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DIAPHYSIAL NUTRIENT FORAMINA OF RADIUS

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ABSTRACT

The topography and direction of nutrient foramina on the long bones are assumed to be constant. In human beings this is not invariably so. **OBJECTIVES:** Present study was conducted to observe the nutrient foramina in radii of Pakistani (Punjabi) people and comparing with that of the Indians. **MATERIAL & METHODS:** Two hundred well preserved radii bones from each sides were examined for the number, the position, the direction and the incidence of asymmetry of the nutrient foramina. All the surfaces of bone were examined in a regular order. To observe the position of foramen, the bone was divided into upper 1/3, junction of upper and middle 1/3, middle 1/3 and lower 1/3. **RESULTS & OBSERVATIONS:** Right radius: Of the 192 foramina, 64 (33.33%) were in the upper third, 32 (16.67%) in the middle third and 96 (50%) at the junction of upper third and middle third of the bone. Of the 192 foramina, 58 (30.21%) were on the anterior surface and 13 (6.77%) on the posterior surface. 85 (44.27%) were present on the anterior border and 36 (18.75%) on the inter-osseous border. Left radius: Of the 177 foramina, 50 (28.25%) were in the upper third, 37 (20.90%) in the middle third and 90 (50.85%) at the junction of upper third and middle third of the bone. Of the 177 foramina, 84 (47.46%) were on the anterior surface and 23 (12.99%) on the posterior surface. 30 (16.95%) were present on the anterior border and 40 (22.60%) on the inter-osseous border. **CONCLUSION:** The arrangement of the diaphysial foramina in the radius usually follows a definite pattern. The foramina are invariably above or at the junction of the upper third with the middle third and most frequently occur on the anterior surface nearer either the anterior or the inter-osseous border. The presence of the nutrient foramina at different levels could be due to differential growth and the length of the bones in different ethnic groups in Pakistani people as compared to the Indians.

INTRODUCTION

The topography and direction of nutrient foramina on the long bones are assumed to be constant. In human being this is not invariably so[1]. Many anomalies have been reported in tetrapods. The foramina were studied in detail in human humerus and femur[2,3,4,5]. The nutrient foramina in the long bones of human limbs are described as being directed towards the elbow and away from the knee because the development of one end of the bone grows faster than the other. Knowledge of the position of the nutrient foramen can be useful in certain surgical procedures. The blood supply of humerus & femur has been described in detail[2,6]. Nutrient foramina on the radius and ulna have been also studied in the past[7]. The nutrient foramen in the cortex provides the site of entry for the nutrient vessels[9]. Position of all nutrient foramina is on the flexor aspect and is more or less around the fixed area[10].

One or more main diaphysial nutrient arteries enter the shaft obliquely through the nutrient foramen leading into the nutrient canals. Their site of entry and angulations are almost constant and characteristically directed away from the dominant growing epiphysis. This is the basis of the growing end hypothesis[11].

The anomalous canals are said to be frequent in femur but rarely occur in radius and seldom in the other bones. Long bones of the both limbs were studied for the number, position, direction, obliquity, symmetry etc. of the diaphysial nutrient foramina[8]. Present study was conducted to observe the above mentioned characteristics of nutrient foramina in Radii of Pakistani (Punjabi) people and comparing with that of the Indians.

MATERIALS & METHODS

Two hundreds well preserved radii bones from each sides were examined for the number, the position, the direction and the incidence of asymmetry of the nutrient foramina. The bones were collected at random from the cadavers (either sex) in the department of Anatomy, K.E Medical College, Lahore, Punjab Medical College, Faisalabad and Independent Medical College, Faisalabad. The recorded ages of the cadavers varied between 25-60 years.

The vascular foramina at the ends of bones were not considered. Only well defined canals or foramina on the shaft were recorded with the help of hand lens so that small foramina would not be missed.

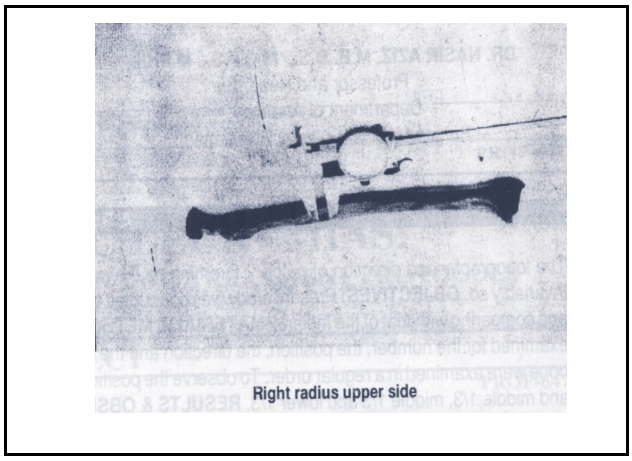
The distance from proximal end of bone to nutrient foramina was measured by means of a divider read on a scale graduated in cms. All the surfaces of bone were examined in a regular order. Foramina within 1 mm from any border were taken to be lying on that border.

