Any of the three major nerves (ulnar, radial or median) may become entrapped at the elbow. Classically this gives rise to local findings such as pain and nerve discomfort whilst distally there is usually altered sensation and in severe cases muscle wasting. Compressive neuropathies are usually progressive in nature and this influences both the clinical picture and treatment options (Table 1).

Ulnar nerve entrapment (cubital tunnel syndrome)

This is the commonest entrapment neuropathy at the elbow and the second most frequent peripheral nerve entrapment following carpal tunnel syndrome.

Aetiology

A variety of bands can compress the ulnar nerve at or near the elbow (Fig. 1). These are arcade of Struthers, the medial intermuscular septum, Osborne’s band at the level of flexor carpi ulnaris apponeurosis or rarely the nerve may become entrapped by hypertrophy of the flexor carpi ulnaris itself. In the arthritic joint, rheumatoid synovitis or bony exostosis can also cause nerve compression.
Nerve compression is also affected by sleeping posture. Sleeping prone with hands under the pillow leads to local pressure on the nerve and this together with traction caused by shoulder abduction and elbow flexion may result in ulnar nerve symptoms. Similar symptoms can occur when driving on a long journey with the elbow rested on the car window shelf.

**Clinical features**

In the early phase of the disease, sensory involvement is manifest by tingling and numbness of the little finger and ulnar side of the ring finger. This is more marked at night particularly in prone sleepers. Later, motor involvement can lead to clawing of the little and ring fingers (paralysis of flexor digitorum profundus (FDP) to these fingers), wasting of the interosseous (IO) muscles particularly the first dorsal interosseous and wasting of the hypothenar eminence.

Clinical examination may reveal diminished sensation in the distribution of the ulnar nerve and a positive Tinel’s test precipitated by tapping the nerve behind the medial epicondyle. Later motor involvement leads to weakness of the first dorsal interosseous, abductor digiti minimi, flexor carpi ulnaris (FCU) and FDP to the little and ring fingers. Froment’s and Wartenburg’s signs are evidence of ulnar nerve dysfunction. Froment’s sign is found when the patient is unable to achieve a firm pinch between the thumb and the side of the index finger without recruiting the flexor pollicis longus tendon. Thumb flexion at the interphalangeal joint occurs and indicates a positive test. Wartenburg’s sign is the inability to adduct the little finger secondary to weakness of the interossi. The finger remains abducted due to the unopposed action of the extensor digiti minimi.

**Investigation**

Plain radiographs anteroposterior, lateral and cubital tunnel views should be performed. They are usually normal but may reveal osteophytic narrowing of the cubital tunnel.

Electrical studies (NCS&EMG) are helpful if positive (NCS show reduced nerve conduction velocity, and EMGs evidence of denervation of muscles). They are also of value in comparison of pre and post-operative results if the patient fails to improve following surgery.

**Treatment**

**Conservative**

- **Night splints**: These can be useful in early cases (sensory) without ulnar nerve subluxation at the elbow. A well moulded and padded night splint at 40 degrees of flexion is worthwhile especially if the history suggests prone sleeping.
- **Injections**: these are not effective and not recommended.¹

**Surgical**

Failure to respond to conservative treatment or late presentation necessitates consideration of surgery. A range of operative procedures are available but until recently there had been no randomized clinical studies to comparing the outcomes. The options include: simple release/decompression of the ulnar nerve, ulnar nerve anterior transposition (superficial, Intramuscular, submuscular) and medial epicondylectomy.

The literature is not clear with regard to the preferred operation. Simple decompression is easier to perform and preserves the blood supply to the nerve. Medial epicondylectomy preserves the blood supply but is associated with other reported complications including medial elbow pain and medial elbow instability. Anterior transposition requires mobilisation of the nerve and may result in disruption of the blood supply and can cause irritation if the nerve is placed superficially.

