

Measurements of Acetabular Angle among Sudanese Population: A Single Centre Study

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Abstract

Original Research Article

Introduction: Acetabular angle is one of the most important osteometric measurements. It has very wide implications in clinical and medico legal practice. **Objectives:** to determine the acetabular angle in Sudanese population, to assess the sex influence, to compare these results with international results. **Patients and Methods:** the study was a prospective, descriptive, cross-sectional hospital based study, conducted at Omdurman Teaching Hospital during the period from March to June 2015, A total coverage of all patients who came for plain pelvic x -ray or IVU during this period were taken as study targets. **Result:** The mean of acetabular angle in males was (37.3) and in females was (35.2) with significant statistical difference. The maximum angle observed in male was 42 with 29 was the minimum. In females the maximum angle was 38 and 29 was the minimum. **Conclusion:** The anatomical difference in this study was significant. Sex influences geometrical measurements of the acetabulum; the male's angles are greater than that of females. In comparing the acetabular angle of both sexes in Sudanese subjects with others there was a high statistical significant racial variation.

Keywords: Acetabular angle, geometrical measurement, medico legal.

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INTRODUCTION

The acetabular angle is a radiographic measurement used when evaluating potential developmental dysplasia of the hip (DDH). It is most useful in patients who have started to ossify the epiphysis since ossification diminishes the usefulness of ultrasound. The angle is formed by a horizontal line connecting both triradiate cartilages (Hilgenreiner line) and a second line which extends along the acetabular roofs. In the adult, where the triradiate cartilages are fused and therefore unapparent, the inferior margin of the pelvic tear drop is used instead. This shifts the horizontal line inferiorly and changes the value of the angle [1, 2].

Normal values in children

The acetabular angle using Hilgenreiner's line should be less than 28 degrees at birth. The angle should become progressively narrower with age [3].

Normal values in adults

The normal range is 33 to 38 degrees. Angles above 47 degrees are seen in patients with acetabular

dysplasia. A measurement between 39 and 46 degrees is indeterminate [3].

Identification of human skeletal remains the most important investigations in forensic medicine and forensic anthropological studies. Many different skeletal remains had been used to help sex identification. One of the most frequently used and most accurate tools is the bony pelvis [4].

There are many differences in osteometric and morphological studies comparing male and female bony pelvis. These differences are mostly related to physiology of female pelvis. Diameters of female pelvis are larger than male pelvis. The different parts of the bony pelvis had been studied to find out these differences in both sexes and their significance in sex identification. One of the most parameters used are the shape and the contour of the articulated pelvis regarding the shape and diameters of the pelvic inlet and outlet. Other points that noticed to be different between the two groups are the acetabular angle, subpubic angle (SPA), obturator foramen, ischial spine, and the ischiopubic index [4].

Four experienced orthopaedic surgeon measured the acetabular angle of sharp in 66 hips by using two methods, the classical method the lateral margin of the acetabular roof was used as landmark, the modified method the lateral margin of the sourcil was used as landmark and the acetabular angle was 48.4 degrees and the mean was 44.8 degrees [5].

This study concentrates on the acetabular angle measurement to notice the different values between both sexes among Sudanese population and if this difference, (if any) could be statistically significant.

MATERIALS AND METHODS

The study was prospective, descriptive, cross-sectional hospital based study, conducted at Omdurman teaching hospital, in a period from March to June 2015 omdurman teaching hospital consider as one of biggest hospital in Omdurman state, with emergency and elective medical services is provided.

Study population includes patients referred to Omdurman teaching hospital for pelvic X-ray, Including plain pelvic X- rays, or X-rays of intravenous urogram (IVU) series. Total coverage for patients referred to Omdurman teaching hospital during this period and fulfilling the criteria were included in the study, a total of 107, (54 males and 53 females).

All pelvic X – rays that clearly show the acetabular angle was included, pelvic X- ray films that showed pelvic or lower limb fracture, pelvic X-ray films with inappropriate alignment and patients with any pelvic or urological disease were excluded.

