Original Research Article

Morphometric and morphological study of nutrient foramina of dry human ulna bones in Telangana region

B Naveen Kumar[1], Udaya Kumar[2*], Kalpana T[3]

[1,2,3]Assistant Professor, Department of Anatomy, Mamata Medical College, Khammam, Telangana, INDIA.
Email: bandarupallinaveen@gmail.com, udaygmc@yahoo.co.in, dr.kalpana0558@gmail.com

Abstract

Background: Nutrient artery is the main source of blood supply of long bones along with the periosteal, epiphyseal and metaphyseal arteries. Nutrient artery enters the bone obliquely through nutrient canal and nutrient foramina. **Materials and Methods:** In the present study, 147 (69 right sided and 78 left sided) ulna bones of unknown age and sex were used from the bone bank of department of Anatomy, Mamata Medical College, Khammam, Telangana. The Foramen index (FI) was calculated using the formula: Foramen index = (DNF/TL) x 100 DNF = the distance from the proximal end of the bone to the nutrient foramen. TL = total bone length. Size of foramina was measured using syringe needles of various gauzes. **Results:** Out of 69 right sided bones, four bones have two nutrient foramen and all the other bones showed single nutrient foramina. On the left side, out of 78 bones, nutrient foramina was absent in one bone and two bones showed two foramen and all the other bones showed single nutrient foramina. Mean foramen index was 36.78 ± 6.21 cm and the foramina are located on the upper and middle third and mostly (89.24%) on the anterior surface. **Conclusion:** The knowledge of morphometry and morphology is of much clinical significance in view of the available recent advancements in the surgical and orthopaedic procedures like joint replacements, graft techniques and micro vascular surgeries.

Key Words: Ulna, Nutrient foramina, Nutrient artery, Blood supply of bone.

[*]**Address for Correspondence:**
Dr. Udaya Kumar, Assistant Professor, Department of Anatomy, Mamata Medical College, Khammam, Rotary Nagar. Telangana–507002, Telangana, INDIA.
Email: udaygmc@yahoo.co.in
Received Date: 11/10/2015 Revised Date: 25/10/2015 Accepted Date: 12/11/2015

Access this article online

Quick Response Code:

Website: www.medpulse.in

DOI: 28 December 2015

INTRODUCTION

Nutrient artery is the main source of blood supply of long bones along with the periosteal, epiphyseal and metaphyseal arteries. Nutrient artery enters the bone obliquely through nutrient foramina[1]. Nutrient foramina is directed away from the growing end, due to differential growth of the ends of the long bone during development[2]. The knowledge of the nutrient foramina in the long bones is required during surgical procedures, especially bone grafts, to ensure proper bone repair.

MATERIALS AND METHODS

In the present study, 147 (69 right sided and 78 left sided) ulna bones of unknown age and sex without any pathological changes were taken into consideration. Cleaned and dry ulna bones were obtained from the bone bank of department of Anatomy, Mamata Medical College, Khammam, Telangana. Osteometric board was used to calculate the total length of the bone and the distance of the nutrient foramina from the upper end. Total length was calculated as the distance between the proximal aspect of the ulnar olecranon process and the most distal aspect of the styloid process of the bone. The Foramen index (FI) was calculated using the formula: FI = (DNF/TL) x 100 (Hughes [5], Shulman [6]). DNF = the distance from the proximal end of the bone to the nutrient foramen. TL = total bone length. Hand lens was used to observe the nutrient foramina. Size of foramina was

How to site this article: B Naveen Kumar, Udaya Kumar, Kalpana T. Morphometric and morphological study of nutrient foramina of dry human ulna bones in Telangana region. *MedPulse – International Medical Journal.* December 2015; 2(12): 975-978. http://www.medpulse.in (accessed 30 December 2015).

measured using syringe needles of various gauzes. Foramina of size less than 24 gauze were not taken into account.

a. Size of the 18 gauze needle was considered to be between 1.27 mm or more (i.e.>1.27 mm).
b. Size of the 20 gauze needle was considered to be between 0.90 mm and 1.27 mm (i.e.0.90mm to < 1.27mm).
c. Size of the 22 gauze needle was considered to be between 0.71 mm and 0.90 mm (i.e.0.71mm to < 0.90 mm).
d. Size of the 24 gauze needle was considered to be between 0.55 mm and 0.71mm (i.e.0.55mm to < 0.71 mm).

