

Research Article

Radiologic Study of Indices in the Greater Sciatic Notch in South Nigerian Population

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Abstract: In forensic and archeological studies, there is the need for identification of human skeletal remains. The greater sciatic notch is very relevant in identification of sex in human skeletal remains. Over the years, different authors had carried various types of measurements on human greater sciatic notch of different sex and races. This study was carried out to determine if indices in the greater sciatic notch can be used in sexing of the hip in South-South Nigerians with the help of radiograph and to establish a baseline data for the population. Anterior-posterior radiographs of adult pelvis (age range, 18-75 years) were evaluated. Five hundred and eighteen (518) radiographs (259 males and 259 females) were those of the South-South people of Nigeria. The parameters considered are maximum width (AB); maximum depth (CO); and the posterior segment (OB), index I and index II of the greater sciatic notch. The mean values of maximum width, maximum depth, posterior segment, index I and index II of males in South-South Nigerian people were 42.24 ± 10.00 (mm), 15.60 ± 3.12 (mm); 14.65 ± 5.24 (mm); 38.81 ± 11.88 and 34.55 ± 7.87 respectively while those of their females were 50.73 ± 10.13 (mm), 14.91 ± 3.39 (mm); 21.39 ± 5.74 (mm); 30.10 ± 7.48 and 42.18 ± 7.57 respectively. The maximum width, posterior segment and index II of the females were significantly higher than that of the males ($p < 0.05$). The maximum depth and index I of the males was significantly higher than that of the females ($p < 0.05$). Identification of sex was carried out with help of demarking point, using $\text{mean} \pm 3\text{S.D.}$ None of the parameters were useful in identification of sex with the use of radiographs. When comparing our result with the works done by other authors there were racial differences. Our observation suggests that metric assessment of the features of the greater sciatic notch with the use of radiograph in South-South Nigerian population should not be used in sex determination, particularly in the case of fragmentary forensic or rare archaeological remains.

Keywords: Archeological, forensic, indices in greater sciatic notch, Nigerians

INTRODUCTION

Sexing of the hip for medico-legal cases should be given a first line charge in our society. The best indicators of sex in the skeleton are to be found in the pelvis. The hip bone is the most reliable skeleton in sexual dimorphism (Ferembach *et al.*, 1980). Medical studies of various indices have been carried out. Such indices include ischiopubic index (Singh and Potturi, 1978), indices of the greater sciatic notch (Segebarth-Orban, 1980) and chilotic index (Derry, 1924). These indices have been measured in different races and ethnic groups. Akpan *et al.* (1998) used a total of 150 X-ray films (A-P view) of the pelvis of adult (90 male and 60 female) Nigerians to measure the width, depth, posterior segment, total and posterior angles of the greater sciatic notch. Kalsey *et al.* (2011) made an attempt to find the baseline data of various parameters pertaining to the greater sciatic notch of 100 hip bones

of known sex (male: female = 80:20) and side (right: left = 50:50), in Punjab, India. Correct sex identification of the human skeleton is important in bioarcheological and forensic practice (Bruzek, 2002). Metric assessment of the greater sciatic notch has been carried out in several studies and has been evaluated for sex identification (Palfrey, 1974; Singh and Potturi, 1978; Dibennardo and Taylor, 1983; Kayalioglu *et al.*, 1995; Akpan *et al.*, 1998; Patriquin *et al.*, 2002, 2003, 2005; Steyn *et al.*, 2004). Different results related to the role of the features of the greater sciatic notch in sex determination were obtained in those studies.

In spite of the relevance of indices in the greater sciatic notch in forensic studies, anthropological, obstetrics and gynaecology; there is lack of literatures in South-South Nigerian Population. The aim of this study therefore was to determine if indices in the greater sciatic notch can be used in sexing of the hip in South-South Nigerians with the help of radiograph and to establish a baseline data for the population.

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Fig. 1: Radiograph showing the maximum width (AB); maximum depth (CO); and the posterior segment (OB) of the greater sciatic notch

MATERIALS AND METHODS

Five hundred and eighteen normal, Standard pelvic Anterior-posterior radiographs (259 male and 259 female) aged between 18 and 75 years were used from their biometric data. This study was conducted in South-South of Nigeria between March, 2011 to November 2011. The following hospitals within South-South Nigerian States were used: University of Port-Harcourt Teaching Hospital, Rivers State, Braithwaite memorial Specialist Hospital, Port Harcourt, Rivers State; Federal Medical Centre, Yenagoa, Bayelsa State, University of Benin Teaching Hospital, Ugbowo, Benin city; Edo State and Rehoboth specialist hospital, D-Line, Rivers State.

