The Upper Extremity

Arm Muscles, Axilla, Brachial Plexus

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Bones of Upper Extremity

- Appendicular Skeleton
- Pectoral Girdle = scapula, clavicle
- Upperlimb
  - Arm: humerus
  - Forearm: radius, ulna
    - Interosseus membrane
  - Hand: carpals, metacarpals, phalanges
- Review Bones + Landmarks studied in Lab!!
Joints of Upper Extremity

- **Sternoclavicular**
  - Synovial-saddle
  - Diarthrosis
- **Acromioclavicular**
  - Synovial-plane
  - Diarthrosis
- **Glenohumeral joint**
  - Synovial-ball&socket
  - Diarthrosis
  - Many ligaments
  - Muscle reinforcement
  - Great Mobility

(a) Articulated pectoral girdle

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Joints of the Upper Extremity

- Elbow Joint
  - Synovial – hinge
  - Diarthrosis
- Articulations
  - Humerus & Ulna
  - Humerus & Radius
- Many Ligaments
Joints of Upper Extremity

- Proximal Radioulnar joint
  - Synovial - pivot
  - Diarthrosis
- Distal Radioulnar joint
  - Synovial – pivot
  - Diarthrosis
- Allows pronation and supination of forearm
Joints of the Upper Extremity

- Radiocarpal joint
  - Synovial-condyloid
  - Distal radius with proximal row of carpals
- Intercarpal joints
  - Synovial-plane
- Carpal-metacarpal (2-5)
  - Synovial-plane
- Trapezium-metacarpal 1
  - Synovial-saddle
- Metacarpal-phalangeal
  - Synovial-condyloid
- Interphalangeal
  - Synovial-hinge
- ALL DIARTHROSES
Review of Naming

What do the following names TELL you about the muscle?

- **Naming**
  - Flexor carpi ulnaris
  - Flexor digitorum superficialis
  - Flexor pollicis longus
  - Pronator quadratus
  - Extensor carpi radialis brevis

Refer to tables in chapter 11 of text for muscle O + I

(Table 11.8-11.13)

Know at least 1 action of *every* muscle
Muscles of Scapula

- If ORIGIN on scapula = Move Arm
  - Subscapulae
  - Supraspinatus
  - Infraspinatus
  - Teres Minor
  - Teres Major
  - Latissimus Dorsi (partial O on scap)
  - Coracobrachialis

- If INSERTION on scapula = Move scapula
  - Rhomboids
  - Trapezius
  - Pectoralis Minor
  - Serratus Ventralis
  - Levator Scapulae

Use location of Insertion to determine movement!!

Rotator Cuff
Innervation of Scapula Muscles

- **Origin on Scapula:**
  - Latissimus dorsi = Thoracodorsal nerve
  - Subscapularis, Teres Major = Subscapular nerves
  - Supraspinatus, Infraspinatus = Suprascapular nerves
  - Teres Minor = Axillary nerve

- **Insertion on Scapula**
  - Levator Scapular, Rhomboids = Dorsal Scapular nerve
  - Pectoralis Minor = Pectoral n.
  - Serratus Ventralis = Long Thoracic n.
  - Trapezius = Accessory n.

Refer to tables in chapter 11 of text for muscle O + I
Know at least 1 action of *every* muscle
Muscles of Arm: Cross elbow, Move forearm

- 2 Compartments
  - Anterior: Flexors of forearm
  - Posterior: Extensors of forearm

- Anterior Compartment
  - Biceps brachii = MC nerve
  - Brachialis = MC nerve
  - Brachioradialis = Radial nerve
  - Coracobrachialis = MC nerve
  - O = coracoid process of scapula
  - I = medial side humeral shaft
  - A = flex, adduct arm

- Posterior Compartment
  - Triceps brachii = Radial nerve
  - Anconeus = Radial nerve

MC = musculocutaneous nerve
Muscles of forearm: Cross wrist + finger joints, moves hand

- Cross Wrist = flex, extend, abduct, adduct hand
- Cross Fingers = flex, extend fingers
- Most muscles fleshy proximally, long tendons distally
- Flexor + Extensor Retinacula
  - wristbands keep tendons from bowing
  - thick, deep fascia
- Anterior Flexor Compartment (Superficial + Deep layers)
  - Most flexors have common tendon on medial epicondyle
  - Contains 2 pronators
  - Innervated by *Median, Ulna nerves
- Posterior Extensor Compartment (Superficial + Deep layers)
  - Innervated by Radial nerve (or branches of)
### Innervation of Anterior Compartment-Forearm Muscles

