L11-Peripheral nerve injuries

Surgery Team
MED 433

MED 433

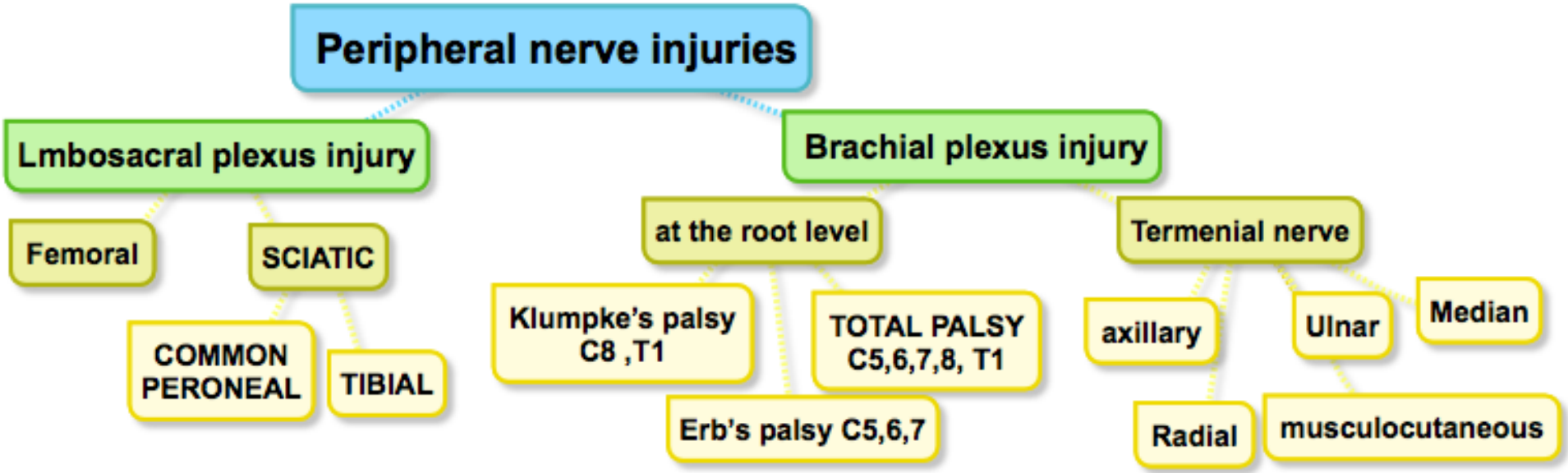
Objectives :

We recommend this website to review the anatomical course of each nerve
http://teachmeanatomy.info/upper-limb/

Color Index: Slides & Raslan's () | Doctor's Notes | Extra Explanation | Additional

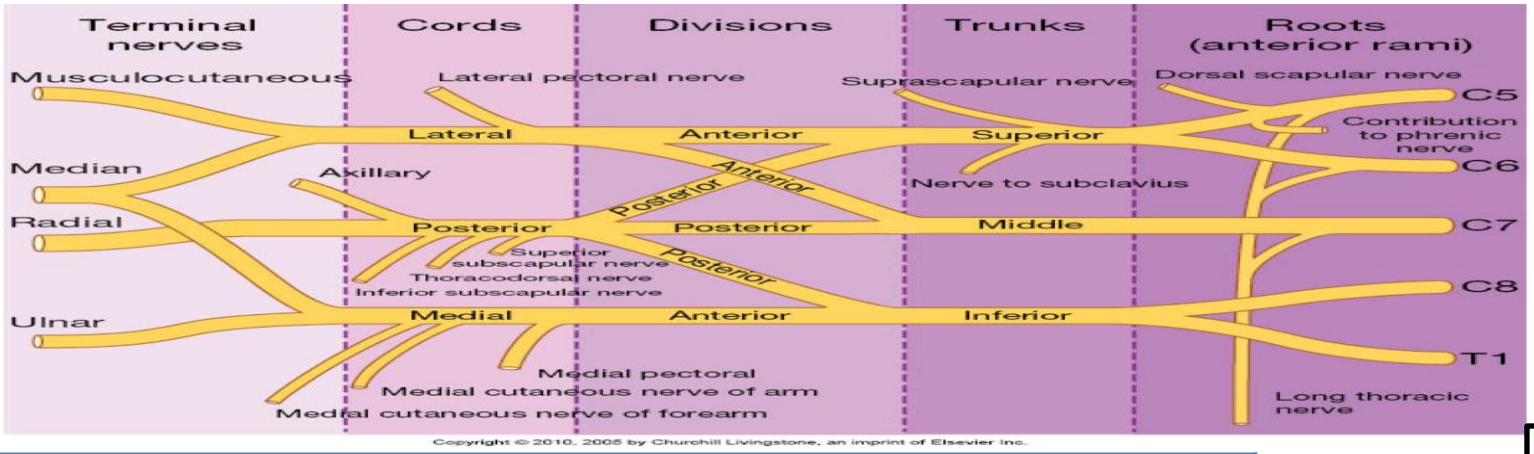
This work is based on doctor's Slides +Notes and Raslan's only (Does not include the book)

