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We described the characteristics of a fascia overlying the ulnar nerve 10 cm distal to the midpoint of the retrocondylar groove. A total of 28 cadaver upper extremities were dissected. The ulnar nerve, between the flexor carpi ulnaris and flexor digitorum profundus was traced distally underneath a thin fascia. The length of the fascia was measured and examined for the presences of segmental fascial thickening, referred to as the Bands. Two types of fascia were found. In Type I three Bands were identified within the fascia. The mean length of the fascia was 5.6 cm. In Type II four Bands were identified and the mean length of the fascia was 7.7 cm. Presence of Bands within the fascia overlying the ulnar nerve in the proximal forearm may require release at the time of ulnar nerve decompression and anterior transposition at the cubital tunnel.

ANATOMIC CHARACTERISTICS OF A FASCIA AND ITS BANDS OVERLYING THE ULNAR NERVE IN THE PROXIMAL FOREARM: A CADAVER STUDY

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Keywords: ulnar nerve compression, cubital tunnel, cadaver study

ABSTRACT

This study describes the characteristics of a fascia overlying the ulnar nerve for 10 cm distal to the midpoint of the retrocondylar groove. A total of 28 cadaver upper extremities were dissected. The ulnar nerve between the flexor carpi ulnaris and flexor digitorum profundus was traced distally underneath a thin fascia. The length of the fascia was measured and examined for the presences of segmental fascial thickening, referred to as 'Bands'. Two types of fascia were found. In Type I three Bands were identified within the fascia. The mean length of the fascia was 5.6 cm. In Type II four Bands were identified and the mean length of the fascia was 7.7 cm. The presence of Bands within the fascia overlying the ulnar nerve in the proximal forearm may require release at the time of decompression or anterior transposition of the ulnar nerve at the cubital tunnel.

INTRODUCTION

At the elbow, the ulnar nerve lies between the medial epicondyle of the humerus and the olecranon, crosses the medial ligament of the elbow joint and enters the front of the forearm between the two heads of the flexor carpi ulnaris (FCU). In the proximal forearm, it runs between the FCU and the flexor digitorum profundus (FDP) muscles (Moore and Dalley, 1999; Spinner, 1978).

Compressive neuropathy of the ulnar nerve typically occurs in the cubital tunnel (Bradshaw and Shefner, 1999; Huang et al., 2004), which is an elliptical fibroosseous tunnel bordered laterally by the elbow joint, medially by the humeral and ulnar heads of the FCU origin and anteriorly by the medial epicondyle. However, the ulnar nerve is vulnerable to compression at other sites in this locality. These can classified as:

A - Pre-cubital tunnel compression sites (1) the medial intermuscular septum (2) the arcade of Struthers and (3) the medial head of triceps.

B - Cubital tunnel compression sites (1), the arcuate ligament of Osborne, which joins the medial epicondyle and the olecranon process, forming the roof of the cubital tunnel and (2) the epitrochleoanconeus muscle.

C - Post-cubital tunnel compression sites (1) the tunnel between the humeral head of the FCU and the medial epicondylar muscles and (2) in the mid-forearm (Amadio and Beckenbaugh, 1986; Degeorges and Masquelet, 2002; Eaton, 1991; Eversmann, 1993; Green and Rayan, 1999; Gonzalez et al., 2001; Inserra and Spinner, 1986; Ochiai et al., 2000; von Schoeder and Scheker, 2003).

Matsuzaki (2001), in a clinical study, described a submuscular membranous tissue under the FCU and covering the ulnar nerve. All of the patients were found to have one or more layers of this submuscular membrane. In some of the patients, Matsuzaki thought that this membranous tissue may have been compressing the ulnar nerve to induce symptoms. Our previous clinical experience with endoscopic release of the cubital tunnel revealed a thin layer of fascia deep to the FCU (Hoffmann and Siemionow, 2005) and this encouraged us to carry out further cadaver studies of the compressing bands in the proximal forearm.

This paper reports the characteristics of a fascia deep to the FCU, overlying the ulnar nerve and holding the nerve down to the deeper FDP muscle in its course for the first 10 cm, or so, distal to the midpoint of the retrocondylar groove.

MATERIALS AND METHODS

A total of 28 ulnar nerves were dissected in 28 upper extremities in 14 fresh cadavers under 3.5x loop magnification. Eight of the cadavers were female and six were male. The average age of the cadavers was 58 (range 54 to 76) years.

A 12 cm longitudinal incision was extended distally from the mid-point of the retrocondylar groove (Fig 1). The ulnar nerve was identified in the postcondylar groove (Fig 2). The humeral and the ulnar heads of the FCU muscle were separated. The ulnar nerve was traced distally under the FCU and was found to be lying underneath a thin fascia over the FDP muscle. The route of the ulnar nerve under the fascia was probed with a nerve probe.

Unlike in previously reported studies (Amadio and Beckenbaugh, 1986; Degeorges and Masquelet, 2002; Green and Rayan, 1999; Gonzalez et al., 2001; Inserra and Spinner, 1986) in which measurements were made from the medial epicondyle, the length of the fascia was measured from the midpoint of the retrocondylar groove down to the point where the ulnar nerve emerged from the underneath the fascia in the middle third of the forearm.

