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Original Research

Assessment of nutrient foramina of clavicle

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ABSTRACT:
Background: The nutrient artery is the principal source of blood supply to a long bone, particularly important during its active growth period in the embryo and foetus, as well as during the early phase of ossification. The present study was conducted to assess variations in nutrient foramina of clavicle. **Materials & Methods:** 82 dried adult human clavicles of both genders were taken. The foraminal distance from the sternal end (DNF) and the total length of the clavicle (TL) were measured in millimeters using Vernier caliper. The foramen index (FI): FI = (DNF/TL) ×100, DNF = Distance of nutrient foramen from the proximal end (sternal end) of the clavicle, TL = total length of clavicle was calculated. **Results:** Out of 82 bones, 40 were of males and 42 were of females. There were 50 right and 32 left clavicles. There were 81 nutrient foramens in right and 48 in left clavicles. The mean total length of clavicle was 142.3 mm of right and 140.9 mm of left clavicle. The mean distance of foramina from sternal end (DNF) was 63.1 mm in right and 60.7 mm in left clavicle. The mean foramen index (FI) of right clavicle was 44.3 % and of left clavicle was 42.1%. The difference was not significant (P> 0.05). **Conclusion:** Morphometric knowledge related to nutrient foramen and its variations are of importance to orthopedic surgeons and radiotherapists while treating clavicular pathologies.
Key words: Clavicle, Morphometric, nutrient foramen

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INTRODUCTION

Clavicle, a modified long bone, is horizontally placed across the root of the neck. Clavicle keeps the arm away from the trunk.[1] Clavicle is the most common bone in the body which is susceptible to fracture. The weakest point of the clavicle is the junction of the middle and outer third. This is the most common site to get fractured when a person falls on the outstretched hand. This is also the position of the nutrient foramen.[2]

The nutrient artery is the principal source of blood supply to a long bone, particularly important during its active growth period in the embryo and foetus, as well as during the early phase of ossification.[3] Nutrient foramen is the largest foramen on the long bone through which nutrient artery for that bone passes.[4] The clavicle is a modified long bone placed horizontally and subcutaneously at the root of neck. It also transmits the weight from upper limb to the axial skeleton. The inferior surface of shaft of clavicle presents a subclavian groove.[5] The nutrient foramen lies at the lateral end of the groove running in the lateral direction. 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.[6] Recent studies report that patients with untreated clavicular fracture show a higher rate of non-union and specific deficits of shoulder function. These cases have shown good results with external or internal fixations with nails, plates, screws, or surgical bone grafting for which the knowledge of the nutrient arterial supply is important.[7] The present study was conducted to assess variations in nutrient foramina of clavicle.

MATERIALS & METHODS

The present study comprised of 82 dried adult human clavicles of both genders. Damaged and deformed bones were not taken into account. The bones were

studied for the number, direction, length- wise location, and positions of the foramina with respect to the surface. The nutrient foramina were detected with a magnifying glass by the presence of a well- marked groove and slightly raised margin at the commencement of the canal. The direction of the canal was determined by using a 24G needle. The foraminal distance from the sternal end (DNF) and the total length of the clavicle (TL) were measured in millimeters using Vernier caliper.

The Hughes formula was used for calculating the foramen index (FI): FI = (DNF/TL) ×100, DNF = Distance of nutrient foramen from the proximal end (sternal end) of the clavicle, TL = total length of clavicle. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Distribution of cases

Total- 82		
Gender	**Males**	**Females**
Number	40	42

Table I shows that out of 82 bones, 40 were of males and 42 were of females.

Table II Morphometry of nutrient foramina of clavicle

Parameters	Right	Left	P value
Number of clavicles	50	32	0.05
Nutrient foramen	81	48	0.01

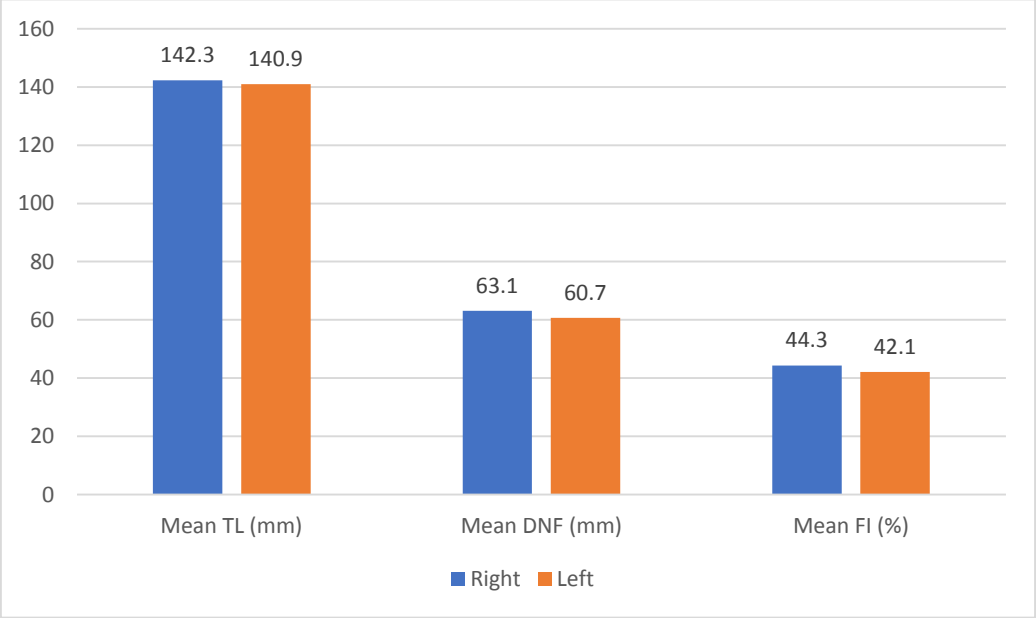
Table II shows that there were 50 right and 32 left clavicles. There were 81 nutrient foramens in right and 48 in left clavicles. The difference was significant (P< 0.05).

