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Incidence of supratrochlear foramen and supracondylar spur and its clinical importance of humerus in western Rajasthan

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Abstract

Introduction: Supratrochlear foramen (STF) is a hole located above the trochlea of the humerus. The coronoid and the olecranon fossa are located at the distal third of the humerus, they are usually separated by a thin wall. Supracondylar spur (SCS) is a hook shaped bony projection, about 2-20mm in length, occasionally project from the anteromedial surface of the shaft of humerus about 5 cm proximal to the medial epicondyle.

Material and Method: 200 humerus bone were studied from the department of anatomy Dr SN Medical College Jodhpur Rajasthan. Bones were examined for supratrochlear foramen and supracondylar spur, its dimension were recorded with vernier caliper and photographs taken.

Result: Out of 200 humeri 42 bones showing the supratrochlear foramen and one bone showing the supracondylar spur.

Conclusion: The STF and SCS is of great importance in as it has clinical, anatomical, radiological and anthropological relevance they are mistakenly diagnosed as an osteolytic lesion in radiograph.

Keywords: STF-supratrochlear foramen, scs- supracondylar spur, vernier caliper

1. Introduction

Supratrochlear foramen (STF) is hole located above the trochlea of the humerus. The coronoid and the olecranon fossa are located at the distal third of the humerus, they are usually separated by a thin wall. In some case this thin wall or membrane is perforated, produce the supratrochlear foramen. Supracondylar spur (SCS) is a hook shaped bony projection, about 2-20mm in length, occasionally project from the anteromedial surface of the shaft of humerus about 5 cm proximal to the medial epicondyle^[1]. The spur may often be joined to the medial epicondyle by a fibrous band called Struther's ligament. The foramen so formed usually encloses the medial nerve and brachial artery. STF and SCS are anatomic variation of great clinical importance and anthropological interest. The causes of the variation are not clear. Both supracondylar foramen and supracondylar spur located in lower 1/3rd of the humerus^[2]. Supracondylar spur was first described by Sir John Struthers a Scottish Anatomist in 1849^[14].

2. Material and Method

The study was conducted at the Department of Anatomy Dr. S.N. Medical College during 2 years. A total 200 bony humerus were analyzed. All bone was from Indian cadavers free from any pathology. Only adult bones were used in this study. The humerus were divided into four group. Humerus with STF (group A), humerus with a translucent STF (group B), humerus without STF (group C) and humerus with SCS (group D)^[3]. Random humerus from the four groups were selected.

The spur size and other dimensions of STF were measured with manual vernier caliper.

Following parameters were studied^[4]

1. Incidence of STF and SCS
2. Morphometric dimensions of STF and SCS



Fig 1: Humeri collected from the department from Dr SN Medical College **Fig 2:** Bone showing the supratroclear foramen.



Fig 3: Bone showing translucent supratroclear foramen



Fig 4: Bone showing supracondylar spur



Fig 5: Measurement of supracondylar spur



Fig 6: Supracondylar spur in lower 1/3rd humerus

3. Result

In the 200 humeri studies, 42 possessed the STF, 124 bone showed a translucent STF. In 34 bones the STF was absent and only one bone (left side) shows the supracondylar spur.

Table 1: Incidence of supratroclear foramen and supracondylar spur

S No.	Group	Number
1.	Group A	42 (21%)
2.	Group B	124 (62%)
3.	Group C	34 (17%)
4.	Group D	1 (0.5%)left side

Most common shape of STF was round in 25 out of 42 humeri with STF, followed by oval in 17 humeri. No triangular or sieve like shape was observed.

Table 2: Shape of the supratroclear foramen

Shape of STF	No. of humerus
Oval	25
Round	17
Triangular	00
Sieve	00

The mean vertical and transverse diameters of STF was observed.

Table 3: Mean diameter of supratroclear foramen

Parameter	Humerus
Mean transverse diameter	5.14 – 5.21 mm
Mean vertical diameter	3.79 – 3.94 mm

Out of 200 humerus only one humerus had the supracondylar spur. The incidence calculated in our study was 0.50 %. The humerus was of left side with supracondylar spur on anteromedial surface.

Table 4: Dimensions of supracondylar spur

Parameter [8]	Measurements
Length of the spur	0.7 cm
Length at the base	0.6 cm
Breadth at the spur	0.3 cm
Distance from anterior border	1.6 cm
Distance from medial border	0.8 cm
Distance from nutrient foramen	7.8 cm
Distance from lower end	6.6 cm

4. Discussion

The supracondylar foramen STF also known as septal aperture, intercondylar or olecranon foramen occurs when the bony wall that separates the olecranon and coronoid fossa at the humerus is absent or perforated. The thickness of the bony septum is 0.5mm to 1 cm. The septum is covered by the synovial membrane; the supratroclear foramen is frequently seen in left side. The aperture can be classified in different shapes such as oval (most common), round, triangular and sieve.

The cause of STF still seen to be unknown, hypothesis such as

1. failure of ossification process
2. Mechanical pressure caused by an enlarged olecranon process during hyperextension of the elbow.

3. Atrophy of the bone after ossification.
4. Disturbances in the calcium metabolism
5. Decrease in blood supply caused by pressure.

The incidence of STF ranges from 0% to almost 60% among different groups of human population. [5] Different races exhibit wide variations in the incidence depending upon the race and sample size studied. STF is often found in primates and thus considered as an atavistic character. Lamb suggested mechanical stress hypothesis in the resorption of the septum at the point of contact of the coronoid or olecranon process of ulna with humerus as a leading factor in the formation of STF such as impact pressure in cases of hyperflexion Or hyper-extension at elbow joint.