The fascia was examined for the presence of fascial thickenings, referred to in this study as ‘Bands’. The distance of each Band from the midpoint of the retrocondylar groove, its width and the distances between the Bands were measured. Finally, the relation between

the nerve and the fascia and its Bands following anterior transposition of the ulnar nerve was evaluated.

RESULTS

Following separation of the two heads of the FCU, the presence of the fascia over the FDP covering the ulnar nerve was confirmed in all of the dissections. Probing between the ulnar nerve and the fascia identified no restrictions from the mid-point of the retrocondylar groove proximally to the distal edge of the fascia in the middle third of the forearm. Either three or four zones of fascial thickening creating distinct fibrous Bands were found throughout the length of the fascia and these are described below as Types I and II.

Type I fascia

Three Bands were identified within the fascia in 12 out of the 28 forearms dissected. The mean length (standard deviation) (range) of the fascia from the midpoint of the retrocondylar groove was 5.6 (0.51) (range 4.9 - 6.1) cm. The mean width of Band 1, Band 2 and Band 3, was 0.6 cm (0.05), 0.5 cm (0.06) and 1.2 cm (0.14), respectively. The mean distance between Band 1 and Band 2 was 0.8 cm and between Band 2 and Band 3 was 1 cm (Fig 3A). Attempting to perform anterior transposition of the ulnar nerve following release of the first two Bands resulted in the nerve kinking against the unreleased third Band (Fig 3B).

Type II superficial investing fascia

Four Bands were identified within the fascia under the FCU in 16 out of the 28 forearm dissections. The mean length (standard deviation) (range) of the fascia from the midpoint

of the retrocondylar groove was 7.7 cm (0.98) (range, 6.4 - 9.2) cm. The mean width of Band 1, Band 2, Band 3 and Band 4 was 0.6 cm (0.04), 0.5 cm (0.04), 1.3 cm (0.3) and 1.9 cm (0.2), respectively. The mean distance between Band 1 and Band 2 was 0.9 cm, between Band 2 and Band 3 was 1 cm and between Band 3 and Band 4 was 0.5 cm (Fig 4). Anterior transposition of the ulnar nerve following release of the first three Bands resulted in the nerve kinking against the unreleased fourth Band

A summary of the data from the 28 ulnar nerve dissections is presented in Tables 1 and 2.

DISCUSSION

The cubital tunnel is the most common site of compression of the ulnar nerve in the upper extremity. Decompressions proximal to the cubital tunnel are occasionally necessary (Ochiai et al., 2000). Commonly performed procedures to decompress the ulnar nerve at, and around, the elbow include simple decompression at the cubital tunnel, anterior transposition of the ulnar nerve (subcutaneous or submuscular) and medial epicondylectomy.

Decompression distal to the cubital tunnel has also been described. A common flexor aponeurosis, deep to the FCU muscle, alone or in association with other compression sites, can be a cause of ulnar nerve compression. This aponeurosis has been described in a number of cadaveric studies. In all of these studies the most distant point of the aponeurosis was measured from the medial epicondyle (Amadio and Beckenbaugh, 1986; Degeorges and Masquelet, 2002; Green and Rayan, 1999; Gonzalez et al., 2001; Inserra and Spinner, 1986) (Table 3). The study by Amadio and Beckenbaugh (1986) included dissection of 20 cadaveric limbs and surgical exploration of eight patients with ulnar nerve compression The authors described the 'flexor-pronator aponeurosis', superficial to the FDP and deep to the flexor digitorum superficialis (FDS) and the FCU. The ulnar nerve passes through this aponeurosis 5 cm distal to the medial epicondyle and 2 to 3 cm distal to the cubital tunnel. In two cases of isolated compression at this level, local decompression was successful in relieving the symptoms of ulnar nerve compression. The authors felt that

this aponeurosis should be considered as a potential cause of persistent symptoms after ulnar nerve surgery at the elbow. A common aponeurosis between the humeral head of the FCU and the FDS of the ring finger has also been described by Inserra and Spinner (1986). These authors described kinking and tethering of the ulnar nerve on transposition without release of the common aponeurosis. Green et al. (1999) described a common flexor aponeurosis between the FCU and the FDS muscles in all of 19 cadaveric elbows studied. The average length of the aponeurosis was found to be 2.9 cm and the average distance from the medial epicondyle to the distal extent was 3.7 cm. Gonzalez et al. (2001), in a study including 39 cadaver elbows, found a discrete elliptically shaped fibrous tunnel formed by the flexor-pronator aponeurosis overlying the ulnar nerve in 17 specimens. The mean distal point of the aponeurosis was 4.2 cm from the medial epicondyle. Degeorges et al. (2002), in an anatomical cadaver study, described fibrous structures of an average of 10 cm in length from the medial epicondyle in 13 cadavers. They described five anatomical variations of the distal cubital tunnel: no aponeurosis between the FCU and the medial epicondylar muscles (54.2%), an aponeurosis less than 1cm wide and 4-5cm from the medial epicondyle fibrous band which was taut between the FCU and the FDS (8.3%), a thin (20.8%) or thick (4.2%) partial aponeurosis between the FCU and the medial epicondylar muscles and a total aponeurosis (12.5%). The most distant point of the aponeurosis was 5-6 cm from the medial epicondyle. All of the above studies describe an aponeurosis between the humeral head of the FCU and the FDS or between the FDS and the FDP as potential sites for compression of the ulnar nerve without any distinct bands.

