Original Article

A study of morphological features of ilium for sex determination in Gujarat state

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ABSTRACT

Background: Hip bone is most commonly used by forensic personnel as well as anatomist and anthropometric expert for sex determination. Many workers have calculated different types of indices to determine the sex of hip bone.

Aim: In present study, determination of sex of hip bone was done by using morphological features.

Materials & Method: Present study was conducted at Dept of Anatomy, PDU medical college, Rajkot on 108 (27 male & female of each side) adult human hip bones. Four morphological features of ilium, 1) Preauricular sulcus 2) Post auricular sulcus 3) Post auricular space and 4) iliac tuberosity were observed.

Results: Iliac tuberosity was most efficient parameter to identify male hip bones (90.74%), while post-auricular sulcus was most efficient parameter to identify female hip bones (72.22%).

Conclusion: Combination of morphological feature is more effective in sex determination than a single feature alone.

Keywords: Morphological features, Sex determination, Ilium

INTRODUCTION

Correct sex identification of the human skeleton is important in bioarcheological and forensic practice. Currect opinion is that the hip bone (os coxae) provides the highest accuracy levels for sex determination [1]. Morphological criteria like greater sciatic notch, width of pelvis, preauricular sulcus, diameter of acetabular fossa and obturator foramen are used by most of investigators for study of sex determination [2]. Instead of a whole bone sometimes only a small piece comes to anatomist or forensic expert for opinion. Iscan and derrich developed a visual assessment method to determine sex via sacroiliac joint involving the posterior half of ilium and its articulation with sacrum [3].

In present study, the morphological features of ilium part of hip bones were observed and their efficacy for correct sex identification was analyzed.

MATERIAL AND METHOD

Present study was carried out at department of anatomy, PDU medical college, Rajkot, Gujarat. Total 108 (27 male & female of each side) adult human hip bones without any abnormalities or deformities were used in study. All the bones were carefully examined for following morphological features. Accordingly, they were labeled M, F and O-type respectively for male, female and non judgment status. All the records were analyzed statistically.

Following four morphological features were studied.

- **Post auricular sulcus**- between iliac tuberosity and posterior auricular surface
- **Postauricular space**- between posterior region of ilium and dorsal surface of sacrum when two bones articulated.
- **Iliac tuberosity**
- **Preauricular sulcus:** According to Boyd and Trevor (1953), the preauricular sulcus is the most dependable character in assessing the sex of a hip bone. Preauricular sulcus is variable like, Deep, Moderate or Shallow sulcus [4]. The

sulcus preauricularis is absent to slight in male but marked in female [5]. Preauricular sulcus is less marked in male and more marked in female [6].

Iscan and Derry (84) conducted that the posterior iliac bone and the way it articulates with the sacrum is “a reliable sex determinant”; the postauricular space as an indicator of sex is “a most reliable one”, an opinion which can be substantiated by the presence of the postauricular sulcus continuing along its horizontal ramus, and further by the fact that the presence of a fossa instead of a tuberosity is a female characteristic [7].

OBSERVATION & DISCUSSION

Table 1 shows Sexual dimorphic characteristic of various morphological features of Ilium, while Table 2 shows category wise classification of morphological features of ilium in both sexes.

Table 1: Sexual dimorphism in various morphological features of Ilium

Sex	Post-auricular sulcus	Post-auricular space	Iliac tuberosity	Preauricular sulcus
Male	Rarely	Narrow	Mound shaped	Less marked/ absent
Female	Uniformly	Large	More variable-pointed/ absent	More marked

Table 2 shows that in male hip bones; preauricular sulcus was identified in 48.14% (n=26), postauricular sulcus in 29.62% (n=16), post auricular space in 64.81% (n=35) and iliac tuberosity in 90.74% (n=49) hip bones. Similarly, in female bones, preauricular sulcus was identified in 68.51% (n=37), post auricular sulcus in 72.22% (n=39), post auricular space in 68.51% (n=37) and iliac tuberosity in 68.51% (n=37).

Table 2: Category wise classification of morphological features in both sexes

	MALE HIP BONES (n=54)			FEMALE HIP BONES (n=54)		
Morphological Features	M-Type	F-Type	O-Type	M-Type	F-Type	O-Type
Preauricular sulcus	n=26 48.14%	n=11 20.37%	n=17 31.48%	n=04 7.40%	n=37 68.51%	n=13 24.07%
Postauricular sulcus	n=16 29.62%	n=07 12.96%	n=31 57.40%	n=03 5.55	n=39 72.22%	n=12 22.22%
Post auricular space	n=35 64.81%	n=14 25.92%	n=05 9.25%	n=11 20.37%	n=37 68.51%	n=06 9.25%
Iliac Tuberosity	n=49 90.74%	n=04 7.40%	n=01 1.85%	n=07 12.96%	n=37 68.51%	n=10 18.50%

