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Original Research Article

A COMPARATIVE STUDY ON NECK SHAFT ANGLE AND LENGTH FEMUR IN SOUTH GUJARAT.

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ABSTRACT

Introduction: The femur is the largest and strongest bone in the body and the structure of its proximal portion allows the leg to move in three dimensions relative to the torso, thus serving as a linchpin of human mobility. Moreover, age related and pediatric disorders at this skeletal site are common and confer strong risk factors for current and future disability. The femur forms the skeleton of the thigh, carries body weight, supports the movements of leg and provides attachment to the muscles. Morphology of bones is very much affected by race, sex, environmental factors and life style.

Materials and Methods: For this study total 285 Femurs of various bodies in central Gujarat were collected randomly and unknown age & sex. 285 Femurs were studied in department of Anatomy, Sri B.K.Shah Medical institute & Research Centre. The following measurements were measured Neck shaft angle, Femoral Length and Neck Length of femur.

Results and Conlusion: Total mean length of femur was 435.8 ± 27.32 (Mean ± SD) mm. Right side mean length of femur was 436.2 ± 27.91 (Mean ± SD) mm. Left side mean length of femur was 433.8 ± 26.14 (Mean ± SD) mm. Maximum length of femur was 446 mm and minimum length was 423 mm.

KEY WORDS : Femur, Femoral Length, Femoral Neck Length, Femoral neck Shaft angle.

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INTRODUCTION

The femur is the longest and strongest bone in the human body. Its length is associated with a striding gait, its strength with weight and muscular forces. Its shaft, almost cylindrical in most of its length and bowed forward, has a proximal round, articular head projecting mainly medially on its short neck, which is a medial curvature of the proximal shaft.

The femoral neck is 5 cm long, narrowest in its mid part and widest laterally, and connects the head to the shaft at an angle of 125° : this facilitates movement at the hip joint, enabling the limb to swing clear of the pelvis. The neck also provides a lever for the action of the muscles acting about the hip joint, which are attached

to the proximal femur. The neck-shaft angle is widest at birth and diminishes until adolescence; it is smaller in females [1].

The neck-shaft angle is defined as the angle between the femoral shaft axis and femoral neck axis. It is also named as Neck Shaft Angle (NSA), Angle of neck of femur, angle of inclination, collodiaphyseal angle, cervicodiaphyseal angle and collum diaphyseal angle. Normal neck shaft angle varies between 120° -140°. If the neck shaft angle is less than 120° is known as coxa vara, when this angle is more than 140° it is called coxa valga. According to study of SP Tuck et al, showed that men had mean neck shaft angle of 130°±3.3, range 121- 138° while women had a smaller mean femoral neck shaft angle of 128°±1.7, range 119-137° [2].

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 [3]. It is also helpful in designing suitable implants with more accurate angulations of femur neck [4]. [Use of undersized or oversized femoral implants can leads to altered soft tissue tensioning and altered patella femoral stresses [5]. In case of improper selection of femur implant, there may be serious problems for the patients in long run [3,6].

MATERIALS AND METHODS

The present study was conducted in the department of Anatomy, Sri B.K.Shah Medical institute & Research Centre,Piparia, Vadodara from Jan 2018 to May 2019. For this study total 285 Femurs of various bodies in central Gujarat were collected randomly and unknown age & sex. 285 Femurs were studied in department of Anatomy, Sri B.K.Shah Medical institute & Research Centre.

The femurs were cleaned in tray and dry. Damaged and incomplete femurs were excluded from the study . After labeling all bones 285 femurs were studied for following measurement.

The following measurements were measured Neck shaft angle, Femoral Length and Neck Length of femur.

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

RESULTS

In the present study a total no. of 285 femurs were studied . Right side femurs were 145 in no. and left side femurs 140 in no.

Following measurement were taken for all femurs (Right & left)

1. Femoral length
2. Neck angle
3. Neck shaft angle.

Table 1: Length of femur.

Side	No.	Mean ± SD (mm)
Total	285	435.8 ± 27.32
Right	145	436.2 ± 27.91
Left	140	433.8 ± 26.14

Table no.1 shows total mean length of femur was 435.8 ± 27.32 (Mean ± SD) mm. Right side mean length of femur was 436.2 ± 27.91 (Mean ± SD) mm. Left side mean length of femur was 433.8 ± 26.14 (Mean ± SD) mm. Maximum length of femur was 446 mm and minimum length was 423 mm.

Table 2: Femoral neck length.

Side	No.	Mean ± SD (mm)
Total	285	38.2 ± 6.8
Right	145	39.8 ± 6.1
Left	140	36.7 ± 5.4

Table no.2 shows total mean length of femoral neck was 38.2 ± 6.8 (Mean ± SD) mm. Right side mean length of femoral neck was 39.8 ± 6.1 (Mean ± SD) mm. Left side mean length of femoral neck was 36.7 ± 5.4 (Mean ± SD) mm. Maximum length of femoral neck was 41 mm and minimum length was 29 mm.

Table 3: Femoral neck shaft angle.

