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Introduction

Ulnar neuropathy at the elbow (UNE) is the second most common entrapment neuropathy of upper extremities and EMG and MRI are widely used to determine the precise entrapment site. However, little is known about the exact morphologic features of UNE using MRI. This study was designed to investigate the MRI findings of UNE correlating with EMG-proven common entrapment sites.

Materials and Methods

53 patients with UNE confirmed by EMG were reviewed. Among them, MRI studies of the elbow were undertaken in 30 patients, in whom MRI findings at three common entrapment sites were analyzed. The entrapment site was defined as the most distal segment where a sharp decline of conduction velocity has occurred along the segment below 6-cm and above 4-cm from the medial epicondyle (ME) of humerus with 2-cm increment. Mean cross sectional area (CSA), relative signal intensity ratio (RSIR) of MRI were evaluated as well as total length of the lesion. The carrying angle of elbow was also measured on plain radiographs (Fig.1).

Results

The most common entrapment site was the segment between below elbow (BE) 2-cm~ME (n=24, 45.28%, Elbow group), followed by BE 4-cm~BE 2-cm (Distal group), AE 2-cm~ME (Proximal group) (Table 1). Mean CSA (0.19 cm²) and DSIR (2.35) were largest at BE 2-cm~ME segment in all groups except that DSIR was highest at AE 2-cm~ME in Proximal group (Fig. 2A, B). Mean length of the lesion was longer in Proximal group (76.02 mm) than in Elbow and Distal groups (Table 2)(Fig. 3A). When UNE occurred in proximal to ME, adjacent muscles which are not innervated by the ulnar nerve also showed significant degeneration (Fig 3B). Average carrying angle tended to increase in subjects who had more distal entrapment sites (Table 3), implicating a hypothesis that forward movement of the medial head of the triceps brachii muscle might result in forward sliding of the ulnar nerve within the cubital tunnel, leading to entrapment of the nerve at more distal site.

Table 1. Frequencies of entrapment sites

	BE 6cm ~	BE 4cm ~	BE 2cm ~	ME ~ AE	AE 2cm ~	Total (N)
	BE 4cm	BE 2cm	ME	2cm	AE 4cm	
Frequency	5	14	24	9	1	53
Percentage (%)	9.43	26.42	45.28	16.98	1.89	100

* BE : Below elbow, AE : Above elbow, ME : Medial epicondyle

Table 2. MRI Findings of Ulnar Neuropathy at the Elbow at Three Common Entrapment Sites

Parameter / Group	Elbow (n=24)	Distal (n=14)	Proximal (n=9)
Cross sectional area (cm ²)	0.19 +/- 0.07	0.19 +/- 0.11	0.13 +/-0.03
Relative signal intensity ratio of the nerve to muscle	2.02 +/- 1.01	1.78 +/- 0.78	2.24 +/- 1.46
Length of lesion (mm)	67.78 +/- 20.96	64.24 +/- 14.74	76.02 +/- 25.35

Table 3. One-way ANOVA test of HEW angles (Carrying angles)

	BE 4cm ~ BE 2cm	BE 2cm ~ ME	ME ~ AE 2cm
	Average (angle)	15.41	11.80
Variance	31.69	20.19	68.51
Observations	14	24	9
F-Value		4.034	
P-value		0.025	



Fig. 1

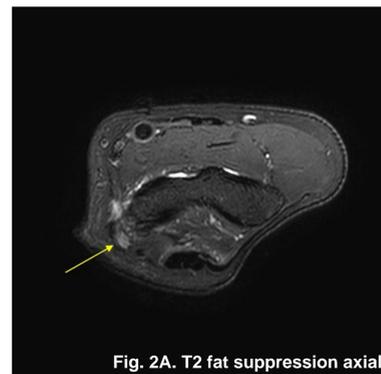


Fig. 2A. T2 fat suppression axial



Fig. 2B. T2 fat suppression sagittal

Figure 2A, 2B. Cross sectional area (long arrow) and relative signal intensity ratio of the entrapped ulnar nerve to adjacent muscles are highest in BE 2-cm ~ ME segment.



Fig. 3A

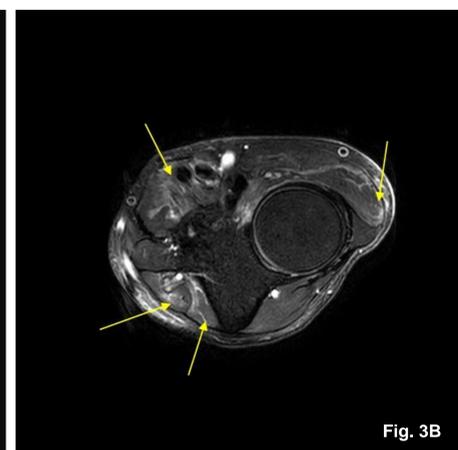


Fig. 3B

Figure 3. T2 fat suppression, sagittal (A) and axial (B) image of the ulnar nerve. Length of the lesion was longer in Proximal group (arrows, 3A), and, in that case, adjacent muscles such as extensor carpi ulnaris, flexor digitorum profundus, and pronator teres which are not innervated by ulnar nerve, also showed significant degeneration (arrows, 3B).

Conclusion

The morphological changes of the ulnar nerve were most prominent in BE 2-cm~ME segment and UNE at more proximal entrapment site tends to have longer lesion and more associated pathologies. Patients with larger cubitus valgus angle showed more distal entrapment site, which may predict the precise incision site and the extent of decompression surgery in UNE.