



## Variation in Number and Position of Nutrient Foramen of Clavicle - A Morphological Study in Telengana State

### KEYWORDS

Clavicle, nutrient foramina, periosteal arteries, neurovascular foramina.

\* Dr. K.R.S.PRASAD RAO

Dr.V.JANAKI

Associate Professor of Anatomy, , GVP Institute of Health Care and Medical Technology, Marikavalasa, Madhurawada, Visakhapatnam-530048,  
\* CORRESPONDING AUTHOR

Assistant Professor of Anatomy, , Osmania Medical College, Hyderabad, Telangana State. India.

**ABSTRACT** **INTRODUCTION:** The clavicle (collar bone) is an unusual long bone which has many unique embryologic features. The main aim of this study is to find variation in number and position of nutrient foramen of the human clavicle which enlightens the operating surgeon in the free vascularised bone grafts and in microsurgical vascularised bone transplantation. **MATERIAL AND METHODS:** 58 (32 on left side & 26 on right side) adult dry human clavicles collected in the department of Anatomy, irrespective of sex and age were studied macroscopically with help of magnifying glasses the data were collected and morphologically analyzed. **OBSERVATIONS AND RESULTS:** neurovascular foramina were observed in all clavicles. The foramen was single in 28 (48.3%) clavicles, double in 19 cases (32.7%) and 5 clavicles (8.3%) had 3 foramina, 6 clavicles had more than 3 foramina (10.3%). In 51 clavicles (89%), the foramen was observed in the medial 2/3rd of length of the bone. In 7 clavicles (11%), the foramen was in the lateral 1/3 of length of the bone. The average distance of the foramen from the sternal end was 6.23cm. In 29 (50%) of the clavicles, the foramen was on the posterior surface. Whereas 24 (40.3%) clavicles, the foramen was observed on the inferior surface. In 4 clavicles (6.9%) had the foramen at its superior surface. Only in 1 clavicle (2.7%) nutrient foramen was present on anterior surface. **CONCLUSION:** The present study showing the presence of nutrient foramen in the posterior surface in significant number of cases contradicts the classical textbook presentation as on in its inferior surface. Knowledge of the localization of nutrient foramina can be useful in certain surgical procedures to preserve the circulation to bone

### INTRODUCTION

The clavicle (collar bone) is an unusual long bone which has many unique embryologic features. It was described that a small foramen may be present in the middle one third of the clavicle, along its superior border. This foramen transmits the nutrient artery and at times, the supraclavicular nerve.[1] In contrast, Knudsen et al.[2] reported that clavicle is supplied by periosteal arteries and the nutrient artery is not found. However few authors[3, 4] suggested that suprascapular artery supplies the middle third region of the clavicle by a nutrient branch. They stated that the nutrient foramen of the clavicle is found at the junction between the lateral and middle third regions. In the radiological literature it was described that this foramen transmits medial fascicle of the supraclavicular nerve. Anatomically it was described that this foramen was present in 2-6% of the population.[5] Other than these few reports, the previous data on the foramina of the clavicle are not found. The knowledge of the neurovascular foramina of the clavicle is clinically important as these are involved in the supraclavicular nerve entrapment syndrome.[6] The knowledge of these foramina is enlightening for the operating surgeon in the free vascularised bone grafts and in microsurgical vascularised bone transplantation. The aim of the present study is to study the variations in number and position of the neurovascular foramina in human adult clavicles.

### MATERIALS AND METHODS

The study included 58 adult clavicles (26 right sides and 36 left side) which were obtained from the department of the Anatomy. The age and sex of the clavicles were not determined. All the bones were macroscopically observed for the number, location and direction of the nutrient foramina. A magnifying lens was used to observe the foramina. The data were collected and morphologically analyzed. The distance of foramina from sternal end was also de-

termined. The mean length of the clavicle also was determined.

