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## X-ray based measurement of acetabular diameter in Kashmiri population of Asiatic region: A tertiary care study

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### Abstract

The acetabulum derives its name from its resemblance to a shallow Roman vinegar cup. Measurements of the acetabulum are crucial in diagnosis, monitoring patient recovery, determining stability of the hip joint and in assessment of acetabular dysplasia. The decision for operative treatment is often based on different radiographic measurements and scores for which normal values are defined. Geometrical measurements of acetabulum differ with respect to age, sex, and race and even within regions. The size, shape and depth of the acetabulum are variable as reported by Govsa F *et al.*, Therefore, the knowledge of various parameters of acetabulum would be helpful in performing surgical procedures such as acetabular reconstruction and planning reorientation procedures using spikes and screws for fixation.

**Keywords:** Total hip arthroplasty, Lower socio economic status, complications, functional outcome

### Introduction

The acetabulum derives its name from its resemblance to a shallow Roman vinegar cup. The acetabulum forms from the coalescence of three ossification centers (collectively called the 'triradiate cartilage'): ilium, pubis and ischium. The triradiate cartilage gives rise to the anterior wall, posterior wall and the dome of the acetabulum. The triradiate cartilage subsequently closes between ages 14 to 16. The acetabulum has an average diameter of  $52 \pm 4$  mm. Males tend to have larger diameters compared to females. Average anteversion of the native acetabulum measures 16 to 21 degrees with an average inclination of 48 degrees. Males tend to have less anteversion than females. The transverse acetabular ligament, located inferiorly, connects the anterior and posterior walls of the acetabulum forming a tension band against deformation of the wall from force transmission. The acetabulum is supported by two strong columns of bone. The anterior and posterior columns connect the acetabulum to the pelvis and allow force transmission between the trunk and the lower extremity.

The acetabular fossa is a central cavity containing the ligamentum teres and a fat pad called pulvinar. The ligamentum teres connects the acetabulum to the fovea of the femoral head. It has been hypothesized to be a pain generator and instrumental in synovial fluid distribution and stability. The labrum, which arises from the limbus, is a ring of connective tissue surrounding the outer edge of the acetabulum.

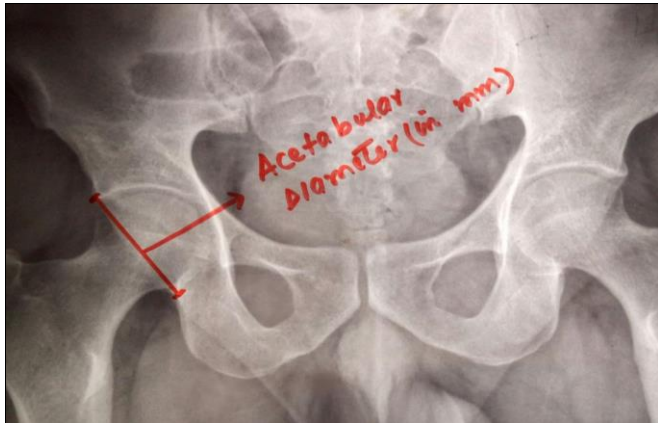
### Materials and methods

The study was conducted in Government Medical College Srinagar from September 2017 to October 2018 on the pelvic radiographs of 300 patients. All age groups of the patients who had undergone for pelvic x-ray AP view routinely for their clinical indication with radiologically normal x-rays were included in the study. These pelvic radiographs were obtained using the standardised protocol: in 15-30 degrees of internal rotation of the hips in the supine position with a film-focus distance of 100 cm and the beam centered on the symphysis pubis. The magnification power of x-ray machine was kept 54%. The values were calculated by multiplying by factor 1.85.

The observations and measurements were made with regards to acetabular diameter. All other data like age, sex, presenting complaints were being collected from available records at the

Medical records department. This collected data was tabulated and analysed. Appropriate statistical technique was applied and help of statistician was sought to find out prevalence and significance of any apparent association based on type of data available. Data was distributed normally with the help of statistician of our medical college for comparison of genders.

**Acetabular Size**



**Fig 1:** showing acetabular size measurement

**Inclusion Criteria**

All age groups who had gone to get an x-ray of pelvis for any clinical indication on routine basis in OPD/EMERGENCY/WARD in the Department of Orthopaedics of Govt. Medical College Srinagar were included in the study.

**Exclusion Criteria**

Radiographs of patients with osteoarthritis, metabolic diseases, hip fractures and pathological (metastatic) hip fracture were excluded from the study.

**Statistical Analysis**

Appropriate statistical technique was applied to find out prevalence and significance of any apparent association based on type of data available.

**Observations**

The following observations were made in this study. We included 300 radiographs of pelvis in this study. 160 belonged and 140 were females.

