
INTERNATIONAL SURGICAL
ANATOMY TEACHING
SERIES



ISATS HANDOUT 2024/25

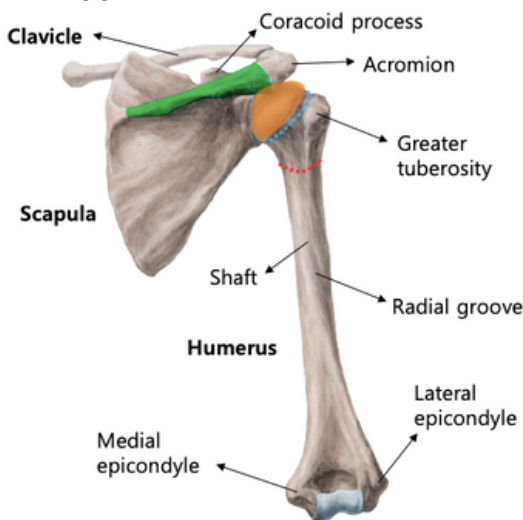
Upper Limb

UPPER LIMB ANATOMY

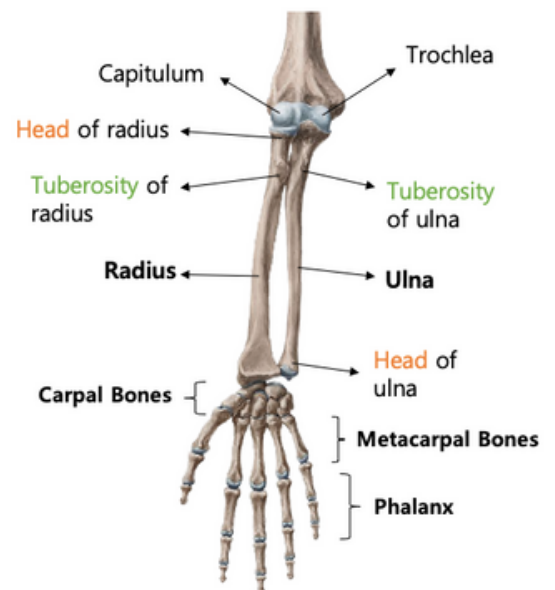
Objectives: Recall the bony anatomy of the upper limb, appreciate the position and function of the rotator cuff muscles, appreciate the muscular compartments of the upper limb, trace the course of important neurovascular structures of the upper limb & apply anatomical knowledge to the setting of trauma and orthopaedic surgery.

Bony Anatomy

- Scapula (Triangular Flat Bone)
 - Bony articulations and muscular attachments
 - Glenoid Fossa
 - Acromion
 - Coracoid Process
 - Scapular Spine
- Humerus (Long Bone)
 - Surgical neck: Axillary Nerve and Posterior Circumflex Humeral Artery
 - Radial Groove: Radial Nerve and Profunda Brachii



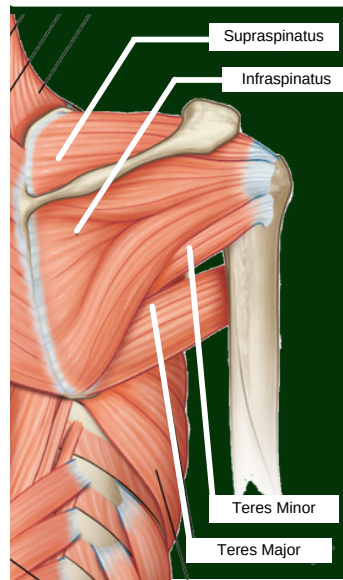
- Radius and Ulna (Long Bones)
 - Hinge joint with the Humerus and a Pivot joint with each other (proximally)
 - Syndesmosis formed by Interosseous membrane
- Carpals (Irregular Bones)
 - **So Long To Pinky; Here Comes The Thumb**
- Metacarpals and Phalanges (Long Bones)



The Rotator Cuff

- Function: Muscles of Concavity Compression
- Supraspinatus: abduction of shoulder to 15°
- Infraspinatus: external rotation
- Subscapularis: internal rotation
- Teres Minor: external rotation + adduction
- Teres Major: internal rotation + extension
- 'The Cable' = intrinsic coordination of Supraspinatus, Infraspinatus and Subscapularis
 - Tendinous interweaving
 - Connects anterior with posterior

Is Teres Major a Rotator Cuff?



What is a rotator cuff?

