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# MEDIAN NEUROPATHY (CARPAL TUNNEL SYNDROME)

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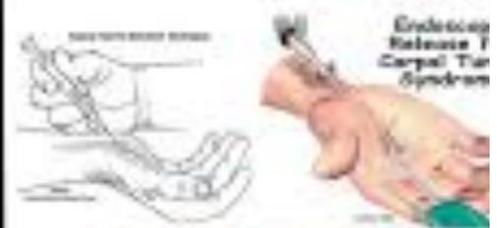
# IF YOU HAVE Carpal Tunnel Syndrome

Try This!!



@DrJaredHartDPT

Instead of This!!



# DEFINITION

- The most common compression neuropathy
- Paresthesia, numbness, subjective swelling, atrophy
- Usually bilateral, more severe in dominant hand
- Women, 30-60y

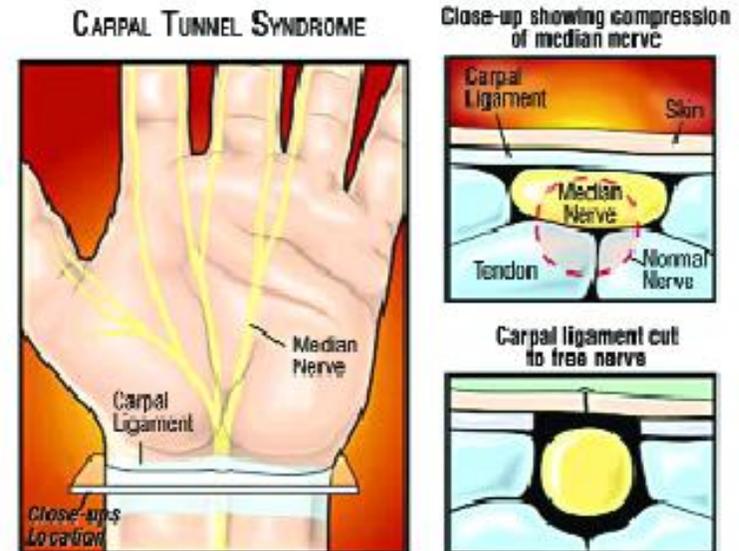


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- Genetic predisposition
  - Association with frozen shoulder and TGF $\beta$ -related fibrotic genes
- Association with other upper extremity musculoskeletal conditions especially RCT (Persian cohort)
- Onset or worsening after COVID (case series)

# PATHOPHYSIOLOGY

- Mechanical trauma
- Increased pressure
- Nerve ischemic injury



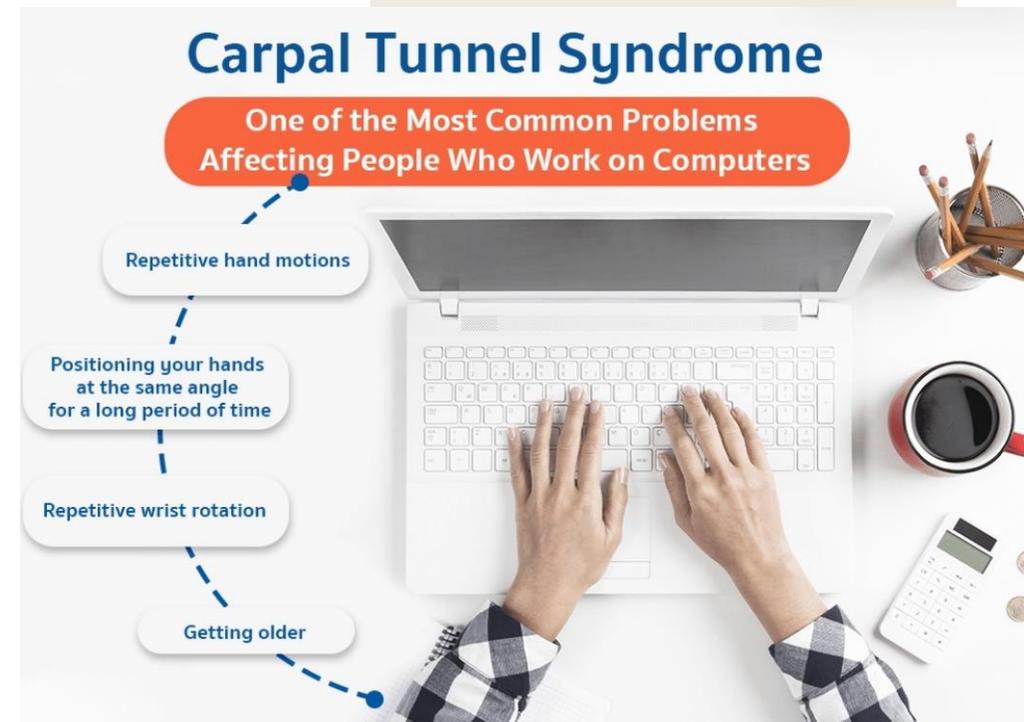
# RISK FACTORS

- Wrist injury, Arthritis
- **Larger wrist and wrist-to-palm ratios**
- DM, Thyroid dis., RA
  - More severe in DM
- Pregnancy, obesity
  - **Obesity increases median nerve CSA and prolongs nerve conduction studies without influencing CTS severity**



