

Upper Limb

Brachial Plexus

- Suprascapular nerve branches off the superior trunk
- Musculocutaneous nerve branches off the lateral cord
- Median nerve branches off the lateral and medial cords
- Ulnar nerve branches off medial cord
- Median nerve branches off the lateral and medial cords
- Radial nerve branches off the posterior cord
- Axillary nerve branches off the posterior cord

Long thoracic nerve branches off nerve roots C6-C7-C8

Lesions of the Brachial Plexus

Upper Trunk (C5, C6)

- Erb's palsy results
- Arm is medially rotated, abducted, extended, and pronated due to injury
- Axillary, suprascapular, and musculocutaneous nerves involved
- Lateral rotators, flexors, and abductors affected

"Waiter's tip" or "Porter's tip" sign

Lower Trunk (C8, T1)

- Thoracic outlet syndrome results
- Involves muscles of the forearm and hand
- "Claw hand" or "Ape hand" sign
- May include a Horner's syndrome

Could be combined with flattening of the thenar eminence if T1 involved

Table III-4-1. The Motor Innervation by the Five Terminal Nerves

Terminal Nerve	Muscles Innervated
Musculocutaneous nerve	All the muscles of the anterior compartment of the arm
Median nerve	All the muscles of the anterior compartment of the forearm except 1 [1/2] muscles (flexor carpi ulnaris and the ulnar [1/2] of the flexor digitorum profundus) The 3 thenar compartment muscles and the 1st and 2nd lumbricals
Ulnar nerve	The 1[1/2] muscles of the forearm not innervated by the median nerve All the muscles of the hand except those innervated by the median nerve
Axillary nerve	Deltoid and teres minor
Radial nerve	The posterior muscles of the arm and forearm

Table III-4-2. The Collateral Nerves of the Brachial Plexus

Collateral Nerve	Muscles or Skin Innervated
Dorsal scapular nerve	Rhomboids
Long thoracic nerve	Serratus anterior
Suprascapular nerve	Supraspinatus and infraspinatus

Lateral pectoral nerve	Pectoralis major
Medial pectoral nerve	Pectoralis major and minor
Upper subscapular nerve	Subscapularis
Middle subscapular (thoracodorsal) nerve	Latissimus dorsi
Lower subscapular nerve	Subscapularis and teres major
Medial brachial cutaneous nerve	Skin of medial arm
Medial antebrachial cutaneous nerve	Skin of medial forearm
All axillary wall muscles supplied by collaterals Post wall – 3 subscapular n/v Ante wall – 2 Pectoral n/v Medial wall – Long thoracic	

Sensory Innervation of the Hand

- Palmar surface
 - Radial nerve--1st dorsal web space
 - Median nerve--lateral palm and anterior surface of index and middle fingers
 - Ulnar nerve--medial palm
 - Dorsal surface
 - Ulnar nerve--medial surface
 - Median nerve--lateral surface
 - Nail beds--branch of the median nerve
- Index finger--dual innervation by median and radial nerves

Nerve Injuries

- **Radial nerve** at:
 - Axilla--loss of extensors at the elbow, wrist and digits
 - Weakened extension at the shoulder
 - Weakened supination
 - Sensory loss of posterior arm, forearm, and hand
 - Cardinal sign: "wrist drop"
 - Elbow--loss of extensors at the wrist and digits
 - Mimics injury caused by fracture of humerus lacerating radial nerve (passed posterior aspect of humerus)
 - Sign is "wrist drop" without shoulder involvement
 - Wrist--sensory loss on posterior hand in 1st dorsal web space
- **Median nerve** at:
 - Elbow—loss of flexion of the digits, thenar muscles, and 1st and 2nd lumbricals; no loss at shoulder or elbow
 - Loss of opposition of thumb
 - Flattening of thenar eminence
 - Cardinal sign: "Ape hand"
 - Wrist--only affect muscles of the hand
 - Occurs in the carpal tunnel
 - No sensory loss for the palm of the hand--innervation does not pass through carpal tunnel
 - Sign is "Ape hand"

- **Ulnar nerve at:**
 - Elbow--loss of abduction and adduction of digits; no loss at shoulder or elbow
 - Cardinal sign: "claw hand" of 4th and 5th digits
 - Wrist--loss of abduction and adduction of digits
 - Loss of 3rd and 4th lumbricals
 - Loss of interossei muscles
- **Musculocutaneous nerve at:**
 - Axilla
 - Greatly weakened shoulder flexion
 - Severely weakened flexion at elbow due to involvement of biceps brachii and brachialis muscles
 - Greatly weakened supination
 - Sensory loss of lateral forearm
 - Axillary nerve—loss of abduction of the arm from 7-70 degrees; results from damage caused by fracture of surgical neck of humerus

Arterial Supply to the Upper Limb

- Subclavian artery
 - Branch of brachiocephalic trunk
 - Pass over 1st rib, under clavicle--changes name to axillary artery
 - Axillary artery
 - From the 1st rib to lower edge of teres major--changes name to brachial artery
 - Several branches
 - Brachial artery
 - A branch is profunda brachii artery which travels with radial nerve
 - Also divides at the cubital fossa into radial and ulnar arteries
 - Radial artery supplies the deep palmar arch
- Ulnar artery supplies the superficial palmar arch

Collateral Circulation

- Shoulder--subscapular (axillary) and suprascapular (subclavian)
- Hand--palmar arches

Mammaries--lateral thoracic artery is principle blood supply to mammaries but would be ligated in radical mastectomy

Joints of the Upper Limb

Shoulder

- Note bony structures
- Scapula articulates with humerus at glenohumeral joint
- Humeral head stabilized in glenoid fossa by rotator cuff muscles
 - Supraspinatus--initiates abduction
 - Infraspinatus--lateral rotator
 - Teres minor--lateral rotator
 - Subscapularis--medial rotator

Dislocation often inferior and may cause damage to axillary nerve

Elbow

- Note bony structures
- Composed of humeroradial joint and humeroulnar joint which permit flexion and extension
- Proximal radioulnar joint which permits pronation and supination

Dislocation may cause damage to ulnar and median nerves as well as brachial artery resulting in "Volkman's contracture" of the hand

Wrist and Hand

- Carpal tunnel is space bounded by flexor retinaculum anteriorly and the carpal bones posteriorly
 - Nine tendons pass through here
 - Four tendons of the flexor digitorum superficialis
 - Four tendons of the flexor digitorum profundus
 - Tendon of the flexor pollicis longus
 - Median nerve also passes through just below flexor retinaculum
 - Scaphoid bone is most frequently fractured--may cause avascular necrosis
- Lunate bone is most frequently dislocated anteriorly—may compress median nerve