

# **CARPAL TUNNEL SYNDROME**

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## **CASE DISCUSSION**

- Dr Saad Haddad

# DEFINITION

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- Is a compressive neuropathy of the median nerve at the wrist “Carpal Tunnel”.

# CARPAL TUNNEL SYNDROME

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- **Carpal tunnel syndrome (CTS) is the most common nerve compression condition in the upper extremity.**
- **Carpal tunnel release (CTR) is one of the most commonly performed procedures in the U.S.**
- **Early stages of CTS are reversible with treatment.**
- **Later or more severe stages of CTS may not be (fully) reversible.**

# CARPAL TUNNEL SYNDROME

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- AGE: 30 to 60 “most common”
- GENDER : F:M ratio is 2-3:1
- PREVELANCE : 1% to 10% of the U.S. population.

# RISK FACTORS

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- **Age and Gender.**
- **Obesity.**
- **Physical inactivity .**
- **Cigarette smoking .**
- **Vibrations associated job Elevation of carpal tunnel pressures**
- **Pregnancy**
- **Diabetes**
- **Alcoholism**

# RISK FACTORS

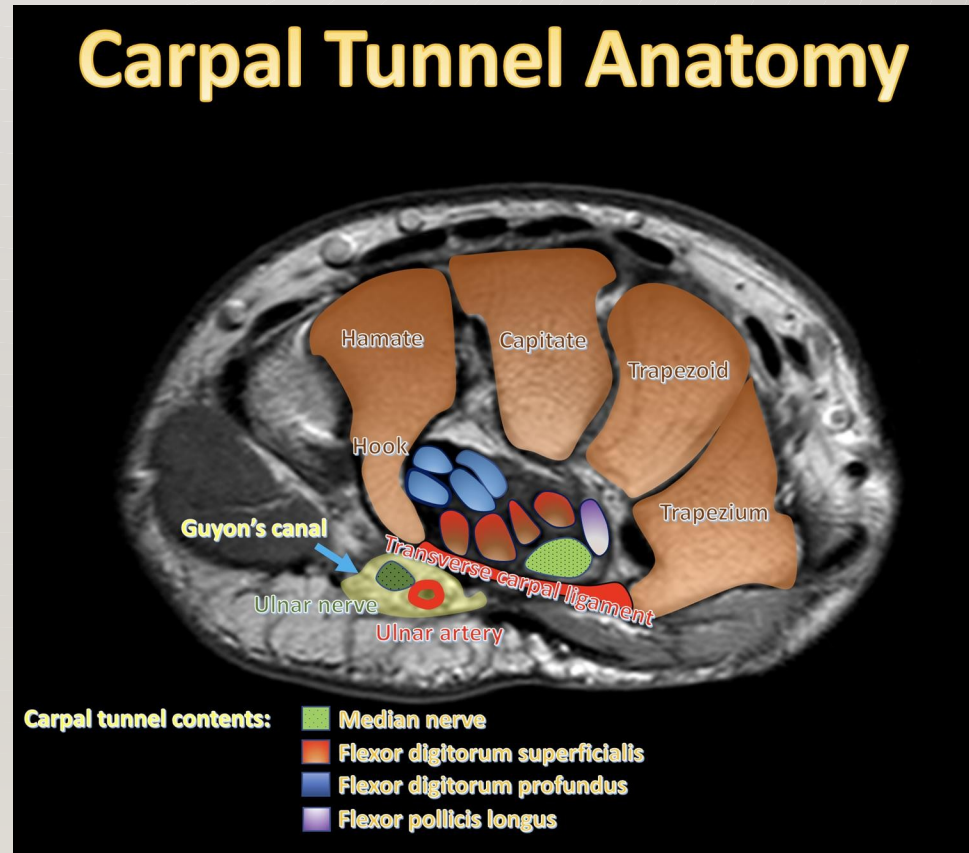
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- Hypothyroidism
- Rheumatoid Arthritis
- Acromegaly
- Menopause
- Chronic Renal Failure
- Space Occupying Lesions
- Use of Oral Contraceptives

