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Original Research Article

MORPHOLOGICAL STUDY OF SUPRATROCHLEAR FORAMEN IN ADULT DRY HUMERUS BONES

Mallikarjun M [1], Raveendra Patil GT *[2], Solomon Krupanidhi U [3].

[1] Professor and Head, Department of Anatomy, Vijayanagar Institute of Medical Sciences (VIMS), Bellary, Karnataka, India.

*[2] Associate professor, Department of Anatomy, Vijayanagar Institute of Medical Sciences (VIMS), Bellary, Karnataka, India.

[3] Professor, Department of Anatomy, Vijayanagar Institute of Medical Sciences (VIMS), Bellary, Karnataka, India.

ABSTRACT

Background:A thin bony plate present between coronoid fossa and olecranon fossa of humerus bone sometimes perforated to form a foramen named as supratrochlear foramen (STF) or septal aperture. This was first described by Meckel in 1825. According to Hirsh (1927) thin plate of bone between coronoid & olecranon fossa is always present until the age of 7 years after which the bony septum occasionally becomes absorbed to form STF. It has been described in hyena, dog, cattle and other primates. STF in the distal end of the humerus is associated with narrow intramedullary canal(IMC). During radiological evaluations of the humerus,the presence of STF may result in erroneous interpretation as osteolytic lesion or cystic lesion. Previous studies on the Indian population have the varying incidences from 19.2% to 34.4%.

Aims and Objectives: The present study was done 1) to know the proportion of STF and 2) to know the various types (shapes) of supratrochlear foramen in adult humerus bones.

Material and Methods: The study was done on 200 (100 Right &100 Left) adult dry humerus bones of both sexes collected over a period of 3 years from the department of Anatomy, Vijayanagar institute of medical sciences (VIMS), Bellary, Karnataka. Study of various types (shapes) of supratrochlear foramen was done by naked eye observation. Opacity and Translucency of septum were observed by placing its lower end against X- ray lobby. The data obtained was tabulated and statistically analysed.

Results: STF was observed in 64(32%) humeri and was classified into various types. Out of 64 humeri having STF the commonest shape was oval 28(43.75%), followed by rectangular 12(18.75%), triangular 8(12.5%), sieve like 6(9.35%), round 5(7.81%) and reniform3(4.68%). We found 2(3.12%) left humeri with multiple sieve like foramen in coronoid olecranon aperature and also in radial fossa. Opaque septum was observed in 79 (39.5%) humeri and translucent septum in 57 (28.5%) humeri.

Conclusion: Supratrochlear foramen is a common anatomical variation in lower end of humerus bone with significant surgical implication. Proper identification of this anomaly on preoperative radiographs should alert the surgeon while insertion of intramedullary nailing for treatment of supracondylar fractures of humerus. The presence of supratrochlear foramen is also important for radiologists and orthopedicians for proper interpretation of X-rays, since they are radiolucent and are easily mistaken for osteolytic and cystic lesions.

KEY WORDS: Supratrochlear foramen, Supracondylar fracture, Intramedullary nailing, Osteolytic lesion, Anthropology.

Corresponding Author: Dr. Raveendra Patil GT, Associate professor, Department of Anatomy, Vijayanagar Institute of Medical Sciences (VIMS), Bellary, Karnataka, India.
Mobile: +919742666674 **E-Mail:** drravi2201@gmail.com

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INTRODUCTION

Supratrochlear foramen (STF) is an important and relatively common variation at the lower end of humerus. A thin translucent septum varying in thickness from 0.5 mm to 5 mm is situated above trochlea separating the coronoid fossa anteriorly and olecranon fossa posteriorly between medial and lateral epicondyles. The thickness of the septum determines its opacity or translucency. In some cases, the septum may be perforated to form Supratrochlear foramen (STF) and is also called by different names– olecranocoronoid septal aperture, intercondylar foramen or epitrochlear foramen. This was first described by Meckel in 1825[1]. According to Hirsh(1927) thin plate of bone between coronoid and olecranon fossa is always present until the age of 7 years after which the bony septum occasionally becomes absorbed to form STF[2]. It has been described in hyena, dog, cattle and other primates[3].

STF in the distal end of the humerus is associated with narrow intramedullary canal(IMC). In humeri with STF the IMC diameter is < 4mm, (normal 6-8mm)more pronounced in the distal end. Measurements of IMC are important in the treatment of intramedullary nailing procedures[4]. During radiological evaluations of the humerus, the presence of STF may result in erroneous interpretation as osteolytic lesion or cystic lesion[5].

