Forearm & Hand Anatomy

Anterior Forearm (* 5 off medial epicondyle)

**FLEXORS** = Median Nerve

- **Superficial Muscles**
  - Median Nerve
    1. * Pronator Teres → C6, C7
    2. * Flexor Carpi Radialis → C6, C7
    3. * Palmaris Longus → C7, C8
    4. * Flexor Digitorum Superficialis → C7, C8, T1

- **Ulnar Nerve**
  1. * Flexor Carpi Ulnaris

- **Deep Muscles**
  - Median Nerve – Anterior Interosseous (AIN)
    1. Flexor Digitorum Profundus (2 + 3) → C8, T1
    2. Flexor Pollicis Longus → C8, T1
    3. Pronator Quadratus → C8, T1
  - Ulnar Nerve
    1. Flexor Digitorum Profundus (4 + 5)

Ulnar nerve forearm:
- FCU → C7, C8
- FDP (4 + 5)

Posterior Forearm (* 5 off lateral epicondyle) OR (^ 2 off supracondylar ridge)

**EXTENSORS** = Radial Nerve

- **Superficial Muscles**
  - Radial Nerve
    1. ^ Brachioradialis → C5, C6, C7
    2. ^ Extensor Carpi Radialis Longus → C6, C7
    3. * Extensor Carpi Radialis Brevis → C7, C8

- Posterior Interosseous (PIN)
  1. * Extensor Digitorum Communis → C7, C8
  2. * Extensor Digitii Minimi → C7, C8
  3. * Extensor Carpi Ulnaris → C7, C8

- **Deep Muscles**
  1. * Supinator → C5, C6

- Posterior Interosseous (PIN)
  1. Abductor Pollicis Longus → C7, C8
  2. Extensor Pollicis Brevis → C7, C8
  3. Extensor Pollicis Longus → C7, C8
  4. Extensor Indicis Proprius → C7, C8

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Carpal Bones

(Radial -> Ulnar)
Some Lovers Try Positions That They Can't Handle

Proximal Row -> Scaphoid, Lunate, Triquetrum, Pisiform
Distal Row -> Trapezium, Trapezoid, Capitate, Hamate

(Ulnar -> Radial)
How Com They Try Picking The Love Seat

Proximal Row -> Hamate, Capitate, Trapezoid, Trapezium
Distal Row -> Pisiform, Triquetrum, Lunate, Scaphoid

Thenar Muscles -> all 5 muscles C8 – T1
- APB -> Abductor Pollicis Brevis -> Median
- FPB -> Flexor Pollicis Brevis -> Median
- FPL -> Flexor Pollicis Longus -> Median
- OP -> Opponens Pollicis -> Median
- ADP -> Adductor Pollicis -> Ulnar
- PB -> Palmaris Brevis -> Ulnar

Tunnel of Guyon
- Formed by hook of hamate + pisiform bones
- Ulnar nerve runs inside

Median nerve:
- Lumbricals 4 + 5
- Opponens Pollicis
- ABD Pollicis Brevis
- Flexor Pollicis Longus
- Flexor Pollicis Brevis

Median nerve:
- Lumbinals 2 + 3
- Lumbinals 4 + 5

Ulnar nerve:
- Adductor Pollicis
- Palmaris Brevis
- All Interossei
- Lumbinals 4 + 5
- 3 Hypothenars

Ulnar nerve:
- 4 Dorsal Interossei (DAB) = Bipennate – ABD fingers
- 3 Palmar Interossei (PAD) = Unipennate – ADD fingers

Hypothenar Muscles -> all 3 muscles C8 – T1
- ABDM -> Abductor Digiti Minimi
- FDMB -> Flexor Digiti Minimi Brevis
- ODM -> Opponens Digiti Minimi

Anatomical Snuff Box
Going from Dorsal -> Palmar side
1 mm on Ulnar side & 2 mms on Radial side...
1. Extensor Pollicis Longus
   • Runs around Lister’s Tubercle an anatomical pulley which increases MA
2. Extensor Pollicis Brevis
3. Abductor Pollicis Longus
   - Radial Artery passes through here...
   - Scaphoid bone is also palpable here.

Carpal Tunnel
9 Tendons + 1 Nerve:
- 4 Tendons of Flexor Digit Superficialis
- 4 Tendons of Flexor Digit Profundus
- 1 Tendon of Flexor Pollicis Longus
- Median Nerve
  • FCR may also be included as it is contained in a separate medial compartment separated by an intercarpal ligament
Borders
- Radial = trapezium + trapezoid
- Ulnar = capitae + hamate

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6.46A, B. Radial artery in the anatomical snuff box.

