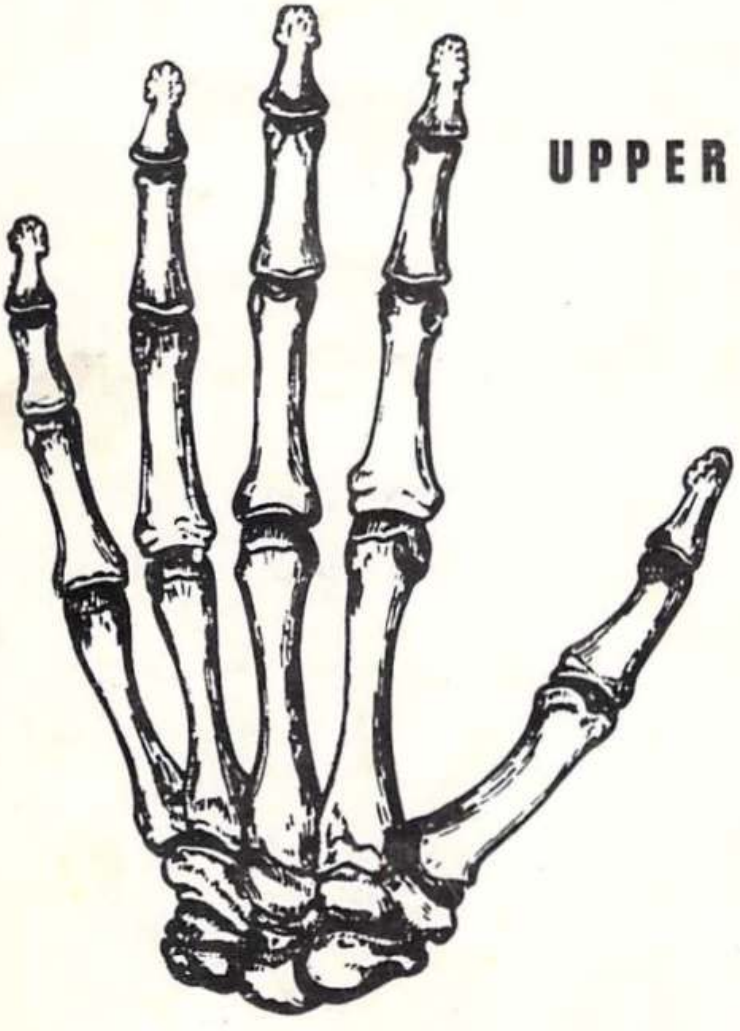
ATLAS OF ANATOMY



UPPER LIMB

by

FAWZI GABALLAH

ZAIZAFON BADAWY

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FAWZI GABALLAH (M . D .)

Professor of Anatomy, Faculty of Medicine,
Cairo University

ZAIZAFON BADAWY (M . D .)

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Cairo University

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PREFACE

This " ATLAS OF ANATOMY " contains 377 figures on the anatomy of Upper Limb. It is based on regional approach with a chapter on the bones and another chapter on the joints. Almost all the anatomical facts are illustrated in a clear and artistic way. All the diagrams are line drawings and are provided with concise explanatory notes.

The authors hope that this diagrammatic atlas will be of value to the medical student who will find the book an effective teaching means which makes much of the subject easy to understand and easy to remember.

Cairo, 1988

FAWZI GABALLAH

ZAIZAFON BADAWY

OTHER BOOKS BY PROF. FAWZI GABALLAH

1. Atlas of Embryology.
2. Basic Embryology.
3. A summary of Anatomy (all parts).
4. Basic Neuroanatomy.
5. Oral Questions in Anatomy.
6. Spotting (a guide ot practical anatomy).

CONTENTS

(I): BONES

(II): REGIONAL ANATOMY

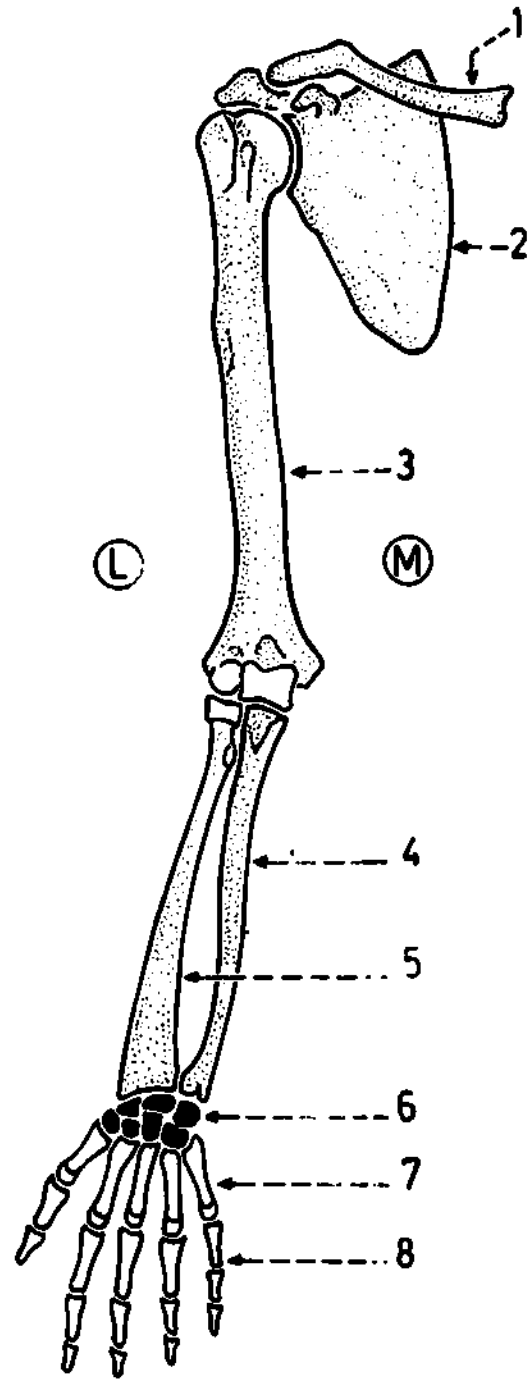
(III): JOINTS

BONES

Fig.(1): BONY SEGMENTS OF THE UPPER LIMB (right side)

The upper limb consists of the shoulder girdle, arm, forearm and hand. The scapula and clavicle are the bones of the shoulder girdle, the humerus is the bone of the arm, the radius and ulna are the bones of the forearm, while the skeleton of the hand consists of the carpus, metacarpus and phalanges.

1. clavicle.
2. scapula.
3. humerus.
4. ulna (medial).
5. radius (lateral).
6. carpus (2 rows of carpal bones).
7. Metacarpus (5 metacarpal bones).
8. phalanges (each finger has 3 phalanges except the thumb which has only 2).



CLAVICLE

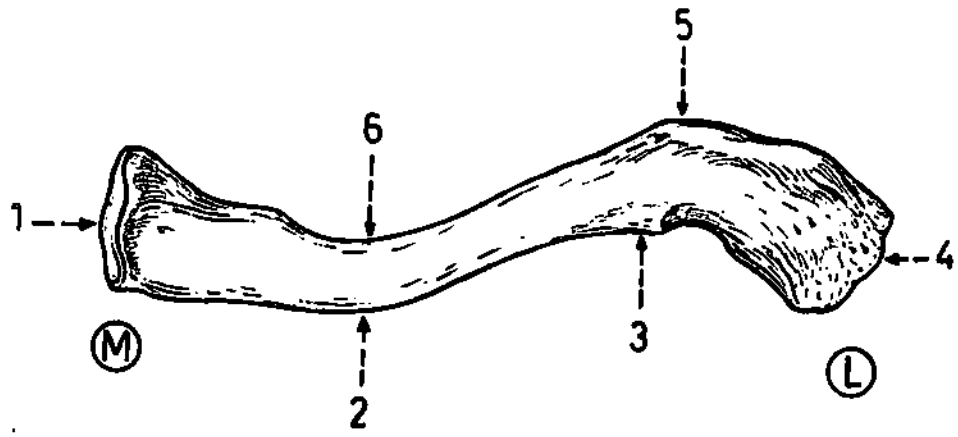


Fig.(2): SUPERIOR ASPECT OF LEFT CLAVICLE
(general features)

1. medial (sternal) end: quadrangular and articulates with the clavicular notch of the manubrium sterni.
2. anterior surface of the medial 2/3 of the shaft (convex forwards).
3. anterior border of the lateral 1/3 of the shaft (concave forwards and is rough forming the deltoid tubercle).
4. lateral (acromial) end: flat and articulates with the acromion.
5. posterior border of the lateral 1/3 of the shaft (convex backwards).
6. posterior surface of the medial 2/3 of the shaft (concave backwards).

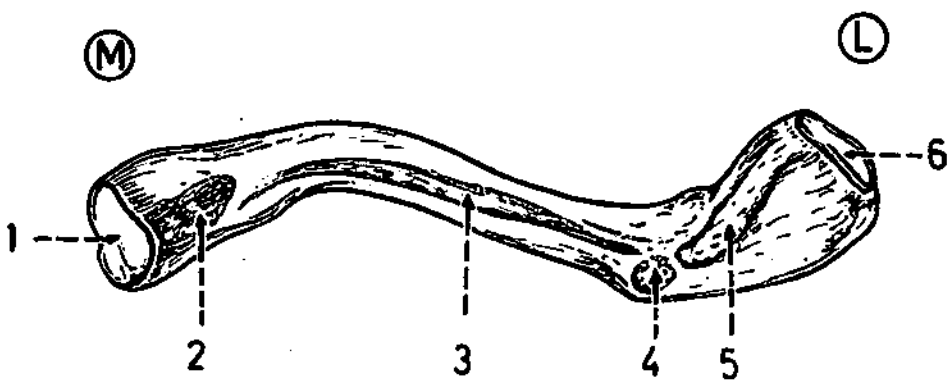
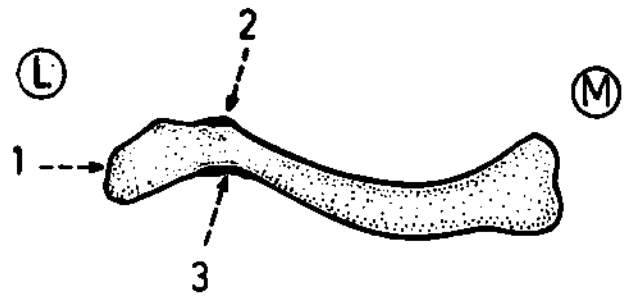


Fig.(3): INFERIOR ASPECT OF LEFT CLAVICLE
(general features)

1. medial end.
2. rough area for costo-clavicular ligament.
3. groove for subclavius muscle.
4. conoid tubercle for the conoid part of coraco-clavicular ligament.
5. trapezoid line for the trapezoid part of coraco-clavicular ligament.
6. lateral end.

Fig.(4): LATERAL 1/3 OF THE CLAVICLE

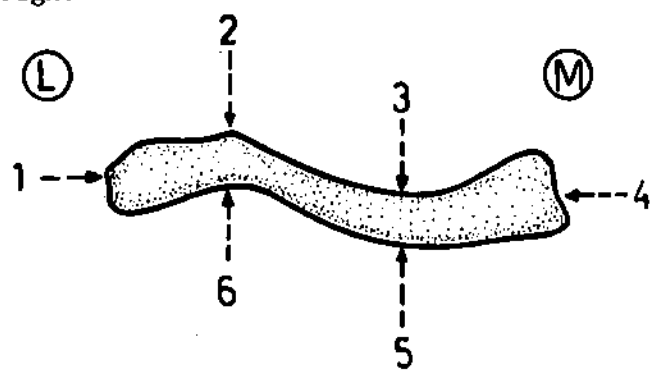


It is flattened and has anterior and posterior borders.

1. lateral end.
2. posterior border.
3. deltoid tubercle (on anterior border).

* It should be noted that the upper surface of the lateral 1/3 is smooth, while its lower surface is markedly rough.

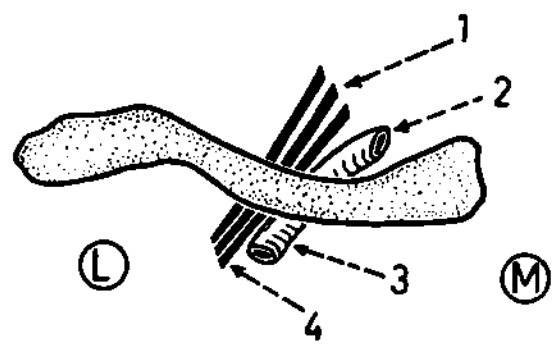
Fig.(5): CURVES OF THE SHAFT OF THE CLAVICLE



The shaft has a double curve so as its medial 2/3 is convex forwards while its lateral 1/3 is concave forwards. The medial 2/3 is cylindrical while the lateral 1/3 is flat.

1. lateral end.
2. posterior border of lateral 1/3.
3. posterior surface of medial 2/3.
4. medial end.
5. anterior surface of medial 2/3.
6. anterior border of lateral 1/3.

Fig.(6): STRUCTURES PASSING BEHIND MEDIAL 2/3 OF THE CLAVICLE



The forward convexity of the medial 2/3 of the clavicle gives room for the passage of the axillary artery and cords of the brachial plexus.

1. trunks of brachial plexus.
2. subclavian artery.
3. axillary artery.
4. cords of brachial plexus.

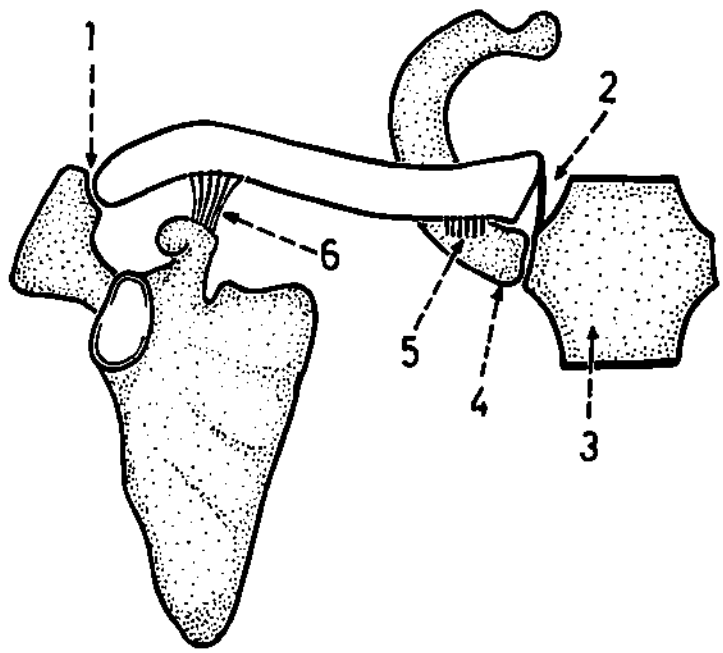


Fig.(7): POSITION AND ARTICULATIONS OF THE CLAVICLE

The clavicle is a long bone which lies horizontally across the root of the neck, extending from the manubrium sterni medially to the acromion of the scapula laterally. It articulates with the manubrium sterni at the sterno-clavicular joint, and with the acromion at the acromio-clavicular joint. Its medial end is supported by the articular disc of the sterno-clavicular joint and by the costo-clavicular ligament, while its lateral end is supported mainly by the coraco-clavicular ligament.

1. acromio-clavicular joint.
2. sterno-clavicular joint (has an articular disc inside its cavity).
3. manubrium sterni.
4. first rib.
5. costo-clavicular ligament (between the clavicle and the 1st rib).
6. coraco-clavicular ligament (between the clavicle and the coracoid process).

* Note that the scapula is suspended from the lateral 1/3 of the clavicle by the strong coraco-clavicular ligament.

* The shoulder girdle has no bony connection with the axial skeleton except at the sterno-clavicular joint.

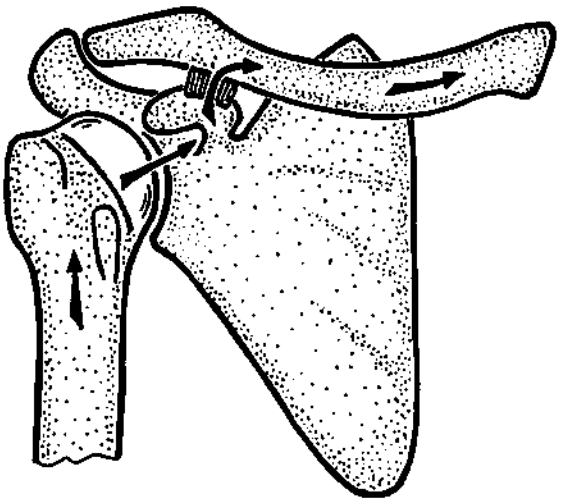


Fig.(8): TRANSMISSION OF THE WEIGHT OF UPPER LIMB

The weight of upper limb is transmitted through the glenoid cavity, coracoid process, coraco-clavicular ligament and medial 2/3 of the clavicle (not the lateral 1/3) to reach the manubrium sterni (part of the axial skeleton) through the sterno-clavicular joint.

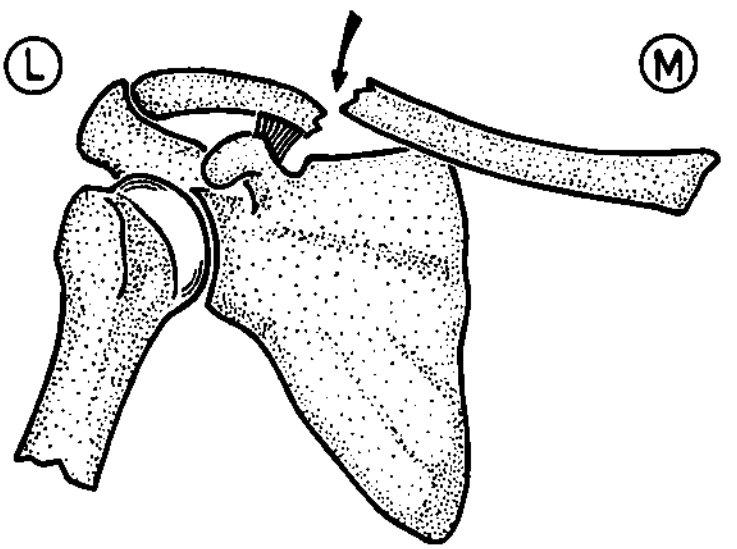


Fig.(9): COMMON SITE OF FRACTURE OF THE CLAVICLE

The clavicle is frequently fractured at the junction of its medial 2/3 with the lateral 1/3. As a result, the lateral 1/3 is drawn downwards by the weight of the limb while the medial 2/3 is little displaced because of the balance exerted by the muscles attached. This is the case with the fracture occurring medial to the attachment of the coraco-clavicular ligament. However, if the fracure is lateral to the coraco-clavicular ligament the lateral 1/3 of the clavicle is not displaced downwards because there is no interference with the transmission of the weight of the limb to the axial skeleton.

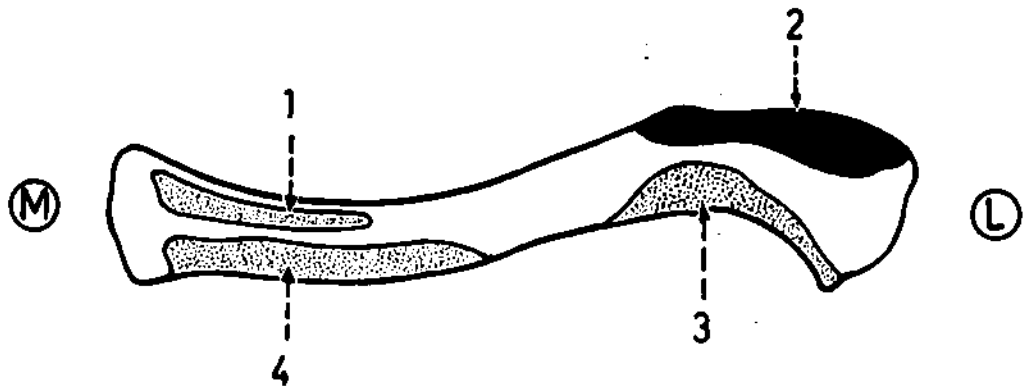


Fig.(10): SUPERIOR ASPECT OF LEFT CLAVICLE
(particular features)

It gives attachment to muscles.

1. origin of sternomastoid (clavicular head).
2. insertion of trapezius.
3. origin of deltoid.
4. origin of pectoralis major (clavicular head).

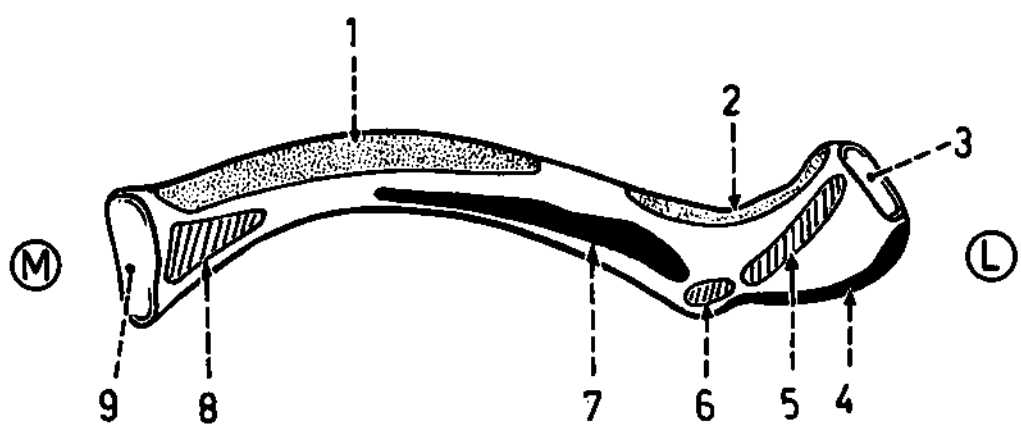


Fig.(11): INFERIOR ASPECT OF LEFT CLAVICLE
(particular features)

This surface is rough as compared with the superior surface which is smooth.
It gives attachment to one muscle (subclavius) and 2 ligaments.

1. origin of pectoralis major (from anterior surface).
2. origin of deltoid (from anterior border of lateral 1/3).
3. facet for acromio-clavicular joint.
4. insertion of trapezius (from posterior border of lateral 1/3).
5. trapezoid part of coraco-clavicular ligament.
6. conoid part of coraco-clavicular ligament.
7. insertion of subclavius (in middle 1/3 of inferior surface).
8. costo-clavicular ligament.
9. facet for sterno-clavicular joint.

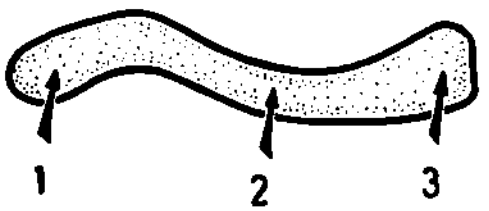


Fig.(12): SUBCUTANEOUS PARTS OF THE CLAVICLE

The clavicle is subcutaneous throughout its whole extent. This means that its shaft as well as its 2 ends can be felt through the skin.

1. lateral end.
2. shaft.
3. medial end.

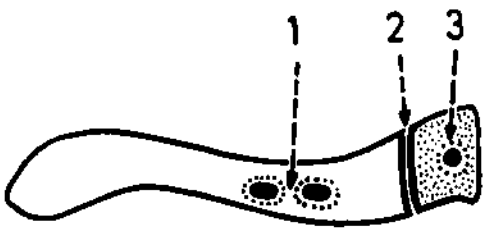


Fig.(13): OSSIFICATION OF THE CLAVICLE

The shaft of the clavicle ossifies in membrane from 2 primary centres which fuse rapidly (all other long bones ossify in cartilage). The medial end ossifies in cartilage and joins the shaft at 22 years.

1. two primary centres of ossification for the shaft (appear by 5th week of intra-uterine life; this is the earliest primary centre to appear).
2. epiphyseal plate of cartilage (ossifies at 22 years).
3. 2ry centre for the medial end (appears at 17 years).

SCAPULA

Fig.(14): VENTRAL ASPECT OF LEFT SCAPULA (general features)

1. coracoid process.
2. facet for acromio-clavicular joint.
3. acromion.
4. glenoid cavity (forms the head of scapula).
5. neck of scapula.
6. lateral border.
7. medial border.
8. costal (ventral) surface.
9. superior border.

* The scapula is triangular in outline and has 2 surfaces, 3 borders, 3 angles and 3 processes (spine, acromion and coracoid process).

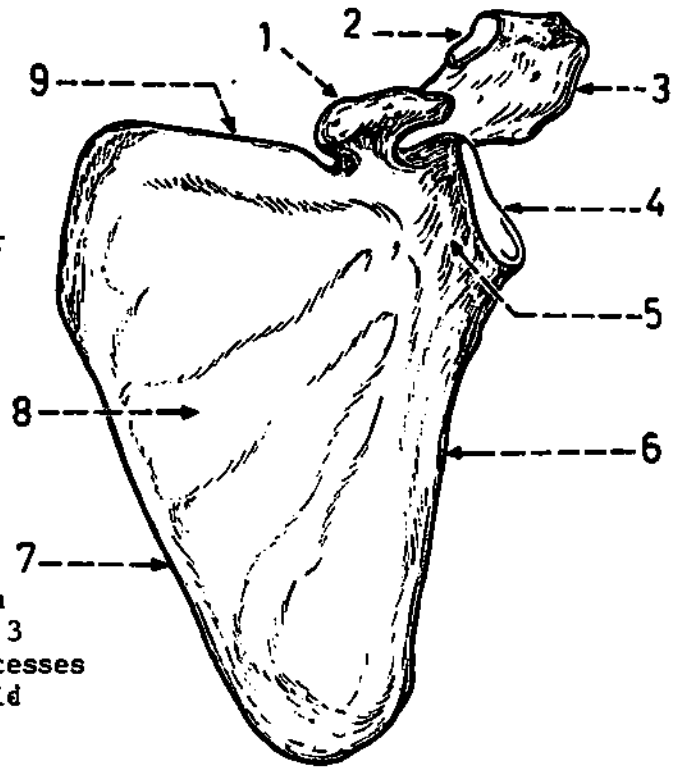


Fig.(15): DORSAL ASPECT OF LEFT SCAPULA (general features)

1. glenoid cavity.
2. acromion.
3. coracoid process.
4. suprascapular notch.
5. spine of the scapula.
6. superior angle.
7. supraspinous fossa.
8. triangular medial end of the spine (root of spine).
9. infraspinous fossa.
10. inferior angle.
11. groove for circumflex scapular artery.

* The dorsal surface of the scapula is characterized by the spine which divides the surface into supraspinous fossa above and infraspinous fossa below.

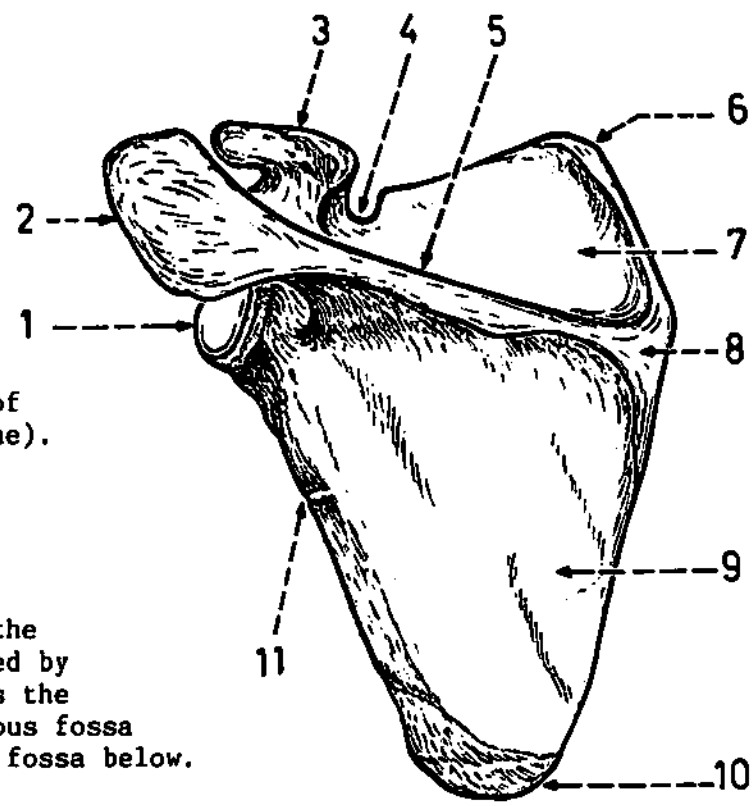


Fig.(16): SPINE OF THE SCAPULA

It is a shelf-like projection on the dorsum of the scapula. It has a free lateral border which bounds the spino-glenoid notch and a posterior border called the crest of the spine.

1. root of the spine.
2. crest of the spine (has upper and lower lips).
3. acromion.
4. lateral border of the spine.
5. arrow in the spino-glenoid notch.
6. a tubercle on the lower lip of the spine.

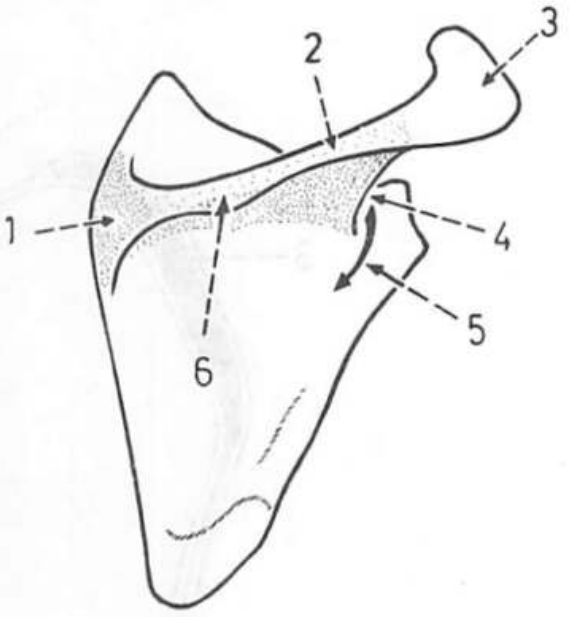


Fig.(17): ACROMION

It is a process which projects from the lateral end of the spine of the scapula.

1. spine of scapula.
2. lateral border of the acromion.
3. acromial angle.
4. posterior border of the acromion.

* The acromial angle lies at the meeting of the lateral and posterior borders of the acromion. It can be felt through the skin and is used in measuring the length of the arm clinically.

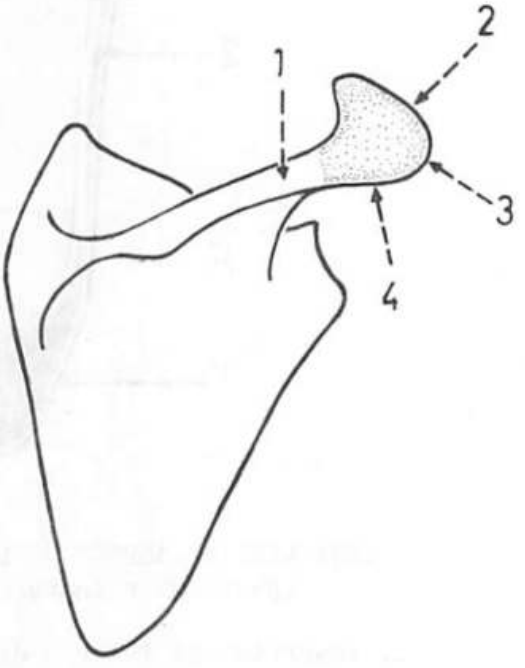
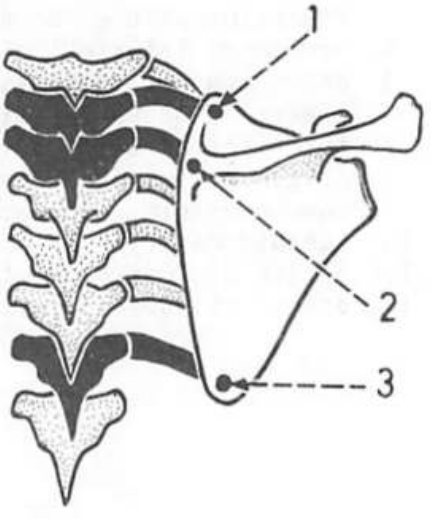


Fig.(18): SURFACE LEVELS OF THE SCAPULA

With the arm by the side,the superior angle of the scapula lies opposite the 2nd rib while its inferior angle lies opposite the 7th rib.

1. superior angle (2nd rib).
2. root of spine (3rd rib).
3. inferior angle (7th rib).



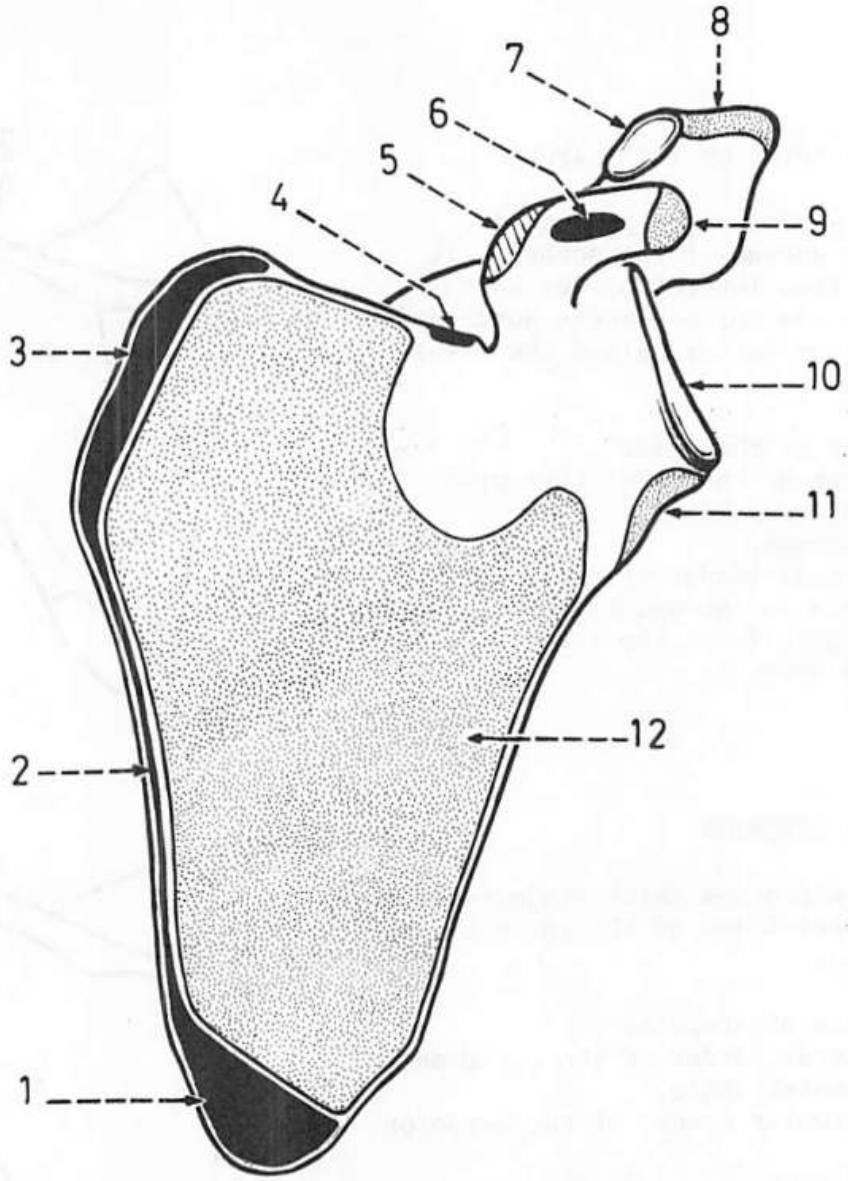


Fig.(19): VENTRAL ASPECT OF LEFT SCAPULA
(particular features)

1. insertion of lower 5 digitations of serratus anterior.
2. insertion of the 2nd and 3rd digitations of serratus anterior.
3. insertion of the 1st digitation of serratus anterior.
4. origin of inferior belly of omohyoid.
5. attachment of coraco-clavicular ligament.
6. insertion of pectoralis minor.
7. facet for acromio-clavicular joint.
8. origin of deltoid (acromial part).
9. common origin of coracobrachialis and short head of biceps brachii.
10. glenoid cavity (for shoulder joint).
11. origin of long head of triceps.
12. origin of subscapularis (from the subscapular fossa).

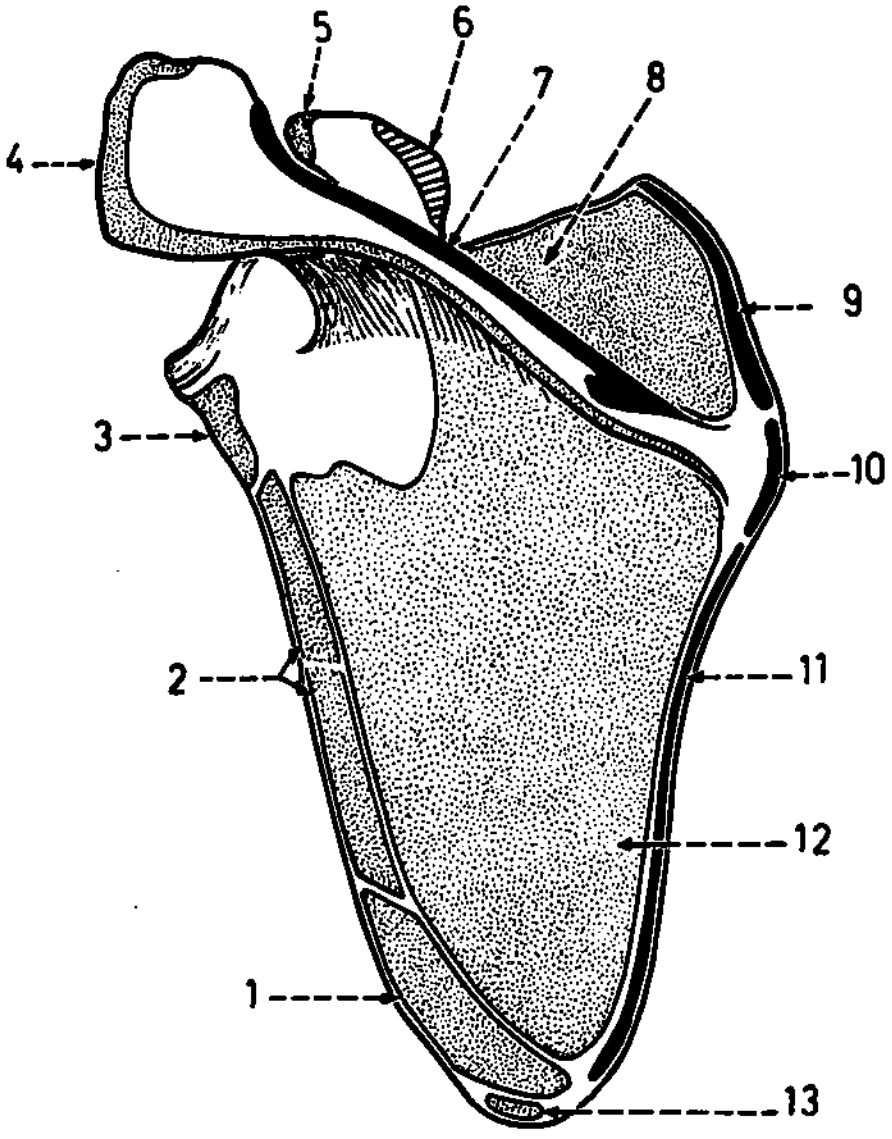


Fig.(20): DORSAL ASPECT OF LEFT SCAPULA
(particular features)

1. origin of teres major.
2. origin of teres minor.
3. origin of long head of triceps.
4. origin of deltoid (extends along the lower lip of the crest of the spine).
5. common origin of coracobrachialis and short head of biceps brachii.
6. attachment of coraco-clavicular ligament.
7. insertion of trapezius (to the upper lip of the crest of the spine).
8. origin of supraspinatus.
9. insertion of levator scapulae.
10. insertion of rhomboideus minor.
11. insertion of rhomboideus major.
12. origin of infraspinatus.
13. a slip of origin of latissimus dorsi.