# ANATOMY OF THE CARPAL TUNNEL BOUNDARIES

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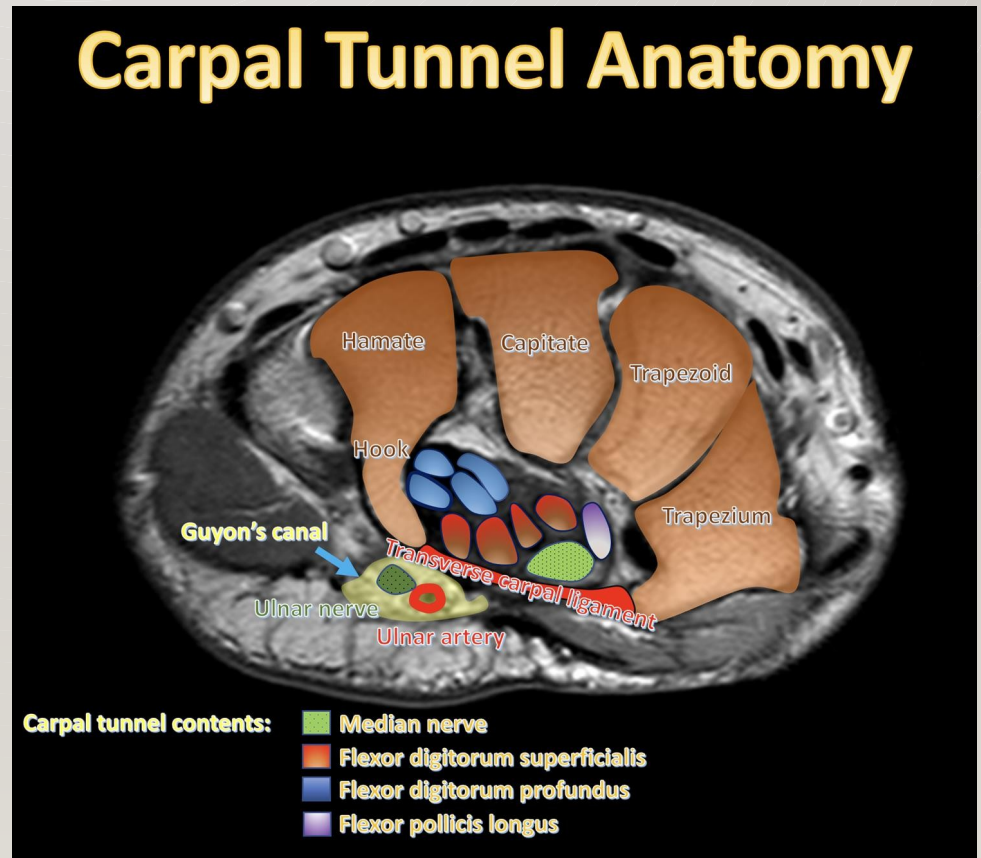
- Radially :scaphoid tubercle and trapezium.
- Ulnarly: hook of hamate and pisiform.
- Palmarly: transverse carpal ligament (roof)
- Dorsally :proximal carpal row (floor)



