Peripheral nerve injuries (upper and lower)

Done by: Amer Al-Salamat
Objectives

- Classification and pathology


Ulnar nerve
Coarse and Branches
• Ulnar nerve is the major branch of the brachial plexus (C8-T1)

• It applies its functions on:
  • Wrist (adduction and flexion).
  • Hand sensation (little finger and medial half of ring finger).
  • Hand movement (all muscles except thenar muscles and the first two lumbricis)
Ulnar nerve injuries give rise to claw hand deformity.

It is a deformity with hyperextension of the MCP joints and flexion of the IP joints of the fingers.

(loss of flexion at MCP and extension at IP joints)
Causes

- There are many causes of ulnar nerve injuries, including pressure, trauma and illness. In some cases, ulnar nerve injuries may arise without a known cause.

- The most common cause of ulnar nerve injury is extended pressure on the ulnar nerve, known as ulnar nerve entrapment.
Levels of the lesion

High:
above the level of elbow, entire nerve function is lost

Low:
1) **Below the elbow** at the junction of the middle and lower third of forearm:
Spared: - function of FDP and FUC
Lost:
1) Motor: HTM, Its, Lum, PB
2) Sensory: dorsal aspect of hand and one and half fingers
2) Proximal to Guyon`s canal:
Spared: FDP, FCU and dorsal sensation
Lost: same as above + loss of volar sensation
3) Distal to Guyon`s canal:
Spared: FDP, FCU, HTM, PB, dorsal and volar sensation
Lost: interossei and lumbricals
Clinical tests:

Froment's sign.

When the patient attempts to pinch with the thumb and index finger, the long flexor of the thumb is used to substitute for the thumb adductor, resulting in flexion of the thumb at the interphalangeal joint.

This characteristic appearance is present in this patient's left hand, caused by an ulnar nerve lesion at the elbow.
Card test
Inability to hold a card or paper in between fingers due to loss of adduction by the palmar interossei

Pen test
Unable to touch the pen due to the loss of action of abductor pollicis brevis
Treatment of ulnar nerve injury

1) prevention
2) nonsurgical treatment
3) surgical treatment
prevention

1) Avoid frequent use of the arm with the elbow bent
2) If you use a computer frequently, make sure that your chair is not too low. Do not rest the elbow on the armrest.
3) Avoid putting pressure on the inside of the arm (do not drive with the arm resting on the open window).
4) Keep the elbow straight at night when you are sleeping (done by wrapping a towel around the straight elbow, wearing an elbow pad backwards, or using a special brace)
Figure 5: Loosely wrapping a towel around your arm with tape can help you to remember not to bend your elbow during the night.
Nonsurgical treatment

1) Anti – inflammatory drugs, ibuprofen, (to reduce swelling around the nerve).

2) Steroid (cortisone) injections around the ulnar nerve are not generally used because there is a risk of damage to the nerve.

3) Exercises (prevents arm and wrist from stiffness).
Surgical treatment

If the nerve is very compressed; or if there is muscle wasting

Surgery:
1) Around the elbow and the wrist or both

More commonly, the nerve is moved from its place behind the elbow to a new place in front of the elbow. This is called an anterior transposition of the ulnar nerve.

The nerve can be moved:
1) under the skin and fat (subcutaneous transposition),
2) within the muscle (intermuscular transposition) 

3) under the muscle (submuscular transposition).
Ulnar paradox

- The higher the lesion of the median and ulnar nerve injury, the less prominent is the deformity and vice versa, because in higher lesions the long finger flexors are paralysed.

