



MEASUREMENT OF LENGTH, DISTANCE OF NUTRIENT FORAMEN AND FORAMINAL INDEX IN 70 DRY TIBIAE.

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ABSTRACT

Introduction: Tibia shin or shank bone larger, stronger bone located on medial aspect of leg. Identified as one of the strongest weight bearing bones of the body. It is subcutaneous throughout its length due to this for the purpose of bone grafting pieces of bones are usually taken from this part only. **Material & Methods:** This study on 70 tibiae (Right =35 and left = 35) was done after obtaining approval from ethical committee of GMC Jammu in Anatomy department was conducted to measure the length of tibia ,to obtain distance of nutrient foramen and to calculate the Foraminal Index in 70 dry tibiae. Instruments used during the study are Osteometric board , Vernier caliper, Hand lens, Thin stiff wire, Black marker pen and Digital camera. After cleaning thoroughly broken and deformed bones were excluded where as length of bone was measured by using Osteometric board and also by using Vernier caliper, black marker used to mark distance of nutrient foramen and the position and the Foraminal Index was calculated by using Hughes 29 formula **Results:** shows mean length of tibia on Right side is 36.68 ± 1.63 cm .The mean length of tibia on left side is 36.69 ± 1.39 cm with mean difference of (-0.01). Where as mean distance of nutrient foramen from proximal end of tibia on Right side is 11.44 ± 1.10 cm and mean distance of nutrient foramen from proximal end of tibia on left side is 11.64 ± 0.88 with mean difference of (-20). Foraminal Index : mean Foraminal Index on Right side is (31.38 ± 3.63) and the mean Foraminal Index on left side is (31.79 ± 2.89) with mean difference of -0.41 .Foraminal Index is calculated by using hughes formula 29 i.e $F.I = \frac{DNF}{TOTAL LENGTH} \times 100$ (DNF = DISTANCE OF NUTRIENT FORAMEN .) **Conclusion:** This study will be helpful for forensic experts so as to identify the unknown bodies and also used for orthopedic surgeons in order to insert different implants in the repairing process of Tibial fractures.

KEYWORDS : Length of Tibia, Foraminal Index, Distance of Nutrient Foramen ,Direction of Nutrient canal.

INTRODUCTION

Tibia, well known for its weight bearing property is a bone of medial aspect of leg portion of lower limbs .Anatomically, It has an upper and a lower end separated by long shaft in between; whereas both of its ends are expanded to form condyles that articulates with through proper articulating surfaces known as menisci. Standing S¹

Lower limb is adapted for walking, running, and weight bearing in bipedal manner where lower end articulates which mechanically modified foot work as a single unit for propulsion of body weight Chaurasia BD²

As these bones are under continuous stress they are at high risk of injuries and trauma due to that they need continuous supply of oxygen and nutrients so as to cope up with such mechanical stress because of that these bones are adapted with nutrient foramen (naturally occurring holes) since fetal age for the passage of adequate amount of blood through nutrient arteries. Gotzen³

Tibia is supplied by numerous arteries entering it through all parts except those areas covered by articular cartilage , generally a single nutrient artery enters the shaft obliquely through nutrient foramina then enters to nutrient canal in the cortical part of shaft which is principal source of nourishment .Lewis Oj⁴

Substantially the direction of nutrient foramina is determined by the growing ends of the bone which is always directed away from its growing ends.

Pattern of branching nutrient artery is quite horizontal in nature before it divides into its ascending and descending branches which are almost at right angles. Nutrient canal obliquity is directed proportional to the growing ends.

As the bone grows in length the nutrient canal becomes more oblique and is inclined to the end where bony cells mature more early due to oxygen saturation brought by blood vessels Mysorekar VR⁵. Where as,

tibia plays an important role in many forensic researches where stature is required to confirm the identity of unknown human remains Bokariya P⁶.

AIMAND OBJECTIVES :

To measure the length of tibiae, To obtain the distance of nutrient foramina, To calculate and also calculate the Foraminal Index.

MATERIALAND METHODS:

Study was conducted on 70 Dry Tibiae (Right =35 and left = 35) of unknown sex after obtaining approval from ethical committee of GMC Jammu in Anatomy department. The purpose of study was, to measure the length of Tibia, To obtain distance of nutrient foramen and to calculate the Foraminal Index all 70 dry Tibiae. which included thoroughly cleaned dried Tibiae after excluding the incomplete ossified, fragmented or broken bones, with any pathology .The instruments used for this purpose were:

- Osteometric board
- Vernier caliper
- Hand lens
- Thin stiff wire
- Black marker pen
- Digital camera for illustration

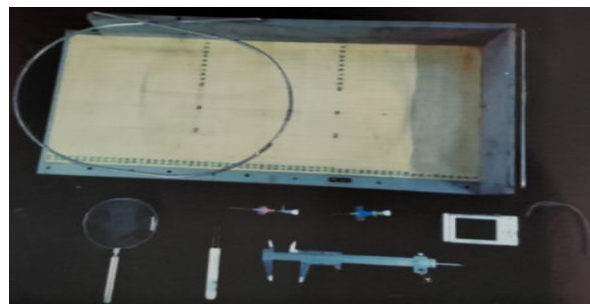


Fig 1: showing instruments used to obtain the measurements.

METHODOLOGY:

Study starts with using labeled bones, dried thoroughly cleaned. Broken and deformed bones were excluded.

