

## INNERVATION OF THE PRONATOR QUADRATUS MUSCLE

### INERVAÇÃO DEL MÚSCULO PRONADOR CUADRADO

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**SUMMARY:** The pronator quadratus is the main muscle responsible for pronation of forearm, helped by the pronator teres. To study the innervation of the pronator quadratus, eighteen forearms from a formol fixed corpses were dissected. We examined the relationship between the anterior interosseous nerve and the pronator quadratus. The wrist articular line was used as reference point. The branch which had the most proximal penetration into the pronator quadratus was 5.4 cm above the wrist articular line in a right forearm and 5.6 cm in a left one, and the branch which had the most distal penetration was 2.5 cm above the wrist articular line in a right forearm and 2.4 cm in a left one. The length of the anterior interosseous nerve and the width of the pronator quadratus muscle were measured. A great knowledge of the anatomical distribution of nerves could be of great help in treatment of the anterior interosseous syndrome.

KEY WORDS: 1. Anatomy; 2. Pronator quadratus muscle; 3. Innervation.

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### INTRODUCTION

The pronator quadratus muscle is the main responsible for the pronation of forearm, and is helped by the pronator teres muscle. These muscles are innervated by branches of the interosseous nerve and the median nerve.

The anterior interosseous nerve arises from the dorsal and radial face of the median nerve alternately (Collins & Weber, 1983; Dellon & Mackinnon, 1987). The anterior interosseous nerve keeps up with the interosseous anterior artery along the anterior surface of the interosseous membrane of forearm, between the long flexor muscle of thumb and deep flexor muscle of fingers, the ones which it innerves. It sends branches to lateral portion of the deep flexor muscle of fingers and supplies, further other structures, the pronator quadratus muscle.

The normal structures and the possible anatomical variations turns the anterior interosseous an extremely vulnerable nerve as for compression and traction. A trauma in the region where this nerve can be found starts a syndrome, but in most of the cases it seems to start spontaneously (Collins & Weber).

To the treatment of this and other lesions is necessary to have an anatomical knowledge which relacionates the location of the nervous branches with the muscle, once there is, although rare, the anatomical variation.

The aim of this study is to give detailed anatomical informations about the quadratus pronator muscle innervation. Due to its great importance to clinical doctors, orthopedists and physiotherapists, not only for a diagnostic help, but also for the treatment and the recovery from lesions, and mainly in cases of surgical interventions in areas where the nervous branches are located.

### MATERIAL AND METHOD

Eighteen forearms were dissected from a formol fixed corpses belonging to the Escola Paulista de Medicina, Universidade Federal de São Paulo e Universidade Cruzeiro do Sul. The causa mortis have not altered the structures of the forearms. There were one female and ten male corpses.

The forearms were measured with a regular ruler. In this procedure the elbow articular line (determined by the medial and lateral epicondyles of humerus), and the wrist articular line (determined by the styloid processes of radius and ulna) were taken as reference.

The anterior interosseous nerve was identified in the cubital fossa and deeply in the superficial flexor muscle of fingers till the point where the quadratus pronator muscle

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was innervated (Fig. 1). This muscle was also detached from its insertion point in the anterior face of radius (Fig. 2).

The nervous branches were measured in respect of the wrist articular line, using the digital pachimeter Mitutoyo.

According to the obtained data, the means of the forearms and the anterior interosseous nerve length, the number of nervous branches and the penetration points of the nervous branches could be calculated. The most proximal and distal penetrations in relation to the wrist articular line were also observed.