In a randomized controlled study, Nabhan et al² compared subcutaneous anterior transposition with simple nerve decompression without transposition. They found no significant differences in outcome. Gervasio et al³ in a prospective randomized study compared simple decompression against anterior submuscular transposition of

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Table 1: Compressive neuropathies

<table>
<thead>
<tr>
<th>Phase</th>
<th>Pathology</th>
<th>Symptoms</th>
<th>NCV</th>
<th>EMG</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early (mild)</td>
<td>Oedema</td>
<td>Intermittent</td>
<td>+/-</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>Intermediate (moderate)</td>
<td>Demyelination</td>
<td>Constant</td>
<td>+</td>
<td>+</td>
<td>+/-</td>
</tr>
<tr>
<td>Late (severe)</td>
<td>Axonal loss &amp; fibrosis</td>
<td>Constant with sensory and/or motor loss</td>
<td>+</td>
<td>+</td>
<td>Surgery with less predictable results</td>
</tr>
</tbody>
</table>

the ulnar nerve in severe cubital tunnel syndrome. No statistically significant difference was found between the two groups with regard to the clinical or the electrophysiological outcome. The surgical treatment outcomes in both groups were 80% and 82.86%, respectively (good to excellent results). Adelaar et al prospectively compared simple release, subcutaneous and submuscular anterior transposition in 32 patients. They found no significant differences in the results. Geujens et al in a randomized prospective study and Baek et al compared medial epicondylectomy with anterior transposition. Again there were no significant differences in the results although more patients were satisfied after medial epicondylectomy and would have the operation again.

In a meta-analysis of randomized controlled trials to compare anterior transposition with simple decompression for treatment of cubital tunnel syndrome no difference in motor nerveconduction velocities or clinical outcome scores was found.

Authors’ preferred management
In patients with sensory symptoms alone who are candidates for surgery, we perform a simple decompression. If sensory and motor signs are both present our preferred option is a subcutaneous anterior transposition.

Radial nerve entrapment

Entrapment syndromes of the radial nerve may involve the main radial nerve, more commonly the posterior interosseous nerve (PIN) or occasionally the superficial (sensory) branch of the nerve.

Radial nerve above the elbow: compression of the main radial nerve above the elbow may be caused by the fibrous arch of the long head of triceps or the lateral head of triceps. It can also occur with the Holstein-Lewis fracture pattern.

Clinically the picture is similar to PIN palsy but there is also involvement of the proximally innervated muscles extensor carpi radialis longus (ECRL), extensor carpi radialis brevis (ECRB, and Brachioradialis). Radial sensory symptoms may also be present.

Electrical studies will usually confirm the diagnosis.

Treatment is conservative for 3–4 months but if there is no evidence of recovery, surgical exploration and decompression should be considered.

Posterior interosseous nerve: compression syndrome and radial tunnel syndrome are usually interchangeable terms. Compression of the PIN is usually caused by one of the following structures: (FREAS) Fibrous band, Recurrent radial vessels (leash of Henry), Extensor carpi radialis brevis, Arcade of Frohse (oval upper edge of supinator) or Supinator (distal border or in the muscle) (Fig. 2) in addition any mass lesion in the area may cause nerve compression.

Radial tunnel syndrome: This must be differentiated from lateral epicondylitis/tennis elbow. In radial tunnel syndrome the tenderness is usually 2–3 cm distal to the radial head in line with the radial nerve. There is continuous aching pain in the region of the arcade of Frohse and the patient usually complains of discomfort when writing.

Figure 2. The fibrous proximal border of the superficial belly of the supinator. The arcade of Frohse (A) is just deep to the reflected extensor carpi radialis brevis muscle (ECRB). The posterior interosseous nerve (PIN) may be compressed by the arcade of Frohse. The superficial radial nerve (SRN) is superficial to the radial tunnel. From: Gelberman: J Bone Joint Surg Am, Volume 75-A(12). December, 1993. 1854–1878.

Electrical studies are not helpful in this condition. The condition is usually treated non-operatively using splints, NSAID and activity modification since the results of surgical release are good in only 60–70%.

Sarhadi et al noted that when the diagnosis of radial tunnel syndrome included at least two of the objective signs—reproduction of the patient’s symptoms with pressure along the course of the radial tunnel, painful resisted supination, or resisted middle finger extension—and each was abolished after infiltration of the tender area with a local anesthetic solution, 16 of 26 cases improved with nonoperative treatment. Nine of the remaining patients underwent radial tunnel release, and seven (78%) reported complete pain relief.

