# Case Report

# Cadaveric Study of Median Nerve Entrapment in the Arm: Report of Two Anatomical Cases

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*The authors report two anatomic cases of median nerve entrapment, which can be one of the causes of carpal tunnel syndrome. Both cases were soft tissue thickening on the distal arm. The first case was the thickening of brachial fascia that resembles the Struther's ligament. The second case was the thickening of the bicipital aponeurosis combined with the supernumerary biceps brachii. Both cases demonstrated the possible cause of median nerve entrapment at the arm, which mimicked the carpal tunnel syndrome that normally occurs at the wrist. The study reports other possibly sites of causes of median nerve entrapment that clinicians should be aware of the median nerve in the arm proximal to the wrist where the carpal tunnel syndrome normally occurs. These are other points of medina nerve entrapment that clinicians should aware.*

**Keywords:** *Entrapment neuropathies, Median Nerve, Struther's ligament, Bicipital aponeurosis*

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Entrapment neuropathies are a group of peripheral nerve disorders resulting from chronic compressions. The nerve compression is commonly found at the site where a nerve passes through a tight tunnel formed by stiff tissue boundaries. The tightly confined passage of the nerve trunk limits tissue movements and lead to sustained tissue pressure gradient. Histologically, the nerve trunk contains well developing microvascular plexuses within its connective tissue envelopes but avoids lymphatic vessels in endoneural space. Various studies on pathophysiology of nerve compression have been reported in both animal models and healthy human volunteers[1,2].

The median nerve is formed by the union of lateral root (C5, 6,7) and medial root (C8 and T1) of corresponding cords of brachial plexus. It descends lateral to the brachial artery and crosses medially at the level of origin of M. Brachioradialis and descends deep to bicipital aponeurosis enters the forearm between two heads of M. Pronator teres and passes deep to the origin of M. Flexor digitorum superficialis within the fascial sheath. While approaching the wrist, it lays superficially between the tendons of M. Flexor digitorum superficialis and M. Flexor carpi radialis deep to the tendon of M. Palmaris longus. Then it passes through the carpal tunnel in which the flexor retinaculum stretches over the nerve and accompanying long flexor tendons[3]. Along the descending course of the median nerve, the mobility may be limited according to the confined space together with anomaly of surrounding soft tissue can cause traction of the nerve in response to the joint motion. The symptom demonstrates as paresthesis of lateral three and one-half digits in palm and distal phalanges of dorsal hand, weakness in flexion and pronation of forearm and radial deviation of wrist as well as flexion of the thumb. In previous studies, various potential entrapment points have been reported. On the distal aspect of the arm, proximal and medial to medial epicondyle of humerus, there was a vestige of supra-condylar process[4,5]. On the cubital fossa where the median nerve passes between a strong fibrous band called bicipital aponeurosis and a massive M. Brachialis[6,7]. The median nerve can also be compressed in the forearm where it traverses between two heads of M. Pronator teres and further down between proximal fibrous arch of M. Flexor digitorum superficialis[8-11]. At the wrist the nerve passing through the fibro-osseous tunnel together with a bunch of long flexor tendons where the nerve entrapment was frequently reported and well-known

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as carpal tunnel syndrome[12,13]. Furthermore, the abnormal musculature like supernumerary of flexor muscles of arm also reported to be a causal factor of nerve entrapment[14,15]. The present study was aimed to investigate the thickening of brachial fascia around the elbow, which was the possible cause of median nerve entrapment.

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The cases were found among 57 cadavers that have been studied by the second year medical students in 2010 at the Department of Anatomy, Faculty of Medicine Siriraj Hospital, Mahidol University. There were 29 males and 27 females; the mean age at the time of death was 65.3 years (range 33-97). This work received the exemption review from Siriraj IRB (code 734/2553). The investigation focused on the thickening of investing fascia on the anterior aspect of the arm that tightly embraced the neurovascular bundle of the median nerve and brachial vessels. The thickening of brachial fascia was found in two of 114 limbs (1.75%). Both were male at the age of 97 and 61 years. The thickening of the fascia was shown in different manners.

