

The Supratrochlear Foramen of Adult Humerus and its Clinical Considerations

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How to cite this article:

Thejeshwari H G, Prakash K.G., Krishna G, et al. The Supratrochlear Foramen of Adult Humerus and its Clinical Considerations. Indian J Anat. 2020;9(3):201–204.

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Abstract

Background: Supratrochlear foramen (STF) is located on the bony septum that separates the olecranon fossa from the coronoid fossa, at the lower end of the humerus. The knowledge of the presence of STF in a humerus may be important for preoperative planning for treatment of supracondylar fracture. The presence of STF may also result in erroneous interpretation of radiographs.

Materials and methods: The STF was studied in detail in 300 (175 right side and 125 left side) human dried humeri of unknown sex and age. The topographical anatomy of the STF was studied in detail, morphometric measurements were taken, and the specimens were photographed.

Results: Out of the 300 bones studied, 140 cases (46.6%) showed the presence of STF. The STF was oval, round, and triangular in shape in 128, 7, and 5 cases, respectively. The mean length of the transverse diameter for supratrochlear foramen was 6.60 mm and 5.9 mm on the left and right sides, respectively. The mean length of the vertical diameter for STF was 4.80 mm and 3.80 mm on the left and right sides, respectively. Most of the bones that had no STF showed a translucency of septum, in 54.4% of the bones.

Conclusions: The results of our study show that STF is more common on the right side, with the oval shape being more common. The respective sides did not exhibit any statistical significant differences. Presence of STF may be important for anthropological, clinical, and academic purpose.

Keywords: Humerus; intramedullary humeral nailing; supratrochlear foramen; Translucent septum.

Introduction

Olecranon and the coronoid fossa of humerus are separated by a thin plate of bone, which may become perforated in some cases to give rise to a foramen known as supratrochlear foramen.¹ Supratrochlear foramen was first described by Meckel (1825).² Since then, it has been described in various animals like dogs, hyenas, cattle, and other primates.^{3,4} Morphologically in humans thin plate of bone present until the age of seven years, after which the bony septum occasionally becomes absorbed to form the STF.⁵ Individuals with this anatomic variation may be able to overextend the elbow joint.⁶ In intramedullary fixation of the humerus is commonly used in traumatic injuries and pathological fractures.⁷ The Proper anatomical knowledge of the humerus is important in preoperative planning in the presence of variations in the distal end of the humerus.⁸ The presence of supratrochlear foramen is also important for radiologists and orthopaedicians for proper interpretation of x-rays as they appear radiolucent and may be mistaken for cystic or osteolytic lesions.⁸ Our study aims to highlight STF incidence, different shapes and clinical importance, which

may be beneficial for anthropologists, orthopaedic surgeons, and radiologists in day-to-day clinical practice.

Materials and Methods

A total of 300 (125 right side and 175 left side) human dried humeri free of any pathological changes and of unknown sex of Indian origin, were studied in Department of Anatomy, Kannur Medical College, Anajakandy, India for various parameters such as; presence or absence of a STF; Shape (oval, round, and triangular); transverse and vertical diameters of the STF and its distance from the tip of the medial epicondyle were measured using a vernier caliper.

Statistical analysis: Data were expressed in Mean±Standard deviation (SD). The Side differences of transverse and vertical diameter of the STF were compared using the unpaired Student's t test; the level of significance was set at $P < 0.05$ (Table 3). All statistical tests were performed using GraphPad Prism version 5.0 for Windows (GraphPad Software, San Diego, CA).

Results

Out of the 300 bones studied, 140 cases (46.6%) showed the presence of STF. In 69 (49.2%) cases on the left side and in 71 (50.7%) cases on the right side, a STF was present. The STF was oval (128), round (7), and triangular (5) in shape (Fig. 1, Table 2). The mean length of the transverse diameter for supratrochlear foramen was 6.60 mm and 5.9 mm on the left and right sides, respectively. The mean length of the vertical diameter for STF was 4.80 mm



Fig. 1: Photograph showing various shapes of supratrochlear foramen (STF). A: triangular STF; B: round STF; C: Transparent STF; D: Oval STF.

and 3.80 mm on the left and right sides, respectively (Table 3). The differences between the sides were not significant (Table 1). The incidence of STF was slight higher on the right side (50.7%) as compared to the left side (49.2). Most of the bones that had no STF showed a translucency of septum, in 54.4% of the bones (Table 1).

