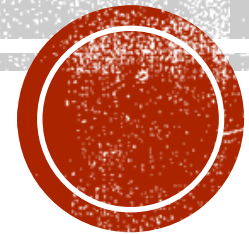
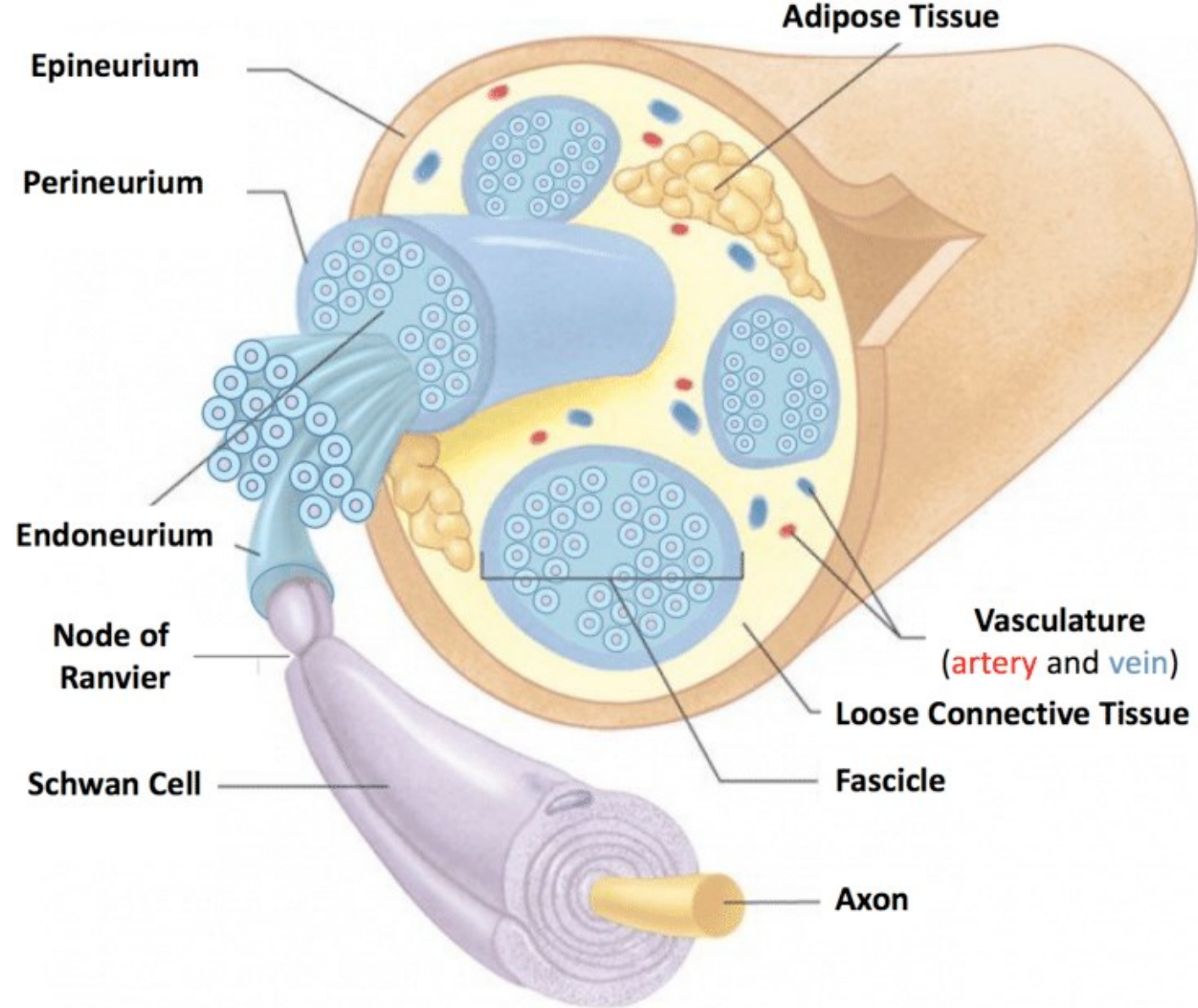


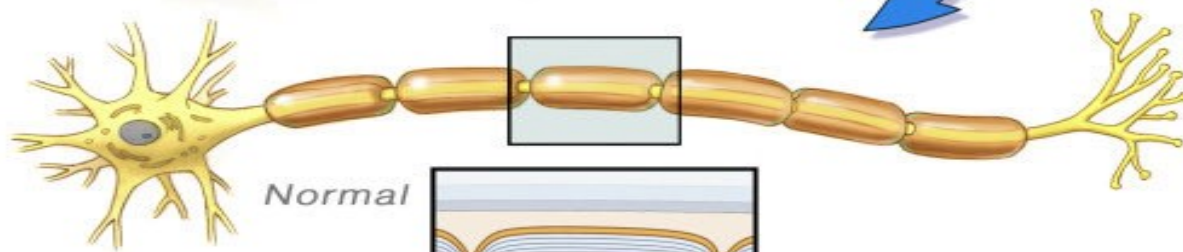
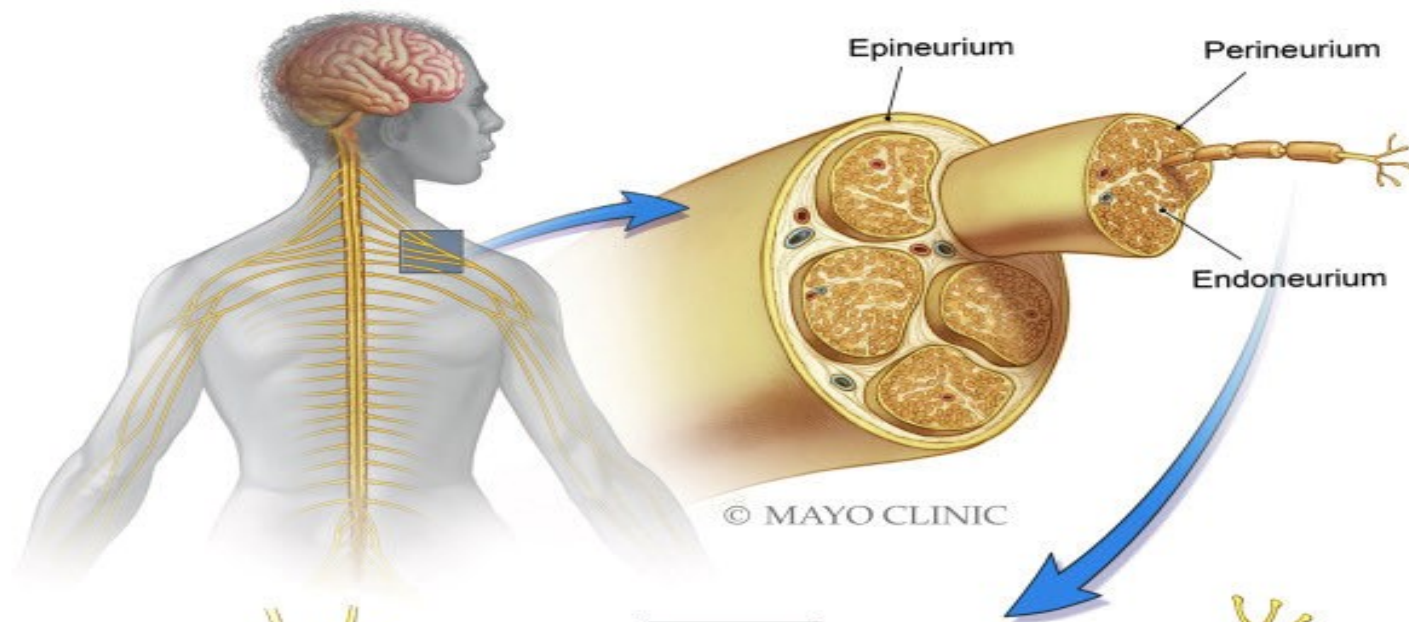
PERIPHERAL NERVE INJURIES



TYPES OF NERVE FIBERS

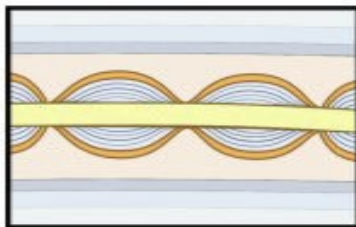
- Velocity proportional to the radius
- $A\alpha$, $A\beta$, $A\gamma$, $A\delta$
- B
- C



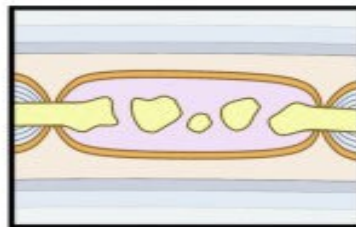


Risk Factors
Pre-existing Neuropathy
Diabetes Mellitus

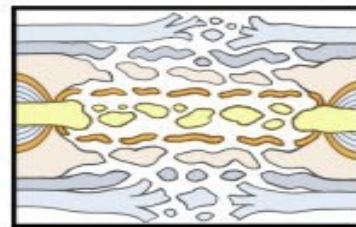
Nerve Damage
Crush
Stretch
Transection
Inflammation



Neuropraxia



Axonotmesis



Neurotmesis

PATHOLOGY OF NERVE INJURIES

1- transient ischemia

acute nerve compression

2- Neurapraxia

- Demyelination only

temporary, good prognosis, intact nerve

3- Axonotmesis

- Demyelination with axonal loss.

Fibers affected, sheath intact.

4- Neurotmesis

Complete transection, needs surgical repair





SYMPTOMS

- **Vary according to the nerve damaged:**

- *Motor; muscle weakness, twitching, painful cramps

- *Sensory; numbness, tingling, hyper or hypoalgesia...

- *both



CAUSES

- 1- **localized damage** : traumatic , compression , tumors , traction , burning and ischemia
- 2- **systemic diseases** : DM, autoimmune diseases

NERVE INJURIES AFFECTING THE UPPER LIMB

- Brachial plexus injury
- Axillary nerve injury
- Median nerve injury
- Radial nerve injury
- Ulnar nerve injury



BRACHIAL PLEXUS INJURY

Clinical exam should establish :

- The level of the lesions :
 1. Upper plexus injury
 2. Lower plexus injury
 3. Total plexus injury
- Preganglionic vs postganglionic
- Type of damage : neuropraxia, axonotmesis, neurotmesis

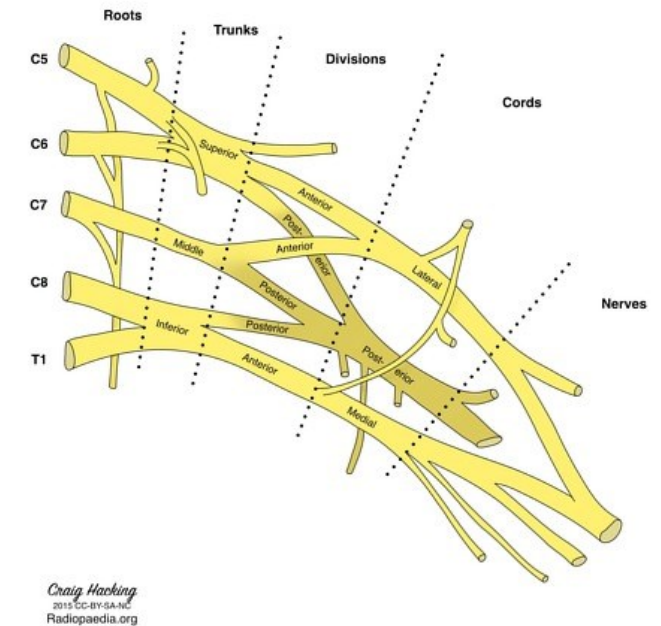
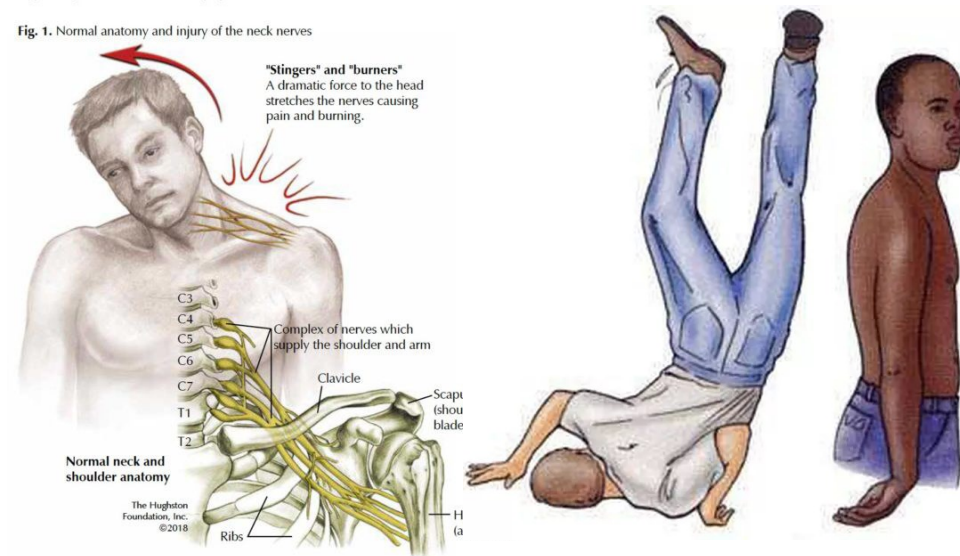
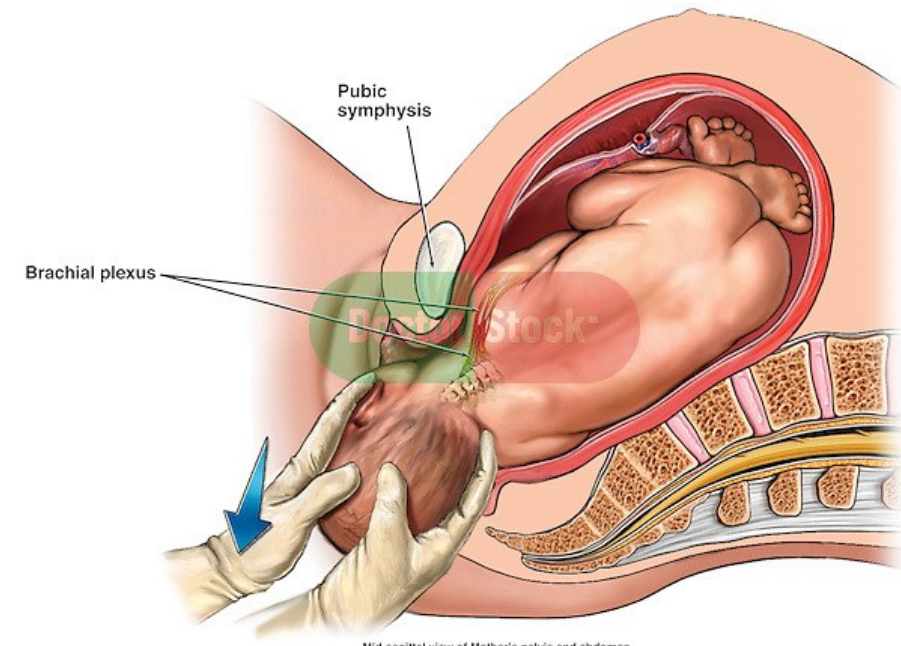