Aims and Objectives: The present study was done 1) to know the proportion of STF and 2) to know the various types (shapes) of supratrochlear foramen in adult humerus bones.

MATERIALS AND METHODS

Source of data: The study was done on 200 (100 Right & 100 Left) adult dry humerus bones of both sexes collected over a period of 3 years from the department of Anatomy, Vijayanagar institute of medical sciences (VIMS), Bellary, Karnataka. Study of various types (shapes) of supratrochlear foramen was done by naked eye observation. Opacity and Translucency of septum were observed by placing its lower end against X- ray lobby. The data obtained was tabulated and statistically analysed.

Study design: It is an observational study.

OBSERVATIONS AND RESULTS

In the present study of 200 adult dry humerus bones, STF was observed in 64 (32%) humeri. STF was more on left humeri (37) than on right humeri (27) (Table 1). Opaque septum was observed in 79 (39.5%) humeri and translucent septum in 57 (28.5%) humeri (Fig 3).

Table 1: Proportion of Opaque septum, Translucent septum & STF in humerus.

Sl.no	Variables	Humerus Left	Humerus Right	Total	Percentage %
1	Opaque septum	34	45	79	39.5
2	Translucent septum	29	28	57	28.5
3	STF	37	27	64	32
	Total	100	100	200	100

Fig. 1: Left Humeri (100) used for the study.

Fig. 2: Right Humeri (100) used for the study.

Fig. 3: Humeri with translucent septum.

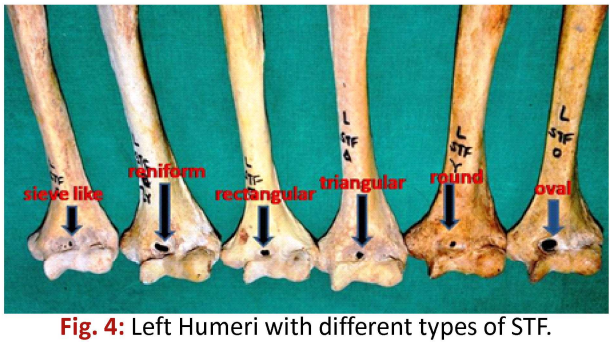


Fig. 4: Left Humeri with different types of STF.

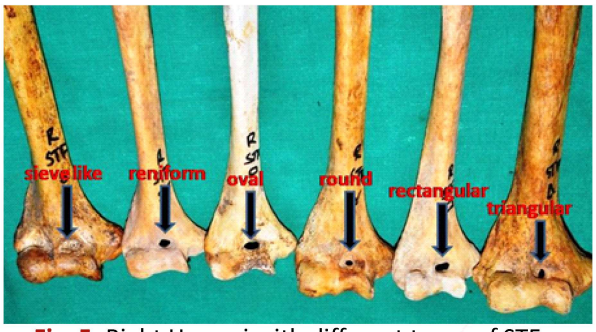


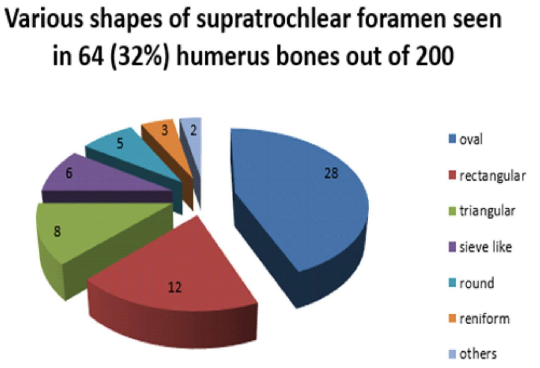
Fig. 5: Right Humeri with different types of STF.

Fig. 6: Humeri with sieve like foramen in septal aperture and also in radial fossa.

In the present study, the most common type (shape) of supratrochlear foramen is oval 28(43.75%) followed by rectangular 12(18.75%), triangular 8(12.5%), sieve like 6(9.35%), round 5(7.81%), reniform 3(4.68%). We found 2(3.12%) left humeri with multiple sieves like foramen in coronoid olecranon aperture and also in radial fossa (Fig 6).

Table 2: Different shapes of Supratrochlear foramen in humerus bone (Fig 4 & 5).

