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Morphometric study of upper end of tibia in Bihar region and its clinical implication in knee Arthroplasty

Dr. Birendra Kumar Sinha[1], Dr. Rashmi Prasad[2*]
[1]MBBS, MS Assistant Professor, Department of Anatomy, Patna Medical College, Patna, Bihar, India
[2]MBBS, MS, Department of Anatomy Patna Medical College, Patna, Bihar, India

Abstract
The present study was planned to evaluate the morphometric study of upper end of tibia. The data generated from the present study will be helpful in the exact measurements of upper end of tibia gender wise before the knee replacement surgeries.
The present study was conducted on 50 adult dry tibias of both sexes, obtained from the Anatomy department of Patna Medical College, Patna. Out of total 50 selected tibias 25 were males and 25 were females identified from the record available in department of Anatomy. All bones were on gross examination were fully ossified and had no evidence of fractures or congenital or pathological anomalies. The bones were measured with sliding calliper.
Based upon the above findings it can be concluded that morphometric data of upper end of tibia by direct observation which will be useful to select correct prosthesis of suitable size according to measurements.

Keywords: dry tibia, upper end, morphometric study

Introduction
The tibia also known as the shinbone or shank bone, is the larger and stronger of the two bones in the leg below the knee in vertebrates (the other being the fibula), and it connects the knee with the ankle bones. The tibia is found on the medial side of the leg next to the fibula and closer to the median plane or centre-line. The tibia is connected to the fibula by the interosseous membrane of the leg, forming a type of fibrous joint called a syndesmosis with very little movement. The tibia is named for the flute tibia. It is the second largest bone in the human body next to the femur. The leg bones are the strongest long bones as they support the rest of the body.
Knee replacement, also known as knee arthroplasty, is a surgical procedure to replace the weight-bearing surfaces of the knee joint to relieve pain and disability. It is most commonly performed for osteoarthritis [1] and also for other knee diseases such as rheumatoid arthritis and psoriatic arthritis. In patients with severe deformity from advanced rheumatoid arthritis, trauma, or long-standing osteoarthritis, the surgery may be more complicated and carry higher risk. Osteoporosis does not typically cause knee pain, deformity, or inflammation and is not a reason to perform knee replacement. Other major causes of debilitating pain include meniscus tears, cartilage defects, and ligament tears. Debilitating pain from osteoarthritis is much more common in the elderly. Knee replacement surgery can be performed as a partial or a total knee replacement [2]. In general, the surgery consists of replacing the diseased or damaged joint surfaces of the knee with metal and plastic components shaped to allow continued motion of the knee. The operation typically involves substantial postoperative pain, and includes vigorous physical rehabilitation. The recovery period may be 6 weeks or longer and may involve the use of mobility aids (e.g. walking frames, canes, crutches) to enable the patient's return to preoperative mobility [3].
Knee replacement surgery is most commonly performed in people with advanced osteoarthritis and should be considered when conservative treatments have been exhausted [4]. Total knee replacement is also an option to correct significant knee joint or bone trauma in young patients. Similarly, total knee replacement can be performed to correct mild valgus or varus deformity. Serious valgus or varus deformity should be corrected by osteotomy. Physical therapy has been shown to improve function and may delay or prevent the need for knee replacement. Pain is often noted when performing physical activities requiring a wide range of motion in the knee joint [5].
The surgery involves exposure of the front of the knee, with detachment of part of the quadriceps muscle (vastusmedialis) from the patella. The patella is displaced to one side of the joint, allowing exposure of the distal end of the femur and the proximal end of the tibia. The ends of these bones are then accurately cut to shape using cutting guides oriented to the long axis of the bones. The cartilages and the anterior cruciate ligament are removed; the posterior cruciate ligament may also be removed [6] but the tibia and fibular collateral ligaments are preserved. Metal components are then impacted onto the bone or fixed using polymethylmethacrylate (PMMA) cement. Alternative techniques exist that affix the implant without cement. These cement-less techniques may involve osseointegration, including porous metal prostheses.
A round ended implant is used for the femur, mimicking the natural shape of the joint. On the tibia the component is flat, although it sometimes has a stem which goes down inside the bone for further stability. A flattened or slightly dished high density polyethylene surface is then inserted on to the tibia component so that the weight is transferred metal to plastic not metal to metal. During the operation any deformities must be corrected, and the ligaments balanced so that the knee has a good range of movement and is stable and aligned. In some cases the articular surface of the patella is also removed and

replaced by a polyethylene button cemented to the posterior surface of the patella. In other cases, the patella is replaced unaltered.

Hence the present study was planned to evaluate the morphometric study of upper end of tibia. The data generated from the present study will be helpful in the exact measurements of upper end of tibia gender wise before the knee replacement surgeries.

