Median Nerve Compression

Hand Therapy Training Program

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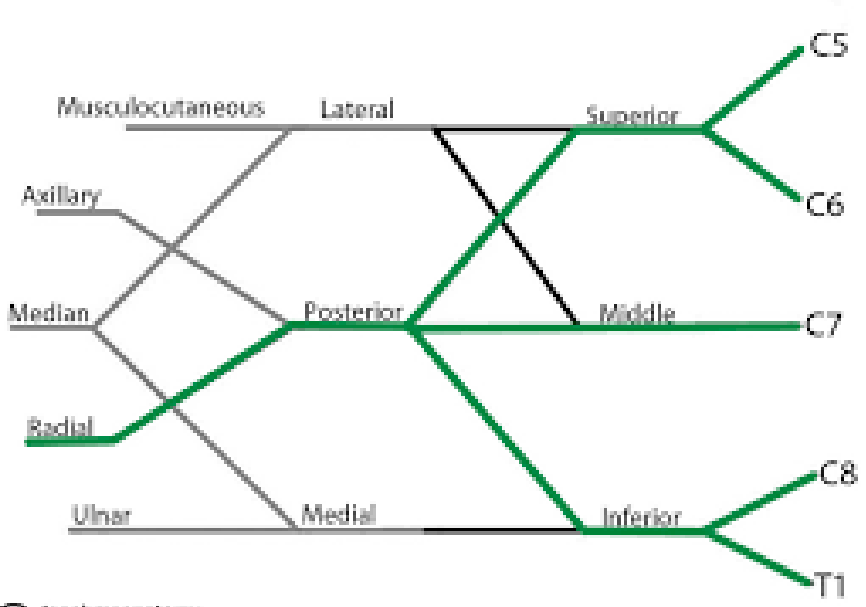
Median Nerve Compressions

* Course of the median nerve
* Sites of compression
* Carpal Tunnel Syndromes, Pronator Syndrome, Anterior Interosseous Nerve Syndrome

1. Anatomy
2. Causes
3. Conservative management
4. surgical management
5. Post op management

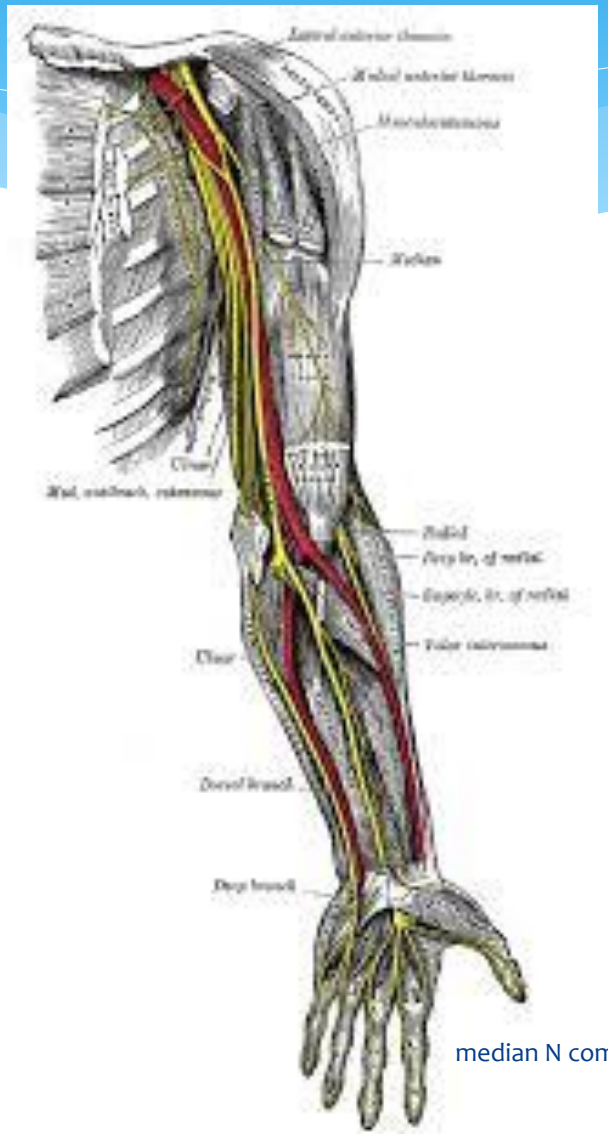
Median Nerve Course

* Median Nerve receive inputs from the medial and lateral cord of the brachial plexus



