European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 9, Issue 7, Summer 2022

ORIGINAL RESEARCH

Radiographic evaluation of the proximal femoral anatomy: An observational study

Dr. Sachin Jagtap Dattatray[1], Dr. Sarita Dixit[2], Dr. Alhad Rameshrao Mohite[3]

[1]Assistant Professor, Department of Anatomy, People's College of Medical Sciences and Research, Bhopal, India.
[2]Assistant Professor, Department of Anatomy, Prasad Institute of Medical Sciences, Lucknow, U.P., India.
[3]Assistant Professor, Department of Radiology KM Medical College and Hospital, Sonkh Road, Mathura, U.P., India

Corresponding author
Dr. Alhad Rameshrao Mohite
Assistant Professor, Department of Radiology KM Medical College and Hospital, Sonkh Road, Mathura, U.P., India

Received: 2 July, 2022 Accepted: 24 July, 2022

Abstract
Background: *The present study was conducted for assessing radiographic evaluation of the proximal femoral anatomy.*
Materials & methods: *A total of 40 males and 40 female subjects were enrolled. Antero-posterior and axial radiographs were evaluated in all the patients. Radiological measurements of proximal femoral geometric parameters were done. Following proximal femoral geometric parameters were assessed: Femoral head diameter (FHD), Femoral neck length (FNL), Neck-shaft angle (FNSA) and Femoral neck anteversion (FNA). All the values obtained were recorded and compared among males and females. All the results were recorded and analysed using SPSS software.*
Results: *Non-significant results were obtained while comparing the femoral neck variables among males and females. However; femoral head diameter was significantly among males in comparison to females.*
Conclusion: *There exits high diversity in the morphology of the femur on the geographic regions of the same population. Our results will improve understanding of femur morphology and might help to choose implant in correspondence with the anatomy of the hip.*

Key words: *Anatomy, Femur, Radiograph*

INTRODUCTION

A variety of diagnostic markers for sexing in human remains have been considered by forensic medicine specialists. Several anatomical structures have been examined for determining the identity and sex of human being including the skull, pelvis and long bones. Due to their high durability, femoral bones are the most useful long bones in sexing. Several factors including femoral length, femoral head diameter and width and angle of the femoral neck have been used for sexing, however, body parts and dimensions vary considerably by age and sex among various races and ethnic groups.[1-3] The longest and strongest bone of the human body is femur. Femoral head diameter is one of the important values in sex differentiation. Femoral head mainly consists of cancellous bone, so is vulnerable to osteoporosis. An elderly person with severe osteoporosis is susceptible to proximal femur fracture. Forensic anthropologist use bone to determine the height of an individual.[4-6] Femoral neck-shaft angle (NSA), also known as the caput-collum-diaphyseal angle, is the intersection between the proximal femoral shaft axis and the femoral neck axis. It plays a role in diagnosis or management of several hip and femur problems, such as osteoarthritis, hip fractures, greater trochanteric pain

syndrome, cerebral palsy, and femoroacetabular impingement.[5- 7] Hence; the present study was conducted for assessing radiographic evaluation of the proximal femoral anatomy.

MATERIALS & METHODS

The present study was conducted for assessing radiographic evaluation of the proximal femoral anatomy. A total of 40 males and 40 female subjects were enrolled. Antero-posterior and axial radiographs were evaluated in all the patients. Subjects with presence of hip disorders, previous hip surgery, hip fracture history etc were excluded from the present study. The axial view of the hip was taken with the patient in the supine position. Radiological measurements of proximal femoral geometric parameters were done. Following proximal femoral geometric parameters were assessed: Femoral head diameter (FHD), Femoral neck length (FNL), Neck-shaft angle (FNSA) and Femoral neck anteversion (FNA). All the values obtained were recorded and compared among males and females. All the results were recorded and analysed using SPSS software.

RESULTS

Mean femoral head diameter and femoral neck length was 37.96 mm and 44.96 mm respectively. Mean neck shaft angle and femoral neck anteversion angle was 126.31 degree and 16.96 degree respectively. Mean femoral head diameter among males and females was 39.45 mm and 37.12 mm respectively. Mean femoral neck length among males and females was 44.86 mm and 45.03 mm respectively. Mean neck shaft angle among males and females was 126.53 degree and 126.19 degree respectively. Mean femoral neck anteversion angle among males and females was 17.12 degree and 16.71 degree respectively. Non-significant results were obtained while comparing the femoral neck variables among males and females. However; femoral head diameter was significantly among males in comparison to females.

