

## Study of Right and Left Asymmetry in Neck Shaft Angle and Neck Length of Femur in Jharkhand Population

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### Abstract

**Introduction:** The proximal end of femur in human is the object of much attention. Geometry of proximal femur has been identified as risk factor for hip fractures. Anatomical study of femur bone serves helpful data to understand different aspect of clinical disease conditions, including common site of fracture, changes in osteoporosis, associated congenital anomalies as well as medicolegal cases. Extensive studies of normal neck angles have been carried out. The values differ considerably in the reports available.

**Materials and Method:** In the present study one hundred dry femora from different colleges of Jharkhand (East India) were studied. The parameters that were measured in one hundred dry femora (51 femora from right side and 49 from left side) are: (a) Neck shaft angle and (b) Neck length of femur.

**Results :** The result of the present study are the mean neck shaft angle of right femora was  $131.44 \pm 4.72^\circ$  and for left femora was  $131.53 \pm 5.29^\circ$ , the mean neck length of right femora was  $29.1 \pm 0.6$  mm and for left femora was  $29.3 \pm 0.1$  mm.

**Conclusion:** All the clinician must be familiar with normal neck- shaft angle for better comprehension of clinical and pathological states of hip joint. The neck- shaft angle, neck length and other parameters are important to design prosthesis for hip replacement. In the present study the mean neck shaft angle of the left femora was feebly higher than in the right femora but statistically not significant ( $p > 0.05$ ). The mean femoral neck length of left femora was feebly higher than the right femora, but statistically nonsignificant ( $p > 0.05$ ).

**Keywords:** Neck-shaft angle, Neck length and femur, Prosthesis, Goniometer.

### I. Introduction

The proximal end of femur in human is the object of much attention. The knowledge of its anatomy is a prerequisite for complete understanding of the mechanics of the hip joint and serves as a basis for the treatment of pathological conditions of the hip and femur.<sup>1</sup> Extensive studies of normal neck angles have been carried out. The hip joint is one of the largest and most stable joints in the body. The joint depends on the angle formed between the neck of the femur and diaphysis that keep the inferior limb more distant from the pelvis and facilitates movement at the hip joint.<sup>2</sup> The femur is the lonest and strongest bone of thigh in human. It is about 45 cm long in an average individual. Like any other long bone it has two ends upper and lower, and a shaft. The upper end bears a rounded head whereas the lower end is widely expanded to form two large condyles. The head is directed medially upward from its short neck. The femoral neck length is approximately 5 cm and connects the head to the shaft at an average angle of  $135^\circ$ . The neck shaft angle has been related to mechanical strength of proximal femur. It is also named as Angle of inclination, Collodiaphyseal angle and Cervicodiaphyseal angle.<sup>3</sup> The neck shaft angle of femur is the obtuse angle formed by intersection of the femoral shaft axis with the femoral neck axis.<sup>4</sup> The neck shaft angle varies with age, stature and width of pelvis. When this angle  $> 135^\circ$ , condition is known as coxavalga. When angle is  $< 120^\circ$ , it is known as coxa vara. The angle of femoral neck is reduced with age. In early infancy the neck shaft angle is about  $150^\circ$ , in childhood  $140^\circ$ , in adult about  $125^\circ$  and in elderly about  $120^\circ$ .<sup>5</sup> The clinical importance of neck shaft angle of femur lies in the diagnosis, treatment and follow up of fractures of the neck of femur, trochanteric fractures, slipped upper femoral epiphysis, development dysplasia of the hip and neuromuscular disorders of the lower extremity. The knowledge of normal asymmetry of right and left neck shaft angle of femur may be of great value in evaluation of patient with known or assumed pathological conditions and in correctional osteotomies in case of femoral fractures. The neck shaft angle can be estimated from a proximal femoral fragment and the required size of the length of the neck can be determined to design the prostheses for the restoration of normal neck shaft angle.<sup>6</sup>

## II. Materials And Methods

Materials for the study consisted of one hundred dry femora , Sliding calliper, Goniometer , scale and pencil. The dry femora were collected from different medical colleges of Jharkhand (East India). Specimen taken under the study were devoid of any Osseous pathology, Previous fracture , Burnt and Abnormal bones and Bones of children .