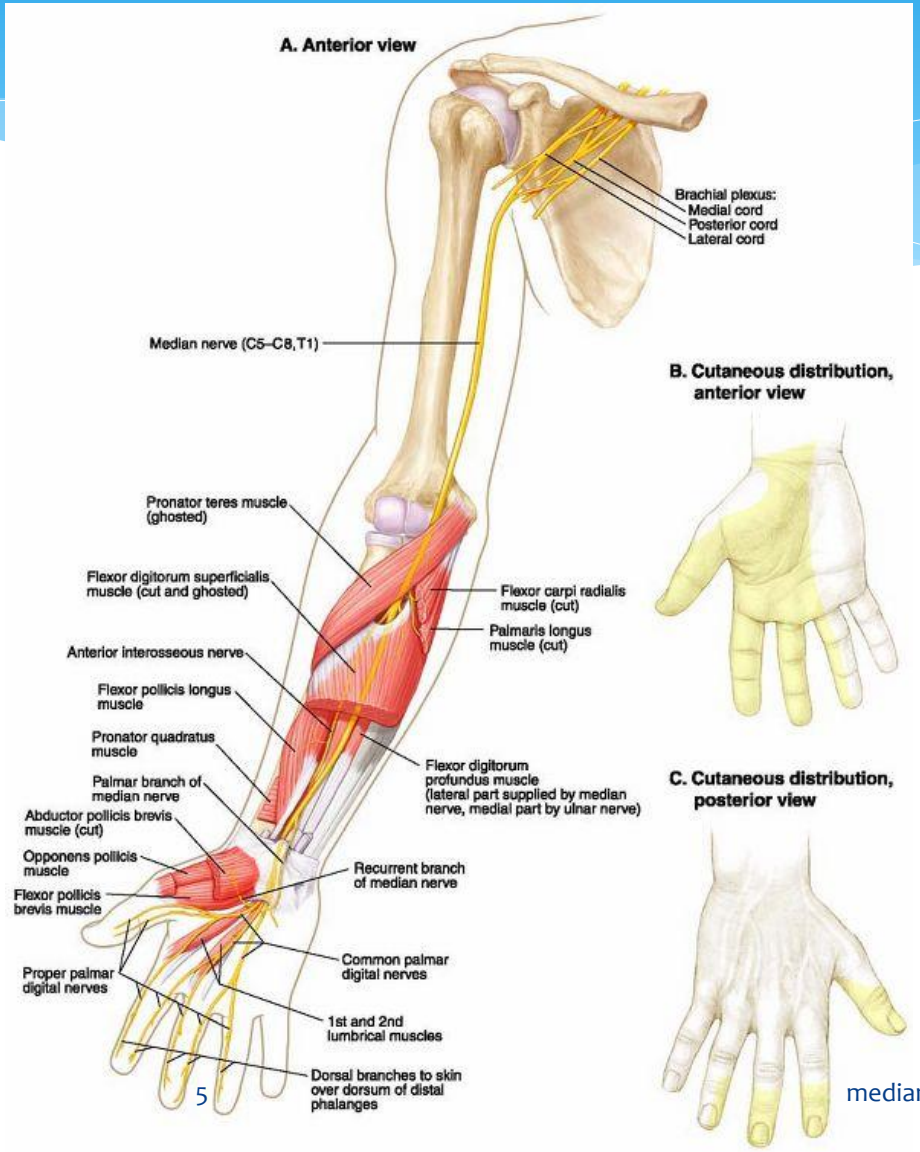
Median Nerve Course

* In courses down the medial side arm between biceps and brachialis
* It runs distally into the cubital fossa
* It gives off no branches into the upper arm



Median Nerve Course

* The median nerves arises from the cubital fossa and passes between the two heads of Pronator Teres
* It then travels between FDS and FDP before emerging between FDS and FCR

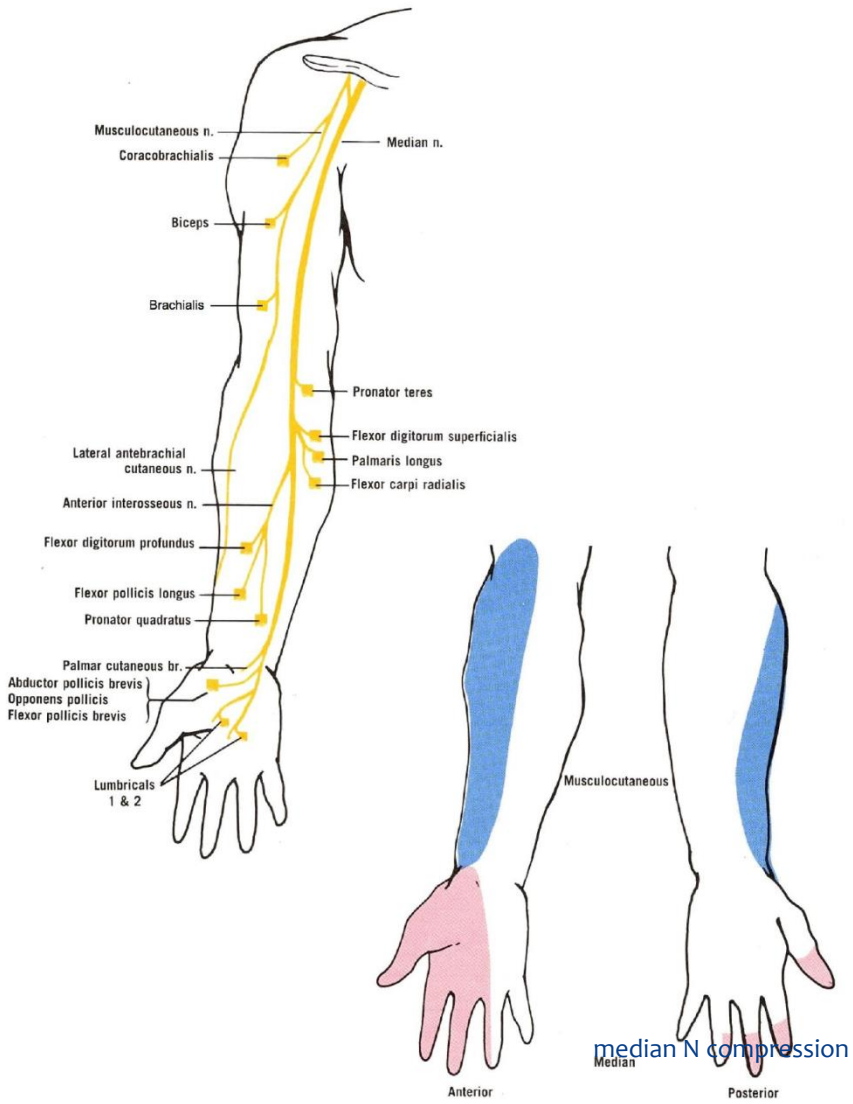


Median Nerve Course

* The median nerve gives off two branches as it course through the forearm

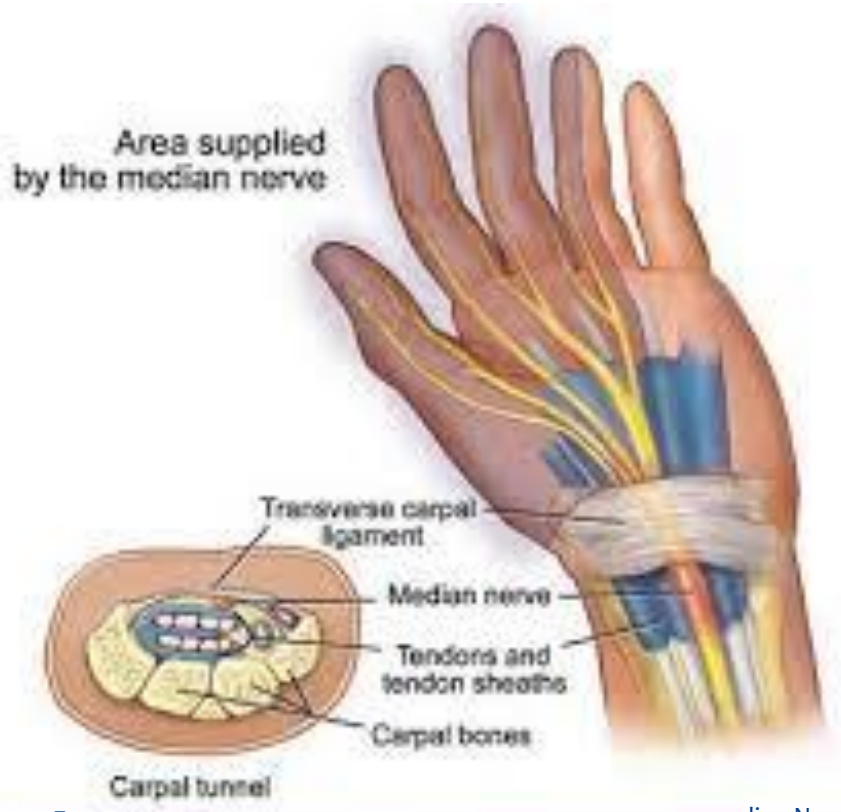
^ anterior interosseous nerve

^ the palmar cutaneous branch of the median nerve



Median Nerve Course

* The median nerve enters the hand through the carpal tunnel. Deep to the transverse carpal ligament along with the FDS. FDP and FPL.



