The Upper Extremity

Shoulder

The word ‘shoulder’ is vague; as the name suggests, the shoulder girdle passes around the top of the thorax, but if asked to point to it, there can be wide variation of opinion. It forms an origin for the arm; but on this point, the only real bony attached for the arm on the thorax is via the clavicle, the rest are purely muscular.

Bones:
- Humerus
- Scapula
- Clavicle

Joints:
The glenohumeral joint
It is between the head of the humerus and the glenoid fossa of the scapula; it consists of a large ball sitting in a small socket. There are few ligaments here, per se, and the joint is stabilised mainly by muscles.

The acromioclavicular joint
It is between acromion of the scapula and the lateral end of the clavicle. Here the lateral end of the clavicle is stabilised (held down) by ligaments between it and the scapula. There is also a bursa here between the acromion and the muscle supraspinatus.

The sternoclavicular joint
It is between the medial end of the clavicle and the manubrium of the sternum. They are two main ligaments here: the supraclavicular ligament, running between the two clavicles across the top of the sternum, and a ligament under it down to the first rib; these both stabilise the medial end of the clavicle.

Figure 1 - Bones of Shoulder Girdle
Muscles of the shoulder:
These are numerous and complex yet, as I said, they provide the primary stability in the shoulder region. They can be learned anatomically and functionally.
Anatomically:
There are 4 groups:
- Rotator cuff muscles
- Muscles from the scapula to the trunk
- Muscles from the scapula to the humerus
- Long muscles

Rotator Cuff Muscles:

Figure 2 - Shoulder Girdle - Bones

These all pass from the scapula to the top of the humerus; they form a cuff around the joint (hence their name) and provide the main stability for the glenohumeral joint. They have individual actions, but collectively it is one of stability
- **Supraspinatus** - Acts to abduct the arm and prevent it dislocating inferiorly the humerus; it acts to externally rotate the humerus
- **Infraspinatus** - Acts to externally rotate the humerus
- **Teres Minor** - Acts to medially rotate the humerus
- **Subscapularis** - Acts to medially rotate the humerus

Muscles from the scapula to the trunk (periscapular) these move the scapula on the trunk.

A. **Levator scapulae**: from TP’s of C1 - 4 down to top medial corner of scapula; it elevates the scapula
B. **Rhombooids** (major and minor): Sp’s of C7 - T5 down to medial edge of scapula; retracts and elevates scapula
C. **Serratus anterior**: from top 8 ribs and wraps around ribs to front medial edge of scapula; protract scapula
D. **Pectoralis minor**: from ribs 3-5, up to coracoid process of scapula, depresses scapula
E. **Trapezius**: from occiput, ligamentum nuchae and all SPs down to T12. Upper fibres down to lateral end of spine of scapula, lower end up to medial end of spine of scapula. Acts to elevate, depress, retract and medially rotate scapula
Coracobrachialis

Serratus anterior (cut)

Teres major

Tendon of latissimus dorsi (cut)

Brachialis

Long head

Medial head

Triceps brachii

Radius

Medial epicondyle of humerus

Biceps brachii tendon

Aponeurosis of biceps brachii

Pronator teres

Ulna

SERRATUS ANTERIOR

BRACHIALIS

RADIUS

BICEPS BRACHII TENDON

PRONATOR TERRIS

ULNA

Muscles from scapula to arm

a) **Coracobrachialis**: From the coracoid process of the scapula to the front of the humerus; it acts to flex the glenohumeral joint.

b) **Teres Major**: From the lateral edge of the scapula, it passes forward to the front of the humerus; it is a powerful adductor, extensor and medial rotator of the glenohumeral joint

c) **Long head of triceps**: from top lateral border of scapular to olecranon of ulna
Long muscles

Figure 5 - Shoulder: Long Muscles

a) **Pectoralis Major**: From the medial half of the clavicle, sternum and 6th rib, across to the front of the humerus; it acts to adduct, flex and medially rotate the glenohumeral joint.

b) **Deltoid**: Lateral third of the clavicle, the acromion, and lateral half of the spine of the scapula; these three heads converge on the deltoid tuberosity, about half way down the lateral edge of the humerus; it acts to flex, extend and abduct the glenohumeral joint.