The Neck-shaft angle is defined as the angle formed between neck axis and long axis of the shaft of femur.<sup>1</sup>(Photograph 1)

- The neck axis was drawn through the midpoint of the neck.
- The shaft axis was drawn through the midpoint of narrowest part of the shaft.
- The angle formed between these two axes measured by goniometer.



**Photograph 1:** showing measurement of neck shaft angle of femur

The Neck length was measured from anterior aspect . The line joining the midpoint taken at the junction of the head and neck and midpoint of the intertrochanteric line was measured with the help of sliding calliper.(Photograph 2)



**Photograph 2:** showing measurement of neck length of femur

## III. Results

The mean neck-shaft angle and neck length of right and left femora were compared irrespective of sex. In femora the mean neck shaft angle was  $131.48 \pm 5.005^\circ$ , in the right femora  $131.44 \pm 4.72^\circ$  and in the left femora  $131.53 \pm 5.29^\circ$  . In the femora the mean neck length was  $29.2 \pm 3.3\text{mm}$ , in the right femora  $29.1 \pm 2.6\text{mm}$  and in the left femora  $29.4 \pm 3.1\text{mm}$ .

**Table 1:** Showing mean values of femoral neck shaft angle and neck length

Parameter		Number	Mean±SD
Neck shaft angle	Total	100	131.48±5.005°
	Right	51	131.44±4.72°
	Left	49	131.53±5.29°
Neck length	Total	100	29.2±3.3mm
	Right	51	29.1±2.6mm
	Left	49	29.4±3.1mm

#### IV. Discussion

In the present study the mean neck shaft angle in the femora was 131.48±5.005°, in the right femora 131.44±4.72° and in the left femora 131.53±5.29°. The mean neck-shaft angle of the left femora was feebly higher than the right side, which was statistically nonsignificant (p>0.05). This was very similar to the earlier South Indian study by Singh(1986) who found mean neck shaft angle for the left femora 131.3±3.9° and for the right femora 131.0±3.6°. Similarly Subhash gujar(2013) also found 136.6±5.45° for left femora and 136±6.68° for the right femora. In another study by Issac (1997) in South Indian population the mean neck shaft angle found on the left side 126.5° and on the right side 126.9°. The Shakil Mohammad (2014) found mean neck shaft angle of right femora was 137.44° and of left femora was 136.9°.

The mean neck length in the present study was found 29.2 ±5.2mm, in the right femora 29.1±02.6 and in the left femora 29.3±03.1mm. The values obtained was closer to the Issac (2003) study in South Indian population, 28.6mm for right side and 28.1mm for the left side. Da Silva (2003) found mean neck length for the right femora 22.3±3.3 mm and for the left femora 23.5±3.6 mm in the Brazilian population. Subhsh Gujar (2013) found mean neck length for the right femora 34.5±4.0mm and for the left femora 34.2±3.62mm in Gujarat (India). Shakil Mohamad Khan and Shaik Hussain (2014) found mean neck length 36.1±4.1 mm for the right femora and 36.4±4.3 mm for the left femora in South Indian population. The mean neck length of the present study(30.7 mm) was closer to the mean neck length found by D.Ravichandran (31.8 mm).

#### V. Conclusion

The neck- shaft angle of femur allows greater mobility of the femur at the hip joint .All the clinician must be familiar with normal neck- shaft angle for better comprehension of clinical and pathological states of hip joint . The neck- shaft angle, neck length and other parameters are important to design prosthesis for hip replacement. Considering the above mentioned importance the present study was conducted to assess the neck length and neck- shaft angle of femur, its variation with respect to side.

In the present study the mean neck shaft angle in the femora was 131.48±5.005°, in the right femora 131.44±4.72° and in the left femora 131.53±5.29°. The mean neck shaft angle of the left femora was feebly higher than in the right femora but statistically not significant (p>0.05). So there is no significant difference between mean neck shaft angle of right and left femora.

The mean neck length in the present study was found 29.2 ±5.2mm, in right femora 29.1±2.6mm and in the left femora 29.3±3.1mm..There was no significant side difference in the neck length. No positive correlation was found between mean neck length and mean neck shaft angle.

This study will be helpful in designing prosthesis for hip replacement, in the diagnosis of various hip pathologies and in the determination of racial variations.

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