

MORPHOLOGICAL AND MORPHOMETRIC STUDY OF TIBIAL NUTRIENT FORAMENNarinder Singh¹, Rachna Magotra², Arban Kumar³, Ashwani Kumar Sharma⁴**HOW TO CITE THIS ARTICLE:**

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ABSTRACT: The present study was conducted in Department of Anatomy, Government Medical College Jammu. Material for the study comprised of seventy adult dry Tibiae, of unknown sex, available in the Department of Anatomy. Bones were labelled from 1 to 70. The number and direction of nutrient foramina on the posterior surface of the shaft was noted and counted. The situation of nutrient foramina in relation to the length of tibiae and in relation to vertical line on posterior surface was observed. The distance of nutrient foramen from the upper and lower end of tibia was measured. It was observed that in most of the bones there was a single nutrient foramen, directed downwards, which was present on the upper half of Tibia. It was present lateral to the vertical line on posterior surface of tibia. The mean distance of nutrient foramina from the upper end of tibia and from the lower end of tibia was more on the right side. The present study gains clinical significance as consistent position of the nutrient foramen is of importance in fractures involving upper third of Tibia through nutrient canal, which disrupts the blood supply to the shaft. This invariably results in delayed union.

KEYWORDS: Tibia, Nutrient foramen, Morphometry.

INTRODUCTION: Tibia (Also called as shin bone or shank bone) is the larger and stronger of the two bones in the leg present on the medial aspect. It is named after the Greek word "Aulos flute" recognized as one of the strongest weight bearing bone of the body. The role of nutrient foramina in the nutrition and growth of the bones is evident from the term 'nutrient' itself.⁽¹⁾ Knowledge of the position of nutrient foramina can be useful in surgical procedures.⁽²⁾ The surgeon must also possess a detailed knowledge of the anatomy of the part on which he is to operate, since the success of these operations, depends to a large extent, on minimal interference with the blood supply of the bone.⁽³⁾ In medicolegal practice, it is possible to estimate the total length of bone, if the ratio between the total length and the distance of nutrient foramen from both the ends is known. This is particularly important in incomplete bones broken at one end. Similarly, the height of an individual can be reconstructed from the length of bone like tibia.⁽⁴⁾

MATERIAL AND METHODS: The present study was conducted in the Department of Anatomy, Government medical college, Jammu. Material for the study comprised of 70 dry Tibiae of adult and unknown sex available in the department of Anatomy. Bones were labelled from 1 to 70. Dry bones which were thoroughly cleaned and complete in all the aspects were included in this study. Broken bones with any kind of deformity were excluded. The nutrient foramen on the posterior surface of the tibia was noted and counted. It was observed, whether it was in the upper half of the tibia, middle half or junction between the upper half and middle half of the tibia. The situation of nutrient foramen in relation to vertical line on posterior surface was noted, that is whether it was medial or lateral to the vertical line the direction of nutrient foramen was observed and the distance of nutrient foramen from the upper and lower end of the tibia was measured by a scale.

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OBSERVATION: All the bones had a single nutrient foramen (table- 1).The nutrient foramen is situated in the upper third of the posterior surface of tibia in all. (Table-2) Most of them lie lateral to the vertical line on the posterior surface (table-3).In all the 70 bones the nutrient foramen was directed downwards. The mean distance of nutrient foramen from the upper end of tibia was compared. On the right side it was 118.23 ± 7.69 mm (Range = 99 -132mm). The corresponding values on left side was 114.34 ± 9.42 mm (Range =100 -130mm). When compared between two sides it was more on right side (Table 4). The mean distance of nutrient foramen from the lower end of tibia was also compared in the present study (Table 4). On the right side, it was 255.83 ± 12.19 mm (Range =235-280 mm). The corresponding values on the left side was 255.43 ± 15.97 mm (Range= 225-285mm). When compared between the two sides the distance was more on the left side. If we have a closer look at table 4, it can be deduced that distance of nutrient foramina from the lower end of tibia is more than its distance from the upper end of the tibia. (Bar Diagram)

DISCUSSION: The number of nutrient foramina on the posterior surface of shaft in present study was found to be single. Earlier studies by Chattarapati & Misra,⁽⁴⁾ Mysorekar,⁽²⁾ Longia et al,⁽⁵⁾ Collipal et al,⁽⁶⁾ and Tejaswi et al,⁽⁷⁾ have also found that in majority of bones single nutrient foramina was present. Thus our study is in agreement with them. . In the present study nutrient foramen was situated in upper one third of posterior surface of all 70 tibiae. Authors like Mysorekar,⁽²⁾ longia et al,⁽⁵⁾ and Tejaswi et al,⁽⁷⁾ also found it to be in upper 1/3rd of posterior surface. Thus our study is in consonance with them.

The nutrient foramen was situated lateral to vertical line in majority of bones in the present study. Similar to our observations, a number of authors like Chattarapati & Misra,⁽⁴⁾ Mysorekar,⁽²⁾ Kate,⁽¹⁾ and Longia et al.⁽⁵⁾ also found it to be mostly situated lateral to vertical line.