Sl.no	Shapes	Humerus Left	Humerus Right	Total	Percentage %
1	Oval	14	14	28	43.75
2	Rectangular	6	6	12	18.75
3	Triangular	6	2	8	12.5
4	Sieve like	5	1	6	9.35
5	Round	2	3	5	7.81
6	Reniform	2	1	3	4.68
7	others	2	0	2	3.12
	Total	37	27	64	100



Pie chart: Showing the Various shapes of supratrochlear foramen seen in 64 (32%) humerus bones out of 200.

DISCUSSION

Many theories have been postulated explaining reasons for STF. Tyl-lianakis et al [6] considered this foramen as atavastic, in contrast to the popular theory of mechanical pressure causing this foramen during hyperextension. Brauer et al [7] suggested that the joint hypermobility on left side for higher prevalence of the same. According to Blakely et al, STF is a phylogenetic character found in primates which is expressed in weaker limbs and suppressed in the stronger limbs [8].

Charles Darwin described STF in humans as one of the characteristics linking origin of man's evolution to lower animals. The STF is commoner in ancient primitive people than modern man; hence the presence of STF can be an invaluable tool to the anthropologists for dating specimens.

The formation of septal humeral aperture finds a probable genetic basis. Chapman et al indicated probable role of T-Box(TBX) genes in the formation of STF. The TBX proteins produced by these genes are crucial for the development of limbs in utero and also in postnatal life [9].

The present study showed the presence of STF in humerus bone was 64 (32%) which is similar to study done by Kate BR et al [10] who also reported STF in 32%,and was higher when compared to study done by authors like Singh S et al [11] in 27.5%, Singhal S et al [12] in 28%, Savitha et al [14] in 28.8%, & Sangeetha V et al [15] in 30.5%, and was lower when compared to study done by Soubhgya R Nayak et al [13] in 34.4%. Previous studies on the Indian population have the varying incidences from 19.2% to 34.4%. Different races exhibit wide variations in incidence of STF ranging from 6.9% to 47%. (Table-3).

Supracondylar fractures account for 17% of all paediatric injuries. Retrograde nailing forms the mainstay treatment [16].

As STF is associated with narrow IMC, antegrade route may be preferred [4]. Sometimes, the presence of STF may be associated with the other anatomical variation in the lower end of humerus such as supracondylar process or ligament of Struthers which could compress the neurovascular structures [17].

Table 3: Comparison of supratrochlear foramen in different races.

Sl.no	Author	Races (population)	Percentage %
1	Akabori 1934 [18]	Australians	46.5
2	Akabori 1934 [18]	Koreans	11
3	Krishnamurthy et al. 2011 [20]	Mexicans	38.7
4	Benfer RA, Tappen NC. 1968 [19]	Americans	6.9
5	Jing LI et 2015 [21]	Chinese	17.5
6	Akabori 1934 [18]	Japanese	18.1
7	Glanville et al 1967 [22]	Africans	47
8	Hrdlicka 1932 [23]	Italians	9.4
9	Soubhagya R Nayak, et al 2009 [13]	Indians	34.4
10	Mallikarjun M et al [2020]	Present study (Indians)	32

CONCLUSION

The present study showed the presence of supratrochlear foramen in 64 (32%) humerus bones. Supratrochlear foramen is a common anatomical variation in lower end of humerus bone with significant surgical implication.Proper identification of this anomaly on preoperative radiographs should alert the surgeon while insertion of intramedullary nailing for treatment of supracondylar fractures of humerus. The presence of supratrochlear foramen is also important for radiologists and orthopedicians for proper interpretation of X-rays, since they are radiolucent and are easily mistaken for osteolytic and cystic lesions.

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Conflicts of Interests: None

REFERENCES

[1]. Meckel JH, Kate BR, Dubey PN. A note on septal apertures in the humerus of central Indians. E anthropol. 1970;33:270-84.

[2]. Hirsh SI, Morton SH, Crysler WE. Osteochondritis dessicans of the supratrochlear septum. J Bone Joint Surg. 1945;27-A:12-24.

[3]. Haziroglu RM, Ozer M. A supratrochlear foramen the humerus of cattle. Anat Histol Embryol. 1990;19:106-8. https://doi.org/10.1111/j.1439-0264.1990.tb00893.x PMid:2240581

[4]. Paraskevas GK, PapaziogasB,Tzaves A, Giaglis G, Kitasoulis P, Natsis K. Supratrochlear foramen the humerus and its relation to intramedullary canal: a potential surgical application. Med Sci Monit. 2010;16(4):119-23.

