Original Article

Morphometric Study of Number, Position and Location of Nutrient Foramina of Fully Ossified Dry Human Radius

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Abstract

Objectives: *The aim of the study was to evaluate the number, position and location of nutrient foramina of fully ossified dry human radius and correlate the findings clinically.*

Methods: *Samples were selected through purposive sampling for this cross sectional descriptive study which was carried out in the Department of anatomy, Mymensingh Medical College during the period of January 2016 to December 2016. Any damaged, incompletely ossified and fractured bones were excluded to contrive a standard measurement. Data were tabulated and statistically analyzed during Microsoft excel and SPSS software.*

Results: *Among 190 radius, single nutrient foramen was found in all bones. The positions of nutrient foramen in upper third and middle third were 64.71% and 35.29% respectively for right radius and 55.93% and 44.07% were respectively for left radius. There was no nutrient foramen found in lower third.*

Conclusion: *Information and details about surgical procedures like bone grafting and bone transplantation.*

Key words: *Nutrient foramen, Long bones, Location, Number*

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Introduction

An opening into the bone shaft for passage of blood vessels to the medullary cavity of a bone for its nourishment and growth is called nutrient foramen[1]. The major blood supply for long bones originates from the nutrient arteries, mainly during the growing period and during the early phases of ossification[2]. During childhood, long bones receive about 80% of the interosseous blood supply from the nutrient arteries and in the case of their absence, the vascularization occurs through the periosteal vessels[2]. Reduction of blood flow to bone leads to ischemia of the metaphysis and growth plate. Currently, the detailed study of blood supply to long bones is a determining factor for the success of new techniques for bone transplant and resection in orthopedics. In transplant techniques, the use of statistical data on the nutrient foramina distribution in long bones makes it possible for the professional to select the osseous section levels of the receptor in order to place the graft without damaging the nutrient arteries, preserving, thus, the diaphyseal vascularization and the transplant consolidation[3]. In bone grafts, the nutrient blood supply is crucial and it should be preserved in order to promote the fracture healing[4]. Thus important information of position, number and direction of nutrient foramina in human radii provides a great help in many surgical and clinical cases such as bone grafts and internal fixation devices[5].

Materials and methods

This study was carries out in the Department of Anatomy, Mymensingh Medical College (MMC), Mymensingh from January 2016 to December 2016. This study was cross sectional descriptive type. The samples were selected through purposive sampling. A total number of 190 fully ossified dry human radius were selected. The nutrient foramina were identified by the presence of a well marked groove, often slightly raised edge at the commencement of the canal. Only diaphysial (shaft's) nutrient foramen of radius was observed in this study. A fine metallic wire was passed through each foramen to confirm their patency. The presence or absence, number, location and position of foramen in relation to specific borders or surfaces of diaphysis were observed. The foramina within 1mm from any border were taken to be lying on that border. Number of nutrient foramen was counted. The exact position was made out whether it was present on the upper or middle or lower one third of the bone.

a b c

Figure 1: Location & number of nutrient foramen showing by arrow mark (a. Ant. Surface b. Ant. border & c. Post. Surface)

Results

Present study showed among 190 radius, single nutrient foramen was found in all bones. The positions of nutrient foramen in upper third and middle third were 64.71% and 35.29% respectively for right radius and 55.93% and 44.07% were respectively for left radius. There was no nutrient foramen found in lower third.