They have described the aponeuroses as a “deep flexor-pronator aponeurosis”, a “common aponeurosis”, a “common flexor aponeurosis”, or a “flexor pronator aponeurosis”

Matsuzaki (2001), in a clinical report on 90 patients undergoing surgical release of cubital tunnel syndrome, observed a submuscular membrane under the FCU and compressing the ulnar nerve in the proximal forearm. All of these patients had one or more layers of this submuscular membrane without any distinct bands. Matsuzaki described this membrane as thick in 68% and thin in 32% of the patients. He found 12 patients to have two and two patients to have three layers of submuscular membrane. In 43 out of the 75 patients, the submuscular membrane was identified as the cause of the ulnar nerve compression and he emphasised the importance of release of this submuscular membrane during surgical treatment of cubital tunnel syndrome.

In our previous study (Hoffmann and Siemionow, 2005), we dissected 12 fresh cadaveric arms distal to the intermuscular raphe between the two heads of the FCU and revealed a thin layer of transparent fascia covering the ulnar nerve. These cadaveric dissections were not included in our present study. Three distinct regions of fascial thickening creating visible bands were identified within the transparent fascia. The distance of the bands from the midpoint of the retrocondylar groove was 3, 5 and 7 cm.

In this cadaver study, we have explored the distal part of the ulnar tunnel up to a distance of 10 cm distal from the midpoint of the retrocondylar groove and we have identified two variants of the fascia deep to the FCU and overlying the ulnar nerve with a mean length of 5.6 (range 4.9-6.1) cm in Type I and 7.7 (range 6.4-9.2) cm in Type II. The fascia covered the ulnar nerve in the forearm in all of 28 nerves studied. The fascia revealed regional thickening creating three to four distinct Bands within the fascia. In 12 out of 28 nerves only three Bands were present, whereas four Bands were found in 16 out of 28 nerves.

The presence of these Bands in the proximal forearm has clinical importance since they may play a role in entrapment of the ulnar nerve or restrict ulnar nerve excursion during upper extremity movements and may be the cause of failure to restore nerve function after simple release of the ulnar nerve at the conventional sites. Unreleased bands may also cause nerve kinking after anterior transposition of the nerve. Unreleased bands may also, sooner or later, lead to development of additional compression and recurrence of symptoms, whichever treatment of cubital tunnel is favored. Therefore, these bands should be addressed specifically when both simple decompression and anterior transposition of the ulnar nerve are performed.

To identify the fascia there is no need for extension of the incision as the distal tunnel can be visualised with either the assistance of an illuminated speculum or the help of an endoscope (Hoffmann and Siemionow, 2005; Tsai et al., 1999). In all cases in which we have attempted to transpose the nerve without distal release of the fascia there was

significant tension, or even kinking, specifically at the level of the third Band. For this reason, we believe it is safer, and necessary, to extend the dissection for 7-9 cm distally, as the fourth Band was found at this distance from the midpoint of the retrocondylar groove in Type II fascia.

These Bands may also be of relevance in patients with recurrent symptoms after decompression surgery and re-exploration of this area should include more distal dissection. However, attention should be paid not to endanger the motor branches of the FCU muscle. The adequacy and extent of distal release may be estimated by insertion of a nerve probe into the proximal forearm and testing the resistance of the Bands within the fascia by anterior movement of the probe. Experienced hand and peripheral nerve surgeons may "intuitively" release the nerve in, at least, the proximal part of the forearm. However, previously, there has been no precise description in the textbooks of how far distally from the retrocondylar groove the dissection should be performed in the upper forearm.

REFERENCES

Amadio PC, Beckenbaugh RD (1986). Entrapment of the ulnar nerve by the deep flexor-pronator aponeurosis. Journal Hand Surgery, 11A: 83-87.

Bradshaw DY, Shefner JM (1999). Ulnar neuropathy at the elbow. Neurologic Clinics, 17: 447-461.

Degeorges R, Masquelet AC (2002). The cubital tunnel: anatomical study of its distal part. Surgical and Radiologic Anatomy, 24: 169-176.

Eaton RG. In: Gelberman RH. (Ed.) Operative Nerve Repair and Reconstruction. Lippincott Williams and Wilkins, 1991: 1077-1085.

Eversmann WW Jr. Entrapment and Compression Neuropathies. In: Green DP. (Ed.) Operative Hand Surgery. 3rd ed. New York: Churchill Livingstone, 1993: 1342-1385.

