

A Study of Supratrochlear Foramen and Their Clinical Significance in a Teaching Hospital of Deccan Plateau

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Abstract

Aim: The supratrochlear foramen is an aperture or hole that is created when the bony septum between the olecranon fossa and coronoid fossa becomes perforated. The STF has achieved importance in recent years as its knowledge is useful for anatomists, anthropologists, orthopedic surgeons, and radiologists. The goal of our study was to determine the morphometric measurements of STF in the Andhra Pradesh population. *Materials & Methods:* The study was conducted on 135 humeri of unknown sex and age. The STF were measured using Vernier calipers and the measurements on both the sides were tabulated & statistically analyzed. A light source was used to determine the translucency of the septum. *Observations & Results:* The prevalence of STF in the present study is 22.96% and is more common on the left side. Majority of STF were oval (61.29%) followed by round apertures (32.25%). In the present study, the mean transverse diameter of the STF was 6.49mm and 6.35 mm, on left and right sides respectively while the vertical diameter was 4.88mm and 4.16mm on left and right sides respectively. *Conclusion:* STF is associated with narrow and shorter medullary canal and anterior angulation at the distal humerus. The knowledge of STF is very important for preoperative planning of intramedullary nailing for treatment of supracondylar fractures, especially following traumatic injuries and pathologic fracture.

Keywords: Supratrochlear; Foramen; Humerus.

Introduction

The supratrochlear foramen is a small hole located above the trochlea of the humerus of several mammals. The supratrochlear foramen (STF) of the humerus has been neglected in standard anatomy and orthopedics books. It is an important and relatively common anatomic variation in the lower end of the humerus. A thin plate of bone called supratrochlear septum separates the olecranon fossa and coronoid fossa of the distal end of humerus. This bony septum may be opaque or translucent or in some cases it may be perforated to form a foramen called asepitrochlear foramen, supratrochlear aperture, septal aperture, intercondylar foramen, but is most commonly referred

to as supratrochlear foramen (STF) [1-3]. This foramen lies between the lateral and the medial epicondyles [4] at the lower end of humerus. Meckel in 1825 was the first person to describe the supratrochlear foramen [5].

STF are of varied shapes. They can be oval, round, triangular, sieve-like, and irregular [6,7]. Studies have shown that the humerus is not perforated in the embryonal stage [8]. The septum is present until 7 years of age, after which it is occasionally absorbed to form STF [9].

Many researchers have described it in dogs, cattle, rats, hyenas and other animals. They believe that it is produced due to the posture they adopt during tearing of food [10].

Supracondylar fractures account for 75% of all fractures in children [4].

STF is associated with narrow and shorter medullary canal and anterior angulation at the distal humerus.

The knowledge of STF is very important for preoperative planning of intramedullary nailing for treatment of supracondylar fractures, especially following traumatic injuries and pathologic

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fracture. In presence of supratrochlear foramen, antegrade route is better for intramedullary nailing than retrograde method [11,12]. Awareness of the various shapes and dimensions such as the transverse (TD) and vertical (VD) distance in which this foramen occurs may help avoid misinterpretation of radiographs [3].

Materials and Methods

The present study was carried out in the Department of anatomy, GSL Medical College & General hospital, Rajahmundry, Andhra Pradesh. Supratrochlear foramen was studied in 135 dried humeri of both sides of unknown sex and age. Only bones free of any pathological changes were included in the study. The bones were examined for the presence of supratrochlear foramen and their size and shape were determined. Vernier calipers was used to measure the vertical and horizontal diameters. A light source was used to determine the translucency of the septum.

Observations and Results

A total of 135 humeri free of any pathological changes were included in the study (Figure 1). There were 69 right and 66 left humeri out of which 10 had round supratrochlear foramen 19 had oval foramen and 2 had irregular STF (Table 1). Around 22 bones showed translucency (Table 2) in the region of



Fig. 1: Shows various shapes of supratrochlear foramen

Table 1:

Foramina	Right humeri (n=69)	Left humeri (n=66)
Round	4	6
Oval	8	11
Irregular	1	1

*STF= supratrochlear foramen n=number of humeri

Table 2:

Foramina	Right humeri	Left humeri
Translucent septum	7	15
Peforated septum	1	6

Table 3A: Shows mean and standard deviation of transverse and vertical diameters of supratrochlear foramen

LEFT SIDE

Transverse diameter	Vertical diameter
Mean = 6.49mm	Mean = 4.88mm
S. D= 1.375	S. D=0.694
Variance =1.890	Variance =0.482
Standard error of mean=0.324	Standard error of mean=0.1639

Table 3B: Shows mean and standard deviation of transverse and vertical diameters of supratrochlear foramen

RIGHT SIDE

Transverse diameter	Vertical diameter
Mean = 6.35 mm	Mean = 4.16mm
S. D= 1.57	S. D=0.673
Variance =2.47	Variance =0.453
Standard error of mean=0.437	Standard error of mean=0.186

supratrochlear septum when illuminated by a source of light from behind (Figure 2). Perforations in the region of supratrochlear septum was observed in 7 bones. The data was tabulated and was statistically analyzed. It was compared with the data obtained in other studies carried out in India and abroad.

