



CLINICAL SIGNIFICANCE OF NUTRIENT FORAMINA OF HUMAN LONG BONES OF UPPER EXTREMITY

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ABSTRACT **Introduction** - Nutrient foramina is an opening into the shaft of bones that provide the passage to the nutrient vessels of the medullary cavity of long bones of the upper extremity. The major blood supply occurs through the nutrient artery. This blood supply is essential during the growing period and early phase of ossification. The direction of nutrient foramina is determined by the growing end of bone. It is away from growing end in the upper extremity long bones so proximal end of humerus and distal end of radius and ulna are the growing ends. **Material and Methods** - The material of present study consisted of 150 adult human dried bones of upper extremity. They divided into 3 group each contains 50 bones. All selected bones were normal without any appearance of pathological changes. **Results** - 150 adult human dried bones of upper extremity show 89% Single nutrient foramina in humerus. In the radius we examined (98%) single nutrient foramina. Present study shows ulna had (94%) single nutrient foramina. **Conclusion** - Present study providing information to the clinical significance of nutrient foramina. Well understanding of characteristic morphological feature of the nutrient foramina is recommended by orthopaedic surgeons.

KEYWORDS : Nutrient Foramina, Humerus, Radius, Ulna, Diaphysis.

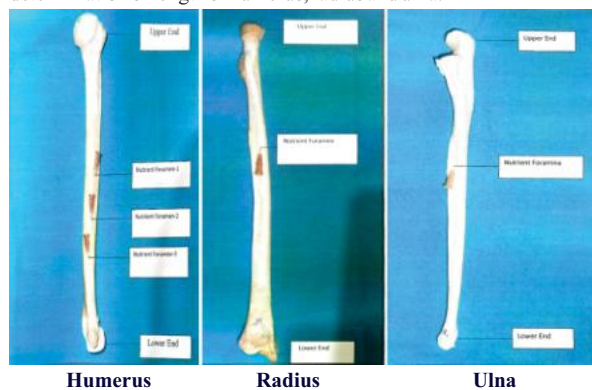
INTRODUCTION

Nutrient foramina is an opening into the shaft of bones that provide the passage to the nutrient vessels of the medullary cavity of long bones of the upper extremity. The major blood supply occurs through the nutrient artery. This blood supply is essential during the growing period and early phase of ossification.¹ Bone is a well vascularized and even changing tissue and organ. The periosteal vessels supply the periosteum, surrounding muscles and outer 1/3 of the underlying cortex. The bone marrow and the inner 2/3 of the cortex are supplied by the medullary circulation maintained by nutrient artery which enters the bone via specific nutrient foramina. There is a considerable intracortical anastomosis between the inner medullary and outer periosteal blood vessels.²

The direction of nutrient foramina is determined by the growing end of bone. It is away from growing end in the upper extremity long bones so proximal end of humerus and distal end of radius and ulna are the growing ends.³

MATERIAL AND METHODS

The material of present study consisted of 150 adult human dried bones of upper extremity obtained from osteology lab of department of anatomy SMMH medical college Saharanpur. They divided into 3 group each contains 50 bones. All selected bones were normal without any appearance of pathological changes. The nutrient foramina observed with the help of a hand lens. Well defined foramina on the shaft/diaphysis were recorded. The location of nutrient foramina is determined by using foraminal index formula and number of foramina were examined of all the bones. Osteometric board was used for determination of length of humerus, radius and ulna.



RESULTS

Total 150 bones examined for number of nutrient foramina of the humerus 88% single foramina, 8% double foramina, 2% triple foramina and 2% absence of foramina. In the radius 98% single

foramina and 2% double foramina. In ulna 94% single foramina, 4% double foramina and 2% absence of foramina.