Table III Assessment of measurement

Parameters	Right	Left	P value
Mean TL (mm)	142.3	140.9	0.14
Mean DNF (mm)	63.1	60.7	0.09
Mean FI (%)	44.3	42.1	0.1

Table III, graph I shows that mean total length of clavicle was 142.3 mm of right and 140.9 mm of left clavicle. The mean distance of foramina from sternal end (DNF) was 63.1 mm in right and 60.7 mm in left clavicle. The mean foramen index (FI) of right clavicle was 44.3 % and of left clavicle was 42.1%. The difference was not significant (P> 0.05).

Graph I Assessment of measurement



DISCUSSION

Human beings are bestowed with the power of bipedal locomotion and the clavicle acts as a strut to allow the free movement of the upper limb away from the chest wall.[8,9] Bones are structures that adapt to their mechanical environment, and from a foetal age adapt to the presence of naturally occurring holes.[10] These holes or nutrient foramina, allow blood vessels to pass

through the bone cortex. The inferior surface of shaft of clavicle presents a subclavian groove.[11] The nutrient foramen lies at the lateral end of the groove running in the lateral direction. It was described that a small foramen may be present in the middle one third of the clavicle, along its superior border.[12] This foramen transmits the nutrient artery and at times, the supraclavicular nerve. 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.[13] The present study was conducted to assess variations in nutrient foramina of clavicle.

In present study, out of 82 bones, 40 were of males and 42 were of females. Aggarwal et al[14] in a descriptive study 79 dry adult human clavicles (40 right, 39 left) were studied, and mean foramen index (FI) was calculated. The mean length of clavicles studied was 141.36 ± 11.11 mm (right 140.51 ± 11.10 mm, left 142.36 ± 11.14 mm). The average distance of foramina (DNF) from the sternal end was 61.48 ± 15.82 mm (right 62.88 ± 16.28 mm, left 59.96 ± 15.12 mm). Nutrient foramen was found in all the studied bones. The total foramina observed are 120. Forty‑four bones have single (55.70%), 29 double (36.71%), and 6 triple (7.59%) foramina. Foramina were distributed on all four surfaces of the clavicle, predominantly on the posterior surface (52.50%). Most foramina were present on the middle third (67.50%) with an average FI% of 43.82 ± 11.85 (right 44.99 ± 12.09, left 42.43 ± 11.41). The foramina were directed toward the acromial end in all cases. The nutrient artery of the clavicle needs to be preserved for maintaining its vitality. Hence, the morphometric and topographic knowledge related to nutrient foramen and its variations are of immense importance to orthopedic surgeons and radiotherapists while treating clavicular pathologies.

We observed that there were 50 right and 32 left clavicles. There were 81 nutrient foramens in right and 48 in left clavicles. Kumar et al[15] studied 102 adult clavicles 52 right sides and 52 left side. All the bones were grossly observed for the number, location and direction of the nutrient foramina. Nutrient foramina were present in 50 clavicles (right) and 44 clavicles (left). Out of which single foramina in 41 clavicles (right) and 36 clavicles (left), double foramina in 9 clavicles (right) and 6 clavicles (left) and three foramina in 2 clavicles (left). Absence of nutrient foramina were found in 2 clavicles (right) and 8 clavicles (left). Maximum number was present in the medial 2/3 and on the posterior surface of 46 bones (right) and 34 Bones (left). All foramina were directed towards the acromial end.

We observed that mean total length of clavicle was 142.3 mm of right and 140.9 mm of left clavicle. The mean distance of foramina from sternal end (DNF) was 63.1 mm in right and 60.7 mm in left clavicle. The mean foramen index (FI) of right clavicle was 44.3 % and of left clavicle was 42.1%. Pereira et al[16] in their study found that the clavicles show more variations on the surface on which the foramina were present.

CONCLUSION

Authors found that morphometric knowledge related to nutrient foramen and its variations are of importance to orthopedic surgeons and radiotherapists while treating clavicular pathologies.

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