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Research Article

ANATOMICAL LOCATION OF NUTRIENT FORAMINA OF HUMERUS INFERENCE TO MICROVASCULAR BONE GRAFT AND DELAYED UNION IN OPEN FRACTURE REDUCTION: A MORPHOMETRIC STUDY OF THE HUMERUS OF THE TANZANIAN ADULTS

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ABSTRACT

The blood supply to the bone is through the nutrient foramina. These foramina are located in the shaft of long bones. Understanding the Anatomy of foramina is important, as it applies in surgical procedures such as microvascular bone grafts and open fracture reductions. The purpose of the study was to determine the position, number of nutrient foramina, foramina index, length and mid circumference of the humerus among Tanzanian Adults. The study was conducted at Muhimbili University and St.J oseph University dissection rooms; we used 74 dried humeral bones. We found that the majority of the foramina were located at the middle third of the humerus; most in the posterior medial (47.3%) and medial side (24.3%) of the shaft of humerus. Few (5.4%) bones had no foramina and majority (87.8%) has single foramina. The Anatomy of nutrient foramina is variant, awareness of the variations is important for surgical precision. Few studies have been conducted in black population and none have included both parameters in a single bone. This is the first study to assess the morphology and topography of the humerus in Tanzanian adults.

INTRODUCTION

The blood supply to the bone is about 10% of the cardiac output. Vascular supply of the bone is essential for delivery of nutrition, oxygen and several regulatory factors. It is also important for the removal of carbon dioxide and other waste products of metabolism. Reduced blood supply will result into bone loss, reduced bone formation due to reduced osteoblast function and reciprocal osteoclatogenesis (Marenzana *et al*, 2013). The healing of fractures, the growth of long bones, and early ossification depends on the nutrient arteries (Pereira *et al*, 2011).

Endosteal cavity receives blood supply from nutrient arteries. These arteries enter through the nutrient foramina which are located in the diaphysis of long bones. Upper limb and lower limb long bones are supplied by these nutrient arteries. When these arteries enter the medullary cavity blood flows through the marrow sinusoids. Several studies have demonstrated the Anatomy of bone blood supply by describing the morphology and nutrient foramina to cite few examples (Simpson,1985; Al-Motabagani, 2002).

Knowledge of blood supply of long bones is important for microvascular bone graft. This is to ensure adequate circulation post-surgery (Rizzo *et al*, 2008; Prashanth *et al*, 2011). In addition the morphological knowledge is important during open surgical procedure particularly in open fracture reductions. This is to ensure that we don't injure the nutrient arteries. Injury of the nutrient artery will result into delayed union or non-union of fractures. Few studies (Mysorekar, 1967; Prashanth *et al*, 2011; Pereira *et al*, 2011) have demonstrated different locations of nutrient foramina in human long bones, however this much needed knowledge have been overlooked in the research arena especially from people of African descent. This study therefore intended to understand the number and position of nutrient foramina, length, foramina index, mid-humeral circumference of the humerus. Location of the nutrient foramina of the humerus among Tanzanian adults is mostly unknown.

MATERIALS AND METHODS

The study was conducted at Muhimbili University and St.Joseph University, Department of Anatomy dissection rooms. We used

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74dried humeral bones. Among these bones; 38 were from the left side and 36 were from the right side. The bones included in this study were normal with no any abnormalities or pathological changes. Age and sex were not determined. We investigated the foramina at the diaphysis. After the foramina identification we marked the foramina using marker pen and put a tie at the point of the foramina. Pictures were taken by using 10 Megapixels camera. We measured the total bone length and the distance from the proximal part of the bone to the Nutrient foramina by using the Verniercaliper and tape measure. We investigated their patency by using the small needle of 24 gaugecaliber. For the bones with double foramina or multiple foramina the largest foramina were taken into consideration. The circumference was measured by using tape measure at the mid- point of the shaft of the bone. The Anatomical locations of the foramina were also determined by first putting the bone into the anatomical position and identifying the side of the foramina by using the conventional anatomical terms of references. Therefore, we determined the number of foramina and the surface allocation. The foramina within 1mm was taken to be within the border, and that outside 1mm were taken to be out of the border, the borders are anterior, posterior, lateral and medial.

We calculated the foramina index to determine the position of the foramina whether proximal third, middle third or distal third. The foramina index was calculated by taking the distance from the proximal end of the bone to the location of nutrient foramina divided by total bone length times 100(FI=D/L X100). All the measurements were taken in nearest millimeters by using the Verniercalliper and tape measure. Data entry and analysis were done by SPSS version 20.