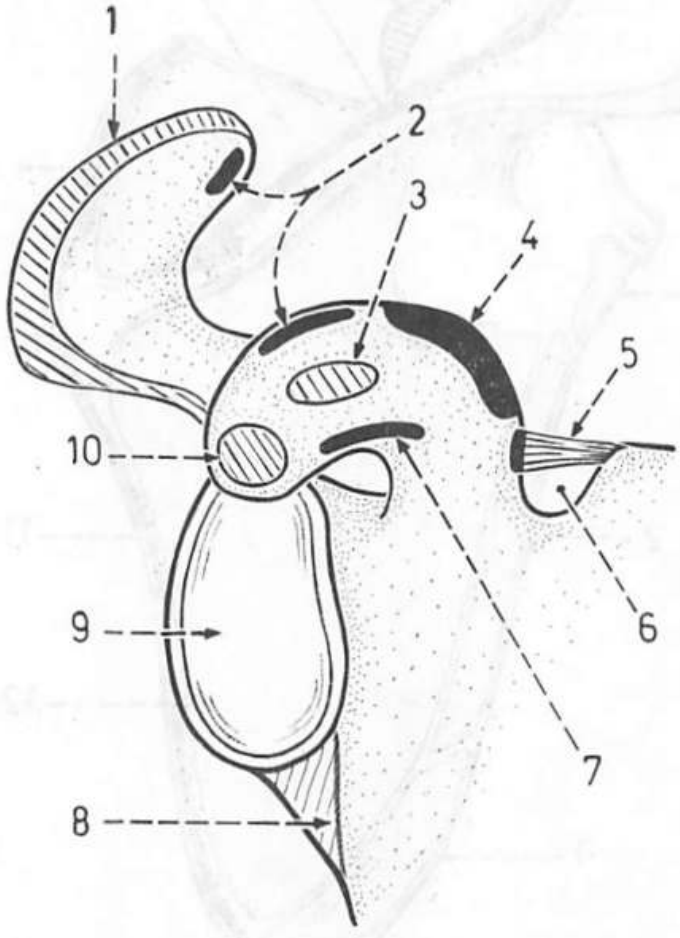


Fig.(21): STRUCTURES ATTACHED TO THE CORACOID PROCESS

It gives attachment to 4 ligaments (coraco-clavicular, coraco-acromial, costo-coracoid and superior transverse scapular), and 3 muscles (pectoralis minor, coracobrachialis and short head of biceps).

1. origin of deltoid (from acromion).
2. attachments of coraco-acromial ligament (extends between the acromion and coracoid process).
3. insertion of pectoralis minor (into medial surface of the coracoid process).
4. coraco-clavicular ligament (from the upper aspect of the process at the point where it is bent).
5. superior transverse scapular (suprascapular) ligament.
6. suprascapular notch.
7. costo-coracoid ligament (thickened upper border of clavi-pectoral fascia; it extends from the lst rib to the medial surface of the process).
8. origin of long head of triceps (from the infraglenoid tubercle).
9. glenoid cavity.
10. combined origin of coracobrachialis and short head of biceps.

Fig.(22): LATERAL ANGLE OF THE SCAPULA

It consists of the head and neck of the scapula. The head bears the glenoid cavity while the neck is the narrow constriction which immediately follows the head.

1. infraglenoid tubercle.
2. glenoid cavity (on the head of the scapula).
3. supraglenoid tubercle.
4. neck of scapula.

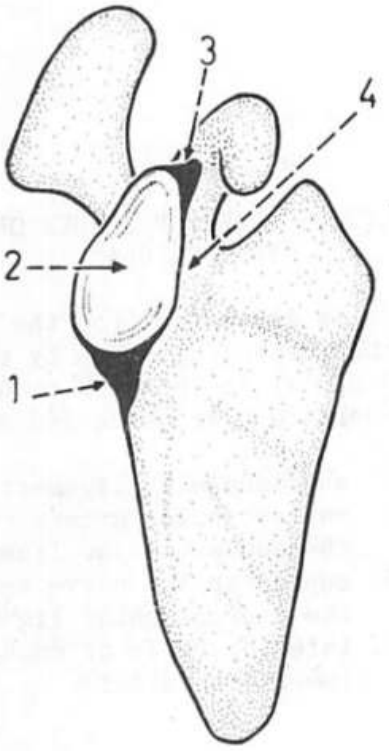
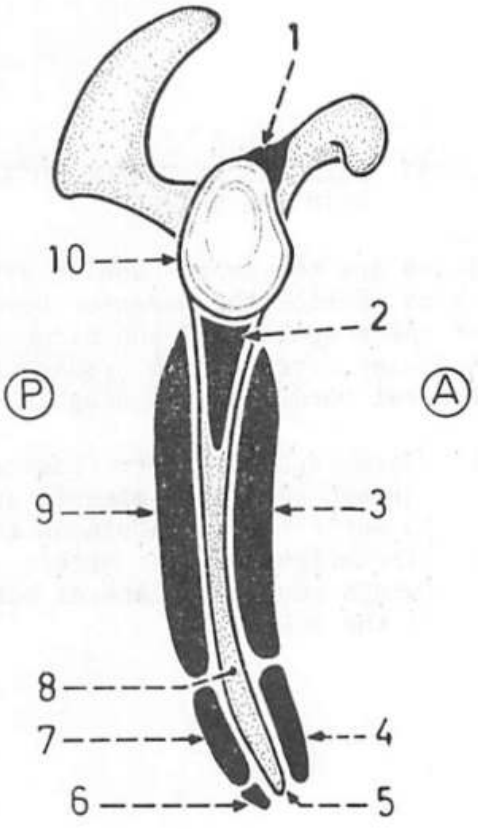


Fig.(23): LATERAL BORDER OF THE SCAPULA (particular features)

1. origin of long head of biceps (from supraglenoid tubercle).
2. origin of long head of triceps (from infraglenoid tubercle).
3. origin of subscapularis (from subscapular fossa).
4. insertion of serratus anterior into inferior angle.
5. inferior angle of scapula.
6. slip of origin of latissimus dorsi from the back of inferior angle.
7. origin of teres major.
8. lateral border of scapula.
9. origin of teres minor.
10. glenoid cavity.



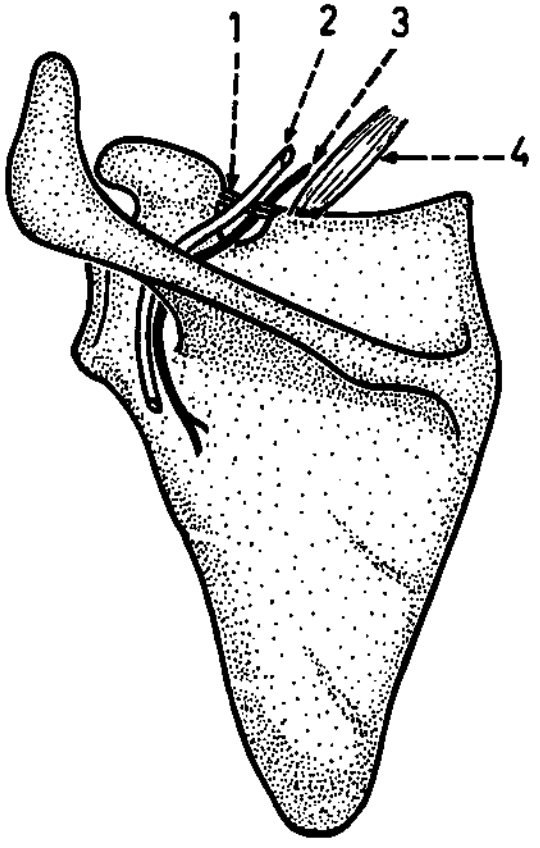


Fig.(24): SUPERIOR BORDER OF THE SCAPULA

It is separated from the root of the coracoid process by the supra-scapular notch which transmits the suprascapular nerve and artery.

1. suprascapular ligament.
2. suprascapular artery (runs above the suprascapular ligament).
3. suprascapular nerve (runs below the suprascapular ligament).
4. inferior belly of omohyoid (omos = shoulder).

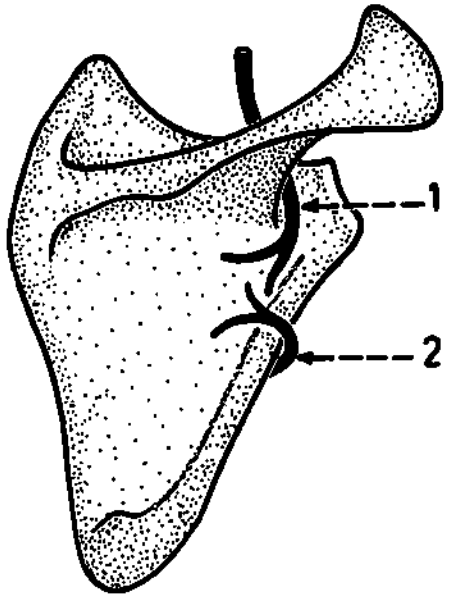


Fig.(25): ARTERIES IN DIRECT CONTACT WITH THE SCAPULA

These are the suprascapular artery which crosses the superior border of the scapula, and the circumflex scapular artery which crosses the lateral border of the scapula.

1. suprascapular artery (passes through the spino-glenoid notch to enter the infraspinous fossa).
2. circumflex scapular artery (winds round the lateral border of the scapula).

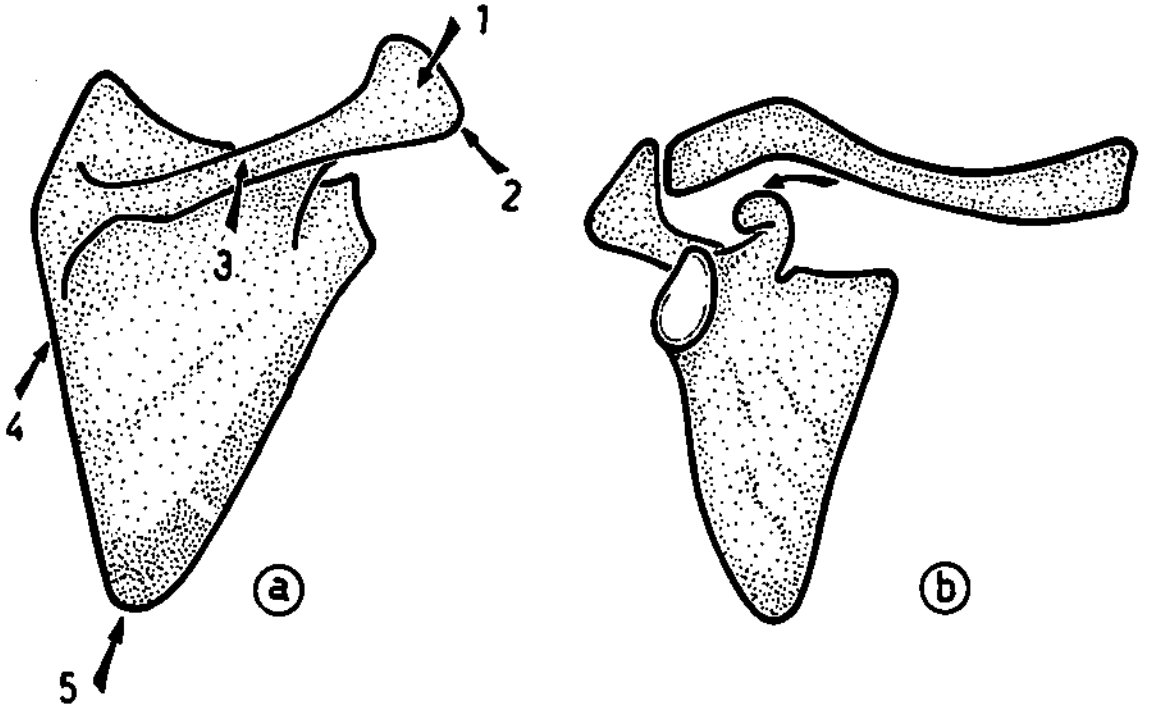


Fig.(26): SUBCUTANEOUS PARTS OF THE SCAPULA

(a) Dorsal aspect: 1. acromion; 2. acromial angle; 3. crest of the spine; 4. medial border; 5. inferior angle.

(b) Ventral aspect: although the tip of the coracoid process is not subcutaneous but it can be felt in the infraclavicular fossa $2\frac{1}{2}$ cm below the junction of the lateral 1/4 of the clavicle with the rest of the bone. It is covered by the anterior part of the deltoid muscle.

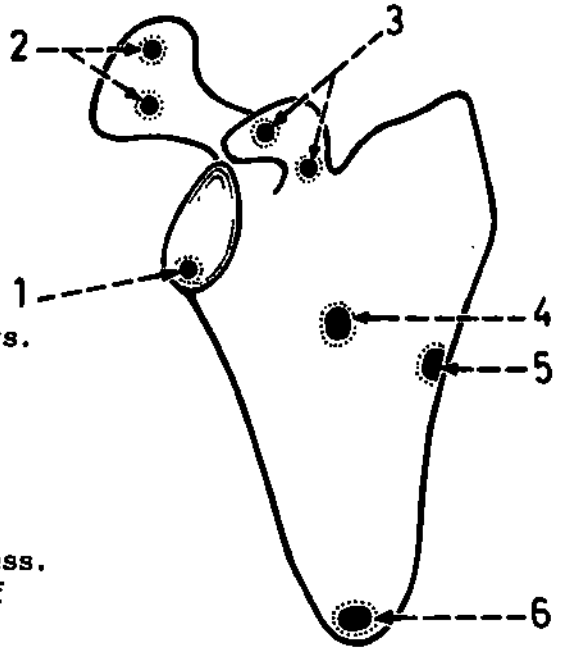


Fig.(27): OSSIFICATION OF THE SCAPULA

It ossifies from 8 centres: one primary centre for the body and the others are secondary centres for the rest of the bone and its processes. The 2ry centres appear at puberty and unite with the bone to form a complete scapula by 20 years. However, the coracoid process starts ossification by the 1st year after birth.

1. 2ry centre for glenoid cavity.
2. two 2ry centres for acromion.
3. two 2ry centres for coracoid process.
4. 1ry centre (appears in 8th week of intra-uterine life).
5. 2ry centre for medial border.
6. 2ry centre for inferior angle.

HUMERUS

Fig.(28): ANTERIOR ASPECT OF LEFT HUMERUS (general features)

1. head of humerus (forms less than 1/2 a sphere).
2. lesser tubercle or tuberosity (faces anteriorly).
3. intertubercular or bicipital groove (has a lateral lip, medial lip and floor).
4. shaft (cylindrical above and triangular below).
5. coronoid fossa (above the trochlea and receives the coronoid process of ulna in flexion of the elbow).
6. medial epicondyle (more prominent than the lateral epicondyle).
7. greater tubercle or tuberosity (faces laterally).
8. deltoid tuberosity (on the middle of the lateral aspect of the humerus).
9. radial fossa (above the capitulum and receives the head of radius in flexion of the elbow).
10. lateral epicondyle.
11. capitulum (articulates with the head of radius and does not extend backwards).
12. trochlea (articulates with the trochlear notch of the ulna).

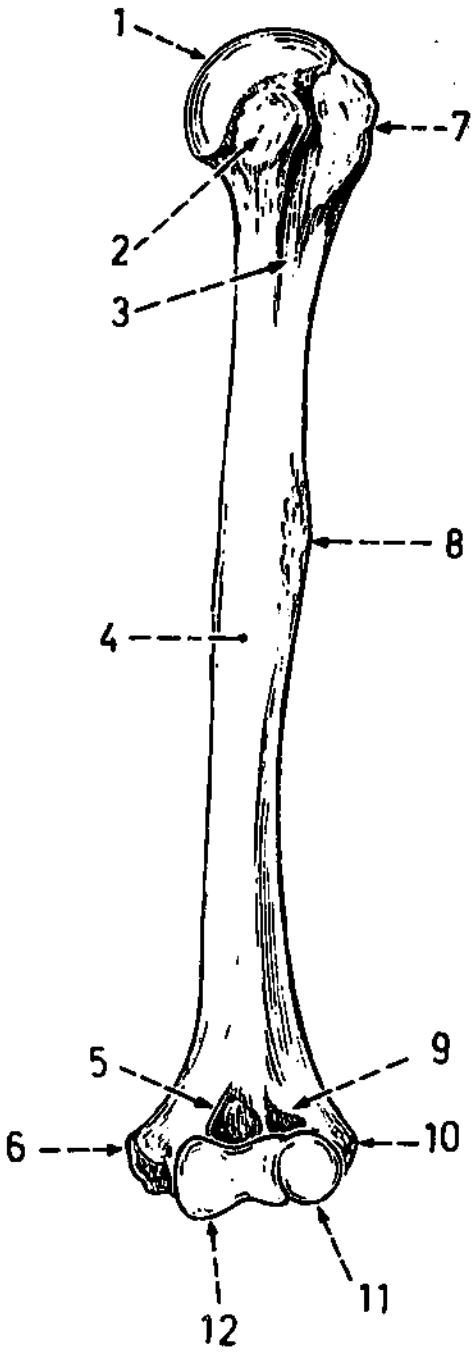
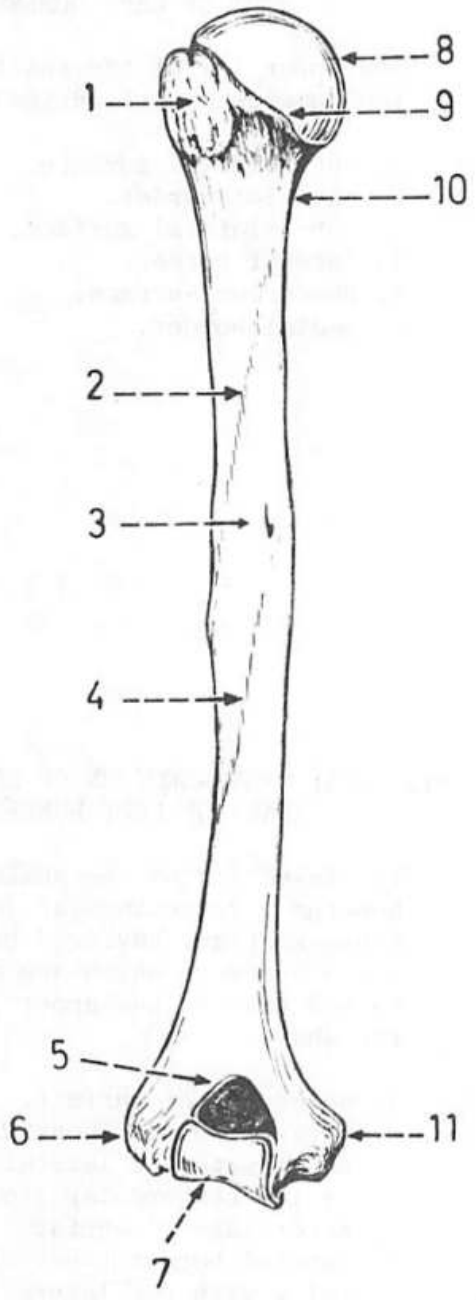


Fig.(29): POSTERIOR ASPECT OF LEFT HUMERUS (general features)



1. greater tubercle.
2. upper lip of the spiral or radial groove.
3. floor of the spiral or radial groove.
4. lower lip of the spiral or radial groove.
5. olecranon fossa (a deep hollow which receives the tip of the olecranon in extension of the elbow).
6. lateral epicondyle.
7. trochlea.
8. head of humerus.
9. anatomical neck (it is the line which immediately adjoins the margin of the head).
10. surgical neck (it is the uppermost part of the shaft which lies just below the greater and lesser tubercles).
11. medial epicondyle.

* The head of the humerus is directed medially, backwards and upwards to articulate with the glenoid cavity of the scapula to form the shoulder joint.

* The lower end articulates with the head of the radius and the trochlear notch of the ulna to form the elbow joint.

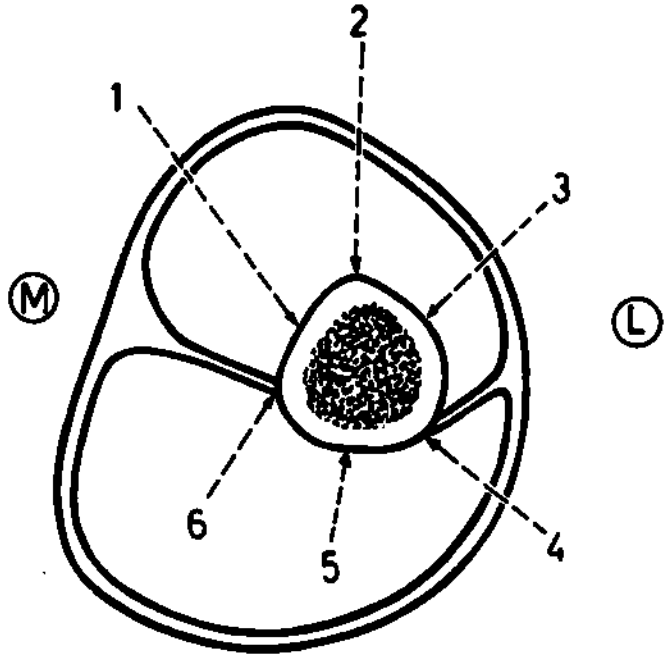


Fig.(30): CROSS-SECTION OF UPPER PART OF LEFT HUMERUS

The upper 1/2 of the shaft of the humerus is cylindrical.

1. anteromedial surface.
2. anterior border.
3. anterolateral surface.
4. lateral border.
5. posterior surface.
6. medial border.

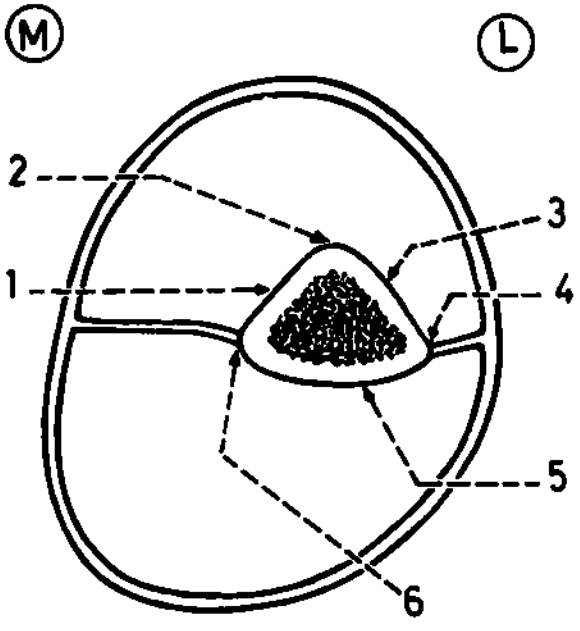


Fig.(31): CROSS-SECTION OF LOWER PART OF LEFT HUMERUS

The lower 1/2 of the shaft of the humerus is triangular in cross-section, having 3 borders and 3 surfaces which are more marked than in the upper 1/2 of the shaft.

1. anteromedial surface.
2. anterior border(continues above with the lateral lip of intertubercular groove).
3. anterolateral surface.
4. lateral border (continues below with the lateral supra-condylar ridge).
5. posterior surface.
6. medial border (continues below with the medial supra-condylar ridge).

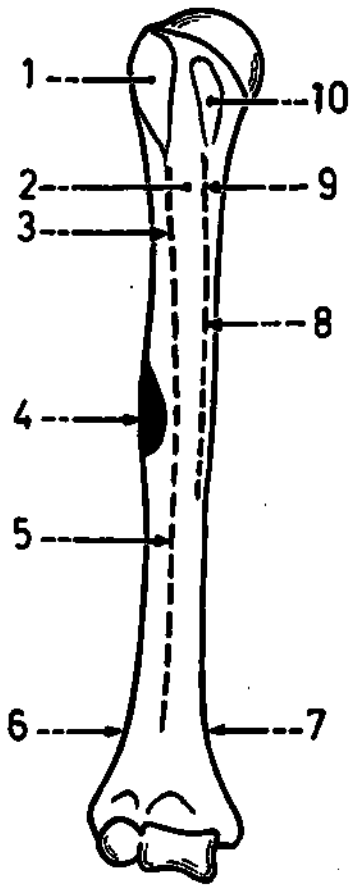


Fig.(32): BORDERS OF THE HUMERUS
(anterior aspect)

The shaft of the humerus has 3 borders (anterior, medial and lateral) which are well-marked in the lower 1/2 of the bone.

1. greater tubercle.
2. intertubercular groove or sulcus.
3. lateral lip of the intertubercular groove (continues below with the anterior border).
4. deltoid tuberosity (at the middle of the anterolateral surface).
5. anterior border (intervenes between the anterolateral and antero-medial surfaces).
6. lateral supracondylar ridge.
7. medial supracondylar ridge.
8. medial border (continues below with the medial supracondylar ridge).
9. medial lip of the intertubercular groove (can be traced with difficulty to the medial border).
10. lesser tubercle.

* The 3 surfaces of the shaft are: anterolateral (between anterior and lateral borders), anteromedial (between anterior and medial borders) and posterior (between medial and lateral borders).

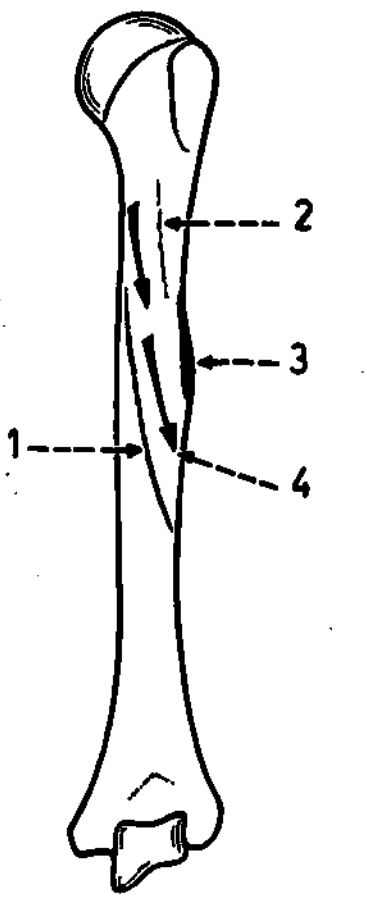


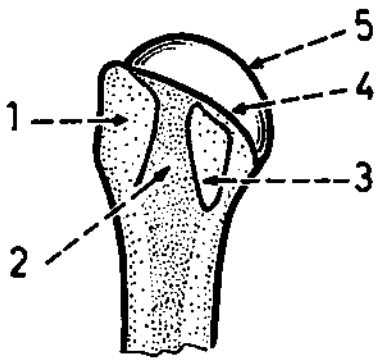
Fig.(33): POSTERIOR SURFACE OF THE HUMERUS
(to show the spiral groove)

The middle 1/3 of the posterior surface of the humerus is crossed obliquely by the spiral groove (radial groove or groove for radial nerve).

1. lower lip of the spiral groove.
2. upper lip of spiral groove (a faint ridge).
3. deltoid tuberosity.
4. arrows in the spiral groove.

* The spiral groove runs downwards and laterally to gain the antero-lateral surface of the humerus.

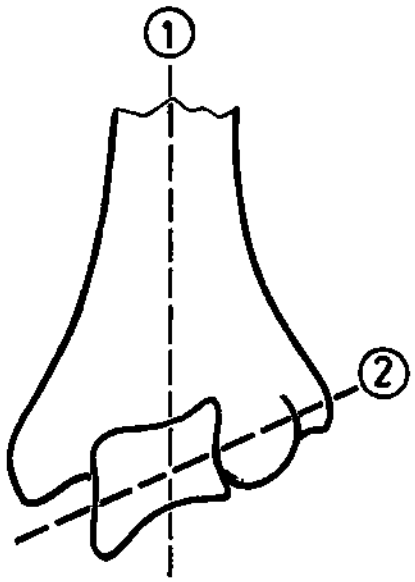
Fig.(34): PARTS OF THE UPPER END OF HUMERUS



The upper end of humerus comprises the head, greater tubercle and lesser tubercle. The 2 tubercles are separated from each other by the intertubercular groove.

1. greater tubercle (directed laterally).
2. intertubercular groove.
3. lesser tubercle (directed forwards).
4. anatomical neck (the line which adjoins the head).
5. head of humerus (articular surface for the shoulder joint).

Fig.(35): OBLIQUITY OF THE LONG AXIS OF THE TROCHLEA

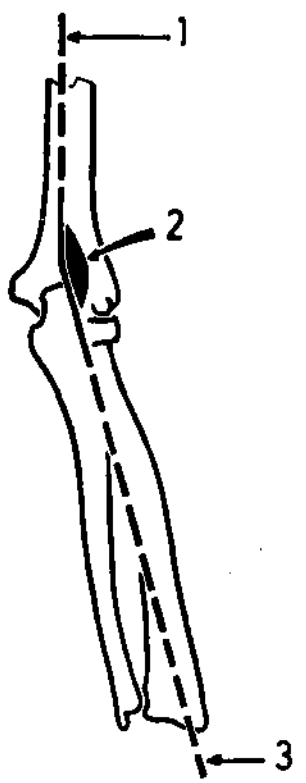


The long axis of the trochlea is set obliquely to the long axis of the shaft of the humerus. This is because the medial margin of the trochlea projects downwards more than its lateral margin.

1. long axis of the humerus.
2. long axis of the trochlea.

* The obliquity of the trochlea is responsible for the formation of the carrying angle.

Fig.(36): CARRYING ANGLE



It is the angle between the long axis of the arm and that of the fully extended and supinated forearm. It is about 165° and is open to the lateral side. It disappears in pronation and in flexion of the forearm. It is produced by the downward projection of the medial margin of the trochlea more than its lateral margin by 6 mm.

1. long axis of arm.
2. carrying angle (open laterally).
3. long axis of extended supinated forearm.

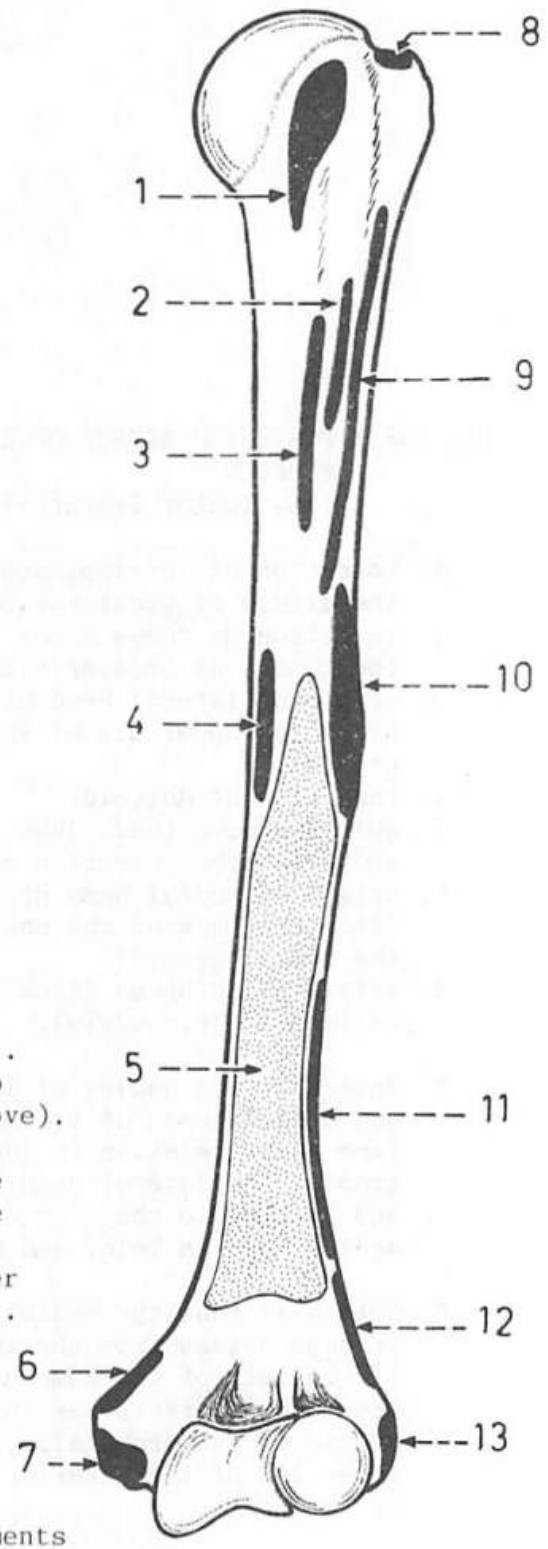


Fig.(37): ANTERIOR ASPECT OF LEFT HUMERUS
(particular features)

1. insertion of subscapularis (into lesser tubercle).
2. insertion of latissimus dorsi (in the floor of intertubercular groove).
3. insertion of teres major (into the medial lip of intertubercular groove).
4. insertion of coracobrachialis (into the middle of the medial border of the shaft opposite the insertion of deltoid).
5. origin of brachialis (from the lower 1/2 of the anterolateral and anteromedial surfaces).
6. origin of pronator teres(humeral head, from medial supracondylar ridge).
7. common flexor origin (from the front of medial epicondyle).
8. insertion of supraspinatus (into uppermost part of greater tubercle).
9. insertion of pectoralis major (into lateral lip of intertubercular groove).
10. insertion of deltoid (into deltoid tuberosity which lies at the middle of the anterolateral surface of the shaft).
11. origin of brachioradialis (from upper 2/3 of lateral supracondylar ridge).
12. origin of extensor carpi radialis longus (from lower 1/3 of lateral supracondylar ridge).
13. common extensor origin (from the front of lateral epicondyle).

* Note that almost all muscle attachments to the upper 1/2 of the humerus are insertions, while those to the lower 1/2 are origins.

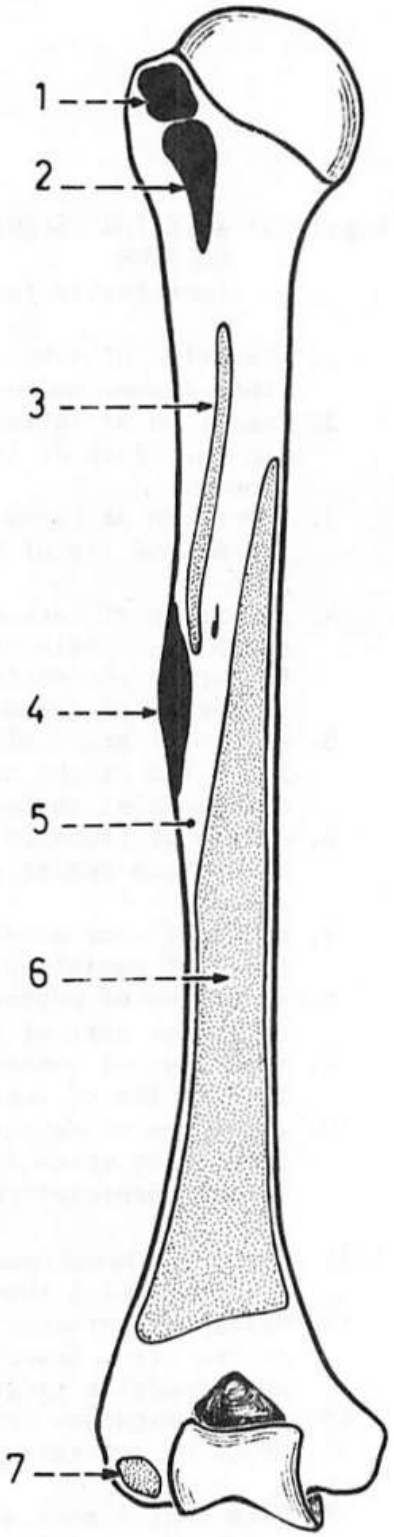


Fig.(38): POSTERIOR ASPECT OF LEFT HUMERUS
(particular features)

1. insertion of infraspinatus (into the middle of greater tubercle).
2. insertion of teres minor (into the lower part of greater tubercle).
3. origin of lateral head of triceps (from the upper lip of the spiral groove).
4. insertion of deltoid.
5. spiral groove (ends just behind and below the insertion of deltoid).
6. origin of medial head of triceps (from the back of the shaft below the spiral groove).
7. origin of anconeus (from the back of lateral epicondyle).

* Note that the naming of lateral and medial heads of triceps comes from their relation to the spiral groove: the lateral head is above and lateral to the groove while the medial head is below and medial.

* Note also that the medial head of triceps arises from the lower 1/2 of the back of the humerus; an area which corresponds to the origin of the brachialis from the lower 1/2 of the anterior aspect of of the bone.

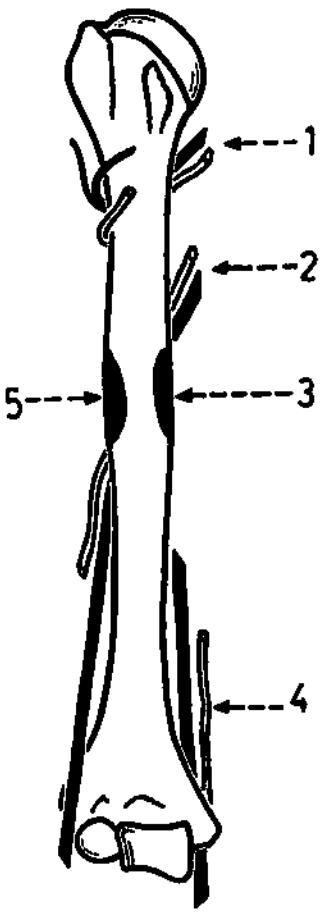


Fig.(39): NERVES AND VESSELS IN DIRECT CONTACT WITH THE HUMERUS

Nerves and vessels which come in direct contact with the bone are liable to injury in case of fracture of that bone. The axillary, radial and ulnar nerves and the accompanying vessels come in direct contact with the humerus.

1. axillary nerve and posterior circumflex humeral artery (in contact with the surgical neck).
2. radial nerve and profunda artery(in the spiral groove).
3. insertion of coracobrachialis.
4. ulnar nerve and ulnar collateral arteries (behind the medial epicondyle).
5. insertion of deltoid.

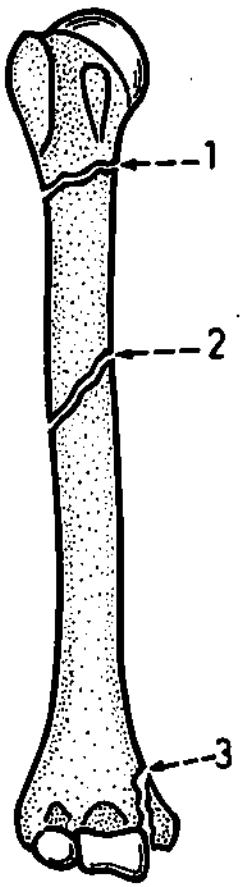


Fig.(40): DANGEROUS SITES OF FRACTURE OF HUMERUS

1. at the surgical neck of humerus: may injure the axillary nerve and posterior circumflex humeral artery.
2. at the middle 1/3 of the shaft: may injure the radial nerve and profunda artery.
3. at the lower end of the bone: may injure the ulnar nerve .

* Note that the median nerve and the radial nerve below the spiral groove are separated from the bone by muscles.

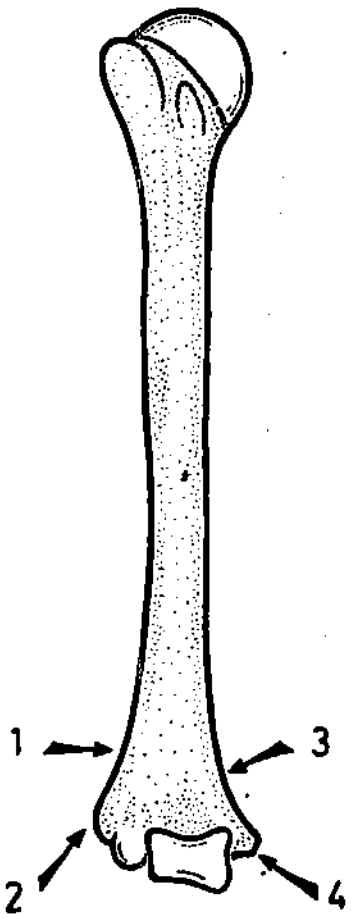


Fig.(41):SUBCUTANEOUS PARTS OF THE HUMERUS

The parts of the humerus which can easily be felt under the skin are the 2 epicondyles and the 2 supracondylar ridges.

1. lateral supracondylar ridge.
2. lateral epicondyle.
3. medial supracondylar ridge.
4. medial epicondyle.

* Note that it is possible to feel the head of the humerus through the axilla with the arm adducted.

* Note also that the greater tubercle cannot normally be felt under the skin, but if the deltoid muscle is paralysed this tubercle can be felt just below the tip of the acromion.

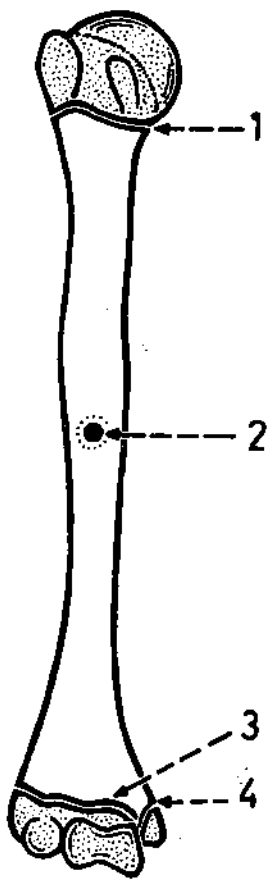


Fig.(42): OSSIFICATION OF THE HUMERUS

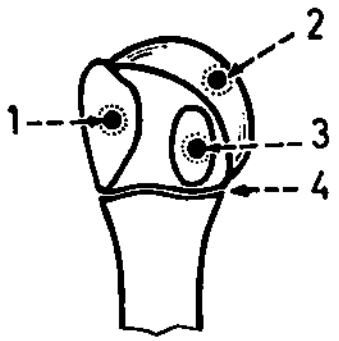
The humerus ossifies from one 1ry centre in the shaft and 7 2ry centres in the 2 ends (3 for the upper end and 4 for the lower end). The upper end of the humerus is called the growing end because it fuses with the shaft later than the lower end.

