

Original Research Article

Morphometric Study Of Hip Joint Space Width In Plain Radiographs Of Adult Kashmiri Population And Its Clinical Implications

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ABSTRACT

Introduction:The knowledge about the hip joint space width which is formed between the head of femur and acetabulum is essential for radiological practice in identifying the pathologies of hip joint like osteoarthritis and in orthopaedic surgeries.

Aim:Determination of mean values of hip joint space width.

Materials and Methods:Normal plain radiographs of pelvis with bilateral hip joints – AP view of both males and females between the 20 to 50 years of age were used for study. A total of 200 x-rays (100 males and 100 females) were included in the study.

Inclusion criteria: a) Patients complaining of pain in hip, who had no joint pathology defined on the basis of radiological examination. b) Patients of age group 20-50 years.c)Patients without any deformity of hip joint. **Exclusion criteria:**a)Patients having history of pathologies like Osteoarthritis, Tuberculosis, Fractures around hip joint. b) Patients having history of Surgical intervention around this area.

Observations:All the 200 xrays belonged to adult (20 to 50 years) population.The overall mean hip joint space width of all the 200 subjects on the right side was 4.44 ± 1.18 mm. The overall mean hip joint space width of all the 200 subjects on the left side was 3.97 ± 0.91 mm. The overall mean hip joint space width at the superolateral margin of all the 100 males was found to be 4.95 ± 1.25 mm on the right side while on the left side it was found to be 4.27 ± 1.00 mm. The overall mean hip joint space width at the superolateral margin of all the 100 females was found to be 4.65 ± 1.32 mm on the right side while on the left side it was found to be 4.06 ± 0.93 mm. The overall mean hip joint space width at the apical region of all the 100 females was found to be 4.33 ± 1.10 mm on the right side while on the left side it was found to be 3.81 ± 0.93 mm . The overall mean hip joint space width at the apical region of all the 100 males was found to be 4.52 ± 1.25 mm on the right side while on the left side it was found to be 4.08 ± 0.90 mm. The overall mean hip joint space width at the superomedial margin of all the 100 females was found to be 4.03 ± 1.03 mm on the right side while on the left side it was found to be 3.67 ± 0.84 mm. The overall mean hip joint space width at

the superomedial margin of all the 100 males was found to be $4.19 \pm 1.13\text{mm}$ on the right side while on the left side it was found to be $3.93 \pm 0.86\text{mm}$.

Conclusion: The results calculated provides important information regarding gender and side variations of hip joint space width for the radiologists, orthopaedic surgeons and anatomists. Radiological knowledge of hip joint space width will help the orthopaedicians in diagnosis and treatment of various clinical conditions like osteoarthritis. The data thus obtained can be used as a baseline for further studies in the departments of Anatomy, Radiodiagnosis and Orthopaedics.

Keywords: Acetabulum, Head of femur, Hip joint space width.

INTRODUCTION

The weight bearing joints of the lower limb are more stable. Hip joint allows the same movements as the mobile shoulder joint, but the range of movements is restricted(1). Hip joint is very important joint in the body owing to its stability and multi-axial nature. Its importance is increased as it may get involved in numerous pathologies and traumatic conditions like fracture neck of femur and dislocation of hip which are very common conditions particularly in elderly. These conditions, if not properly diagnosed and treated may lead to various complications which in turn can cause decrease in its range of motion, leading to impairment and disability. e.g, fracture neck of femur if not diagnosed and treated properly it may lead to mal-union or non-union which can cause limping. The knowledge about different diameters of head and different dimensions of neck of femur is essential in orthopaedic surgery, for radiological practice in identifying pathology of bone and also for determining age (2).

The hip joint is a synovial joint of ball and socket variety.

Articular surfaces:

The femoral head articulates with the cup-shaped acetabulum, its centre lying a little below the middle third of the Inguinal ligament. The profile of the anterior margin of the joint is parallel to the middle third of the Inguinal ligament. The articular surfaces are reciprocally curved but neither co-extensive nor completely congruent. The close packed position of the hip joint is one of the full extension, with slight abduction and medial rotation. Evidences appear to suggest that the articular surface of the femoral head is spheroidal or slightly ovoid in youth, but that it tends to become almost spherical with advancing age. The femoral head is covered by articular cartilage, except over the rough pit (fovea capitis) where the ligamentum teres is attached. In front, the cartilage extends laterally over a small area on the adjoining neck. Articular cartilage is generally thicker in centre than in the periphery. Cartilage thickness is maximal anterosuperiorly in the acetabulum and anterolaterally on the femoral head, the two areas that corresponds to the principal load bearing areas within the joint. (3)

Acetabulum:

A cup shaped deep concavity facing laterally and anteroinferiorly. All the three parts of hip bone constitute to it as follows:

Pubis - its anterior $1/5^{\text{th}}$

Ischium - little more than its posterior $2/5^{\text{th}}$ and

Ilium - little less than its superior $2/5^{\text{th}}$.