Fig. 1. Normal anatomy and injury of the neck nerves



OBSTETRICAL BRACHIAL PLEXUS INJURY

- Erb's palsy :
- It's typically caused by a physical injury during newborn delivery or by traumatic force downward on the upper arm and shoulder, damaging the brachial plexus.
- *Up to 80% of congenital brachial plexus injury*
- Due to excessive lateral neck flexion
- Affects the upper part of brachial plexus: C6C7
- manifested by weak flexion (biceps), abduction (deltoid), external rotation (infra spinatus, supra spinatus)
- WAITER'S TIP POSITION



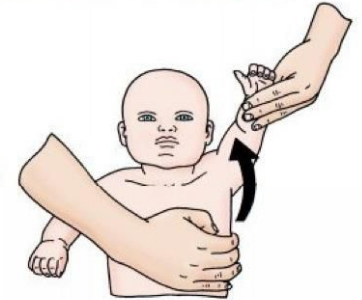
- **Diagnosis:**
- Generally by history and physical examination.
- If the dx is unclear, nerve conduction studies are ordered
- **Treatment:**
- Physiotherapy
- Most babies show full recovery with minimal treatment
- The baby may need referral to a surgeon if he shows poor response

It is extremely important that you do not attempt to perform these exercises until you have been instructed by a Physiotherapist. They will inform you of which specific exercises are appropriate for your child.

A: Shoulder exercises

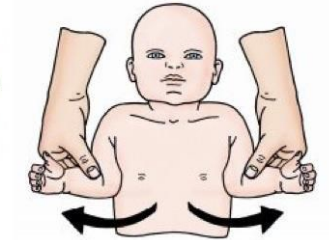
1. Elevation

Gently hold your child's forearm and lift their arm up above their head. Keep the arm close to their ear.



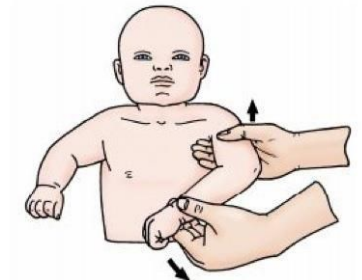
2. Lateral Rotation

This is the most important exercise. Bend your child's elbow to 90° whilst holding the elbow in at the side. Rotate the arm out to the side towards the mat. It is important that you do both of their arms together. This allows you to compare the affected arm with the unaffected arm and to ensure that your child doesn't roll and limit their movement.

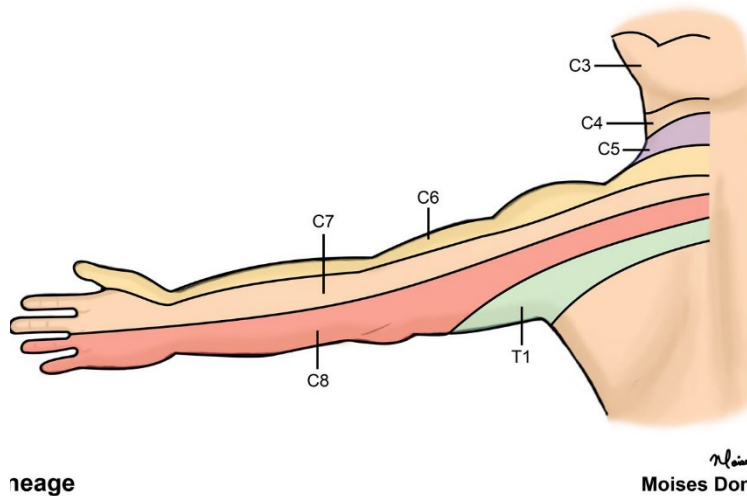


3. Posterior capsule stretch

Place one hand onto your child's shoulder and with your other hand grasp your child's forearm and take it across their chest so that their elbow and shoulder are held at 90°. Then apply a downward pressure onto their forearm.

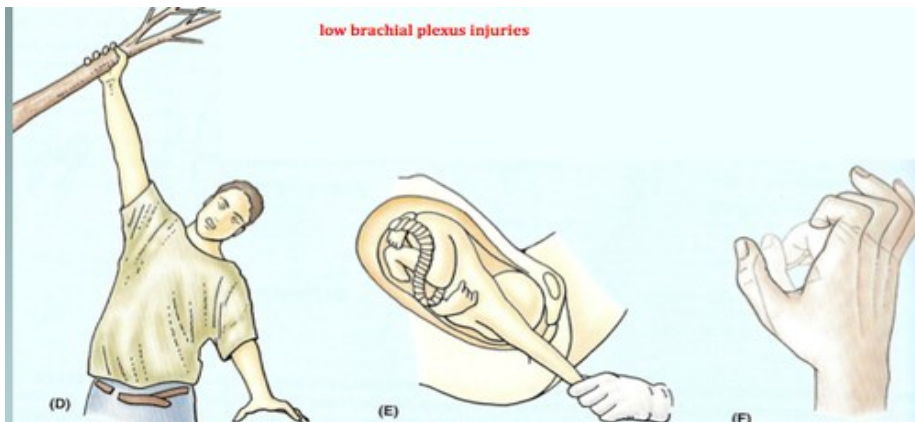


Upper Extremity Dermatome Posterior View



KLUMPKE PALSY (VERY RARE)

- Lower trunk of brachial plexus C8T1
- **Etiology:**
 - *Excessive upward traction on the arm during delivery “hyperabduction”*
 - *Compression of lower trunk by pancoast tumor*
- **Features:**
 - *Weakness of intrinsic hand muscles “**claw hand**”*
 - *Horner syndrome??*
 - *decreased peripheral pulse, part of thoracic outlet syndrome*
 - *Sensory loss over C8T1 dermatome*
 - *Stiff shoulder joint*



- **Diagnosis:**

- Symptoms are enough
- The doctor may use MRI to locate the damage

- **Treatment**

- Gentle massage and physical therapy
- Most babies recover from Klumpke's palsy
- When the nerve is torn instead of just being stretched surgery is needed



PERIPHERAL NERVE INJURIES IN THE UPPER EXTREMITY

1-Axillary nerve C5C6

- Common causes:

Anterior shoulder dislocation, Surgical neck fracture of humerus

- Features:

Paralysis of deltoid, teres minor (abduction and ext rotation) and atrophied deltoid

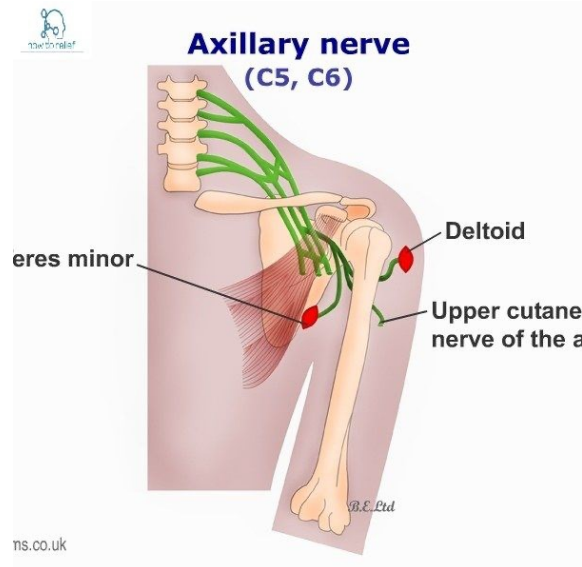
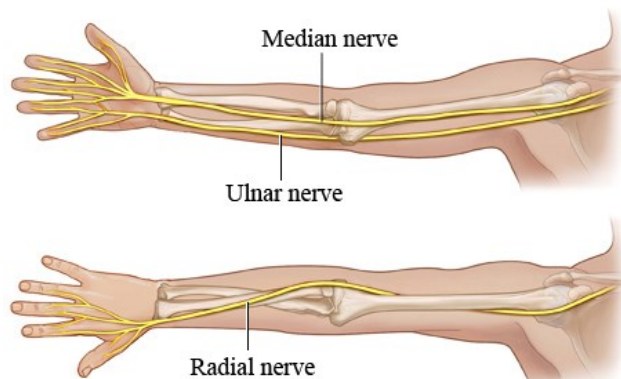


Figure 1) A 24-year-old man (patient 5) with an isolated left axillary nerve

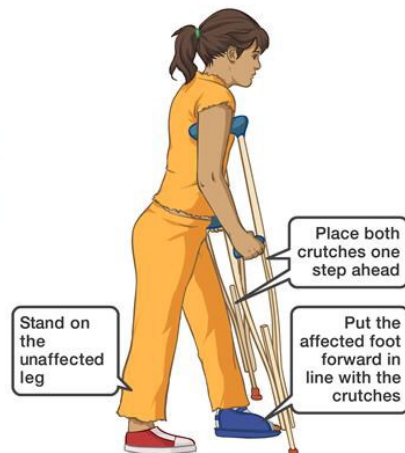


RADIAL NERVE INJURY

- C5T1
- Course?
- Causes:
 - **axillary**, compression from crutch use, Saturday night palsy
 - **Mid-arm**: mid shaft fracture
 - **Wrist**: radial fracture



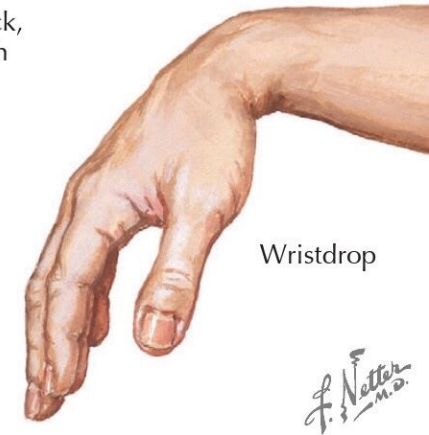
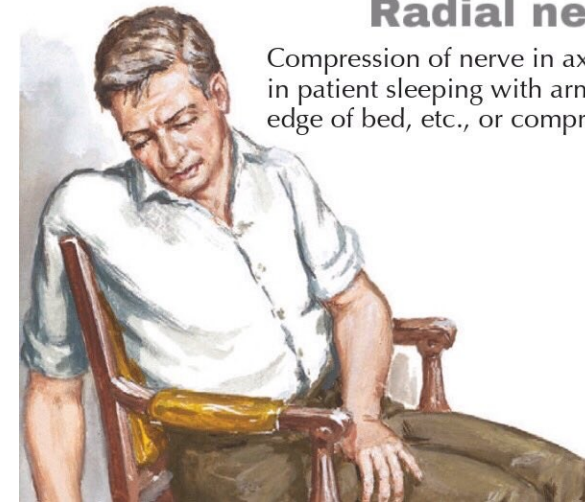
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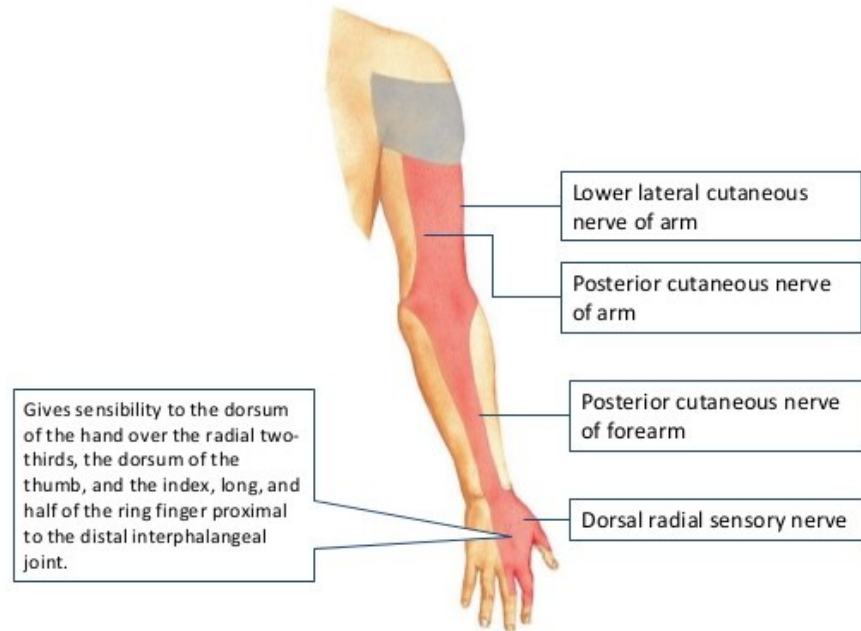
Radial nerve

Compression of nerve in axilla or upper arm in patient sleeping with arm over chair back, edge of bed, etc., or compression by crutch