Bone (150)	0 Foramina (%)	1 Foramina (%)	2 Foramina (%)	3 Foramina (%)
Humerus (50)	1 (2%)	44 (88%)	4 (8%)	1 (2%)
Radius (50)	0 (0%)	49 (98%)	1 (2%)	0 (0%)
Ulna (50)	1 (2%)	47 (94%)	2 (4%)	0 (0%)

The mean $\pm$ sd position of nutrient foramina according to foraminal index formula divided into 3 types

Type- 1 foramina index up to 33.33, foramen present in proximal one third of bone.

Type- 2 foramina index up to 33.33 - 66.66, foramen present in middle one third of bone.

Type- 3 foramina index above 66.66, foramen present in distal one third of bone.

Bone	No of Foramina	Mean $\pm$ Sd	Type 1	Type 2	Type 3
Humerus	57	56.94 $\pm$ 7.37	3 (5.25%)	51 (89.5%)	3 (5.25%)
Radius	51	37.76 $\pm$ 3.92	23 (45.1%)	28 (54.9%)	-
Ulna	51	36.98 $\pm$ 5.17	18 (35.3%)	33 (64.7%)	-

DISCUSSION

Present study reflect single nutrient foramina has a higher percentage 88% in the humerus compared to double 8% and triple foramina 2% respectively. Many authors^{3,4,5,6} reported higher percentage of single foramina which is almost similar to present study. In the radius we examined 98% single nutrient foramina and 2% double foramina. In other studies majority of authors^{3,4,7,8} was found more than 90% single nutrient foramina in radius. Present study shows ulna had 94% single nutrient foramina and 4% double foramina. Other study reported single nutrient foramina in more than 91% of ulna.^{3,4,7,9}

In the present study 89.5% nutrient foramina located middle one third, 5.25% in proximal and distal one third of humerus with foramina index mean $\pm$ sd (56.94 $\pm$ 7.37). other authors^{3,5,9,10} also found the same middle one third of humerus in different area. Present study reported 54.95% in the middle one third and 45.1% in the proximal one third of humerus which is close to previous study.^{3,4,9} Present study reported 64.7% in middle one third and 35.3% in proximal one third of ulna. Other authors also reported majority of nutrient foramina in middle one third and proximal one third. Similar to us all authors^{3,4,7} agreed no nutrient foramina in the distal one third of ulna.

CONCLUSION

Present study confirmed previously reported data regarding number and position of nutrient foramina in long bones of upper extremity. Present study providing information to the clinical significance of nutrient foramina. Well understanding of characteristic morphological feature of the nutrient foramina is recommended by orthopaedic surgeons.

REFERENCES

1. Lewis OJ. The blood supply of developing long bones with special reference to the metaphysis. *J. Bone Jt Surg.* (1960), 38; 928 – 933.
2. Rhinelander FW. The normal microcirculation of diaphyseal cortex and its response to fracture. *J. Bone Jt Surg.* (1968), 50; 784 – 800.
3. Mysorekar VR. Diaphyseal nutrient foramina in human long bones. *J. Anat.* (1967), 101; 813 – 822.
4. Shulman SS. Observations on the nutrient foramina of the human radius and ulna. *Anat. Rec.* (1959), 134; 685 – 697.
5. Carroll SE. A study of the nutrient foramina of the humeral diaphysis. *J. Bone Jt. Surg.* (1963), 45; 176 – 181.
6. Skawina A. et al. The vascular system of human foetal long bones – A electron microscope study of corrosion caste. *J. Anat.* (1994), 185; 369 – 376.
7. Longia GS. et al. Study of diaphyseal nutrient foramina in human long bones. *Acta Anat.* (1980), 107; 399 – 406.
8. Kizilkanat E. et al. Location, number and clinical significance of nutrient foramina in human long bones. *Ann. Anat.* (2007), 189; 87-95.
9. Campos F. et al. A study of the nutrient foramina in human long bones. *Surg. Radiol. Anat.* (1987), 9; 251 – 255.
10. Nagel A. The clinical significance of the nutrient artery. *Orthop. Rev.* (1993), 22; 557 – 561.