Peripheral nerve injuries

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427 notes, voice lecture.

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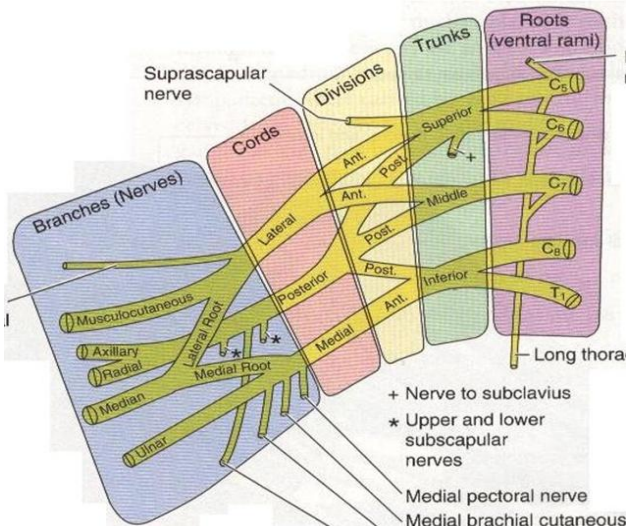
Nerve injuries in the upper limb



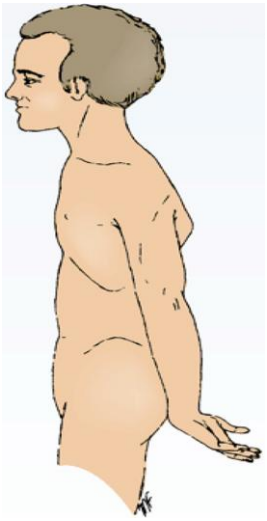
Types of injuries:

- Peripheral nerve injuries:
  - Axillary nerve
  - Musculocutaneous
  - Median nerve
  - Ulnar nerve
  - Radial nerve
- Brachial plexus injuries
  - Basic anatomy:
    - 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 Roots, Trunks, divisions, cords and terminal branches
  - Classification of brachial plexus injuries:
    - Open injuries (stab wounds or gunshot wounds):
      - Can be at any level (roots, trunks, divisions, etc...)
      - Classified into
        - supraclavicular (roots, trunks, divisions)
        - infraclavicular (divisions, cords, terminal branches)
    - Closed injuries:
      - More common than open injuries
      - Injury is most commonly at the root level
      - Caused by car accidents, outstretching of the shoulder like when playing sports or during difficult deliveries where the baby is pulled in emergency situations
      - Examination of closed injuries: Nerves are not examined, Roots are examined by examining dermatomes and myotomes

Root	Dermatome	Myotome
C5	Shoulder tip + lateral arm	Shoulder abduction + external rotation
C6	Lateral forearm + thumb and index finger	Elbow flexion
C7	Middle finger	Wrist extension
C8	Ring and little finger + lower aspect of medial forearm	Making a fist
T1	Upper aspect of medial forearm + medial arm	Finger crossing

Types of closed brachial plexus injuries:

- Upper brachial plexus lesion:
  - Called Erb's palsy (**Erb-Duchenne Palsy**)
  - Injury to C5, C6 and C7
    - C5: loses the ability to abduct the shoulder and external rotation
    - C6: loses the ability to flex elbow
    - C7: loses the ability to extend the wrist
  - Clinically :
    - The patient will have (opposite to the normal function of the damaged nerves):
      - shoulder adduction
      - internal rotation
      - extension of the elbow
      - wrist flexion
    - this is called waiter's tip position



  - Associated injuries:
    - injury to the phrenic nerve which arises from the 3rd, 4th, and 5th cervical roots
    - so half of the diaphragm will be paralyzed
    - in adults X-ray will show elevated hemi diaphragm
    - in children the intercostals are not strong enough to compensate so the baby will have breathing problems (obstetric palsy)
- Lower brachial plexus lesion:
  - Called Klumpke's palsy
  - Injury to C8 and T1
    - C8: loses the ability to make a fist
    - T1: loses the ability to cross fingers
  - Clinically: The patient will have simian hand and clawing of all fingers
  - Associated injuries:
    - Sympathetic nerves to the face come from a branch of the first thoracic nerve T1
    - If T1 is injured then sympathetic to the face are lost on one side and that will result in Horner syndrome, which is:
      - Ptosis (dropping of the upper eyelid)
      - Miosis (constricted pupil)
      - Anhydrosis (inability to sweat)
- Total Palsy:
  - Injury to all roots C5, C6, C7,C8, T1
  - Patient is unable to move entire limb: flail limb
- Quick clinical hints:
  - Upper lesion (C5,C6,C7) → Erb's palsy and phrenic nerve symptoms
  - Lower lesion (C8, T1)→ Klumpke's palsy and sympathetic symptoms
  - Total lesion(C5,C6,C7,C8,T1)→ flail limb and both phrenic and sympathetic symptoms

