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Original article

Morphology and morphometry of the ulnar head of the pronator teres muscle in relation to median nerve compression at the proximal forearm

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ABSTRACT

Introduction: The pronator syndrome is a rare compression neuropathy of the median nerve. Ulnar head of the pronator teres muscle may cause compression at proximal forearm.
Hypothesis: Detailed morphologic and morphometric studies on the anatomy of the ulnar head of pronator teres is scarce.
Material and methods: We dissected 112 forearms of fresh cadavers. We evaluated the morphology and morphometry of the ulnar head of pronator teres muscle.
Results: The average ulnar head width was 16.3 ± 8.2 mm. The median nerve passed anterior to the ulnar head at a distance of 50.4 ± 10.7 mm from the interepicondylar line. We classified the morphology of the ulnar head into 5 types. In type 1, the ulnar head was fibromuscular in 60 forearms (53.6%). In type 2, it was muscular in 23 forearms (20.5%). In type 3, it was just a fibrotic band in 18 forearms (16.1%). In type 4, it was absent in 9 forearms (8%). In type 5, the ulnar head had two arches in 2 forearms (1.8%). In 80 forearms (71.5%: types 1, 3, and 5), the ulnar head was either fibromuscular or a fibrotic band.
Discussion: Although the pronator syndrome is a rare compression syndrome, the ulnar head of pronator teres is reported as the major cause of entrapment in the majority of the cases. The location of the compression of the median nerve in relation to the ulnar head of pronator teres muscle and the morphology of the ulnar head is important for open or minimally-invasive surgical treatment.
Type of study: Sectional study.
Level of evidence: Basic science study.

1. Introduction

The pronator syndrome (PS) is a rare clinical condition that results from the compression of the median nerve (MN) at the elbow [1,2]. Patients usually have aching pain in the anterior aspect of the forearm, weakness in forearm muscles except the pronator teres muscle (PT) and decreased sensation over the thenar eminence and from first to lateral fourth digits [1,3,4]. Despite any scientific proof, provocation tests – like resisting patient's hand during pronation – are preferred for clinical assessment of these patients [1–3]. Conservative treatment is the main option in management of PS [2,3]. Surgery may be useful if the patient has persistent debilitating symptoms despite conservative treatment [2,3].

The MN compression may occur at the level of the supracondylar ligament (of Struthers), lacertus fibrosus, humeral (PTh) and ulnar (PTu) heads of PT, and the proximal fibrous arch (sublimis bridge) of flexor digitorum superficialis muscle [1–3]. Hypertrophied PT, fibrous bands of the PTu or the course of the MN dorsal to the PTu constitute the majority of reasons for compression in patients with PS [4–8].

Various cadaveric and operative studies cover the anatomy of the MN and its relation to the PT [4–7,9–12]. Most of these studies investigate the course of the MN in relation to PTh and PTu and the presence of any fibrous structures regarding the PTu. Despite these studies, detailed information regarding the morphometry and morphology of the PTu that may lead to MN compression is scarce in the literature [12].

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We aimed to investigate the morphology of the PTu in relation to the MN and supply morphometric data on the location of this possible compression site of the MN.

2. Materials and methods

We dissected the forearms of 58 (51 male and 7 female) fresh cadavers. We excluded any forearm with a prior surgery and history of trauma. Therefore, we included a total of 112 fresh forearms (54 right and 58 left sides) to this study. We measured the distance between the medial epicondyle and the tip of ulnar styloid process as the forearm length. We exposed the subcutaneous tissue with a longitudinal incision extending from distal arm to the wrist crease. After identifying the lacertus fibrosus, we cut it along with the deep fascia to expose the PT and the medial flexor muscle mass. We dissected the MN along its course at the elbow until it reached the PT. We measured the distance of the entrance point of the MN between PTh and PTu to the interepicondylar line. Then, we liberated the PT at its radial attachment and observed the MN inferiorly as it passed between the PTh and PTu. We investigated the morphology of the PTu and the presence of any fibrous structures that may lead to MN compression. We also measured the width of PTu as the MN traversed it.

We used a statistical editing software (IBM SPSS Statistics for Windows®, v. 21.0. Armonk, NY; IBM Corp.) for analyzing the acquired data.

