

## Transverse Diameters of Head and Neck of Femur in Central India Population

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### Abstract

**Introduction:** The proximal end of Femur consists of the head, the anatomical neck which joins head to the trochanters, trochanters which serve as insertion sites for muscles, and the surgical neck that attaches the proximal epiphysis with the diaphysis. It is imperative for Anatomists, Radiologists, Forensic experts and Orthopaedicians alike to stay abreast about the morphometric characteristics of proximal Femur. **Objectives:** This study was planned to measure transverse diameters of head and neck of Femurs in central India population. **Materials and Methods:** This study was performed on 100 dried, intact, nonpathological Femurs of both gender over a period of 2 years. Vernier Calipers, Osteometric Board, Goniometer, and Fiberglass Tape were used for measurement of transverse diameters of head and neck of Femurs. **Results:** Transverse Diameter of Head (TDH) was found to be  $4.3 \pm 0.3$  cm on both sides in males, and  $4.3 \pm 0.5$  cm (Right side) and  $4.3 \pm 0.2$  cm (Left Side) in females. In males, Transverse Diameter of Neck (TDN) was  $2.6 \pm 0.3$  cm (Right side) and  $2.5 \pm 0.3$  cm (Left Side). TDH and TDN were found to be higher in female Femurs. There was no statistically significant difference in TDH and TDN between Right and Left side. **Conclusion:** Femur being most important bone of thigh, health care practitioners should be well aware of head & neck morphometry of Femur and its variations.

**Keywords:** Femur, Diaphyses, Head, Anatomy.

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### Introduction

The femur is the longest and one of the sturdiest bones in human body. It forms the skeleton of thigh, carries body weight, supports the movements of legs, provides attachments to muscles, forms red blood corpuscles and is a storehouse of calcium and phosphorus. It separates humans from other primates. The structural changes to human femur are distinctively associated with the evolution of human bipedalism and erect posture. The upper end of femur presents a head, a neck, a greater and lesser trochanter.

The head (Caput Femoris) is spherical (a little over a hemisphere) and is directed medially, upwards, and slightly forwards. The larger portion of its convexity is above and in front. It has a smooth surface covered with cartilage, except at the fovea capitis femoris, an ovoid depression located a little lower and posterior to the centre of head which provides attachment to the ligamentum teres.

Maximum stress during bodily movements occurs at the neck of Femur (Collum Femoris). The neck is cylindrical in shape and connects head to the body. It forms a wide angle with the body that opens medialwards. It is flattened anteroposteriorly, constricted in the middle, and wider laterally than medially. It is pierced by several vascular foramina on the anterior surface.

The posterior surface of neck broader, smoother and more concave compared to the anterior surface. Approximately a centimetre above the intertrochanteric line, the posterior part of the capsule of the hip-joint is attached to it. The superior border of neck is pierced by large vascular foramina and ends at greater trochanter laterally. The inferior border of neck is long and slender, and curves slightly backwards to end at lesser trochanter.

Proximal femur fractures have become quite rampant in today's hectic lifestyle and these numbers probably will continue to rise particularly affecting the elderly people[1]. Apart from decreasing bone mass with aging[2], several other factors are implicated in these fractures, like reduced muscle mass[3], postural unsteadiness, quality of bone[4], genetic factors such as type 2 collagen synthesizing gene polymorphism[5] and the geometry of the proximal femur[6].

### Materials and methods

This descriptive research study was in department of Anatomy over a period of two years. The study was approved by the Institutional Ethics Committee of L N Medical College And Research Centre, Bhopal, Madhya Pradesh, India beforehand. A total of 100 Femurs (male = 61, female = 39) were selected.

Dried adult Femurs of both gender and sides were included in the study. Segmented, mal-united, deformed Femurs and the ones with unclear bony landmarks were excluded. Vernier Calipers, Osteometric Board, Goniometer, and Fiberglass tape were used for measurement of transverse diameters of head and neck of Femurs. The diameters were expressed in centimeters.

