

The Ulnar nerve

Before digging in for an EMG clinic I like to take a sneaky look at the referral forms, it gives me some idea whether I will be diverting to golf course on the way home or rushing to beat closing time. If there is one request that makes my heart skip with joy it is 'please exclude ulnar neuropathy'. Ulnar nerve conduction studies are technically easy to perform and can often provide an accurate localisation of the presenting symptoms, so this issue I will briefly review the anatomy of the ulnar nerve and the neurophysiological approach to ulnar neuropathy.

Anatomy

The Ulnar nerve is derived in most instances exclusively from the C8/T1 nerve roots although sometimes there is a minor C7 component. Nearly all ulnar fibres arise in the lower trunk of the brachial plexus and pass through the medial cord, the terminal extension of which is the ulnar nerve. It is worth remembering that a large portion of the median nerve and the medial antebrachial cutaneous nerve also arises from the medial cord. The ulnar nerve runs down the medial aspect of the arm, and there are no significant branches in the arm. At the elbow the nerve passes into the groove between the medial epicondyle and

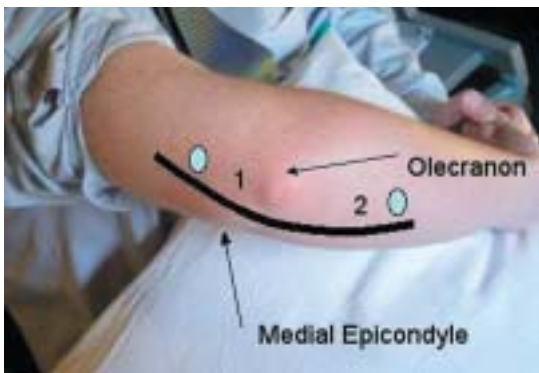


Figure 1: Anatomy of the ulnar nerve at the elbow, the ulnar nerve passes over elbow in the groove between the olecranon and the medial epicondyle, the ulnar groove (1). The nerve then enters the nerve under the aponeurosis between the two heads of the flexor carpi ulnaris (cubital tunnel).

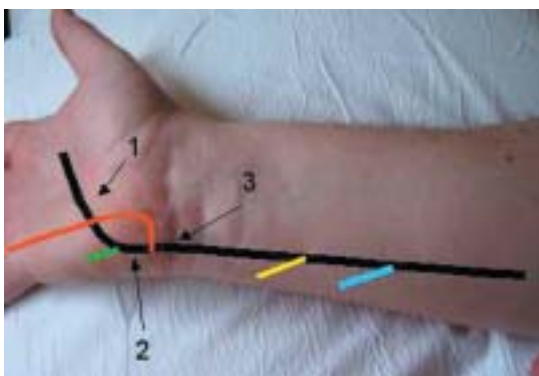


Figure 2: Anatomy of the ulnar nerve at the elbow, the branches are the dorsal ulnar cutaneous sensory (blue), the palmar cutaneous sensory (yellow), hypothenar motor (green) and the digital sensory (red), the trunk of the nerve in the hand continues as the deep palmar motor branch. The clinical features depend on the site of compression. At site 1 there is wasting of intrinsic hand muscles with sensory sparing and sparing of the hypothenar eminence, at site 2 there is involvement of the hypothenar eminence with sensory sparing, at site 3 there is sensory involvement of the digits sparing the palm.

olecranon process, the ulnar groove. Just beyond the groove the nerve runs under a tendonous arch formed by the two heads of the flexor carpi ulnaris muscle. This arch is commonly referred to as the cubital tunnel but is more correctly called the humeral-ulnar aponeurosis (HUA) (Figure 1). Muscular branches to the flexor carpi ulnaris muscle and the ulnar portion of flexor digitorum profundus are found at this site. The ulnar nerve then passes down the medial forearm with the next important branch being the dorsal cutaneous sensory branch just proximal to the wrist. This nerve supplies sensation to the dorsal medial hand and digits, whilst at the ulnar styloid there is a palmar cutaneous branch that supplies the palmar aspect of the hand. Finally the ulnar nerve passes into the hand through Guyon's canal. The proximal wall of Guyon's canal is formed by the pisiform bone; the distal wall by the hook of hamate; the floor is formed by a combination of the thick transverse carpal ligament and the hamate and triquetrum bones and finally the roof is formed loosely but at the outlet is narrowed by a ligament running from the pisiform bone to the hamate. The branches in Guyon's canal are shown in figure 2. The muscles supplied by the nerve are outlined in table 1.

Like the peroneal nerve at the knee the ulnar nerve's close association with the elbow and superficial pathway render it particularly vulnerable to external compression and trauma in the ulnar groove. The most common cause of an ulnar neuropathy is chronic mechanical trauma, (but see Table 2 for other causes). The nerve may also be compressed under the arch of the HUA giving rise to the 'cubital tunnel syndrome'- term often mistakenly applied to all ulnar neuropathy at the elbow. Ulnar nerve compression at the wrist is less common, however it is always worth bearing in mind as it is often missed or the atrophy of intrinsic hand muscles without sensory involvement is mistaken for a generalised motor neuropathy. The common causes of ulnar neuropathy at the wrist are outlined in table 2.

