



### Testing for Sensory Nerve Loss

- C5 – lateral side of cubital fossa
- C6 – thumb
- C7 – middle finger
- C8 – minimal digit
- T1 – medial side of cubital fossa

### Testing for Motor Nerve Loss

- C5 – arm abduction (supraspinatus and deltoid)
- C6 – forearm flexors (brachialis and biceps brachii)
- C7 – forearm extensors (triceps)
- C8 – digital flexors (FDP)
- T1 – index, middle, and ring finger abduction and adduction (dorsal and palmar interossei)

### Injuries to Roots/Trunks of Brachial Plexus

- **C5/C6 roots or Superior Trunk Injury:**
  - Most often due to excessive separation of head and shoulder during fall, motorcycle accident, or “botched delivery”
    - Violently
  - Can also be caused by a stab or bullet wound to the neck

- Tearing or stretching of roots/trunk results
- “*Waiter’s Tip*” or *Erb-Duchenne Palsy* is often the resultant disorder
  - loss of flexion, abduction, and lateral rotation at shoulder joint
  - upper limb hangs by side in medial rotation (prone)
  - muscles most severely affected are the deltoid, biceps brachii, brachialis, brachioradialis, supraspinatus, subscapularis, teres major, infraspinatus, teres minor (last two = chief lateral rotators of upper limb)
  - end up affecting musculocutaneous, axillary, radial, upper and lower subscapular, median, lateral pectoral, and thoracodorsal nerves
  - Pectoralis Major and Latissimus dorsi still medially rotate
  - No abduction of arm or flexion of forearm
  - With Time: rounded contour of shoulder flattens
- **Involving Posterior Cord:**
  - Often due to poorly fitting crutches, which exert pressure on the radial nerve
  - “*Saturday Night Palsy*”: when an intoxicated person hangs his or her arm over the back of a chair for extended periods of unconsciousness
  - “*wrist drop*” is often the resultant disorder
    - Individual is unable to extend the forearm, hand, or digits due to affected muscles innervated by the radial nerve
- **C8/T1 Roots or Inferior Trunk Injury**
  - Usually results from sudden upward pulling of the upper limb
  - May also arise due to cervical rib or pulmonary carcinoma
  - Usually affects function of the ulnar nerve
  - “*Claw Hand*” (to be covered in branch injuries)

#### Brachial Plexus Branch Injuries

- **Long Thoracic Nerve – “*Winged Scapula*”**
  - Usually results from axillary trauma (often from gunshot or stab wound)
  - Patient cannot hold scapula against thorax wall when asked to push against wall
  - Cannot fully abduct upper limb on affected side because scapula cannot be rotated
- **Musculocutaneous Nerve**
  - If injured within the axilla, weakness of upper limb flexion results
  - Severe weakness of forearm flexion
  - Weakness when supinating forearm from a partially flexed position (biceps brachii)
- **Radial Nerve**
  - Injury to Radial Groove of Humerus
    - Lesioned due to fractured humerus
    - Little loss of forearm extension
    - However “*wrist drop*” does occur
  - Injury at the neck of the Radius
    - At this point, called the “deep radial nerve”
    - “*Wrist drop*” is not as severe because ECRL and ECRB are spare (their innervation occurs more proximal)
    - still have loss of digital extension of proximal phalanges and thumb muscle impairments
      - adductor pollicis, etc.
- **Median Nerve**
  - Injury in Axilla or Arm
    - Loss of forearm pronation
    - Diminished hand and digital flexion

