The Prevalence of Supracondyloid Process in the Living: A Radiographic Study

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ABSTRACT

Objective: *The spur or the supracondyloid process of the humerus has been of special interest to anatomists, anthropologists and clinicians. Apart from the anthropological research by ancient authors and clinical studies carried out half a century ago, no study of this variation appear in the literature. The aim of the present work is to investigate this variation in the living subjects.*
Methods: *The present information was performed on direct radiograms of the elbow obtained from the volunteer individuals. This study was carried out over a 3-year period from 2005–2008.*
Results: *The spur was found in 9 cases among the 903 persons examined. Bilateral occurrence of the process was higher than that reported in the literature. The cases with the spur reported mild pain in the forearm over a long period.*
Conclusion: *This study showed a higher occurrence of bilateral supracondyloid process than previously reported. It is also suggested that the cases reported as asymptomatic may not be fully free of the complaint of pain which might assist the clinician in their diagnosis.*

Keywords: Brachial artery, median nerve, struthers ligament, supracondylar spur, variation

Prevalencia del Proceso Supracondileo en los Vivos: un Estudio Radiográfico

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RESUMEN

Objetivo: *El espolón o proceso supracondileo del húmero ha sido de interés especial para anatomistas, antropólogos y médicos. Aparte de la investigación antropológica por autores en la antigüedad, y los estudios clínicos llevados a cabo tan sólo hace medio siglo, no hay un estudio de esta variación en la literatura. El objetivo del trabajo presente es investigar esta variación en los sujetos vivos.*
Métodos: *La información presente procede directamente de radiogramas del codo hechos a individuos voluntarios. Este estudio se llevó a cabo por un periodo de 3 años, desde el 2005 al 2008.*
Resultados: *Se encontró el espolón en 9 casos entre las 903 personas examinadas. La ocurrencia bilateral del proceso fue más alta que la reportada en la literatura. Los casos con espolón reportaron un dolor ligero en el antebrazo por un periodo largo.*
Conclusión: *Este estudio mostró una ocurrencia más alta del proceso supracondileo bilateral que la reportada anteriormente en la literatura. También sugiere que los casos reportados como asintomáticos pueden no estar totalmente libres de quejas de dolor, las cuales podrían ayudar al médico en su diagnóstico.*

Palabras claves: Arteria braquial o humeral, nervio medio, nervio mediano, ligamento de Struthers, espolón supracondileo, variación

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INTRODUCTION

Since the early 18th century, the spur or the supracondylar process variation of the humerus has been of special interest to anatomists, anthropologists and clinicians. The spur was first described as a clinically significant entity by Struthers (1). Ancient authors reported the incidence and racial

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distribution of this variation (2–5). Much later, its significance as a potential source for compression of the median nerve (6), ulnar nerve (7), combined median and ulnar nerve (8), brachial artery (9) and fracture of the supracondylar process (10) was recognized in clinical practice. The spur and a fibrous band (the ligament of Struthers) extending between the process and the medial epicondyle may co-exist. Several cases have been reported in which a spur with the ligament caused symptomatic compression of the median nerve (11), brachial artery (12) and the ulnar nerve (13). A literature review revealed that after early anthropologic publication by ancient authors, no study was performed on the distribution of the spur. Using palpation and fluoroscopy, there has been only two published series investigating the process in the living subjects (2, 14). We did not find any study that addressed the distribution of the spur in the living, using radiographic or other methods. Hence, radiographs of the elbow region were examined for this variation in a population of Turkish individuals. The literature was also reviewed on this topic.

SUBJECTS AND METHOD

The Animal Experiments and Ethics committee of Yuzuncu Yil University approved the experiments. This study was carried out over a three-year period from 2005 to 2008 at the university hospital.

