

The Supratrochlear Foramen of Humerus: A Human Anatomic Study

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ABSTRACT

Background: Supratrochlear foramen is an aperture which may be present at the lower end of the humerus. It results when a thin plate of bone separating the olecranon from the coronoid fossae gets perforated. Its exact etiology is not known but it is a neglected entity of immense clinical importance.

Aim: To study the incidence & describe the features of supratrochlear foramen in dried humeri available in the bone bank of Anatomy department.

Methods: The study was carried out on 200 dried human humeri taken from the bone bank of King Edward Medical University. Shape of the foramen was observed, the dimensions of the foramen & the distance of the margins of the foramen to the two epicondyles was measured with a vernier caliper. In the bones where the foramen was absent the opacity/ translucency / transparency of the bony septum was observed.

Results: The supratrochlear foramen was present in 17% bones & was more common on the left side. An oval shape was present in 9.5% bones followed by a round & irregular one. In majority of bones the supratrochlear septum was opaque. The mean vertical & transverse diameters were 3.8 mm & 5.2 mm respectively.

Conclusions: The knowledge about the existence of supratrochlear foramen is important for the Anatomists, Radiologists, Anthropologists & Orthopedic surgeons. The knowledge of its presence in the humerus may be particularly beneficial to the orthopedic surgeons in preoperative planning of intramedullary nailing in supracondylar fractures of humerus.

Key words: Supratrochlear foramen, humerus, epicondyles, intramedullary nailing

INTRODUCTION

The supratrochlear foramen is a variation present in the lower end of the humerus. The coronoid & olecranon fossae are located at the distal end of the humerus on its anterior & posterior surfaces respectively. The coronoid & olecranon processes of ulna fit into these fossae¹. The two fossae are separated by a thin, opaque/ translucent/ transparent bony lamina of compact bone, known as supratrochlear septum varying in thickness from 0.5 – 1 cm². This septum is lined by synovial membrane in the living. It may show several perforations or a single aperture called supratrochlear foramen, (also called epitrochlear foramen, intercondylar foramen, septal aperture and supratrochlear aperture)³. Meckel (1825) was the first person to describe this foramen. The foramen may be of different shapes, but is most commonly oval, round, triangular, irregular, sieve like etc. Its incidence among different races varies between 0 – 60%⁴. Individuals with this variation are able to overextend their elbow joints⁵. According to Hirsh (1927) the supratrochlear septum is always present up to the age of seven years after which it occasionally gets absorbed to form the supratrochlear foramen⁶. Various theories regarding the development of this foramen have been put forward. Some authors have

suggested a genetic etiology. It is yet unclear as to what degree these factors contribute to the formation of supratrochlear foramen⁷.

Several studies have indicated that this foramen is associated with a narrow intramedullary canal at the distal end of the humerus. Normally the diameter of the canal is 6-8 mm but in the presence of this variation the diameter of the intramedullary canal is <4mm⁸. Supracondylar fracture of humerus is a common occurrence in children & is treated by intramedullary nailing. This procedure may be compromised in the presence of this foramen & narrow intramedullary canal associated with it. The knowledge about the presence of this foramen is important in planning the nailing of fractures at the distal end of the humerus⁹. The area of the supratrochlear foramen is relatively radiolucent & can be misinterpreted as a cystic or osteolytic lesion¹⁰.

In this study we have highlighted the incidence of supratrochlear foramen in population of Lahore. This knowledge may be of importance to orthopedic surgeons, radiologists, anatomists & anthropologists in their clinical practice.

MATERIALS & METHODS:

The study was conducted on humeri taken from the bone bank of King Edward Medical University, Lahore. A total of 200 dried adult humeri were examined to see the presence of supratrochlear foramen. Out of these bones 110 belonged to males & 90 to females. Bones with a fracture or any pathology were excluded from the study. Gender determination was done. Shape of the foramina was observed. morphological & morphometric analysis of the supratrochlear foramina was done. The transverse diameter (TsD) & vertical diameter (VtD) of the foramen were measured with the help of a vernier calipers. The

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distance from the lateral margin of the foramen to the lateral epicondyle (LM-LE) & from the medial margin of the foramen to the medial epicondyle (MM-ME) was also measured. In the humeri where the foramen was absent, the translucency/ transparency/ opacity of the septum was noted by throwing light from the posterior aspect of the supratrochlear septum to the anterior. Randomly selected bones without foramen & bones with supratrochlear foramen were subjected to radiological examination to determine the diameter of the intramedullary canal.

Statistical analysis of the measurements was carried out by using SPSS version 20. mean, standard deviation, maximum & minimum were calculated from the recorded measurements.