Mind Map


Peripheral nerve injuries
Lmbosacral plexus injury
Femoral
SCIATIC
COMMON PERONEAL
TIBIAL
Brachial plexus injury
at the root level
Klumpke's palsy C8 ,T1
TOTAL PALSY C5,6,7,8, T1
Erb's palsy C5,6,7
Termenial nerve
axillary
Radial
Ulnar
Median
musculocutaneous

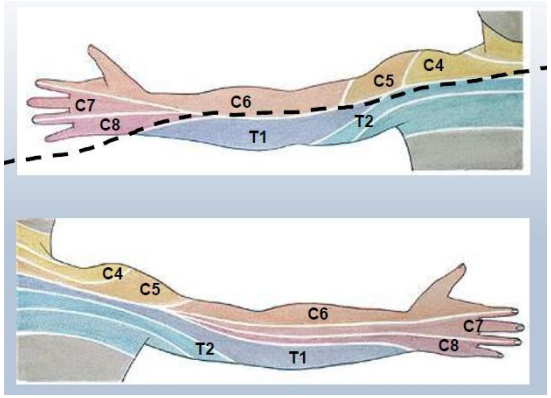
Brachial plexus injury

- It is formed from the union of the anterior rami of the 5th,6th,7th,8th cervical and 1st thoracic nerves (C5, C6, C7,C8,T1)
- The plexus is divided into **R**oots, **T**runks, **D**ivisions, **C**ords and terminal **B**ranches



Examination of the brachial plexus roots:		
Root	**Myotomes (motor function)**	**Dermatomes (sensory function)**
C5	shoulder **abduction and external rotation**	**Shoulder tip + lateral arm**
C6	elbow **flexion**	**Lateral forearm + thumb and index finger**
C7	wrist **extension**	**Middle finger**
C8	making a fist	**Ring and little finger + lower aspect of medial forearm**
T1	hand intrinsics muscles* **(finger crossing)**	**Upper aspect of medial forearm + medial arm**

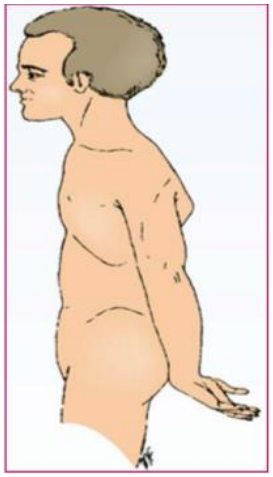
Note:
middle finger by the middle root=C7



*hand intrinsics muscles: ms. That originate and inserted in the hand. Which are Thenar, hypothenar , interosseous and lumbricals ms.
interosseous and lumbricals ms. they act together to flex themetacarpophalangeal joint and extend the interphalangeal joints.
So if U lose both > claw hand (if index finger lose interosseous ms. Alone will not get clawed)

