OPEN ACCESS
Scholars International Journal of Anatomy and Physiology
Abbreviated Key Title: Sch Int J Anat Physiol
ISSN 2616-8618 (Print) |ISSN 2617-345X (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: http://saudijournals.com/sijap/

Original Research Article

A Study on the Number of the Nutrient Foramina in Adult Human Forearm Bones in Population of Uttar Pradesh

Rakesh Mishra[1*], Sneha Yadav[2]

[1]Department of Human Anatomy, Sardar Patel Post Graduate Institute of Dental and Medical Sciences, Raibareli Rd, Utrathia, Chaudhary Vihar, Lucknow, Uttar Pradesh 226025, India

[2]Department of Pharmacology, Sardar Patel Post Graduate Institute of Dental and Medical Sciences, Raibareli Rd, Utrathia, Chaudhary Vihar, Lucknow, Uttar Pradesh 226025, India

***Corresponding author:** Dr. Rakesh Mishra

| **Received:** 03.04.2019 | **Accepted:** 12.04.2019 | **Published:** 19.04.2019

DOI:10.21276/sijap.2019.2.4.1

Abstract

The present study has been carried out to determine the number of the nutrient foramina in adult human forearm bones. The nutrient foramina are cavities that conduct the nutrient arteries and the peripheral nerves. The nutrient artery provides the main source of blood supply to the long bones. The present study was done on 114 adult humen forearm bones comprising 57 radii and 57 ulnae to observe number of nutrient foramina and our result shows out of 114 forearm bones 105 bones (92.10%) had single nutrient foramina and 8 bones had double nutrient foramina and 1 bone had no nutrient foramina. We can conclude from the result both Forearm bones possess a nutrient foramina which enlightening to the resection in orthopedics and also for the bone grafting.

Keywords: Nutrient Foramina, Number, Radius, Ulna.

INTRODUCTION

The nutrient foramina are cavities that conduct the nutrient arteries and the peripheral nerves. The major blood supply for long bones originates from the nutrient arteries, mainly during the growing period and during the early phases of ossification [1-3]. Blood supply to the long bones in human body is by nutrient arteries, epiphysial arteries, metaphysial arteries and periosteal arteries [4]. Among these arteries, nutrient arteries play a major role by supplying inner 2/3rd of cortex and whole medulla of the diaphysis [5]. 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 [6]. In bone grafts, the nutrient blood supply is crucial and it should be preserved in order to promote fracture healing [7, 3]. Moreover, the presence of preserved nutrient blood flow is essential for the survival of the osteocytes in cases of tumor resection, traumas, and congenital pseudoarthrosis [2, 3].

MATERIALS AND METHODS

The study was conducted on 114 adult human forearm bones comprising 57 radii (34 right + 23 left) and 57 ulnae (26 right + 31 left), each irrespective of sex and age obtained from the Department of Anatomy, Integral Institute of Medical Science and Research and King George Medical University, Lucknow. The inclusion Criteria are dry adult human Radius and dry human ulna bones irrespective of sex & age and exclusion criteria are deformed bones, damaged bones and bones with callous formation.

In all these bones after determining their side, nutrient foramina were observed with the presence of a well-marked groove leading to the foramen, and often slightly raised edge of the foramen at the commencement of the canal, in doubtful cases hand lens was used to determine number. The foramina at the ends of the bone were ignored.

