



MORPHOLOGICAL STUDY OF NUTRIENT FORAMINA IN DRY HUMAN FIBULA IN TELANGANA REGION.

Anatomy

DR. V.JANAKI Associate Professor, Dept of Anatomy, Kakatiya Medical College, WARANGAL. TELANGANA STATE.

Dr. Aparna Veda Priya. K. Associate Professor, Dept of Anatomy, Osmania Medical College, HYDERABAD. TELANGANA STATE.

ABSTRACT

Introduction: Nutrient foramen is an opening in the shaft of bone which gives passage to the blood vessels, which provide main nutrition to the shaft of long bone. The knowledge of nutrient foramen is important in surgical procedures like bone grafting, microsurgical vascularised bone transplantation, open reduction of fracture etc.

Materials and methods: The study was conducted on 100 (50 right and 50 left) dry human fibula bones collected from the Department of Anatomy, Osmania and Kakatiya Medical Colleges, Telangana Region. These bones were separated into right and left side bones. Numbers were given to all bones. The nutrient foramina location, distribution, direction and number/s were identified macroscopically by using hand lens and result were analysed.

Results: In our study, we found 12% of nutrient foramina were directed towards the growing end. In this study we found 89% of fibulae have single nutrient foramina. We also found that 2% of total fibulae were having no foramen, 9% were having double foramina. Most of the foramina are located in middle 1/3rd of the shaft (84%), followed by 10% on upper 1/3rd and 4% on lower 1/3rd. Most of the fibula having nutrient foramina (88%) on posterior surface, followed by (6%) on the interosseous border, 2% on anterior surface, 2% of foramina present on lateral surface of shaft of fibulae.

Out of 90% Nutrient Foramina present on posterior surface, most of the foramina present lateral to the crest (48%), followed by (30%) on the crest, and (12%) medial to the crest.

Conclusion: This study has provided additional information on the morphology and topography of nutrient foramen in fibulae. This knowledge of nutrient foramen is useful in certain surgical procedures to preserve the circulation.

KEYWORDS:

Fibulae, Nutrient artery, Nutrient foramen

INTRODUCTION:

The long bone is supplied by a nutrient artery which enters the bone obliquely through the nutrient foramen, which is directed away as a rule from the growing end. It is well known that they seek the elbow and flee from knee¹. This is because one end of long bone grows faster than the other. Their position in mammalian bones are variable and may alter during the growth². Knowledge about location of these foramina is useful in certain operative procedures to preserve the circulation^{3,4,5}. The fibulae are used as a vascularised graft for conditions such as stabilization of lost mandible, spine and even in tibia. Free vascularised fibular graft offers a reliable method of reconstruction after excision of bone tumor and other bony defects. The neurovascular structures at risk for injury during fibular bone graft harvesting include the peroneal nerve and their muscular branch in proximal 1/3rd and the peroneal vessels in middle 1/3rd^{6,7}. Certain morphological and topographical studies are available on nutrient foramen of fibulae, but none so far reported in Telangana region. Findings of such morphological studies can be of great importance for orthopaedic surgeons, anatomists and forensic experts.

MATERIALS AND METHODS:

The study was conducted on 100 (50 right and 50 left) dry human fibula bones collected from the Department of Anatomy, Osmania and Kakatiya Medical College, Telangana Region. These bones were separated into right and left side bones. Number was given to all bones. Nutrient foramen were identified by the presence of well marked groove leading to them and by a well marked, often slightly raised edge at the commencement of that canal. Number, distribution and direction of nutrient foramen in relation to specific surfaces and growing ends of fibulae were analyzed. Keen observation was done for direction of nutrient foramen by using magnifying hand lens. For determining the topographical distribution of nutrient foramen along the length of fibular shaft, each bone was divided into three parts (upper, middle and lower 1/3rd) after measuring the length of bone and it was noticed that which part/ parts of bone

possessed the foramen. All the data were first collected in a standardized sheet followed by tabulation for calculating the percentages of distribution of nutrient foramen along the length of fibulae and in relation to the surfaces.

RESULTS:

In our study, we found 12% of nutrient foramina were directed towards the growing end. In this study we found 89% of fibulae have single nutrient foramina. We also found that 2% of total fibulae were having no foramen, 9% were having double foramina (figure-1). Most of the foramina are located in middle 1/3rd of the shaft (84%), followed by 10% on upper 1/3rd and 4% on lower 1/3rd. Most of the fibula having nutrient foramina (88%) on posterior surface, followed by (6%) on the interosseous border, 2% on anterior surface, 2% of foramina present on lateral surface of shaft of fibulae.

Out of 90% Nutrient Foramina present on posterior surface, most of the foramina present lateral to the crest (48%), followed by (30%) on the crest, and (12%) medial to the crest.

DISCUSSION:

In our study, 89% fibulae had single foramen, 9% had two and 2% fibulae had no foramen (Table-1). McKee⁶ reported that out of 323 fibulae in his study, 86.4% had one foramen, 7.7% had two, 6% had no foramen and only 1 fibula (0.3%) had three foramina. Forriol et al⁸ studied 33 fibulae and 100% of fibulae in his study had single foramen. Mysorekar⁴ found one foramen in 92.8% fibulae, 2 foramen in 3.3% and 3.9% fibulae showed no foramen. Guo⁹ studied 295 fibulae, out of which 10 fibulae (3.39%) had double foramen and 5 fibulae (1.7%) had no foramen. Pereira et al¹⁰ studied 115 fibulae and found 2 foramen in 0.87% and single foramen in 99.3% fibulae. It was reported that in instances where nutrient foramen is absent, the bone is likely to be supplied by periosteal arteries.²

In present study, 84% foramen were located in middle 1/3rd of fibulae, 10% in upper 1/3rd and 4% in lower 1/3rd (Table-2).