Posterior interosseous nerve entrapment: is similar to radial tunnel syndrome but associated with weakness of the PIN innervated muscles.

Investigation: EMG studies are usually diagnostic.

Treatment: this is initially conservative with activity modification and NSAID for 3 months. If this fails, surgical decompression is considered. Surgery gives good results in about 85% of cases.

Sensory branch of radial nerve (cheiralgia paresthetica or Wartenberg’s syndrome)

The sensory branch of the radial nerve is usually compressed between brachioradialis and the extensor carpi radialis longus about 6–8 cm above the radial styloid. Symptoms may be aggravated by a tight wrist watch, hand cuffs or tight bracelets.

Clinically, there is paraesthesia and numbness in the radiodorsal aspect of the hand with a positive Tinel’s sign over the nerve. Symptoms can be precipitated by forceful forearm pronation for 30–60 seconds.

Treatment is conservative initially. Failure to improve in 6 months warrants surgical decompression.
Median nerve entrapment

Two distinct entrapment syndromes of the median nerve are recognized namely pronator syndrome and anterior interosseous syndrome. The clinical features of these syndromes are different but their aetiological factors are similar.

Aetiology

Structures that cause compression of the median nerve include the supracondylar process (present in 1% of the population) and its ligamentous extension to the medial epicondyle the ligament of Struthers, the lacertus fibrosus, between the superficial and deep heads of pronator teres and muscular anomalies eg. Gantzer muscle (accessory head of flexor pollicis longus) (Fig. 3). More distally the nerve may be compressed within the arch of flexor digitorum superficialis (FDS).

Clinical features

Pronator syndrome

The features of this syndrome are often vague. Diffuse proximal forearm discomfort and weakness may be present and at times there may also be sensory changes in the distribution of the palmar cutaneous branch of the median nerve. Provocative tests when positive are helpful to confirm the diagnosis (Fig. 4). These include pain on resisted elbow flexion and forearm supination, pain on resisted pronation with elbow extended and pain on resisted middle finger proximal interphalangeal (PIP) joint flexion.

Anterior interosseous nerve syndrome

This usually presents with diffuse flexor forearm discomfort together with abrupt weakness or total paralysis of the anterior interosseous nerve innervated muscles (radial 2 FDP, flexor pollicis longus (FPL), pronator quadratus). The anterior interosseous nerve does not carry cutaneous sensory fibres but does carry many proprioceptive fibres from the flexor muscles leading to the appreciation of forearm discomfort.


On examination, the patient is asked to demonstrate the OK sign (Kiloh-Nevin sign); this is a precision thumb and index finger tip to tip pinch. It is dependent on an intact powerful FPL and FDP to the index finger. In anterior interosseous nerve syndrome there is extension of the index DIPJ and the thumb IPJ forming a square instead of a circle.

Abrupt weakness of FPL together with flexor forearm pain mimic the picture of FPL rupture and this must be excluded to avoid misplaced surgery to repair a tendon when a nerve decompression more proximally is indicated. Intact FPL demonstrates the tenodesis effect (passive hyperextension of the metacarpo-phalangeal (MPC) joint of the thumb leads to flexion at the IP joint). Careful assessment of the power of the index FDP and the pronator quadratus (resisted forearm pronation with the elbow fully flexed) should indicate dysfunction of the anterior interosseous nerve if present.

Parsonage-Turner syndrome is bilateral anterior interosseous nerve palsy caused by viral brachial neuritis. In this syndrome the motor loss is usually preceded by severe intense pain in the shoulder region.

Investigation

Plain radiography of the elbow may show a supracondylar process and is mandatory if surgery is contemplated.

EMG studies are not usually sensitive enough to detect pronator syndrome and the diagnosis is usually made clinically. In anterior interosseous nerve syndrome EMG studies for the FPL or pronator quadratus should be done and are helpful to confirm the diagnosis.

Treatment

Primary treatment is conservative in the form of rest, splints and NSAID for 3–6 months especially in incomplete lesions or in the presence of other neurological signs. Surgery is indicated if significant symptoms of a complete lesion persist for 6 months. It consists of an anterior approach to the elbow and proximal forearm and must involve release of all potential sites of compression.

References