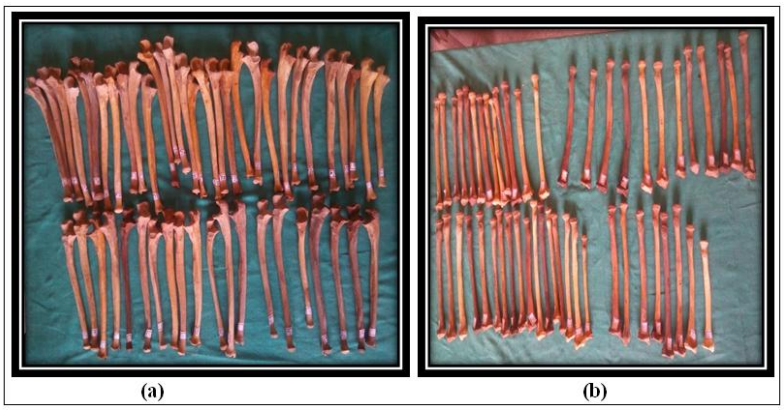

Fig-1: Ulnae (a) and Radii (b) used in the study as a material

OBSERVATION AND RESULTS

Table-1: Shows Number of Nutrient Foramina

Bone		NUMBER OF NUTRIENT FORAMINA			
		Absent	1	2	>2
Radius n=57	Right n=34	-	32(94.11%)	2(5.88%)	-
	Left n=23	-	23(100%)	-	-
	Total n=57	-	55(96.49%)	2(3.50%)	-
Ulna n=57	Right n=26	-	21(80.76%)	5(19.23%)	-
	Left n=31	01(3.22%)	29(93.54%)	01(3.22%)	-
	Total n=57	01(1.75%)	50(87.71%)	06(10.52%)	-
Total Forearm Bones n=114		01(0.87%)	105(92.10%)	08(7.01%)	-

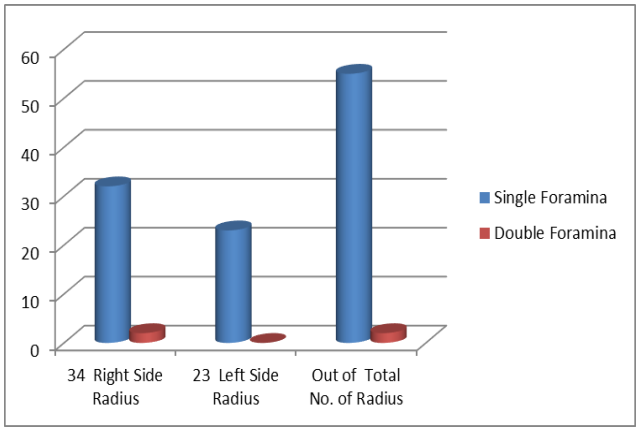

Fig-2: Number ofNutrient Foramina in radii

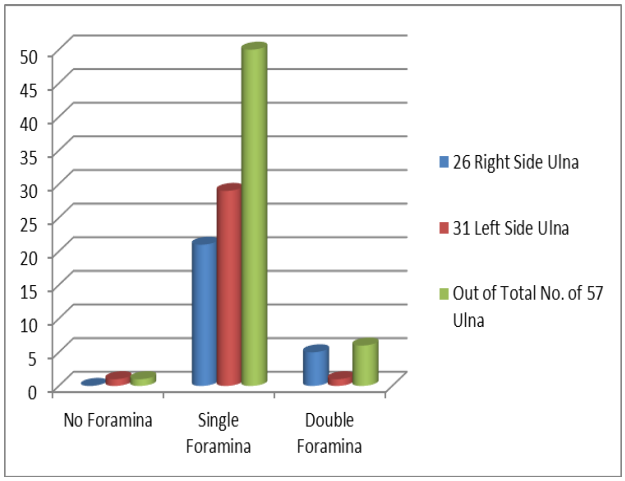

Fig-3: Number of Nutrient Foramina in Ulnae

Table-1 and its Fig 2 & 3 shows that out of total 57 radii, single nutrient foramina was found in 55 radii (96.49%) and double nutrient foramina in 2 radii (3.50%). Out of 57 ulnae, single nutrient foramina was found in 50 ulnae (87.71%) and double nutrient foramina in 06 ulnae (10.52%). The nutrient foramina was not found in 01 Ulna (1.75%). Out of 114 forearm bones studied, 105 bones (92.10%) had single nutrient foramina, 08 bones (7.01%) had double nutrient foramina and one bone had no Nutrient Foramina.

