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Original Research

Morphometric dimensions of Proximal Femur of males in a Indian population

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ABSTRACT:

Background: The femur is the longest, heaviest, and strongest bone in the human body. The knowledge of proximal femur geometry is essential in the understanding and treatment of hip pathologies. The present study was undertaken for assessing the age related variation on morphometric dimensions of Proximal Femur of males in Indian population. **Materials & methods:** A total of 40 male femur bones were obtained from department of human anatomy. All the bones were categorized into two groups; Less than 45 years of age and More than 45 years of age. Only those bone were included which were within the age range of 30 to 60 years. Complete demographic and clinical data of all the bones was collected from the data record files. Measurements were done and different morphometric parameters were assessed. All the parameters were compared on the basis of age group. All the results were recorded and analyzed by SPSS software. **Results:** The mean anteroposterior physeal angle was 74.12° while mean lateral physeal angle was 81.99°. Mean neck version was 9.46° while mean angle of inclination was 129.41°. Mean anteroposterior physeal angle in subjects of less than 45 years and more than 45 years of age was 74.1° and 74.14° respectively. Mean lateral physeal angle among subjects of less than 45 years and more than 45 years of age was 81.95° and 82.05° respectively. Mean neck version among subjects of less than 45 years and more than 45 years was 9.51° and 9.42° respectively. Non-significant results were obtained while comparing the morphometric dimension of male's femur among different age group. **Conclusion:** The results of this study will be useful as a reference for physical and forensic anthropology as well as the design of medical devices suitable for Indian population.

Key words: Skeletal, Deformities, Males

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INTRODUCTION

The femur is the longest, heaviest, and strongest bone in the human body. At the proximal end, the pyramid-shaped neck attaches the spherical head at the apex and the cylindrical shaft at the base. There are also 2 prominent bony protrusions, the greater trochanter and lesser trochanter, that attach to muscles that move the hip and knee. The angle between the neck and shaft, also known as the inclination angle is about 128 degrees in the average adult. However, the inclination angle decreases with age.[1- 3] The hip is a ball-in-socket joint that is composed of the acetabulum of the pelvis encompassing the femoral head. The head is pointed in a medial, superior, and slightly anterior direction. Ligamentum teres femoris connects the acetabulum to the fovea capitis femoris, which is a pit on the head.[4, 5]

Prevalence of hip osteoarthritis, fracture neck femur and other hip joint ailments are increasing day by day. Arthroplasty is the definite treatment for these patients. The femur forms the skeleton of the thigh, carries body weight, supports the movements of leg and provides attachment to the muscles. Morphology of bones is very much affected by race, sex, environmental factors and life style. A population based study by Nurzenski et al., showed that life style factors also influence geometric indices of bone strength in the proximal femur. FHO and VO are significant tools for range of motion and abductor muscle strength after total hip arthroplasty. Commercially available hip prostheses are made based on European data. So the undersize and oversize hip prosthesis in THA (Total Hip Arthroplasty) can affect these functions. Goal of the surgical intervention is mostly to achieve anatomical

reduction with a stable fracture fixation which helps bone reunion and allows early mobilization. A better contour fit bone and plate is crucial to establish a stronger bone plate construction.[6,7] The knowledge of proximal femur geometry is essential in the understanding and treatment of hip pathologies. Hence; the present study was undertaken to evaluate the age related variation on morphometric dimensions of Proximal Femur of males of Indian population.

MATERIALS & METHODS

The present study was undertaken to evaluate the age related variation on morphometric dimensions of Proximal Femur of males. A total of 40 male femur bones were obtained from department of human anatomy. All the bones were categorized into two groups; Less than 45 years of age and More than 45 years of age. Only those bone were included which were within the age range of 30 to 60 years. Complete demographic and clinical data of all the bones was collected from the data record files. Measurements were done and different morphometric parameters were assessed. All the parameters were compared on the basis of age group. All the results were recorded and analyzed by SPSS software. Mann-Whitney U test was used for evaluation of level of significance.