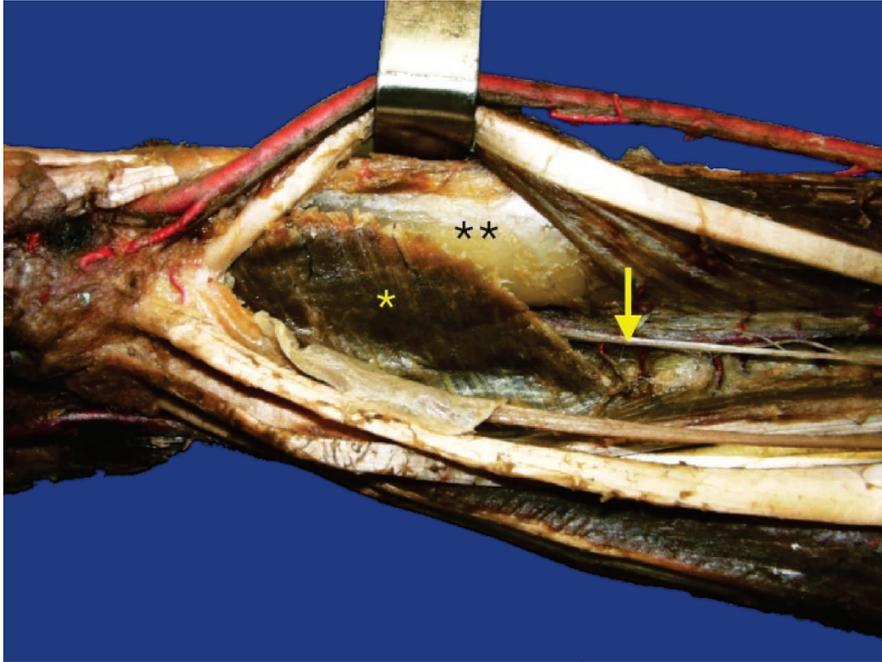


Fig. 1. Anterior interosseous nerve (arrow) penetrating under the pronator quadratus muscle. \* inserts on the anterior face of the radius bone\*\*

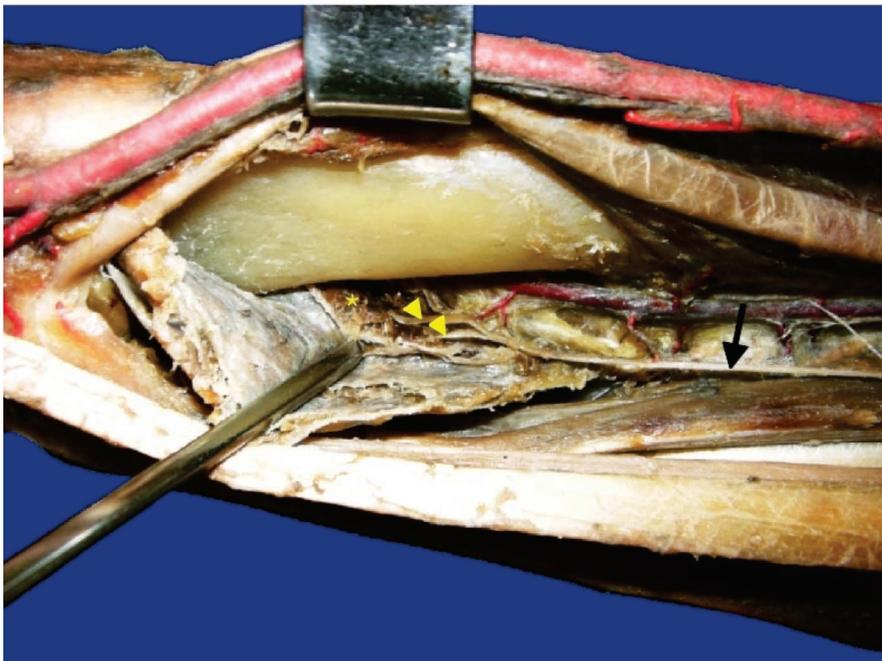


Fig. 2. Anterior interosseous nerve (arrow) and its branches (arrowshead) penetrating into the pronator quadratus muscle.

## RESULTS

### Right superior member

The forearm length varied from 23.7 to 27.5 cm, with average length of 25.3 cm.

The average length of the quadratus pronator was 6 cm, with a variance from 5.3 to 6.8 cm.

### Anterior interosseous nerve

For determination of the anterior interosseous nerve, we considered the point where it originated until the point where the most distal nervous branch penetrated into the quadratus pronator muscle. It could be noticed that the length of the anterior interosseous nerve has varied from 17.6 to 24.1 cm, with average length of 21.7 cm.

