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Original Research Article.

Anthropometric Evaluation of Digital X Rays of Hip Joints at a Tertiary Care Centre

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ABSTRACT

Background: Proximal femur has a significant functional modification on erect bipedal posture. The morphology of the proximal femur, especially the relationship between proximal femur and the shaft of femur is an interesting subject in orthopedic literature. Hence; the present study was conducted for comparing anthropometry evaluation of the digital X rays of the right and left hip joints.

Materials and Methods: A comprehensive examination was conducted on one hundred hips belonging to individuals aged between 18 and 60 years, specifically targeting patients with normal hip morphology. Anteroposterior plain radiographs of both hips were captured while the subjects were positioned supine, ensuring that the hips were aligned neutrally. Measurements of the neck-shaft angle (NSA), head diameter (HD), and neck width (NW) of the femur were taken from the "full-screen" view, with the images magnified to improve clarity and accuracy.

Results: The mean neck shaft angle was 133.1 degrees; the mean head diameter was 43.8 mm and the mean neck width was 30.04 mm. The mean neck shaft angle of right side and left side were 133.5 degrees and 131.8 degrees, respectively. The mean head diameter of the right side and left side were 42.1 mm and 41.9 mm, respectively. The mean neck width of right side and left side were 29.9 mm and 30.01 mm, respectively.

Conclusion: In conclusion, while there were minimal differences between the right and left sides, the data showed a slight variation in neck shaft angle (133.5° vs 131.8°) and minimal differences in head diameter (42.1 mm vs 41.9 mm) and neck width (29.9 mm vs 30.01 mm) between the two sides. These findings provide valuable insights into the anthropometric characteristics of the hip joint, which can be useful for clinical and surgical applications.

Key words: Anthropometric dimensions; Arthroplasty; Hip; Femur.

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INTRODUCTION

Proximal femur has a significant functional modification on erect bipedal posture. The morphology of the proximal femur, especially the relationship between proximal femur and the shaft of femur is an interesting subject in orthopedic literature. The geometry of the proximal femur is determined by genetic and environmental factors such as age, race, sex, and lifestyle.[1] Anthropometric dimensions described for proximal femur in Westerners might be quite different from those encountered among Indians. Hence, the knowledge regarding proximal femur is important for understanding the biomechanics of the hip as well as surgical planning.[2]

Anthropometric analysis of the proximal femur will be useful in the management of the pathological conditions such as osteoarthritis of the hip, fracture neck of femur, and pertrochanteric fractures.[3] Hence; the present study was conducted for comparing anthropometry analysis of the digital X rays of the right and left hip joints.

MATERIAL AND METHODS

A comprehensive examination was conducted on one hundred hips belonging to individuals aged between 18 and 60 years, specifically targeting patients with normal hip morphology.

Anteroposterior plain radiographs of both hips were captured while the subjects were positioned supine, ensuring that the hips were aligned neutrally. Measurements of the neck-shaft angle (NSA), head diameter (HD), and neck width (NW) of the femur were taken from the "full-screen" view, with the images magnified to improve clarity and accuracy.

Table 1: Morphometric analysis of the hip joint

Parameters	Mean
Head diameter	43.8
Neck shaft angle	133.1
Neck width	30.04

Table 2: Analysis of various parameters as per side of the hip

Parameters	Side	Mean
Head diameter	**Right**	42.1
	Left	41.9
Neck shaft angle	**Right**	133.5
	Left	131.8
Neck width	**Right**	29.9
	Left	30.01

RESULTS

The mean neck shaft angle was 133.1 degrees, the mean head diameter was 43.8 mm and the mean neck width was 30.04 mm. The mean neck shaft angle of right side and left side were 133.5 degrees and 131.8 degrees, respectively. The mean head diameter of the right side and left side were 42.1 mm and 41.9 mm, respectively. The mean neck width of right side and left side were 29.9 mm and 30.01 mm, respectively.

DISCUSSION

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.[4] Morphology of bones is very much affected by race, sex, environmental factors and lifestyle. A population based study by Nurzenski et al., showed that life style factors also influence geometric indices of bone strength in the proximal femur.[5] FHO and VO are significant tools for range of motion and abductor muscle strength after total hip arthroplasty.[6] Commercially available hip prostheses are made based on European data.[7,8] 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.[9] Morphometric study of the proximal femur was performed in different population and communities.[10] Hence; the present study was conducted for comparing anthropometry analysis of the digital X rays of the right and left hip joints.

In this study, the mean neck shaft angle was 133.1 degrees, the mean head diameter was 43.8 mm and the mean neck width was 30.04 mm. The mean neck shaft angle of right side and left side were 133.5 degrees and 131.8 degrees, respectively. The mean head diameter of the right side and left side were 42.1 mm and 41.9 mm, respectively. The mean neck width of right side and left side were 29.9 mm and 30.01 mm, respectively. The study by Sengodan VC et al[11] was done among 200 individuals (400 hips) with a normal hip joint after ethical committee clearance. Computed tomography scanning of proximal femur was done. Neck-shaft angle (NSA), neck width (NW), head diameter (HD), acetabular angle (AA) of sharp, horizontal offset (HO), vertical offset (VO), medullary canal diameter at the level of lesser trochanter (MD_{LT}), and acetabular version (AV) were measured. These parameters were tabulated and compared with various populations and statistically analyzed. The mean values were NSA 135°, NW 27 mm, femoral HD (HD) 42.5 mm, AA of sharp 35.5°, HO 37 mm, VO 46 mm, MD_{LT}20 mm, and AV 18.64°. The values differ when compared with Western population. This study results differed when compared with other Indian studies done in Northern and Northeast Indian population. Significant differences noted in the parameters between sexes and between the sides of the hip joint. There are significant differences in anthropometric parameters of proximal femur. Even within the Indian population, the anthropometric parameters vary region to region. Verma M et al[12] measured the parameters of proximal femur and to analyse their correlation by using standard statistical analysis. 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. Normally distributed variables were compared using Student's t-test to analyse significant effect. 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. These parameters can be used for designing the prosthesis and plates for hip joint reconstructive surgeries suitable for Indian population.

CONCLUSION

In conclusion, while there were minimal differences between the right and left sides, the data showed a slight variation in neck shaft angle (133.5° vs 131.8°) and minimal differences in head diameter (42.1 mm vs 41.9 mm) and neck width (29.9 mm vs 30.01 mm) between the two sides. These findings provide valuable insights into the anthropometric characteristics of the hip joint, which can be useful for clinical and surgical applications.

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