Pectoral girdle, SUPERIEUR ARM AND HAND

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The pectoral girdle is the set of bones which connect the upper limb to the axial skeleton on each side.

It consists of the

- clavicle
- scapula in humans
- in those species with three bones in the pectoral girdle, the coracoid.

- No joint exists between each clavicle and the thorax, instead the muscular connection between the two permits relatively great mobility of the shoulder girdle in relation to the pelvic girdle.

- In humans, the only joints between shoulder girdle and axial skeleton are the sternoclavicular joints on each side.
Pectoral girdle

- pectoral girdle = 2 clavicles + 2 scapulae

- **clavicle**: collar bone; keeps shoulders apart; vestigial or absent in quadrupeds; synovial joints with acromion process of scapula, and manubrium (sternum)

- **scapula**: shoulder blade; flat bone; coracoid process/spine: sites for muscle attachments to arm/thorax; extension of quadr limb (scapula glide); glenoid fossa forms synovial joint (shoulder) with humerus
1. Clavicle
2. Scapula
3. Humerus
4. Sternum
5. Cervical vertebrae
6. Thoracic vertebra
1. First rib
2. Scapula
3. Humerus
4. Cervical vertebrae
5. Thoracic vertebrae
anterior-posterior view

clavicle

scapula

humerus

ribs
three year old boy

growth plate

clavicle

scapula

humerus

anterior-posterior view
Immediately under the skin, the **pectoralis major**, **deltoid**, and **trapezius muscles** can be palpated. The **clavipectoral triangle** (or deltopectoral triangle), which contains the cephalic vein, is bordered by the clavicle, pectoralis major muscle and deltoid muscle. Finally, remember that the **neurovascular bundle** containing the axillary artery, axillary vein and brachial plexus courses under the clavicle and deep to the pectoralis major and minor before coursing into the arm.
Bony landmarks include the spine of the scapula, medial border of the scapula, and the acromion. Superficial muscles include the three parts of the trapezius, the deltoid, the teres major and the latissimus dorsi.
Humerus and Scapula

Posterior View - Features

- Superior notch of scapula
- Clavicle (cut)
- Superior angle of scapula
- Supraspinatus fossa of scapula
- Spine of scapula
- Medial angle of scapula
- Infraspinatus fossa of scapula
- Medial margin of scapula
- Inferior angle of scapula
- Lateral margin of scapula
- Head of humerus
- Anatomical neck of humerus
- Neck of scapula
- Groove for circumflex scapular vessels
- Surgical neck of humerus
- Intragnoid tubercle of scapula
- Deltoid tuberosity of humerus
- Groove for radial nerve
- Olecranon fossa of humerus
- Medial epicondyle of humerus
- Lateral epicondyle of humerus
- Trochlea of humerus

(A) Scapula

ACROMION
ACROMIAL ANGLE
SUPRASCAPULAR NOTCH
SUPERIOR ANGLE
CORACOID PROCESS
SPINE OF SCAPULA
OSTEAL CAVITY

(B) Clavicle

STERNAL FACET
ACROMIAL FACET

(b) Right clavicle, superior view

Anterior
Acromial (lateral) end

Anterior
Acromial end

Posterior
Sternal end

(c) Right clavicle, inferior view

Anterior

Posterior
anterior-posterior view: shoulder joint

- acromion
- coracoid
- scapula
- humerus
A). clavicle

- **Acromial end**: is flat and has a small facet for articulation with the acromion;
- **Sternal end**: has a large facet for articulation with the manubrium, and first costal cartilage;
- **Conoid tubercle**: conoid ligament of the coracoclavicular ligament attaches here;

Right
B). scapula

1). posterior surface
   • spine
   • acromion
   • coracoid process
   • suprascapular notch
   • supraspinous fossae
   • infraspinous fossae

2). borders
   • superior border
   • medial border
   • lateral border

3). anterior surface
   • scapular fossae

4). lateral end
   • glenoid cavity
Joints

• *Glenohumeral* - humerus articulating with glenoid fossa of scapula

• *Sternoclavicular (SC)* - proximal clavicle articulating with manubrium and cartilage of rib 1

• *Acromioclavicular (AC)* - acromian process of scapula articulating with distal clavicle

• *Coracoclavicular* - coracoid process of scapula articulating with inferior clavicle

• *Scapulothoracic* - anterior scapula articulating with thoracic wall
Movements of Scapula and Muscles Causing Movement:

