

## Study of Nutrient Foramen on Dry Humerus of Wardha District

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### ABSTRACT

*Background:* Humerus is a long bone of upper limb in humans. The nutrient foramen (NF) in the humerus is a bone aperture that conducts peripheral nerves and nutrient arteries. This nutrient artery provides the majority of the blood for the long bones. The blood vessels give nourishment and growth to the bone. During the growth time and prior stages of calcification, as well as operative treatment procedures such as bone grafts, this supply is critical. In Orth, Tumour excision, congenital pseudoarthrosis, and transplant procedures are all discussed. The goal from the study was identifying quantity, nutrient foramen position, its direction as well as whether they follow the general norm of nutrient foramina being directed away from the end of the bone which is growing. There is essential role of nutrient artery for fusion of bones which are fractured. In some surgical operations information and knowledge of nutrient foramen helps the doctor in the treatment. So, in relation to morphological and clinical aspects the study of nutrient is important.

*Material and methods:* The study will be concerned with 320 dry arm bone of human population (left and right arm combined) that will be collected from anatomy department, Jawaharlal Nehru Medical College, Sawangi. Some information such as sex and age of bones will be unknown and they would never be necessarily paired. Hand magnifying lens, metallic wires will be used in this study.

*Results:* Data will be collected and will be analyzed statistically.

*Conclusion:* We can expect conclusion that maximum number of the bones may follow "Growing End Theory". The details will be lying down equivalent information that will assist doctor in operative procedure, analysis of images produced radiologically etc.

**Key words:** Medullary cavity, Nutrient foramen, Humerus, Nutrient artery

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### INTRODUCTION

The blood vessels enter the bone from an opening called nutrient foramen. The blood vessels give nourishment and growth to bone. The main supply of blood for the long bones at the time of growth period is the nutrient artery. In some surgical operations information and knowledge of nutrient foramen helps the doctor in the treatment. Due to ischemia of the medullary bone with reduced metaphysical formation of blood vessels of metaphysics and growth plate during childhood, blood

vessels are affected. The bones end which is growing determines nutrient foramen's direction, the end which is growing grows faster than non-growing end. In both limbs they may show varying directions. In only some studies this was seen [1].

One of the vascular mineralized connective tissues is bone. The bone carries out most of the important task in the human body. In consonance to the bone's shape the blood providing vessels to bone varies. In bones which are of long type, usually three series of blood vessels are there: epiphyseal, metaphyseal, and diaphyseal arteries. An opening in bony stem i.e. nutrient foramen that provides passage in the cavity (medullary) of a bone for blood vessels for its growth and its nutrition.

For vessels supplying blood to the marrow cavity the entry and exit route is the nutrient foramen which precedes nutrient canal. Their entry points as well as directions are nearly persistent and usually from the dominant growing extremity directed away. The nutrient

foramen in the lower extremity is in the direction away from the knee (i.e. tibia and fibula's lower end and femur's upper end). To prevent the effect on bone movement the nutrient vessels become tortuous before entering the nutrient foramen. Descending branches and ascending branches in cavity of medulla are formed when nutrient artery goes in the shaft obliquely. Number of small parallel channels is formed from each branch, this end in the metaphysis in the adult which anastomose with periosteal and metaphyseal and epiphyseal arteries. In mammalian bones the location of nutrient foramina is uncertain and also changes with the growth. The nutrient foramen are usually located a bit beneath the middle of antero-medial surface (AMS) near medial border (MB) and it's direction is in downward direction although their quantity, direction and location vary in humans [2].

Nowadays bone fracture is growing as the cases of accidents on roads or some wounds during playing etc. are rising. If the supply of blood to the bones is not confirmed it can then result in slow down of the process of joining of the bone revealing the essential part is played by artery's supply of medullary part for restoring the blood flow of the damaged area. This shows the importance of awareness about site of nutrient foramen and this will help doctor to restrict the harm to nutrient artery [3]. In some operative procedure information of nutrient foramen such as its quantity and position provides a lot of help to doctor [4].

The bone which is longest and largest in superior extremity is humerus. It has got supply from brachial artery's one of the branches that is nutrient artery. The main supply of blood is provided by this artery. Therefore, at the time of fusion of bone this artery has a significant part in repairing the bone. So to help the recovery process faster protecting the nutrient artery is essential [5].

For the bones that are long the supply of blood which provides them nutrition is very important. So, they need to be saved so as to increase fracture curing process. It is generally one in quantity and its position is antero-medial side in humerus, also it is slightly under the midpoint near the border of medial side [4].

