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Morphometric Study of Nutrient Foramina of Human Ulna - In Telangana Region

Medical Science

KEYWORDS : Nutrient artery, Nutrient foramina, Shaft of long bones, Upper limb bones

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ABSTRACT

The major blood supply to the long bones occurs through the nutrient arteries, which enters through the nutrient foramina. Nutrient foramina play an important role in nutrition and growth of the bones. Most of the nutrient arteries follow the rule, 'to the elbow I go, from the knee I flee' but they are variable in position. In this study variation in number, location, direction & its importance in the growing end of long bones were studied in the Adult Human Ulna bones. A total of 98 ulnae were studied, of which 42 were belonging to the left side and 46 were belonging to the right side. Total number of nutrient foramen were 152, of which Single nutrient foramen found in 66(66 Foramina), Double nutrient foramen found in 20 bones(40Foramina),Three foramina found in4 bones(12 Foramina),Four foramina found in 6 bones (24 Foramina) and 5 foramina found in 2 bones (10 Foramina). Most of the nutrient foramen found in the middle 1/3rd of shaft of ulna. Most of the foramina are found on anterior surface of ulna(138 foramina) . All the nutrient foramen directed upwards i.e. towards elbow. Average length of ulna was 25.99cms; average distance of nutrient foramen from the upper end was 8.5 cms.

The study of nutrient foramina is not only of academic interest but also in medico-legal practice in relation to their position.

INTRODUCTION

Nutrient foramen is the largest foramen on the shaft of long bones through which nutrient artery for that bone passes[1] . The nutrient foramina has been studied in the past by Havers(1691), Berard(1835), Schwalbe(1876), Langer(1876), Retterer(1884) and Parson(1905). [2] Berard was the first to correlate the direction of the canal with the ossification and growth of the bone.[3] Humphrey was working on the direction and obliquity of nutrient canals postulated periosteal slipping theory, the canal finally directed away from the growing end. [4] Harris has stated that the position of nutrient foramina is constant during the growth of long bone. Lutken has stated that position of nutrient foramina is variable & typical position of nutrient foramina can be determined after a study on human bones[5]. . Careful observation has also been made on the position of nutrient foramina in relation to upper end of long bones. Aim of the present study is

I. To know the common position of nutrient foramina and its variations from the normal positions.
II. To know the number of nutrient foramina in the shaft of a particular bone.
III. To know the different position of nutrient foramina with reference to the surface of shaft long bone.
IV. To know the direction of nutrient foramina with reference to the growing ends of the bone.

The present study was conducted to find out the variability of the position of the nutrient foramina and its importance in orthopedic procedures and evaluating techniques.

MATERIALS AND METHODS

The study included 98 ulna bones of which (42 left and 46 right) of unknown age and sex, collected from the department of Anatomy, Osmania Medical College, Hyderabad, Telangana State, India . Each bone was examined in detail for the number, position & direction of nutrient foramina. The nutrient foramen was identified by the presence of a well marked groove and raised edge at the commencement of the canal. The exact position of the nutrient foramina was made out whether it was present on the upper or middle or lower one third of the bone; on which surface or border of the bone it was present. The total length of Ulna and distance of nutrient foramen from the upper end also measured.

OBSERVATIONS AND RESULTS:

A total of 98 ulnae were studied, of which 42 were belonging to the left side and 46 were belonging to the right side. Total number of nutrient foramen were 152, of which Single nutrient foramen found in 66(66 Foramina), Double nutrient foramen found in 20 bones(40Foramina),Three foramina found in4 bones(12 Foramina),Four foramina found in 6 bones (24 Foramina) and 5 foramina found in 2 bones (10 Foramina). Most of the nutrient foramen found in the middle 1/3rd (74 foramina),followed by upper 1/3rd (50 foramina) and least number of foramina found onlower1/3rd (28 foramina) of shaft of ulna. Most of the foramina are found on anterior surface of ulna(138 foramina), followed by posterior surface(8 foramina), then followed by interosseous border(4foramina) and least number of foramina found on anterior border(2 foramina) (Table-1&2). All the nutrient foramen directed upwards i.e. towards elbow. Average length of ulna was 25.99cms; average distance of nutrient foramen from the upper end was 8.5 cms.

