Clinical Anatomy of the Median Nerve

Author

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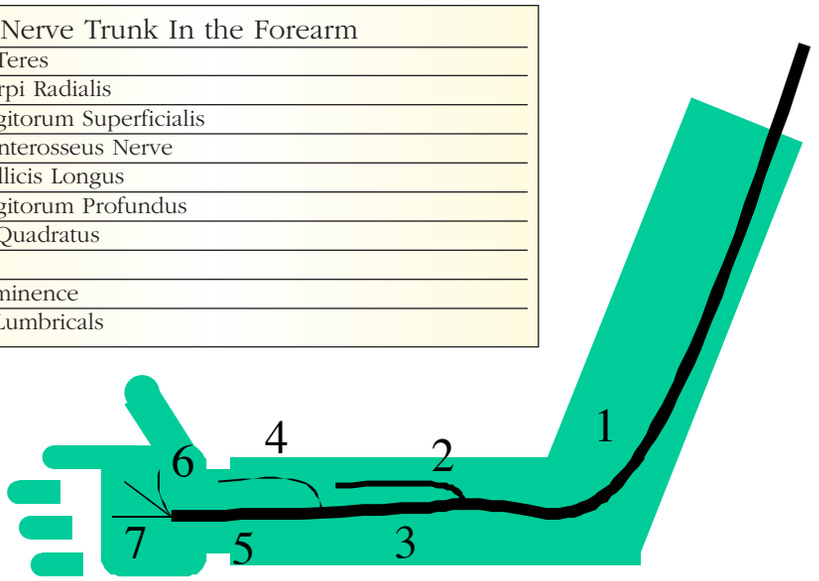
I realise that save for all but the most ardent afficionado an inch by inch discussion of the components of the peripheral nervous system can rapidly induce somnolence. To avoid raking up memories of afternoon snoozes in the back seats of the anatomy lecture theatre I will focus on those nerves that commonly present with entrapment syndromes or as a result of trauma. In any discussion of the clinical anatomy of the peripheral nervous system it is hard to avoid dwelling a great deal on the median nerve. Carpal tunnel syndrome is by far the commonest peripheral entrapment neuropathy, roughly 3% of women and 1% of men will develop carpal tunnel syndrome at some stage. In the catchment area for our neurophysiology service that is roughly 10,000 patients.

Anatomy

The median receives fibres from C6, C7, C8 and T1 roots. It may sometimes contain C5 fibres. It is formed in the axilla by a branch each from the medial and lateral chords of the brachial plexus, which arise on either side of the axillary artery and fuse to form the nerve anterior to the artery. In the arm it is closely related to the brachial artery. (ACNR vol1, issue 2, pp24-25). There is not much action in the arm otherwise as the median nerve has no branches above the cubital fossa. The nerve enters the cubital fossa lateral to the brachialis tendon and passes between the two heads of the pronator teres. In pronator teres it gives off the anterior interosseus branch. The nerve continues in the forearm sandwiched between flexor digitorum profundus and flexor digitorum superficialis. Just above the wrist the nerve emerges to lie between the flexor digitourm superficialis and flexor carpi ulnaris muscles. Here the nerve gives off the palmar cutaneous branch that supplies the skin of the central portion of the palm. Unfortunately the nerve then passes through the carpal tunnel into the hand, lying in the carpal tunnel anterior and lateral to the tendons of flexor digitorum superficialis, in the hand the nerve divides into a muscular branch and palmar digital branches. The muscular branch supplies the thenar eminence, the palmar digital branch supplies sensation to the palmar aspect of the lateral 3 1/2 digits and the lateral two lumbricals. The muscles supplied by the median nerve are summarised in table 1, the course of the nerve is summarised in figure 1.