The routine distance from which these radiographs were taken was 100 cm. 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 five years. In taking these measurements the radiographs were placed on the horizontal surface of an illuminator and the following measurement were taken with the help of a vernier calliper. A marker was used to mark these points for clear visualization.

The definitions of the measurements were taken from the literature and were selected on the basis of their being good discriminators in previous studies. These are clearly defined in the available literature (Singh and Potturi, 1978; Milne, 1990; Kayalioglu *et al.*, 1995). The piriform tubercle was taken as the posterior point (B) and the tip of the ischial spine was taken as the anterior point (A) of the width (AB). Maximum depth (OC) was determined between the baseline (AB) and the deepest point (C) of the greater sciatic notch. Also, (OB) was designated as the posterior segment in the Fig. 1.

The following parameters of the greater sciatic notch were considered:

- **Maximal width (AB):** The distance between the position A and B
- **Maximal depth (OC):** Perpendicular to the width
- **(OB):** Posterior segment of the width
- **Index I:** Maximal depth (OC) x100/Maximal width (AB)
- **Index II:** Posterior segment of the width (OB) x100/Maximal width (AB)

These parameters were obtained from the available literature.

All linear measurements were in millimeters for each parameter. The Data on the measured parameters were analyzed using the z-test to determine the sex differences and ($p < 0.05$) was taken as being statistically significant. The actual ranges for the male and female sexes were 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 $\text{mean} \pm 3\text{Standard Deviation}$ (Jit and Singh, 1966).

RESULTS

The result of the mean, standard deviation and range of all radiographic measurements in the greater sciatic notch In South-South Nigerian population are shown in Table 1. The mean maximum width for males and females where 42.24 ± 10.00 and 50.73 ± 10.13 (mm). The maximal width which was described in Fig. 1 was sexually dimorphic. The females mean maximal width is significantly higher than that of the males ($p < 0.05$). The mean maximal depth of males and females in the greater sciatic notch were 15.60 ± 3.12 and 14.91 ± 3.39 (mm). The maximal depth which was described in Fig. 1 was sexually dimorphic.

The males mean maximal depth is significantly higher than that of the females ($p < 0.05$). The mean values for posterior segment of males and females were 14.65 ± 5.24 and 21.39 ± 5.74 (mm). The females had a significantly larger value for posterior segment compared to the males ($p < 0.05$). The mean values of Index I for males and females were 38.81 ± 11.88 and 30.10 ± 7.48 . The males had a significantly higher index I compared to that of the females. The mean values of Index II for males and females were 34.55 ± 7.87 and

Table 1: Showing mean and standard deviation of parameters measured in the greater sciatic notch

Parameter	N	Male mean±S.D.	Female mean±S.D.	p	Range for males	Range for females
AB	259	42.24±10.00 (mm)	50.73±10.13	p<0.05	20.96-65.02	24.80-71.60
OC	259	15.60±3.12 (mm)	14.91±3.39	p<0.05	7.20-24.22	7.36-29.73
OB	259	14.65±5.24 (mm)	21.39±5.74	p<0.05	6.28-32.81	5.79-37.00
Index I	259	38.81±11.88	30.10±7.48	p<0.05	18.27-91.67	15.27-72.58
Index II	259	34.55±7.87	42.18±7.57	p<0.05	14.08-55.00	68.72-49.28

S.D.: Standard deviation; N: Sample size; AB: Maximum width; CO: Maximum depth; OB: Posterior segment

Table 2: Distribution of the validity of the features of the greater sciatic notch in sex determination according to different studies

Studies Author, year, population and sample size (n)	Feature of greater sciatic notch				
	Max. width (AB)	Max. depth (OC)	Posterior segment (OB)	Index I	Index II
Palfrey (1974), West African population, N = 64	+	-	+	-	-
Singh and Potturi (1978), Indian population, N = 200	-	-	+	-	+
Dibennardo and Taylor (1983), American white and black population, N = 260	-	+	-	-	-
Kayalioglu <i>et al.</i> (1995), Anatolian population, N = 218	-	-	+	-	+
Akpan <i>et al.</i> (1998), Nigerian population, N = 150	-	-	-	-	+
Patriquin <i>et al.</i> (2002), South African white and black population, N = 400	+	+	+	-	-
Steyn <i>et al.</i> (2004), South African black and white population, N = 115	+	-	-	-	-
Present study	-	-	-	-	-

+: Valid feature; -: Invalid feature; Max.: Maximum

42.18±7.57. The females in South-South Nigeria had a significantly higher Index II than the males.

