



## Practical Approach to Focal Neuropathies

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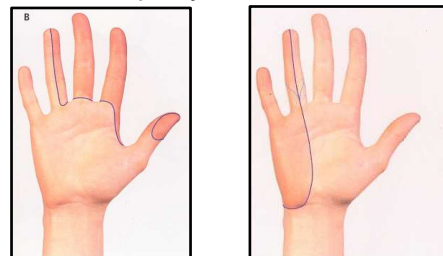
## Outline

- Hand numbness
- Hand atrophy
- Wrist drop
- Foot drop

## HAND NUMBNESS

### The most common causes of hand numbness

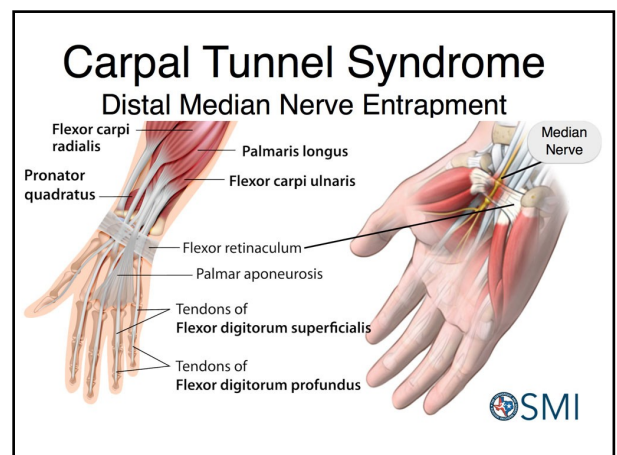
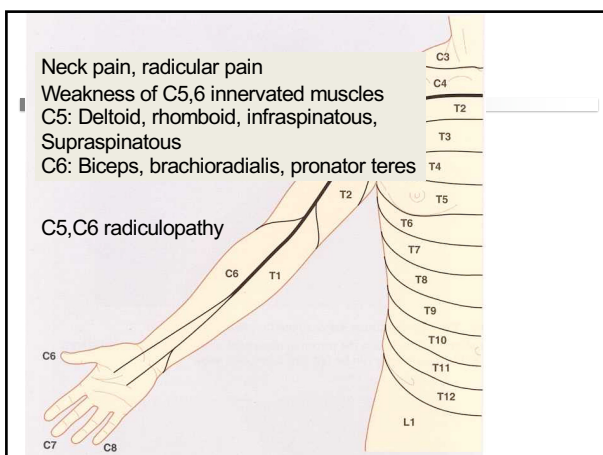
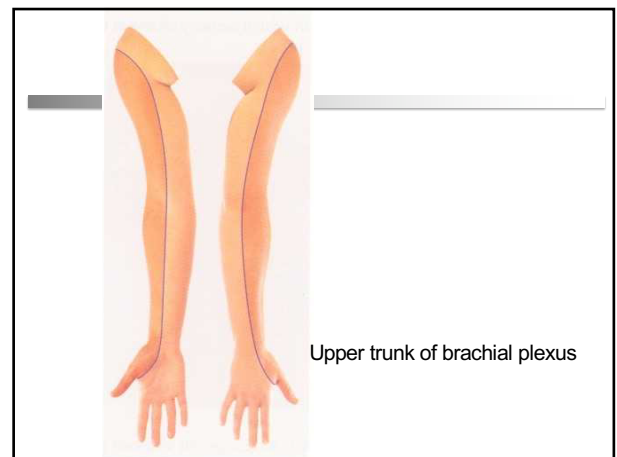
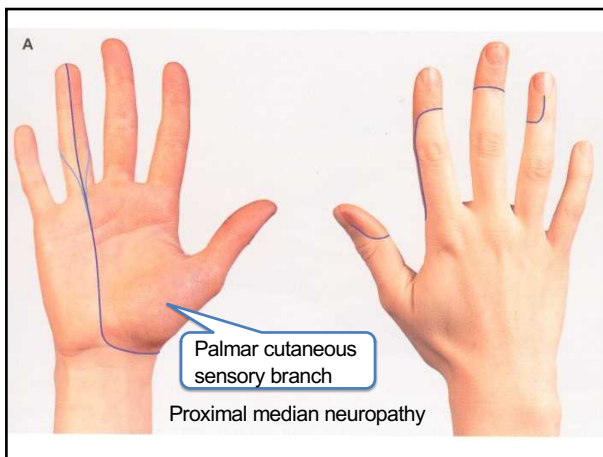
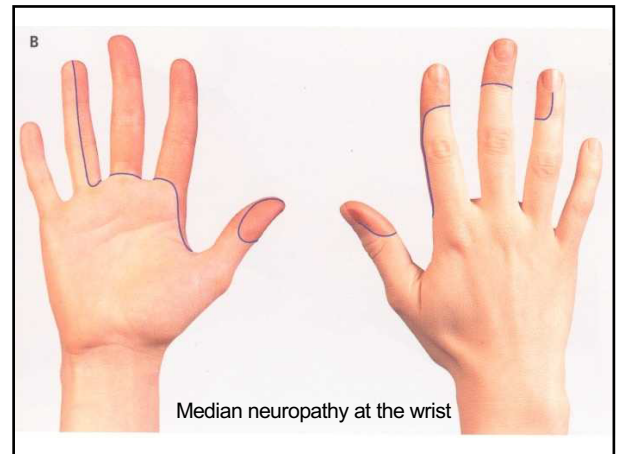
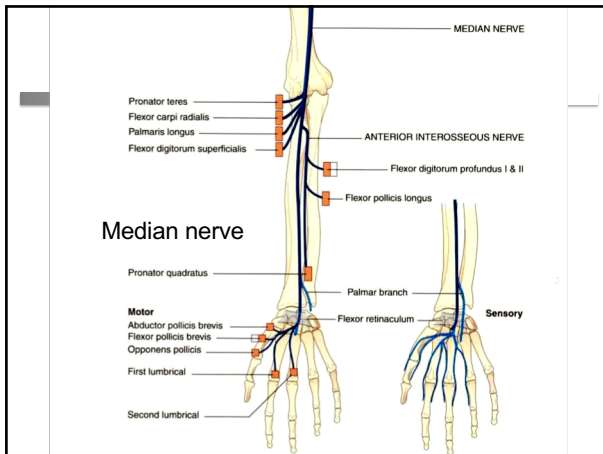
- Median neuropathy at the wrist
- Ulnar neuropathy at the elbow

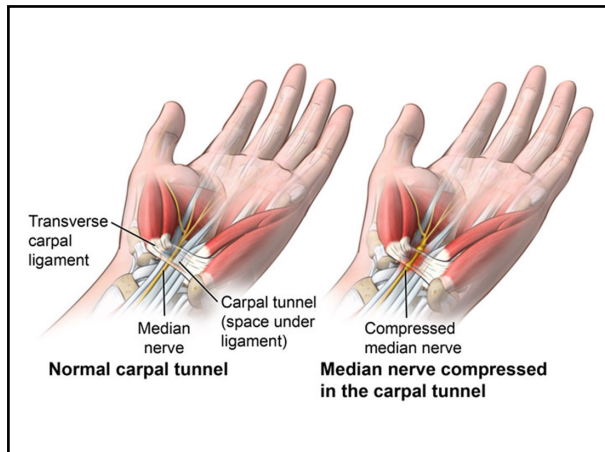


## NUMBNESS IN THE THUMB, INDEX, AND MIDDLE FINGERS

### Numbness in the thumb, index, and middle fingers

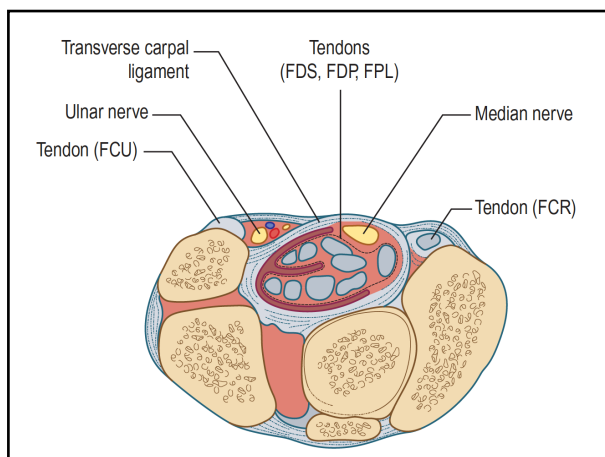
- Median neuropathy at the wrist
- Proximal median neuropathy
- Upper trunk plexopathy
- C6,7 radiculopathy





## Carpal tunnel syndrome

- Nocturnal paresthesias in the hand, may radiate up to shoulder.
- Paresthesias during daytime, particularly during the use of the hand with forced flexion or extension at the wrist.