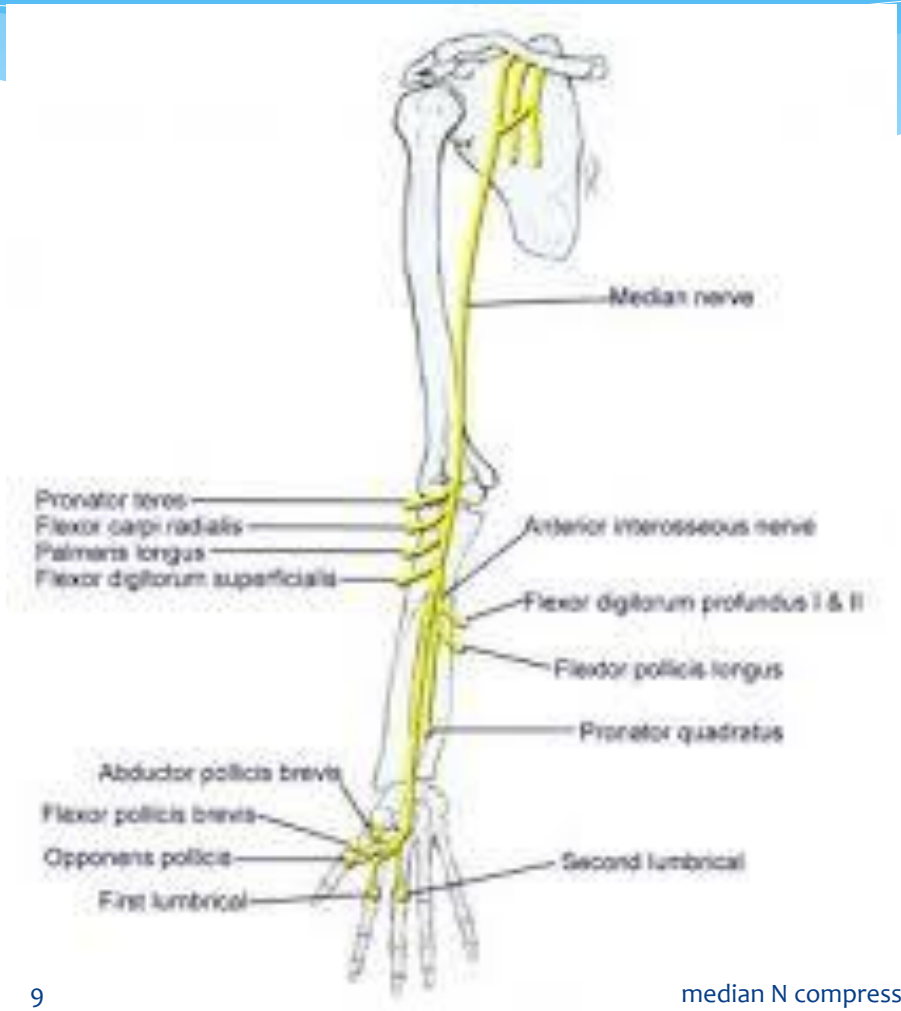
Question 1

* The Median nerve usually enters the forearm :
* 1. between the two heads of the supinator
* 2. between the two heads of the pronator teres
* 3. posterior to the brachial artery
* 4. superficial to the lacertus fibrosis

Median Nerve Innervates

No branches in the arm

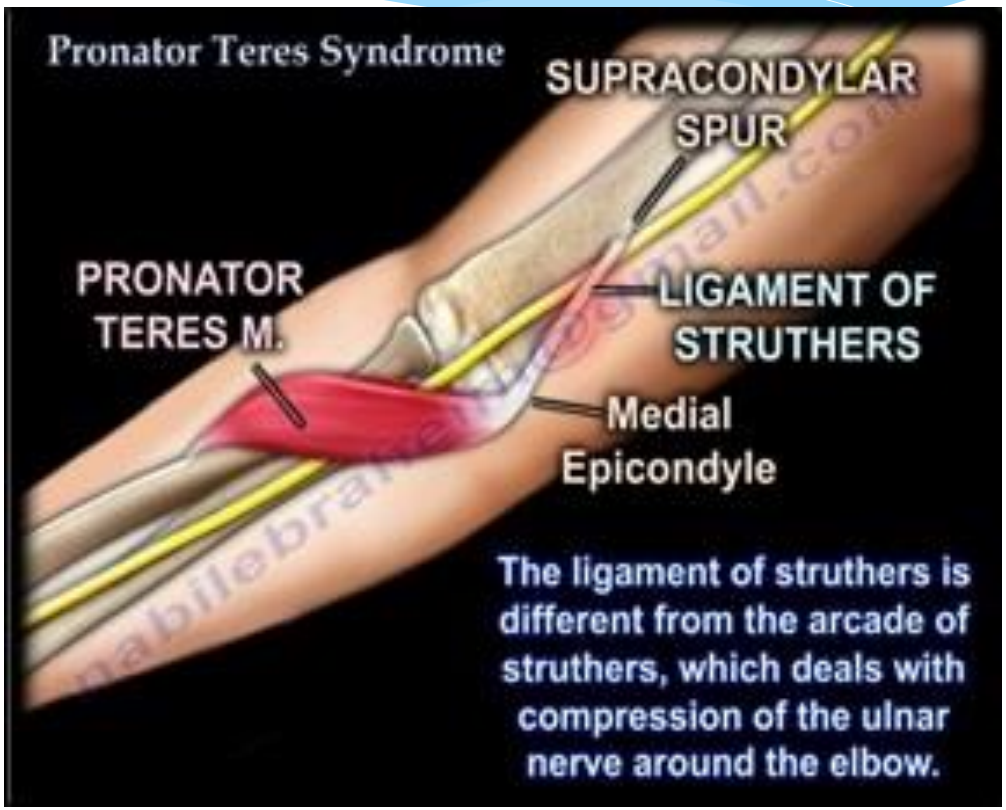
* Forearm (Median N)
  ^PT
  ^FCR
  ^PL
  ^FDS
* Foearm (Anterior Interossei N)
  ^FDP
  ^FPL
  ^PQ
* Wrist/Hand
  ^APB
  ^OP
  ^FPB (superficial head)
  ^Lumbricals (I II)



