Radiographic Determination Of Sex Differences In Ischiopubic Index Of A Nigerian Population

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Citation

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Abstract

The objective of this research work was to study the ischiopubic index in Cross River State in Nigeria. This was done by measuring the pubic and ischial lengths in 214-ray films (114 males and 100 females) of Cross River State indigenes. The ischiopubic index was calculated by dividing the pubic length by ischial length and by multiplying by 100.The sex differences of the pubic length, ischial length and ischiopubic index was found to be statistically significant when male and female x-ray films are compared ($p<0.001$).The demarking points of these parameters were worked out to determine sex. The demarking point of the ischiopubic index was more useful in sex determination assigning sex to 69% males and 81% females. The ischiopubic index therefore is a useful parameter in sexing of the hipbone.

This research carried out in Departments of Radiology of the University of Calabar Teaching Hospital and the University of Calabar Medical Center

There was no external funding for this research

INTRODUCTION

The sexual differences noticed in the pelvis are of interest to anatomist anthropologists as well as gynecologists. Davivong [1] and Washburn [2] determined the ischiopubic index obtained by dividing the length of pubis by the length of the ischium. They concluded that this index is one of the parameters influencing the size of the pelvic inlet.

The growth of the pelvis is largely in width resulting in a wide pelvic inlet [3] . It is known that females with narrow pelvic cavity find it more difficult to deliver babies naturally than those with wide pelvic cavity. This study determined the sex differences using the ischiopubic index in Cross River State of Nigeria. Lack of comparative data in the Nigerian population necessitated this study. The knowledge of this index will be of gynaecological significance and will help to estimate to an extent the outcome of labour.

The results obtained will be compared with that of other races and will be of importance in sex determination.

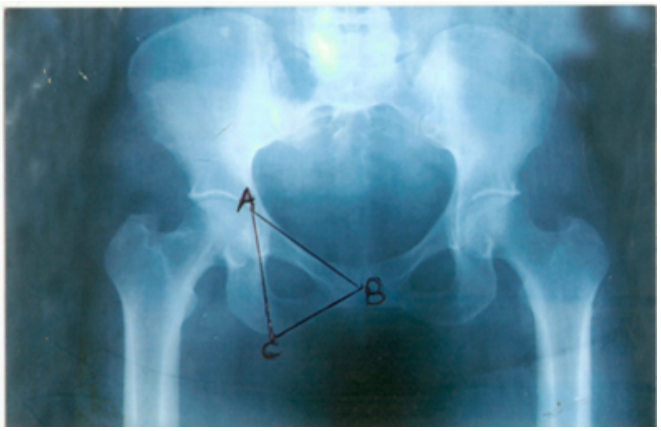
MATERIALS AND METHODS

The materials used in this research work included 214 radiographs of patients belonging to different age groups from the Department of Radiology, University of Calabar Teaching Hospital and the University of Calabar Medical Center. Out of these radiographs 114 were males and 100 were females. The routine distance from which these radiographs were taken was 92cm. All the radiographs were of anteroposterior view. All the radiographs were free from pathological changes and belonged to adults from the ages of eighteen to seventy years.

The technique used for measuring the ischiopubic index was as described by Schultz [3] . The index was determined by dividing the length of the pubis by the length of the ischium and multiplied by hundred. The length of ischium and pubis were measured from the point where they meet at the triradiate cartilage. In taking these measurements the radiographs were placed on the horizontal surface of an illuminator and the following measurement were taken (Fig1)

Figure 1

Fig. 1: The radiograph of pelvis showing the measurements of the ischial length AC and pubic length AB



Ischial length: A straight line AC was drawn on the radiograph from the center of triradiate cartilage to the maximum ischial tuberosity.

Pubic length: A straight line AB was drawn on the radiograph from the center of the triradiate cartilage to the pubic symphysis.

Ischiopubic index: The index was calculated as below.