Table 1

Median Nerve Trunk In the Forearm
Pronator Teres
Flexor Carpi Radialis
Flexor Digitorum Superficialis
Anterior Interosseus Nerve
Flexor Pollicis Longus
Flexor Digitorum Profundus
Pronator Quadratus
Hand
Thenar Eminence
Lateral 2 Lumbricals



Branches of the Median Nerve

1. Branches to Pronator Teres, Palmaris Longus, Flexor Carpi Radialis, Flexor Digitorum, Superficialis
2. Anterior Interosseus
3. Nerve passes between flexor digitorum superficialis and flexor digitorum profundus.
4. Palmar cutaneous branch
5. Nerve in carpal tunnel
6. Branch to thenar eminence
7. Branches to lumbrical and cutaneous branches to 3 1/2 digits.

Entrapment syndromes

There are three well described entrapment syndromes involving the median nerve or its branches, namely carpal tunnel syndrome, pronator teres syndrome and anterior interosseous syndrome.

Carpal Tunnel Syndrome

Carpal tunnel syndrome due to compression of the median nerve in the carpal tunnel syndrome, commonly presents with sensory disturbance and pain in the hand. I have found that one of the most useful diagnostic clues is the presence of sensory symptoms at night time relieved by changing hand posture. It is also worth remembering that carpal tunnel syndrome can sometimes present with symptoms in an ulnar or radial nerve distribution. In my opinion clinical testing with Tinel's sign adds little to a good history. There are as many ways of testing electrophysiogically for carpal tunnel syndrome as there are neurophysiologists, my own preference is to compare median sensory conduction velocity across wrist with ulnar velocity. This should be supported by measurement of motor conduction across the wrist and motor conduction in the forearm segment.

Anterior Interosseus Nerve Palsy

There are a number of causes described for anterior interosseus nerve palsy. These include fractures of the radius midshaft, excessive exercise or penetrating injuries to the forearm although many cases may be idiopathic. Selective involvement of the anterior interosseus nerve may be seen in brachial neuritis. It presents principally as weakness of the index finger and thumb. On clinical examination this is best observed by observing the pinch attitude of the thumb and index finger. Neurophysiological evaluation should include motor and sensory studies of the median nerve to exclude median nerve trunk involvement. Needle EMG should be performed on flexor pollicis longus and compared with a muscle innervated in the forearm by the median nerve trunk, flexor digitorum superficialis is usually the easiest.

Pronator Syndrome

This is due to compression of the median nerve as it passes through pronator teres. Classically it presents with pain on the

volar surface of the forearm following prolonged pronation of the forearm. Often there are no signs and neurophysiological evaluation is normal. It may also be difficult to distinguish from carpal tunnel syndrome. Useful clues however are dyaesthesia in the 'palmar triangle' and replication of symptoms by prolonged pronation. Sometimes nerve conduction studies in severe cases may demonstrate focal slowing of median motor conduction in the forearm segment.

Other Causes of Median Neuropathy

Compression of the median nerve at the elbow can result from a supracondylar ligament (Ligament of Struthers), compression in the forearm can occur in the proximal arch of the flexor digitorum superficialis. Trauma can obviously occur to the nerve anywhere along its course. Types of injury can include penetrating injuries in the axilla and fracture to the shaft of the humerus. Acute compression can occur as a result of bleeding into the forearm or the placement of A/V fistulas in dialysis. Neurophysiologically these are confirmed by demonstrating slowing of conduction across the site of injury or compression and neuropathic features on EMG on those muscles supplied by branches given off below the site of injury or compression.

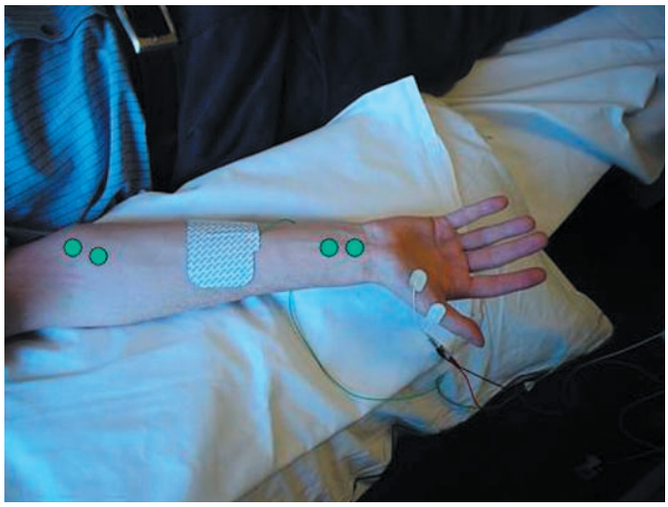


Figure 1: Set up for Median motor study, electrodes are placed over the abductor pollicis brevis (APB), the nerve is stimulated at the wrist and elbow (green markers).