Sites of Compression

* Ligament of struthers and supracondylar process

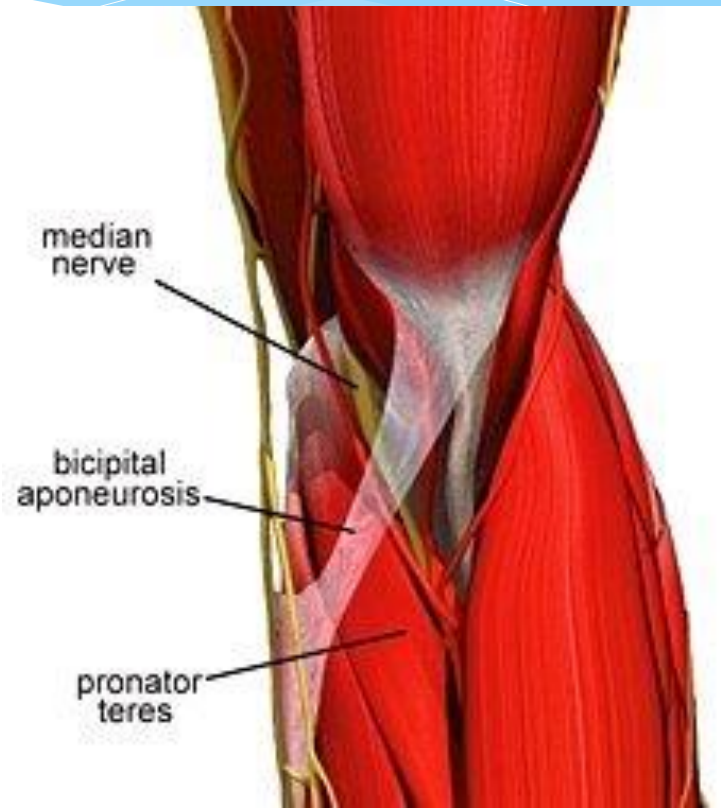
  ^may cause a friction generating angle

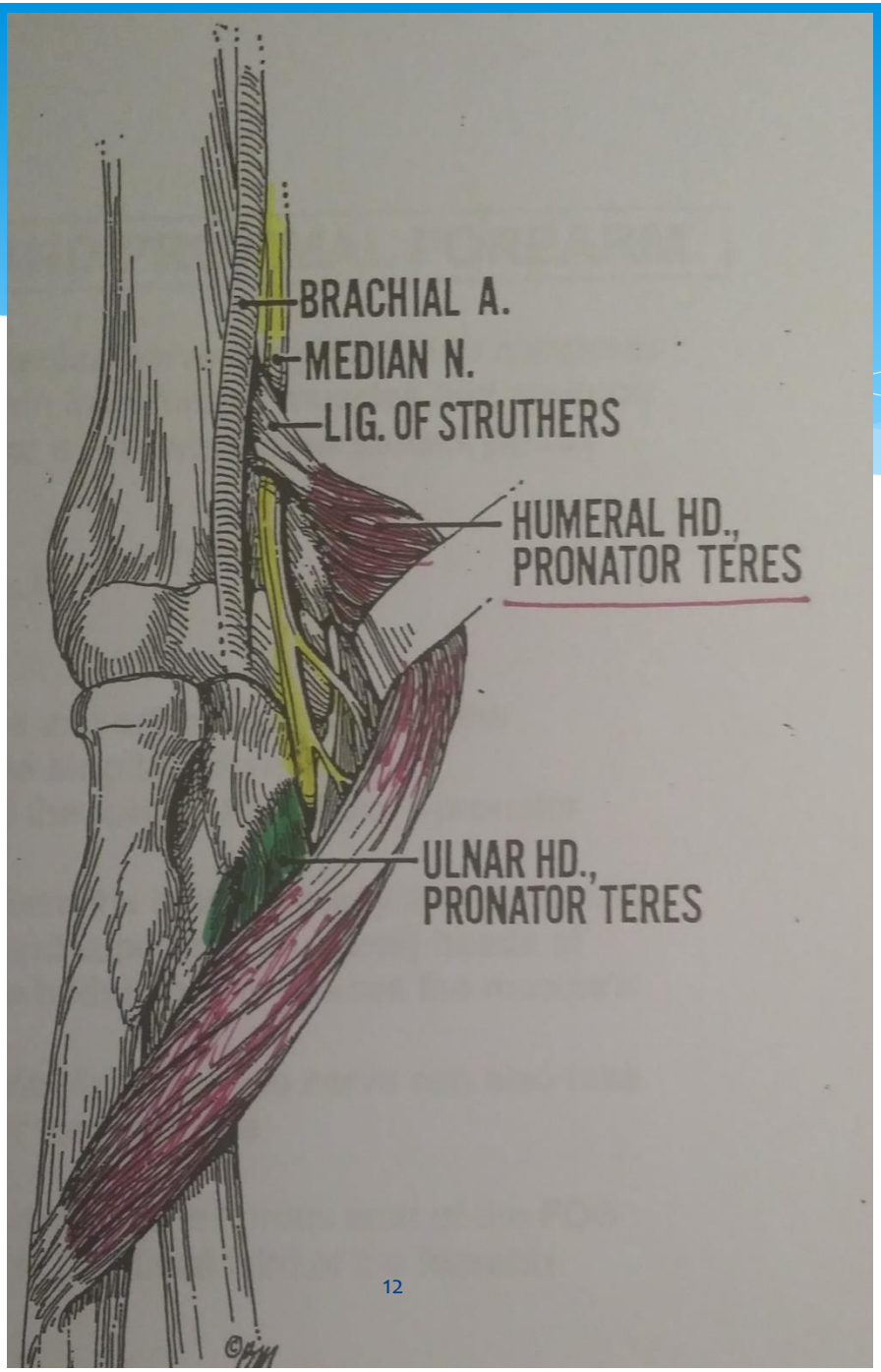


Sites of Compression

* Bicipital Aponeurosis

~strong resisted flexion may cause compression of the nerve




BRACHIAL A.
MEDIAN N.
LIG. OF STRUTHERS
HUMERAL HD.,
PRONATOR TERES
ULNAR HD.,
PRONATOR TERES

Sites of Compression

* The two heads of origin of Pronator Teres

  ~ when the forearm is pronated the median nerve may be subject to compression

Sites of Compression

* Fibrous Arch between the two heads of FDS—sublimis bridge.