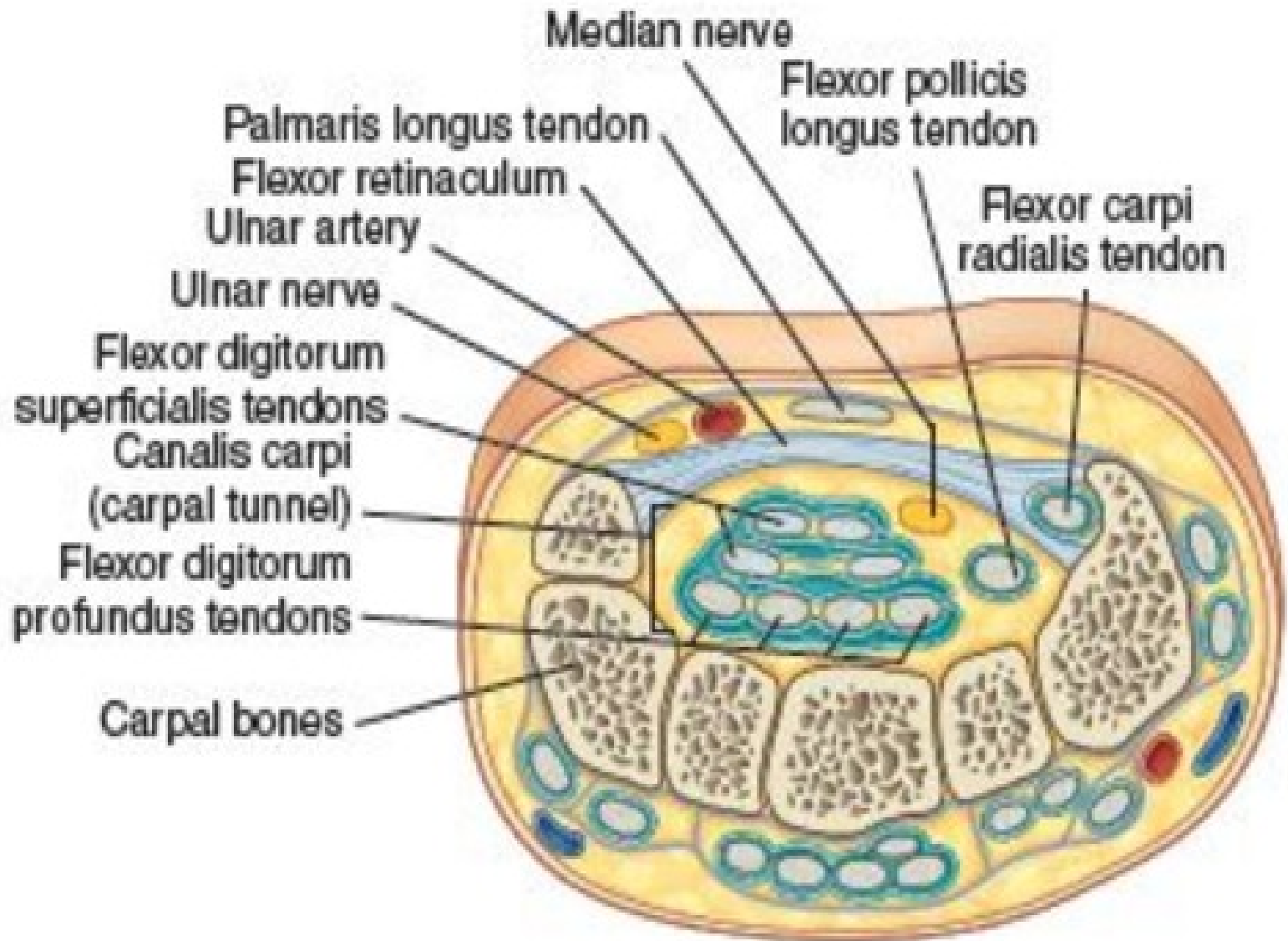
# ANATOMY OF THE CARPAL TUNNEL

## Contents :

- nine flexor tendons
- one nerve (median nerve)
- **FPL** is the **most radial** structure









**Anterior view**

# PHYSIOLOGY

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- The **normal resting pressure** at the carpal tunnel in **neutral** position **WITHOUT CTS** is **2.5** mmgh
- The **normal resting pressure** at the carpal tunnel in **neutral** position **WITH CTS** is **30** mmgh
- The normal resting pressure at the carpal tunnel in **max flexion or extension** position **WITHOUT CTS** is **30** mmgh
- The **normal resting pressure** at the carpal tunnel in **max flexion or extension** position **WITH CTS** is **90 - 110** mmgh

# PHYSIOLOGY

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- Elevation of carpal tunnel pressures of **more than 20 to 30 mm Hg** impedes epineurial blood flow, and nerve function is impaired .

# CAUSES

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graph TD; CAUSES --> ANATOMICAL; CAUSES --> PHYSIOLOGICAL; CAUSES --> EXTERNAL_FORCES[EXTERNAL FORCES]; ANATOMICAL --> Decrease_in_Size_of_CT[Decrease in Size of CT]; ANATOMICAL --> Increase_in_Contents_of_Canal[Increase in Contents of Canal]; PHYSIOLOGICAL --> Neuropathic_Conditions[Neuropathic Conditions]; PHYSIOLOGICAL --> Inflammatory_Conditions[Inflammatory Conditions]; PHYSIOLOGICAL --> Alterations_of_Fluid_Balance[Alterations of Fluid Balance];
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**ANATOMICAL**

