ORIGINAL RESEARCH

Morphometric study of distal end femur in the central India population: Comparison with other ethnic groups and it's clinical implication in knee joint prostheses

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ABSTRACT

Background: Knee joint is a complex joint which includes both tibiofemoral joint and patellofemoral joint. The bony geometry of the tibia and femur contributes to the static stability of the knee joint and is responsible for the normal knee kinematics.The distal extremity of the femur is wider and presents a widely expanded double condyle bearing partly articular surface for transmission of weight to the tibia. **Objective:** To study morphometric study of distal end femur in the population of central India: comparison with other ethnic groups and it's clinical implication in knee joint prostheses. **Material and Methods:** In this Cross-sectional descriptive study, 250 dry human femurs,125 right side and 125 left side, were examined, in the LN Medical College, Bhopal (Madhya Pradesh) region, where the morphology and morphometry of the distal end of femur including bicondylar width, anteroposterior and transverse diameter of medial and lateral condyle and intercondylar width were measured and statistically analyzed. **Results:** In this study there were no statistically significant parameters between right and left femur. **Conclusion:** The present study aims to assess different morphometric parameters of distal end of femur, to compile and analyze the results, and formulate a baseline data for future studies with relevance to Indian population. These parameters of the distal end of femur can be used to guide treatment and monitor outcome of total knee replacement surgeries in Indian scenario.

INTRODUCTION

The knee joint is a complex variety of synovial joint in which lower end of femur articulates with the upper end of tibia and patella forming femorotibial and femoropatellar articulations respectively[1]. The distal extremity of the femur is wider and presents a widely expanded double condyle bearing partly articular surface for transmission of weight to the tibia.The lateral condyle is more prominent and broader both in it's antero-posterior and transverse diameters. The medial condyle is larger than the lateral condyle due to more weight bearing caused by the centre of mass being medial to the knee[2].

Osteoarthritis is a degenerative disease causing deterioration and musculoskeletal disability of the knee joint[3]. Total knee arthroplasty (TKA) is a highly complex and precise procedure that aims to relieve pain and improve function of the knee joint[4]. The long term success of the TKA procedure depends largely on accurate bone cuts, adequate soft tissue balancing, and prosthesis selection that appropriately matches the dimensions of the cut surfaces of the distal femur and proximal tibia[3]. Appropriate sizing of the components is important during TKA; mismatch between the dimensions of prostheses and bones may increase the complexity of surgery. AP oversizing of the femoral component alters the flexion gap, leading to tightness or anterior overstuffing which increases the risk of patellofemoral symptoms postoperatively. Medial or lateral overhang of either the femoral or tibial component can cause soft tissue impingement[5].

MATERIAL AND METHODS

In this Cross-sectional descriptive study, 250 dry human femurs,125 right side and 125 left side, were examined, in the Department of Anatomy, LN Medical College, Bhopal Madhya Pradesh region, where the morphology and morphometry of the distal end of femur and following parameters were observed

- Bicondylar width-Maximum distance between both femoral epicondyles (BCW)
- Maximum anteroposterior distance of lateral femoral condyle (LCAPD)
- Maximum anteroposterior distance of medial femoral condyle (MCAPD)
- Maximum transverse distance of medial femoral condyle (MCTD)
- Maximum transverse distance of lateral femoral condyle (LCTD)
- Intercondylar Notch Width (ICW)

All the metric parameters were statiscally analysed.

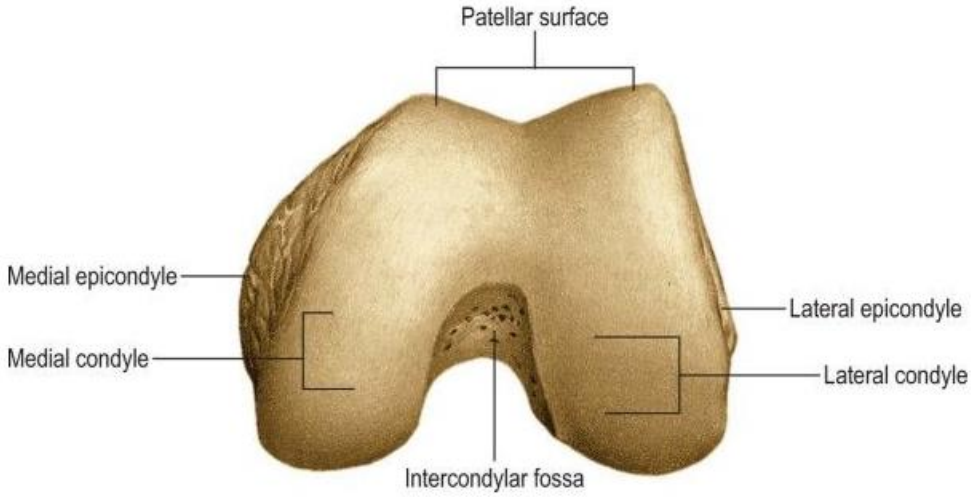

Figure 1 – Showing the medial condyle, lateral condyle and intercondylar fossa of distal end of femur.