(A) Head of ulna
Anatomical snuff box
Extensor pollicis brevis tendon
Extensor pollicis longus tendon
Extensor retinaculum
Superficial branch of radial nerve
Scaphoid bone
Radial artery in anatomical snuff box
Trapezium bone
Base of 1st metacarpal

(B) Styloid process of radius
Extensor pollicis brevis tendon
Extensor pollicis longus tendon
Scaphoid bone
Radial artery in anatomical snuff box
Trapezium bone
Base of 1st metacarpal
Abductor pollicis longus

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Nerve Injuries Affecting the Hand

1. Median Nerve Injury
   - Parasthesia or anesthesia of median nerve distribution.
   - Muscle weakness or paralysis of median nerve distribution; atrophy of thenar eminence.
     - thumb drops back in plane of other digits ("Ape Hand")
     - the fingers can still open, but using the thumb to hold or stabilize grip will be difficult because the muscles for thumb opposition (median) are affected.

   Median Nerve Injury Summary of Muscles Lost
   - Opponens Pollicis
   - Abductor Pollicis Brevis
   - Flexor Pollicis Brevis (superficial head)
   - Lumbricals to digits 2 & 3

2. Ulnar Nerve Injury
   - Remember division of lumbricals $2 + 3 = \text{median}$, $4 + 5 = \text{ulnar}$.
     - the hand appears as a "Benediction Sign" / Bishops Hand / Partial Claw Hand.
     - difficulty with grasp as ulnar side of hand is power producing side.
     - loss of all Interossei + only the lumbricales to digits 4 + 5.
     - Adductor Pollicis function is lost. 😊 Difficulty performing shadow puppets 😊

   Ulnar Nerve Injury Summary of Muscles Lost
   - All Hypothenar muscles (ABDM, ODM, FDM)
   - Lumbricals to digits 4 & 5 and all Interossei
   - Adductor Pollicis
   - Flexor Pollicis brevis (deep head)
   - Palmaris Brevis

3. Radial Nerve Injury
   - sensory changes may be present on the back of the hand, forearm or arm depending on location of the lesion.
   - inability to extend wrist, hand, fingers and thumb.
   - thumb extension is lost because the Abductor Pollicis Longus, Extensor Pollicis Longus & Extensor Pollicis Brevis are radial nerve innervated.
     - "Wrist Drop" wrist flexors placed in passively insufficient position.
     - decreased grip strength may be seen along with the inability to grasp objects due to the inability to extend wrist to maintain proper length – tension relationships of the wrist.

4. Claw Hand Deformity
   - typically the result of a double injury to the median and ulnar nerves.
   - normally seen with diabetic or alcoholic neuropathies.
   - a glove type parasthesia may be seen with the symptoms starting at finger tips and slowly progresses up the hand.
     - A neuropathy affects an equal peripheral nerve distribution.
     - A nerve injury or root problem affects a specific distribution.
Hand Deformities

1. **Ulnar Drift** – results from the pull of finger flexors on the collateral ligaments on the ulnar side of the fingers. This causes a progressive breakdown of the collateral ligaments on the radial side at an increased rate causing the digits to drift towards the ulna.

2. **Boutonniere Deformity** – problem lies in the lateral bands of the extensor mechanism migrating anteriorly due to the breakdown and degeneration of the ligaments normally holding them in place. This anterior migration causes the lateral bands to become PIP flexors instead of extensors. The button-hole appearance results from the PIP joint popping out from in between the lateral bands placing the affected digit(s) in PIP flexion and DIP hyperextension.

3. **Swan Neck Deformity** – caused by a breakdown of the volar plates at the PIP joint. Normally the volar plates prevent the digits from hyperextension when the extensor mechanism contracts but, because nothing holds them down to prevent PIP hyperextension, the affected digit(s) appears as a ‘swan – neck’ or in a position PIP hyperextension and DIP flexion.

4. **Mallet Finger** – typically seen in RA where the lateral bands are attacked before their insertion. A mallet finger can also be caused by a rupture or avulsion of the lateral bands, such as a baseball hitting the tip of the distal phalanx. It is much better to have an avulsion fracture because the fracture heals better and has a better prognosis.

5. **Bouchards Nodes** – Associated with OA. Appear in PIPs as an osteophyte.
   - “Bouchard is by the nail”

6. **Heberdens Nodes** – Associated with OA. Appear in DIPs as an osteophyte.
   - “Heberden is halfway up the finger”

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