c) **Latissimus dorsi**: From the iliac crest of the pelvis, all the SPs up to T8; it acts to adduct, extend and medially rotate the glenohumeral joint.
Looking at these groups of muscles functionally:

<table>
<thead>
<tr>
<th>Flexors</th>
<th>Extensors</th>
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<tbody>
<tr>
<td>Coracobrachialis</td>
<td>Deltoïd, posterior</td>
</tr>
<tr>
<td>Deltoid, anterior</td>
<td>Teres Major</td>
</tr>
<tr>
<td>Biceps, short and long heads</td>
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<td></td>
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<tr>
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<td>Teres minor + Infraspinatus (elements of)</td>
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<td>Medial Rotation</td>
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<tr>
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<td>Protractors</td>
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<td>Pectoralis major</td>
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Problems affecting the shoulder region:
- Frozen shoulder: manifests as gross stiffness and immobility, frequently with lots of pain. Person cannot abduct (lift) or extend arm
- Dislocations: can occur at any of the three joints, but usually the glenohumeral joint
- Fractures: usually of the clavicle; they never set in a straight line
- Osteoarthritis: usually at A/C joint

The Upper Extremity

Bones: Humerus, Ulna, Radius, 8 carpal bones, 5 metacarpal, bones, 14 phalanges.

Joints

Elbow: There are effectively three joints in the elbow joint; it being stabilised primarily by bony configuration, (Fig 56) the humerus ‘fitting’ into the ulna.

Bones—Humerus, ulna, radius

Joints—There are three:
  a) **Humeroulnar** — between the Trochlear (humerus) and ulna
  b) **Humeroradial** — between the capitulum and radius
  c) **Radioulnar** — between the proximal heads of radius and ulna

The first two constitute the hinge of the elbow, allowing flexion and extension.
The radioulnar is a pivot joint allowing rotation — supination and pronation of the hand

Figure 6 - Elbow Joint

Ligaments:
- Collateral
- Annular (around the radial head, to allow rotation)
Muscles moving the elbow:

**Flexors:**

- **Biceps brachii:** It has two heads from the scapula, both passing down to the radius and the deep fascia of the forearm; it flexes the elbow
- **Brachialis:** From the lower half of the humerus to the ulna; it acts to flex the elbow
- **Brachioradialis:** from the inferior lateral edge of the humerus, down to the styloid process at the distal end of the radius; it flexes the elbow
- **Pronator teres:** from the medial epicondyle of the humerus, it passes across to the radius; it flexes and pronates the elbow.

**Figure 7 - Elbow Flexors**

**Extensors:**

**Triceps:** This arises from three heads, two from the humerus (medial and lateral heads) and one from the top lateral edge of the scapula (long head), they all converge on to one tendon attaching to the olecranon of the ulna; it extends the elbow.
**Supinators:**

**Supinator:** Arises from the lateral epicondyle of humerus (CEO), passing across to the lateral edge of the radius; it supinates (turns the palm up)

**Biceps brachii:** se above; it also acts to supinate the forearm

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**Pronators:**

**Pronator teres:** Arises from the medial epicondyle (CFO) and passes across to the lateral edge of the radius; it pronates the forearm (turns the palm down), it also flexes the elbow.

**Pronator quadratus:** this is at the distal end of the forearm, it arises from the ulna and passes across to the radius; it pronates the forearm.
Wrist
This is really a complex of joints between the forearm and the hand.

Bones
It encompasses the distal radius (mainly) and ulna, the eight bones of the carpus (wrist) and the proximal ends of the metacarpals.

Figure 8 - Bones of Hand and Wrist

Bones of the wrist: It consists of two rows; proximal and distal
- Proximal:
  o scaphoid, lunate, triquetral, pisiform
- Distal:
  o hamate, capitate, trapezoid, trapezium
(Starting laterally at the styloid process of the radius, moving medially; and then laterally again across the distal row. Remembering the bones in order is quite taxing, so make up a sentence of the initial letters; e.g. Suzie longs to pee, her corset's too tight)

Carpal Tunnel
There are two main bony prominences on the anterior side of the wrist for a particular fascial attachment; this fascia is called the flexor retinaculum. It stretches across the front of the wrist and forms the roof of the carpal tunnel through which passes all the long flexor tendons, vessels and nerves passing into the palmer side of the hand.