- Can only be defined by naming involved muscles
- Functional similarity
 - Only Concave Compression
 - Should include Teres Major
- Neurovascular supply, Attachments and other Functions
 - Not shared

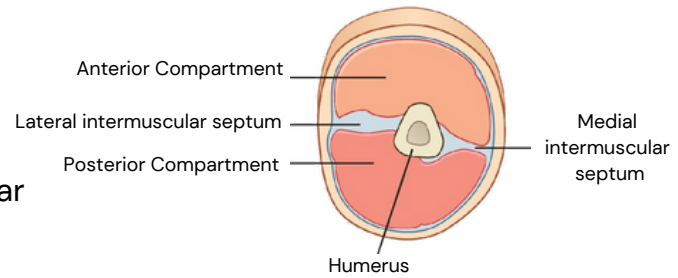
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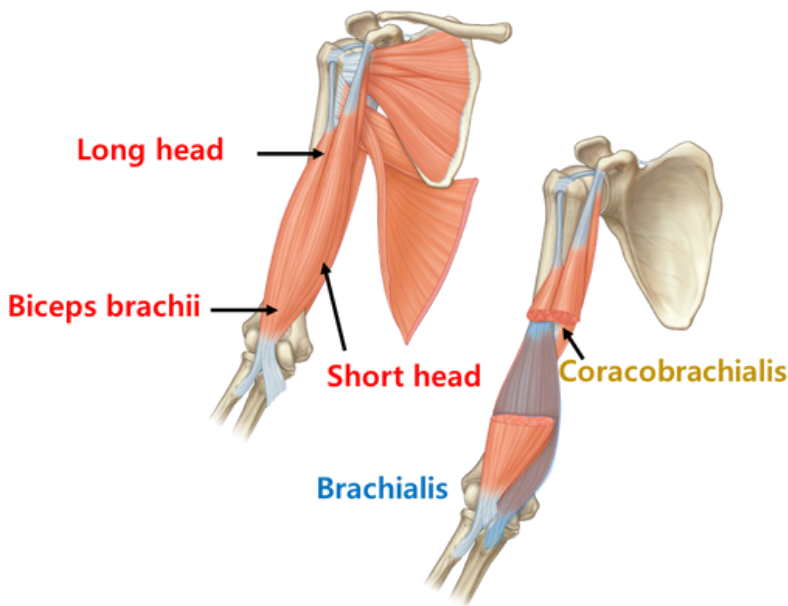
Compartments of the Arm

Overview

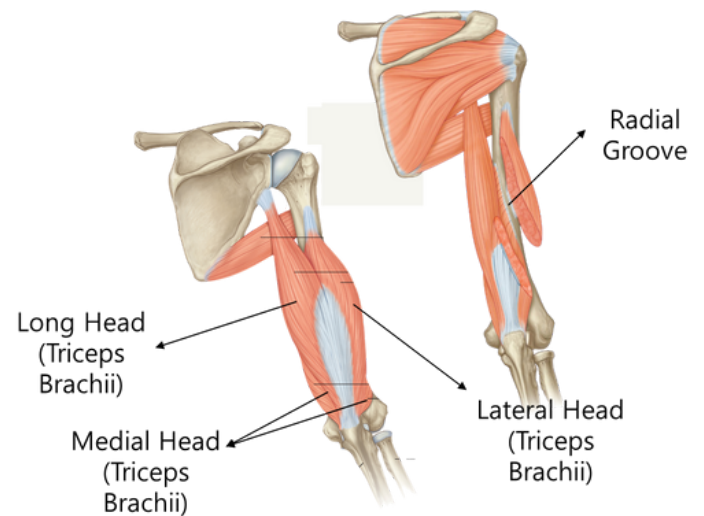
- Delineated by the Lateral and Medial Intermuscular septae
 - Lateral: fascia of deltoid → lateral epicondyle
 - Medial: fascia of teres major → medial epicondyle



Anterior Compartment



Posterior Compartment



Muscles	Function
Biceps Brachii (Short + Long)	Flexion (Elbow + Shoulder), Supination
Brachialis	Elbow flexion
Coracobrachialis	Shoulder flexion

- **Innervation**
 - Musculocutaneous nerve (C5,6,7)
- **Arterial Supply**
 - Variable branches of Brachial Artery

Muscles	Function
Long Head of Triceps	Forced elbow extension + assisted shoulder extension and adduction
Medial Head of Triceps	Elbow extension
Lateral Head of Triceps	Forced elbow extension