### OBSERVATIONS AND RESULTS

In the present study we observed the neurovascular foramina in all the clavicles. All the foramina were directed towards the Acromial end which gives the idea that Sternal end of clavicle is the growing end. The foramen was single in 28 (48.3%) clavicles, double foramina present in 19 cases (32.7%) and triple foramina present in 5 clavicles (8.3%), 6 clavicles have more than 3 foramina (10.3%). In 51 clavicles (89%), the foramen was observed in the medial 2/3rd length of the bone. In 7 clavicles (11%), the foramen was in the lateral 1/3 of the bone. The average distance of the foramen from the sternal end was 6.85cm. The mean length of clavicle was 13.7cm. In 29 (50%) of the clavicles, the foramen was on the posterior surface. Whereas 24 (40.3%) clavicles, the foramen was observed on the inferior surface. In 4 clavicles (6.9%) had the foramen at its superior surface. Only in 1 clavicle (2.7%) nutrient foramen was present on anterior surface. Out of 58 clavicles 30 clavicles (52%) have additional nutrient foramina in addition to main nutrient foramina.

### DISCUSSION

Nutrient arteries which are the main blood supply to long bones are particularly vital during the active growth period and at the early phases of ossification.[7] These nutrient arteries pass through the nutrient foramina, the position of nutrient foramina and the direction of nutrient canal in mammalian bones are variable and may alter during the growth.[8] There are few studies available which reported the morphology of nutrient foramina of upper limb, lower limb long bones,[9, 10] metacarpal, metatarsal bones[11] and phalanges.[12] But the detailed study reporting the morphology of the foramina of the clavicle has not been reported hitherto. Knudsen et al. reported that

clavicle gets the nourishment by the suprascapular, thoracoacromial and internal thoracic arteries. According to these authors the clavicle is supplied by periosteal arteries and not by the nutrient artery. Unlike other long bones, it does not have a medullary cavity[13] and is therefore does not dependent on a nutrient artery. Few authors hypothesize that with respect to the development of the clavicle, there could be nutrient artery to the primary centers of ossification and to the late secondary center at the sternal end of the clavicle.

In the present study we observed the neurovascular foramina in all the clavicles. In All the clavicle foramina were directed towards the acromial end which gives the idea that sternal end of clavicle is the growing end. The present study supports the reports of Fischer and Carret,[3] Kumar et al.[1] and Havet et al.[4] that the clavicle has nutrient foramina and supplied by the nutrient artery . This study also supports the reports of Rahul Rai and Shailaza Shrestha[14] that the average distance of the foramen from sterna end lies between 6-7cm, in the present study also we got the same. We observed multiple neurovascular foramina in 30 clavicles out of 58 clavicles. In The present study also studied the topography of these foramina, 51 clavicles (89%), the foramen was observed in the medial 2/3<sup>rd</sup>S . In 7 clavicles (11%), the foramen was in the lateral 1/3<sup>rd</sup> . Standard text books of anatomy state that the foramina were present at the inferior surface. But in the in the present study we observed that, in 29 (50%) of the clavicles, the foramen was on the posterior surface . Whereas 24 (40.3%) clavicles, the foramen was observed on the inferior surface . In 4 clavicles (6.9%) had the foramen at its superior surface .only in 1 clavicle(2.7%) nutrient foramen present on anterior surface. Out of 58 clavicles 30 clavicles (52%) had additional nutrient foraminas in addition to main nutrient foramina. Havet et al described the arterial supply of the clavicle to clarify the pathological mechanism and the surgical procedure of non-unions. They reported that periosteal artery was always present on the superior surface and anterior border of the clavicle, but never on the inferior surface or posterior border. Jelev L, Surchev L (2007)[15] and StudyShohei et al.[16] reported that they have treated two patients who had entrapment neuropathy of the supraclavicular nerve attributable to an osseous tunnel of the clavicle and decompression of the entrapped nerve relieved symptoms in both patients.

**CONCLUSION**

The present study has provided additional information about the the variations in number and position of the neurovascular foramina in human adult clavicles . In the classical anatomy text books, it was described that this foramen is present on its inferior surface. But our findings suggest that it is more common on its posterior surface. The foramina often multiple and directed towards the acromial end.

