

Upper limb (UL)

**skeleton, joints, muscles, blood supply, venous and lymphatic drainage,
innervation, regional anatomy**

Skeleton of UL

Shoulder girdle

1/ clavicle

- sternal end
 - sternal facet
 - impression for costoclavicular lig.
- body of clavicle
 - subclavian groove
- acromial end
 - acromial facet
 - tuberosity for coracoclavicular lig.
 - trapezoid line and conoid tubercle

2/ scapula

- anterior (costal) surface – subscapular fossa – muscular lines
- posterior (dorsal) surface
 - spine of scapula
 - acromion – clavicular facet
 - supraspinous and infraspinous fossae
- medial and lateral margins
- superior margin
 - suprascapular notch
 - coracoid process
- lateral angle
 - neck of scapula
 - glenoid cavity
 - supraglenoid and infraglenoid tubercles
- superior and inferior angles

Free UL on arm

1/ humerus

- head of humerus
 - anatomical and surgical necks
 - greater and lesser tubercles
 - crest of greater and lesser tubercles
 - intertubercular sulcus (bicipital groove)
- body of humerus
 - anterolateral surface – deltoid tuberosity
 - anteromedial surface
 - posterior surface – groove for radial n.
 - medial and lateral supracondylar ridges
 - medial epicondyle – groove for ulnar n.
 - lateral epicondyle
- condyle of humerus
 - capitulum and trochlea of humerus
 - radial and coronoid fossae, olecranon fossa

on forearm

1/ ulna

- olecranon
- coronoid process
- trochlear notch
- radial notch

- body of ulna
 - ulnar tuberosity
 - anterior, posterior, and interosseous borders
 - anterior, posterior, and medial surfaces
 - supinator crest
- head of ulna
 - articular circumference
 - ulnar styloid process

2/ radius

- head of radius
 - articular facet
 - articular circumference
 - neck of radius
- body of radius
 - radial tuberosity
 - anterior, posterior, and interosseous borders
 - anterior, posterior surfaces
 - lateral surface – pronator tuberosity

- dorsal tubercle
- ulnar notch
- carpal articular surface
- radial styloid process

on hand

1/ carpal bones

- proximal row
 - scaphoid – tubercle of scaphoid
 - lunate
 - triquetrum
 - pisiform
- distal row
 - trapezium – tubercle of trapezium
 - trapezoid
 - capitate – head of capitate
 - hamate – hook (hamulus) of hamate
- radial and ulnar carpal eminences – carpal groove

2/ metacarpal bones

- base – styloid process of 3rd metacarpal
- body
- head

3/ phalanges

- proximal phalanx – base, body, and head
- middle phalanx – base, body, and head
- distal phalanx – base, body, and tuberosity of distal phalangs

Joints of UL

Immobile syndesmoses

1/ shoulder girdle

- interclavicular lig.
- costoclavicular lig.
- coracoacromial lig. (fornix humeri)
- superior and inferior transverse scapular ligg.

2/ free UL

- coracoclavicular lig. – trapezoid and conoid ligg.
- antebrachial interosseous membrane – oblique cord

Mobile

1/ shoulder girdle

- sternoclavicular joint – anterior and posterior sternoclavicular ligg.
the only one synovial joint between UL and the trunk. The rest of the UL skeleton is connected to the trunk by fibrous tissue (costoclavicular lig.) and by muscles of the thorax (thoracohumeral muscles) and the back (spinothumeral muscles)
- acromioclavicular joint – acromioclavicular lig.

2/ free UL

- shoulder joint – connection between free UL and shoulder girdle
 - articular capsule
 - coracohumeral lig.
 - glenoid labrum
 - tendon of long head of biceps brachii m.
 - intertubercular tendon sheath

elbow joint

- humeroradial joint – radial (lateral) collateral lig
- humeroulnar joint – ulnar (medial) collateral lig
- radioulnar proximal joint – annular lig. of radius

distal radioulnar joint

joints of the hand

- radiocarpal (wrist) joint – radial and ulnar carpal collateral ligg.
 - palmar and dorsal radiocarpal ligg.
 - palmar ulnocarpal lig.
- pisiform joints – pisohamate and pisometacarpal ligg.
- intercapal joints – palmar and dorsal intercarpal ligg.
- midcarpal joint – radiate carpal lig.
- carpometacarpal joints – palmar carpometacarpal ligg. and dorsal carpometacarpal ligg
- intermetacarpal joints
- metacarpophalangeal joints – collateral ligg.
 - deep transverse metacarpal lig.
- interphalangeal joints – collateral ligg.