- **Innervation**
 - Radial nerve (C6,7,8)
- **Arterial Supply**
 - Profunda Brachii

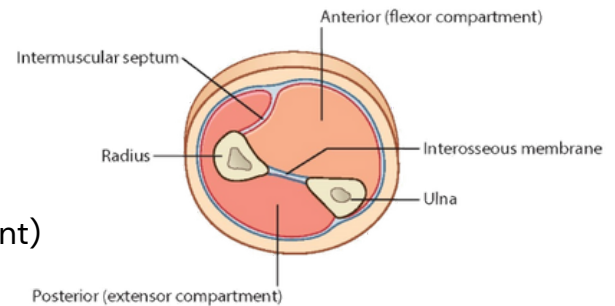
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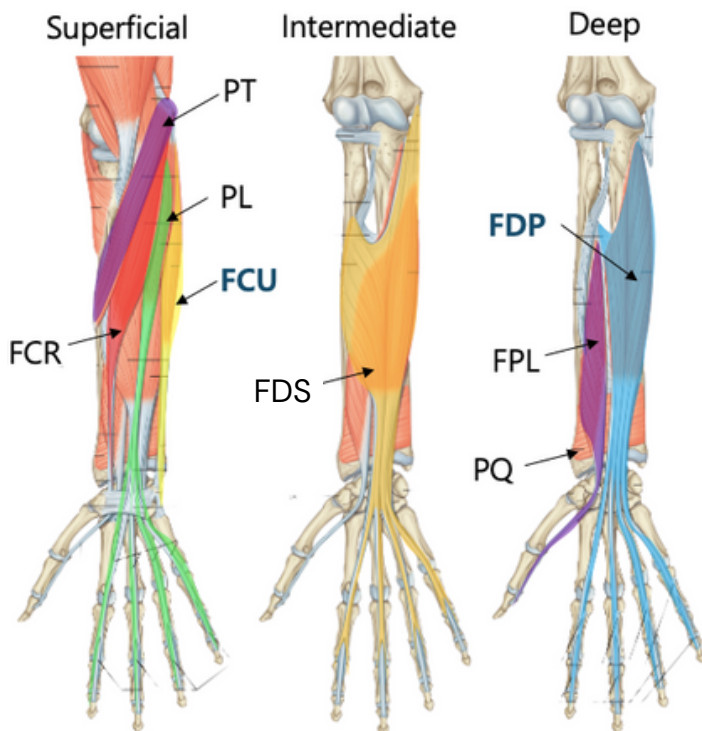
Compartments of the Forearm

Overview

- More defined than in the Arm
- Involve the Interosseous Membrane (syndesmosis joint)



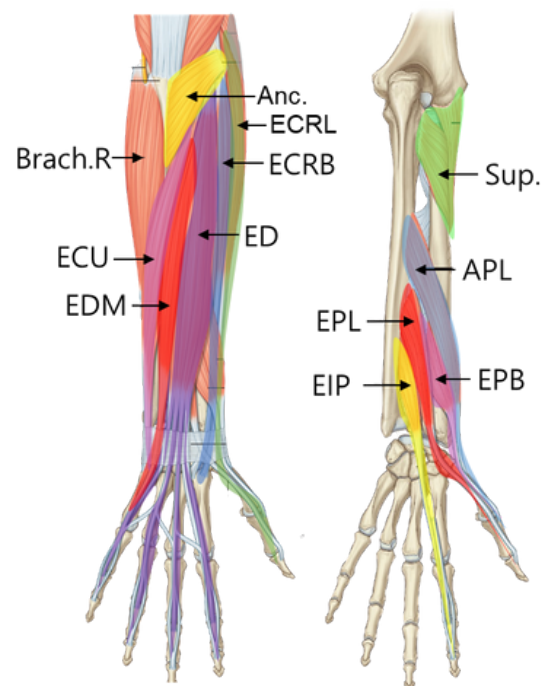
Anterior Compartment



FCR, flexor carpi radialis; **PT**, pronator teres; **PL**, palmaris longus; **FCU**, flexor carpi ulnaris; **FDS**, flexor digitorum superficialis; **FDP**, flexor digitorum profundus; **FPL**, flexor pollicis longus; **PQ**, pronator quadratus

- **Function**
 - Flexion of the wrist, MCP, PIP, DIP and thumb
 - Pronation (Pronator Teres and Quadratus)
- **Innervation**
 - Median Nerve – all except...
 - Ulnar Nerve – FCU and medial part of FDP
- **Arterial Supply**
 - Branches of the Radial and Ulnar arteries

