Section: Anatomy

Original Research Article

A RADIOLOGICAL STUDY OF MEASUREMENT OF ACETABULAR DIAMETER AND ACETABULAR DEPTH IN ADULT KASHMIR POPULATION.

Sajad Hamid[1], Rohul Afza Kaloo[2], Mahak Mushtaq Kanyu[3], Mohd Arif Makdoomi[4]

[1] *Associate Professor, Department of Anatomy, SKIMS Medical College, Bemina, Srinagar, India.*
[2]*Assistant Professor, Department of Anatomy, SKIMS Medical College, Bemina, Srinagar, India.*
[3]*Post Graduate, Department of Anatomy, Government Medical College, Srinagar, India.*
[4]*Senior Resident, Department of Anatomy, Government Medical College, Srinagar, India.*

Received *: 02/06/2024*
Received in revised form *: 04/08/2024*
Accepted *: 21/08/2024*

Corresponding Author:
Dr. Mohd Arif Makdoomi,
Senior Resident, Department of Anatomy, Government Medical College, Srinagar, India.
Email: medicalacademyanatomy@gmail.com

DOI: 10.70034/ijmedph.2024.3.80

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2024; 14 (3); 443-446

ABSTRACT

Background: The acetabulum is a part of hip bone which is cup shaped and is contributed by ilium, ischium and pubis. Measurements of acetabulum are important in determining stability of hip joint, assessment of acetabular dysplasia, diagnosing various clinical conditions and monitoring patient's recovery. **Aims:** The aim of the present study was to examine the normal acetabular morphometry and to determine any side and gender variations in the anatomical parameters of the acetabulum.
Material and Methods: 200 normal X-rays of pelvis with bilateral hips of males (100) and females (100) of the age group 20-50 years were used in the present study. For each hip, the acetabular diameter and acetabular depth were measured.
Results: The overall mean value of acetabular diameter in males was found to be 54.1 ± 3.4 mm. The mean values of acetabular diameter in males was found to be 54.3 ± 3.6 mm on the right side, while on the left side it was found to be 53.7 ± 3.3 mm. The overall mean value of acetabular diameter in females was found to be 53.0 ± 3.1 mm. The mean values of acetabular diameter in females was found to be 53.6 ± 3.2 on the right side, while on the left side it was found to be 52.4 ± 3.1 mm. In males, the mean value of acetabular depth on the right side was found to be 12.5 ± 3.3 mm while on the left side it was found to be 12.1 ± 3.1 mm making an average acetabular depth of 12.3 ± 3.2 mm. In case of females, the mean value of the acetabular depth on the right side was found to be 11.4 ± 2.5 mm while on the left side it was found to be 11.2 ± 2.6 mm making an average acetabular depth of 11.3 ± 2.5 mm.
Conclusion: There were significant gender and side variations in Kashmiri population for both the examined anatomical perimeters of acetabulum. Knowledge about the average dimensions of acetabulum will assist in carrying out various surgical procedures like total hip replacement and designing of various prostheses suitably according to need.
Keywords: Acetabulum, hip joint, morphometry, acetabular dysplasia, prostheses.

INTRODUCTION

The hip joint is a synovial joint of ball and socket variety. The femoral head articulates with the cup-shaped acetabulum.[1] Acetabulum is a cup shaped deep concavity facing laterally and anteroinferiorly. All the three parts of hip bone constitute to it as follows: Pubis ¬¬- its anterior 1/5th, Ischium - little more than its posterior 2/5th and Ilium - little less than its superior 2/5th.The acetabular margin is deficient inferiorly to form a notch called acetabular notch. Margin of acetabulum provides attachment to labrumacetabulare which bridges the acetabular notch as transverse acetabular ligament and converts the notch into a foramen called acetabular foramen. It has a horseshoe shaped articular surface (lunate

surface) and non-articular central acetabular fossa. Lunate surface is covered by hyaline cartilage while acetabular fossa lodges a pad of fat.[2] There has been continuous demand from the orthopedic surgeons for the proper implant formation for the patients who need hip joint replacements mainly cement less femoral stem. Thus proper knowledge of the anatomical parameters of the bony components of the hip joint is very essential as it will lead to better understanding of various clinical conditions and their treatment.[3,4] In surgeries around the hip joint It is important to know the anatomical landmarks and the length of screws that can be placed at various points of acetabulum so as not to damage the presence of neurovascular structures in the nearby surroundings.[5] There can be morphometric variations in different populations which results from ethnic, gender and racial differences.[6]

Aims: The aim of the present study was to examine the normal acetabular morphometry and to determine any side and gender variations in the anatomical parameters of the acetabulum.

