

A Study about Prevalence and Position of Accessory Nutrient Foramina in Cadaveric Human Radius and Ulna Bones in Anatomy Department of a Medical College in North India

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ABSTRACT

Introduction: Nutrient artery is the main source of blood supply to the long bones. As in 1% cases nutrient foramina and nutrient artery may be positioned in unusual positions, therefore, knowledge about various other positions of nutrient foramina is important for various operative and diagnostic prospective.

Aims and objectives: The presence, position, number, direction, and distances of nutrient foramina from the various landmarks on the bone have importance in various orthopedic procedures as nutrient artery has a pivotal role in the growth and development of the long bones. The present study was done to know the prevalence of accessory nutrient foramina and its position in human ulna and radius.

Materials and methods: In this study, 100 ulna and 100 radius bones were studied in the Department of Anatomy, Sarojini Naidu Medical College, Agra, Uttar Pradesh, India, for the presence of accessory nutrient foramina and its position from the proximal epiphysis of the long bones.

Results: Accessory nutrient foramina was present in 6% of radius bones and 11% of ulna bones. Middle third part among radius bones and upper third part among ulna bones were most common positions of accessory nutrient foramina.

Conclusion: This study provides precise knowledge of accessory nutrient foramen in long bones. Knowledge of accessory nutrient foramina prevalence and position is of immense importance for orthopedician in treating complicated fractures of long bones. The location of accessory nutrient foramen is also important in various other orthopedic procedures like bone grafts, tumor resection, correction of congenital pseudoarthrosis, and many other microvascular surgeries.

Keywords: Bone graft, Bone transplantation, Diaphysis, Internal fixation, Long bone, Nutrient artery.

How to cite this article: Garg S. A Study about Prevalence and Position of Accessory Nutrient Foramina in Cadaveric Human Radius and Ulna Bones in Anatomy Department of a Medical College in North India. *Int J Adv Integ Med Sci* 2018;3(1):5-7.

Source of support: Nil

Conflict of interest: None

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INTRODUCTION

Nutrient artery is the main artery supplying blood to the long bone along with periosteal arteries. Nutrient artery originates from local artery of that region. It enters in the shaft of long bones through nutrient foramina. In general, most of the long bones have single nutrient foramina, but in few persons in some long bones accessory foramina is also present.¹ Nutrient artery is very important for bone growth during early growing periods and early phases of ossification of bones. Therefore, knowledge of this accessory nutrient foramina position is of great importance for orthopedician dealing with complicated procedures involving bone diaphysis.²

Nutrient foramina is passage of nutrient arteries and peripheral nerves to the shaft of long bones. Long bones derive majority of interosseous blood supply from nutrient arteries and some parts from the periosteal arteries.³

According to Harris, during the growth of long bones, position of nutrient foramina remains constant.⁴

An understanding of the location and the number of nutrient foramina in long bones is therefore, important in orthopedic surgical procedures, such as joint replacement therapy, fracture repair bone grafts, and vascularized bone microsurgery as well as medicolegal cases.³

The nutrient foramina was identified by the presence of a well-marked groove leading to the foramen, and by a well-marked often slightly raised edge by the side of the foramen at the commencement of the nutrient canal. For direction of nutrient canal, a fine stiff wire was used and it was passed through the nutrient foramen to confirm its direction.⁵

Importance of nutrient foramen is relevant to fracture treatment. Combined periosteal and medullary blood supply to the bone cortex helps to explain the success of nailing of long bone fractures.⁵

In the radius the nutrient foramen is, invariably, above the middle of the bone and in the ulna, it is in the middle third. In both, the foramen most frequently occurs on the anterior surface nearer to either the anterior or interosseous border. There is some symmetry in the position of the foramina on the two sides.⁶

In many tetrapods, there is variation in the directions of nutrient foramina, but in mammals and birds, Hughes pointed out that anomalous canal are frequent, especially in femur.⁷

Exact location and distribution of the nutrient foramina in bone diaphysis is important to avoid damage to the nutrient vessels during surgical procedures.⁸ Position and number of nutrient foramina in long bones are very important in orthopedic surgical procedures like joint replacement therapy, fracture repair, bone grafts, and vascularized bone microsurgery.⁹

MATERIALS AND METHODS

An osteological study on nutrient foramina in radius and ulna was conducted in the Department of Anatomy, Sarojini Naidu Medical College, Agra, Uttar Pradesh, India. This study was conducted on 100 radius and 100 ulna bones of cannabis. The bones were examined for the presence and position of necessary nutrients for a minute. Two different observers observe the bone separately and in case of discrepancy third observer opinion was sorted. All the measurements were taken with Osteometric Board and Digital Vernier Caliper.