Figure 2: Set up for median sensory study, digital nerves are stimulated with ring electrodes and the response is recorded radial to the palmaris tendon.

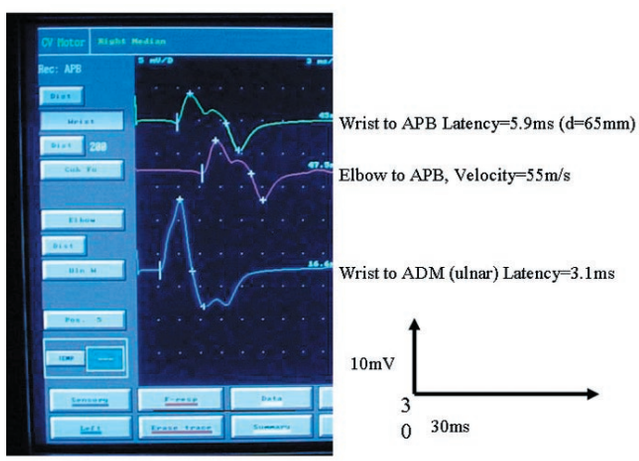


Figure 3: Median motor study in carpal tunnel syndrome, median motor conduction is delayed across the carpal tunnel, note the difference in latency between the distal median motor study and the normal distal ulnar study, median conduction in the forearm is within normal limits.

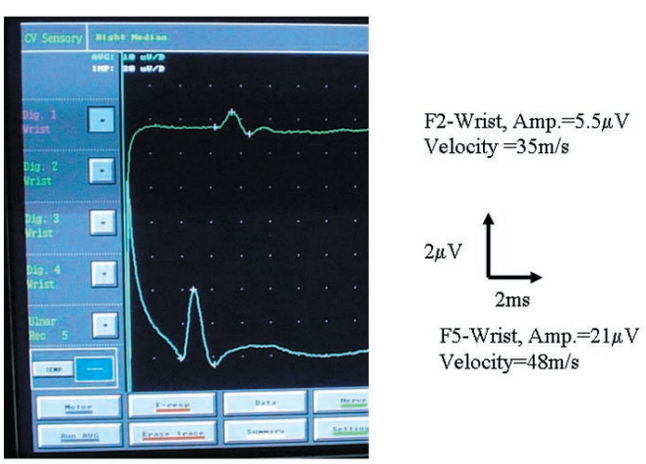


Figure 4: Median sensory study in carpal tunnel syndrome, note the slowing and the reduction in amplitude in the median sensory action potential compared with the normal ulnar sensory action potential.

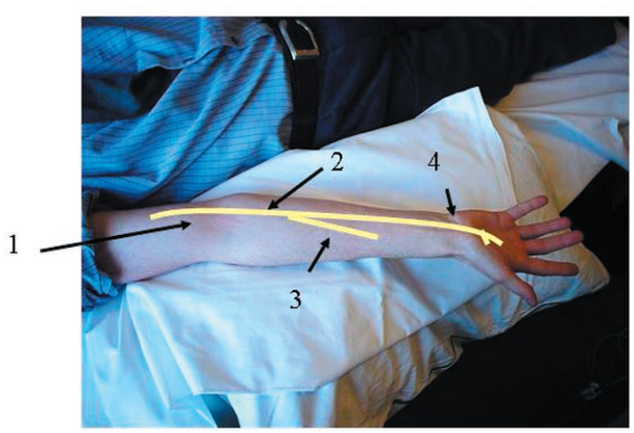


Figure 5: Four sites of median nerve entrapment, 1 Ligament of Struthers, 2 Pronator Teres, 3 Anterior interosseus nerve, 4 Carpal Tunnel.