[5]. Lamb DS. The olecranon perforation. Am Anthrapol. 890;3;159-74. https://doi.org/10.1525/aa.1890.3.2.02a00050

[6]. Tyl¬lianakis M, Tsompos P, Anagnostou K et al. Intramedullary nailing of humeral diaphyseal fractures. Is distal locking really necessary? Int. J Shoulder Surg. 2013;7(2):65-8. https://doi.org/10.4103/0973-6042.114233PMid:23960365 PMCid:PMC3743033

[7]. Brauer CA, Lee BM, Bae DS et al. A systemic review of medial and lateral entry pinning versus lateral entry pinning of supracondylar fracture of humerus. J Pediatric Orthop. 2007;27:181-6. https://doi.org/10.1097/bpo.0 b013e3180316cf1 PMid:17314643

[8]. Blakely RL, Marmouze RJ, Wynne DD: The Incidence of the Perforation of the coronoid-olecranon Septum in the Middle Mississippian Population of Dickson Mounds, Fulton Coun¬ty, Illinois. In Proceedings of the Indiana Academy of Sci¬ence, 2013;78:73-82.

[9]. Chapman DL, Garvey N, Hancock S, Alexiou M, Agulnik SI, Gibson-Brown JJ et al. Expression of the Tbox family genes, TBx1-TBx 5, during early mouse development. Dev Dyn.1996;206:379-90.https://doi.org/10.1002/(SICI)1097-0177(199608)206:4<379::AID-AJA4>3.0.CO;2-F

[10]. Kate BR, Dubey PN. A note on septal apertures in the Humerus. E Anthropol.1970;33:270-84.

[11]. Singh S, Singh SP. A study of the supratrochlear foramen in the humerus of North Indians. J Anat Soc India. 1972;21:52-56.

[12]. Singhal S, Rao V. Supratrochlear foramen of the humerus. Anat Sci Int. 2007;82(2):105-7. https://doi.org/10.1111/j.1447-073X.2007.00172.xPMid:17585566

[13]. Soubhagya R Nayak, Srijit Das, Krishnamurthy A, Prabhu V, Potu BK. Supratrochlear foramen of the humerus: Anatomico-Radiological study with clinical implications. Upsala J of Med Sci. 2009;114(2):90-4. https://doi.org/10.1080/03009730802688819 PMid:19396695 PMCid:PMC2852753

[14]. Savitha V, Dakshayani KR. Study of supratrochlear foramen of humerus. Int J Ant Res. 2016;4(4):2979-83. https://doi.org/10.16965/ijar.2016.387

[15]. Sangeetha V, Premchand SA. Morphology of humeral septal aperture: an osteologic study. NJBMS 2017;8(2):83-6.

[16]. Cheng JC, Shen WY. Limb fracture in different paediatric age group: a study of 3350 children. J Orthop Trauma,1993;7:15-22. https://doi.org/10.1097/00005131-199302000-00004PMid:8433194

[17]. Varlam H, St Antoe D, Christol RO. Supracondylar process and supratrochlear foramen of humerus:a case report and review of literature. Morphologie: bulletin de 1 Association de anatomists.2005;89(286):121-5. https://doi.org/10.1016/S1286-0115(05)83248-5.

[18]. Akabori E. Septal apertures in the humerus in Japanese, Ainu and Koreans. Am J Phys Anthropol. 1934;18:395-400. https://doi.org/10.1002/ajpa.1330180320

[19]. Benfer RA, Tappen NC. The occurrence of the septal perforation of the humerus in three non-human primate species. Am J Phys Anthropol. 1968;29:19-28. https://doi.org/10.1002/ajpa.1330290111 PMid:4971986

[20]. Krishnamurthy A, Yelicharla AR, Takkalapalli A, Munishamappa V, Bovinndala EB, Chandramohan M. Supratrochlear foramen of humerus - a morphometric study. Int J Biol Med Res. 2011;2(3):829-31.

[21]. Jing LI, Qinghua MAO, Wenyuan LI, Xiaoyan LI. An anatomical study of the Supratrochlear foramen of Jining population. Turk J Med Sci. 2015;45(6):1369-73. https://doi.org/10.3906/sag-1407-44 PMid:26775396

[22]. Glanville EV. Perforation of the coronoid-olecranon septum humero-ulnar relationships in Netherlands and African populations. Am J Phys Anthropol. 1967;26:85-92. https://doi.org/10.1002ajpa.1330260111 PMid:5633731

[23]. Hrdlicka A. The humerus: septal apertures. Anthropologie. 1932;10:31-95.

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