

## Full Length Research Article

# A STUDY OF NUTRIENT FORAMEN IN LONG BONES OF SUPERIOR EXTREMITY IN HUMAN BEING

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### ABSTRACT

The nutrient foramina are cavities that conduct the nutrient arteries and the peripheral nerves on the shaft of long bones. Long bones receive most of the interosseous blood supply from the nutrient arteries, and sometimes through the periosteal vessels. Nutrient arteries play an important role in nutrition and growth of the bones particularly during its growth period in the embryo and fetus as well as during early phases of ossification. Total one hundred eleven long bones of upper limb i.e. thirty seven each of the Humerus, Radius & ulna was taken from Department of Anatomy, Pt.J.N.M. Medical College, Raipur & was studied for the location, direction, number of Nutrient foramen. & It was found that most of the long bones follow the dictum "Towards the elbow I go, away from the knee I flee". & the Direction of nutrient foramen is opposite to growing end i.e. away from the elbow. Double nutrient foramen was found in few cases of humerus & radius. The Nutrient foramen in humerus was found in middle 1/3<sup>rd</sup> in most of the cases & in lower 1/3<sup>rd</sup> in few cases. The nutrient foramen in radius was found in middle 1/3<sup>rd</sup> & some in upper 1/3<sup>rd</sup>. In Ulna the nutrient foramina in 1/3<sup>rd</sup> cases found in upper 1/3<sup>rd</sup> & in 2/3<sup>rd</sup> cases found in middle 1/3<sup>rd</sup>. This anatomical study of nutrient foramina in shaft of long bones is of paramount importance in medico-legal aspect and also important in surgical procedures like bone grafting and microsurgical bone transplantation.

Key words: Nutrient Foramen, Diaphysis, Nutrient artery.

### INTRODUCTION

Nutrient foramen is the largest foramen on the shaft of long bones through which nutrient artery for that bone passes. Berard (Berard, 1835) was the first to correlate the direction of the canal with the ossification and growth of the bone. Humphrey<sup>(8)</sup> was working on the direction and obliquity of nutrient canals postulated periosteal slipping theory, the canal finally directed away from the growing end. Harris (Harris, 1933) has stated that the position of nutrient foramina is constant during the growth of long bone. Lutken (Lutken Poul, 1950) has stated that position of nutrient foramina is variable and typical position of nutrient foramina can be determined after a study on human bones. Aim of the present study is to find out the direction of nutrient foramina with reference to the growing ends of the bone., number of nutrient foramen present, common position of nutrient foramen.

### MATERIALS AND METHODS

For this study Total 111 long bones of upper limb (37 humerus, 37 radii, 37 ulna) were taken From the Department of Anatomy, Pt. J. N.M. Medical College, Raipur. The bones for examination were washed properly and dried. Each bone was examined in detail for the number, position and direction of nutrient foramina.

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The nutrient foramen was identified by the presence of a well marked groove and raised edge at the commencement of the canal. The exact position of the nutrient foramina was made out whether it was present on the upper or middle or lower one third of the bone. The total length of long bones and distance of nutrient foramen from the upper end also measured. Sliding caliper and Osteometric board, magnifying glass were used for measuring these parameters.

### RESULTS

Table.1 shows length of different long bones. The mean length of humerus, radius and ulna are 30.25,23.85,25.35 respectively. The distance of Nutrient foramen from upper end are 17.95,8.85,9.25 respectively.

Table 2 shows that number of nutrient foramina in long bones were variable. Most of the bones having only one nutrient foramen, Presence of two nutrient foramina were observed in Humerus (5.4%) cases. In Radius only one case (2.7%). Two nutrient foramen found three nutrient foramen was not found in any of the long bones of upper limb

In Table III ,For locating the position of nutrient foramina the bones were divided in to 3 segments upper 1/3<sup>rd</sup>,middle 1/3<sup>rd</sup>,lower 1/3<sup>rd</sup> In Humerus nutrient foramina was found in middle 1/3<sup>rd</sup> in 36 bones, in one bone it was found in lower 1/3<sup>rd</sup> & no nutrient foramen in upper 1/3<sup>rd</sup>.

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In radius nutrient foramina was found in upper 1/3<sup>rd</sup> in 9 cases & in 28 cases it was found in middle 1/3<sup>rd</sup>. no nutrient foramen was found in lower 1/3<sup>rd</sup>. In ulna nutrient foramina is found at the upper 1/3<sup>rd</sup> in 12 cases in middle 1/3<sup>rd</sup> in 25 cases and not found in lower 1/3<sup>rd</sup>.