Table 1: Frequency of Supratrochlear foramen and Translucent septum.

Sl. No.	Types	Total	Percentage (%)
1	Translucent septum	160	54.4
2	STF	140	46.6

Table 2: Different shapes of foraminae and their prevalence.

Sl no	Shapes	Total	Percentage (%)
1	Oval	128	91.4
2	Round	7	5
3	Triangular	5	3.5

Table 3: Different measurements in supratrochlear foramen. Data are shown as mean ±standard deviation & range).

	Right side		Left side	
	Mean±SD	Range	Mean±SD	Range
Transverse diameter for supratrochlear foramen (mm)	5.9 ±2.1	3.2-8.5	6.6 ±1.47	2.2-10.1
Vertical diameter for supratrochlear foramen (mm)	4.80±2.3	2-7.5	3.8±0.99	2.2-5.6

Differences between the sides were not significant ($P > 0.05$, unpaired Student's t test).

Table 4: Incidence of supratrochlear foramen in various human races.

Serial no.	Author	Population studied	Incidence (%)
1.	Trotter M 1935	White Americans	4.3
2.	Ndou R et al 2013	African Negroes	21.7
3.	Akabori, 1934	Ainus	8.8
4.	Akabori, 1934	Japanese	18.1
5.	Nayak SR 2009	Indians	34.4
6.	Hirsh, 1927 (quoted by Morton and Crysler)	Arkansas Indians	58
7.	Present study	South Indians	46.6

Discussion

The supratrochlear foramen (STF) was first described by Meckel in 1825.² The STF is of great interest to anthropologists, who claim it as important in establishing relationships between humans

and lower animals,² According to Hrdlicka, the perforation is very frequent in primates other than man.⁹ Apart from its evolutionary significance STF has much clinical and surgical importance in the recent times.¹⁰ There is a wide variation in the rate of the STF occurrence in various human populations. Studies on STF in different populations showed an incidence of 58% in Arkansas Indians⁹, African Negroes (21.7%), South Africans (32.5%)¹¹, in White Americans (4.3%)¹², in American Negroes (18.4%)¹², 18.1% in Japanese¹³, 17.5% in Chinese.¹⁴ 6.1% in Netherlands¹⁵ (Table 4). The incidence of STF in the Indian population ranges from 28% to 34.4%.¹⁶ In the present study, majority of STF were oval (91.4%) followed by it was round shape (5%). Veerappan et al.¹⁶ observed oval shape in 42.85%, round shape in 37.71%, triangular shape in 14.28% and sieve like in 7.14% in their study. A study had defined the STF to be ovoid in shape with the long axis transversal (6.3/3.7 mm).¹⁷ Another study reported that STF, Transverse diameter were left side (6.55 mm) and right side (5.99 mm) and vertical diameter left (4.85 mm) and right (3.81 mm) side respectively.⁸ In our study transverse diameter for supratrochlear foramen was 6.60 mm and 5.9 mm and mean length of the vertical diameter for STF was 4.80 mm and 3.80 mm on the left and right sides.

Limitations

Dry humeri of unknown gender and age were considered in the study. The effect of the ulnar morphometry and its bearing on the formation of STF could not be ascertained.

Conclusion

The results of our study showed 46.6% STF incidence in the south Indian population, with the left side predominant. By its high incidence it is important to the orthopaedician in the preoperative planning at distal humerus and to the radiologist for differentiating it from other pathological or morphometric variations.

Acknowledgement

The authors thank all the nonteaching members of department of anatomy for their assistance while conducting this investigation.

Conflict of interest: Declared none by Authors.

Sources of Funding: Nil.

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