Clinical data was collected from X-ray films and images of pelvic region taken from patients with no orthopedic or urological diseases. After that the X-ray films are printed out, then the acetabular angle was measured by drawing a horizontal line connecting both triradiate cartilages (Hilgenreiner line) and a second line which extends along the acetabular roofs. Then the acetabular angle measured by using the goniometry.

Data collection sheets were used to include the study variations and to record the results.

Data were analyzed with Statistical Package for the Social Sciences (SPSS) version23. Qualitative data were analyzed using correlation test and simple linear regression, and the P-value was considered significant if less than 0.05. Written informed consent obtained from each participant, and ethical clearance was obtained from the ethical committee of The National Ribat University, as well as hospital administration approval.

RESULTS

One hundred and seven patients, who attended to Omdurman teaching hospital and underwent pelvic Xrays were included in the study, Fifty four of these patients were males (50.5%) and 53 were females (49.5%) as shown in Table-1.

Approximately Eighty four percent of the data were collected from plain pelvic x-rays and 15.9 % were from IVU studies as shown in Figure-1.

A fifty four male pelvic X-rays had been examined and acetabular angles were measured, that the maximum degree of the acetabular angle was 42 and the minimum degree was 29, Mean angle was 37.3 and the standard deviation (SD) was 2.0 as shown in Table-2.

Acetabular angle in the fifty three female pelvic X-rays it were measured, the maximum degree was 38 and the minimum degree was 29, with a mean value of 35.2 and SD of 2 as shown in Table-2.

Regarding degree of the acetabular angle and it's frequency in the study, values of 35, 36 and 37were found to be the most common in the study population as shown in Table-3.

Regarding the relation between degree of the acetabular angle and gender, most of the degrees are between (34) to (37) in both genders as shown in Table-4.

Table-1: Demographic characteristics of included population

Outcome		Number of patients (n=107)	Percentage (100%)
Gender	Male	54	50.5%
	Female	53	49.5%
Age group	15-30 year	23	21.5%
	31-45 year	42	39.3%
	Above 45 year	42	39.3%

Table-2: Values of the acetabular angle with gender

Sex	N	Range	Mean	SD
Male	54	29-42	37.3	2.0
Female	53	29- 38	35.2	2

Table-3: Showing the degree of the acetabular angle and its frequency

Degree of acetabular angle		
	Frequency	Percent
29	1	.9
31	1	.9
32	1	.9
33	7	6.5
34	13	12.1
35	18	16.8
36	18	16.8
37	18	16.8
38	14	13.1
39	8	7.5
40	4	3.7
41	3	2.8
42	1	.9
Total	107	100.0

Table-4: Showing the relation between degree of the acetabular angle and the gender

Degree of acetabular angle in group * Gender				
		Gender		Total
		Male	Female	
Degree of acetabular angle in group	29-33	2	8	10
	34-37	26	41	67
	38-42	26	4	30
Total		54	53	107

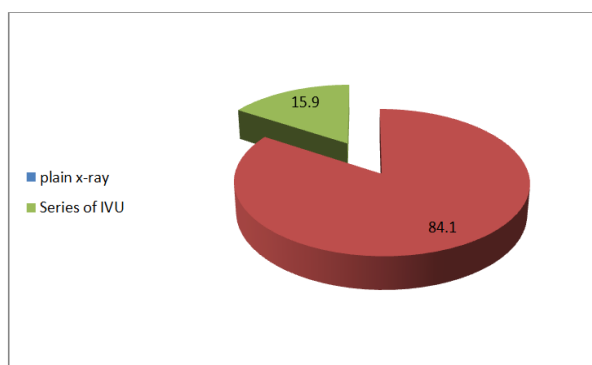


Fig-1: Showing the type of pelvic x-ray used in the study

DISCUSSION

The present study focuses on the presence of normal anatomical variation on the acetabular angle by analyzing pelvic X-rays of 107 subjects. The results were compared with some published studies discussing the same issue.

Out of 107 patients 54 were males and 53 were females. The mean of acetabular angle in males was (37.3) and in females was (35.2) with significant statistical difference. The maximum angle observed in male was 42 with 29 being the minimum.