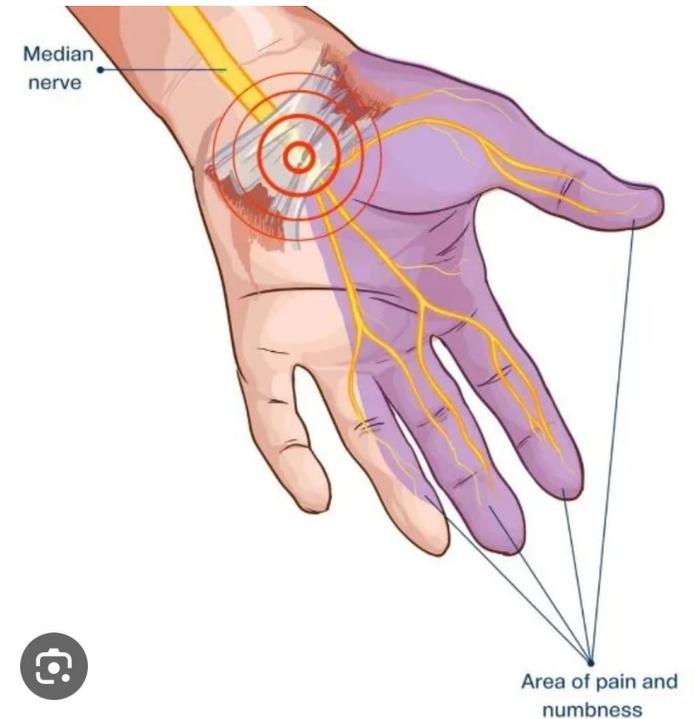
# RISK FACTORS

- Prolonged extreme flex. or ext.
- Repetitive use of the flexor muscles
- **Occupational**
  - 10% among dental surgeons
  - Correlate with hours of working with computer, diet, physical activity, ergonomics



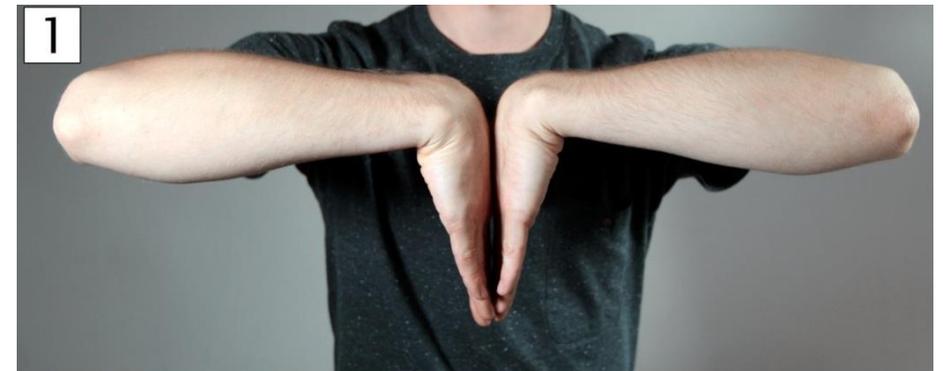
# SYMPTOMS

- Sensory changes in the radial 3 1/2 digits, first at night
- Positional pain, better with shaking (flick sign)
- Later stages, persistent numbness and finally weakness
- +/- Volar wrist pain, radicular forearm pain
- Feeling of swelling and coldness



# PHYSICAL EXAMINATION

- Most sensitive: 2-point discrimination (between median and ulnar)
- Thenar weakness
- Phalen test: Forced flexion
- Reverse Phalen test: Forced extension
- Tinel sign
- Nerve compression test (1 min): high specificity (83%)



# FUNCTIONAL LIMITATIONS

- Sleep disturbance
- Driving and working with computer mouse
- Grip maintaining weakness
- Hand precision in severe cases (unbuttoning)