- **Protraction (scapular abduction)** - serratus anterior, pectoralis minor
- **Retraction (scapular adduction)** - trapezius, rhomboid, levator scapulæ
- **Downward Rotation** - rhomboids, pectoralis minor
- **Upward rotation** - trapezius, serratus anterior
- **Depression** - trapezius (lower), pectoralis minor, subclavius
- **Elevation** - trapezius (upper), levatro scapulæ, rhomboid
- **acromion** - lateral extension of spine of scapula;
- **spine of scapula** - the trapezius and deltoid attach here;
- **greater scapular notch** - point at which the spine of the scapula ends, but the acromion continues;
- **coracoid process** - partially seen as it projects anteriorly;
- **supraspinous fossa** - the supraspinatus muscle originates here (part of rotator cuff);
- **infraspinous fossa** - the infraspinatus muscles originate here (part of rotator cuff);
- **lateral border** - teres minor muscle attaches here (part of rotator cuff), as does the teres major and the long head of the triceps brachii.
• **supraglenoid tubercle** - the long head of the biceps brachii attaches here;
• **infraglenoid tubercle** - the long head of the triceps brachii attaches here;
• **spinous process** - divides the supraspinous and infraspinous fossae, and serves as attachment for the deltoid and trapezius muscles;
• **acromion** - articulates with the clavicle and is an attachment for the trapezius and deltoid muscles;
• **superior and inferior angles**;
• **coracoid process** - serves as an attachment point for the short head of the biceps brachii, corachobrachialis, and pectoralis minor.
Glenohumeral joint
A variety of muscles attach to the humerus. These enable movement at the elbow and at the shoulder. The rotator cuff muscles attach at the proximal humerus, and can rotate and abduct the arm at the shoulder. Some of the forearm muscles, (such as pronator teres, and the flexors and extensors of the wrist) also attach to the distal humerus.
1). proximal end
   • head of the humerus
   • greater & lesser tubercle

2). distal end
   • condyle
     • capitulum
     • trochlea
   • epicondyle

3). fossa
   • coronoid fossa
   • olecranon
1. Head
2. Anatomical Neck
3. Lesser Tubercle
4. Intertubercular Groove
5. Greater Tubercle
6. Surgical Neck
7. Deltoid Tuberosity

1. Radial Fossa
2. Lateral Epicondyle
3. Capitulum
4. Trochlea
5. Medial Epicondyle
6. Coronoid Fossa
7. Olecranon Fossa
Epiphysial lines of humerus in a young adult. Anterior aspect. The lines of attachment of the articular capsules are in blue.
Common Shoulder Injuries

- **Dislocation** - anteriorly (subcoracoid), posteriorly (subspinous) or downward (subglenoid) are three most common
  - common when humerus is abducted and externally rotated
- **Rotator Cuff Damage** (impingement syndrome, tears, especially "throwers" [javelin, tennis, pitchers, swimmers])
- **Subscapular Neuropathy** - denervation of infraspinatus with accompanying loss of strength during external rotation of humerus that is common in volleyball
Forearm

line radius up with thumb
line ulna up with little finger

A). **ulna**
1). proximal
   - olecranon
   - coronoid process
   - troclear notch
   - radial notch
2). distal
   - head of the ulna
   - styloid process

B). **radius**
1). proximal
   - head of the radius
   - radial tuberosity
2). distal
   - ulnar notch
   - styloid process
Ulna and Radius of the Right Forearm

- Olecranon process
- Head
- Neck
- Radial tuberosity
- Trochlear (semilunar) notch
- Coronoid process
- Radial notch of ulna
- Ulna
- Radius
- Head
- Styloid process
Joints

- **Humeroulnar Joint** - hinge joint (between trochlea and trochlear notch of ulna = "elbow joint")
- **Humeroradial Joint** - gliding joint (between capitulum and proximal head of radius)
- **Proximal Radioulnar Joint** - pivot joint (annular ligament binds radial head of radius to radial notch of ulna)
HUMERUS (ANTERIOR)

- lateral supracondylar ridge
- radial fossa
- lateral epicondyle
- capitulum
- medial supracondylar ridge
- coronoid fossa
- medial epicondyle
- trochlea
Ulna - Proximal & Distal End
(Anterior Aspect)

1. Olecranon Process
2. Semilunar Notch
3. Coronoid Process
4. Tuberosity
5. Radial Notch
6. Ulna (Shaft)
7. Head of Ulna
8. Styloid Process
1. Head of Radius
2. Neck of Radius
3. Radial Tuberosity
4. Radius (Shaft)
5. Styloid Process
6. Ulnar Notch
Wrist and Hand

Bones (29 including radius and ulna)
• radius/ulna
• carpals
  • proximal row (medial to lateral)
    • scaphoid, lunate, triquetrum, pisiform
  • distal row (medial to lateral)
    • trapezium, trapezoid, capitate, hamate
• metacarpals
• phalanges
A). carpals
   2 rows of 4 each lateral to medial
A). carpals
1). proximal (articulate radius and ulna)
   a). scaphoid
   b). luna
   c). triquetral
   d). pisiform