1. line of fusion of the upper end with the shaft (at 18 years).
2. 1ry centre of ossification (8th week of intrauterine life).
3. line of fusion of the lower end with the shaft (at 16 years).
4. line of fusion of the medial epicondyle (a separate epiphysis) with the lower end (unites at 20 years).

* In females fusion of the upper and lower ends of the bone with the shaft occurs 2 years earlier than in males (a general rule).

Fig.(43): OSSIFICATION OF UPPER END OF HUMERUS

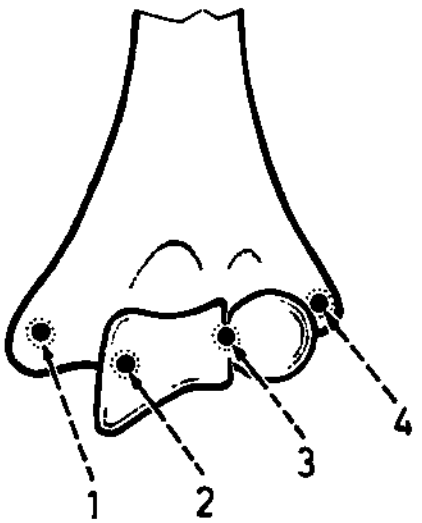
The upper end ossifies from 3 2ry centres for the head, greater tubercle and lesser tubercle. These 3 centres join together by the 6th year to form a single large epiphysis which is the upper end. This epiphysis unites with the shaft at about 18 years.



1. centre for greater tubercle (appears during the 2nd year).
2. centre for the head (appears during the 1st year).
3. centre for lesser tubercle (appears during the 5th year).
4. line of fusion with the shaft (fuses at 18 years)

Fig.(44): OSSIFICATION OF LOWER END OF HUMERUS

The lower end ossifies from 4 2ry centres for the capitulum, medial part of trochlea, medial epicondyle and lateral epicondyle. The trochlea, capitulum and lateral epicondyle unite at puberty to form one epiphysis (lower end of humerus). This epiphysis unites with the shaft at 16 years. The medial epicondyle forms a separate epiphysis which unites with the lower end of humerus later on at 20 years.



1. centre for medial epicondyle (appears during the 6th year).
2. centre for medial part of trochlea (appears during the 10th year).
3. centre for capitulum (appears during the 1st year).
4. centre for lateral epicondyle (appears during the 12th year).

RADIUS and ULNA

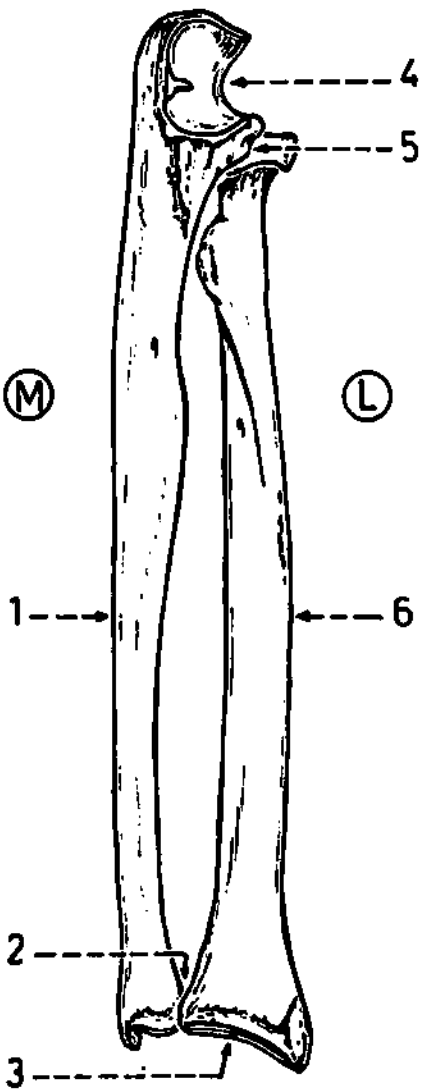


Fig.(45): BONES OF LEFT FOREARM ARTICULATING TOGETHER

The bones of the forearm are the radius and ulna which articulate together at the superior radio-ulnar joint (above) and the inferior radio-ulnar joint (below). The radius lies laterally while the ulna lies medially. The 2 bones together articulate above with the lower end of the humerus to form the elbow joint, and articulate below with the carpal bones to form the wrist joint.

1. ulna (lies medially).
2. inferior radio-ulnar joint.
3. articular surface for the wrist joint.
4. articular surface for the elbow joint.
5. superior radio-ulnar joint.
6. radius (lies laterally).

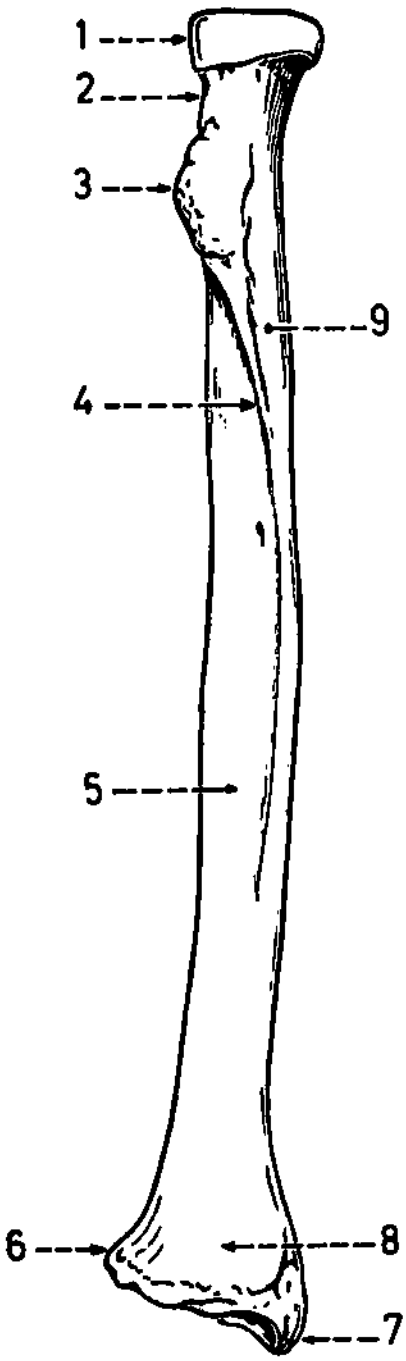


Fig.(46): ANTERIOR ASPECT OF LEFT RADIUS (general features)

1. head of radius (disc-shaped).
2. neck (the constricted part below the head).
3. radial tuberosity (its posterior part is rough while its anterior part is smooth).
4. upper oblique part of the anterior border.
5. anterior surface (between the anterior and interosseous borders).
6. medial surface of lower end of radius (concave articular surface for the head of ulna; it is called ulnar notch).
7. styloid process of radius (it is the downward projection of the lateral surface of the lower end).
8. anterior surface of lower end of radius (smooth and slightly concave).
9. lateral surface of the shaft of radius (gently convex and encroaches on the anterior and posterior aspects of the bone in the upper part due to the obliquity of the upper parts of the anterior and posterior borders of the shaft).

* Note that the upper end of the bone which consists of the head, neck and tuberosity is smaller than the lower end, and that the shaft of the radius is gently convex laterally.

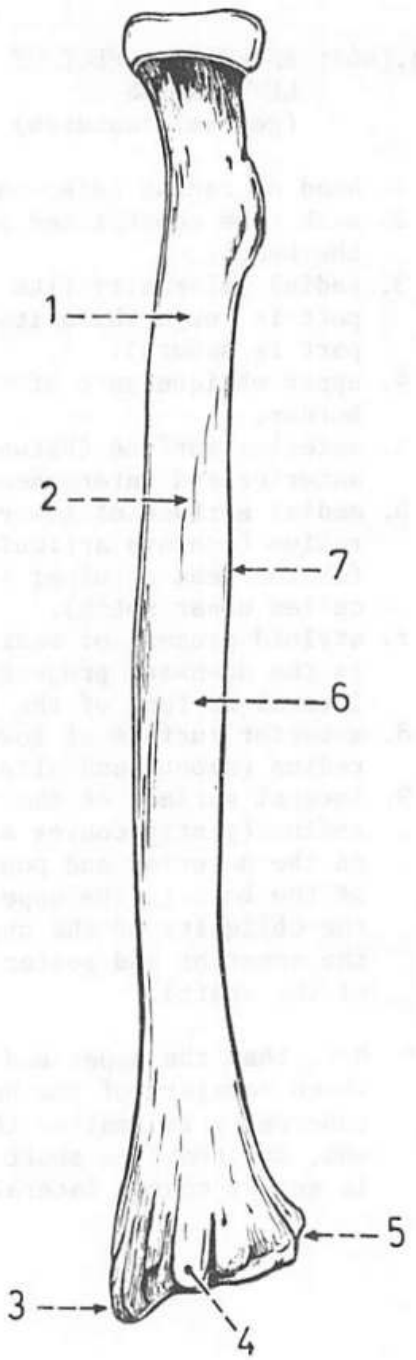


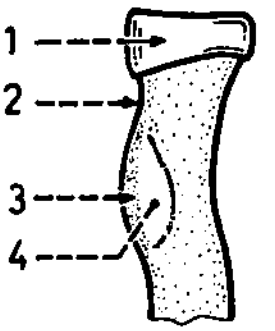
Fig.(47): POSTERIOR ASPECT OF LEFT RADIUS (general features)

The posterior aspect of the bone is easily identified from the lower end which is rough and irregular as compared with its anterior surface which is flat and smooth.

1. lateral surface (encroaches on the upper part of the posterior aspect of the bone owing to the obliquity of the upper part of the posterior border; the lateral surface lies between the anterior and posterior borders of the shaft).
2. upper oblique part of the posterior border.
3. styloid process of radius.
4. dorsal tubercle (an elevated area on the back of the lower end).
5. ulnar notch (for articulation with the head of the ulna to form the inferior radio-ulnar joint; it marks the medial surface of the lower end of the radius).
6. posterior surface (between the posterior and interosseous borders of the shaft).
7. interosseous border (the sharpest border and is directed medially; it gives attachment to the interosseous membrane).

Fig.(48): UPPER END OF LEFT RADIUS

It consists of the head, neck and radial tuberosity.

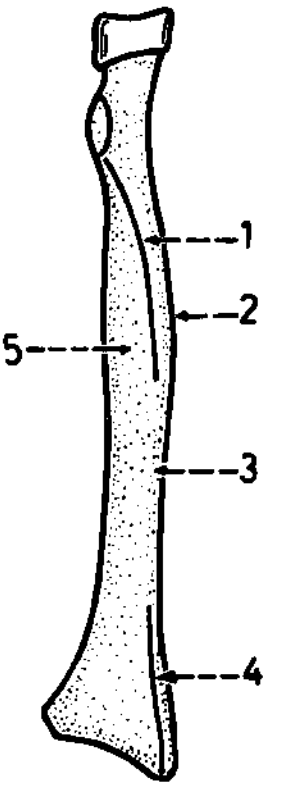


1. head of radius (its upper surface is concave for articulation with the capitulum and its circumference is convex for articulation with the radial notch of the ulna).
2. neck of radius (is the constricted part below the head).
3. rough posterior part of the radial tuberosity (for insertion of the biceps tendon).
4. smooth anterior part of the radial tuberosity (related to a bursa deep to the tendon of the biceps).

* The medial aspect of the upper end is identified by the fact that the articular circumference of the head is widest medially, and the radial tuberosity is directed medially.

Fig.(49): ANTERIOR BORDER OF THE RADIUS

It begins just below the radial tuberosity and runs obliquely downwards and laterally where it is called the anterior oblique line of radius. The border becomes indefinite in the middle part of the bone but becomes well-marked again at the lower end where it forms a sharp crest along the lateral margin of the anterior surface.



1. anterior oblique line of radius (upper part of the anterior border).
2. lateral surface (convex laterally).
3. indefinite middle part of the anterior border.
4. lower part of the anterior border.
5. anterior surface of the shaft.

Fig.(50): ANTERIOR ASPECT OF LEFT ULNA
(general features)

The ulna is the medial bone of forearm and lies parallel with the radius in the supine position. Its upper end is larger and shows the trochlear notch while its lower end is smaller and shows the head and styloid process.

1. olecranon (projects forwards above the trochlear notch).
2. coronoid process (projects forwards below the trochlear notch).
3. tuberosity of ulna (a rough area on the lower part of the anterior surface of the coronoid process).
4. medial surface of the shaft (between the anterior and posterior borders).
5. anterior border (thick and rounded and begins above at the medial side of the tuberosity of the ulna).
6. styloid process (projects from the posteromedial aspect of the lower end).
7. head of ulna (directed laterally to articulate with the ulnar notch of the radius).
8. oblique rough strip on the anterior surface of the shaft (for the origin of pronator quadratus).
9. anterior surface of the shaft (between the anterior and interosseous borders).
10. interosseous border (the sharpest and is directed laterally; it gives attachment to the interosseous membrane).
11. supinator crest (it is a well-marked ridge which lies in line with the interosseous border).
12. radial notch (lies on the lateral surface of the coronoid process and articulates with the head of the radius).
13. trochlear notch (is directed anteriorly and is bounded above by the olecranon and below by the coronoid process).

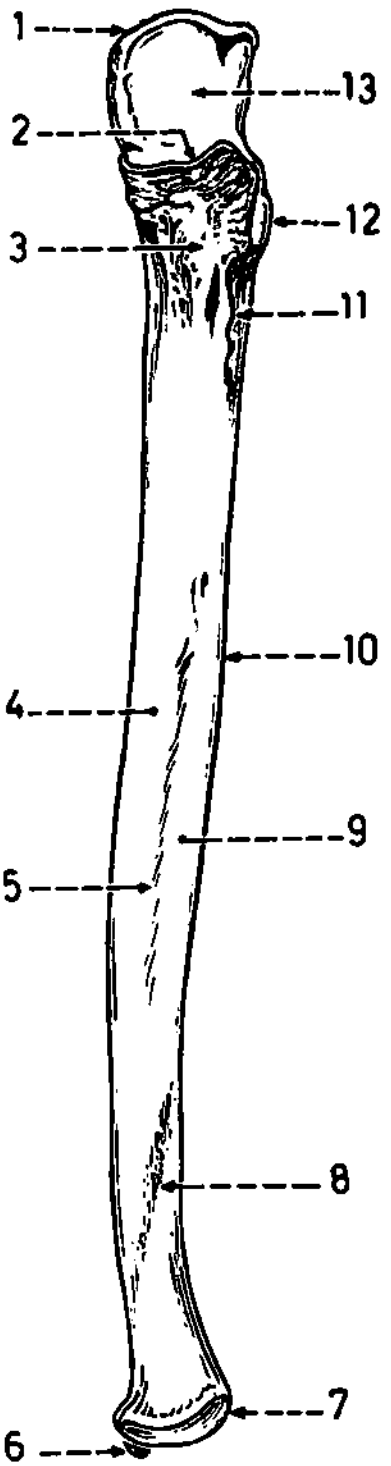


Fig.(51): POSTERIOR ASPECT OF LEFT ULNA
(general features)

1. upper border of the olecranon (forms the bony point which can easily be felt on the back of elbow).
2. uppermost part of posterior border (reaches up to the apex of the posterior aspect of the olecranon).
3. middle part of posterior border (can be traced down to the styloid process).
4. styloid process.
5. head of ulna.
6. groove between the head and styloid process (for the tendon of extensor carpi ulnaris).
7. posterior surface of the shaft (between the posterior and interosseous borders).
8. interosseous border.
9. oblique line on the posterior surface (forms the lateral boundary of the triangular area for the anconeus).
10. triangular area on the posterior surface for the insertion of anconeus muscle.
11. lateral surface of the coronoid process.

* Note that the upper 3/4 of the shaft of the ulna is triangular on cross-section, while its lower 1/4 is cylindrical.

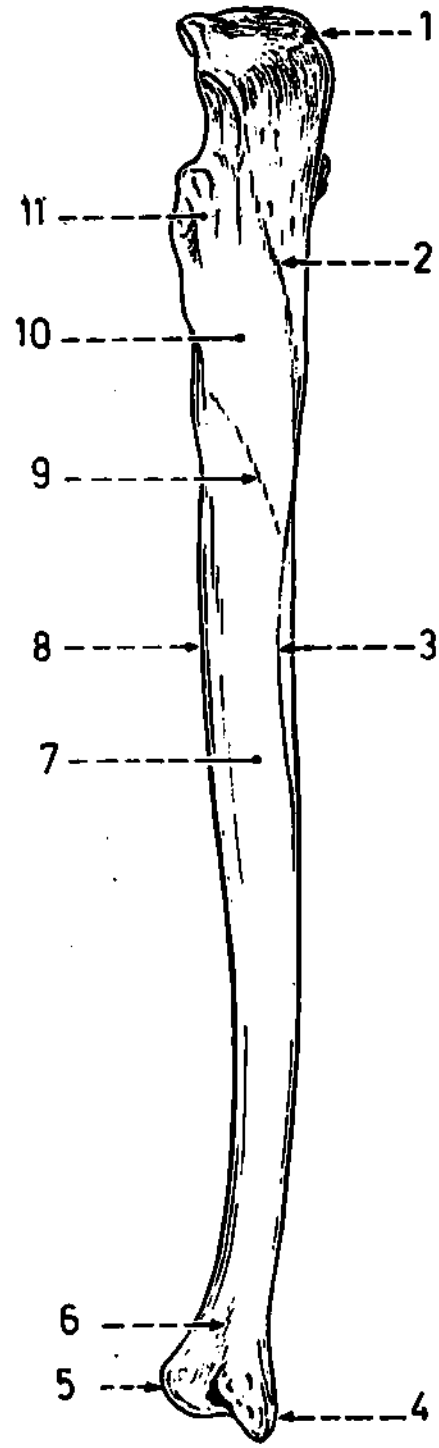
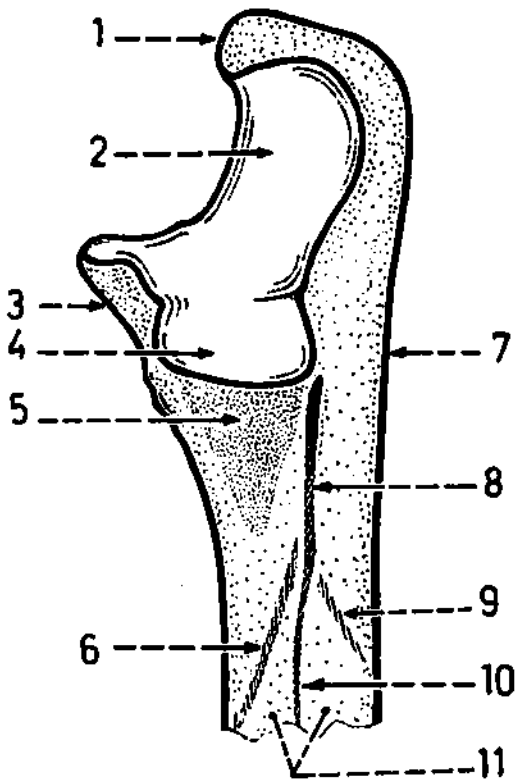


Fig.(52): LATERAL ASPECT OF UPPER PART OF LEFT ULNA

1. olecranon.
2. trochlear notch.
3. coronoid process.
4. radial notch.
5. supinator fossa: a depression below the radial notch and in front of the supinator crest (origin of supinator muscle).
6. uppermost part of the interosseous border (continues above with the supinator crest).
7. posterior border.
8. supinator crest (a prominent vertical ridge below the posterior end of the radial notch) (origin of supinator muscle).
9. oblique line on the posterior surface.
10. upper part of the vertical line which divides the posterior surface into medial and lateral strips).
11. medial and lateral strips of the posterior surface.



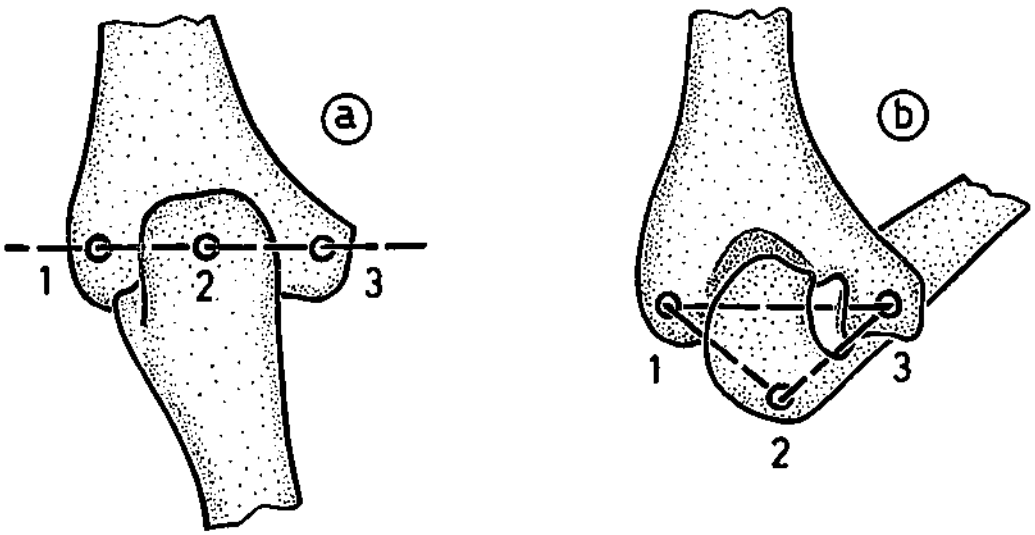


Fig.(53): THE 3 BONY POINTS FELT ON THE BACK OF THE ELBOW

These 3 points are: upper border of the olecranon, medial epicondyle and lateral epicondyle.

(a) The elbow in full extension: The 3 bony points lie on one horizontal line.
(b) The elbow in full flexion: the 3 bony points form an equilateral triangle.

1. lateral epicondyle; 2. olecranon; 3. medial epicondyle.

Fig.(54): SURFACES AND BORDERS OF RADIUS AND ULNA (cross-section)

1. lateral surface of radius.
2. anterior border of radius.
3. anterior surface of radius.
4. interosseous border of radius.
5. interosseous membrane.
6. interosseous border of ulna.
7. anterior surface of ulna.
8. anterior border of ulna.
9. ulna (medial).
10. medial surface of ulna.
11. posterior border of ulna.
12. posterior surface of ulna.
13. posterior surface of radius.
14 posterior border of radius.
15. radius (lateral).

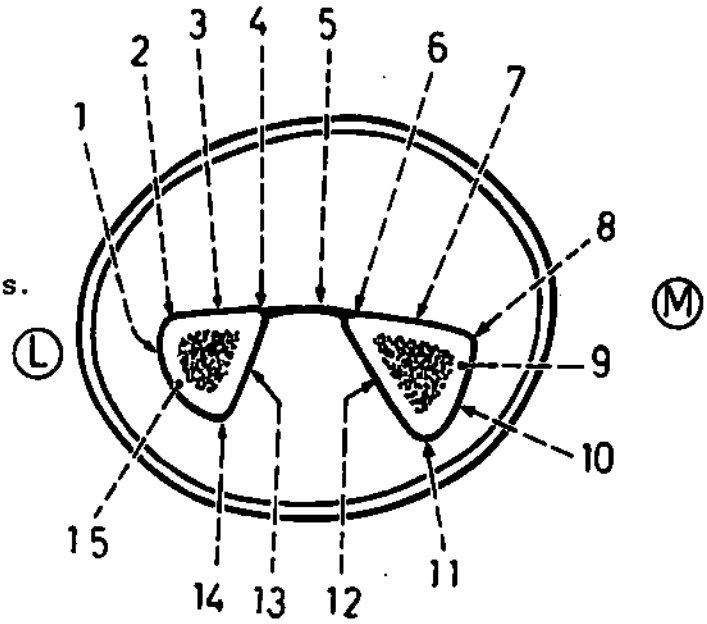


Fig.(55): POSTERIOR SURFACES AND BORDERS OF RADIUS AND ULNA

1. uppermost part of posterior border of ulna.
2. oblique line on the upper part of posterior surface of ulna.
3. vertical ridge on the middle part of the posterior surface of ulna.
4. posterior surface of ulna.
5. triangular area for anconeus.
6. upper oblique part of the posterior border of radius.
7. middle part of the posterior border of radius (well-defined).
8. posterior surface of radius.

* At the radial tuberosity the anterior and posterior borders of the radius converge.

* At the supinator crest of the ulna the interosseous border and the oblique line of the posterior surface converge.

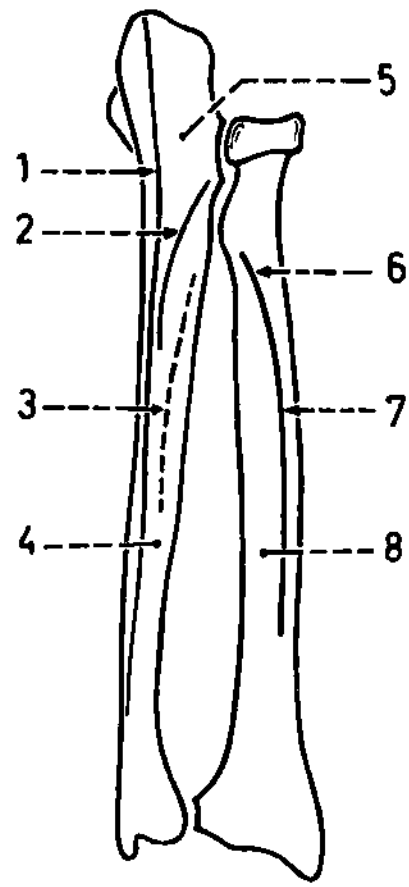


Fig.(56): BEGINNING OF ANTERIOR BORDER OF THE ULNA

The anterior border of the ulna begins higher up at the medial side of the ulnar tuberosity.

1. ulnar tuberosity.
2. uppermost part of anterior border of ulna.
3. medial surface of ulna.
4. anterior surface of ulna.

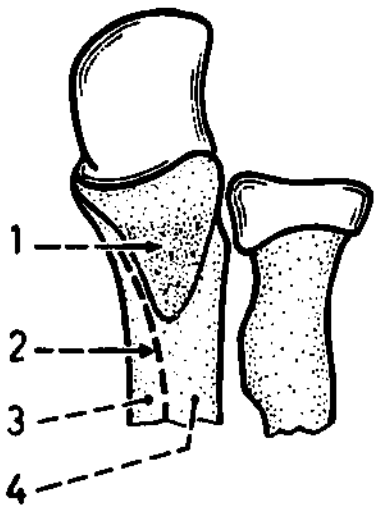


Fig.(57): ARTICULATIONS OF THE HEAD OF THE ULNA

The head of ulna articulates laterally with the ulnar notch of radius and below with the articular disc. The disc separates the head of the ulna from the lunate bone and excludes it from direct articulation with the carpal bones.

1. styloid process of radius (lower than that of the ulna).
2. articular disc.
3. styloid process of ulna.
4. inferior radio-ulnar joint.

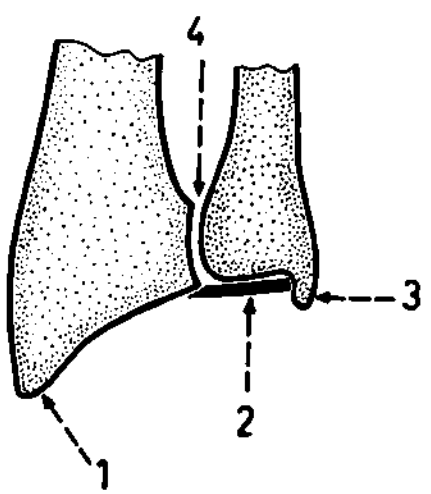


Fig.(58):INFERIOR SURFACES OF RADIUS AND ULNA

The inferior surfaces of the lower ends of radius and ulna are articular. The inferior surface of radius articulates with the scaphoid and lunate bones while the inferior surface of the ulna articulates with the articular disc.

1. styloid process of radius.
2. triangular area for articulation with the scaphoid.
3. quadrangular area for articulation with the lunate.
4. head of ulna.
5. styloid process of ulna.

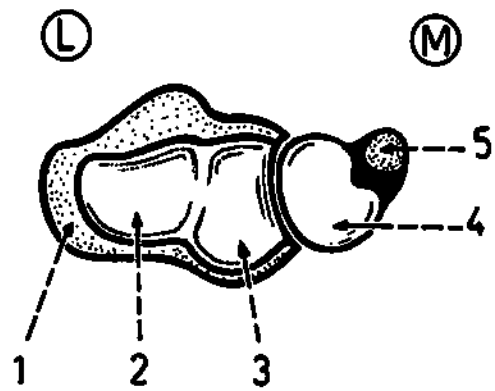


Fig.(59): BACK OF LOWER ENDS OF RADIUS AND ULNA

1. styloid process of radius (lower than that of ulna).
2. dorsal tubercle of radius (can be felt under the skin).
3. groove for the tendon of extensor pollicis longus.
4. head of ulna.
5. styloid process of ulna.
6. groove for the tendon of extensor carpi ulnaris.

* The posterior surface of the radius is irregular due to the presence of grooves for the tendons of the extensor muscles.

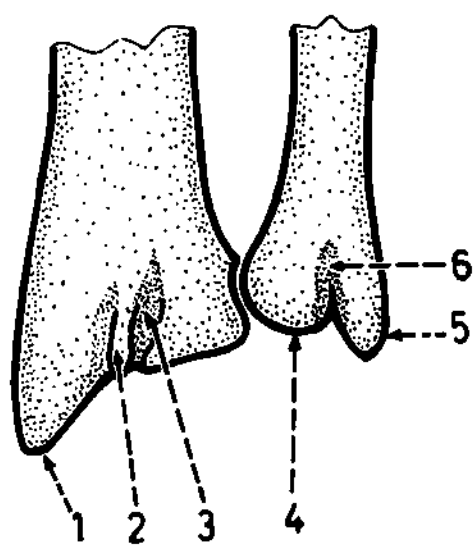


Fig.(60): ANTERIOR ASPECT OF RADIUS AND ULNA (particular features)

1. a slip of origin of flexor digitorum superficialis (from uppermost part of medial side of coronoid process; a part of the humero-ulnar head).
2. ulnar head of origin of pronator teres (from the medial side of coronoid process).
3. insertion of brachialis (into the front of coronoid process and ulnar tuberosity).
4. a slip of origin of flexor pollicis longus (from the medial border of coronoid process).
5. origin of flexor digitorum profundus (from the anterior and medial surfaces of upper 3/4 of ulna).
6. origin of pronator quadratus (from an oblique ridge on the anterior surface of the lower 1/4 of ulna).
7. insertion of brachioradialis (into the lateral side of lower end of radius).
8. insertion of pronator quadratus (into the lower 1/4 of the anterior surface of radius).
9. origin of flexor pollicis longus (from the anterior surface of radius).
10. insertion of pronator teres (into the middle of lateral surface of radius).
11. radial origin of flexor digitorum superficialis (from the anterior oblique line of radius).
12. insertion of supinator (into the upper 1/3 of lateral surface of radius).
13. insertion of biceps (into the radial tuberosity).

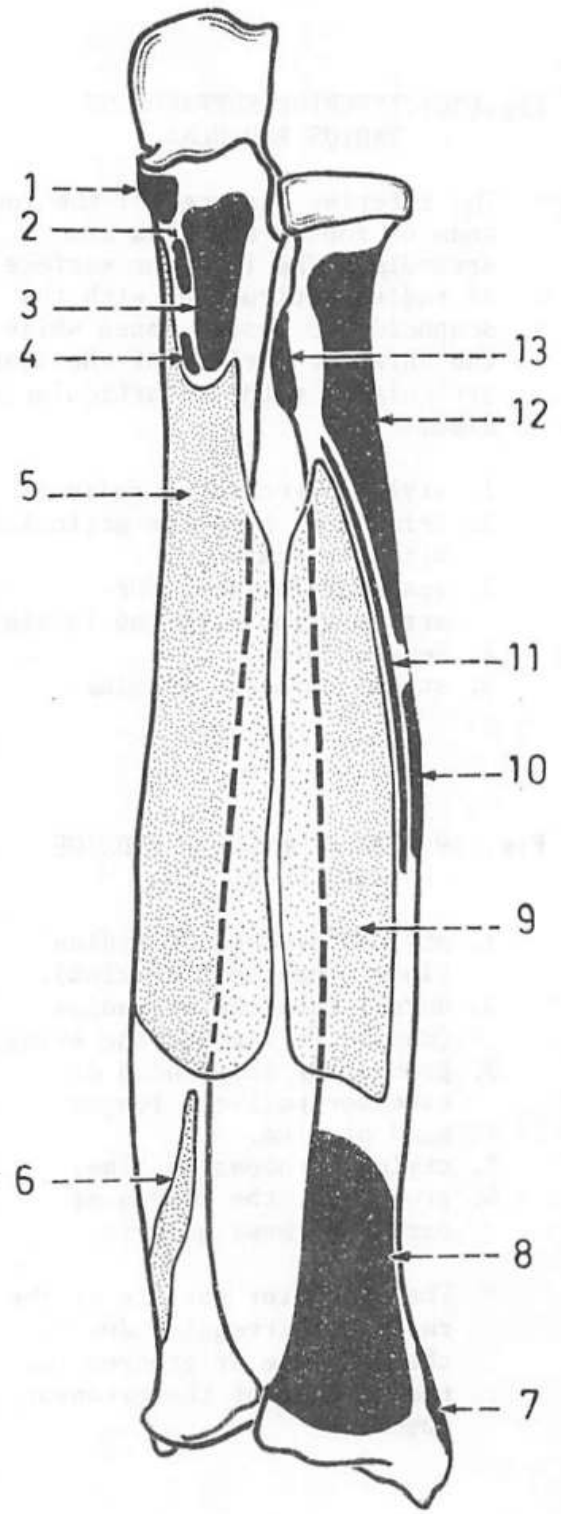


Fig.(61): POSTERIOR ASPECT OF RADIUS AND ULNA (particular features)

1. insertion of supinator (into the upper 1/3 of lateral surface of radius).
2. insertion of pronator teres (into the middle of lateral surface of radius; at maximum convexity).
3. origin of extensor pollicis brevis (from the middle part of posterior surface of radius).
4. insertion of brachioradialis (into the lateral surface of lower end of radius).
5. dorsal tubercle of radius.
6. origin of extensor indicis (from the lower part of posterior surface of ulna).
7. origin of extensor pollicis longus (from the middle part of posterior surface of ulna).
8. origin of abductor pollicis longus (from the upper part of posterior surface of ulna and from the middle part of posterior surface of radius).
9. common origin of extensor carpi ulnaris, flexor carpi ulnaris and flexor digitorum profundus by aponeurosis from the posterior border of ulna.
10. insertion of anconeus (into the lateral side of olecranon and upper 1/4 of posterior surface of ulna).
11. insertion of triceps (into the posterior part of the upper surface of olecranon).

* Note that the extensor pollicis longus and extensor pollicis brevis arise side by side just below the abductor pollicis longus.

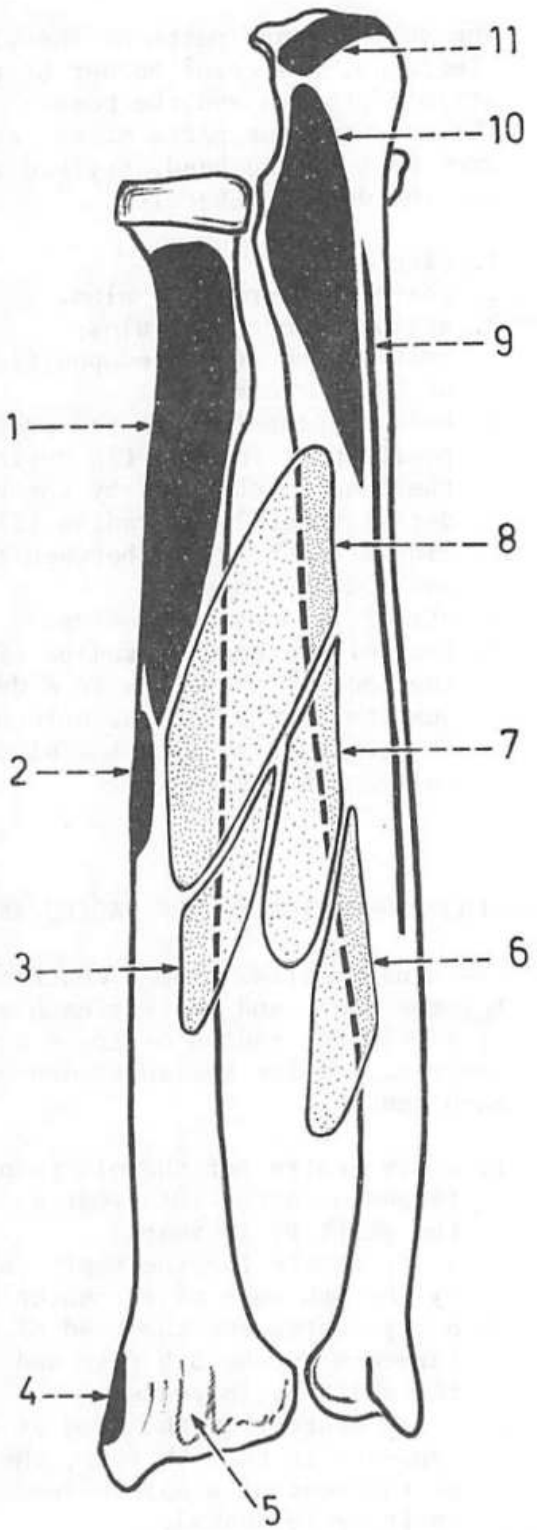


Fig.(62): SUBCUTANEOUS PARTS OF RADIUS AND ULNA

The subcutaneous parts of the ulna are: olecranon, posterior border of the shaft, styloid process and the head.
The subcutaneous parts of the radius are: back of the head, styloid process and the dorsal tubercle.

1. olecranon.
2. posterior border of ulna.
3. styloid process of ulna: felt in the supinated position of the forearm.
4. head of ulna; felt in the pronated position of forearm (in supination the head is obscured by the radius).
5. dorsal tubercle of radius (lies in line with the cleft between the index and middle fingers).
6. styloid process of radius.
7. back of the head of radius (felt on the back of the elbow in a depression just below the lateral epicondyle of the humerus, with the elbow fully extended).

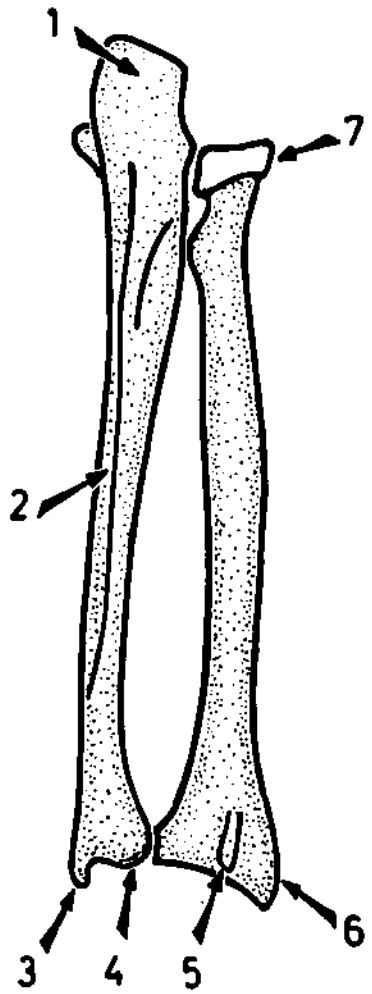
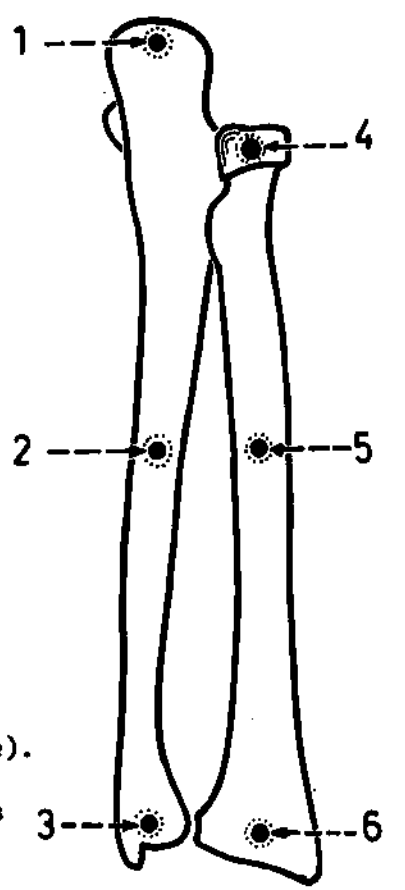


Fig.(63): OSSIFICATION OF RADIUS AND ULNA

The ulna ossifies from 3 centres: one for the shaft and one for each end.
Similarly, the radius ossifies from 3 centres: one for the shaft and one for each end.

