DOI: 10.7860/JCDR/2014/6743.3915

Original Article

Anatomy Section

Morphological Study of the Supracondylar Process of the Humerus and Its Clinical Implications

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ABSTRACT

Background: The supracondylar process of the humerus, which is also called the supra-epitrochlear, epicondylar, epicondylic process or a supratrochlear spur, is a hook-like, bony spine of variable size that may project distally from the anteromedial surface of the humerus. It represents the embryologic vestigial remnant of climbing animals and seen in many reptiles, most marsupials, cats, lemurs and American monkeys.

Materials and Methods: Two hundred and forty dried humeri were studied from department of Anatomy, Sri Siddhartha Medical College, Tumkur, Karnataka, India. The bones were examined for supracondylar process. On finding, the dimensions were recorded and photographed.

Results: Out of 240 dried humeri examined we found only 1 humerus of the left side with an osseous spine on the anteromedial surface. The incidence calculated in this study was 0.41%.

Conclusion: The supracondylar process is frequently misjudged as a pathological condition of the bone rather than as a normal anatomical variation. Though, this process has been of more interest to anatomists and anthropologists because of a possible link to the origins and relations of the human races than to clinicians, many of whom are not aware of its occasional presence. It is usually clinically silent, but may become symptomatic by presenting as a mass or can be associated with symptoms of median nerve compression and claudication of the brachial artery.

Keywords: Supracondylar process, Humerus, Struther's ligament

INTRODUCTION

The supracondylar process of the humerus, which is also called the supra-epitrochlear, epicondylar, epicondylic process or a supratrochlear spur, is a hook-like, bony spine of variable size that may project distally from the anteromedial surface of the humerus. It is 2-20 mm in length and about 5 cm proximal to the medial epicondyle. It may be joined to the medial epicondyle by a fibrous band ('Ligament of Struthers') which may ossify. The process, band and shaft of the humerus form a ring or canal through which the median nerve and the brachial artery (or a branch of it) may be transmitted [1]. The process and the Ligament of Struthers may give insertion to a portion of the abnormally low fibers (the third head) of coracobrachialis muscle and may also give origin to the pronator teres muscle [2]. The median nerve and/or brachial artery may become compressed causing clinical symptoms. Struthers [3], Solieri [4], and Aydinlioglu et al., [5] have described cases of median nerve entrapment. Compression and claudication of brachial artery has been reported by Hafid et al., [6] and Thompson and Edwards [7]. Quain [8] described a rare case of ulnar artery compression. Spinner [9] discussed fractures of supracondylar process.

In 1818 and 1819, Tiedemann reported the occurrence of this process in apes and monkeys and the first illustration of a supra-condylar process appears in 'Tiedmann's Tabulae Arterium' [10]. The incidence varies from 0.1% to 5.7% [11]. Terry [12] reported finding a supracondyloid process in 6 of 515 (1.16%) whites, but only once in 1,000 (0.1%) Negroes. It is a normal anatomical structure in climbing animals [5]. It represents the embryologic vestigial remnant of climbing animals and is seen in many reptiles, most marsupials, cats, lemurs and American monkeys [13]. The present study is carried out to study the incidence of the supracondylar process of the humerus in South Indians and discuss its clinical implications.

MATERIAL AND METHODS

The study was conducted on 240 dried humeri which were collected from Department of Anatomy, Sri Siddhartha Medical College, Tumkur, Karnataka, India. The bones were examined for any osseous projection from distal part under daylight. On finding a supracondylar process, the dimensions of the projection were recorded and photographed.

RESULTS

Out of 240 dried humeri examined, we found only 1 humerus of the left-side with an osseous spine on the anteromedial surface (See [Table/Fig-1&2]. It was 6 cm proximal to the medial epicondyle, was projecting 0.5 cm from the surface and the base was 1 cm long vertically and 1 cm broad. The spine was directed forwards and medially. The distance between the tip of the spine to medial supracondylar ridge was 1.5 cm. The distance of spine from nutrient foramen was 4.7 cm. The total length (from the lowest tip of the trochlea to the highest point of the head) of this humerus was 31 cm. The incidence calculated in this study was 0.41%.

DISCUSSION

The incidence of the supracondylar process of the humerus is very low and the percentage of incidence, as given by different authors varies [Table/Fig-3]. The dimensions of the supracondylar process in our study are markedly different from other studies done by Gupta RK [14], Oluyemi KA [15] and others [Table/Fig-4]. There is a high incidence of unilateral supracondylar process of the humerus in 'Cornelia de Lange syndrome', an autosomal recessive trait, occurring in approximately one in every 10,000 live births [16].

It is usually clinically silent, but may become symptomatic by presenting as a mass or can be associated with symptoms of median nerve compression and claudication of the brachial artery [17].