# DIAGNOSTIC STUDIES

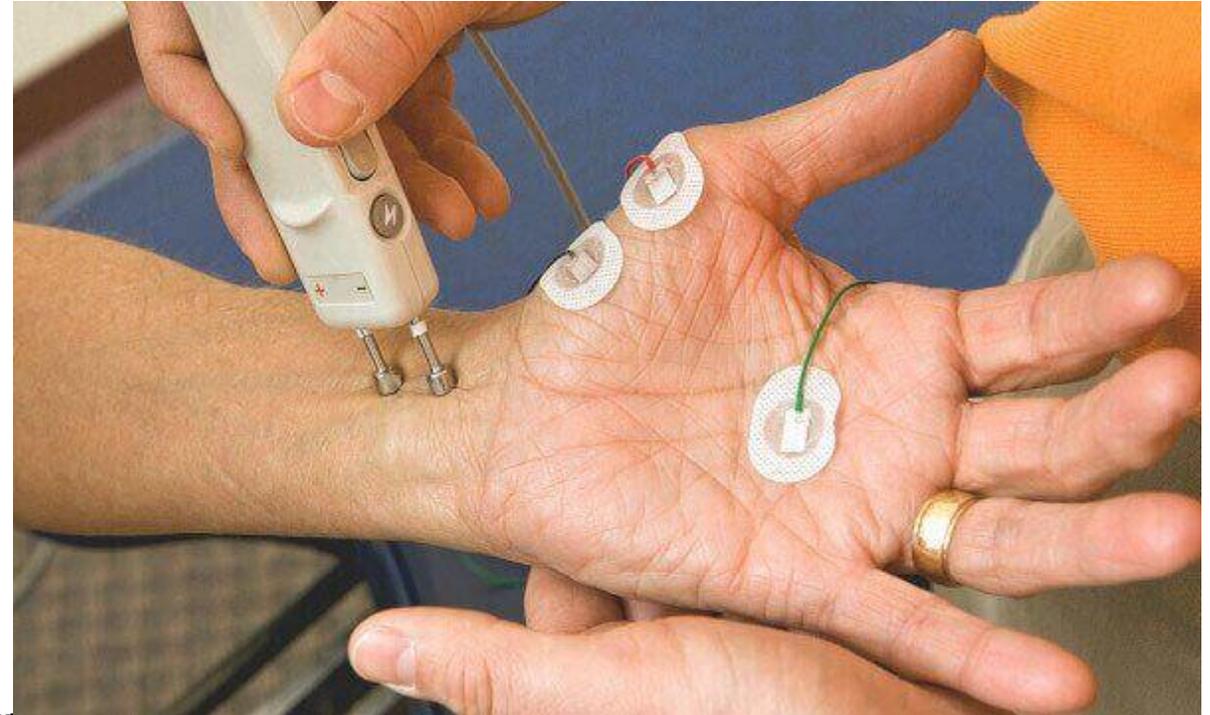
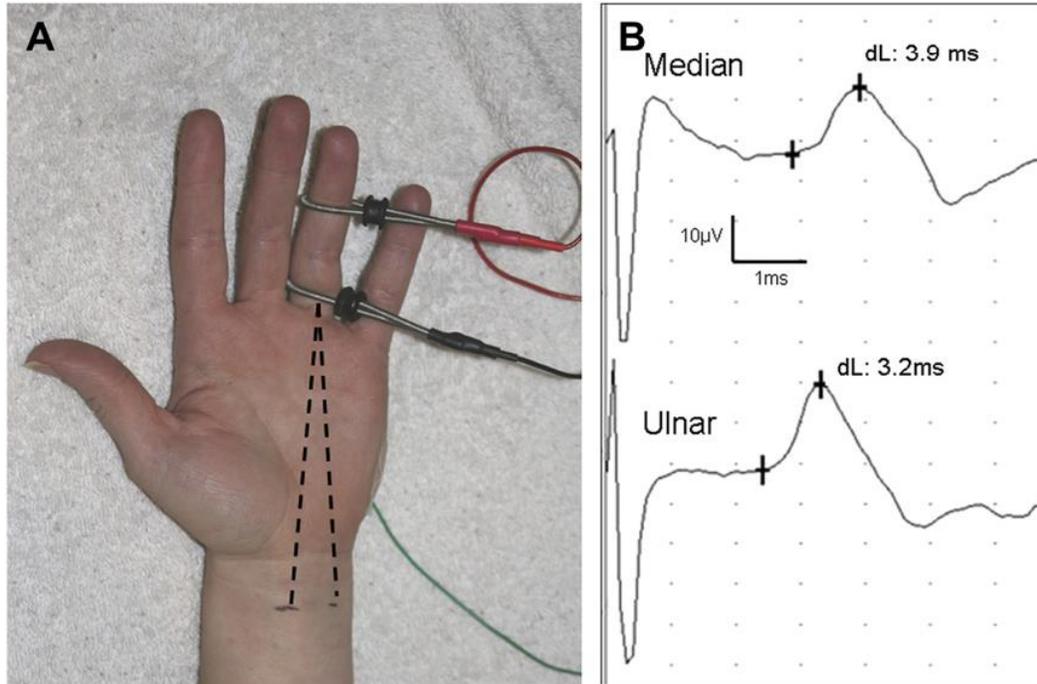
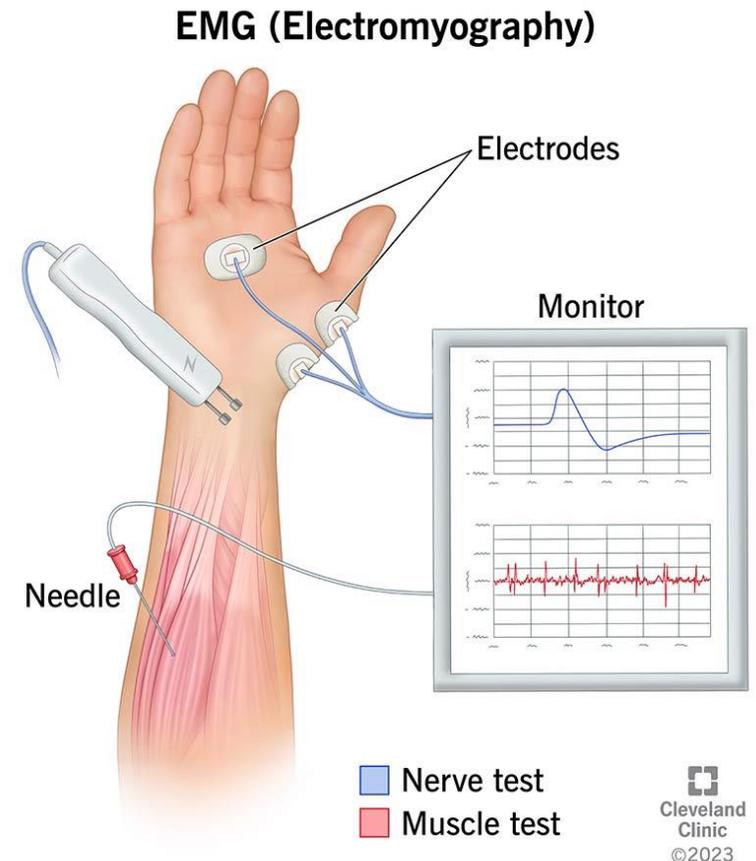


Fig. 2. (A) Setup for the median-ulnar antidermic studies to the fourth digit (ring finger).