Peripheral nerve injuries

Axillary nerve:

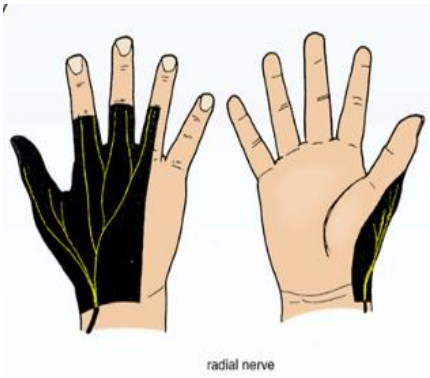
- Isolated injuries to the Axillary nerve most commonly happens with ***shoulder dislocation***
- Supplies the Deltoid and Teres minor muscle
- Clinical features:
    - Motor:
        - To the deltoid muscle so the patient will not be able to abduct his shoulder
        - The patient can still initiate abduction (action of supraspinatus)
        - It also supplies teres minor that does external rotation which is the same action of infraspinatus, 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
- Summary: loss of abduction and sensation over the lateral arm

Musculocutaneous nerve:

- Isolated injuries usually happen with stab wounds or gunshots
- Supplies corachobrachilis, biceps , brachalis muscles
- Clinical features:
    - Motor:
        - Corachobrachilis and brachalis are not important clinically
        - Biceps:
            - Weak supination (because the supinator muscle can compensate)
            - Loss of flexion
    - Sensory: loss of sensation over the lateral forearm and the thumb
- Summary: loss of elbow flexion and sensation over the lateral forearm + weak supination

Radial nerve:

- Runs in the spiral groove so injuries happen in humours bone fractures
- Distribution:
    - Upper arm (axilla): supplies the triceps -strong extensor of the elbow
    - Lower arm(above the elbow):
        - Brachioradialis
        - Extensor Carpi radialis longus – wrist extension
    - Forearm:
        - Sensory branch: sensation over the three and a half fingers laterally on the dorsal side
        - Motor branch called the posterior interossous nerve: thumb and finger extension
- Clinical features:
    - Humours fracture in spiral groove with radial nerve injury:
        - Normal elbow (triceps is supplied higher, spared)
        - No wrist extension (drop wrist)
        - No thumb and finger extension
        - Numbness or loss of sensation
    - Posterior interossoues nerve injury:



        - Stab wound in the forearm
        - Elbow and wrist are normal
        - Thumb and finger extension are lost
            - Finger muscles:
                - metacarpophalengeal (MP) joints
                    - Extension is by the radial nerve
                    - Flexion is by the ulnar nerve by the interossie and lumbrical
                - Intraphalengeal joints (IP)
                    - Extension is by the ulnar nerve by the interossie and lumbrical muscles
                    - Flexion by the long flexors of the forearm
        - ***No sensory symptoms!!! Pure motor nerve***
    - Saturday night palsy:
        - Very high injury of the radial nerve due to compression of the nerve in the axilla
        - ***Everything is affected*** (wrist, elbow, fingers, thumb and sensation)
        - Called like this because drunk people sleep with an arm behind the chair that causes the compression
    - Summary:
        - Remember where the lesion happened
        - Injury to the radial nerve in the axilla: all motor and sensory functions are lost
        - Injury to the nerve in the spiral groove: triceps is spared and everything else is lost
        - Injury in the forearm to the posterior interossous nerve: elbow, wrist and sensation are normal.