***Decrease in  
Size of CT***

***Increase in  
Contents of  
Canal***

**PHYSIOLOGICAL**

***Neuropathic  
Conditions***

***Inflammatory  
Conditions***

***Alterations of  
Fluid Balance***

**EXTERNAL  
FORCES**

## **Anatomy**

### ***Decrease in Size of Carpal Tunnel***

- Bony abnormalities of the carpal bones
- Acromegaly
- Flexion or extension of wrist

### ***Increase in Contents of Canal***

- Forearm and wrist fractures (Colles fracture, scaphoid fracture)
- Dislocations and subluxations (scaphoid rotary subluxation, lunate volar dislocation)
- Posttraumatic arthritis (osteophytes)
- Musculotendinous variants
- Aberrant muscles (lumbrical, palmaris longus, palmaris profundus)
- Local tumors (neuroma, lipoma, multiple myeloma, ganglion cysts)
- Persistent medial artery (thrombosed or patent)
- Hypertrophic synovium
- Hematoma (hemophilia, anticoagulation therapy, trauma)

## **Physiology**

### ***Neuropathic Conditions***

- Diabetes mellitus
- Alcoholism
- Double-crush syndrome
- Exposure to industrial solvents

### ***Inflammatory Conditions***

- Rheumatoid arthritis
- Gout
- Nonspecific tenosynovitis
- Infection

### ***Alterations of Fluid Balance***

- Pregnancy
- Menopause
- Eclampsia
- Thyroid disorders (especially hypothyroidism)
- Renal failure
- Long-term hemodialysis
- Raynaud disease
- Obesity
- Lupus erythematosus
- Scleroderma
- Amyloidosis
- Paget disease

# EXTERNAL FORCES

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- Vibrations
- External Pressure