RESULTS

Table 1: Showing the length of the bone, distance of the proximal nutrient foramina from the upper end and foramen index

Side	Total length of the bone		Distance from upper end to NF		Foramen Index	
	Median in cm	Mean ± SD in cm	Median in cm	Mean ± SD in cm	Median	Mean ± SD
Right (n = 69)	25.7	25.53 ± 1.87	9.2	9.26 ± 1.87	34.94	36.2 ± 6.37
Left (n = 78)	25.1	25.09 ± 1.87	9.1	9.36 ± 1.62	35.87	37.37± 6.05

n = total number of bones, SD = standard deviation, NF = Nutrient foramina

Table 2: Showing the segmental position of nutrient foramen:

Right radius (N= 91)	(total no of foramina = 69) NF	Percentage	Left radius (N = 88)	(total no of foramina = 78) NF	Percentage
Upper 1/3rd	20	28.99%	Upper 1/3rd	23	31.46%
Middle 1/3rd	46	66.67%	Middle 1/3rd	53	66.29%
At the junction of upper and middle 1/3rd	3	4.34 %	Lower 1/3rd	2	2.25%

N = total no of bones, NF = no. of foramina in each segment, No foramina were observed in the lower 1/3rd of the bone.

Table 3: Showing the location of nutrient foramen on the bone:

Location of foramina	No. of foramen Right (N = 69)	Percentage	Left (N=78)	Percentage
Anterior surface	63	91.3 %	68	87.18%
Interosseous boarder	4	5.79 %	5	6.41%
Anterior border	2	2.89%	5	6.41%

N = total no. of foramen

Table 4: Showing the size of the nutrient foramen

Size of the foramen	Right (N=69)	Percentage	Left (N=78)	Percentage
≥1.27 mm	4	5.79 %	8	10.25 %
≥ 0.90mm to < 1.27mm	6	8.69 %	6	7.69%
≥ 0.71mm to < 0.90 mm	28	40.57 %	27	34.61%
≥ 0.55mm to < 0.71 mm	31	44.93 %	37	47.43%

N = total no.of foramen

Figure 1: Showing two nutrient foramina on the enterior surface

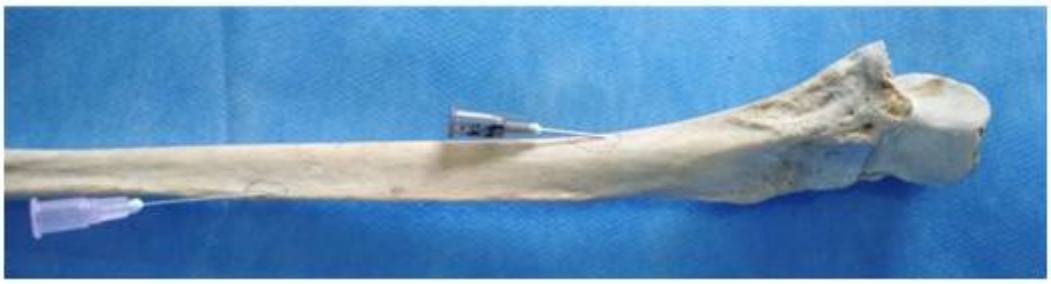

Figure 2: Showing nutrient foramina on anterior border and interosseous border.

Direction of the nutrient foramina: In all the bones of both right and left side, the nutrient foramen were directed upwards (i.e. towards the elbow joint). Incidence of nutrient foramen: Out of 69 right sided bones, four bones have two nutrient foramen and all the other bones showed single nutrient foramina. On the left side, out of 78 bones, in one bone nutrient foramina (of size above 24 gauze) was not at all found in the shaft, two bones showed two foramen and all the other bones showed single nutrient foramina. Total length of the bone, distance from the upper end to proximal nutrient foramina and formen index are shown in the Table 1. Segmental position and location of nutrient foramen on the bone and the size of foramina are shown in the Table 2, 3 and 4.

DISCUSSION

During development, nutrient artery enters the bone obliquely by excavating the bone which is being newly formed and contributes to 70 to 80 percent of the growth and development.[8,9] Mysorekar *et al*[10] opined that the direction of nutrient foramina is away from the growing end due to differential growth of the ends of the long bone, but Henderson *et al*[11] observed in his studies that the above mentioned fact is not always true in case of mammals. In the present study it was observed that the all the nutrient foramina are directed towards the elbow joint, away from the growing end as quoted by Mysorekar. According to the observation by Longia *et al*[12], the nutrient foramina is usually observed on the flexor surfaces of the bones. The same is observed in almost all the other studies of ulna bone by Murali Manju *et al*[13], Durgesh *et al*[14], Satish M Patel *et al*[15], Sharma *et al*[16] and including the present study [Fig no 1 and Fig No. 2]. On the contrary KS Solanke[17], Ojaswini Malukar *et al*[18] found that 1.29%, 1.06% of bones, respectively, have nutrient foramina on the location other than flexor surface. The location of the nutrient foramina in relation to the segmental position was observed was in correlation with all the other authors excepting KRS Prasad *et al*[19], which reported 18.4% of bones have nutrient foramina in the lower 1/3rd of the ulna bone. The mean foramen Index observed in the present study is 36.78 ± 6.21 cm. Mysorekar[1] and Shulman[7] reported the absence of nutrient foramina in ulna bone in 0.6% and 1.1% respectively, which closely corresponds with the present study of 0.68%. Whereas Solanke KS *et al*[18] observed the absence of nutrient foramina in 3.75% bones. According Patake SM *et al*[2], In case of absence of nutrient foramina, the periosteal arteries take the role of nutrient artery in nourishing the bone.