Direction of nutrient foramina was found to be directed downwards in case of the present study, as its relationship with the growing end of long bones has been enunciated in the Wolff's law that it seeks the elbow and flees the knee. Tejaswi et al.⁽⁷⁾ also found it to be directed downwards. Only Longia et al,⁽⁵⁾ encountered 3.5% of tibiae disobeying this law. According to Hughes.⁽⁸⁾ There are variations in the direction of the nutrient foramina in many tetrapods and also similarity in the nutrient foraminal pattern in mammals and birds.

The mean distance of nutrient foramina from the upper end of tibia and from the lower end of tibia was more on the right side. Earlier Chattarapati & Misra,⁽⁴⁾ had measured distance of nutrient foramina from the both ends of tibia in Gujarat population and found it to be more on the right side which is in accordance with our study.

SUMMARY: The present study was conducted on 70 adult human tibiae, 35 each on right and left side. Different morphological features of nutrient foramen were looked for and morphometrical parameters were measured. It was concluded that all the bone of the present study depicted only one nutrient foramen situated on the upper third of the bones and directed downwards. In majority of the bones, it was situated lateral to the vertical line. The distance of nutrient foramen from both the upper and lower end was more on the right side.

The present study gains clinical significance as the anatomy of the nutrient foramen especially its consistent location and the large size becomes important because fractures involving upper third of tibia through the nutrient canal which disturbs the blood supply to the shaft. This invariably results in delayed union. During transfer of a large, straight, high density cortical bone

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graft, its predictable location favours safe manipulation and so damage to nutrient vessels during surgical procedure is avoided.

Author	Race	No. of bones with nutrient foramina					
		One		Two		Three	
		Rt.	Lt.	Rt.	Lt.	Rt.	Lt.
Present study	North Indian	35	35	-	-	-	-

Table 1: Comparison of No. of nutrient foramina

Author	Race	Situation of nutrient foramina					
		Upper1/3rd		Middle1/3rd		Junction of upper 1/3rd and middle 1/3rd	
		Rt.	Lt.	Rt.	Lt.	Rt.	Lt.
Present study	North Indian	35	35	-	-	-	-

Table 2: Comparison of situation of nutrient foramina in relation to length of tibia

Author	Race	Situation of nutrient foramina					
		Lateral to vertical line		On vertical line		Medial to vertical line	
		Rt.	Lt.	Rt.	Lt.	Rt.	Lt.
Present study	North Indian	31	32	-	-	04	03

Table 3: Comparison of Situation of Nutrient Foramina in Relation to Vertical Line

Distance from (mm)	Author	Race	Mean±SD(n)		Range	
			Rt.	Lt.	Rt.	Lt.
Upper end	Present study	North Indian	118.23±7.69	114.34±9.42	99-132	100-130
Lower end	Present study	North Indian	255.83±12.19	255.43±15.97	235-280	225-285

Table 4: Comparisons of Distance of Nutrient Foramina From the Upper End and Lower End of Tibia

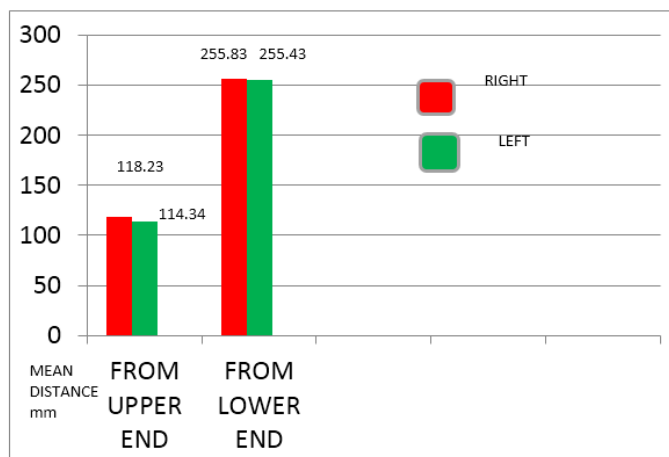


Fig. 1: Comparison of Distance of Nutrient Foramina from the Upper End and Lower End of Tibia

REFERENCES:

1. Kate BR. Nutrient Foramina in human long bones. J Anat Soc Ind 1971; 20(3):139-145.
2. Mysorekar VR. Diaphyseal nutrient foramina in human long bones. J Anat 1967; 101(4):813-822.
3. Laing P.G. The blood supply of the femoral shaft; an anatomical study J Bone joint Surg B 1953; 35: 462-466.
4. Chattrapati DN and Misra BD. Position of the nutrient foramen on the shafts of human long bones. J Anat Soc Ind 1967; 16: 54-63.
5. Longia GS, Ajmani ML, Saxena SK, and Thomas RJ. Study of the diaphyseal nutrient foramina in human long bones. Acta Anat 1980; 107:399-406.
6. Collipal E, Vergas R, Parra X, Silva H, and Sol MD. Diaphyseal nutrient foramina in the femur, tibia, and fibula bones. Int J Morphol 2007; 25(2):305-308.
7. Tejaswi HL, Shetty K and Dakshayani KR. Anatomic study of the nutrient foramina in the human tibiae and their clinical importance. Int J Recent trends in Sci and Tech 2014; 9 (3):334-336.
8. Hughes H. The factors determining the direction of the canal for the nutrient artery in the long bones of mammals and birds. Acta Anat 1952; 15:261-280.

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