RESULTS

The results obtained are summarized in Figures and Tables below

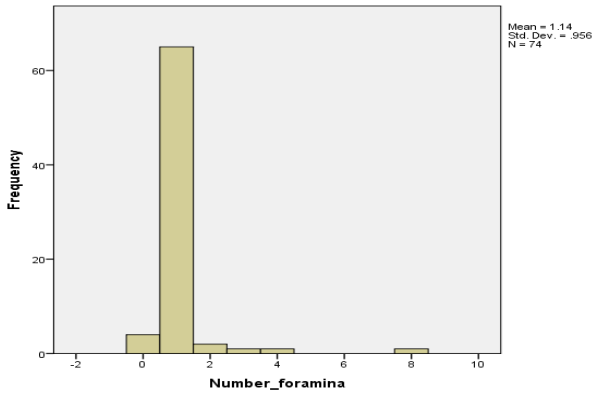

Figure 1 Histogram showing the results depicted in table 2 above

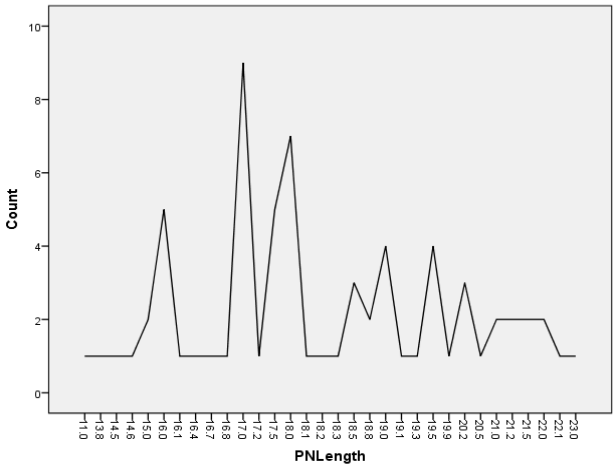

Figure 2 Showing a distance from the proximal end to the Nutrient foramen of the bones used in the study against the number of bones

Table 1 Shows different location of the foramina in the right and the left humerus: From the table above most of the foramina were located at the posterior medial side (47.3%).

			Position of _foramina						Total
			0	Medial	Anterior medial	Anterior Lateral	Posterior	Posterior medial	
side	Right	Count	3	12	8	1	2	10	36
		% within side	8.3%	33.3%	22.2%	2.8%	5.6%	27.8%	100.0%
	Left	Count	1	6	0	0	6	25	38
		% within side	2.6%	15.8%	0.0%	0.0%	15.8%	65.8%	100.0%
Total		Count	4	18	8	1	8	35	74
		% within side	5.4%	24.3%	10.8%	1.4%	10.8%	47.3%	100.0%

Table 2 Shows number of foramina: From the table 2 above most (87.8%) of the bones have single foramina

Number of foramina		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	4	5.4	5.4	5.4
	1	65	87.8	87.8	93.2
	2	2	2.7	2.7	95.9
	3	1	1.4	1.4	97.3
	4	1	1.4	1.4	98.6
	8	1	1.4	1.4	100.0
	Total	74	100.0	100.0	

Table 3 Measurements of central tendency and spread for Foramina index: The table 3 above shows the mean foramina index is 57.8%.

Foramina Index		
N	Valid	70
	Missing	4
Mean		57.8609
Median		57.9978
Mode		56.25
Std. Deviation		5.90943
Variance		34.921
Range		36.39
Minimum		35.48
Maximum		71.88

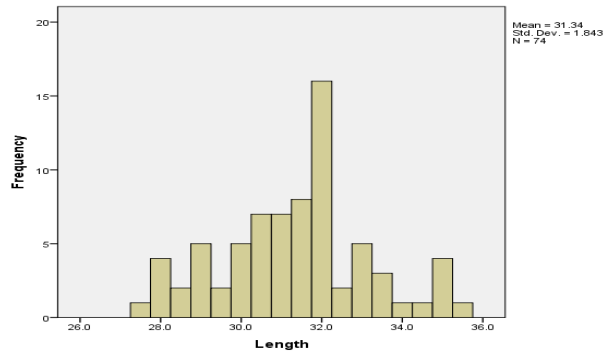

Figure 3 Histogram showing the Total length(cm) of the bones used in the study against their frequency in which most of the boneswas having an average length of 31.34cm

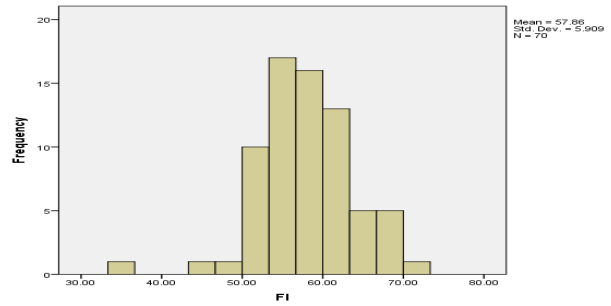

Figure 4 Histogram showing the Foramina Index(FI) with corresponding frequency of occurrence; in most of the bones FI was ranging from 50-60 with an average of 57.86 as it is shown above.

