



## Original Article

# Neck Shaft Angle of Femur and Its Clinical Implications

Authors

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### Abstract

**Background:** Neck shaft angle is formed by femur shaft axis and femoral neck. This angle varies with age, physique, habits and genetic makeup vary in different ethnic group, so it is possible that the anthropometric dimensions of proximal end of femur for western group is different from Indian population.

**Objectives:** The objectives of this study is to determine the femur length, femur neck length and neck shaft angle of femur.

**Material and Method:** The present study was conducted in the Narayan Medical College, Sasaram, Bihar from November 2018 to May 2019. The specimen was collected from Narayan Medical College and other medical colleges of Bihar. Following measurement were taken, length of femur, anterior neck length and neck shaft angle of femur.

**Results:** The results obtained from this study were mean length of femur was  $416.02 \pm 16.45$  mm, right were  $415 \pm 1837$  mm and left were  $416.02 \pm 16.45$  mm. The mean neck length was  $37.70 \pm 3.60$ , right and left were  $35.15 \pm 3.64$  mm and  $36.27 \pm 3.50$  mm respectively. The mean neck shaft angle was  $133.99 \pm 4.45$  degree, right and left neck shaft angle were  $133.63 \pm 4.38$  degree and  $134.34 \pm 4.55$  degree respectively.

**Conclusion:** There is no significant difference between measurement of right and left femur. The radiologists and orthopaedists use this normal range of measurement in diagnosis and treatment of disease of hip.

**Keyword:** Femoral length, neck length, neck shaft angle of femur.

### Introduction

The anatomical knowledge of femur bone is important to understand different clinical disease conditions such as common site of fracture, changes in osteoporosis, associated congenital anomalies as well as medico-legal cases. The femur is the longest and strongest bone and its length is associated with striding gate. It has upper end, shaft and lower end. The upper end consist of head, neck, greater and lesser trochanters. The

shaft is almost cylindrical bowed forward. Head projecting medially from its short neck which articulate with acetabulum and form hip joint. The distal end of femur is expanded transversally and presents two condyle that articulate with tibia. The neck shaft angle of femur is formed by femoral shaft axis and femoral neck. The angle facilitate movement at hip joint to swing the limb clear of pelvis<sup>[1]</sup>. The neck shaft angle varies with age, stature and width of pelvis. When the neck shaft

angle is less than  $120^{\circ}$  the condition is known as Coxavara, whereas when this angle is more than  $135^{\circ}$  known as Coxavalga. This angle is reduced with age. In early infancy the neck shaft angle is about  $150^{\circ}$ , in childhood  $140^{\circ}$ , in adult  $125^{\circ}$  and in elderly angle is about  $120^{\circ}$ . Since built, physique, habits and genetic makeup vary in different ethnic group, so it is possible that anthropometric dimensions of proximal end of femur for western region is different from Indian population<sup>[2,3,4]</sup>. The knowledge of neck shaft angle is important in diagnosis and treatment of fracture of upper end of femur. Adequate size of length of neck is required to design prosthesis for restoration of normal neck shaft angle. The aim of this study to find out femoral length, neck length and neck shaft angle.

### Material and Method

82 dry femurs (41 right and 41 left) of unknown age and sex were collected from department of Anatomy, Narayan Medical College, Sasaram, Darbhanga Medical College and also from Sri Krishna Medical College, Muzaffarpur during the period of November 2018 to May 2019. Fractured and deformed bones were excluded from the study. The following parameter were taken-

1. Femoral length- It is the maximum distance between the upper end of head of femur and lowest point on femoral condyle. Femoral length were measured with the help of osteometric board.
2. Femoral neck length- It is the distance between base of femoral head and intertrochanteric line at the junction of front of neck and shaft. Femoral neck were with the help of sliding caliper.
3. Neck shaft angle of femur- The neck shaft angle is formed by axis of neck with the axis of shaft. NSA were measured with the help of goniometer. Axis of neck is formed by the line joining the two center point on front of neck and the axis of shaft is formed by the two center point on front of shaft.

### Results



**Fig.1.** Measurement of femoral neck length



**Fig. 2.** Measurement of femoral neck shaft angle

**Table 1** Showing the Result of all parameter

Parameter		Mean (mm)	Range (mm)	Standard deviation
Femoral length (mm)	Right	415.34	356-468	18.37
	Left	416.71	365-452	14.48
	Total	416.02	356-468	16.45
Neck length (mm)	Right	35.15	26-41	3.64
	Left	36.27	26-44	3.50
	Total	35.70	26-44	3.60
Neck shaft angle (degree)	Right	133.63	121-140	4.38
	Left	134.34	120-139	4.55
	Total	133.99	120-140	4.45

In the present study, the mean femoral length was 416.02±16.45 mm, right femur was 415.34±18.37 mm and left femur was 416.71±14.48 mm. The mean neck length of femur was 35.70±3.60 mm,

right and left was 35.15±3.64 mm and 36.27±3.50 mm respectively. The mean neck shaft angle of femur was 133.99±4.45, right and left was 133.63±4.38 and 134.34±4.55.