Muscles (mm.) of UL

Mm. of shoulder girdle	These muscles (with the exception of teres major m.) form rotator cuff of shoulder joint 1/ anterior group subscapular m. 2/ posterior group supraspinatus m., infraspinatus m., teres minor m., teres major m.
Mm. of arm	1/ anterior group biceps brachii m. – long and short heads coracobrachialis m., brachialis m. 2/ posterior group triceps brachii m. – long, lateral, and medial heads anconeus m.
Mm. of forearm	1/ anterior group pronator teres m., flexor carpi radialis m., palmaris longus m., flexor carpi ulnaris m. flexor digitorum superficialis m. flexor digitorum profundus m., flexor pollicis longus m. pronator quadratus m. flexor retinaculum 2/ lateral group brachioradialis m., extensor carpi radialis longus m., extensor carpi radialis brevis m. supinator m. 3/ posterior group extensor digitorum m., extensor digiti minimi m., extensor carpi ulnaris m. abductor pollicis longus m., extensor pollicis brevis m., extensor pollicis longus m., extensor indicis m. radial foveolar extensor retinaculum
Mm. of hand	1/ thenar abductor pollicis brevis m. abductor pollicis m. flexor pollicis brevis m. opponens pollicis m. 2/ hypothenar abductor digiti minimi m., flexor digiti minimi m., opponens digiti minimi m. 3/ central group lumbricales mm., palmar interossei mm., dorsal interossei mm.
Carpal tunnel	flexor carpi radialis m. + flexor pollicis longus m. + flexor digitorum superficialis and profundus mm. + median n.

Arterial supply of UL

Subclavian a. the right one is shorter because of brachiocephalic trunk
1/ thyrocervical trunk
suprascapular a.
transverse cervical a.

Region of supply: scapular region

Axillary a. continuation of subclavian a.
medially to pectoralis minor m.
1/ superior (supreme) thoracic a.
2/ thoracoacromial a.
pectoral br.
acromial br.
clavicular br.
deltoid br.

behind pectoralis minor m.

1/ lateral thoracic a.

laterally to pectoralis minor m.

1/ subscapular a.

circumflex scapular a.

thoracodorsal a.

2/ anterior humeral circumflex a.

3/ posterior humeral circumflex a.

Region of supply: axillary fossa, deltoid region

Brachial a. continuation of axillary a., terminates by radial and ulnar aa.
1/ deep brachial a.
medial collateral a.
radial collateral a.
2/ superior ulnar collateral a.
3/ inferior ulnar collateral a.

Region of supply: brachial region

Rete articulare of elbow joint superior and inferior ulnar collateral aa.
radial, ulnar, and interosseous recurrent aa.

Radial a. 1/ radial recurrent a.
2/ muscular br.
3/ superficial palmar br.
4/ dorsal carpal br. – dorsal metacarpal aa.
5/ deep palmar arch – palmar metacarpal aa.
6/ princeps pollicis a. – radialis indicis a.

Region of supply: cubital region, antebrachial region, carpal region, back of the hand, ventral digital surface, dorsal digital surface

- Ulnar a.**
- 1/ ulnar recurrent a.
 - 2/ common interosseous a.
 - anterior interosseous a.
 - posterior interosseous a. – recurrent interosseous a.
 - 3/ muscular brr.
 - 4/ dorsal carpal br.
 - 5/ deep palmar arch
 - 6/ superficial palmar arch – common digital palmar aa.
 - proper digital palmar aa.

Region of supply: cubital region, antebrachial region, carpal region, palm of the hand, back of the hand, ventral and dorsal digital surface

- Superficial palmar arch**
- main source of blood comes through ulnar a.
 arises from ulnar a. and superficial palmar br. of radial a.
 1/ common and proper palmar digital aa.