Table 3: Number of hip bones with combination of two or more than two features

	Combinations of morphological features	MALE % (n= 54)	FEMALE % (n= 54)
Present of only one feature, other three are absent	I	01 =1.85%	00 =0%
	II	01 =1.85%	00 =0%
	III	01 =1.85%	04 =7.4%
	IV	04 =7.4%	00 =0%
Present of any two features, other two are absent	I + II	00 =0%	04 =7.4%
	I + III	01 =1.85%	01 =1.85%
	I + IV	03 =5.55%	01 =1.85%
	II + III	00 =0%	04 =7.4%
	II + IV	05 =9.25%	00 =0%
	III +IV	11 =20.37% p<0.05	03 =5.55%
Present of any three features, any one absent	I + II + III	00 =0%	03 =5.55%
	II + III + IV	05 =9.25%	05 =9.25%
	III + IV + I	16 =29.62% p<0.03	05 =9.25%
	IV + I + II	04 =7.4%	11 =20.37% p>0.05
Present of all four features	I + II +III + IV	01 =1.85%	12 =22.22% P<0.005

I = Preauricular sulcus, II=Post auricular sulcus, III=Post auricular space, IV=Iliac tuberosity

It was found that all the morphological features showed statistically significant difference ($p<0.05$) between male and female bone. M type, F type and O type features of all the morphological features measured showed statistically significant difference ($p<0.05$) in male and female hip bones. M type Preauricular sulcus, F type Post auricular sulcus, M type post auricular space and M type Iliac tuberosity showed statistically significant difference as compared to other types in respective morphological feature group. Of all the types, M type Iliac tuberosity showed statistically highest difference ($p<0.000004$) in male and female hip bones. Also it was observed that F type of morphological features showed less variation in number in female hip bones as compared to M type of morphological features in male hip bones. M type iliac tuberosity and F type post auricular sulcus differentiated maximum number of male and female hip bones respectively.

Figure 1: Post auricular space

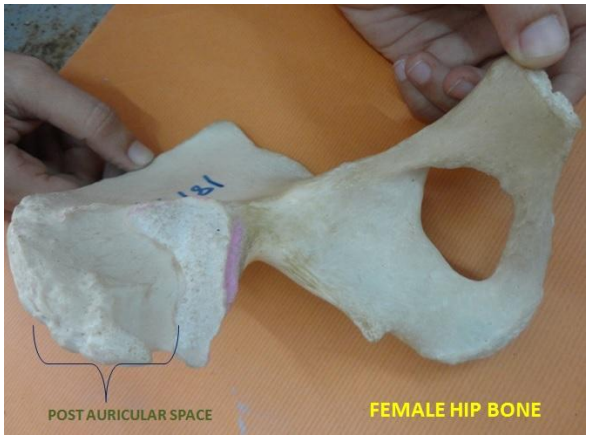
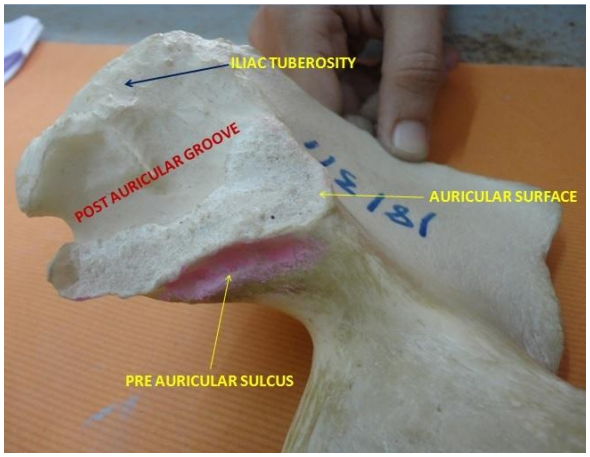
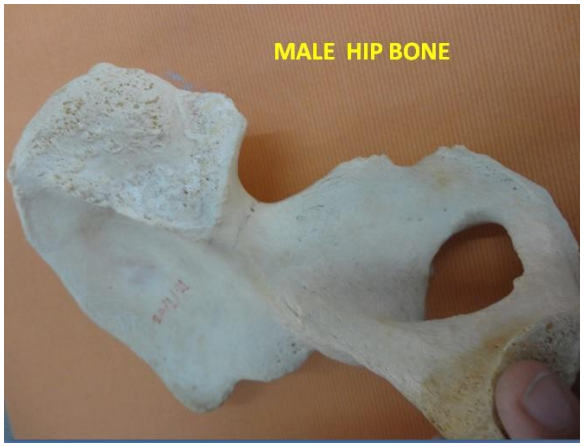


Figure 2: Iliac tuberosity & Pre auricular sulcus. Note deep post auricular groove in this female bone



Instead of a single feature present in a series, combination of 2 or more than 2 features in a single bone to determine the sex of the bone (table 3) was observed. M type and F type of all four features were present in 1.85% and 22.22% of male and female bones respectively which was statistically significant ($p<0.004$). Male hip bones showed that combination of three features (III, IV & I) of M type was present in 29.62% of male bones; while in female hip bones combination of three features (IV, I & II) of F type was present in 20.37% of bones both of which were statistically significant ($p<0.005$). Presence of any two features of M type in male was between 0% to 20.37% and of F type in female was 0% to 7.4%. Presence of only one feature was not seen in more than 7.4%.

Figure 3: Shallow post auricular groove in male



CONCLUSION

Present study showed statistically significant difference by all the four morphological features in hip bones of both sexes. Combination of morphological feature is more effective in sex determination than a single feature.

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