

## Original Research Article

# Study of neck shaft angle of femur in population of Bihar

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### ABSTRACT

**Background:** Neck shaft angle is the angle formed between the long axis of shaft and long axis of neck. Neck shaft angle of femur is an important parameter considering the biomechanics of hip joint. Neck shaft angle gives important information regarding race to which they belong. Normal neck shaft angle is in the range of  $120^{\circ}$  -  $140^{\circ}$ . Objective of the study was to find out the neck shaft angle of femur and correlate with the previous study.

**Methods:** present study was conducted on 60 dry femur collected from different medical colleges of Bihar. The neck shaft angle was measured by Goniometer.

**Results:** In this study the neck shaft angle of femur was  $130.82^{\circ}$ , in male neck shaft angle of femur was  $130.28^{\circ}$  and in females it was  $131.42^{\circ}$ .

**Conclusions:** There is no significance difference between the male and female neck shaft angle. Orthopaedists use the normal range and mean of the neck shaft angle in diagnosis and treatment of the disease of hip. The angle is increased in poliomyelitis, congenital subluxation and dislocation of hip and decreased in congenital coxa vara.

**Keywords:** Angle of inclination, Collodiaphyseal angle, Femur, Neck shaft angle

### INTRODUCTION

The femur or thigh bone is the strongest and longest bone of the body and about 45 cm long in an average man that means approximately one fourth of the height of individual. It has upper end, lower end and a cylindrical shaft. Upper end consists of head, neck, greater and lesser trochanter, inter-trochanteric line and inter-trochanteric crest. The neck is about 5 cm long, connects the head to the shaft and is directed upward, medially and slightly forward and making an angle about  $125^{\circ}$  with shaft but the angle is wider in children. The elongated neck shaft angle facilitates movement at hip joint enabling the limb to swing clearly.<sup>1</sup>

The neck shaft angle is defined as the angle between the long axis of shaft of femur and long axis femoral neck.

Neck shaft angle is also known as angle of inclination, angle of neck of femur, collodiaphyseal angle, cervicodiaphyseal angle and collum diaphyseal angle. Normal neck shaft angle varies between  $120^{\circ}$ - $140^{\circ}$ .

If the neck shaft angle is less than  $120^{\circ}$  is known as coxa vara, when this angle is more than  $140^{\circ}$  it is called coxa valga. According to study of SP Tuck et al, showed that men had mean neck shaft angle of  $130^{\circ} \pm 3.3$ , range  $121^{\circ}$ - $138^{\circ}$  while women had a smaller mean femoral neck shaft angle of  $128^{\circ} \pm 1.7$ , range  $119^{\circ}$ - $137^{\circ}$ .<sup>2</sup>

The knowledge of the neck shaft angle is valuable in the diagnosis and treatment of fracture of upper end of femur. The neck shaft angle can be estimated from proximal fragment of femur and required size of the length of neck can be determined to design prosthesis for the restoration

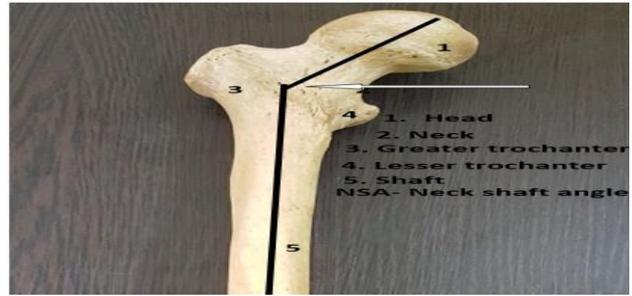
of normal shaft angle. It is important to know about the proximal femoral geometry in pre-operative planning of osteotomy, arthroplasty or fracture fixation.<sup>3</sup> It is also helpful in designing suitable implants with more accurate angulations of femur neck.<sup>4</sup> Use of undersized or oversized femoral implants can leads to altered soft tissue tensioning and altered patella femoral stresses.<sup>5</sup> In case of improper selection of femur implant, there may be serious problems for the patients in long run.<sup>3,6</sup>

The main aim of this study was to correct the different types of deformity and to have a normal good walking mechanism and to know the recent methodology and they're by attempt to evaluate the range of normal angles of femur and their sex differences.

