



Determination of Sex of Human Sacrum - A Metric Study

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ABSTRACT

A study for determination of sex of human sacrum was carried on 66 dry human sacra in which 51 were male and 15 were female of known sex. These were collected from the department of anatomy, M P Shah Govt. Medical College, Jamnagar. There were different parameters viz. mid ventral straight length, mid ventral curved length, anterior straight breadth, mid-sagittal diameter of sacral basis, maximum transverse diameter of sacral basis were measured & sacral index were calculated and statistically analyzed. After detailed study it could be determined that mid ventral straight length, mid ventral curved length & sacral index were significant for determining sex of sacrum in Saurashtra (Gujarat) region.

Key words: Sacrum, sex determination, sacral parameters

INTRODUCTION

Determination of sex will be useful for anatomists, experts in forensic medicine and physical anthropologists. Though by only metrical (by taking measurements) study of sacrum does not determine 100% of sex. A morphological & radiological study of sacrum may add for further accuracy.

The sacrum is large, flattened, triangular bone formed by the fusion of five sacral vertebrae & forms the posterior superior part of bony pelvis. [1]

There is variation in the relative length and breadth of the sacrum in different races of men, and also in some races the length exceeded the breadth and that in others an opposite relation prevailed that differences can be expressed by various methods. [2]

It is considered that corpus (body) of primary sacral segment of sacrum (S1) of females is relatively smaller and lateral section (costal part and wing) is relatively larger. [3] Sacrum is one of the bones that exhibit sex differences; hence it is used in the identification of skeletal remains. Till now the various Indian and non-Indian workers have worked on skull and pelvis for determination of sex. However, it is observed that there is less work done on the sacrum.

Therefore the present work is an attempt to establish some of the parameters which will be of great help in sexual dimorphism, both in anthropometric and medico legal study.

MATERIALS & METHODS

Materials used in present study were 66 sacra (51 male & 15 female) of known sex. They were collected from department of anatomy, M P Shah Govt. Medical College, Jamnagar (Gujarat). Selected sacra were adult, fully ossified & of known sex, and fractured, pathological, lumbarization, sacralization and of unknown sex were excluded.

Instruments that were used in present study are stainless steel sliding vernier caliper, standardized flexible ribbon tape. Demarcating points (By calculating $\text{mean} \pm 3\text{SD}$) were recorded; from these we can determine that the sacrum is definitely male or definitely female. Therefore by getting percentage beyond demarking point (DP), we can calculate percentage of definitely male or female sacrum.

In sort, we can “statistically fixed” a measurement above which it is either definitely male or definitely female. This point is known as demarking point. The details of the parameters taken are as follows:

1. Mid ventral straight length (Fig.1): is measured by stainless steel sliding caliper from promontorium in mid-sagittal plane to corresponding point on antero – inferior margin of the last sacral vertebra (tip of sacrum). [4]



Fig.1 Mid ventral straight length

2. Mid ventral curved length (Fig.2): is measured by Standardized flexible ribbon tape from anterior margin of middle of promontory to antero – inferior margin of the last sacral vertebra (tip of sacrum) along the concavity of the anterior surface of the sacrum. [4]
3. Anterior straight breadth (sacral breadth) (Fig.3): is measured by stainless steel sliding caliper maximum transverse breadth of the sacrum in the level of anterior projection of auricular surface. [4]
4. Antero – posterior diameter of body of S1 vertebrae (Mid – sagittal diameter of sacral basis) (Fig.4): Antero – posterior diameter of body of S1 vertebrae by stainless steel sliding caliper by taking one point on antero – superior border and another point on the postero – superior border of S1 sacral vertebral body. [4]
5. Transverse diameter of body of S1 vertebrae (Maximum transverse diameter of sacral basis) (Fig.5): is measured by stainless steel sliding caliper by taking one point on each side of the lateral most point on the superior surface of body of S1 vertebrae. [4]



