



Original Article

A study on the prevalence of the anconeus epitrochlearis muscle by magnetic resonance imaging[☆]



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ABSTRACT

Objective: To analyze magnetic resonance imaging (MRI) of the elbow area to quantify the presence of the anconeus epitrochlearis muscle.

Methods: A total of 232 exams were analyzed; 218 were included, of which 141 were of men and 77, women.

Results: Presence of the muscle was observed in 29 cases (13.3%), demonstrating that the presence of this muscle on images does not have a statistical correlation with the gender or age of the individual.

Conclusion: The prevalence of the anconeus epitrochlearis muscle is variable, without a pattern of normality.

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Estudo da prevalência do músculo ancôneo epitrocLEAR por ressonância magnética

RESUMO

Objetivo: Analisar imagens de ressonância magnética da região do cotovelo para quantificar a presença o músculo ancôneo epitrocLEAR.

Métodos: Foram analisados 232 exames, foram incluídos 218, dos quais 141 eram homens e 77 mulheres.

Resultados: Observou-se a presença do músculo em 29 casos (13,3%), a presença desse músculo em imagens não apresentou correlação estatística com o gênero ou com a idade do indivíduo.

Palavras-chave:

Varição anatômica

Membro superior

Sistema musculoesquelético

[☆] Study conducted at the Hospital Alemão Oswaldo Cruz, São Paulo, SP, Brazil.

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Conclusão: A prevalência do músculo ancônio epitrocLEAR é variável, sem a presença de um padrão de normalidade.

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Introduction

Muscular anatomical variations are commonly observed; they may consist of the absence of a muscle in the majority of the population, accessory or surplus muscles, or deviation from the normal course, as well as presenting anomalous origin or insertion, or having a belly or supernumerary origin. Accessory muscles are anatomical variations that represent additional muscles, distinct from those found in most individuals.

With the technological advances in diagnostic imaging and the innovation of its equipment, especially regarding the quality of sectional images (such as computed tomography and magnetic resonance imaging), the analysis and study of muscular anatomical variations have become much simpler, due to the precision in distinguishing muscle tissue from other tissues. Furthermore, as it is an *in vivo* method, it is not necessary to dissect cadavers, which generates a significant increase in the population available for study.

The anconeus epitrocLEAR muscle (AEM) is present in several animal species, such as reptiles, amphibians, and mainly mammals; in humans, it is considered an anomalous or accessory muscle.¹⁻³ It follows the same path as the fibrous retinaculum, which forms the roof of the cubital tunnel, or the Osborne's ligament,⁴ considered by Testut to be a fibrous remnant of this ligament.⁵ It originates in the inferior region of the medial epicondyle, inserting posteromedially on the olecranon.

Its prevalence has varied greatly among authors since it was first described in 1866 by Gruber,⁶ who termed it the sixth anconeus muscle: it ranges from 1% to 34%.^{2,7-10} When compared to its constant presence in most primates, it is considered an evolutionary remnant in humans.^{1,4,11}

The clinical importance of this accessory muscle is justified when its presence is symptomatic and is associated with ulnar tunnel syndrome, compressive neuritis of the ulnar nerve, and other painful elbow syndromes. In most cases, the AEM causes compression of the ulnar nerve in its passage through the groove of the ulnar nerve in the humerus, medially to the trochlea.^{2,3,9,10,12,13}

Objective

To analyze magnetic resonance imaging of the elbow region and assess the presence of the AEM. To quantify the presence of this muscle in relation to gender and age.

Methods

A total of 232 magnetic resonance elbow exams were recorded on a PACS database, created in a Signa Horizon HDXT model

using a 1.5 T magnetic field, from General Electric Medical Systems. The analyzed images were T1- and T2-weighted with fat saturation, without contrast, acquired in the axial planes – the machine was programmed perpendicular to the plane of the elbow joint, starting at 10 cm above the joint until the radius tuberosity. The exams were provided by the diagnostic center for images of the institution involved, according to the opinion of the Ethics Committee (No. 1.051.245); the study was registered at Plataforma Brasil (CAAE: 42869015.0.0000.0070). The exams were filed on CD-R media and analyzed using the Centricity software DICOM viewer[®] 3.0 (General Electric Medical Systems), provided automatically in the filing of the exams. The identity of the patients was confidential; only gender, age, and the studied side were recorded.