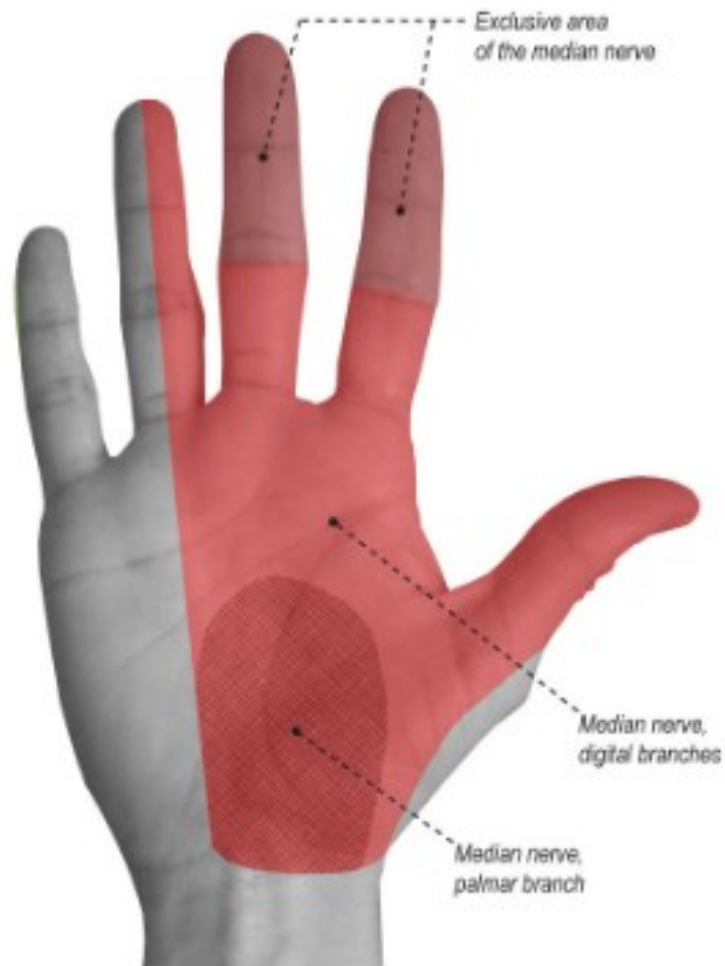


# PRESENTATION

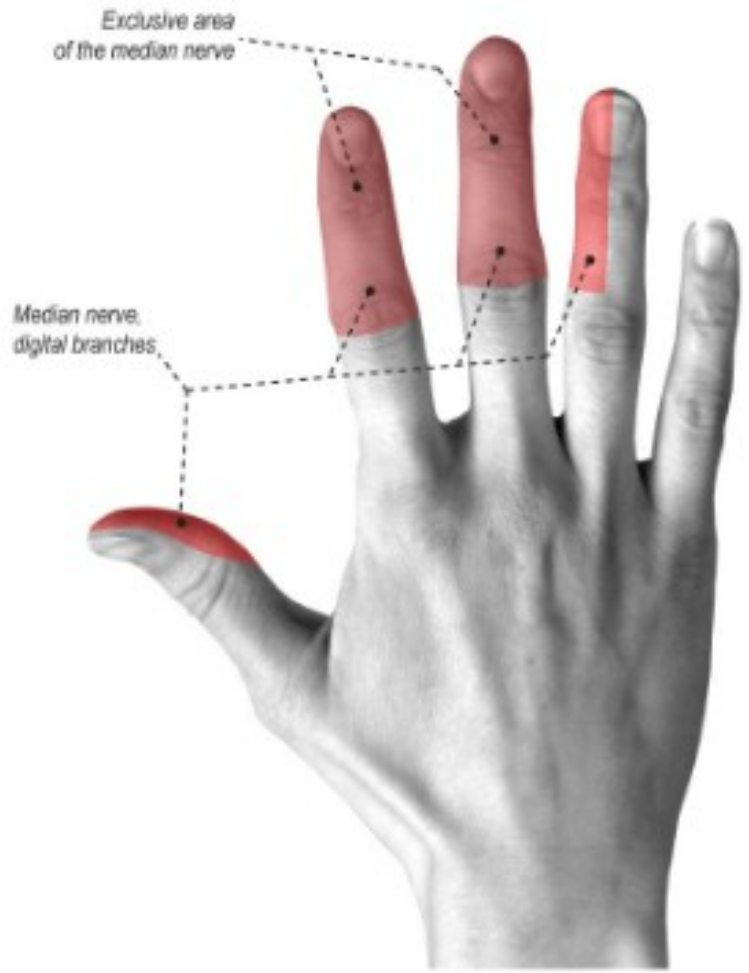
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- Wide variation according to degree of compression, duration, personal conditions.
- paresthesia or numbness (or both) in the median nerve distribution(thumb, index finger, middle finger, and radial side of the ring finger)
- Nocturnal paresthesias is nearly pathognomonic.

**Anterior View**

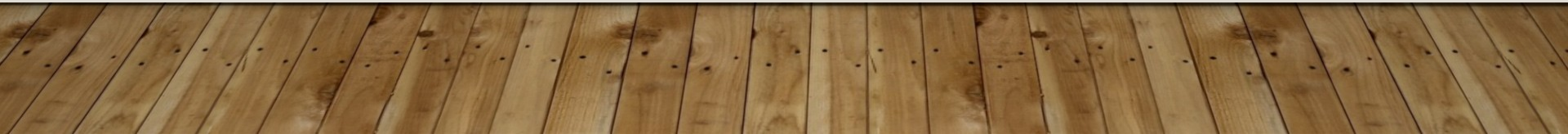


**Posterior View**



# **CASE PRESENTATION**

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# BASIC HISTORY EXAMINATION DIAGNOSIS

- **Name** : Sara
- **Age** : 57
- **Sex** : Female
- **Status** : Married
- **Ethnicity** :



## Hx of Present illness

4 months ago

- Gradual onset of numbness of both hands

2 months ago

- Symptoms got worse
- Difficulty holding things and loss of control of the radial 3 digits

1 month ago

- The patient was diagnosed with cervical spine disc prolapse and sent to us to rule out CTS



# BASIC HISTORY EXAMINATION DIAGNOSIS

## Hx of Present illness

- Clumsiness
- may awaken her at night.
- Paresthesias at “fixed wrist activities” such as reading a book or a newspaper, driving, or use of a keyboard or mouse.
- Aching ,Weakness and .