Sites of Compression

* Carpal Tunnel

~the most common place for compression

Carpal Tunnel Question 2

* What ten structures are contained in the Carpal Tunnel?

Carpal Tunnel Anatomy

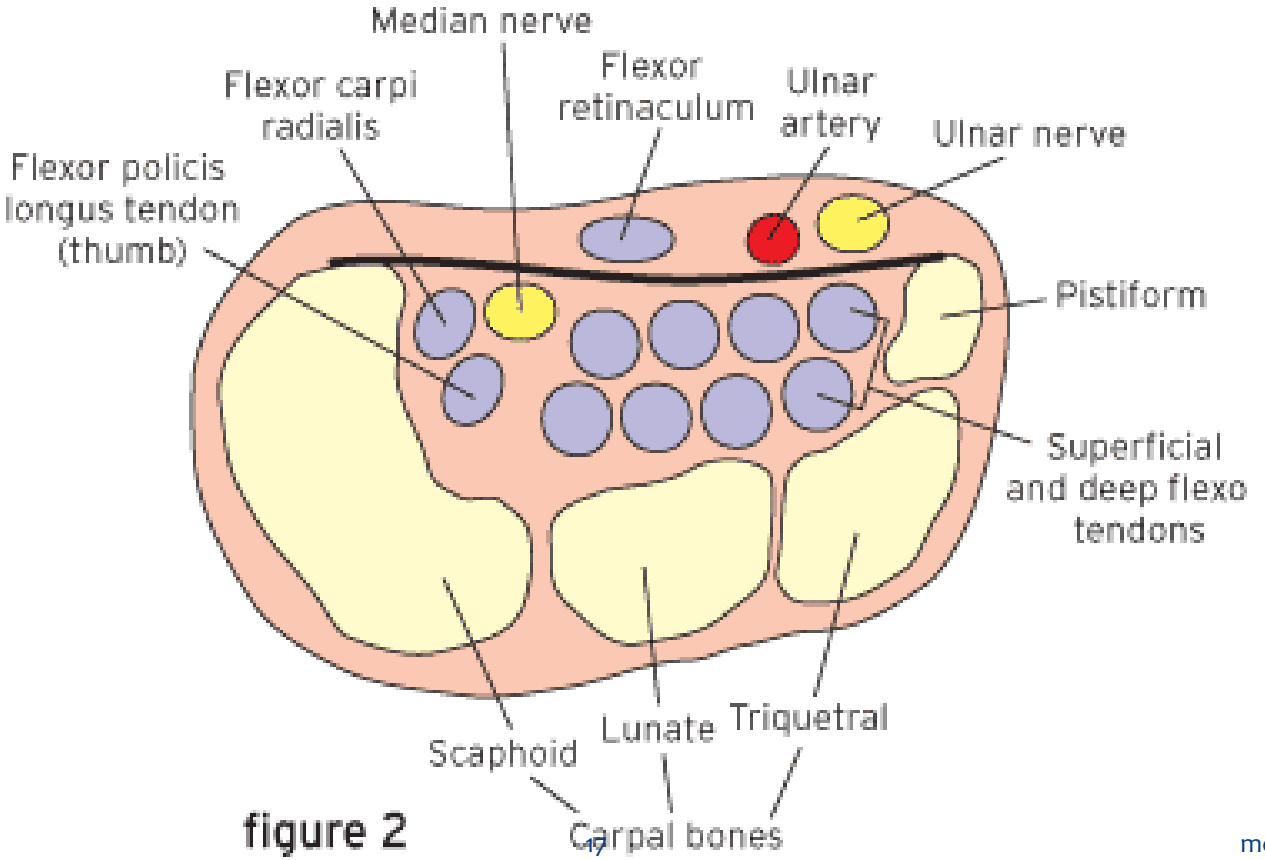


figure 2

Carpal Tunnel Causes

* Pathophysiology

~due to an increase in carpal tunnel pressure

CT pressure: normal =2.6mmhg

CTS =32mmHg

Carpal Tunnel Risk Factors

* Obesity—increase incidence 25x
* Pregnancy
* RA
* OA
* Diabetes
* Hypothyoidism
* Post fracture
* Flexor tenosynovitis
* Mechanical force: repeating , vibration
* Extreme posture of wrist flexion or extension.
* Post menopausal women
* Abnormal muscle structure.

Clinical Examination

* Acute

~can develop post a major trauma in particular post distal radial fracture.

~carpal dislocation or crush injury (eg: lunate dislocation)

Clinical Examination

* Chronic

~Insidious onset

~Pain and Numbness in Median nerve distribution

Clinical Examination

* Night time symptoms

  ~Describes needing to shake hand to relieve symptoms

* Day time symptoms

  ~Often report symptoms while holding a book

  ~driving holding the phone or combing hair

* Pain radiating up arm

Clinical Examination

* Muscle atrophy

  Thenar eminence wasting

* Decreased manual dexterity

  Complain of difficulties with tasks such as doing up buttons

Clinical Examination

* Objective:

~observation:

~ROM

~Muscle Strength

~Special tests:

*Phalen's

*Tinel's

*Carpal Compression test

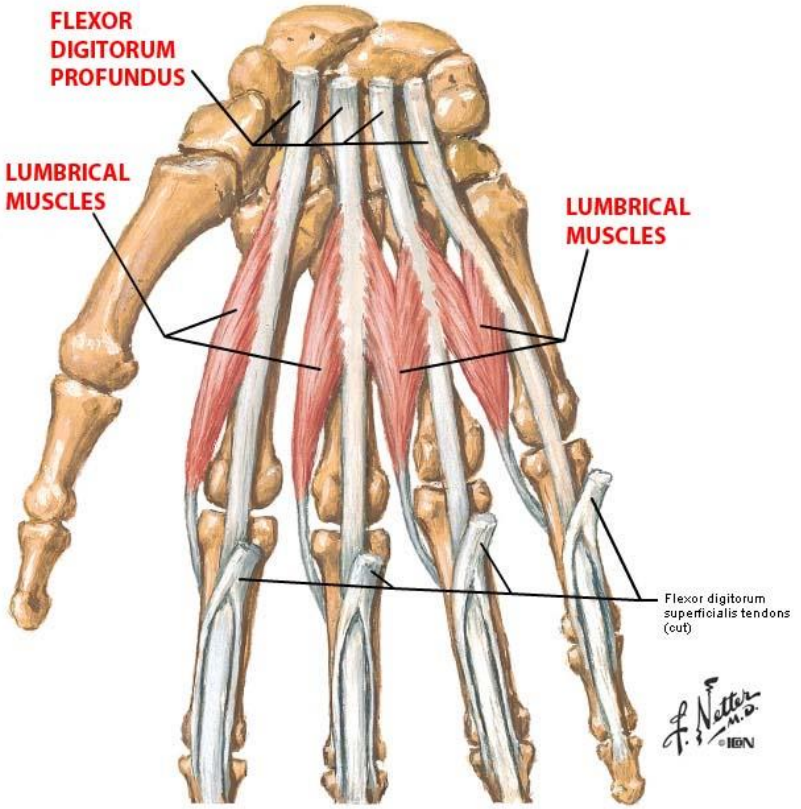
* Semmes Weinestein Monofilament test

* Two points discrimination

Clinical Examination

Lumbrical Incursion test:

