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Original Research Article

SUPRATROCHLEAR FORAMEN-ANATOMICAL VARIATIONS AND ITS CLINICAL IMPLICATIONS

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ABSTRACT

Background: The Supratrochlear foramen (STF) is an important anatomical variation resulting from perforation of olecranon-coronoid septum present between two epicondyles of humerus.

Material and methods: The study was conducted in 78 (41 left side and 37 right side) human dried humeri of unknown sex and age. The topographical anatomy of the STF was studied in detail, morphometric measurements were taken and specimens were photographed. Radiographs of humerus were taken to observe the translucency of septum and the diameter of intramedullary canal was measured at three levels 1) below the surgical neck 2) junction between upper 2/3rd and lower 1/3rd of shaft 3) above the olecranon fossa.

Results: Out of 78 bones studied,15 bones showed the presence of STF. The STF was oval, round and triangular in shape in 7, 5 and 3 bones respectively. The mean transverse and vertical diameters of supratrochlear foramen were 5.46 mm,5.82 mm and 3.94mm, 3.82mm on the left and right sides respectively. The mean diameter of the intramedullary canal was 4.51mm for the humeri with STF and in the normal humeri it was 5.77mm.

Conclusion: The knowledge of STF is essential in diagnostic orthopaedics, in intramedullary nailing of humerus in supracondylar fracture. STF is a radiolucent area in radiographs and this may be misinterpreted as osteolytic or cystic lesion.

KEY WORDS: Humerus, supratrochlear foramen, intramedullary canal, translucent septum.

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INTRODUCTION

A thin plate of bone separates the olecranon and the coronoid fossa, which may become perforated in some cases to give rise to a foramen known as “septal aperture” or “supratrochlear foramen”[1]. The STF was first described by Meckel [2]. Since then, it has been described in various animals like dogs, hyenas, cattle and other primates [3,4]. According to Hirsh (1927) the thin plate of bone between the olecranon and coronoid fossa is always present until the age of seven years, after which the bony septum occasionally becomes absorbed to form the STF [5].

Now a days, there has been increased incidence in intramedullary fixation of the humerus following high incidence of traumatic injuries and pathological fractures(6).

As supracondylar fractures are common in children, it requires proper pinning technique for stable configuration. So the definite structure of humerus and its variations play important role in treatment of supracondylar fractures of humerus to avoid operative errors. Hence present study aims to highlight the incidence, morphological features and clinical importance of STF which might be helpful for Anthropologist, Orthopaedic surgeons and Radiologists.

MATERIALS AND METHODS

The present study was conducted in 78 dried human humeri of unknown sex from the department of anatomy, Government Dharmapuri Medical college, Dharmapuri. Each humerus was studied for the presence of STF and its shape (oval, round, triangular, sleeve like). The vertical and transverse diameter of the foramen were measured by the digital Vernier caliper.

Radiographs were taken for the humerus with supratrochlear foramen and humerus without the foramen to observe the translucency of septum between coronoid and radial fossa in the lower end of humerus. Measurement of intramedullary canal were taken in radiographs in three levels 1) below the surgical neck 2) junction between upper 2/3rd and lower 1/3rd of shaft 3) above the olecranon fossa (fig 3).

Fig. 1: Supratrochlear foramen of humerus - A) Oval, B) Circular.

Fig. 2: Radiograph of humerus with STF(A) & Translucency of bony septum (B).

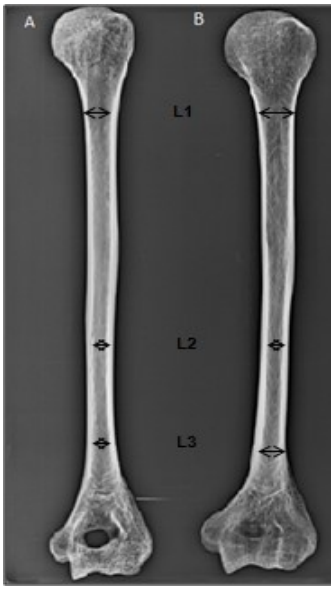

Fig. 3: Measurement of diameter of Intramedullary canal at 3 levels.

A -Humerus with STF.
B- Humerus without STF.

OBSERVATIONS

Among 78 specimens of humerus 41 are of left side, 37 are of right side. STF was seen in 15 bones, 9 were left side and 5 were right side. Most common shape of STF was oval 46.6%, followed by round in 33.3% (Fig 1) and triangular in 20 % (Table 1). The mean transverse, vertical diameter of STF and mean diameter of intramedullary canal at 3 different levels were tabulated in Table 2 and Table 3. The mean diameter of intramedullary canal without STF was 5.77mm and with STF was 4.51mm. Translucency of septum was noticed in 28 specimens (35.8%) (fig.2).