Statistical analysis was done with the help of MS Excel and Graph Pad software. Unpaired student's t test was used to compare the

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means and p value of less than 0.05 was considered as statistically significant.

## Results

Results are summarized in tabular form (Tables 1 – 5). As depicted in Table 2, TDH and TDN were found to be higher in female Femurs. There was no statistically significant difference in TDH and TDN gender and side wise (Tables 3 – 5).

**Table 1. Gender and side wise number of Femurs included in the study.**

Gender	Right Side	Left Side	Total
Male	32	29	61
Female	18	21	39

**Table 2. Comparison between male and female Femurs (Unpaired student's t test).**

	Male (n =61)	Female (n =39)	p Value
TDH (in cm)	4.2 ± 0.2	4.3 ± 0.2	0.0165
TDN (in cm)	2.5 ± 0.2	2.6 ± 0.2	0.0165

**Table 3. Comparison between right and left side Femurs (Unpaired student's t test).**

	Right side (n =50)	Left side (n =50)	p Value
TDH (in cm)	4.3 ± 0.3	4.3 ± 0.3	1.000
TDN (in cm)	2.6 ± 0.3	2.6 ± 0.2	1.000

**Table 4. Gender wise comparison of right and left side Femurs (Unpaired student's t test).**

	Right side (n =50)			Left side (n =50)		
	Male (n = 32)	Female (n = 18)	p Value	Male (n = 29)	Female (n = 21)	p Value
TDH (in cm)	4.3 ± 0.3	4.3 ± 0.5	1.000	4.3 ± 0.3	4.3 ± 0.2	1.000
TDN (in cm)	2.6 ± 0.3	2.7 ± 0.3	0.2635	2.5 ± 0.3	2.6 ± 0.2	0.1908

**Table 5. Side wise comparison of male and female Femurs (Unpaired student's t test).**

	Male (n =61)			Female (n =39)		
	Right Side (n = 32)	Left Side (n = 29)	p Value	Right Side (n = 18)	Left Side (n = 21)	p Value
TDH (in cm)	4.3 ± 0.3	4.3 ± 0.3	1.0000	4.3 ± 0.5	4.3 ± 0.2	1.0000
TDN (in cm)	2.6 ± 0.3	2.5 ± 0.3	0.1986	2.7 ± 0.3	2.6 ± 0.2	0.2226

## Discussion

Just like any other human bone, the head and neck of femur shows gender differences in male and female bones and these have immense applied and practical value in medicolegal field[7]. Our study also showed that both TDH and TDN were significantly higher in female Femurs (Table 2). Our results are similar to the results reported by Purkait R[7], Soni G et al[8] and Srivastava R et al[9].

Ziylan T[10] reported that there is no significant difference between right and left femurs. A study by T. Jayachandra Pillai et al[11] showed that the TDH varies from 28 mm to 44 mm (mean 37.86 mm). As per Rashid S et al.[12] the mean TDH was 42.65 ± 3.25 mm for right and 42.36 ± 3.69 mm for left femur. In our study we did not find any significant difference between right and left femurs (Table 3).

According to Chowdhary et al.[13] the TDN of the femur was 5.82 ± 0.19 cm and 4.21 ± 0.20 cm in male and female femurs respectively and the difference was significant. The mean diameters (vertical and transverse) of head and neck of femur were lower than their study. Komatsu T[14] concluded that the mean actual measurements were: 44.6 (MLD) and 40.9 (APD) for subcapital diameters; 33.5 (MLD) and 27.5 (APD) for midcervical diameters; and 44.0 (MLD) and 27.9 (APD) for basilar diameters.

When we compared the parameters of left and right sides in both sexes, TDH and TDN showed statistically non-significant difference (Table 4 and 5). The results obtained from this study can be used as a reference for other studies in department of Radiology, Orthopaedics, Forensic Medicine and Anatomy. More importantly these can also be used in designing prosthesis for various Orthopaedic surgeries which involve the head of femur.

## Conclusion

Femur being most important bone of thigh, health care practitioners should be well aware of head & neck morphometry of Femur and its variations.

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