The nutrient foramen is tiny or big so as to have entry of the vessels supplying blood. The foramen then gives nutrient canal from where vessel enter to provide nutrition to medullary cavity of bone. The place of entering, angle of entering in majority of the time is same [5]. So preserving nutrient foramen during operations is very important to prevent damage to the vessels supplying blood to the bone.

### Background/Rationale

In relation to morphological and clinical aspects the study of nutrient foramen is important. Vascular system of bone relates to pathological conditions related to fracture recovery or an infection that generally act on the growing skeleton. During orthopedic operative process

like fracture restoring, replacement of joint, grafting of bone etc. the information of the nutrient foramen is important so as to prevent nutrient foramen at the time of open reduction for improving the relieving of fracture [1].

Nowadays in the modern times due to growing industries and changing lifestyles and reliance on machines, bone injuries and fractures of bone are common. There is an important role of blood supply in healing wounds and fractures. Realization of the differences in the quantity, position, dimensions and the direction of nutrient foramen is essential as injury to nutrient artery because of some circumstances such as road traffic accident, trauma, orthopedic removal of surface of bone in open reduction comminuted internal fixation of the humerus for the plaque insertion etc. This may lead to insufficient supply of blood. It is well known fact that lack of arterial supply causes fusion delay or fractures [2].

In the OPD the knowledge of nutrient foramen is crucial. All the features of bone, such as their repairing process and growth depends on the supply of blood, which is mainly given by nutrient artery [6]. Doctors need to be informed that the healing of the fracture is not fast or does not take place when the fracture passes near area of foramen. As the technology is expanding, nowadays the fracture is operated surgically, that is not cheap and complication risk is there [6].

### Objectives

The main aim of this study is to examine the nutrient foramen on dry adult humerus in relation to different aspects. The chief purpose of this research is to:

- Identify the presence of nutrient foramen
- Observe the number of nutrient foramen
- Observe their direction and
- Observe on which surface it is located

As the study on this topic is less, and the information can help during orthopedic procedure to the surgeon. Abnormal, humerus that has fracture will be eliminated from analysis. It is suggested that a considerable knowledge of features of the framework of bones should be known to the doctor. At the time of clinical process precise location and different positions of nutrient foramen on bone shaft should be known so as to prevent any harm to the vessels providing nutrition. Consciousness of differences in nutrient foramen is essential as harm to any nutrient artery because of any source will be causing insufficient supply of blood. So, this study is necessary as there is very less study done in our region. There is essential role of nutrient artery for fusion of bones which are fractured. In some surgical operations information and knowledge of nutrient foramen helps the doctor in the treatment. So, in relation to morphological and clinical aspects the study of nutrient is important.

### MATERIAL AND METHODS

The sample will be taken from Anatomy Department

Jawaharlal Nehru Medical College, DMIMS (DU), Sawangi, Wardha. In the study 320 dry adult humeri will be studied, of which 130 bones from left arm and 190 bones from right arm. Some information will be unknown such as sex and age of the bone; they will not necessarily be paired. We will be taking only normal bones for our study. We will be excluding fragmented bones, bones with incomplete ossification, with any signs of gross pathology or distortion, and then 320 bones will be included in the study. The nutrient foramen will be identified by the groove leading to nutrient foramen. Similarly, slightly raised margins at edges of the nutrient foramen will also help in its identification. In case of multiple foramina, the largest nutrient foramen will be considered to be principal nutrient foramen. Nutrient foramen will be fully observed with proper lighting.

All observations will be done by the author. To avoid bias, three measurements will be taken and mean will be calculated. Data will be analyzed for central tendency and descriptive statistics will be performed. These results will be compared with findings of similar studies conducted nationally and internationally, and an attempt will be made to know any clinical correlation.

On the following basis the bones will be studied:

On the shaft the presence of nutrient foramen: 320 humerus will be studied, 130 of left arm and 190 of right arm. We will be using hand magnifying lens for identifying the nutrient foramen.

The number of nutrient foramen: we will use hand magnifying lens for identifying nutrient foramen.

Nutrient foramen obliquity and its direction will be also observed: for this a stiff wire will be used so as to check and confirm the obliquity of the foramen and its direction.

The surface where the nutrient foramen is located: Humerus will be inspected so as to see the position of nutrient foramen in consonance with posterior, antero-medial, antero-lateral surfaces.

The instruments that will be utilized in this study will be metallic wire and hand magnifying lens.

#### Data analysis

Data will be conveyed as standard deviation for continuous variables and means and percentage for categorical variables.