Graph 1: Femoral geometric variables

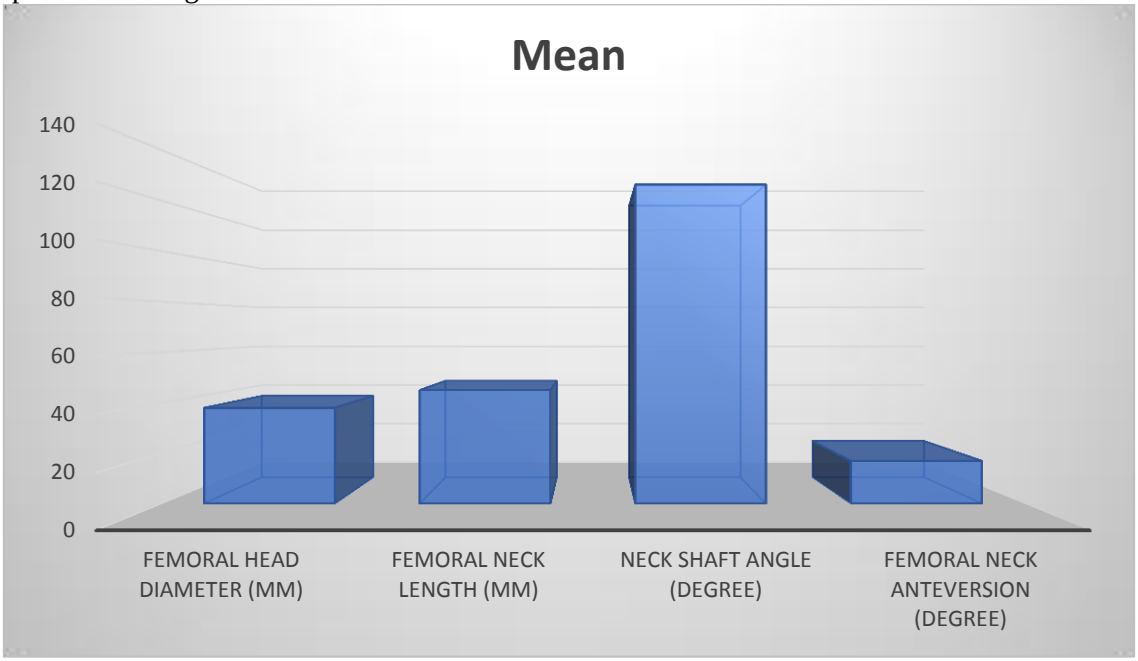

Table 1: Comparison of femoral variables among males and females

Variable	Males	females	p-value
Femoral head diameter (mm)	39.45	37.12	0.001*
Femoral neck length (mm)	44.86	45.03	0.128
Neck shaft angle (Degree)	126.53	126.19	0.652
Femoral neck anteversion (Degree)	17.12	16.71	0.745

*: Significant

DISCUSSION

Stature or body height is one of the most important and useful anthropometric parameters that determine the physical identity of an individual and also essential for the medical and dietary evaluation in the living individual. Previous authors have demonstrated the presence of both endosteal and periosteal variation, and the need for multiple stem designs to achieve close fit. Some other previous have evaluated sex and ethnic differences in bone architecture and therefore established the need for developing gender-specific implants. Females may need more smaller femoral designs. Different ethnic populations have different femoral configurations. There are also major differences between both genders. Different ethnic populations and different genders all need different types of orthopaedic femoral implant designs.[6- 10] Hence; the present study was conducted for assessing radiographic evaluation of the proximal femoral anatomy.

Mean femoral head diameter and femoral neck length was 37.96 mm and 44.96 mm respectively. Mean neck shaft angle and femoral neck anteversion angle was 126.31 degree and 16.96 degree respectively. Mean femoral head diameter among males and females was 39.45 mm and 37.12 mm respectively. Mean femoral neck length among males and females was 44.86 mm and 45.03 mm respectively. In a similar study conducted by Gillespie RJ et al, authors examined a group of male and female distal femora matched for age and height, to determine if there was a difference in the aspect ratio and the height of the anterior flange between the genders. The femoral length, the anteroposterior height, height of the lateral and medial flanges and the mediolateral width were measured in all the specimens. The mechanical axis of the femur, the cut articular width and the aspect ratio were assessed. Statistical analysis of the effect of gender upon the aspect ratio and the lateral and medial flanges was undertaken, controlling for age, height and race. The mean aspect ratio of male femora was 1.21 and of female femora it was 1.16. There was no significant difference between male and female specimens in the mean size of the lateral flange and 7.02 mm, or of the medial flange.[10]

