

TOPOGRAPHIC ANATOMY AND MORPHOLOGY OF NUTRIENT FORAMEN OF THE CLAVICLE -AN OSTEOLOGICAL STUDY.

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ABSTRACT

There are few studies available which reported the morphology of nutrient foramina of upper limb, lower limb long bones^{1,2} metacarpal, metatarsal bones³ and phalanges⁴. But the detailed study reporting the morphology of the foramina of the clavicle has not been reported hitherto. The present study aimed to evaluate the topographic anatomy and morphology of the nutrient foramen of clavicle with respect to its number, location (region, surface) and direction. The study was conducted in 106 clavicles, nutrient foramen was absent in 1.88% cases, and in (75.47%) it was situated on the posterior surface. In two clavicles (1.89%) the growing end was acromial as the direction of the nutrient foramen was towards the sternal end.

Keywords: clavicle, nutrient foramen, morphology

INTRODUCTION

The clavicle (collar bone) is an unusual long bone which has many unique embryological features. It is the first bone to ossify and is intramembranous in origin⁵. It is a horizontally placed, 'f' shaped, tubular bone that connects the appendicular and axial skeletons. Normally the nutrient foramen lies in the lateral one-third, on the inferior surface lateral to the subclavian groove and is laterally inclined, variation may occur with regard to its number, situation and direction, and it is not uncommon to find multiple foramina, which are more at the junction between the middle and lateral thirds.

The topography and morphology of these foramina is enlightening for the operating surgeon in the free vascularised bone graft.

The present study aimed to evaluate the topographic anatomy and morphology of the nutrient foramen of clavicle with respect to its number, location (region, surface) and direction in this part of population

MATERIALS AND METHODS

The study included 106(61 right sides, 45 left) adult intact clavicles of unknown sex and age, obtained from the osteology section of the anatomy department of LLRM Medical College Meerut. Damaged bones and bones showing pathological changes were excluded from this study. 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, and a

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probe was used to ascertain the direction. The data were collected on a standardized sheet and morphologically analyzed.

OBSERVATION AND RESULT

The nutrient foramina were present in 104 (98.11%) clavicles, and absent in 2(01.89%) clavicles. The foramen was single in 38 (35.84%) clavicles, double in 47 (44.33%) and more than two in 19 (17.92%) clavicles (Fig. 2B). In 92 (86.79%) clavicles, the foramen was observed in the middle 1/3 region (Fig. 2A). In 7 (06.60%) clavicles, the foramen was at the medial 1/3 region (Fig. 2B) and in 5 (4.70%) clavicle, it was seen on the lateral 1/3 (Fig. 2C). In 21 (19.81%) of the clavicles, the foramen was on the inferior surface (Fig. 1B). Whereas in 80 (75.47%) clavicles, the foramen was observed on the posterior surface (Fig. 1A). Only 3 clavicles (2.83%) had the foramen at its superior surface (Fig. 1C). In 102 (96.23%) clavicles, the foramina were directed towards the acromial end, and in 2 (01.89%) clavicles, it was directed towards the sternal end, which implies that the growing end was acromial. This is a variation as normally the growing end is sternal. Such an observation has not yet been reported. The topographical distribution of the nutrient foramina is summarized in Table. 1

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 ossification⁶. 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 growth⁷. Knudsen et al.⁸ opined 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. The nutrient foramen was explained as the site of major venous drainage. The absence of nutrient artery to the clavicle as found in 2(01.89%) clavicles may be explained by the fact that, unlike other long bones, it does not have a medullary cavity⁹ and is therefore does not dependent on a nutrient artery⁸. Few authors hypothesize that with respect to the development of the blood supply to 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 clavicle⁸, this probably may be responsible for the presence of more than one nutrient foramina.

In the present study, the nutrient foramina observed in 98.11% of the clavicles, 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 Carret¹⁰, Kumar et al.⁵ and Havet et al.¹¹ that the clavicle has nutrient foramina and supplied by the nutrient artery. Standard text books of anatomy state that the foramina were present at the inferior surface. But in the present study we observed that, in 75.47% the foramina were present on the posterior surface (Fig. 1A) and were present on the inferior surface in 19.81% of the clavicles (Fig. 1B). Only 02.83% clavicle had foramen on

Table 1. Showing the topographical distribution of the NF (NF – nutrient foramina)

Topographical Distribution Number of Clavicle (N=104)

Number of foramina	Single 38 (35.84%)	Double 47 (44.33%)	Multiple 19 (17.92%)
Region of clavicle	Middle1/3 92 (86.79%)	Medial1/3 7 (06.60%)	Lateral1/3 5 (04.71%)
Surface of clavicle	Inferior surface 21 (19.81%)	Posterior surface 80 (75.47%)	Superior surface 3 (02.83%)
Direction of NF	Acromial end 102 (96.22%)	Sternal end 2 (01.89%)	

Figure legends



Afig 1. Clavicles showing the nutrient foramen (arrow mark) A. at the posterior surface; B. at the inferior surface; C. at the superior surface.



Fig 2. Clavicles showing the nutrient foramen (arrow mark) A. at the middle 1/3 region; B. at the medial 1/3 region, C. at the lateral 1/3 region
*Multiple foramina

its superior surface (Fig. 1C). These results are close to the study done by Maluker et al¹²

The middle third region of the clavicle is most commonly involved in any type of injury and account for 5–10% of all fractures in adults¹¹. In 92 clavicles (86.79%) the nutrient foramina were situated in the middle one- third of the clavicle, which supports the study of Maluker (84%) but it is in contrast to the classical text books like Gray's which state it to be present predominantly in lateral one third, which was only (4.71%) in our study, this difference might be due to geographical and racial distribution.

CONCLUSION

The neurovascular foramina of the clavicle are clinically important as these are involved in the supraclavicular nerve entrapment syndrome¹³ Knowledge of the localization of nutrient foramina can be useful in certain surgical procedures to preserve the circulation, as microvascular bone transfer is becoming more popular. The present study has provided additional information about the topographical anatomy and morphology of the foramina of this bone which can be enlightening for procedures like bone grafting, internal fixation and coracoclavicular ligament repair.

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