The distribution of the validity of features of the greater sciatic notch in sex determination is given in Table 2. There was comparison according to different studies carried out by different authors. It was observed that none of the parameters can be used for identification of sex. This is because when using the formulae mean±3S.D. (Jit and Singh, 1966) for demarking point, the percentage identified by sex was very low. Therefore, none of the parameters can be used for sex identification. When comparing our result with the works done by other authors there were racial differences.

DISCUSSION

The morphology (maximal width, maximal depth and posterior segment width) of the greater sciatic notch has been used in different studies addressing different populations for sex determination. Bruzek (2002) stated that the precision of sex determination using the morphology of the greater sciatic notch to describe the shape of the greater sciatic notch corresponds directly to an estimation of the discriminatory power (varying by around 70%) of this trait. Jovanovics *et al.* (1968) tested the reliability of the greater sciatic notch in sex determination on deformed ossa coxae and concluded that pathological changes and abnormalities deforming the pelvis do not affect the greater sciatic notch in either sex and reported that this feature is still a reliable indicator in these conditions. Palfrey (1974) studied West African skeletons of known sex and found highly significant differences between the sexes regarding the width and posterior segment width of the greater sciatic notch, except for the depth of the greater sciatic notch. Singh and Potturi (1978) reported that the width and depth of the greater sciatic notch are useless criteria for sex identification but also that the width of the posterior segment and Index II successfully assigned sex to a high percentage of hip bones (95-97%). Dibennardo and Taylor (1983) investigated the adult coxae of American blacks and

whites of known sex and found that the depth of the greater sciatic notch was larger in females in both races. Kayalioglu *et al.* (1995) analyzed the adult coxae of unknown sex from the skeletal collection at their department and found the maximal width, maximal depth and posterior width of the greater sciatic notch to be 36.71, 24.96, 7.14, 70.87 and 17.32 mm for males, respectively. They reported that the maximum width was not a good parameter, while posterior segment width and Index II were indeed good parameters for sex determination. Akpan *et al.* (1998) used X-ray films (A-P view) of the pelvis of adult Nigerians to measure the width, depth and posterior width of the greater sciatic notch. They reported that the width, depth of the greater sciatic notch and Index I were insignificant criteria, but that Index II was the most useful criterion in sex determination. Patriquin *et al.* (2002, 2003 and 2005) found the maximal width, maximal depth and posterior width of the greater sciatic notch to be 43.03 mm (in whites) and 36.96 mm (in blacks); 26.55 mm (in whites) and 22.68 mm (in blacks); 15.56 mm (in whites) and 9.31 mm (in blacks) for males, respectively. They reported that the width of the greater sciatic notch is larger in females, but deeper in males and that there are significant sex differences among both South African males and females and whites and blacks. This present study is in keeping with the result of Patriquin *et al.* (2002, 2003 and 2005). Steyn *et al.* (2004) used geometric morphometric analysis of the greater sciatic notch and reported that this feature may not be so reliable, especially in South African white males. Nevertheless, they found that South African black males have a typical narrow shape and that both black and white females have typical wide notches.

In this study, an anthropometric study of the greater sciatic notch with radiographs, none of the measured parameters were useful in the identification of sex when using the formulae mean±3S.D. (Jit and Singh, 1966). Bruzek (2002) indicated that it is difficult to admit that the sexual traits of the skeleton may be more clearly expressed in one sex than the other. The total degree of sexual dimorphism of any bone is a function of the interaction of the partial dimorphism of

certain major regions of the bone. Thus, according to the concept of functional integration, lower levels of sexual dimorphism in a given morpho-functional complex can be functionally compensated by higher levels of dimorphism in another morpho-functional complex. Intersegment size relationships are sex- and population-specific. With both genetic and functional components, the existence and degree of trait expression appears to be population-specific (Haun, 2000; Bruzek, 2002).

CONCLUSION

In conclusion, our results suggest that metric assessment of the features of the greater sciatic notch should not be used in sex determination in South-South Nigerian population, particularly in the case of fragmentary forensic or rare archaeological remains. In this respect, even anthropometric measurements of the skeletal remains of a single archaeological population should afford valuable information about the features of different populations. Furthermore, the different results obtained for the different populations should be useful for comparisons with similar studies and for improving the identification of human pelvis.

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