Length of pubis /Length of Ischium X100

STATISTICAL ANALYSIS AND OTHER CALCULATIONS

Data on the measured parameters were analyzed using one way analysis of variance. The Student's t-test was used to determine the sex differences and ($p<0.001$) was taken as being statistically significant. The actual range for the male and female sexes was found out. The highest and lowest values of this range were used in gender determination. The identification point is the low or high value got from the actual range of the values measured from male and female pelvis. The demarking point is the low or high values deduced from the calculated range which is got by using the formula mean ±3Standard Deviation Jit and Singh [4] . The difference between the two points is that the identification point is deduced from recorded actual range values while the demarking point is deduced from the calculated range values. The two values were used to find the percentage of the recorded values from the radiographs. The highest percentage indicated which of the parameters was more useful in gender differentiation.

RESULTS

Pubic length: The pubic length in females was observed to be higher than in male.

These differences were observed to be statistically significant ($p<0.001$) (Tables 1 and 2).The identification point for the males was 42mm and 82mm for the females. The identification point assigned sex to 50% males and 31% females. The percentage identified by the demarking point was 48% for males and females.

Ischial length: The ischial length of males measured more than that of females. This difference was found to be statistically significant ($p<0.001$).The maximum ischial length for females was 79mm and this served as identification points and assigned sex to 58% of male radiographs and 61% of female radiographs. The demarking point for the male and female ischial lengths was 85mm and 43mm respectively. This identified 51% male and 41% female radiographs (Tables 1 and 2).

Ischiopubic Index: The ischiopubic index of the females was higher than that of males. This index varied from 71-23 with the mean of 94.2± 9.9 in the males. In the females, the index varied from 79-154 with a mean of 118.8± 12.8. This difference was statistically significant ($p<0.001$). The identification point for the male was 84 and that of the female was 123 and this assigned sex to 61% males and 64% females. The percentage of radiographs identified by demarking point was 69% for males and 81% for females.

Figure 2

Table 1: Measurement in (mm) and calculations of pubic length, ischial length and ischiopubic index of males in Cross River State

Measurements and calculations	Pubic length	Ischial length	Ischiopubic Index
No	114	114	114
Mean	65.6*	69.9*	94.2*
Standard deviation	±8.6	±10.9	±9.9
Actual range	41-82	42-88	71-123
Identification point	<42	>79	<84
Percentage Identification point	50%	58%	61%
Calculated range	40-93	43-107	65-125
Demarking points	<41	>85	<80
Percentage demarking points	48%	51%	69%

*P<0.001 was statistically significant (male versus female)

Figure 3

Table 2: Measurement in (mm) of pubic length, ischial length and ischiopubic index in female in Cross River State

Measurements and calculations	Pubic length	Ischial length	Ischiopubic Index
No	100	100	100
Mean	75.6*	63.6*	118.8*
Standard deviation	±11.4	±7.6	±12.8
Actual range	42-95	42-79	79-158
Identification point	<82	>42	<123
Percentage Identification point	31%	47%	64%
Calculated range	41-110	41-88	80-155
Demarking points	<93	>43	<125
% Beyond demarking points	15.5	40.9	80.4

*P<0.001 was statistically significant (male versus female).

Figure 4

Table 3: Comparative analysis of pubic length, ischial length and ischiopubic index in different races

Racial Group Source	Pubic Length				Ischial Length				Ischiopubic Index			
	Male		Female		Male		Female		Male		Female	
	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean
Eskimos[1]	129	74.1	95	80.1	129	88.4	95	81.0	129	83.9	95	98.8
American Whites[1]	100	73.8	100	77.9	100	88.4	100	78.3	100	83.6	100	99.5
American Negros[2]	50	69.2	50	73.5	50	86.6	50	77.5	50	79.9	50	95.0
Bantus[3]	82	66.2	70	73.2	82	80.3	70	74.8	82	82.5	70	98.1
Australian Aborigines[1]	89	63.3	72	69.2	89	81.2	72	74.7	89	76.0	72	92.7
Nigerian (present study)	114	65.8	100	75.6	114	70.1	100	64.5	114	94.2	100	117.3

