



A MORPHOLOGICAL STUDY OF NUTRIENT FORAMEN OF DRY HUMAN TIBIA- IN GUJARAT REGION

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ABSTRACT

Background: Preservation of vascularity of tibia is of paramount during its surgical interventions. **Material & Methods:** 160 dry tibias from Medical College Baroda, were examined for nutrient foramina location, number, direction & its relation to other bony landmark. **Results:** Single nutrient foramen directed downwards was the rule. The location of nutrient foramen closely resembled with the data of previous similar studies done in other parts of the India. **Conclusion:** The present study generated database for nutrient foramen of tibia. This can be utilized by surgeons to preserve nutrient artery during operations for fracture repair, tumor and bone grafts involving tibia.

KEYWORDS : bone graft, fracture repair, nutrient artery, nutrient foramen, tibia, vascularity.

INTRODUCTION

All long bones in the body are supplied by a single nutrient artery in majority of cases which enters the bone in the diaphysis. The nutrient artery is supplemented by epiphyseal, metaphyseal and periosteal vessels in providing blood supply to the long bones.

The nutrient artery to the tibia is a branch of posterior tibial artery or peroneal artery. It supplies the inner two-thirds of the cortex and is the chief blood supply of cortical bone. The nutrient artery enters the shaft of the tibia generally in its upper one third; this arrangement deprives the nutrition to the lower one third of shaft, thus making the lower one third of tibia more liable to undergo non union in the event of fracture.

The knowledge of location of nutrient foramen in long bones is of paramount importance to the surgeons as minimal interference with the vascularity of the bone during surgical procedures or during fracture repairs will improve the surgical outcome substantially. Many studies have been done in the past to find out the number, location and direction of nutrient foramina of tibia.

Present study was undertaken to generate the data on exact location of nutrient foramen in tibia from Gujarat region and to compare the findings with the similar studies done in other parts of the India.

MATERIAL & METHODS

The present study was conducted on dry specimen of tibia from the department of Anatomy, Medical college baroda from Gujarat region. Side determination of the dry tibia was done using existing universally accepted criteria. The Vernier caliper was used for all the distance measurements.

Following observations were made on each tibia:

1. Number of nutrient foramina
2. Situation of nutrient foramina in tibia (in reference to upper, middle or lower one-third of the shaft)
3. Direction of the nutrient foramina
4. Location of nutrient foramen in reference to Soleal line on posterior surface of tibial shaft (Medial/Lateral to Soleal line)
5. Horizontal distance of Nutrient foramen from the Soleal Line.

RESULTS

The present study was done on 160 dry tibias (80 Right & 80 Left) of both the sexes from the department of Anatomy of Medical college baroda in Gujarat. In all the samples single nutrient foramen was found on the posterior surface of the shaft.

We noticed that in 160 (100%) tibia the nutrient foramen was located on the shaft in its upper one third (Table 1). In all 160 tibias the direction of nutrient foramen was observed to be downward towards its lower end. The location of nutrient foramen when compared with Soleal line determined that in 153 (95.7%) tibia it was located lateral to the Soleal line (Table 2).

As the nutrient foramen was located in upper one third of shaft of tibia in 100 % of the cases, the exact distance of the nutrient foramen was measured from two landmarks: i) the junction of upper & middle one third of the shaft; ii) the Soleal line.

We discovered that (Table 3) the nutrient foramen was located on posterior surface of shaft: i) In right tibias at an average distance of 14 mm ($\pm$ 4.27) and 10.4 mm ($\pm$ 4.22) ii) In left tibias at lateral to Soleal line.

Table 1: Location of nutrient foramen in the tibia

	Sample size	Location of nutrient foramen on shaft		
		Upper 1/3	U 1/3 & M 1/3 Junction	Middle 1/3
Right Tibia	80	80	0	0
Left Tibia	80	80	0	0
Total	160	160	0	0
Percentage	100%	100%	0	0

Table 2: Direction & relation of Nutrient Foramen (NF) with Soleal line (SL) on tibia

	Direction of NF		Relation of NF with Soleal line		
	Upward	Downward	Medial to SL	Lateral to SL	On SL
Right Tibia	0	80	0	77	3
Left Tibia	0	80	1	76	3
Total	0	160	1	153	6

Table 3: Distance of nutrient foramen from soleal line

	Sample size	Mean distance of NF from Soleal line in mm(Range)	
Right Tibia	80	14.0 + - 4.27	(0-20)mm
Left Tibia	80	10.4 + - 4.22	(0-22)mm

DISCUSSION

The nutrient artery plays major role in blood supply of a long bone. The nutrient artery to tibia is derived from posterior tibial artery near its origin. It is one of the largest of the nutrients arteries. Rhinelander et al (1972) have reported that the nutrient artery to the tibia supplies the inner two-thirds of the cortex and is the chief blood supply of cortical bone. A single nutrient foramen on the shaft of the tibia is a common observation of the past studies. Few researchers have also reported the double diaphyseal nutrient foramen on the tibia as a rare occurrence. In the present study, a single nutrient foramen on shaft was a rule in all 160 tibias.

All of these nutrient foramina were directed downwards towards the lower end of the tibia. The nutrient foramen was located in upper one third of tibial shaft in 100% of the present study sample. Thus our study shows that the data from Gujarat region on location of nutrient foramen of tibia is in concurrence with many previous studies done in the different parts of the india(Table 4).

The nutrient foramen was situated lateral to Soleal line >95% of the present study samples. only one of the nutrient foramen was lying medial to Soleal line. The knowledge of exact location of nutrient foramen of tibia is highly useful for the surgeons who perform fracture repair or are involved in surgical interventions of tibia.

Table 4: comparison with previous studies for location of nutrient foramen of tibia

Studies(Yr)	Region	Sample size	Location of Nutrient foramen on shaft		
			U 1/3	M1/3	U/M Junction
Longia(1980)	India (Zansi)	210	91.90%	8.10%	0%
Gandhi (2013)	India (North)	100	100%	0%	0%
Tejaswi H. L.(2014)	India (Karnataka)	150	94.90%	5.10%	0%
Present Study	India (Gujarat)	160	100%	0%	0%

Table 5: Comparison with previous studies for relation of nutrient foramen of tibia with Soleal line

Studies (Yr)	Region	Sample size	Location of Nutrient foramen on shaft	
			Lateral to SL	On SL
Murlimanju BV (2011)	India	69	66	02
Ankolekar (2013)	India (Karnataka)	50	35	7
Tejaswi H. L.(2014)	India (Karnataka)	150	91.21	1.37%
Present Study	India (Gujarat)	160	95.7%	4.3%

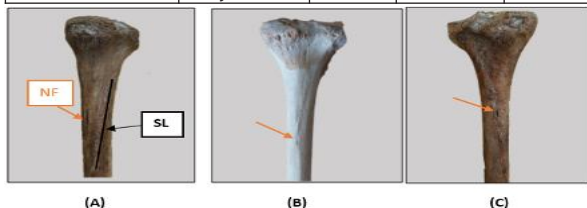


Image 1



(D)

Image 1: Situation of nutrient foramen on tibia (A) In upper 1/3rd of shaft; Medial to soleal line(Right Tibia) (B and c) On Soleal line (D) Distance of nutrient foramen from the soleal line.

CONCLUSION

The present study reconfirms that the nutrient artery to tibia enters into upper 1/3rd of its shaft on its posterior aspect lateral to Soleal line in 100% of the cases. Clinical procedures involving this area shall be done with extreme care to preserve the chief blood supply of tibia.

The data from Gujarat region about number, direction & location of nutrient foramen of tibia closely resembles the data from other parts of the india.

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