Brachial plexus injury

classification of brachial plexus injuries	
Open injuries	**Closed injuries**
(stab wounds or gunshot wounds): o **Can be at any level (**roots, trunks, divisions, etc.) o Classified into: 1- Supraclavicular (roots, trunks, divisions) 2- Infraclavicular (divisions, cords, terminal branches)	o **More common than open injuries** o Injury is **most commonly at the roots level** o Caused by **car accidents, outstretching of the shoulder like when playing sports or during difficult deliveries where the baby is pulled in emergency situations**



(Figure 1)

waiter's tip posture

Shoulder adduction
And Internal rotation
Extension of the elbow
Wrist flexion

(Figure 2)

Ape hand

(no hand intrinsics muscles leading to clawing of all fingers)

(Figure 3)

Horner syndrome

- **Ptosis (dropping of the upper eyelid)**
- **Miosis (constricted pupil)**
- **Anhydrosis (inability to sweat)**

Brachial plexus injury

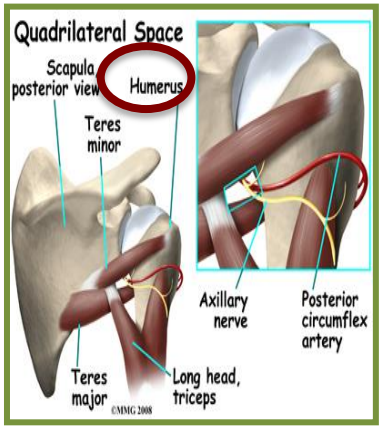
Median injury > NO claw
Ulnar injury > Ulnar claw
Both or Klumpke's palsy > Ape Hand

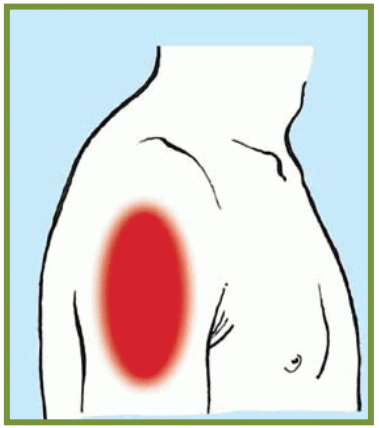
Types Of Closed Brachial Plexus Injuries

	Upper Brachial Plexus Lesion Erb's palsy (Erb-Duchenne Palsy)	Lower Brachial Plexus Lesion Klumpke's palsy	Total Palsy
Injured nerve	C5,6,7	C8 and T1	C5, C6, C7, C8, T1
Motor exam	• C5: loses the ability to abduct the shoulder and external rotation ➔ Shoulder adduction And Internal rotation • C6: loses the ability to flex elbow ➔ Extension of the elbow • C7: loses the ability to extend the wrist ➔ Wrist flexion	o C8: loses the ability to make a fist o T1: loses the ability to cross fingers ➔ The patient will have simian hand and clawing of all fingers	Patient is unable to move entire limb: flail limb and both phrenic and sympathetic symptoms
Sensory exam	Loss of sensation over C5: Shoulder tip + lateral arm C6: lateral forearm, thumb, index C7: middle finger	Loss of sensation over C8:Ring and little finger + lower aspect of medial forearm T1:Upper aspect of medial forearm + medial arm	
Specific sign	waiter's tip posture (Figure 1 in the previous slide)	Ape hand (Figure 2) (no hand intrinsics ms.) leading to clawing of all fingers)	
Associated injuries	o Injury to the phrenic nerve which arises from the 3rd, 4th, and 5th cervical roots, so half of the diaphragm will be paralyzed (C three, four and five >keep the diaphragm a live) o In adults X-ray will show elevated hemi diaphragm o In children the intercostals are not strong enough to compensate so the baby will have breathing problems (obstetric palsy)	o Sympathetic nerves to the face come from a branch of the first thoracic nerve T1 o If T1 is injured then sympathetic to the face are lost on ipsilateral side ➔ Horner syndrome, (Figure 3) which is: • Ptosis (dropping of the upper eyelid) • Miosis (constricted pupil) • Anhydrosis (inability to sweat)	

