

Morphometric Study on the Dimensions of Upper End of Tibia in Wayanad Population

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Abstract

Introduction: Arthritis and injuries of a knee joint is a common problem encountered during the old age which requires total knee replacements and Unicompartmental knee arthroplasty. Morphometric parameters of condyles of the tibia can be useful for the treatment and monitor the outcome of these surgeries by selecting specific knee prosthesis for that particular population. *Aims:* To measure the various parameters of the proximal end of the tibia in Wayanad population. *Methods:* In the present study, sixty-eight (30-right and 38-left) adult fully ossified tibia were taken and various parameters of the upper end of the tibia were measured using Vernier caliper. Statistical analysis of this data was done using SPSS software version 16. *Results:* The present study was done on both left and right tibia. The following data was obtained.

On Left side: Mean \pm SD of circumference -18.59 \pm 1.7cm,

Surface area of medial condyle-13.23 \pm 2.53cm²,

Surface area of lateral condyle- 12.19 \pm 2.56cm² and

Intercondylar surface area- 4.93 \pm 1.16 cm².

On Right side: Mean \pm SD of circumference-18.5 \pm 1.3cm,

Surface area of medial condyle-12.85 \pm 2.44 cm²,

Surface area of lateral condyle-12.06 \pm 2.46cm² and

Intercondylar surface area-5.06 \pm 0.81cm²

Conclusion: Knowledge about the dimensions of the upper end of the tibia will be helpful for anatomists, anthropologists, and Orthopedicians in cases of knee arthroplasty procedures, Unicompartmental knee arthroplasty, and meniscal transplantation.

Keywords: Morphometric; Synovial joint; Arthroplasty; Meniscal transplantation

Introduction

The knee joint is a complex synovial joint consisting of the femorotibial and femoro patellar articulations. It functions to control center of body mass and posture in the daily activities. This

necessitates a wide range of movements in three dimensions coupled with the ability to withstand high pressure. The mobility and stability add are achieved by the interaction between the articular surfaces, the passive stabilizer and the muscles that cross the joint. The relatively incongruent nature of the joint surface makes the knee joint inherently unstable [1].

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Several forms of arthritis such as inflammatory and posttraumatic arthritis due to a regular playing of many sports like football and also osteoarthritis is the most common pathological disorder which affects the knee joint. The treatment for that is usually total knee arthroplasty (TKA) [2].

TKA has undergone improvements by recent technological progressions in prosthetic design,

instrumentation, surgical techniques and rehabilitation [3]. TKA is a precision operation requiring precise soft tissue balancing and resection of bone thickness equal to the thickness of the prosthetic component implanted, so that the flexion-extension spacing are equal, permitting joint stability throughout the range of motion. Prosthetic selection, accurate sizing and proper placement of the components decide the success of this procedure. The A-P measurement of prosthesis is significant in sustaining flexion-extension spacing while the mediolateral measurement decides satisfactory coverage of the resected bone and tension free wound closure [4].

In Unicompartamental arthritis of the knee in elderly patients, the treatment of choice is Unicompartamental knee arthroplasty [5]. The prosthesis which is presently being used in the practice is best suited for the western population, therefore, leading to implant size incompatibility with the resected bony surfaces [6].

So, the aim of the present study was to measure various parameters of the proximal end of the tibia in Wayanad population.

Materials and Methods

In the present study, sixty-eight (30-right and 38-left) adult fully ossified tibia were taken from Department of Anatomy, DMWIMS, Wayanad, Kerala. Various parameters like A-P and transverse diameter of the medial, lateral and Intercondylar area of the tibia were measured using Vernier caliper. Area of the condyles and Intercondylar area were measured using the formula: Area of condyle = Anterior-posterior length (A-P) × Transverse diameter (TD) of the condyle.

The circumference of the tibia was measured using a measuring tape. Statistical analysis like mean and Standard deviation of this data was done using SPSS software version 16.

All the measurements were taken by a single author in order to minimize human error. After obtaining the results, was plotted for better interpretation of the results.

Results

The Data and statistical analysis are shown in Table 1 and 2:

Table 1 Showing the Mean and Range of all morphometric parameters of the Right and left tibia.