Case I was the right arm of a male aged at 97 years (Fig. 1), anteromedial aspect of the distal arm deep to the M. biceps brachii, there was the thickening brachial fascia embracing the median nerve and brachial artery. The fascia was separated from the investing layer of the brachialis muscle by the communicating branch between median and musculocutaneous nerves. The thickening fascia appeared as a triangular membrane. Apex of the fascia projected to supracondylar ridge, lateral border was underneath the deep surface of M. biceps brachii and medial border extended to the medial epicondyle. The median nerve and brachial artery were tethered by the medial border of the fascia.

Case II was the left arm of a male aged at 61 years revealed a broad thickening of bicipital aponeurosis that covered the medial half of the cubital area and tightly embraced the neurovascular bundle. There was also an accessory muscular slip that descended separately on the medial border of the biceps brachii, giving a distal tendinous part to join the bicipital aponeurosis (Fig. 2). After incising the aponeurosis and loosening the nerve and vessels, the tiny tendon of the accessory muscular slip was also found passing underneath the nerve and vessels (Fig. 3). This demonstrated a tight tunnel embracing the neurovascular bundle that was formed by the

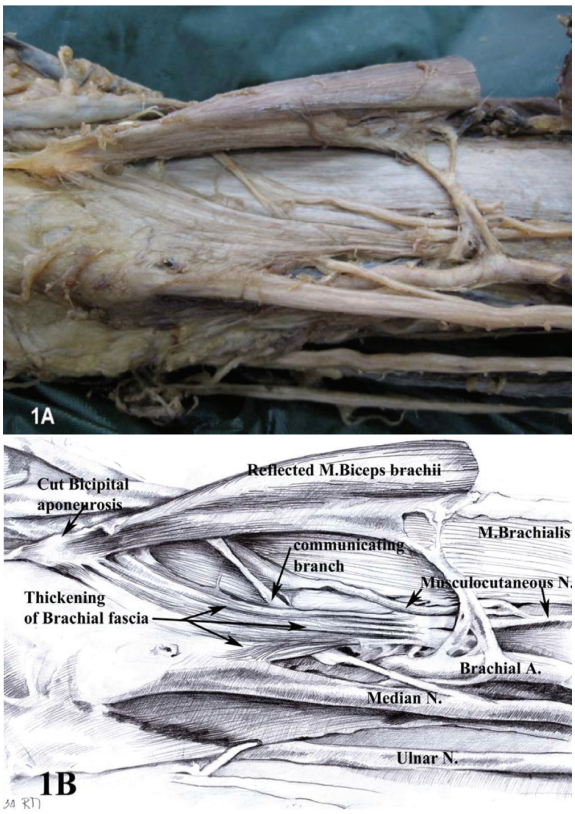


**Fig. 1** (A) A photo of Case I showed thickening of the brachial fascia situated underneath the biceps and bicipital aponeusosis descended from the medial supracondylar ridge crossing the neurovascular bundle to medial epicondyle and embracing the bundle. (B) Illustrative drawing of the Case I designated the related structures

distal part of the accessory muscle. The tendon finally attached to anterior aspect of medial condyle of humerus beneath the brachialis muscle (Fig. 4).

**Discussion**

The median nerve compression at carpal tunnel is the most common and well-known, but compression of the nerve elsewhere along the course of the median nerve is still uncommon. However, both may show the same symptom of sensory deficit on the lateral three and a half digits in palm and distal phalanges of dorsal hand but the nerve entrapment above elbow will demonstrate weakness of flexor muscles of forearm. The present study revealed 1.75% of soft tissue thickening on the distal arm and tethered the median nerve and brachial vessels. Despite the study being carried out in a cadaver, this anatomic

