

## Upper Extremities: Forearm and Hand

The upper extremity is an intricate system that allows for complex movements. The forearm and hand are composed of a series of bones that allow for stability and mobility. These include the radius and ulna in the forearm and 8 carpal bones in the wrist. These carpal bones connect the radius and ulna to the metacarpal bones. The carpal bones form the dorsal bounds of the carpal tunnel, which is bounded on the ventral side by the flexor retinaculum (also known as the transverse carpal ligament). The carpal tunnel contains flexor tendons for the digits and the median nerve. Compression of the median nerve in this space is called carpal tunnel syndrome. Somatic dysfunction of the wrist may contribute to this condition, as wrist flexion and extension dysfunctions also involve dorsal or ventral glide of the carpal bones. Proximally, the forearm may be evaluated by looking at the carrying angle - the angle of deviation of the forearm from the humerus. Common problems of the elbow include nerve palsies, lateral epicondylitis (tennis elbow) and medial epicondylitis (golfer's elbow). Like the wrist, forearm structures are also prone to somatic dysfunctions. Ulnar dysfunctions are commonly abduction or adduction, while radial head dysfunctions are posterior or anterior. Anterior radial heads are associated with supination and backward falls, whereas posterior radial heads are associated with pronation and forward falls. The interosseous membrane, a fascial sheet between the radius and ulna, may have a somatic dysfunction and retain strain patterns long after an injury.



PLAY PICMONIC

### Hand

#### Carpal Bones

##### Car-pool Bones

The carpal bones, also known as wrist bones, are 8 small bones that connect the hand to the forearm. These include the scaphoid, lunate, triquetrum, pisiform, trapezium, trapezoid, capitate, and hamate. Proximally, the carpal bones articulate with the radius and ulna. Distally, they articulate with the metacarpals. The carpal bones, especially the scaphoid, are susceptible to injury from trauma. Please review the Hand Bones Picmonic for more detailed information about the carpal bones.

#### Carpal Tunnel

##### Car-pool Tunnel

The carpal tunnel is an anatomic space bounded by the carpal bones and the flexor retinaculum (also known as the transverse carpal ligament). This space contains 9 tendons (one flexor pollicis longus, four flexor digitorum superficialis, four flexor digitorum profundus) and the median nerve. Because the carpal tunnel is bounded, any increase in the contents of the carpal tunnel (e.g. from edema) or decrease in the carpal tunnel space can compress the median nerve. Median nerve compression in the carpal tunnel is known as carpal tunnel syndrome, which presents with paresthesia, pain, and/or weakness in the hands. Please review the Carpal Tunnel Syndrome Picmonic for more information.

### Hand Somatic Dysfunction

#### Wrist Dysfunction

##### Wrist Dysfunctioning

Somatic dysfunction in the bones of the wrist can greatly impact wrist and hand function and contribute to unpleasant symptoms. Restrictions in the freedom of motion of the carpal bones may contribute to the pathophysiology of carpal tunnel syndrome, while restrictions of the junction of the carpal bones and forearm can reduce joint motion and function. Wrist somatic dysfunctions include flexion dysfunction and extension dysfunction. In

flexion dysfunction, the wrist prefers flexion and the carpal bones glide dorsally. In extension dysfunction, the wrist prefers extension and the carpal bones glide ventrally.

## Forearm

### Carrying Angle

#### Arm Angle

The carrying angle is the angle between two intersecting lines. The first line is the long axis of the humerus. The second passes through both the distal and proximal radial-ulnar joints. Roughly, it is how much the forearm deviates laterally from the humerus. It is akin to the Q angle of the knee, and similarly may be abnormal, either varus or valgus. The mechanics between the elbow and wrist joint have a parallelogram effect. When the carrying angle is reduced (cubitus varus) the ulna is adducted and the wrist abducted. When the carrying angle is increased (cubitus valgus) the ulna is abducted and the wrist adducted.

### Nerve Palsies

#### Nerve Pause

The brachial plexus supplies the upper extremity after receiving and reorganizing fibers from lower cervical and upper thoracic roots. The cervical roots, brachial plexus, and peripheral nerves of the upper extremity are relatively vulnerable to injury. Injuries to motor nerves can give rise to pathognomonic weakness, or palsies. Please review the Picmonic playlist Nerve Palsies for more details on specific nerve palsies of the upper extremity.

### Lateral Epicondylitis (Tennis Elbow)

#### Ladder, E-cone, and Tennis Player

Lateral epicondylitis, also known as tennis elbow, is a tendinopathy affecting tendons attached to the lateral humeral epicondyle. These tendons, namely the extensor carpi radialis, suffer repeated microtrauma leading to pain on the lateral elbow. Tennis elbow is a relatively common condition, much more common than golfer's elbow. Treatment is usually conservative, but occasionally invasive procedures are required.

### Medial Epicondylitis (Golfer's Elbow)

#### Metal-E-cone Humerus-bone on Fire and Golfer

Medial epicondylitis, also known as golfer's elbow, is a tendinopathy of the flexor and pronator muscle groups. The flexor digitorum superficialis, pronator teres, flexor carpi ulnaris, and flexor carpi radialis may all be affected. Golfer's elbow is less common than tennis elbow and frequently affects throwing athletes. Treatment begins with conservative measures.

## Forearm Somatic Dysfunction

### Ulnar Dysfunction

#### Underwear Dysfunction

Ulnar somatic dysfunction is frequently found in association with other forearm somatic dysfunctions, such as those of the radial head and wrist. Ulnar somatic dysfunctions include ulnar abduction and ulnar adduction. Abduction occurs when the distal aspect of the ulna moves medially while the proximal aspect moves laterally. Adduction is the opposite of these motions.

### Anterior Radial Head

#### Anteater Radio Head

Radial head somatic dysfunctions are common in practice and on exams. The radial head (the proximal aspect that articulates at the elbow) rotates on a long axis during pronation and supination. These motions are also associated with a teeter-totter motion of the whole bone. This makes the radial head have a slight anterior-posterior glide. An anterior radial head (e.g. stuck in anterior glide) is associated with supination. Anterior radial head somatic dysfunction may be acquired from falling backward on an outstretched arm - trauma while the forearm is supinated. On exam, the patient will have difficulty with forearm pronation.

## Posterior Radial Head

### Post-traumatic Radio Head

Radial head somatic dysfunctions are common in practice and on exams. The radial head (the proximal aspect that articulates at the elbow) rotates on a long axis during pronation and supination. These motions are also associated with a teeter-totter motion of the whole bone. This makes the radial head have a slight anterior-posterior glide. A posterior radial head is associated with pronation. Posterior radial head dysfunction is commonly acquired during a fall on an outstretched hand - trauma while the forearm is pronated. On physical exam, the patient will have difficulty with supination.

## Interosseous Membrane Dysfunction

### Interosseous Membrane Dysfunction

The interosseous membrane is a thin sheet of fascia extending downward and medially from the radial shaft to the ulna. The interosseous membrane can develop and retain strains from prior injuries, thus perpetuating pain and reduced function. Palpation of the interosseous membrane may reveal tenderness and/or tension. Somatic dysfunction of the interosseous membrane may be treated with manipulative techniques such as myofascial release.