1. a 2ry centre for the olecranon (appears in the 10th year and joins the shaft by 16 years).
2. a 1ry centre for the shaft (appears by the 8th week of intrauterine life).
3. a 2ry centre for the head of ulna (appears in the 5th year and joins the shaft by 18 years).
4. a 2ry centre for the head of radius (appears in the 5th year, the same as the head of ulna; it fuses with the shaft by 16 years).
5. a 1ry centre for the shaft of radius (appears by the 8th week of intrauterine life).
6. a 2ry centre for the lower end of radius (appears by the end of the 1st year and fuses with the shaft by 18 years).



HAND

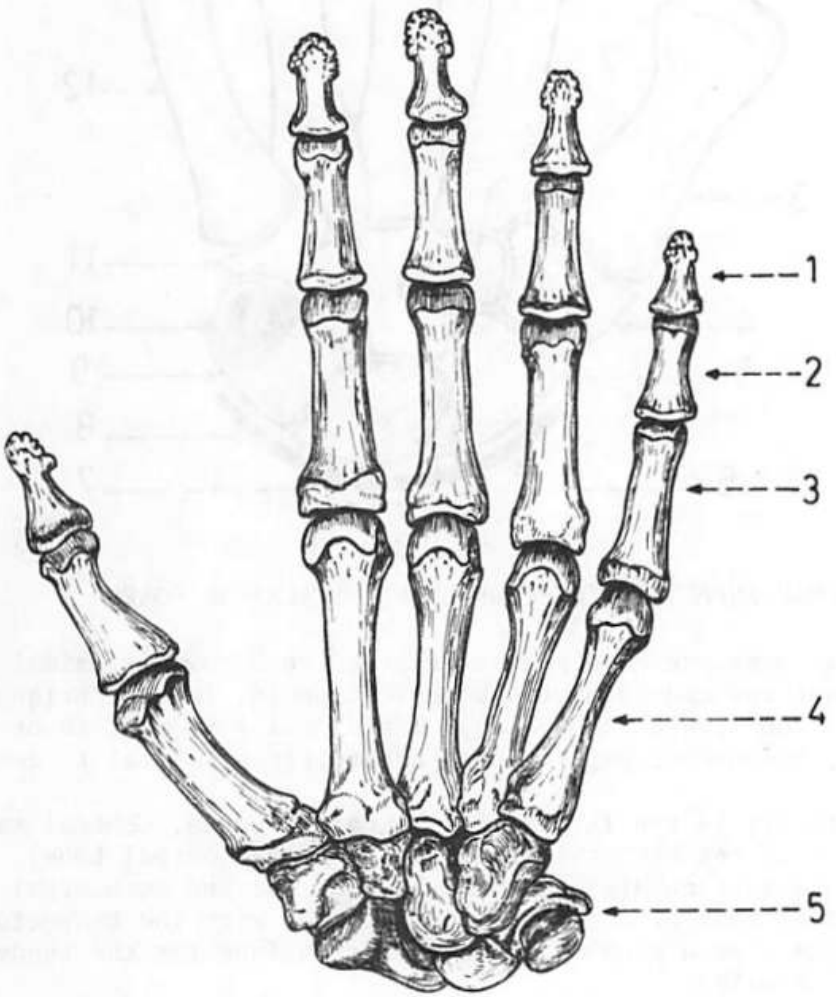


Fig.(64): SKELETON OF THE HAND
(anterior aspect)

The skeleton of the hand consists of 8 carpal bones (carpus), 5 metacarpal bones and phalanges (3 for each finger except the thumb which has only 2).

1. distal phalanx.
2. middle phalanx.
3. proximal phalanx.
4. metacarpal bone.
5. carpal bones.

* The fingers are numbered from lateral to medial where the thumb is the lst and the little finger is the 5th.

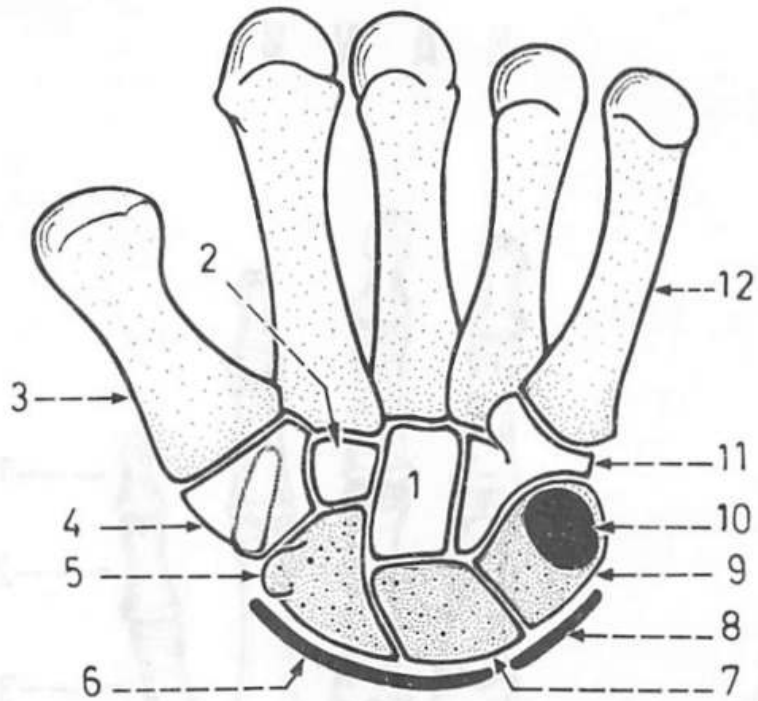


Fig.(65): PALMAR ASPECT OF THE CARPAL AND METACARPAL BONES

The carpal bones are 8 in number arranged in 2 rows (proximal and distal). The proximal row consists of 4 bones: scaphoid, lunate, triquetral and pisiform (from lateral to medial). The distal row consists of 4 bones: trapezium, trapezoid, capitate and hamate (from lateral to medial).

1. capitate (it is the largest of all carpal bones, central in position and articulates with the base of the 3rd metacarpal bone).
2. trapezoid (articulates with the base of the 2nd metacarpal bone).
3. metacarpal bone of the thumb (articulates with the trapezium).
4. trapezium (has a groove on its palmar surface for the tendon of flexor carpi radialis).
5. scaphoid (it has a tubercle on its palmar surface).
6. inferior surface of lower end of radius (articulates with the scaphoid and lunate).
7. lunate.
8. articular disc (separates the head of the ulna from the lunate and triquetral bone).
9. triquetral bone.
10. pisiform (lies on the palmar surface of the triquetral bone).
11. hamate (has a hook which projects from its palmar surface).
12. metacarpal bone of the little finger (the 5th).

* Note the following: the capitate is the first to ossify while the pisiform is the last to do so. The scaphoid has a constricted middle part (waist) and so it is the commonest to be fractured. The lunate has its anterior surface larger than its posterior surface, therefore, it is commonly dislocated forwards.

Fig.(66): SCAPHOID BONE

It is the largest bone in the proximal row. It is long and has a narrow waist which is frequently fractured. It has a tubercle on its palmar surface.

1. waist of the scaphoid.
2. tubercle of the scaphoid.

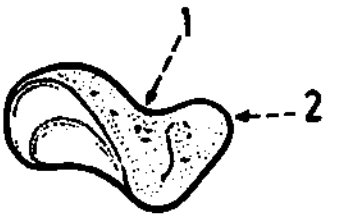


Fig.(67): HAMATE

It is characterized by the presence of a hook-like process which projects from its palmar surface; this process is called hamulus.

1. hook of hamate.
2. body of hamate.

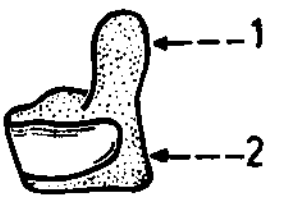


Fig.(68): METACARPAL BONE

The metacarpal bone is a miniature long bone having a shaft, a head and a base. The heads of the metacarpal bones form the prominences of the knuckles of the hand.

1. head of metacarpal.
2. shaft of metacarpal.
3. base of metacarpal.

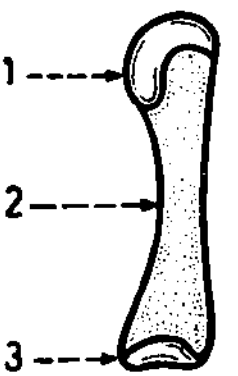
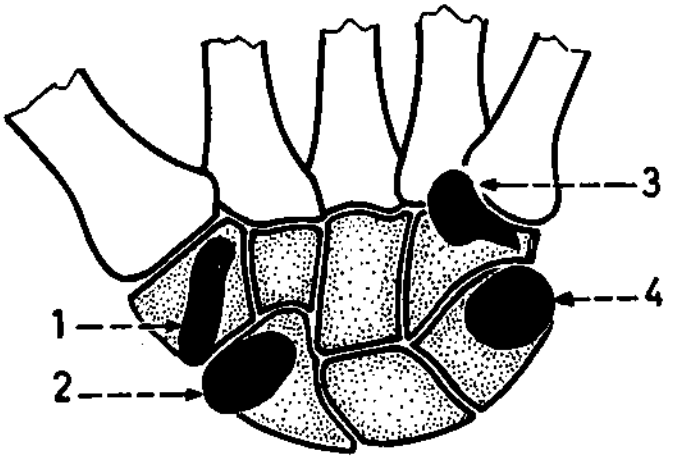


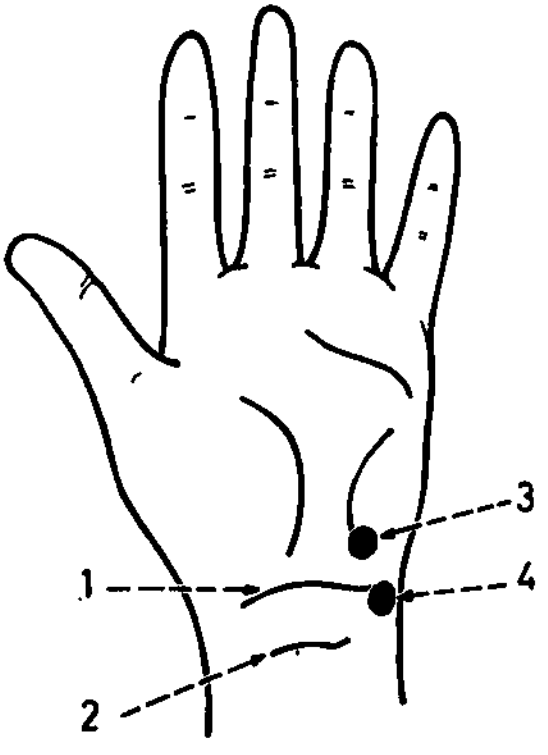
Fig.(69): EDGES OF THE CARPAL GROOVE



The palmar surface of the carpus is deeply concave to form the carpal groove.
The lateral edge of the carpal groove is formed by the tubercle of scaphoid and the tubercle of trapezium, while its medial edge is formed by the pisiform and the hook of the hamate.
The 2 edges of the groove give attachment to the flexor retinaculum thus transforming the groove into the carpal tunnel.

1. tubercle of trapezium.
2. tubercle of scaphoid.
3. hook of hamate.
4. pisiform.

Fig.(70): SURFACE LANDMARKS ON THE FRONT OF THE WRIST



The pisiform and the hook of hamate can be felt on the medial side of the front of the wrist.

1. distal transverse crease of the wrist.
2. proximal transverse crease of the wrist.
3. hook of hamate (can be felt 1 finger-breadth distal to the pisiform bone).
4. pisiform bone (can be felt at the medial end of the distal transverse crease).

Fig.(71): DORSAL ASPECT OF CARPAL BONES

All the carpal bones are seen from the dorsal aspect except the pisiform which lies on the palmar surface of the triquetral bone.

1. lunate.
2. triquetral.
3. hamate.
4. capitate.
5. trapezoid.
6. 1st metacarpal bone.
7. trapezium.
8. scaphoid.

* The capitate fits proximally into the concavity formed by the lunate and scaphoid.

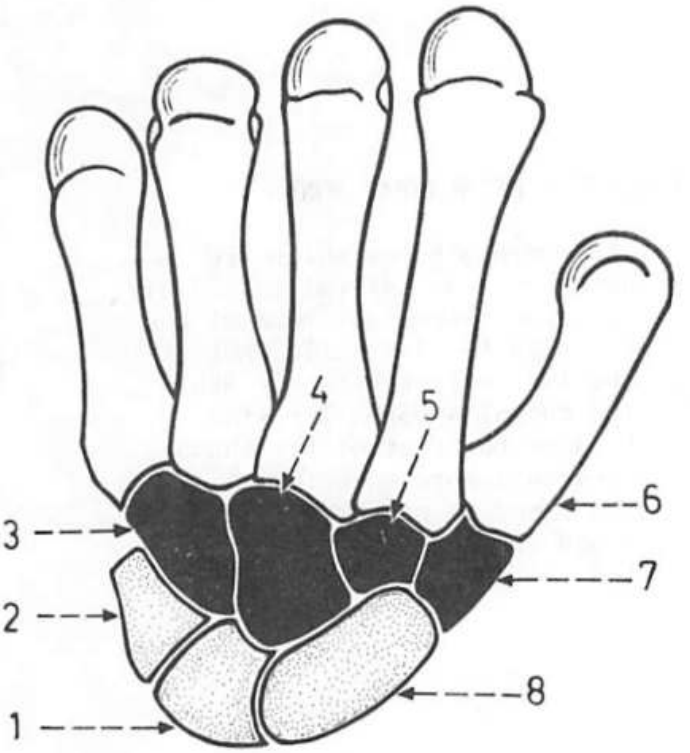


Fig.(72): INSERTIONS INTO THE BASES OF METACARPAL BONES (dorsal aspect)

1. insertion of extensor carpi ulnaris (into dorsal surface of the base of 5th metacarpal).
2. insertion of extensor carpi radialis brevis (into the dorsal surface of the base of 3rd metacarpal).
3. insertion of extensor carpi radialis longus (into the dorsal surface of the base of 2nd metacarpal).
4. insertion of abductor pollicis longus (into lateral side of the base of 1st metacarpal).

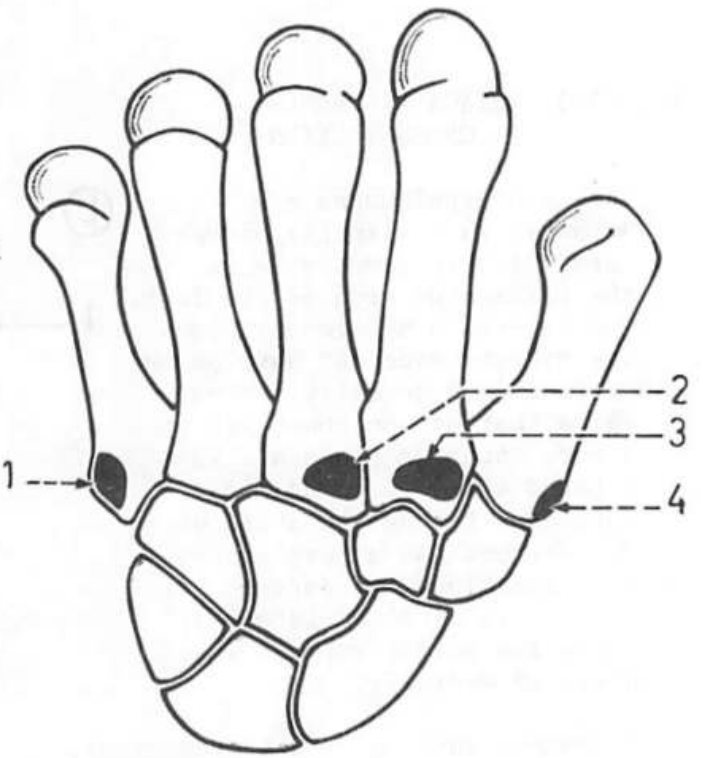
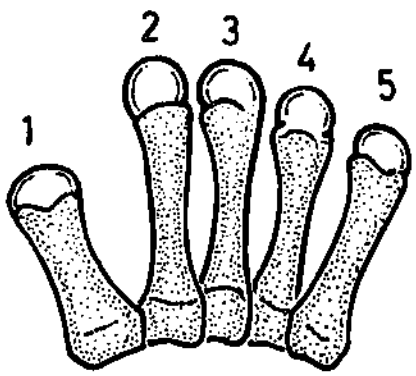
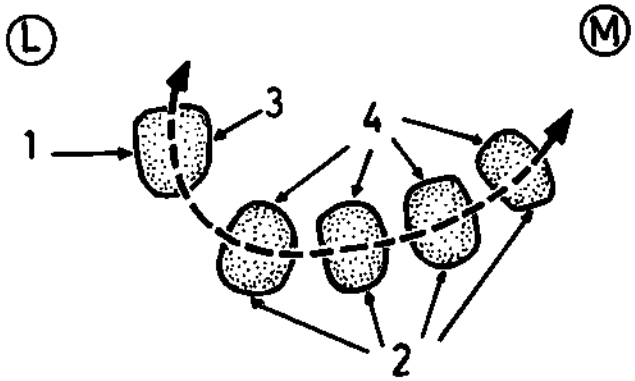


Fig.(73): METACARPAL BONES



These are 5 bones which are numbered from lateral to medial, i.e. the metacarpal bone of the thumb is the 1st while that of the little finger is the 5th. The medial 4 bones lie side by side but that of the thumb lies on a more anterior plane and is rotated medially round its long axis.

Fig.(74): METACARPAL BONES IN CROSS-SECTION



The metacarpal bones are arranged in a slightly arched form which is comparable to the transverse arch of the foot. The lateral 4 metacarpal bones lie side by side and have palmar surfaces and dorsal surfaces, while that of the thumb lie on a more anterior plane and is rotated medially round its long axis through an angle of 90 degrees. As a result of this rotation, its dorsal surface is directed laterally while its palmar surface is directed medially.

1. dorsal surface of 1st metacarpal.
2. dorsal surfaces of the medial 4 metacarpals.
3. palmar surface of 1st metacarpal.
4. palmar surfaces of the medial 4 metacarpals.

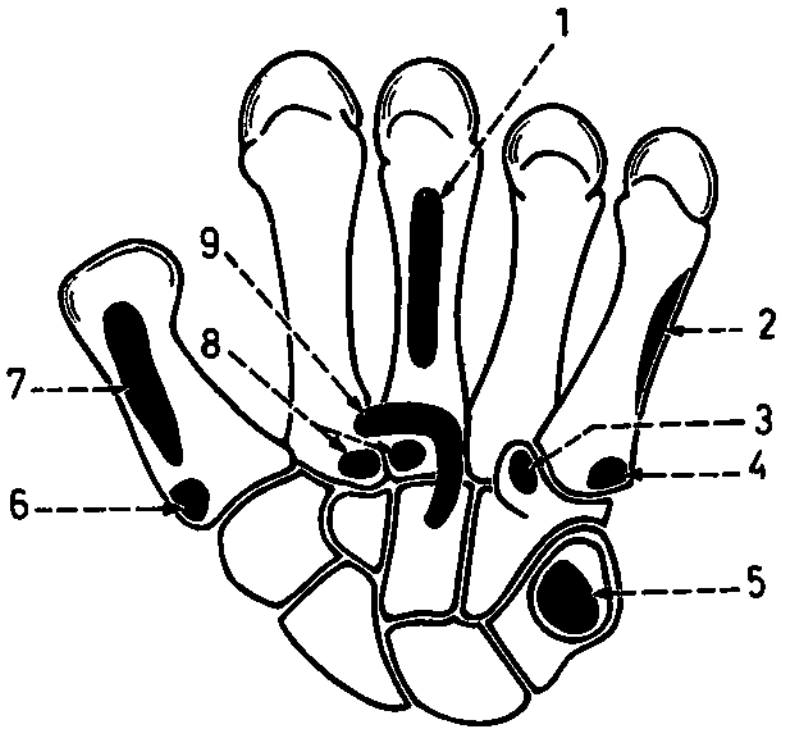


Fig.(75): PALMAR ASPECT OF THE CARPAL AND METACARPAL BONES
(particular features)

1. origin of transverse head of adductor pollicis (from the front of the 3rd metacarpal bone).
2. insertion of opponens digiti minimi (into the medial margin of 5th metacarpal) (digiti minimi = of the little digit).
3. attachment of the piso-hamate ligament (to the hook of hamate).
4. attachment of piso-metacarpal ligament (into the base of 5th metacarpal).
5. insertion of flexor carpi ulnaris (into the pisiform bone; it continues to the hamate and the base of 5th metacarpal bone as the piso-hamate and piso-metacarpal ligaments respectively).
6. insertion of abductor pollicis longus (into the lateral side of the base of 5th metacarpal).
7. insertion of opponens pollicis (into the lateral 1/2 of the palmar surface of 1st metacarpal bone) (pollex = thumb).
8. insertion of flexor carpi radialis (into the palmar surfaces of the bases of the 2nd and 3rd metacarpals).
9. origin of oblique head of adductor pollicis (from the capitate bone and bases of 2nd and 3rd metacarpals).

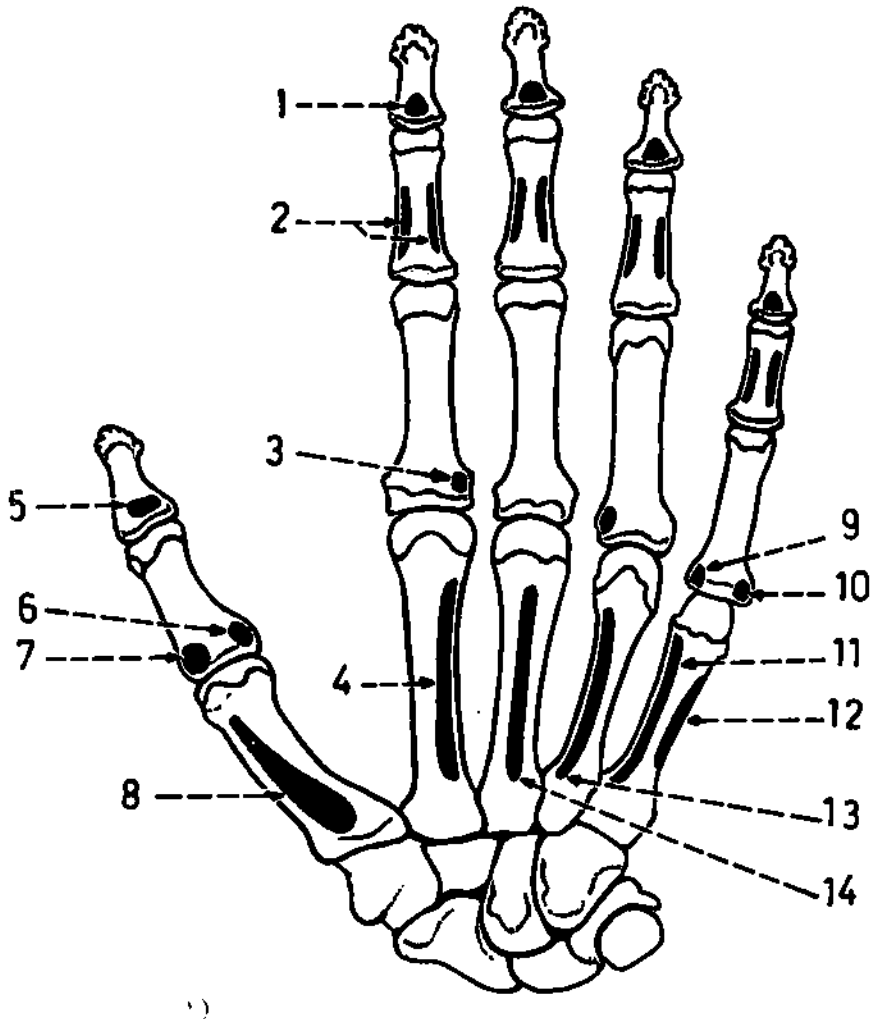


Fig.(76): PALMAR ASPECT OF THE SKELETON OF THE HAND
(particular features)

1. insertion of flexor digitorum profundus (into the base of terminal phalanx).
2. insertion of flexor digitorum superficialis (into the margins of the palmar surface of the middle phalanx).
3. insertion of 2nd palmar interosseous.
4. origin of the 2nd palmar interosseous (from the 2nd metacarpal).
5. insertion of flexor pollicis longus (into the base of terminal phalanx of the thumb).
6. insertion of adductor pollicis (into the medial side of the base of the proximal phalanx of the thumb).
7. insertion of abductor pollicis brevis (into the lateral side of the base of the proximal phalanx of the thumb).
8. insertion of opponens pollicis (into the 1st metacarpal).
9. insertion of 4th palmar interosseous.
10. insertion of abductor digiti minimi.
11. origin of 4th palmar interosseous.
12. insertion of opponens digiti minimi.
13. origin of 3rd palmar interosseous.
14. origin of the transverse head of adductor pollicis (from the 3rd metacarpal).

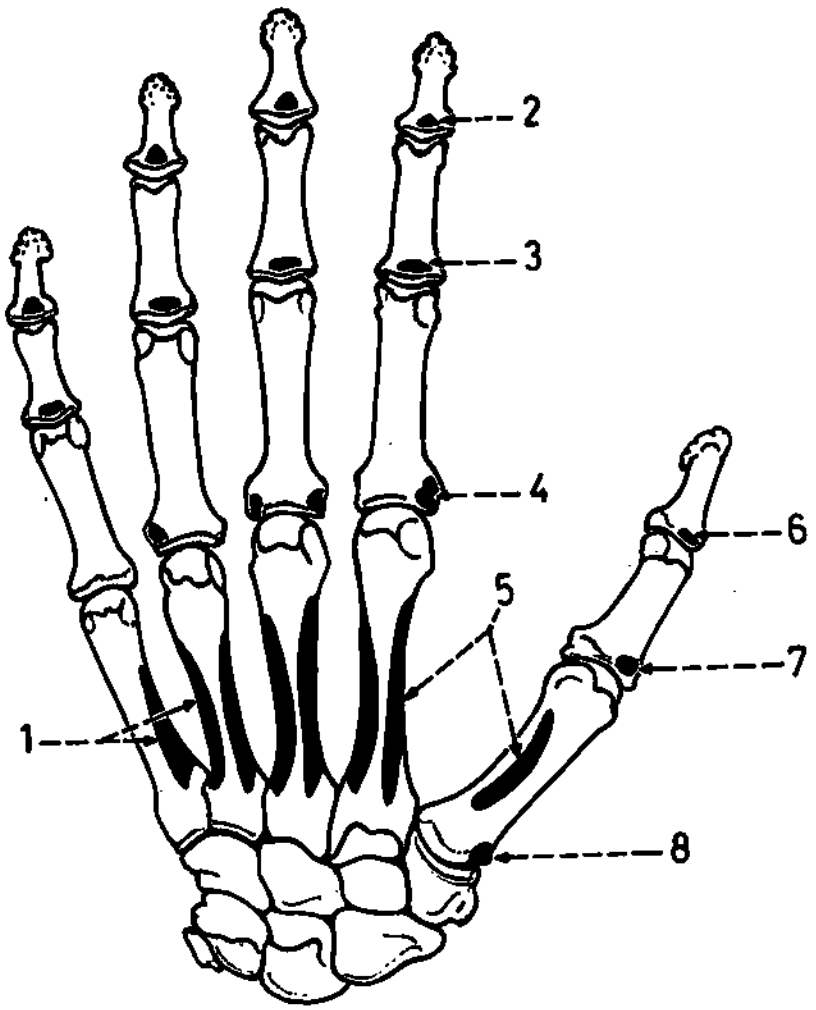


Fig.(77): DORSAL ASPECT OF THE SKELETON OF THE HAND
(particular features)

1. origin of 4th dorsal interosseous (from adjacent sides of the 4th and 5th metacarpal bones).
2. attachment of the 2 collateral parts of the extensor expansion into the base of the distal phalanx (insertion of extensor digitorum).
3. attachment of the central part of the extensor expansion into the base of the middle phalanx (insertion of extensor digitorum).
4. insertion of 1st dorsal interosseous (into the base of the proximal phalanx of the 2nd finger).
5. origin of 1st dorsal interosseous (from adjacent sides of the 1st and 2nd metacarpal bones).
6. insertion of extensor pollicis longus (into the base of the distal phalanx of the thumb).
7. insertion of extensor pollicis brevis (into the base of the proximal phalanx of the thumb).
8. insertion of abductor pollicis longus (into the base of the 1st metacarpal bone).

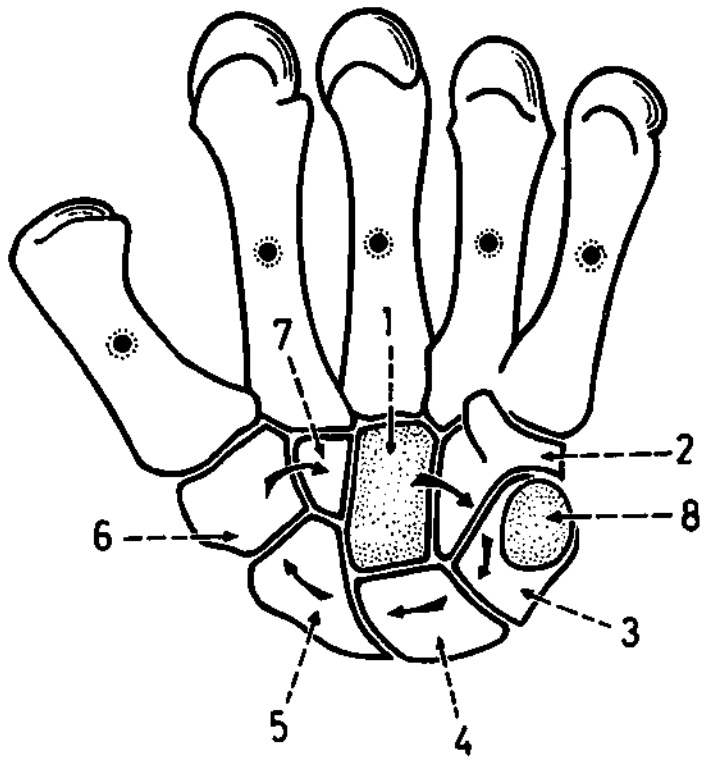


Fig.(78): OSSIFICATION OF CARPAL BONES

All the carpal bones are cartilagenous at birth. Each bone ossifies from a single centre of ossification where the capitate is the 1st to ossify (1st year) while the pisiform is the last to do so (10th year). Excluding the pisiform, the other 7 carpal bones show ossification centres during the first 5 years after birth in the following order: capitate, hamate, triquetral, lunate, scaphoid, trapezium and trapezoid.

1. capitate (early in the 1st year).
2. hamate (late in the 1st year).
3. triquetral (2nd year).
4. lunate (3rd year).
5. scaphoid (4th year).
6. trapezium (5th year).
7. trapezoid (5th year).
8. pisiform (10th year).

* Ossification of the carpal bones is used clinically as an indicator of the physical development and state of nutrition of the individual. The time of ossification is delayed in malnutrition.

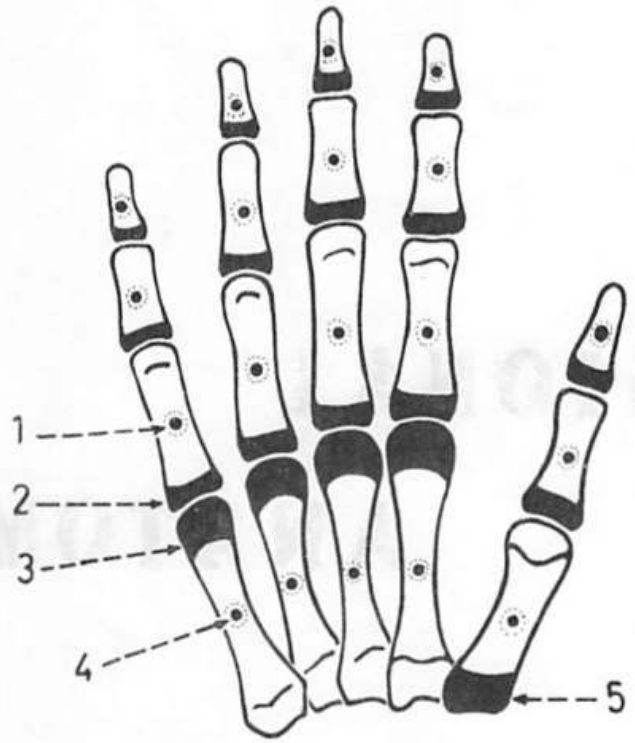


Fig.(79): OSSIFICATION OF METACARPAL BONES AND PHALANGES

Each metacarpal bone ossifies from 2 centres: a 1ry centre for the shaft and a 2ry centre for the head, except the thumb which has its 2ry centre in the base (like a phalanx).
Each phalanx (all fingers including the thumb) ossifies from 2 centres: a 1ry centre for the shaft and a 2ry centre for the base.

1. primary centre for the shaft of phalanx (appears in 8th week of intrauterine life).
2. secondary centre for the base of phalanx (appears in 3rd year and fuses with the shaft at 18 years).
3. secondary centre in the head of metacarpal bone (appears in 3rd year and fuses with the shaft at 18 years; the same as the base of a phalanx).
4. primary centre for the shaft of metacarpal bone (appears in 8th week of intrauterine life).
5. secondary centre for the base of the metacarpal bone of the thumb (appears in 3rd year and fuses with the shaft at 18 years).

REGIONAL ANATOMY

PECTORAL REGION and BREAST

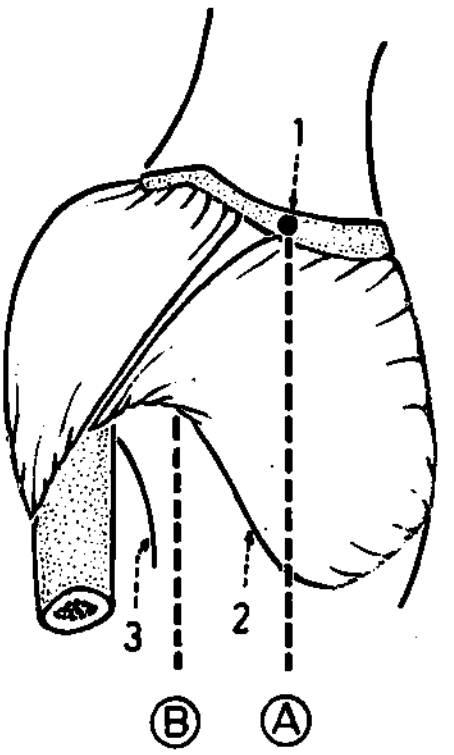


Fig.(80): MIDCLAVICULAR AND MIDAXILLARY PLANES

(A) midclavicular plane: runs vertically from the mid-clavicular point downwards.
(B) midaxillary plane: runs vertically in the middle of the axilla, midway between the anterior and posterior axillary folds.

1. midclavicular point (mid-way between the 2 ends of the clavicle.
2. anterior axillary fold (formed by the lower border of pectoralis major).
3. posterior axillary fold (formed by the latissimus dorsi and teres major).

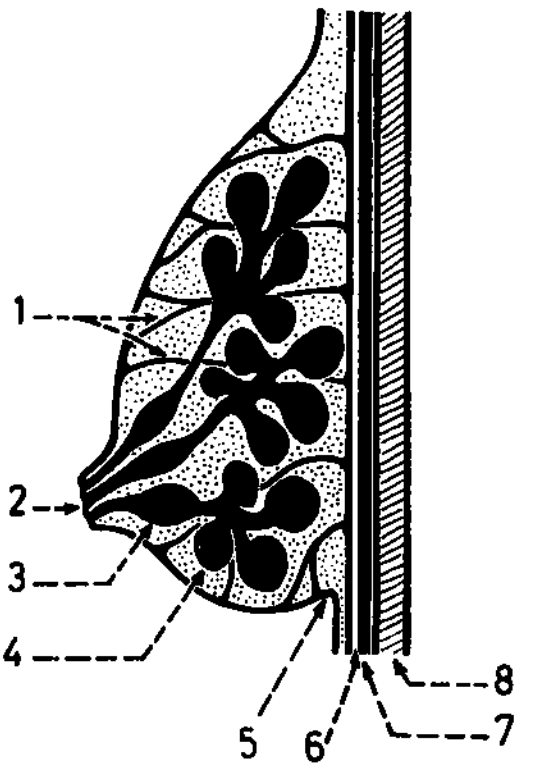


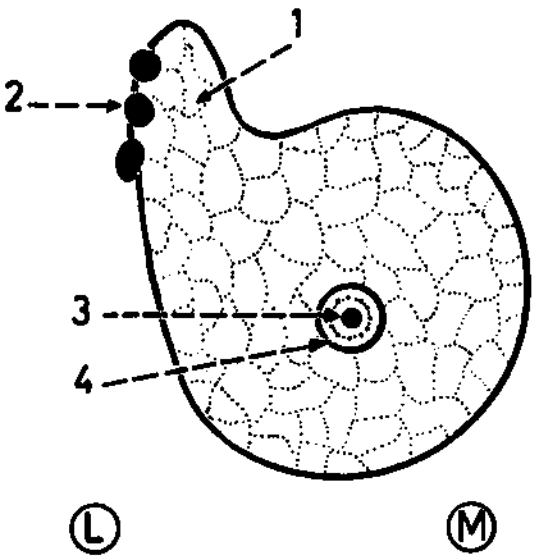
Fig.(81): COMPONENTS OF THE BREAST

The breast consists of the mammary gland, fat and the overlying skin which includes the nipple and areola. The mammary gland consists of 15-20 lobes each of which opens on the nipple by a lactiferous duct.

1. fibrous septa between the lobes (suspensory ligaments of Cooper).
2. nipple.
3. lactiferous sinus (dilated terminal part of the lactiferous duct).
4. lobe of mammary gland.
5. base of mammary gland.
6. submammary space (between the base of the breast and the underlying deep fascia).
7. deep fascia of pectoral region.
8. muscles deep to the breast.

Fig.(82): PARTS OF THE MAMMARY GLAND

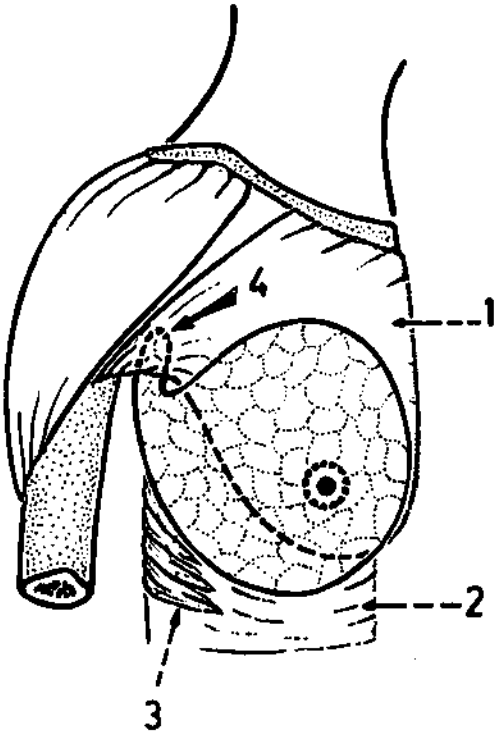
The mammary gland lies in the superficial fascia of the pectoral region with its base extending vertically from the 2nd to the 6th rib and transversely from the side of the sternum to the midaxillary line. Its tail extends upwards towards the axilla and is directly related to the pectoral group of axillary lymph nodes. Its nipple lies opposite the 4th intercostal space and is surrounded by a pigmented area of skin termed the the areola.



1. tail of mammary gland.
2. pectoral group of axillary lymph nodes.
3. nipple (on its surface open the lactiferous ducts).
4. areola (an area of pigmented skin surrounding the nipple).

