

Radiologic Determination of Acetabula Index and Centre Edge Angle in South-South Nigerian Population

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Abstract: This study was carried out to give a report on the average acetabula index and centre edge angle, its sexual dimorphism in South-South Nigerian population and to examine if there is racial differences in acetabula index and centre edge angle when compared to other races. Anteroposterior radiographs of adult pelvis (age range, 18-75 years) were evaluated. Five hundred and eighteen (518) radiographs (259 males and 259 females) were used. The morphological measurements were Acetabula index of Sharp and centre edge angle of Wiberg. The mean centre edge angle of males and females were $34.39^{\circ} \pm 5.53^{\circ}$ and $35.58^{\circ} \pm 5.74^{\circ}$. There was sexual dimorphism with respect to the centre edge angle. The female centre edge angle was significantly higher than that of the male centre edge angle ($p < 0.05$). The mean Acetabula angle of Sharp for males and females were $36.39^{\circ} \pm 4.04^{\circ}$ and $36.99^{\circ} \pm 3.65^{\circ}$. There was no significant difference between the males Acetabula angle of Sharp and that of the females ($p > 0.05$). There was a negative correlation between the centre edge angle and acetabula index for males ($p > 0.05$). There was also a negative correlation between the centre edge angle and acetabula index for females ($p > 0.05$). The total mean centre edge angle was $34.98^{\circ} \pm 5.66^{\circ}$ for south South Nigerian population. The total mean acetabula index was $36.69^{\circ} \pm 3.86^{\circ}$ for south South Nigerians. These results were compared with other races in the literature. It was observed that there was a racial differences with respect to centre edge angle and Acetabula index. Knowledge gained from this study will be useful to the orthopaedic surgeon, clinician, anthropologist and in forensic science. In treating hip dysplasia, local values should be given cognizance.

Keywords: Acetabula index, anthropologist, centre edge angle, forensic science, Nigerians, orthopaedic surgeon

INTRODUCTION

The increasing occurrence of aseptic loosening, often accompanied by extensive acetabular defects, confronts the surgeon with severe difficulties (Kuno and Eugen, 2003). Umer *et al.* (2006), used Standardised plain anteroposterior radiographs of 522 hip joints of 261 asymptomatic patients (mean age, 60 years; range, 16-99 years) to assess and evaluate the usefulness of seven morphological measurements of the acetabulum in establishing the prevalence of acetabular dysplasia in the Singaporean population.

The prevalence of acetabular dysplasia has been reported as 3.3% in Nigerian men (Ali-Gombe *et al.*, 1996), 3.4% in white females in Britain (Lane *et al.*, 1997), 4.5% in Chinese men (Lau *et al.*, 1995), 3.8% in another British population (Cooperman *et al.*, 1983) 1.8% in the Korean population (Han *et al.*, 1998) and 2.4% in the Turkish population (Aktas *et al.*, 2000). The prevalence of acetabular dysplasia in the Singaporean study was 7.3%, which was much higher than the Korean, Chinese, and Turkish populations. This suggests that hip joint morphometry may show geographical differences.

It is sad to note that there is no literature in South South Nigerian population to show what could be used as normal values and to know how far one's acetabula index and centre edge angle has deviated from the normal standard values and were pathological values are expected.

The aim of this investigation was to examine normal acetabula index and centre edge angle, its sex dimorphism in South-South Nigerian population. It is also aimed at examining if there is racial differences in acetabula index and centre edge angle when compared to other races.

MATERIALS AND METHODS

Five hundred and eighteen normal, Standard pelvic anteriorposterior 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

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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 18 to 75 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 pencil; ruler and protractor. A marker was used to mark these points for clear visualization.

The centre of the femoral head was identified and I made a tracing of the hip joint and then took a measurement.

After identifying the centre of the femoral head, a vertical line was drawn through this point with the help of a ruler. The angle subtended by this line to the line joining the centre to the outermost edge of the acetabulum was the centre edge angle and it is measured with the help of a protractor. A measurement of $<20^\circ$ was considered dysplasia (Fredensborg, 1976).

