International Journal of Advanced Research and Review

www.ijarr.in

OBSERVATIONAL STUDY TO LOCATE NUTRIENT FORAMINA IN LONG BONES OF UPPER EXTREMITY IN WESTERN POPULATION

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ABSTRACT

Introduction: The nutrient foramina is a opening that carry 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. The aim of the study was to evaluate the number, position and direction of the nutrient foramina in the humerus, radius and uulna of dry bones of western rajasthan origion and correlate the findings clinically.

Material and Methods: Humerus, radius and ulna 100 each were taken from the department of Anatomy,Dr S.N. Medical College,Jodhpur and studied for the location ,direction and number of Nutrient foramina.Inclusion of these bones were irrespective of the gender and age. Sliding caliper and osteometric board,magnifying glass were used for measuring these parameters

Result: It were found that the direction of nutrient foramina is opposite to the growing end i.e.seek the elbow. Double nutrient foramina were found in (17%), (18%) cases of humerus and radius respectively.The nutrient foramen in(100%) humerus was found in middle 1/3rd. The nutrient foramen in (90%)radius was found in middle 1/3rd and (10%) in upper 1/3rd.in (85 %) Ulna the nutrient foramina was found in middle1/3rd and(15%) in upper 1/3.

Conclusion

This anatomical study of nutrient foramina in shaft study 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(N.F),Daiphysis,Nutrient Artery (N.A) .

INTRODUCTION

The nutrient artery is principal source of blood supply to long bones and it is important during their active growth period, as well as during the early phase of ossification.Nutrient artery enters the bone through Nutrient Foramen(N.F.),is directed obliquely,and edges of the oblique part are elevated for the entrance of nutrient artery .NF is always directed away from the growing end,commanly explained by the axim 'seek the elbow and flee from the knee'. Knowledge about precise location and direction of the nutrient artery of long bones with its common variation is of supreme importance during any surgical or orthopaedic procedures of limbs,such as bone grafting and microvascular bone transplantations.The present study were conducted to provide information on morphology and topography of nutrient foramen in human upper limb long bones in western rajasthan population from India and to discuss their clinical significance.

MATERIAL AND METHODS

For this study humerus,radius,ulna 100 each were taken from the department of anatomy,Dr S.N.Medical College,Jodhpur and studied for location,direction,number of nutrient foramina.The nutrient foramen was identified by the presence of well marked groove and raised edge at the commencement of the canal.The exact positin of the nutrient foramina were made out whether it were present on the upper or middle or lower one third of the bone.The total length of the 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.

The NF was identified by the groove leading to NF.Similarly raised margins at edges of the NF also helped in its identification.A 26-gauge needle were passed through the foramen to confirm its direction(Figure 2).In case of presence of multiple foramina ,the largest NF was considered to be principal NF.

$$MEAN = \frac{Total\ or\ Sum\ of\ the\ observations}{\text{Number of Observations}} = \frac{(X1+X2+\cdots,+Xn)}{n}$$

$$\mathbf{x} = \frac{\sum X}{n}$$

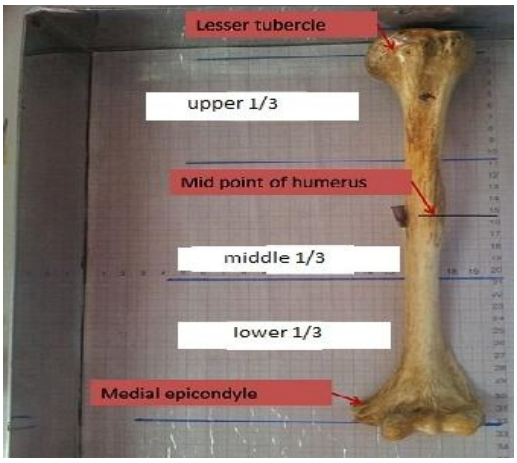

Figure 1.Measuring **length of humerus on osteometric board**

Figure 2:A 26-gauge surgical needle used to cinfirm the depth and slope of nutrient foramen

DISCUSSION

In the embryonic period all the nutrient arteries course caudally.This is in hemodynamic point of view to force the blood from cephalic to caudal side.Tis agrees with adult rules "towards the elbow and away from the knee".This is said to be due to unequal growth of the ends of 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)[11]. The direction of nutrient foramen 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 terapods,there is variation in the directions of nutrient foramina,but in mammals and birds Huges pointed out that Anomalous canal are frequent.(Hughes,1952)[4] .The blood supply of femur has been studied thoroughly by Luxor Kuliga and Turk (Luxor *etal.,* 1904) blood supply of femur and humerus has been investigated by Lutken (Lutken Poul, 1950)[10], Laing (Laing,1953)[7] and Carroll (Carroll, 1963)[1]. Nutrient foramina of radius and ulna have been studied by Shullman (Shullman, 1959). Longia GS *et al.* (Longia *et al.,* 1980)[9]. Stated that the vascular theory offers the best explanation of all reported anomalies as well as thenormal fashioning of nutrient canals it also explains that intact arterial supply is important for healing of a fractured bone. NF is the external opening of the nutrient canal.