MATERIAL AND METHODS

The present study was conducted in the Department of Anatomy in collaboration with the Department of Radiodiagnosis and Imaging,. Proper ethical clearance was taken from institutional committee under number IEC/1422/2023/38 . 200 normal X-rays of pelvis with bilateral hips of males (100) and females (100) of the age group 20-50 years were used in the present study. For each hip, the acetabular diameter and acetabular depth were measured.

Inclusion Criteria

1. Patients complaining of pain in hip, who had no joint pathology defined on the basis of radiological examination.
2. Patients of age group 20-50 years.
3. Patients without any deformity of hip joint.

Exclusion Criteria

1. Patients having history of pathologies like Osteoarthritis, Tuberculosis, Fractures around hip joint.
2. Patients having history of surgical intervention on proximal femur, acetabulum or pelvis.
3. Patients who did not have the radiographs with appropriate technique.

Technique of x-ray

Radiological measurements used in the present study were obtained from the standard pelvic radiographs. The anteroposteriorview of radiographs were used, while the patient was in supine position and both the lower limbs internally rotated at 15 º. The film focal distance of these radiographs was 1.2 metres. The mid-point between the two anterior superior iliac spines and upper boundary of symphysis pubis was used for centralization.

The acetabular diameter was measured as the line joining the lateral margin of the acetabular roof and upper corner of pubis (Figure 1).[7] The acetabular depth was defined as the greatest perpendicular distance from the acetabular roof to the line joining the lateral margin of the acetabular roof and the upper corner of the pubis on the same side (Figure 2).[8]

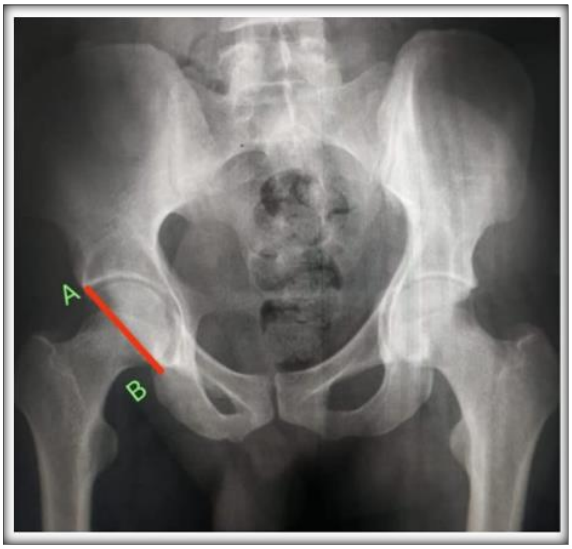

Figure 1: Showing acetabular diameter (AB)

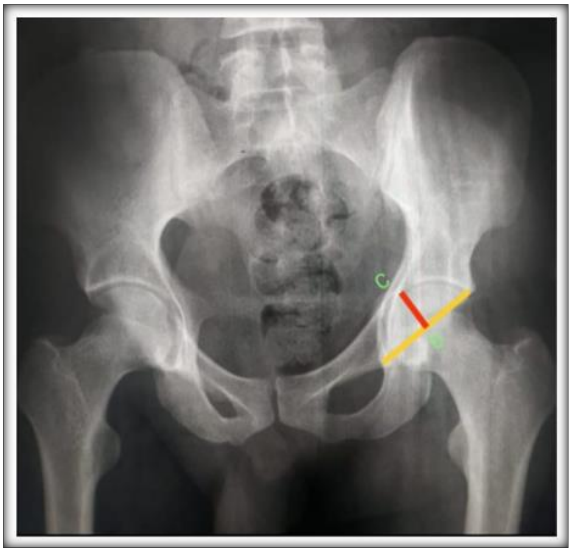

Figure 2: Showing acetabular depth (CD)

RESULTS

Following observations were made in this study. 200 normal X-rays of pelvis with bilateral hips of males (100) and females (100) of the age group 20-50 years were used in the present study.