fist position with wrist at neutral position. Hold for 30-40 seconds---- produced symptoms= +ve



Differential Diagnosis

* Proximal Compression
  FDS
  PT
  TOS
  C6 Radiculopathy

Quick Screen for Commonly associated Problems

* 1st CMCJ OA
* De Quervain's
* Trigger fingers/thumbs
* Epicondylitis
* Ulnar nerve compression

Question 3

What causes nocturnal pain with CTS

1) Sleeping position
2) Vascular stasis
3) Thenar atrophy
4) 1) and 2)
5) All of the above

Literature review

* Posture
* Load
* External Pressure

On

Carpal Tunnel Pressure (CTP)

Literature review

CTP's are affected by

- changes in posture of wrist, fingers, thumb, forearm
- loads applied to PL, FDP, FDS, FPL, lumbricals
- externally applied forces to the palm and wrist areas
- vibration

Effect of wrist Posture

* Normal CTPs (Gelberman et al 1901)
  - 2.5mmHg = wrist neutral
  - 31 mm Hg = normal wrist flexion
  - 30mm Hg = maximal wrist extension

Clinical Implication

* Proper position for wrist splintage is neutral
* Prefabricated splint often position wrist in extension
* Working posture of wrist in neutral

Effects of finger position

* Lumbrical incursion
* Suspect lumbrical involvement with CTS when complaining of intermittent numbness when:

  writing,

  holding books

  carrying objects in intrinsic plus position

Clinical Implications

* Wrist control splinting may be insufficient to reduce CTPs
* Lumbrical block added to wrist splint to hold MCPJ's at 20-40 flexion = ↓finger flexion by 50%
  = ↓lumbrical incursion
  = ↓CTPs

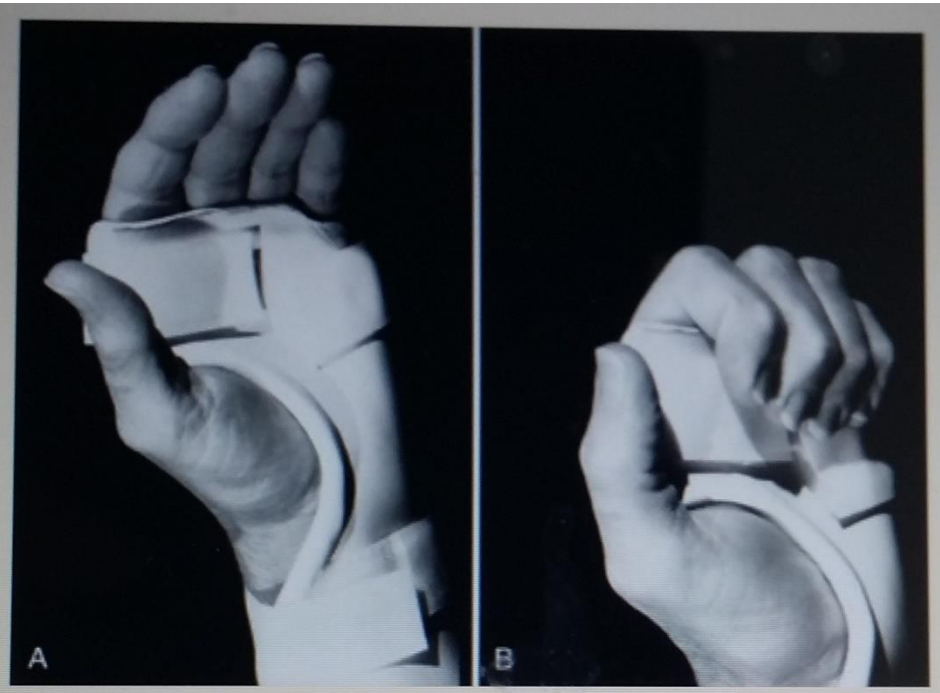


Figure 49-2 **A,** Patients with well-developed lumbricals, a positive Berger's test, associated flexor or extensor synovitis, or who tend to constantly flex the digits to relieve symptoms should be positioned with the wrist neutral and metacarpophalangeal joints blocked at 20 to 40 degrees of flexion to prevent lumbrical incursion and decrease flexor and extensor excursion. **B,** This orthotic position decreases pressure at the A1 pulley as well as in the carpal tunnel by

Clinical Implications

* Alter work posture that require repetitive gripping and sustained grip
* Avoid use of therapy aids that encourage repetitive gripping

Question 4

In which position should a patients wrist be splinted for conservative management of CTS

A. Wrist extension (20◦)
B. Wrist neutral (0◦)
C. Wrist flexion (20◦)
D. Wrist flexion (40◦)

Effects of combined tendon load and posture

Carpal Tunnel Pressures > 200mmHg upon making a strong fist

Cobb et al 1995, Seradge et al 1995

Effects of combined tendon load and posture

Fingertip loading increase carpal tunnel pressure concluded that sustained pinch/grip aggravate MN neuropathy at the wrist

(Remple et al 1997)

Clinical Implications

* Strengthening should not be a part of conservative management for CTS (Evan 2001)
* Work postures to avoid

  >isolated fingertip pressure and sustained grasp

  >forceful pinch grip

  >sustained pinch grip
* Aim in work with wrist and fingers in a neutral position

Effect of Thumb

Carpal Tunnel Pressures are increased by:

* 1st CMCJ OA
* Pull of opponent on flexor retinaculum
* Sustained intrinsic thenar contraction i.e., when holding heavy book

(Ditmars and Houin 1986, Keir et al 1997)

Clinical Implications

* Evaluate for 1st CMCJ inflammation or arthritis
* Avoid work posture that combine repetitive grip and pinch
* Decrease adduction force by increasing grip size

Effect of Forearm Position

90◦ supination increases CTP> 225%

(Rempel et al 1098)

clinical Implications

* Aim to work posture of 45 ◦ pronation
* Tool redesign may be needed
* Isometric strengthening in neutral forearm
* May need to rethink position of sensibility testing

Effect on Externally applied pressure

1KG of external force increases CTP

(Cobb et al 1995)

Clinical Implications

Need to take closer look at pressures applied by strengthening tools and immobilising/stretching splints used in clinical practice:

- hand grippers
- Some work-stimulation tools
- POPs
- Progressive static splinting for wrist

Question5

Putty is an excellent choice for conservative rehabilitation of CTS:

True or False.