### DISCUSSION

The supply of the bone to the blood is principal element for fracture repair. If some sort of harm happens to the artery which provides nutrition to the bones at the time of operative process it can lead to slow down the fixation process of the bone. Numerous study that has taken place for humerus shows certainly in maximum number of humerus have nutrient artery which was found to be only one and out of those not many had extra accessory arteries. Some studies also give mentions for our present

understanding, that there is difference in the nutrient foramen number resulting from different population studies [3].

There is distinct design of positioning of nutrient foramen on diaphyseal surface in bones that are long. The definite place varies significantly but nutrient foramen is usually present on flexor aspect. The most possible region of fragility might be the foramen. The fracture which is caused due to stress could be identified from its location in relation to that of nutrient foramen, arrangement of edema [1].

For the bones that are long the supply of blood which provides them nutrition is very important. So they need to be saved so as to increase fracture curing process. It is generally one in quantity and its position is antero-medial side in humerus, also it is slightly under the midpoint near the border of medial side [4].

Amongst all the bones present in the upper extremity the humerus gets maximum supply of blood vessels. The majority of the supply comes from the branches of radial, axillary, ulnar and brachial arteries. So, the most dangerous point in surgical process is near these arteries. Therefore the awareness related to the morphology, anatomy and blood supply is necessary [5].

According to a research one foramen was seen in 60% of bones, two foramen was seen in 30% of the bones, three foramen were seen in 5% of bones, no foramen was seen on 5% of bones [1]. Majority of the nutrient foramen were located distally and 76.85% nutrient foramen were seen on antero-medial surface on shaft. Diversity in obliquity in foramen was not seen [1].

According to another study one foramen was present in 62.50% of bones, two foramen were present in 28.75% of the bones, three foramen were present in 7.5% of bones, no foramen was seen on 1.25% of bones [2]. In relation to position 43.43% nutrient foramen occur on surface that is antero-medial, 37.37% nutrient foramen the border which is on medial side, 14.14% nutrient foramen on surface that is posterior, 2.02% nutrient foramen occur on both anterior border and anterolateral surface, 1.01% nutrient foramen were observed on border which is on lateral side. Distal end was the direction in which all the nutrient foramen made their direction [2].

According to a study one nutrient foramen occur in 87% of bones, two nutrient foramen occur in 11% of the bones. In relation to position 57% nutrient foramen were found to be present on the border which was medially, 43% nutrient foramen were found to be present on the surface that is anteromedial, 3% nutrient foramen were observed to be present on border occurring laterally, 3% nutrient foramen were found to be present on surface which was posterior. The direction of foramen was going to the elbow joint i.e. distant from the growing end [5].

### RESULTS

Data will be collected and will be analyzed statistically.

Some tables will be made after collecting the information to study the observations. The observations will then be compared with the previous studies.

### INTERPRETATION

Nowadays in the modern times due to growing industries and changing lifestyles and reliance on machines, bone injuries and fractures of bone are common. There is an important role of blood supply in healing wounds and fractures. Realization of the differences in the quantity, position, dimensions and the direction of nutrient foramen is essential as injury to nutrient artery because of some circumstances such as road traffic accident, trauma, orthopedic removal of surface of bone in open reduction comminuted internal fixation of the humerus for the plaque insertion etc. This may lead to insufficient supply of blood. It is well known fact that lack of arterial supply causes fusion delay or fractures [2].

The information helps bone transplant surgeons and vascular surgeons to keep away from the graft ischemia in course of transplant of arm's surgical procedure with unlucky sufferers, accidents/seizure victims as a consequence offering adequate vascularization and growing the probabilities of successful transplantation. This study may give essential information about morphology and topography of nutrient foramen in upper limb long bones and the knowledge of this study will be useful in planning orthopedic procedures [2]. These population specific findings may be of useful for review by orthopedic surgeons to plan surgical interventions in the arm regions.

At the time of close or open surgical process there are greater possibilities of injury to nutrient artery so the awareness of the position and other related information of nutrient foramen is crucial. The slow process of fusion of fractured bone occurs if the nutrient artery is injured. Therefore to avoid damage or injury to this crucial part this study will help orthopedic to prevent this area from harm while bone grafting, bone repairing, surgeries etc. [4].

In the OPD the knowledge of nutrient foramen is crucial. All the features of bone, such as their repairing process and growth depends on the supply of blood, which is mainly given by nutrient artery [6]. Doctors need to be

informed that the healing of the fracture is not fast or does not take place when the fracture passes near area of foramen. As the technology is expanding, nowadays the fracture is operated surgically, that is not cheap and complication risk is there [6-10]. So we can say that the presence of vessels that supply blood to bone is crucial and awareness about its importance can help orthopedic doctor while surgical or clinical procedures to prevent damage to these vessels.

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