DISCUSSION

The direction of nutrient foramina 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[6]. Nutrient foramina of radius and ulna have been studied by Shullman(1959)[7] . Longia GS et al[8],stated that the vascular theory offers the best explanation of all reported anomalies as well as the normal fashioning of nutrient canals. Mysorekar [6] studied 180 ulnae were observed of which four bones has double nutrient foramina and two bones with no foramina. Total numbers of nutrient foramina were 188, of which 117(62%) were in the middle third, 66 (35%) were in the upper third & five at the junction.

In the present study total 98 ulnae were studied, of which 42 were belonging to the left side and 46 were belonging to the right side. Total number of nutrient foramen were 152, of which Single nutrient foramen found in 66 bones (66 Foramina), Double nutrient foramen found in 20 bones(40Foramina),Three foramina found in4 bones(12

Foramina),Four foramina found in 6 bones (24 Foramina) and 5 foramina found in 2 bones (10 Foramina). In the present study all the ulna bones had nutrient foramina, we couldn't found any ulna bones without nutrient foramina. Normally nutrient artery to humerus arises either from brachial arteries or from the arterial profunda brachii either as single or multiple branches, to radius either from the anterior interrosseous or posterior interrosseous arteries, to ulna either from the ulnar arteries or from the muscular branches of the ulnar arteries[9-12] .

In the present study. All the nutrient foramen were directed upwards i.e. towards elbow. Total number of nutrient foramen in ulnae were 152 of which 74foramina (48.5%) were found in middle 1/3rd, 50 foramina were found in upper 1/3rd (35%) and 28 foramina were found in lower 1/3rd of ulna(16.5%). Total number of nutrient foramen in ulnae were 152 of which138 foramina were found on anterior surface of ulna(92%),8 foramina on posterior surface(4.8%),4 on interrosseous border(2%) and 2 foramina were found on anterior border(1.2%).

CONCLUSION

One hundred & four long bones of the upper limb of unknown age and sex, from the department of Anatomy, Osmania Medical College , Hyderabad were studied for position, number, direction & obliquity of nutrient foramen. Variations in number & position were found in ulna. The different theory of normal & abnormal directions of nutrient foramina has also been discussed. This anatomical study of nutrient foramina in shaft of long bones is of paramount importance in medico-legal aspect and also important in surgical procedures like bone grafting and microsurgical bone transplantation.

Table -1: Distribution of number of Nutrient Foramina in Rt &Lt ulna

Side of the bone	No of ulna	Total no of foramina	No of nutrient foramina					
			0	1	2	3	4	5
Right	46	72	--	46	6 (6x2=12)	2 (3+3=6)	2 (4+4=8)	–
Left	42	80	–	20	14 (14x2=28)	2 (3+3=6)	4 (4x4=16)	2 (2x5=10)
	88	152	--	66 (66f)	20 (40f)	4 (12f)	6 (24f)	2 (10f)

Table -2: Tophographic distribution of Nutrient Foramina in Rt&Lt ulna

Side of the bone	Total no of foramina	Upper 1/3rd	Middle 1/3rd	Lower 1/3rd	AB	AS	PS	IB
Right	72	30	36	6	2	64	4	2
Light	80	20	38	22	--	74	4	2
	152	50	74	28	2	134	8	4

Ulna (AB- Anterior border, AS- Anterior surface, PS- posterior surface, IB- Interosseous border)

Figure-1: showing A- Left ulna with 3 foramina, B- Left ulna with 4 foramina, C &D – Left Ulna with 5 foramina (above downwards).

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