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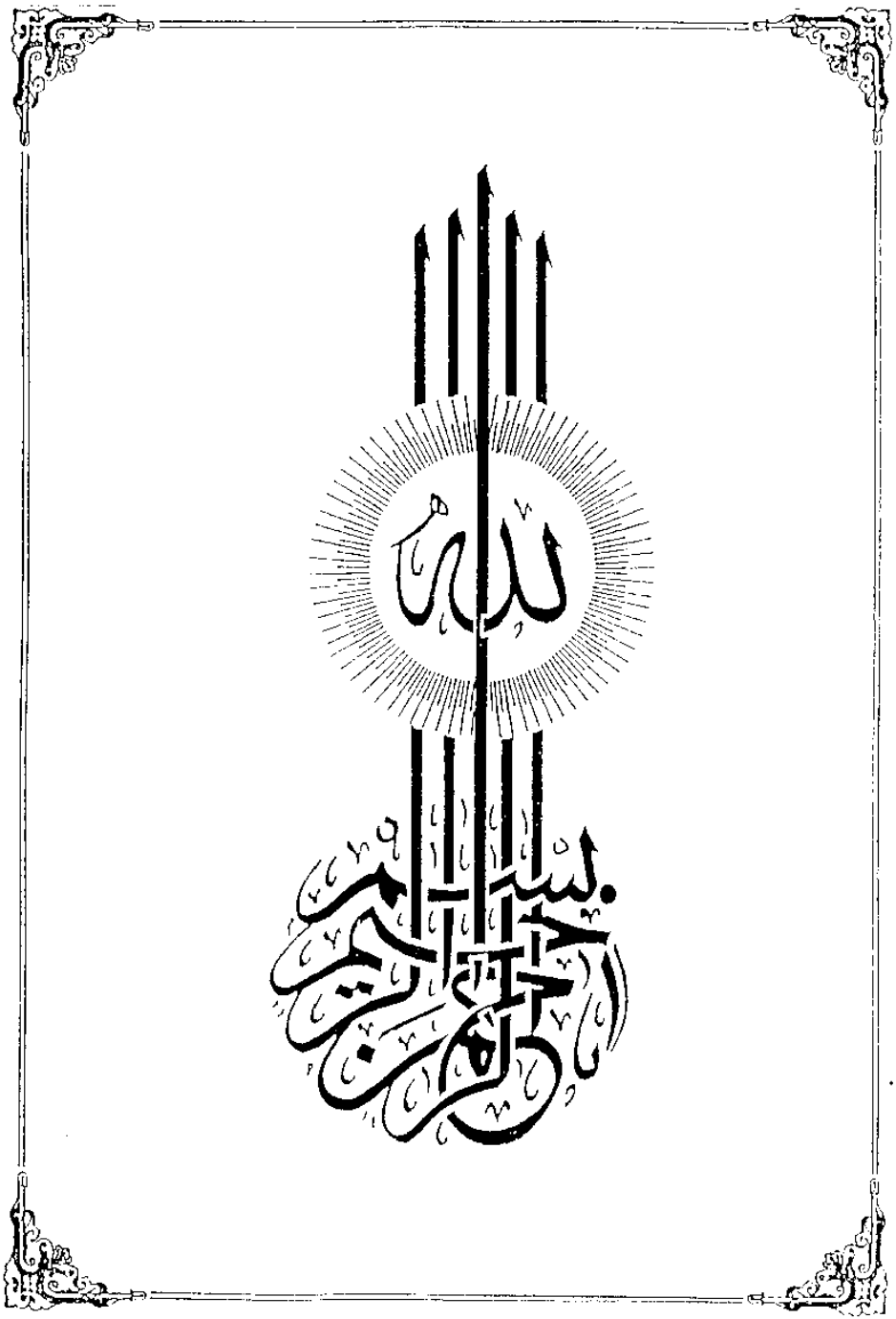
C O N T E N T S



CUBITAL TUNNEL SYNDROME

INTRODUCTION

When a nerve is subjected to a local compression it loses its conductivity . This is manifested by paresis or paralysis of muscles and may be accompanied by disturbances or loss of sensibility in its zone of distribution . Nerve compression syndromes are fashionable nowadays . It is recognised that many peripheral nerves can be involved if , in their anatomical courses , they traverse a fibro-osseous tunnel whose confines are inelastic .