Fig.2 Mid ventral curved length



Fig.3 Anterior straight breadth



Fig.4 AP diameter of body of S1



Fig.5 Transverse diameter of body of S1

OBSERVATION

The range, mean, mean \pm 3SD, identification point, demarcating point and percentage beyond demarcating point of various parameters were recorded (table – 1)

When P value is between 0.05-0.01, it is statistically significant, P value <0.01 is statistically highly significant, & P value <0.005 is statistically very highly significant. [5]

Table 1: Showing various parameters of sacrum and their statistical analysis

No.	Parameter	Sex	Range	Mean	Mean \pm 3SD	Identification Point (IP) cm	Demarcating point (DP) cm	P value
1	Mid ventral straight length	M	9-13	11	7.32	>11.1	>12.47	0.0001
		F	7.5-11.1	9	6.37-12.47	<9	<7.32	
2	Mid ventral curved length	M	9.5-13.9	11.40	8.14-14.56	>11.7	>13.17	0.0001
		F	8-11.7	9.97	6.77-13.17	<9.5	<8.14	
3	Anterior straight breadth	M	7.9-11.5	9.80	7.63-12.6	<8.3	<7.23	0.093
		F	8.3-11	9.58	7.23-11.93	>11.5	>12.6	
4	AP diameter of body of S1	M	2.7-3.6	3.10	2.36-3.86	>3.3	>3.87	0.0001
		F	2.3-3.3	2.80	1.73-3.87	<2.7	<2.36	
5	Transverse diameter of body of S1	M	4-5.5	4.70	3.35-6.1	>6	>6.69	0.12
		F	3-6	4.41	2.13-6.69	<4	<3.35	

DISCUSSION

In the present study effort has been made to find the sex of the sacrum with the available data in relation to the various parameters.

Mid ventral straight length: Mean value of mid ventral straight length measured by Davivongs^[6] were less than other Indian

workers, so we can say different races having different size of sacrum. Various Indian workers like Raju et al (1980),^[7] Mishra et al (2003),^[8] Arora et al (2008),^[9] Kanika et al (2011)^[10] also measured mid ventral straight length. All workers found statistically highly significant difference between male and female (p value is

<0.001) for mid ventral straight length of sacrum, so mid ventral straight length or sacral length was important & significant for determination of sex of sacrum.

Mid ventral curved length: As in mid ventral straight length, mean value of mid ventral curved length were also less in Australian aborigines (Davivongs), [6] than Indian workers. Mishra et al (2003) [8] & Kanika et al (2011) [10] also measured mid ventral straight length and found statistically significant difference between male and female (p value is <0.001) for mid ventral straight length of sacrum.

Anterior straight breadth: Significance level of anterior straight breadth is very low, % of bone identified were almost nil, as calculated by various authors. Though Arora et al (2008) [9] found statistically significant value for anterior straight breadth (p value was <0.0002). He concludes that width of sacrum was relevant and more significant for determination of sex.

AP diameter of body of S1: As 1st sacral vertebra is larger in males AP diameter of body of S1 is higher in males than female. Davivongs (1963) [6] shows significant p value (i.e. <0.001) for AP diameter of body of S1. Mishra et al (2003) [8] & Kanika et al (2011) [10] found statistically not significant (p value is >0.05) values.

Transverse diameter of body of S1: In males body of S1 is larger so, transverse diameter of body of S1 is also more than in female. Many workers worked on transverse diameter of body of S1. Davivongs (1963), [6] Raju et al (1980), [7] & Mishra et al (2003) [8] has got statistically significant values for transverse diameter of body of S1 (p value <0.001). Raju et al (1980) [7] stated in his conclusion that transverse diameter of body of S1 is more reliable and significant criteria for sex determination of sacrum.

SUMMARY & CONCLUSION

After detailed calculation, data arranged in tabulated form. And comparison of data of the present is done with other studies of same kind. So, from detailed study it would be concluded that mid ventral straight length, mid ventral curved length & AP diameter of body of S1 which are highly significant for determination of sex of sacrum. So in present study these two parameters i.e. mid ventral straight length & mid ventral curved length are highly significant for determination of sex of sacrum in Gujarat region.

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