

A MORPHOMETRIC STUDY OF SUPRATROCHLEAR FORAMEN OF THE HUMERUS IN WESTERN INDIAN DRY BONE SAMPLE

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ABSTRACT

Background: In the distal end of humerus, the coronoid fossa in front and the olecranon fossa behind is separated by a thin lamina of bone, the coronoidolecranon septum (COS). This thin plate of bone sometimes become transparent or perforated in some cases and give rise to a foramen called septal aperture or commonly known as supratrochlear foramen (STF).

Objective: The present study describes the incidence, different shapes, morphological features, and clinical importance of foramen in the humerus of Western Indian population.

Materials and Methods: The presence of supratrochlear foramen was studied in 85 dry adult humeri of unknown sex and of both sides. A total of 170 (85 right sided and 85 left sided) Adult human dried humeri were obtained. Mean and standard deviations for different measurement of foramina was calculated. Unpaired t test was applied to test the significance of difference of different measurements of the foramen of the humerus between left and right side.

Results: Out of total 170 humeri studied STF were present in 61(35.88%) humeri. Most of foramen were oval shaped that is 32(37.64) on left side and 08(9.41%) on right side. Most of septum on left side 27 (31.76%) and right side of humeri 35 (41.17%) were having translucent septum. Difference between measurements of vertical and transverse diameter of right and left sided foramina were not statistically significant ($p>0.05$). Difference between measurements of distance of foramen from medial epicondyle and lateral epicondyle and midpoint of trochlea on right and left sides were not statistically significant ($p>0.05$).

Conclusions: The supratrochlear foramen has much clinical importance. The foramen should be kept in mind during any surgical or radiological intervention to aid in proper diagnosis and treatment.

KEY WORDS: Humerus, supratrochlear foramen, translucency.

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INTRODUCTION

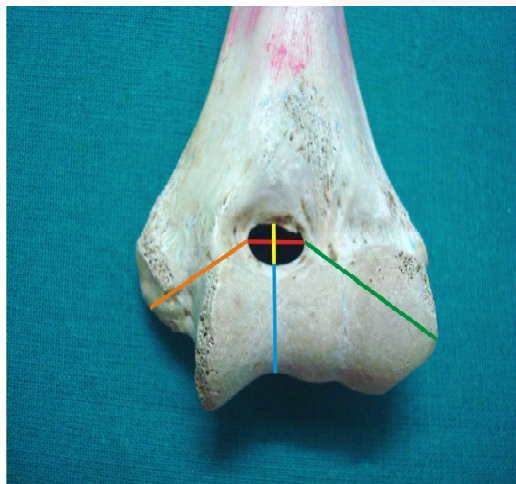
Lower end of humerus has two large fossae, the olecranon and the coronoid fossa. In the distal end of humerus, the coronoid fossa in front and

the olecranon fossa behind is separated by a thin lamina of bone, the coronoidolecranon septum (COS). This thin plate of bone sometimes become transparent or perforated in some cases

and give rise to a foramen called septal aperture or commonly known as supratrochlear foramen (STF). Early findings of Morton in 1945 revealed that this thin plate is always present until the age of seven years after which it becomes absorbed to form STF [1]. Hardlicka observed that the perforation is more frequent in higher primates other than man [2]. Hirsh quotes examinations by Martin which revealed the presence of STF in 58% of Arkansas Indians, 21.7% of African Negroes and 4.2% in White Americans. Hirsh mentioned that the pressure of olecranon process may decrease the blood supply leading to septal aperture formation [3]. Individuals with this anatomic variation may be able to overextend the elbow joint [4]. The anatomical structure of the humerus may play an important role in the intramedullary fixation thereby stressing the need of prior anatomical knowledge and preoperative planning in the presence of variations like STF in the distal end of the humerus [5]. The present study describes the incidence, different shapes, morphological features, and clinical importance of foramen in the humerus of Western Indian population.

MATERIALS AND METHODS

Fig. 1: Various Diameters and distances of Supratrochlear foramina.