**Discussion**

**Table 2** Comparison of length of femur

Authors	Population	Side	Femur length (mm)
Pandya et al (2011)[5]	Gujarat	Right	M: 451.8 F: 417.4
		Left	M: 453.3 F: 420.4
Bhosale and Zambare (2013)[6]	Ahmednagar	Right	M: 450.8 F: 416.4
		Left	M: 452.3 F: 420.4
Timonov et al. (2014) [7]	Bulgaria	Right	M: 461.7
		Left	F: 411.7
Dhivya (2015) [8]	South Indian	Right	412.9
		Left	418.8
Ozandac et al. (2015)	Turkey	Right	429.5
		Left	431.3
Present study (2019)	Bihar	Right	415.34
		Left	416.71

The length of femur among different population tabulated in table 2. The differences in femur length is multifactorial due to genetic constitution, environment and nutritional status which affects the morphology of bones. In this study, the length

of femur was 416.02 mm, right femur was 415.34 mm and left femur was 416.71. This is closely related to study done by Dhivya et al in South Indian population.

**Table 3** Showing comparison of neck length of femur

Authors	Population	Side	Neck length
Khan and Saheb (2014) [9]	South india	Right	36.1±4.1mm
		Left	36.4±4.3mm
Ozandac et al. (2015)	Turkey	Right	22.2
		Left	22.5
Sundar and Sangeetha (2018) [10]	South India	Right	28.8
		Left	31.8
Chaudhary et al. (2019) [11]	Karnataka	Right	28.8±3.3
		Left	28.8±4.0
Present study	Bihar	Right	35.15±3.64
		Left	36.27±3.50

In this study, the mean neck length of femur was 35.15 and 36.27 mm in right and left respectively.

This data is closely related to the study done by Khan and Saheb in south india population.

**Table.4.** Showing comparison of neck shaft angle

Authors	Population	Side	Neck shaft angle
Osorio et al. (2009)	Chile	Right	124.3°
		Left	123.9°
Gujar S (2013)[1]		Right	136.6 <sup>0</sup>
		Left	136.6 <sup>0</sup>
Khan and Saheb (2014) [9]	South Indian	Right	137.30 <sup>0</sup>
		Left	136.90 <sup>0</sup>
Ozandac et al. (2015)	Turkey	Right	121.1°
		Left	122.2°
Dhivya (2015)	South Indian	Right	132.66 <sup>0</sup>
		Left	135.02 <sup>0</sup>
Sinha RR et al (2017) [12]	Bihar		Male-130.28 <sup>0</sup> Female-131.42 <sup>0</sup>
Present study	Bihar	Right	133.63 <sup>0</sup>
		Left	134.34 <sup>0</sup>

The mean neck shaft angle of femur of present study was 133.63 mm and 134.34 mm in right and left side respectively. This results are in agreement with study done by Gujar S.

### Conclusion

There is was no significant difference between measurement of right and left femur. The statistical analysis of morphometry of different parameters among various population shows a large amount of variations may be due to climate, hereditary, diet and others geographical factors related to life style. The angle is increased in congenital subluxation and dislocation of hip, cerebral palsy, poliomyelitis and idiopathic scoliosis and decreased in posttraumatic coxavara due to malunited neck of femur and inter trochantic fracture.

### References

1. Subhash Gujar, Sanjay Vikani, Jigna Parmar, K V Bondre. A correlation between femoral neck shaft angle to femoral neck length. IJAR;2013;04(05).
2. Williams Perter L. Warwick Roger. Dyson Mary Bannister Lawrence H. Gray's Anatomy.. Churchill livingstone London. Editor J. 40th e 1989;434.

3. R A Duthie, M F Bruce, J D Hutchison - Changing proximal femoral geometry in north east Scotland: an osteometric study. BMJ 1998;316:16.
4. Norkin, C.C. and P.K. Levangie. The hip complex. In Joint Structure and Function. Philadelphia: F.A. Davis. 1983;255–289.
5. Pandya AM, Singel TC, Akbari VJ, Dangar KP, Tank KC, Patel MP. Sexual dimorphism of maximum femoral length. Natl J Med Res 2011;1:2.
6. Bhosale RS, Zambare BR. Sex determination from femur using length of femur in Maharashtra. J Dent Med Sci 2013;3:01-3.
7. Timonov P, Fasova A et al. A study of sexual dimorphism in the femur among contemporary Bulgarian population. Euras J Anthropol 5(1):46–53, 2014
8. Dhivya S, Nandhini V. A Study of Certain Femoral Metrics in South Indian Population and its Clinical Importance. Int J Sci Stud 2015;3(7):132-135.
9. Shakil Mohamad Khan, Shaik Hussain Saheb. Study on Neck Shaft Angle and Femoral Length of South Indian Femurs. Int J Anat Res 2014;2(4):633635.
10. Sundar G., Sangeetha V. Morphometric Study of Human Femur. International Journal of Medical Research and Pharmaceutical Sciences 2018; 5(3): 52-55
11. Chaudhary PN, Shirol VS, Virupaxi RD. A morphometric study of femoral length, anterior neck length, and neck-shaft angle in dry femora: A cross-sectional study. Indian J Health Sci Biomed Res 2017;10:331-4.
12. Sinha RR et al. Int J Res Med Sci. 2017 Nov;5(11):4819-4821.