**TABLE-1:DISTRIBUTION OF NUTRIENT FORAMINA IN CLAVICLE**

Side of clavicle	Total no of clavicles	Presence of nutrient foramina on medial-2/3 <sup>rd</sup>	Presence of nutrient foraina on lateral-1/3 <sup>rd</sup>	No of clavicles more than one foramina
Rt.clavicle	26	25	1	10
Lt.clavicle	32	26	6	20
total	58	51	7	30

**TABLE-2: DISTRIBUTION OF ADDITIONAL AND NUTRIENT FORMINA IN CLAVICLE**

Side of clavicle	Total no of clavicles	Single foramina	Double foramina	Triple foramina	More than three foramina
Rt.clavicle	26	16	8	1	1
Lt.clavicle	32	12	11	4	5
Total	58	28	19	5	6

**TABLE-3 : LOCATION OF NUTRIENT FORAMINA IN CLAVICLE**

Side of clavicle	Medial				Lateral1/3 <sup>rd</sup>		Total
	2/3 <sup>rd</sup> Superior surface	inferior surface	posterior surface	anterior surface	Superior surface	Inferior surface	
Rt.clavicle	2	10	13			1	26
Lt.clavicle	1	07	16	1	1	6	32
Total	3	17	29	1	1	7	58



**Figure:1 A-showing 2foramina, B- showing 3foramina, C-having 4 foramina, D-having 5foramina (above downwards)**

**REFERENCES**

1. Kumar R, Lindell MM, Madewell JE, David R, Swischuk LE (1989) The clavicle: Normal and abnormal. Radiographics 9: 677-706.
2. Knudsen FW, Andersen M, Krag C (1989) The arterial supply of the clavicle. Surg Radiol Anat 11: 211-214.
3. Fischer LP, Carret JP (1978) Vascularisation artérielle des os chez l'homme. Bull Assoc Anat 62: 419-454.
4. Havet E, Duparc F, Tobenas-Dujardin A-C, Muller J-M, Delas B, Freger P (2008) Vascular anatomical basis of clavicular non-union. Surg Radiol Anat 30: 23-28.
5. Freyschmidt J, Sternberg A, Brossmann J, Wiens J (2003) Borderlands of normal and early pathological findings in skeletal radiography, 5th edn. Thieme, New York, p 305-318.
6. Gelberman RH, Verdeck WN, Brodhead WT (1975) Supraclavicular nerve-

entrapment syndrome. *J Bone Joint Surg Am* 57: 119.

7. Kizilkanat E, Boyan N, Ozsahin ET, Soames R, Oguz O (2007) Location, number and clinical significance of nutrient foramina in human long bones. *Ann Anat* 189: 87-95.
8. Henderson RG (1978) The position of the nutrient foramen in the growing tibia and femur of the rat. *J Anat* 125: 593-599.
9. Forriol Campos F, Gomez L, Gianonatti M, Fernandez R (1987) A study of the nutrient foramina in human long bones. *Surg Radiol Anat* 9: 251-255.
10. Gumusburun E, Yucel F, Ozkan Y, Akgun Z (1994) A study of the nutrient foramina of lower limb long bones. *Surg Radiol Anat* 16: 409-412.
11. Patake SM, Mysorekar VR (1977) Diaphysial nutrient foramina in human metacarpals and metatarsals. *J Anat* 124: 299-304.
12. Mysorekar VR, Nandedkar AN (1979) Diaphysial nutrient foramina in human phalanges. *J Anat* 128: 315-322.
13. Standring S (ed) (2006) *Gray's Anatomy. The anatomical basis of clinical practice*, 39th edn, Churchill livingstone, Spain, p 817-818.
14. Rahul Rai, Shailaza Shrestha, B Kavitha (jan.2014) Morphological and topographical anatomy of nutrient foramina in human clavicles and their clinical importance. *IOSR-JDMS* vol: 13, issue: 1 Ver.4(jan.2014), pg no.37-40.
15. Jeleu L, Surchev L (2007) Study of variant anatomical structures (bony canals, fibrous bands and muscles) in relation to potential supraclavicular nerve entrapment. *Clin Anat* 20: 278-285.
16. Shohei O, Yasuhito T, Yoshizumi M, Tatsuya K, Yoshinori T (2005) Traction neuropathy of the supraclavicular nerve attributable to an osseous tunnel of the clavicle. *Clin Orthop Relat Res* 431: 238-240.