Cubital tunnel syndrome

Introduction

Cubital tunnel syndrome is the second most common peripheral entrapment syndrome after carpal tunnel syndrome (Fernandez et al, 1998). It is a chronic neuropathy of the ulnar nerve, resulting in a sensory, motor or mixed neuropathy. It is most commonly seen in adults and affects twice as many men as women. The incidence is thought to be rising, in part as a result of the use of mobile phones, during which the elbow is held in sharp flexion for prolonged periods (Darowish et al, 2009).

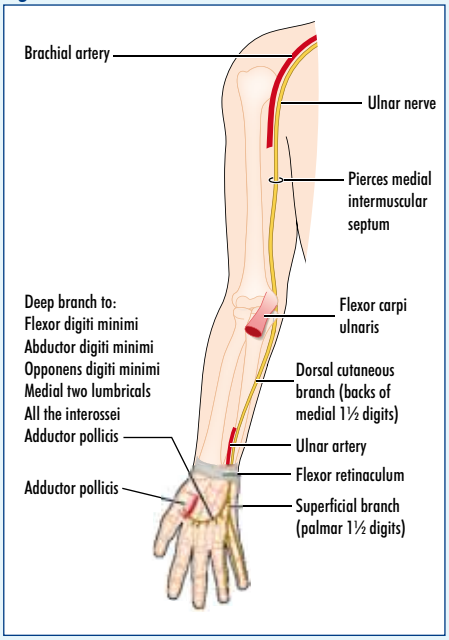
This article discusses the anatomy of the ulnar nerve and the pathology, diagnosis and management of cubital tunnel syndrome.

Anatomy

The ulnar nerve is a mixed sensory and motor nerve arising from the medial cord of the brachial plexus (*Figure 1*). It lies medial to the brachial artery as far as the middle of the humerus, lying on the coracobrachialis. At the mid-arm, it pierces the medial intermuscular septum and passes into the posterior compartment. At the elbow the ulnar nerve turns sharply to enter the cubital tunnel, which is formed by the medial epicondyle and the olecranon. The roof of the cubital tunnel is covered by Osbourne's ligament, which is a thickened transverse band between the humeral and ulnar head of the flexor carpi ulnaris (Palmer and Hughes, 2010).

At the elbow the ulnar nerve branches, first giving off a sensory branch to the joint and then motor branches to the flexor carpi ulnaris and the medial two flexor digitorum profundus muscles. In the lower forearm, 6–10 cm proximal to the wrist crease, the ulnar nerve gives off a dorsal cutaneous branch which supplies sensation to the dorsal medial 1½ digits. Distally the ulnar nerve passes superficial to the flexor retinaculum of the wrist, enters Guyon's canal and divides into two terminal branches: the superficial branch supplying the palmar skin of the medial 1½ digits and a deep branch supplying the hypothenar muscles as well as the medial two lumbricals, all the interossei and the adductor pollicis.

Figure 1. The ulnar nerve.



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Pathology

The ulnar nerve can be compressed at various sites along its course. At the elbow sites include the arcade of Struthers, the medial intermuscular septum, the medial epicondyle, the cubital tunnel and the deep flexor pronator aponeurosis. The most common site of ulnar nerve compression is within the cubital tunnel, causes of which are stated in *Table 1*.

Table 1. Causes of ulnar nerve compression within the cubital tunnel

Osteophytes
Ganglia
Hypertrophy of the medial head of the triceps muscle
Elbow deformity, such as cubitus valgus
Ulnar nerve subluxation, with recurrent dislocation of the nerve from the cubital tunnel

Within the cubital tunnel, the ulnar nerve follows a relatively constrained path and can be compromised as a result of direct neuronal compression or compression of its blood supply. As the ulnar nerve lies medially and at some distance from the axis of rotation of the elbow joint, elbow movement requires the nerve to both stretch and slide through the cubital tunnel. Prolonged elbow flexion predisposes to raised intra-neural pressure and the development of cubital tunnel syndrome.

Such postural-induced symptoms occur with regular phone use and the lay press have consequently labelled this syndrome as 'mobile phone elbow' (Sims, 2009). In addition to mechanical aetiologies, cubital tunnel syndrome is associated with several systemic conditions, including diabetes, thyroid disease, renal failure, inflammatory arthropathies, alcoholism and malnutrition. Pregnancy and obesity are also risk factors, but many cases are idiopathic.

Diagnosis

Diagnosis is based upon thorough history and clinical examination. Nerve conduction studies are often performed to confirm diagnosis.