In the evaluation of the presence of the AEM, the following reference points were considered: in the axial plane, from proximal to distal, the cuts were observed from the beginning of the medial epicondyle (medial supracondylar ridge), passing through the entire olecranon until the ulnar tuberosity level. The presence of a muscular belly was observed in the region of ulnar nerve groove in the humerus, in a section in which the capitellum, the trochlea, both humeral epicondyles, and the olecranon can be visualized on a single cut, characterizing the presence of the AEM.

Exams from healthy adults and without any previous surgery or placement of osteosynthesis in the region examined were included; those in which there was evident muscle injury or presence of neoplasias that altered the normal anatomy of the region of interest were excluded. The exams were separately assessed for the presence or absence of the AEM by two observers, who have over seven years of experience in sectional human anatomy by magnetic resonance imaging.

After the quantification of the AEM, metric and volumetric analysis were performed using AnalyzePro 1.0 software from AnalyzeDirect. Measurements of length and volume were considered as the mean calculated from the measurements made by each of the observers separately, using the same version of the same software.

Results

Of the 232 exams evaluated, 218 met the inclusion criteria proposed in the present study's methods.

Of these, 141 were male (65%) and 77 female (35%); 127 exams were from right elbows (58%) and 91, left (42%). Of the elbows analyzed, 29 had the AEM (13.3%); [Table 1](#) presents the distribution between genders and sides.

The mean age of the evaluated patients was 44 years; the youngest patient was 13 years old and the oldest, 83. [Table 2](#)

Table 1 – Prevalence of the anconeus epitrochlearis muscle.

Absent	189	86.7%	Side			Gender			
Present	29	13.3%							
Right/male	9	4.1%	Right	17	58.6%	Male	19	65.5%	
Right/female	8	3.7%							
Left/male	10	4.6%	Left	12	41.4%	Female	10	34.5%	
Left/female	2	0.9%							

Table 2 – Prevalence of the anconeus epitrochlearis muscle in relation to the age of the evaluated individuals.

Age (years)	Up to 19	From 20 to 29	From 30 to 39	From 40 to 49	From 50 to 59	From 60 to 69	From 70 to 79	From 80 to 89	Total
Individuals	12	15	45	62	61	17	4	2	218
Prevalence	0	2	9	7	8	1	1	1	29
	0.0%	13.3%	20.0%	11.3%	13.1%	5.9%	25.0%	50.0%	13.3%

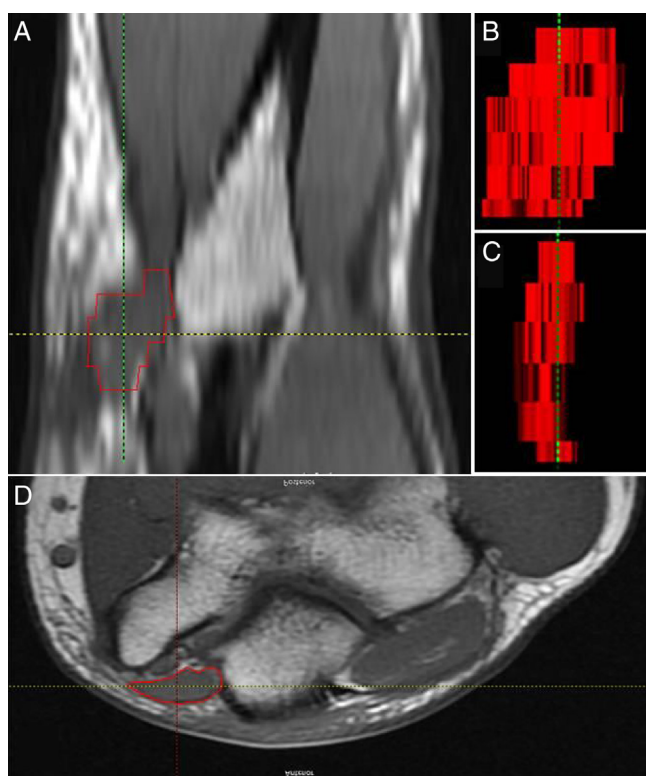


Fig. 1 – Compilation of the images from the AnalyzePro volumetry software. (A) Coronal reconstruction of the axial sequence shown in (D); the AEM is highlighted from the cut-to-cut selection in an axial plane. (B) Volumetric selection in a frontal plane. (C) Volumetric selection in a lateral plane. (D) Axial T1-weighted image, highlighting the AEM.

indicates that a higher prevalence of AEM was observed in young adults and adults (30–59 years).