3. Results

The average forearm length was 263.7 ± 21 mm. The MN reached the PTu at a distance of 50.36 ± 10.7 mm from the interepicondylar line. The average PTu width was 16.31 ± 8.2 mm. We classified the morphology of the PTu into five types regarding its structure. In type 1, the PTu was fibromuscular (n = 60, 53.6%) (Fig. 1). We further divided this type into 3 subtypes with regard to the width of the PTu. In type 1a, the PTu was smaller than 10 mm (n = 5, 4.5%) (Fig. 1A); in type 1b, it was 10 to 20 mm (n = 32, 28.6%) (Fig. 1B); in type 1c, it was larger than 20 mm (n = 23, 20.5%) (Fig. 1C). In type 2, the PTu was muscular (n = 23, 20.5%) (Fig. 2). We divided this type into 3 subtypes with regard to the width of the PTu as well. In type 2a, the PTu was smaller than 10 mm (n = 4, 3.6%) (Fig. 2A); in type 2b, it was 10 to 20 mm (n = 6, 5.3%) (Fig. 2B);

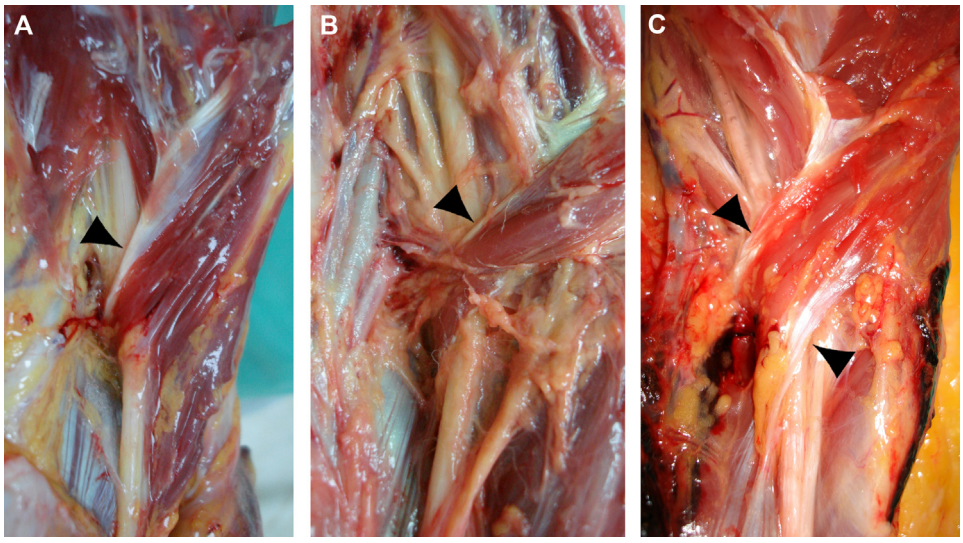

Fig. 1. The ulnar head of pronator teres is fibromuscular (type 1). A: type 1a. B: type 1b. C: type 1c. Black arrowheads show the fibrous component of the PTu.

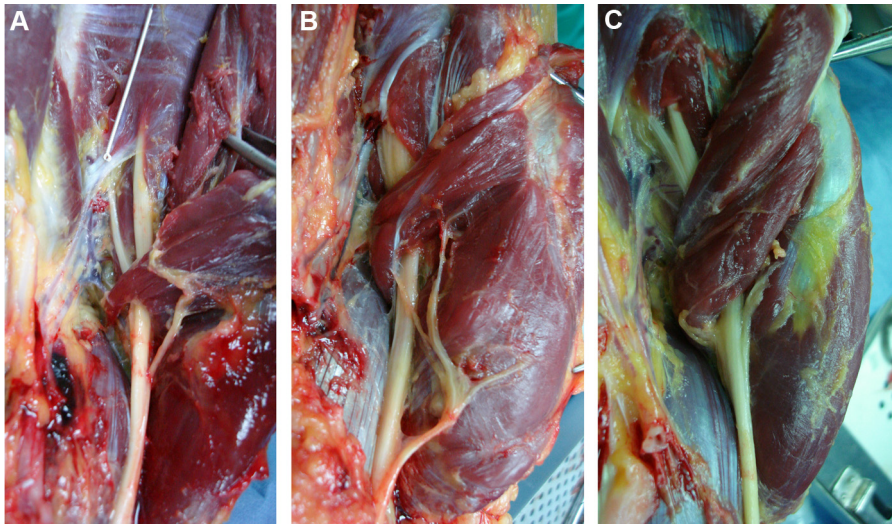

Fig. 2. The ulnar head of pronator teres is muscular (type 2). A: type 2a. B: type 2b. C: type 2c.

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