Posterior Compartment



Brach.R, brachioradialis; **ECU**, extensor carpi ulnaris; **EDM**, extensor digiti minimi; **Anc.**, anconeus; **ED**, extensor digitorum; **ECRL**, extensor carpi radialis longus; **ECRB**, extensor carpi radialis brevis; **EPL**, extensor pollicis longus; **EIP**, extensor indicus (proprius); **Sup.**, supinator; **EPB**, extensor pollicis brevis; **APL**, abductor pollicis longus

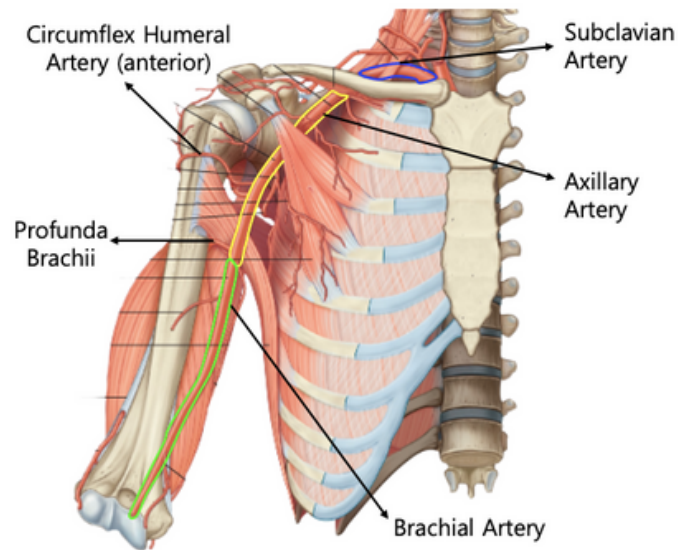
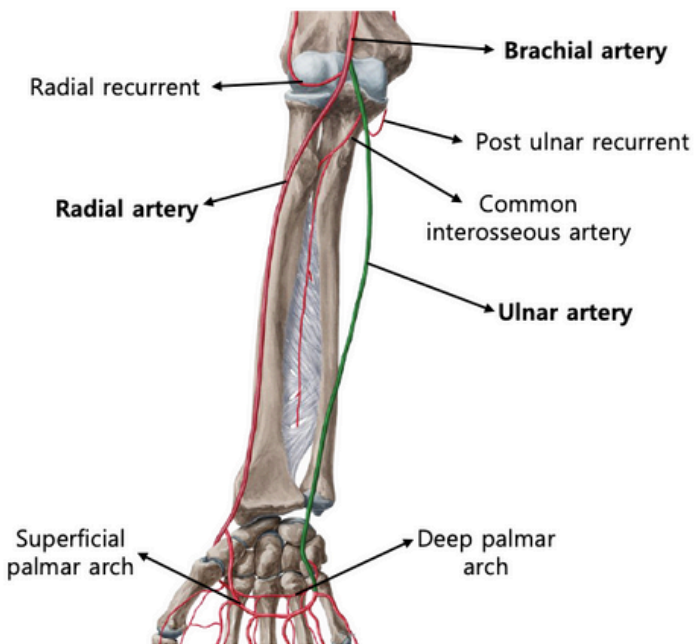
- **Function**
 - Extension of the wrist, MCP, PIP, DIP and thumb
 - Minor Supination (Supinator)
- **Innervation**
 - Radial Nerve + Posterior Interosseous Branch (Radial)
- **Arterial Supply**
 - Radial Artery Branches

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Brachial Artery

- Nomenclature - continuation of the Axillary Artery
- Begins: Inferior border of Teres Major
- Ends: ~1cm Distal to elbow (at bifurcation)