The process ends in a roughened point at which a dense fibrous band (Ligament of Struthers) continues to the medial epicondyle [13]. From embryological point of view, the Struther's ligament lies between the tendon of the latissimus dorsi and the coracobrachialis and corresponds to the lower part of the tendon of the vestigial latissimo-condyloideus, a muscle found in climbing mammals which

[Table/Fig-1]: Showing left sided humerus with supracondylar process

[Table/Fig-2]: Showing only the distal part of the humerus with supracondylar process

extends from the tendon of insertion of the latissimus dorsi muscle to the medial epicondyle [18]. Rarely, this fibrous band may ossify forming a supracondylar foramen, a tunnel which transmits the median nerve and the brachial artery and sometimes a variant ulnar artery [19] or the ulnar nerve [20]. In lower mammals, the osseo-fibrous tunnel formed by the humerus, supracondylar process and the Struthers' ligament serves to protect the nerves and vessels going to the forearm [20]. In human, the presence of supracondylar process and the Struthers' ligament is usually asymptomatic, but also it is an important entrapment site for the median nerve and brachial artery. Entrapment of brachial artery and median nerve by this ligament at the level of supracondylar process is known as the supracondylar process syndrome which can be treated by surgical removal of the process and ligament [21]. The compression symptoms include severe paresthesia and hyperesthesia of the hand and fingers, ischemic pain of the forearm, embolization of the distal arm arteries and disappearance of the radial or ulnar pulse on full extension and supination of the forearm [18, 20]. More rarely, ulnar nerve compression can also occur if the fibromuscular band from the process, instead of being attached to the medial epicondyle, extends downward as a band which blends with the fibrous arch between the two heads of the flexor carpi ulnaris. The

Sl. No	Author	Incidence	Population/race
1	Gruber (1865)	2.7%	European race
2	Danforth (1924)	0.5%	Mixed (Review)
3	Adachi (1928)	0.8%	Mixed (Review)
4	Terry (1930)	1.16%	European race
5	Terry (1930)	0.1%	Negroes
6	Hrdliýka (1923)	1%	American Indians
7	Dellon (1986)	1.15%	European race
8	Parkinson (1954)	0.4%	Mixed population
9	Natsis (2008)	1.3%	Caucasian s
10	Gupta (2008)	0.26%	Indians (Gujrat)
11	Oluyemi (2007)	2.5%	Nigerians
12	Prabahita (2012)	1.25%	Indians (Assam)
13	Present study	0.41%	Indians (Karnataka)

[Table/Fig-3]: The Incidence of supracondylar process reported in studies of different races

Measurement of supracondylar process	In Gupta RK study	In Oluyemi KA study	In Prabahita B study	Present study
Length of spine	0.3 cm	1.6 cm	1.1 cm	0.5 cm
Distance of spine from medial epicondyle	6.5 cm	5.5 cm	4.4 cm	6.0 cm
Breadth at the base of spine	1.1 cm	-	1.5 cm	1.0 cm
Distance of spine from nutrient foramen	-	5.3 cm	6.5 cm	4.7 cm

[Table/Fig-4]: Showing measurements of supracondylar process as reported by different authors

anterior surfaces of the humerus are also covered by the brachialis muscle. The spine is thus likely to be within the substance of the brachialis muscle. This could probably impair the function of the muscle [22]. The diagnosis of the process and evaluation of the amount of compression of the neurovascular bundle can be made by EMG and Doppler evaluation, together with physical examination. Nerve conduction velocity testing and electromyography have rarely been helpful in confirming the diagnosis but have been useful in identifying concomitant nerve compression at other sites in the limb [23,24].

A supracondylar process should be differentiated from osteo-chondroma. The spur is oriented distally, towards the elbow joint and there is no discontinuity in the cortex of the humerus. An osteochondroma points away from the joint. X-ray films of the supracondylar process show an intact underlying humeral cortex, whereas in an osteochondroma, the cortex of the tumour is continuous with the humeral cortex. Heterotopic bone such as myositis ossificans may also mimic a supracondylar process. The anteroposterior radiographic view is most important since the lateral view may fail to show the spur on the anteromedial surface of the humerus [25]. Rare cases of fractures of the process have also been reported. Fracture of the process following trauma may cause median nerve compression symptoms as reported by Newman [26]. Treatment consists of excision of the supracondylar spur and the associated ligament of Struthers. The spur has been reported to recur and it is, therefore, recommended that the spur be removed together with the overlying periosteum [9].

CONCLUSION

The supracondylar process is frequently misjudged as a pathological condition of the bone rather than as a normal anatomical variation. It is usually clinically silent, but may become symptomatic by presenting as a mass or can be associated with symptoms of median nerve compression and claudication of the brachial artery.

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FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Jun 20, 2013**
Date of Peer Review: **Sep 05, 2013**
Date of Acceptance: **Nov 24, 2013**
Date of Publishing: **Jan 12, 2014**