OSTEOMETRIC BOARD was used to measure the distance of the bone, Vernier caliper was used to measure the length of bone as well as to find out the distance from proximal end of bone to its nutrient foramen where as Hand lens was used to locate the distance of nutrient foramen. After determining the side of tibia, the length of tibia was measured by osteometric board. Nutrient foramina were identified by the groove leading to them with slightly raised edges at the commencement of the canal. A keen observation was done to obtain the direction and length by introducing a thin stiff wire through the foramen in each tibia encircling with black marker pen Also the nutrient foramina was found to be directed away from growing ends, which is indicated by putting an arrow. Lastly all the tibiae was studied and were Digitally photographed, recording of variations regarding the length and size of nutrient foramen was done.



Fig 2 showing the measurement of nutrient foramin distance from upper end of Tibia.

Calculation of Foraminal Index: $\text{DNF}/\text{Total length} \times 100$ (Hughes 29 formula.)

DNF = Distance of nutrient foramen.

RESULTS:

mean length of tibia on Right side is 36.68 ± 1.63 cm with maximum length of 40.00 cm and minimum of 33.00 cm length where as, mean length of tibia on left side is 36.69 ± 1.39 cm with max. of 40.00 cm and min length of 33.00 cm shows length of tibia is statistically not significant as $P = 0.975$. The mean distance of nutrient foramen from proximal end of Right side of tibia is 11.44 ± 1.09 with Maximum of 14.00 cm and Minimum of 10.00 cm and the mean distance of nutrient foramen from proximal end of bone of left side is 11.64 ± 0.87 cm with Maximum of 13.50 cm and Minimum of 10.00 cm where as distance of nutrient foraminae from proximal end of tibia is not significant as $p = 0.398$

Where as, Foraminal Index on Right side of tibia is 31.37 ± 3.63 cm with max. of 38.89 cm and min. of 26.32 cm, the Foraminal Index on left side of tibia is 31.78 ± 2.98 cm with max. of 39.71 cm and min. of 26.32 cm with mean Foraminal Index of 31.59 ± 3.25 cm. the Foraminal Index of tibia is statistically not significant as $p = 0.606$.

Table 1 Length of tibiae ,distance of nutrient foramina with Foraminal Index.

Parameter	Mean $\pm$ SD	Minimum	Maximum
Tibia Length	36.69 ± 1.50	33.00	40.00
Distance of nutrient foramen	11.54 ± 0.98	10.00	14.00
FI	31.59 ± 3.25	26.32	39.71

Table 1. shows mean length of Tibiae 36.69 (SD ± 1.50), distance of nutrient foramen was 11.54 (SD ± 0.98) and Foraminal Index 31.59 (SD ± 3.25).

Table 2. Length of Right Tibia with distance of nutrient foramina and Foraminal Index

Parameter	Mean $\pm$ SD	Minimum	Maximum
Tibia length	36.68 ± 1.63	33.00	40.00
Distance of nutrient foramen	11.44 ± 1.09	10.00	14.00
FI	31.37 ± 3.63	26.32	38.89

Table 3 Length of Left Tibia, with distance of nutrient foramina and Foraminal Index.

Parameter	Mean $\pm$ SD	Minimum	Maximum
Tibia length	36.69 ± 1.37	33.00	40.00

Distance of nutrient foramen	11.64 ± 0.87	10.00	13.50
FI	31.78 ± 2.89	26.32	39.71

DISCUSSION:

present study was conducted on 70 tibiae bones 35 Right and 35 left sided The results were compared with other published studies :

In the present study mean length of Right tibia is 36.68 ± 1.63 cm and that of left tibia was 36.69 ± 1.39 cm the mean value was found to be 36.69 cm with Foraminal Index for Right sided tibia is 31.37 ± 3.63 cm and for left tibia was 31.78 ± 2.98 cm with mean Foraminal Index of 31.59 ± 3.25 cm which is very similar to the study given by Gupta RK and Kumari GA (2014)⁵ showed mean length of right tibia 36.1 cm mean length of left sided tibia 36.44 cm with Foraminal Index of 32.66 cm and 33.09 cm for right and left sided tibia, Gupta C et al (2015)⁸ gives mean length right tibia was 37.75 ± 3.45 cm and mean length of left tibia was 37.68 ± 1.61 cm with Foraminal Index of 34.66 cm and 34.33 cm for right and left tibia another studies which are in accordance to our study are given by Pereira G et al (2011)⁶ showed mean length of right and left sided tibia was 37.31 cm and Foraminal Index of 32.9 ± 6 cm and 32.3 ± 2.8 cm for right and left tibia and Kizilkant E et al (2006)¹⁰ shows mean length of right and left tibia was 35.8 cm with Foraminal Index of 31.2 cm for both right and left tibia .Another study was conducted on central Indian population estimated mean length of right sided tibia was 371.30 ± 23.20 mm and for left sides tibia was 379.41 ± 18.90 mm which is not in unison to our findings Bokariya P⁴.

Tibia plays an important role in Anthropological research because of its resistance to decomposition an ability to retain its anatomical form long after death Williams PL et al¹².

CONCLUSION:

Vantage of Study : measurement of length of tibia is useful for many researches in estimation of human stature which is particularly helpful in identification of missing persons or dead bodies in disasters, burial discoveries, anthropological researches and also in medico legal researches. whereas due to its resistance to disintegration and the ability to retain in its anatomical form long after death at the same time exact knowledge of nutrient foramina in bone is important so as to avoid damage to nutrient vessels during important surgical procedures like vascularized bone microsurgery, fracture repair, joint replacement and also during bone grafting procedures.

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