The direction and obliquity of the foramina were noted. The relative sizes of foramen were noted in case of two or more foramina to determine the main and accessory foramen. A fine wire was used to pass through the foramen to enter into the medullary cavity in case of doubt about the nature of the foramina.

Nutrient foramina showed a distinct groove or canal proximal to the foramen and the margin of the foramen and the adjacent canal were slightly raised above the surface of the rest of the bone. To observe the position of foramen, the bone was divided into upper 1/3, junction of upper and middle 1/3, middle 1/3 and lower 1/3.The position of a foramen was determined by measuring its distance from fixed joints on the proximal and distal ends of Ihe bone. The photographs were taken and the observations were recorded.

RESULTS

The observations are given in Table I, II, III and shown in the Fig. 1,2,3.



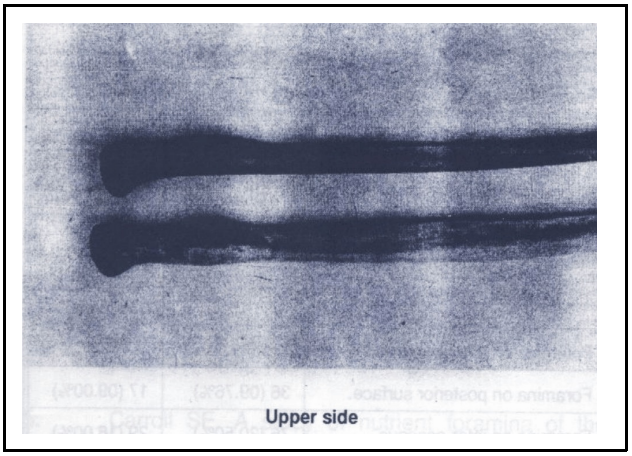
RIGHT RADIUS:

Out of two hundred radii. twelve had no foramina and four had double foramina (Table-l). Of the 192 foramina, 64 (33.33%) were in the upper third, 32 (16.67%) in the middle third and 96 (50%) at the junction of upper third and middle third of the bone (Table-ll).

Of the 192 foramina, 58 (30.21 %) were on the anterior surface and 13 (6.77%) on the posterior surface. 85 (44.27%) were present on the anterior border and 36 (18.75%) on the inter-osseous border (Table-ll).

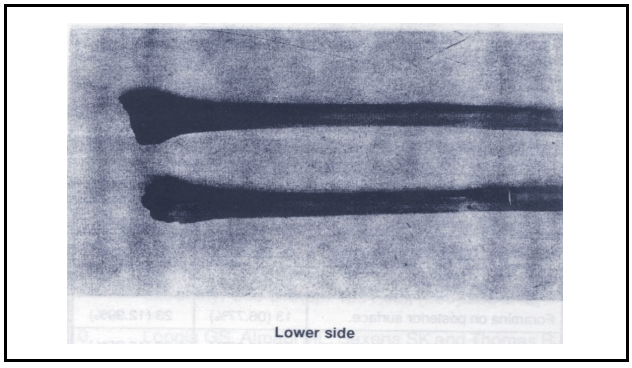
The foramina were present in upper two thirds of the bone and most frequently occur on the anterior surface and border of the bone.

There was no change in the obliquity when the foramina were in the centre of the bone as compared to when they were nearer the ends. In those specimens having double foramina were on the anterior surface or one was on the anterior border and other on inter-osseous border. Direction of the nutrient foramen was represented as oblique in 28 and vertical in 164 specimens. Length of the nutrient canal is shown in Table-l and Fig-1.



LEFT RADIUS:

Out of two hundred radii, twenty five had no foramina and two had double foramina (Table-l). Of the 177 foramina, 50 (28.25%) were in the upper third, 37 (20.90%) in the middle third and 90 (50.85%) at the junction of upper third and middle third of the bone (Table-ll).



Of the 177 foramina, 84 (47.46%) were on the anterior surface and 23 (12.99%) on the posterior surface. 30 (16.95%) were present on the anterior border and 40 (22.60%) on the inter-osseous border (Table-ll).