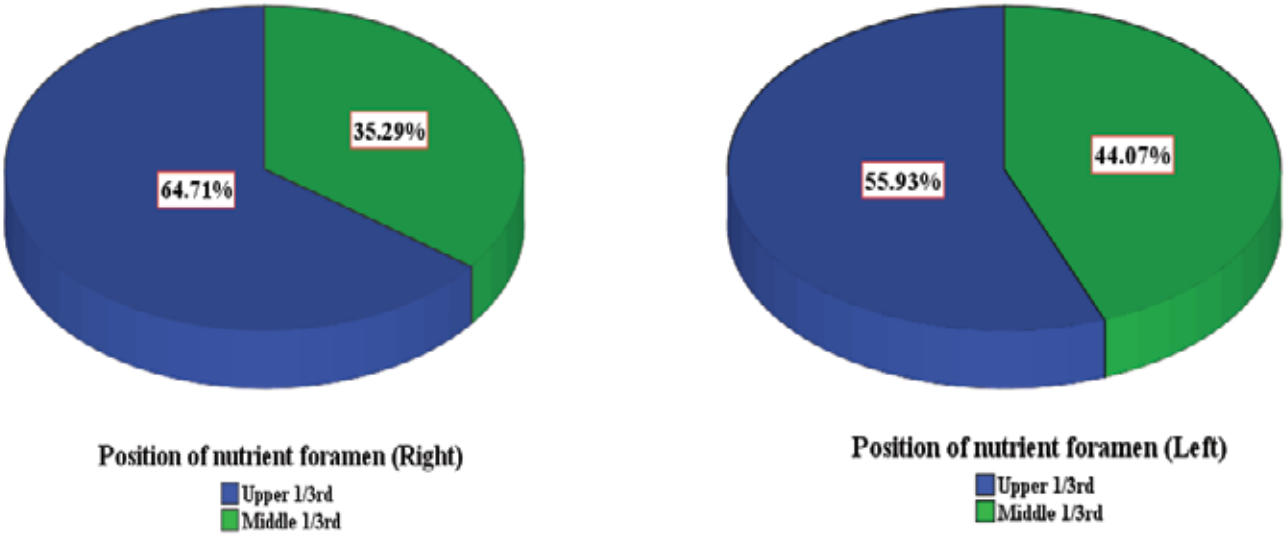

Figure 2: Pie chart showing frequency distribution of position of nutrient foramen of right (n=98) and left radius (n=92)

The locations of nutrient foramen on anterior surface, posterior surface, medial border and anterior border were 39.77%, 3.51%, 33.33% & 23.39% respectively for right radius and 28.49%, 6.45%, 35.48% & 29.57% respectively for left radius.

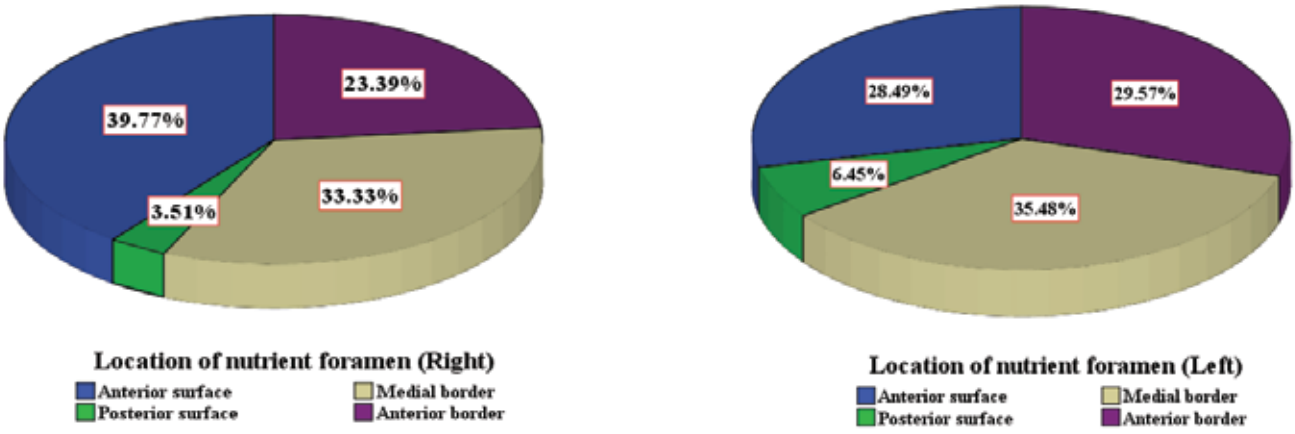

Figure 3: Pie chart showing frequency distribution of locations of nutrient foramen of right (n=98) and left radius (n=92)