The acetabular margin is deficient inferiorly to form a notch called acetabular notch. Margin of acetabulum provides attachment to labrum acetabulare 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 (4). The upper end of femur includes the head, the neck, the greater trochanter, the lesser trochanter, the intertrochanteric line and the intertrochanteric crest. There may be anatomical variations present in proximal femur depending on gender, races, age and genetic structure (5).

Head:

The head is articular, forms $2/3^{\text{rd}}$ of a sphere and fits as a ball in the acetabular socket to form hip joint. It is covered by articular hyaline cartilage, except near its centre where a pit or fovea exists for the attachment of ligamentum teres femoris(6).

Hip joint space width: It is the interbone area on the radiograph between the roof of hip joint which is formed by acetabulum and the upper part of femoral head facing acetabulum (7).

Aims and objectives:

Determination of mean values of hip joint space width.

Materials and methods:

The present study was conducted in the Department of Anatomy, Government Medical College, Srinagar. Normal plain radiographs of pelvis with bilateral hip joints – AP view were used for study of both males and females between the 20 to 50 years of age. A total of 200 x-rays (100 males and 100 females) were included in the study.

Inclusion criteria:

Plain radiographs of pelvis with bilateral hip joints - AP view of following patients were included in the study:

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.

Instruments used: Marker, Vernier Caliper

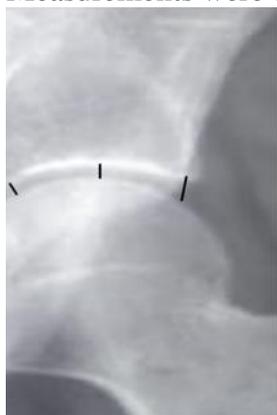


METHODS:

Hip joint space width was measured at 3 sites :(Lequesne M etal2004).

1. Superolateral
2. Apical
3. Superomedial

Measurements were done with the help of marker and vernier caliper.



RESULTS:

The present study was conducted in the Department of Anatomy, Government Medical College Srinagar, J&K, India. In our present study the radiographs were taken in digital format. The data was analysed both separately and compared with other side in both the sexes and summarized in the tables separately.

Sex	Frequency	Percent
Female	100	50.0
Male	100	50.0
Total	200	100.0

Table 1: Showing gender distribution of study population.

The table 1 shows gender distribution of study population. A total of 200 x-rays were included in the study, 100 males (50 percent) and 100 females (50 percent)

Age in Years	Frequency	Percent
≤30.0	54	27.0
31.0 - 40.0	69	34.5
41.0+	77	38.5
Total	200	100.0
MEAN + SD = 37.3 ± 8.47 Years		

Table 2: Showing age distribution of study population.

The table 2 shows age distribution of study population. All the 200 x-rays belonged to adult (20-50 years) population. Of the age less than or equal to 30 years, there were 54 x-rays contributing 27 percent of the total x-rays. Similarly, age group 31-40 years, there were 69 x-rays, making 34.5 percent of total x-rays. Age group 41-50 years, there were 77 x-rays, making 38.5 percent of the total x-rays. The mean age of study under population was 37.3 years ± 8.7 years.

Side	Number	MeanJSW (MM)	S.D
RT Side	200	4.44	1.18
LT Side	200	3.97	0.91

Table 3: Showing Overall Mean JSW and Standard Deviation In 200 Subjects.

The table 3 shows that the mean JSW of all the 200 x rays on the right side was 4.44 mm with the standard deviation of 1.18 mm. While on the left side it was 3.97 mm with the standard deviation of 0.91mm.

Gender	Number	Right (JSW)	Left (JSW)
Female	100	4.65 ± 1.32mm	4.06 ± 0.93mm
Male	100	4.95 ± 1.25mm	4.27 ± 1.00mm

Table 4 : Showing Gender Variation Of Mean Hip Joint Space Width At The Superolateral Margin

The table 4 shows the overall mean hip joint space width at the superolateral margin of all the 100 females was found to be 4.65 ± 1.32 mm on the right side while on the left side it was found to be 4.06 ± 0.93 mm. The overall mean hip joint space width of all the 100 males was found to be 4.95 ± 1.25 mm on the right side while on the left side it was found to be 4.27 ± 1.00 mm.

Gender	Number	Right JSW	Left JSW
Female	100	4.33± 1.10mm	3.81 ± 0.93mm
Male	100	4.52± 1.25mm	4.08 ± 0.90mm

Table 5 : Showing Gender Variation Of Mean Hip Joint Space Width At The Apical Region

The table5 shows the overall mean hip joint space width at the apical region of all the 100 females was found to be 4.33 ± 1.10mm on the right side while on the left side it was found to be 3.81 ± 0.93mm . The overall mean hip joint space width of all the 100 males was found to be 4.52 ± 1.25mm on the right side while on the left side it was found to be 4.08 ± 0.90mm

Gender	Number	Right JSW	Left JSW
Female	100	4.03 ± 1.03mm	3.67 ± 0.84mm
Male	100	4.19 ± 1.13mm	3.93 ± 0.86mm

Table 6 : Showing Gender Variation Of Mean Hip Joint Space Width At The Superiomedial margin.