The direction of nutrient foramina in human long bones is directed away from the growing end. This is due to one end of long bone is growing faster than the other end (Mysorekar, 1967). All the upwardly directed foramina were situated much below the middle of the shaft of the bone.

**Table 1. Mean values of various parameters of long bones**

	Total length (in cm)	Distance of N.F from upper end (in cm)	Distance of N.F from lower end(in cm)
Humerus	30.25	17.95	12.4
Radius	23.85	8.85	14.38
ulna	25.35	9.25	16.15

**Table 2. Showing percentage of incidence of nutrient foramina in long bones**

	One nutrient foramina (%)	Two nutrient foramina (%)	Three nutrient foramina (%)
Humerus	94.6%	5.4%	0
Radius	97.29%	2.7%	0
ulna	100	0	0

**Table 3. Showing the position of nutrient foramina in segment of long bones**

	Upper 1/3rd	Middle 1/3rd	Lower 1/3rd
Humerus	0	36	1
Radius	9	28	0
ulna	12	25	0

## DISCUSSION

In embryonic period all the nutrient arteries course caudally. This is true in hemodynamic point of view to force the blood from cephalic to caudal side. This agrees with adult rules "towards the knee and away from elbow". This is said to be due to unequal growth of the ends of the long bones. The arrangement of diaphyseal nutrient foramen in long bones usually follows a definite pattern. Position is constant and seen on flexor surfaces. (Shamsunder Rao, 2014). The direction of nutrient foramina in human long bones is directed away from the growing end. This is due to one end of long bone is growing faster than the other end. In many tetrapods, there is variation in the directions of nutrient foramina, but in mammals and birds Hughes pointed out that Anomalous canal are frequent. (Hughes, 1952). The blood supply of femur has been studied thoroughly by Luxor Kuliga and Turk (Luxor *et al.*, 1904), blood supply of femur and humerus has been investigated by Lutken (Lutken Poul, 1950), Laing (Laing, 1953) and Carroll (Carroll, 1963). Nutrient foramina of radius and ulna have been studied by Shullman (Shullman, 1959). Longia GS *et al.* (Longia *et al.*, 1980). Stated that the vascular theory offers the best explanation of all reported anomalies as well as the normal fashioning of nutrient canals.

### Location of nutrient foramen in different segments of long bones

Mysorkar reported the nutrient foramen in Humerus along the medial border in 4th segment. The present study correlates with this study. In Radius, Mysorkar reported nutrient foramen in 2nd segment, in present study also in most of the cases nutrient foramen is found in 2<sup>nd</sup> segment i.e in middle 1/3<sup>rd</sup>. In Ulna the nutrient foramina in 1/3<sup>rd</sup> cases found in upper 1/3<sup>rd</sup> and in 2/3<sup>rd</sup> cases found in middle 1/3<sup>rd</sup>.

### Direction of nutrient canal

Direction and obliquity of nutrient canal shows the general pattern i.e away from the elbow.

There was no change in the obliquity of the canal when the foramina were situated in the centre of the bone compared to when they were nearer the ends.

### Percentage of nutrient foramen in long bones:

The incidence of occurrence of two nutrient foramina is 5.4% in Humerus, 2.7% in radius and two nutrient foramen was not seen in ulna.

### Conclusion

Total one hundred eleven long bones of upper limb i.e. thirty seven each of the Humerus, Radius and ulna was taken from Department of Anatomy, Pt. J. N. M. Medical College, Raipur and was studied for the location, direction, number of Nutrient foramen. It was found that most of the long bones follow the dictum "Towards the elbow I go, away from the knee I flee". Double nutrient foramen was found in few cases of humerus and radius. The Nutrient foramen in humerus was found in middle 1/3<sup>rd</sup> in most of the cases and in lower 1/3<sup>rd</sup> in few cases. The nutrient foramen in radius was found in middle 1/3<sup>rd</sup> and some in upper 1/3<sup>rd</sup>. In Ulna the nutrient foramina in 1/3<sup>rd</sup> cases found in upper 1/3<sup>rd</sup> and in 2/3<sup>rd</sup> cases found in middle 1/3<sup>rd</sup>. This anatomical study of nutrient foramina in shaft of long bones is of paramount importance in medico-legal aspect and also important in surgical procedures like bone grafting and microsurgical bone transplantation

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