



MORPHOMETRIC STUDY OF DISTAL END OF TIBIA, WITH SPECIAL EMPHASIS ON MORPHOMETRY OF FIBULAR INCISURA AND ITS CLINICAL RELEVANCE

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ABSTRACT

Introduction: Ankle is commonly injured joint, for its reconstruction surgeries and in the manufacture of its implants various dimensions of lower articulating end of tibia and fibula are needed. So, this study was done to measure various dimensions of distal articulating end of tibia. Material and Method: 30 dried human adult tibia were obtained from Dept. of anatomy SKIMS medical college Bemina Srinagar and from skeleton sets used by medical students of same institute. Observation : Following parameters were measured : Length of tibia, Width of the fibular incisura, Depth of the fibular incisura, Height of the fibular incisura, Height of medial malleolus, Breadth of medial malleolus, Width of the tibial plafond, Length of the tibial plafond, all the measurements were statistically analysed. Racial differences were seen. Conclusion: The morphometry of the parameters of distal end of tibia, along with the dimension Fibular Incisura are useful in radiological anatomy and reconstructive surgeries of ankle joint.

KEYWORDS : Morphometry, fibular Incisura, Reconstruction.

INTRODUCTION:

The ankle joint is a chief weight bearing joint of the body. The anatomical relationship between the tibia and the fibula at ankle is of great importance for the proper function of the distal tibiofibular joint and thus for the structural and functional integrity. The tibial articulation with the talus occurs mainly with the tibial plafond (TP); a saddle shaped facet on the distal end of the tibia and the medial surface of the medial malleolus (MM). The morphometry of the distal tibia is significant when the stability of these articulations is put into account.^{1,2} Fibular incisura found on the lateral surface of the distal end of the tibia articulates with the fibula, forming distal joint. The fibular notch is triangular in shape. Its integrity may be disrupted in case of ankle fractures and dislocations. Hence, the morphometric data of fibular incisura are also important in order to perform surgical reconstructions after dislocation fractures.^{3,4,5,6} Ankle is commonly injured joint, for its reconstruction surgeries and in the manufacture of its implants various dimensions of lower articulating end of tibia and fibula are needed. So, this study was done to measure various dimensions of distal articulating end of tibia.

MATERIAL AND METHOD:

30 dried human adult tibia were obtained from Dept. of anatomy SKIMS medical college Bemina Srinagar and from skeleton sets used by medical students of same institute. All bones were fully ossified and had no evidence of fractures, congenital or pathological anomalies. All measurements were obtained using Vernier Caliper. All measurements were taken in cm.

Following parameters were measured:⁷

1. Length of tibia: is defined as the vertical distance from the most superior point on the medial tibial condyle to the most inferior point on the medial malleolus.
2. Width of the fibular incisura: is the distance between anterior and posterior tubercles 1 cm proximal to the tibial plafond
3. Depth of the fibular incisura: the distance from the deepest point of the FI to a line between tips of the anterior and posterior tubercles
4. Height of the fibular incisura: is the vertical distance between the tibial plafond and the point where the interosseous border of the tibia splits into anterior and posterior edges.
5. Height of medial malleolus: the distance from its base at

the tibial plafond to its tip.

6. Breadth of medial malleolus: defined as its anteroposterior length.
7. Width of the tibial plafond: is the mediolateral dimension of the talar facet at the middle of the joint.
8. Length of the tibial plafond: the anteroposterior dimension of the talar facet at the middle of the joint were measured.

OBSERVATIONS AND RESULTS:

S. No:	Parameter	n	Mean	S.D
1	Length of tibia	30	35.73	1.84
2	Width of the fibular incisura	30	2.33	0.25
3	Depth of the fibular incisura	30	0.5	0.074
4	Height of the fibular incisura	30	3.22	0.53
5	Height of medial malleolus	30	1.61	0.28
6	Breadth of medial malleolus	30	2.3	0.18
7	Width of the tibial plafond	30	2.90	0.24
8	Length of the tibial plafond	30	3.08	0.28

DISCUSSION:

The measurements of the distal end of tibia are vital for stability of ankle joint and is used in designing of prostheses for ankle arthroplasty. The preoperative and postoperative assessment of ankle sprains and ankle fractures will become very convenient with the precise knowledge of ankle joint. These morphometric data may help to easily understand and interpret plain radiographs, computed tomography and magnetic resonance images. It could also be important to perform surgical reconstructions after dislocation fractures.

On measuring length of tibia we found mean length to be 35.73 we compared to mean values of study done by Balakrishnan YA et al⁷, the mean values are 37.65 and the difference was statistically significant, which may imply South Indians are taller as compared to North Indians.

On comparing mean values of height and breadth of medial malleolus, the values are almost similar to the mean values of study done by Balakrishnan YA et al.