- The loss of finger flexion makes the deformity look less obvious.
Radial nerve

*Radial nerve* (in the radial groove)

*Deep branch of the radial nerve*
Radial nerve injury

Causes:
- **General causes**:
  - metabolic diseases, collagen diseases, malignancies, endogenous or exogenous toxins, chemical or mechanical trauma, etc.
- **Local causes**
  - 1) In the axilla:
    - Aneurysm of the axillary vessels /Crutch palsy
  - 2) In the shoulder:
    - Proximal humeral /Shoulder dislocation
3) In the spiral groove (5 `s) Shaft
Saturday night
  Syringe palsy
  `S ` march`s tourniquet palsy
4) Between spiral groove and lateral epicondyle:
  shaft humerus / Supracondylar humerus /
  Lateral epicondyle of humerus /
  Penetrating and gunshot injuries /
5) At the elbow:
Posterior dislocation of elbow / head of radius

6) Causes in the forearm:
both bones of forearm / Penetrating and gunshot injuries
Levels of lesion

**High**
above spiral groove---- total palsy

**Low :**
Type 1 (Between the spiral groove and the lateral epicondyle ) : -
Spared : - elbow extensor
Lost : -
1) Motor : wrist extensor, thumb extensor, finger extensor
2) Sensory : dorsum of first web space
Type 2 (below the elbow)
Spared:
Elbow extensor /Wrist extensor

Lost:
Motor: thumb extensor, finger extensor
Sensory: First web space
Clinical features

Depend upon the site of the injury: -

Lesions in or above the axilla:
Paralysis and wasting of all the muscles innervated.
Clinically, this is manifest as:
1) weakness of forearm extension and flexion - triceps and brachioradialis
2) wrist drop and finger drop - paralysis of the extensors of the wrist and digits
3) weakness of the long thumb abductor and extensor muscles
4) Sensory loss on the dorsum of hand and forearm appropriate to the cutaneous distribution
Lesions around the humerus spare brachioradialis and extensor carpi radialis longus.

Posterior interosseous palsy (due to a dislocation or fracture of the elbow). weakness of finger extension, and of thumb extension and abduction. little or no wrist drop, and usually, no sensory loss.
Wrist Drop (Radial Nerve Injury)
Muscles supplied by the radial nerve and how to test each:
C7,8: triceps - ask patient to extend elbow against resistance.
C5,6: brachioradialis - ask patient to flex elbow with forearm half way between pronation and supination.
C6,7: extensor carpi radialis longus - ask patient to extend wrist to radial side with fingers extended.
C5,6: supinator - with arm by side, ask patient to resist hand pronation.
C7,8: extensor digitorum - ask patient to keep fingers extended at MCP joint.
C7,8: extensor carpi ulnaris - ask patient to extend wrist to ulnar side. C7,8: abductor pollicis longus - ask patient to abduct thumb at 90° to palm.
C7,8: extensor pollicis brevis - ask patient to extend thumb at MCP joint.
C7,8: extensor pollicis longus - ask patient to resist thumb flexion at IP joint.
MEDIAN NERVE

- Mixed nerve (contain motor & sensory fibers).
- Root value: C 5,6,7,8 & T1
- Runs in the median plane of the forearm, so it's called median nerve

Median nerve is formed by lateral root from lateral cord and medial root from medial cord of brachial plexus
- Median nerve runs lateral side of axillary artery
In arm
• median nerve continues to run on the lateral side of brachial artery till the middle of arm, where it crosses infront of the artery and passes anterior to the elbow joint into forearm
In forearm
• Enters to the forearm b/w two heads of pronator teres

• Muscular branches supply muscles of thenar eminence (abductor pollicis brevis, opponens pollicis and flexor pollicis brevis)
Finally divides into 4 to 5 palmar digital branches supplying lateral three and half digit and their nail beds

• Also, motor branches are given to the first and second lumbrical muscles
INJURY TO MEDIAN NERVE

- Median nerve is most commonly injured near the wrist or high up in the forearm.

- **Low median nerve palsy**
  - Injury in the distal third of the forearm
  - Cuts in front of wrist or by carpal dislocation
  - There will be sparing of the forearm muscles, but the muscles of the hand will be paralysed.
  - Thenar eminence is wasted and thumb abduction and opposition are weak.
  - Sensation is lost over the radial three and half digits and trophic changes may be seen.
High median nerve palsy

- Injury proximal to the elbow
- Generally due to forearm fractures or elbow dislocation
- Stabs and gunshot wounds may damage the nerve at any level
- This will cause paralysis of all the muscles supplied by the median nerve in the forearm and hand
Median nerve compression

- Three separate syndromes are recognised
  1. Carpal tunnel syndrome
  2. Pronator syndrome
  3. Anterior interosseous syndrome

  **Pronator syndrome**

  *Pronator teres* syndrome is a compression neuropathy of the median nerve at the elbow.