## คำถาม

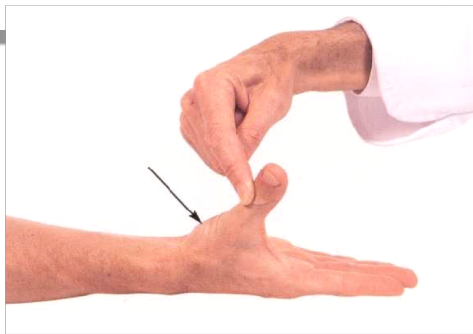
- ชามือแต่เท้าไม่ชา? ชามือมากกว่าเท้า?
- ชามือไหน?
- ชานิ้วไหนในมือมากที่สุด?
- อาการเป็นมากตอนไหน?
- ทำงานลักษณะอย่างไร?

## ทำงานลักษณะอย่างไร?

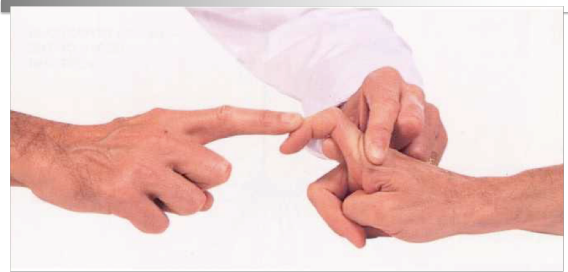
- แม่บ้าน
- พิมพ์ดีด
- เขียนหนังสือ
- นับแบงค์ ตรวจสลาก
- ขับรถนานๆ
- เย็บผ้าใช้จักร
- งานที่ต้องถืออะไรแน่นๆทั้งวัน

## Carpal tunnel syndrome

- Local pain at the wrist.
- Sensory symptoms of the first three digits and the radial half of the fourth digit. (Most commonly volar tip of the second and third finger)
- Weakness of thumb abduction and opposition (LOAF)



Abductor pollicis brevis



1<sup>st</sup> lumbrical



Opponens pollicis



Thenar atrophy in CTS

## Carpal tunnel syndrome

- Tinel's sign – about 40-70% sensitivity
- Phalen's sign – about 60-80% sensitivity

## Condition related to CTS

- Work related
- Ganglia
- Rheumatoid arthritis (RA)
- Increased susceptibility:
  - Diabetes
  - Hereditary neuropathies

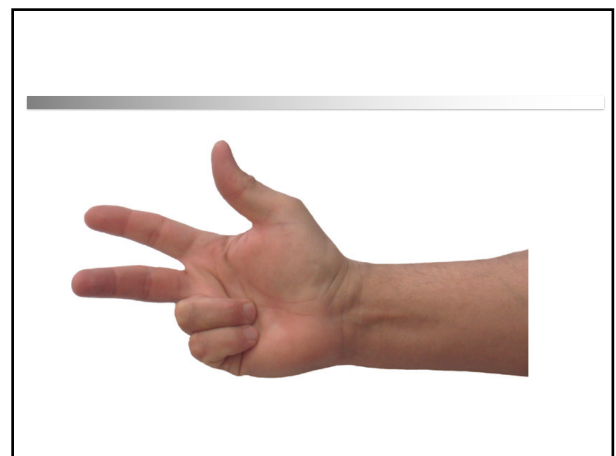
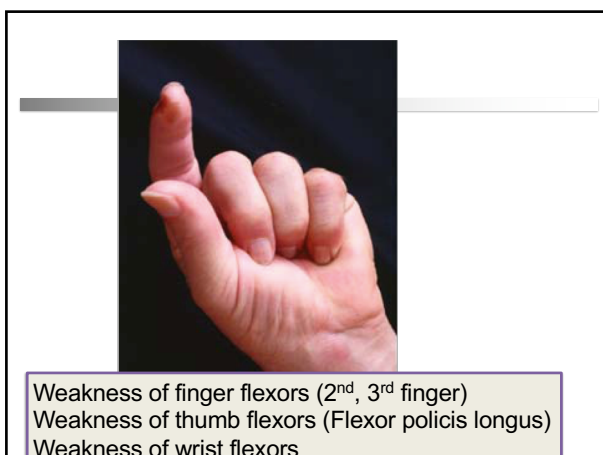
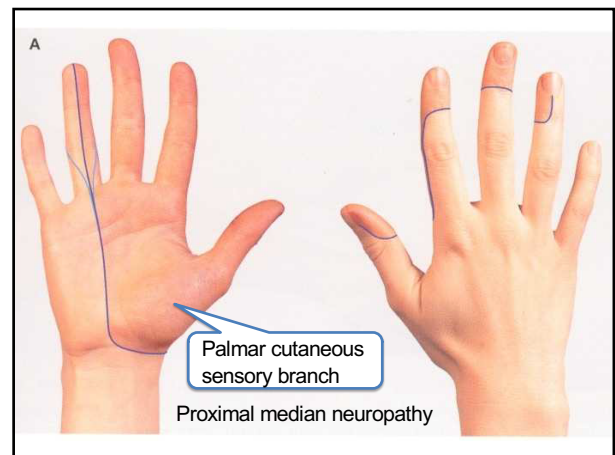
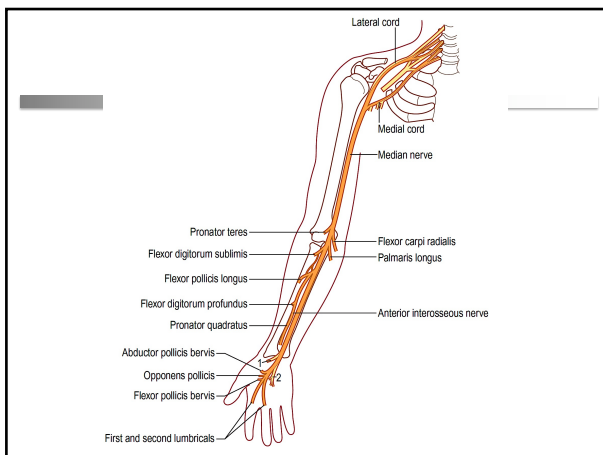


## Conditions related to CTS

- Others:
  - Acromegaly
  - Amyloidosis
  - A-V shunt
  - Hypothyroidism
  - Mucopolysaccharidosis
  - Pregnancy

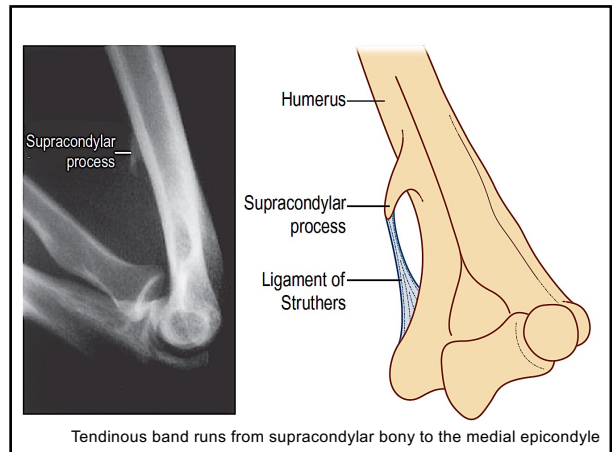
## Proximal median neuropathy

- Rare
- Weakness involved
- Finger flexors of 2<sup>nd</sup> and 3<sup>rd</sup> fingers
- Thumb flexors
- Wrist flexors