Fig.(83): MUSCLES DEEP TO THE BREAST

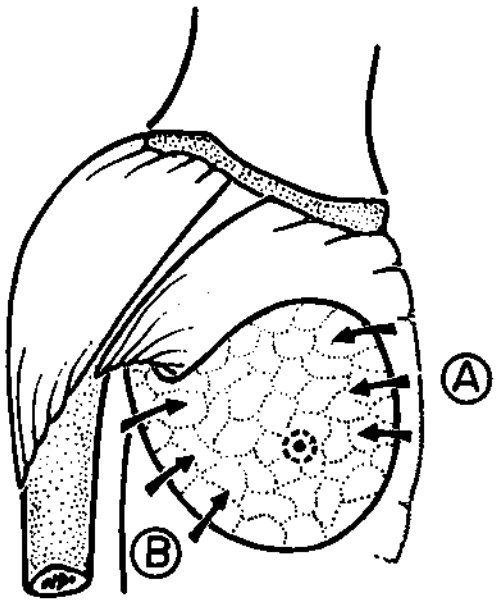
The breast lies over 3 muscles: pectoralis major, serratus anterior and aponeurosis of the external oblique muscle of the abdomen.



1. pectoralis major.
2. aponeurosis of the external oblique muscle of abdomen.
3. serratus anterior.
4. tail of mammary gland (ascends into the axilla along the lower border of pectoralis major).

* The direct relation of the mammary gland to the aponeurosis of the external oblique muscle explains the lymph drainage of the lower part of the gland to the plexus of lymph vessels on the rectus sheath.

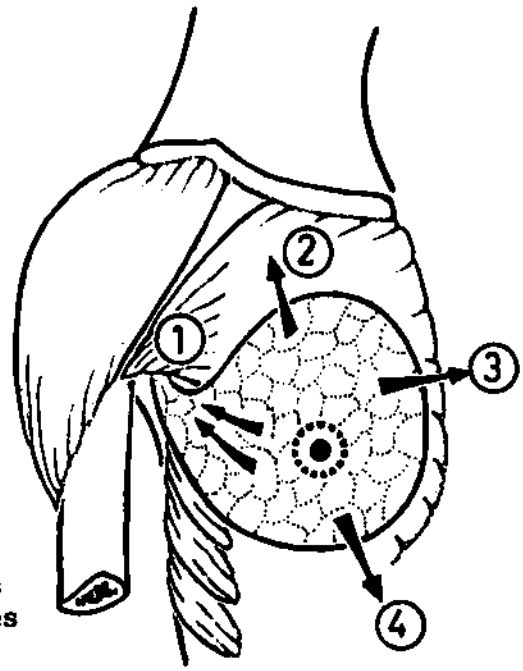
Fig.(84): ARTERIES OF MAMMARY GLAND



The mammary gland receives arterial supply from 3 main sources: lateral thoracic branch of the axillary artery, lateral branches of the posterior intercostal arteries and perforating branches of the internal thoracic artery.

(A) Branches supplying medial part of the gland: from perforating branches of the internal thoracic artery especially the 2nd, 3rd and 4th branches.
(B) Branches supplying the lateral part of the gland: from the lateral thoracic artery and lateral branches of the posterior intercostal arteries.

Fig.(85): LYMPH DRAINAGE OF MAMMARY GLAND

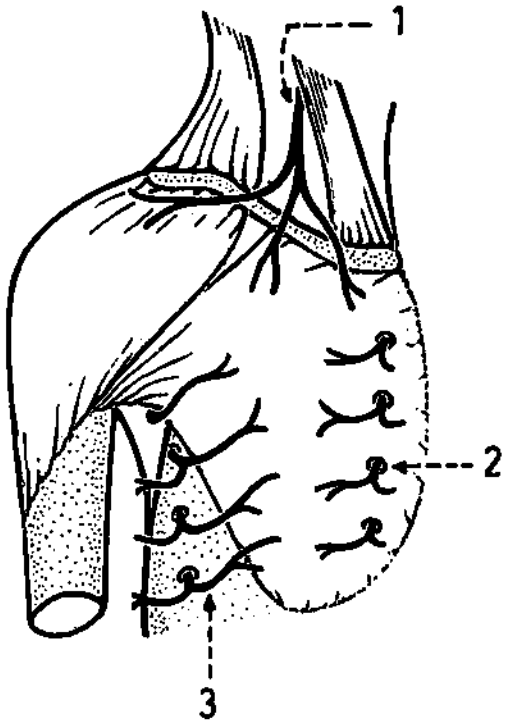


It is of surgical importance because of its role in the spread of metastasis of cancer breast.

1. lateral quadrant of the gland: drains into the pectoral group of axillary lymph nodes.
2. upper quadrant of the gland: drains directly to the apical group of axillary lymph nodes.
3. medial quadrant of the gland: drains into the parasternal nodes which lie inside the chest alongside the internal thoracic artery.
4. lower quadrant of the gland: drains into the lymph plexus on the rectus sheath as well as into a plexus on the inferior surface of the diaphragm.

* The following points should be noted:
a- 75% of lymph from the breast passes to the axillary nodes, while 25% passes to the parasternal nodes.
b- There is a communication with the axillary lymph nodes of the opposite side as well as with the lower deep cervical nodes situated in the root of the neck.

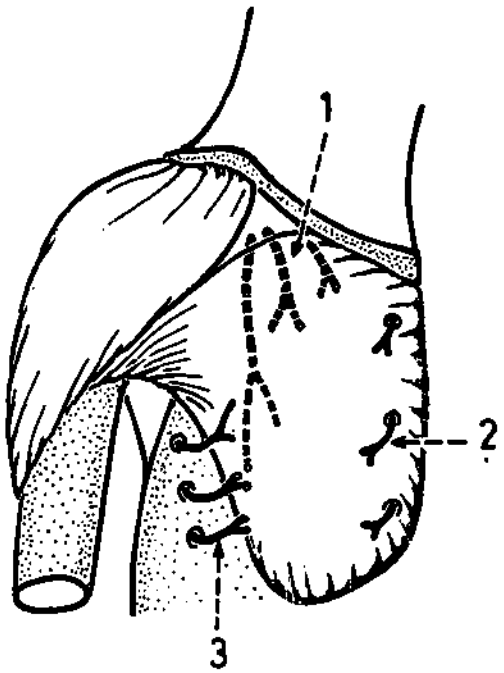
Fig.(86): CUTANEOUS NERVES OF PECTORAL REGION



The skin of the pectoral region is supplied by the supraclavicular nerves as well as by the anterior and lateral cutaneous branches of the intercostal nerves.

1. supraclavicular nerves (from the cervical plexus and supply the upper part of the pectoral region down to the level of sternal angle; C.3, 4).
2. anterior cutaneous branches of intercostal nerves (supply the medial part of the skin of the pectoral region).
3. lateral cutaneous branches of intercostal nerves (supply the lateral part of the skin of the pectoral region).

Fig.(87): ARTERIES OF PECTORAL REGION



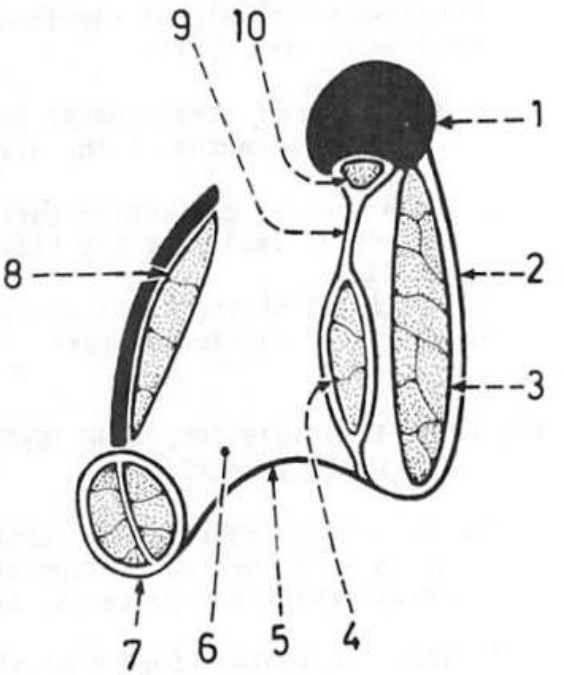
They are derived from the axillary (superior thoracic, acromio-thoracic and lateral thoracic), from the perforating branches of internal thoracic and from lateral branches of posterior intercostal arteries.

1. superior thoracic, acromio-thoracic and lateral thoracic arteries (above).
2. perforating branches of internal thoracic artery (medially).
3. lateral branches of posterior intercostal arteries (laterally).

* The superior thoracic, acromio-thoracic and lateral thoracic arteries are derived from the axillary artery, the internal thoracic is derived from the subclavian artery, while the posterior intercostals are derived from the thoracic aorta.

Fig.(88): PECTORAL FASCIA (vertical section)

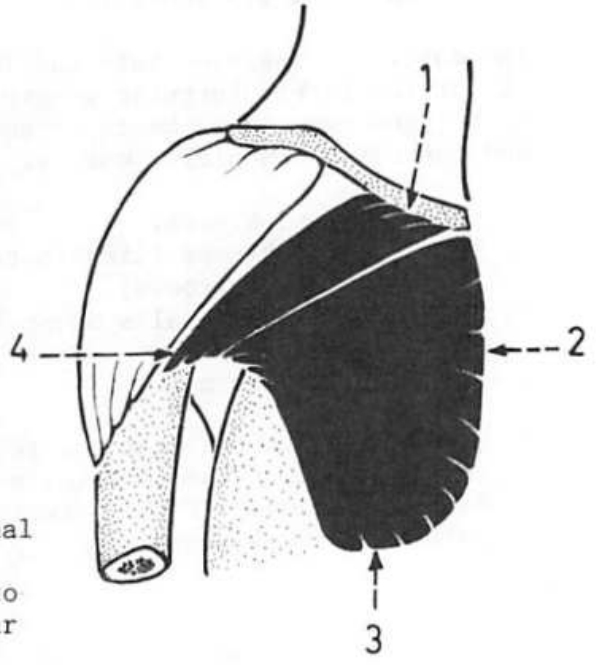
The pectoral fascia is the deep fascia of the pectoral region which covers the pectoralis major and ascends deep to it to enclose the pectoralis minor and form the clavipectoral fascia. It extends in the floor of the axilla to cover the latissimus dorsi; in the floor of the axilla it is specially thickened and forms the axillary fascia.



1. clavicle.
2. pectoral fascia over pectoralis major.
3. pectoralis major(in the anterior wall of axilla).
4. pectoralis minor (in anterior wall of the axilla).
5. axillary fascia (floor of the axilla).
6. cavity of the axilla.
7. latissimus dorsi (forms part of the posterior wall of the axilla).
8. subscapularis (part of the posterior wall of the axilla).
9. clavipectoral fascia.
10. subclavius (enclosed within the clavipectoral fascia

Fig.(89): PECTORALIS MAJOR

It is the superficial muscle of the pectoral region and consists of 2 parts (clavicular and sternocostal).



1. origin of clavicular part from the anterior surface of the medial 1/2 of the clavicle.
2. origin of sternocostal part from the sternum and upper 6 costal cartilages.
3. origin from aponeurosis of external oblique muscle of abdomen.
4. insertion of pectoralis major into the lateral lip of intertubercular groove of the humerus.

Fig.(90): PARTS OF PECTORALIS MAJOR

The muscle consists of clavicular and sternocostal parts.

1. insertion of sternocostal part (posterior lamina of the bilaminar tendon).
2. insertion of clavicular part (anterior lamina of the bilaminar tendon).
3. origin of sternocostal part.
4. origin of clavicular part.

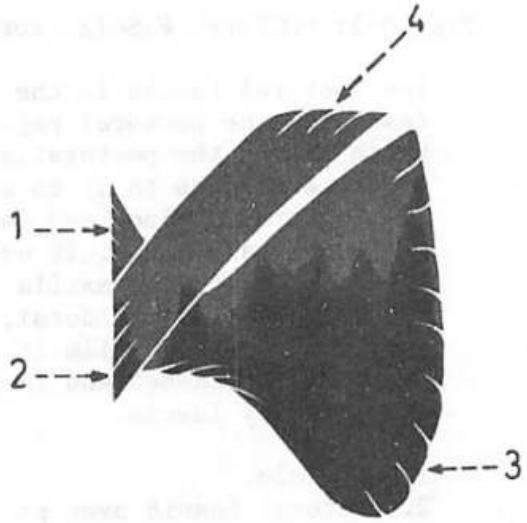


Fig.(91): BILAMINAR TENDON OF INSERTION OF PECTORALIS MAJOR

The tendon of insertion of pectoralis major is bilaminar consisting of anterior lamina and posterior lamina.

1. anterior lamina (formed mainly by the clavicular part).
2. posterior lamina (formed by the :ep sternocostal part and ascends deep to the anterior lamina).
3. rounded lower margin of the bilaminar tendon.

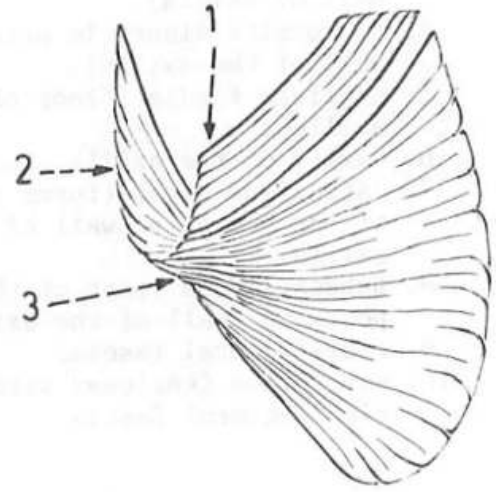
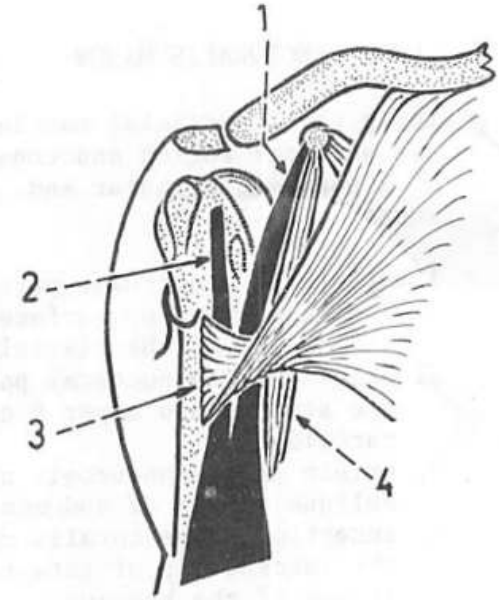


Fig.(92): RELATIONS OF PECTORALIS MAJOR AT ITS INSERTION

The muscle is inserted into the lateral lip of the intertubercular groove. Here, it bridges over the 2 heads of the biceps and the coracobrachialis muscle.

1. short head of biceps.
2. long head of biceps (lies in the intertubercular groove).
3. insertion of pectoralis major by bilaminar tendon.
4. coracobrachialis muscle.

* It should be noted that the tendon of insertion of the pectoralis major lies under cover of the anterior part of the deltoid.



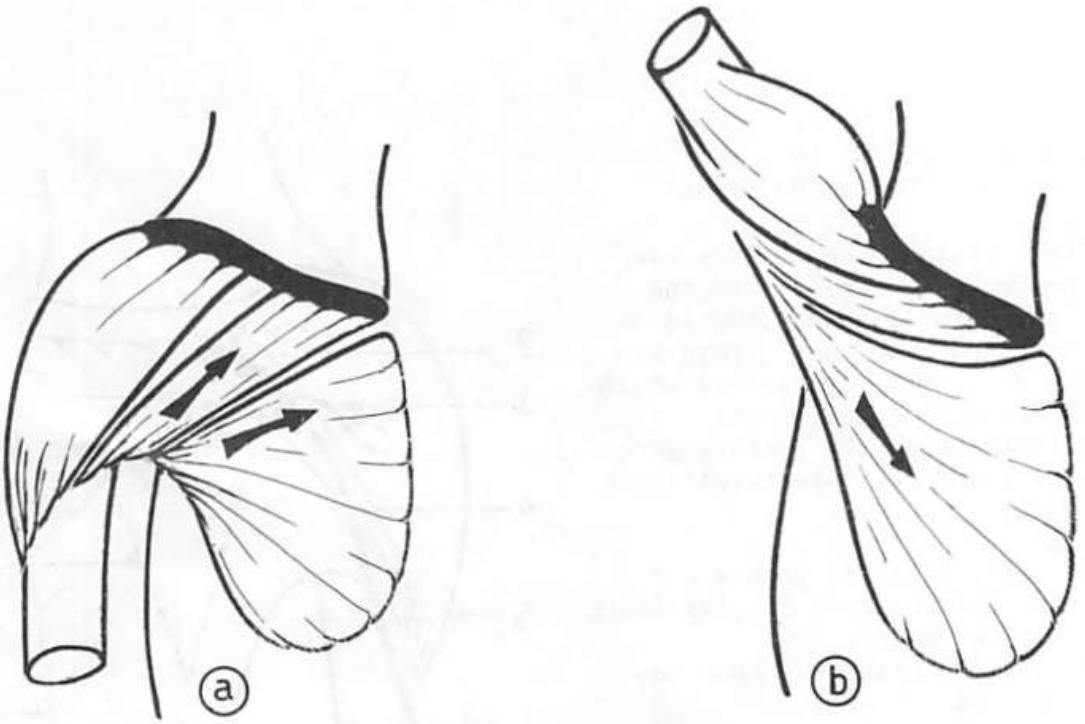


Fig.(93): ACTION OF PECTORALIS MAJOR

(a) Action of the clavicular part and upper fibres of sternocostal part: flexion of the arm ; this action draws the arm in front of the chest (see fig.94).

(b) Action of the sternocostal part: draws the raised arm downwards (in climbing, the sternocostal part pulls the body upwards).

* The action of the muscle as a whole is adduction, flexion and medial rotation of the arm.

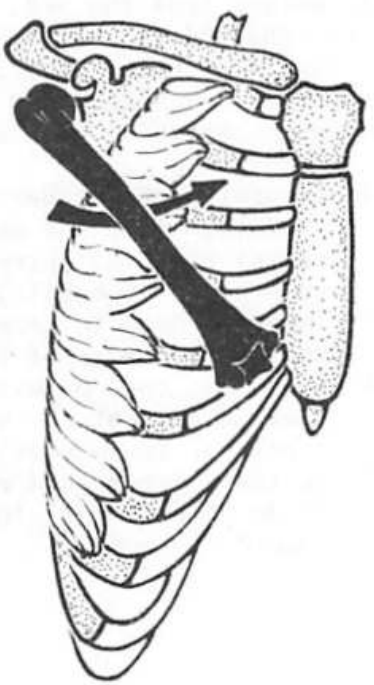


Fig.(94): THE HUMERUS IN THE POSITION OF FLEXION

Flexion of the arm brings it to the front of the chest. This is explained by the fact that flexion and extension of the arm take place at right angle to the plane of the scapula.

Fig.(95): RELATIONS OF PECTORALIS MAJOR

The pectoralis major lies over the pectoralis minor and the clavipectoral fascia,and is separated from the deltoid by the delto-pectoral groove which lodges the cephalic vein, deltoid branch of thoraco-acromial artery and delto-pectoral lymph nodes.

1. delto-pectoral groove.
2. tip of coracoid process (deep to the deltoid).
3. deltoid branch of thoraco-acromial artery.
4. cephalic vein.
5. deltoid muscle.
6. delto-pectoral lymph nodes.
7. pectoralis major.
8. pectoralis minor (deep to the middle part of pectoralis major).
9. site of clavipectoral fascia.

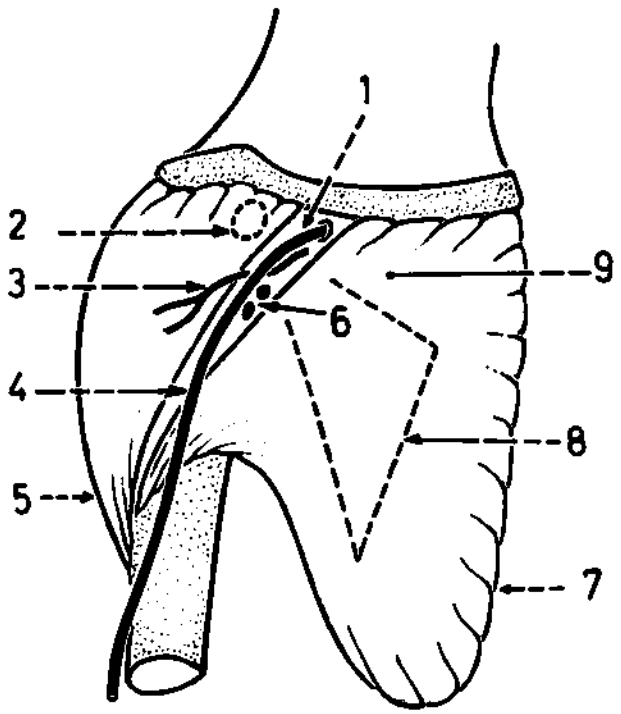
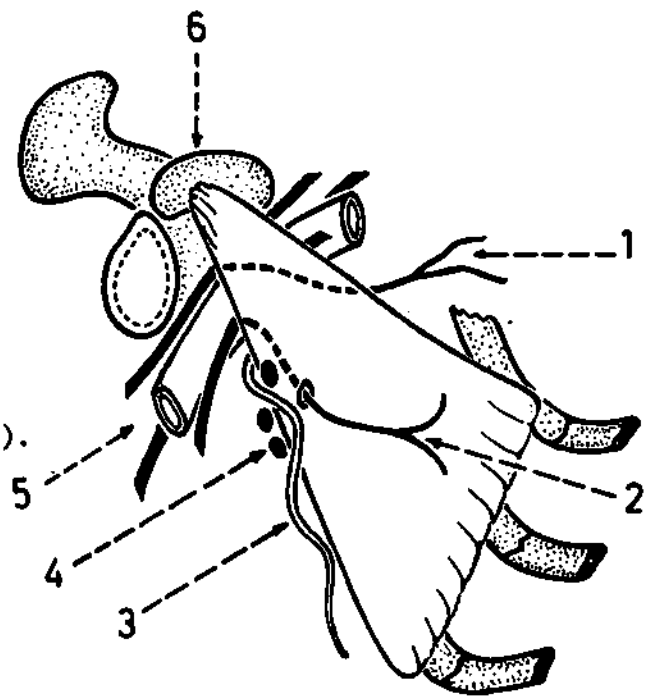


Fig.(96): PECTORALIS MINOR

It arises from the 3rd, 4th and 5th ribs and is inserted into the coracoid process. It bridges over the axillary artery and related cords of brachial plexus.

1. lateral pectoral nerve (passing above the muscle).
2. medial pectoral nerve (piercing the muscle).
3. lateral thoracic artery (along the lower border of the muscle).
4. pectoral group of axillary lymph nodes (along the lower border of the muscle).
5. axillary artery and related cords of brachial plexus.
6. coracoid process.



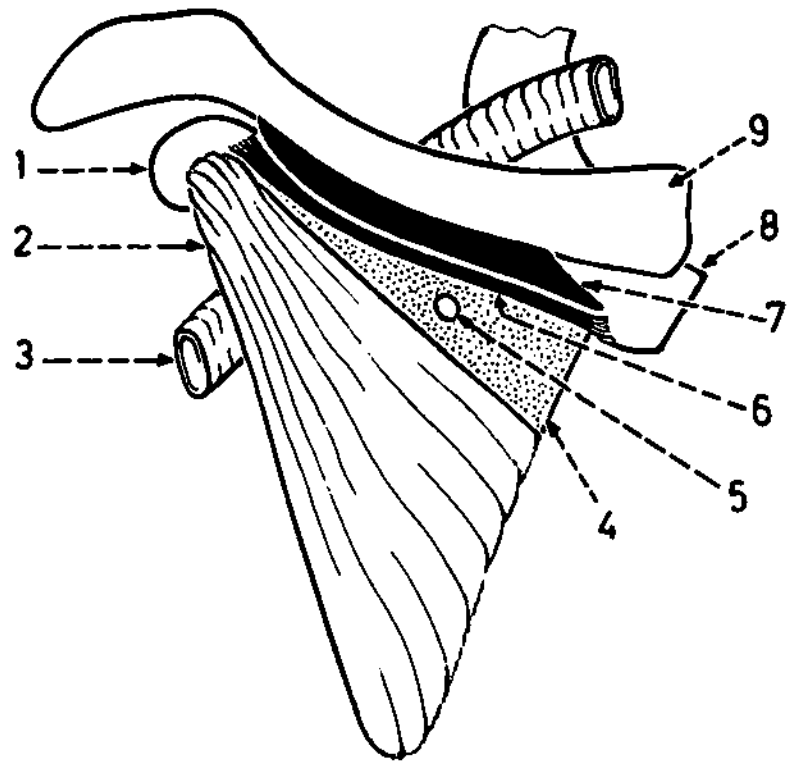


Fig.(97): CLAVIPECTORAL FASCIA

It is a strong fibrous sheet extending from the pectoralis minor to the clavicle. It encloses the pectoralis minor below and the subclavius above,and is pierced by many structures (see fig. 98). Just below the subclavius the fascia is especially thickened to form the costo-coracoid ligament which extends along the lower border of the subclavius,from the 1st rib medially to the coracoid process laterally.

1. coracoid process.
2. pectoralis minor.
3. axillary artery emerging from under cover of the clavipectoral fascia and pectoralis minor.
4. clavipectoral fascia (fills the gap between the pectoralis minor and the clavicle).
5. perforation for the cephalic vein.
6. costo-coracoid ligament.
7. subclavius muscle.
8. 1st rib.
9. clavicle.

Fig.(98): STRUCTURES PIERCING THE CLAVIPECTORAL FASCIA

The clavipectoral fascia is pierced by numerous structures which are situated deep to the clavicular part of pectoralis major. These structures are: cephalic vein, acromio-thoracic artery, lateral pectoral nerve and lymph vessels.

1. cephalic vein (joins the axillary vein).
2. pectoralis major.
3. pectoralis minor.
4. lymph vessels passing to the apical lymph nodes.
5. apical group of axillary lymph nodes.
6. axillary vein.
7. axillary artery.
8. lateral cord of brachial plexus.
9. lateral pectoral nerve.
10. acromio-thoracic artery.
11. clavipectoral fascia (vertical section).

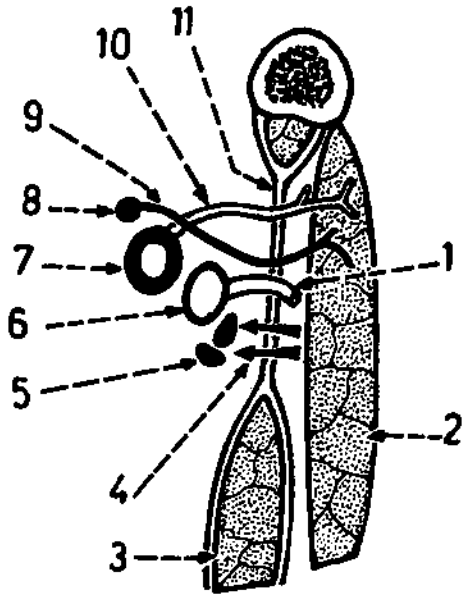


Fig.(99): ACTION OF PECTORALIS MINOR

It draws the scapula downwards and forwards, i.e. it protracts the scapula. In addition, the muscle depresses the point of the shoulder.

AXILLA

BOUNDARIES OF THE AXILLA

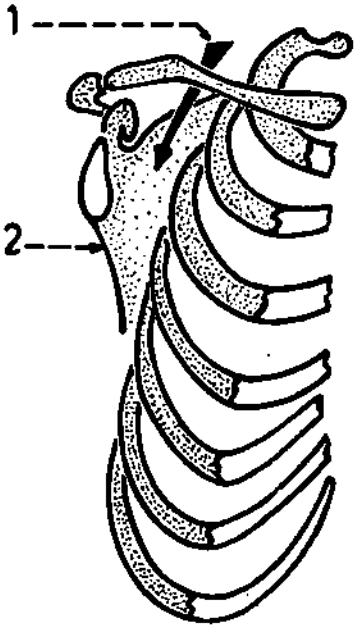


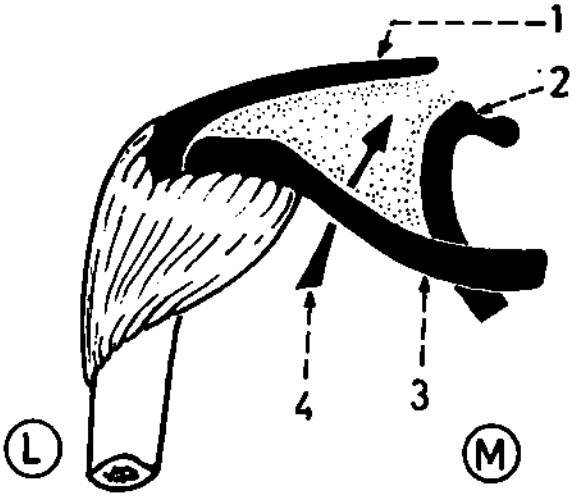
Fig.(100): BONY BOUNDARIES OF THE AXILLA

The axilla is the pyramidal space between the upper part of the side of the chest medially, the scapula posteriorly, and the upper part of medial side of the arm laterally. The axilla communicates with the root of the neck through a gap situated behind the clavicle (apex of the axilla).

1. arrow passing through the axilla.
2. scapula.

N.B.: The lateral wall is not shown.

Fig.(101): BOUNDARIES OF THE APEX OF THE AXILLA



It is a triangular gap which is bounded in front by the clavicle, behind by the upper border of the scapula and medially by the outer border of the 1st rib. It transmits the axillary vessels and cords of the brachial plexus from the root of the neck to the axilla.

1. upper border of scapula.
2. 1st rib.
3. clavicle.
4. arrow passing through the apex of the axilla.

Fig.(102): POSITION OF THE AXILLA

The axilla is the space between the upper part of the side of the chest and the upper part of the medial side of the arm. It has 4 walls, apex and base.

1. posterior wall of axilla.
2. lateral wall of axilla.
3. medial wall of axilla.
4. anterior wall of axilla.
5. arrow into the axilla (from base to apex).

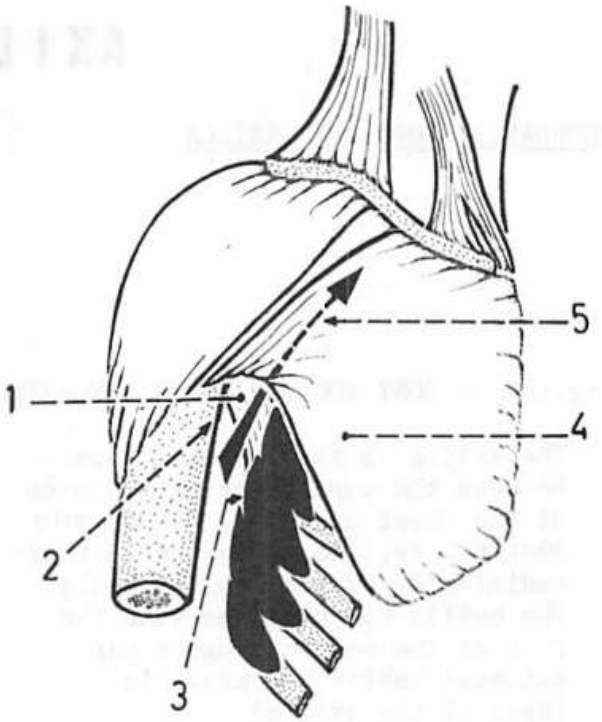


Fig.(103): FOLDS OF THE AXILLA

The axilla has 2 folds (anterior and posterior). The anterior fold is formed by the lower border of the pectoralis major. The posterior fold is lower than the anterior fold and is formed by both the latissimus dorsi and the teres major.

1. posterior axillary fold (the lower border of the posterior wall of axilla).
2. anterior axillary fold (the lower border of the anterior wall of axilla which is represented by the pectoralis major only).
3. pectoralis minor (beneath the middle part of pectoralis major and does not reach the anterior axillary fold).

* The arrow indicates the position of the axilla.

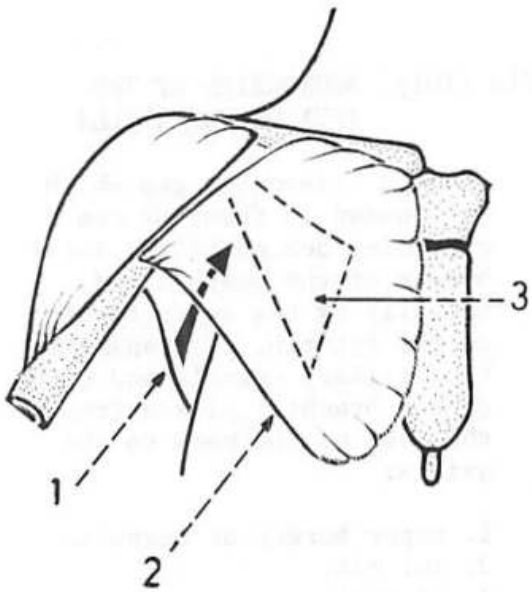
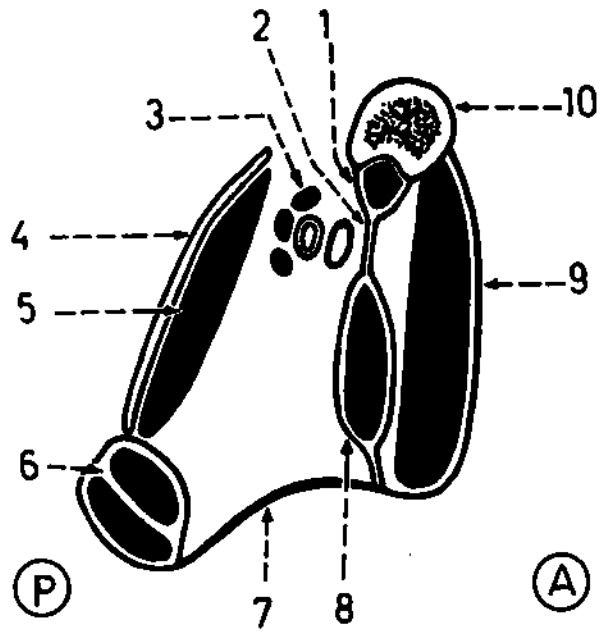


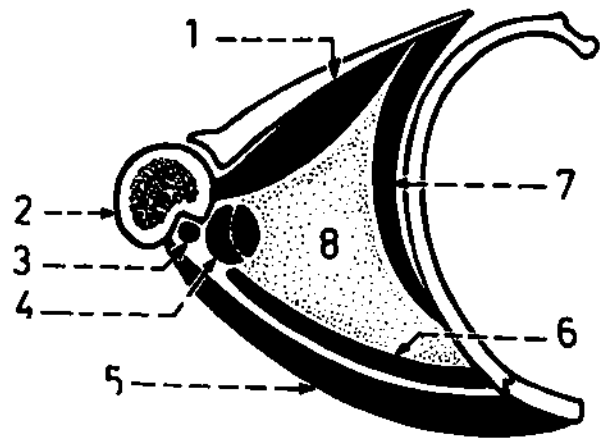
Fig.(104): WALLS OF THE AXILLA
(vertical section)



This figure shows the anterior wall of the axilla (formed by pectoralis major, pectoralis minor, subclavius and clavi-pectoral fascia), posterior wall (formed by subscapularis, teres major and latissimus dorsi) and floor(formed by the axillary fascia).

1. subclavius.
2. clavipectoral fascia.
3. neurovascular bundle (content of the axilla).
4. scapula.
5. subscapularis.
6. latissimus dorsi and teres major.
7. axillary fascia (floor).
8. pectoralis minor.
9. pectoralis major.
10. clavicle.

Fig.(105): WALLS OF THE AXILLA
(horizontal section)



This figure shows the 4 walls of the axilla. The anterior and posterior walls converge towards the lateral wall which is formed by the humerus, coracobrachialis and short head of biceps.

1. subscapularis (posterior wall).
2. upper part of humerus.
3. long head of biceps (in the intertubercular groove).
4. coracobrachialis and short head of biceps (lateral wall).
5. pectoralis major (anterior wall).
6. pectoralis minor (anterior wall).
7. serratus anterior (medial wall).
8. cavity of axilla.

* The lateral wall is the narrowest of all the 4 walls of the axilla.

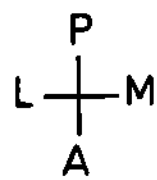


Fig.(106): ANTERIOR WALL OF AXILLA

It is formed of 2 layers (superficial and deep). The superficial layer is formed by the pectoralis major, while the deep layer is formed by the pectoralis minor, clavipectoral fascia and subclavius.

1. clavipectoral fascia.
2. lateral pectoral nerve (enters the upper part of pectoralis major).
3. lateral cord of brachial plexus.
4. posterior cord of brachial plexus.
5. medial cord of brachial plexus.
6. 1st part of axillary artery.
7. axillary vein.
8. pectoralis minor.
9. pectoralis major.
10. subclavius.
11. clavicle.

* The 1st part of the axillary artery and the related cords of brachial plexus are important deep relations to the upper part of the anterior wall of the axilla.

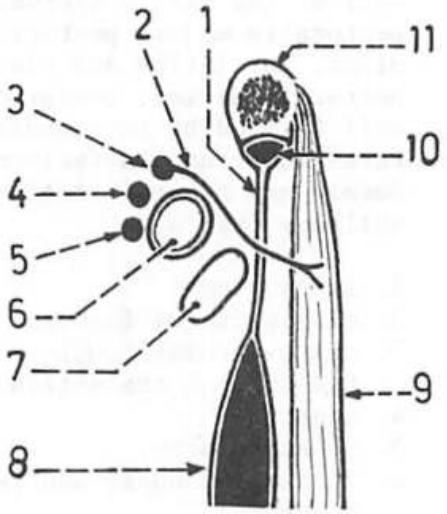


Fig.(107): LATERAL WALL OF AXILLA

It is formed by the upper part of the humerus, coracobrachialis and short head of the biceps. It is the narrowest wall.

1. long head of biceps (in the intertubercular groove).
2. short head of biceps (in contact with the upper part of the humerus).
3. coracobrachialis (in contact with the upper part of the humerus).
4. tendon of insertion of pectoralis major (reflected laterally).

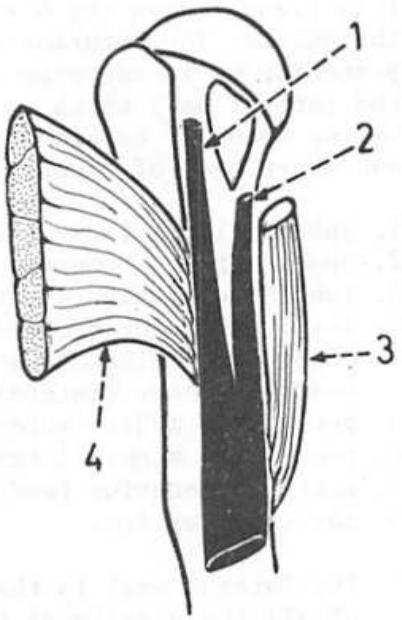
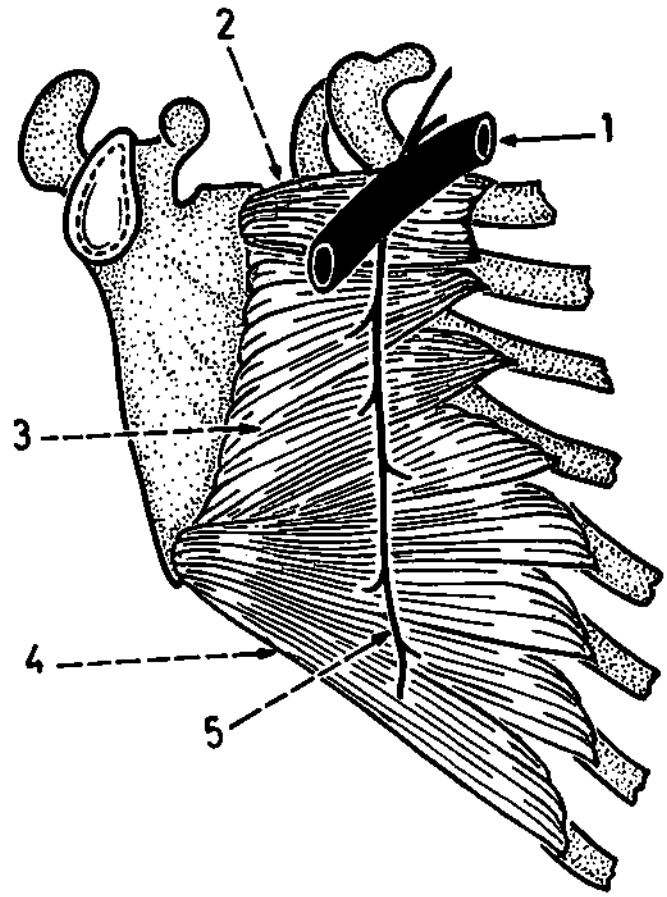


Fig.(108): MEDIAL WALL OF AXILLA

It is formed by the upper part of the serratus anterior, the upper 5 ribs and the intercostal muscles between these ribs. The nerve to serratus anterior descends vertically on the surface of serratus anterior and here it is liable to injury.

