



Morphometric Study of Hip Joint Space Width On Plain Radiographs with Respect to Following Parameters- Gender, Side and Margins of Hip joint space width

Dr. Shamima Banoo¹, Dr. Mohd. Arif Makdoomi², Dr. Shahid Kaleem³, Dr. Sajad Hamid^{4*}, Dr. Manmeet Kour⁵

¹Assistant Professor Anatomy, Govt. Medical College, Srinagar

²Post MD Senior Resident/Tutor, Anatomy, Govt. Medical College, Srinagar.

³Post MD Senior Resident/Tutor, Anatomy, Govt. Medical College, Srinagar.

^{4*}Associate Professor, Anatomy SKIMS Medical College, Bemina

⁵Assistant Professor Anatomy, Govt. Medical College, Srinagar

*Corresponding Author:-Dr. Sajad Hamid *Associate Professor, Anatomy SKIMS Medical College, Bemina.9469401953, Email:-drsajadk@rediffmail.com

ABSTRACT

Introduction:

The knowledge about the hip space width which is made between the top of femur and acetabulum is important for radiological practice in identifying the pathologies of hip like osteoarthritis and in orthopaedic surgeries. Aim:Determination of mean values of hip 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 aged were used for study. 200 x-rays (100 males and 100 females) were included within the study. Inclusion criteria: a) Patients complaining of pain in hip, who had no joint pathology defined on the idea of radiological examination. b) Patients aged group 20-50 years.c)Patients with no deformity of hip. Exclusion criteria:a)Patients having history of pathologies like Osteoarthritis, Tuberculosis, Fractures around hip. 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 space width of all the 200 subjects on the right side was 4.44 ± 1.18 mm. The general mean hip space width of all the 200 subjects on the left side was 3.97 ± 0.91 mm. The general mean hip 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 had been found to be 4.27 ± 1.00 mm. The general mean hip 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 had been found to be 4.06 ± 0.93 mm. The general mean hip 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 had been found to be 3.81 ± 0.93 mm . The general mean hip 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 had been found to be 4.08 ± 0.90 mm. The general mean hip 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 had been found to be 3.67 ± 0.84 mm. The general mean hip 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 had been found to be 3.93 ± 0.86 mm. Conclusion: The results calculated provides important information regarding gender and side variations of hip space width for the radiologists, orthopaedic surgeons and anatomists. Radiological

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knowledge of hip space width will help the orthopaedicians in diagnosis and treatment of varied clinical conditions like osteoarthritis. The information thus obtained are often used as a baseline for further studies within the departments of Anatomy, Radiodiagnosis and Orthopaedics.

Keywords: Acetabulum, Head of femur, hip space width.

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INTRODUCTION

The weight bearing joints of the lower limb are more stable. Hip allows an equivalent movements as shoulder joint, but the range of movements is restricted(1). Hip is extremely important joint within the body due to its stability and multi-axial nature. Its importance is increased because it may become involved in numerous pathologies and traumatic conditions like fracture neck of femur and dislocation of hip which are quite common conditions particularly in elderly. These conditions, if not properly diagnosed and treated may cause various complications which successively can cause decrease in its range of motion, resulting in impairment and disability. e.g, fracture neck of femur if not diagnosed and treated properly it is going to cause mal-union or non-union which may cause limping. The knowledge about different diameters of head and different dimensions of neck of femur is important in orthopaedic surgery, for radiological practice in identifying pathology of bone and also for determining age (2). The hip is a ball and socket variety of Synovial Joints. Articular surfaces: The femoral head articulates with the cup-shaped acetabulum, its centre lying a touch below the center third of the Inguinal ligament. The profile of the anterior margin of the joint is parallel to the center 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 is one among the complete 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 roofed by articular cartilage, except over the rough pit (fovea capitis) where the ligamentum teres is attached. In front, the cartilage extends

laterally over a little area on the adjoining neck. Articular cartilage is usually thicker in centre than within the periphery. Cartilage thickness is maximal anterosuperiorly within 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 there to as follows: Pubis - its anterior 1/5th, Ischium - little quite its posterior 2/5th and ilium - little but its superior 2/5th. The acetabular margin is deficient inferiorly to make 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 roofed by cartilage while acetabular fossa lodges a pad of fat (4). The upper end of femur includes the top, the neck, the greater trochanter, the lesser trochanter, the intertrochanteric line and therefore the intertrochanteric crest. There could also be anatomical variations present in proximal femur counting on gender, races, age and genetic structure (5). Head: The head is articular, forms 2/3rd of a sphere and fits as a ball within the acetabular socket to make hip. It is covered by articular 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 which is made by acetabulum and therefore the upper a part of femoral head facing acetabulum (7).