The table 6 shows the overall mean hip joint space width at the superomedial margin of all the 100 females was found to be 4.03 ± 1.03mm on the right side while on the left side it was found to be 3.67 ± 0.84mm. The overall mean hip joint space width of all the 100 males was found to be 4.19 ± 1.13mm on the right side while on the left side it was found to be 3.93 ± 0.86mm.

DISCUSSION:

The normal hip joint space width shows large interindividual variability: the SD is close to 1 mm, for a mean value close to 4 mm, depending on the site of measurement; extreme values in our series were 3–5 mm. These values are not far from other published results. In the principal studies, mean (range) JSW values at the apical site (often the only site measured) were 4 (2–7) mm (8), 3.83 to 3.98 (2.2–6.3) mm (9) and 4.33 (2.2–7.5) mm (10). The last of these studies was probably the most reliable, as it used a magnifying glass with 0.01 mm graduations, rather than a simple ruler. A study of 118 normal hips of Turkish subjects, using a dial caliper with 0.02 mm graduations, gave mean values of 3.62 (0.59) mm (11). However, the site of measurement was the JSW at the narrowest point, and supine abdominal radiographs rather than pelvic radiographs were used. In our Study the mean JSW at the Apical region was 4.33 on the Right side in females and 4.52 on Right side in males. The mean JSW at Apical region was 3.81 on Left side in females and 4.08 on the Left side in males.

Using the JSW narrowest point on intravenous urography films, a recent English study showed a similar JSW difference between men (n=257) and women (n=276): 0.34 mm (95% CI 0.24 to 0.44) (12). We confirm that the JSW is larger in men than in women. The mean JSW at the of all

the 200 xrays on the right side was 4.80 mm with the standard deviation of 1.28 mm. While on the left side it was 4.16 mm with the standard deviation of 0.96mm. The overall mean hip joint space width at the superolateral margin of all the 100 females was found to be 4.65 ± 1.32 mm on the right side while on the left side it was found to be 4.06 ± 0.93 mm. The overall mean hip joint space width at the superolateral margin of all the 100 males was found to be 4.95 ± 1.25 mm on the right side while on the left side it was found to be 4.27 ± 1.00 mm. The overall mean hip joint space width at the superomedial margin of all the 100 females was found to be 4.03 ± 1.03 mm on the right side while on the left side it was found to be 3.67 ± 0.84 mm. The overall mean hip joint space width at the superomedial margin of all the 100 males was found to be 4.19 ± 1.13 mm on the right side while on the left side it was found to be 3.93 ± 0.86 mm.

The minimal normal hip JSW value is important for epidemiological studies of OA, where a diagnostic cut off point of 2.5 mm is generally used(13) ; this seems appropriate when the JSW is measured at the superolateral site, but the site of measurement is not always mentioned. In our series, the minimal JSW values at the superomedial, apical, and superolateral sites, were seen among females. In our study, all hips with JSW <2 mm were therefore excluded from the analysis of normal values. To define a threshold beneath which the JSW may be considered pathological, one can either choose the minimal value at the appropriate site or adopt the lower normal values, defined as mean – 2SD, that is 2.72, 2.35, and 1.81 mm, respectively, at the three sites. These values were close to the generally used cut off point, except for JSW at the superomedial site, which is rarely considered by itself for setting a limit between normal and pathological JSW. A JSW gradient, with a decline from the superolateral site to the superomedial site, was found in majority of hips in our series. To our knowledge, this JSW gradient has only been mentioned in two previous reports. Reis *et al* measured the JSW at all three sites on pelvic radiographs of 171 healthy subjects, using a magnifying glass with 0.1 mm graduations, and found higher values at the superolateral site than at the apical (“superointermediate”) site, and higher values at the apical site than at the superomedial site (10). In another study of supine pelvic radiographs of 25 healthy men aged 45–65 years, a significant difference was also found between the mean JSW at the superolateral and superomedial sites (4.9 (1) and 4.3 (0.6) mm, respectively) (14).

CONCLUSION:

The results calculated provides important information regarding gender and side variations of hip joint space width for the radiologists, orthopaedic surgeons and anatomists. Radiological knowledge of hip joint space width will help the orthopaedicians in diagnosis and treatment of various clinical conditions like osteoarthritis. The data thus obtained can be used as a baseline for further studies in the departments of Anatomy, Radiodiagnosis and Orthopaedics

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