RESULT

The observation of various parameters like bicondylar width, intercondylar width, intercondylar height, intercondylar depth, intercondylar curvature are as follows-

PARAMETERS	RIGHT FEMUR (in mm)	LEFT FEMUR (in mm)
BCW	65.82 ± 4.80	66.21 ± 4.43
LCAPD	56.52 ± 4.18	56.49 ± 3.69
MCAPD	55.58 ± 4.15	55.80 ± 3.77
MCTD	21.82 ± 2.44	22.09 ± 2.15
LCTD	26.07 ± 2.64	26.16 ± 2.33
ICW	24.00 ± 4.93	22.67 ± 4.81

DISCUSSION

By the statistical analysis of the above data it can be seen that the maximum antero-posterior diameter and transverse diameter of the lateral condyle is greater than that of the medial condyle for both the femurs.
In this study there were no statistically significant parameters between right and left femur.

COMPARISON WITH OTHER ETHNIC GROUPS

A. Non-Indian Population

POPULATION	BCW
Thai (Chaichunkul et al.)	64.06 ± 6.31
Korean (Lim et al.)	78.6 ± 5.1
Malay (Hussain et al.)	74.88 ± 3.55
Iranian (Moghtadaei et al.)	67.06 ± 6.39
Iranian (Birjandinejad et al.)	67.53 ± 6.66
Chinese (Yue et al.)	82.6 ± 3.6
Chinese (Cheng et al.)	71.0 ± 3.0
Caucasian (Yue et al.)	86.0 ± 5.6
Taiwanese (Ho et al.)	70.2 ± 5.4
Present study	63.52 ± 6.22 (Right side)
	66.52 ± 7.37 (Left side)

B. Indian Population

POPULATION (REGION)	BCW (RIGHT FEMUR)	BCW (LEFT FEMUR)	ICW (RIGHT FEMUR)	ICW (LEFT FEMUR)
Tamilnadu (Ravichandran et al.)	74.58 ± 0.57	73.97 ± 0.61	18.89 ± 0.29	18.65 ± 0.27
West bengal (Mistri et al.)	74.43 ± 6.10	73.98 ± 5.99	19.12 ± 2.5	18.65 ± 2.8
Delhi(Shweta et al.)	73.1 ± 6.14	72.16 ± 6.58	20.82 ± 2.57	21.0 ± 3.13
West bengal (Biswas et al.)	71.71 ± 4.50	70.71 ± 5.25	20.86 ± 2.52	19.45 ± 2.57
Gujrat (Zalawadia et al.)	74.48 ± 1.90	74.59 ± 2.75	20.31 ± 2.94	20.91 ± 1.32
Gujrat (Hiren et al.)	69.60 ± 5.04	69.80 ± 4.96	20.40 ± 3.17	18.70 ± 2.52
Present study	63.52 ± 6.22	66.52 ± 7.37	24.00 ± 4.93	22.67 ± 4.81

- When we compare the bicondylar width of present study with other ethnic groups of western counterparts it can be observed that the parameter of ethnic groups (Caucasians, Chinese, Malay, Koreans & Taiwanese) are greater than our population whereas Iranian and Thai populations have approximately similar dimensions.
- When we compare it with the other studies of Indian population it can be seen that the parameters for the region Central India is smaller than that of other regions of India for both the parameters BCW and ICW.

SUMMARY AND CONCLUSION

Selection of appropriate implant is required to avoid complications like loosening of implant or impingement of surrounding soft tissue and ensure minimal mismatch and improvement in clinical outcome[6]. The present study aims to assess different morphometric parameters of distal end of femur, to compile and analyze the results, and formulate a baseline data for future studies with relevance to Indian population.These parameters of the distal end of femur can be used to guide treatment and monitor outcome of total knee replacement surgeries in Indian scenario.

ABBREVATION

Bicondylar width-Maximum distance between both femoral epicondyles (BCW) , Maximum anteroposterior distance of lateral femoral condyle (LCAPD), Maximum anteroposterior distance of medial femoral condyle (MCAPD), Maximum transverse distance of medial femoral condyle (MCTD), Maximum transverse distance of lateral femoral condyle (LCTD), Intercondylar Notch Width (ICW)

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