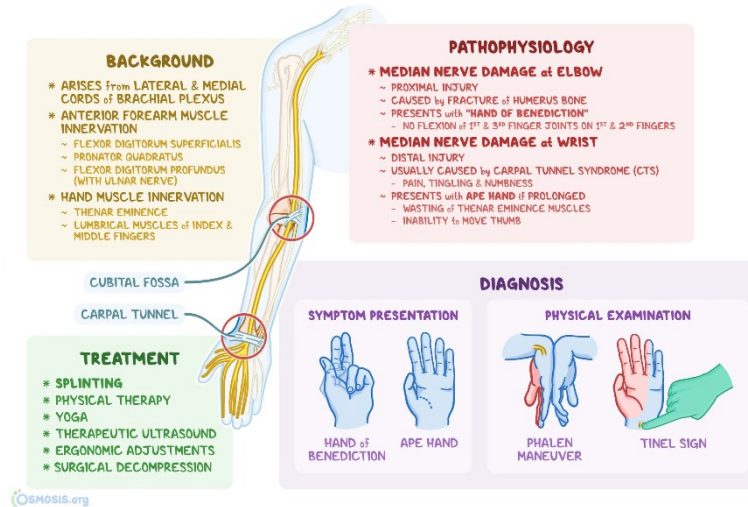
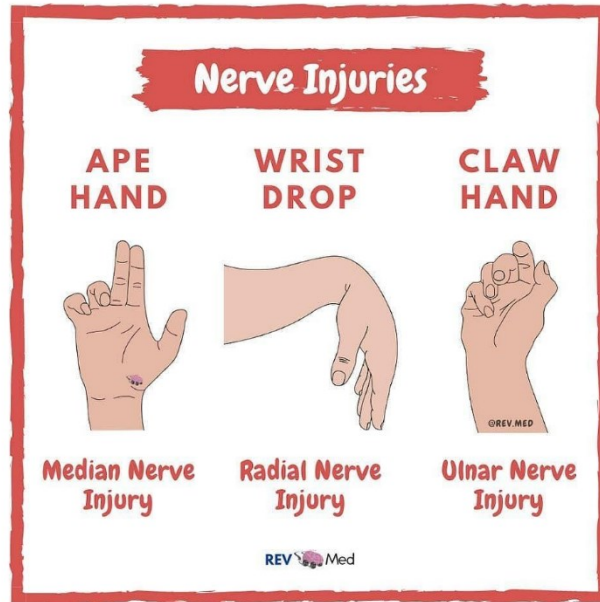
RADIAL NERVE INJURY

Cutaneous innervation from radial nerve



- Features
- *Motor*:
 - Axillary injury: impaired triceps muscle function, also wrist drop
 - Mid-shaft fracture: wrist drop
 - Wrist fracture: reduced grip strength
- *Sensory*: dorsal aspect of the thumb, index, middle, lateral half of ring finger
- Dorsal arm and forearm





MEDIAN NERVE INJURY C5T1

- **Causes**
 - Proximally: supracondylar fracture
 - Distally: carpal tunnel syndrome, suicidal attempts
- **Symptoms**
 - Pain along the anterior forearm
 - Numbness, tingling in the thumb, index and middle fingers



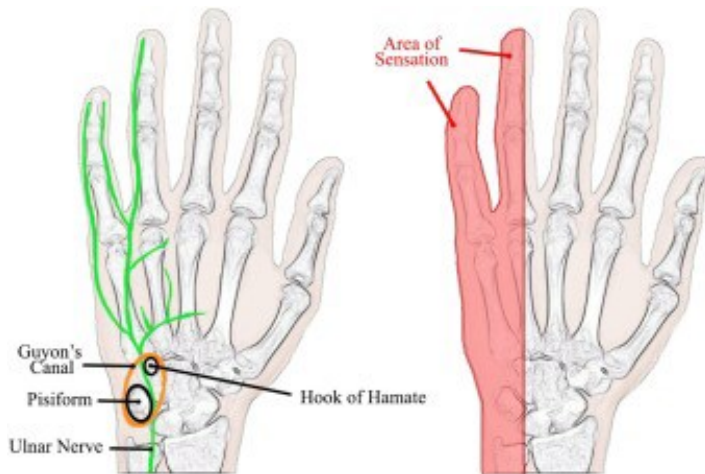
MEDIAN NERVE INJURY

- Symptoms:
- Atrophied thenar muscles
- Impaired flexion of wrist, thumb, middle and index fingers “Hand of benediction”





[Click for a more detailed view](#)



ULNAR NERVE INJURY C8T1

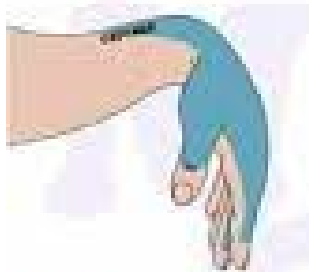
- Causes:
 - Entrapment in the elbow, cubital tunnel syndrome
 - Entrapment in the wrist
- Signs and symptoms:
 - Claw hand
 - Impaired adduction/ abduction of fingers
 - Impaired sensation along palmar and dorsal part of little and half of ring fingers



Nerve Palsies of the Hand

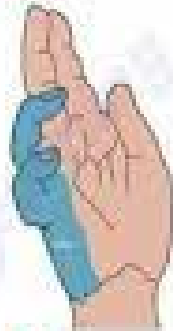
Mnemonics :- **DR CUMA**

Drop hand



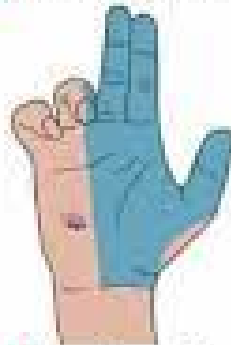
Radial nerve

Claw hand







Ulnar nerve

Median nerve



Ape hand

Neuro Testing Maneuvers for Elbow Dislocation

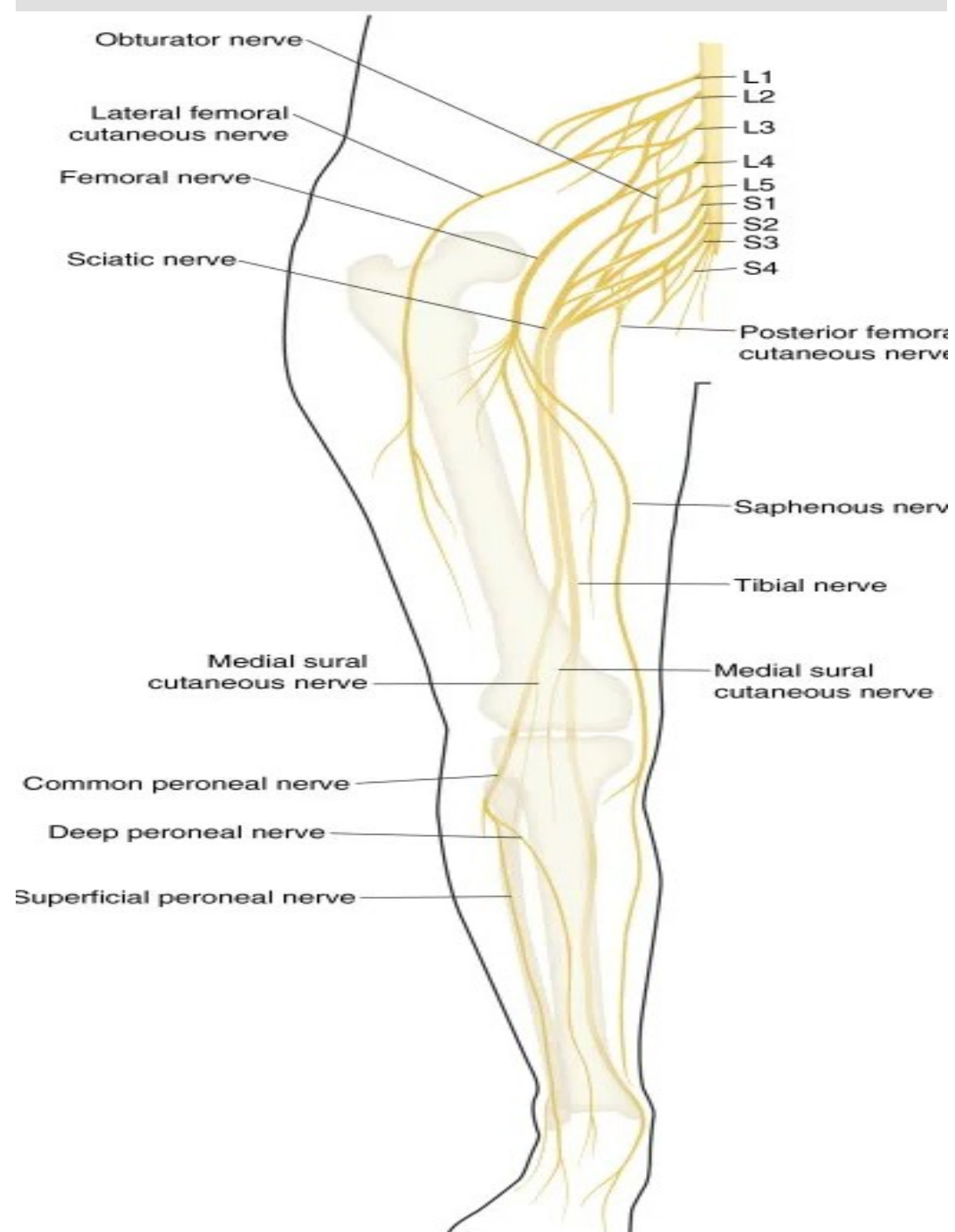
"Peace sign" against resistance	Ulnar nerve	
"Hitchhiker" / Thumbs up	Radial nerve	
"Power to the people"	Median nerve	
OK sign	Median nerve (anterior interosseous)	

Quick peripheral nerve exam of the upper extremity

	Motor function	Sensory function
Ulnar nerve	Peace sign	Tip of 5 th digit
Radial nerve	Hitchhiker thumb	Dorsal thumb, 1 st webspace
Median nerve	Power to the people fist, "OK" sign*	Tip of 2 nd digit

*anterior interosseous nerve (branch of the median)





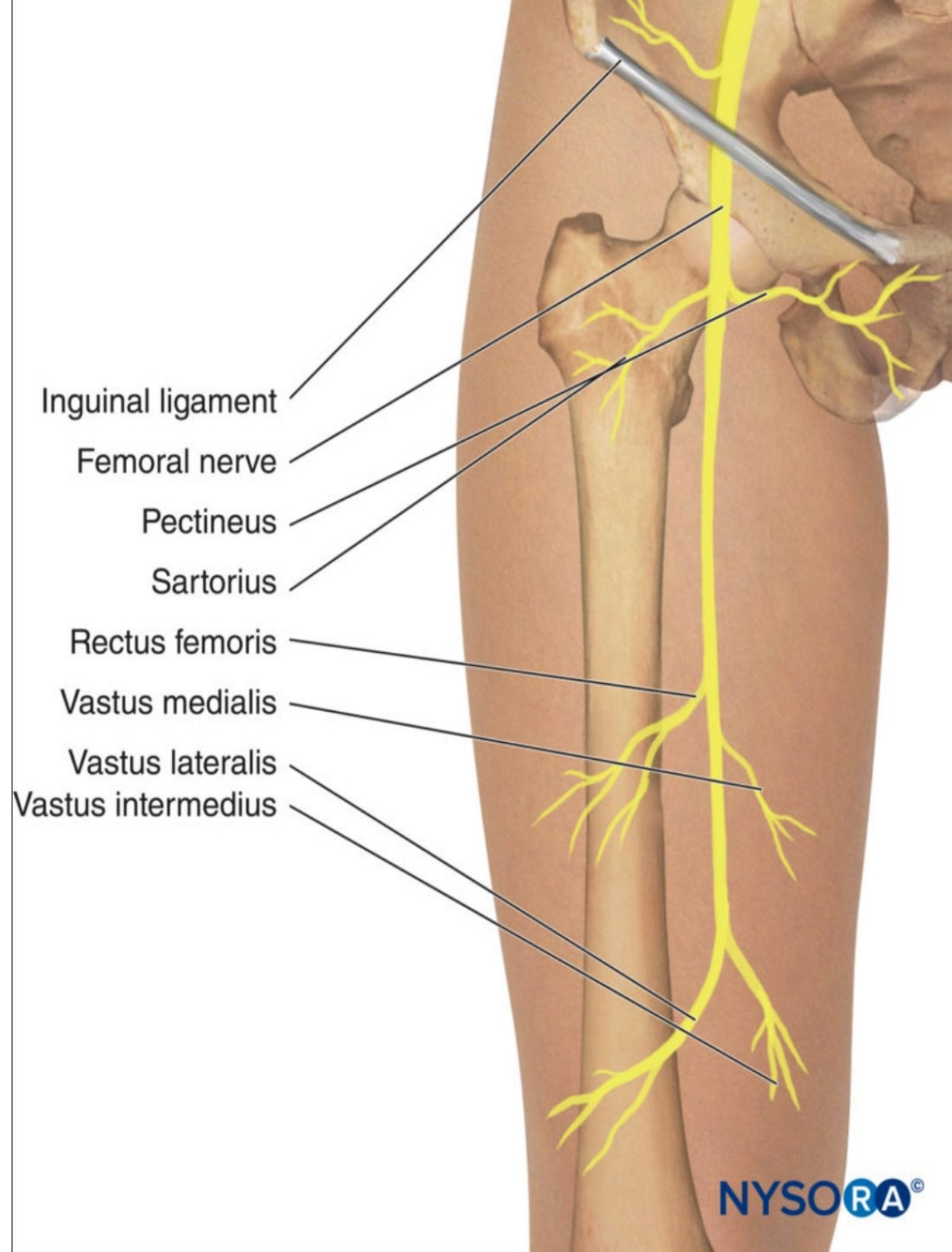
NERVE INJURIES AFFECTING THE LOWER LIMB

Femoral nerve

Sciatic nerve

Peroneal nerves





FEMORAL NERVE (L2-L4)