Table 1: Shape of Supratrochlear Foramen (STF)

S. No	Shape of STF	No of Humeri	Percentage
1	Oval	7	46.70%
2	Round	5	33.30%
3	Triangular	3	20%
4	Sieve	0	0%

Table 2: Different Measurements in Supratrochlear foramen.

Diameter (mm)	Right side	Left side
Mean Transverse Diameter	5.82	5.46
Mean Vertical Diameter	3.94	3.82

Table 3: Mean Diameter of Intramedullary Canal of Humerus with and without STF.

Different levels of Humerus	Mean Diameter of Intramedullary canal with STF	Mean Diameter of Intramedullary canal without STF
Below the surgical neck	4.5mm	5.81mm
Junction between upper 2/3 and lower 1/3 of shaft	4.82mm	6.24mm
Above the coronoid fossa	4.21	5.26mm

Table 4: Comparative data of incidence of Supratrochlear foramen in human races.

RACES	INCIDENCE (%)
Americans (Benfer & Mc kern, 1966)	6.9
Egyptians (Orztuk et al. 2000)	7.9
Japanese (Akabori,1934)	18.1
North Indians (Singh & singh,1972)	27.5
South Indians (Singh & Roa, 2007)	28
Eastern Indians (Chatterjee,1968)	27.4
Central Indians (Kate & Dubey,1970)	32
South Africans (Nodu et al, 2012)	32.5
Present study	19.2

DISCUSSION

The supratrochlear foramen is a neglected entity in both Anatomy and Orthopaedic text books [7]. Darwin mentioned STF in humans as one of the characteristic that shows man's close relationship to lower forms [10].

The incidence of STF varies in different races (Table 4). In our study the STF was found in 19.2% bones which coincide with the result of Akabori et al. But Jadhav et al [11] reported a higher incidence of STF (40.78%) in their study. STF was more common on left side than right side, which coincides with the findings of Kaur et al [12]. The shape of the STF observed in our study were oval 46.6%, round 33.3%, triangle 20% which is almost similar to those observed by Diwan et al [13]. Jadhav et al [11] reported a sieve like appearance of STF in 3.22% of bones in their study but in our study there was no such appearance. Translucent septum was seen on 28 humeri in that 53.5% of right side humeri and 46.4% left side humeri in the present study which is almost same as the result of Sunday et al [14].

Number of hypothesis were proposed regarding the cause of supratrochlear foramen. Some opine that it may be a racial anomaly or atavistic [15]. Darwin mentioned STF in humans as one of the characteristics that shows man's close relationship to lower forms [10]. According to Hirsh, the thin plate of bone is always present between olecranon and coronoid fossa up to 7 years after which the bony plate occasionally becomes absorbed to form the STF [16]. Mays suggested that hyperflexion of elbow joint which reabsorbs the humeral septum when the coronoid process of ulna make contact with it [17].

In the present study we observed the mean diameter of the medullary canal was less (4.48 mm) in humerus with STF, but in the normal humeri it was 6.36 mm. Akpinar et al [6] studied that the bones with STF have narrow medullary canal (less than 4mm) ,which makes the retrograde nailing more difficult and increases the chance of secondary fracture of distal end of humerus. Due to the narrowing of distal medullary canal in bones with STF, an ante-grade route has been advocated rather than a retrograde nailing route [18].

Nayak et al [16] observed in plain radiographs that the STF was located closer to medial epicondyle resulting in difficult intramedullary nailing. In our present study the position of STF is located near to the medial epicondyle, it coincides with Nayak et al [16]. The mean distance of the foramen from medial epicondyle is 23.84mm and the mean distance from lateral epicondyle is 24.06mm

De wilde et al [19] mentioned that STF is a relatively radiolucent area, commonly described as "Pseudo lesion" in an x ray of the upper limb and can be mistaken as an osteolytic or cystic lesion. The STF is more common in ancient primitive people than modern man, hence the presence of STF can be a reliable tool for the anthropologists for dating specimen [14].

So the presence of the foramen should be kept in mind during any orthopaedic, surgical and diagnostic procedure on lower end of humerus.

CONCLUSION

The STF is a neglected but important anatomical variation in the distal end of humerus. Incidence of STF in our present study is 19.2 % with left side prominence. The knowledge of STF is essential for orthopaedic surgeon for preoperative planning in fractures of distal end of humerus and to choose ideal nailing procedure. The radiologist need to be familiar with STF in order to avoid misdiagnosis during interpretation of plain radiographs and CT scans of distal third of the humerus.

ABBREVIATIONS

STF – Supra-Trochlear Foramen

Conflicts of Interests: None

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