Multimodality Assessment of Ulnar Neuropathy at the Elbow Prior to Surgical Decompression

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Introduction

Traditional diagnosis of nerve entrapment syndromes is confirmed by clinical and electrodiagnostic evaluations. High-resolution imaging techniques, such as magnetic resonance (MR) and ultrasound (US) imaging, have made it possible to visualize focal abnormalities in nerve anatomy. Previous studies have demonstrated that magnetic resonance neurography (MRN) has higher sensitivity than nerve conduction studies in diagnosing ulnar nerve entrapment at the elbow, and evidence is emerging of a similar benefit of high-resolution US of the ulnar nerve. We present a case showing concordance of US and MRN findings with clinical, electrodiagnostic, and intraoperative findings.

Methods

56-year old man presented with right hand weakness, numbness, and paresthesia. Electrodiagnostic studies were consistent with ulnar nerve entrapment at the elbow with an enlarged ulnar nerve confirmed by MRN. We compared cross-sectional areas of the enlarged ulnar nerve by US and MRN to assess how well these two imaging techniques correlate.

Conclusions

US can be a quick and non-invasive alternative to MRN in patients with multiple compression syndromes or inconclusive electrodiagnostic results. This report demonstrates agreement between electrodiagnostic, MR, and US imaging results in confirming the diagnosis of ulnar nerve entrapment at the elbow made initially on the basis of clinical history, symptoms, and physical exam findings. These findings imply that one or more of these tests can help confirm the clinical diagnosis of ulnar neuropathy at the elbow, especially in ambiguous cases.

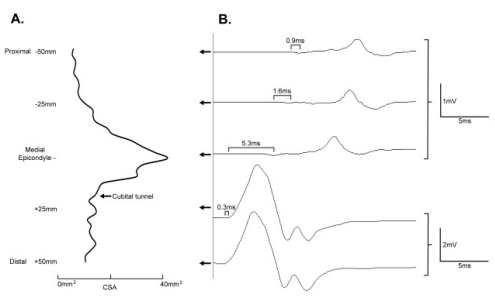
Learning Objectives

Imaging of the ulnar nerve may prove to be a useful technique to confirm the diagnosis of ulnar neuropathy at the elbow, particularly when standard electrodiagnostic studies are unable to localize the site of ulnar nerve injury. By the conclusion of this session, participants should be able to: 1) understand that the use of US and/or MRN techniques are available for diagnosing difficult ulnar neuropathy cases and 2) that the cross-sectional areas of the enlarged ulnar nerve correlate well by US and MRN.

Results

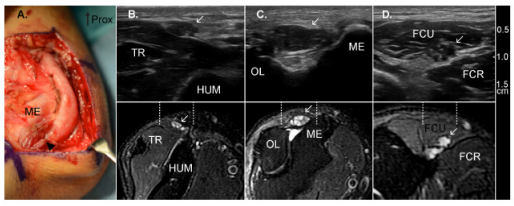
Our case study shows for the first time that cross-sectional area measured using US and MRN correlate well. Moreover, the nerve swelling may have direct functional consequences as conduction block and marked slowing of motor nerve conduction identified on electrodiagnostic studies corresponded with the segment demonstrating maximal nerve enlargement.

Figure 1



Correlation between neurophysiological findings and nerve cross sectional area (CSA). CSA was assessed on sequential 3mm slices of the MRN between 5cm proximal to the medial epicondyle (ME) and 5cm distal to the ME (A). The position of the entrance to the cubital tunnel as assessed on MRN is marked. Short-segment ulnar nerve stimulation was performed across the elbow recording from abductor digiti minimi, with stimulation 5cm above the ME, 2.5cm above the ME, at the ME, 2.5cm below the ME, and 5cm below the ME. Resulting compound muscle action potentials (CMAPs) and latency differences between CMAPs are shown (B), with evidence of marked conduction slowing and conduction block occurring between the ME and 2.5cm distal, which includes the site of compression in the cubital tunnel. The approximate position of ulnar nerve stimulation is marked with reference to CSA values (arrows).

Figure 2



Multimodality assessment of ulnar neuropathy at the elbow. At surgery, ulnar nerve entrapment was noted in the cubital tunnel with marked enlargement of the ulnar nerve proximal to the site of compression. The site of entrapment (arrow head) was subsequently released (A). Preoperative imaging with high-definition US (upper images; proximal to the elbow = B, at the condylar groove = C, distal to the cubital tunnel =D) and anatomically corresponding MRN axial T2 images (lower images; B-D as above) correlated with the surgical findings, and the findings of ulnar nerve enlargement were similar at corresponding levels on US and MRN. CSA measured on each imaging modality were similar at each level and were as follows: Proximal to elbow (B) – US = 0.11cm2, MRN = 0.13cm2; At condylar groove (C) – US = 0.45cm2, MRN = 0.45cm2; Distal to cubital tunnel (D) – US = 0.12cm2, MRN = 0.13cm2. MRN demonstrated increased ulnar nerve signal extending to the proximal and distal limits of the scanned region.