# DIAGNOSTIC STUDIES

- Electrodiagnostic study (EMG-NCS): GOLD STANDARD
  - Severity
  - Guidance for treatment
  - Remaining symptoms after treatment : do not necessarily return to normal after CTR
  - R/O other problems
  - In one study, 8% candidates for CTR were NL or mild CTS
  - Still, the most prognostic and sensitive option



# DIAGNOSTIC STUDIES

## ■ Sonography

- Increase in nerve size in proximal and distal of the tunnel
  - >34% difference between max and min cross-sectional area
- Flattening
- Increased stiffness in sono-elastography
- Subsynovial connective tissue thickness
- In doubtful or secondary cases (Specially RA: 32% tenosynovitis, 11% cyst)
  - Alternative for cases with diabetic neuropathy
- Presence of lipoma or other space occupying lesions

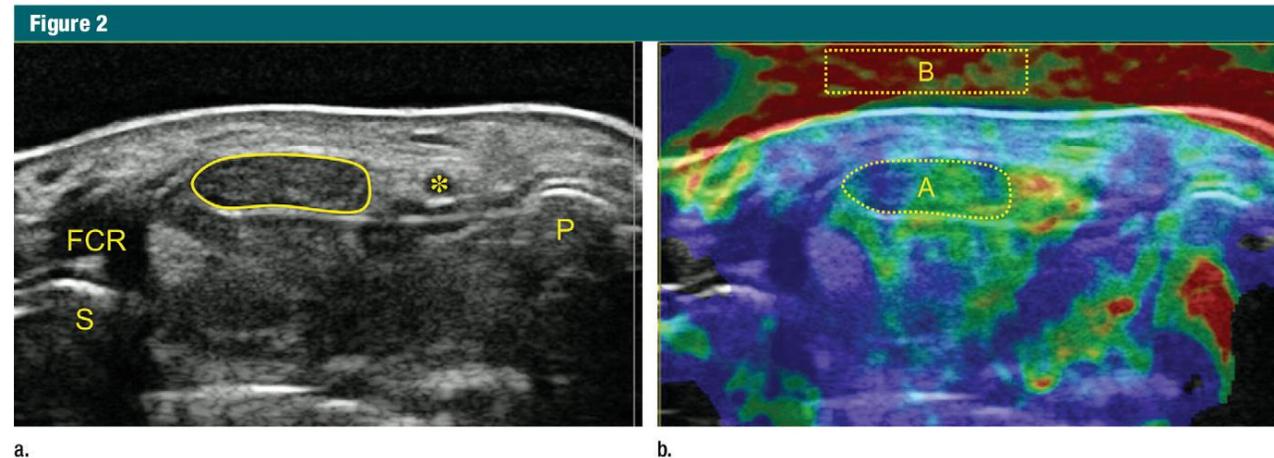
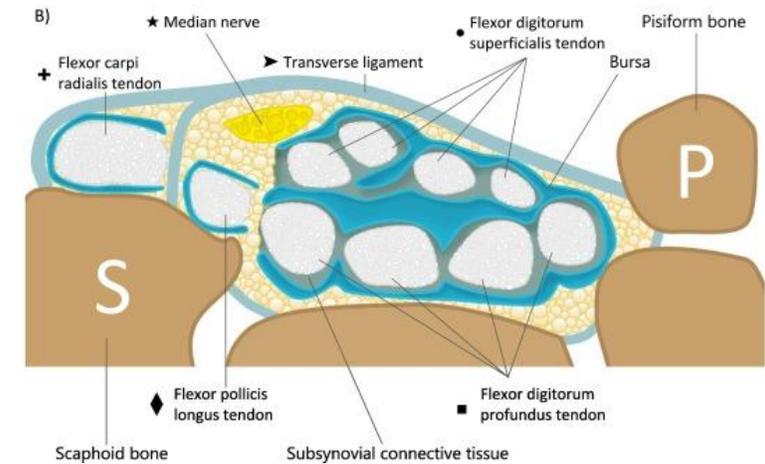
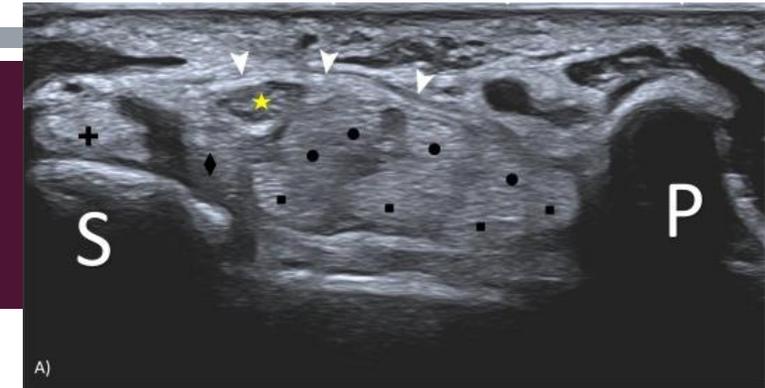


Figure 2: Transverse images obtained in 64-year-old woman with CTS. (a) Conventional B-mode US image shows the MN CSA corresponding to the circle with

# DIAGNOSIS

- Lab data: ESR, TFT, FBS, RF
- In one study out of 2859 proteins 4 were associated with CTS: potential drug targets