Gonzalez MH, Lotfi P, Bendre A, Mandelbroyt Y, Lieska N (2001). The ulnar nerve at the elbow and its local branching: an anatomic study. Journal of Hand Surgery, 26B: 142-144.

Green JR Jr, Rayan GM (1999). The cubital tunnel: anatomic, histologic, and biomechanical study. Journal of Shoulder and Elbow Surgery, 8: 466-470.

Hoffmann R, Siemionow M (2006). The endoscopic management of cubital tunnel syndrome. Journal of Hand Surgery, 31B: 23-29.

Huang JH, Samadani U, Zager EL (2004). Ulnar nerve entrapment neuropathy at the elbow: simple decompression. Neurosurgery, 55: 1150-1153.

Inserra S, Spinner M (1986). An anatomic factor significant in transposition of the ulnar nerve. Journal of Hand Surgery, 11A: 80-82.

Matsuzaki A (2001). Membranous tissue under the flexor carpi ulnaris muscle as a cause of cubital tunnel syndrome. Hand Surgery, 6: 191-197.

Moore KL, Dalley AF. Upper limb. In: Kelly PJ (Ed.) Clinically Oriented Anatomy 4th ed. Lippincott Williams and Wilkins 1999: 708-763.

Ochiai N, Honmo J, Tsujino A, Nisiura Y (2000). Electrodiagnosis in entrapment neuropathy by the arcade of Struthers. Clinical orthopedics and related research 378: 129-135.

Spinner M. Injuries to the major branches of peripheral nerves of the forearm. The ulnar nerve. 2nd ed. Saunders Company 1978: 230-245.

Tsai TM, Chen IC, Majd ME, Lim BH (1999). Cubital tunnel release with endoscopic assistance: results of a new technique. Journal of Hand Surgery, 24A: 21-29.

von Schroeder HP, Scheker LR (2003). Redefining the "Arcade of Struthers". Journal of Hand Surgery, 28A: 1018-1021.

FIGURE LEGENDS

Figure 1: Skin incision markings for the dissection of the ulnar nerve in this study.

Figure 2: Diagram showing the normal anatomy of the ulnar nerve at the elbow.

Figure 3: Type I fascia

a) Diagram showing the mean length of the fascia (range, 4.9-6.1 cm) and the mean width of the three Bands within the fascia,

b) Kinking of the ulnar nerve by Band 3 after release of Bands 1 and 2 during a mock anterior transposition. (B: Band).

Figure 4: Type II fascia

a) Diagram showing the mean length of the fascia (range, 6.4-9.2 cm) and the mean width of the four Bands within the fascia,

b) A probe inserted underneath the fascia with the four fibrous Bands marked with blue dye. (B: Band).

Figure 1

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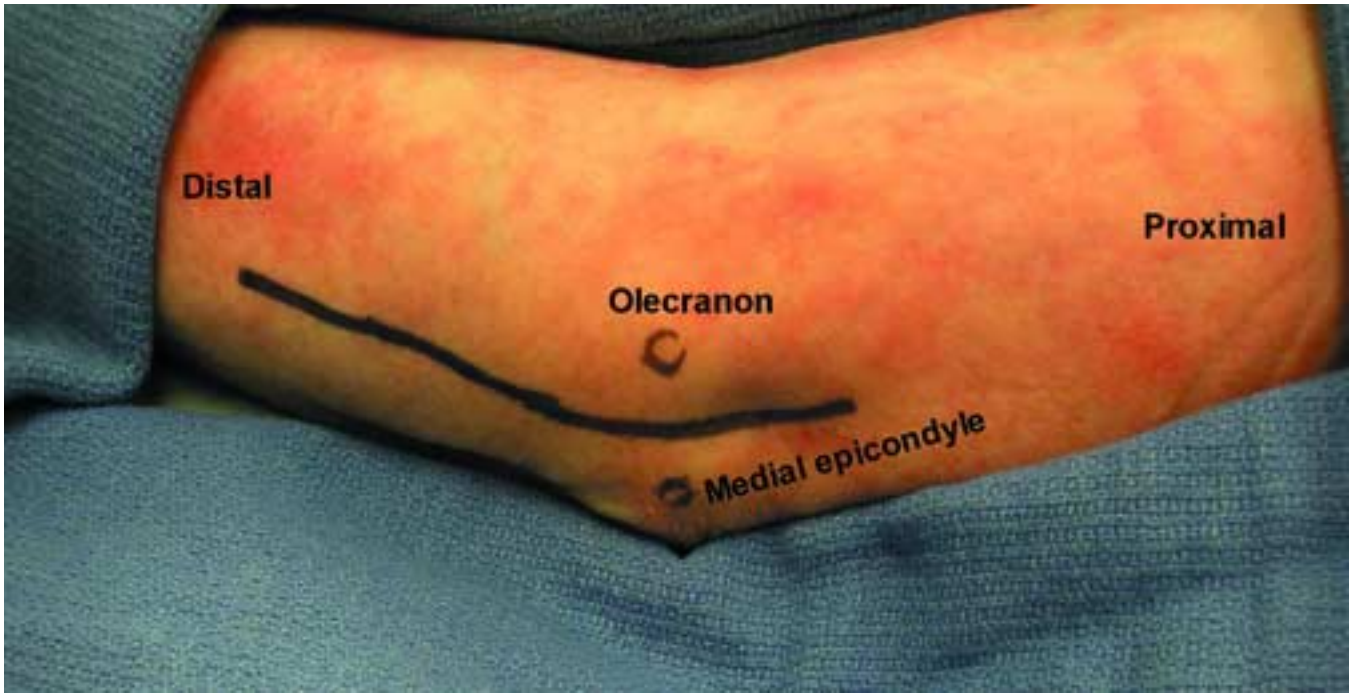