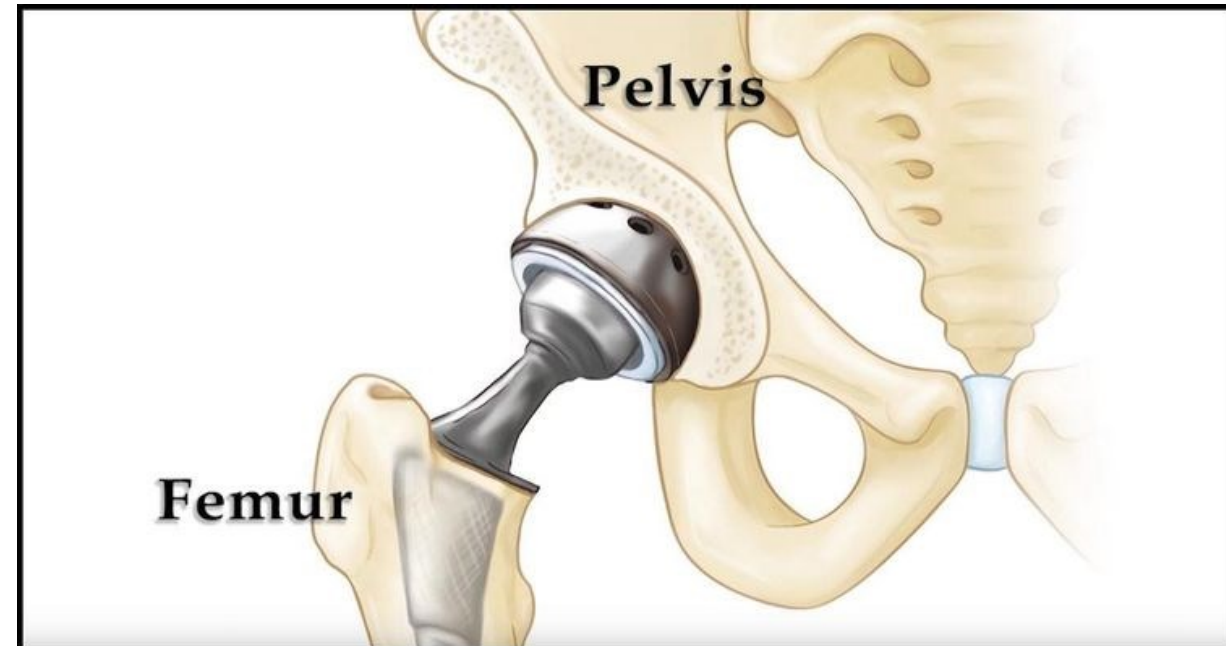
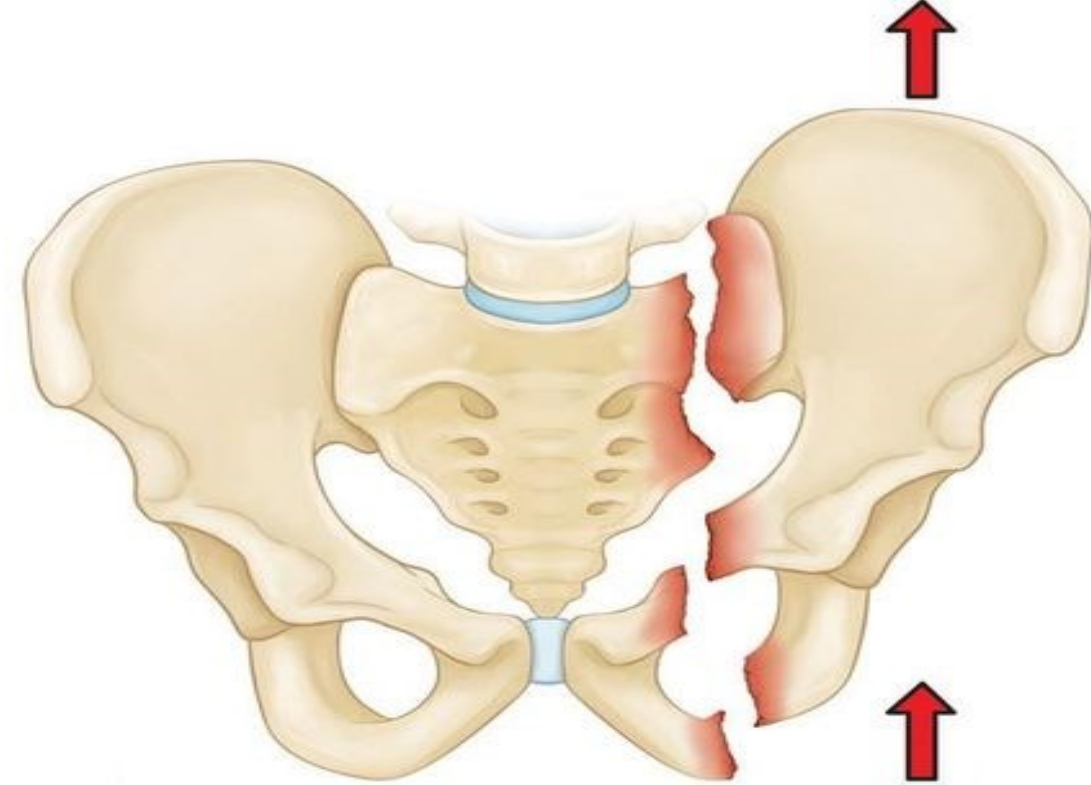
FEMORAL NERVE (L2-L4)

- Common causes :

Direct injury (pelvic fracture , ..)

Iatrogenic (pelvic , abdominal or spinal surgeries)

Prolonged pressure in the nerve



- Clinical features:

- (Motor)**

Quadriceps → weakness in knee extension and decrease patellar tendon reflexes

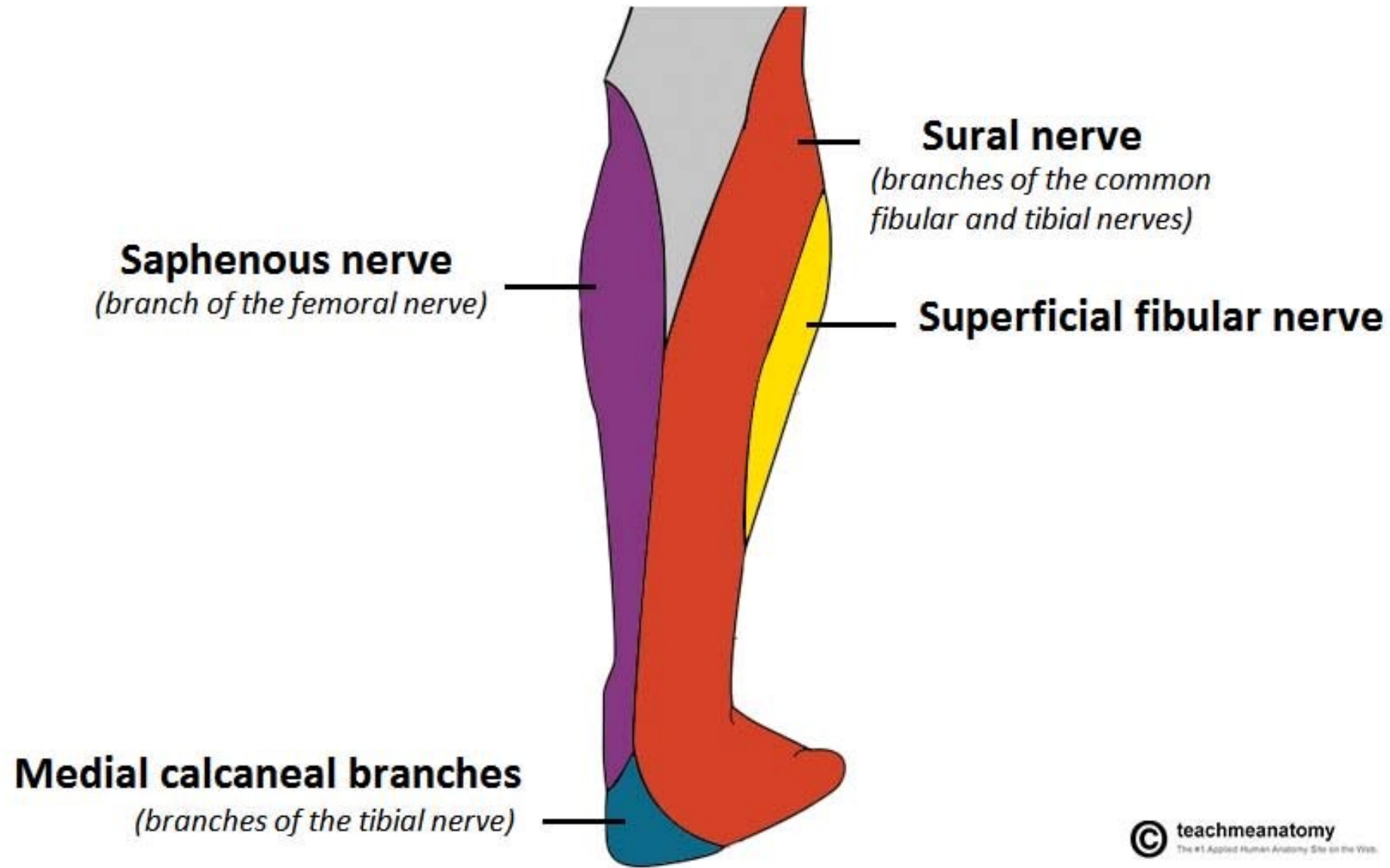
Iliopsoas, pectineus, rectus femoris and sartorius → impaired hip flexion

- (Sensory)**

saphenous → numbness in the medial lower leg, knee and medial edge of the foot

Anterior cutaneous branches → anteromedial thigh





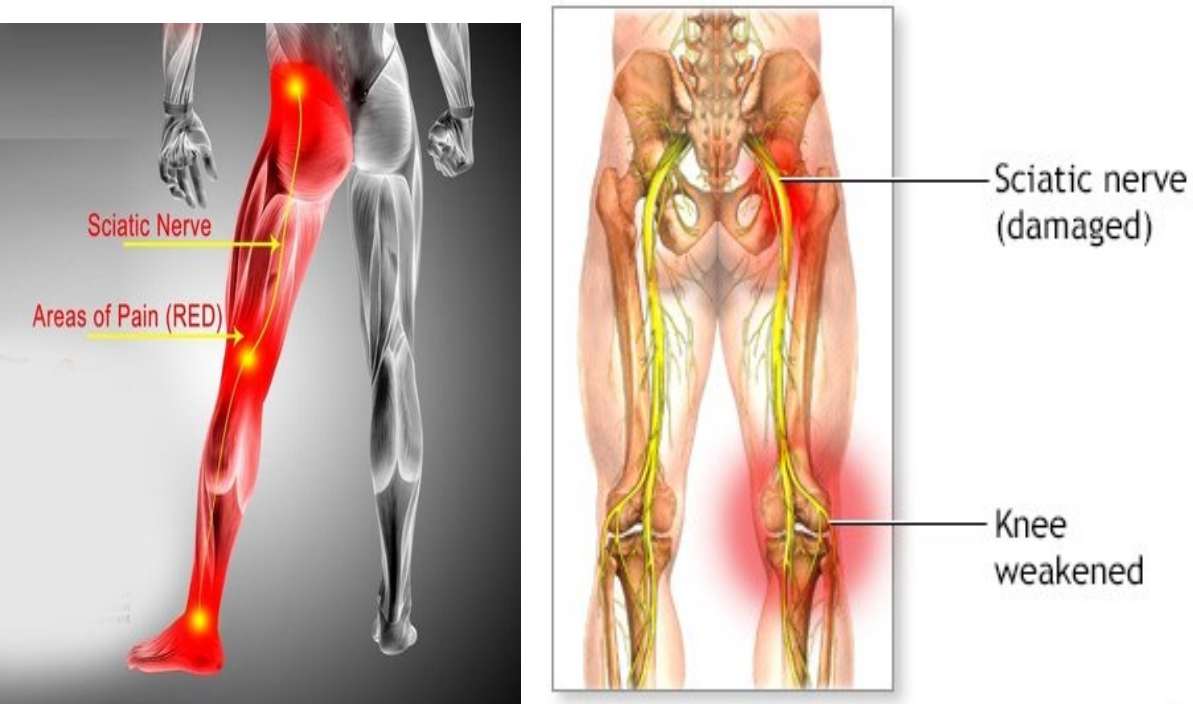
SCIATIC NERVE L4-S3

■ **Common Causes :**

- Posterior hip dislocation
- Complication of hip replacement
- Herniated lumbar disc

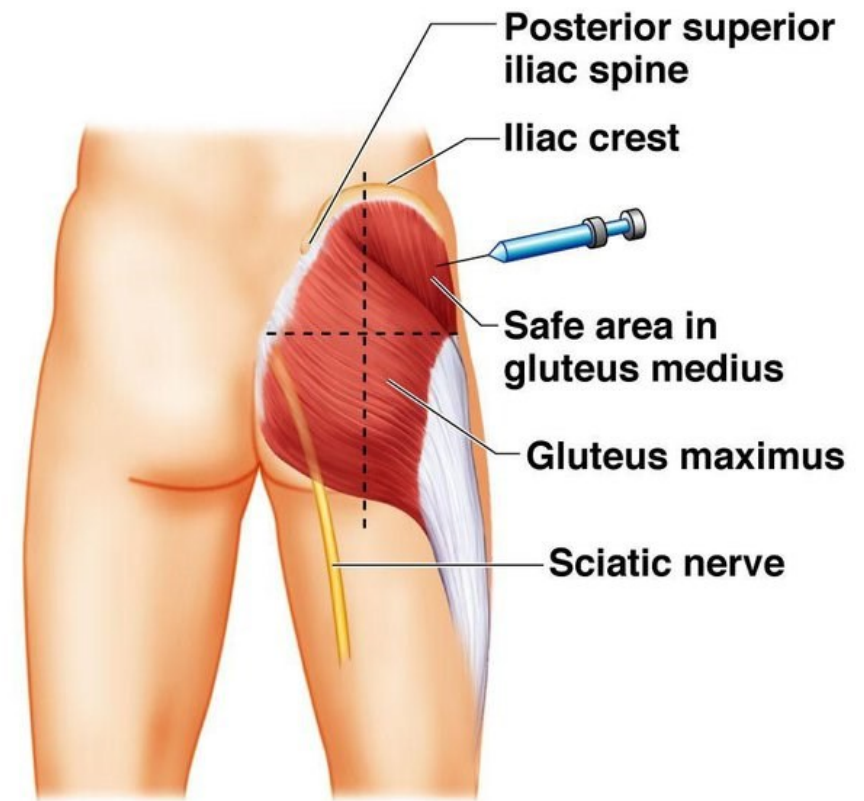
■ **Clinical features :**

- paralysis in Hamstring muscles + adductor magnus → impaired knee flexion and hip extension
- Sciatic nerve splits into tibial + common peroneal nerve → motor deficits in their muscles
- Lower leg and foot numbness and paresthesia





WHAT IS THE IATROGENIC SCIATIC NERVE INJURY ?

