

# THE STUDY OF NUTRIENT FORAMEN OF BONES OF ARM AND FOREARM IN ADULTS

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## ABSTRACT

The variation in presence of number of nutrient foramen is important in long bones as nutrient foramen gives passage for entrance of nutrient arteries in to the bone. The present study was conducted on total 114 dry human long bones in department of anatomy, Era's lucknow medical college, lucknow. . The aim of the study was to determine the number of nutrient foramen in long bones of upper limb. Ethical approval was procured from the institutional ethical committee. In our study 97.40% humerus bones show single nutrient foramen, and 2.60% humerus bones show double NF, and all the radius and ulna show the single NF. The results of our study is similar with previous studies. The importance of knowledge about NF is very use full in orthopedic surgeries and in micro vascular bone grafting.

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## INTRODUCTION

Blood supply to the long bones in human body is by nutrient arteries, epiphyseal arteries, metaphyseal arteries and periosteal arteries. Among these arteries, nutrient arteries play a major role by supplying inner 2/3<sup>rd</sup> of cortex and whole medulla of the diaphysis (1,2).

Nutrient foramen is an opening into the bone shaft which gives passage to the blood vessels of the medullary cavity of a bone, for its nourishment and growth. It has been suggested that the direction of the nutrient foramina is determined by the growing end of the bone, which is supposed to grow at least twice as fast as the non-growing end. As a result, the nutrient vessels move away from the growing end of the bone (3). The position of nutrient foramina is constant during the growth of long bone (4). The position of nutrient foramina is variable and typical position of nutrient foramina can be determined after a study on human bones (5).

The topographical knowledge of these foramina is useful in certain operative procedures to preserve the circulation (6,7). Some bones such as femur and humerus have several nutrient foramina. Before entering the nutrient foramen the nutrient vessels become tortuous so that they will not affect the bone movement (8). Nutrient arteries play an important role during active growth period as well as uniting callus in fractured bone (9).

One or two main diaphyseal nutrient arteries enter the shaft obliquely through nutrient foramina leading into

nutrient canals. Their sites of entry are almost constant and characteristically directed away from the dominant growing epiphysis (10).

## MATERIALS AND METHOD-

The study was conducted in total 114 ( 38 each) long bones of arm and forearm without any bias of age and sex, the material was collected from department of Anatomy, ELMC, Lucknow. The materials used were Hand lens, Hypodermic needle (26 gauge),

Nutrient foramen was observed in all bones by the naked eye and then with the help of hand lens.

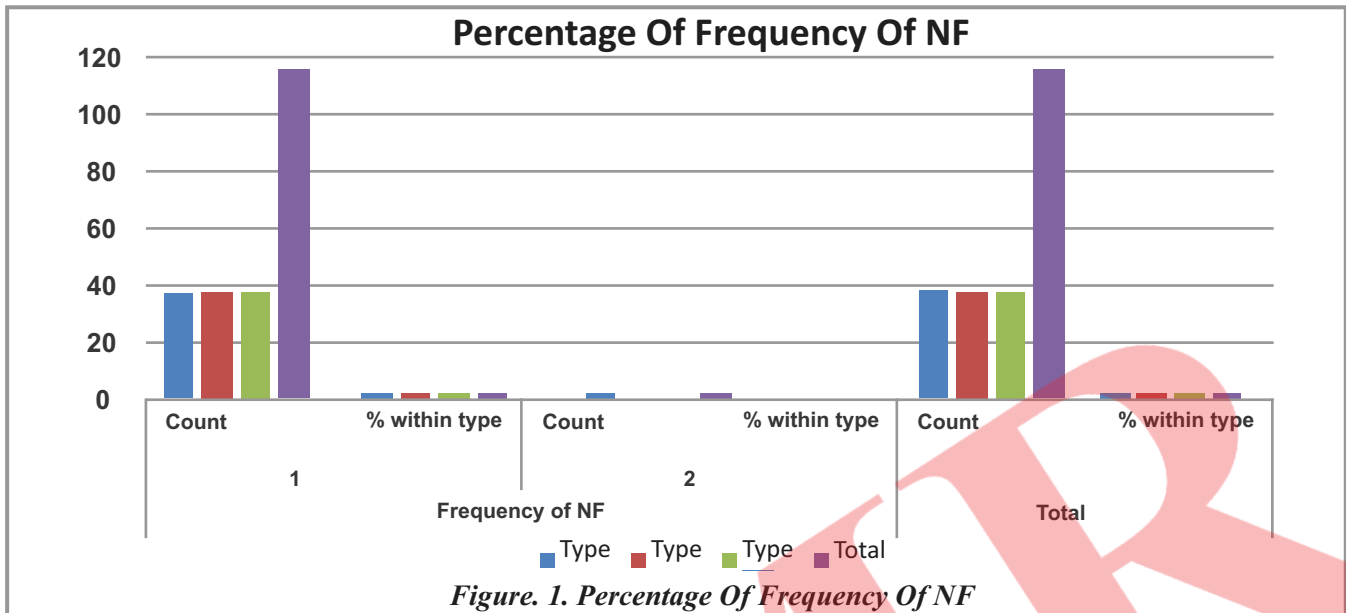
## OBSERVATIONS AND RESULTS

The number of nutrient foramen was observed according to its presence or absence. In most of the bones single nutrient foramen was observed and in some bones incidence of double foramen was also found.

