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Key Words

Tibia, distal end of tibia, morphometry, tibial plafond, medial malleolus

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Received: 01 September 2024

Accepted: 6 October 2024

Published: 9 October 2024

Citation: Juned Labbai, Vijaykumar Shinde and Amarendra Kabadi, 2024. Morphometric Study of Distal end of Tibia in South Indian Population. Res. J. Med. Sci., 18: 6-8, doi: 10.36478/makrjms.2024.11.6.8

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Morphometric Study of Distal End of Tibia in South Indian Population

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ABSTRACT

The lower end of tibia along with its medial malleolus and the lateral malleolus of the fibula form a deep recess to accommodate the body of talus. Measurements of distal end of tibia will help in surgical reconstruction as well as in the design of prosthesis of talocrural joint and percutaneous plate fixation of fractures of the distal tibia. To study the morphometry of distal end of dry adult Tibia. One Hundred Fifty (150) dry adult Tibia (76 left and 74 right) obtained from the Department of Anatomy were studied with help of vernier caliper. The mean height of medial malleolus of tibia on the left side was 15.87 ± 1.42 mm and on the right side was 15.81 ± 1.55 mm. The mean anteroposterior length of medial malleolus of tibia on the left side was 23.95 ± 2.00 mm and on the right side was 23.01 ± 1.88 mm. The study provides a comprehensive data about the morphometry of distal end of dry adult Tibia which will help in reconstruction surgeries of the ankle joint.

INTRODUCTION

The lower end of tibia along with its medial malleolus and the lateral malleolus of the fibula form a deep recess to accommodate the body of talus^[1].

Since distal tibia bears body weight in a relatively small surface area during the stance phase of gait, it is subjected to high biomechanical strains that in turn affect bone modelling. It is therefore plausible to postulate significant differences in distal tibial dimensions. Several authors have derived linear regressions to estimate the maximum length of long bones from the measurement of its fragments in different populations^[2].

Although intact long bones are most ideal in estimation of the stature of unidentified individual, in forensic cases where natural disasters present bone fragments, researchers have deemed it necessary to develop regression equations from these bone fragments to use it to estimate the length of the intact long bone from which the stature of the individual can be further derived^[3].

Ankle is one of the most commonly injured joint and there is very limited amount of literature available on morphometry of the distal articular surfaces of tibia which will help in the reconstruction surgeries and construction of implants. So, this study was undertaken to measure various parameters of distal articulating surfaces of tibia.

MATERIALS AND METHODS

The study was conducted on 150 dry adult Tibia, obtained from department of Anatomy of tertiary care teaching institutes of South India. The study was done after due permission from the Institutional Ethics Committee.

Inclusion Criteria: All dry adult tibia of undetermined gender and age were included in the study.

Exclusion Criteria: Damaged bones, bones affected due to any pathology, bones of paediatric age group were excluded from the study.

Each tibia was assigned serial number and they were labelled from 1-150.

Out of total Tibia available, 150 (76 left and 74 right) were selected for the study. Data was collected by Vernier caliper (0-200 mm with a precision of 0.01 mm).

Statistical Analysis: Descriptive statistical methods like mean, SD and percentage was used for depicting and analyzing data. Student's t-test (unpaired t-test) was used to find out the p-value, which determines the difference in the values between left and right Tibia. The value of 'p' <0.05 was considered significant.

Following Parameters were Recorded in a Proforma:

- Maximum height of medial malleolus (Fig.1).
- Maximum anteroposterior length of medial malleolus (Fig.2).
- Maximum anteroposterior length of tibial plafond (Inferior articular surface of tibia) (Fig.3).
- Maximum transverse width of the tibial plafond (Inferior articular surface of tibia) (Fig.4).