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Nerve</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Superficial Muscles</strong></td>
<td></td>
</tr>
<tr>
<td>Flexor digitorum superficialis</td>
<td>Median</td>
</tr>
<tr>
<td>Flexor carpi radialis</td>
<td>Median</td>
</tr>
<tr>
<td>Pronator teres</td>
<td>Median</td>
</tr>
<tr>
<td>Palmaris longus</td>
<td>Median</td>
</tr>
<tr>
<td>Flexor carpi ulnaris</td>
<td>Ulnar</td>
</tr>
<tr>
<td><strong>Deep Muscles</strong></td>
<td></td>
</tr>
<tr>
<td>Pronator quadratus</td>
<td>Median</td>
</tr>
<tr>
<td>Flexor pollicis longus</td>
<td>Median</td>
</tr>
<tr>
<td>Flexor digitorum profundus</td>
<td>Ulnar (med 1/2)</td>
</tr>
</tbody>
</table>
Anterior Compartment Forearm

- Flexor Carpi Radialis
- Flexor Retinaculum
- Brachioradialis
- Flexor Carpi Ulnaris
- Pronator Teres
- Flexor Digitorum Superficialis

Flexor Digitorum Superficialis is deep to other flexors
Innervation of Posterior Compartment-Forearm Muscles

- **Superficial**
  - Extensor carpi radialis longus  Radial
  - Extensor digitorum  Radial
  - Extensor carpi ulnaris  Radial

- **Deep**
  - Supinatus  Radial
  - Abductor pollicis longus  Radial
  - Extensor pollicis longus + brevis  Radial
  - Extensor indicus  Radial
## Intrinsic Muscles of Hand

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Nerve</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pinky (little finger)</strong></td>
<td></td>
</tr>
<tr>
<td>• All digiti minimi</td>
<td>Ulnar</td>
</tr>
<tr>
<td>(Flexor, Abductor, Opponens)</td>
<td></td>
</tr>
<tr>
<td><strong>Thumb</strong></td>
<td></td>
</tr>
<tr>
<td>• Abductor pollicis brevis</td>
<td>Median</td>
</tr>
<tr>
<td>• Flexor pollicis brevis</td>
<td>Median</td>
</tr>
<tr>
<td>• Opponens pollicis</td>
<td>Median</td>
</tr>
<tr>
<td>• Adductor pollicis</td>
<td>Ulnar</td>
</tr>
<tr>
<td><strong>Other Intrinsic Muscles</strong></td>
<td></td>
</tr>
<tr>
<td>• Palmar + Dorsal Interossei</td>
<td>Ulnar</td>
</tr>
<tr>
<td>• Lumbricals</td>
<td>Median, Ulnar</td>
</tr>
</tbody>
</table>
Intrinsic Muscles of Hand

Palmar Interossei

Dorsal Interossei

Lumbricals

Interossei help the lumbricals to extend IP joints and flex MC-P joints
Blood Supply: Veins

SUPERCIFIAL
- Cephalic (arm-forearm)
- Basilic (arm-forearm)
- Median Cubital (elbow)
- Median Vein
- SF. Palmar Venous Arch
- Digital

DEEP
- Subclavian (neck)
- Axillary (axilla)
- Brachial (arm-elbow)
- Radial (forearm)
- Ulnar (forearm)
- Deep Palmous Venous arch

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Blood Supply: Arteries

- Subclavian (neck)
- Axillary (armpit)
  - Subscapular
- Brachial (arm)
  - Deep brachial
- Radial (forearm)
- Ulnar (forearm)
  - Common Interosseous
- Superficial & Deep Palmar arches
  - Digital

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Axilla = Armpit

- Region between arm and chest
- Boundaries
  - Ventral - pectoral muscles
  - Dorsal = latissimus dorsi, teres major, subscapularis
  - Medial = serratus ventralis
  - Lateral = bicipital groove of humerus
- Contents
  - Axillary lymph nodes, Axillary vessels
  - Brachial Plexus
Surface Anatomy of Upper Limb

- Biceps + Triceps brachii
- Olecranon Process
- Medial Epicondyle
- Cubital Fossa
  - Anterior surface elbow
  - Contents
    - Median Cubital Vein
    - Brachial Artery
    - Median Nerve
  - Boundaries
    - Medial= Pronator teres
    - Lateral= Brachioradialis
    - Superior= Line between epicondyles

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Surface Anatomy of Upper Limb

- **Carpal Tunnel**
  - Carpals concave anteriorly
  - Carpal ligament covers it
  - Contains: long tendons, Median nerve
  - Inflammation of tendons = compression of Median nerve

