Original Article

Morphological study of nutrient foramina in ulna

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Abstract

The blood supply to the long bones is important in healing process. Operative procedures in fracture of the bones may disturb the blood supply. This may lead to prolonged healing process and non union especially in forearm. To prevent the damage to the blood vessels, a study of the nutrient foramen in relation to its position, number, direction and its variations in forearm bones is essential. In the present study 100 ulnae, among them 50 of right side and 50 of left side were chosen. The sex was unknown. The study of nutrient foramina is carried out and discussed.
Key Words: Nutrient foramen (NF), Ulna.

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Received Date: 14/11/2016 Revised Date: 21/12/2016 Accepted Date: 12/01/2017

Access this article online

Quick Response Code:

Website: www.medpulse.in

DOI: 23 January 2017

INTRODUCTION

The long bones are having the diaphysis which includes the shaft. The epiphysis and metaphysic is either end of the bones. The blood supply of the long bones is important in healing of the bone fractures and in surgical procedures. Any obstruction in the flow of blood to the bones will lead to delayed and nonunion. The direction of the nutrient artery is towards the slow growing end of the long bone. This requires more blood to keep pace with the opposite end of the long bone. The popular mnemonic is "To the elbow I go, from the knee I flee". Most of the long bones are having single nutrient foramina, but sometimes it may be absent or more than one may be present. The position of the nutrient foramina is usually in the middle of the shaft of the long bones. This position is calculated by Hughes foraminal index. Using this index ulna is divided into three parts[1and6]. Ulnar shaft fracture may damage the nutrient artery and it may lead to delayed or non union. Considering all these factors an attempt is made to study the nutrient foramina of ulna in the KLE's Department of Anatomy, J N Medical College Belagavi of North Karnataka.

MATERIALS AND METHODS

Total of 100 Ulnae were collected from the KLE's Department of Anatomy J. N. Medical College Belagavi. Among them 50 were of left sided and 50 were right sided. They were of unknown sex. These were examined with the naked eye for the nutrient foramina. The following parameters were observed.

1. Position of the nutrient foramina.
2. Number of nutrient foramina.
3. Direction of nutrient foramina.
4. Patency of nutrient foramina.

Position of the nutrient foramina was measured from the lower end of the ulnar tuberosity by the ruler. The situation of nutrient foramina on different surfaces and different borders were noted. The patency of the nutrient foramina were noted by inserting a 24 gauge needle fitted with a colored flag to provide the better view.

RESULTS

Among 100 ulnae 31 (62%) of the right side showed NF on the anterior surface. Whereas in the left side ulnae 34 (68%) showed NF on the anterior surface. (Table No. 1) and (Fig: no.4.) Three ulnae of left side showed NF on posterior surface (6%). No NF found on posterior surface of right side ulna. (Table No. 1) and (Fig: no.5.) One ulna from right side and one from the left side showed NF on medial surface (2%). (Table No. 1) and (Fig: no.6.) 16

How to site this article: R D Virupaxi, S M Bhimalli, S B Chetan, D P Dixit, Y Sanjay Kumar. Morphological study of nutrient foramina in ulna. *MedPulse – International Medical Journal.* January 2017; 4(1): 122-124. http://www.medpulse.in (accessed 25 January 2017).

Ulnae of right side are having NF on the anterior border (32%). Whereas 10 ulnae of left side are having on the anterior border (20%). (Table No. 1) and (Fig: no.8.) No NF found on the posterior border. Four ulnae of both sides were having NF on the interosseous or lateral border (4%). (Table No. 1) and (Fig: no.7.) One left side ulna is having NF on the medial border of the olecrenonfossa Two ulnae were having 2 NF instead of one on right side. (4%) and six ulnae on left side (12%).

Table 1

Sl. No.	Nutrient Foramina.	Right Ulna.	Left Ulna.
1	On the anterior surface	31(62%)	34(68%)
2	On the posterior surface	Nil.	03(6%)
3	On the medial surface	01(2%)	01(2%)
4	On the anterior border	16(32%)	10(20%)
5	On the posterior border	Nil.	Nil.
6	On the interosseous border	04(4%)	04(4%)
7	Medial border of olecrenon fossa	Nil.	01(2%)
8	No. of NF (More than one)	02(4%)	06(12%)