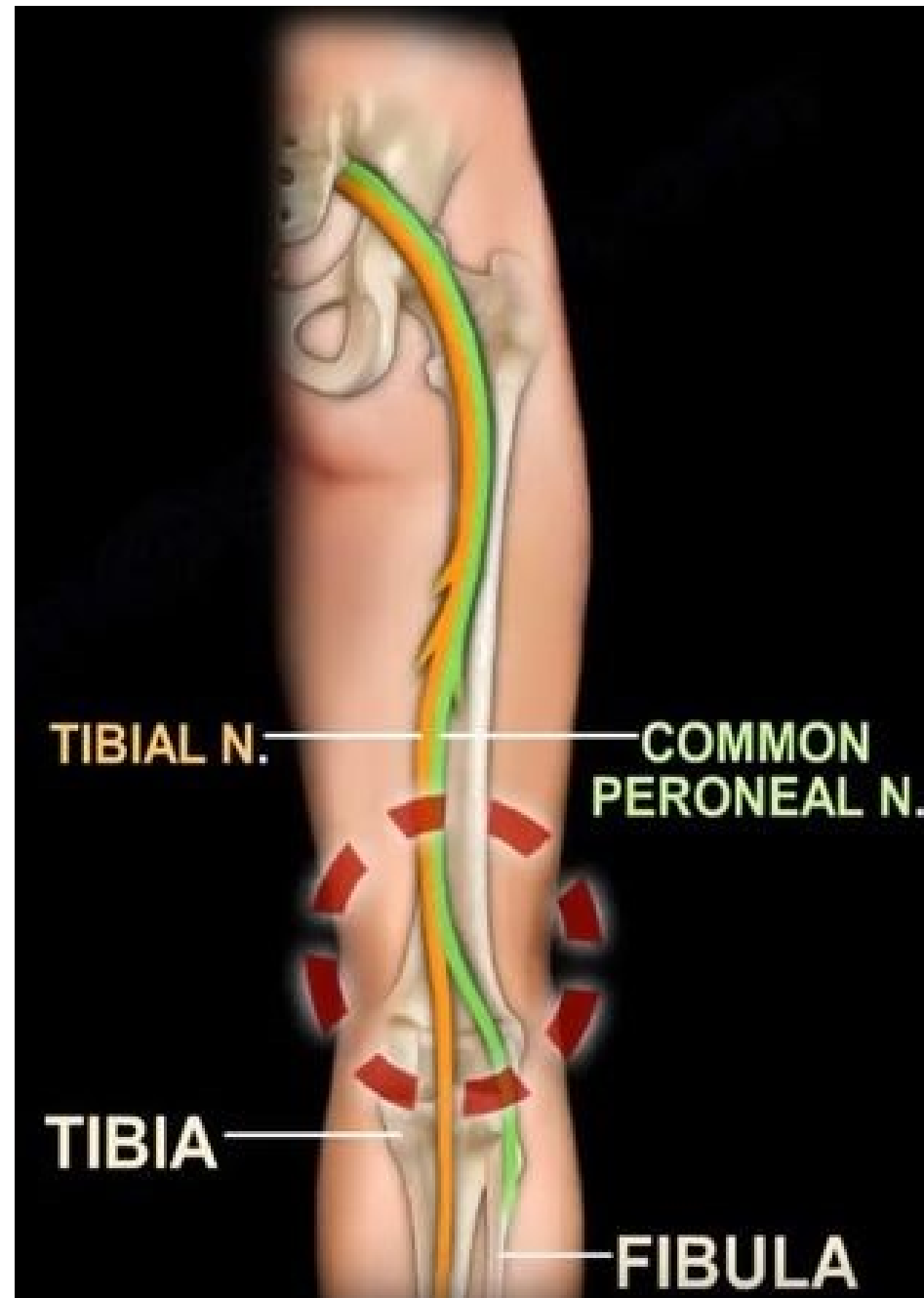


(b)

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- *The sciatic nerve is the most commonly injured nerve because of an IM injection owing to its large size and the buttock being a common injection site*

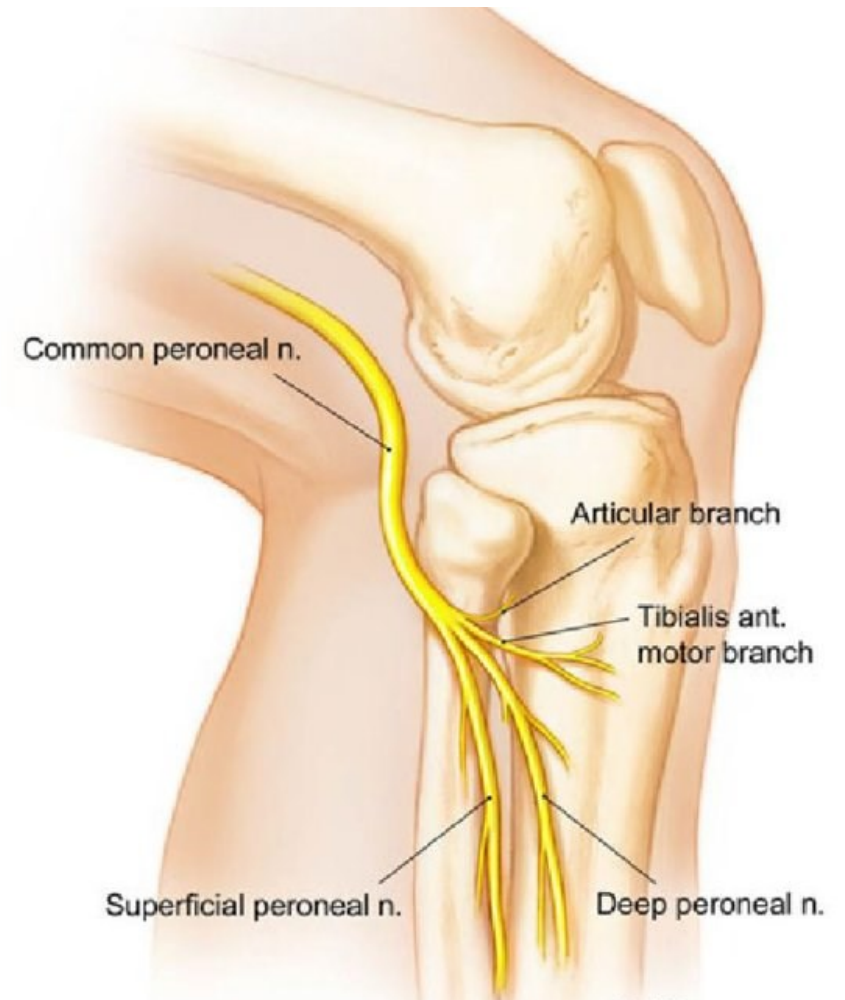
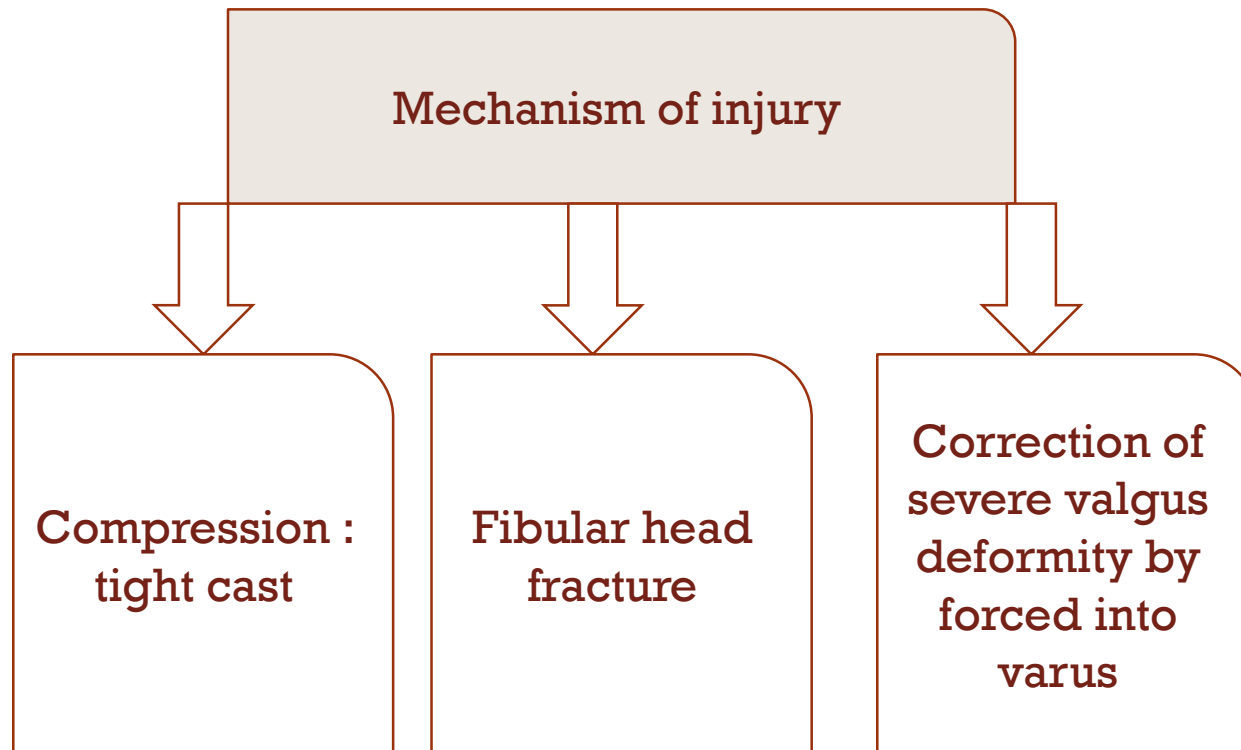


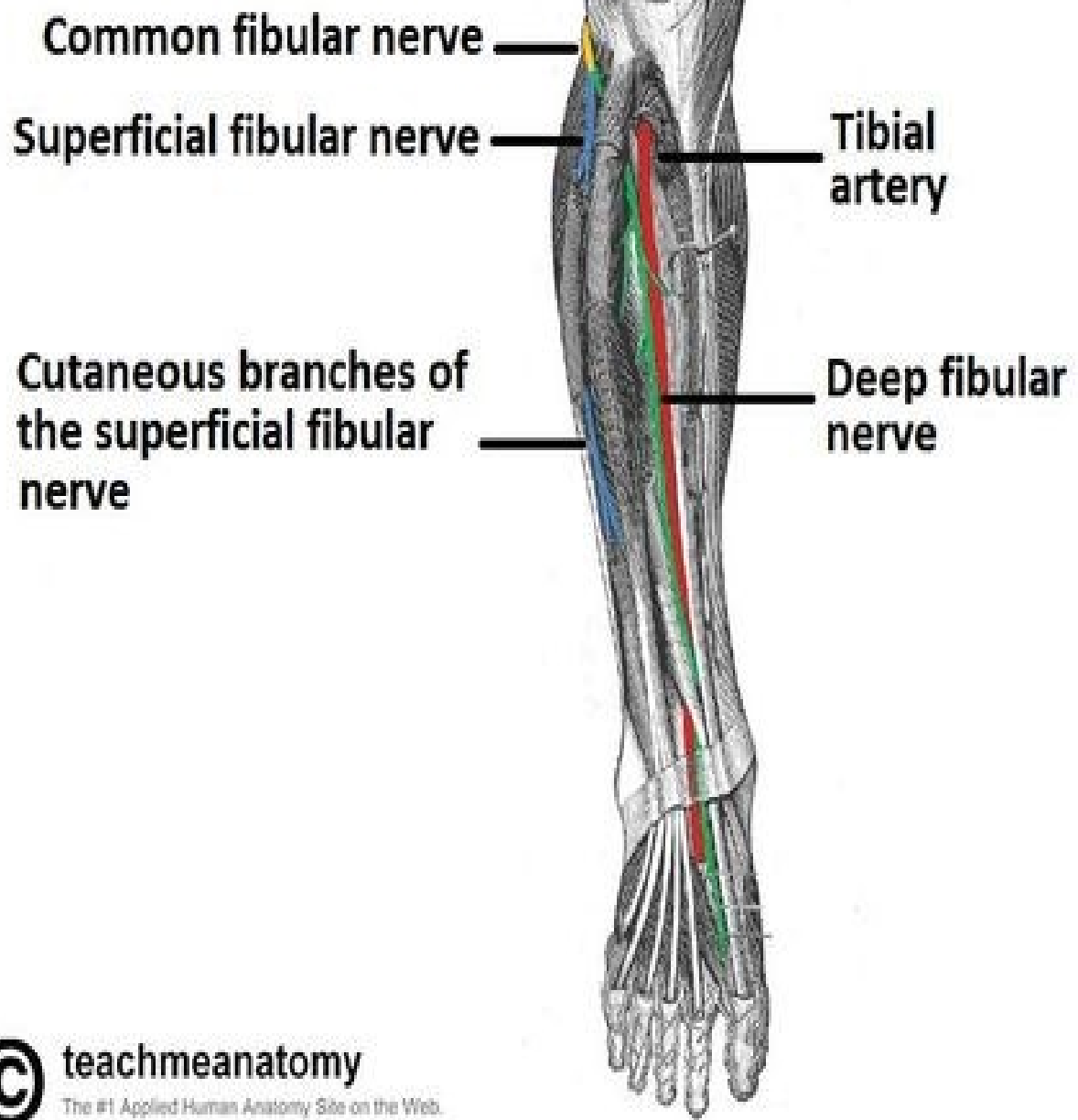


PERONEAL NERVES

Common peroneal nerve injury

Is the most common peripheral nerve injury lesion of the lower extremity





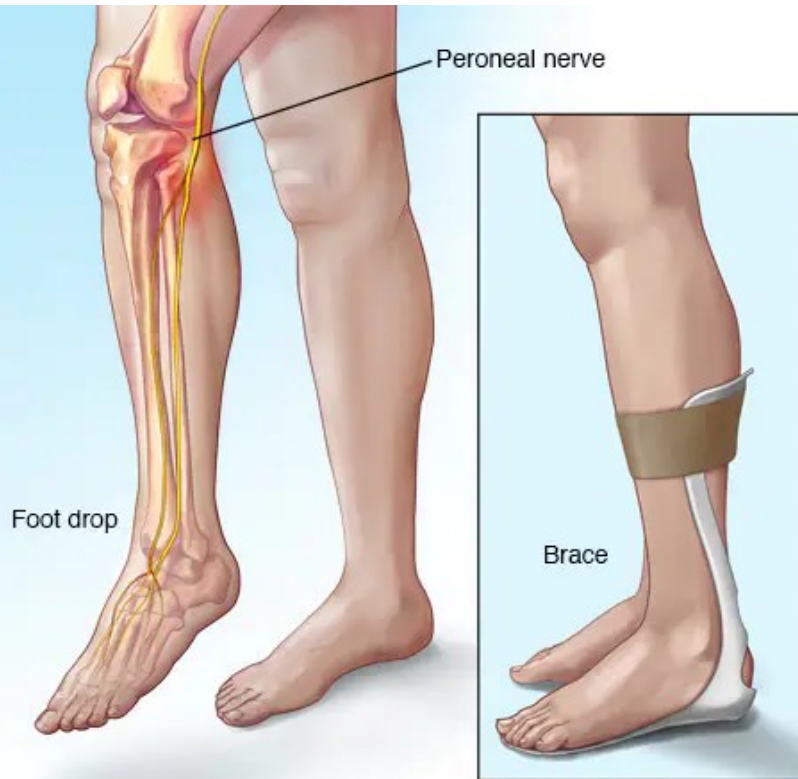
Clinical features:

Superficial peroneal nerve injury: impaired eversion of foot

Deep peroneal nerve injury : paralysis of foot and toe extensors (dorsiflexion)

Leading to :

- Foot drop
- steppage gait

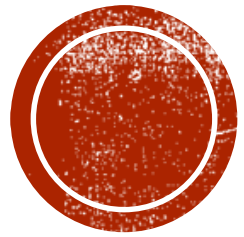


Rem ;

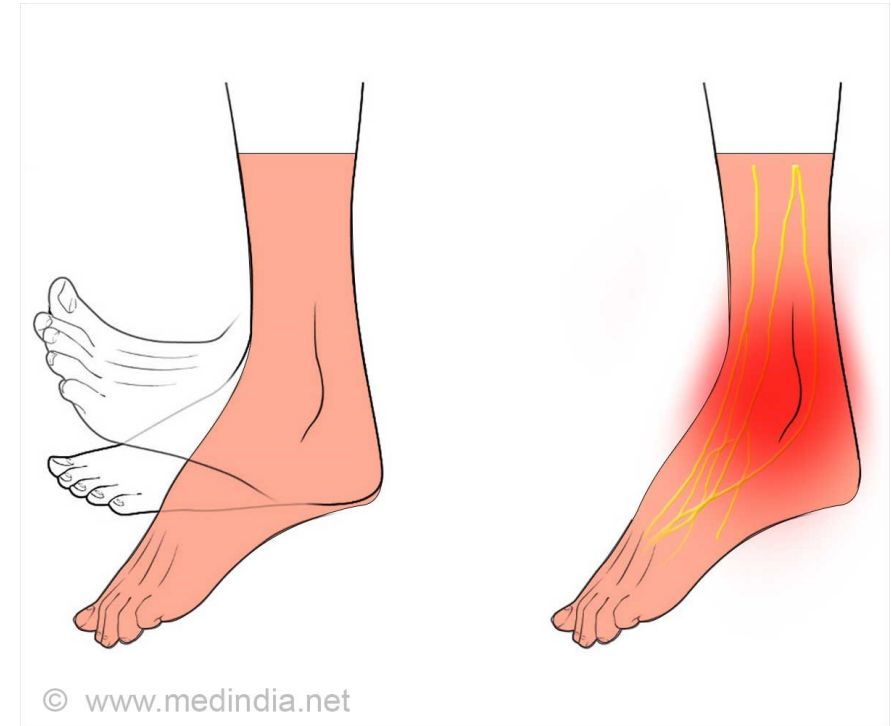
deep peroneal → ankle dorsiflexion + sensory to 1st web space

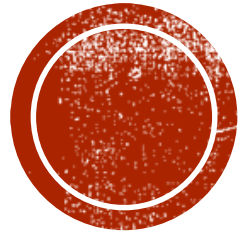
Superficial peroneal → eversion of foot + sensory to the dorsum of foot except the deep peroneal part





PED = **P**eroneal
Everts and
Dorsiflexes, if
injured, foot dro**PED**





NERVE ENTRAPMENT SYNDROMES

Soft tissue compress the tunnel

■ ***Common sites :***

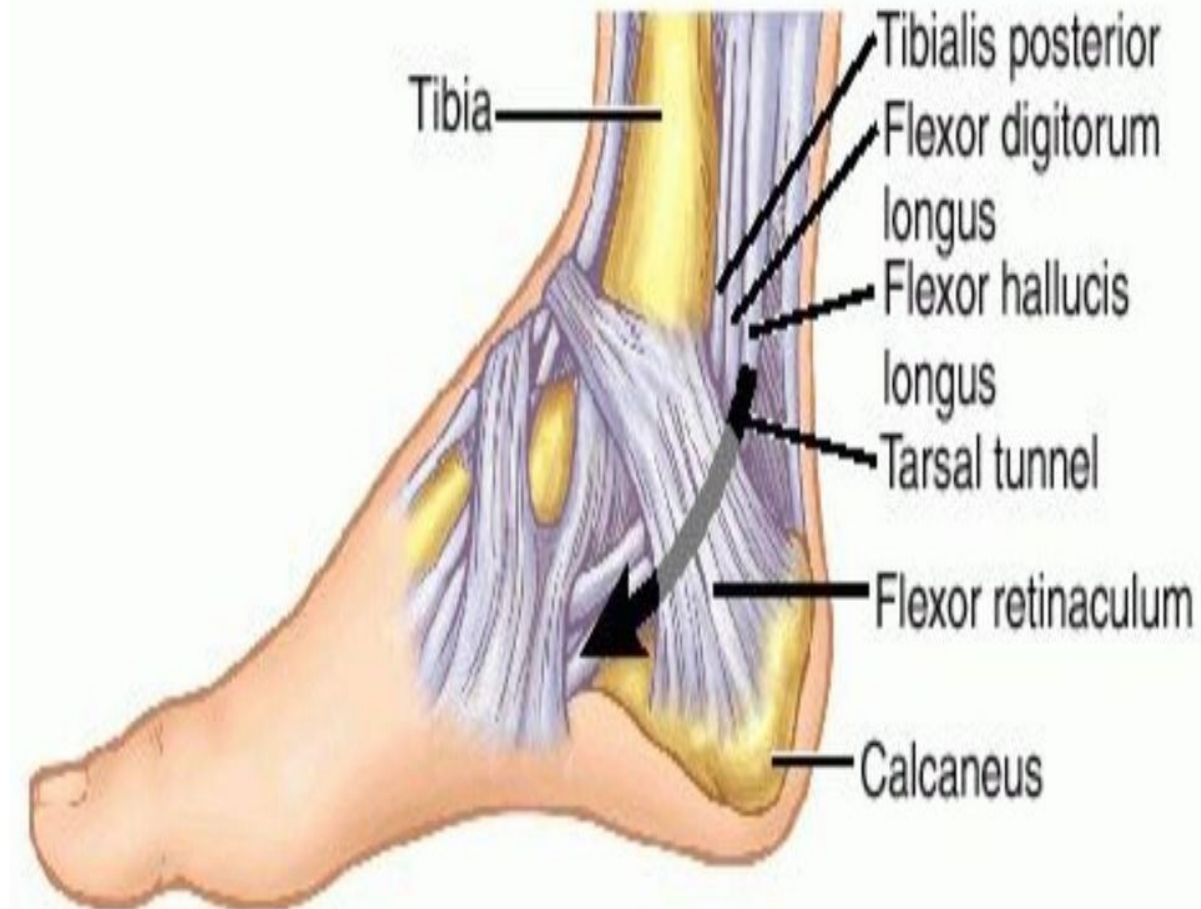
- 1- carpal tunnel
- 2- cubital tunnel
- 3- fascial septa of the forearm
- 4- tarsal tunnel
- 5- thoracic outlet

***Most common sites are the carpal tunnel at the wrist
(median nerve) and the cubital tunnel at the elbow
(ulner nerve)***

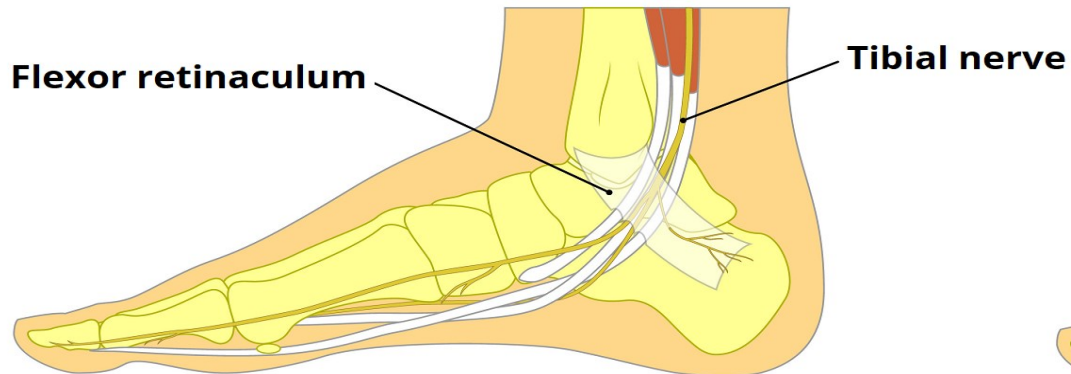


TARSAL TUNNEL

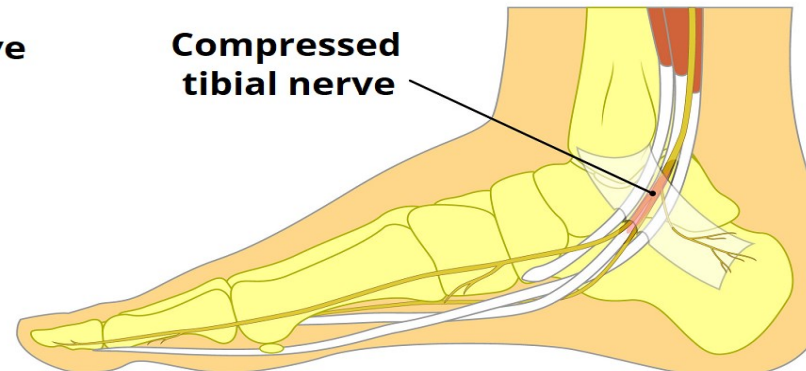
- peripheral neuropathy caused by chronic or acute compression of the tibial nerve by the flexor retinaculum of the foot at the medial ankle.
- Commonly due to trauma



NORMAL FOOT



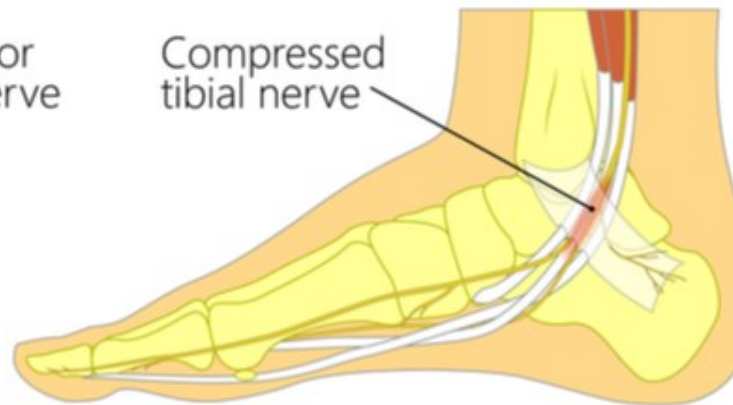
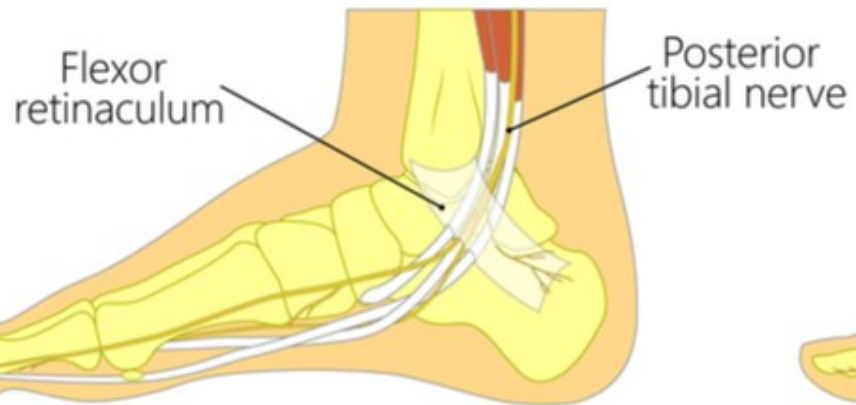
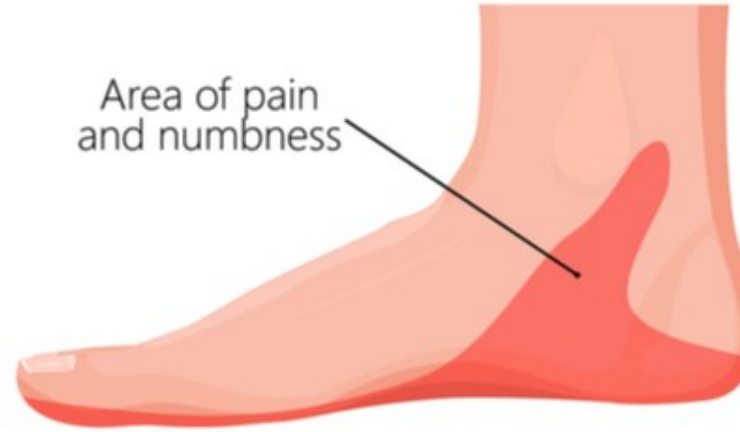
TARSAL TUNNEL SYNDROME



NORMAL FOOT



TARSAL TUNNEL SYNDROME



Clinical features :

1- Neuropathic pain and paresthesia in the heel, sole of the foot, and first three toes .

