### **Research Paper**

Anatomy

# **Comparative Morphometric Study of Nutrient Foramina** of Dry Adult Human Fibula in Vindhya and Mahakoshal **Region : Original Article**

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## ABSTRACT

Background: Knowledge of the nutrient foramen anatomy of fibula is great value to the orthopedic surgeons, maxillofacial surgeons and also plastic surgeons. Nowadays fibula is the bone of choice for various types of vascular bone graft procedures and dental implants. The aim of our present work is to analyze the comparative study of the number, position, size and direction of the nutrient foramina in fibula between two regions of central India.

Material and Method: The study was done in Department of Anatomy, S.S. medical college Rewa and N.S.C.B. Medical College Jabalpur (M.P.). 100 adult human fibulae were collected from Department of Anatomy.

Results: About 85% of the nutrient foramina pointed away from the growing end of the diaphysis with remaining 15% pointing towards the growing end in both population of Mahakoshal and Vindhya region. In respect to number of nutrient foramina we found that majority of bones of both population have single dominant nutrient foramina but, approximately 10% fibulae in Mahakoshal region showed more number of secondary foramina as opposed to Vindhya region.

Conclusion: This bone has profound medico legal importance and clinical application especially in orthopaedic surgeries and in dentistry.

### KEYWORDS : Fibula, Nutrient foramina (NF), Foraminal Index (FI), Nutrient Artery.

**INTRODUCTION:** Fibula is one of our lateral leg bone which does not take part in weight transmission of the body<sup>1</sup>. Usually it is supplied by one nutrient artery that is peroneal artery branch of popliteal artery<sup>2</sup>. This artery enters in to bone through an opening present in diaphysis of long bone called as nutrient foramina which is further traversed by nutrient canal. After entering it to medullary cavity this artery divides it to an ascending and descending branch. So the nutrient aretry is the principal supply to bone<sup>3, 4</sup>. Along with the diaphyseal nutrient foramina there are many numbers of small secondary foramina is also present for periosteal vessels. This nutrient foramen, in the majority of cases is directed away from the growing end hence it is popularly stated that foramina `seek the elbow and flee from the knee<sup>5,6</sup>. This is because the one end of the limb bone grows faster than the other7. So our present study was undertaken to investigate the nutrient foramina distribution in fibula that helps to surgeons of both Mahakoshal and Vindhya region.

MATERIALS AND METHODS: This study was conducted on 100 macerated specimens of adult human Fibula. These were collected from the department of Anatomy of two medical colleges ie S.S. medical college Rewa and N.S.C.B. medical college jabalpur respectively denotes the Vindhya and Mahakoshal region. Bones with notable physical and pathological signs were excluded from the study. The instruments used for the study were an Aerospace sliding caliper, hypodermic needles of size 25G (0.56mm), steel wire, hand lens, marking pen etc. Each fibula was numbered serially with a marking pen to help in identification. Their side (Left or Right) was determined. The diaphysial nutrient foramina were observed in all the bones with a hand-lens and encircled with a marker The location, number, direction of nutrient foramen were observed and analyzed. The total bone length of fibula was measured by taken the distance between the apex of the head of the fibula and the tip of the lateral malleolus. The position of the nutrient foramen was expressed as the percentage of the total bone length and was calculated by the formula according to (Hughes, 1952): FI=DNF/TL×100, where FI is the foraminal index; DNF the distance from the proximal end of the bone to the nutrient foramen and TL the total length of bone<sup>8,9</sup>.Statistical analysis was done using SPSS version 11, and  $P \le 0.05$  was used to infer on the level of statistical significance. The following statistical analyses were undertaken: frequency tables were used to calculate measures of central tendency (mean, range and standard deviation); student T test for comparisons of means between the two population groups.. The present study was well compared and correlated with the available literatures.

**RESULTS:** The results were analyzed and tabulated using the range ,mean and standard deviation of foramina index determined. Here from Tables 1 to 3 give the details of the results in terms of nutrient foramina number, position and direction.

