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SEXING OF SACRUM BY SACRAL INDEX AND KIMURA'S BASE-WING INDEX.

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ABSTRACT

A study for sexing of sacra was carried on 64 sacra (32 male & 32 female sacra) by two methods. One method used was sacral index and the other method was Kimura's base-wing index. The measuring instrument used was sliding vernier caliper. The method of sacral index showed high success rate as compared with Kimura's base-wing index method.

Keywords : Sacra, sacral index, Kimura's base-wing index.

INTRODUCTION

The identification of sex in human skeletal remains an important component of many anthropological investigations, and should be based on measurements and observations on the entire skeleton to be meaningful (Stewart 1954). Sacrum is an important bone for identification of sex in human skeletal system. Since it is a component of axial skeleton and because of its contribution to the pelvic girdle and in turn to the functional differences in the region between the sexes, it has an applied importance in determining sex with the help of measurements carried upon it. Over the years different authors had carried various types of measurements on human sacra of different races and regions.

The well known method for determination of male type sacrum or female type sacrum has always ideally been the Sacral Index method as explained in the Hrdlicka's Practical Anthropometry. The formula for Sacral Index is; Sacral Index = Width of Sacrum x 100 / Height of Sacrum.

MATERIALS & METHODS

Materials

The materials for the present study consisted of 64 human adult sacra obtained from Dept. of Anatomy, M. P. Shah Medical College, Jamnagar, Saurashtra region. All the sacra were normal, fully ossified, were devoid of any osteophytes and were fully mature.

Methods

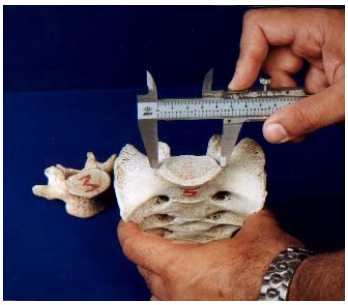
There were two methods followed. And in both the methods, the use of sliding vernier caliper was incorporated. The first method was to determine the sacral index of sacrum. Therefore sacral index was measured by taking the breadth and length of individual sacrum with the help of vernier caliper and adopting the method demonstrated in Hrdlicka's Practical Anthropometry. The stem of caliper was applied to upper surface of the body of first sacral vertebra and measurement of maximum breadth was taken across the greatest expanse of lateral masses of the bone as shown in photograph-1.

Photograph-1.(to measure the width of sacrum)
SVC=sliding vernier caliper, S=sacrum

The maximum height or length was measured by applying the sliding caliper to middle of promontory and middle of anteroinferior border of fifth sacral vertebra as shown in photograph-2. Thus sacral index was calculated as Width (maximum breadth) x 100 / Maximum Height.

Photograph-2.(to measure the height of sacrum)

The second method adopted by the present study for sexing the sacrum was by means of Kimura's method of base-wing index. According to the above method, the transverse width of sacral base, as shown in photograph-3(i.e.: the transverse width of superior surface of body of first sacral vertebra i.e.: transverse diameter of body of S1) was taken. And the other parameter the transverse width of the wing (lateral margin of the base to the most lateral border of the wing or ala of sacrum) as shown in phoptograph-4 was taken into consideration.



Photograph-3.(to measure the base of sacrum)

Photograph-4.(to measure the wing of sacrum)

And therefore Kimura's Base-wing index was calculated as Width of wing x 100 / width of base. (Width of the base = transverse diameter of body of S1 or transverse width of superior surface of body of first sacral vertebra.)

OBSERVATIONS

Table-1

Sacral index (t=10.06, t>3.55, p<0.001)

	Male (mm.)	Female(mm.)
Range	90.5 - 106	104.8 - 131
Mean	96.25	113.25
S.D.	4.6	5.74
Mean±3S.D.	82.45 -110.05	96.03 - 130.
Demarking point	<96.03	>110.05
Percentage of bone identified by demarking point	62.5% N=20 readings	68.75% N=22 readings

Table-2

Base-Wing index (Right side) t=2.06, t>2.02, p<0.05 (mm.)

	Male (right side)	Female (mm.) (right side)
Range	41.5 - 83.7	64 - 100.5
Mean	61.55	79.5
S.D.	11.7	11.93
Mean±3S.D.	26.45 - 96.65	43.71 - 115.29
Demarking point	< 43.71	> 96.65
Percentage of bone identified by demarking point	18.75% (N=6 readings)	18.75% (N=6 readings)

Table-3

Base-Wing index (Left side) t=1.79, t<2.02, p>0.05

	Female(left side) (mm)	**Male**(left side) (mm)
Range	41.2 - 87	64 - 103.7
Mean	62.15	75.9
S.D.	12.64	9.3
Mean±3S.D.	24.23 - 100.07	48 - 103.8
Demarking point	<48	>100.07
Percentage of bone identified by demarking point	18.75% (N=6 readings)	18.75% (N=6 readings)

The individual measurements were carried out with the help of vernier caliper, i.e. height, width and index of the sacra and statistical analysis were carried out for both the methods and the results were compiled and arranged in the above tables. The observations showed that in case of the sacral index method; the range for males was 90.5 - 106

and in case of females it was 104.8 - 131; mean for males was 96.25 and for females it was 113.25, as shown in table-1. Thus by using mean±3S.D., the demarking point for males was <96.03 and for females was >110.05. The present study had found 20 readings of male falling within the demarking point and 22 readings of female falling within the demarking point. Therefore, the percentage beyond demarking point for males was 62.5% and for females was 68.75% with an accuracy of 99.75% as shown in table-1.