Fig 1: Illustration Showing Measurement of Height of Medial Malleolus



Fig 2: Illustration Showing Measurement of Anteroposterior Length of Medial Malleolus



Fig 3: Illustration Showing Measurement of Anteroposterior Length of Tibial Plafond



Fig 4: Illustration Showing Measurement of Width of Tibial Plafond of Tibial Plafond

Table 1: *student's t-Test (Unpaired t-Test) was Used to Find Out the P-value

Morphometric measurement	Left side (Mean±SD)	Right side (Mean±SD)	p-value*
Height of medial malleolus of tibia	15.87±1.42 mm	15.81±1.55 mm	0.791
Anteroposterior length of medial malleolus	23.95±2.00 mm	23.01±1.88 mm	0.004
Anteroposterior length of tibial plafond	29.28±2.36 mm	28.88 ±2.63 mm	0.326
Transverse width of the tibial plafond	29.31±1.89 mm	29.37±2.06 mm	0.848

Table 2: Comparison of Height of Medial Malleolus of Tibia with Previous Studies

Study	Year	Country	Material for study	Mean (in mm)
Pamela M ^[2]	2013	Kenya	Dry bones	14.19±1.89
Sarala D et al ^[4]	2014	India	Dry bones	Left : 13.98±1.59 Right : 13.75±1.73
Naidoo N et al ^[5]	2015	South Africa	Dry bones	Male : 15.05 Female : 14.00
Present Study		India	Dry bones	Left : 15.87±1.42 Right : 15.8±1.55

Table 3: Comparison of anteroposterior length of medial malleolus of tibia with previous studies

Study	Year	Country	Material for study	Mean (in mm)
Pamela M et al ^[1]	2013	Kenya	Dry bones	21.88 ± 2.22
Sarala D et al ^[4]	2014	India	Dry bones	Left : 24.11 ± 2.60 Right : 24.32 ± 2.18
Present Study		India	Dry bones	Left : 23.95 ± 2.00 Right : 23.01 ± 1.88

Table 4: Comparison of Anteroposterior Length of Tibial Plafond with Previous Studies

Study	Year	Country	Material for study	Mean (in mm)
Pamela M ^[2]	2013	Kenya	Dry bones	28.61 ± 2.39
Sarala D et al ^[4]	2014	India	Dry bones	Left : 25.55 ± 2.35 Right : 25.61 ± 2.50
Present Study		India	Dry bones	Left : 29.28 ± 2.36 Right : 28.88 ± 2.63

Table 5: Comparison of Width of Tibial Plafond with Previous Studies

Study	Year	Country	Material for study	Mean (in mm)
Pamela M ^[2]	2013	Kenya	Dry bones	26.55 ± 2.18
Sarala D et al ^[4]	2014	India	Dry bones	Left : 27.07 ± 2.59 Right : 26.90 ± 2.89
Present Study		India	Dry bones	Left : 29.31 ± 1.89 Right : 29.37 ± 2.06

RESULTS AND DISCUSSIONS

The measurements of the distal end of tibia and fibula are vital in considering the stability of ankle joint, in designing of prostheses for use in ankle arthroplasty and in interpretation of diagnostic images of the ankle joint^[1].

Since distal tibia bears body weight in a relatively small surface area during the stance phase of gait, it is subjected to high biomechanical strains that in turn affect bone modeling. It is therefore plausible to postulate significant differences in distal tibial dimensions^[2].

Following tables depict comparison of values obtained from present study with the previous studies.

The mean height of medial malleolus in present study is slightly greater than previous studies mentioned in above table.

The mean anteroposterior length of medial malleolus in present study is slightly greater than study done by Pamela^[2] but similar to study done by Sarala^[4].

The mean length of tibial plafond in present study is greater than both previous studies mentioned in above table.

The mean length of tibial plafond in present study is greater than both previous studies mentioned in the above table.

On comparison with similar studies conducted in other populations, it is evident that the anatomical profile of Indians is different, hence highlighting the need for sizing of prostheses specific to the population in question^[5].

CONCLUSION

The study provides a comprehensive data about the morphometry of distal end of dry adult Tibia which will help in reconstruction surgeries and design of prosthesis of the ankle joint.

Conflict of Interest: None.

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