#### Table 1 Number and location of nutrient foramina observed in fibula

		0	1	2	To- tal	Post surface (on the medial crest)	Post surface (bet the medial crest and post bor- der)	Lat. sur- face	Med. sur- face
Vindhya Population	Right	2	26	08	34	23	09	02	-
	Left	1	21	04	25	18	05	02	-
Maha- koshal population	Right	3	24	11	35	25	05	05	-
	Left	0	23	10	33	28	03	02	-

### Table 2

Mean length and direction of nutrient foramina observed in fibula

			Direction		
		Mean length	Away from the growing end	Towards the growing end	
Vindhva Population	Right	35.80±2.53	30(88.2%)	04(11.76%)	
	Left	35.45±1.33	21(84.2%)	04(15.8%)	
Mahakoshal	Right	36.01±1.53	29(82.85%)	06(17.14%)	
population	Left	35.90±0.67	27(88.00%)	06(12.00%)	

### Table 3

### Range, Mean ± Standard deviation (SD) of foraminal indices(FI) observed in the fibula

		Range	Mean±SD	Average		
Vindhya Population	Right	35.92-65.56	40.37±6.30			
	Left	36.39-68.79	42.81±0.84	41.59±1.72		

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Mahakoshal population	Right	37.85-51.50	44.67±9.65	42.85±2.57	
	Left	39.04-55.68	41.03±2.39		

DISCUSSION: Our present study showed that the mean length of fibula was 35.35cm in Vindhya population and 36.00cm in Mahakoshal population. According to student t test the p value was insignificant(p≥0.05). The mean lengths of the fibula were similar to that reported in previous studied populations of south africans Pedzisai Mazengenya and Mamorapelo D. Fasemore 2015) 10, southern Brazilians (Pereira et al., 2011)<sup>11</sup>, Turkish (Kizilkanat et al., 2007)<sup>12</sup>, and in Chileans (Collipal et al., 2007) 13. In vindhya population 86% of fibula had their nutrient foramina pointing away from the growing end and rest 14% pointed towards the growing end. In Mahakoshal population 85% of fibula had their nutrient foramina pointing away from the growing end of diaphysis and rest 15% pointed towards the growing end. Mysorekar (1967) 14 reported that the majority of the fibulae had their nutrient foramina pointing away from the growing end of the bone towards the ankle joints among the Indian population. The majority of fibula in both population possess single nutrient foramina, while the number of two foramina was slightly greater in Mahakoshal population. Occurrence of a single nutrient foramina on the fibula was the commonest (Pedzisai Mazengenya and Mamorapelo D. Fasemore 2015, Pereira et al., 2011, Kizilkanat et al., 2007, Sendemir and Çimen,1994 and Longia et al.,1980) followed by two (Guo,1981; Gümüsburun et al., 1994;) and then none (Mysorekar, 1967) but rarely three as observed by Mckee et al. (1984). There are conflicting reports on the location of the nutrient foramina on the surfaces of the fibula. In the present study, most of the nutrient foramina were located on the medial crest (posterior surface), followed by the Posterior surface (between the medial crest and post border), and the least number on lateral surface of the bone. The posterior surface of the fibula was reported to harbour the majority of the nutrient foramina in some previous studies and reported as 90% by Pedzisai Mazengenya and Mamorapelo D. Fasemore (2015) among black and white south africans and 100% by Kizilkanat et al. (2007) among the Turkish population. On the contrary, nutrient foramina were observed most frequently on the medial surface (Forriol Campos et al., 1987; Sendemir and Çimen, 1994), lateral surface (Pereira et al., 2011) and on the medial crest (Mysorekar, 1967). In the present study most of the nutrient foramina were located along the middle third of the fibula (97.91%) (Type-2), the rest (2.08%) were located in the distal third (Type-3), while no foramina detected in the proximal third of the fibula in both regions. The mean foraminal index (FI) was 41.59±1.72 and foramen index ranging between 35.92 to 68.79 % of the bone length in vindha region. Among Mahakoshal population the mean foraminal index (FI) was 42.85±2.57 and foramen index ranging between 37.85 to 55.68 % of the bone length.

**5. CONCLUSION:** To conclude that our comparative study between two regions of central India was very helpful to the orthopedic surgeons and dental surgeons.Preoperative knowledge about detailed anatomy of nutrient foramina is recommended,to provide maxium application of fibula in various procedures. This study also helps in age estimation, sex determination, stature determination from the fragments of bone.

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