The angle subtended by the line joining the outermost ossified portion of the acetabulum to the pelvic teardrop was the Sharp's acetabular angle. A measurement of $>43^\circ$ was considered dysplasia (Sharp, 1961). Acetabular dysplasia is defined by either a centre edge angle of $\leq 25^\circ$ (severe if $<20^\circ$) or an acetabular depth of <9 mm (Han *et al.*, 1998; Yoshimura *et al.*, 1998).

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.

RESULTS

The result of the mean, standard deviation and range of all radiographic measurements such as Acetabula angle of Sharp and centre edge angle of Wiberg in South-South Nigerian population are shown in Table 1. The mean centre edge angle of males and females were $34.39^\circ \pm 5.53^\circ$ and $35.58^\circ \pm 5.74^\circ$. The centre edge angle which was described in Fig. 1 was sexually dimorphic. The female centre edge angle was significantly higher than that of the male centre edge angle ($p < 0.05$). The mean Acetabula angle of Sharp for males and females were $36.39^\circ \pm 4.04^\circ$ and $36.99^\circ \pm 3.65^\circ$. The Acetabula angle of Sharp which was described in Fig. 2 was not sexually dimorphic. There



Fig. 1: An anteroposterior radiograph showing a normal centre edge angle of wiberg



Fig. 2: An anteroposterior radiograph showing acetabular angle of sharp

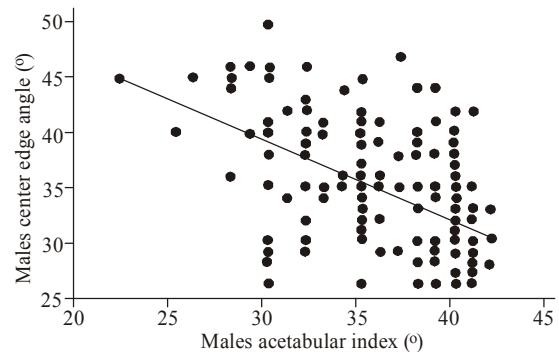


Fig. 3: Correlation between males centre edge angle and males acetabula index

Male CE angle: male AC angle $r^2 = 0.2774$;
 $r = -0.5267$; $y = 60.418 - 0.7213*x$

was no significant difference between the males Acetabula angle of Sharp and that of the females ($p > 0.05$). Figure 3 shows the correlation between the centre edge angle and the Acetabula angle of Sharp for Male subjects. There was a negative correlation between the centre edge angle and acetabula index for males ($p > 0.05$). Figure 4 also shows the correlation

Subjects	N	AC angle of sharp	CE angle of wiberg
South-South males	259	$36.39^\circ \pm 4.04^\circ$	$34.39^\circ \pm 5.53^\circ$
South-South females	259	$36.99^\circ \pm 3.65^\circ$	$35.58^\circ \pm 5.74^\circ$
Range for males	259	22.00°-42.00°	26.00°-50.00°
Range for females	259	26.00°-42.00°	26.00°-50.00°

($p < 0.05$) for CE angle between males and females; ($p > 0.05$) for AC angle between males and females; N: Sample size; AC: Acetabula angle; CE: Centre edge angle of wiberg

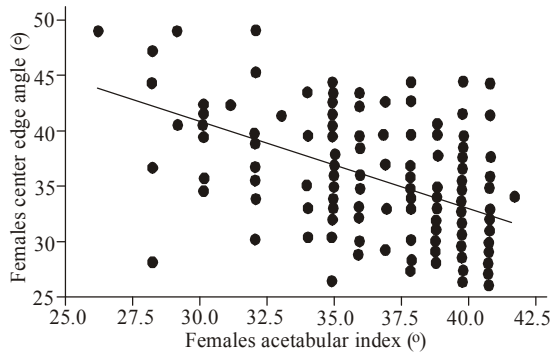


Fig. 4: Correlation between female centre edge angle and female acetabula angle
 Female AC angle: female CE angle: $r^2 = 0.2581$;
 $r = -0.5080$, $y = 65.0871 - 0.7978 * x$

between the centre edge angle of Wiberg and the acetabula angle of Sharp for females. There was also a negative correlation ($p > 0.05$). The total mean centre edge angle was $34.98^\circ \pm 5.66^\circ$. The total mean acetabula index was $36.69^\circ \pm 3.86^\circ$ for South-South Nigerians.