Isolated peripheral nerve injury

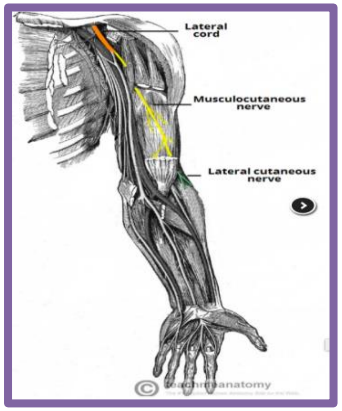
1- Isolated axillary nerve injury	
Course	It passes inferiorly and laterally along the posterior wall of the axilla.Then, it passes posteriorly (through a quadrangular space) and passes **around the surgical neck of the humerus**. ➔ **Supplies the Deltoid (shoulder abduction)&** ➔ **Teres minor muscle (external rotation)**
Causes	**shoulder dislocation /surgery/trauma**
Motor exam	loss of Deltoid ➔**Limitation of shoulder abduction**. (The patient can still initiate abduction (action of supraspinatus) Teres minor and infraspinatus have the same action so the patient can still externally rotate his arm
Sensory	**Loss of sensation over the skin of the lateral arm on lower half of the deltoid**

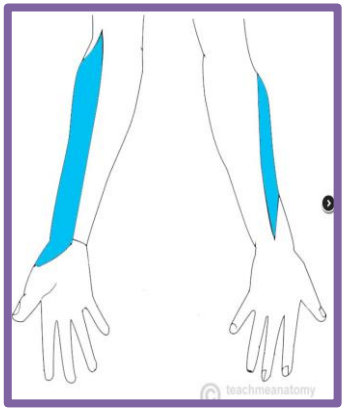




Isolated peripheral nerve injury

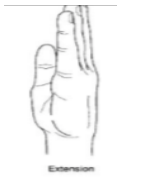
2- Isolated musculocutaneous nerve injury	
Course	the musculocutaneous nerve leaves the axilla, and pierces the coracobrachialis muscle, It then passes down the arm, anterior to the brachialis muscle but deep to the biceps brachii, innervating them both.It nerve emerges laterally to the biceps tendon, and **continues into the forearm as the lateral cutaneous nerve. It provides sensory innervation to the lateral aspect of the forearm***
Causes	usually stab wounds near the axilla
Motor exam	• Corachobrachilis and brachalis are not important clinically • **Biceps:** **Weak supination (because the supinator muscle can compensate)** **Loss of elbow flexion**
Sensory	**Loss of sensation over the lateral forearm and the thumb**

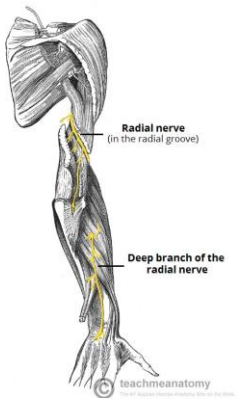




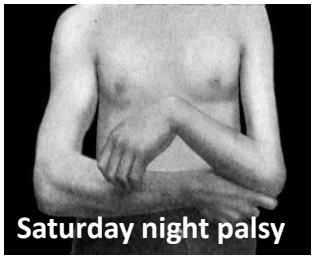
Isolated peripheral nerve injury

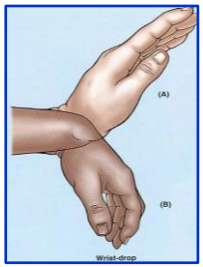
RADIAL NERVE (radial N. supplies the extensors of the arm)	
Course	The nerve arises in the axilla, it supplies the **triceps** in the upper arm**(strong extensor of the elbow)**, Then goes in the spiral groove of the humerus, Then supplies the **wrist extensors at the elbow level**.(Brachioradialis ,**Extensor Carpi radialis longus – wrist extension)** Within the forearm, the nerve terminates by dividing into two branches: 1)**superficial radial nerve**: **pure sensory, sensation over the three and a half fingers laterally on the dorsal side.** 2)**posterior interosseous nerve: pure motor** which supplies **thumb extension and finger extension at the metacarpophalengeal joints.**