Present study showed an incidence of STF as 21% which is in conformity with the reports of Akabori [6] in Mexicans, Ananthi *et al.* and Bhanu *et al.* and more than stated in the reports of Benfer *et al.*, Trotter, Mays and less as reported by Akabori in Australians & Egyptian races. Singhal S *et al.* and Anupama Mahaj an reported the incidence to be 28% and 26% respectively. Earlier studies showed an incidence of 27.4% in Eastern Indians, 32% in Central Indians, 27.5% in North Indians, 28% in South Indians and 34.4% in overall Indians.

Table 5: Previous studies of supratroclear foramen and Incidence

S. No	Author	Population	STF %
1.	Akabori (15)	Australians	46.5
2.	Akabori (15)	Egyptians	43.9
3.	Akabori (15)	Mexicans	30.7
4.	Anupama M (8)	North Indians	26
5.	Singhal &Rao (3)	South Indians	28
6.	Ananthi <i>et al.</i> (16)	Indians	31.3
7.	Benfer <i>et al.</i> (7)	Americans	6.9
8.	Bhanu (9)	Indians	30.5
9.	Trotter (18)	American Africans	12.6
10.	Trotter (18)	American whites	4.3
11.	Mays (14)	English	6.9
12.	Hima (6)	Eastern Indians	27.4
13.	Kate (1)	Central Indians	32
14.	Kate (1)	Overall Indians	34.4

Supratrochlear fracture of humerus accounts for 75% of the total of pediatric age group injuries. Its treatment requires an adequate route of pin entry [7]. The presence of STF at the lower end of humerus may cause hindrance in planning out intramedullary humeral nailing procedure in the distal end of humerus, thus establishing the need to have a better anatomical understanding of lower end of humerus [7]. Antegrade intramedullary nailing procedure is preferred over the retrograde procedure in such cases of humerus with STF.

Supracondylar spur is a vestigial structure found in climbing mammals and felines that once served as the insertion of the muscle latissimocondyloideus [11]. The supracondylar spur is rudimentary homologous of supracondylar foramen or entepicondylar foramen found in lower animals. It has a protective role in numbers of cat family. It forms the roof of a foramen that transmit a neurovascular bundles.

In our study the incidence calculated was 0.50 %. The reported incidence of SCS varied from 0.1 % to 2.7 % in different races.

The incidence of supracondylar spur as given by different authors

Table 6: Previous studies of supracondylar spur and incidence

S. No.	Name of author	Year	No. of humerus	Supracondylar spur (SCS)	Incidence	Average length
1.	Lattupalli hema	2015	152	1	0.65 %	20 mm
2	Shivaleelac	2014	240	1	0.41 %	10 mm
3.	Ravi Vandana	2014	133	1	0.75 %	8 mm
4.	Shiny Vinilash	2014	70	2	2.50 %	6.5 mm
5.	Prabahita Barush	2012	80	1	1.25 %	11 mm
6.	Ganesan Murgaperumal	2012	30	1	3.30 %	10 mm
7.	Gupta R K	2008	380	1	0.26 %	3 mm
8.	Natsis	2008	750	10	1.30 %	9.5 mm
9.	Oleyemi K A	2007	40	1	2.50 %	16 mm

There is high incidence of unilateral supracondylar spur of the humerus in Cornelia de large syndrome, an autosomal recessive trait, occurring in approximately one in every 10 thousand live birth [15]. From embryological point of views the struther s ligament lies between the tendon of the latissimus dorsi and the coracobrachialis and corresponding to the lower part of the vestigial latissimocondyloideus a muscle found in climbing mammals which extends from the tendon of insertion of the latissimus dorsi muscle to the medial epicondyles.

The supracondylar foramen has very a low incidence in Indian population. 90% of the supracondylar process was very common on left side humerus and more common in male subjects [12]. Various authors referred the supracondylar process as supraepitroclic, epicondylitis, epicondylic, supracondyloid and supracondylar spur. It is an embryological vestigial remnant of the supracondylar foramen or end epitroclic foramen found in apes, monkeys, lininf reptiles, most marsupials, members of cat family especially jaguars, occasionally present in orang-utan, gorilla and normally present in climbing animals like lemurs [13].

Supracondylar process of humerus is usually an incidental finding in radiograph can also be diagnosed by palpation. Pressure from the ligament on the artery or have many very rarely cause an irrigative spasm of the vessels or a median nerve palsy. Such palsy can mimic the “carpal tunnel syndrome”.

Median nerve compression and claudication of brachial artery may present as the symptoms of fracture of the supracondylar spur. [10]

Entrapment of brachial artery and median nerve by this ligament at the level of supracondylar spur is known as supracondylar process Syndrome which can be treated by surgical removal of the process and ligament.

Compression of such structure causes paresthesia and hyperesthesia of hand and fingers.

5. Conclusions

The STF and SCS is of great clinical importance in as it has clinical, anatomical, radiological and anthropological relevance they are mistakenly diagnosed as an osteolytic lesion in radiograph. Symptoms due to STF and SCS of humerus, although rare are common enough to make it the subject of routine examination with pain and disturbance of sensibility of hand. The awareness of supracondylar spur is important for the orthopedic surgeon as it may affect the preoperative planning in case of distal humerus fractures.

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