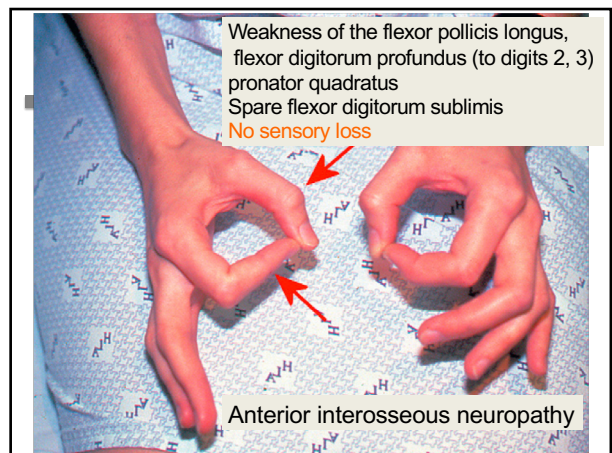
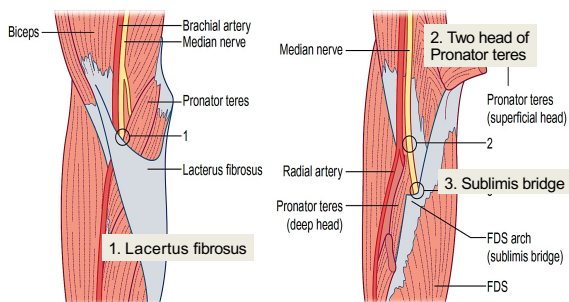


## Proximal median neuropathy

- Causes
- Entrapment at the ligament of Struther (rare)
- Pronator teres syndrome
- Traumatic lesion: cast, venipuncture, hematoma, tumor
- Anterior interosseus neuropathy
  - Direct injury
  - Midshaft radius fractures
  - Idiopathic brachial plexitis



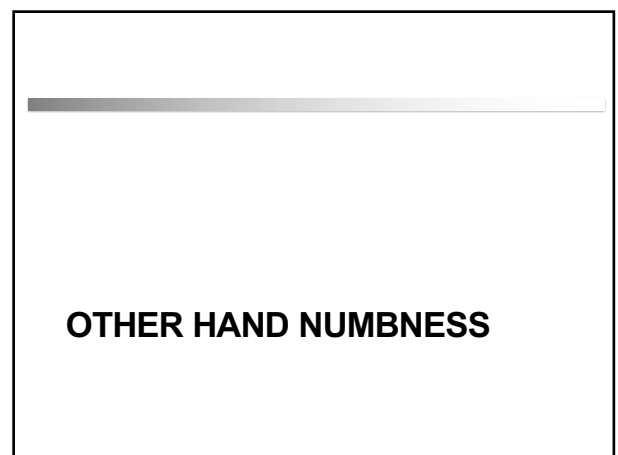
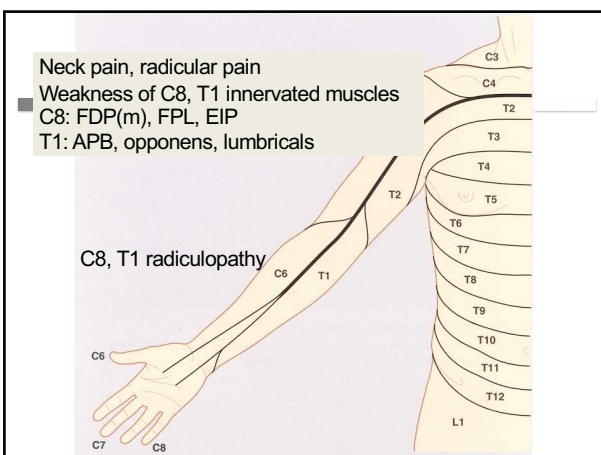
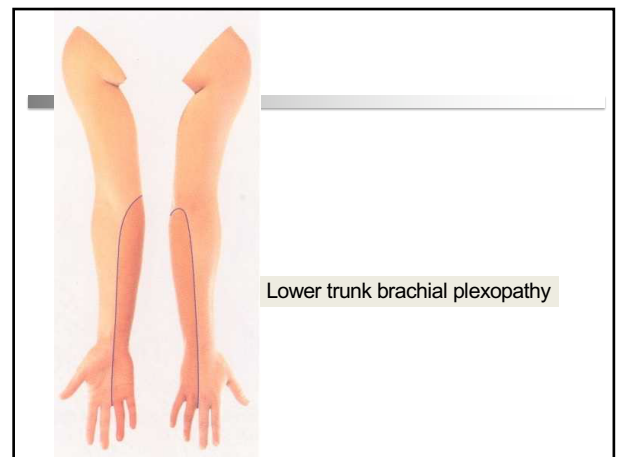
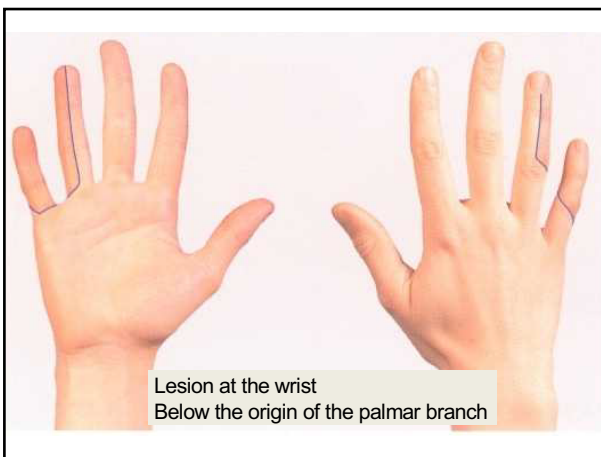
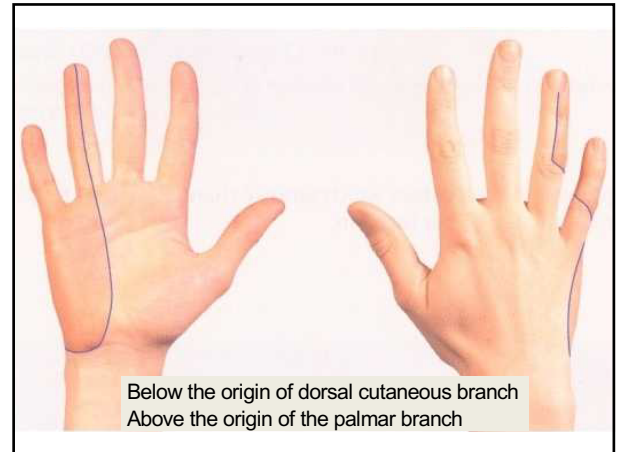
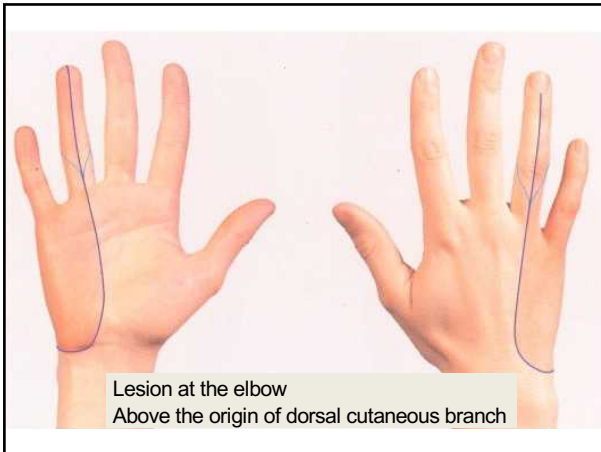
## Pronator teres syndrome