The study was performed on direct radiograms of the elbow. Radiographs were obtained by Siemens Multix Pro/Top, 0.5 version, G05OG Type. The present study reviewed 903 cases (501 males, 402 female), most of whom were volunteers (university students and medical/paramedical personals). The others were 25 patients with complaints in the upper extremity (pain, paraesthesia *etc*) and 120 patients possessing no complaints in the upper extremities, who were out patients at Rheumatology, Physical medicine and Rehabilitation and Orthopaedics and Traumatology clinics outpatients. Three patients who complained of pain were treated in the Rheumatology, Physical medicine and Rehabilitation clinics. The radiographs showing pathologic findings such as tumours or cystic lesions were excluded. The films were evaluated by the authors of this study and an experienced orthopedist together. The genders of persons with the spur were recorded and the side (bilateral, unilateral-right, unilateral-left). For statistical analysis, Z test was used to compare the genders (female- male).

RESULTS

There was full agreement on yes/no choice among the observers. In this series of 903 cases, 9 spurs were found (Fig. 1). The separate values for the prevalence were found as in; i) the volunteers, 8 cases, ii) the asymptomatic patients, 1 case, and iii) the symptomatic patients, 0 case. The incidence of the spur was found as 1%. Bilateral occurrence of the spur was found in 0.55% of persons. The females had more spur than the males, 4 and 1 respectively. Unilateral-right localization of the spur was seen in male and female patients. Unilateral-left position was found in the two male cases only. The present study indicated a bilateral occurrence of (0.55 %) for the variation as well as an equal distribution for the right/the left (0.2% and 0.2%). The females and the males with the variation were 5 and 4 persons, respectively. Table 1 summarizes the distribution of this process by gender and side in detail.

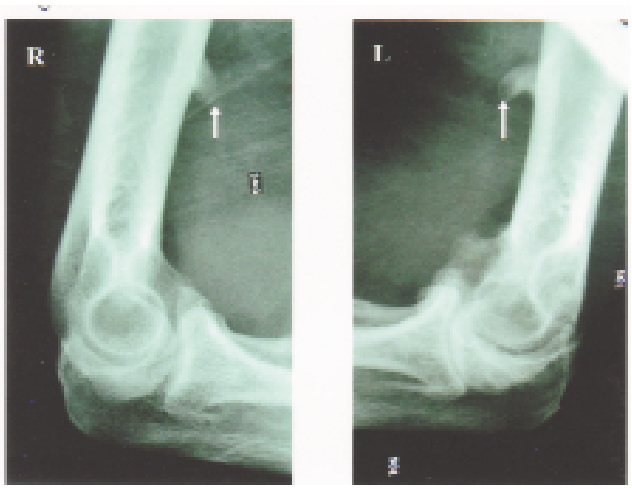

Fig. 1: Bilateral spur of a male person (arrows); right and left appearance.

The ratios found in location of bilateral, unilateral-right and unilateral-left processes were analysed according to gender and there was no statistically significant finding at any location ($p > 0.05$).

Table 1: The distribution of the spur by sex and side in living subjects from Turkish individuals. **Uni-R,** Unilateral Right; **Uni-L,** Unilateral Left; **Uni-T,** Unilateral total. **NS,** nonsignificant ($p > 0.05$).

	Bilateral (n)			Uni-R (N)			Uni-L (n)			Uni-T (n)		
	n	%			%			%			%	
Male	501	1	0.20	1	0.20		2	0.22		3	0.59	
Female	402	4	0.99 NS	1	0.20	NS	0	0.00	NS	1	0.20	NS
Total	903	5	0.55	2	0.22		2	0.22		4	0.99	

DISCUSSION

The present study found the incidence of this variation as 1%. The precise incidence of the spur is not known. The first records of the incidence have been taken from observations on cadavers and the skeleton. The cadaver study by Gruber showed a 2.7% prevalence in 1889; the other cadaver work by Testut gave a low frequency, 0.6%; a considerably higher incidence was seen in special groups, as criminals and the insane (2). In the living subject, this process was first found in 7 persons out of 1000 dispensary patients by using a palpation method by Terry (2). In 1954, Parkinson discovered only 2 instances of a spur in 500 consecutive patients by a careful fluoroscopic search, the incidence was 0.4 per cent (14). These are a lower incidence than that in the present study.

In our study, bilateral spurs were observed in 5 of 9 cases, with an incidence of 0.55% (Figure 1). Bilateral appearance of this process has been reported in clinical reports (11). The study on the living reported the bilateral occurrence in only one person, 0.1% (2). The Testut study of 929 cadavers showed the bilateral supracondyloid process in one case, which is given for comparison by Terry (2). The prevalence in the present study was higher. Bilateral clinical appearance might be an incidental finding which was encountered in symptomatic cases.