Gumusburun et al¹¹ studied 60 fibulae and found that 92.3% of foramen were located in middle 1/3rd of fibulae. McKee 6 also found that 96% foramen were located in middle 1/3rd of fibulae, while Guo 9 reported in his study that 66.4% foramen were in proximal 1/3rd, 15% in middle 1/3rd and 13.5% in distal 1/3rd of fibulae. Variations in these studies are of regional and racial importance.

In present study 88% of bones having nutrient foramen on posterior surface, 2% on medial surface, 2% on lateral surface, 6% on posterior interosseous border and 2% bones do not have any nutrient foramina (Table-3). Gumusburun et al¹¹ found that 88.5% foramen were on medial surface, 9.8% on posterior surface and 1.6% on lateral surface. Mysorekar⁴ observed that 56% foramen were located on medial surface and 26% on posterior surface, while Forriol et al⁸ found almost equal distribution of foramen in posterior and medial surface. All the above studies showed striking difference from our study, but study of McKee 6 showed that most of the nutrient foramen of fibulae were on posterior surface. McKee 6 observed that 67.5% foramen were on posterior surface and 13% on medial surface. Malukar et al¹² also found that 90.8% nutrient foramen of fibulae were located in posterior surface, 6.5% on medial surface and 2.2% on lateral surface.

In present study, 12% of foramen showed their direction towards growing end contrary to the belief that nutrient artery runs opposite to the growing end. Malukar et al¹² studied on 1000 long bones and noted that fibulae are the bone which showed maximum variation in the direction of nutrient canal i.e. towards the growing end.

CONCLUSION:

Knowledge about this foramen is useful in the surgical procedures to preserve the circulation. These findings are of importance to orthopaedic surgeons who perform open reduction of fractures, bone graft surgeries.

Table 1: Study of numbers of nutrient foramen in fibulae

	Lt. fibula (50)	Rt. fibula (50)	Total fibula	Total%
No of foramen	No of fibula	No of fibula	No of fibula	%
0	-	2	2	2
1	44	45	89	89
2	6	3	9	9

Table 2: Distribution of nutrient foramen on the shaft of fibulae

Side	No of bones	No of fibula having Nutrient foramina	Location of foramina	No of fibula having foramina in	percentage
Right	50	50	Upper 1/3 rd	02	04
			middle 1/3 rd	46	92
			Lower 1/3 rd	02	04
Left	50	46	Upper 1/3 rd	06	12
			middle 1/3 rd	38	76
			Lower 1/3 rd	02	04
Total	100	98	Upper 1/3 rd	10	10
			middle 1/3 rd	84	84
			Lower 1/3 rd	04	04

Table 3: Location of nutrient foramen on various surface of shaft fibulae

Side	No of bones	Surface or border of fibula bone	No of fibula having foramina	percentage
Right	50	Medial surface	-	-
		Lateral surface	-	-
		Posterior surface	46	92
		Interosseous border	04	08
Left	50	Medial surface	02	04
		Lateral surface	02	04
		Posterior surface	40	80
		Interosseous border	02	04

Total	100	Medial surface	02	04
		Lateral surface	02	04
		Posterior surface	88	88
		Interosseous border	06	06
		Fibula without nutrient foramina	02	02

Table 4: Study of direction of nutrient foramen in fibulae

Side	No of bones	Direction of nutrient foramina	No of fibula showing foramina towards growing end	Total percentage
Right	50	Towards the growing end	4	08
		Away from growing end	46	92
Left	50	Towards the growing end	8	16
		Away from growing end	38	76
Total	100	Towards the growing end	12	12
		Away from growing end	86	86



Figure- 1: showing fibula with double nutrient foramina

REFERENCES:

- Mysorekar VR, Nandedkar AN. Diaphysal nutrient foramina in human phalanges. J Anat 1979; 128(2):315-322.
- Patake SM, Mysorekar VR. Diaphysal nutrient foramina in human metacarpals and metatarsals. J Anat, 1977, 124(Pt 2):299-304.
- Henderson RG. The position of the nutrient foramen in the growing tibia and femur of the rat. J Anat 1978; 125(3):593-599.
- Mysorekar VR. Diaphysal nutrient foramina in human long bones. J Anat 1967; 101(4): 813-822.
- Taylor GI. Fibular transplantation. In: Serafin D, Bunke HJ (eds), Microsurgical composite tissue transplantation, C.V. Mosby Co., St. Louis, 1979; 418-423.
- McKee NH, Haw P, Vettese T. Anatomical study of the nutrient foramen in the shaft of the fibula. Clin Orthop Relat Res 1984; 184:141-144.
- Ebraheim NA, Elgafy H, Xu R. Bone-graft harvesting from iliac and fibular donor sites: Techniques and complications. J. Amer. Acad. Orthop. Surg. 2001; 9: 210-218.
- Forriol Campos F, Pellico L G, Alias M G, Fernandez-Valencia R. A study of the nutrient foramina in human long bones. Surg. Radiol. Anat. 1987; 9:251-55
- Guo F. Observations of the blood supply to the fibula. Arch. Orthop. Traumat. Surg. 1981; 98:147-51
- Pereira GAM, Lopes PTC, Santos AMPV, Silveira FHS. Nutrient Foramina in the Upper and Lower Limb Long Bones: Morphometric Study in Bones of Southern Brazilian Adults. 2011; Int. J. Morphol. 29(2):514-520
- Gümüşburun E, Yücel F, Özkan Y, Akgün Z. A study of the nutrient foramina of lower limb long bones. Surg. Radiol. Anat. 1994; 16:409-12
- Malukar O, Joshi H. Diaphysal nutrient foramina in long bones and miniature long bones. National Journal of Integrated Research in Medicine 2011; 2(2):23-26