History

Symptoms may be transient initially and of insidious onset. Sensory disturbance tends to occur first, resulting from early microvascular compression and neural ischaemia. Symptoms include numbness and tingling in the little and ulnar half of the ring finger (*Figure 2*). Pain maybe a predominant complaint for some and this often occurs at the level of the cubital tunnel.

Figure 2. Sensory distribution of the ulnar nerve.

Exacerbating factors may include sleeping in the fetal position and working for prolonged periods with flexed elbows. A history of elbow trauma is significant as this may result in an abnormal carrying angle, which stretches the ulnar nerve, leading to a tardy ulnar nerve palsy (Abe et al, 1995). With continued or worsening compression demyelination and axonal loss may occur, which result in motor symptoms. Patients complain of weakness and functional disturbance, such as clumsiness and dropping objects. With further progression, patients may present with hand deformity.

Examination

With early presentation, there may be few clinical signs. Inspect for evidence of hypothenar wasting and intrinsic muscle loss. In severe disease, signs may include wasting of the first dorsal interosseous muscle, Wartenberg's sign (inability to adduct the extended small finger) and clawing of the little and ring fingers may occur (*Figure 3*).

Assess both the sensory and motor function of the hands. Decreased sensation should be restricted to the ulnar nerve distribution (*Figure 2*). Preserved dorsal ulnar hand sensation suggests a more distal lesion, such as compression within Guyon's canal. Full assessment should include fine touch, pin-prick sensation and two-point discrimination. An inability to perceive a difference of less than 5 mm is abnormal and constitutes a late finding.

When assessing strength, key muscles are the hypothenar muscles, interossei and the adductor pollicis. Little finger abduction strength can be used to assess abductor digiti minimi and hypothenar function while the crossed finger test (middle finger over the index finger) is a simple and reliable test for interossei function. Froment's test will elicit weakness of adductor pollicis in which case the patient will hyperflex the thumb interphalangeal joint to compensate for loss of the adductor pollicis strength. *Figure 4* shows abnormal flexion of the patient's left thumb interphalangeal joint.

Examine above the elbows to identify an abnormal carrying angle and evidence of previous trauma. Use the opposite elbow as a standard. Clinical examination must also include the neck and shoulder. Pain on neck movement mimicking the patient's symptoms could indicate cervical disc disease while pain on shoulder movement could indicate a brachial plexus lesion. To complete the examination, there are special tests, which reply on provocation to reproduce and exacerbate symptoms in an ulnar distribution. These include the elbow flexion test and Tinel's percussion test. In the elbow flexion test, the elbow is fully flexed with the wrist in neutral for 1 minute. Tinel's percussion test involves tapping over the ulnar nerve posterior to the medial epicondyle (*Figure 5*).

Nerve conduction studies

Nerve conduction studies are able to localize the site of nerve dysfunction and grade disease severity. They play an important role in excluding an alternative diagnosis and are particularly useful when it is difficult to localize ulnar nerve entrapment solely on clinical findings. In cubital tunnel syndrome, one would expect to find nerve conduction slowed around the elbow; a motor conduction velocity across the elbow less than 50 m/s is considered positive. Nerve conduction studies have a sensitivity ranging from 37–86% (American Association of Electrodiagnostic Medicine et al, 1999), thus a negative test result does not exclude the diagnosis.

Research to improve diagnostics tests is ongoing and recently there has been interest in the use of high-resolution ultrasound scans. Enlargement of the ulnar nerve is an important component of cubital tunnel syndrome and this can be detected by high-resolution ultrasound (Okamoto et al, 2000; Beekman et al, 2004). The combination of high-resolution ultrasound and nerve conduction studies increases the sensitivity of diagnosis to 98% (Beekman et al, 2004), but this technique is not in routine practice and larger studies are needed.

Before confirming a diagnosis of cubital tunnel syndrome and proceeding with treatment, it is important to consider the differential diagnosis (*Table 2*). Further supportive tests should be requested when there is diagnostic uncertainty. Cervical spine and chest radiographs can identify extra-dural spinal lesions such as cervical disc disease or thoracic outlet syndrome caused by an accessory cervical rib. Magnetic resonance imaging is invaluable for identifying rarer intra-dural causes such as a spinal cord tumour. An elbow radiograph can identify osteoarthritis and calcification in the medial collateral ligament and should be taken if there is a history of previous trauma. Distal to the elbow, the ulnar nerve can be compressed by a ganglion cyst, neuroma or aneurysm of the ulnar artery in Guyon's canal. Magnetic resonance imaging and ultrasound are useful in identifying these rarer lesions.