Osborne (1957) , described the surgical anatomy of tardy ulnar neuritis which might follow an old fracture or osteoarthritis of the elbow or arise beside an otherwise normal joint . He noted that the incidence or the severity of the neuritis was not necessary proportional to the degree of joint deformity . In exploring such cases he found , in almost every case , a band of fibrous tissue termed " the arcuate ligament ", bridging the two heads of the flexor carpi ulnaris . This band , also called Osborne ligament (Seddon 1975) , lies directly over the ulnar nerve . It is slack in extension and is tightened with elbow flexion , compressing the underling nerve . He considered its effect to be similar to that of the transverse carpal ligament at the wrist on the median nerve . Feindel and Stratford (1958) , described the anatomy at the elbow joint level where the ulnar nerve is susceptible to compression . They proposed the term " cubital tunnel " and used the term " cubital tunnel syndrome " to describe the clinical picture of localized ulnar nerve compression at this level . Because the treatment of compression nerve syndromes is not a case

problem , it is relatively simple , it becomes all the more important to recognise this syndrome early while the changes in the nerves and muscles are still reversible (Brooke 1963) .

A N A T O M Y

I - Flexor Carpi Ulnaris

Origin and Insertion :

The flexor carpi ulnaris lies along the ulnar side of the forearm and arises by two heads ; humeral and ulnar ; connected by a tendinous or an aponeurotic band forming an arch. The humeral head is very small and arises from the medial epicondyle of the humerus by the common tendon . The ulnar head arises from the medial margin of the olecranon and the upper two thirds of the posterior border of the ulna by an aponeurosis common to it and the extensor carpi ulnaris and the flexor digitorum profundus and from the intermuscular septum between it and the flexor digitorum superficialis . The muscle fibres end in a tendon which is formed along the enterolateral border of the muscle in its distal half and is inserted into the pisiform bone which is actually a sesamoid bone in the tendon , hence it is prolonged to the hamate and the fifth metacarpal bone by the pisohamate and the pisometacarpal ligaments . It is also attached by a few fibres to the flexor retinaculum . The ulnar vessels and nerves lies on the lateral side of its tendon of insertion.

Nerve Supply :

It is supplied by the ulnar nerve ; but in over 90 per cent of cases the fibres come from the lateral cord (C6 & 7) by a communication in the axilla (Last 1976) .

Action :

It is a flexor of the wrist with the flexor carpi radialis and the palmaris longus when present . Acting with the extensor carpi ulnaris , it is a powerfull adduction of the hand.Both come into play as synergic muscles to prevent abduction of the hand when the thumb is actively

extended at its carpometacarpal joint . In addition , the flexor carpi ulnaris fixes the pisiform bone during contraction of the hypothenar muscles .

II - Anatomy Of The Medial Aspect Of The Elbow Joint :

The elbow joint is essentially a synovial joint of a ginge variety and has therefore strong radial and ulnar collateral ligaments while the anterior and posterior parts of the fibrous capsule are weak and contain many oblique fibres which allow the full range of movements . The elbow joint includes two articulations , (I) The numero-ulnar between the trochlea of the humerus and the trochlear notch of the ulna and (2) The humero - radial between the capitulum of the humerus and the facet on the head of the radius

The Ulnar Collateral Ligament (Fig. I) :

It is a thick triangular band consisting of two portions , an anterior and a posterior united by a thinner intermediate oblique portion. The anterior portion , is attached above by its apex to the front part of the medial epicondyle of the humerus and below by its broad base to a tubercle on the upper part of the medial margin of the coronoid process or the sublime tubercle . The posterior portion , also is triangular in shape , attached above to the lower and posterior part of the medial epicondyle and below to the medial margin of the olecranon . Between these two bands few intermediate fibres descend from the medial epicondyle to an oblique band -often feebly developed- which streches between the olecranon and the coronoid process .

As the ulnar nerve descends from behind the medial epicondyle into the

forearm , it lies on the posterior and the oblique portions of the ligament and in close relation to the bony tubercle on the medial margin of the coronoid process or the sublime tubercle (Fig. 2) . The ulnar nerve supplies twigs to the ulnar collateral ligament as it lies behind the medial epicondyle . It is important to mention that the ulnar collateral ligament tends to bulge medially on flexion of the elbow joint and this may also decreases the space available in the cubital tunnel .

Movements :

The only appreciable movement possible at the elbow joint , is the simple movement of flexion and extension . The movement of extension is limited by the tension of the fibrous capsule and the muscles on the front of the joint ; that of flexion is chiefly by the apposition of the soft parts . When the forearm is fully extended and the hand supinated , the upper arm and the forearm are not in the same line ; the forearm is directed somewhat laterally , and forms with the upper arm an angle of about 163° . The carrying angle fits the elbow into the waist when the arm is by the side and it is significant that the carrying angle is more pronounced in women than in men . The carrying angle is caused partly by the medial edge of the trochlea of the humerus , which projects about 6mm below the lateral edge , and partly by the obliquity of the superior articular surface of the coronoid process , which is not set at right angles to the shaft of the ulna . The carrying angle is masked in pronation of the extended forearm .