Discussion

In this study all radius was found to contain single nutrient foramen. Shaheen[6] (2009) conducted a study and found that 100% radius had single nutrient foramen which was similar to present study. But Ukoha et al.[7] (2013) found single nutrient foramen only in 68% of cases of his study which was lower than present study. Shah and Saiyad[5] (2014) performed a study and found that among 198 radius 194 bones had single foramen. Pereira, Lopes, Santos and Silveira[2] (2011) described number of single nutrient foramina in radii as 99.4%. Reddy et al.[8] (2016) found among 28 left radius 27 had single foramen and among 26 right radius 25 had single foramen. Vinay and kumar[9] (2011) performed a study on 32 radii. They found that 31 radius had single foramina. Solanke, Bhatnagar and Pokhrel[10] (2014) found that 92.50% radius had single foramen. Roul and Goyal[11] (2015) described that 97.29% radius had single foramina. All the above findings were almost similar to present study. On the other side Ukoha et al.[7] (2013) found that 32% had no nutrient foramen. Shah and Saiyad[5] (2014) performed a study and found that among 197 bones 3 bones had two foramina. Reddy et al.[8] (2016) found among 28 left radius 1 had double foramen and among 26 right radius 1 had double foramen. Vinay and kumar[9] (2011) performed a study on 32 radii. They found that 1 bone had double foramina. Solanke, Bhatnagar and Pokhrel[10] (2014) found that 2.50% had double foramina and 5% had no nutrient foramen. Roul and Goyal[11] (2015) described that 2.7% had double foramina. All above findings were not similar to present study. In this present study the locations of nutrient foramen on anterior surface, posterior surface, medial border and anterior border are 39.77%, 3.51%, 33.33%,23.39% respectively for right radius and 28.49%, 6.45%, 35.48%, 29.57% respectively for left radius. But Ukoha et al. (2013) found that 45.7% of all nutrient foramina were on anterior surface, 8.6% were on posterior surface and 31.4% on anterior surface (close to anterior border) respectively which were higher than present study. They also mentioned that 14.3% nutrient foramina were on anterior surface (close to interosseous border) which were lower than present study. But they did not mention the side of radius. Shah and Saiyad[5] (2014) found that among 198 radius 197 had nutrient foramina on anterior surface. Reddy et al.[8] (2016) described that among 26 right radius 23 bones had nutrient foramina on anterior surface, 2 had on interosseous border and 1 had on posterior surface. Vinay and kumar[9] (2011) found that among 15 right radius 10 had nutrient foramina on anterior surface, 1 had on anterior border, 3 had on medial border and 1 bone had on both anterior surface and interosseous border. They also described that among 17 left radius 14 had nutrient foramen on anterior surface and 3 had on medial borber. All the above results were not similar to present study. On the other hand Pereira, Lopes, Santos and Silveira[2] (2011) operated a study and found that 73.2% nutrient foramina were located in anterior aspect. Patel and Vora[1] (2015) found 87.5% nutrient foramina on anterior surface and 12.5% on posterior surface. Solanke, Bhatnagar and Pokhrel[10] (2014) described 66.25% nutrient foramina on anterior surface. Shaheen[6] (2009) described 89.9% nutrient foramina on anterior surface and 10% on posterior surface. All the findings were higher than present study. In the present study the positions of nutrient foramen in upper 1/3rd and middle 1/3rd are 64.71% and 35.29% respectively for right radius and 55.93% and 44.07% respectively for left radius. Ukoha et al.[7] (2013) found the positions of nutrient foramen on proximal third and middle third as 57.1% and 42.9% respectively which was not similar to present study. Vinay and kumar[9] (2011) performed a study and found that among 15 right radius 5 bones had nutrient foramen on upper 1/3rd, 9 bones had on middle 1/3rd and 1 bone had on both upper and middle 1/3rd. They also described that among 17 left radius 3 bones had nutrient foramen on upper 1/3rd and 14 bones had on middle 1/3rd. There were no nutrient foramina in lower 1/3rd. Roul and Goyal[11] (2015) found that among 37 radii 9 radius had nutrient foramen on upper 1/3rd and 28 on middle 1/3rd irrespective of side. All the

above findings were dissimilar to present study. Shaheen[6] (2009) performed a study and found the position of nutrient foramen in upper 1/3rd and middle 1/3rd as 43.3% and 56.6% respectively which was not similar to present study. She also found that there were no nutrient foramina in the distal 1/3rd. This finding was similar to present study.

Conclusion

The results of incidence of position, number and location of nutrient foramina are consistent with the most of the studies and indicate that in most of the bones they are located on anterior surface. Maximum nutrient foramina are on the proximal third which indicates that the upper end is growing end. In this study no nutrient foramina found on the lower third for the radius. Besides in this study all the radius have single foramina which indicate single source of arterial supply. An accurate knowledge of the location of the nutrient foramina in long bones would help in preventing intraoperative injuries in orthopaedic as well as in plastic and reconstructive surgery. Placement of internal fixation devices can be appropriately done with the knowledge of variations in the nutrient foramen.

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