



Morphometry Of Femoral Head Diameter On Plain Radiographs Of Adult Kashmiri Population And Its Clinical Implications

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Abstract

Introduction: The knowledge about the diameter of head of femur is essential for orthopaedic surgeons in selecting prosthesis for hip replacement surgeries. It also helps radiologists in diagnosing various conditions like Perthes disease. This knowledge about the diameter of head of femur in both sexes also helps the anatomists and forensic experts.

Aim: Determination of mean values of Femoral Head Diameter.

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: The mean Femoral head diameter of all the 200 xrays on the right side was 47.24 mm with the standard deviation of 3.63 mm. While on the left side it was 46.13 mm with the standard deviation of 3.97mm. The overall mean femoral head diameter in 100 radiographs of males on the right side was found to be 49.17 ± 3.75 mm (44 – 53mm) while on the left side it was found to be 47.96 ± 4.53 mm (43 – 51 mm). In case of females, the mean femoral head diameter in 100 radiographs on right side was found to be 45.32 ± 3.52 mm (41 – 52 mm) while on the left side it was found to be 44.34 ± 3.31 mm (41 -50 mm).

Conclusion: The results calculated provides important information regarding gender and side variations of Femoral head diameter for the radiologists, orthopaedic surgeons, anatomists and forensic experts. The data thus obtained can be used as a baseline for further studies in the departments of Anatomy, Radiodiagnosis and Orthopaedics.

Keywords: Femoral Head Diameter, Prosthesis, Hip replacement surgeries.

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Introduction

The femur is longest and strongest bone of human body (1). 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

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anatomical variations present in proximal femur depending on gender, races, age and genetic structure(2). The head is articular, forms 2/3rd 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(3). Femoral head diameter is of utmost importance in sex differentiation (4). The femoral head is prone to osteoporosis because it is mainly composed of cancellous bones. Severe osteoporosis makes an elderly person susceptible to fractures of proximal femur (5)

Aims And Objectives

Determination of mean values of Femoral Head Diameter.

Materials and Methods

The present hospital based observational study was conducted in the Department of Anatomy in collaboration with the Department of Radiodiagnosis and Imaging, Government Medical College, Srinagar after obtaining the ethical clearance from the Institutional Ethical Committee vide clearance No. IEC/1422/2023/38- DATED: 22-05-2019. 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.

Instruments used:

Measuring scale.

Divider.

Marker.



Figure 1 : showing instruments used

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 hipjoint.
2. Patients having history of surgical intervention on proximal femur, acetabulum or pelvis.
3. Patients who did not

have the radiographs with appropriate technique.

Methods

The present study was conducted in the Department of Anatomy, Government Medical College, Srinagar in collaboration with the Department of Radio-diagnosis and imaging Government Medical College, Srinagar. 200 x-rays of males (100) and females (100) of pelvis with both hips anteroposterior view in the age group of 20-50 years were used in the present study. The radiographs belonged to patients who had presented with pain hip or lower back.

Only those radiographs were included in the present study which did not show any pathological condition.

Technique of x-ray:

Radiological measurements used in the present study were obtained from the standard pelvic radiographs. The anteroposterior view of radiographs were used, while the patient was in supine position and both the lower limbs internally rotated at 15°. 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 (6,7,8). Radiographs having following features were

included in the study: Symmetrical obturator foramen. Lateralization of greater trochanter. Clarity of pyriform fossa. Pubis and coccyx in the same plane. Absence of hip joint arthrosis.

The femoral head is approximated as a sphere (9). Centre of head of femur is marked with the help of divider by marking a point on the head of femur which is equidistant from 3 points on the circumference of head of femur. After marking the centre of head of femur (A), draw a line from A to the circumference of head of femur and marked it as B. From A, draw another line to a point C which is exactly opposite to B such that AB=AC thus forming the diameter of head of femur.