DISCUSSION

Table-2: Comparison of number of Nutrient Foramina of radius

S.NO	Author	Sample size	Absent	1	2	> 2
1	Mysorekar 1967 [10]	180	2.2%	93.3%	4.4%	0%
2	Pereira *et al*., 2011 [14]	157	0%	99.4%	0.6%	0%
3	Murlimanju *et al*., 2011 [11]	72	4.2%	94.4%	1.4%	0%
4	Arora *et al*., 2011 [15]	109	0%	98.17%	1.8%	0%
5	Sharma M *et al*., 2013 [12]	40	5%	80%	15%	0%
6	Anusha *et al*., 2013	50	1%	92%	6%	0%
7	Ukoha *et al*., 2013 [16]	50	32%	68%	0%	0%
8	Solanke *et al*., 2014 [17]	80	5%	92.5%	2.5%	0%
9	Gopalakrishna *et al*., 2014 [18]	110	0%	94.55%	5.45%	0%
10	Parmar *et al*., 2014 [8]	60	0%	96.6%	3.3%	0%
11	Roul Bichitrananda *et al*., 2015 [19]	37	0%	97.29%	2.7%	0%
12	Patel *et al*., 2015 [13]	40	0%	100%	0%	0%
13	Reddy *et al*., 2015 [9]	54	0%	96.3%	3.7%	0%
14	Rao *et al*., 2016 [20]	92	4.3%	86.9%	8.6%	0%
15	**Present Study 2017**	**57**	**0%**	**96.49%**	**3.5%**	**0%**

Table-3: Comparison of number of Nutrient Foramina of Ulna

S. No	Author	Sample size	Absent	1	2	>2
1	Mysorekar 1967 [10]	180	1.1%	93.3%	5.5%	0%
2	Pereira *et al*., 2011 [11]	146	0%	98.6%	1.4%	0%
3	Murlimanju *et al*., 2011 [11]	75	0%	100%	0%	0%
4	Sharma M *et al*., 2013 [12]	40	0%	95%	5%	0%
5	Anusha *et al*., 2013	50	0%	100%	0%	0%
6	Ukoha *et al*., 2013 [16]	50	22%	78%	0%	0%
7	Solanke *et al*., 2014 [17]	80	3.7%	96.25%	0%	0%
8	Parmar *et al*., 2014 [8]	60	0%	100%	0%	0%
9	Roul Bichitrananda *et al*., 2015 [19]	37	0%	100%	0%	0%
10	Patel *et al*., 2015 [13]	40	0%	92.5%	7.5%	0%
11	Reddy *et al*., 2015 [9]	50	0%	100%	0%	0%
12	Rao *et al*., 2016 [20]	98	12.3%	67.3%	20.4%	0%
13	Present Study 2017	57	1.75%	87.71%	10.52%	0%

Radii in Table-2, shows that in the present study, the highest percentage was that of single nutrient foramina (96.49%) while few double nutrient foramina (3.5%) were present, which is close to previous studies done by Parmar *et al*., [8] and Reddy *et al*., [9] Except, absence of nutrient foramina, was observed by Mysorekar [10], Murlimanju *et al*., [11] and Sharma M *et al*., [12] but not found in present observation.

Ulnae in Table-3, shows that absence of nutrient foramina in 1.75%, is close to observation of Mysorekar [10]. Also high percentage of single nutrient foramina (87.71%) while few double nutrient foramina (10.52%) were observed in the present study which is in similarity with Mysorekar [10], Sharma M *et al*., [12] and Patel *et al*., [13].

CONCLUSIONS

We can conclude from the result both Forearm bones possess a nutrient foramen which is key factor for the success of new techniques for bone transplant and resection in orthopedics.

REFERENCES

1. Lewis, O. J. (1956). The blood supply of developing long bones with special reference to the metaphyses. *The Journal of bone and joint surgery. British volume*, *38*(4), 928-933.
2. Sendemir, E., & Cimen, A. (1991). Nutrient foramina in the shafts of lower limb long bones: situation and number. *Surgical and Radiologic Anatomy*, *13*(2), 105-108.
3. Gümüsburun, E., Yücel, F., Ozkan, Y., & Akgün, Z. (1994). A study of the nutrient foramina of

lower limb long bones. *Surgical and Radiologic Anatomy*, *16*(4), 409-412.