- **Anatomical Snuffbox**
  - Lateral = E. pollicis brevis
  - Medial = E. pollicis longus
  - Floor = scaphoid, styloid of radius
  - Contains Radial Artery (pulse)

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Brachial Plexus

- Network of nerves; part in neck, part in axilla
- Muscles of upper limb receive innervation from nerves of the brachial plexus
- Formed from Ventral Rami of Inferior 4 Cervical Nerves (C₅-₈) and T₁
Where Ventral Rami Come From

Dorsal Root

Dorsal Ramus of spinal nerve

Ventral Ramus of spinal nerve

spinal nerve

Ventral Root

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Parts of Brachial Plexus

- **R**eally **T**ired? **D**rink **C**offee **B**uddy!

- **R** = ROOTS (ventral rami)
- **T** = TRUNKS
- **D** = DIVISIONS
- **C** = CORDS
- **B** = BRANCHES
Roots join to form Trunks! (in neck)

- Ventral Rami

- **C5** ➔ Upper Trunk
- **C6** ➔ Upper Trunk

- **C7** ➔ Middle Trunk
- **C8** ➔ Middle Trunk
- **T1** ➔ Lower Trunk
Trunks Split to form Divisions! (in neck)

- Trunks

- Upper
  - Anterior
  - Posterior

- Middle
  - Anterior
  - Posterior

- Lower
  - Anterior
  - Posterior
Divisions Join to form Cords! (in axilla)

Trunks | Divisions | Cords

U A M A L A P

LATERAL CORD

MEDIAL CORD

POSTERIOR CORD

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Cords Give off Branches!! (in axilla)

- **Lateral**
  - Musculocutaneous

- **Medial**
  - Median
  - Ulnar

- **Posterior**
  - Radial
  - Axillary (thoracodorsal)
  - (subscapular)
Learn Figure 14.11c in textbook!
Innervation by Posterior Cord

- Radial Nerve (largest branch)
  - Course: Through arm, around humerus, around lateral epicondyle, then divides
  - Innervates: all posterior muscles of arm and forearm
    - Triceps brachii, anconeus, supinator, brachioradialis
  - Divides in forearm:
    - Superficial = skin of arm and dorsolateral surface of hand
    - Deep = extensor muscles of forearm (eg E. carpi radialis L + B)
  - Damage to Radial Nerve = wristdrop
    - Inability to extend the hand, st inability to fully extend forearm
Innervation by Posterior Cord (continued)

- **Axillary Nerve** (runs w/ caudal humeral circumflex a.)
  - Innervates:
    - Deltoid and Teres minor (motor inn)
    - Capsule of shoulder, skin of shoulder (sensory inn)

- **Subscapular Nerve** {branches of C5 + C6 rami}
  - Innervates: Subscapularis, Teres major

- **Thoracodorsal Nerve** (runs w/thoracodorsal a+v)
  - Innervates: Latissimus dorsi
Innervation by Lateral Cord

- **Musculocutaneous**
  - Course: branches to arm, distal to elbow becomes cutaneous for lateral forearm skin
  - Innervates
    - Biceps brachii, brachialis, coracobrachialis (motor inn)
    - Skin distal to elbow (sensory)

- **Suprascapular (runs w/suprascapular a+v) {C5, C6}**
  - Innervates: Supraspinatus, Infraspinatus
Innervation by both Lateral and Medial Cords

- **Median**
  - **Course:** middle of brachial plexus, does not branch in arm, distal to elbow provides many branches to most forearm flexors, passes through carpal tunnel to hand to lateral palmar intrinsics
  - **Innervates:** most muscles of anterior forearm (motor inn)
    - (eg) most flexors, some intrinsics (thumb)
  - **Innervates:** skin of lateral 2/3 hand on palm side, dorsum of fingers 2+3 (sensory inn)
  - **Nerve Damage = “Ape” Hand**
    - Inability to Oppose Thumb
Innervation by Medial Cord

- **Ulnar**
  - **Course:** runs along medial side of arm, behind medial epicondyle, superficial to carpal tunnel into hand, branches to supply intrinsics and skin
  - **Innervates:**
    - FCU and part of FDP, most intrinsics (motor inn)
    - Skin of medial 2/3 of hand A+P (sensory inn)
  - **Nerve Damage: Clawhand**
    - Inability to extend fingers at interphalangeal joints, results in permanent flexion = claw
Cutaneous Innervation to the Hand

PALMAR

DORSAL

- Ulnar
- Median
- Radial

CUTANEOUS, SENSORY NERVES OF THE HAND