



ORIGINAL RESEARCH PAPER

Anatomy

STUDY OF VARIOUS DIMENSIONS OF TIBIAL TUBEROSITY IN DRY HUMAN TIBIA

**KEY WORDS:** Tibial Tuberosity, intercondylar area, Tibia.

Dr Arban Kumar

Dr Simriti\* B 2 Medical Enclave GMC Jammu - 180001 \*Corresponding Author

Dr Sunanda Raina

ABSTRACT

Tibial Tuberosity is the truncated apex of a triangular area and lies at the proximal end of the anterior border of tibia, where the anterior condylar surfaces merge. It is an apophysis and develops in traction. The present study was designed on dry human tibia, with the aims and objectives to study morphometric study of tibial tuberosity. It can be stated that both upper smooth as well as lower rough part of tibial tuberosity are marginally longer on right side in North Indian. The most prominent point on the tibial tuberosity from anterior border of intercondylar area is of significant importance to the orthopaedicians, radiologists, rehabilitation specialists and sports medicine specialists.

INTRODUCTION

Tibial Tuberosity is the truncated apex of a triangular area and lies at the proximal end of the anterior border of tibia, where the anterior condylar surfaces merge. It is an apophysis and develops in traction[1]. The tibial tuberosity begins to ossify between seven and nine years as a distal focus. This progressively enlarges proximally and anteriorly while the proximal tibial epiphysis concomitantly expands downwards into tuberosity[2] It projects little downwards and is divided into a distal rough region and a proximal smooth region. The patellar tendon is attached to the proximal smooth area while the distal end is palpable [3]. An abnormal lateral position of the tibial tuberosity causes distal malalignment of the tensor mechanism of the knee and can lead to the lateral tracking of the patella which causes anterior knee pain or objective patellar instability and is mainly characterized by recurrent dislocation[4].

MATERIAL AND METHODS

The tibia is one of the most studied bones by the Western workers. However, not much data is available in North Indian population. The present study was conducted in Department of Anatomy, Government Medical College, Jammu comprising of 70 dry tibia of adult age of unknown sex. Bones were labelled from 1-70 with suffix 'L' or 'R' indicating right or left respectively. Following measurements were taken:

1. Distance of tibial tuberosity from the anterior border of intercondylar area: it was measured with vernier calipers as the distance taken from anterior border of intercondylar area up to upper end of tuberosity(CD in given figure 1)
2. Ridge between proximal smooth and distal rough part of tibial tuberosity: It was noted whether it was distinct or faint.
3. Length of upper smooth part of tibial tuberosity: It was measured with vernier calipers as the distance taken from upper end of tibial tuberosity upto between proximal smooth and distal rough part (EF in fig. 1)
4. Length of lower rough part of tibial tuberosity: It was measured with vernier calipers as the distance taken from ridge upto distal end of tibial tuberosity (FG in fig. 1)
5. Breadth of upper smooth part of tibial tuberosity: It was measured with vernier calipers as the widest transverse diameter of upper smooth part (HI in fig. 1)
6. Breadth of lower rough part of tibial tuberosity: It was measured with vernier caliper as the widest transverse diameter of rough lower part (JK in fig. 1)



Fig: 1

- AB:** length of vertical groove on the anterior surface of lateral condyle.
- CD :** distance of tibial tuberosity from the anterior border of intercondylar area
- EF:** length of upper smooth part of tibial tuberosity
- FG :** Length of lower rough part of tibia tuberosity
- HI :** breath of upper smooth part of tibial tuberosity
- JK:** breath of lower rough part tibial tuberosity

The present study was therefore designed on dry human tibia, with the aims and objectives to study morphometric study of tibial tuberosity.

RESULTS

1. Distance of tibial tuberosity from the anterior border of intercondylar area: This had been depicted in Table 10.

**TABLE 1: Comparison Of Distance Of Tibial Tuberosity From Anterior Border Of Inter Condylar Area**

Author	Race	Mean + SD (mm) (u)		Range	
		Rt	Lt	Rt	Lt
Present Study	North Indian	11.86±3.01 (35)	12.92±2.28 (35)	7.91-22.48	10.51-19.06

In the present study on right side, the mean distance of tibial tuberosity from the anterior border of intercondylar area was 11.86±3.01 mm (Range=7.91-22.48). The corresponding values on left side were 12.92±2.28mm (Range=10.51-19.06mm). On comparison between the two sides, it was slightly more on left side.