### Frequency of NF

|                 |   | Crosstab      |        |        |        | Total  |
|-----------------|---|---------------|--------|--------|--------|--------|
|                 |   | Type          |        |        |        |        |
|                 |   | HUMERUS       | RADIUS | ULNA   |        |        |
| Frequency of NF | 1 | Count         | 37     | 38     | 38     | 113    |
|                 |   | % within type | 97.4%  | 100.0% | 100.0% | 99.1%  |
|                 | 2 | Count         | 1      | 0      | 0      | 1      |
|                 |   | % within type | 2.6%   | .0%    | .0%    | .9%    |
| Total           |   | Count         | 38     | 38     | 38     | 114    |
|                 |   | % within type | 100.0% | 100.0% | 100.0% | 100.0% |

**Table. 1 Showing The Percentage Of Frequency Of Nf**



**Fig. 2. Diagram showing nutrient foramen**

In humerus (37 bones) 97.4% bones have single nutrient foramen and only (1 bone) 2.6% bone has double nutrient foramen. While in case of radius (38 bones) 100% bones have single nutrient foramen. And all ulna (38 bones) 100% bones have single nutrient foramen.

**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. 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 (11).

Humerus is the largest bone of upper limb so it has highest vascularity among the bones of upper limb. Blood supply is mainly by brachial artery and also by axillary, radial and ulnar arteries. The periosteal and metaphyseal arteries supply the outer cortex and metaphysis of bone and the inner half of cortex and medulla depend upon nutrient artery for blood supply.

Vascularity of humerus was studied by Laing and he stated that nutrient artery of humerus must be protected during operations done on shaft of humerus (12)

Menck J et al. reported that the inner part of humerus is usually supplied by just one nutrient artery entering the nutrient foramen just below its middle part. In radius the artery arises from the anterior or posterior interosseous artery, this explains the foramina on its posterior surface. The ulna gets its nutrient artery from the ulnar artery or any of its muscular branches. In both radius and ulna, the main branch of the nutrient artery has an ascending course. The anterior interosseous artery, as the main artery of periosteal and end osteal supply of human ulna and radius, is important in transplantation and reconstruction, especially with a view to reduce the rate of pseudarthrosis. The nutrient arteries of the ulna and radius enter the bones in the second proximal quarter of diaphysis, at the radius from anterior to medial, at the ulna from anterior to antero-lateral (13).

**Frequency of NF**

In our study 97.40% humerus bones show single nutrient foramen, and 2.60% humerus bones show double NF, this findings is more similar the study was done by B. V. Murlimanju et al. in 2011, found presence of single NF in 93.8% humerus bones, and double NF in 3.1% humerus bones. In our study the frequency of occurrence of nutrient foramen in humerus is more or less similar as previous studies.

In our study all the radius and ulna bones show single nutrient foramen, and this results is also similar to study done by B.V. Murlimanju et al. in 2011, they also found that all radius show single nutrient foramen. In case of ulna the results of our study is exact same as previous study so our study is correlates with previous study.

| Year | Studied by                      | Sample size | No. of NF   |
|------|---------------------------------|-------------|---|
| 2018 | Current study                   | 114         | 97.4% H-1NF,2.6% H-2NF,100%R-1NF,100% U-1NF                         |
| 2017 | Arvind Kumar Pankaj et al. (14) | 350         | 80.86% -1NF,13.42%-2 NF,0.29% -3 NF<br>5.43% -Absent                |
| 2016 | Asharani S K et al.(15)         | 120         | 87% -1 NF<br>11% - 2 NF   |
| 2016 | Guthi Reddy et al.(16)          | 104         | 96.3% R -1 NF,3.7% R-2NF<br>100% U -1NF                             |
| 2015 | Satish M. Patel et al.(17)      | 120         | 66% H -1NF,68% R -1 NF<br>78% U -1NF                                |
| 2015 | Mansur DI et al.(18)            | 253         | 60.87%H-1 NF,28.85% H-2NF,6.32% H -<br>3NF,1.98% H-4NF,1.9%H-Absent |
| 2014 | KS Solanke et al.(19)           | 260         | 4% H -Absent,5% R -Absent,3.75% U-Absent<br>4% H-2 NF,2.5% R-2 NF   |

**Table. 2. Comparison Of Frequency Of Nutrient Foramen With Previous Studies**

## CONCLUSION

Total one hundred fourteen long bones of upper limb i.e. thirty eight each of the Humerus, Radius and ulna was taken from Department of Anatomy, Era's Lucknow Medical College Lucknow, and was studied for the number of Nutrient foramen. It was found that double nutrient foramen was found in one case of humerus, and all the radius and ulna show only one nutrient foramen.

This anatomical study of nutrient foramina in shaft of long bones is of paramount importance considering its medico-legal aspect. It is also important for surgical procedures like bone grafting and micro surgical bone transplantation.

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