Figure 2

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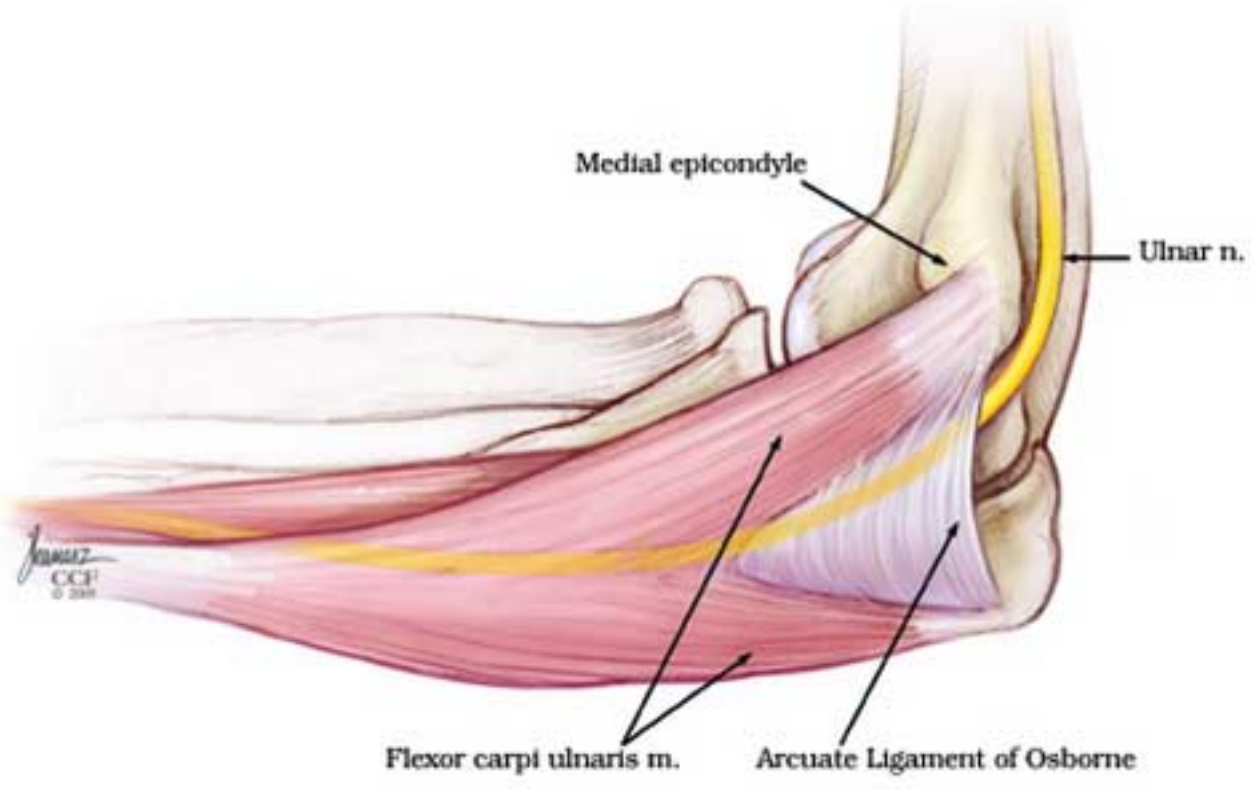