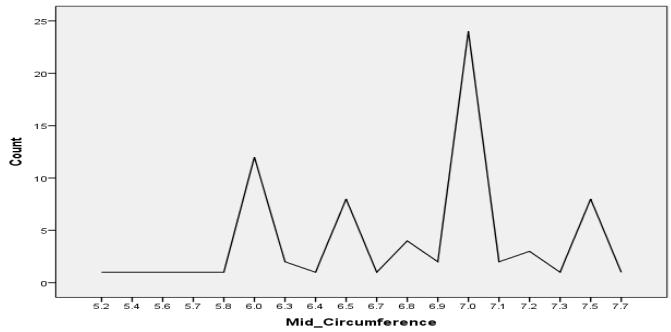

Figure 5 Showing the Mid-circumference of which most of the bones were having 7.0cm

Figure 6 Pictures above showing Humerus bones with different lengths and foramina positions marked by the black arrow.

DISCUSSION

In one of the study conducted in India shows the position of the foramina were located mostly at the middle third, in about 86(65%) of these 105(80.1%) were located at the anterior medial surface of the bone (Ojaswini *et al*, 2011). In another study in India out of 179 humerus, 75 (42 %) had more than one foramen. In the same study of all of the foramina 106 (40 %) were on the anteromedial surface of the bone. In a different study, 101 (40 %) were located at the on the medial border, and only 50 (19 %) in the spiral groove. About (75) having multiple foramina, 38(51 %) had one each in the spiral groove and on the anteromedial surface or medial border. In one specimen there were as many as three foramina in the spiral groove (Mysorekar,1967).

Other studies have shown the foramina were located at Medial anterior surface in 156(89.7%) with most of the bones 154 (88%) having a single foramina, the foramina index analysis mean were 55.2 which means most of the foramina are located on the middle third (Pereira *et al*, 2011). The study among Nigerians humeral morphology shows 99(66%) has single foramina 12(8%) has double foramina, most foramina were located at the anterior medial surface109 (90.8%) and most were positioned at the middle third (FI=56.28) (Ukoha *et al*, 2013). Our study shows the mean foramina index is 57.8 which differs slightly from the previous studies. Single foramina accounts to 65(87.6%), which is higher as compared to other studies. Most of the foramina were located at the posterior medial in 35(47.3%), this is different from previous studies from other regions in which most of the foramina were located on the anterior medial surface.

CONCLUSION

Our study has shown that most of the foramina are single and located at the middle third of the humerus. This position of the humerus should be taken into consideration during open fracture reductions involving the middle third of the humerus so as to prevent nutrient artery damage. This will ensure continuous irrigation of the bone post reduction and hence fast healing.

References

1. Marenzana Massimo, Arnett Timothy R,(2013). The Key Role of the Blood Supply to Bone. *Nat Publ Gr Bone research*;1(3):203-215.
2. Pereira, G. A. M.; Lopes, P. T. C.; Santos, A. M. P. V. & Silveira, F. H. S,(2011). Nutrient Foramina in the Upper and Lower Limb Long Bones : Morphometric Study in Bones of Southern Brazilian Adults. *Int. J. Morphol*;29(2):514-520.
3. Simpson Hamish,(1985). The blood supply of the periosteum. *J Anat*;140 (4):697-704.
4. Al-Motabagani, M.A.H,(2002).The Arterial Architecture Of The Human Femoral Diaphysis. *Journal of the Anatomical Society of India*;51(1):27-31.
5. Rizzo M, Moran SL,(2008). Vascularized Bone Grafts and Their Applications in the Treatment of Carpal Pathology;1(212):213-227.
6. Prashanth KU, Murlimanju B V, Prabhu L V, Kumar CG, Pai MM, Dhananjaya KVN,(2011). Morphological and topographical anatomy of nutrient foramina in the lower limb long bones and its clinical importance. *Australasian Medical Journal*;4(10):530-537.
7. Mysorekar VR,(1967). Diaphysial nutrient foramina in

human long bones.*J. Anat.*, 101, 4:813-822.
8. Ojaswini Malukar, Dr. Hemang Joshi,(2011). Diaphysial Nutrient Foramina In Long Bones And Miniature Long Bones.NJIRM;Vol 2(2):23-26.
9. Ukoha Ukoha Ukoha, Kosisochukwu Emmanuel Umeasalugo, Henry C Nzeako, Damian N Ezejindu,Obioma C Ejimofor, Izuchukwu F Obazie, (2013). A study of nutrient foramina in long bones of nigerians.*National journal of medical research*; 3(4):304-308.

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