2- Weakness and atrophy of intrinsic foot muscles (severe cases)

Symptoms worsen with walking, prolonged standing, and at night



CARPAL TUNNEL SYNDROME

- Compression of median nerve beneath transverse carpal ligament

Causes

Thickening of retinaculum

Tumor

ganglion

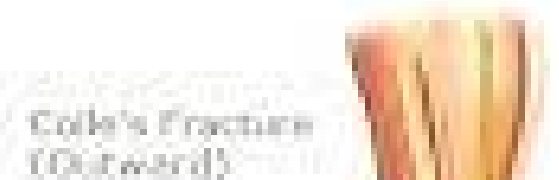
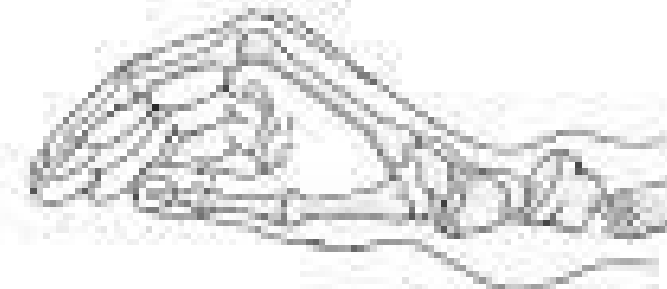
synovitis

Lunate dislocation

Colles fracture

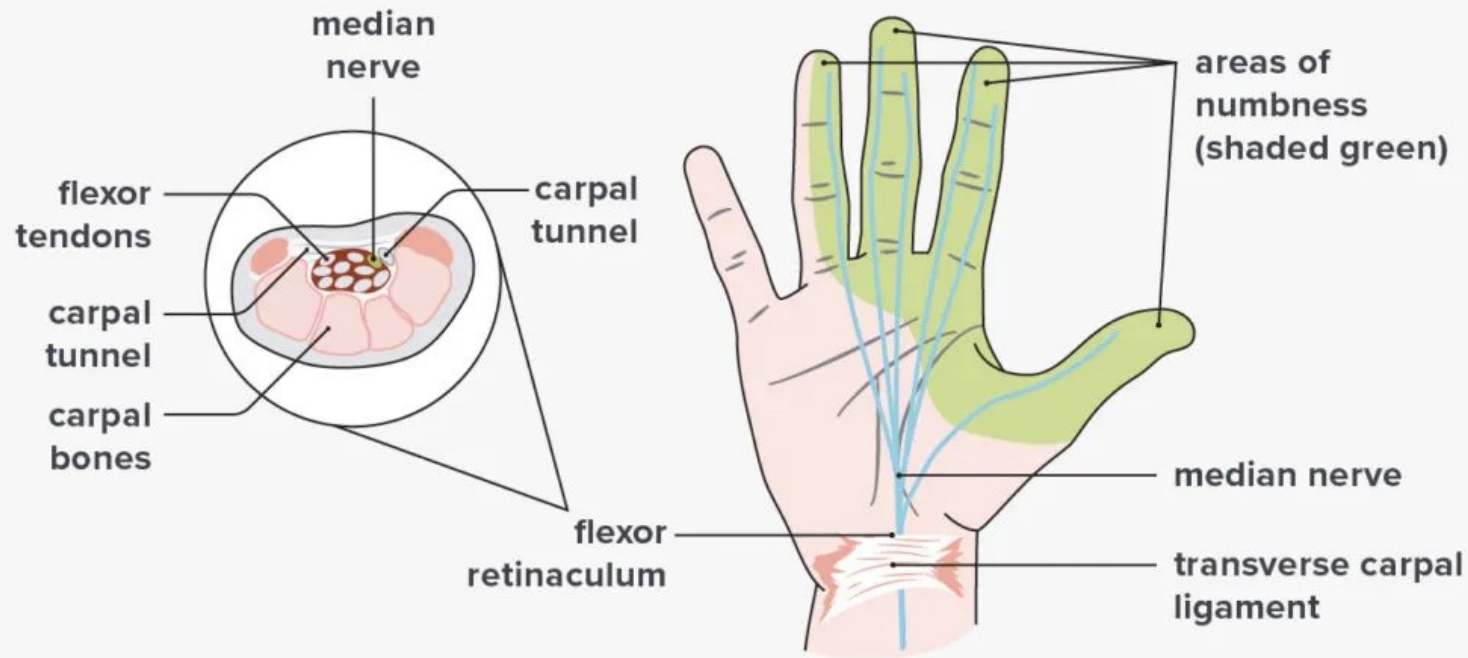


Bender Fork Deformity



■ Clinical features :

CARPAL TUNNEL



MEDICALNEWS TODAY

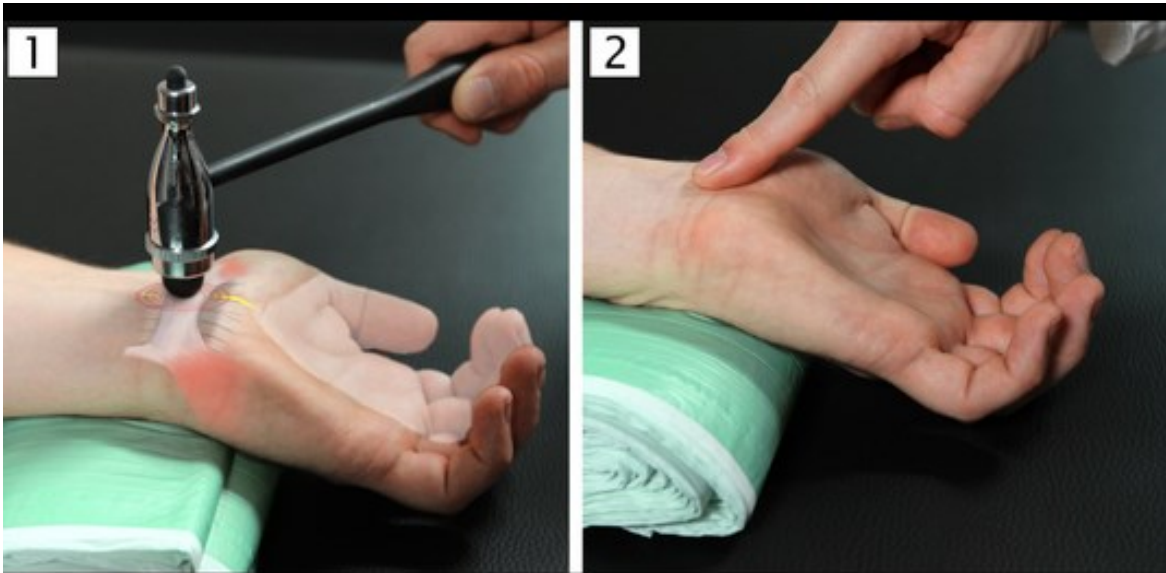
- Symptoms worsen at night
- Paresthesia , loss of sensation , pain
- Weakened pinch and grip (dropping objects)
- Severe, sustained compression lead to thenar atrophy , impaired thumb position



PHYSICAL EXAMINATION

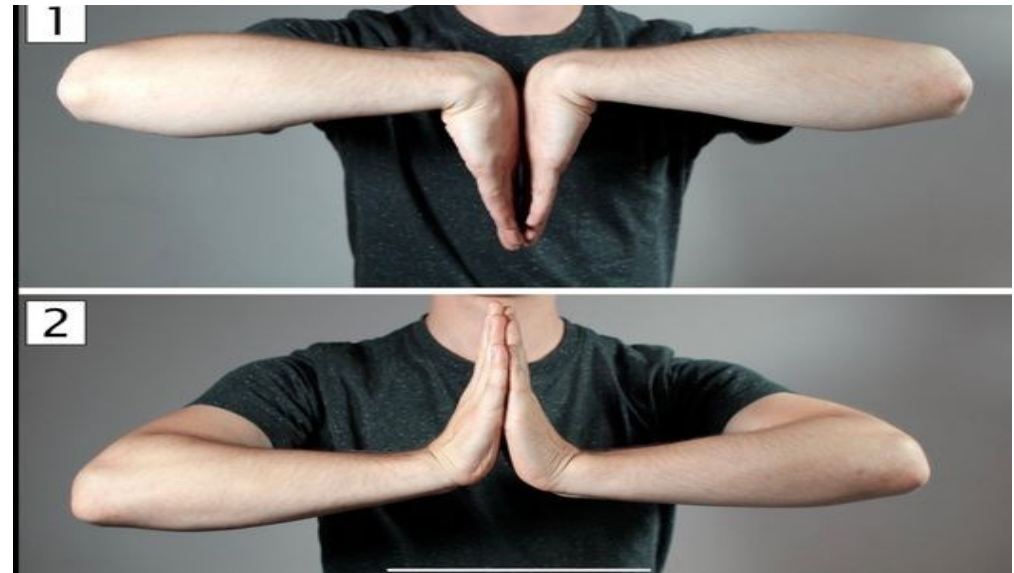
Tinel's sign

Percussion of the superficial thin myelinated sensory nerve leads to paresthesia via direct mechanical irritation



Phalen's test

Highly specific



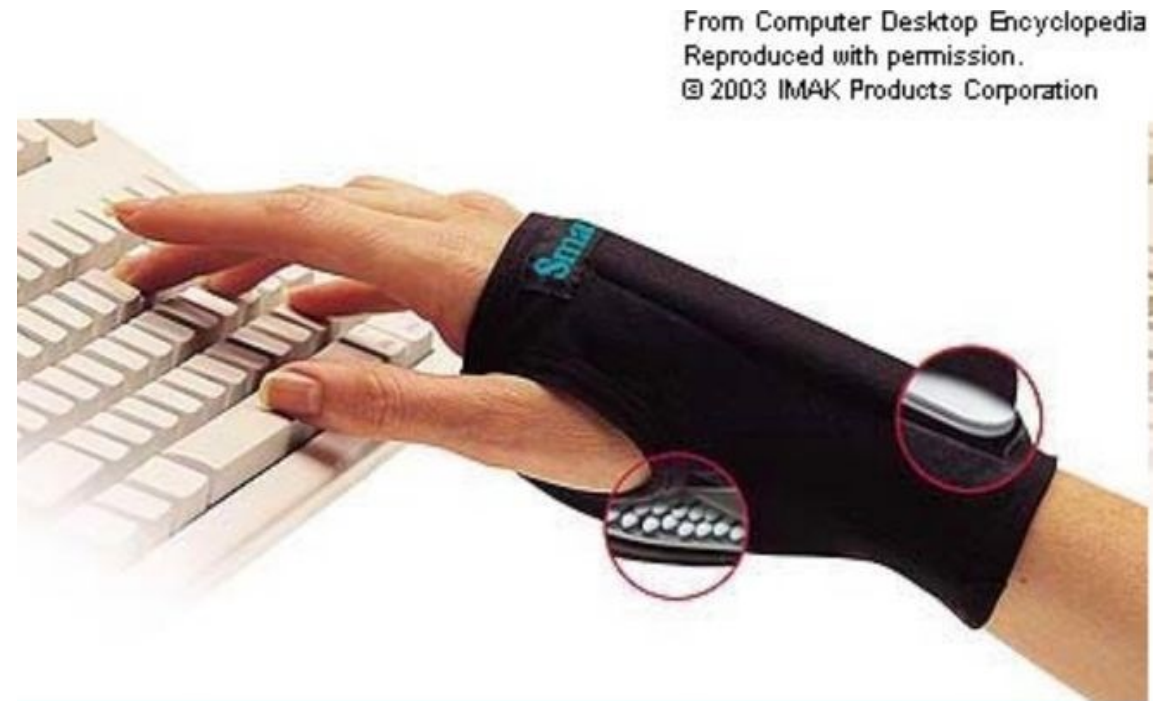
TREATMENT

Depending on the symptoms :

Mild to moderate

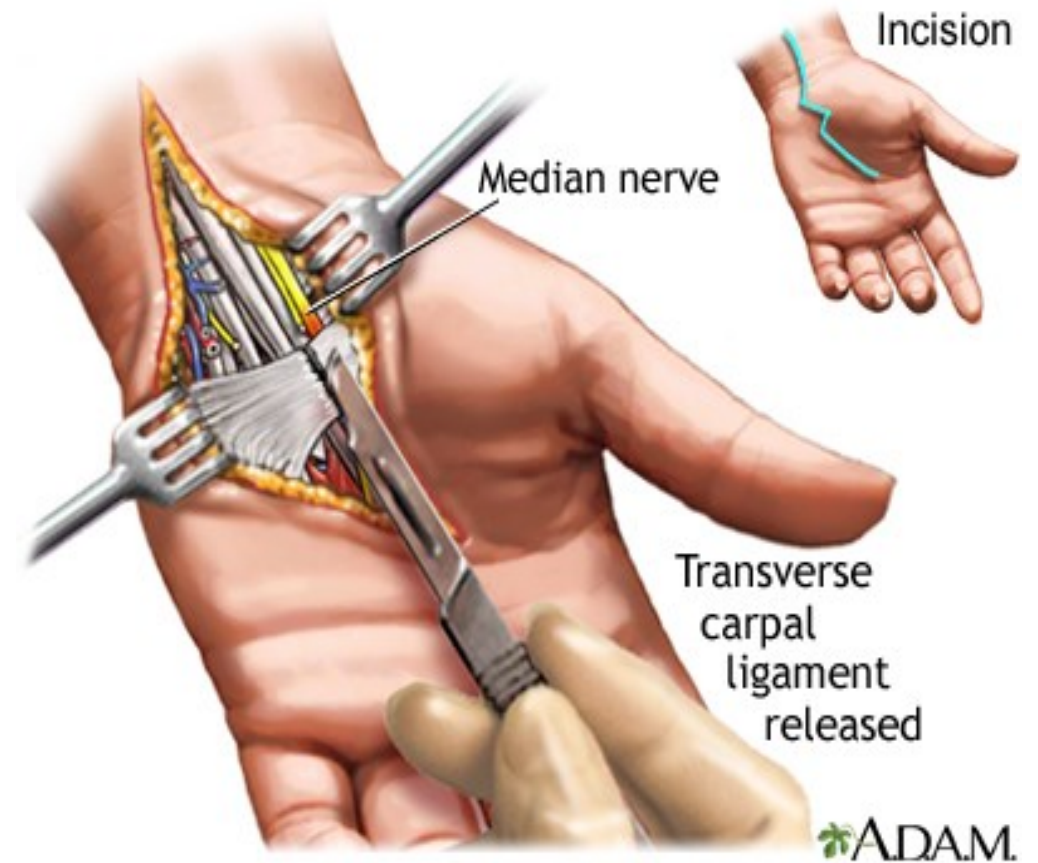
Conservative treatment :