Course

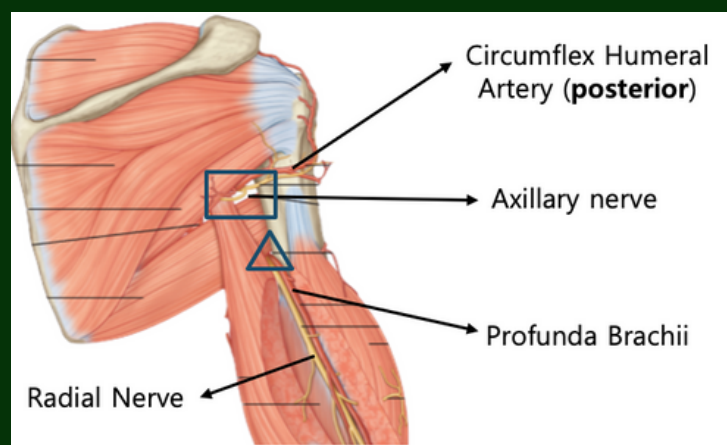
- Predominantly medial to humerus
- Crosses to mid-point between epicondyles
- Wholly superficial
- Bifurcates into radial and ulnar arteries within cubital fossa
- Radial artery - extends across posterior forearm.
 - Branches: radial recurrent a.
 - Hand - deep palmar arch
- Ulnar artery - extends across anteromedial forearm
 - Branches - common interosseous, posterior and anterior ulnar recurrent arteries
 - Hand - superficial palmar arch

Quadrangular Space

- Axillary Nerve
- Posterior Circumflex Humeral Artery

Triangular Interval

- Radial Nerve
- Profunda Brachii Artery

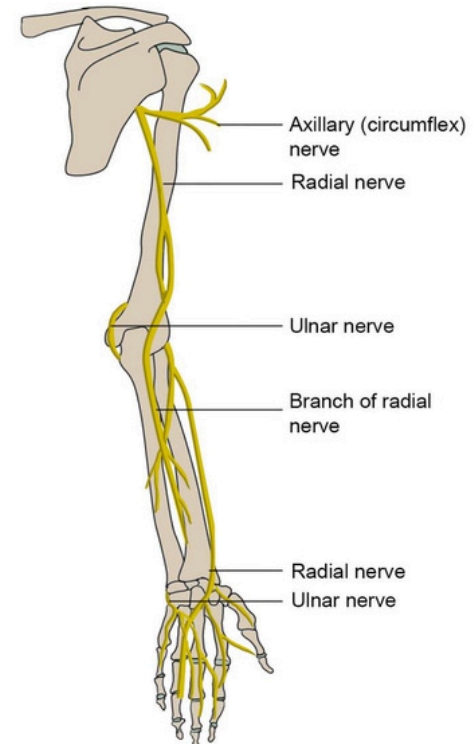
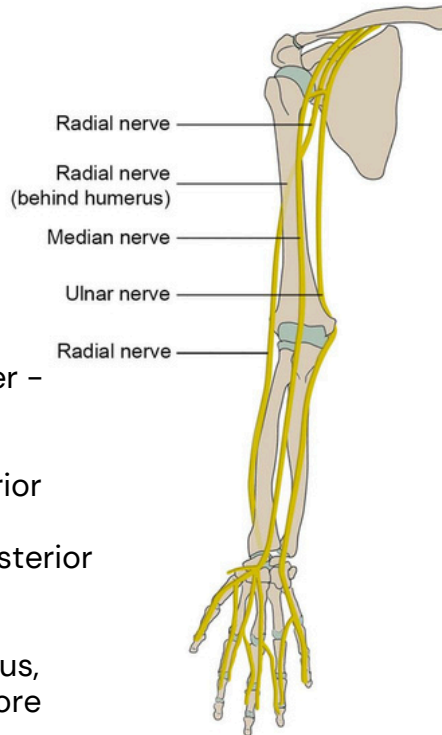


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Brachial Plexus

- Roots, Trunks, Divisions, Cords, Branches (**Read That Damn Cadaver Book**)
 - Roots: C5–C8+T1 – (spinal foramina)
 - Trunks: Upper, Middle Lower – (scalenes)
 - Divisions: Anterior & Posterior
 - Cords: Lateral, Medial & Posterior – (axillary artery)
 - Branches: Musculocutaneous, Median, Radial & Ulnar + more



Median Nerve

- Lateral and Medial Cord combine over Brachial Artery
- Runs medial to Brachial Artery before crossing into cubital fossa
- Between heads of pronator teres → into anterior compartment (forearm)
- Between FDS and FDP
 - Gives off anterior interosseous branch
- Carpal tunnel
- Terminal Motor & Sensory branches in hand

Ulnar Nerve

- Medial Cord
- Pierces medial intermuscular septum (3/5 length of humerus) → enters posterior compartment (arm)
- Cubital Tunnel
- Enters anterior compartment (forearm) between heads of FCU
- Runs medial to FDP
- Guyon's canal
- Terminal Motor (FCU + 1/2 FDP) & Sensory (4th and 5th digits) branches in hand