  **Anterior interosseous syndrome**

  a medical condition in which damage to the anterior interosseous nerve (AIN), a motor branch of the median nerve, causes pain in the forearm and a characteristic weakness of the pincer movement of the thumb and index finger.
Carpul tunnel syndrome

It is compressive neuropathy of median nerve as it passes through the carpal tunnel of the wrist joint.

Causes
• Ideopathic - Most common
• Inflammatory - Rheumatoid Arthritis - Wrist osteoarthritis
• Post traumatic - Bone thickening
• Endocrine – Myxoedema

High prevalence rates have been reported in persons who perform certain repetitive wrist motions (frequent computer users)
Symptoms and Signs include

- Pain of the hand and wrist associated with tingling and numbness, classically distributed along the median nerve (the palmar side of the thumb, the index and middle fingers, and the radial half of the ring finger).

- Typically, the patient wakes at night with burning or aching pain and shakes the hand to obtain relief and restore sensation.

- Thenar atrophy and weakness of thumb opposition and abduction may develop late.
Physical examination for CTS

- Phalen’s maneuver OR REVERSE PRAYER SIGN

TINELS SIGN
Digital nerves

- Nerves supplying the hand
- Palmar aspect: 3 and ½ fingers supplied by median nerve, 1 and ½ fingers supplied by ulnar nerve
- Dorsal aspect: more than 50% supplied by radial nerve, the rest by ulnar and some by median nerve
- **Palmar digital nerves** may refer to:
  - Common palmar digital nerves of median nerve
  - Common palmar digital nerves of ulnar nerve
  - Proper palmar digital nerves of median nerve
  - Proper palmar digital nerves of ulnar nerve
- **Dorsal digital nerves** may refer to:
  - Dorsal digital nerves of radial nerve
  - Dorsal digital nerves of ulnar nerve
Digital nerve gets injured by 2 way
**direct damage to one of the main nerve (radial, ulnar, median)**
Or by direct damage to the hand
The patient complaint from pain, stiffness, loss of functions or contracture
**the main nerve responsible for motor supplying for the hand??
Median nerve
Major nerve for hand sensory and motor

Special test for each nerve on hand

- A: median nerve
- B: ulnar nerve
- C: radial nerve
Objectives

- Classification and pathology


1) **Anatomy:** the femoral nerve comes from the lumbar plexus, formed by union of dorsal divisions of anterior rami of L2, L3, L4

It runs along the psoas major muscle and traverses behind the inguinal ligament into the femoral triangle lateral to the femoral vessels.
Nerve supply:

1- **articular branches** to the hip and knee joints.

2- **It gives motor innervation** to iliopsoas, pectineus, sartorius, and quadriceps femoris.

3- **It gives sensory branches:** It gives 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**.
• What actions does the femoral nerve bring about?

• **Hip flexion**, **knee extension**.

• what will be the result of damage to this nerve?

• Weakness of the knee *extension* (quadriceps) and *numbness* of the anterior thigh and medial aspect of the leg. The knee jerk is depressed.

• How does it commonly injured?
A gunshot wound, a knife stab, bleeding into the thigh, pelvic fracture or by a traction during an operation.
Evaluation

1) CT scan to the plevic in case of suspected hematoma
   - 2) Nerve conduction studies and needle electromyography

Treatment

- It depends on the cause, in case of hematoma evacuation is needed, surgery is indicated in case of decompression
Sciatic nerve (L4-S3)

• The sciatic nerve is derived from the **lumbosacral plexus**. After its formation, it leaves the pelvis and enters the gluteal region via greater sciatic foramen. It emerges inferiorly to the **piriformis** muscle and descends in an inferolateral direction.

• As the nerve moves through the gluteal region, it crosses the posterior surface of the superior gemellus, obturator internus, inferior gemellus. It then enters the posterior thigh by passing deep to the **long** head of the **biceps femoris**.