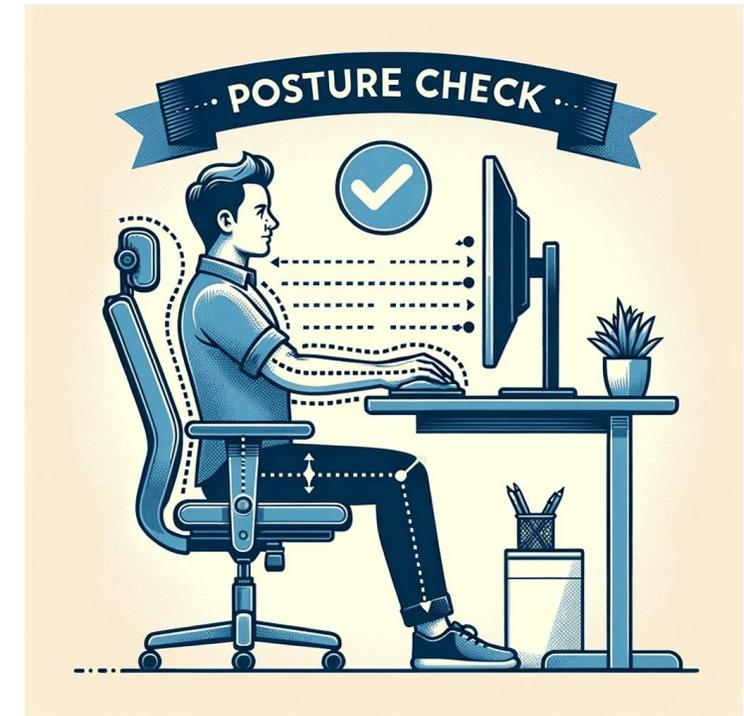
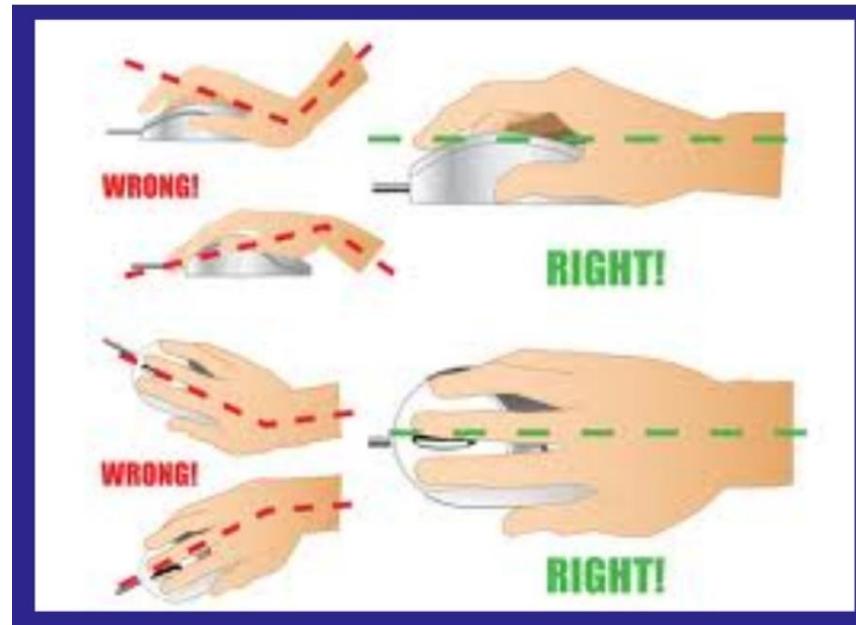
# INITIAL TREATMENT

- Night splint in 20° extension or neutral+ NSAID (better in full time)
  - Give time for 2 weeks
- 6 weeks of splint with partially restricted MCPs showed better result than cockup
- NSAID and B6 alone were no better than placebo
- Pregabalin was effective in mild to moderate
- Oral steroid: Effective but unnecessary (prednisolone 25mg/D 10 days)
- L-carnitine,  $\alpha$ -lipoic acid, phosphatidylserine, Curcumin, C, E and B1, B2, B6 and B12 vitamins



# INITIAL TREATMENTS

- Working ergonomics
- Underlying conditions
- Periods of rest and work
- Ice after activity

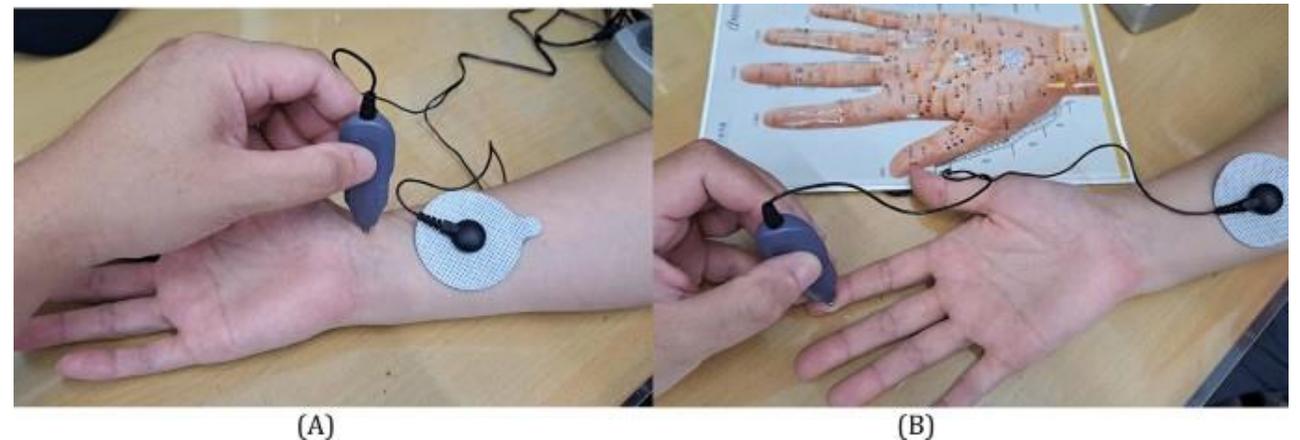


# PT

- PT: Short term effect (Including LASER)
  - Better effect in PT+acupuncture
  - Electroacupuncture-like magnetic therapy: better modality
  - No effects from LLLT or phonophoresis
  - Mechanical interface treatment, including joint and soft tissue techniques were effective