The number of branches of the anterior interosseous nerve for the referred muscle has varied from 4 to 8, with average of 5.4 branches.

The nervous branch destined to the quadratus pronator muscle with the most proximal penetration was located 5.4 cm above the wrist articular line; and the one with the most distal penetration was 2.5 cm above the referred line, therefore, the penetration mean point of the nervous branches was 3.6 cm above this same line.

### Left superior member

The forearm length has varied from 22.5 to 27 cm, with average length of 25.1 cm.

The average width of the quadratus pronator muscle was 6 cm, varying from 5 to 6.9 cm.

### Anterior interosseous nerve

We could notice that the length of the anterior interosseous nerve, as for the left superior members, has varied from 17.5 to 23.5 cm, with average length of 20.7.

The number of branches of the anterior interosseous nerve to the referred muscle has varied from 3 to 6 branches with an average of 4.6.

The nervous branch destined to the quadratus pronator muscle with the most proximal penetration was located 5.6 cm above the wrist articular line and the one with the most distal penetration was 2.4 cm above this referred line, therefore the average penetration point of the nervous branches was 3.9 cm above the same line.

Table I. Data about the innervation of the quadratus pronator muscle.

	Superior right member	Superior left member
Forearms length average	25.3 cm	25.1 cm
Branch of the A. I. N with the more proximal penetration	5.4 cm (- w.a.l.)	5.6 cm (- w.a.l.)
Branch of the A.I.N with the more distal penetration	2.4 cm (- w.a.l.)	2.4 cm (- w.a.l.)
Mean point of penetration of the nervous branches	3.6 cm (- w.a.l.)	3.9 cm (- w.a.l.)
Average of number of branches of the A.I.N.	5.4 branches	4.6 branches
Average of the A.I.N. length	21.7 cm	20.7 cm

w. a. l. = wrist articular line      A.I.N. = Anterior interosseous nerve

### DISCUSSION

The anterior interosseous nerve commonly innervates the long flexor muscle of thumb, the quadratus pronator muscle and the lateral portion of the deep flexor muscle of fingers. We could not observe in this study, that anterior interosseous nerve has a relation to the innervation of other muscles as Sunderland, 1968; Collins & Weber; Frazão *et al.*, 2000 observed in their studies.

Collins & Weber and Spinner, 1970, claim that the anterior interosseous nerve arises from about 5 to 8 cm below the lateral epicondyle of humerus. We do not agree with this statement, since in most cases we could observe this nerve arising from the distal third of the arm.

The anterior interosseous nerve can suffer some kind of lesion through its course, so, the anatomical knowledge of this branch is very important, because in surgical cases the decompression of only one of these points cannot be enough to cure the syndrome, like the one that occurs in the anterior interosseous nerve.

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**RESUMEN:** El músculo pronador cuadrado en el Hombre es el responsable de la pronación del antebrazo, ayudado por el músculo pronador redondo. Estudiamos la inervación del músculo pronador cuadrado en 18 antebrazos de cadáveres fijados en formol al 10%. Examinamos las relaciones entre el nervio interóseo anterior y el músculo pronador cuadrado. La línea articular radiocarpiana fue utilizada como punto de referencia. En el antebrazo derecho el ramo de penetración más proximal en el músculo pronador cuadrado fue 5.4 cm proximal a la línea articular radiocarpiana y 5.6 cm en el lado izquierdo. El ramo de penetración más distal en el músculo pronador cuadrado, fue de 2,5 cm en el lado derecho siendo esta distancia de 2,4 cm en el lado izquierdo con respecto a la línea articular radiocarpiana. Fueron medidos la longitud del nervio interóseo anterior y el ancho del músculo pronador cuadrado. Un buen conocimiento de la distribución anatómica en la región, puede ser de gran ayuda en el tratamiento del síndrome interóseo anterior.

PALABRAS CLAVE: 1. Anatomía; 2. Músculo pronador cuadrado; 3. Inervación.

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