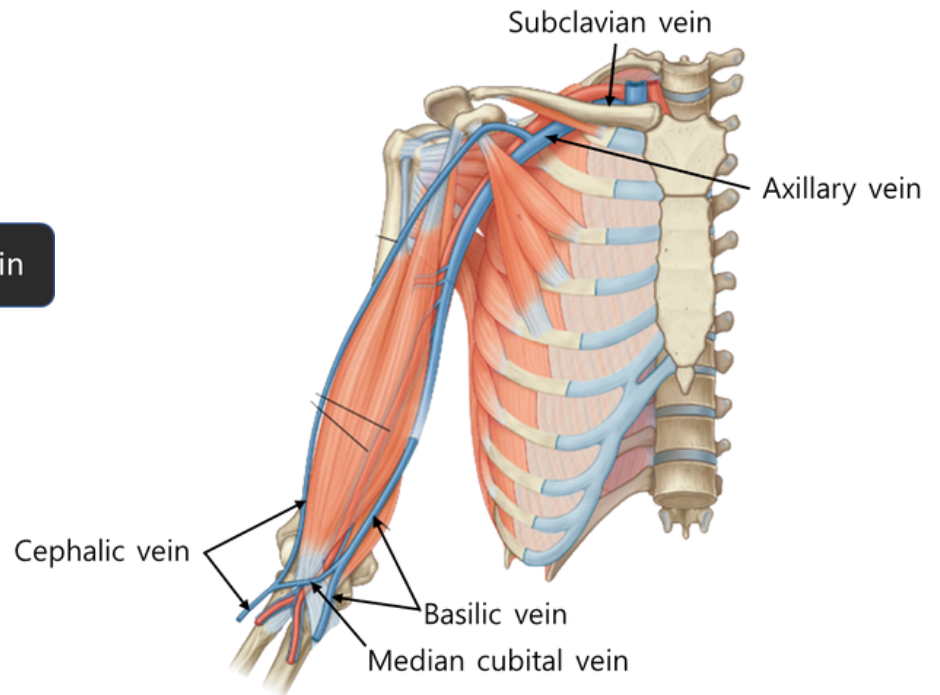
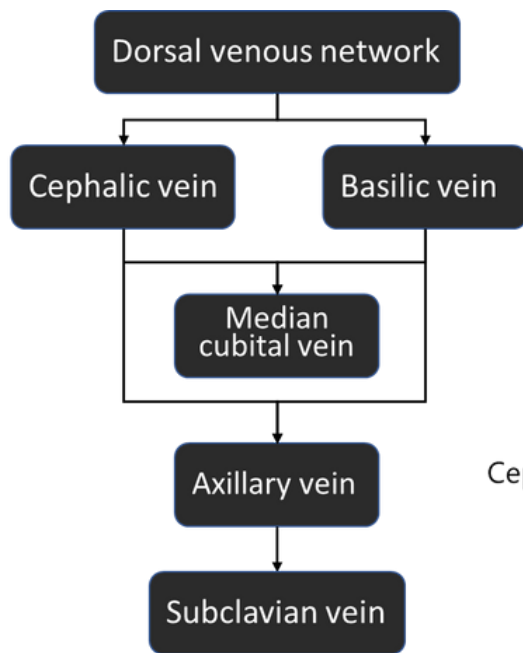
Radial Nerve

- Posterior cord → Triangular interval → enters posterior compartment
- Radial groove between attachments of the medial and lateral heads of triceps
- Perforates lateral intermuscular septum → enters anterior compartment (arm)
- Between brachioradialis and brachialis → divides into posterior interosseous + superficial radial nerve
- Superficial branch beneath brachioradialis → pierces deep fascia and runs over anatomical snuffbox
- Terminal Sensory branches in hand