# BASIC **HISTORY** EXAMINATION DIAGNOSIS

## Hx of Past illness

### Social Hx

- Employee
- Using PC
- Motor cycle riding often
- No trauma

### Disease Hx

- DM
- Hypothyroidism
- No Gout
- No RA
- No renal diseases



# BASIC **HISTORY** EXAMINATION DIAGNOSIS

## Hx of Past illness

### Medication Hx

- No medications

### Family Hx

- None of the patient's family had these symptoms before





# BASIC HISTORY EXAMINATION DIAGNOSIS

**Thenar atrophy ( Negative in Our patient )**



# BASIC HISTORY EXAMINATION DIAGNOSIS

Carpal tunnel  
compression  
test (Durkan's test)

Is the most sensitive test  
to diagnose carpal tunnels  
syndrome

Positive in this patient

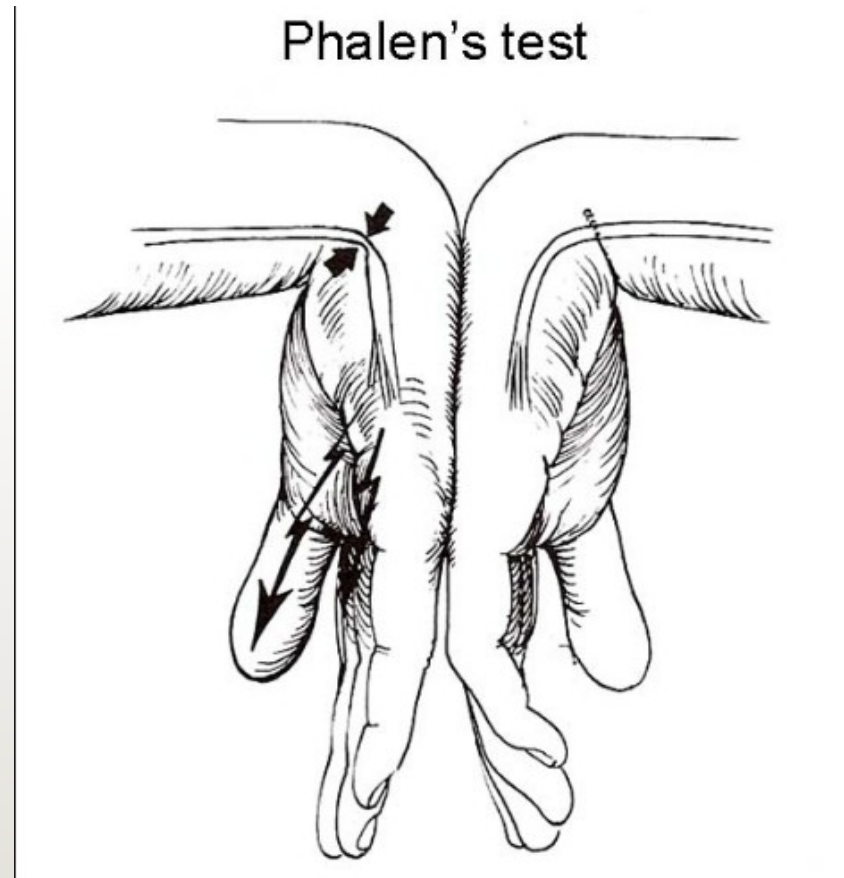


# BASIC HISTORY EXAMINATION DIAGNOSIS

volar wrist flexion for about 60 sec produces symptoms

less sensitive than Durkan's test

Positive in our patient



# BASIC HISTORY EXAMINATION DIAGNOSIS

provocative tests  
performed by tapping the  
median nerve over the  
volar carpal tunnel

Negative in our patient



## Semmes-Weinstein testing

Mono-filaments of increased diameter touched to the palmer side of digit until patient can determine which digit is touched.