Figure 3a

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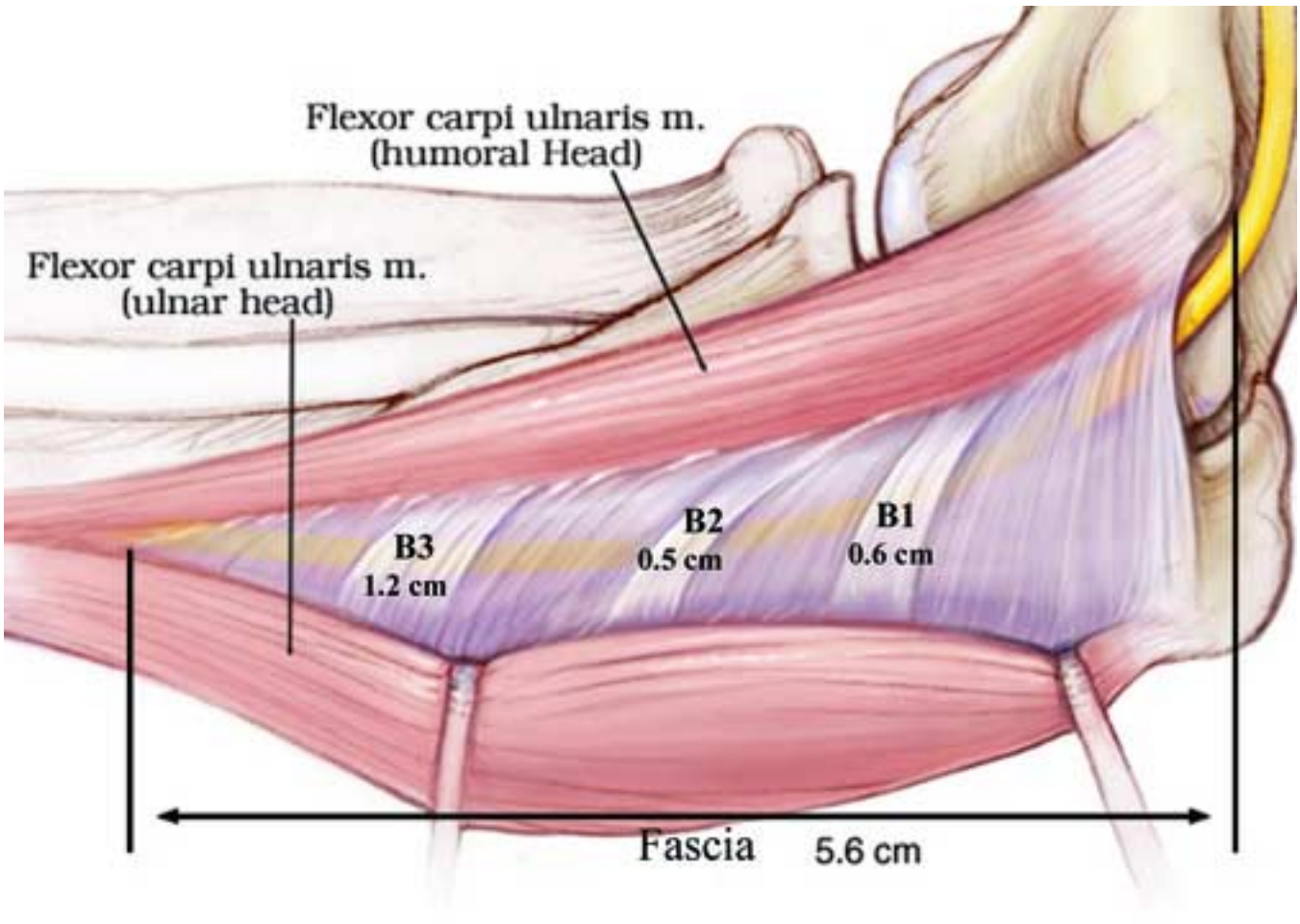

Figure 3b

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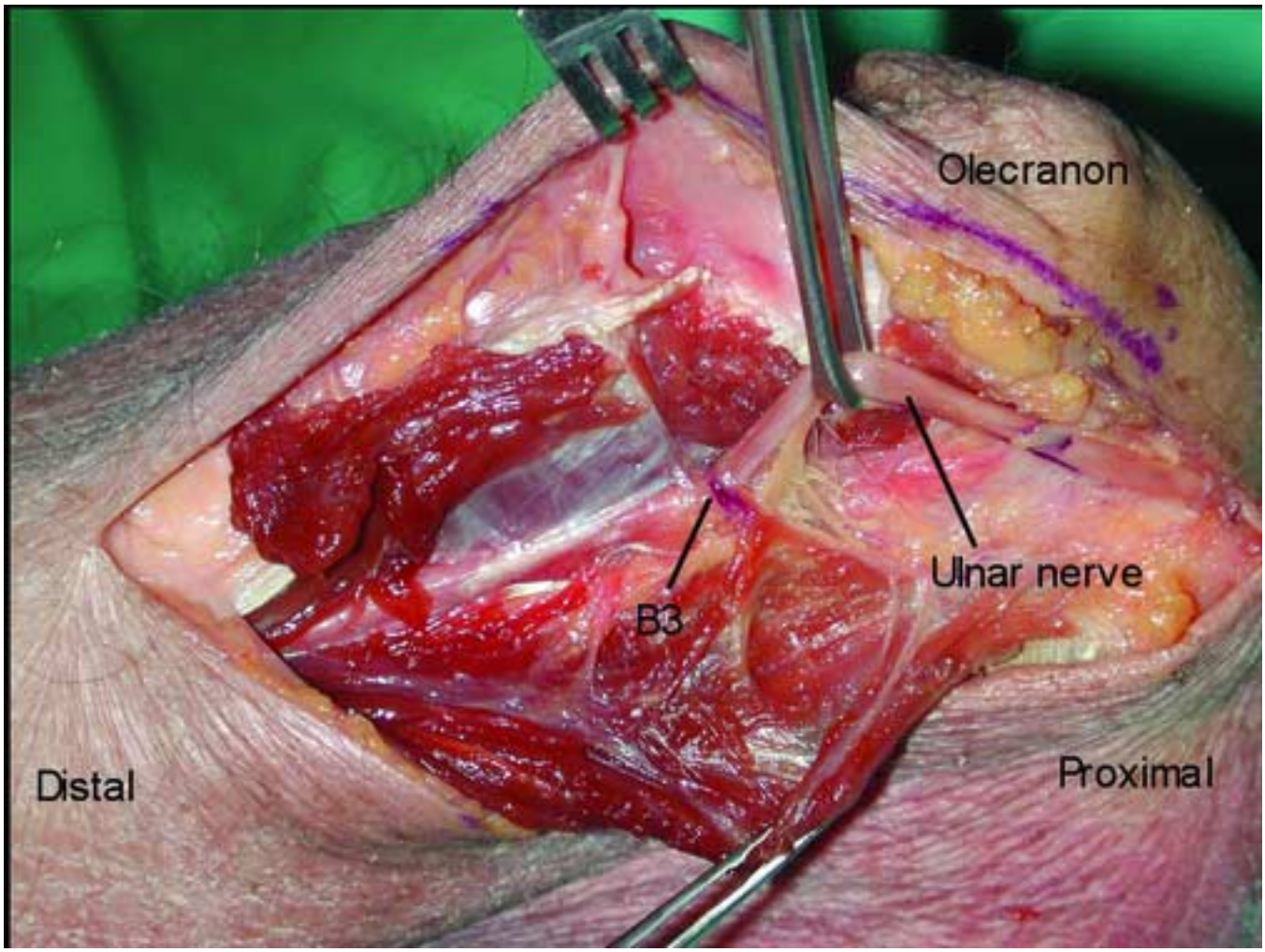