Side	No.	Mean ± SD (Degree)
Total	285	137.2 ± 5.1
Right	145	136.9 ± 4.67
Left	140	137.6 ± 4.91

Table no.3 shows total mean femoral neck shaft angle was 137.2 ± 5.1 degree. Right side mean

femoral neck shaft angle was 136.9 ± 4.67 degree. Left side mean femoral neck shaft angle 137.6 ± 4.91 degree . Maximum femoral neck shaft angle was 146^0 and minimum angle was 121^0.

DISCUSSION AND CONCLUSION

Knowledge of the morphometric values of femoral segments is important in forensic, anatomic and anthropological cases to estimate the stature of unknown.

The neck of femur lies at an angle with the shaft-the neck-shaft angle. The angle in the new born is nearly equal to the adult. The average being 126.5° and range being 106°-151°. There is a racial and gender difference, smaller in females when compared to males. The difference in mean femoral length in between populations may possibly be a result of factors affecting bone morphology such as genetic constitution, diet, nutrition status, environment, and physical activity [9].

Femoral length:

Table 4: Comparison of length of femur.

Study	Side	No.	Mean ± SD (mm)
Present study	Total	285	435.8 ± 27.32
	Right	145	436.2 ± 27.91
	Left	140	433.8 ± 26.14
Shivashankarappa A et al [7]	Total	457	426 ± 32.76
	Right	273	434.3 ± 28.54
	Left	214	418.7 ± 36.14
Shakil Mohamad Khan et al [8]	Total	250	446.2 ± 26.39
	Right	121	446.6 ± 2.66
	Left	129	445.8 ± 26.12
Subhash Gujar et al [9]	Total	250	438 ± 25.64
	Right	119	439.57 ± 25.98
	Left	131	436.57 ± 25.31
Ravi G.O et al [10]	Total	592	447.1 ± 28.94
	Right	281	447.9 ±28.72
	Left	311	446.2 ± 29.12

The maximum length of femur was 446 mm and minimum length was 423 mm. The maximum length of left side femur was 436 mm and minimum length was 423 mm. The maximum length of right side femur was 446 mm and minimum length was 424 mm.

The mean femoral length in present study was 435.8 ± 27.32 mm. It was compared with Shivashankarappa A et al[7] (426 ± 32.76), Shakil Mohamad Khan et al[8] (446.2 ± 26.39) , Subhash Gujar et al[9] (438 ± 25.64) and Ravi G.O et al[10] (447.1 ± 28.94)

Table 5: Comparison of femoral neck length.

Study	Side	No.	Mean ± SD (mm)
Present study	Total	285	38.2 ± 6.8
	Right	145	39.8 ± 6.1
	Left	140	36.7 ± 5.4
Shivashankarappa A et al [7]	Total	457	38.8 ± 7.2
	Right	273	40.6 ± 5.3
	Left	214	36.3 ± 7.1
Shakil Mohamad Khan et al [8]	Total	250	36.3 ± 4.2
	Right	121	36.1 ± 4.1
	Left	129	36.4 ± 4.3
Subhash Gujar et al [9]	Total	250	34.4 ± 3.8
	Right	119	34.52 ± 4.0
	Left	131	34.21 ± 3.62
Ravi G.O et al [10]	Total	592	36.3 ±5.4
	Right	281	36.4 ± 5.2
	Left	311	36.1 ± 5.6

The mean femoral neck length in present study was 38.2 ± 6.8 mm. It was compared with Shivashankarappa A et al[7] (38.8 ± 7.2), Shakil Mohamad Khan et al[8] (36.3 ± 4.2) , Subhash Gujar et al [9] (34.4 ± 3.8) and Ravi G.O et al[10] (36.3 ±5.4) .

Our study results also in correlation with Siwach RC study, mean femur neck length was 37.2 mm and minimum effective neck length was 22.6 mm.

Table 6: Comparison of femoral neck angle.

Study	Side	No.	Mean ± SD (Degree)
Present study	Total	285	137.2 ± 5.1^0
	Right	145	136.9 ± 4.67^0
	Left	140	137.6 ± 4.91^0
Shivashankarappa A et al [7]	Total	457	138.3 ± 5.67^0
	Right	273	136.2 ± 4.54^0
	Left	214	140.1 ± 5.43^0
Shakil Mohamad Khan et al [8]	Total	250	137.1
	Right	121	137.3
	Left	129	136.9
Subhash Gujar et al [9]	Total	250	136.3 ± 6^0
	Right	119	136.0 ± 6.68^0
	Left	131	136.6 ± 5.45^0
Ravi G.O et al [10]	Total	592	136.8 ± 4.45^0
	Right	281	136.9 ± 4.41^0
	Left	311	136.7 ± 4.49^0

The mean femoral neck angle in present study was 137.2 ± 5.1^0. It was compared with Shivashankarappa A et al[7] (138.3 ± 5.67^0), Shakil Mohamad Khan et al[8] (137.1^0) , Subhash Gujar

et al [9] (136.3 ± 6^0) and Ravi G.O et al[10] (136.8 ± 4.45^0).

Our study results were also compared with Ravichandran et al [11] (126.55).

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.

The knowledge of the morphometric values of femoral segments is important in forensic, anatomic and archaeological cases in order to identify unknown bodies and stature [12,13]. It is also helpful for the clinician in the treatment of proximal and distal femoral fractures [14,15].

Conflicts of Interests: None

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