Applied Anatomy :

Malunited fracture of the lateral condyle or supracondylar

fractures of the humerus in children resulting in an increase in the carrying angle , i.e. , a cubitus valgus deformity , are oftenly followed by tardy paralysis of the ulnar nerve , because the nerve is gradually strached in its groove behind the medial epicondyle and an irritative syndrome or incomplete paralysis of the nerve is produced . In addition , the cubitus valgus deformity can reduce the space available in the cubital tunnel .

III - The Medial Epicondyle

It occupies the medial part of the non articular portion of the condyle of the humerus . It forms a blunt projection on the medial side of the condyle . It is subcutaneous and can easily be identified through the skin while the elbow is flexed . The center of ossification for the medial epicondyle forms a separate epiphysis which is entirely extracapsular, and is placed on the posteromedial aspect of the epicondyle ,It is separated from the rest of the lower epiphysis by a downgroth from the shaft , with which it unites at about the twentieth year . The posterior surface of the medial epicondyle is smooth and is crossed by the ulnar nerve , which lies in a shallow sulcus , as it runs down into the forearm . In this situation the ulnar nreve can be felt and rolled against the bone . If the pressure exerted is sufficient , sensations are aroused , and they are identical with those produced when the nerve is jarred against the epicondyle, i.e. by a knock on the ' funny bone ' . The lower part of the anterior surface of the medial epicondyle shows an impression which gives attachment for the anterior portion of the ulnar collateral ligament..

Applied Anatomy :

Avulsion fractures of the medial epicondyle , especially if it is

displaced inside the elbow joint , or if it is associated with dislocation of the elbow joint may be associated with ulnar palsy due to traction on the nerve . Roughening of the posterior surface of the medial epicondyle after healing of simple fractures of the medial epicondyle is also followed by tardy ulnar neuritis due to continuous friction of the ulnar nerve in its groove behind the humeral epicondyle or due to compression of the nerve in the narrowed tunnel .

IV - The Ulnar Nerve

The ulnar nerve is the largest branch of the medial cord of the brachial plexus from the eighth cervical and the first thoracic segments of the spinal cord. It receives a branch from the lateral cord (C 6,7) , in over 90 % of cases . These fibres are given off in the forearm as the motor branch to the flexor carpi ulnaris (Last 1978) . Like the other large nerves that spring from the brachial plexus , it arises opposite the lower border of the pectoralis minor near the coracoid process and descends along the medial side of the axillary artery and the proximal half of the brachial artery . At the level of insertion of the coracobrachialis at the middle of the humerus , it leaves the brachial artery and accompanied by the ulnar collateral artery , it passes backwards through the medial intermuscular septum to the posterior aspect of the arm . Then it descends infront of the medial head of the triceps muscle to the back of the medial epicondyle , where it lies in contact with the periosteum under an expansion of the triceps tendon which fuses medially with the deep fascia of the forearm . As it enters the forearm between the humeral and ulnar heads of the flexor carpi ulnaris , the aponeurotic band confines the nerve in the cubital

tunnel where it is liable to compression during flexion of the elbow joint. Pechan & Julis (1975) demonstrated in fresh cadavers that flexion of the elbow combined with extension of the wrist increases the pressure in the ulnar nerve threefold . Furthermore , placing the hand behind the head results in an intraneural pressure which is six times as high as in the relaxed nerve , and thus well above interstitial perfusion pressure . This pressure can be reduced significantly by releasing the flexor carpi ulnaris aponeurotic band or The Osborne ligament . The ulnar nerve lies against the medial ligament of the elbow joint to which it gives a twig of supply . The ulnar nerve is more easily compressed against the medial surface of the coronoid process than against the humerus where it lies behind the medial epicondyle . It gives off no branches while it is in the axilla and the upper arm .

The intraneural arrangement of the nerve bundles is also relevant to a study of the effects of compressive lesions on the ulnar nerve .Sunderland (1945) found the arrangement of the nerve bundles within the ulnar nerve at the elbow joint level (Fig. 3) as being that most of the nerve fibres destined for the flexor carpi ulnaris and the flexor digitorum profundus lie deeply in the nerve , whereas the motor fibres for the intrinsic muscles of the hand and the sensory fibres run more superficially . Vanderpool et al (1968) , in a theoretically speaking , suggested that compression on the superficial aspect of the nerve would affect the forearm muscles least , whereas compression arising in the floor of the ulnar groove would produce early involvement of the forearm muscles . However , the varying physiological susceptibilities of motor and sensory

nerve fibres also play a role in determining the clinical effects of nerve compression and may override the purely anatomical consideration (Brooks 1963) .

