Clarification of Terms

- **Palmar** is synonymous with anterior aspect of the wrist and hand
- **Ventral** is also synonymous with anterior aspect of the wrist and hand
- **Dorsal** refers to the posterior aspect of the wrist and hand

Clarification of Terms...cont

- The wrist is made up of 2 joints:
  - **Radiocarpal joint**
  - **Midcarpal joint**
Osteology of the Wrist (Bones)

- Ten bones are involved: the distal radius, distal ulna, and eight carpal bones (wrist bones)
- The carpal bones are arranged in 2 rows of 4 bones each
  - Starting on the thumb side of the proximal row are the **scaphoid**, **lunate**, **triquetrum**, and **pisiform**
  - Starting on the thumb side of the distal row are the **trapezium**, **trapezoid**, **capitate**, and **hamate**

Mansfield, p124 & Lippert, p162

---

**Draw**

- Trace your left hand and forearm on a piece of paper
- Label it "Right hand – Anterior View"
- Draw and label the radius and ulna
- Based on the previous slide, draw in the 2 rows of carpal bones and label them
- This will require that you can comprehend and utilize medical terminology!
Osteology of the Wrist (Bones)...cont

- Ulnar Styloid Process
- Radial Styloid Process
- Hook of Hamate
- Medial Epicondyle of humerus
- Lateral Epicondyle of humerus
- Supracondylar Ridge of humerus

Clarification of Terms

- The hand is made up of the thumb, metacarpals, and phalanges
- The digits are numbered (with the thumb being #1 and the small finger being #5)
- The digits can also be referred to as: thumb, index (or pointer), long, ring and small
Osteology of the Hand (Bones)
- The thumb and fingers have essentially the same bone structure, however the thumb has only 2 phalanges and the fingers have 3
- The hand, made up of the thumb and 4 fingers, has:
  - 5 metacarpals
  - 5 proximal phalanges
  - 4 middle phalanges
  - 5 distal phalanges
- There are no significant bony landmarks on these bones
- The proximal end of the metacarpals and phalanges is called the base, and the distal end is called the head.
- http://www.youtube.com/watch?v=Z6jUzWUGcOs&feature=related

Radiocarpal Joint: Joint Structure
- Consists proximally of the distal end of the radius and the radioulnar disk
- Consists distally of the scaphoid, lunate and triquetrum
- Synovial joint – condyloid
- The concave distal end of the radius and articular disk articulates with the convex scaphoid, lunate and triquetrum
- Accepts approximately 80% of the force that crosses the wrist

Radiocarpal Joint: Joint Movement
- **Osteokinematics:**
  - Biaxial joint allowing flexion, extension, radial deviation and ulnar deviation
  - The combination of all 4 motions is called circumdution
  - There is no rotation at the wrist
- **Arthrokinematics:**
  - The convex-shaped proximal row of carpal bones moves in a direction that is opposite the hand
  - Therefore, during wrist flexion, the carpals glide posteriorly on the radius and articular disk
  - (The same happens for the mid-carpal joint and it happens simultaneously with the radiocarpal joint)
Midcarpal Joint: Joint Structure

- Aka intercarpal joints
- Irregular shape classified as plane joints
- Non-axial joints that allow gliding motions, which collectively contribute to radiocarpal joint motions (flexion, extension, radial deviation and ulnar deviation)

Mansfield, p131 & Lippert, p161

Midcarpal Joint: Joint Movement

- **Osteokinematics:**
  - Non-axial joints that allow gliding motions, which collectively contribute to radiocarpal joint motions (flexion, extension, radial deviation and ulnar deviation)

- **Arthrokinematics:**
  - Follows the concave-convex rule
  - Roll and slide occur in opposite directions for flexion/extension and radial/ulnar deviation

Mansfield, p131 & Lippert, p161

Supporting Structures of both radiocarpal joint and midcarpal joint

- The joints of the wrist are enclosed within a fibrous capsule
- The capsule is thickened by extrinsic and intrinsic ligaments
  - Extrinsic ligaments originate proximally outside the carpal bones and attach distally within the carpal bones
  - Intrinsic ligaments have both proximal and distal attachments located within the carpal bones
- Detailed anatomy of the intrinsic ligaments is beyond the scope of this class. As a group, the intrinsic ligaments interconnect various carpal bones, help transfer forces between the hand and the forearm and maintain the natural shapes of the radiocarpal and midcarpal joints