Mean values of Width and length of Tibial plafond differ between present study and study done by Balakrishnan YA et al, showing racial differences in morphometry of lower end of tibia.

A study was done on 35 dry adult tibia-fibula sets by Taser F, Toker S, Kilincoglu V. ² 35% of cases presented a significantly concave shape ($>$ or $=$ 4 mm) and 65% had shallow concave fibular incisura ($<$ 4 mm) in both genders. Balakrishnan YA et al study showed 6 tibias fibular incisura depth being less than 4mm and the rest 144 tibias showed the depth of fibular incisura more than 4mm. A study done by Rachana R Kulkarni ⁸ found that the mean width of fibular incisura was 2.32 cm and the depth was 0.61 cm. 88.2% bones presented deeply concave fibular incisura and 11.8% presented shallow fibular incisura. In a study conducted by Ebraheim et al. ⁹ 60% cases presented a deeply concave and 40% shallow concave fibular incisura. In present study 80% of all bones showed deeply concave fibular incisura, which goes with most of the previously done studies.

The height of the FI in the current study was found to be 3.22 cm which is similar findings to that of research done by Misiani Musa, Mandela Pamela et al ¹⁰, Kulkarni et al, while study of FI on Turkish people by Taser et al., 2009 found that the mean of height of FI was 39.14 ± 2.75 mm. This could be due to racial variations. A lower bifurcation of the tibial ridge suggests shorter FI while the depth of the FI increases proximo-distally, a lower division of the tibial ridge results in a shallower FI.

The width of FI in present study was 2.33 mm, The results being similar to study done by Shivaji B. Sukre, Santosh Kumar Dope, Deepak N. ¹¹ Kawale in Govt. college of Aurangabad and also to a study done by Taser et al, Misiani Musa et al, Mandela Pamela et al, Yildirim et al. The width of the FI is representative of the size of the TS joint. Since a wider FI indicates a greater separation of the anterior and posterior incisural tubercles. This translates to a shallower incisura that predisposes an individual to instability of the TS joint.

CONCLUSION:

The morphometry of the parameters of distal end of tibia, along with the dimension Fibular Incisura are useful to interpret radiographs, CT, MRI of TS joint and talocrural joint. This study also useful for orthopedic surgeons for placement of implants of appropriate dimensions in ankle reconstruction surgeries. Syndesmotic injury may be difficult to appreciate by radiographic criteria because of variations in the amount of rotation, the wide anatomic variability in the depth of the fibular incisura.

REFERENCES:

1. Standing, S. Gray's Anatomy. 40th ed. Edinburgh: Elsevier Churchill Livingstone, 2008.
2. Taser, F, S Toker, and V Kilincoglu. "Evaluation of morphometric characteristics of the fibular incisura on dry bones." *Joint diseases and related surgery*, 20, 2009, 52-58.
3. Ebraheim NA, Taser F, Shafiq Q, Yeasting RA. Anatomical evaluation and clinical importance of the tibiofibular syndesmosis ligaments. *Surg Radiol Anat* 2006;28:142-149.
4. Sarrafian SK. Osteology, syndesmolgy. In: *Anatomy of the foot and ankle*. Sarrafian SK (editor). Philadelphia: Lippincott; 1983. p.351-43.
5. Ebraheim NA, Lu J, Yang H, Rollins J. The fibular incisura of the tibia on CT scan: A cadaver study. *Foot Ankle Int* 1998;19:318-321.
6. Mavi A, Yildirim H, Gunes H, Pestamalci T, Gumusburun E. The fibular incisura of the tibia with recurrent sprained ankle on magnetic resonance imaging. *Saudi Med J* 2002;23:845-849.
7. Balakrishnan YA, Vikram S, Rao PC, Revankar SK. STUDY OF DISTAL DIMENSIONS OF TIBIA IN CORRELATION WITH THE LENGTH OF TIBIA. *Int J Anat Res* 2018, Vol 6(2.3):5354-59.
8. Kulkarni RR, Rao CP, S. Nidhi. Importance of fibular incisura measurements in ankle reconstructive surgeries. *International journal of A.J Institute of Medical Sciences* 2012;1:8085.
9. Ebraheim NA, Taser F, Shafiq Q, Yeasting RA. Anatomical evaluation and clinical importance of tibiofibular syndesmosis ligaments. *Surg Radiol Anat* 2006;28:142-149.
10. Misiani Musa, Mandela Pamela, Obimbo Moses et al. Morphometric characteristics of the fibular incisura in adult Kenyans. *Anatomy Journal of Africa*. 2014;3(1):243-249.
11. Shivaji B. S, Santosh K D, Deepak N. K. MORPHOMETRIC STUDY OF THE HUMAN FIBULAR INCISURA. *Int J Anat Res* 2016, Vol 4(2):2372-75. ISSN 2321-4287