The foramina were present in upper two thirds of the bone and most frequently occur on the anterior surface and border of the bone. There was no

change in the obliquity when the foramina were in the centre of the bone as compared to when they were nearer the ends. In those specimens having double foramina were on the anterior surface or one was on the anterior border and other on inter-osseous border. Direction of the nutrient foramen was represented as oblique in 42 and vertical in 135 specimens. Length of the nutrient canal is given in Table-l.

Table-1

		Right radius (n=200).	Left radius (n=200).
Froamen	Absent	12 (06.00%)	25(12.50%)
	Double	04 (02.00%)	02 (01.00%)
	Present	188 (94.00%) (188: single + 04:double=192)	175 (87.50%) (175: single+2:double=177)
Direction of nutrient canal.	Oblique	28 (85.425)	42 (23.73%)
	Vertical	164 (85.425)	135(76.73%)
	Minimum	03 mm	02mm
Length of the nutrient canal.	Maximum	15mm	20mm
	Average	09 mm	11mm

Table-II

	Right radius (n=200 radii)	Left radius (n=200 radii)
No. Of foramina.	192	177
Foramina in upper third.	64(33.33%)	50 (28.25%)
Foramina in middle third.	32.(16.67%)	37 (20.90%)
Foramina in lower third.	Absent	Absent
Junction of upper and middle third.	96(50.00%)	90 (50.85%)
Foramina on anterior surface.	58 (30.21%)	84 (47.46%)
Foramina on posterior surface.	13 (06.77%)	23 (12.99%)
Foramina on anterior border.	85 (44.27%)	30 (16.95%)
Foramina on inter-osseous border.	36 (18.75%)	40 (22.60%)

DISCUSSION

The arrangement of the diaphysial foramina in the radius usually follows a definite pattern. The foramina are invariably above or at the junction of the upper third with the middle third and most frequently occur on the anterior surface nearer either the anterior or the inter-osseous border. There is some symmetry in the position of the foramina of the two sides. The blood supply of the radius also describes the presence of the nutrient foramina on the surface concerned.

It has been suggested that the direction of the nutrient foramina is determined by the growing end of the bone. The growing end of the bone is supposed to grow at least twice as fast as the other end[8]. This theory fails to explain the abnormal direction of the foramina which were described by the earlier vorkers.

in our study the foramina are usually present at the junction of the upper and middle third (50.41%) and in the upper third (30.90%) of the radii. But in

case of the study conducted by Mysorekar, most of the nutrient foramina were on middle third (62%) and upper third (36%) of the bone and only 2% were present at the junction of the upper and middle third of the bone. These findings could explain the variation in the blood supply of the radii (Table-Ill).

Table-III

	Present study	Indian study
No. of foramina.	369	184
Foramina in upper third.	114 (30.90%)	67 (36.00%)
Foramina in middle third.	69 (18.69%)	114 (62.00%)
Foramina in lower third.	Absent	Absent
Junction of upper and middle third.	186 (50.41%)	03 (02.00%)
Foramina on anterior surface.	142 (38.48%)	Anteior surface & border. 138 (75.00%)
Foramina on posterior surface.	115 (31.16%)	
Foramina on anterior border.	36 (09.76%(	17 (09.00%)
Foramina on inter-osseous border.	76 (20.50%)	29 (160.00%)

The presence of nutrient foramina on the anterior surface and border are in close conformity to the study conducted by Mysorekar[8]. For the direction and the length of the nutrient canal no reference was available for comparison at the time of study.

The nutrient artery to a long bone may have various sources of origin i.e., from anterior and posterior inter-osseous arteries. This also explains the presence of the foramina on the posterior aspect of the bone. The presence of the nutrient foramina at different levels could be due to differential growth and the ends of the bones in different ethnic groups in Pakistani people as compared to the Indians.

Certain surgical applications to the present findings deserve special attention. The proximal halves of the forearm bones are well covered by the muscle bellies which would ensure an adequate periosteal blood supply to the diaphysis. The distal halves, however, are devoid of any significant muscle attachment. The delayed or non-union if occur in the lower end of the radius could be caused primarily by the normal anatomy of the nutrient arteries. The knowledge of the presence of the nutrient foramina and the blood supply of the bone is help full to the surgeon while doing the surgery.

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The supreme happiness of life is the conviction of being loved for yourself, or more correctly, being loved in spite of yourself.

Victor Hugo