- 1- steroid injection
- 2- padded, volar splint worn during the night



- Moderate to severe or no response to conservative treatment

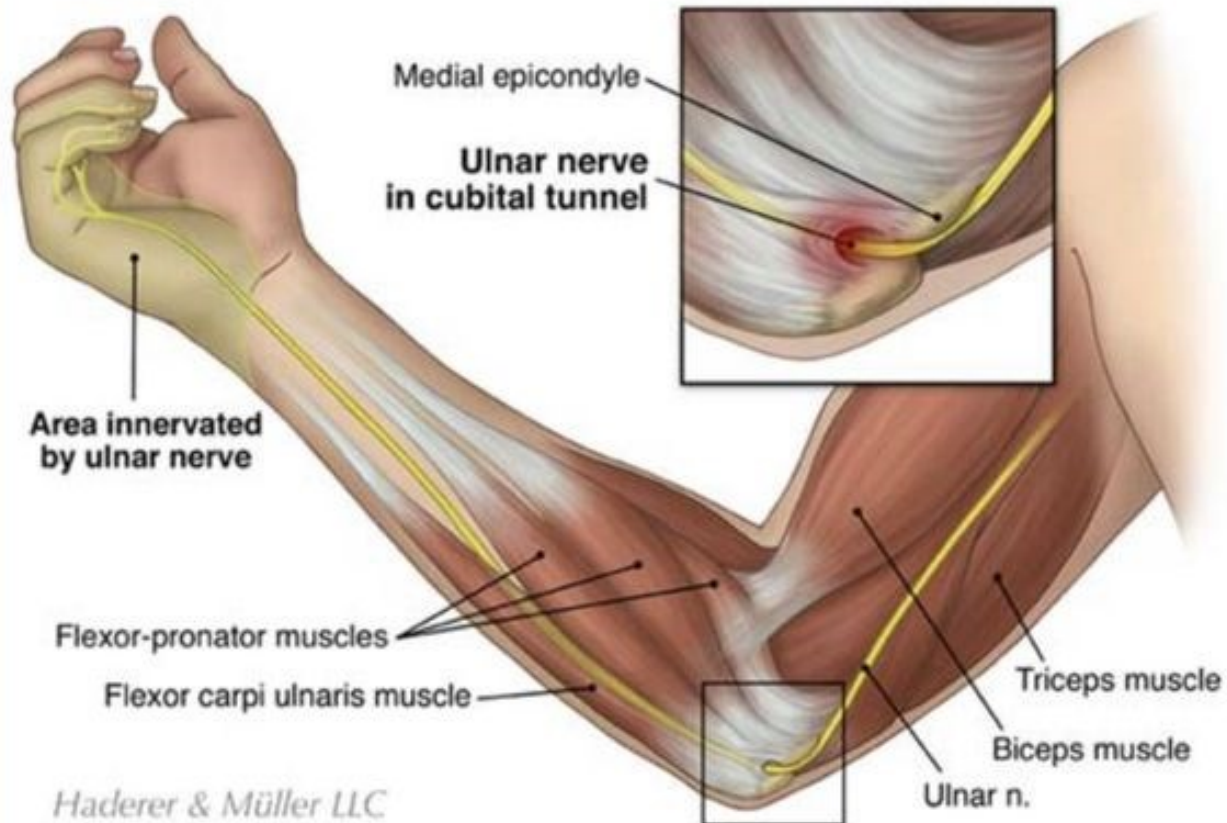
Nerve decompression



- Compression either at the elbow or the wrist

Elbow → cubital tunnel syndrome

Wrist → guyon's canal syndrome or ulnar tunnel syndrome



ULNAR NERVE ENTRAPMENT



■ ***At the elbow :***

- Behind the medial epicondyle
- Commonly in middle-aged men (while carpal tunnel more common in women)
- causes : leaning on the elbow or prolonged elbow flexion , blunt trauma ,...

- ***At the wrist :***

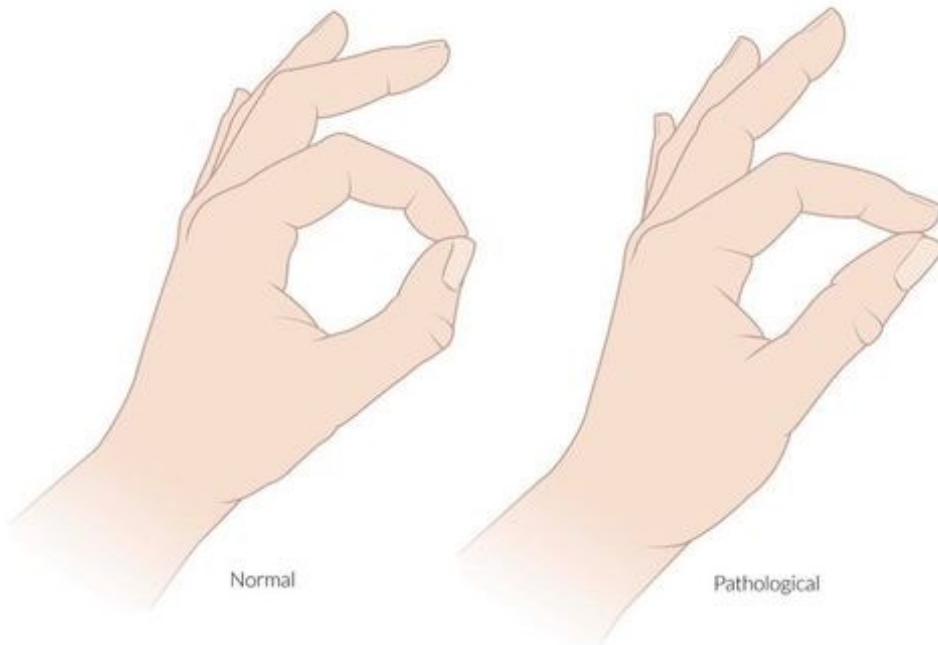
- In front of the wrist just radial to the pisiform
- The cause is usually a ganglion from the underlying joint, but neurological symptoms may also be produced by external pressure



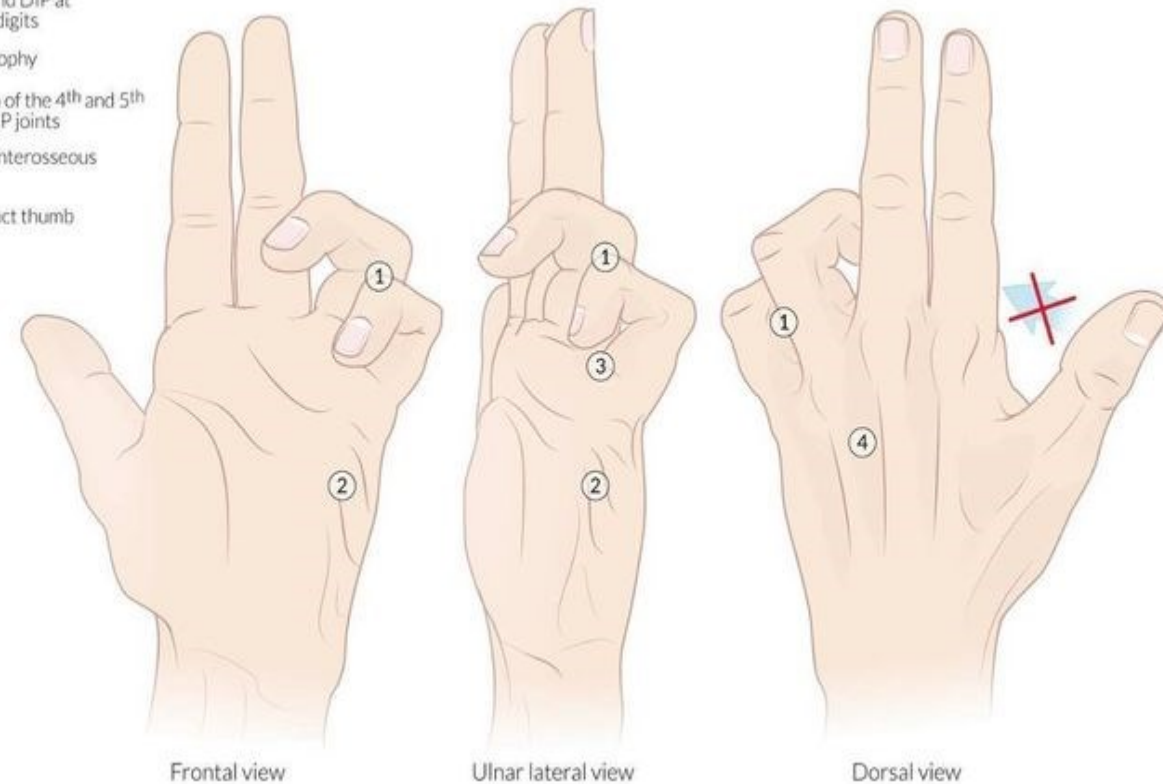
Clinical features (motor)

- 1- atrophy of the hypothenar muscles
→ inability to flex the ring and little fingers when asked to make a fist similar to “ok sign”

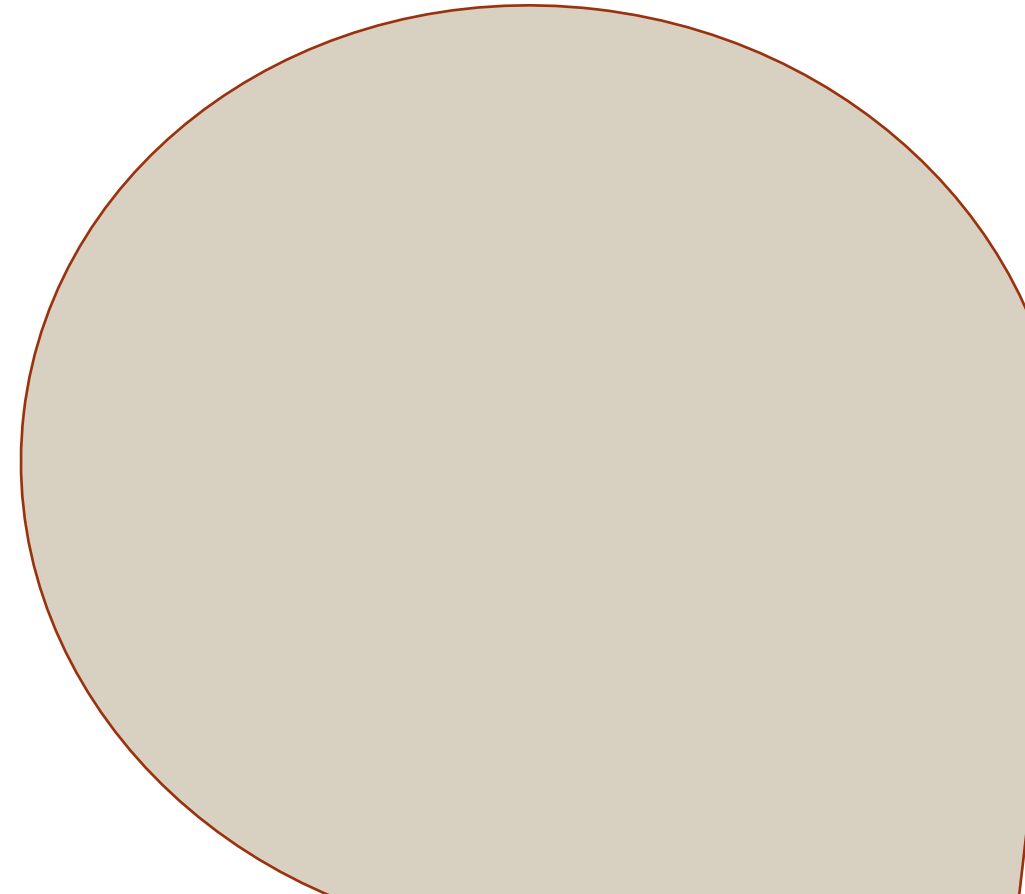
2- claw hand deformity (ulnar claw)



- ① Flexion of PIP and DIP at the 4th and 5th digits
 - ② Hypothenar atrophy
 - ③ Hyperextension of the 4th and 5th digits at the MCP joints
 - ④ Atrophy of the interosseous muscles
- ✗ Inability to adduct thumb



- 3- froment sign : The thumb flexes at the interphalangeal joint while pinching a piece of paper to compensate for a weak adductor pollicis musc



Clinical features (sensory)

■ ***lesions at the elbow:***

- Positive Tinel test: marked paresthesias can be reproduced in the ulnar portion of the hand by tapping on the medial epicondyle of the humerus.
- Elbow lesions typically present with referred pain in the forearm.

■ ***Lesions at the ulnar canal :***

- The ulnar canal is divided into three zones Zones