Similarly, according to table-2 and table-3; the Kimura's base-wing index for right side and left side respectively, with their range, mean and standard deviation (S.D.) were shown. The percentage beyond demarking point for base-wing index of right as well as of left side was 18.75% for both males and females. Thus, the Kimura's base-wing index for right side showed 6 readings as male type and 6 readings as female type and same was true for the left side.

The t value for sacral index was 10.06 and p value was <0.001 and as t was >3.55, it was considered highly significant. The t value for Kimura's base-wing index of right side was 2.06 and p<0.05 and the t value for base-wing index of left side was 1.79 and p>0.05 and therefore they were not significant.

DISCUSSION

Flander (1978) had showed the univariate and multivariate methods for sexing the sacrum. She had used numerous new osteometric dimensions (around 15 dimensions), the method she had followed was rather complex. Flander's study was useful because she had developed a technique to assess sex and race simultaneously by using sacra from American Blacks and Whites (50 each sex-race).Two discriminant functions were developed by her. The first one assumed that race was known. The accuracy of determination based on a total of six measurements ranged from an average of 84% for Whites to 91% for Blacks. The most discriminating variables were the anteroposterior dimension of the S1 body and transverse breadth of the S1 body for both races in known races. In the second function, she had assumed race to be unknown. Classification accuracy ranged from 54% to 78%. Stradalova (1974), had also shown a complex method for sexing of sacra using 15 dimensions and her sample consisted of 128 sacra (72 males, 56 females) from Charles University, Prague. The accuracy ranged from 86.5% to 88.5%, depending on the number of measurements taken. Kimura (1982) had presented a base-wing index and his samples included Japanese sacra (52 males and 51 females) from the Yokohama city Medical school, American Whites (50 males and 50 females), and American Blacks (49 males and 48 females) from the Terry collection. Measurements and the index obtained from these collections included the transverse width of the sacral base (i.e. the transverse width of superior surface of first sacral vertebra), and transverse width of the wing (lateral margin of the base to the most lateral border of the wing i.e. ala of sacrum) and the index was calculated as width of the wing X 100 / width of base i.e. Kimura's index = Width of wing X 100 / Width of base.

The Present study had adopted two methods for sexing of sacrum; one was the sacral index method as described by Hrdlicka`s Practical Anthropometry and other method was of Kimura`s Base-Wing index method. The observations obtained by the present study as a result of the above two methods on 64 sacra were shown in respective tables. Mishra et al (2003), showed in their study that while using sacral index method, 39.2% of male sacra were identified and 80.1% of female sacra were identified by demarking point; But they also showed that only 2.7% of male sacra were identified (demarking point) and 38.0% of female sacra (demarking point) were identified when they used the alar index method.

Alar index = length of ala X 100 / transverse diameter of body of S1.

The Alar index was same as Kimura's base-wing index.

Thus comparative graphs showing the standard deviation and means of length, width, transverse diameter of body of S1, length of ala, sacral index and base-wing index of the sacra (both male and female), were constructed according to the studies by Mishra et al and the present study.

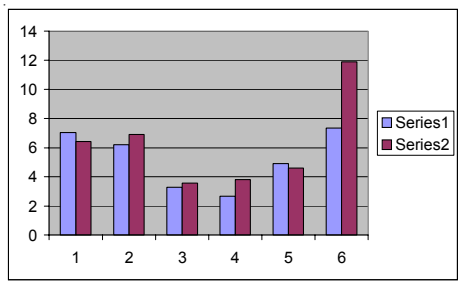
Similarly, percentage of bone identified by demarking point by using sacral index and alar

index according to Mishra et al was shown as graphical representation and also percentage of bone identified by demarking point by using sacral index and Kimura's base-wing index according to the present study was also represented in the form of graphs.

Similarly the Present study showed that according to sacral index method; 62.5% of male sacra were identified (demarking point) and 68.75% of female sacra (demarking point) were identified. Thus 20 readings out of 32 males sacra confirmed male type and 22 reading out of 32 female sacra confirmed female type by using Sacral index method. The present study also showed that according to Kimura's Base/Wing index method only 18.75% (demarking point) of male and female sacra were identified both on the right and left sides. Thus, only 6 readings out of 32 male sacra confirmed male type and 6 readings out of 32 female sacra confirmed female type while using Kimura's Base/ Wing index method.

CONCLUSION

The present study therefore revealed that for sexing of sacrum, the readings obtained by sacral index method were more relevant and more



Graph- 1
Series 1 is Mishra et al and Series 2 is Present study. (S.D. of male type).
1- height, 2- width, 3- transverse diameter of body of S1, 4- ala, 5- sacral index and 6- Kimura's base-wing index

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