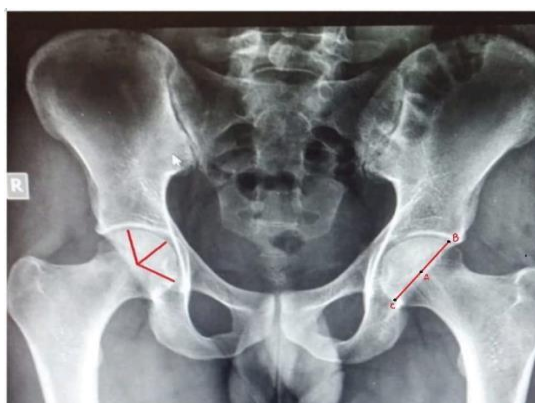


FIGURE 2: Showing the technique to determine the center of head of femur and diameter of head of femur

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 \pm 8.7 years.

Side	Number	Mean FHD (MM)	S.D
RT Side	200	47.24	3.63
LT Side	200	46.13	3.97

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

The table 3 shows that the mean FHD of all the 200 xrays on the right side was 47.24 mm with the standard deviation of 3.63 mm. While on

the left side it was 46.13 mm with the standard deviation of 3.97mm.

Gender	Number	Right (FHD)	Left (FHD)
Female	100	45.32 + 3.52mm	44.34+3.31mm
Male	100	49.17 + 3.75mm	47.96 \pm 4.53mm

Table 4 : Showing Gender Variation Of Mean FHD on right and left sides.

The table 4 shows the overall Femoral head diameter of all the 100 females was found to be 45.32 \pm 3.52 mm on the right side while on the left side it was found to be 44.34 \pm 3.31 mm. The overall mean Femoral head diameter of all the 100 males was found to be 49.17 \pm 3.75 mm on the right side while on the left side it was found to be 47.96 \pm 4.53 mm.

Males Have Greater Value Of Femoral Head Diameters Than That Of Females Suggesting That FHD Are Of Value In Sex Differentiation. Since Nigerians [Asala S (2)] Are Taller Than Indians , This Can Be A Major Reason Why The Values Of FHD Of Kashmiri People Of Present Study Were Smaller Than Nigerians . There Was Quite Similarity Between The Femoral Head Diameter And Male Female Variation Of Existing Study With The Study On The Northern Zone Population Of Bangladesh By Afroze And Huda(14). Several Studies Have Focused On The Femoral Head Diameter For Different Ethnic Populations. The Various Possible Reasons For The Difference In The Result Includes Ancestry , Selection Criteria , Inter Observer Error And Difference In Sample Size , The Average Age Of Sample And The Methods For Obtaining The Femoral Head Diameters. X-Ray study of Dry Femora By Siwach(15) In a Biometric Analysis Exemplified That Mean Femoral Head Diameter Was 4.353cm In Indians While Dry Femora In Caucasians By Nobel Pc Et Al(16) On The Basis Of Radiological Osteometric Measurements Demonstrated That Average Femoral Head Diameter Is 4.61cm. The Reason For The Difference In The Values May Be Due To Error In Magnification In Living Body.

Discussion

In the Current Study , The Mean Femoral Head Diameter On Right Side In 200 Subjects Was Found To Be 47.24 \pm 3.63mm While On Left Side It Was Found To Be 46.13 \pm 3.97mm .Thus Noteworthy Difference Has Been Found Out In FHD Between Right And Left Side . In Radiographs Of 100 Females , The Mean Value Of FHD Was Found To Be 45.32 \pm 3.52 Mm On The Right Side While On The Left Side It Was Found To Be 44.34 \pm 3.31 Mm. The Overall Mean Femoral Head Diameter Of All The 100 Males was Found To Be 49.17 \pm 3.75 Mm On The Right Side While On The Left Side It Was Found To Be 47.96 \pm 4.53 Mm. The Above Findings Were Consistent With The Study By Riad Et Al (10) in Bangladeshi population Harris Et Al (11)In American Population , Acar Et Al (12) In Turkish Population And Caiaffo Et Al (13) In Brazilian Population . It Is Clear From The Present Study That Kashmiri



Conclusion

The Result Of The Present Study Provides Important Information Regarding Gender And Side Variations Of Femoral Head Diameter For The Orthopaedic Surgeons To Calculate The Size Of Prosthesis To Be Used For Total Hip Replacement Or Partial Hip Replacement. It Also Provides Useful Information For Radiologists And Anatomists. The Radiological Knowledge Of Femoral Head Diameter Will Also Help The Orthopaedicians In Diagnosing And Treatment Of Various Clinical Conditions. The Data Thus Obtained Can Be Used As A Baseline For Further Studies In The Department Of Orthopaedics , Anatomy And Radiology.