The ulnar nerve enters the forearm between the two heads of the flexor carpi ulnaris , under cover of the flattened fibrous aponeurotic band or the Osborne ligament . Then under cover of the belly of the flexor carpi ulnaris , which it supplies , it lies upon the flexor digitorum profundus and it is immediately lateral to the ulnar artery , down to a level just proximal to the wrist .The ulnar nerve supplies from the eighth cervical segment of the spinal cord branches to the ulnar half (usually) of the flexor digitorum profundus (Last 1978) , the branches of supply to the flexor carpi ulnaris contain the fibres from the 6th and 7th cervical roots ,i.e. , the fibres brought to the ulnar nerve in the axilla (Last 1978) .

The ulnar nerve and the ulnar artery emerge from beneath the tendon of the flexor carpi ulnaris just proximal to the wrist and pass across the flexor retinaculum into the hand close to the radial side of the pisiform bone (Gray 1964) . It divides there into its two terminal branches , the deep and the superficial .

Branches in the forearm :

Articular : To the elbow joint .

Muscular : Two in number . They arise near the elbow , one supplies the flexor carpi ulnaris and the other supplies the medial half of the flexor digitorum profundus .

Palmar cutaneous branch : Arises at a variable point below the middle of the forearm (Cunningham 1987) , and pierces the

deep fascia above the flexor retinaculum to supply the skin over the hypotnenar muscles (Last I976) . It sometimes supply the palmaris brevis (Gray I954) .

Dorsal branch : Arises about 5cm above the wrist . It passes distally and backwards deep to the flexor carpi ulnaris , perforates the deep fascia near the pisiform bone . It turns backwards crossing the medial surface of the carpus where it can be felt. The dorsal branch divides into two branches , one supplies the medial side of the little finger , the second supplies the adjacent sides of the little and ring fingers. On the little finger the dorsal digital nerves extend only as far as the base of the distal phalanx and on the ring finger as far as the base of the middle phalanx .

The superficial branch :

Descends deep to the palmaris brevis , supplies it and divides into two palmar digital nerves , which can be compressed against the hook of the hamate bone ((Gray I964) . The medial of the two branches passes to the medial side of the little finger . The lateral branch joined by a communicating branch from the nearest digital branch of the median nerve , it divides into two branches near the cleft between the little finger and the ring finger . Each terminates at the end of the digit by dividing into two branches , one of them (palmar) ramifies in the pulp of the digit and the other (dorsal) in the bed of the nail (Cunningham I967) .

The deep branch :

Passes deeply into the palm between the heads of origin of the flexor and abductor digiti minimi . It passes between the origin of the opponens

digiti minimi and the fifth metacarpal bone lying on the hook of the hamate bone , whose distal border it incents with a shallow groove , passing down to the interossei . It arches deeply in the palm within the concavity of the deep palmar arch . It gives motor branches (TI) to the three hypothenar muscles , the two lumbricals on the ulnar side , all the interossei and both heads of the adductor pollicis .

The deep terminal branch of the ulnar nerve is said to give branches to some of the intercarpal , carpometacarpal and intermetacarpal joints . The precise details of the origin and distribution of these branches are uncertain.

Applied Anatomy :

The ulnar nerve is liable to be injuried more commonly around the elbow joint while it is lying behind the medial epicondyle of the humerus. Dislocation of the elbow joint or avulsion fractures of the medial epicondyle, in which the body fragment is trapped in the joint , an injury that occurs more commonly in children than adults , the ulnar nerve palsy is caused by compression , traction or both on the nerve .

Roughening and irrigularities of the posterior surface of the medial epicondyle after healing of a simple fracture of the medial epicondyle can also lead to tardy ulnar neuritis as the nerve is no longer free to alter shape or position . Cubitus valgus deformity resulting from a fracture in the region of the elbow during childhood including the supracondylar fractures and fractures of the lateral humeral condyle , can also be complicated by tardy ulnar neuritis due to traction neuritis and decrease in the space available in the cubital tunnel .

Summary of Ulnar Nerve Distribution

No branches in the upper arm .

At the elbow and upper third of the forearm :

- 2 Articular branches to the elbow joint .
- 2 Muscular branches to the flexor carpi ulnaris and the flexor digitorum profundus .

At the middle and lower third of the forearm :

- Palmar cutaneous branch to the ulnar third of the palm .
- Dorsal branch of the ulnar nerve to the ulnar third of the dorsum of the hand and the little and medial half of the ring fingers .

At the wrist and hand :

- Superficial branch :
  - Palmaris brevis .
  - Two palmar digital branches to the little and medial half of the ring fingers .
- Deep branch : It is muscular to

  Abductor digiti minimi
  Flexor digiti minimi
  Opponens minimi
  Ulnar two lumbricals
  Dorsal four interossei
  Volar four interossei
  Adductor pollicis
  Flexor pollicis brevis (occasionally) .