Clinical Assessment

Ulnar neuropathies often present with progressive weakness or even wasting of intrinsic hand muscles. If there are sensory symptoms they usually involve the ring and little finger. In ulnar nerve compression at the elbow there is weakness of most of the intrinsic hand muscles, this may result in the classic benediction posture, this is essentially due to clawing of the fourth and fifth fingers.



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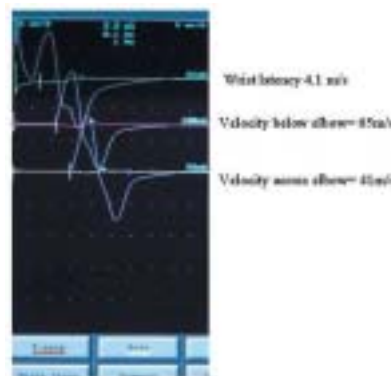


Figure 3: Normal ulnar motor study, this is performed by recording over the hypothenar eminence, and stimulating at the wrist, below the elbow and above the elbow.

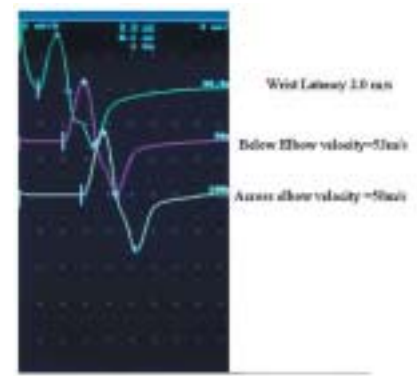


Figure 4: Study in ulnar nerve compression at the elbow, note the slowing across the elbow and decrease in amplitude (a normal study is superimposed in gray).

There are also two eponymous signs associated with ulnar neuropathy at the elbow. In Wartenburg's sign the little finger remains in an abducted posture due to weakness of the third palmar interosseus muscle - patients may complain of the little finger getting caught when they put their hand in a pocket. Froment's sign occurs when attempting to pinch an object, because of weakness of the intrinsic hand muscles, the long flexors of the thumb and index fingers are used resulting in a flexed thumb and index finger posture. In compression of the nerve at the wrist the degree of involvement depends on the exact site of compression (Figure 2).

Neurophysiological Assessment

As compression at the elbow is by far the most common cause, the first step is to examine ulnar nerve conduction across the elbow. In compression of the nerve at the elbow there is focal slowing of motor conduction across the elbow segment (at least 10m/s slower than the below elbow segment). This should also be accompanied by a sensory study from the little finger to assess for any sensory axonal loss. If this study is normal it is sometimes worthwhile performing an inching study looking at conduction in 2.5cm segments of the nerve across the elbow, again the principal sign being focal slowing. In compression at the wrist there may be a focal increase in distal latency if the compression occurs before the branch to the hypothenar muscles, sensory studies may be abnormal depending on the site of compression. If these are normal or if there is an ulnar neuropathy without focal slowing then it is worth considering a C8/T1 radiculopathy or lower trunk plexopathy. In a radiculopathy there will be denervation of both the ulnar innervated muscles and abductor pollicis brevis while sensory studies from the little finger and the medial ante-brachial nerve will be normal. In a lower trunk plexopathy there may be denervation with abnormal sensory studies from both the little

finger and the medial ante-brachial nerve. If there is wasting without sensory disturbance it is worth considering compression to the deep palmar motor branch. To test for this, place a needle in the first dorsal interosseous and measure the latency of conduction from the wrist to the muscle. Finally if you still are drawing a blank it is worthwhile testing median conduction across the wrist as carpal tunnel syndrome can sometimes present with sensory symptoms in an ulnar nerve distribution.

Table 1: Muscles innervated by ulnar nerve.

<p>Branches in the Forearm Flexor Carpi Ulnaris Medial Division of Flexor Digitorum Profundus</p> <p>Branches at Wrist Hypothenar Eminence Deep Palmar Motor Branch Palmar Interossei Dorsal Interossei 3rd and 4th Lumbricals Adductor Pollicis Deep head of Flexor Pollicis Brevis</p>
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Table 2: Causes of Ulnar Neuropathy

<p>Anatomical Compression at Elbow Ganglia Tumours Fibrous Bands Accessory Muscles</p> <p>Chronic Compression at Elbow Trauma and arthritic change Leaning on elbow including the use of crutches Prolonged immobilisation</p> <p>Ulnar Neuropathy at Wrist Trauma Ganglia in Guyons Canal Prolonged external compression eg cycling, power tools, crutches</p>
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