The vessel that initially invaginates ossifying cartilage at the centre of ossification act as a nutrient artery and lies in nutrient canal within NF .Mysorkar(1967)[11] 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 were found in 2nd segment i.e in middle 1/3rd. In ulna nutrient foramina were found in middle 1/3rd in most of the cases.

In general direction and obliquity of nutrient canal shows the general pattern i.e. away from the elbow.knowledge regarding nutrient foramina of bones is useful in surgical procedures such as microvascular bone transfer in order to preserve the circulation.

It is well known that one of the causes of delayed union or non union of fracture is lack of arterial supply.The morphological knwoledge of nutrient foramina is significantly important for

orthopaedic surgeons undertaking an open reduction of a fracture to avoid injuring the nutrient artery and thus lessening the chances of delayed or non-union of fracture.The external opening of the nutrient canal,usually referred to as the nutrient foramen,has a particular position for each bone.it is generally agreed that the vessels which occupy the nutrient foramen are derived from those that took part in the initial invasion of ossifying cartilage,so that the nutrient foramen was at the site of the original centre of ossification

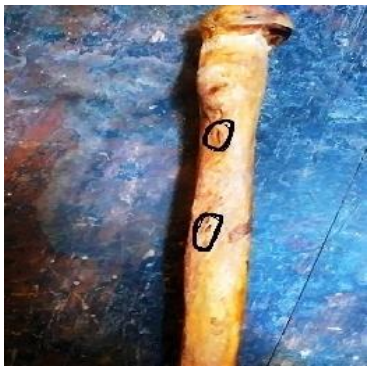

Figure 3: Double nutrient foramina in the shaft of radius indicated by circle

RESULTS

Length of different long bones has been mentioned in Table 1. The mean length of humerus, radius and ulna were 142.15,114.55,125.85cm respectively. The distance of nutrient foramina from upper end were 79.1,41.4,49.4cm respectively.

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	142.15	79.1	63
RADIUS	114.55	41.8	72.5
ULNA	125.85	49.4	76.4

The 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 radius (18%) . (17%) in humerus and none in ulna.Three nutrient foramina were not found in any of the long bones of upper limb.

TABLE 2:Showing percentage of the incidence of nutrient foramina in long bones

	One nutrient foramina (%)	Two nutrient foramina (%)	Three nutrient foramina (%)
HUMERUS	83	17	0
RADIUS	82	18	0
ULNA	100	0	0

For locating the position of nutrient foramina the bones were divided in to 3 segments upper 1/3rd,middle 1/3rd ,lower 1/3rd .In humerus nutrient foramina were found in middle 1/3rd in (100%) cases,no nutrient foramen in lower 1/3rd and no nutrient foramen in upper 1/3rd. In radius nutrient foramina were found in upper 1/3rd in (10%) cases and in 90 cases they were found in middle 1/3rd.No nutrient foramen was found in lower 1/3rd. In ulna nutrient foramina

were found at the upper 1/3rd in 15% cases in middle 1/3rd in(85%) cases and not found in lower 1/3rd.

In table 3: Position of nutrient foramina in segment of long bones in percentage

	Upper 1/3(%)	Middle 1/3(%)	Lower 1/3(%)
Humerus	**0**	**100**	**0**
Radius	**10**	**90**	**0**
Ulna	**15**	**85**	**0**

CONCLUSION

Humerus,.radius,ulna 100 each were taken from the department of Anatomy ,Dr S.N. Medical College , Jodhpur and studied for the location,direction,number of Nutrient foramen.The nutrient foramen in(100%) humerus was found in middle 1/3rd. The nutrient foramen in (90%) radius was found in middle 1/3rd and (10%) in upper 1/3rd.in (85 %) Ulna the nutrient foramina was found in middle1/3rd and(15%) in upper 1/3. This anatomical study of nutrient foramina in shaft of long bones is of paramount importance in medico-legal aspect, in surgical procedures like bone grafting and microsurgical bone transplantation.

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