DISCUSSION

In forensic practice, experts are often called upon to identify skeletal remains which often involve diagnosis of sex. Sexual differences are more pronounced in the pelvic bone from fetal life. Sexual differences in adult pelvis has been studied and measured extensively. These studies involved metrical and non –metrical characteristics whose range overlap between the sexes [5] . Medical studies of various indices have been carried out. Such indices include ischiopubic index [6] , indices of the greater sciatic notch [5-8,] and chilotic index [9-11] .These indices have been measured in different races and ethnic groups.

In the present study the pubic and ischial length could not identify reasonable percentage of pelvis in both males and females though the mean value of these parameters were statistically significant (p<0.001) when the male and female values were compared. They could not be used in sexing because the percentage identified by demarking point was low. The ischiopubic index however was observed to be useful in sex differentiation. The mean values of this index were observed to be statistically significant (p<0.001) and the percentage identified by demarking point was 69% for males for males and 81% for females. Washburn [6] working on this index identified 80% and 100% for American males and females respectively. The slightly low percentage for demarking point in the present study compared with the work of Washburn [2] may be because pelvic radiographs were used whereas Washburn measured directly pelvic skeleton of American hip bones. In a recent study, Igbigbi and Msaman [11] measured the ischiopubic index in black Malawian and found that it was useful for gender determination using adult skeletons or radiographs. With the skeletal bones, sex could be assigned to 92% males and 100% females whereas using radiographs sex was accurately assigned to 87.8% males 100% females respectively.

The pubic length, ischial length and ischiopubic index differ in different races. A comparative data of these parameters in different races are shown in table 3. The pubic length of Australian Aborigines had the lowest mean value of 63.3mm for males and 69.2mm for females. The Eskimos [12] had the highest mean value of 94.1mm for males and 80.1mm for females. In the present study the pubic length of Nigerian males was recorded as 65.8mm while that of females was 75.7mm.

The mean ischial length in Nigerian males was recorded as 70.1mm and that of the females was 64.5mm. These were the lowest when compared to those of other races. For the males, the American whites and the Eskimos had the highest values of 88.4mm while for the females the Eskimos had the highest ischial length of 81.0mm followed by American whites with value of 78.3mm.

The mean ischiopubic index was highest in the present study in both males and females while the Australian Aborigines had the lowest mean ischiopubic index. In Nigerian males and females the mean ischiopubic was 94.2 and 117.3 respectively. In the Australian Aborigines it was 76.0 and 92.7 in males and females respectively. Though the primary function of the pelvis in males and females is for locomotion, it is specially adapted for childbirth in the females [12] . This may explain the significantly higher sexual differences in ischiopubic index observed in the females in all the races when compared with that of the males (Table 3).

The racial differences observed may either be due to environmental or hereditary factors or both [14] . Maclanghlin and Bruce [15] observed that sexual dimorphism in body size is a critical factor in influencing pelvic dimorphism. They observed that the pubic length for both sexes particularly that of the females showed accelerated changes depending on the body size. Body size is known to be influenced by environmental, nutritional and genetic factors. Rissech and Malgosa [16] working on pubis growth study on sexual and age diagnostic confirmed that ischiopubic index is one of the good variables for sub- adult sex determination. Racial hereditary factor acts as primary factor within which functional activities operate as secondary factor.

These parameters were observed to vary between ethnic groups as in the cases of American whites and Negroes [11] . The present study on a small Nigerian population should not be taken as representing the whole Nigerian population. This is because Nigeria is made of many ethnic groups each of which has characteristic differences in body size. The people of Cross River State (South- South) in the present study are small in stature when compared with the people in the Northern and Western part of Nigeria. Further studies is being carried out to compare the pubic length, ischial length and ischiopubic index in the Northern, western and Middle belt parts of Nigeria. Such results will be compared with the present result to deduce a more reliable data for the Nigerian population.

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