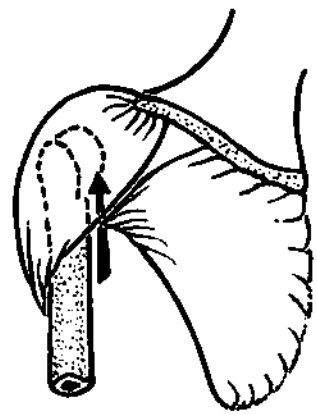


1. axillary artery (crossing over the 1st digitation of serratus anterior).
2. 1st digitation of serratus anterior (inserted into the superior angle of the scapula).
3. insertion of the 2nd and 3rd digitations of serratus anterior (into the whole medial border of the scapula).
4. insertion of the lower 5 digitations of serratus anterior (into the inferior angle of the scapula).
5. nerve to serratus anterior or long thoracic nerve (descends on the surface of serratus anterior in the mid-axillary line).

* Note that the serratus anterior arises by 8 digitations from the upper 8 ribs and is inserted into the medial border of the scapula.

Fig.(109): PALPATION OF THE HEAD OF HUMERUS

The head of the humerus can be felt through the axilla with the finger pushed upwards along its lateral wall, with the arm adducted to relax the axillary fascia of the floor of the axilla.



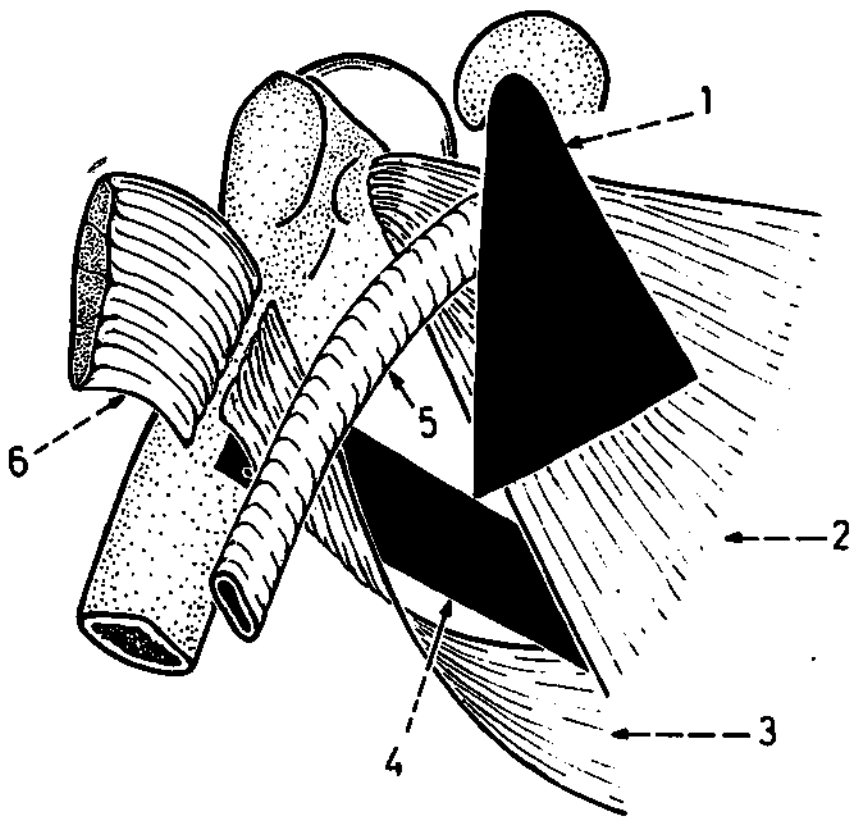


Fig.(110): POSTERIOR WALL OF AXILLA

It is formed by the subscapularis above and both the teres major and latissimus dorsi below. The tendon of the latissimus dorsi winds round the teres major where it is at 1st behind, then comes below and finally in front of it close to its insertion into the intertubercular groove.

1. pectoralis minor (part of the anterior wall of the axilla crossing over the 2nd part of the axillary artery).
2. subscapularis.
3. latissimus dorsi (winding round the teres major).
4. teres major.
5. axillary artery.
6. tendon of insertion of pectoralis major.

* The rounded lower border of the posterior wall of the axilla which is formed by the latissimus dorsi and teres major forms the posterior fold of the axilla.

* The posterior wall of the axilla forms a muscle bed for the axillary artery.

Fig.(111): AXILLARY ARTERY AND RELATED CORDS OF BRACHIAL PLEXUS

The axillary artery and related cords of brachial plexus traverse the axilla from its apex to its base where they lie along the lateral wall of the axilla. Therefore, the lateral wall is dangerous surgically.

1. lst rib (crossed by the subclavian artery and trunks of brachial plexus).
2. axillary artery and related cords of brachial plexus.
3. lateral wall of the axilla.

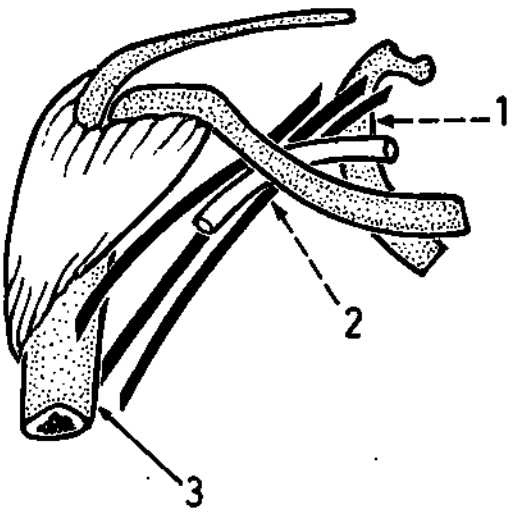
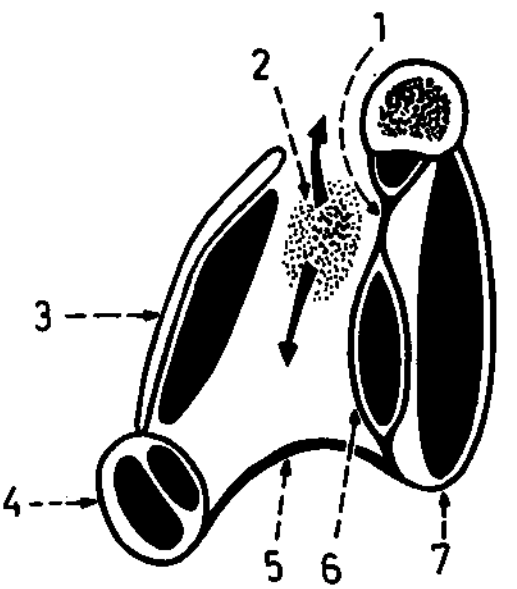


Fig.(112): SPREAD OF PUS INSIDE THE AXILLA

Pus accumulating inside the axilla (e.g. from an infected lymph node) may extend either upwards into the root of the neck through the apex of the axilla or downwards towards the floor of the axilla where it can be drained.

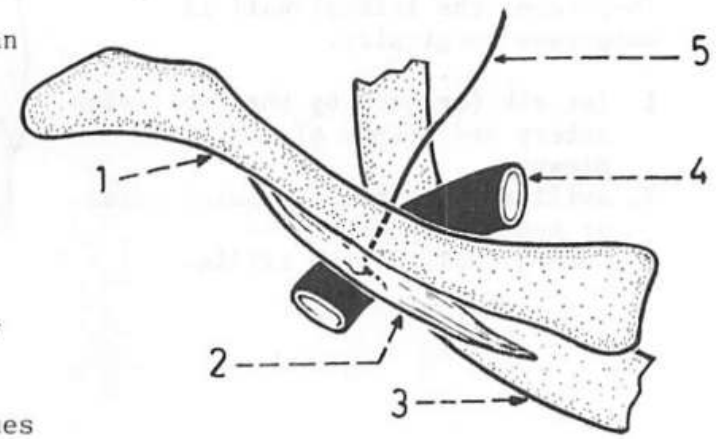
1. clavipectoral fascia.
2. pus inside the axilla.
3. posterior wall of axilla.
4. posterior fold of axilla.
5. floor of axilla.
6. pectoralis minor.
7. anterior fold of axilla.



AXILLARY VESSELS

Fig.(113): BEGINNING OF AXILLARY ARTERY

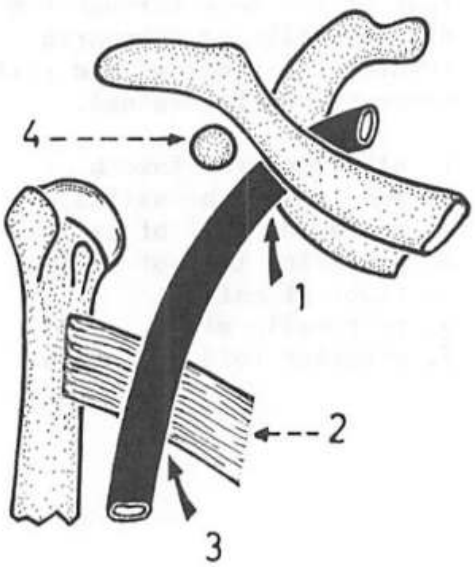
It begins at the outer border of the lst rib as the continuation of the subclavian artery. At its beginning, it lies deep to the clavicle from which it is separated by the subclavius muscle.



1. clavicle.
2. subclavius muscle (arises from the lst rib and is inserted into the inferior surface of the clavicle).
3. lst rib.
4. subclavian artery (continues as the axillary artery).
5. nerve to subclavius (arises from the upper trunk of brachial plexus and descends in front of the subclavian artery to end in the subclavius).

Fig.(114): BEGINNING AND END OF AXILLARY ARTERY

It begins at the outer border of the lst rib and ends at the lower border of teres major where it becomes the brachial artery.



1. beginning of axillary artery.
2. teres major.
3. end of axillary artery.
4. coracoid process.

* The axillary artery acquires a curved course with the arm adducted, but it straightens when the arm is abducted.

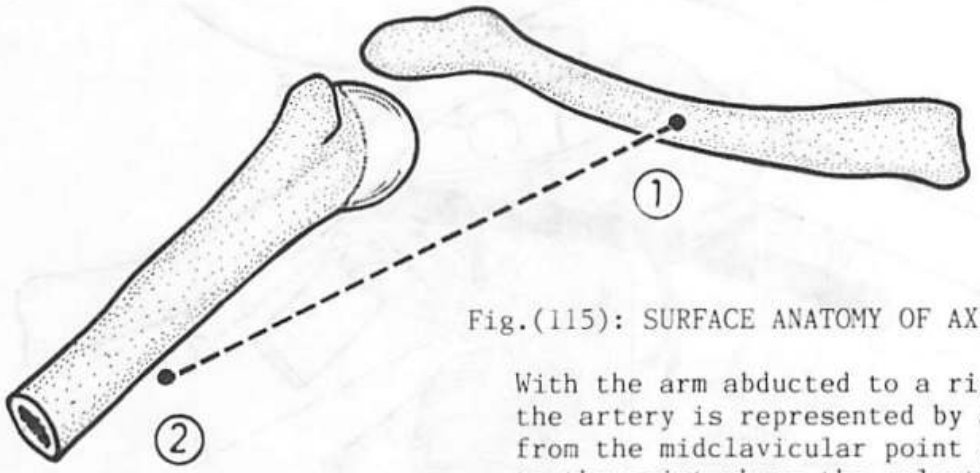


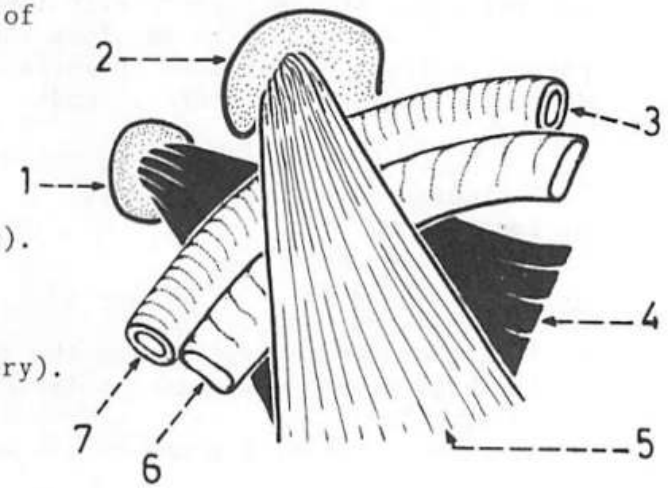
Fig.(115): SURFACE ANATOMY OF AXILLARY ARTERY

With the arm abducted to a right angle, the artery is represented by a line drawn from the midclavicular point (point 1) to the point where the pulsations of the artery are felt at the middle of the medial side of the arm (point 2).

Fig.(116): PARTS OF AXILLARY ARTERY

The axillary artery is divided into 3 parts by the pectoralis minor. The 1st part is above the muscle, the 2nd part passes under cover of the muscle, while the 3rd part lies below the muscle.

1. lesser tubercle (receives insertion of subscapularis.
2. coracoid process (receives insertion of pectoralis minor).
3. 1st part of axillary artery.
4. subscapularis.
5. pectoralis minor (crossing over the 2nd part of the artery).
6. axillary vein.
7. 3rd part of axillary artery.



* The 2nd part of the artery passes medial to the coracoid process between 2 muscles: pectoralis minor anteriorly, and subscapularis posteriorly.

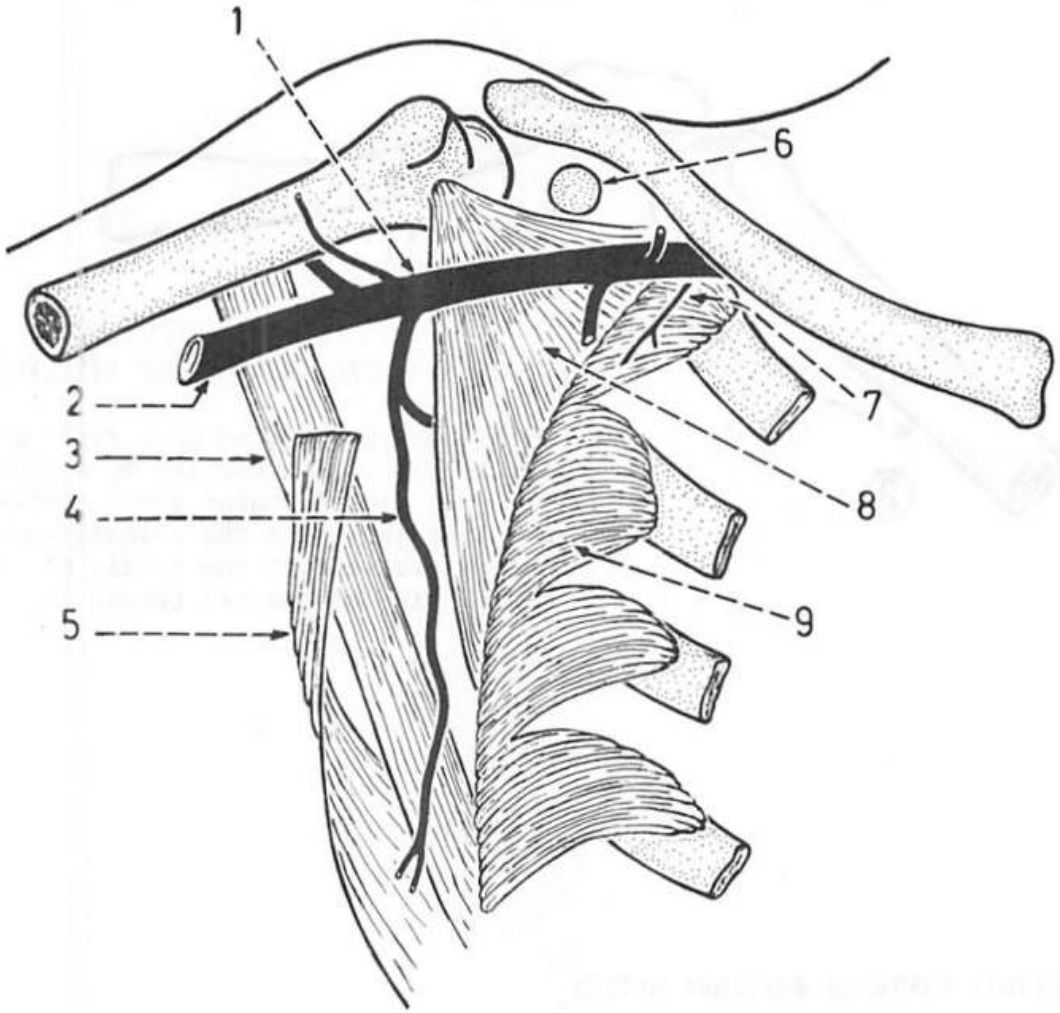


Fig.(117): COURSE OF AXILLARY ARTERY

The axillary artery traverses the axilla from its medial wall to its lateral wall. At its beginning,it lies in front of the lst digitation of serratus anterior with the long thoracic nerve in between. It then passes in front of the subscapularis and the insertion of latissimus dorsi and teres major where it ends.

1. 3rd part of axillary artery.
2. beginning of brachial artery.
3. teres major.
4. subscapular artery.
5. latissimus dorsi.
6. coracoid process.
7. long thoracic nerve (between the lst part of axillary artery and lst digitation of serratus anterior).
8. subscapularis.
9. serratus anterior (in the medial wall of the axilla).

Fig.(118): ANTERIOR RELATIONS OF AXILLARY ARTERY

The axillary artery is deeply situated for most of its course where it is covered by the anterior wall of the axilla (pectoralis major and pectoralis minor). However, its lowermost part is superficial as it is covered by skin and fascia only, and here its pulsations can be felt.

1. lowermost part of axillary artery (superficial).
2. posterior axillary fold.
3. pectoralis major.
4. pectoralis minor.
5. axillary artery (deep).

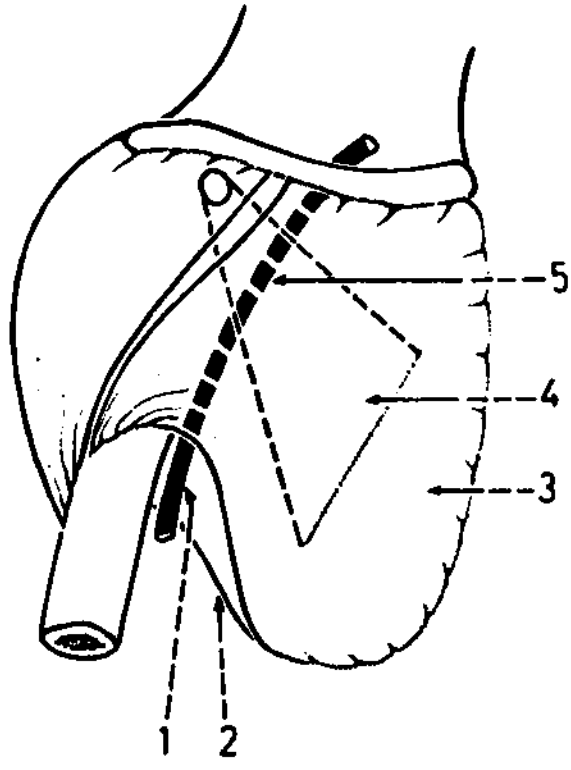
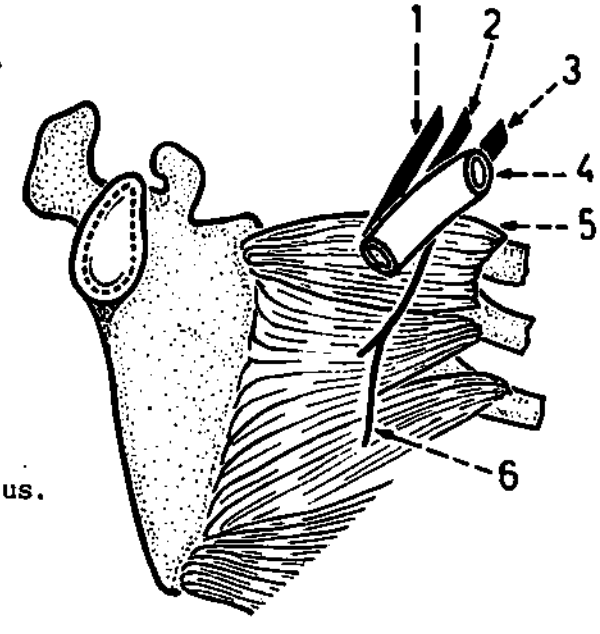


Fig.(119): NERVES RELATED TO 1st PART OF AXILLARY ARTERY

The lateral and posterior cords of brachial plexus are lateral to the artery while the medial cord and the long thoracic nerve are behind it between the artery and the 1st digitation of serratus anterior muscle.

1. lateral cord of brachial plexus (above the posterior cord).
2. posterior cord of brachial plexus.
3. medial cord of brachial plexus (below the posterior cord).
4. 1st part of axillary artery.
5. 1st digitation of serratus anterior.
6. long thoracic nerve (nerve to serratus anterior).



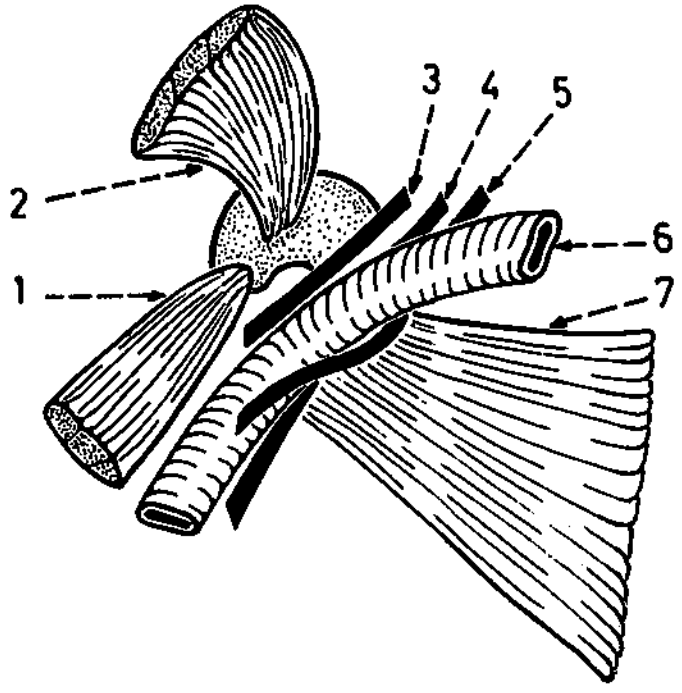


Fig.(120): NERVES RELATED TO 2nd PART OF AXILLARY ARTERY

The 3 cords of the brachial plexus change their positions in relation to the 2nd part of the axillary artery where the lateral cord comes lateral to the artery, the posterior cord posterior to it and the medial cord medial to it (according to their names). The lateral cord separates the artery from the coracobrachialis, while the posterior cord separates it from the subscapularis (note that the medial cord separates the 1st part of the artery from the 1st digitation of serratus anterior).

1. coracobrachialis.
2. pectoralis minor (reflected).
3. lateral cord of brachial plexus.
4. posterior cord of brachial plexus.
5. medial cord of brachial plexus.
6. axillary artery.
7. subscapularis.

* Note that the 3 cords of brachial plexus lie one above the other lateral and posterior to the 1st part of axillary artery, but they separate to surround the 2nd part of the artery.

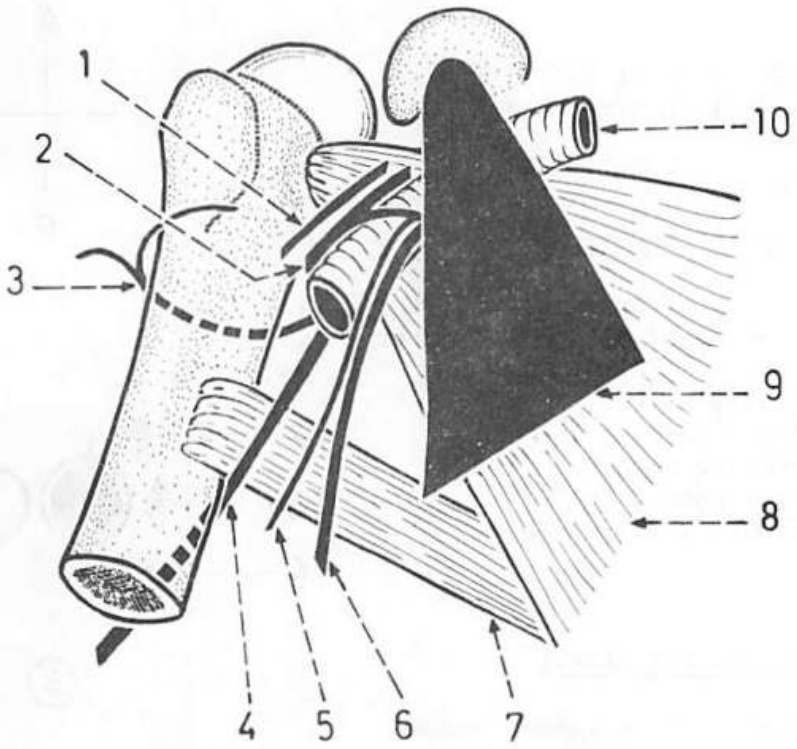
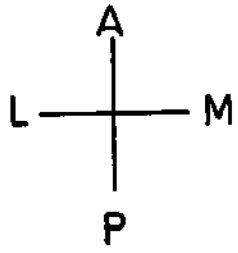


Fig.(121): NERVES RELATED TO 3rd PART OF AXILLARY ARTERY

The 3rd part of axillary artery is related to branches of the 3 cords as compared with the 1st and 2nd parts of the artery which are related to the cords themselves.
The 3rd part of the artery is related laterally to the branches of the lateral cord (musculocutaneous and lateral root of median nerve), related medially to the branches of the medial cord (ulnar nerve, medial root of median nerve and medial cutaneous nerve of forearm) and related posteriorly to branches of the posterior cord (radial and axillary).

1. musculocutaneous nerve.
2. median nerve (formed by the union of medial and lateral roots).
3. axillary nerve (winds behind the surgical neck of humerus).
4. radial nerve (passes behind the middle 1/3 of the humerus, in the spiral groove).
5. medial cutaneous nerve of forearm.
6. ulnar nerve.
7. teres major (its lower border marks the lowest limit of the axilla).
8. subscapularis.
9. pectoralis minor (overlies the 2nd part of the artery).
10. axillary artery.

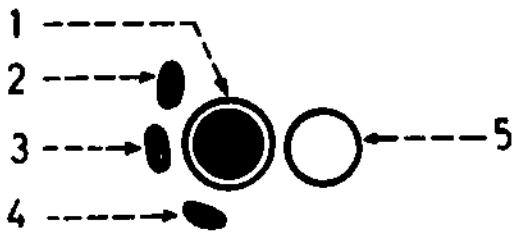
Fig.(122): RELATIONS OF THE AXILLARY ARTERY TO NERVES (T.S.)



(a) 1st part of the artery:

The 3 cords of brachial plexus lie lateral and behind the artery.

1. axillary artery.
2. lateral cord.
3. posterior cord.
4. medial cord.
5. axillary vein (medial).



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(b) 2nd part of the artery:

The 3 cords are arranged around the artery according to their names.

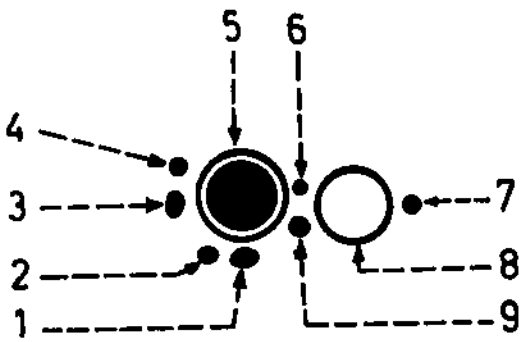
1. axillary artery.
2. lateral cord (lateral).
3. posterior cord (posterior).
4. medial cord (medial, between it and the vein).
5. axillary vein.

ⓑ

(c) 3rd part of the artery:

The artery is related to the branches of the cords.

1. radial nerve (posterior).
2. axillary nerve (posterior).
3. median nerve (lateral).
4. musculocutaneous nerve (lateral).
5. axillary artery.
6. medial cutaneous nerve of forearm (medial).
7. medial cutaneous nerve of arm (medial to the vein).
8. axillary vein.
9. ulnar nerve (medial to the artery).



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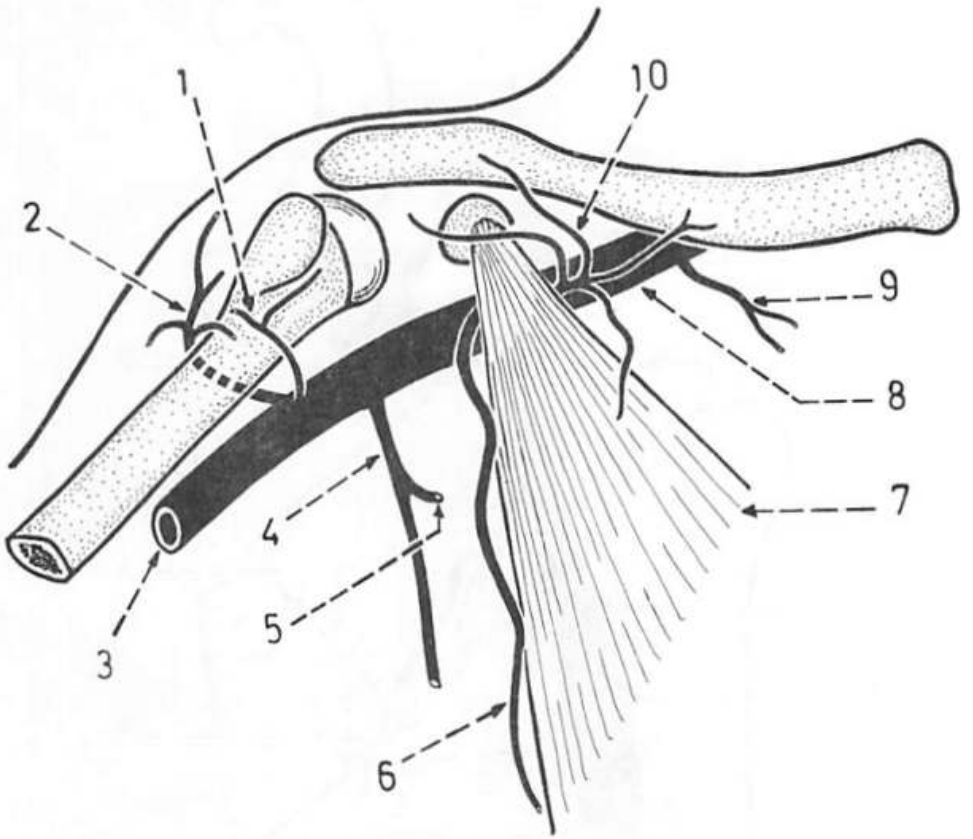


Fig.(123): BRANCHES OF AXILLARY ARTERY

The 1st part of the artery gives off one branch (superior thoracic), the 2nd part gives off 2 branches (acromio-thoracic and lateral thoracic), and the 3rd part gives off 3 branches (anterior circumflex humeral, posterior circumflex humeral and subscapular).

1. anterior circumflex humeral artery (passes in front of the surgical neck of humerus and gives off an ascending branch).
2. posterior circumflex humeral artery (passes behind the surgical neck of humerus and anastomoses with the anterior circumflex).
3. 3rd part of axillary artery.
4. subscapular artery (passes along the lateral border of the scapula).
5. circumflex scapular artery (a branch of the subscapular artery).
6. lateral thoracic artery (descends along the lower border of pectoralis minor, on the side of the chest).
7. pectoralis minor (crosses over the 2nd part of the artery).
8. 1st part of axillary artery.
9. superior thoracic artery (to the upper part of the chest).
10. acromio-thoracic artery (emerges at the upper border of pectoralis minor and divides immediately into 4 branches: a-acromial, b-pectoral, c-clavicular and d-deltoid).

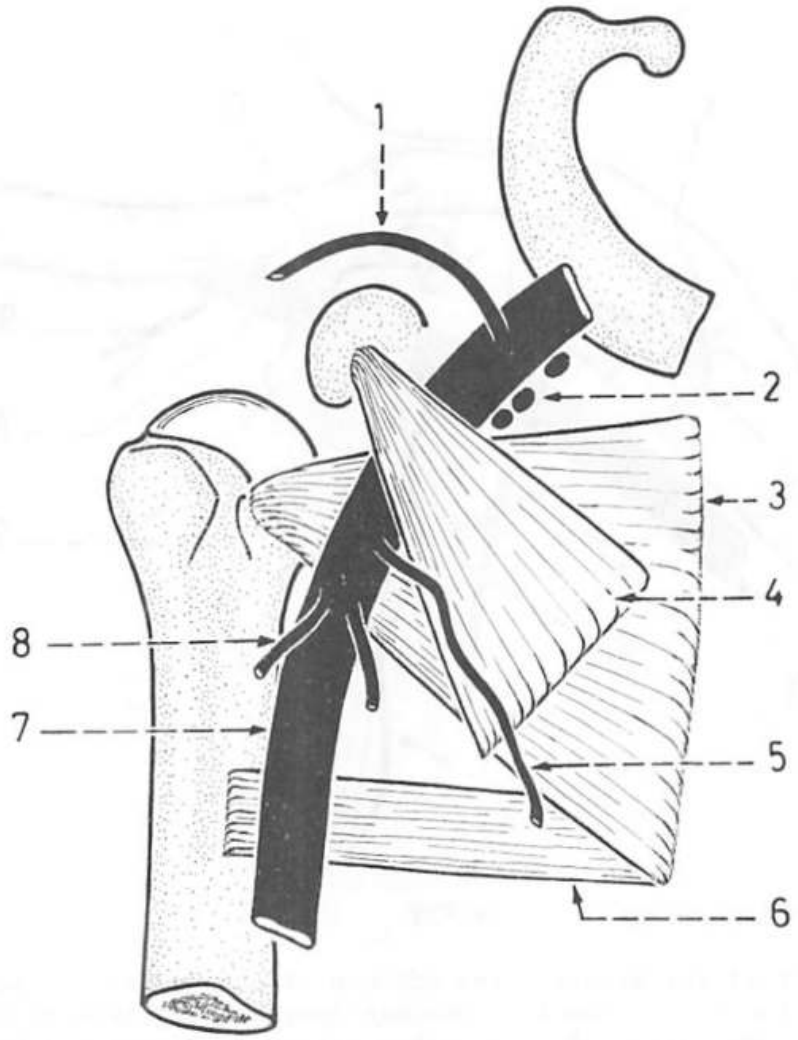


Fig.(124): AXILLARY VEIN

It begins at the lower border of the teres major as the continuation of the basilic vein and ends at the outer border of the lst rib to become the subclavian vein (the reverse direction of the axillary artery).
It receives the venae commitantes of the brachial artery at the lower border of subscapularis and the cephalic vein above the pectoralis minor.
All through its course it lies medial to the axillary artery.

1. cephalic vein.
2. apical group of lymph nodes(alongside the uppermost part of the vein).
3. subscapularis.
4. pectoralis minor.
5. lateral thoracic vein (runs on the side of the chest and anastomoses with the superficial epigastric vein which is a tributary of the great saphenous vein to form the thoraco-epigastric vein).
6. teres major.
7. axillary vein.
8. venae comitantes of the brachial artery (join the axillary vein at the lower border of subscapularis).

AXILLARY LYMPH NODES

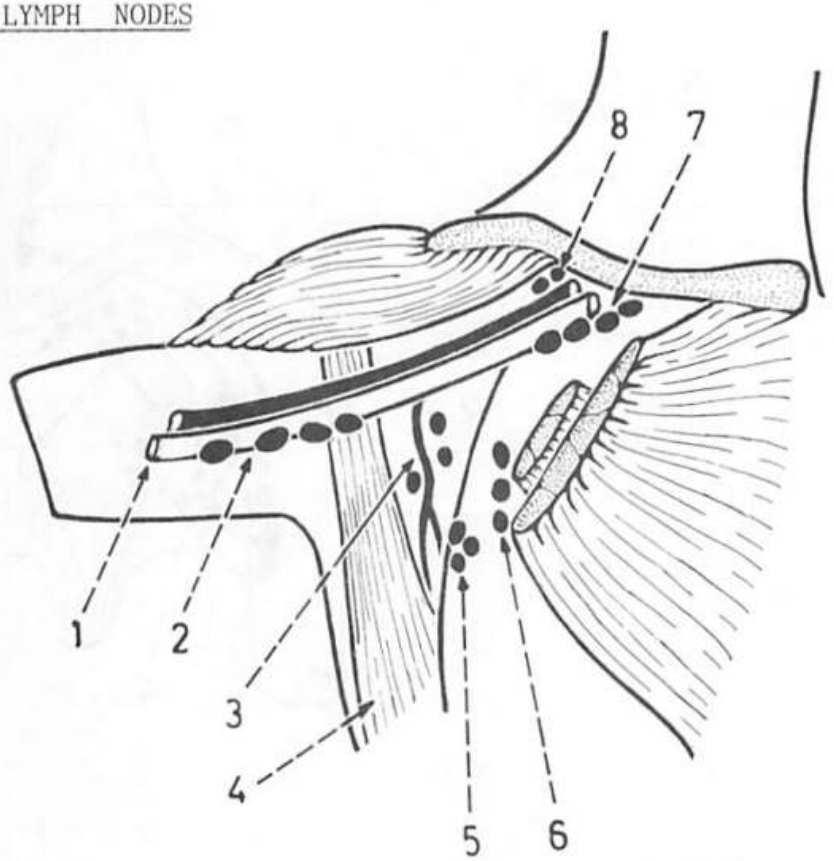


Fig.(125): AXILLARY LYMPH NODES

These are 5 groups of lymph nodes which are distributed in relation to the boundaries of the axilla. These groups are: lateral, anterior (pectoral), posterior (subscapular), central and apical. Each of these groups (except the central) lies along blood vessels.

1. axillary vein.
2. lateral group of nodes (in relation to the lateral wall of the axilla, alongside the lower part of axillary vein).
3. posterior (subscapular) group of nodes (related to the posterior wall of the axilla, alongside the subscapular vessels).
4. teres major.
5. central group of nodes (embedded in the fat which fills the centre of the axilla, it lies near the floor of the axilla and can be felt when enlarged).
6. anterior (pectoral) group of nodes (in relation to the anterior wall of the axilla,alongside the lateral thoracic vessels).
7. apical group of nodes (at the apex of the axilla, alongside the upper part of axillary vein).
8. delto-pectoral (infraclavicular) lymph nodes (lie along the upper part of the cephalic vein and do not belong to the axillary lymph nodes).

Fig.(126): FLOW OF LYMPH FROM THE AXILLARY LYMPH NODES

Lymph vessels from the anterior, posterior and lateral groups of lymph nodes pass to the central as well as to the apical groups. Few vessels also pass to the lower deep cervical nodes.

1. lower deep cervical nodes.
2. posterior group.
3. lateral group.
4. central group.
5. pectoralis minor.
6. anterior (pectoral) group.
7. apical group.

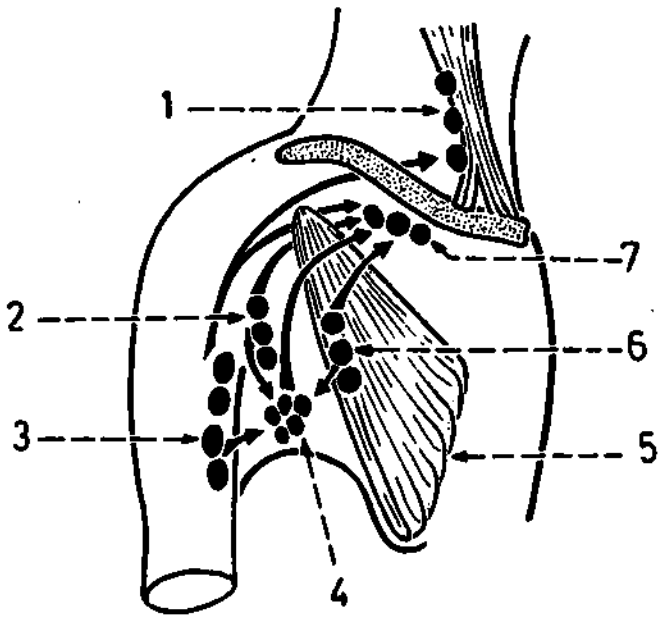


Fig.(127): APICAL GROUP OF LYMPH NODES

They receive afferent vessels from all the other axillary groups, directly from the upper quadrant of mammary gland and from the delto-pectoral nodes. The majority of its efferents form the subclavian lymph trunk while few efferents end in the lower deep cervical nodes.