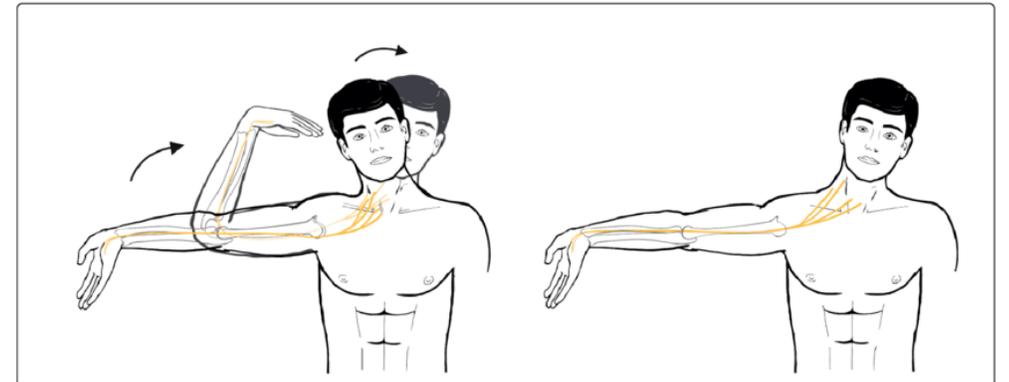


Figure 2. Location and the method of laser radiation



# REHABILITATION

- Life style changes
- Occupational therapy: Wrist and forearm flex/ext stretches
- Icing
- **Cupping > kinesio taping for pregnant patients**
- Generalized conditioning: proved to be effective
- **Neurodynamic mobilization: immediate effect**
- **Gliding exercises improve US and clinical outcome in moderate CTS**



# REHABILITATION (POSTOPERATIVE)

- No splinting
- Immediate active motion
- Shorter duration of postoperative activity restriction guidance was associated with faster RTA.
- Passive ROM: 4 weeks
- Strengthening 3-4 weeks
- Return to work: after 17 days.
- Photobiomodulation therapy after CTR

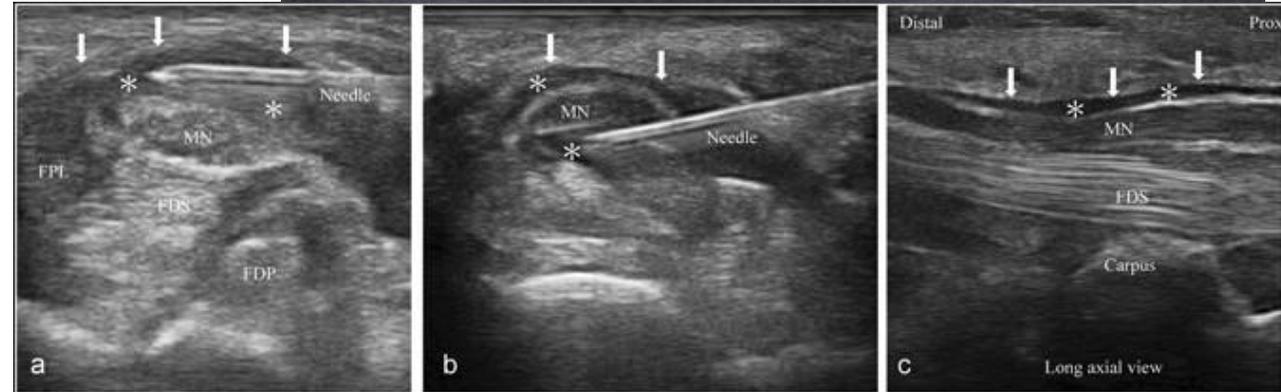
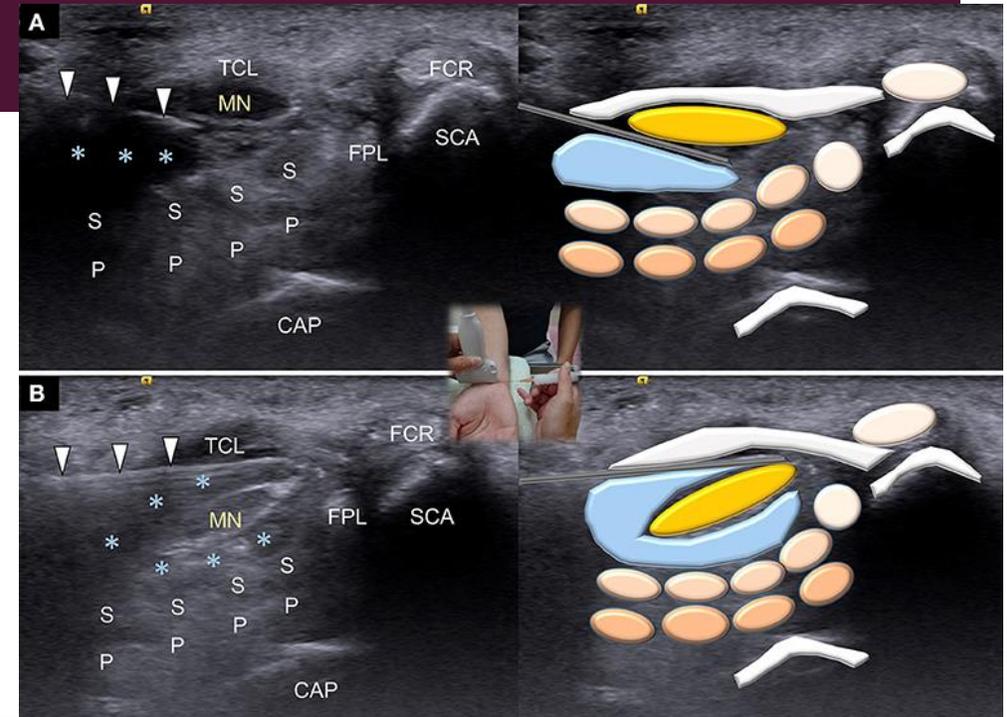
# PROCEDURES