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Venous drainage

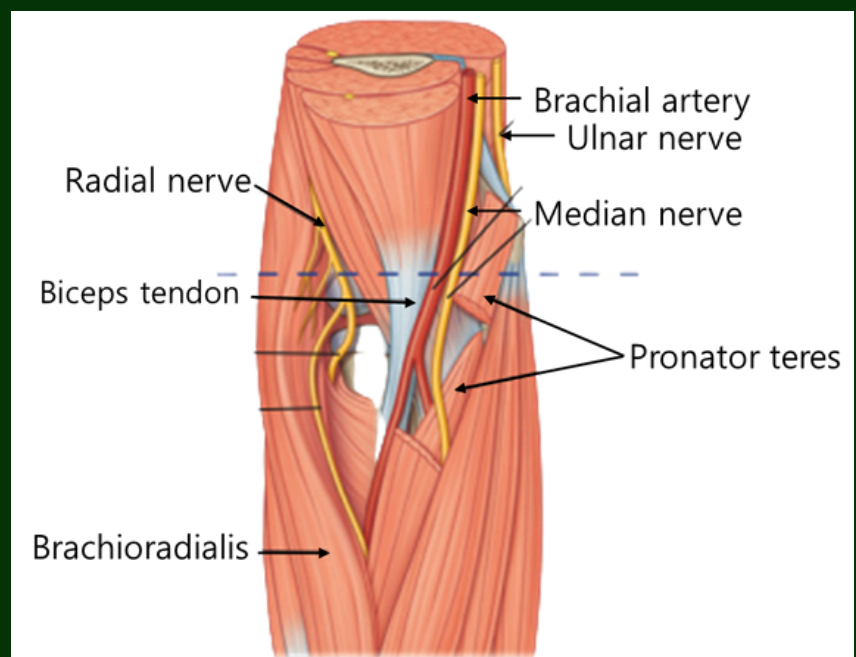


Cubital fossa

- Superior border: Imaginary line across medial and lateral epicondyle
- Lateral border: Brachioradialis
- Medial border: Pronator teres
- Floor: Brachialis and supinator
- Roof: Bicipital aponeurosis

Content

- Really Need Beer To Be At My Nicest
- Radial nerve, Biceps Tendon, Brachial Artery, Median Nerve
- Median cubital vein lies superficial to cubital fossa – separated by bicipital aponeurosis

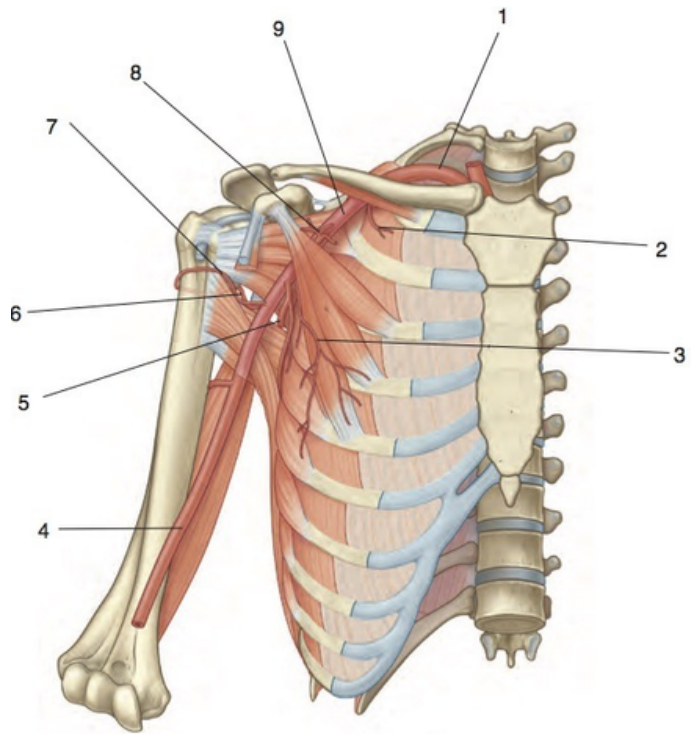


UPPER LIMB ANATOMY

Test yourself

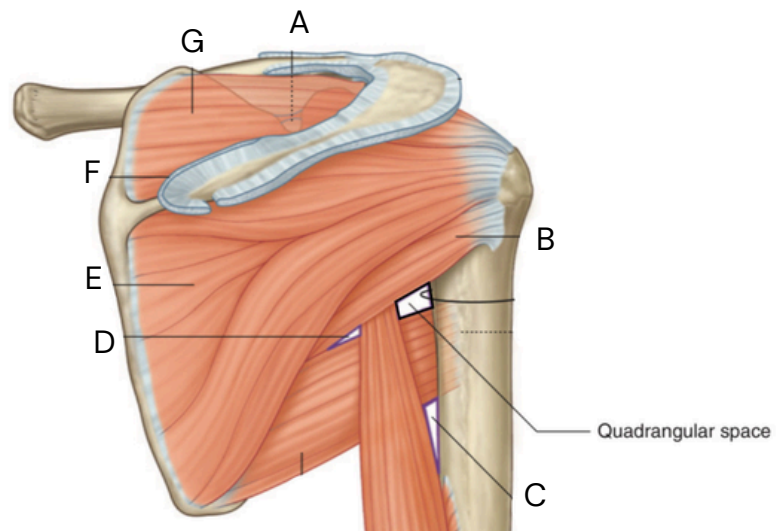
1) Label the structures in the diagram:

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9



2) Label the structures:

- A
- B
- C
- D
- E
- F
- G



UPPER LIMB ANATOMY

Test yourself

MCQ 1

A 29-year-old male presents with difficulty raising his arm above his head after a fall. Imaging reveals a dislocation of the shoulder joint. Which structure is most responsible for preventing inferior displacement of the humeral head?