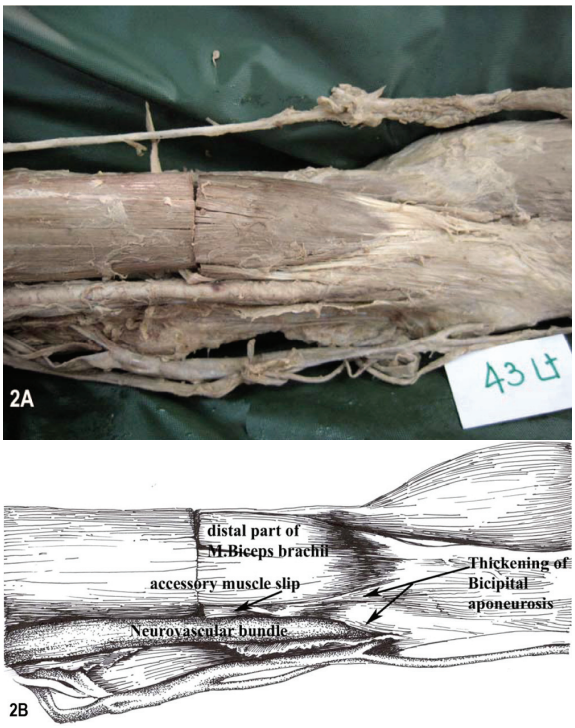


**Fig. 2** (A) A photo of Case II showed an extensive thickening of bicipital aponeurosis and an accessory muscular slip on medial border of biceps brachii muscle embracing the neurovascular bundle. (B) Illustrative drawing of the Case II designated the related structures

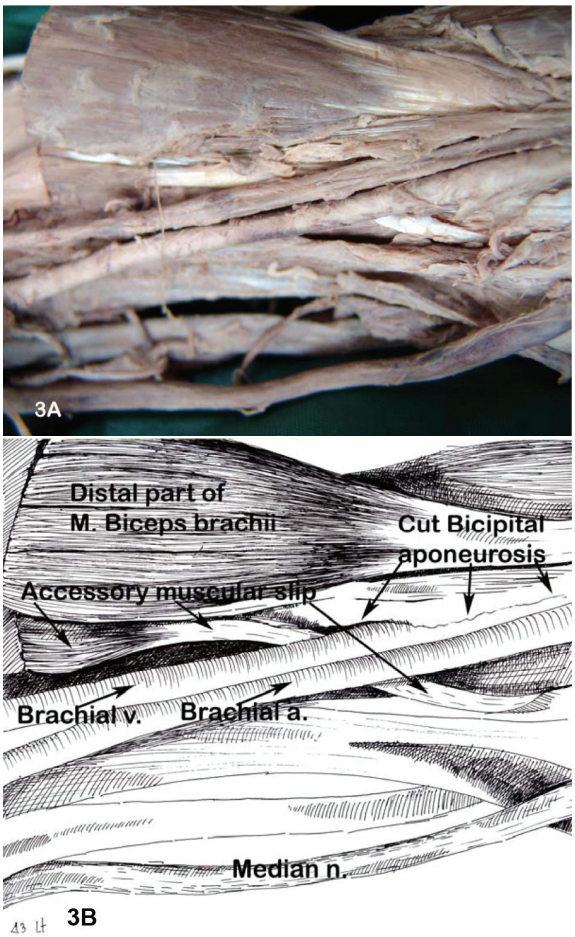


**Fig. 3** (A) A photo of Case II after the bicipital aponeurosis was incised to expose the vessels and nerve (fell off from its pose), the distal tendinous part of accessory muscular slip was presented and passing beneath the neurovascular bundle. (B) Illustrative drawing of the Case II designated the related structures

finding clearly demonstrated the constraint of mobility of median nerve which possibly induced the nerve compression. The thickening of brachial fascia found in Case I, particularly the medial-most fibrous band, to some extent resembled the Struther's ligament, which was reported as a cause of median nerve compression[16,17] and demonstrated by using MRI[18,19] and high-frequency ultrasound[20]. The Struthers' ligament frequently associated with supracondylar process, a beaklike bony spur, projected downward medially from medial supracondylar ridge 5-7 cm from medial epicondyle. Usually the Struthers' ligament arose from the apex of the supracondylar process and attached to the medial epicondyle. This was known as a rudimentary tendon of the vestigial lattisimo-condyloideus muscle, which normally presented in climbing animals such as marsupials, cats, and lemurs[21]. The Struther's ligament also existed in the absence of supracondylar process[16,17]. Moreover, the process and ligament provided an extensive attachment for M. Pronator teres[22]. The variant origin of M. Pronator teres has been rarely reported in a clinical setting[23] and in cadaveric findings[10]. According to its topography and attachment, the extraordinary thickening fascia in the present study was possibly the remnant of the M. Pronator teres and arose from the medial thickening edge which represent the vestigial Struther's ligament.