Mean neck shaft angle among males and females was 126.53 degree and 126.19 degree respectively. Mean femoral neck anteversion angle among males and females was 17.12 degree and 16.71 degree respectively. Non-significant results were obtained while comparing the femoral neck variables among males and females. However; femoral head diameter was significantly among males in comparison to females. Moosa SS et al, in another previous study, analysed maximum length, trochanteric oblique length, and diameter of the femur head for sexual dimorphism. The maximum length of the femur (L), trochanteric oblique length (TOL), and vertical diameter of the head (VDH) were measured using an osteometric board and digital Vernier calipers. The mean length of the femur was 436.88 mm in males and 402.38 mm in females, respectively. The mean trochanteric oblique length of the femur was 423.78 mm in males and 387.18 mm in females, respectively. Depending upon the results of this study, it was concluded that the mean values of maximum length, trochanteric oblique length, and vertical diameter of the femur head are significantly higher in males than females.[11] In a study done by Rogers et al. on 203 patients to check for side-to-side variability of the NSA using upright anteroposterior pelvis radiographs, no significant variability between the two angles was found. Similarly, a study done in India on 110 patients using supine anteroposterior pelvis radiographs concluded that the NSA angle of the contralateral femur can be used as a template during repair. Future randomized control trials comparing the outcome of using the NSA of the contralateral femur versus other methods during surgery would provide more conclusive evidence.[12, 13]

CONCLUSION

There exits high diversity in the morphology of the femur on the geographic regions of the same population. Our results will improve understanding of femur morphology and might help to choose implant in correspondence with the anatomy of the hip.

REFERENCES

1. Saukko P, Knight B. Knight's forensic pathology. 3rd ed. London: Arnold; 2004. pp. 106e13.
2. Igbigbi PS. Collo-diaphysial angle of the femur in east African subjects. Clin Anat 2003;16:416e9.
3. Kay RM, Jaki KA, Skaggs DL. The effect of femoral rotation on the projected femoral neck-shaft angle. J Pediatr Orthop. 2000;20:736–9

4. Nissen N, Hauge EM, Abrahamsen B, Jensen JEB, Mosekilde L, Brixen K. Geometry of the proximal femur in relation to age and sex: a cross-sectional study in healthy adult Danes. Acta Radiol 2005;5:514e8.
5. Gilligan I, Chandraphak S, Mahakkanukrauh P. Femoral neck-shaft angle in humans: variation relating to climate, clothing, lifestyle, sex, age and side. J Anat. 2013;223:133–51.
6. Altubasi I, Hamzeh H, Madi M. Measurement of Neck-Shaft Angle Using CT Scout View in Healthy Jordanian Adults - A Reliability and Agreement Study. J Adv Med Med Res. 2020;32:9–17
7. Fischer CS, Kühn J-P, Völzke H, et al. The neck-shaft angle: an update on reference values and associated factors. Acta Orthop. 2020;91:53–7.
8. Elbuken F, Baykara M, Ozturk C. Standardisation of the neck-shaft angle and measurement of age-, gender- and BMI-related changes in the femoral neck using DXA. Singapore Med J. 2012;53:587–90.
9. Unnanuntana A, Toogood P, Hart D, Cooperman D, Grant RE. Evaluation of proximal femoral geometry using digital photographs. J Orthop Res 2010;28: 1399e404.
10. Gillespie RJ, Levine A, Fitzgerald SJ, Kolaczko J, DeMaio M, Marcus RE, Cooperman DR. Gender differences in the anatomy of the distal femur. J Bone Joint Surg Br. 2011 Mar;93(3):357-63
11. Moosa SS, Shaikh MHR, Khwaja M, Shaikh SAH, Siddiqui FB, Daimi SRH, Hiware SD, Ismail EE, Begum Y. Sexual dimorphic parameters of femur: a clinical guide in orthopedics and forensic studies. J Med Life. 2021 Nov-Dec;14(6):762-768
12. Rogers MJ, King TL, Kim J, et al. Femoral Neck Shaft Angle and Management of Proximal Femur Fractures: Is the Contralateral Femur a Reliable Template?. J Orthop Trauma. 2021;35:529–34.
13. Pathak SK, Maheshwari P, Ughareja P, et al. Evaluation of femoral neck shaft angle on plain radiographs and its clinical implications. Int J Res Orthop. 2016;2:383.