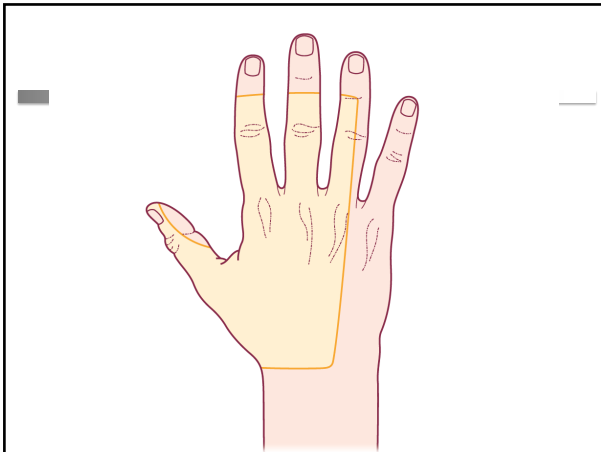


## NUMBNESS IN THE RING AND LITTLE FINGERS

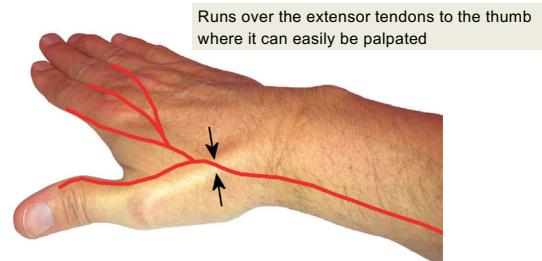
## Numbness in the ring and little fingers

- Ulnar neuropathy at the wrist
- Ulnar neuropathy at the elbow
- Lower trunk plexopathy
- C8 T1 radiculopathy





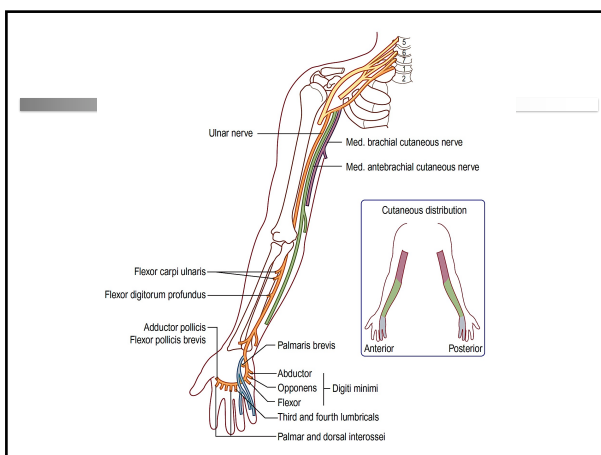
### Superficial radial sensory neuropathy



### Superficial radial sensory neuropathy

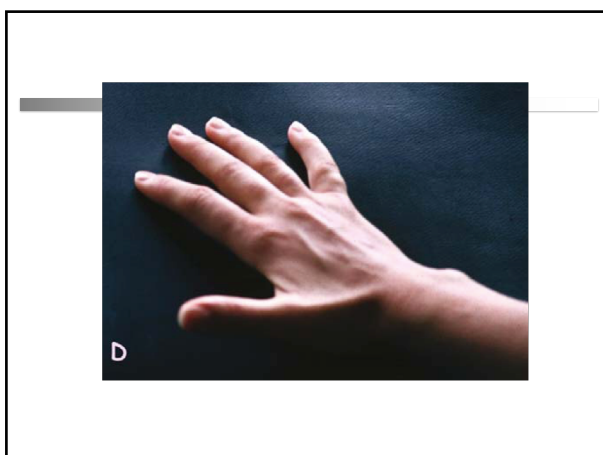
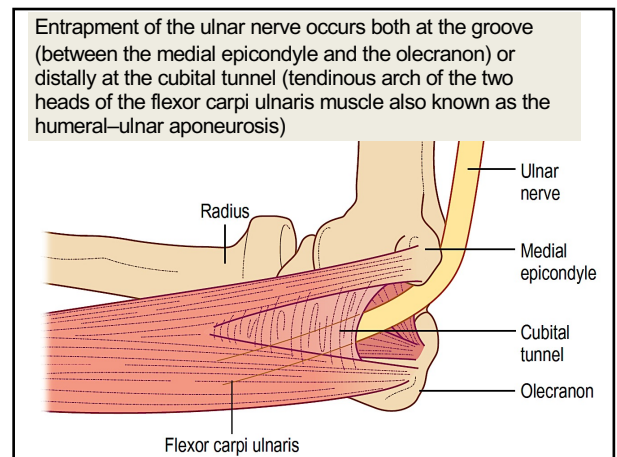
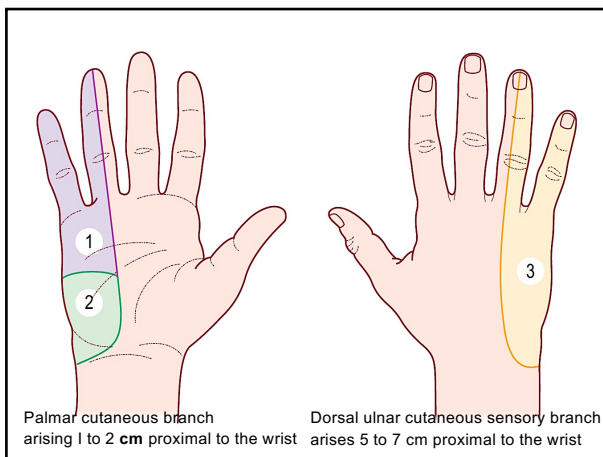
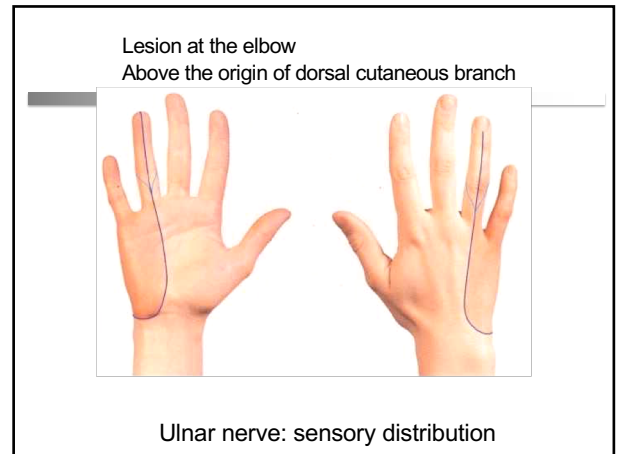
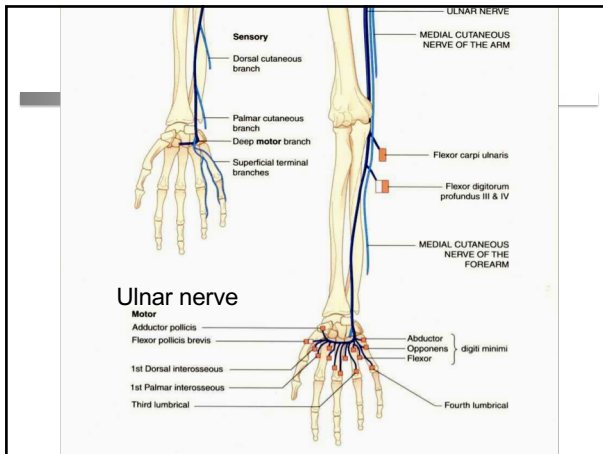
- “Cheiralgia Paresthetica”
- Tight-fitting bands, watches, bracelets or handcuffs