Table 1 shows that the overall mean value of acetabular diameter in males was found to be 54.1 + 3.4 mm. The overall mean value of acetabular diameter in females was found to be 53.0 + 3.1 mm. In males the overall mean value of acetabular depth was found to be 12.3 + 3.2 mm and the overall mean

value of acetabular depth in females was 11.3 + 2.5mm. [Table 1]

Table 2 shows that the mean values of acetabular diameter in males was found to be 54.3 + 3.6 mm on the right side, while on the left side it was found to be 53.7 + 3.3 mm. The mean values of acetabular diameter in females was found to be 53.6 + 3.2 mm on the right side, while on the left side it was found to be 52.4 + 3.1 mm. [Table 2]

Table 3 shows that in males, the mean value of acetabular depth on the right side was found to be 12.5 + 3.3 mm while on the left side it was found to be 12.1 + 3.1 mm. In case of females, the mean value of the acetabular depth on the right side was found to be 11.4 + 2.5 mm while on the left side it was found to be 11.2 + 2.6 mm. [Table 3]

Table 1: Showing Average Values of Acetabulum Diameter and Depth in Males and Females

Gender	Acetabulum Diameter	Acetabulum Depth
MALES	**54.1 ± 3.4mm**	**12.3 ± 3.2mm**
FEMALES	**53.0 ± 3.1mm**	**11.3 ± 2.5mm**

Table 2: Showing Side Variations of Acetabulum Diameter in Males and Females

Gender	Right Side	Left Side
MALES	**54.3 ± 3.6mm**	**53.7± 3.3mm**
FEMALES	**53.6 ± 3.2mm**	**52.4 ± 3.1mm**

Table 3: Showing Side Variations of Acetabulum Depth in Males and Females

Gender	Right Side	Left Side
MALES	**12.5 ± 3.3mm**	**12.1 ± 3.1mm**
FEMALES	**11.4 ± 2.5mm**	**11.2 ± 2.6mm**

DISCUSSION

The morphometry of hip joint is of paramount importance in diagonosing various clinical conditions like osteoarthritis. It helps orthopedicians to get suitable prosthesis and in early detection of disputed gender by forensic experts. Knowledge about the diamentions of acetabulum will help in designing suitable prosthesis.[9] Radiolgical study on the acetabulum have been done by different authors in different parts of the worlds. Variations have been reported in the various dimensions of the acetabulum worldwide and these variations are because of genetics, lifestyle, race. Evaluations of dimensions of hip joint is necessary for pre-operative planing inorder to estimate the size of the acetabular cup in the surgical procedures on the acetabulum, especially in total hip replacement surgery. The prensent study which aimed to measure acetabular diamensions on x-rays in our region and compare it with the study available and to find if any differences are there.

In our study it was found that the acetabular diameter was more on the right side as compared to that of left side while acetabular diameter was found to be higher in case of males as compared to that of females. The study conducted by Sindhu K S et al,[7] also showed that the males are having more acetabular diameter as compared to that of females. The mean values of acetabular diameter in males was found to be 54.3 + 3.6mm on the right side, while on the left side it was found to be 53.7 + 3.3 mm. The overall mean value of acetabular diameter in females was found to be 53.0 + 3.1 mm. The mean values of acetabular diameter in females was found to be 53.6 + 3.2 on the right side, while on the left side it was found to be 52.4 + 3.1 mm. Ma H et al,[10] and Yiming et al,[11] conducted studies on chinese population and found that the acetabular diameter was more on the right side as compared to that of left side while acetabular diameter was found to be higher in case of males as compared to that of females. These findings are consistent with our study.

In males, the mean value of acetabular depth in our study on the right side was found to be 12.5 + 3.3 mm while on the left side it was found to be 12.1 + 3.1 mm making an average acetabular depth of 12.3 + 3.2 mm. In case of females, the mean value of the acetabular depth on the right side was found to be 11.4 + 2.5 mm while on the left side it was found to be 11.2 + 2.6 mm making an average acetabular depth of 11.3 + 2.5 mm. Thus the mean values of acetabular depth was found to be greater in males in compared to that of females while on the right side the values were found to be more than that of the left side. The values of our study corroborates with the study of Genser Strobl et al,[12] and Jermic D et al,[13] who also found that the males have more acetabular depth as compared to that of females.