Figure 4a

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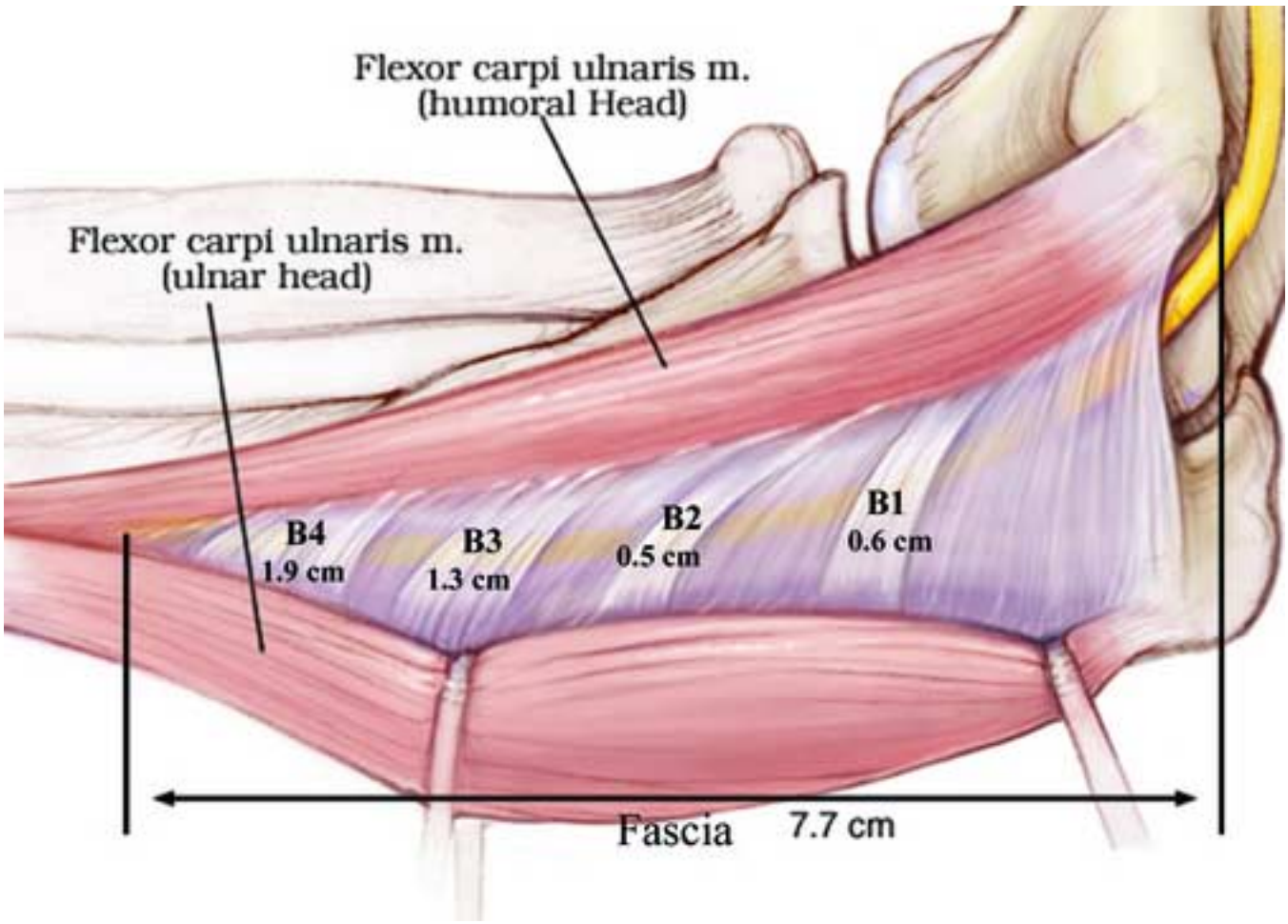

Figure 4b

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Table(s)

Table 1. Summary of the data from the 12 ulnar nerve dissections in 6 cadavers with Type I fascia.