Figure 9 - Carpal Tunnel
The muscles that move the fingers also move the wrist and are arranged in layers, so they will be dealt with collectively:
- Anterior groups
  o 3 layers: superficial, intermediate and deep (all flexors)
- Posterior group
  o 2 layers; superficial and deep (all extensors)
Anterior groups:

Figure 10 - Wrist - Anterior Group - Flexors

Superficial:
- **Flexors carpi ulnaris:**
  - Arises from the CFO, down to the medial side of the wrist
- **Flexor carpi radialis:**
  - Arises from the CFO, down to the lateral side of the wrist
- **Palmaris longus:**
  - Arises from the CFO, down to the fascia of the palm

These collectively flex wrist (only).

Intermediate:
- **Flexor digitorum superficialis:**
  - From the CFO, down to the distal phalanx; flexes whole finger from DIJ

Deep
- **Flexor digitorum profundus:**
  - From the CFO down to the middle phalanx; flexes fingers at PIJ
- **Flexor pollicis longus:**
  - From the radius, down to the distal phalanx of the thumb (only flexes thumb)
Extensor groups: (all posterior)

Figure 11 - Wrist - Posterior Group - Extensors

Deep
- **Extensor indicis:**
  - distal part of ulna down to distal phalanx of index finger; it points index finger
- **Extensor pollicis longus:**
  - from middle part of ulna to distal phalanx of thumb; extends thumb
- **Extensor pollicis brevis:**
  - from ulna down to proximal phalanx of thumb

Superficial:
- **Extensor digitorum:** from the CEO down to the distal phalanx; it extends fingers
- **Extensor digiti minimi:** from the CEO down to the distal phalanx of the little finger; it extends the little finger (pinkyel)
- **Extensor carpi ulnaris:** from CEO down to the medial side of the wrist; extends wrist
- **Extensor carpi radialis brevis:** from CEO) down to lateral side of the wrist; extends wrist
- **Extensor carpi radialis longus:** from CEO down to lateral side of wrist; extends wrist
- **Abductor pollicis longus:** from radius down to the distal phalanx of thumb: extends thumb
The Hand

The hand is unique, not only in that the fingers can flex allowing it to grasp, but the thumb has movement across the palm, or opposition.

Bones

From the distal row of carpal bones are the 5 metacarpals, which are numbered 1 – 5; 1 being on the thumb side.

Muscles:

These are collectively called the intrinsic muscles of the hand, of which there are three groups:

- **Thenar eminence:**
  - flexor pollicis brevis,
  - abductor pollicis,
  - opponens pollicis.

- **Hypothenar eminence:**
  - flexor digiti minimi,
  - abductor digiti minimi,
  - opponens digiti minimi (these move the thumb and little finger)
Muscles between the metacarpals:
- **Posterior interossei**: abduct the fingers
- **Anterior interossei**: adduct the fingers
- **Lumbrical**: flexes the metacarpal-phalangeal joints of the fingers

Problems affecting wrist and hands

**Sprain and strains** – usually from trauma, RSI

**Rheumatoid arthritis** – regarded as an autoimmune condition, pain and swelling is symmetrical (bilateral)
**Carpal tunnel syndrome** – a condition where there is a reduced space under the carpal tunnel causing pins and needles, or numbness, in the palm of the hand via irritation of the median nerve.

**Trauma** - causing fractures (e.g. Colles fracture) and dislocations

![Figure 14 - Colles Fracture](image)

**Osteoarthritis**

Osteoarthritis is seen as 'wear and tear' and manifests as stiffness, pain and joint deformity

- **Heberden’s nodes** – bony changes at the DIJ from O/A
- **Bouchard’s nodes** – bony changes at PIJ from O/A

![Figure 15 - Heberden’s Nodes and Bouchard’s Nodes](image)
Gout – An inflammation and deformation caused by the deposition of sodium urate (from uric acid). Caused by a genetic fault in purine metabolism

Figure 16 - Gout in Fingers