

How to Cite:

Vijayasree, U., Kala, M., & Krishnaveni, S. (2022). Clinical significance and morphometry of various dimensions of lower end of adult dried femurs in south Indian region. *International Journal of Health Sciences*, 6(S2), 8580–8585.
<https://doi.org/10.53730/ijhs.v6nS2.7189>

Clinical significance and morphometry of various dimensions of lower end of adult dried femurs in south Indian region

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Abstract---Objectives: The present study was aimed to study the morphometry of various diameters of lower end of femur like intercondylar notch width, intercondylar notch depth, bicondylar width, condylar depth of right and left side femurs to find differences and to compare in Indian population. It also observed that intercondylar notch dimensions may show impact on the increased risk of ACL (Anterior cruciate ligament) injury and have the clinical significance in knee joint related surgeries. Materials & Methods: The present study was conducted on total number of 44 adult dried human femurs at department of Anatomy, RVM Institute of Medical Sciences and Research center in Telangana state, India. Result: Results showed that statistically no significant difference in right and left side femora in present study. Means and SD were 20.94 + 3.12, 26.28+ 4.14, 74.11+ 3.73, 59.03+ 3.15 and 20.71 + 3.46, 25.85+ 3.21, 73.47+ 4.25, 56.64+ 4.11. Conclusion: Present study data may be useful to clinicians, orthopedic surgeons, and sports medicine experts and diagnostics fields to avoid risks in anterior cruciate ligaments.

Keywords---morphometry, anterior cruciate ligament, intercondylar notch, fracture.

Introduction

The femur is the longest and strongest bone in the body and its distal end is made for transmits the weight of the body to the tibia. The lower end of the femur is widely expanded part, it has two massive medial and lateral condyles and intercondylar notch is located between them. They are partially articular and commonly transmit the weight of the body to the tibia to form the complex knee joint.¹

The femoral intercondylar notch or fossa has anatomical and clinical significant part because as it is the site of attachment of the Anterior Cruciate Ligament (ACL) and it stabilizes the knee joint.² The shape and other dimensions of the intercondylar notch with related to the Anterior Cruciate Ligament is very important during ligament injury or degeneration shown as clinically significant risk factor in previous studies.³

ACL is the most vulnerable and injured ligament in patients like degenerative osteoarthritis and sports athletes.⁴ Morphometric analysis of the distal femur is the fundamental idea of the femoral part of a total knee joint replacement surgery.⁵ According to Anderson et al intercondylar notch is differentiated in to two shapes, round or inverted U and steep A-shaped or cresting wave-shaped.⁶

Materials and Methods

The present morphometric study of lower end of femur was conducted on 44 adult dried femurs. Right side 22 and left side 22 Femurs were taken to study various parameters (Figure: 1). Dried bones were selected from department of Anatomy, RVM Institute of Medical Sciences and Research center, LaxmakkaPally, Mulugu, Siddipet, Telangana state, India. Abnormal, Pathological and fracture bones were excluded from the study. The following measurements were taken by using digital vernier caliper according to standard measuring methods and guidelines by Ravichandran et al⁷ and Wada et al⁸. The shape of intercondylar notch was noted by observation and inspection.

- Intercondylar notch width: Measurement of maximum distance of intercondylar notch
- Intercondylar notch depth: Measurement of maximum depth of intercondylar notch
- Bicondylar width: Measurement of maximum distance between two condyles
- Condylar depth: Condylar depth was taken as maximum antero posterior height of the lateral femoral condyle.

The statistical analysis was done after obtaining complete data of all measurements and also compared right and left femurs values. Data was represented as mean $\pm$ SD. Statistical significant of p-value was considered less than 0.05.