4. Weinstein, S. L., & Buckwalter, J. A. (Eds.). (2005). *Turek's orthopaedics: principles and their application*. Lippincott Williams & Wilkins.
5. Chaurasia, B. D. (2009). Skeleton. Handbook of General Anatomy. New Delhi: C.B.S. (Ed 4th).
6. Trueta, J. (1974). Blood supply and the rate of healing of tibial fractures. *Clinical Orthopaedics and Related Research®*, *105*, 11-26.
7. Longia, G. S., Ajmani, M. L., Saxena, S. K., & Thomas, R. J. (1980). Study of diaphyseal nutrient foramina in human long bones. *Cells Tissues Organs*, *107*(4), 399-406.
8. Parmar, A. M., Vaghela, B., Shah, K., Patel, B., & Trivedi, B. (2014). Morphometric analysis of nutrient foramina in human typical long bones of upper limb. *Natl J Integr Res Med*, *5*(5), 26-29.
9. Reddy, G. R. M. K., Siddaramulu, C., & Bilodi, A. K. S. (2016). Morphometric Study of The Nutrient Foramina of Unknown Radius And Ulna And Their Clinical Importance In The Region of Kadapa [Rayalaseema], Andhra Pradesh. *Journal of Evid Based Med Health Care*. 3(27): 1222-1229.
10. Mysorekar, V. R. (1967). Diaphysial nutrient foramina in human long bones. *Journal of anatomy*, *101*(Pt 4), 813-822.
11. Murlimanju, B. V., Prashanth, K. U., Prabhu, L. V., Saralaya, V. V., Pai, M. M., & Rai, R. (2011). Morphological and topographical anatomy of nutrient foramina in human upper limb long bones and their surgical importance. *Rom J Morphol Embryol*, *52*(3), 859-862.
12. Sharma, M., Prashar, R., Sharma, T., & Wadhwa, A. (2013). Morphological Variations of Nutrient Foramina in upper limb long Bones. *International Journal of Medical and Dental Sciences*, *2*(2), 177-181.
13. Patel, S. M., & Vora, R. K. (2015). Anatomical study of nutrient foramina in long bones of human upper limbs. *IAIM*, *2*(8), 94-98.
14. Pereira, P. H. F., Voorwald, H. C. J., Cioffi, M. O. H., Mullinari, D. R., Da Luz, S. M., & Da Silva, M. L. C. P. (2011). Sugarcane bagasse pulping and bleaching: Thermal and chemical characterization. *BioResources*, *6*(3), 2471-2482.
15. Arora, S., Thornton, K., Murata, G., Deming, P., Kalishman, S., Dion, D., ... & Kistin, M. (2011). Outcomes of treatment for hepatitis C virus infection by primary care providers. *New England Journal of Medicine*, *364*(23), 2199-2207.
16. Ukoha, U. U., Egwu, O. A., Ezeani, M. C., Anyabolu, A. E., Ejimofor, O. C., Nzeako, H. C., & Umeasalugo, K. E. (2013). Estimation of stature using footprints in an adult student population in Nigeria. *IJBAR*, *4*, 827-833.
17. Solanke, B. L. (2014). Association between intimate partner violence and utilisation of maternal health services in Nigeria. *African Population Studies*, *28*, 933-945.
18. Gopalakrishna, S., Mandal, T., Mitra, S., & Moreau, G. (2014). LHC signatures of warped-space vectorlike quarks. *Journal of High Energy Physics*, *2014*(8), 79.
19. Khare, S., Chatterjee, M., Roul, B., & Mandle, H. (2015). Estimation of Gestational Age by Real Time Ultrasonography (Biparietal Diameter and Head Circumference) to Estimate the Fetal Morphometry in IInd and IIIrd Trimester. *Indian Journal of Anatomy*, *4*(3), 123.
20. Rao, S., Kota, L. N., Li, Z., Yao, Y., Tang, J., Mao, C., ... & Xu, Q. (2016). Accelerated leukocyte telomere erosion in schizophrenia: Evidence from the present study and a meta-analysis. *Journal of psychiatric research*, *79*, 50-56.