Positive result value is  $>2.83$

most sensitive sensory test for detecting early CTS

measures a single nerve fiber innervating a receptor or group of receptors



# BASIC

# HISTORY

# EXAMINATION

# DIAGNOSIS

Numbness in median  
nerve territory +

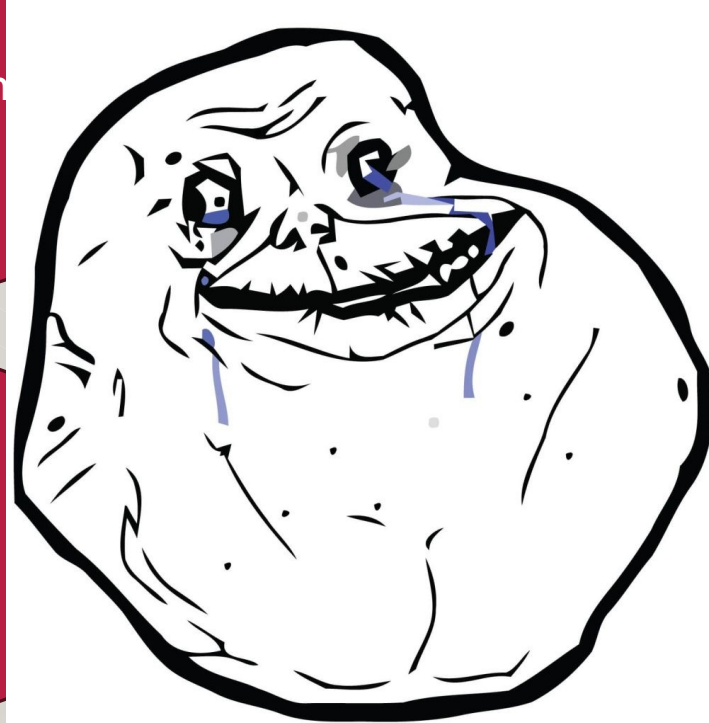
Nocturnal Numbness +

Thenar Atrophy -

Phalen Test +

Tinel Test -

2 point discrimination  
loss -



# **CTS OR NOT ?**

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- **NCS ?**



# BASIC HISTORY EXAMINATION **DIAGNOSIS**

## NCS & EMG

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- EMG and NCV overview :
  - often the only objective evidence of a compressive neuropathy (valuable in work comp patients with secondary gain issues)
  - not needed to establish diagnosis (diagnosis is clinical) but recommended if surgical management is being considered



# BASIC HISTORY EXAMINATION DIAGNOSIS

## NCS & EMG

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- demyelination leads to
  - NCV
    - increase latencies (slowing) of NCV
      - distal sensory latency of  $> 3.2$  ms
      - motor latencies  $> 4.3$  ms
    - decreased conduction velocities less specific than latencies
      - velocity of  $< 52$  m/sec is abnormal

# BASIC HISTORY EXAMINATION **DIAGNOSIS**

## NCS & EMG

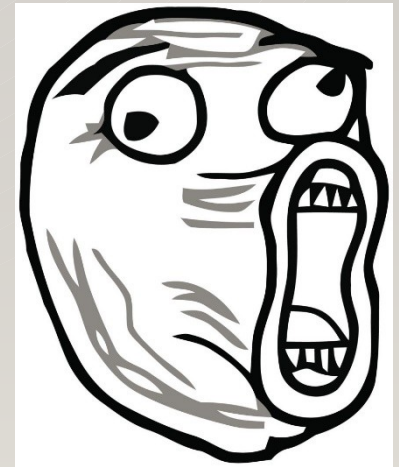
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- EMG
  - test the electrical activity of individual muscle fibers and motor units
  - detail insertional and spontaneous activity
  - potential pathologic findings
    - increased insertional activity
    - sharp waves
    - fibrillations
    - fasciculations
    - complex repetitive discharges

## ARE NCS DIAGNOSTIC ?

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- Cost effectiveness
- High rate of false positive cases



# BASIC HISTORY EXAMINATION DIAGNOSIS

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- Diagnosis is clinical
- The most specific tests were the hand diagram and Tinel sign.
- a patient with
  - abnormal hand diagram,
  - a positive Durkan test,
  - abnormal Semmes-Weinstein sensibility testing.
  - night pain

has a probability of 86% of having carpal tunnel syndrome.