**METHODS**

The present study was conducted on 60 dry femurs. 60 human dried femur bones obtained from department of anatomy and department forensic medicine of Indira Gandhi Institute of Medical Sciences, Patna Bihar and also from different medical colleges of Bihar. Femur bone with prominent pathological changes or damaged bones were excluded. Neck shaft angle is defined as the angle between the long axis of shaft and the long axis of neck of femur. The angle is measured with the help of goniometer. In this study neck shaft angle was measured by marking long axis of shaft and long axis of neck. The long axis of neck was drawn by taking two points, one at the center of head and other at the upper end of the midpoint of the narrowest part of the neck.

Then joined the two points, this line represents the axis of thee neck. Long axis of shaft was drawn by taking two mid-points of shaft, one at the upper end of shaft and other at the lower end of shaft, the two points were joined and same line was extended at the upper end to cut the long axis of neck. The angle was measured by the help of goniometer and the angle was noted.



**Figure 1: Neck shaft angle (NSA).**

**RESULTS**

In this study, neck shaft angle was measured and recorded in 60 femurs. Among 60 femurs, 36 were classified as male and 24 were female. The minimum angle measured was 119<sup>0</sup> and maximum angle was 141<sup>0</sup>. The mean neck shaft of all femur was 130<sup>0</sup>±4.86. The mean neck shaft angle in male was 130<sup>0</sup>.28 and in female was 131<sup>0</sup>.42. Neck shaft angle was slightly greater in female bones than male bones.

**Table 1: Showing the result of neck shaft angle.**

	N	Mini- mum	Maxi- mum	Mean	Std. deviation
Neck shaft angle	60	119 <sup>0</sup>	141 <sup>0</sup>	130.82 <sup>0</sup>	4.86

**Table 2: Comparison of mean and standard deviation of neck shaft angle between male and female.**

	Sex	N	Mean	Std. deviation
Neck shaft angle	Male	36	130.28 <sup>0</sup>	5.71
	Female	24	131.42 <sup>0</sup>	3.28

**Table 3. Comparison of neck shaft angle of present study with previous study.**

Author	Year	Sample size	Population	Method	Neck shaft angle	Standard deviation
Rc Siwach	2003	150	Rohtak	Dry bone	123.5	4.3
RC Siwach	2003	150	Rohtak	Dry bone-x ray	123	4.3
KC Saikia	2008	92	Guahati	Ct	139.5	7.5
TR Deshmukh	2010	77	Vidarbha	X-ray	131.5	-
present study	2017	60	Bihar	Dry bones	130.82	4.86

**DISCUSSION**

The mean neck shaft angle of this study was similar to the study done by most Indian authors. The study done by KC Saikia among people of Guwahati using CT scan was 139.5 which was very high neck shaft angle as compared

to other studies.<sup>7</sup> The study done by RC Siwach in 2003 among people of Rohtak using dry bones, neck shaft angle was 123.5<sup>0</sup> which is very low compared to this study.<sup>8</sup> The neck shaft angle of present study was similar to study done by TR Deshmukh in Vidarbha.<sup>9</sup> There are wide range of variations in neck shaft angle in different

study in different population group. The variations in nonmechanized rural people have lowest angle and the urban people have maximum neck shaft angle.

The femoral neck shaft angle shows considerable variation both within and between human populations. Anderson JY in their study of 30 different population group, there are considerable pattern of increased mean angles with an increasingly sedentary existence.<sup>10</sup> He observed that strong pattern of increasing neck shaft angle with decreasing mobility and decreasing neck shaft angle with more heavy workers. This is evident in reduced or absent weight bearing during development seen in infantile congenital dislocation of hip, slipped femoral capital epiphysis, cerebral palsy and immature idiopathic scoliosis.<sup>11,12</sup>

Physique, habits and genetic makeup vary in different ethnic groups, so anthropometric dimensions described as normal for proximal end of femur for westerns might be quite different from those encountered amongst Indians. Neck shaft angle are very high (150<sup>0</sup>) in neonates and then gradually decreases during development, reaching adult values during adolescence.<sup>13,14</sup>

## CONCLUSION

In the present study, data collected from 60 femur from Bihar in the northern part of India were analyzed and compared with those of previous study of different regions of India. In the present study, the mean neck shaft angle was 130.82<sup>0</sup>. The neck shaft angle was ranging between 119<sup>0</sup> to 141<sup>0</sup>. There was no significant difference between male and female neck shaft angle of femur.

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