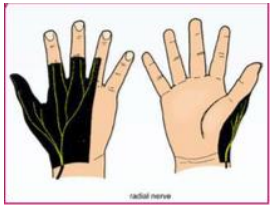




Radial nerve injuries (it's important to know the lesion at whish level)			
	Saturday night palsy		Isolated posterior interosseous nerve injury
Cause	**drunk falling asleep on the edge of a chair compresses the radial nerve in the axilla**	**Fracture humerus at the spiral groove**	**Stab wound in the forearm**
Motor exam	**loss of EXTENSION at the: elbow , wrist, thumb, and fingers (drop wrist)**	**Normal elbow extension (triceps is supplied higher, spared) but a DROP WRIST (no wrist extension)and no thumb/finger extension**	**Normal elbow and wrist extension. but can not extend the thumb or fingers (NO WRIST DROP)***
Sensory exam	**sensation over the three and a half fingers laterally on the dorsal side.**		**NO SENSORY LOSS** (pure motor nerve)





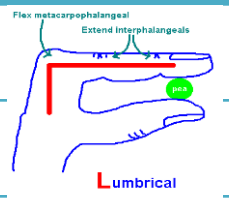


***The nerve that supply the supinator and the extensor carpi radialis longus will be undamaged, and because the latter muscle is powerful, it will keep the wrist joint extended**

Isolated peripheral nerve injury

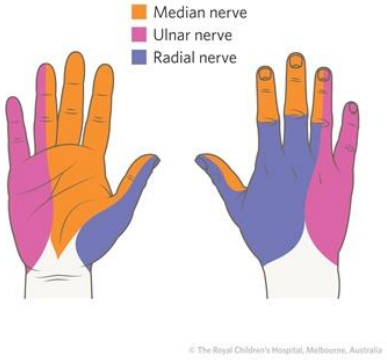
Forearm:	Nerve supply
A) 5 superficial muscles: o Pronator teres → pronation of the forearm o Flexor carpi radialis → wrist flexion o Palmaris longus → wrist flexion o Flexor carpi ulnaris → wrist flexion o Flexor digitorum superficialis → flexion of the proximal Intraphalengeal joints (PIP) so flexes the middle phalynx	**The median nerve has 2 branches** **1) Superficial which supplies all the superficial group muscles EXCEPT** **Flexor carpi ulnaris (supplied by ulnar nerve)**
B) 3 deep muscles: o Flexor digitorum profundus o Flexor pollicis longus o Pronotor quadrates	**2) Deep (anterior interossous nerve) which supplies the deep 2 and a half muscles (PURE MOTOR) EXCEPT Half of flexor digitorum profundus to the little and ring finger (supplied by ulnar n.)**

Hand Intrinsics Muscles	Nerve supply
• **Hypothenar**:little finger abduction, opposition • **Thenar:** opposition of thumb + adduction of the thumb (adductor pollicis) • **Interossie**: abduction and adduction of the fingers(except for little finger abduction) + **MP flexion + IP extension** • **Lumbricals**:**MP flexion+IP extension(anti-claw)**	**The hand has 20 muscles** o 15 supplied by the ulnar nerve (3 hypothenar + 8 interossei (dorsal and palmar) + 2 lumbricals + adductor pollicis + Palmaris brevis) 5 by the median nerve (3 thenar + 2 lumbricals (1st and 2nd) **All the actions are from the ulnar nerve** **Except one and half are from the median nerve**: o Opposition of the thumb o Index and middle radial lumbricals