Methodology

The present study was conducted on 50 adult dry tibia of both sexes, obtained from the Anatomy department of Patna Medical College, Patna. As all the specimens were cadaveric no consent was possible and permission of ethical committee was not deemed necessary.

Out of total 50 selected tibia 25 were males and 25 were females identified from the record available in department of Anatomy. All bones were on gross examination were fully ossified and had no evidence of fractures or congenital or pathological anomalies. The bones were measured with sliding calliper.

Inclusion Criteria: Bones with no evidence of fractures or congenital or pathological anomalies. Exclusion Criteria: Bones which are damaged with arthritic changes.

The following parameters were evaluated in the selected bones:

1. Bicondylar width (BCW) – the maximum distance across tibial condyles in transverse plane.
2. Medial condylar antero-posterior distance of superior articular surface (MCAPD).
3. Medial condylar transverse distance of superior articular surface (MCTD).
4. Lateral condylar antero-posterior distance of superior articular surface (LCAPD).
5. Lateral condylar transverse distance of superior articular surface (LCTD).

Results & Discussion

The study of the 50 tibia is collected and presented as below. The data from the total 50 tibia were collected and presented below. Table 1 gives the idea about the measurement of upper end of the tibia in mm.

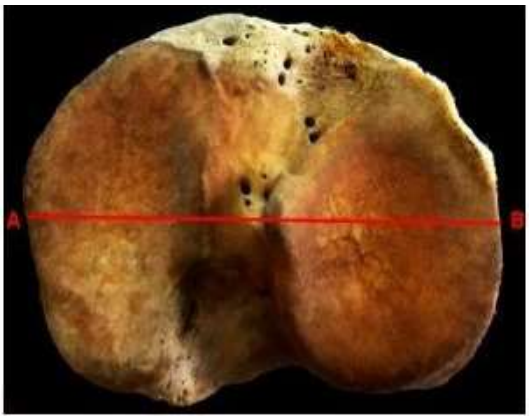

Fig 1: Superior view of upper end of tibia

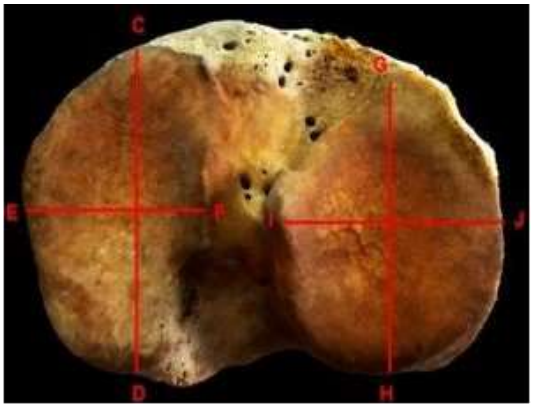

Fig 2: Superior view of upper end of tibia

Table 1: Measurements of upper end of the tibia in mm.

Parameters	Side	Male (Mean±SD)	Female (Mean±SD)
BCW (AB in figure-1)	Right	73.5 ± 2.4	67.3 ± 2.1
	Left	75.1 ± 1.9	66.7 ± 2.3
MCAPD (CD in figure-2)	Right	43.4 ± 2.1	38.9 ± 1.5
	Left	45.2 ± 2.6	38.5 ± 2.3
MCTD (EF in figure-2)	Right	28.5 ± 1.2	25.9 ± 1.4
	Left	28.6 ± 1.4	25.7 ± 1.5
LCAPD (GH in figure-2)	Right	39.1 ± 2.5	35.7 ± 2.1
	Left	38.9 ± 2.7	35.6 ± 2.6
LCTD (IJ in figure-2)	Right	26.9 ± 1.5	25.5 ± 1.3
	Left	27.6 ± 1.8	25.7 ± 1.5

There are certain studies which are done in pastsuggest that indirect method of measurement like CT scan and MRI are found inaccurate andnot precise even though correction done by the projection methods as well as by the resolutions[7-8]. So obviously direct method of measurements are certainly beneficial over the indirect methods like CT scan and MRI and direct method will give the accurate morphometric data.Because the direct method of measurement is accurate we can match these morphometric data to make knee prosthesis for knee joint replacement surgery with the resected surface of the knee that will improve long term success of prosthesis and lesser complications in andafter total knee joint replacement. There are several studies done which are based on western population and also the prosthesis available in market is based on western Caucasian population [9-10] although the Indian population have smaller knees as compared to them.This study will provide data of upper end of tibiafor Indian population and will influence in theclinical outcome to design improved knee prosthesis based on our Indian knee measurements.

Conclusion

Based upon the above findings it can be concluded that morphometric data ofupper end of tibia by direct observation whichwill be useful to select correct prosthesis ofsuitable size according to measurements.

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