MATERIAL AND METHODOLOGY

The present study was conducted within 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 aged. 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 within the study: 1. Patients complaining of pain in hip, who had no joint pathology defined on radiological examination. 2. Patients aged group 20-50 years. 3. Patients with no deformity of hip. **Exclusion criteria:** 1. Patients having history of pathologies like Osteoarthritis, Tuberculosis, Fractures around hip. 2. Patients having history of surgical intervention on proximal

femur, acetabulum or pelvis. 3. Patients who didn't have the radiographs with appropriate technique. Instruments used: Marker, vernier micrometer

METHODOLOGY: Hip joint space width was measured at 3 sites :(Lequesne M etal2004). 1. Superolateral 2. Apical 3. Superomedial .Measurements were done with the assistance of marker and vernier micrometer.

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

Table 1: Showing gender distribution of study population.

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

Based on Table 1, it can be concluded that the study population consists of 100 females and 100 males, with a total of 200 participants. The percentages show that the gender

distribution is evenly split, with females comprising 50% of the sample and males also comprising 50% of the sample.

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Table 2: Showing age distribution of study population.

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%

All the 200 x-rays belonged to adult (20-50 years) population. Of the age but or adequate to 30 years, there have been 54 x-rays contributing 27 percent of the entire x-rays. Similarly, age bracket 31-40 years, there have

been 69 x-rays, making 34.5 percent of total x-rays, age bracket 41-50 years, there have been 77 x-rays, making 38.5 percent of the entire x-rays. The mean age of study under population was 37.3 years + 8.7 years.

Table 3: Showing Overall Mean JSW and variance In 200 Subjects

Side	Number	Mean JSW (mm)	Standard Deviation
Right	200	4.44	1.18
Left	200	3.97	0.91

The table shows the number of measurements taken for each side (Right and Left), the mean joint space width (JSW) in millimeters, and the standard deviation of the JSW measurements for each side.



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

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

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

The table shows the number of measurements taken for each gender (Female and Male), the mean right and left joint space width (JSW) in millimeters, and the standard deviation of the JSW measurements for each side and gender.

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.

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

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

The table shows the number of measurements taken for each gender (Female and Male), the mean right and left joint space width (JSW) in millimeters, and the standard deviation of the JSW measurements for each side and gender.

The table 5 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

The table 6 shows the general mean hip space width at the superomedial margin

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

The table shows the number of measurements taken for each gender (Female and Male), the mean right and left joint space width (JSW) in millimeters, and the standard deviation of the JSW measurements for each side and gender.

General mean hip space width at the superomedial margin of all the 100 females was found to be 4.03 ± 1.03mm on the proper side while on the left side it had been found to be 3.67 ± 0.84mm. the general mean hip 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 had been found to be 3.93 ± 0.86mm.

DISCUSSION: The traditional hip space width shows large interindividual variability: the SD

is on the brink of 1 mm, for a mean on the brink of 4 mm, counting on the location of measurement; extreme values in our series were 3–5 mm. These values aren't far away from other published results. within the principal studies, mean (range) JSW values at the apical site (often the sole 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 those studies was probably the foremost reliable, because it used a hand glass with



0.01 mm graduations, instead of an easy ruler. A study of 118 normal hips of Turkish subjects, employing a dial caliper with 0.02 mm graduations, gave mean values of 3.62 (0.59) mm(11). However, the location of measurement was the JSW at the narrowest point, and supine abdominal radiographs instead of 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 an identical JSW difference between men (n = 257) and Woman (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 of all the 200 xrays on the Right side was 4.80 mm with the quality deviation of 1.28 mm. While on the left side it had been 4.16 mm with the quality deviation of 0.96mm. The general mean hip 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 had been found to be 4.06 ± 0.93 mm. The general mean hip 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 had been found to be 4.27 ± 1.00 mm. The general mean hip 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 had been found to be 3.67 ± 0.84 mm. The general mean hip 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 had been found to be 3.93 ± 0.86 mm. The minimal normal hip JSW value is vital for epidemiological studies of OA, where a diagnostic cut off point 2.5 mm is usually used(13); this seems appropriate when the JSW is measured at the superolateral site, but the location of measurement isn't 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

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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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