The 'p' value is >0.05 so there is no significant difference between the measurement of right and left side tibial measurements as shown in Table 2.



Fig. 1: Showing the measurement of the circumference of Tibia using a measuring tape



Fig. 2: Showing the measurement Anterior -posterior diameter of the medial condyle of the tibia using vernier caliper

Discussion

In the design process of the tibia prosthesis for TKA we should be aware of the geometry and anatomy of the knee which is variable, irrespective of gender and the human race [4].

According to the present study, the tibial circumference was less in Wayanad population when compared to study of Ivan et al. [3] and Gupta

Table 1: The Mean and Range of all morphometric parameters of the Right and left tibia

Parameters	Right Tibia Measurements (Mean ± SD in cm)	Left Tibia Measurements (Mean ± SD in cm)
A-P length of Medial condyle	4.44±0.4	4.52±0.4
Transverse diameter of medial condyle	2.87±0.3	2.90±0.3
A-P length of lateral condyle	4.10±0.4	4.13±0.4
Transverse diameter of lateral condyle	2.92±0.3	2.92±0.4
A-P length of Intercondylar area	4.69±0.4	4.47±0.5
Transverse diameter of Intercondylar area	1.08±0.2	1.09±0.2
A-P length of articular part of Medial condyle	3.57±0.4	4.08±0.4
A-P length of articular part of lateral condyle	3.60±0.4	3.99±0.4

Table 2: The Mean and range of circumference of the upper end of the tibia, the surface area of lateral condyle, medial condyle and intercondylar region of right and left tibia with 'p' value.

Parameter	Right Side Tibia	Left Side Tibia	P value
Mean ± SD of Tibial circumference in cm	18.5± 1.3	18.59±1.7	0.877
Surface area of medial condyle in cm ²	12.85±2.44	13.23±2.53	0.539
Surface area of lateral condyle in cm ²	12.06±2.46	12.19±2.56	0.840
Intercondylar surface area in cm ²	4.93±1.16	4.93±1.16	0.612

et al. [2] as shown in Table 3 this may be due to racial variation in built of the individual.

In the present study, the surface area of the medial condyle of the tibia was more when compared to the previous study as shown in Table 4. The surface area of lateral condyle of the tibia in the present study was more than the previous study as shown in Table 5.

In clinical practice, surgeons do not favor implants with insufficient tibial coverage as this induces the possibility of tibial implant collapse [5,6]. There is a need for standardization of size of the prosthesis depending on the region and race.

It was reported that parameters differ from the medial and lateral compartment. So, the present study has reported the morphometry of tibial condylar and the intercondylar area which will be helpful for the surgeon to select suitable size prosthesis in case of knee replacement surgery.

The study will provide guidelines for designing appropriate Tibial unicompartamental knee arthroplasty and complete knee arthroplasty component because few studies in which the failure of Unicompartamental knee arthroplasty occurred due to implant loosening [4].

Table 3: The comparison of Tibial circumference in different studies

Studies	Left Tibia (circumference in cm)	Right Tibia (circumference in cm)
Ivan. et.al study ³ (2014)	19.36±1.5	19.33±1.44
Chandni Gupta.et.al study ² (2015)	19.07±1.65	18.95±0.68
In present study (2017)	18.59±1.7	18.5±1.3

Table 4: The comparison of the surface area of the medial condyle of the tibia in different studies

Studies	Left Tibia	Right Tibia
Srivastva.et.al study ⁴ (2014)	(Area in cm ²)	(Area in cm ²)
Chandni Gupta.et.al study ² (2015)	11.01	11.52
In present study(2017)	12.12±2.12	12.30±1.45

Table 5: The comparison of the surface area of lateral condyle of the tibia in different studies

Studies	Left Tibia (Area in cm ²)	Right Tibia (Area in cm ²)
Srivastva.et.al study ⁴ (2014)	10.52	10.75
Chandni Gupta.et.al study ² (2015)	11.92±2.09	10.89±1.44
In present study(2017)	12.19±2.56	12.06±2.46

Conclusion

The Knowledge about the dimensions of the upper end of the tibia will be helpful for anatomists, anthropologists, and Orthopedicians in cases of knee arthroplasty procedures like Unicompartmental knee arthroplasty and meniscal transplantation.

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