In females the maximum angle observed was 38 and 29 was the minimum (62.6%) of the participant have the acetabular angle between (34) and (37) degree

so this mean that the normal angle for the Sudanese in both sex is between these degrees.

In the study the mean for age is about (42.1) with standard deviation (13) and the mean for degree of acetabular angle is (36) with standard deviation (2.2).

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°±2.7° and for women were 38.8°±2.4° [5-9].

In study conducted in a Malawi population the mean of acetabular angles in men was 35.52° more than in women (29.43°), and this difference was significant (P<0.001), so that these values are lower from our result [10].

In study conducted in South Nigerian Population the total mean acetabular angle was $36.69^{\circ} \pm 3.85^{\circ}$ The mean acetabular index for males was $36.39^{\circ} \pm 4.04^{\circ}$ and $36.99^{\circ} \pm 3.65^{\circ}$ for females, this almost similar to our result [11].

In this present study, the mean for degree of acetabular angle is (36), SD (2.2), the mean values is lower that of the Japanese, Singapore and Koreans population. But it is almost similar to the Egyptian, Nigerian population and higher than the Malawians population. [10]

All the studies showed that the acetabular angle is greater in male than in female with significant statistical difference. With some differences in measurement that may be referred to some extent to the ethnic differences in population of each geographic area.

CONCLUSIONS

Anatomical differences in the acetabular angle were significant in the present study. Sex influences geometrical measurements of the acetabulum. Male angles are greater than females. In comparing the acetabular angle of both sexes in Sudanese subjects with others, there was a high statistical significant variation. Acetabular angle value varies among populations of the different countries, age and sex and this will allow us to use it in diagnosis of abnormalities and medico-legal identification of sex and race.

RECOMMENDATION

1. More elaborated studies should be done to study the acetabular angle in different ethnic groups in Sudan with large sample size.
2. Useful utilization of acetabular angle measurement In Forensic medicine to determine the sex of unknown skeletal remains.
3. Useful utilization of acetabular angle measurement in clinical diagnosis in adult DDH.

Conflict of Interest: No conflict of interest.

REFERENCNCES

1. Last RJ. Lower limb. In: Last RJ. editor. Anatomy regional and applied. 9th ed. UK: Elsevier, 1998:215-221.
2. Gray H. Osteology. In: Williams PL, Warwick R. editors. Gray's anatomy. 36th ed. UK: Churchill Livingstone. 1980: 368-390.
3. Moore KL, Dalley AF. The pelvis. In: Agur MR, Moore BA, Sun B, Squd KH. editors. Clinically oriented anatomy. 5thed. London: Lippincott Williams and Wikins. 1999:332-340.
4. Heather WH, Cheryl K, Anthony BF. Identification of human skeletal remains. Forensic Osteological Analysis chapter 3:17-28.
5. Harris WH. Etiology of osteoarthritis of the hip. Clinical orthopaedics and related research. 1986 Dec(213):20-33.
6. Han CD, Yoo JH, Lee WS, Choe WS. Radiographic parameters of acetabulum for dysplasia in Korean adults. Yonsei medical journal. 1998 Oct 1;39(5):404-8.
7. Nakamura SH, Ninomiya SE, Nakamura TO. Primary osteoarthritis of the hip joint in Japan. Clinical Orthopaedics and Related Research. 1989 Apr(241):190-6.
8. Tarek AA. Hip morphologic measurements in an Egyptian population. Orthopedics, 2011; 34(4): 262.
9. Umer M, Thambyah A, Tan WT, De SD. Acetabular morphometry for determining hip dysplasia in the Singaporean population. Journal of Orthopaedic Surgery. 2006 Apr;14(1):27-31.
10. Msamati BC. Geometric measurements of the acetabulum in adult Malawians. 2003; 15(1): 71-79 .
11. Okoseimiema SC, Udoaka AI. Radiologic determination of acetabula index and centre edge angle in South-South Nigerian population. British Journal of Dairy Sciences. 2013 Sep 1;3(3):22-5.