- Steroid injection (much more accurate under US guide)
- **Trans-flexor carpi radialis (tFCR), volar radial (VR): safest techniques**
- Worsening for a few hours
- Recurrence: It is not proven to be more than surgery
- **If less than severe symptoms, and good adherence to treatment, non-surgical treatments should be the first line. (Steroid better than splinting)**
- **Better than PT (Metaanalysis)**
- **Better long term results plus ESWT**



# PROCEDURES

- Hydrodissection: More effective with higher volume (10ml) in moderate CTS
  - Better with midazolam
- PRP better than steroid and dextrose
- Steroid similar to dextrose 5%
- US-guided significantly better than landmark injection



# SURGERY

- Indication:
  - No response to conservative treatment after 3-6m and Definite diagnosis with EMG
  - Atrophy and weakness
- Timing is important!
  - Long-lasting symptoms can lead to irreversible axonal damage
  - 88% of patients were satisfied with the outcome of surgery in delayed surgery (5yrs)
- The most common reason for poor result: Poor diagnosis
- Local gentamicin in the open wound for 3 minutes after completing the nerve release was not significantly effective
- More susceptible to trigger finger after CTR (metanalysis)

- Endoscopic

- better in terms of operation time, wound size, postoperative scar size and incision healing time.
- Increased chances of revision (low absolute risk)
- No difference in time of return to work

- Opponensplasty in severe CTS

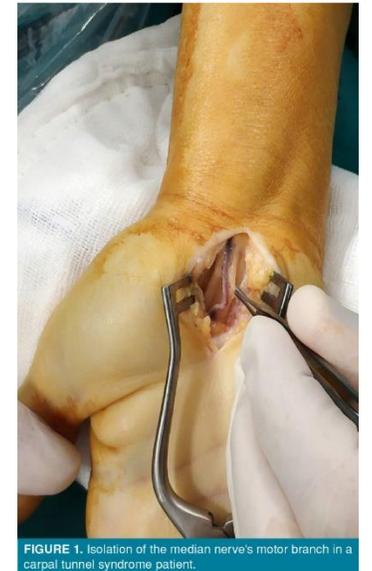
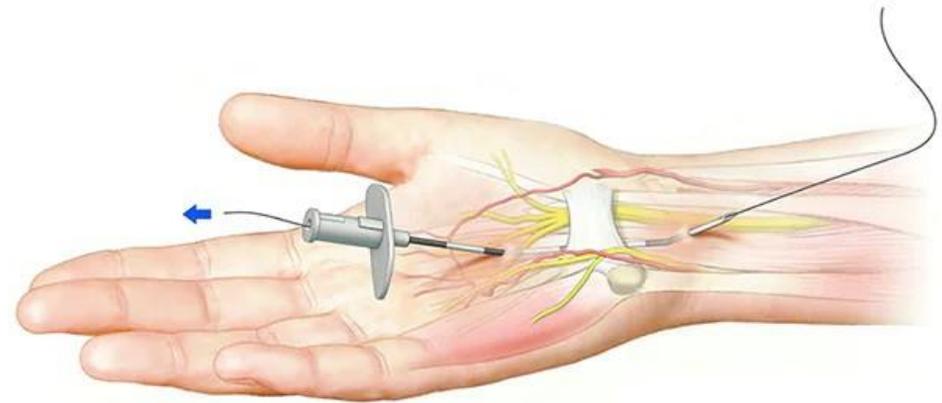


FIGURE 1. Isolation of the median nerve's motor branch in a carpal tunnel syndrome patient.

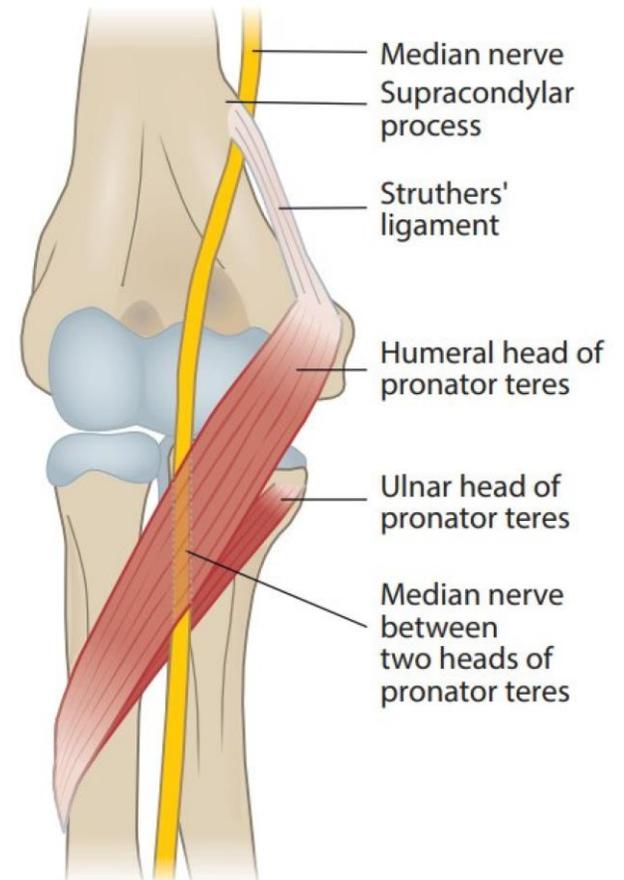
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- **Ultrasound-guided carpal tunnel release**
  - **Outpatient**
  - **Good outcome**
  - **Ultra-minimally invasive**