2. Ridge between proximal smooth and distal rough part of tibial tuberosity: It was found to be prominently distinct in all bones on both the sides.
3. Length of upper smooth part of tibial tuberosity : Table 2 shows the length of upper smooth part of tibial tuberosity on both sides.

**Table 2: Comparison Of Length Of Upper Smooth & Lower Rough Part Of Tibial Tuberosity**

Length (mm)	Side	Mean+SD(n)	Range
Upper smooth part	Rt	22.31±4.06(35)	16.72-29.93
	Lt	22.03±4.71 (35)	14.86-31.30
Lower Rough Part	Rt	48.68±6.96 (35)	37.02-67.99
	Lt	48.56±7.13 (35)	39.09-61.07

In the present sample, on right side the mean length of upper smooth part of tuberosity was found to be 22.31±4.06mm(Range=16.72-29.93mm). The corresponding values on left side were 22.03±4.71mm (Range=14.86-31.30mm). It was slightly more on right side.

4. Length of lower rough part of tibial tuberosity: Table 11 also shows the length of lower rough part of tibial tuberosity. On

right side, it was 48.68±6.96mm (Range=37.02-67.99mm). The corresponding values on the left side were 48.56±7.13mm (Range=39.09-61.07mm).When compared between the two sides, it was slightly more on right side.

- Breadth of upper smooth part of tibial tuberosity: The breadth of upper smooth part of tibial tuberosity has been depicted in Table 3.

**Table 3: Comparison Of Breadth Of Upper Smooth & Lower Rough Part Of Tibial Tuberosity**

Breadth (mm)	Side	Mean+SD(n)	Range
Upper smooth part	Rt	20.04+1.68 (35)	16.04-23.83
	Lt	20.50+1.56 (35)	18.22-24.83
Lower Rough Part	Rt	20.51+2.26(35)	16.16-23.73
	Lt	19.82 ± 2.72 (35)	13.77-23.47

On the right side, it was found to be 20.04±1.68mm (Range=16.04-23.83mm) on left side, it was 20.50±1.56mm (Range=18.22-24.83mm). When compared between the two sides, the diameter was slightly more on left side.

- Breadth of lower rough part of tibial tuberosity: Table 12 also shows the breadth of lower rough part of tibial tuberosity. On the right side, it was found to be 20.51±2.26mm (Range=16.16-23.73mm). While on left side, it was 19.82+2.72mm (Range=13.77-23.47mm). When compared between the two sides, the breadth was more on right side.

**DISCUSSION**

The mean distance and range of tibial tuberosity from the anterior border of intercondylar area in the present study was more on left side. Earlier Hughes and Sunderland in 1946 had measured this distance to be 10 mm in Australian population but irrespective of side. The size, shape and position of the tibial tuberosity are important for the extension of the knee joint [5]. Ridge between proximal smooth and distal rough part of tibial tuberosity was found to be distinct in all bones on both the sides as also described by Standring S et al[3]. The mean length of upper smooth part and lower rough part of tibial tuberosity was slightly more on right side. Thus it can be stated that both upper smooth as well as lower rough part of tibial tuberosity are marginally longer on right side in North Indian. Breadth of upper smooth part and lower rough part of tibial tuberosity was slightly more in former and less in latter as evidenced by Gandhi S et al[6]. Ligamentum patellae attachment alterations have been reported by Lewis[7]. He reported that ligamentum patellae of adult tibia may be attached almost entirely to the upper tibial epiphysis or partially to epiphysis and diaphysis. Jacobsen has documented 16 areas of different attachments of ligamentum patellae by his morphometric studies[8] which is not in consistent with our study. In present study the most prominent point on the tibial tuberosity was 13 mm from anterior border of intercondylar area whereas in the study done by Rashmi was 6.8 mm and it is located in the proximal part of the tibial tuberosity, the site of attachment of patellar tendon[9]. Therefore the concept of traction appophysis that it is caused by the force of ligmentum patella can be confirmed.

**CONCLUSION**

The mean values and range for the height of proximal rough part and distal smooth part of facet on lateral surface of distal end was more on right side however no data could be ascertained for comparison in this regard and will necessitate further study with clinicians who deals with the adolescent injuries around the knee. The most prominent point on the tibial tuberosity from anterior border of intercondylar area is of significant importance to the orthopaedcians, radiologists, rehabilitation specialists and sports medicine specialists.

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