### HAND ATROPHY

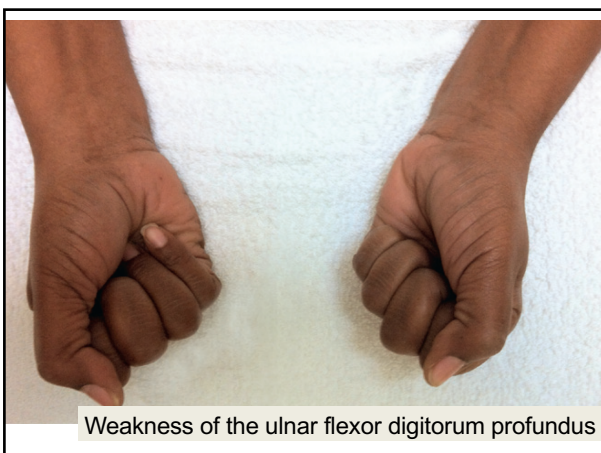
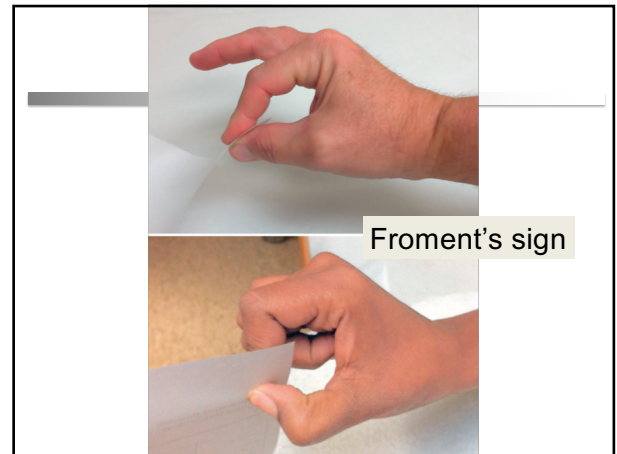
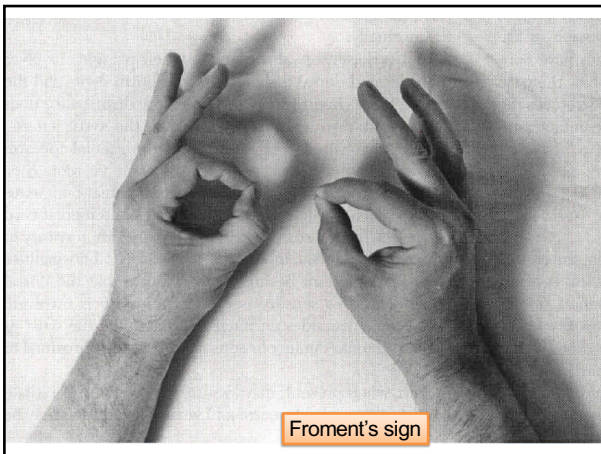


### Ulnar neuropathy

- At the elbow
- At the wrist (Guyon's canal)







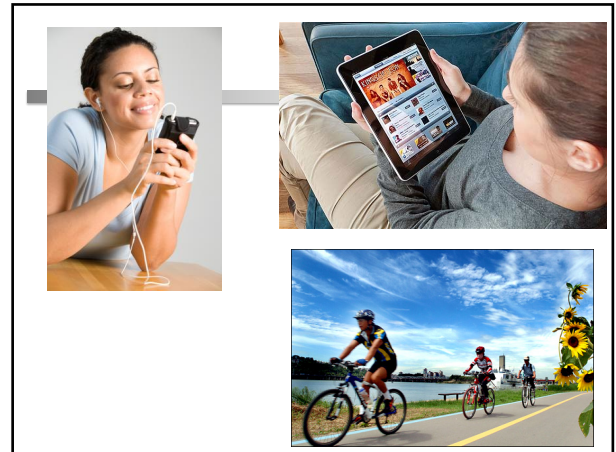
### Causes of ulnar neuropathy at the elbow

- Repeated trauma, external compression
- Subluxation of the ulnar nerve out of the groove during elbow flexion (controversial)
- Tardy ulnar palsy (previous elbow fracture)
- Ganglia, tumor (rare)



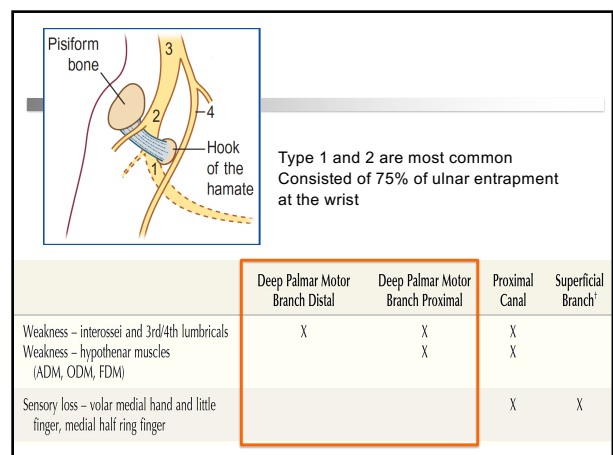
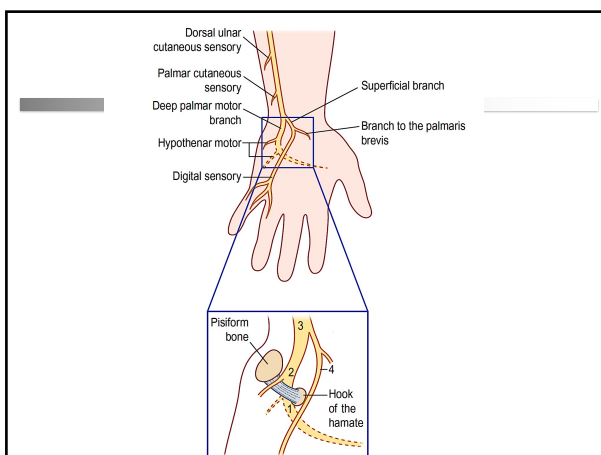
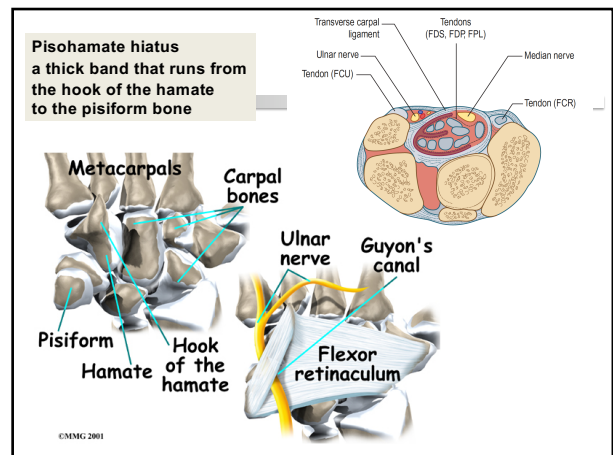
## กิจกรรมที่ทำให้เกิด ulnar neuropathy

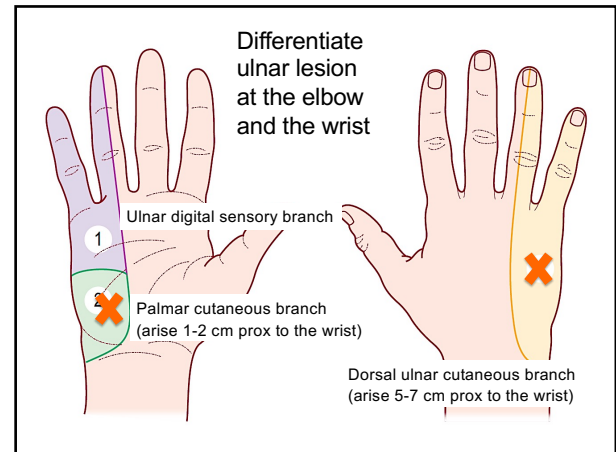
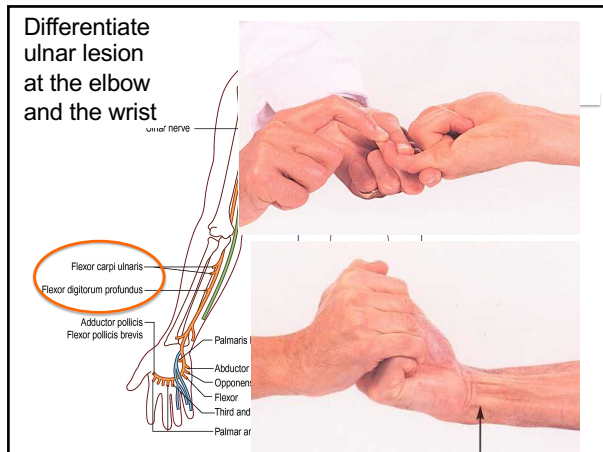
- ทำงานหรือกิจกรรมในท่างอข้อศอกนานๆ
- นั่งเท้าหรือวางข้อศอกนานๆ