**Table 1:** Total number of males and females

Sex	No. of x-rays
Male	160
Female	140

**Table 2:** Age wise distribution

Age Group	No. of Males	No. of Females	Total
10-20	19	09	28
21-30	35	31	66
31-40	45	35	80
41-50	31	31	62
51-60	20	20	40
61-70	10	14	24
	160	140	300

The mean acetabular size in males was 59.94± 0.85 mm (40-74). The mean acetabular size in females was 59.72± 1.15 mm (52-70). The difference in the mean acetabular size of males

and females was found to be statistically insignificant (p value is 0.05).

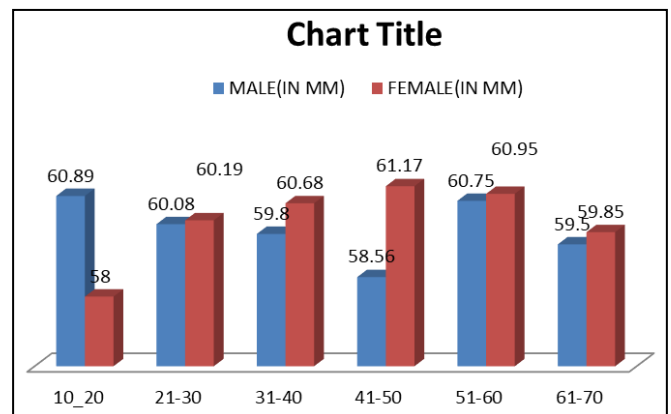
**Table 3:** Observation of acetabular diameter age and sex wise

Age Group (Years)	Male (In Mm)	Female (In Mm)
10-20	60.89(50-69)	58(52-66)
21-30	60.08(45-74)	60.19(52-70)
31-40	59.80(44-69)	60.68(54-68)
41-50	58.56(40-74)	61.17(54-70)
51-60	60.75(42-74)	60.95(54-70)
61-70	59.50(56-65)	59.85(54-66)
Average	59.94 (40-74)	59.72 (52-70)

**Table 4:** Distribution according to acetabular diameter

	N	Mean	SD
Male	160	59.94	0.85
Female	140	59.72	1.15

N = No of observations, Sd = Standard deviation



**Fig 2:** Showing acetabular diameter in males and females

**Discussion**

The studies on acetabular diameter have been done in different authors in different parts of the world. Variations in acetabular diameter has been found and this can be attributed to varying level of activity, genetics, race, diet and lifestyle. Despite lot of research in the anatomic and biomechanical factors which influence the modality of treatment of orthopaedics conditions, consideration of acetabular diameter has gained less importance in assessment of hip biomechanics and preoperative planning and templating of hip surgeries. Present study was aimed to measure hip joint anthropometry radiologically in our region and compare it to the studies available and to find if any difference exists. We measured acetabular size on standard AP view radiograph of people attending our hospital who required pelvis radiograph with otherwise normal hip joints.

It is necessary to evaluate the diameter of the acetabulum as part of the preoperative planning in order to estimate the size of the acetabular cup in the surgical procedure of the acetabulum, especially in total hip arthroplasty. The measurement of the acetabular diameter was performed in the anteroposterior view of the pelvic radiograph, and the commercial template is routinely used to solve the magnification problem and to estimate the size of the acetabulum and the prosthesis. The acetabular diameter in our study was 59.84mm, for males it was 59.94mm and for females it was 59.72mm. Comparing with studies from Thailand, Bavornrt Chukpaiwong and Nam Chai had 54.29mm and 51.82mm respectively. In a cadaveric study from USA by Munif A Hatem in skeletons from Cleveland

Museum, the acetabular diameter was found 51mm in males and 45.53 in females. This difference may be due to racial diversity in various skeletons of Museum.

**Table 5:** Showing comparison of acetabular diameter in different studies

Study	Acetabular diameter (in mm)
Bavornrt Chukpaiwong	54.29
Nam Chai	51.82
Munif A Hatem	51 in males / 45.53 females
Present study	59.84

Overall our results are comparable to most of the studies consisting of identical ethnicity population. The differences observed in acetabular diameter measurement obtained may be due to some being directly obtained from the dry bones while others from radiological studies of patients and radiographic examination in dry femurs and there may be some differences among observers also.

### Summary and conclusion

This study concludes that there are no significant differences in acetabular diameter among north Indian population compared to ethnically similar populations. Significant differences exist between Indian and European and African anthropometry. Within Indian population also, the anthropometric parameters vary from region to region, hence this study may be useful for designing the total hip prosthesis among the Indian population. Awareness of the average dimensions of the acetabulum and femoral head will assist prosthetists in designing a suitable prosthesis according to the need of a particular individual.

However our study was small with only 300 persons. A large multicentric study is needed to confirm our results.

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