CONCLUSION

The knowledge of morphometry and morphology is of much clinical significance in view of the available recent advancements in the surgical and orthopaedic procedures like joint replacements, graft techniques and micro vascular surgeries. The results of this study are in consistent with almost all the other studies. This added information may adjoin the present statistical data available, especially in the Telangana region.

ACKNOWLEDGEMENTS

Authors acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. The authors are also grateful to authors / editors / publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed. We are grateful to all the teaching and non-teaching staff members of our department for their help and co-operation.

REFERENCES

1. Mysorekar VR, Nandedkar AN, Diaphysial nutrient foramina in human phalanges, J Anat, 1979, 128(Pt 2):315–322.
2. Patake SM, Mysorekar VR, Diaphysial nutrient foramina in human metacarpals and metatarsals, J Anat, 1977, 124(Pt 2):299–304.
3. Mysorekar VR, Diaphysial nutrient foramina in human long bones, J Anat, 1967, 101(Pt 4):813–822.
4. Taylor GI, Fibular transplantation. In: Serafin D, Bunke HJ (eds), Microsurgical composite tissue transplantation, C.V. Mosby Co., St. Louis, 1979, 418–423.

5. McKee NH, Haw P, Vettese T, Anatomic study of the nutrient foramen in the shaft of the fibula, Clin Orthop Relat Res, 1984, 184:141–144.
6. Hughes H. The factors determining the direction of the canal for the nutrient artery in the long bones of mammals and birds. Acta Anat (Basel) 1952;15: 261-280.
7. Shulman, S.S. Observations on the nutrient foramina of the human radius and ulna. Anat. Rec. 1959;134: 685-697.
8. Datta AK. The sclerous tissue. In: Principles of General anatomy, 6th ed. Chapter 6, 2005; KP Basu publishing Co, Kolkata, 68-73.
9. Forriol Campos F, Gomez L, Gianonatti M, Fernandez R. A study of the nutrient foramina in human long bones. Surg Radiol Anat 1987; 9:251-255.
10. Mysorekar, V.R. (1967). Diaphysial nutrient foramina in human long bones. J. Anat.101: 813 - 822.
11. Henderson RG. The position of the nutrient foramen in the growing tibia and femur of the rat. J Anat 1978; 125: 593-599.
12. Longia, G.S., Ajmani, M.L., Saxena, S.K., Thomas, R.J. (1980). Study of diaphyseal nutrient foramina in human long bones. Acta Anat. (Basel) 107: 399 - 406.
13. B V Murali Manju, K U Prashanth, Latha V. Prabhu, Vsudeva V. Saralaya, Mangala M. Pai, Rajalakshmi Rai, Morphological and topographical anatomy of nutrient foramina in human upper limb long bones and their surgical importance; Rom J Morphol Embryol 2011, 52(3):859–862
14. Durgesh V, Venugopala Rao B, Roja Rani CH, Vijaya Lakshmi K; A Study of the Nutrient Foramen of Ulna. Research and Reviews: Journal of Medical and Health Sciences; 2014, Vol 3 (4), 136-140.
15. Patel SM, Vora RK. Anatomical study of nutrient foramina in long bones of human upper limbs. IAIM, 2015; 2(8): 94-98.
16. Sharma M, Prashar R, Sharma T, Wadhwa A. Morphological Variations of Nutrient Foramina in upper limb long bones. Int J Med and Dent Sci 2013; 2(2): 177-181.
17. Solanke KS, Bhatnagar R, Pokhrel R. Number and position of nutrient foramina in humerus, radius and ulna of human dry bones of Indian origin with clinical correlation. OA Anatomy 2014 Feb 01; 2(1):4.
18. Ojaswini Malukar, Hemang Joshi; Diaphysial Nutrient Foramina In Long Bones And Miniature Long Bones; NJIRM 2011; Vol. 2(2). 23 - 26.

Source of Support: None Declared
Conflict of Interest: None Declared