

Original Articles

Sexual Dimorphism in Morphometry of the Acetabulum in Adult Bangladeshi People

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Abstract

Context: Morphometry of acetabulum bears immense clinical, surgical, and medicolegal significance. It helps clinicians to diagnose and manage hip dysplasia and hip osteoarthritis. Radiological Morphometric parameters of the acetabulum are essential to orthopaedic surgeons for planning before acetabulum surgery and selection of appropriate size acetabular components during total hip arthroplasty. The present study was designed to establish data on different morphometric parameters of the acetabulum in the adult Bangladeshi population and to determine differences in these parameters between males and females.

Materials and methods: The study was conducted in the Department of Anatomy, Sir Salimullah Medical College, Dhaka from July 2020 to June 2021 on the anteroposterior radiographs of the pelvis of 70 adult Bangladeshi people age ranging from 25-45 years. Acetabular width and acetabular depth were measured unilaterally from the left side on the radiographs with MB ruler software. Then acetabular quotient was calculated. Comparison of the parameters between adult Bangladeshi males and females was done by unpaired student's t-test.

Results: The mean acetabular width of male and female were 66.69 ± 3.49 mm and 60.19 ± 4.20 mm respectively; the mean acetabular depth of male and female were 20.47 ± 2.67 mm and 19.15 ± 2.92 mm respectively and the acetabular quotient of male and female were 305.09 ± 31.59 and 313.97 ± 31.84 respectively.

Conclusion: In the present study mean acetabular width was significantly higher in males while mean acetabular quotient was higher in females and the difference was significant.

Keywords: morphometry, acetabulum

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Introduction

The acetabulum is the hemispherical cavity on the lateral surface of the hip bone that articulates with the spheroidal femoral head to form the hip joint. The acetabular labrum is a fibrocartilaginous rim that attaches to the acetabular margin and deepens

the acetabular socket. More than half of the femoral head is covered by acetabulum. This configuration makes the hip joint stable and allows a full range of movement.¹

Abnormalities in the depth, diameter, and orientation of the acetabulum may cause hip dysplasia and pincer femoroacetabular impingement.² In hip dysplasia, the acetabular roof is underdeveloped, vertically oriented, and shallow resulting in a smaller surface area for weight bearing. Therefore, there is much force per unit surface area while walking which may cause early degeneration of the hip joint.³ However, pincer femoroacetabular impingement is related to the increased acetabular depth and over-coverage of the femoral head.⁴

'Morphometry' comes from the Greek word 'morphe' which means 'shape or form' and 'metria' means

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measurement. Morphometry is a branch of anthropometry that deals with the study of the size, and shape of the components of biological forms and their variations in populations.⁵

Morphometry of acetabulum is important to anatomists, radiologists, clinicians, orthopaedic surgeons, and forensic experts. Different radiographic measurements of the acetabulum in a normal population will help radiologists and clinicians diagnose hip dysplasia and other hip joint related diseases. Radiological evaluation of acetabulum is necessary to orthopaedic surgeons for proper surgical planning before acetabulum osteotomy and selection of appropriate size acetabular cup during total hip replacement surgery.⁶ Moreover, morphometric parameters of the acetabulum will assist the prosthetists in designing population-specific hip joint implants and prostheses.

The acetabulum is smaller and shallower in females compared to males.¹ The differences in the morphometric parameters of the acetabulum between males and females will help forensic experts in determining sex.⁷

Morphometry of acetabulum was studied in different countries by many researchers. Previous studies showed that morphometric parameters of the acetabulum were influenced by age, sex, level of activity, race, ethnicity, and social customs of a person.⁸ As there is no published article on morphometry of the acetabulum in Bangladesh, the present study was done on the plain digital anteroposterior radiograph of the pelvis on a cross-section of adult Bangladeshi population to determine morphometric parameters of the acetabulum in adult Bangladeshi population.

Materials and methods

This was a cross sectional analytical type of study carried out in the Department of Anatomy, Sir Salimullah Medical College, Dhaka from July 2020 to June 2021 on 70 adults Bangladeshi (35 males and 35 females) people, age ranging from 25-45 years advised by their physicians to take plain digital radiographs of the pelvis. Informed consent was obtained from every study subject with an explanation

of the purpose and nature of the study. The radiographs of the pelvis in which the hip joints were reported as normal were collected. The sample was collected by a convenient sampling method. After proper magnification and resolution, morphometric parameters of the acetabulum were measured unilaterally from the left side with MB ruler software. The acetabular quotient was calculated. Comparison of different parameters of the acetabulum between adult Bangladeshi males and females was done by unpaired student's t-test.

Procedure for measuring morphometric parameters of the acetabulum:

Acetabular width (AW) (Fig.-1):

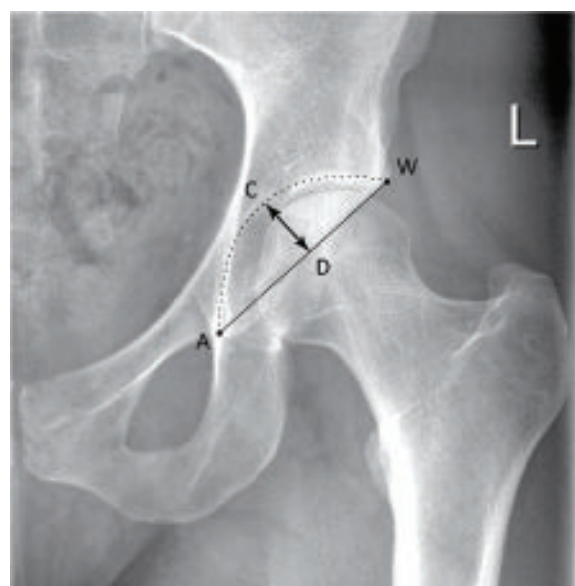


Fig.-1: Plain digital radiograph of pelvis AP view showing measurement of acetabular width (AW) and acetabular depth (CD) of the left hip joint, A-inferior point of acetabular teardrop, W- lateral edge of acetabulum, C- center point of acetabular dome, D- midpoint of acetabular width