Mansfield, p127
Supporting Structures of both radiocarpal joint and midcarpal joint...cont

- The Four primary extrinsic ligaments supporting the wrist:

<table>
<thead>
<tr>
<th>Ligament</th>
<th>Location</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dorsal radiocarpal ligament</td>
<td>Between radius and dorsal side of carpal bones</td>
<td>Resists extreme flexions</td>
</tr>
<tr>
<td>Radial collateral ligament</td>
<td>Lateral aspect between radius and carpal bones</td>
<td>Resists extremes of ulnar deviation</td>
</tr>
<tr>
<td>Palmar radiocarpal ligament</td>
<td>Thickest ligament of the wrist, on the palmar aspect between the radius and carpal bones</td>
<td>Resists extremes of wrist extension</td>
</tr>
<tr>
<td>Ulnar collateral ligament</td>
<td>Located on the ulnar aspect between the ulna and carpal bones</td>
<td>Resists extremes of radial deviation and helps stabilize the distal Radioulnar joint</td>
</tr>
</tbody>
</table>

Mansfield, p128

Supporting Structures of both radiocarpal joint and midcarpal joint...cont

- Flexor Retinaculum: ligament spanning the entire anterior surface of the wrist, holds flexor tendons close to the wrist when the wrist flexes. It also acts as a “tie beam” preventing the carpal bones from spreading apart.

- Extensor Retinaculum:
  - A ligament traversing the posterior side of the wrist in a medial-lateral direction, holding the extensor tendons close to the wrist, especially during active wrist extension

Myology of the Wrist (Muscles)

- Muscles crossing the wrist joint and having primary function at the wrist will be discussed here
  - Anterior Muscles
    - Flexor Carpi Ulnaris (FCU)
    - Flexor Carpi Radialis (FCR)
    - Palmaris Longus
  - Posterior Muscles
    - Extensor Carpi Radialis Longus (ECRL)
    - Extensor Carpi Radialis Brevis (ECRB)
    - Extensor Carpi Ulnaris (ECU)

Lippert, p166
Myology of the Wrist (Muscles)...cont

- General Statements regarding the wrist muscles:
  - 1. the flexors originate proximally on the medial epicondyle
  - 2. the extensors originate proximally on the lateral epicondyle
  - 3. the distal attachment for all wrist muscles is a metacarpal (except for palmaris longus)
  - 4. the names of the muscles will generally indicate what their action is

Myology of the Wrist...cont

- **Prime Movers:**

<table>
<thead>
<tr>
<th>Action</th>
<th>Muscles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion</td>
<td>FCR, FCU</td>
</tr>
<tr>
<td>Extension</td>
<td>ECRL, ECRB, ECU</td>
</tr>
<tr>
<td>Radial Deviation</td>
<td>FCR, ECRL</td>
</tr>
<tr>
<td>Ulnar Deviation</td>
<td>FCU, ECU</td>
</tr>
</tbody>
</table>

Myology of the Wrist

**Flexor Carpi Ulnaris (FCU)**

- **Origin:** Medial epicondyle of the humerus; common flexor tendon and posterior border of the middle 1/3 of the ulna
- **Insertion:** Base of the 5th metacarpal and pisiform; palmar aspect
- **Innervation:** Ulnar n.
- **Action:** Wrist flexion, ulnar deviation
- **"Ulnar"** What's in a name? Common origin?
Myology of the Wrist

**Flexor Carpi Radialis (FCR)**

<table>
<thead>
<tr>
<th>Origin</th>
<th>Medial epicondyle of the humerus - common flexor tendon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion</td>
<td>Base of the 2nd metacarpal - palmar aspect</td>
</tr>
<tr>
<td>Innervation</td>
<td>Median n.</td>
</tr>
<tr>
<td>Action</td>
<td>Wrist flexion, radial deviation*</td>
</tr>
<tr>
<td>&quot;tidbit&quot;</td>
<td>What's in a name? Common origin?</td>
</tr>
</tbody>
</table>

- Lippert, p165

---

Myology of the Wrist

**Palmaris Longus**

<table>
<thead>
<tr>
<th>Origin</th>
<th>Medial epicondyle of the humerus - common flexor tendon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion</td>
<td>Transverse carpal ligament and the palmar fascia</td>
</tr>
<tr>
<td>Innervation</td>
<td>Median n.</td>
</tr>
<tr>
<td>Action</td>
<td>Wrist flexion</td>
</tr>
<tr>
<td>&quot;tidbit&quot;</td>
<td>Approximately 10% of the population will NOT have this muscle</td>
</tr>
</tbody>
</table>