Finger muscles		Come here sign
metacarpophalengeal (MP) joints	o **Extension** is by the **radial nerve** o **Flexion** is by the **ulnar nerve by the interossie and lumbrical**	
Intraphalengeal joints (IP)	o **Extension** is by **the ulnar nerve by the interossie and lumbrical muscles** o **Flexion** by the **long flexors of the forearm**	

Isolated peripheral nerve injury

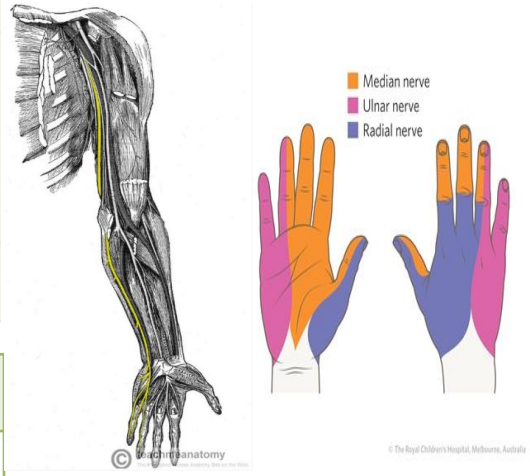
Median Nerve	
Motor supply	**Forearm:** o Superficial flexors **except flexor carpi ulnaris** o Deep flexors **except half of flexor digitorum profundus to little and ring finger** **Hand:** o Thenar muscles o Index and middle lumbricals
Sensory	lateral 3 and a half fingers on the palmer side



median nerve injuries		
	Anterior interosseous nerve injury	**Injury of median nerve**
Cause	**At the elbow region:** **Supracodylar fracture of the humerus.**	**At the wrist level:** **laceration, carpal tunnel syndrome, suicide**
Motor exam	Affects the deep 2 and half muscles: • Half of Flexor digitorum profundus of the index • Flexor pollicis longus of the Thumb • Pronotor quadrates (pronation is not lost because of pronator teres)	**only loss of thumb opposition.** The loss of radial 2 lumbricals does not cause clawing because the interosseous muscles are intact
Sensory	**NO SENSORY LOSS**	lateral 3 and a half fingers on the palmer side
Specific sign	**can not make a perfect "O"= the "O" sign** the thumb, index and middle fingers because he can't flex the tips of the index and middle finger (DIP joint: this is the action of the flexor digitorum profundus ms. Of Index) 	**No specific sign**

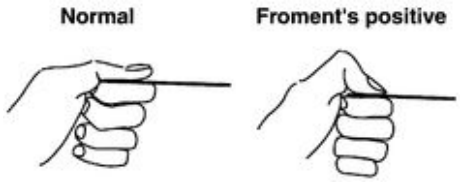
Isolated peripheral nerve injury

Ulnar Nerve	
Motor	FOREARM: o Flexor carpi ulnaris o Medial half of flexor digitorum profundus HAND: o Lumbricals + interossie + hypothenar + adductor pollicis
Sensory	medial 1 and a half fingers front and back of the hand



Ulnar Nerve Injuries		
Level	At the elbow level	At the wrist
Motor Exam	loss of flexor carpi ulnaris and half of flexor digitorum profundus all of the hand muscles • cannot oppose the little finger • atrophy of hypothenar muscles • Cannot adduct or abduct the fingers Ends up with ulnar claw hand*	All hand muscles: • Hypothenar atrophy • No opposition of the little finger • Cannot adduct or abduct the fingers • Loss of thumb adduction resulting in froment's sign**
Sensory	Loss medial 1 and a half fingers front and back of the hand	

ulnar claw hand



**Froment's sign: you ask the patient to hold a pen with his thumb but he cannot so he contracts the flexor pollicis longus because the adductor pollicis is lost

Median And Ulnar Nerve Injury At The Wrist

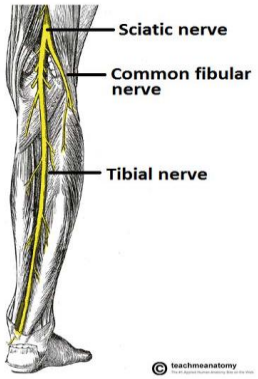
- Loss of intrinsic muscles.
- Loss of sensation.
- Clawing of all the fingers = ape hand (semian hand).