RESULTS

The mean anteroposterior physeal angle was 74.12° while mean lateral physeal angle was 81.99°. Mean neck version was 9.46° while mean angle of inclination was 129.41°. Mean anteroposterior physeal angle in subjects of less than 45 years and more than 45 years of age was 74.1° and 74.14° respectively. Mean lateral physeal angle among subjects of less than 45 years and more than 45 years of age was 81.95° and 82.05° respectively. Mean neck version among subjects of less than 45 years and more than 45 years was 9.51° and 9.42° respectively. Non-significant results were obtained while comparing the morphometric dimension of male's femur among different age group.

Table 1: Morphometric measurements

Measurements	Mean	SD
Anteroposterior physeal angle	74.12°	6.32°
Lateral physeal angle	81.99°	6.12°
Neck version	9.46°	8.69°
Angle of inclination	129.41	6.11°

Table 2: Comparison of Morphometric measurements among subjects divided on the basis of age group

Measurements	Age group (years)		p- value
	Less than 45 years	More than 45 years	
Anteroposterior physeal angle	74.10°	74.14°	0.62
Lateral physeal angle	81.95°	82.05°	0.41
Neck version	9.51°	9.42°	0.33
Angle of inclination	129.37°	129.45°	0.81

DISCUSSION

The main function of the femur is weight bearing and gait stability. The upper body's weight sits on the 2 femoral heads. The capsular ligament is a strong thick sheath that wraps around the acetabulum periosteum and proximal femur. It holds the femoral head within the acetabulum of the pelvis. The capsular ligament limits internal rotation but allows for external rotation.[5,6]

Over 80,000 artificial hip joint replacement are done annually worldwide. There are regional differences in the stature of human beings so prosthesis should be designed according to specific population. Few authors highlighted that a mismatch between femoral bone and stem may definitely result in micromotion which can lead to thigh pain, osteolysis and aseptic loosening. If the implant is too large the femur can fracture so the tendency is to undersize for safety but highly undersized implant may fail to bond with bone.[7-10]

Hence; the present study was undertaken for assessing the age related variation on morphometric dimensions of Proximal Femur of 40 males in a Indian population. In the present study, the mean anteroposterior physeal angle was 74.12° while mean lateral physeal angle was 81.99°. Mean neck version was 9.46° while mean angle of inclination was 129.41°. Mean anteroposterior physeal angle in subjects of less than 45 years and more than 45 years of age was 74.1° and 74.14° respectively. Mean lateral physeal angle among subjects of less than 45 years and more than 45 years of age was 81.95° and 82.05° respectively. Toogood et al analyzed 375 adult cadaveric femurs in order to provide a global assessment of proximal femoral morphology and comparisons between gender and age. Similarly, Unnanuntana et al performed a limited evaluation of the anatomy of adult femurs, specifically comparing genders and race, based upon only five measurements (neck-shaft angle, femoral head diameter, horizontal and vertical offset, and the distance from the lesser trochanter to the centre of the femoral head). Moreover, Young et al conducted

studies comparing the left and right proximal femurs and found substantial symmetry among adults. Bixby et al performed a cross-sectional investigation examining CT scans of paediatric hips, but only analyzed adolescent subjects and limited their assessment to alpha angle, femoral head diameter, offset and epiphyseal extension.[9- 13]

In the present study, mean neck version among subjects of less than 45 years and more than 45 years was 9.51° and 9.42° respectively. Non-significant results were obtained while comparing the

The specimens had a neutral mean neck-shaft angle (130.7º) and anteversion (12.8º), and the sphericity of the ossified femoral heads was symmetrical. Male specimens had significantly higher alpha angles ($p = 0.01$), posterior offset ($p = 0.02$), neck width ($p = 0.04$) and head-neck length ratio ($p = 0.02$) values than female specimens. Strong positive correlations exist between length/size parameters and age, while negligible correlations were noted for angular measurements. Their study establishes reference values for a comprehensive list of anatomical parameters for the skeletally-immature ossified proximal femur.[14]