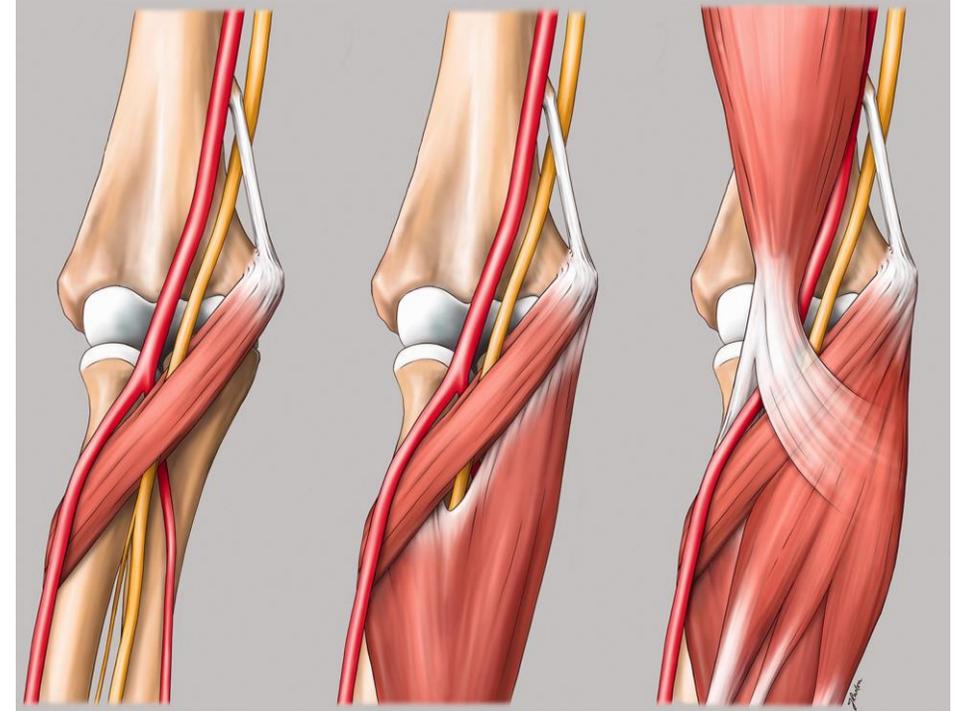
# STRUTHER LIGAMENT

- Ligament originating from a spur 3-6 cm above medial epicondyle
- 0.7-2.7% of population
- Weakness in grip, forceful wrist flexion
- Numbness
- Deep forearm pain, worsening with supination/pronation
- Tinnel +/-



# LACERTUS FIBROSUS

- Similar to sruther ligament with different etiology
- Both have good response to surgery



# PRONATOR TERES SYNDROM

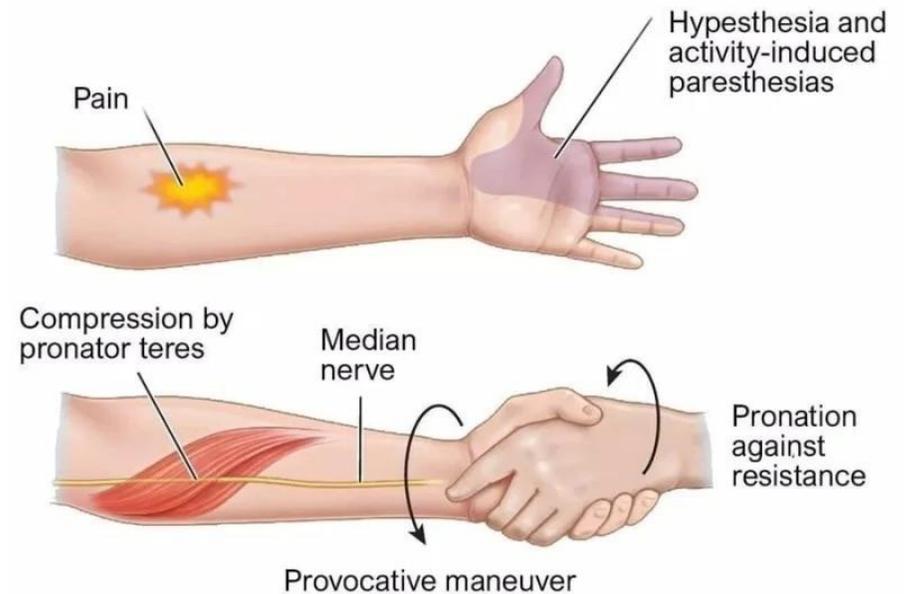
- Etiologies
  - Pronator teres hypertrophy
  - Repetitive supination/pronation
  - Grocery bag neuropathy

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# SIGN AND SYMPTOMS

- Pain, diffuse numbness with repetitive supination/pronation
- NO NIGHT PARESTHSIA
- Thenar paresthesia
- The most common finding: PT tenderness

## Pronator Teres Syndrome



# DIAGNOSIS AND TREATMENT

- Edx can be positive in severe cases or while provocation with forceful pronation
- Decreased amplitude of SNAP and CMAP, Decreased NCV of median nerve in forearm
- Inching method
- Treatment
  - Usually conservative +/- steroid injection in PT
  - surgery

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