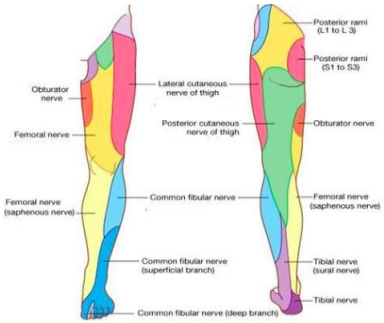
*no claw in the index or middle fingers because the radial 2 lumbricals are intact

Lumbosacral plexus injury

Foot Drop> common proneal injury
Wrist drop> radial N. injury

Lower limb nerve injuries				
Nerve		**Course**	**Motor exam**	**Sensory**
Femoral nerve injury		Descends lateral to psoas major & enters the thigh behind the inguinal ligament Passes lateral to femoral artery & divides into terminal branches. The first cutaneous branches of the femoral nerve are the **anterior cutaneous branches** that arise in the femoral triangle. They supply the skin on the **anteromedial thigh**. The last cutaneous branch of the femoral nerve is the **saphenous nerve** which supplies the skin on the **medial side of the leg and the foot**.	**-Wasting of quadriceps femoris** **-Loss of extension of knee** **-Weak flexion of hip (psoas major is intact)**	**loss of sensation over areas supplied antero-medial aspect of thigh & medial side of leg & foot**
SCIATIC NERVE	**Posterior Tibial N.**	Descends through popliteal fossa to **posterior compartment of leg,** accompanied with posterior tibial vessels Passes deep to flexor retinaculum to reach **the sole of foot** where it divides into 2 terminal branches	-loss of toe and ankle extension (planterflexion)	**loss of sensation in the sole of the foot**
	Common peroneal (fibular) N.	Leaves popliteal fossa & turns around the **lateral aspect of neck of fibula.** Then divides into: **Superficial peroneal: descends into lateral compartment of leg** **Deep peroneal: descends into anterior compartment of leg**	-loss of toe and ankle flexion (dorsiflexion) **(foot drop) lose the ability to dorsiflex**	**loss of sensation in lateral leg and dorsum of foot**





FROM Principles and Practice of Surgery A DAVIDSON TITLE

Carpal tunnel syndrome

The syndrome consists of symptoms of pain and numbness in the distribution of the median nerve in the hand. It is more common in patients with diabetes, hypothyroidism, acromegaly and pregnancy. Symptoms may be intermittent, are usually worst at night, and may be relieved by shaking the hand while holding it in a dependent position. The symptoms are often provoked by wrist flexion. On examination, there are usually no signs. Occasionally, there may be wasting of the thenar eminence, weakness of the abductor pollicis brevis, and diminished or altered sensation in the median nerve distribution. Tapping over the nerve in the carpal tunnel may elicit paraesthesia in the median nerve distribution (Tinel's sign). Phalen's test involves acutely flexing the wrist and holding it in this position. This may precipitate paraesthesia or numbness, and this is abnormal if it occurs within 1 minute. The diagnosis can be confirmed using electrophysiology to measure nerve conduction velocity and distal motor latency. Treatment depends on severity of symptoms. Splinting the wrist or injections of steroid into the carpal tunnel provide relief in a third of cases. If this fails, the transverse carpal ligament can be divided surgically, and in many cases this can be performed as a day case under local anaesthetic.

Ulnar nerve compression at the elbow

This is usually due to acute and chronic trauma, osteoarthritis or rheumatoid arthritis. The nerve may suffer repeated dislocation over the medial epicondyle on flexion of the elbow. Sometimes, the nerve may be compressed by the aponeurosis between the two heads of flexor carpi ulnaris. There is pain in the forearm and wasting of the small muscles of the hand, leading in the worst cases to an ulnar 'claw' hand. There may be reduced sensation in the ulnar distribution of the hand. The diagnosis may be made clinically, but electrophysiology is recommended to confirm the diagnosis. Treatment consists of surgically releasing and decompressing the nerve.