Inclusion Criteria

Adult human radius and ulna bones available in the Department of Anatomy irrespective of sex and race were taken for the study.

Exclusion Criteria

Radius and ulna showing any gross asymmetry or broken were rejected.

RESULTS

The present study was conducted in the Department of Anatomy, Sarojini Naidu Medical College, Agra, Uttar Pradesh, India, on cadaveric bones, and 100 radius and 100 ulna bones were included in the study.

Table 1 shows prevalence of accessory nutrient foramina in radius bones. Out of 100 radius bones, only 6 (6%) bones were found to have accessory nutrient foramina.

Table 2 shows distribution of radius bones having accessory nutrient foramina according to the position of foramina. Out of 6 radius bones having accessory nutrient foramina, 1 (16.67%) bone had accessory nutrient

Table 1: Prevalence of accessory nutrient foramina among radius bones (n = 100)

Total radius bones examined	100	100%
No. of radius bones with accessory nutrient foramina	6	6

Table 2: Distribution of radius bones according to the position of accessory nutrient foramina (n = 6)

Place of accessory nutrient foramina	No. of radius bones	Percentage
Upper third part	1	16.67
Middle third part	4	66.66
Lower third part	1	16.67
Total bones	6	100.00

Table 3: Prevalence of accessory nutrient foramina among ulna bones (n = 100)

Total ulna bones examined	100	100%
No. of ulna bones with accessory nutrient foramina	11	11

Table 4: Distribution of ulna bones according to the position of accessory nutrient foramina (n = 11)

Place of accessory nutrient foramina	No. of ulna bones	Percentage
Upper third part	6	54.55
Middle third part	2	18.18
Lower third part	3	27.27
Total bones	11	100.00

foramina presented in upper third of the diaphysis. One (16.67%) bone had accessory foramina presented in lower third of the diaphysis. Majority 4 (66.66%) radius bones had nutrient foramina presented in middle third of the diaphysis.

Table 3 shows prevalence of accessory nutrient foramen in ulna bones. Out of 100 ulna bones, 11 (11%) bones had accessory nutrient phenomena present in the diaphysis.

Table 4 shows distribution of ulna bones having accessory nutrient foramina according to position of foramina. Out of 11 radius bones having accessory nutrient foramina, majority 6 (54.55%) ulna bones had nutrient foramina present in upper third of the diaphysis and at least 2 (18.18%) bones had accessory nutrient foramina present in middle third of the diaphysis. Three (27.27%) bones had accessory foramina present in lower third of the diaphysis.

DISCUSSION

In the present study, 6% of radius bones had accessory nutrient foramina present on the shaft of bone. In a study conducted by Vinay and Kumar,⁴ it has been found that 3.2% of radius bones had accessory nutrient foramina and a study by Ashwini et al.¹⁰ found that the prevalence of accessory nutrient foramina was 10.15% in radius bones.

In our study, majority 66.66% radius bones had accessory foramina present in the middle third of shaft. Similar findings were found in the study conducted by Vinay and Kumar⁴ that majority 72.70% of radius bones had accessory nutrient foramina in the middle third. Ashwini et al.¹⁰

found that majority 57.14% radius bones had accessory nutrient foramina in the middle third.

In the present study, 11% of ulna bones had accessory nutrient foramina present on the shaft of bone. In a study conducted by Vinay and Kumar,⁴ it was found that 12.5% of ulna bones had accessory nutrient foramina. Ashwini et al.¹⁰ found that prevalence of accessory nutrient foramina was 21.42% in ulna bones.

In our study, majority 54.55% ulna bones had accessory foramina present in the upper third of shaft. Similar findings were found in the study conducted by Vinay and Kumar⁴ that majority 55.50% of ulna bones had accessory nutrient foramina in the upper third. Ashwini et al.¹⁰ found that majority 50% ulna bones had accessory nutrient foramina in the upper third.

CONCLUSION

The knowledge about these foramina is useful in the surgical procedures to preserve the circulation.¹¹ Injury to the nutrient artery at the time of fracture, or at subsequent manipulation, may be a significant factor predisposing to faulty union. The levels of osseous section are selected according to the localization of the diaphysis nutrient foramina in order to preserve diaphyseal vascularization of the recipient to support the consolidation with the osseous graft.¹²

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