- A. Coracohumeral ligament
- B. Supraspinatus muscle
- C. Inferior glenohumeral ligament
- D. Deltoid muscle
- E. Biceps brachii tendon

MCQ 3

A 34-year-old construction worker sustains a deep laceration to the anterior aspect of his forearm. He is unable to flex his distal interphalangeal joint of the index finger. Which muscle is most likely injured?

- A. Flexor digitorum superficialis
- B. Flexor carpi radialis
- C. Flexor digitorum profundus
- D. Pronator teres
- E. Brachioradialis

MCQ 5

A 60-year-old woman presents with limited abduction of her arm after being diagnosed with frozen shoulder (adhesive capsulitis). Which of the following joints is primarily involved in this condition?

- A. Acromioclavicular joint
- B. Glenohumeral joint
- C. Sternoclavicular joint
- D. Scapulothoracic joint
- E. Elbow joint

MCQ 2

A 40-year-old woman is diagnosed with carpal tunnel syndrome. Which of the following structures passes through the carpal tunnel?

- A. Flexor carpi ulnaris tendon
- B. Palmaris longus tendon
- C. Median nerve
- D. Ulnar nerve
- E. Radial artery

MCQ 4

A 25-year-old man presents with a midshaft clavicular fracture after a bicycle accident. Which muscle pulls the medial fragment of the clavicle superiorly in such injuries?

- A. Pectoralis major
- B. Sternocleidomastoid
- C. Trapezius
- D. Deltoid
- E. Subclavius

MCQ 6

A 33-year-old weightlifter complains of pain and swelling in the cubital fossa. On examination, a prominent structure can be seen in this region. Which of the following structures is typically located in the cubital fossa?

- A. Ulnar artery
- B. Median cubital vein
- C. Ulnar nerve
- D. Radial nerve
- E. Basilic vein

UPPER LIMB ANATOMY

Test yourself

OSCE Station – Case Based Discussion

A 34-year-old man attended a friend's party on Saturday night, where he consumed a significant amount of alcohol. He eventually fell asleep in an awkward position with his right arm draped over the back of a chair. Upon waking the next morning, he noticed that he was unable to extend his right wrist and fingers. He also reported numbness on the back of his hand and forearm. There is no associated neck pain, and the left arm is unaffected. On physical examination, the patient has a wrist drop, weakness in finger extension, and reduced sensation over the dorsum of the hand and forearm. He can still flex his fingers and move his shoulder without difficulty.



Q1. What is the likely diagnosis in this case?

Q2. Why is wrist and finger flexion preserved in this patient?

Q3. How could this condition be managed conservatively?

Q4. How could this patient be managed surgically?

Q5. What is a key differential diagnosis that should be ruled out in this patient, and how would you differentiate it?

This can be ruled out using a cervical spine MRI or nerve conduction studies.

out is C7 radiculopathy. This causes weakness in both arm and forearm extensors and can be associated with neck pain.

within 3-4 months, surgical exploration may be considered for a possible nerve decompression 5. A key differential to rule

considered to increase extensor strength as well as NSAIDs for pain relief 4. If severe damage and no signs of improvement

not radial nerve 3. Conservative management involves rest and using a splint to prevent wrist drop, physiotherapy may be

1. Compression of the radial nerve – Saturday night palsy 2. Wrist and finger flexion controlled by median and ulnar nerve –

OSCEs

C,C,C,B,B,B

MCQs

Cut edge of trapezius, G. Supraspinatus

2. A. Suprascapular notch, B. Medial lip of intertubercular sulcus, C. Triangular interval, D. Triangular space, E. Infraspinatus, F.

humeral circumflex artery, 7. Anterior humeral circumflex artery, 8. Axillary artery

1. Subclavian, 2. Superior thoracic artery, 3. Lateral thoracic artery, 4. Brachial artery, 5. Subscapular artery, 6. Posterior

Labels

Answers