First we must know the supply of the forearm flexors and hand before studying the median and ulnar nerves:

Forearm muscles:

Muscle grouping:

- 5 superficial muscles:
    - Pronator teres →pronation of the forearm
    - Flexor carpi radialis →wrist flexion
    - Palmaris longus → wrist flexion
    - Flexor carpi ulnaris → wrist flexion
    - Flexor digitorum superficialis → flexion of the proximal Intraphalengeal joints joints (PIP) so flexes the middle phalynx
- 3 deep
    - Flexor digitorum profundus
    - Flexor pollicis longus
    - Pronotor quadrates

Nerve supply:

- All of these muscles are supplied by the median nerve except 1 and a half are supplied by the ulnar nerve:
    - Flexor carpi ulnaris

- Half of flexor digitorum profundus to the little and ring finger
- The median nerve has 2 branches
  - Superficial which supplies the superficial group
  - Deep (anterior interossoues nerve) which supplies the deep 2 and a half muscles(PURE MOTOR)

Hand muscles:

Muscle grouping:

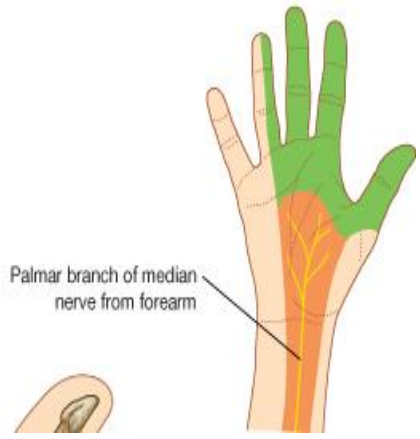
- Hypothenar: opposition of the little finger
- Thenar: opposition of thumb + adduction of the thumb (adductor pollicis)
- Interossie: abduction and adduction of the fingers + MP flexion + IP extension
- Lumbricals: MP flexion + IP extension

Nerve supply:

- The hand has 20 muscles
  - 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 (1^{st} and 2^{nd})
- All the actions are from the ulnar nerve except 2 are from the median nerve:
  - Opposition of the thumb
  - Index and middle lumbricals

Median nerve:

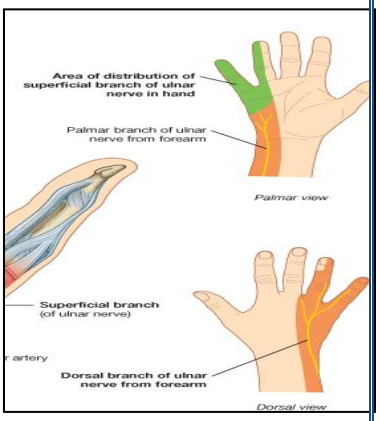
- Motor:
  - Superficial flexors except flexor carpi ulnaris
  - Deep flexors except half of flexor digitorum profundus to little and ring finger
  - Thenar muscles
  - Index and middle lumbricals
- Sensory: lateral 3 and a half fingers on the palmer side



- Clinically:
  - Anterior interosseous nerve injury:
    - Affects the deep 2 and half muscles
      - Half of Flexor digitorum profundus
      - Flexor pollicis longus
      - Pronotor quadrates (pronation is not lost because of pronator teres)
    - Sign: the patient "<u>cannot make a perfect O</u>" with 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 muscle)
  - Median nerve injury at level of wrist:
    - Common in patients who attempt suicide
    - Loss of opposition
    - Loss of sensation 3 and a half lateral
    - Lumbricals are lost but interossie do the job
    - They still can make an "O", bend the wrist and flex the PIP

        - Carpal tunnel syndrome:
            - Loss of sensation first
            - If untreated weakness of opposition
- Summary:
    - injury to median nerve at level of the wrist: loss of opposition and loss of sensation
    - injury to anterior interosseous branch of median nerve: patient cannot make an O + normal sensation

Ulnar nerve



- Motor:
    - Flexor carpi ulnaris
    - Medial half of flexor digitorum profundus
    - Lumbricals + interossie + hypothenar + adductor pollicis
- Sensory: medial 1 and a half fingers front and back of the hand
- Clinically:
    - Ulnar nerve injury:
        - loss of flexor carpi ulnaris and half of flexor digitorum profundus
        - loss of sensation
        - all of the hand muscles
            - cannot oppose the little finger
            - atrophy of hypothenar muscles
            - Cannot adduct or abduct the fingers
        - Ends up with <u>ulnar claw hand</u>

    - Ulnar nerve injury at the wrist:
        - Sensation is lost
        - 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
        - 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
    - Summary of ulnar nerve injury:
        - Ulnar claw
        - Loss of sensation
        - Hypothenar atrophy
        - Positive froment's sign
        - Cannot adduct or abduct the fingers

Median and ulnar nerve injury at the wrist:

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