Region of supply: palm of the hand, ventral and dorsal digital surface

- Deep palmar arch**
- main source of blood comes through radial a.
 arises from radial a. and deep palmar br. of ulnar a.
 1/ palmar metacarpal aa.

Region of supply: palm of the hand

Venous drainage of UL

- Superficial veins**
- 1/ dorsal digital vv.
 - 2/ intercapitular vv.
 - 3/ dorsal metacarpal vv.
 - 4/ posterior venous network of hand
 - 5/ cephalic v. – accessory cephalic v.
 - 6/ basilic v.
 - 7/ median cubital v. – median cephalic v., median basilic v.
 - 8/ median antebrachial v.

- Deep veins**
- are usually doubled, they accompany arteries of the same names;
 contrary to it, axillary v. and subclavian v. are unpaired.
- 1/ palmar metacarpal vv.
 - 2/ deep palmar venous arch
 - 3/ radial vv.
 - 4/ ulnar vv.
 - 5/ anterior and posterior interosseous vv.
 - 6/ brachial vv. – receive basilic v.
 - 7/ axillary v. – receives cephalic v.
 - 8/ subclavian v. – receive suprascapular v., dorsal scapular v., thoracoacromial v., subscapular v., anterior and posterior humeral circumflex vv.

Lymphatic drainage of UL

superficial lymphatic collectors – run independently from blood vessels

deep lymphatic collectors – run along blood vessels

lnn.= lymph nodes

cubital lymph nodes

deltopectoral (infraclavicular) **lymph nodes** located in deltopectoral triangle

– along cephalic v.

axillary lymph nodes: receive lymph from UL, thoracic wall and approximately 75% of lymph from breast, lymph continues into subclavian lymph trunk

brachial (lateral, humeral) axillary lnn. – along axillary v.

subscapular (posterior) axillary lnn. – along subscapular v.

pectoral (anterior) axillary lnn. – along lateral thoracic v.

central axillary lnn. – distant from vessels

apical axillary lnn. – main group in apex of axilla

Innervation of UL

Cervical plexus

C1 – C4

lateral, intermediate, and medial supraclavicular nn.

Region of innervation: skin of deltoid and infraclavicular regions

Brachial plexus

C4 – Th1

superior trunk – ventral brr. of C4, C5 and C6

middle trunk – ventral br. of C7

inferior trunk – ventral brr. of C8 and T1

1/ supraclavicular part

dorsal scapular n., long thoracic n., subclavian n., suprascapular n.
thoracodorsal n., medial and lateral pectoral nn.

2/ infraclavicular part

posterior cord = arises from posterior brr. of all three trunks

axillary n. – lateral superior cutaneous n. of arm

radial n. – posterior cutaneous n. of arm

lateral inferior cutaneous n. of arm

posterior cutaneous n. of forearm

deep br. – posterior interosseous n. of forearm

superficial br. – dorsal digital nn.

lateral cord = arises from anterior brr. of superior and middle trunks

musculocutaneous n. – lateral cutaneous n. of forearm

lateral root of median n.

medial cord = arises from anterior br. of inferior trunk

medial root of median n.

medial cutaneous n. of arm – intercostobrachial nn.

medial cutaneous n. of forearm – anterior and posterior brr.

ulnar n. – dorsal br. – dorsal digital nn.

superficial br. – common and proper digital palmar nn.

median n. – anterior interosseous n. of forearm

– common and proper digital palmar nn.

Region of innervation: motor and sensory innervation of upper limb with the exception of areas supplied from cervical plexus

Regional anatomy of UL

Borders of UL against the trunk precise boundaries of UL do not exist, because on the bones of upper limb are inserted both thoracohumeral and spinohumeral muscles, which belong to muscles of the thorax or back, respectively

Regions of UL infraclavicular, deltoid, scapular, axillary, brachial, cubital, antebrachial, carpal, regions of hand

Infraclavicular region

Superficial structures platysma, intermediate and medial supraclavicular nn.
Deep structures cephalic v., thoracoacromial a. and v., pectoral nn., axillary a. and v., infraclavicular part of brachial plexus

Deltoid region

Superficial structures lateral supraclavicular nn., superior lateral cutaneous n. of arm
Deep structures axillary n., posterior circumflex humeral a. and v.