## CTS-6 SCORE

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> [J Hand Surg Am. 2022 Jun;47\(6\):501-506. doi: 10.1016/j.jhlsa.2022.01.024. Epub 2022 Mar 5.](#)

### **The Reliability of the CTS-6 for Examiners With Varying Levels of Clinical Experience**

[Louis C Grandizio](#)<sup>1</sup>, [Benchaa Boualam](#)<sup>2</sup>, [Parker Shea](#)<sup>2</sup>, [Matthew Hoehn](#)<sup>2</sup>, [Charlene Cove](#)<sup>2</sup>, [Idorenyin F Udoeyo](#)<sup>2</sup>, [C Liam Dwyer](#)<sup>2</sup>, [Joel C Klana](#)<sup>2</sup>

Affiliations + expand

PMID: 35260242 DOI: [10.1016/j.jhlsa.2022.01.024](#)

**Purpose:** To assess the interrater reliability of the CTS-6 for examiners with varying levels of clinical expertise. We also aimed to analyze this instrument's sensitivity (Sn) and specificity (Sp), using the CTS-6 score obtained by a hand surgeon as a reference standard.

## CTS-6 SCORE

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**Results:** Two hundred seven patients were included. For the diagnosis of CTS (CTS-6 score of 12 or greater as determined by a hand surgeon), there was substantial agreement between the 3 groups (Fleiss kappa 0.73; 95% CI [0.65 -0.82];  $P < .05$ ). For individual CTS-6 components, the agreement between the groups was highest for assessing subjective numbness and lowest for assessing a Tinel sign (Fleiss kappa of 0.77 and 0.49, respectively). The Sn/Sp for diagnosing CTS was 87%/91% for the medical student group and 81%/95% for the occupational hand therapist group.

**Conclusions:** The CTS-6 can be reliably used as a screening and diagnostic tool for CTS by clinicians with a variety of experience levels and without specific fellowship training in upper-extremity surgery.

**Type of study/level of evidence:** Diagnostic I.

## History

1- Numbness predominately or exclusively in median distribution

Sensory symptoms are mostly in the thumb, index, middle, and/or ring fingers

3.5

2- Nocturnal numbness

Symptoms are prominent when patient sleeps, and numbness wakes patient from sleep

4

## Physical Examination

3- Thenar atrophy and/or weakness

The bulk of the thenar area is reduced or manual motor testing shows strength of grade 4 or less

5

4- Positive Phalen's test

Flexion of the wrist reproduces or worsens symptoms of numbness in median nerve territory

5

5- Loss of 2-point discrimination

A failure to discriminate 2 points held 5 mm or less apart from one another, in the median nerve innervated digits, is a positive test suggestive of CTS

4.5

6- Positive Tinel sign

Light tapping over the median nerve at the level of the carpal tunnel causing radiating paresthesia into the median nerve innervated digits (not proximally) is a positive test

4

\*Scores range from 0–26, with a score of 12 or more, considered diagnostic of carpal tunnel syndrome.

# TREATMENT

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Conservative VS surgical



# CONSERVATIVE

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- indications

- First line of treatment
- Mild symptoms, without atrophy and not long standing condition.
- Refuse surgery
- Waiting for surgery

- modalities

- night splints (good for patients with nocturnal symptoms only)
- activity modification (avoid aggravating activity)

# CONSERVATIVE

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- **NSAIDS.**
- **night splints** (good for patients with nocturnal symptoms only)
- **activity modifications**

# WRIST SPLINTS

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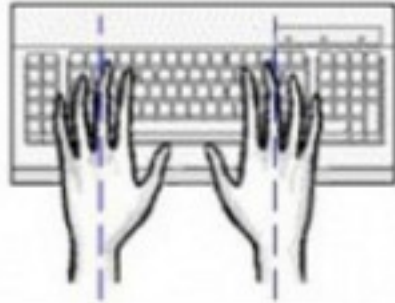


**WRONG!**

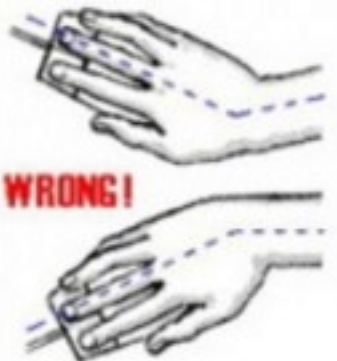


**RIGHT!**

**RIGHT!**



**WRONG!**



**WRONG!**



**RIGHT!**

**RIGHT!**



**WRONG!**



# STEROID INJECTION

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- Temporarily relief
- Improvement is good prognostic factor
- Blind or U/S guided
- Under aseptic technique

AND THEN

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# **SURGICAL TREATMENT**

**THANK YOU**

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