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## **Morphometric analysis of proximal end of femur in north Indian population**

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### **Abstract**

**Background:** Morphometric analysis help in reconstruction of bone and a proper surgical planning. It also helps in making of surgical plates and creating of screw and other implanted supported which help in proper management of proximal fracture treatment. Such type of morphometric measurement also helps an anthropology and forensic analysis.

**Objectives:** To determine the dimension of proximal end of femur

**Material and Methods:** This is an observational cross sectional study. 100 femur were taken with known sex to measure the head vertical diameter (HVD), Neck vertical diameter and Head transverse diameter on both side of each humerus. The different parameters of each humerus were measured by with the help of Digital Vernier calipers.

**Results:** The mean head vertical diameter of male was  $45.46 \pm 1.7$  and in female  $40.57 \pm 2.56$ . The mean neck vertical diameter of male  $32.57 \pm 2.857$  and in female it was  $24.59 \pm 2.9$ . The mean head transverse diameter for male was  $44.91 \pm 1.91$  and in female  $40.36 \pm 2.57$ .

**Keywords:** femur, head of femur, proximal end of femur

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### **Introduction**

Femur is the thigh bone which is longest and strong bone in our body. It consists of two ends proximal and distal. The proximal end of femur consisting head neck on it upper part and its distal part consisting two large projections known as greater trochanter and lesser trochanter. Femur head is spherical in shape which articulates with the acetabulum and from hip joint. The average length of neck is 4-5cm and diameter is smallest from back and compressed at its middle. On its medial surface, it has a non-articular pit called fovea which gives attachment to the round ligament of the head of the femur. Femoral neck is a cylindrical strut of bone which connects the head to the shaft of the femur. Approximately at an angle of  $125^{\circ}$  the neck projects superomedially from the shaft and also it projects slightly forwards. The greater and lesser trochanters provide attachments to the muscles that move the hip joint <sup>[1]</sup>. Proximal end is the commonest site of fractures which involved neck and trochanter <sup>[2]</sup>. Morphometry analysis of proximal end of femur is very important due to it's varies with different ethnicity and individuals. Proximal femur fracture including neck and trochanters and for its early recovery implantation is the best method <sup>[3]</sup>. Implants required dynamic hip screws, cancellous screws, blade and plates are designed according to the measurements of proximal end of femur. These implants required exclusively designed based on measurements <sup>[4]</sup>. The present study therefore aims to evaluate the morphometry of proximal end of femur of North Indian population and to compare it with

similar studies. It may also be useful for biomechanics in designing and creating implants for the local population.

### **Material and Methods**

#### **Study Population**

The study was carried out on 100 dry adult femur in which 74 was male and 46 was female with known gender collected from Department of Anatomy, Ganesh Shankar Vidyarthi Memorial Medical College Kanpur over a period of six month July 2020 to December 2020.

#### **Methodology**

The different parameters of each humerus were measured by with the help of Digital Vernier calipers.

Measurements to be determined are as follows:

- 1. HVD:** head vertical diameter on both side.
- 2. NVD:** Neck vertical diameter on both side.
- 3. HTD:** Head transverse diameter on both side.

#### **Inclusion Criteria**

Complete unbreakable femur.

#### **Exclusion Criteria**

Broken femur.

#### **Statistical Analysis**

Statistical analysis was performed by using computer-based software, Statistical Package for Social Science (SPSS). Mean values of parameters were compared to determine.

**Result**

In our current study we observed that the mean head vertical diameter of male was  $45.46 \pm 1.7$  and in female  $40.57 \pm 2.56$  and its significant value t – test (11.09) and P- test (<0.001) which was shown in table 1. The mean neck vertical diameter of male  $32.57 \pm 2.857$  and in female it was  $24.59 \pm 2.9$  and its significant value t – test (5.89) and P- test (<0.001). The mean head transverse diameter for male was  $44.91 \pm 1.91$  and in female  $40.36 \pm 2.57$  and its significant value t – test (10.36) and P- test (<0.001).



**Fig 1:** Head Vertical diameter



**Fig 2:** Head transverse diameter



**Fig 3:** Neck Vertical Diameter

**Table 1:** Showing mean difference of Head vertical diameter in male and female

Parameter	Male	Female	Test of signification	
	Mean $\pm$ S.D	Mean $\pm$ S.D	T- test	P- test
Head vertical diameter (mm)	$45.46 \pm 1.7$	$40.57 \pm 2.56$	11.09	<0.001

**Table 2:** Showing mean difference of Neck vertical diameter in male and female

Parameter	Male	Female	Test of signification	
	Mean $\pm$ S.D	Mean $\pm$ S.D	T- test	P- test
Neck vertical diameter (mm)	$32.57 \pm 2.857$	$24.59 \pm 2.9$	5.89	<0.001

**Table 3:** Showing mean difference of Head transverse diameter in male and female

Parameter	Male	Female	Test of Signification	
	Mean $\pm$ S.D	Mean $\pm$ S.D	T- test	P- test
Head transverse diameter (mm)	$44.91 \pm 1.91$	$40.36 \pm 2.57$	10.36	<0.001

**Discussion**

**Head Vertical Diameter**

In this study we observed that the mean head vertical diameter of male was  $45.46 \pm 1.7$  and in female  $40.57 \pm 2.56$  and its significant value t – test (11.09) and P- test (<0.001) in north Indian population. Our findings are in accordance with Khaleel N *et al.* [5], whose finding value for left was  $42.24 \pm 3.53$ mm, while mean right was  $41.63 \pm 3.09$  mm. In another study Rumapurkait *et al.* [6] found that maximum head diameter alone could correctly assign sex to 92.5% of males and 95.5% females, they also found that head vertical diameter of right femur was significantly greater than left which was similar with our study. Tanerziylan *et al.* [7]. Found left side was  $43.2 \pm 3.2$  and right side  $45.2 \pm 4.0$ .

**Neck Vertical Diameter**

In this study we found that neck vertical diameter male was  $32.57 \pm 2.857$  and in female  $24.59 \pm 2.9$ . While comparing our study with Tanerziylan *et al.* [7] found left side  $30.6 \pm 3.0$  and  $30.7 \pm 0.8$  on right. In another study Ravi G.O *et al.* [8] found on right was  $36.4 \pm 5.2$  mm and left was femur was  $36.1 \pm 5.6$ mm. D. Ravichandran *et al.* [9] observed mean of the both side  $30.99$  mm.

**Head Transverse Diameter**

In our present study we found  $44.91 \pm 1.91$  in male,  $40.36 \pm 2.57$  in female while comparing our study with T. Jayachandra Pillai *et al.* [10] who reported minimum 28 mm to maximum 44 mm with a mean value of 37.86 mm. In another study conducted by Abhinav Jogani *et al.* [11] who found the mean diameter was 42.2 mm. Similarly Rawal *et al.* [12] and Rubin *et al.* [13] found the mean diameter was  $45.41 \pm 3.6$  mm and  $43.4 \pm 2.6$  mm respectively.

**Conclusion**

In the total hip replacement and proximal femur fracture management the morphometry is a good criteria for obtaining parameter for developing implants. Such more regional study help us to obtained more data for which help as for making more accurate implants Thesedata help in further correlation with radiological data and formulate new techniques for effective remodelling of the prosthesis. The knowledge of morphometry of

proximal end of femur will be useful in anthropological and medico-legal practice, as well as to orthopaedicians for diagnosis and treatment of disease related to hip and femur

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