- Lippert, p165

---

The Wrist Flexor Muscles

- How do we stretch the wrist flexors?
- How do we strengthen the wrist flexors concentrically? Eccentrically?
Myology of the Wrist

**Extensor Carpi Radialis Brevis (ECRB)**

<table>
<thead>
<tr>
<th>Origin</th>
<th>Lateral epicondyle of the humerus, common extensor tendon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion</td>
<td>Base of the 3rd metacarpal, dorsal aspect</td>
</tr>
<tr>
<td>Innervation</td>
<td>Radial n.</td>
</tr>
<tr>
<td>Action</td>
<td>Wrist extension</td>
</tr>
<tr>
<td>&quot;tidbit&quot;</td>
<td>What's in a name? Common origin?</td>
</tr>
</tbody>
</table>

Lippert, p.166

Myology of the Wrist

**Extensor Carpi Radialis Longus (ECRL)**

<table>
<thead>
<tr>
<th>Origin</th>
<th>Lateral epicondyle of the humerus, common extensor tendon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion</td>
<td>Base of the second metacarpal, dorsal aspect</td>
</tr>
<tr>
<td>Innervation</td>
<td>Radial n.</td>
</tr>
<tr>
<td>Action</td>
<td>Wrist extension, radial deviation</td>
</tr>
<tr>
<td>&quot;tidbit&quot;</td>
<td>What's in a name? Common origin?</td>
</tr>
</tbody>
</table>

Lippert, p.166

Myology of the Wrist

**Extensor Carpi Ulnaris (ECU)**

<table>
<thead>
<tr>
<th>Origin</th>
<th>Lateral epicondyle of the humerus, common extensor tendon and posterior border of the middle 1/3 of the ulna</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion</td>
<td>Base of the 5th metacarpal, dorsal surface</td>
</tr>
<tr>
<td>Innervation</td>
<td>Radial n.</td>
</tr>
<tr>
<td>Action</td>
<td>Wrist extension, ulnar deviation</td>
</tr>
<tr>
<td>&quot;tidbit&quot;</td>
<td>What's in a name? Common origin?</td>
</tr>
</tbody>
</table>

Lippert, p.166
Wrist Extensor Muscles
• How do we stretch the wrist extensor muscles?
• How do we strengthen the wrist extensor muscles concentrically? Eccentrically? Isometrically?
• What’s the difference between extending the wrist with the forearm in pronation vs forearm neutral?

Myology of Wrist...cont
• Tendon position of anterior wrist muscles

http://www.youtube.com/watch?v=ioDXUwErJJA&feature=related
Anatomical Relationships

- The wrist flexors are relatively superficial, are located on the anterior aspect of the forearm and originate on the medial epicondyle.
- Beneath the wrist flexors are the flexors of the thumb and hand.
- The wrist extensors are relatively superficial, are located on the posterior aspect of the forearm and originate on the lateral epicondyle.
- From lateral to medial, they go: ECRL, ECRB, ED & EDM (hand muscles), ECU.
- Note: all wrist, hand and thumb tendons are contained by the extensor retinaculum.

Summary of Muscle Innervation:

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Nerve</th>
<th>Spinal Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECRL</td>
<td>Radial</td>
<td>C6, C7</td>
</tr>
<tr>
<td>ECRB</td>
<td>Radial</td>
<td>C6, C7</td>
</tr>
<tr>
<td>ECU</td>
<td>Radial</td>
<td>C6, C7, C8</td>
</tr>
<tr>
<td>FCR</td>
<td>Median</td>
<td>C6, C7</td>
</tr>
<tr>
<td>Palmaris Longus</td>
<td>Median</td>
<td>C6, C7</td>
</tr>
<tr>
<td>FCU</td>
<td>Ulnar</td>
<td>C8, T1</td>
</tr>
</tbody>
</table>

Pin the Tail on the Donkey

- Point to the…
- Wrist flexors
- Wrist extensors
Identify!

- Flexor Carpi Ulnaris
- Palmaris Longus
- Flexor Carpi Radialis

Identify!

- Extensor carpi radialis brevis
- Extensor carpi radialis longus
- Extensor carpi ulnaris
- Flexor carpi ulnaris
- Extensor retinaculum

Muscles of Forearm (Superficial Layers), Posterolateral View
References