References

1. Adekoya-cole TO, Akinmokun OI, Soyebi KO, Oguche OE. Femoral neck shaft angle: Aradiological anthropometric study. Niger Postgrad Med J 2016; 23:17-20.
2. Chaurasia BD. Bones of lower limb. In: Garg K, Mittal PS, Chandrupatla M (editors).BD Chaurasia's Human Anatomy: Regional and Applied Dissection and Clinical. 6th edition, volume-2. New Delhi: CBS publishers and distributors Pvt. Ltd; 2013.pp.6-39.
3. Datta AK. Appendicular skeleton. In: Datta AK (editor). Essentials of human osteology. 2nd edition Kolkata: Current Books International; 2005.pp.161-243
4. Asala SA, Mbajiorgu FE, Papandro BA. A comparative study of femoral head diameters and sex differentiation in Nigerians. Acta Anat1998;162:232-37.
5. Lv L, Meng G, Gong H, Zhu D, Zhu W. A new method for the measurement and analysis of three-dimensional morphological parameters of proximal male femur. Biomed Res. 2012; 23(2):219-226.
6. Clohisy JC, Carlisle JC, Beaulé PE, Kim YJ, Trousdale RT, Sierra RJ, et al. A systematic approach to the plain radiographic evaluation of the young adult hip. J Bone Joint Surg Am.2008;90 Suppl 4:47-66.
7. Tannast M, Murphy SB, Langlotz F, Anderson SE, Siebenrock KA. Estimation of pelvic tilt on anteroposterior X-rays—a comparison of six parameters. Skeletal Radiol. 2006;35(3):149- 155.
8. Polesello GC, Nakao TS, de Queiroz MC, Daniachi D, Ricioli W. Proposal for standardization of radiographic studies on the hip and pelvis. Rev Bras Ortop. 2011;46(6):634.
9. Subburaj K, Ravi B, Agarwal M. Computer- aided methods for assessing lower limb deformities in orthopaedic surgery planning. Comput Med Imaging Graph. 2010;34(4):277- 288
10. Subburaj K, Ravi B, Agarwal M. Computer- aided methods for assessing lower limb deformities in Orthopedic Surgery planning. Comput Med Imaging Graph. 2010;34(4): 277-288
11. Riad Zannat MD , Akhtar Khalada , Amin Nahid Farhana . Radiological measurement of the femoral head diameter: male-female variations and relationships with the stature in adult Bengali Bangladeshi's. Annals of international medical and dental research. 2020;7(2):1-5
12. Harris JD, Gerrie BJ, Varner KE, Lintner DM, McCulloch PC. Radiographic Prevalence of Dysplasia, Cam, and Pincer Deformities in Elite Ballet. Am J Sports Med. 2016;44(1):20- 27
13. Acar N, Unal M. Radiological Evaluation of the Proximal Femoral Geometric Features in the Turkish Population. SDÜ Týp Fakültesi Dergisi. 2017;24(4):127-134.
14. Caiaffo V, de Albuquerque PPF, de Albuquerque PV, de Oliveira BDR. Sexual Diagnosis Through Morphometric Evaluation of the Proximal Femur. J Morphol. 2019;37(2).
15. Afroze A, Huda MD. Femoral head diameters and sex differentiation in the northern zone (Rajshahi) of Bangladesh. TAJ: Journal of Teachers Association. 2005;18(2):84-88.
16. Siwach R. Anthropometric study of proximal femur geometry and its clinical application. Ann Natl Acad Med Sci. 2018;54(04):203-215.
17. Noble PC, Alexander JW, Lindahl LJ, Yew DT, Granberry WM, Tullos HS. The anatomic basis of femoral component design. Clin. Orthop. Relat. Res. 1988;235:148-165.