Scapular region

Superficial structures dorsal brr. of thoracic nn., lateral cutaneous brr. of intercostal nn., lateral supraclavicular nn.
Deep structures suprascapular a. and v., suprascapular n., circumflex scapular a.

Axillary region

Superficial structures lateral thoracic v., thoracoepigastric vv., intercostobrachial n., lateral cutaneous br. of intercostal nn.
Deep structures *axillary fossa:*
 axillary a. and its branches, axillary vein and its tributaries,
 long thoracic n., thoracodorsal n., axillary lymph nodes,
 infraclavicular part of brachial plexus and its terminal nn.
medial axillary gap (omotricipital foramen): circumflex scapular a.
lateral axillary gap (humeroetricipital foramen): axillary n.,
 posterior circumflex humeral a. and v.

Anterior brachial region

Superficial structures cephalic v., basilic v., medial cutaneous n. of arm, medial cutaneous n. of forearm
Deep structures brachial a., deep brachial a. et vv., superior ulnar collateral a et vv., brachial vv., median n., radial n., ulnar n., musculocutaneous n., medial cutaneous n. of forearm

Posterior brachial region

Superficial structures	inferior lateral cutaneous n. of arm, medial cutaneous n. of arm, posterior cutaneous n. of arm
Deep structures	radial n., deep brachial a. and v., ulnar n., superior ulnar collateral a.

Anterior cubital region

Superficial structures	median cubital v., cephalic v., basilic v., median antebrachial v., lateral cutaneous n. of forearm, medial cutaneous n. of forearm
Deep structures	<i>cubital fossa:</i> brachial a., inferior ulnar collateral a., radial a., ulnar a., radial recurrent a., ulnar recurrent a., common interosseous a., radial collateral a., median n., radial n.

Posterior cubital region

Superficial structures	posterior cutaneous n. of forearm, posterior br. of medial cutaneous n. of forearm
Deep structures	ulnar n., superior ulnar collateral a.

Anterior antebrachial region

Superficial	cephalic v., basilic v., median antebrachial v., lateral cutaneous n. of forearm, medial cutaneous n. of forearm, palmar br. of median n., palmar br. of ulnar n.
Deep structures	radial a., superficial br. of radial n., ulnar a. and n., median n., anterior interosseous a. and n.

Posterior antebrachial region

Superficial structures	accessory cephalic v., posterior cutaneous n. of forearm, lateral cutaneous n. of forearm, superficial br. of radial n., posterior br. of medial cutaneous n. of forearm
Deep structures	posterior interosseous a. and n.

Anterior carpal region

Superficial structures	palmar br. of median n., palmar br. of ulnar n., superficial br. of radial n., anterior br. of medial cutaneous n. of forearm
Deep structures	radial a. <i>carpal canal:</i> median n. <i>ulnar canal:</i> ulnar a. and n.

Posterior carpal region

Superficial structures	superficial br. of radial n., cephalic v., dorsal br. of ulnar n., posterior cutaneous n. of forearm, basilic v.
Deep structures:	posterior carpal arch (network), dorsal synovial tendinous sheaths <i>anatomical snuff box:</i> radial a. dorsal carpal br. of radial a.

Palm of the hand

Superficial structures	palmaris brevis m., palmar br. of median n., palmar br. of ulna n., superficial br. of radial n., common and proper digital palmar aa., proper digital palmar nn.
Deep structures	<i>ulnar palmar space, radial palmar space and middle palmar space:</i> superficial and deep brr. of ulnar n., ulnar a., superficial palmar arch, common digital palmar aa., metacarpal palmar aa., median n., common and proper digital palmar nn., palmar superficial br. of radial a. <i>interosseous space of hand:</i> deep palmar arch

Back of the hand

Superficial	dorsal metacarpal vv., posterior venous network of hand, cephalic v., basilic v., superficial br. of radial n., dorsal br. of ulnar n.
Deep structures	<i>anatomical snuff box:</i> radial a. dorsal metacarpal aa.

Palmar digital surface

Superficial structures	proper palmar digital aa. and nn., terminal palmar arch
Deep structures	tendinous chiasma

Dorsal digital surface

Superficial structures	dorsal digital aa. and vv. dorsal digital nn.
Deep structures	dorsal aponeurosis