- Loss of palmar and digital sensation
    - Loss of sweating on the lateral palm
    - *Wasting of the thenar eminence* occurs over time
  - Injury in Forearm
    - *Pronator Teres or Anterior Interosseous Syndrome*
    - Loss of deep compartment muscles
    - No thenar eminence wasting
    - Resultant disorder sometimes referred to as “*Benedictus Hand*” or “*Pope’s Blessing*”
      - Cannot flex lateral 2 fingers
  - Injury at wrist
    - “*Carpal Tunnel Syndrome*” – compression of median nerve as it passes deep to the flexor retinaculum (caused by any number of things)
    - Results in loss of sensation (immediate) and *wasting of the thenar eminence* (delayed)
- **Ulnar Nerve**
  - Injury in the Axilla, Arm or Medial Epicondyle
    - Often due to fracture (particularly at medial epicondyle)
    - Results in severe motor and sensory loss to the hand
    - “*Claw Hand*”
      - occurs from the resulting imbalance of flexion/extension at the MP and IP joints
      - hyperextended MP joints and somewhat flexed IP joints (loss of lumbricals 4-5) of digits 4-5
      - loss of abduction and adduction of digits 2-5 (loss of interossei)
      - patient will have difficulty making a fist – FDP to digits 4-5 affected
  - Injury at Wrist
    - *Clawing* becomes more evident because the FDP has been spared and is not opposed by the lumbrical actions
    - Can make a fist – FDP spared
- Tonic Contraction:
  - A muscle is never completely relaxed
  - Always exerts some type of action
- Opposing forces by opposing muscles (ie. Flexors vs. extensors, pronators vs. supinators) hold joints in equilibrium
  - If innervation is interrupted to one muscle group, opposing group becomes dominant
- Musculocutaneous: C5,C6,C7
  - Injure musculocutaneous (same for sensory or motor)
  - Die or regenerate
    - If regen/degen changes the entire length of the nerve fibers will be evident microscopically
- Axillary: only C5 and C6 due to developmental changes
  - Can follow degen/regen microscopically both proximally and distally

List of Nerves and Muscles they Innervate:

- **Dorsal Scapular N.**
  - Levator scapulae
  - Rhomboid major
  - Rhomboid minor
- **Thoracodorsal N.**
  - Latissimus dorsi
- **Suprascapular N.**
  - Suprascapularis
  - Infraspinatus
- **Lower Subscapular N.**
  - Teres major
  - Subscapularis (lower part)
- **Upper Subscapular N.**
  - Subscapularis (upper part)
- **Medial Pectoral N.**
  - Pectoralis Major
  - Pectoralis Minor
- **Lateral Pectoral N.**
  - Pectoralis Major
- **N. to Subclavius**
  - Subclavius
- **Long Thoracic N.**
  - Serratus Anterior
- **Musculocutaneous N.**
  - Biceps brachii
  - Brachialis
  - Coracobrachialis
- **Axillary N.**
  - Deltoid
  - Teres minor
- **Median Nerve**
  - Pronator teres
  - Flexor carpi radialis
  - Palmaris longus
  - Flexor digitorum superficialis
  - **Anterior Interosseous N.**
    - Flexor digitorum profundus (lateral ½)
    - Flexor pollicis longus
    - Pronator quadratus
  - **Recurrent Branch of the Median N.**
    - Abductor pollicis brevis
    - Flexor pollicis brevis
    - Opponens pollicis
    - Lumbricals 1 and 2
- **Ulnar N.**
  - Flexor carpi ulnaris
  - Flexor digitorum profundus (medial ½)
  - **Deep branch of the Ulnar N.**
    - Opponens digiti minimi
    - Abductor digiti minimi
    - Flexor digiti minimi
    - Lumbricals 3 and 4
    - Dorsal interossei
    - Palmar interossei
    - Adductor pollicis
  - **Superficial Branch of the Ulnar N.**
    - Palmaris brevis
- **Radial N.**
  - Triceps brachii
  - Anconeus
  - Brachioradialis
  - Extensor carpi radialis longus
  - **Deep Branch of the Radial N.**
    - Extensor carpi radialis brevis
    - Supinator
  - **Posterior Interosseous N.**
    - Extensor digitorum
    - Extensor digiti minimi
    - Extensor carpi ulnaris
    - Abductor pollicis longus
    - Extensor pollicis brevis
    - Extensor pollicis longus
    - Extensor indicis