Effect on Work Tasks

Specific work tasks implicated as risk factors in CTS

* Keying on a computer
* Operating on mouse
* Using excessive strength incongruous postures of wrist, hand and elbow
* Sustaining constantly pressure on palm
* Engaging in tearing motion
* Vibrating hand tools

Effect of Work Tasks

Enough evidence from experiential studies to suggest that both incidence and severity CTS can be improved with changes in work patterns

* ↓duration
* ↓frequency
* ↓Intensity
* ↓Extreme wrist postures
* ↓Vibration

Question 6

All of the following are important for healthy computer use except:

A. Maintaining the wrist in neutral position
B. Taking frequent breaks
C. Always using a wrist rest
D. Stretching frequently

Conservative Management

* Splinting, wrist neutral, include MCPJ if indicated
* Education+++
* Work site assessment
* Rest
* NSAIDs
* CSI
* Metabolic control of other medical problem
* Weight loss

Surgical Management

Indications

* Progressive impairment of sensation
* Motor weakness and atrophy
* Space occupying lesion
* Persistent symptoms despite conservative management

Open versus endoscopic

Post Op Complication

* Incomplete relief of pain
* Poor recovery of sensory and motor function
* Symptoms recurrence
* Perineal scarring with associated symptoms
* Scar tenderness
* Pillar pain
* PL inflammation
* Incomplete tendon glide
* Complex Regional Pain Syndrome
* Laceration to flexor tendon or nerve
* Neuroma in continuity
* Wound infection
* Wound dehiscence from early suture removal
* Suture abscess
* Trigger fingers-limits patient's willingness to exercise

Post op therapy

Therapy can be commenced early

- Oedema management
- Tendon gliding exercises
- Median nerve mobilisation programme
- Pain management
- Scar management

Post op Hand Therapy

Scar Management:

scar tenderness = most common problem

Most effective techniques:

> carefully planned surgical incisions

> wrist control splintage that decrease tension on the wound site

> benign wound healing

> paper tape

> desensitization techniques

Post Op Hand Therapy

* Continue sensory monitoring important
* Strengthening and work conditioning
* Patient advised:
  > slowly strengthen with normal use
  > avoid repetitive grip and pinch
  > avoid vibration tools (3/12)

Pillar Pain

Pain in the thenar or hypothenar areas.

Will resolved with time

Taping will help.

Soft tissue mobilisation

Pronator Syndrome

* Very Rare
* < 1% of compression neuropathies

Site of Compression

* Ligament of struthers and supracondylar process
  + may cause a friction generating angle
  + rarely thought to be a cause of Pronator Syndrome
* Bicipital Aponeurosis
* Pronator teres
* Fibrous arch of two heads of FDS

Clinical Examination

* Forearm Pain
* Paraesthesia and hypoesthesia (cutaneous distribution of MN in hand, +/- over the thenar eminence
* Patient c/o perceived weakness of the extremity secondary to pain
* Patients occupation frequently require repetitive use of their upper extremity

Clinical Examination

* Pain on palpation of the median nerve in the proximal forearm
* Pronator teres may be tender, firm or apparently enlarged
* No weakness of the Midian-innervated intrinsic and extrinsic muscles
* +ve Tinel's sign in proximal forearm as compared to CTS
* Paraesthesia increased with mild compression over the proximal muscle mass of PT
* Sensibility tests: +Ve
* Nerve conductive test: not useful

Clinical examination

* Palpation of medial humeral condyle and distal diaphysis may reveal a bony prominence, the supracondyloid process (commonly associated with the ligament of struthers)

Provocative Tests

* Resisted elbow flexion with forearm in supination---implicates Bicipital Aponeurosis
* Resisted forearm pronation with elbow in full extension---implicates between the two head of PT
* Isolated IPJs flexion of MF---implicates fibrous orgin of FDS

Conservative Management

* Behaviour Modification
* splintage = long arm removable splint
  >elbow 90 degrees flexion
  >forearm slight pronation
  >wrist slight flexion
* 50% success (Johnson et al 1989)
* CSI: little to offer

Question 7

All of the following are potential compression sites for pronator syndrome:

1. Bicipital aponeurosis
2. Ligament of Struthers
3. Pronator Teres
4. FDS arch

True or False?

Operation Management

* Incision 15-20 cm long over anteromedial aspect elbow

* Decompression by incision bands pronator

  +/- bicipital aponeurosis

  +/- FDS fibrous arch

Post Op Management

* Bulky plaster-reinforced A E dressing
  elbow 90◦ forearm 45◦ wrist slightly flex
* Gentl elbow, wrist finger ROM
* Neural gliding
* Scar mangagement
* Avoidance resistance activity 6-8/52