Discussion

The function and formation of supratrochlear foramen is largely obscure. Normally foramina serve as conduits for vessels and nerves, while apertures are merely openings in bones with no structure passing through them [13]. No anatomical structure is known to pass through the STF and thus it does fit the definition of foramina.

There are numerous theories that have been proposed as to how these foramina are formed. STF may be an atavistic character [12]. Another hypothesis suggests that the STFs are mechanically induced and can be considered as part of the mechanical & anatomical relationship between humerus and ulna during normal flexion and extension at the elbow [13].

Some believe that STF is formed by resorption from anterior surface of septum [4]. A greater degree of joint hypermobility in females than in males can be

the reason behind the greater prevalence of septal aperture in females [14]. A small flexion angle is associated with high robusticity of the humerus [15]. It has often been noticed that populations which have a high frequency of septum perforation tend also to have a low robusticity of the bones [16].

Overall, studies have shown that septal apertures were more common among ancient human populations, especially in late Europeans. Its left side frequency can be explained on the basis of handedness. It is more common on the non-dominant left hand as the dominant right limb has more robust bones [17,18]



Fig. 2: Shows translucency of supratrochlear foramen

Table 4: Shows incidence of STFs in different populations in percentages

Populations of countries	Incidence in percentage
South Africans	32.5%
Egyptians	7.9%
Greeks	0.304%
Americans	6.9%
Japanese	18.1%
Chinese	17.5%
Netherlands	6.1%
Italians	9.4%
African negroes	21.7%

The prevalence of STF in the present study is 22.96%. The prevalence of the STF in the human population varies from 0.3% to almost 60% worldwide (Table 4). In the present study, the prevalence of the STF was higher on the left side.

In our study, majority of STF were oval (61.29%) followed by round apertures (32.25%). This is similar to the findings of Veerappan et al who found oval STFs in 42.85% & round apertures in 37.71% of humeri. Translucent septum was seen in 16.29% of cases which is much less than reported by Nayak et al who recorded it as 56.7%. Veerappan et al also

observed translucent supratrochlear foramen in 50% of subjects.

In the present study, the mean transverse diameter of the STF was 6.49mm and 6.35 mm, on left and right sides respectively while the vertical diameter was 4.88mm and 4.16 mm on left and right sides respectively (Table 3A & 3B).

This result was consistent with a study by Mathew et al. [22]. The results obtained in the present study are comparable with that of other authors like Nayak et al. [21], Krishnamurthy et al. [23], and Veerappan et al. [5]

Incidence in Indian populations showed 27.4% in Eastern Indians [9], 32% in Central Indians [24], 27.56% in North Indians [25], 28% in South Indians [6] and 34.4% in overall Indians [24].

The below table shows the comparative data in south (Table 5.1, Table 5.2, Table 5.3, Table 5.4 and Table 5.5) Indian population.

Table 5.1: Tamilnadu

Suba Ananthikumaraswamy et al [28]	31.3%
Veerappan et al[5]	19.1%

Table 5.2: Karnataka

Soubhagya R Nayak et al [21]	34.3 %
Suruchi Singhal et al [26]	28%
Raghavendra et al [27]	28%
Varalaxmi K L et al [29]	25.8%

Table 5.3: Telangana

B. Mahitha et al [26, 28]	18.7%
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Table 5.4: Kerala

Mathew A J et al[22]	24.5%
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Table 5.5: Andhrapradesh

P Sharmila Bhanu et al [7]	30.58%
Krishnamurthy A et al [23]	23%
Hima Bindu et al[9]	20%

Conclusion

Thus, to conclude, observations in this study are comparable to other data obtained from Andhra Pradesh. This study showed a prevalence of STFs as 22.96% and more common on left side as reported by many other workers. Knowledge of supratrochlear foramen in the distal humerus is important as a diagnostic tool in orthopedics for intramedullary nailing of the humerus

Also presence of STF as a radiolucent area in radiographs and may be misinterpreted as an osteolytic or cystic lesion resulting in wrong diagnosis and complications.

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