while sexing the hip bone. Similar statistical significant difference was seen related to side of hip bone for one parameter i.e. Distance between ASIS to IPE (P 0.035), side related study of anterior border parameters demands a further

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elaborative work with larger sample size to arrive on a solid conclusion. So in addition to conventional methods used for sexing of human hip bones, the findings of present study may play the role of an additional tool for increasing the accuracy in determining the sex of hip bone. And it can be stated that metric analysis of anterior border of hip bone may be useful in carrying out medico legal examination, anthropological assessment and archaeological evaluation of skeletal remains.

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