Verma et al aimed to measure the parameters of proximal femur in Ninety one dry bones (44 left and 47 right) were used. Femur Head Diameter (FHD), Femur Neck Length (FNL), Femur Neck Diameter (FND), Femur Neck Thickness (FNT), Cervicodiaphyseal Angle (CDA) was directly measured with the help of anthropometric instruments. Femur Head Offset (FHO) and Vertical Offset (VO) were measured in the anteroposterior digital photographs. Results showed that there was a significant difference between right and left side of FND and CDA. Pearson correlation coefficient was used to analyse the relationship among variables. FHO had high correlation with the VO (0.687, $p<0.001$). Authors concluded that these parameters can be used for designing the prosthesis and plates for hip joint reconstructive surgeries suitable for Indian population.[15]

morphometric dimension of male's femur among different age group. Beutel BG et al characterized structural anatomy in skeletally-immature patients, examined potential differences between genders, and analyze how these anatomical parameters change with age. Cadaveric femurs from the Hamann-Todd Osteological Collection were examined. A total of 43 femurs from ages four to 17 years met inclusion criteria. The majority were female (56%); no difference existed in age between genders ($p = 0.62$).

CONCLUSION

The results of this study will be useful as a reference for physical and forensic anthropology as well as the design of medical devices suitable for Indian population.

REFERENCES

1. Chowdhary S, Naushaba H, Begum J, Ahmed S, Khan LF, Parash TH, et al. [Morphometrical and topographical anatomy of position of nutrient foramen on fully ossified left femur. Delta Med Coll J. 2013;1(1):13-18.
2. Nurzenski MK, Briffa NK, Price IR, Khoo CCB, Devine A, Beck JT. Geometric indices of bone strength are associated with physical activity and dietary calcium intake in Healthy older women. J Bone Miner Res. 2007;22(3):416-24.
3. McGroryJ, Morrey BF, Chahalan TD, Kai-Nan AN, Cabanela ME. Effect of femoral offset on range of motion and abductor muscle strength after total hip arthroplasty. J Bone Joint Surg. 1995;77(B):865-69.
4. Rubin PJ, Leyvraz PF, Aubaniac JM, Argenson JN, Esteve P, Roguin BD. The morphology of the proximal femur: a three dimensional radiographic analysis. Journal of bone and Joint Surgery B. 1992; 74(1): 28-32
5. Soutter R, Bradford EH. Twists in normal and in the congenitally dislocated femora. NY Med J. 1903;78:1071–1077.
6. Stulberg SD, Cordell LD, Harris WH, Ramsey PL, MacEwen GD. Unrecognized childhood hip disease: a major cause of idiopathic osteoarthritis of the hip. Hip: Proceedings of the Third Open Scientific Meeting of the Hip Society. St Louis, MO: CV Mosby; 1975:212–228.
7. Reynolds A. The fractured femur. Radiol Technol. 2013 Jan-Feb;84(3):273-91; quiz p.292-4.
8. Wagner FV, Negrão JR, Campos J, Ward SR, Haghighi P, Trudell DJ, Resnick D. Capsular ligaments of the hip: anatomic, histologic, and positional study in cadaveric specimens with MR arthrography. Radiology. 2012 Apr;263(1):189-98.
9. Toogood PA, Skalak A, Cooperman DR.. Proximal femoral anatomy in the normal human population. Clin Orthop Relat Res 2009;467:876-885.
10. Unnanuntana A, Toogood P, Hart D, Cooperman D, Grant RE.. Evaluation of proximal femoral geometry using digital photographs. J Orthop Res 2010;28:1399-1404.
11. Young EY, Gebhart J, Cooperman D, Ahn NU.. Are the left and right proximal femurs symmetric? Clin Orthop Relat Res 2013;471:1593-1601
12. Young EY, Gebhart JJ, Bajwa N, Cooperman DR, Ahn NU.. Femoral head asymmetry and coxa magna: anatomic study. J Pediatr Orthop 2014;34:415-420.
13. Bixby SD, Kienle K-P, Nasreddine A, et al. . Reference values for proximal femoral anatomy in adolescents based on sex, physis, and imaging plane. Am J Sports Med 2013;41:2074-2082.
14. Beutel BG, Girdler SJ, Collins JA, Otsuka NY, Chu A. Characterization of proximal femoral anatomy in the skeletally-immature patient. J Child Orthop. 2018;12(2):167-172. doi:10.1302/1863-2548.12.180011
15. Verma M et al. Morphometry of Proximal Femur in Indian Population. Journal Of Clinical And Diagnostic Research 2017; 11(2):AC01-AC04