Figure 1

Figure 2

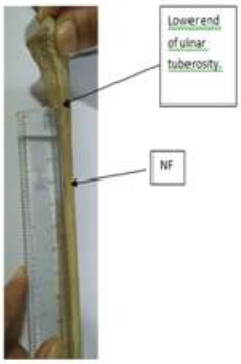

Figure 3

Figure 4

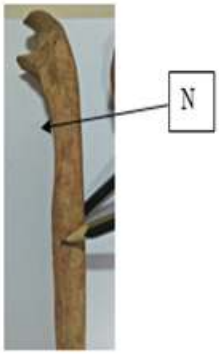

Figure 5

Figure 6

Figure 7

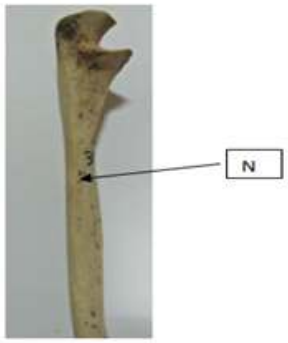

Figure 8

Figure 9

Figure 10

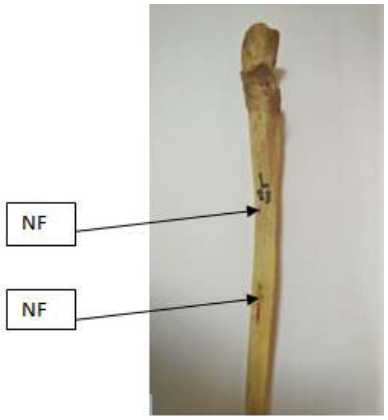

Figure 11

Legend

Figure 1: Diagram of Right Ulna; **Figure 2:** Diagram of Left Ulna; **Figure 3:** Diagram showing measurement of NF by ruler; **Figure 4:** Diagram showing NF on Anterior Surface; **Figure 5:** Diagram showing NF on Posterior Surface; **Figure 6:** Diagram showing NF on Medial Surface; **Figure 7:** Diagram showing NF on lateral or interosseous border; **Figure 8:** Diagram showing NF on anterior border; **Figure 9:** Diagram showing NF on medial border of olecrenon fossa; **Figure 10:** Showing Patency of NF; **Figure 11:** More than one NF.

The mean distance of nutrient foramina from the tip of the ulnar tuberosity on the anterior surface of right ulna is 4.38 cms. Mean distance on the left ulna is 5.0 cms.

DISCUSSION

The shaft of the long bones is supplied by the nutrient artery which enters through the nutrient foramina. The nutrient arteries in the diaphysis enter obliquely through the nutrient foramina leading into nutrient canals. The site of the artery and angulations are constant (Bernard 1855)[2] 90% of the long bones have single nutrient foramina in the middle third of the shaft. All are slanting away from the epiphysis (Patakeand Mysurkar 1977)[3]. These arteries are having only endothelium which lies on thin layers of supportive connective tissue (Yoffey 1962)[4]. Nutrient artery is the main artery particularly during the active growth period and early phases of ossification[5]. Hughes H conducted a study of the nutrient canal direction in long bones of birds and mammals. He found out many variations[1and6] The arteries were penetrating near the area of capsular insertion. These nutrient arteries enter in the proximal quarter of diaphysis of the both bones i.e. ulna and radius. In the radius it enters from anterior to medial direction whereas in ulna it enters from anterior to antero-lateral. Near the articular surfaces the vessels come from the anatomoses around the elbow region[7].One of the causes for delayed and non union of the bones in fractures is lack of blood supply[8]. Lacroix P studied the organization of the bones and concluded that the pull of muscle attachments on the periosteum explained certain anomalous nutrient foramina directions[9]. The ulnar artery gives rise to common interosseous artery which in turn divides into anterior and posterior interoseous arteries. The anterior interosseous vessel supplies on an average 7 branches (range, 3-11 branches) to the ulna diaphysis spaced at generally regular 2cms intervals. The branches were decreased in the distal end. The posterior interosseous artery supplies an average of 11 branches (range, 9-14 branches) to the ulna diaphysis spaced at 1cm intervals[10] Non-surgical treatment of ulnar isolated fractures is more prone to complications and this is associated with malunion and non union[11]. In a study conducted by Durgesh V and Venugopal Rao B found out that 4 ulnae showed NF on the interosseous border[12]. In our study 8 were on interosseous border. In their study most of the nutrient foramina are on the anterior surface which correlates our study. Average distance from ulnar tuberosity was 2-7 cms in their studies whereas in our study it was 4-5cms. No nutrient foramina found on distal third of the shaft as well as on posterior border. Direction of NF was towards the elbow in both studies.

CONCLUSION

The present study throws the light on the position and number of nutrient foramina of ulna and its application in surgical procedures and fractures. This information is useful to orthopedicians in treating the fractures.

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Source of Support: None Declared
Conflict of Interest: None Declared