ISSN : 2949 - 9100

International Journal of Health and Dentistry Care (IJHDC)

IJHDC : Health and Dental Publication
Available Online at: www.ijhdc.com
Volume – 4, Issue – 3, May – June – 2025, Page No. : 22 – 26

An Evolution Study of Morphometric and Topographic Nutrient Foramen in human clavicle

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Citation This Article: Alder V. Atansever, "An Evolution Study of Morphometric and Topographic Nutrient Foramen in human clavicle", IJHDC – May – June – 2025, Volume. – 4, Issue – 3, P. No. 22 – 26.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: The term clavicle is derived from the Latin word clavis, a nutrient foramen is an opening in the bone through which blood vessels pass into the medullary cavity, facilitating growth and nourishment. Morphological and morphometric studies of the nutrient foramen are valuable for anatomists, forensic experts, anthropologists, and orthopaedic surgeons.

Aims and Objectives: To estimate the number, position, location, and direction of nutrient foramina in human clavicles.

Materials and Methods: The present study was conducted on 36 dry adult human clavicles of unknown age and sex, obtained from the Department of Anatomy.

Results: Nutrient foramina were present in all 36 (100%) clavicles. A total of 44 foramina were observed. A single foramen was found in 78% of clavicles, two foramina in 17%, and three foramina in 5%. Most foramina were located on the inferior surface, predominantly in the middle third of the clavicle.

Conclusion: Nutrient foramina play a crucial role in surgical and orthopaedic procedures such as bone grafting and microsurgical vascularized bone transplantation.

Keywords: Blood Vessels, Transplantation, Morphometric, Microsurgical Vascularized.

Introduction

The clavicle is the first bone to undergo primary ossification, beginning in the 5th or 6th week of intrauterine life, and is also the last bone to complete ossification. A nutrient foramen is usually located in the diaphysis and provides passage for blood vessels into the medullary cavity, thereby ensuring nourishment and development.

In the clavicle, the nutrient foramen is typically found lateral to the subclavian groove on the inferior surface, transmitting the nutrient artery derived from the suprascapular artery.

Topographical knowledge of nutrient foramina is essential during radiation therapy to preserve arterial

supply. Furthermore, variations in the foramina are important when placing internal fixation devices in clavicular fractures. Their morphology and position are of particular significance in surgical procedures such as bone grafting and microsurgical vascularized bone transplantation.

Aims and Objectives

To estimate the number, position, direction, and location of nutrient foramina in 36 dry adult human clavicles.

Materials and Methods

The study was carried out on 36 dry adult clavicles of unknown age and sex, obtained from the Department of Anatomy.

Number: The number of nutrient foramina present in each clavicle.

Location: The shaft was divided into three segments—medial one-third, middle one-third, and lateral one-third—and the location of foramina was noted accordingly.

Position: The position of foramina was noted in relation to the anterior, superior, inferior, and posterior surfaces.

Direction: The direction was examined to determine whether the foramen was directed toward or away from the acromial end.

Results

In the present study, nutrient foramina were observed in all 36 clavicles (100%). Out of these, a single foramen was present in 28 clavicles (78%) {figure 1, 2, 3}, two foramina in 6 clavicles (17%) {figure 4, 5}, and three foramina in 2 clavicles (5%). The majority of foramina were located on the inferior surface, most commonly in the middle one-third of the clavicle.

A total of 36 clavicles were examined in the study. Of these, 20 were right clavicles and 16 were left clavicles. The majority of the clavicles, 28 out of 36, had a single nutrient foramen. This accounted for 75% of the right clavicles and 81% of the left clavicles. Six clavicles had two foramina, while only two clavicles had three foramina shown in table 1.

In a total of 36 clavicles with 44 nutrient foramina, the study found a strong concentration on the anterior surface. Specifically, 36 of the foramina, or 82%, were located on the anterior surface. This was consistent across both sides, with 80% on the right and 84% on the left. The remaining 8 foramina (18%) were found on the posterior surface, with 5 on the right and 3 on the left. No nutrient foramina were found on the superior or inferior surfaces shown in table 2.

The study analyzed the location of 44 nutrient foramina and found that most were in the middle third of the clavicle. A total of 36 foramina (81%) were located in this section. The distribution was very similar on both sides, with 80% on the right and 84% on the left clavicles. A smaller number of foramina were found in the lateral third (11%) and the medial third (7%) of the clavicle. These findings align with earlier studies that also found the majority of foramina in the middle third shown in table 3.

The study observed that all 44 nutrient foramina were directed towards the acromial end of the clavicle. This was a consistent finding across all 36 bones examined. The right clavicles had 25 foramina, and all were directed towards the acromial end. Similarly, the 19 foramina found on the left clavicles were also all directed towards the acromial end. This result is in agreement with findings from other studies on the direction of nutrient foramina shown in table 4.

Discussion

Nutrient arteries are the vital origin of blood supply to the bones. The topographical knowledge of nutrient

foramen is useful in certain operative procedures in orthopaedics, as well as in plastic and reconstructive surgery.

In present study, the total number of nutrient foramen observed was 44. Out of which 25 nutrient foramen were present in right sided clavicle bones and 19 were present in left sided clavicle bones. Most of clavicles (78%) showed the presence of a single nutrient foramen.

Figure 1

Figure 2

Figure 3

Figure 4

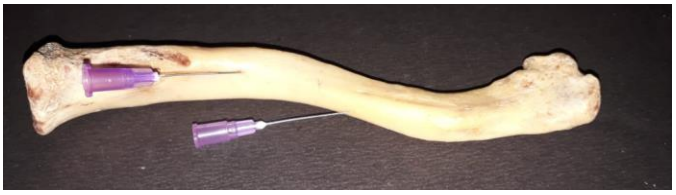

Figure 5

Table 1: Number of nutrient foramen

No. of nutrient foramen	Right clavicle (n=20)	Left clavicle (n=16)	Total (n=36)
One	15 (75%)	13 (81%)	28 (78%)
Two	3 (15%)	3 (19%)	6 (17%)
Three	2 (10%)	0 (0%)	2 (5%)
Total	20	16	36

Table 2: Distribution of nutrient foramina according to position

Side	No. of bones	No. of nutrient foramina	Position of nutrient foramina			
			Superior surface	Anterior surface	Inferior surface	Posterior surface
Right	20	25	0	20 (80%)	0	5 (20%)

Left	16	19	0	16 (84%)	0	3 (16%)
Total	36	44	0	36 (82%)	0	8 (18%)

Table 3: Showing distribution of nutrient foramina according to location

Side	No. of Bones	No. of nutrient foramina	Location of nutrient foramina		
			Medial 1/3rd	Middle 1/3rd	Lateral 1/3rd
Right	20	25	2 (8%)	20 (80%)	3 (12%)
Left	16	19	1 (5%)	16 (84%)	2 (11%)
Total	36	44	3 (7%)	36 (81%)	5 (11%)

Table 4: Showing direction of nutrient foramina towards or away from the acromial end

Side	No. of bones	No. of nutrient foramina	Direction of nutrient foramina	
			Towards acromial end	Away from acromial end
Right	20	25	25	0
Left	16	19	19	0
Total	36	44	44	0

Conclusion

Total number of nutrient foramen observed in present study was 44. The number, position, location, and direction of nutrient foramen was observed. The findings were tabulated and compared with results of previous researchers. Knowledge of all these parameters play an essential role in surgical and orthopedic procedures such as bone grafting, intramedullary nail fixation, plate fixation and microsurgical vascularized bone transplantation.

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