1. from delto-pectoral nodes.
2. from posterior nodes.
3. from lateral nodes.
4. from central nodes.
5. from anterior nodes.
6. from mammary gland.
7. apical nodes.
8. subclavian lymph trunk.
9. innominate vein.
10. right lymphatic duct.
11. internal jugular vein.
12. jugular lymph trunk.
13. deep cervical nodes.
14. subclavian vein.

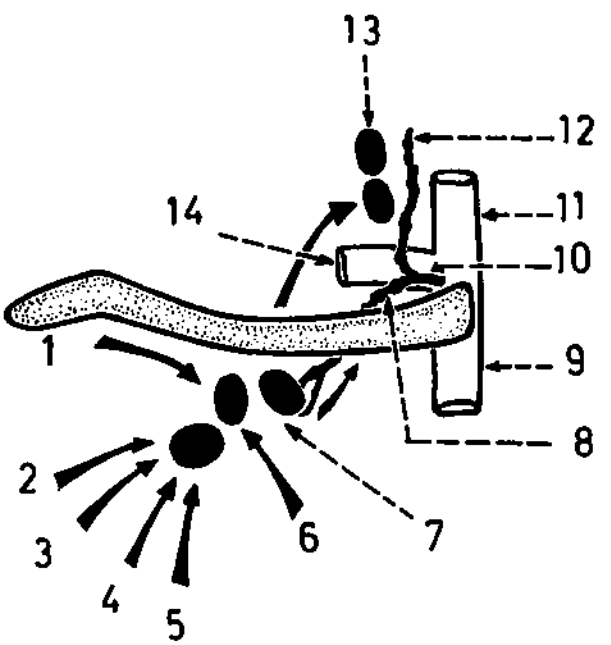
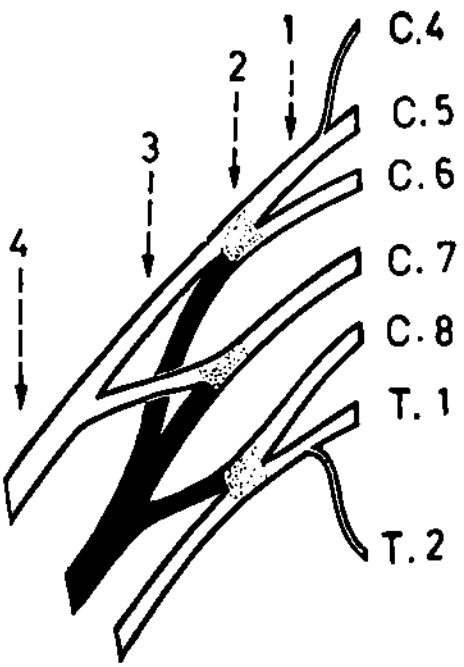


Fig.(128): FORMATION OF BRACHIAL PLEXUS

The brachial plexus consists of roots (ventral rami of C. 5,6,7,8, and T. 1), 3 trunks (upper, middle and lower) and 3 cords (lateral, medial and posterior).

1. roots of the plexus.
2. trunks.
3. division of the trunks into anterior and posterior divisions.
4. cords.

* The plexus receives additional twigs from C. 4 above, and from T.2 below.



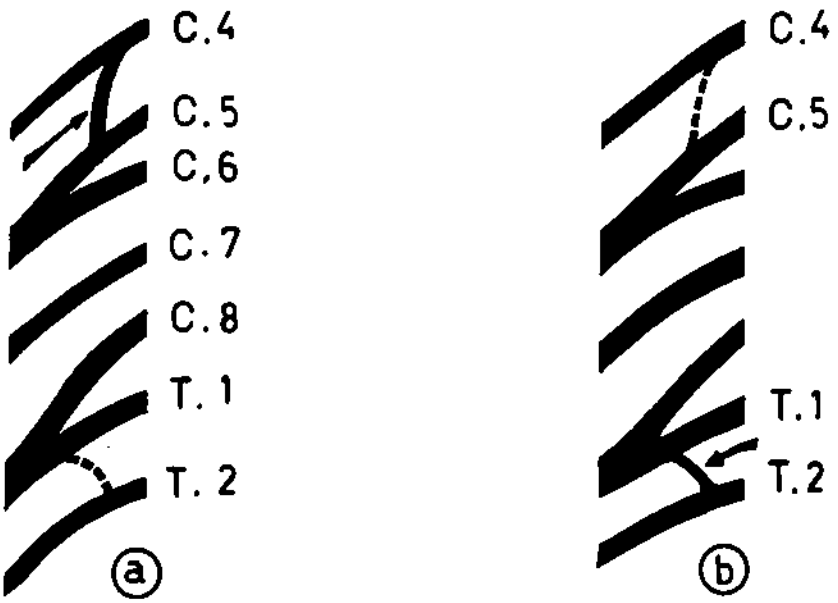


Fig.(129): PREFIXED AND POSTFIXED PLEXUS

In the prefixed type of brachial plexus the contribution from C.4 is exceptionally large, while in the postfixed type the contribution from T.2 is exceptionally large.

(a) prefixed type.

(b) postfixed type.

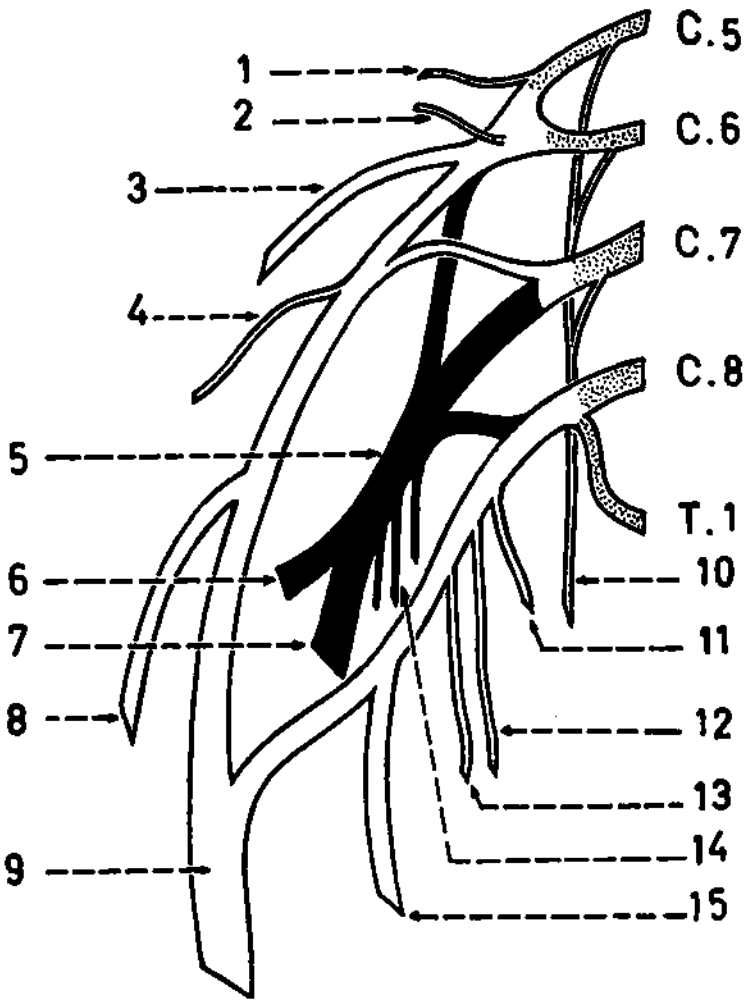


Fig.(130): BRANCHES OF THE BRACHIAL PLEXUS

The roots and trunks of the brachial plexus lie in the neck, while the cords lie in the axilla. The roots of the plexus give off mainly the dorsal scapular and long thoracic nerves. The upper trunk gives off the nerve to subclavius and the suprascapular nerve, but the other 2 trunks have no branches. The lateral cord has 3 branches (lateral pectoral, musculocutaneous and lateral root of median nerve), the medial cord has 5 branches (medial pectoral, medial root of median nerve, ulnar, medial cutaneous nerve of arm and medial cutaneous nerve of forearm) and the posterior cord has 5 branches (upper subscapular, lower subscapular, thoracodorsal, axillary and radial).

1. dorsal scapular nerve (nerve to rhomboids).
2. nerve to subclavius.
3. suprascapular nerve.
4. lateral pectoral nerve.
5. posterior cord.
6. axillary nerve.
7. radial nerve
8. musculocutaneous nerve.
9. median nerve (formed by medial and lateral roots).
10. long thoracic nerve.
11. medial pectoral nerve.
12. medial cutaneous nerve of arm.
13. medial cutaneous nerve of forearm.
14. thoracodorsal and upper and lower subscapular nerves.
15. ulnar nerve.

Fig.(131): FIBRES FROM C.7 TO THE ULNAR NERVE

The ulnar nerve (C.8, T.1) gets additional fibres from C.7 which pass through the lateral root of the median nerve and then through communication between the median and ulnar nerves in the axilla or in the arm.

1. lateral root of median nerve.
2. median nerve.
3. communication between the median and ulnar nerves.
4. ulnar nerve.

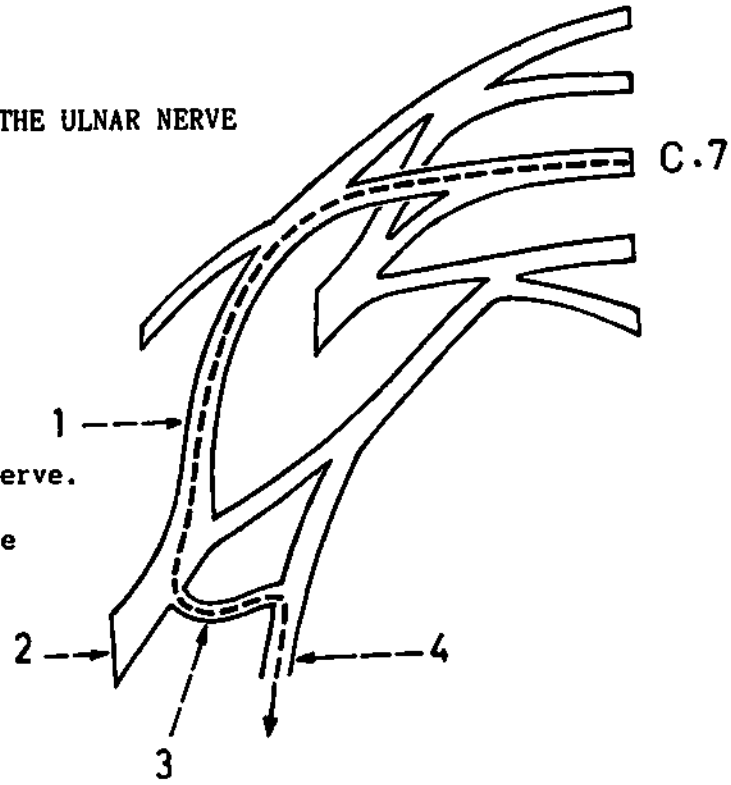
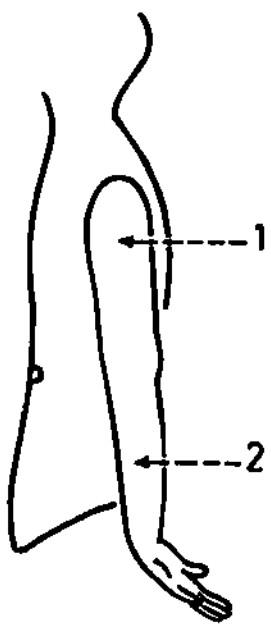


Fig.(132): ERB'S PARALYSIS

It is due to injury to the upper trunk of the brachial plexus which is formed by C.5 and C.6. In this case the arm hangs by the side (adducted) due to paralysis of the deltoid and supra-spinatus. The forearm is extended , and pronated due to paralysis of the biceps, brachialis and supinator. The resulting deformity in the upper limb is also called Porter's tip deformity.

1. adducted arm.
2. extended and pronated forearm.

* Injury to the lower trunk of the brachial plexus which is formed by C.8 and T.1 results in Klumpke's paralysis which is manifested by claw-hand deformity.



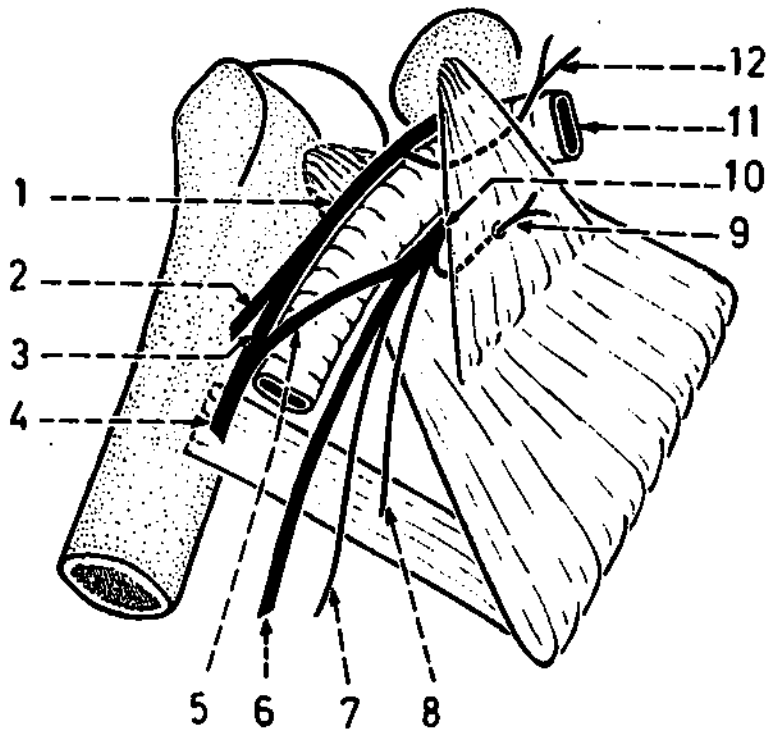


Fig.(133): BRANCHES OF THE LATERAL AND MEDIAL CORDS OF BRACHIAL PLEXUS

The lateral cord is formed by the union of the anterior divisions of the upper and middle trunks (C.5,6,7), while the medial cord is formed by the anterior division of the lower trunk only (C.8, T.1). The lateral cord has 3 branches: lateral pectoral, musculocutaneous and the lateral root of median nerve, while the medial cord has 5 branches: medial pectoral, medial cutaneous nerve of arm, medial cutaneous nerve of forearm, ulnar nerve and medial root of the median nerve.

1. lateral cord (lateral to the axillary artery).
2. musculocutaneous nerve.
3. lateral root of the median nerve.
4. median nerve (lateral to the axillary artery).
5. medial root of the median nerve (crosses in front of the artery to join the lateral root).
6. ulnar nerve.
7. medial cutaneous nerve of forearm.
8. medial cutaneous nerve of arm.
9. medial pectoral nerve (pierces the pectoralis minor).
10. medial cord (medial to the axillary artery).
11. axillary artery.
12. lateral pectoral nerve (crosses in front of the artery to reach the pectoralis major).

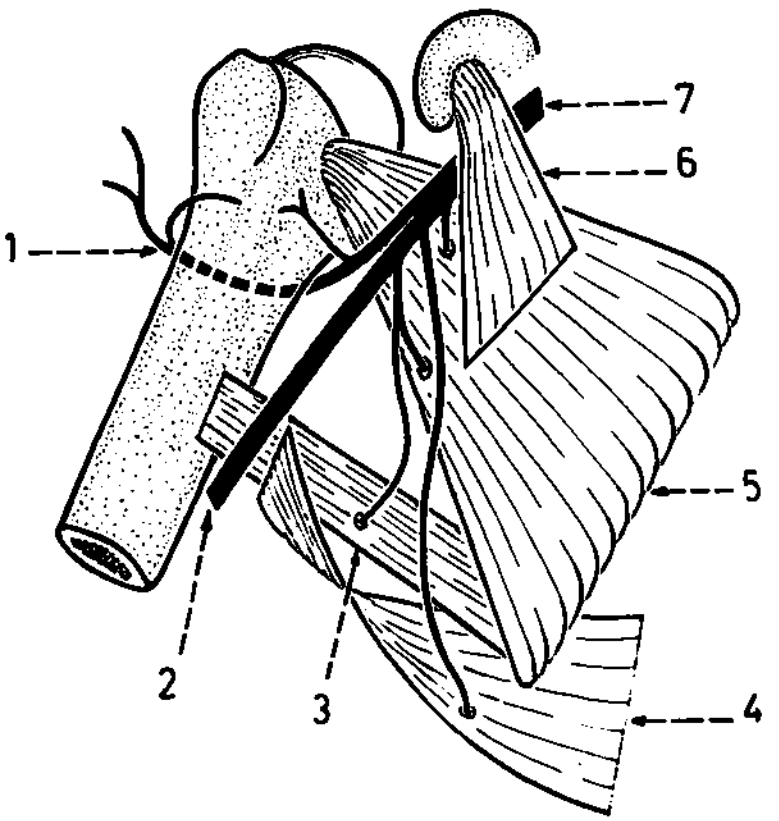


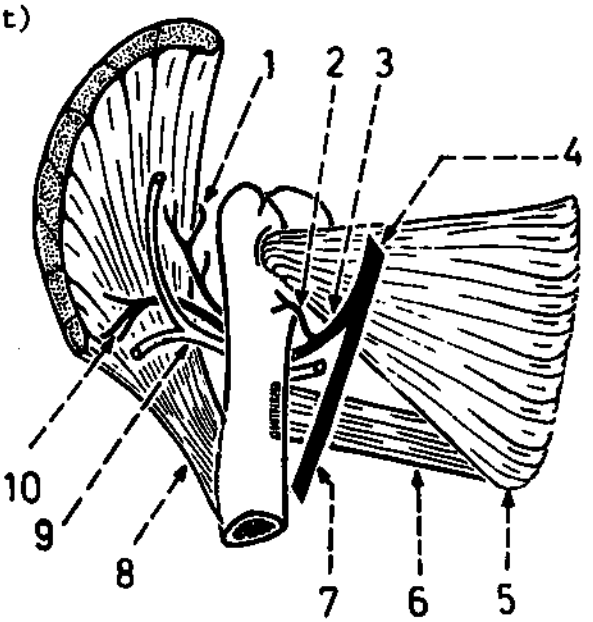
Fig.(134): BRANCHES OF THE POSTERIOR CORD OF BRACHIAL PLEXUS.

The posterior cord is formed by the union of the posterior divisions of all the 3 trunks, and therefore it contains fibres from all the 5 roots of the brachial plexus (C.5,6,7,8, and T.1). Because the posterior cord is situated behind the 2nd part of axillary artery, the branches of the cord retain their position posterior to the 3rd part of the axillary artery. It has 5 branches: upper subscapular, lower subscapular, thoracodorsal (nerve to latissimus dorsi), axillary and radial nerves.

1. axillary nerve (winds round the surgical neck of the humerus from behind).
2. radial nerve (passes downwards to the middle of the back of the arm, in the spiral groove).
3. teres major (lower limit of the axilla).
4. latissimus dorsi.
5. subscapularis (posterior relation to the posterior cord).
6. pectoralis minor.
7. posterior cord.

* It should be noted that the posterior cord supplies the skin and muscles of the back of the arm and forearm, while the lateral and medial cords supply the skin and muscles of the front of the arm and forearm.

Fig.(135): AXILLARY NERVE (from in front)

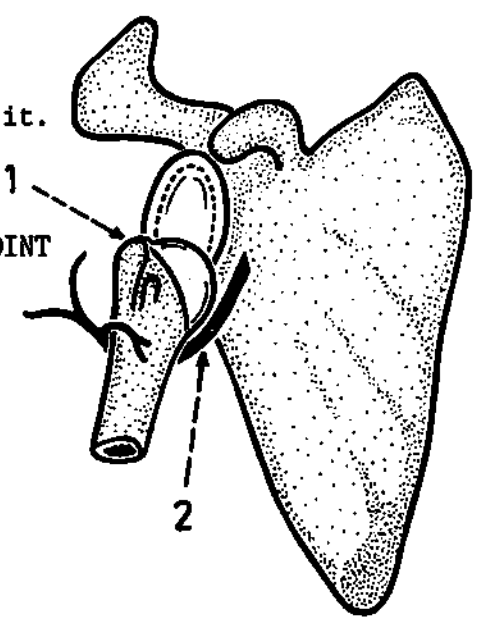


It arises from the posterior cord and passes through the quadrangular space in company with the posterior circumflex humeral artery. It winds round the back of surgical neck of the humerus where it divides into anterior and posterior divisions. It supplies 2 muscles (deltoid and teres minor), the shoulder joint and gives off the upper lateral cutaneous nerve of arm.

1. upper lateral cutaneous nerve of arm (from posterior division and winds round the posterior border of the deltoid).
2. articular branch to the shoulder joint.
3. axillary nerve (passing in the quadrangular space).
4. posterior cord.
5. subscapularis.
6. teres major.
7. radial nerve.
8. deltoid.
9. posterior circumflex humeral artery.
10. anterior division of axillary nerve.

* Note that the axillary nerve passes backwards above the teres major, while the radial nerve passes backwards below it.

Fig.(136): DOWNWARD DISLOCATION OF SHOULDER JOINT



In this dislocation the head of the humerus is displaced downwards out of the glenoid cavity and the axillary nerve is liable to be injured.

1. head of humerus.
2. axillary nerve.

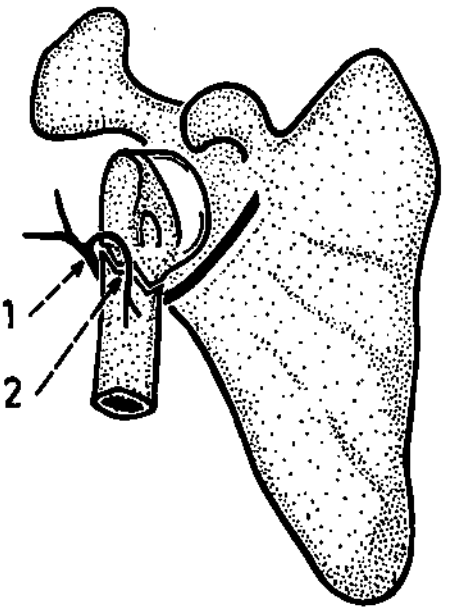


Fig.(137): FRACTURE OF SURGICAL NECK OF THE HUMERUS

In this fracture the axillary nerve may be injured leading to paralysis of the teres minor and deltoid muscles. There will be failure of abduction of the shoulder joint up to 90°.

1. axillary nerve.
2. fracture of surgical neck.

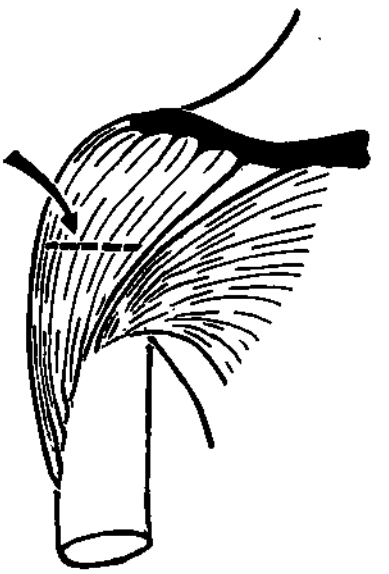
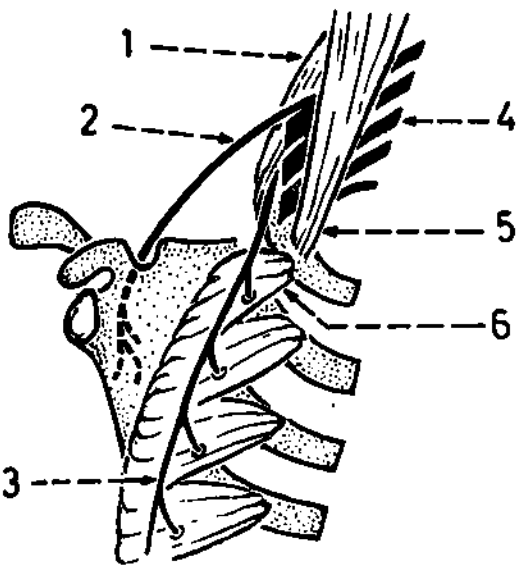


Fig.(138): SURFACE ANATOMY OF THE AXILLARY NERVE

It is represented by a horizontal line drawn across the middle of the deltoid muscle.

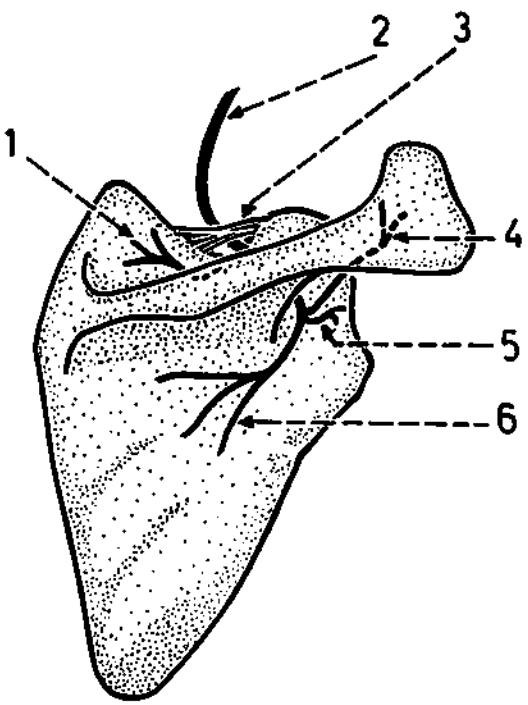
Fig.(139): SUPRASCAPULAR AND LONG THORACIC NERVES



The suprascapular nerve arises in the neck from the upper trunk of brachial plexus and descends behind the clavicle to reach the suprascapular notch.
The long thoracic nerve (nerve to serratus anterior) arises from the roots of brachial plexus (C.5,6,7) and descends superficial to the 1st digitation of serratus anterior deep to the axillary artery. It descends on the surface of the serratus anterior in the midaxillary line, and here it is exposed to damage leading to winged scapula.

1. scalenus medius (in the neck).
2. suprascapular nerve (in the neck).
3. long thoracic nerve.
4. roots of brachial plexus.
5. scalenus anterior (in front of the trunks of brachial plexus).
6. 1st digitation of serratus anterior.

Fig.(140): SUPRASCAPULAR NERVE



The suprascapular nerve passes through the suprascapular notch deep to the suprascapular ligament. It enters the supraspinous fossa and then passes through the spinoglenoid notch to end in the infraspinous fossa.

1. branch to supraspinatus.
2. suprascapular nerve.
3. suprascapular ligament.
4. branch to acromio-clavicular joint.
5. branch to shoulder joint.
6. branches to infraspinatus.

* The nerve supplies 2 muscles (supraspinatus and infraspinatus) and 2 joints (acromio-clavicular and shoulder).

MUSCLES OF THE BACK

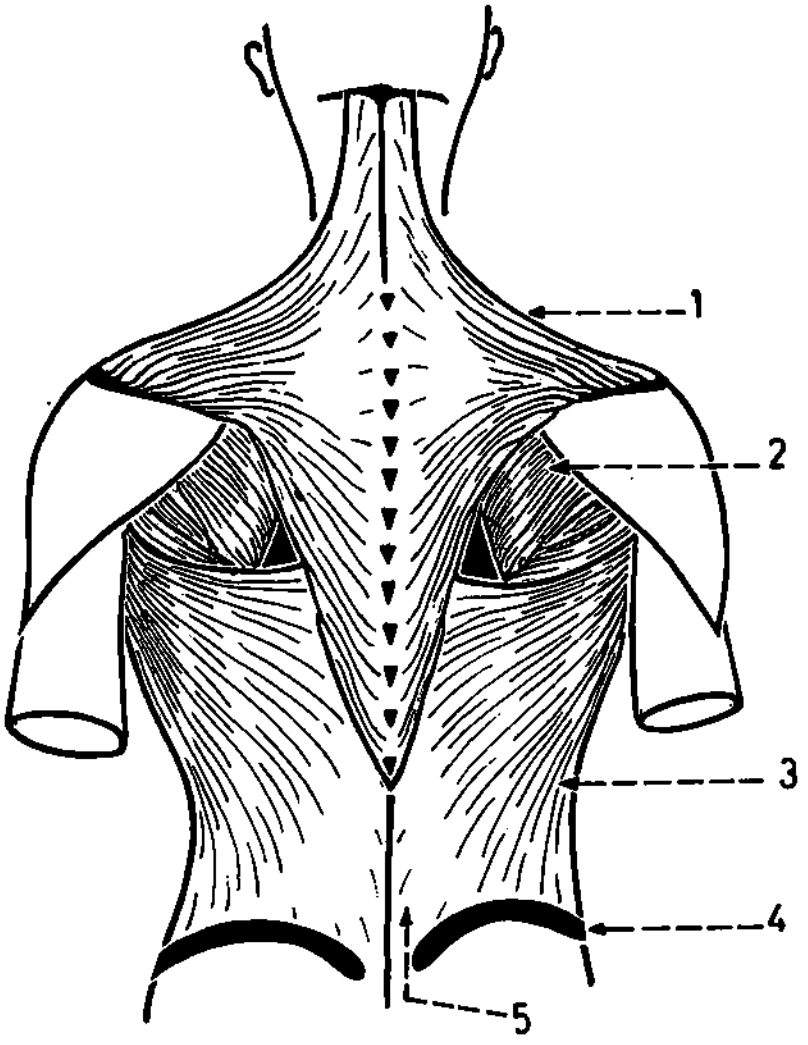


Fig.(141): SUPERFICIAL LAYER OF MUSCLES OF THE BACK

This superficial layer consists of 2 muscles: trapezius above, and latissimus dorsi below. These 2 muscles are characterized by having wide origins from which the fibres converge towards a narrow insertion. The trapezius is inserted into the bones of the shoulder girdle (clavicle and scapula) and therefore, it acts on this girdle, while the latissimus dorsi is inserted into the upper part of the humerus and therefore, it acts on the shoulder joint.

1. trapezius.
2. infraspinatus.
3. latissimus dorsi.
4. iliac crest.
5. thoracolumbar fascia (gives origin to the latissimus dorsi).

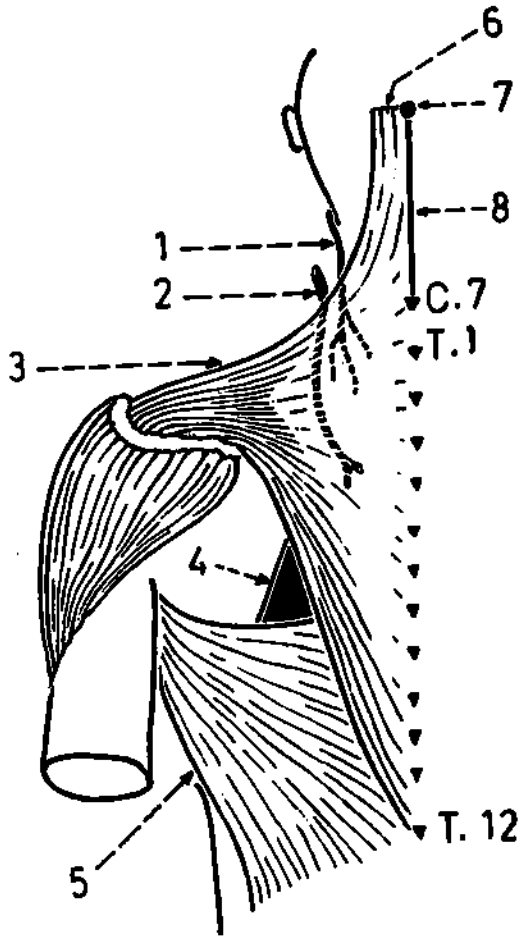


Fig.(142): TRAPEZIUS MUSCLE

It is a triangular muscle which covers the back of the neck and upper 1/2 of the back of the chest. The trapezius muscles of both sides form together a trapezium (trapezium = an irregular 4-sided figure).
The muscle has a wide linear origin from the superior nuchal line, external occipital protuberance, ligamentum nuchae, spine of 7th cervical vertebra and spines of all thoracic vertebrae (from above downwards).
It is inserted into the lateral 1/3 of the clavicle, medial margin of the acromion and superior lip of the crest of the spine of the scapula.

1. spinal root of accessory nerve (enters the deep surface of trapezius).
2. superficial branch of transverse cervical artery.
3. trapezius muscle.
4. triangle of auscultation.
5. latissimus dorsi.
6. superior nuchal line.
7. external occipital protuberance.
8. ligamentum nuchae.

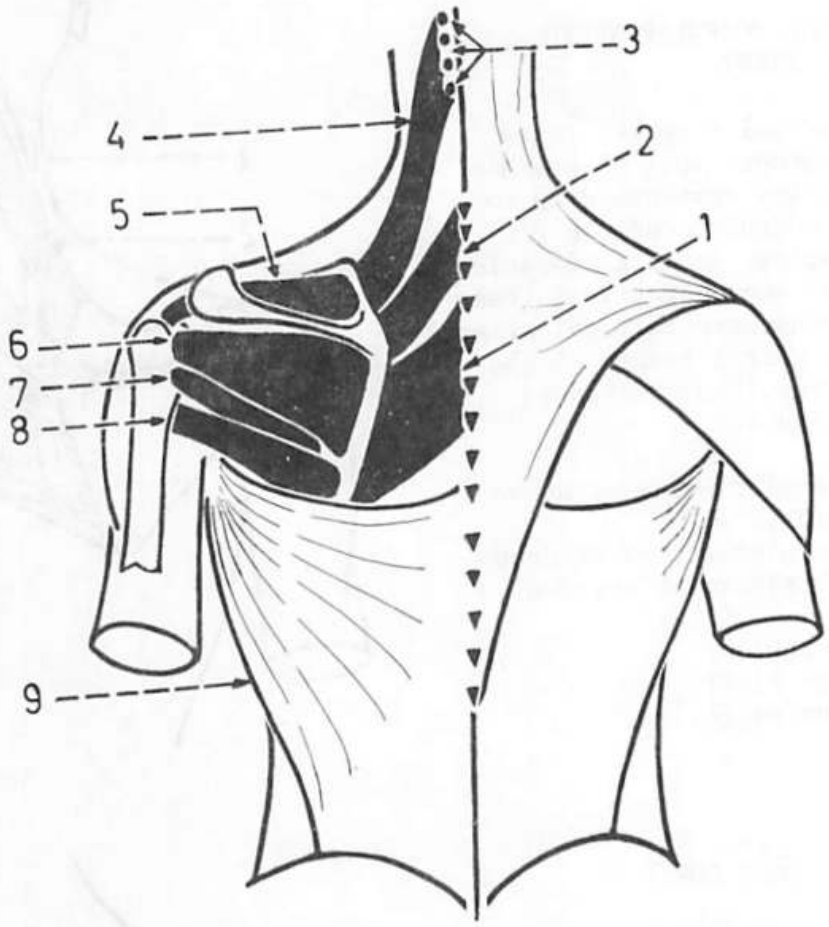


Fig.(143): MUSCLES DEEP TO THE TRAPEZIUS

These are the levator scapulae, rhomboideus minor and rhomboideus major which form together the muscles of the 2nd layer of the back. This is in addition to the muscles on the back of the scapula.

1. rhomboideus major (inserted into the medial border of the scapula below the root of the spine).
2. rhomboideus minor (inserted into the medial border of the scapula at the root of the spine).
3. transverse processes of the upper 4 cervical vertebrae.
4. levator scapulae (inserted into the medial border of the scapula above the root of the spine).
5. supraspinatus (above the spine of the scapula).
6. infraspinatus (below the spine of the scapula).
7. teres minor (along the lateral border of the scapula).
8. teres major (just below the teres minor).
9. latissimus dorsi.

Fig.(144): DORSAL SCAPULAR NERVE AND ARTERY

The dorsal scapular nerve arises from the uppermost root of brachial plexus (C.5) and descends deep to the levator scapulae and the 2 rhomboid muscles. It is accompanied by the dorsal scapular artery (deep branch of transverse cervical artery) close to the medial border of the scapula. It supplies the above-mentioned 3 muscles.

1. dorsal scapular nerve or nerve to rhomboids.
2. dorsal scapular artery or deep branch of transverse cervical artery.
3. levator scapulae.
4. rhomboideus minor.
5. rhomboideus major.

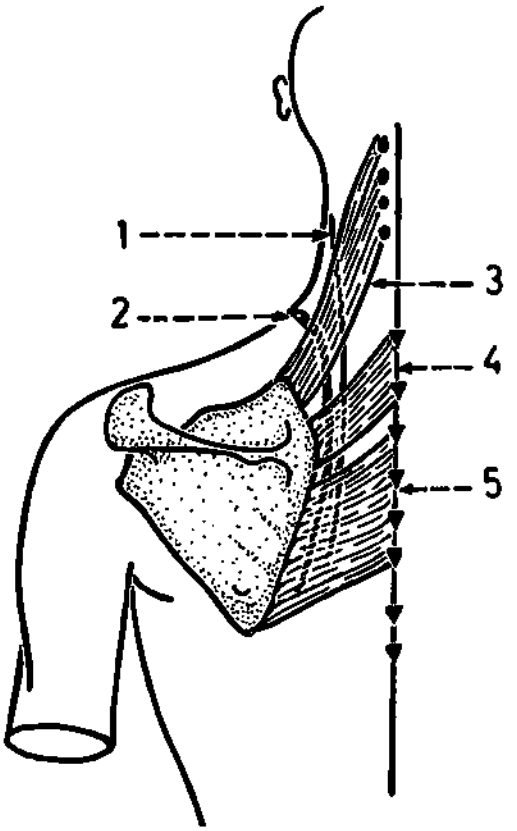


Fig.(145): LATISSIMUS DORSI

It is a large triangular muscle which arises from the lower 6 thoracic spines, thoracolumbar fascia, iliac crest and lower 4 ribs with few slips from the inferior angle of the scapula. It has an upper and lateral free borders.

1. teres major.
2. tendon of insertion of latissimus dorsi (winds round the teres major and is inserted in front of it into the floor of the intertubercular groove).
3. lateral oblique border of latissimus dorsi.
4. iliac crest.
5. upper horizontal border of latissimus dorsi.
6. spines of lower 6 thoracic vertebrae.
7. thoracolumbar fascia.

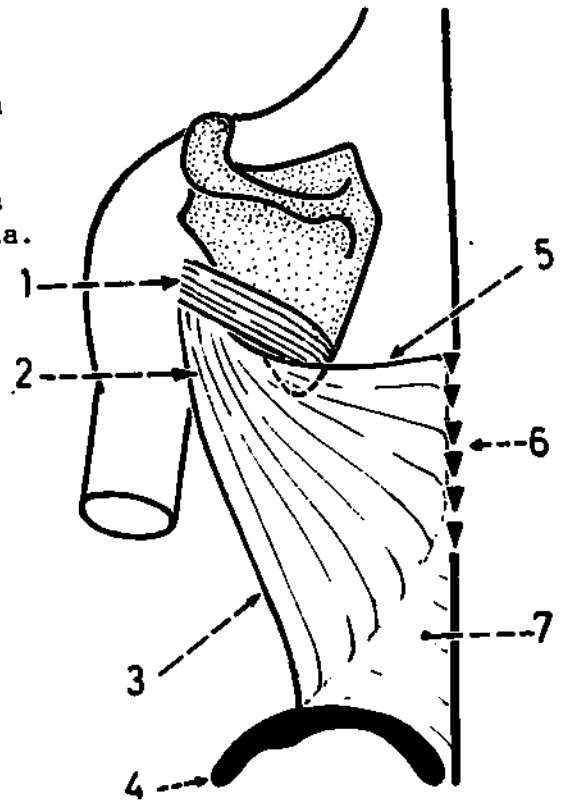


Fig.(146): TRIANGLES RELATED TO THE LATISSIMUS DORSI

The latissimus dorsi is related to 2 triangles: triangle of auscultation above at its upper border, and the lumbar triangle below at its lateral border.

1. teres major.
2. triangle of auscultation (bounded laterally by medial border of scapula, medially by lateral border of trapezius and below by upper border of latissimus dorsi).
3. origin of latissimus dorsi.
4. thoracolumbar fascia.
5. iliac crest.
6. lumbar triangle (bounded laterally by external oblique muscle of abdomen, medially by lateral border of latissimus dorsi and below by the iliac crest).
7. thoracodorsal nerve (on the deep surface of the muscle).