Muscle length ranged from 8.31 mm to 26.2 mm (mean of 18.12 mm, ± 5.42 mm), and its volume ranged from 295.05 mm³ to 1967.92 mm³ (mean of 882.94 mm³, ± 295.05 mm³; Fig. 1).

The intra-observer agreement was moderate (Kappa test: 0.574); the disagreements were reassessed, first individually and then with the observation together, so that a consensus could be reached by the observers.

Discussion

The discrepancy regarding the AEM starts by its nomenclature. In 1866, it was termed the anconeus sextus muscle by Gruber⁶; unlike the fourth and fifth anconeus muscles, which are treated as variations of the triceps brachii muscle, the AEM is considered a variation of the flexor carpi ulnaris. It is also called the anconeus internus, the epitrochleo-olecranonis, and the epitrochleo-cubital.^{14,15}

Since its first description, its prevalence is also quite divergent among the authors,^{6,9,16-22} ranging from 3% to 34%. In the present study, the AEM was observed in 29 elbows (Fig. 2), a result similar to previous studies.^{6,9,17}

The inconstant and variable presence of this muscle is not an exclusive characteristic of the human species. Galton¹ reported the presence of AEM in other species of mammals, such as the Capuchin monkey, eastern quoll, Eurasian hare, giant armadillo, Philippine flying lemur, wombat, echidna, sloth, seal, anteater, lion, and grizzly bear. In a comparative study, Abdala and Diogo²³ reported the presence of AEM in the salamander, sand frog, red-eared slider turtle, ocellated lizard, broad-snouted caiman, and even in the domestic cock. As in humans, the AEM is variable in primates; it appears only in certain species of orangutans, such as the Borneo orangutan, and in chimpanzees.^{24,25} Unlike humans, primates and other mammals have the AEM classified as a tensor muscle of the forearm fascia,²⁴ and as an ulnar flexor of the forearm in amphibians, reptiles, and birds.²³

AEM prevalence is higher in lower primates and lemurs, tending to disappear in arthropod monkeys,⁴ providing an evolutionary clue regarding this muscle.

In the present sample, no statistical correlation was observed between AEM presence and gender (chi-squared: 0.01) or age (chi-squared: 0.955).

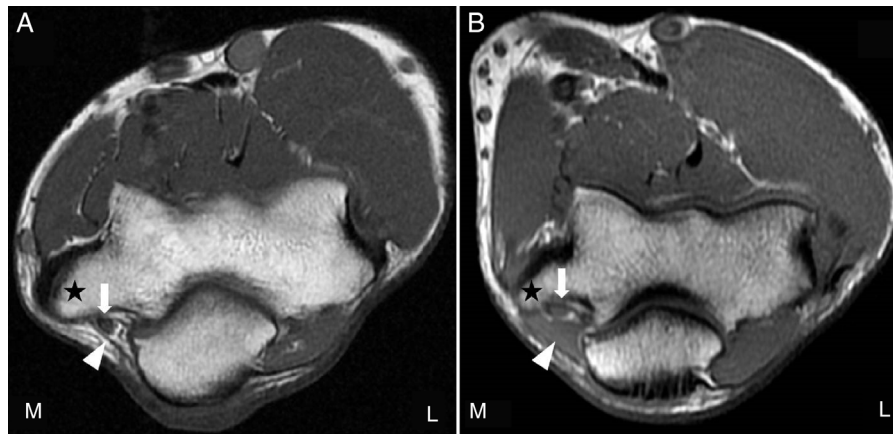


Fig. 2 – Left elbow axial T1-weighted magnetic resonance imaging. (A) Absence of AEM. Star, medial epicondyle; arrow, ulnar nerve; arrowhead, fibrous retinaculum (Osborne's ligament). (B) Presence of AEM. Star, medial epicondyle; arrow, ulnar nerve; arrowhead, AEM; L, lateral; M, medial.

The fact that more samples are available at the moment, due to the increasing advance of *in vivo* techniques allows a more accurate and assertive verification of the actual prevalence of this muscle.

Conclusion

The prevalence of the AEM in humans and other species is variable, without a pattern of normality. No statistical correlation was observed between the presence of this muscle and age or gender of the individuals.

Conflicts of interest

The authors declare no conflicts of interest.

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