Cadaver No	Fascia Length (cm)	Band Widths (cm)			Distances between the Bands (cm)	
		B1	B2	B3	Between B1 and B2	Between B2 and B3
1	4.9	0.6	0.6	0.9	0.5	0.8
2	6	0.5	0.4	1.2	0.9	1.1
3	5	0.7	0.5	1.1	0.6	0.9
4	5.8	0.5	0.4	1.3	0.8	1
5	6.1	0.5	0.5	1.3	1	1.2
6	5.6	0.6	0.5	1.2	0.7	0.9
Mean	**5.6**	**0.6**	**0.5**	**1.2**	**0.8**	**1**

B:Band

Deleted: superficial investing

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[This and the next table should include the distances between the bands for completeness]

Table(s)

Table 2. Summary of the data from the 16 ulnar nerve dissections in 8 cadavers with Type II fascia.

Deleted: superficial investing

Cadaver No	Fascia Length (cm)	Band Widths (cm)				Distances between the Bands (cm)		
		B1	B2	B3	B4	Between B1 and B2	Between B2 and B3	Between B3 and B4
1	6.7	0.6	0.5	1.2	1.9	0.9	0.8	0.4
2	8.0	0.6	0.5	1.8	1.8	0.8	1	0.6
3	8.1	0.8	0.5	1.5	2.1	1	0.9	0.7
4	8.4	0.6	0.5	1	1.7	1.2	1.1	0.6
5	7.7	0.7	0.6	0.9	2.2	0.9	0.8	0.5
6	6.7	0.6	0.5	1.1	1.9	0.8	0.7	0.4
7	6.4	0.6	0.5	1.1	1.8	0.9	0.7	0.4
8	9.2	0.6	0.5	1.4	1.8	1.1	1.2	0.7
Mean	**7.7**	**0.6**	**0.5**	**1.3**	**1.9**	**1**	**0.9**	**0.5**

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B: Band

Table 3. Descriptions of the flexor-pronator aponeurosis (FPA) in the cadaver studies.

Author	Year	Number of Dissections	Presence of the FPA in the dissected cadavers	Distal Extension of the FPA from the Medial Epicondyle
Inserra and Spinner	1986	10 Extremities	Not mentioned	1.5-2 cm
Amadio	1986	20 Cadavers	100%	5 cm
Green	1999	19 Extremities	100%	2. 9 cm
Gonzalez	2001	38 Cadavers	43.5% of cadavers	4.2 cm
Degeorges	2002	24 Extremities	45.8% of extremities	6 cm

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Anatomic Characteristics of a Transparent Submuscular Membrane and its Bands Overlying the Ulnar Nerve in the Upper Forearm: A Cadaver Study

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Dear Dr. Elliot:

Enclosed please find the revised version of the manuscript entitled **"ANATOMIC CHARACTERISTICS OF A FASCIA AND ITS BANDS OVERLYING THE ULNAR NERVE IN THE PROXIMAL FOREARM: A CADAVER STUDY".**

In response to the comments concerning the aponeurosis, a paragraph was added into the Discussion section page 10, line 20-22 and page 11, line 1-2.

We have deleted the words superficial and investing and accepted all the corrections and changes. We also have reduced the abstract and added the distances between the bands into the tables. We have responded to the comments of the Editor using 'track changes' in Word.

I hope you will find this revised version of the manuscript acceptable for publication in the Journal of Hand Surgery (European Volume).

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*** Submission Letter**

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Dear Dr. Elliot:

Enclosed please find the manuscript entitled "**Anatomic Characteristics of a Transparent Submuscular Membrane and its Bands Overlying the Ulnar Nerve in the Upper Forearm: A Cadaver Study**" as Part II of our previous study entitled "The endoscopic management of cubital tunnel syndrome" which was published in volume 31, 2006 of the Journal of Hand Surgery (British and European Volume).

We confirm that:
1. All the authors have been actively involved in the planning and enactment of the study, and have also assisted with the preparation of the submitted article.
2. The paper has not been submitted elsewhere.
3. The references have been downloaded from MedLine database.
4. The references have been checked and are correct.
5. The authors have read the Guide to Authors and the paper conforms to this Guide in all respects.

I hope you will find this manuscript of interest to the readers of the Journal of Hand Surgery (British and European Volume).

Maria Siemionow, M.D., Ph.D., D.Sc.