Results

The present study results were obtained from total number of 44 femurs (Right: 22 and Left: 22). The means and SDs of intercondylar notch width, intercondylar notch depth, bicondylar width, condylar depth of right and left side was 20.94 ± 3.12 , 26.28 ± 4.14 , 74.11 ± 3.73 , 59.03 ± 3.15 and 20.71 ± 3.46 , 25.85 ± 3.21 , 73.47 ± 4.25 , 56.64 ± 4.11 . The shape of intercondylar notch was observed in the present study was as inverted U shape in 73% and inverted V shape in 27%. The data was statistically not significant in intercondylar notch width, intercondylar notch depth, bicondylar width and statistically significant in condylar depth in and analysis was done with unpaired t test (Table: 1).



Figure: 1 shows A. Measurement of Intercondylar notch width, B. Intercondylar notch depth C. Bicondylar width, D. Condylar depth of lower end of femur.

Parameter	Right Side in mm (n= 22) Mean $\pm$ SD	Left Side mm (n= 22) Mean $\pm$ SD	P -Value
Intercondylar notch Width (ICW)	20.94 ± 3.12	20.71 ± 3.46	0.4064
Intercondylar notch depth (ICD)	26.28 ± 4.14	25.85 ± 3.21	0.3498
Bicondylar width (CW)	74.11 ± 3.73	73.47 ± 4.25	0.2968
Condylar Depth (CD)	59.03 ± 3.15	56.64 ± 4.11	0.0180

Table 1: Mean, standard deviation and P value of different parameters of Right and Left femur

Discussion

A narrow intercondylar notch can be a consequence to the anterior cruciate ligament injury or rupture, so the present morpho metrical study was carried out to find out various important dimensions at lower end of femur to propose its

clinical evidence. There is a literature gap in ACL relation to the intercondylar notch in dry femurs in south Indian populations. Present study explained and showed the results that statistically not significant in intercondylar notch width, intercondylar notch depth, bicondylar width and statistically significant in condylar depth of lower end of femur. Previous studies noticed the relevance of Intercondylar notch measurements to ACL as follows, the association between the narrow notch widths may be increased in ACL damage, the risk factor has been seen both in young and old knee arthritis patients with acute on set of ACL tears.⁹ The reason behind the narrowing of intercondylar notch in osteoarthritis was confirmed that growth of osteophytes in notch, this incidence may increase especially in degenerative arthritis.¹⁰ As intercondylar notch was two different shapes, the shape also showed direct impact on performance of the ACL.¹¹ Morphometric data of lower end of femur also clinically important while selecting the prosthesis, otherwise it may cause the ACL rupture, other soft tissue injuries, loosening of prosthesis and instability of in knee joint.¹² In the present study the shape of intercondylar notch was observed as inverted U shape in 73% and inverted V shape in 27%.

The present study results was almost similar to previous study done by Ameet K J and Murlimanju BV as 73.2% was inverted 'U' shaped and 26.8% cases were inverted 'V' shaped.¹³ Various Indian studies reported, Inter Condylar Notch Width for the right and left sides were 21.66 and 21.5 mm and the mean bicondylar width for the right and left sides were 72.82 mm and 71.62 mm and study showed that, statistical significant.¹⁴ These studies also showed similar results in Shweta et al¹⁵, Biswas et al¹⁶ and Neelima et al¹⁷. According to Attada Prasanna veer study in south Indian population results showed that, mean intercondylar notch width and depth, and width and depth of femoral condyles are as follows 18.49 ± 11.8 , 26.95 ± 12.7 , 73.79 ± 14.5 , 56.18 ± 13.7 and study was statistically significant.¹⁸ Knowledge of anatomical aspects of the lower end of the femur is very essential for the radiologists and orthopedic surgeons, as knee replacement requires placement of implant with maximum degree of accuracy.¹⁹

Conclusion

The present morphometric data may help and gives the prior knowledge and information to clinicians and orthopedic surgeons, post operative rehabilitation team, diagnostic field people related to ACL management and treatment. The present study analyses the normal range of dimensions like Intercondylar notch width, depth, bicondylar width and depth and shape in south Indian population.

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