The spur is usually unilateral as a clinically obvious entity (15). In the present study, the unilateral appearance was encountered less than the bilateral, 4 cases with a frequency of 0.99%. The studies discussed above, on the one hand, showed a considerably higher unilateral prevalence. While in the cadaver study by Testut, the process was observed to be higher in left than in right. It was found to be most frequent on the left side in living subjects (2). The results for the unilateral spur from the extensive studies (the present study included) indicated variable dominance to side.

Of 9 individuals having this variation in the present study, 5 were females. In the study with living patients by Terry and the cadaver study by Testut, the females possessing the spur were less than the males (2). Hrdlička (3) stated that this process is more common in the females than in the males. According to the author, this situation is related to the greater conservatism of past conditions in the female. However, the present study showed that the localization of the spur has no statistically significant sexual dimorphism.

This study with living Turkish individuals is an extensive work including a large number of persons and indicated a frequency of 1%. In a previous study, the incidence from the laboratory materials of the humeri with no knowledge of gender (n = 114) was reported as 1.7% (16). The frequency of the variation in several populations was found as: United States, 1.03% in males and 1.8% in females; Ireland, 1.34% in males and 0.57% in females; Germany, 0% in both genders; Italy, 0% in males and 1.72% in females; Indian, 0.097% in adults and 0% in children and the young; Eskimo, 1.6% (3–5). This process occurs with different frequencies in all European Caucasians, Negroes, Melanesians and Australians, however, do not have a real process (3, 4).

The spur is associated with other anatomic variants; *ie* Struthers ligament (11, 12), an anomalous origin of the pronator teres (17) and high division of the brachial artery (18). The spur also associates with the Cornelia de Lange Syndrome which represents mental retardation, a characteristic facies, a variety of skeletal changes and mandibular spur (19). In our cases, there was no symptom related to this syndrome. As stated above, the spur and ligament of Struthers complex might form a partially or completely ossified roof of a tunnel in some cases. There may be no evidence of this form of Struthers' ligament in the present study.

Clinicians believe that this variation represent a phylogenetic vestige of the supracondyloid foramen found in some animals. The fact is that this foramen was found in many extinct and living reptiles and some mammals, particularly of the more primitive orders. Most marsupials as well as some carnivores, especially members of the cat family have such a foramen (20). While the spur presents its relative frequency in the European Caucasians the process and its homologous forms rarely occured in early man, and the anthropoids as well as in many of the lower apes. If the spur is an atavism, on the other hand, several coloured races examined manifest only slight tendency to revert to an archaic type. This contrast that its relative frequency in *ie* European Caucasians and its rarity among coloured peoples (American Indians, American Negroes, Japanese, Melanesians, Australians, Chinese and the yellow race) was reported in anthropologic research (3–5). Terry (5) proposed that this process is inherently characteristic. Terry (2) reported that this process was also found in family members of a person possessing it. This was not confirmed in the present study. The findings in the present study are more consistent with what is the trend in European Caucasians.

The proximity of this process to neurovascular structures can lead to serious compromise. Symptomatic spur usually represents three types: 1) a palpable mass often irritated by minor trauma, 2) a fracture of the bony process, 3) a compression syndrome involving a neural or vascular structure or both (21). According to clinicians, most of these spur remains asymptomatic, in spite of a close relationship of neurovascular structures to it. Within the population of humans possessing this process, the frequency of clinical problem in the way of nerve and artery compression is unknown, but it must be very low (15). Our cases with the spur complained of a mild chronic pain in the forearm. The pain might be the result of repetitive minor trauma causing inflammation and oedema. Unfortunately, an EMG could not be performed on the subjects in this study. This could have added further interesting.

In conclusion, the findings in caucasian suggest that this variation might be a character of the whites. The higher

the bilateral incidence in the present study, in comparison with previous works might suggest a peculiarity to this society. There is no significant sexual dominance in the incidence of the spur. Also the cases reported as asymptomatic might have mild pain at times which could be useful to the clinicians' diagnosis.

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