## Ulnar neuropathy at the wrist

- “Guyon’s canal”
- Causes
- Ganglion cyst within the canal
- Repetitive movement or pressure against the ulnar n at the wrist
  - Bikers
  - Repetitive use of stamp or hand tools





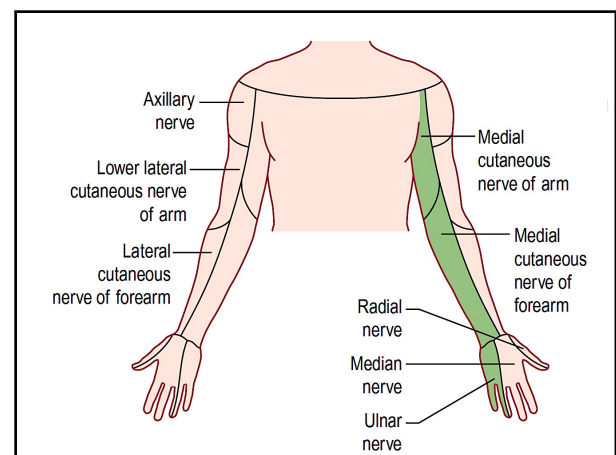
## Differential diagnosis of hand atrophy

- Unilateral
  - Ulnar neuropathy
  - Lower trunk plexopathy
  - C8 T1 radiculopathy
  - Monomelic amyotrophy
  - Multifocal motor neuropathy with conduction block
- Bilateral hand atrophy
  - Motor neuron disease
  - Syringomyelia

	UNW*	UNE	Medial Cord	Lower Trunk	C8-T1
Weakness of the interossei	X	X	X	X	X
Weakness of the hypothenar muscles	X	X	X	X	X
Weakness of the third and fourth lumbricals	X	X	X	X	X
Weakness of distal finger flexion of the little and ring fingers		X	X	X	X
Weakness of thumb abduction			X	X	X
Weakness of thumb flexion			X	X	X
Weakness of index finger extension				X	X
Sensory loss of the volar medial hand, volar little finger, and volar medial ring finger	X	X	X	X	X
Sensory loss of the dorsal medial hand, dorsal little finger, and dorsal medial ring finger		X	X	X	X
Sensory loss of the medial forearm			X	X	X
Tinel's sign at the elbow		X			
Neck pain					X

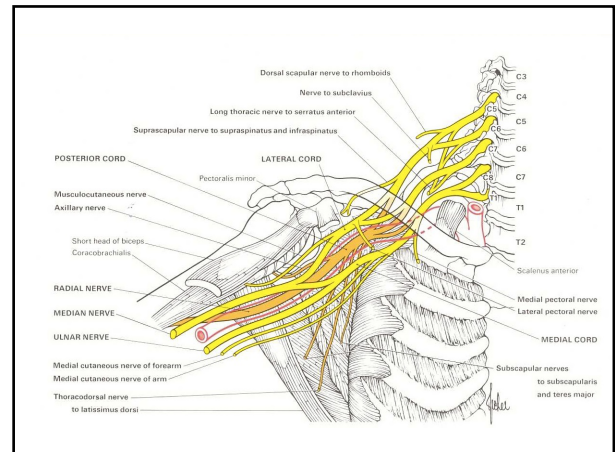
## Lower trunk plexopathy

- Weakness:
  - All ulnar muscles
  - Median C8,T1 muscles (APB, FPL, FDP-M)
  - Radial C8 muscles (EIP, ext. pollicis brevis)
- Sensory loss:



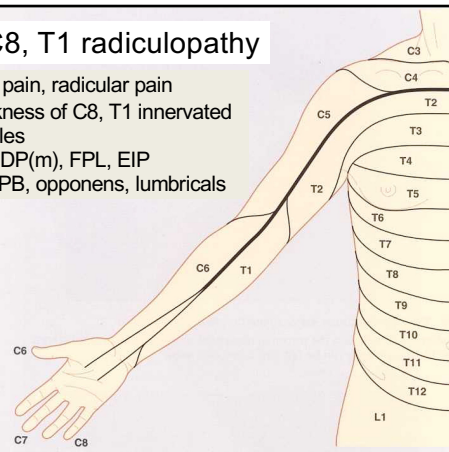
## Differential diagnosis of lower trunk brachial plexopathy

- Traumatic plexopathy
- Tumor invasion eg. Pancoast tumor
- Post radiation: breast cancer
- Post median sternotomy
- Thoracic outlet syndrome



## C8, T1 radiculopathy

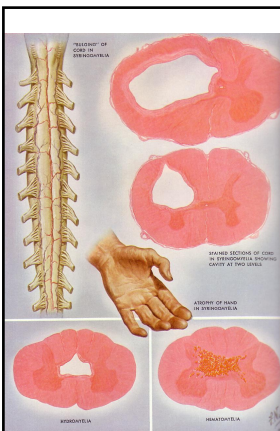
Neck pain, radicular pain  
Weakness of C8, T1 innervated muscles  
C8: FDP(m), FPL, EIP  
T1: APB, opponens, lumbricals



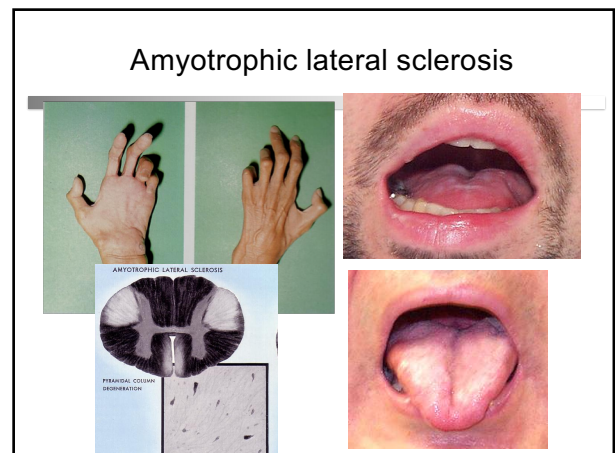
## Differential diagnosis of hand atrophy

- Unilateral
  - Ulnar neuropathy
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  - C8 T1 radiculopathy
  - Monomelic amyotrophy
  - Multifocal motor neuropathy with conduction block
- Bilateral hand atrophy
  - Motor neuron disease
  - Syringomyelia