Case II presented not only with a thickening of bicipital aponeurosis, but also had an accessory muscular slip that extended its tendon underneath the neurovascular bundle and attached to the anterior aspect of the medial epicondyle. The thickening of

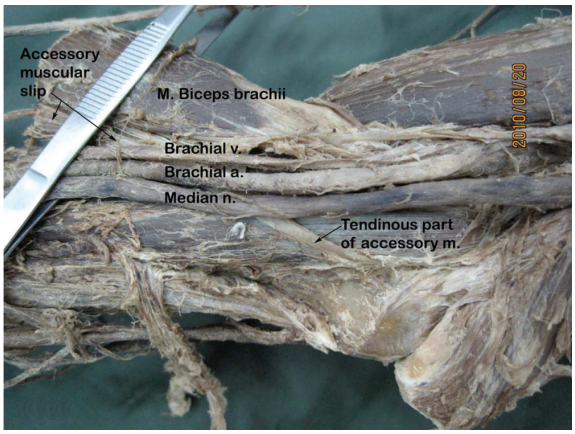


**Fig. 4** A photo of Case II illustrated the tendinous attachment of the accessory muscle to anterior aspect of medial condyle of the humerus

bicipital aponeurosis caused compression of the median nerve has been documented[6,7]. Similarly, the supernumerary biceps brachii was also reported to cause nerve entrapment[14,15] depending on the pattern of the accessory muscles and its location. The distal part of the accessory muscular slip forms a confined tubular passage embracing the median nerve and brachial artery to exhibit a possible cause of nerve compression. This also corresponded with Paval et al[24] who reported an extramuscular fascicle with continuous tendinous slip, which was considered as one of the potential causes of nerve entrapment. The present study intends to urge surgeons, clinicians and medical personnel to keep in mind the possible anatomic variation around the elbow, which can cause symptoms similar to carpal tunnel syndrome.

## Conclusion

The present study reported two cases (1.75%) of soft tissue thickening on the distal arm trapping the median nerve and brachial artery. Case I was the thickening of brachial fascia, which resembles Struther's ligament. Case II was the thickening of the bicipital aponeurosis associated with the supernumerary biceps brachii. Both cases indicated the entrapment of the median nerve by the extraordinary thickening fascia in the arm. Notwithstanding the present work was cadaveric finding, it provided the anatomic ground of the possible cause of carpal tunnel syndrome.

## Potential conflicts of interest

None.

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## *การศึกษาเส้นประสาทมีเดียนถูกกดทับบริเวณแขนในศพ: รายงานในอาจารย์ใหญ่สองราย*

***สิทธา ปิยะวินิจวงศ์, นพมาศ ขำเปรมศรี, เมธี วงศ์ศิริพร, จันทิมา รุ่งเรืองชัย***

*ผู้นิพนธ์รายงานสองกรณีที่เส้นประสาทมีเดียนถูกกดทับในร่างอาจารย์ใหญ่ ซึ่งสามารถเป็นสาเหตุหนึ่งของกลุ่มอาการอุโมงค์ข้อมือ ทั้งสองกรณีเกิดจากการหนาตัวของเนื้อเยื่อบริเวณส่วนปลายของต้นแขน กรณีแรกพบการหนาตัวของพังผืดบริเวณต้นแขน (brachial fascia) ซึ่งคล้าย Struther' s ligament กรณีที่สองเป็นการหนาตัวของเอ็นแผ่ของกล้ามเนื้อไบเซ็ปส์ร่วมกับการมีกล้ามเนื้อ biceps brachii ที่เกินจำนวน ทั้งสองกรณีแสดงให้เห็นว่าการกดทับของเส้นประสาทมีเดียนที่บริเวณแขนอาจทำให้เกิดอาการคล้ายกลุ่มอาการอุโมงค์ข้อมือ ซึ่งปกติจะเกิดการกดทับประสาทที่ต่อข้อมือ การศึกษานี้รายงานตำแหน่งที่อาจเกิดการกดทับของเส้นประสาท มีเดียนที่แพทย์พึงตระหนัก*