CONCLUSION

Proper knowledge about the acetabular diamensions is important to understand the biomechanics of hip joint. The values of acetabular depth and acetabular diameter were found to be more in males as compared to that of females, the values were found to be more on the right side as compared to that of left side. There are significant differences in acetabular diamensions between Indian and the people of other countries. In India the morphometric parameters varies from reigon to reigon. Thus this study can be useful for diagonosing various clinical

conditions and for designing prosthesis for total hip replacement.

Role Of Each Author

Dr. Sajad Hamid: Led the study's design and conceptualization, overseeing the research process and providing overall guidance.

Dr. Rohul Afza Kaloo: Handled manuscript writing and literature review, drafting the paper and situating the study within existing research.

Dr. Mahak Mushtaq Kanyu: Conducted data analysis and statistical evaluation, interpreting the results and validating the study's findings.

Dr. Mohd Arif Makdoomi: Managed data collection and radiological analysis, ensuring accurate measurement of acetabular dimensions.The corresponding author manages manuscript submission and communication with the journal, addresses reviewers' comments, ensures proper authorship and ethical compliance, handles publication proofs, and deals with post-publication inquiries

Each author made critical contributions aligned with their expertise, justifying their roles .

REFERENCES

1. Gray H. Pelvic girdle, gluteal region, thigh and hip joint. In: Standring S, Borley NR, Collins P, Crossman AR, Gatzoulis MA, Healy JC, et al (editoris). Gray's Anatomy: the anatomical basis of clinical practice. 40th edition, London: Churchill Livingstone Elsevier; 2008. pp.1349-92.
2. Faruqi N A. Human Osteology (A Clinical Orientation), 2ndEdition 2000, CBS Publishers Pvt. Ltd.pp.107-26.
3. Siwach RC, Dahiya S. Anthropometric study of proximal femur geometry and its clinical application. Indian J Orthop. 2003:37247–51.
4. Najjar EI, McWilliams ER. Forensic anthropology: The structure, morphology and variations human bone and dentition. Springfield, IL: Charles C Thomas; 1978
5. Pathrot D, Ul Haq R, Aggarwal AN, Nagar M, Bhatt S. Assessment of the geometry of proximal femur for short cephalomedullary nail placement: An observational study in dry femora and living subjects. Indian J Orthop. 2014; 50:269–76.
6. Rawal B, Ribeiro R, Malhotra R, Bhatnagar N. Anthropometric measurements to design best-fit femoral stem for the Indian population. Indian J Orthop. 2012; 46:46–53.
7. Sindhu K S, Shubha R. Study of acetabular depth, diameter and acetabular depth ratio of hip joint of south indian population. Journal of Cardiovascular Disease Reasearch. 2024;15(03):1235-1244.
8. Antoniades L, Spector TD, Macgregor AJ. The genetic contribution to hip joint morphometry and relationship to hip cartilage thickness. Osteoarthritis Cartilage 2001; 9(6): 593–5.
9. Ornetti, P.; Maillefert, J.F.; Paternotte, S.; Dougados, M.; Gossec, L. Influence of the experience of the reader on reliability of joint space width measurement. A crosssectional multiple reading study in hip osteoarthritis. Joint Bone Spine 2011, 78, 499–505.
10. Ma H, Han Y, Yang Q, Gong Y, Hao S, Li Y, Liu J. Three-dimensional computed tomography reconstruction measurements of acetabulum in Chinese adults. Anat Rec (Hoboken). 2014 Apr;297(4):643-9.
11. Yiming Zeng,1 You Wang,1 Zhenan Zhu,1 Tingting Tang,1 Kerong Dai1 and Shijing Qiu, Differences in acetabular morphology related to side and sex in a Chinese population, J. Anat. (2012) 220, pp256–26
12. Genser-Strobl B, Sora MC. Potential of P40 plastination for morphometric hip measurements. Surg Radiol Anat 2005;27(2): 147–51.
13. Jermic D, Macuzic I Z, Vulovic M. Sex differences in anatomical parameters of acetabulum among asymptomatic Serbian population. Vojnosanit Pregl 2011; 68(11): 935–939.