## Syringomyelia



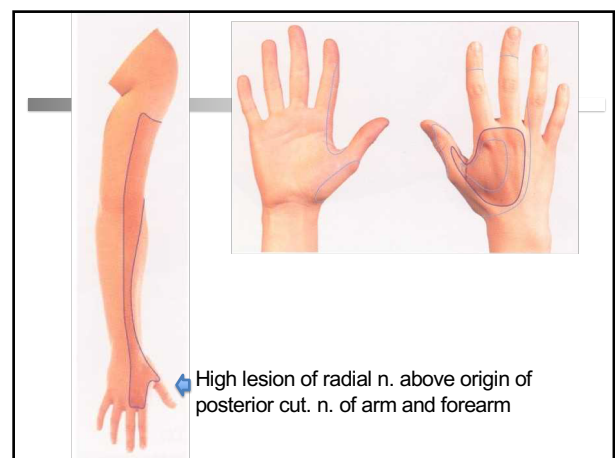
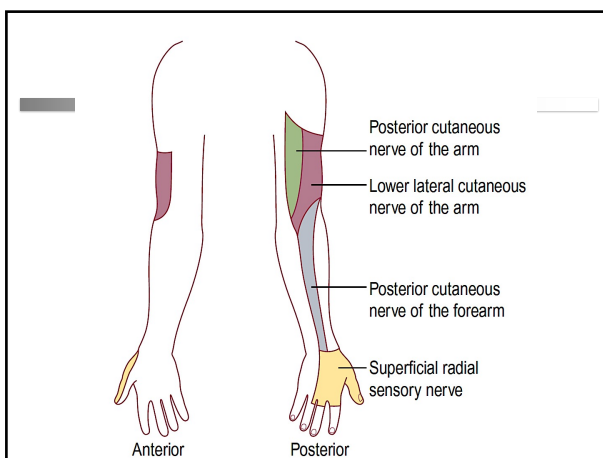
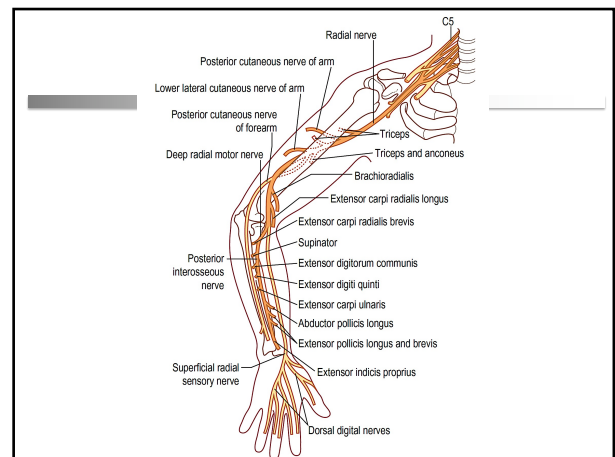
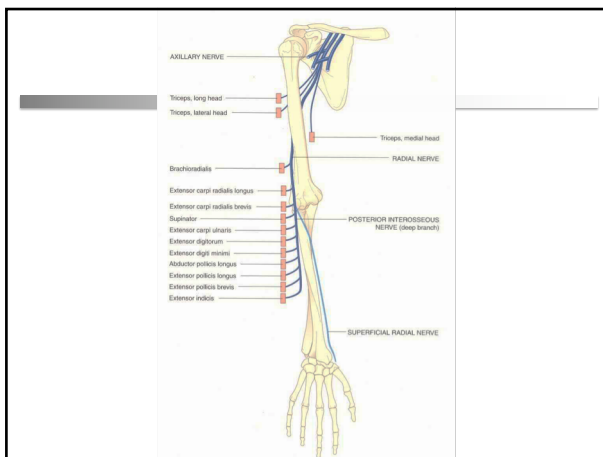
## Amyotrophic lateral sclerosis



## WRIST DROP

### Causes of wrist drop

- Posterior interosseous neuropathy
- Radial neuropathy at the spiral groove
- Radial neuropathy in the axilla
- Posterior cord brachial plexus lesion
- C7 radiculopathy
- Central nervous system lesion



	Posterior Interosseous Neuropathy	Radial Nerve: Spiral Groove	Radial nerve: Axilla	Posterior Cord	C7
Wrist drop or finger drop	X	X	X	X	X
Radial deviation on wrist extension	X				
Weakness of supination (mild)		X	X	X	
Weakness of elbow flexion (mild)		X	X	X	
Diminished brachioradialis tendon reflex		X	X	X	
Weakness of elbow extension			X	X	X
Diminished triceps tendon reflex			X	X	X
Weakness of shoulder abduction				X	
Sensory loss in lateral dorsal hand		X	X	X	X (equivocal)
Sensory loss in posterior arm or forearm			X	X	X (equivocal)
Weakness of wrist flexion					X

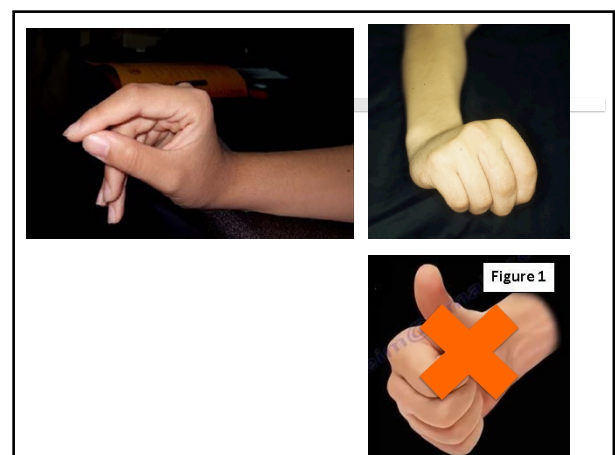
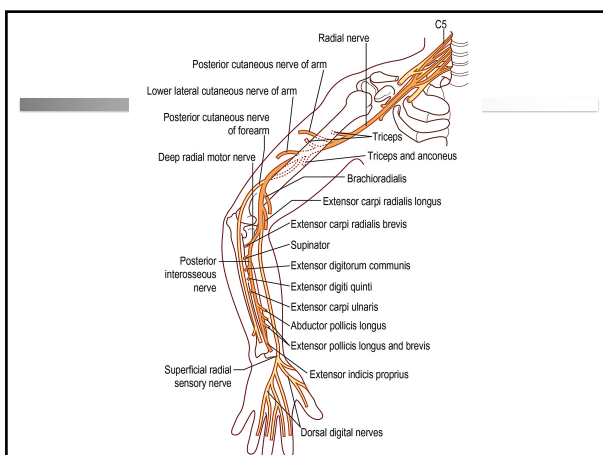
X, may be present.

	Posterior Interosseous Neuropathy	Radial Nerve: Spiral Groove	Radial Nerve: Axilla	Posterior Cord	C7
<b>EMG Findings</b>					
Extensor indicis proprius	X	X	X	X	X
Extensor digitorum communis	X	X	X	X	X
Extensor carpi ulnaris	X	X	X	X	X
Extensor carpi radialis-long head		X	X	X	X
Brachioradialis		X	X	X	
Supinator		X	X	X	
Anconeus			X	X	X
Triceps			X	X	X
Deltoid				X	
Latissimus dorsi				X	X
Flexor carpi radialis, pronator teres					X
Cervical paraspinal muscles					X
<b>Nerve Conduction Study Findings</b>					
Abnormal radial SNAP (if axonal)		X	X	X	
Low radial CMAP (if axonal)	X	X	X	X	X
Conduction block at spiral groove (if demyelinating)		X			
Conduction block between forearm and elbow (if demyelinating)	X				

## FINGER DROP WITHOUT WRIST DROP

## Posterior interosseous neuropathy

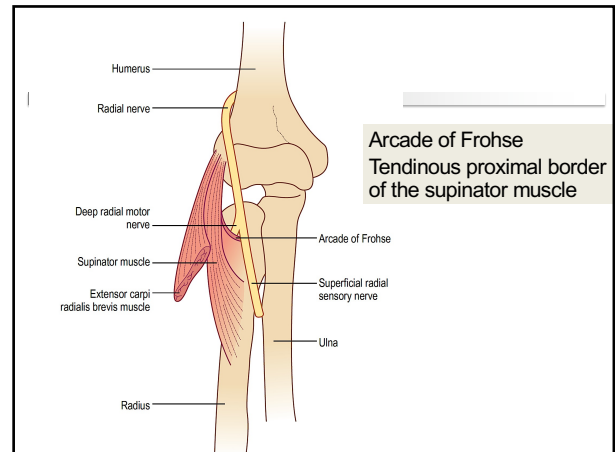
- Weakness of finger extensors
- Mild weakness of wrist extensors with radial deviation on wrist extension
- No sensory loss





## Etiologies

- Entrapment under the Arcade of Frohse
- Mass lesion (eg. ganglion cysts, tumors)



## Causes of wrist drop

- Posterior interosseous neuropathy
- Radial neuropathy at the spiral groove
- Radial neuropathy in the axilla
- Posterior cord brachial plexus lesion
- C7 radiculopathy
- Central nervous system lesion

	Posterior Interosseous Neuropathy	Radial Nerve: Spiral Groove	Radial nerve: Axilla	Posterior Cord	C7
Wrist drop or finger drop	X	X	X	X	X
Radial deviation on wrist extension	X				
Weakness of supination (mild)		X	X	X	
Weakness of elbow flexion (mild)		X	X	X	
Diminished brachioradialis tendon reflex		X	X	X	
Weakness of elbow extension			X	X	X
Diminished triceps tendon reflex			X	X	X
Weakness of shoulder abduction				X	
Sensory loss in lateral dorsal hand		X	X	X	X (equivocal)
Sensory loss in posterior arm or forearm			X	X	X (equivocal)
Weakness of wrist flexion					X

X, may be present.