• Within the posterior thigh, the nerve gives rise to branches to the hamstring muscles and adductor magnus. When the sciatic nerve reaches the apex of the **popliteal fossa**, it terminates by bifurcating into the **tibial** and **common peroneal (fibular)** nerves.
Motor Functions of sciatic nerve
- Innervates all of the muscles in the posterior compartment of the thigh, including the **hamstring portion** of adductor magnus, (apart from the short head of the biceps femoris)
- Which is supplied by common peroneal nerve).

- **Tibial Portion** - innervates all muscles in the **posterior compartment of the leg. All muscles in the sole of the foot.**

- **Common peroneal Portion (Fibular)**
  - Short head of biceps femoris,
  - all muscles in the anterior and
  - lateral compartments of the leg and
  - extensor digitorum brevis.
• **Sensory Functions:**
• **Tibial Portion:** Innervates the skin on the posterolateral and medial surfaces of the foot as well as the sole of the foot.
• **Common peroneal Portion:**
  • Innervates the skin on the anterolateral surface of the leg
  • and the dorsal aspect of the foot
• The course of the common peroneal nerve
• It descends obliquely along the lateral side of the popliteal fossa to the head of the fibula. It lies between the tendon of the biceps femoris and lateral head of the gastrocnemius muscle, winds around the neck of the fibula, between the peroneus longus and the bone, and divides beneath the muscle into the superficial peroneal nerve and deep peroneal nerve.
The tibial nerve: The tibial nerve passes through the popliteal fossa to pass below the arch of soleus. Below the soleus muscle the nerve lies close to the tibia and supplies the tibialis posterior, the flexor digitorum longus and the flexor hallucis longus. The nerve passes into the foot running posterior to the medial malleolus. Here it is bound down by the flexor retinaculum in company with the posterior tibial artery. In the foot, the nerve divides into medial and lateral plantar branches.
• What actions does the sciatic nerve bring about?

• Hip extension, knee flexion and rotation
• What will result of damage to this nerve and clinical presentation?
• **The** hamstering and all the muscles below the knee are paralysed.
• **The** ankle jerk is absent.
• **Sensation** below the knee is lost except the medial side of the leg which is supplied by the saphenaus a branch of the femoral nerve.
• **The** patient walks with a drop foot and a high stepping gait to avoid dragging the insensitive foot on the ground.
If sensory loss extends into the thigh and the gluteal muscles suspect an associated lumbosacral plexus injury.

In late cases the limb is wasted with fixed deformity of the foot and trophic ulcers on the sole.
How is it commonly injured?

- Posterior hip dislocation (car accident) (m.c)
- Stab injury at the gluteal region
• Acquired hip dislocation

• -When femur is flexed, adducted and medially located

• -Post hip dislocation is more common

• -Results sciatic nerve injury
Peroneal nerve injuries

- The common peroneal nerve is often damaged at the level of the fibular neck either by knee dislocation or during operative correction of knee valgus or lateral ligament injuries.

- What actions does the common peroneal nerve bring about?
  
  Foot inversion, eversion and dorsiflexion
What is the result of damage to this nerve?

- **The** patient has a drop foot and can neither dorsiflex nor evert their foot.
- **He** walk with high steeping gait to avoid catching the toes.
- **Sensation** is lost over the front and outer half of the leg and the dorsum of the foot.
Foot drop

- It is inability to raise the front part of the foot due to weakness or paralysis of the tibialis anterior muscle that lifts the foot up.

- When the patient is walking he will have a steppage gait meaning he slaps his foot down on the floor and his gait will show he is raising his thigh up in an exaggerated fashion.
Tibial nerve

- The tibial nerve supplies the flexors of the ankle and toes.
- Injury to this nerve will result inability to planterflex the ankle or flex the toes, sensation is lost over the sole.
- The posterior tibial nerve runs behind the medial malleolus gives off a small calcaneal branch then divides into medial and lateral planter nerves which supply the intrinsic muscles of the foot.
- Fractures and dislocations of the ankle may injure any of these branches.
- Posterior tibial nerve injuries cause wide sensory loss and clawing of the toes due to paralysis to the intrinsic muscles.
Thank You