

## STUDY ON NECK SHAFT ANGLE AND FEMORAL LENGTH OF SOUTH INDIAN FEMURS

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### ABSTRACT

**Background:** Femoral neck anteversion describes the angle subtended by the femoral neck with reference to the transcondylar plane of the distal end of the femur and is usually 15° to 45°. This along with the neck shaft angle, hip axis length, femoral neck width influence the risk of femoral neck fracture. Femoral neck anteversion angle has to be taken into consideration when reduction and fixation is selected as a method of treatment.

**Objectives:** The objectives of present study to find out the measurements of Neck shaft angle, Femoral Length and Neck Length of femur.

**Materials and Methods:** In present study have used 250 femurs from different colleges in south India. The following measurements were conducted Neck shaft angle, Femoral Length and Neck Length of femur.

**Results:** The results of present study are the length of femur was 446.2±26.39mm, right femur was 446.6±26.66mm and left femur was 445.8±26.12mm, the Neck Length femur was 36.3±4.2mm, right femur was 36.1±4.1mm and left femur was 36.4±4.3m. the neck shaft angle of femur was 137.1°, right femur was 137.3° and left femur was 136.9°.

**Conclusion:** There is no significance difference between right and left femur measurements. Orthopaedists and Radiologists use the normal range and means of the neck shaft angle in the diagnosis and treatment of the disease of the hip. The angle is increased in congenital subluxation and dislocation of the hip, poliomyelitis, cerebral palsy and idiopathic scoliosis and decreased in the congenital coxavara, post traumatic coxa vara due to malunited femoral neck and inter trochanteric fractures.

**KEY WORDS:** Femoral Length, Neck Length, Neck Shaft angle and Femur.

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### INTRODUCTION

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. The femur is the longest & strongest bone in the body. Its length is associated with a striding gait, its strength with the weight and muscular forces which it must withstand. Its shaft is almost cylindrical. It has a proximal rounded articular head projecting medially from its short neck.

The femoral neck length is approximately 5cm long and connects the head to shaft at an average angle of 135°. This angle facilitates movements at the hip joint, enabling the limb to swing clear of the pelvis[1].

Osteoporosis is generally considered to be a condition affecting women, but up to 30% of fragility fractures occur in men. The lifetime risk of fracture at the age of 50 years has been estimated to be 20% for men. Bone mineral density has long been recognised as an important skeleton determinant of fracture risk,

but it is becoming apparent that skeletal geometry also influences the risk. This has been most extensively studied in women at the hip, in terms of hip axis length, femoral neck axis length, neck shaft angle and femoral neck width. The role of all of these factors as independent predictors of hip fracture risk is controversial in both sexes, with studies giving conflicting results. This uncertainty may have arisen partly because of differences in study design, numbers of patients studied, and also because of wide variations in geometric parameters in different countries and races. Given this variation, it may be necessary to generate data specific to the population under consideration. According to study of S. P. Tuck et al, showed that men had a mean femoral NSA of  $130^{\circ} \pm 3.3$ , range 121–138°, whilst women had a significantly smaller mean femoral neck shaft angle of  $128^{\circ} \pm 1.7$ , range 119–137°[2].

The neck shaft angle varies with age, stature and width of pelvis. When this angle  $>135^{\circ}$ , condition is known as coxavalga. When angle  $<120^{\circ}$ , it is known as coxa vara. The angle of femoral neck is reduce with aging. In early infancy the neck shaft angle is about  $150^{\circ}$ , in childhood  $140^{\circ}$ , in adult about  $125^{\circ}$  and in elderly about  $120^{\circ}$ . Operations on proximal femur are one of the commonest in orthopaedic surgical practice. The aim of these operations is to remove pathology & restore anatomy to the normal as far as possible. Since build, physique, habits & genetic makeup vary markedly in different ethnic groups, it is possible that anthropometric dimensions describe as normal for proximal end of femur for western region be quite different from these encountered amongst Indian[3,4,5].