RESULTS

Table 1: Incidence of Supratrochlear foramina of humerus

Side	n	%age
Right	12	35.2
Left	22	64.7
Total	34	17

Table 2: Incidence of shapes of various supratrochlear foramina of humeri

Shapes	Sides		Total%
	Right	Left	
Oval	8	11	19(9.5%)
Circular	2	3	5(2.5%)
Triangular	0	1	1(0.5%)
Irregular	1	4	5(2.5%)
Sieve like	2	2	4(2%)
Grand total	13	21	34(17%)

Out of the 200 humeri studied (103 right side & 97 left side) supratrochlear foramen was present in 34 bones. The incidence of STF was more common on left side (64.7%) than the right (35.2%). The supratrochlear foramina were of different shapes, commonest being the oval shape followed by circular, irregular, sieve like & triangular shapes. The supratrochlear septum was opaque in 41 (20.5%), translucent in 125 humeri (62.5%). No transparent septum

Table 3 Mean value & range of Transverse & Vertical diameters of STF in the left & right humeri

Side	Transverse diameter (in mm)			Vertical diameter (in mm)		
	Mean	Maximum	Minimum	Mean	Maximum	Minimum
Right	5.2 + 2.69	10.16	1.8	3.8 + 1.24	6.4	1.3
Left	4.9 + 2.75	9.8	1.46	3.2 + 1.19	5.9	1.4

Table 4: The mean distance from borders of Supratrochlear foramen to the Lateral & Medial Epicondyles of humeri

Side	Right			Left		
	Mean	Maximum	Minimum	Mean	Maximum	Minimum
LM-LE	27.4+ 3.0	32	20.1	26.2+ 2.8	28.3	21.4
MM-ME	21.7+ 0.45	28.9	20.3	25.3+ 0.24	27.1	20.8

DISCUSSION

The supratrochlear foramen is an aperture of variable size & shape present in the bony septum that separates the olecranon from the coronoid fossa at the lower end of humerus¹¹. It is a neglected entity but is of immense clinical importance.

The incidence of STF varies in different races. A past study carried out in India mentions a 26% incidence of STF¹². An incidence of 6.9% in Americans, 7.9% in

was observed in our study. The mean vertical diameter (Vt D) of STF was 3.8 mm & mean transverse diameter (Ts D) 5.2 mm. The mean distance from margin of STF to medial epicondyle (MM-ME) on the right side was 21.7 & on the left side was 25.3. similarly the mean distance from margin of STF to lateral epicondyle (LM-LE) on left side was 26.2 mm & on right side was 27.4.

Fig. 1: An oval STF



Fig. 3: Radiographs of Humeri with STF showing narrow medullary canals



Egyptians & 18.1% in the Japanese population has been quoted¹³. Our study shows an incidence of 17% (Table 1) which is in accordance with the previous studies. The foramen was more common on the left side (64.7%) in our study (Table 1). Similar results were reported in studies carried out in India^{14,15}.

In this study the shape of majority of foramina was oval (19%) followed by circular & irregular (5% each) (Table 2). An earlier study mentions a rounded STF in 47.37% &

oval in 42.11%¹⁴, however an oval foramen was more common in other studies^{16,17} which was consistent with our findings.

We observed an opaque septum in 20.5% bones & translucent in 62.5%. our results matched closely with a few other studies^{18, 19}. A Turkish study²⁰ however mentions a 20.5% incidence of translucent septum.

We measured the transverse & vertical diameter of STF in our study (Table 3). Similar results were mentioned in a study carried out in India²¹ however much variations in these diameter have been observed by other reseachers^{22, 23}. An awareness of the different shapes & dimensions of STF may help to avoid misinterpretation of radiographs

In the present study the mean distance from the margin of STF to the medial epicondyle on both sides & that of tip lateral epicondyle to margin of STF on right & left sides was measured (Table 4). Our findings corroborated with those of earlier studies^{24,25,26}.

The exact etiology of the foramen is not clear. Whether STF is due to lack of ossification or due to post ossification atrophy of bone is still debatable²⁷. The presence of the foramen may lead to fracture from even a low energy trauma. It is associated with reduced robustness & a narrow medullary canal which may produce difficulty during intramedullary nailing in supracondylar fractures of humerus which is the commonest fracture in pediatric age group. The knowledge of its presence is important for the radiologist to avoid misdiagnosis while interpreting radiographs. STF is more common in primitive ancient people compared to modern human beings. Its presence may be helpful to the anthropologists for dating specimens.

CONCLUSION

The knowledge about STF is of profound significance not only to the anatomists & anthropologist but also to the clinicians. Its knowledge is important for the orthopedic surgeon because of its significance in planning intramedullary nailing in patients with fractures at the distal end of the humerus. Prior knowledge about STF may be beneficial to the radiologist & may prevent erroneous interpretation of X Rays as it appears radiolucent & may mimic an osteolytic lesion or a cyst.

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