Summary

1. Upper lesion (C5, C6, C7) → Erb's palsy and phrenic nerve symptoms (waiter's tip posture)
2. Lower lesion (C8, T1) → Klumpke's palsy and sympathetic symptoms.(APE hand claw of all fingers)
3. Total lesion (C5, C6, C7, C8, T1) → flail limb and both phrenic and sympathetic symptoms.
4. Axillary injury → Limitation of shoulder abduction and sensation over the lateral arm
5. musculocutaneous injury → Loss of elbow flexion, weak supination, and loss of sensation over the lateral forearm.
6. Radial injury:

-Injury to the radial n. in the axilla(Saturday night palsy): All motor and sensory functions are lost.
-Injury to the radial n. in the spiral groove: Triceps is spared and everything else is lost.(wrist drop)
-Injury to the radial n. in the forearm to the posterior interosseous nerve: Elbow, wrist, and sensation are normal.

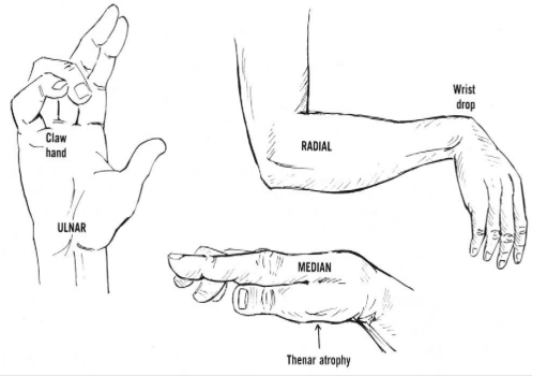
7. Median injury:

Injury to anterior interosseous branch of median nerve→ patient cannot make an O+ normal sensation.
Median nerve injury at wrist level → Loss of opposition and loss of sensation on the lateral 3 and half fingers on the palmer side.

8. Ulnar injury:

At elbow level → ulnar claw hand
At wrist Level → froment's sign

9. Median and ulnar nerve injury at the wrist→ Loss of intrinsic muscles, Loss of sensation, Clawing of all the fingers = ape hand (semian hand).
10. Femoral injury → Loss of extension of knee, Weak flexion of hip , loss of sensation over anteromedial aspect of thigh & medial side of leg & foot
10. posterior tibial injury → loss of flexion of the toes/ankle, loss of sensation in the sole of the foot.
12. Common peroneal → loss peroneus muscles and loss of toe extension and ankle extension (foot drop),loss of sensation in lateral leg and dorsum of foot



MCQs

Patient had a shoulder dislocation. On examination of Upper Limb shows completely normal EXCEPT that there is Limitation of shoulder abduction and numbness over the the lateral arm .
The nerve injury is??

A. Musculocutaneous nerve.
B. axillary nerve . ans
C. median nerve.
D. Ulnar nerve.

Patient was stabbed near the axilla. His examination was completely normal EXCEPT He cant flex his elbow and numbness over the lateral forearm
Which one of the following is the injured nerve??

A. Musculocutaneous nerve. ans
B. axillary nerve .
C. median nerve.
D. Ulnar nerve.

Patient had fracture of Supracodylar of the humerus. His examination was completely normal but the examiner noticed the patient can't flex the tips of the index and middle finger and make a perfect O sign , sensory examination was unremarkable.
Which one of the following is the injured nerve??
A. Posterior interosseous nerve.
B. Anterior interosseous nerve. Ans
C. axillary nerve.
D. Ulnar nerve

Thank You..

Done By :
Anjod Almuhareb
Rahma Alshehri
Revised By:
Faisal S. AlGhamdi

surgery433@gmail.com