Red - Transverse diameter

Yellow - Vertical Diameter

Blue - Distance of foramen from midpoint of trochlea

Orange - Distance of foramen from medial epicondyle

Green - Distance of foramen from Lateral epicondyle

The presence of supratrochlear foramen was studied in a total of 170 (85 right sided and 85 left sided) humeri of unknown sex and of both sides. The bones were collected from the

Department of Anatomy, of a tertiary care teaching hospital. The observed bones were free from any pathology. All these bones were carefully observed and screened. The STF were morphologically and morphometrically analyzed. The apertures which were having the regular margins were considered. The transverse and vertical diameters of the foramen were measured. Distance of foramen from medial epicondyle and lateral epicondyle and midpoint of trochlea were measured (Fig.1). The Vernier caliper with minimum scale of 0.01 millimeter (mm) was used to measure the maximum transverse and vertical diameters of STF.

Differences of different measurements of the STF were compared using the unpaired t test; the level of significance was set at $P < 0.05$. The incidence of the supratrochlear foramen was found on the right and left side. In addition to the presence of foramen, shape of foramen was also noted. In bones where the foramen was absent, the translucency or opacity of the septum was observed. Translucency of coronoid-olecranon septum was noted with the help of transmitted light from posterior to anterior.

RESULTS

A total of 170 (85 right sided and 85 left sided) Adult human dried humeri were studied for the presence or absence of Supratrochlear foramen. Out of total 170 humeri studied STF were present in 61 (35.88%) humeri. On left side Supratrochlear foramen were present in 41 (48.23%) humeri, while 44 (51.76%) humeri on left sides were having septum. On right side Supratrochlear foramen were present in 20 (23.52%) humeri, while 65 (76.47%) humeri on right sides were having septum.

Table 1: Shapes of Supratrochlear foramina.

Shape	Left (n=85)	Right (n=85)
Oval	32 (37.64)	08 (9.41)
Round	00 (0.00)	02 (2.35)
Heart	01 (1.17)	01 (1.17)
Kidney	04 (4.70)	02 (2.35)
Circular	4 (4.70)	07 (8.23)
Total	41 (48.23)	20 (23.52)

It is evident from Table 1 that most of foramen were oval shaped that is 32 (37.64) on left side

and 08(9.41%) on right side. few of the foramen were round, heart, kidney and circular shaped. (Fig. 2).

Fig. 2: Various Shapes of Supratrochlear foramina.



Table 2: Type of Septum.

Type of Septum	Left (n=85)	Right (n=85)
Translucent	27(31.76%)	35(41.17)
Opaque	17(20.00%)	30(35.29)
Total	44(51.76)	65(76.47)

It is evident from Table 2 that 44(51.76%) humeri on left sides were having septum while 65 (76.47%) humeri on right sides were having septum. Most of septum on left side (31.76%) and right side of humeri (41.17%) were having translucent septum.

Fig 3: Round Supratrochlear foramina along with Septum.



Table 3: Diameters of Supratrochlear foramina.

Variable	Right Side	Left side	t value	P value
Vertical diameter of Supratrochlear foramina	3.75±1.48	4.68±1.43	2.33	0.84
Transverse diameter of Supratrochlear foramina	5.5±2.89	6.48±2.47	1.31	0.41

It is evident from Table 3 that difference between measurements of vertical and transverse diameter of right and left sided foramina was not statistically significant ($p>0.05$)

Table 4: Distance of foramen from medial epicondyle and lateral epicondyle and midpoint of trochlea.

Distance	Left	Right	T value	P value
Distance of foramen from medial epicondyle	2.52±0.32	2.47±0.33	0.55	0.92
Distance of foramen from lateral epicondyle	2.57±0.27	2.47±0.19	1.27	0.2
Distance of foramen from midpoint of trochlea	1.46±0.18	1.41±0.22	0.96	0.33

It is evident from Table 4 that difference between measurements of distance of foramen from medial epicondyle and lateral epicondyle and midpoint of trochlea on right and left sides were not statistically significant ($p>0.05$).