	Posterior Interosseous Neuropathy	Radial Nerve: Spiral Groove	Radial Nerve: Axilla	Posterior Cord	C7
<b>EMG Findings</b>					
Extensor indicis proprius	X	X	X	X	X
Extensor digitorum communis	X	X	X	X	X
Extensor carpi ulnaris	X	X	X	X	X
Extensor carpi radialis-long head		X	X	X	X
Brachioradialis		X	X	X	
Supinator		X	X	X	
Anconeus			X	X	X
Triceps			X	X	X
Deltoid				X	
Latissimus dorsi				X	X
Flexor carpi radialis, pronator teres					X
Cervical paraspinal muscles					X
<b>Nerve Conduction Study Findings</b>					
Abnormal radial SNAP (if axonal)		X	X	X	
Low radial CMAP (if axonal)	X	X	X	X	X
Conduction block at spiral groove (if demyelinating)		X			
Conduction block between forearm and elbow (if demyelinating)	X				

## CNS lesion

- Cortical lesion at the hand area
- Cause weakness of the finger extensors, wrist extensor but also weakness of the other intrinsic hand muscles
- No clear sensory loss
- Hyperreflexia (may have to wait 1-2 weeks after acute lesion)



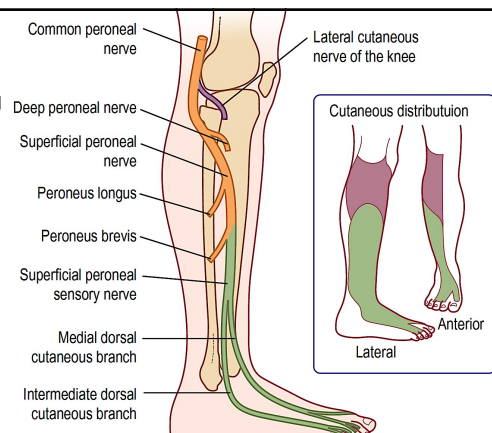
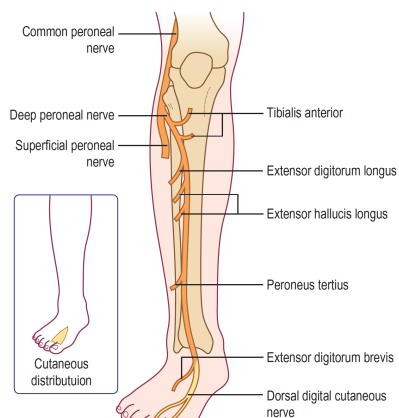
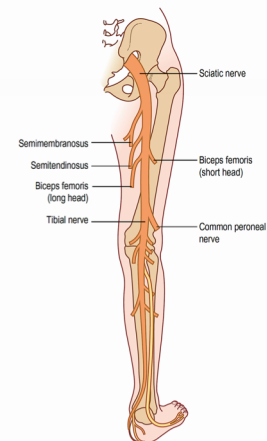
## FOOT DROP

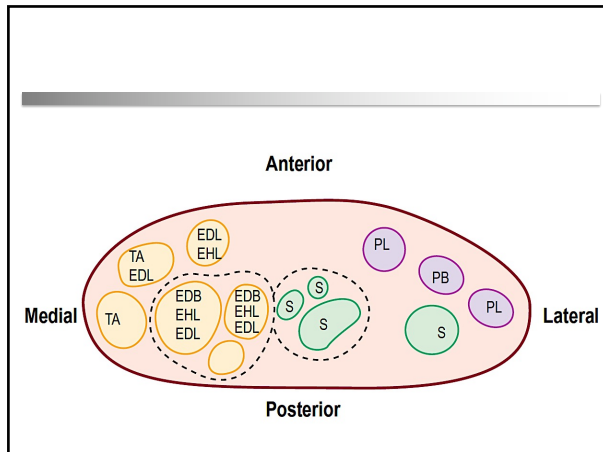
## Causes of foot drop

- Deep peroneal neuropathy
- Common peroneal neuropathy
- Sciatic neuropathy
- Lumbosacral plexopathy
- L5 radiculopathy
- Parasagittal lesion

## Peroneal neuropathy

- Deep peroneal neuropathy
- Common peroneal neuropathy





### Etiology of peroneal neuropathy at the fibular neck

Trauma (including fracture)  
 Stretch (forcible ankle inversion)  
 Compression  
 Casts  
 Stockings  
 Immobilization after anesthesia, sedation, or intoxication  
 Occupational  
 Gardening  
 Farm work (squatting, kneeling)  
 Entrapment (fibular tunnel)  
 Mass lesions (ganglia, tumors, Baker's cyst)  
 Miscellaneous (weight loss, habitual leg crossing)

### Differential diagnosis of peroneal neuropathy

	Deep Peroneal Nerve	Common Peroneal Nerve	Sciatic Nerve	Lumbosacral Plexus	L5
Weakness of foot dorsiflexion	X	X	X	X	X
Weakness of foot eversion		X	X	X	X
Weakness of foot inversion			X	X	X
Weakness of knee flexion			X	X	X
Weakness of glutei				X	X
Decreased ankle tendon reflex			X <sup>1</sup>	X <sup>1</sup>	X <sup>1</sup>
Sensory loss in webspace great toe	X	X	X	X	X
Sensory loss in dorsum of foot		X	X	X	X
Sensory loss in lateral calf		X	X	X	X
Sensory loss in lateral knee			X	X	X
Sensory loss in sole foot			X <sup>1</sup>	X <sup>1</sup>	X <sup>1</sup>
Sensory loss in posterior thigh				X <sup>1</sup>	X <sup>1</sup>
Tinel's sign at fibular neck	X	X			
Hip and thigh pain			X	X	X
Back pain					X
Positive straight-leg raise test					X

X = may be present; <sup>1</sup>May be present if lesion involves S1 fibers as well; CMAP = compound muscle action potential; SNAP = sensory nerve action potential

### When to consider that foot drop is not from peroneal nerve lesion!!

- Weakness of ankle inversion (tibialis posterior – innervated by the tibial nerve)
- Preferential weakness of the EHL (L5–S1) out of proportion to the TA (L4–L5). In a peroneal neuropathy, these two muscles usually are equally affected; in an L5 radiculopathy, the EHL usually is weaker than the TA because of its predominant L5 innervation
- Sensory loss over the lateral knee (distribution of the lateral cutaneous nerve of the knee)
- Sensory loss over the sole of the foot, lateral foot, or medial calf (distribution of the plantar, sural, or saphenous nerves)
- Any weakness of hip abduction, extension, or internal rotation (gluteus medius, tensor fascia latae, gluteus maximus – innervated by the superior and inferior gluteal nerves).
- Any asymmetry of the ankle reflex

### Conclusion

- Hand numbness
- Hand atrophy
- Wrist drop
- Foot drop

**Clinical and  
Good Physical Examination  
is the Key**