The knowledge of the angle of inclination is a valuable aid in the diagnosis and treatment of the fractures of upper end of femur. The length of the femur and stature are of forensic & anthropological significance. Bony markers such as the head & neck of femur can be used in determining the femoral length when only a fragment of proximal femur is available & the required size of length of the neck can be determined to design prosthesis for restoration of normal neck shaft angle. The present study aim is that to find out femoral length, Neck length and Neck shaft angle.

## MATERIALS AND METHODS

In present study have used 250 femurs from different colleges in south India. The following measurements were measured Neck shaft angle, Femoral Length and Neck Length of femur.

Instruments Used for this study are Sliding Caliper, Osteometric Board and measurements measured according to standard anthropometrical method[6,7].

## RESULTS

The results of present study are the length of femur was  $446.2 \pm 26.39$ mm, right femur was  $446.6 \pm 26.66$ mm and left femur was  $445.8 \pm 26.12$ mm, the Neck Length femur was  $36.3 \pm 4.2$ mm, right femur was  $36.1 \pm 4.1$ mm and left femur was  $36.4 \pm 4.3$ mm. The neck shaft angle of femur was  $137.1^{\circ}$ , right femur was  $137.3^{\circ}$  and left femur was  $136.9^{\circ}$ (Table 1).

**Table 1:** Showing the results of femoral length, Neck Length and Neck Shaft angle.

Parameter	Number	Mean $\pm$ SD(mm)
Femoral Length	Total	250
	Right	121
	Left	129
Neck Length	Total	250
	Right	121
	Left	129
Neck Shaft Angle	Total	250
	Right	121
	Left	129

## DISCUSSION

In our study the length of femur was  $446.2 \pm 26.39$  mm, right femur was  $446.6 \pm 26.66$  mm and left femur was  $445.8 \pm 26.12$  mm. our results in agreement with Pandya A M et al study[6], in this study mean value of maximum length was higher in male as compared to female. Calculated t-value and P value showed that the difference in the mean maximum length in male and female was highly statistically significant with  $P < 0.001$  on both side. For right male bone calculated range was 379.99-523.63 and for right female bone it was 358.26-476.70, according to Pandya A study right femur with maximum length more than  $>476.70$  mm can be correctly classified as a male and right femur with maximum length less than  $<379.99$  mm can be correctly classified as a female. according to Pandya if the length is between 379.99 mm and

476.70 mm, sexing was not possible[8]. The present study femur length is correlated with study of Rajeshwari S B[9]. According to Rajeshwari S B, the calculated range for right male was 379.88-523.33 mm and that for right female it was 358.16-476.80 mm.

The mean femur neck length of present study was  $36.3 \pm 4.2$  mm, the right femur neck length was  $36.1 \pm 4.1$  mm and the left femur neck length was  $36.4 \pm 4.3$  mm, our results are in agreement with Ravichandran et al study, in their study the mean femur neck length was 31.88mm[10]. Our results also in correlation with Siwach RC[11] study in his study the mean femur neck length was 37.2 mm and minimum effective neck length was 22.6 mm.

The mean Neck shaft angle of present study  $137.1^\circ$ , the right femur neck shaft angle  $137.3^\circ$  and the left was  $136.9^\circ$ . Our results are in agreement with Ravichandran et al study, in their study the neck shaft angle was  $126.55^\circ$ [10]. Our results also in agreement with study of Subhash Gujar, in their study the average neck shaft angle was  $136.2^\circ$ . The average neck shaft angle of Isaac et al study was  $126.7^\circ$ [1], In Siwach RC study it was  $123.5^\circ$ . in our study the neck shaft angle correlates positively with length of neck of femur[12].

## CONCLUSION

In the present study the mean femoral neck angle was  $137.1^\circ$ , was  $9.8^\circ$ . mean femur neck length was  $36.3 \pm 4.2$  mm and the mean length of femur was  $446.2 \pm 26.39$  mm. There was no significant difference between right and left femur bones. Therefore this study will be of use in the fields of orthopaedic surgery to diagnose various hip pathologies and in planning derotation osteotomy of femur, forensic anthropology to determine the racial variations of the femoral anteversion and also to the anatomists.

**Conflicts of Interests: None**

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