DISCUSSION

The cause of STF has been debated by many authors, some authors considered it to be due to mechanical pressure during hyperextension or by large olecranon process. If mechanical pressure due to olecranon process was the causative factor then it would have been more common in males and on right side. Some opine that STF is formed by resorption from anterior surface of the septum. Others say it arises from impingement on humeral septum by coronoid and olecranon process [6].

In present study, Out of total 170 humeri studied Supratrochlear foramen was present in 61(35.88%) humeri. There are previous studies in the Indian population which reported the incidence to be 32%, 28%, 27.5%, and 27.4% in Central Indians, South Indians, North Indians, and Eastern Indians, respectively [7-10]. The global statistics show that STF has an incidence ranged from 4.2% to 58% [11,12]. Most of foramen were oval shaped that is 32(37.64) on left side and 08(9.41%) on right side. few of the foramen were round, heart, kidney and circular shaped. Literature described three different shapes of supratrochlear foramen-oval, round and triangular. Diwan *et al* described three different shapes of supratrochlear foramen-oval, round and triangular. Majority are oval shaped followed by round and triangular [13]. This septal aperture is seen mostly on the left sided bones than right. Similar to present study, the STF occurred in oval (136), round (77), triangular (9), and irregular (34) shapes in a South African dry bone sample [14].

In present study, 44(51.76%) humeri on left sides were having septum while 65(76.47%) humeri on right sides were having septum. Most of septum on left side (31.76%) and right side of humeri (41.17%) were having translucent septum. Septal aperture may be unilateral or bilateral. If unilateral it is more common on the left side, if it is bilateral, a larger aperture will be seen on the left side bone [3,15]. Contrary to present study, Nayak et al reported that STF was more common on the right side, with the oval shape being more common [16]. In a study by Singhal and Rao translucent septum was seen in 66% of the bones, in 51.51% of right and in 48.48% of the left. Only nine bones had opaque septae (6%) [8]. In a study by Nayak et al, the mean length of the transverse diameter for supratrochlear foramen was 6.55 mm and 5.99 mm on the left and right sides, respectively. The mean length of the vertical diameter for STF was 4.85 mm and 3.81 mm on the left and right sides, respectively [16]. In present study, difference between measurements of vertical and transverse diameter of right and left sided foramina and difference between measurements of distance of foramen from medial epicondyle and lateral epicondyle and midpoint of trochlea on right and left sides were not statistically significant ($p>0.05$).

The anatomical knowledge of STF is beneficial for anthropologists, orthopedic surgeons and radiologists in day to day clinical practice. On X-ray, STF presents as radiolucent areas simulating an osteolytic or cystic lesion. Such pseudo lesions may lead to false positive diagnosis of osteolytic or cystic lesion [4]. Hence knowledge of STF may check wrong interpretation of X-rays by radiologists. Supratrochlear fracture of humerus is very common in paediatric age group and it can alter line of fracture as well as management. Due to its clinical relevance its presence cannot be ignored [17]. Intramedullary humeral nailing is done to treat supracondylar fractures which become more difficult in presence of STF leading to secondary fractures. There is a lot of debate about route of pin entry in cases with STF because STF is always associated with narrow medullary canal at the distal end of humerus. Therefore, the knowledge of presence of STF

may be important for preoperative planning for treatment of supracondylar fractures and perform antegrade medullary nailing rather than retrograde medullary nailing [18].

CONCLUSION

Supratrochlear foramen was present in 61(35.88%) humeri. Most of foramina were oval shaped and septal aperture may be unilateral or bilateral. If unilateral it is more common on the left side. Most of septum on left side (31.76%) and right side of humeri (41.17%) were having translucent septum. The Supratrochlear foramen has much clinical importance. The presence of such foramen should be excluded before surgical intervention on the humerus. The foramen should be kept in mind during any surgical or radiological intervention to aid in proper diagnosis and treatment.

Conflicts of Interests: None

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