Figure 4. Froment's sign.

Figure 3. Ulnar claw hand.

Figure 5. Tinel's percussion test.

Table 2. Differential diagnosis for cubital tunnel syndrome

C8/T1 radiculopathy (cervical root compression)
Thoracic outlet syndrome
Compression of the ulnar nerve at the wrist (Guyon's canal)
Two or more of the above = double crush syndrome

Management

Non-operative management

In the absence of pronounced motor affection or clinical evidence of a long-standing lesion, a trial period of non-operative management may be used. Patient education is essential and activity modification should be discussed. Avoidance of provocation factors such as prolonged elbow flexion can be curative. In addition, orthotic devices such as daytime elbow pads or night splints may be tried which limit elbow flexion to 45°.

Physiotherapy input has proven beneficial, particularly with respect to teaching neural gliding stretches that help improve the gliding of nerves within the arm. In a trial of non-operative management using the above techniques, 89% of patients with mild to moderate cubital tunnel syndrome had spontaneous recovery (Svernlov et al, 2009). Unfortunately, the relapse rate with non-operative management is high (Mowlavi et al, 2000) and disease progression can occur. Once intrinsic atrophy occurs, nothing can be done to restore the intrinsic motor loss. Thus, if there is no improvement after 6–12 weeks surgery should be considered.

Operative management

There are several operative treatments, all of which involve decompression of the ulna nerve around the elbow. These include simple decompression with release of the roof of cubital tunnel, anterior transposition of the nerve to a subcutaneous or sub-muscular plane and medial epicondylectomy. Risks associated with cubital tunnel surgery include infection, haematoma, persistent sensory deficit or motor weakness, neuroma, complex regional pain syndrome and damage to the medial collateral ligaments.

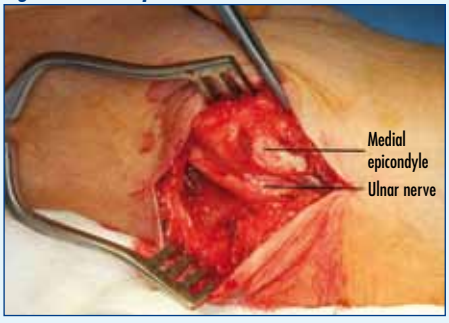
Meta-analysis of randomized trials (Macadam et al, 2008) did not establish one technique to be superior. Hence it is common practice to decompress the nerve in situ, as this is considered the simplest and safest technique (*Figure 6*). In this procedure a 6–10 cm incision is made along the course of the ulnar nerve, between the medal epicondyle and the olecranon. Care must be taken to avoid branches of the medial antebrachial cutaneous nerve. The nerve is retained in its anatomical position. Symptom relief post-surgery is high and achieved in greater than 70% (Paine, 1970; Chan et al, 1980; Davies et al, 1991).

In rare cases where simple decompression does not provide full resolution of symptoms, revision surgery with anterior transposition of the nerve can be effective (Goldfarb et al, 2009). In this procedure the nerve is moved anterior to the elbow axis of flexion. This has the benefits of both decreasing longitudinal traction on the nerve and removing the pressure on the nerve that was present when located within the cubital tunnel. The transposed nerve can be left in one of three locations: subcutaneous, intramuscular or submuscular plane. A drawback of anterior transposition is that by completely freeing the nerve from its soft tissue surroundings, the blood supply (vasa vasorum) may be compromised, leading to secondary ischaemic neuritis.

Conclusions

Cubital tunnel syndrome results from increased pressure on the ulnar nerve at the elbow. There are several known aetiologies, including prolonged elbow flexion, diabetes, inflammatory arthropathies and previous elbow trauma. Diagnosis relies on thorough history and examination, along with supportive tests such as nerve conduction studies. In patients with mild cubital tunnel syndrome, patient education, physiotherapy and orthotic devises can be effective. In more advanced cases, surgical treatment should be considered. **BJHM**

Figure 6. Decompression of the ulnar nerve.



Conflict of interest: none.

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KEY POINTS

- Cubital tunnel syndrome is the second most common peripheral entrapment syndrome, after carpal tunnel syndrome.
- Typical symptoms include paraesthesia and pain over the ulnar side of the elbow, forearm and hand.
- Weakness and wasting of the hypothenar and intrinsic muscles of the hand may develop. Clawing and loss of hand function may result.
- Non-operative and operative treatments are available.
- Surgical success rates are high, but further research is required to improve adjuvant diagnostic tests and to identify the optimal surgical technique.