DISCUSSION

The mean centre-edge angle reported by Wiberg was 36° in a Swedish population, 35° in a United States population (Massie and Howorth, 1950), and 36.2° (standard deviation (S.D.), 6.9°) in a British population (Yoshimura, 1998). Fredensborg (1976) measured another Swedish population and reported a mean angle of 35° (S.D., 6.6°). Among the Japanese population, the mean centre-edge angle has been reported at various notably lower measurements: 32.2° (S.D., 6.4°) (Nakamura *et al.*, 1989) and 30° (S.D., 6.2°) (Fujii *et al.*, 1994). The Korean population were reported to have centre-edge angles of 32.6° (S.D., 5.7°) (Han *et al.*, 1998). The total mean centre edge angle in this present study was $34.98^\circ \pm 5.66^\circ$. This is lower than the result gotten for the Swedish population and United State of American Population. But our result is higher than the report from the Korean population and Japanese population.

The mean center edge angles of Egyptian men were $35.5^\circ \pm 4.6^\circ$ and $32.8^\circ \pm 4.7^\circ$ for women (Tarek, 2011). The centre Edge angle of Singapore females were $33.54^\circ \pm 7.14^\circ$ and $30.63^\circ \pm 8.19^\circ$ for males (Umer *et al.*, 2006). In this present study, the mean centre edge angle for males was ($34.39^\circ \pm 5.53^\circ$) and that of females was ($35.58^\circ \pm 5.74^\circ$). This values shows a racial difference in centre edge angle of wiberg. Our value is higher than the results from Singapore.

The acetabular angle described by Sharp (1961) is one of the most common radiographic measurements used to assess acetabular dysplasia. Nakamura *et al.* (1989) reported a mean acetabular angle of 38° (S.D., 3.6°) (males, 37.3° (S.D., 3.7°); females, 38.6° (S.D.,

3.4°)) among the Japanese population. Stulberg and Harris (1974) reported the mean acetabular angle of 32.2° in white males, whereas Harris (1986) reported 32.1° in white females. Han *et al.* (1998) reported the mean acetabular angle among Koreans to be 37.0° (S.D., 3.7°) (males, 36.5° (S.D., 3.5°); females, 37.5° (S.D., 3.8°)). In a Singaporean study by Umer *et al.* (2006), the mean acetabular angle was 39.46° (S.D., 6.04°) (males, 39.85° (S.D., 6.00°); females, 38.25° (S.D., 5.98°)). The mean Sharp angles for Egyptian men were $36^\circ \pm 2.7^\circ$ and for women were $38.8^\circ \pm 2.4^\circ$ (Tarek, 2011).

In this present study, the total mean acetabula angle was $36.69^\circ \pm 3.85^\circ$. This total mean value is lower than that of the Japanese population by Nakamura *et al.* (1989) and the values from Singapore (Umer *et al.*, 2006). The mean acetabula index for males was $36.39^\circ \pm 4.04^\circ$ and $36.99^\circ \pm 3.65^\circ$ for females. Our mean value is lower than that of the Japanese population by Nakamura *et al.* (1989) and the values from Singapore (Umer *et al.*, 2006). This shows that there is a racial differences in the acetabula angle of Sharp.

This provides a rationale for considering these measurements as complementary methods in the diagnosis of acetabular dysplasia.

CONCLUSION

When treating hip dysplasia, local values should be given cognizance.

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