Anterior Interosseous Syndrome

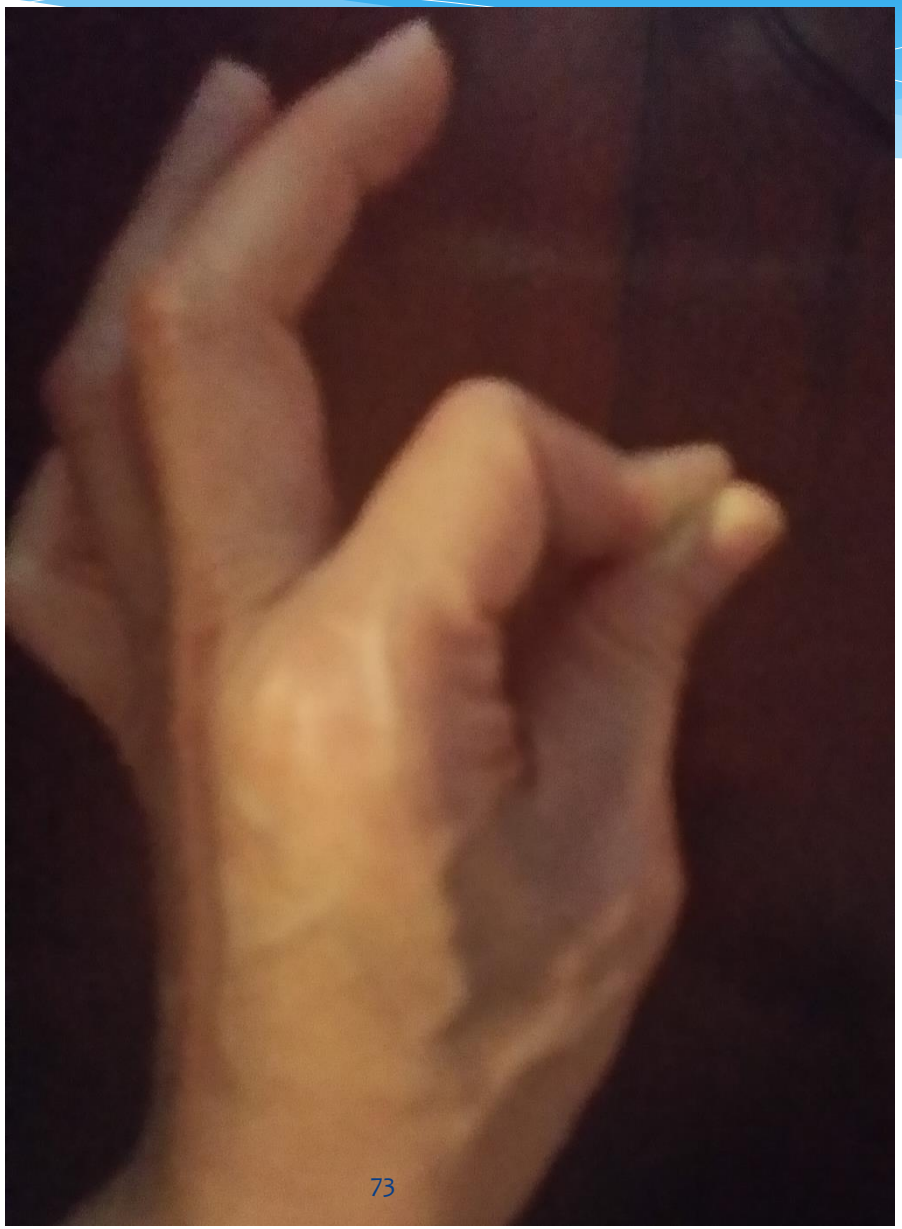
* <1 % of compression neuropathies
* Onset usually spontaneous

causes

* Fractures (supracondylar humeral fracture, forearm fracture, elbow fractures)
* Compression by PT, FDS arch
* Neural inflammation

Clinical Features

* **Paralysis of FPL and FDP to the IF**
* +/- pronator quadratus and FDP to the MF
* To test PQ
  > resisted forced supination with elbow maximally flexed to eliminate effect of PT (75% of pronation strength)
  >compare with other side
* Sensibility is not affected
* EMG valuable



Treatment

* Initial period of observation
* Rest
* NASAID's
* Splinting
* Surgical decompression as per pronator syndrome

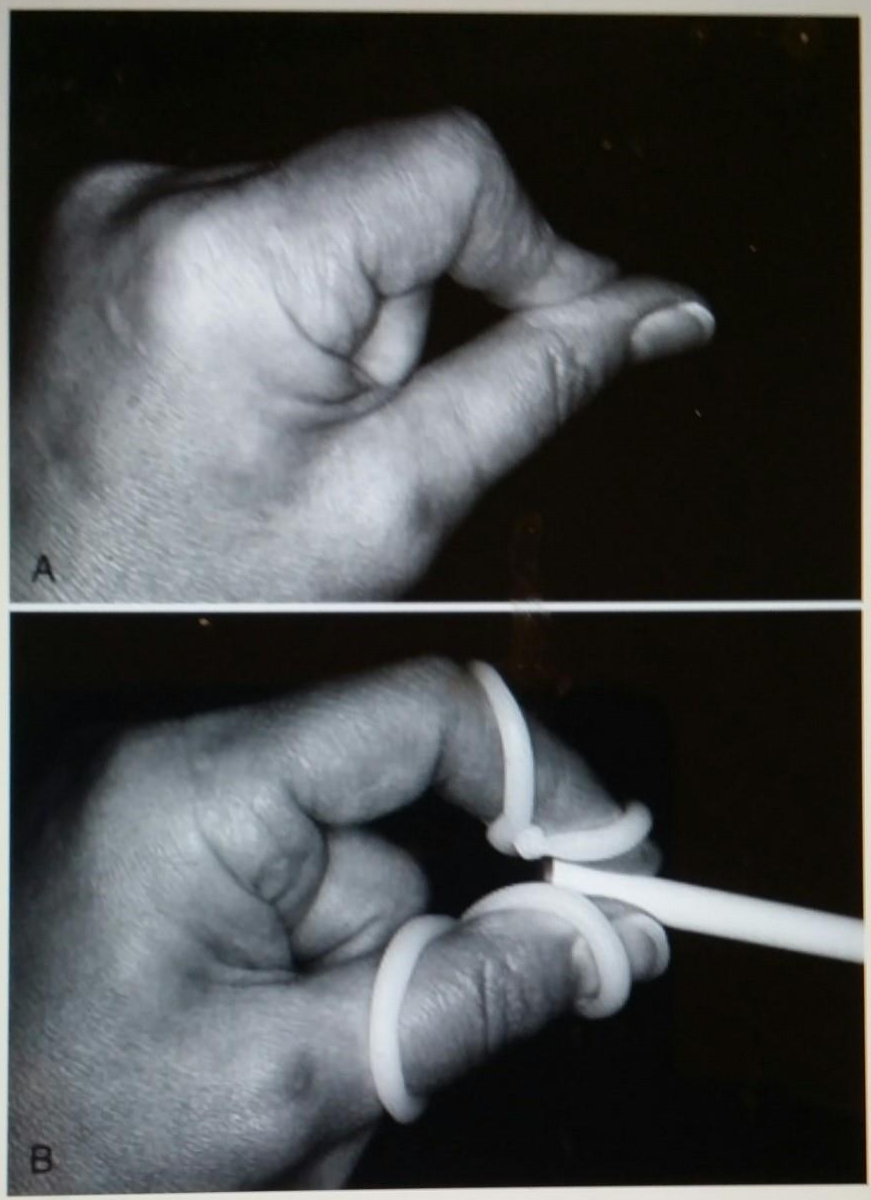


Figure 34-15 A, Fingertip pinch is impossible in anterior nerve palsy. **B,** Small