It is the distance from the inferior point of the acetabular teardrop to the lateral margin of the acetabular rim.⁹ To measure the acetabular width of the left hip joint on the plain digital radiograph of pelvis AP view, the inferior point of the acetabular teardrop and lateral point of the acetabular rim were identified and marked. The linear distance between

the marked points was measured by MB ruler software and recorded on the datasheet.

Acetabular depth (AD) (Fig.-1):

Acetabular depth is measured as a perpendicular line from the midpoint of the acetabular width to the acetabular dome.⁹ To measure the acetabular depth of the left hip joint on the plain digital radiograph of pelvis AP view, a perpendicular line was drawn from the midpoint of acetabular width to the acetabular dome, and the length of this line was measured by MB ruler software and recorded on the datasheet.

Procedure for calculating acetabular quotient (AQ)

The acetabular quotient assesses the relationship of the depth of the acetabulum to its width. It is determined by dividing the depth of the acetabulum by the width of the acetabulum and then multiplied by 1000.⁹

$$AQ = \frac{AD}{AW} \times 1000$$

Ethical clearance:

The study was approved by the Ethical Review Committee of Sir Salimullah Medical College, Dhaka.

Results

Acetabular width (AW)

In males, the mean±SD of acetabular width (AW) was 66.69±3.49 mm and the range was 56.56- 72.58 mm. In females, the mean±SD of acetabular width (AW) was 60.19±4.20 mm and the range was 52.94- 69.61 mm. Mean acetabular width was significantly (p=0.000) higher in males compared to females.

Acetabular depth (AD)

In males, the mean±SD of acetabular depth (AD) was 20.47±2.67 mm and the range was from 15.92 mm to 27.57 mm. In females, the mean±SD of acetabular depth (AD) was 19.15±2.92 mm and the range was from 14.43 mm to 29.45 mm. No significant difference was found in mean acetabular depth (AD) between males and females (p=0.083).

Acetabular quotient (AQ)

In males, mean±SD of acetabular quotient (AQ) was 305.09±31.59 and it ranged from 248.51 to 390.73. In females, mean±SD of the acetabular quotient (AQ) was 313.97±31.84 and it ranged from 242.48 to 385.07. The mean acetabular quotient (AQ) was significantly (p=0.046) higher in females than males.

Table I
Acetabular width (mm) and acetabular depth (mm) in male and female (N = 70)

Variables (in mm)	Male (n = 35) Mean ± SD (range)	Female (n = 35) Mean ± SD (range)	P value
Acetabular width	66.99 ± 3.49 (56.56- 72.58)	60.19 ± 4.20 (52.94- 69.61)	0.000*
Acetabular depth	20.47 ± 2.67 (15.92 - 27.57)	19.15 ± 2.92 (14.43 - 29.45)	0.083 ^{ns}

Comparison between sex was done by unpaired Student's t-test

*= Significant at P < 0.01 (2 tailed)

ns = Not Significant, P > 0.05

N= Total sample size

n= Sample size in each group

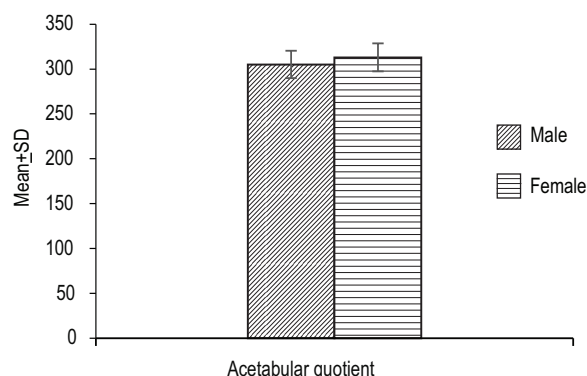


Fig.-2: Bar diagram showing acetabular quotient in males and females (N=70)

Discussion

In the present study, the mean acetabular width was significantly higher ($P < 0.01$) in males than females. The study finding of the present study correlated with the study finding by Zeng et al¹⁰ on the Chinese population and the study finding by Edwards et al¹¹ on European Caucasian, American Caucasian, African American, and Chinese populations.

In the present study, no significant difference ($P > 0.05$) was observed in mean acetabular depth between males and females. A similar study finding was found in a population of North-eastern India¹², Turkey¹³, Iran¹⁴, and Southern China.¹⁰ However, statistically significant gender difference in acetabular depth was found in a population of Southern China¹⁰ and European Caucasian, American Caucasian, African American, and Chinese population.¹¹

In the present study, the mean acetabular quotient (AQ) was significantly higher in females than males ($P < 0.05$). This finding corroborated with the study finding by Edwards et al¹¹ on European Caucasian, American Caucasian, African American, and Chinese populations. Jacobson et al¹⁵ studied this variable without considering sexual variation in the population of Copenhagen city. So, no comparison was possible with the present study.

Conclusion

In the present study, mean acetabular width was significantly higher in males than females, while

mean acetabular depth showed no significant gender differences. Acetabular quotient was significantly higher in females than males.

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