2). distal (articulate with metacarpals)
   a). trapezium
   b). trapezoid
   c). capitate
   d). hamate

B). metacarpals
numbered 1 to 5 starting with the thumb side

C). phalanges
numbered 1 to 5 starting with the thumb side
   • proximal phalanx
   • medial phalanx
   • distal phalanx
Bones of the Right Hand (Dorsal Surface)

1. Styloid Process of Radius
2. Navicular (Scaphoid)
3. Lunate
4. Triquetral
5. Pisiform
6. Trapezium
7. Trapezoid
8. Capitate
9. Hamate
10. Metacarpal
11. Proximal Phalange
12. Middle Phalange
13. Distal Phalange
14. Styloid Process of Ulna
Bones of the Right Hand (Palmar Surface)

1. Navicular (Scaphoid)
2. Lunate
3. Triquetral
4. Pisiform
5. Trapezium
6. Trapezoid
7. Capitate
8. Hamate
9. Metacarpal
10. Proximal Phalange
11. Middle Phalange
12. Distal Phalange
Some upper extremity bones and landmarks to be familiar with

Clavicle:
- Acromial extremity
- Conoid tubercle
- Subclavian groove
- Costal tuberosity
- Sternal extremity

Clavicle:
- Acromioclavicular [AC] joint (acromian process and distal clavicle)
- Conoid tubercle
- Subclavian groove
- Costal tuberosity
- Sternal extremity

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Sternoclavicular [SC] joint (proximal clavicle and manubrium + 1st rib)

Scapula:
- Acromian process
- Coracoid process
- Scapular notch
- Superior border
- Medial border
- Lateral border
- Superior angle
- Inferior angle
- Subscapular fossa
- Infraspinous fossa
- Supraspinous fossa
- Glenoid fossa

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- Supraspinous fossa
- Glenoid fossa

Coracovicular joint (coracoid process and inferior clavicle)

Scapula:
- Acromian process
- Coracoid process
- Scapular notch
- Superior border
- Medial border
- Lateral border
- Superior angle
- Inferior angle
- Subscapular fossa
- Infraspinous fossa
- Supraspinous fossa
- Glenoid fossa

Scaupolothoracic joint (anterior scapula and thoracic wall)

Glenohumeral joint (humeral head and glenoid fossa)
Humerus:
- Head
- Neck
- Greater tubercle
- Lesser tubercle
- Intertubercular (bicipital) groove
- Deltoid tuberosity
- Shaft (diaphysis)
- Lateral supracondylar ridge
- Lateral epicondyle
- Capitulum  Humeroradial joint (gliding joint between capitulum and radial head)
- Radial fossa
- Medial supracondylar ridge
- Medial epicondyle
- Trochlea  Humeroulnar joint (humeral trochlea and trochlear notch of ulna) "elbow joint"
- Coronoid fossa
- Olecranon fossa

Radius:
- Head  Radioulnar joints
- Neck
- Radial tuberosity
- Shaft (diaphysis)
- Styloid process
Ulna:
• Olecranon process
• Semilunar (trochlear) notch
• Coronoid process
• Ulnar tuberosity
• Shaft (diaphysis)
• Head
• Styloid process

Wrist/Hand: Wrist joint (condyloid between distal radius and proximal carpals)
Carpals: (radial to ulnar)
• Proximal Row Intercarpals (gliding or plane joints between carpal bone)
• Scaphoid
• Lunate
• Triquetrum
• Pisiform
• Disal Row
• Trapezium
• Trapezoid
• Capitate
• Hamate
5 Metacarpals (1 = thumb)  Carpometacarpal (CMC) (saddle for 1, plane for 2-5)

Phalanges/digits (14 per hand)
• 5 proximal phalanges
  Proximal Interphalangeal (PIP) (hinge joint between 1st and 2nd phalanges of 2-5)
  Interphalangeal (IP) (hinge joint on thumb only between distal and proximal phalanx)
• 4 middle phalanges (thumb doesn't have)
• 5 distal phalanges
  Distal Interphalangeal (DIP) (hinge joint between middle and distal phalanges of 2-5)
Want an easy way to remember the carpal bones?!?

*Remember this...*
Naughty (Navicular)
Lovers (Lunate)
Try (Triquetral)
Positions (Pisiform)
That (Trapezium)
They (Trapezoid)
Can't (Capitate)
Handle (Hamate)
WHAT'S WRONG
Comminuted clavicle fracture; Note 5\textsuperscript{th} rib fracture in addition
Fracture Dislocations of the Proximal Humerus:
anterior-posterior view: adult

humerus

fracture

radius ulna