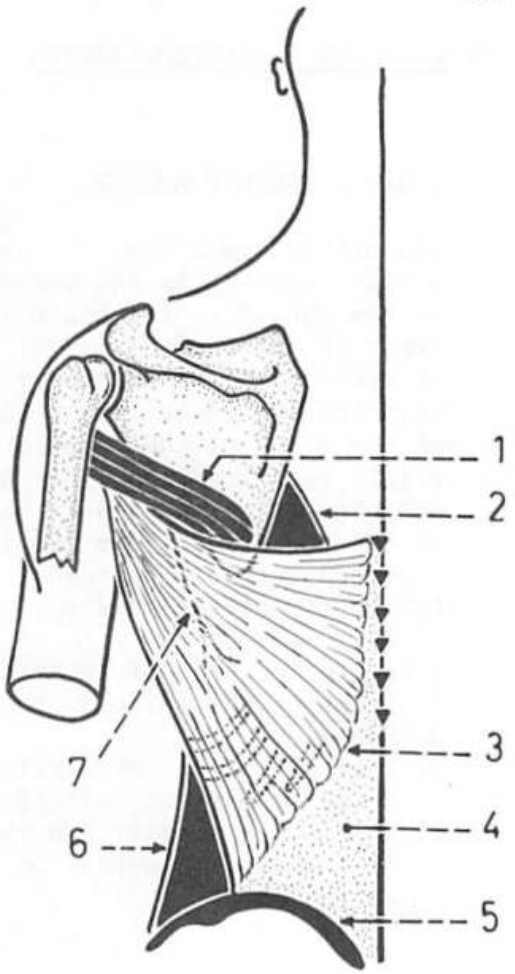
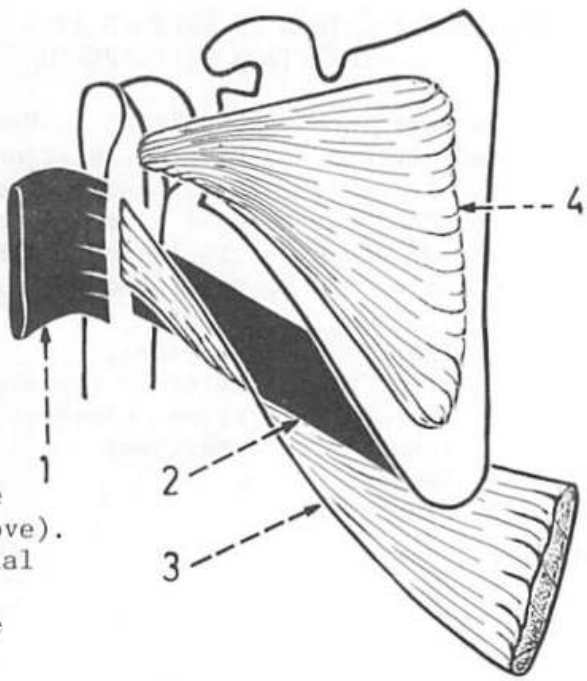


Fig.(147): INSERTION OF LATISSIMUS DORSI

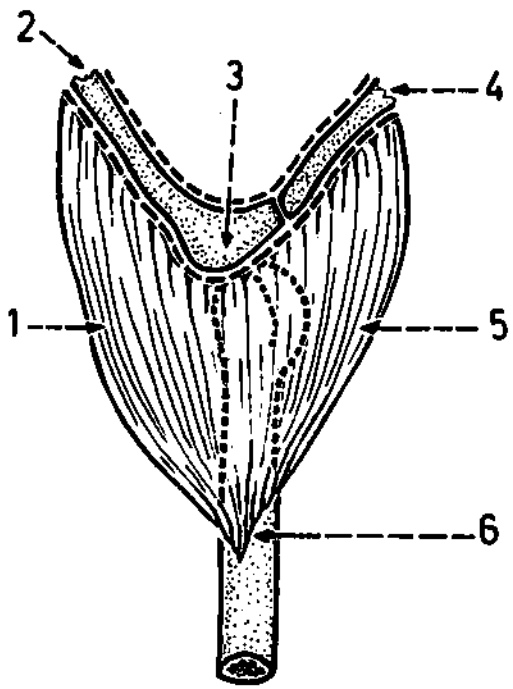
The latissimus dorsi close to its insertion has triple relations to the teres major. At the inferior angle of the scapula it lies behind the teres major, then comes below it then finally in front of it where it is inserted into the floor of the intertubercular groove.

1. pectoralis major (inserted into the lateral lip of intertubercular groove).
2. teres major (inserted into the medial lip of intertubercular groove).
3. latissimus dorsi (inserted into the floor of intertubercular groove).
4. subscapularis.



MUSCLES OF SHOULDER REGION

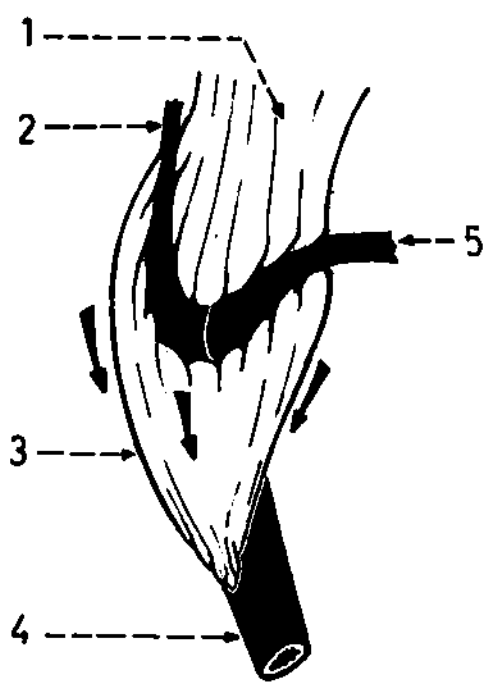
Fig.(148): DELTOID MUSCLE



The deltoid is a thick triangular muscle which forms the rounded contour of the shoulder. It arises from the front of the lateral 1/3 of the clavicle, lateral margin of the acromion and lower lip of the crest of the spine of the scapula (the origin is a V-shaped line which corresponds to the insertion of the trapezius). The muscle is inserted into the deltoid tuberosity of the humerus.

1. posterior part of deltoid.
2. crest of the spine of the scapula.
3. acromion.
4. lateral 1/3 of the clavicle.
5. anterior part of deltoid.
6. deltoid tuberosity (on the middle of the lateral aspect of the shaft of the humerus).

Fig.(149): ORIGIN OF DELTOID AND INSERTION OF TRAPEZIUS



The origin of the deltoid is V-shaped and corresponds to the insertion of the trapezius. The 2 muscles are attached to the same bones: lateral 1/3 of the clavicle, acromion and crest of the spine of the scapula.

1. trapezius (insertion).
2. crest of the spine of the scapula.
3. deltoid (its fibres converge towards its insertion).
4. humerus.
5. clavicle.

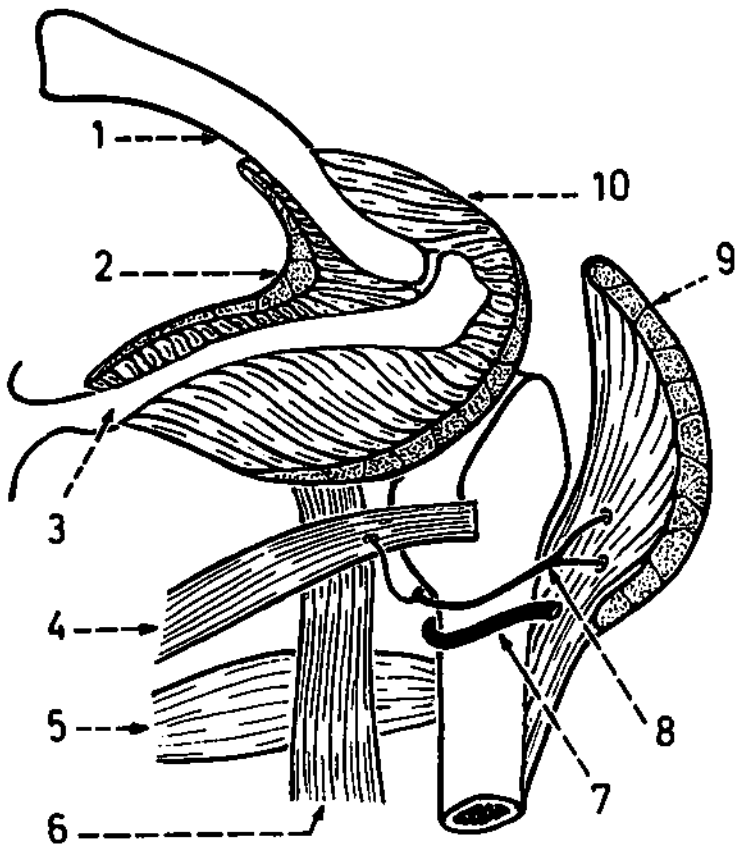


Fig.(150): SOME STRUCTURES DEEP TO THE DELTOID (from behind)

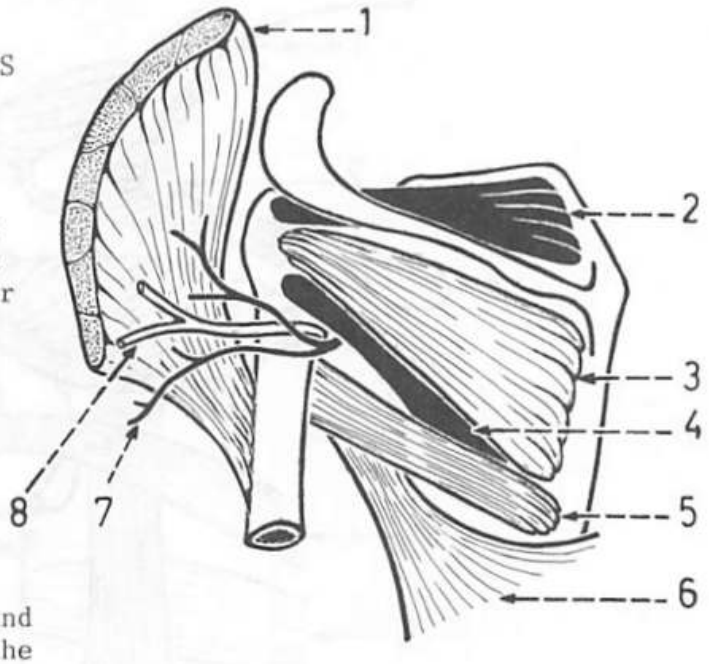
The deltoid has many deep relations: upper end and surgical neck of the humerus, axillary nerve and posterior circumflex humeral artery, and insertions of muscles into the upper end of the humerus.

1. clavicle.
2. insertion of the trapezius.
3. crest of the spine of the scapula.
4. teres minor.
5. teres major.
6. long head of triceps (divides the interval between the 2 teres muscles into a medial triangular space and a lateral quadrangular space).
7. posterior circumflex humeral artery (emerges from the quadrangular space and winds round the back of the surgical neck of the humerus).
8. axillary nerve (accompanies the artery around the surgical neck).
9. deltoid muscle (cut).
10. origin of deltoid muscle.

* The anterior border of the muscle overlies the coracoid process which can be felt by deep pressure 1 inch below the junction of the lateral 1/4 and medial 3/4 of the clavicle.

* The middle part of the deltoid overlies the greater tubercle of the humerus and this is responsible for the rounded contour of the shoulder which is lost if the deltoid is paralysed.

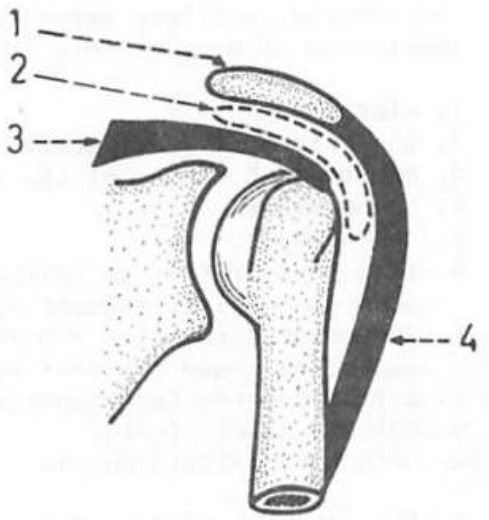
Fig.(151): INSERTIONS OF MUSCLES DEEP TO THE DELTOID (from behind)



These are the insertions of supraspinatus, infraspinatus and teres minor (all of them are inserted into the greater tubercle).

1. deltoid.
2. supraspinatus.
3. infraspinatus.
4. teres minor.
5. teres major.
6. latissimus dorsi.
7. posterior division of axillary nerve (winds round the posterior border of the deltoid to become the upper lateral cutaneous nerve of arm).
8. posterior circumflex humeral artery.

Fig.(152): SUBACROMIAL BURSA



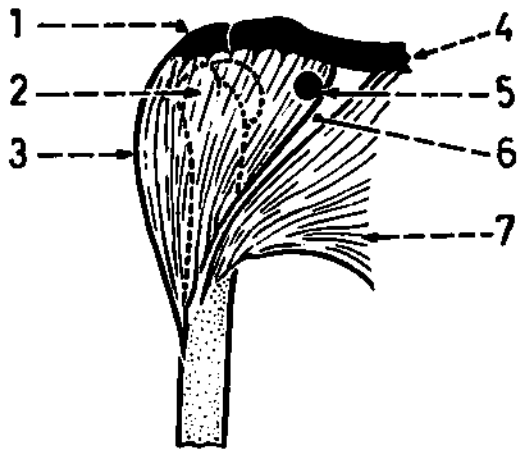
This bursa lies beneath the acromion, between it and the tendon of supraspinatus. It extends deep to the upper part of the deltoid muscle.

1. acromion.
2. subacromial bursa.
3. supraspinatus.
4. deltoid.

* In inflammation of the subacromial bursa, pain is felt at the shoulder joint during early abduction because of the contraction of the supraspinatus muscle.

Fig.(153): ANTERIOR PART OF DELTOID

It is the part which arises from the clavicle and it covers the coracoid process and the lesser tubercle of the humerus. In addition, it lies over the insertion of subscapularis, insertion of pectoralis minor, coracobrachialis and the 2 heads of the biceps. It is separated from the pectoralis major by the deltopectoral groove.



1. acromion.
2. upper end of humerus.
3. rounded contour of the deltoid.
4. clavicle.
5. coracoid process.
6. deltopectoral groove.
7. pectoralis major.

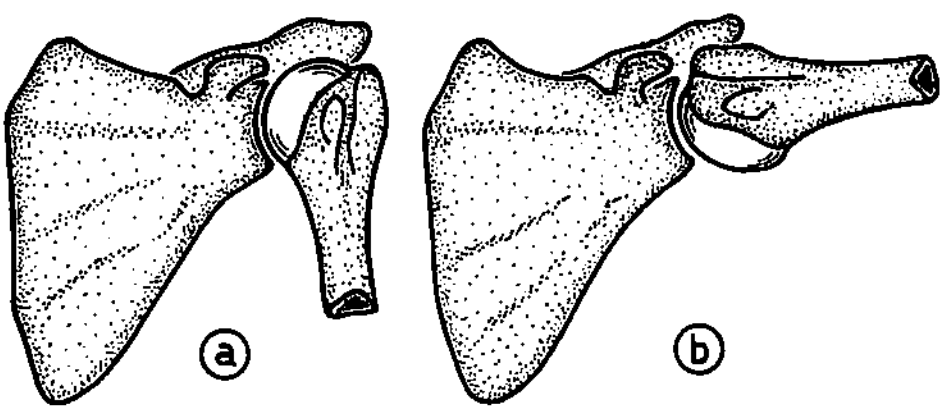


Fig.(154): ABDUCTION AT THE SHOULDER UP TO 90°

The deltoid muscle is responsible for abduction of the shoulder joint from 15° up to 90° (the supraspinatus is responsible for abduction from 0° to 15°).

(a) shoulder joint in the anatomical position (at rest).

(b) shoulder joint abducted to 90°.

Fig.(155): THE 3 MUSCLES INSERTED INTO THE GREATER TUBERCLE

These muscles are the supraspinatus, infraspinatus and teres minor. They are inserted into the greater tubercle very close to the shoulder joint and form with the subscapularis in front what is called " rotator cuff ".

1. supraspinatus.
2. infraspinatus.
3. teres minor.

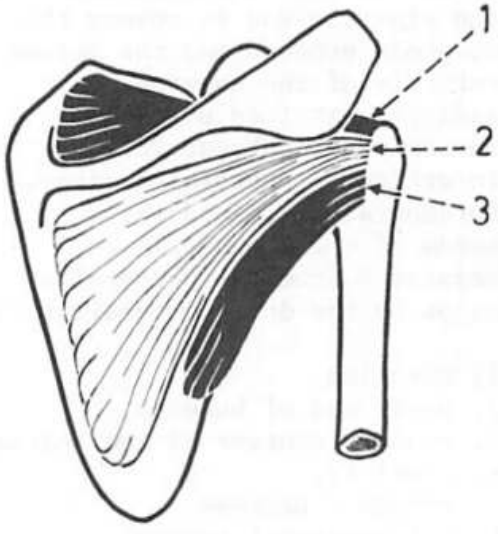


Fig.(156): TERES MINOR AND TERES MAJOR

The 2 muscles arise close together from the back of the lateral border of the scapula but they are inserted far apart, thus are separated from each other by a triangular interval. This interval is divided by the long head of triceps into a medial triangular space and a lateral quadrangular space (see fig.157).

1. teres minor.
2. teres major.

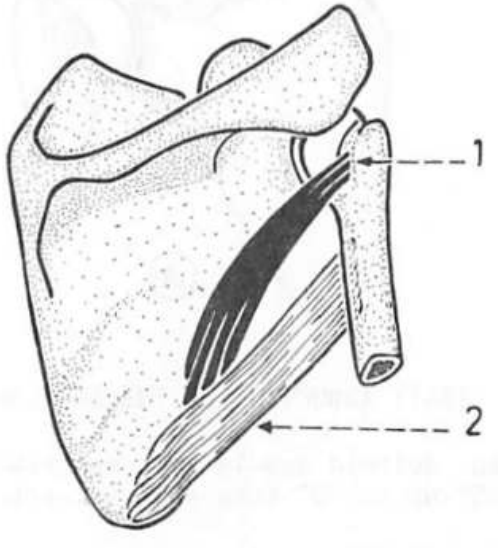
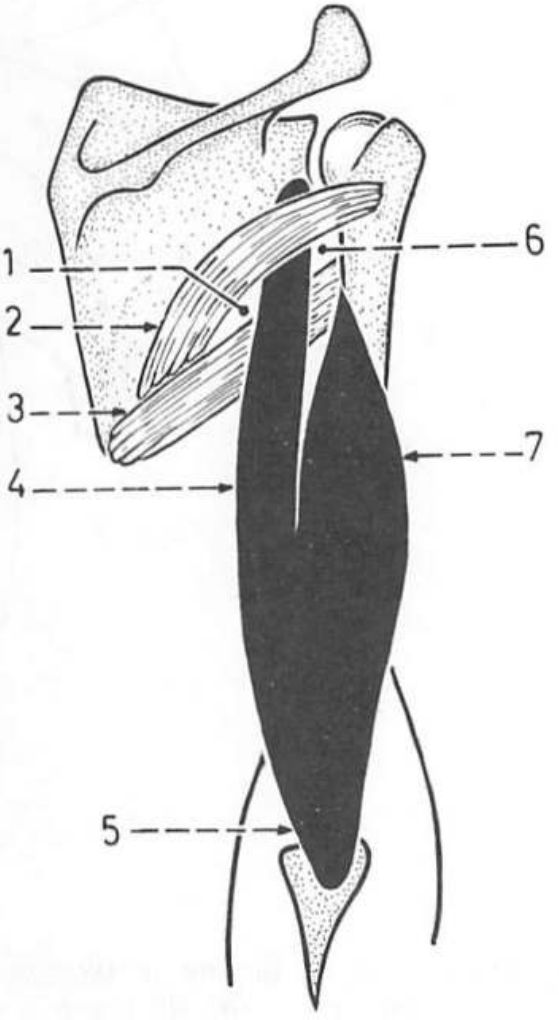


Fig.(157): TRIANGULAR AND QUADRANGULAR SPACES

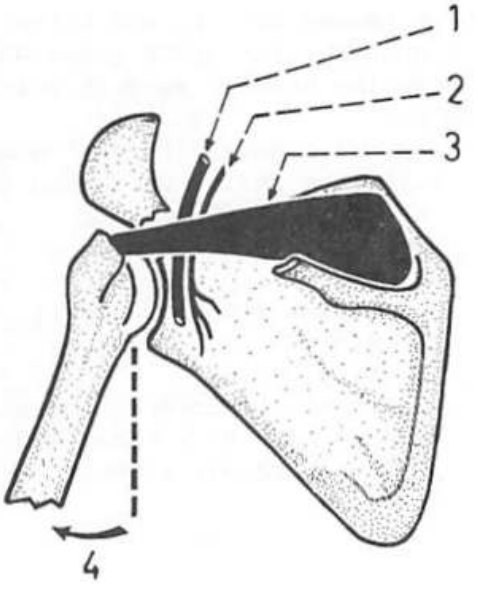


These spaces lie between the teres minor and teres major (as seen from behind) and are separated from each other by the long head of triceps.

1. triangular space (medial to the long head of triceps; bounded by teres minor above, teres major below and long head of triceps laterally).
2. teres minor.
3. teres major.
4. long head of triceps.
5. insertion of triceps.
6. quadrangular space (lateral to the long head of triceps; bounded by teres minor above, teres major below, long head of triceps medially and surgical neck of humerus laterally).
7. lateral head of triceps.

* It should be noted that the subscapularis forms the upper boundary of the 2 spaces from in front, thus replacing the teres minor.

Fig.(158): SUPRASPINATUS MUSCLE



It fills the supraspinous fossa overlying the suprascapular nerve and vessels. It abducts the shoulder from 0° to 15°.

1. suprascapular artery.
2. suprascapular nerve.
3. supraspinatus (the spine of scapula is removed).
4. early abduction of shoulder joint (from 0° to 15°).

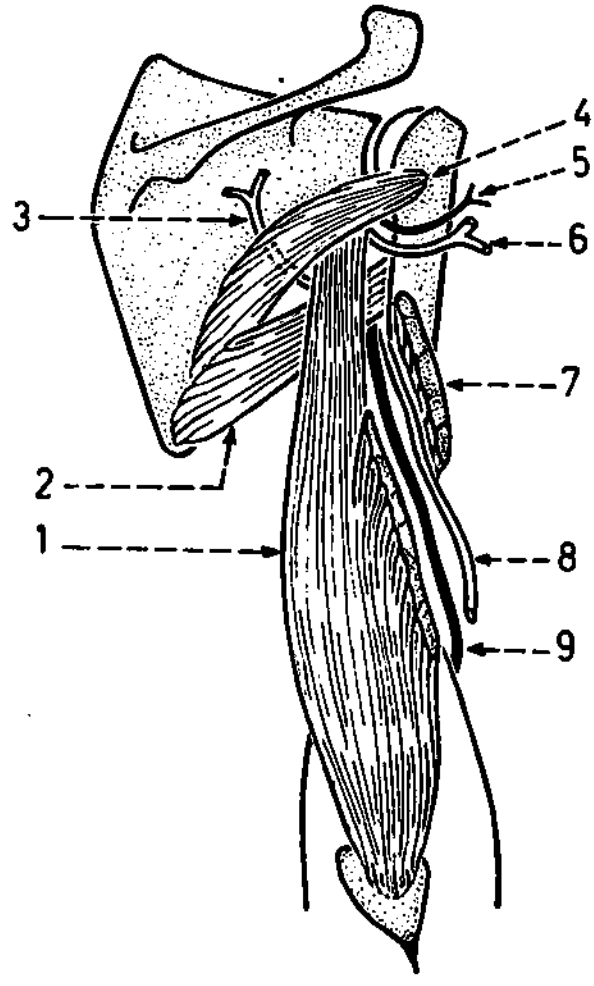


Fig.(159): CONTENTS OF THE TRIANGULAR AND QUADRANGULAR SPACES AND THE SPIRAL GROOVE (seen from behind)

The triangular space contains only the circumflex scapular artery which passes deep to the teres minor to enter the infraspinous fossa.
The quadrangular space contains the axillary nerve and posterior circumflex humeral vessels which wind round the surgical neck of the humerus
The spiral groove lies on the middle of the back of the humerus and contains the radial nerve and profunda brachii vessels.

1. long head of triceps.
2. teres major.
3. circumflex scapular artery.
4. teres minor.
5. axillary nerve.
6. posterior circumflex humeral artery.
7. lateral head of triceps (cut to expose the spiral groove).
8. profunda brachii artery.
9. radial nerve.

Fig.(160): SUBSCAPULARIS MUSCLE

It fills the subscapular fossa on the front of the scapula, and forms part of the posterior wall of the axilla. It is inserted into the lesser tubercle of the humerus and is regarded as a muscle of the rotator cuff.

1. subscapular bursa (between the muscle and the neck of the scapula and communicates with the cavity of the shoulder joint).
2. subscapularis muscle.

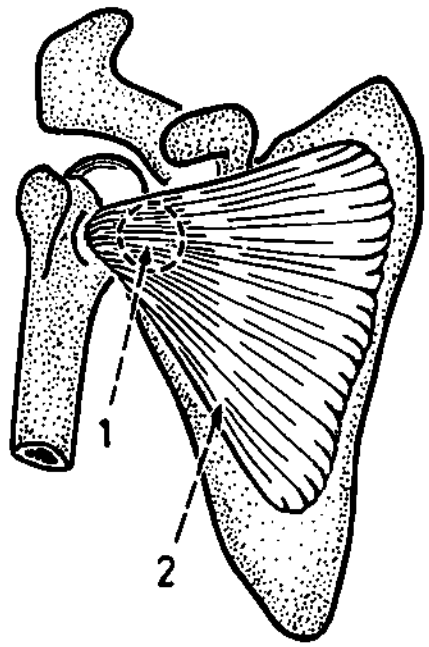
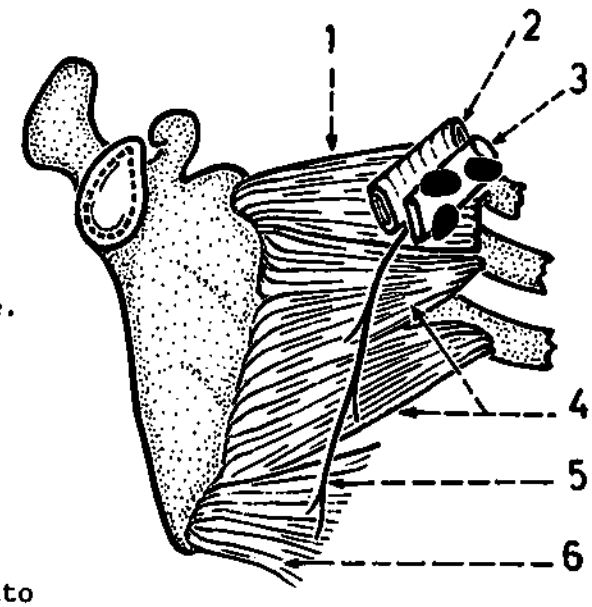


Fig.(161): SERRATUS ANTERIOR MUSCLE

It is a large muscle which covers the upper part of the side of the chest, forming part of the medial wall of the axilla. It arises by 8 digitations from the upper 8 ribs and is inserted into the whole medial border of the scapula. Its nerve descends vertically on its surface in the midaxillary line.

1. 1st digitation (from the 1st and 2nd ribs to superior angle of scapula).
2. 1st part of axillary artery.
3. axillary vein and apical nodes.
4. 2nd and 3rd digitations.
5. long thoracic nerve (C.5,6,7).
6. lower 5 digitations (inserted into inferior angle of scapula).



* See also fig.(108) on the serratus anterior.

Fig.(162): OMOHYOID MUSCLE

The omohyoid has superior belly and inferior belly connected together by intermediate tendon. The superior belly is attached to the hyoid bone while the inferior belly is attached to the superior border of the scapula close to the suprascapular notch (omos = shoulder).

1. superior belly of omohyoid.
2. intermediate tendon.
3. inferior belly of omohyoid.
4. suprascapular artery.
5. suprascapular nerve.

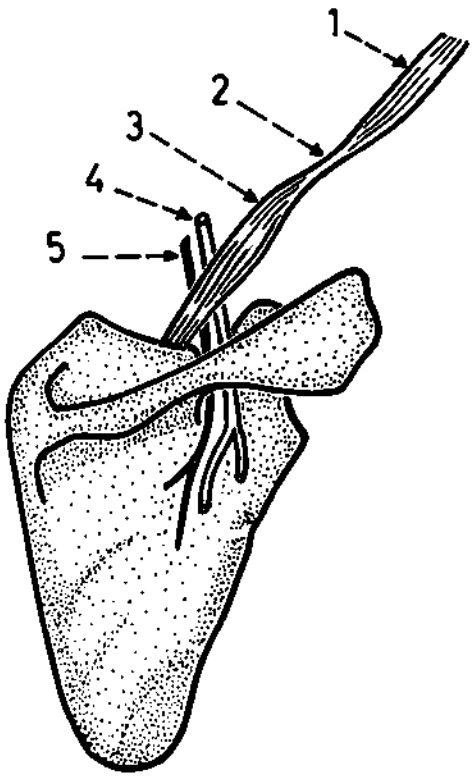
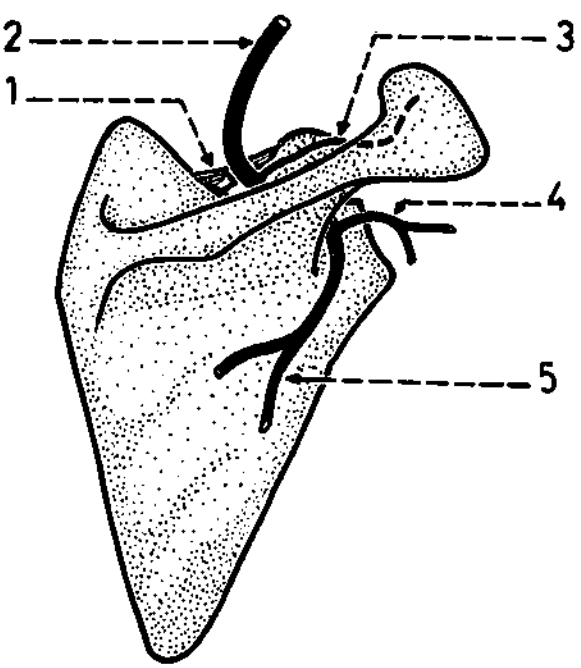


Fig.(163): SUPRASCAPULAR ARTERY

It arises in the neck from the thyrocervical trunk which is a branch of the 1st part of the subclavian artery. It passes above the suprascapular ligament to enter the supraspinous fossa and then continues through the spinoglenoid notch to reach the infraspinous fossa.

1. suprascapular ligament.
2. suprascapular artery.
3. articular branch to the acromioclavicular joint.
4. articular branch to the shoulder joint.
5. termination of the artery.

* The suprascapular artery supplies nutrient branches to the clavicle and scapula.



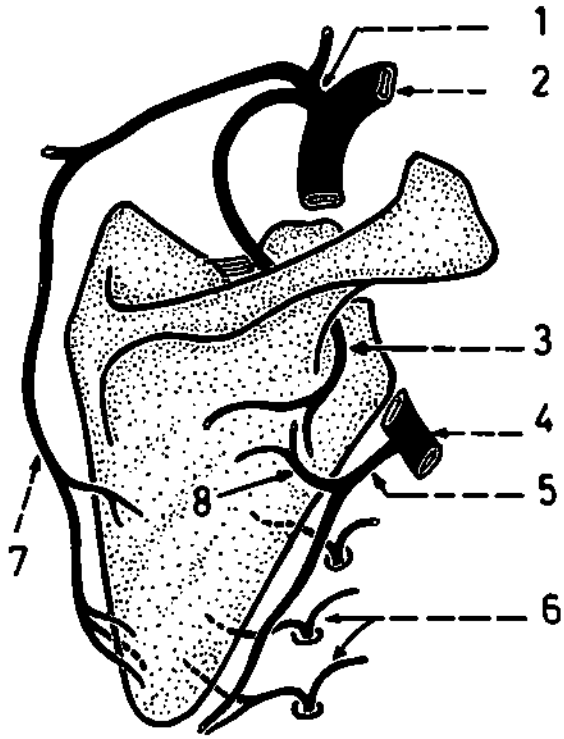


Fig.(164) ANASTOMOSIS AROUND THE SCAPULA

It is a very rich anastomosis and of surgical importance as it forms a link between the 1st part of subclavian artery and the 3rd part of axillary artery. The arteries sharing in the anastomosis are: supra-scapular artery (from thyrocervical trunk, from 1st part of subclavian), deep branch of transverse cervical artery (from thyrocervical trunk, from 1st part of subclavian), circumflex scapular artery (from subscapular artery, from 3rd part of axillary artery), and lateral branches of the posterior intercostal arteries (from descending thoracic aorta).

1. thyrocervical trunk.
2. 1st part of subclavian artery.
3. suprascapular artery (crosses the superior border of the scapula).
4. 3rd part of axillary artery.
5. subscapular artery (runs along the lateral border of the scapula).
6. lateral branches of posterior intercostal arteries (emerging on the side of the chest).
7. deep branch of transverse cervical artery (along the medial border of the scapula).
8. circumflex scapular artery (crosses the lateral border of the scapula).

* Note that the deep branch of transverse cervical artery may also be termed dorsal scapular artery.

A R M

MUSCLES OF THE ARM

Fig.(165): COMPARTMENTS OF THE ARM (T.S.)

The arm is divided into anterior and posterior compartments by the humerus and 2 intermuscular septa (lateral and medial).

1. anterior compartment.
2. medial intermuscular septum (attached to the medial epicondyle, medial supracondylar ridge and lower part of the medial lip of intertubercular groove).
3. posterior compartment.
4. humerus (T.S.).
5. lateral intermuscular septum (attached to the lateral epicondyle, lateral supracondylar ridge and lower part of the lateral lip of intertubercular groove).

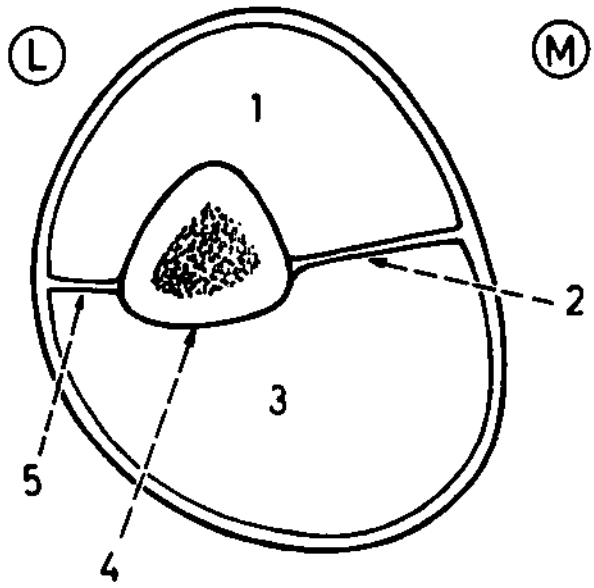
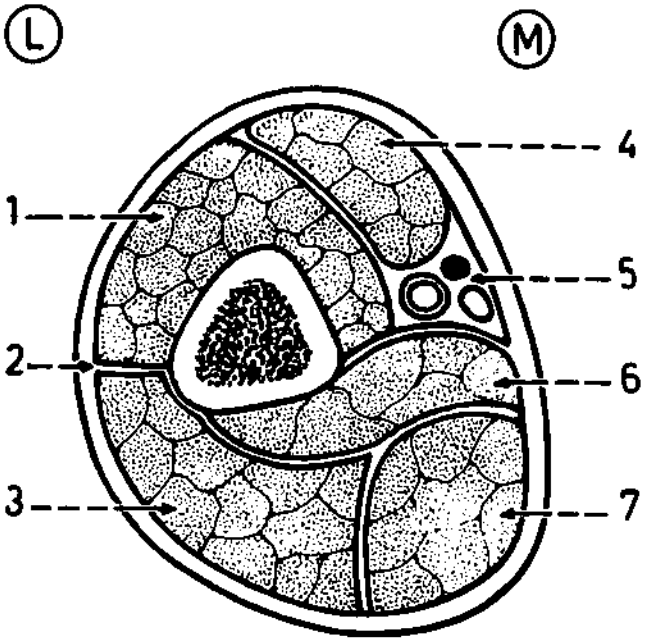


Fig.(166): TRANSVERSE SECTION IN RIGHT ARM (just below insertion of coracobrachialis)

This section shows the brachialis and biceps muscles in the anterior compartment and the 3 heads of triceps in the posterior compartment. The brachial vessels and median nerve lie in the anterior compartment on the medial side of brachialis.

1. brachialis.
2. lateral intermuscular septum.
3. lateral head of triceps.
4. biceps brachii.
5. brachial vessels and median nerve.
6. medial head of triceps.
7. long head of triceps.



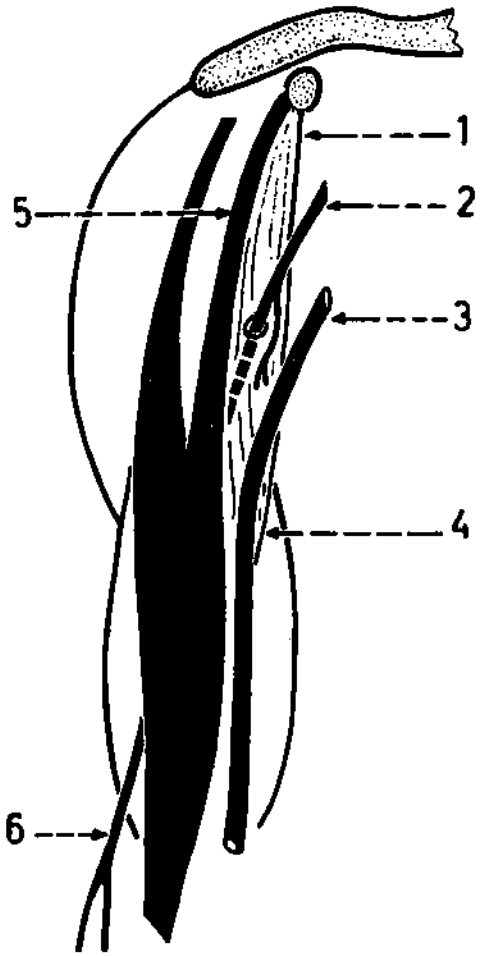


Fig.(167): CORACOBRACHIALIS MUSCLE

It arises from the tip of coracoid process in common with the short head of biceps, and is inserted into the middle of the medial border of the humerus.

1. origin (from coracoid process).
2. musculocutaneous (pierces the muscle after giving off its nerve supply).
3. brachial artery.
4. insertion of coracobrachialis muscle.
5. short head of biceps (fused with the coracobrachialis).
6. lateral cutaneous nerve of forearm (continuation of musculocutaneous nerve).

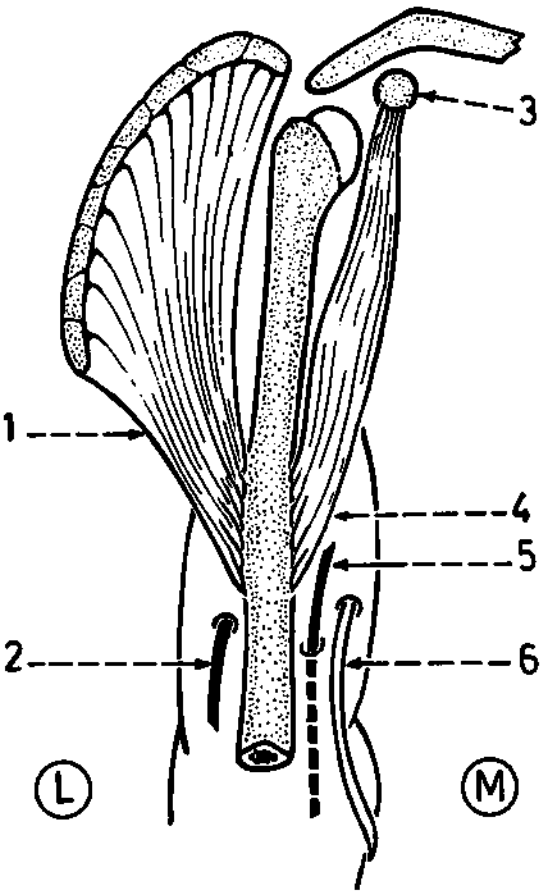


Fig.(168): STRUCTURES AT THE INSERTION OF CORACOBRACHIALIS

These are: insertion of deltoid, the basilic vein pierces the deep fascia, the ulnar nerve pierces the medial septum, the radial nerve pierces the lateral septum, the median nerve crosses the brachial artery from lateral to medial and the nutrient artery enters the humerus.

1. insertion of deltoid.
2. radial nerve (enters the anterior compartment).
3. coracoid process.
4. insertion of coracobrachialis (opposite that of the deltoid).
5. ulnar nerve (enters the posterior compartment).
6. basilic vein (pierces the deep fascia).

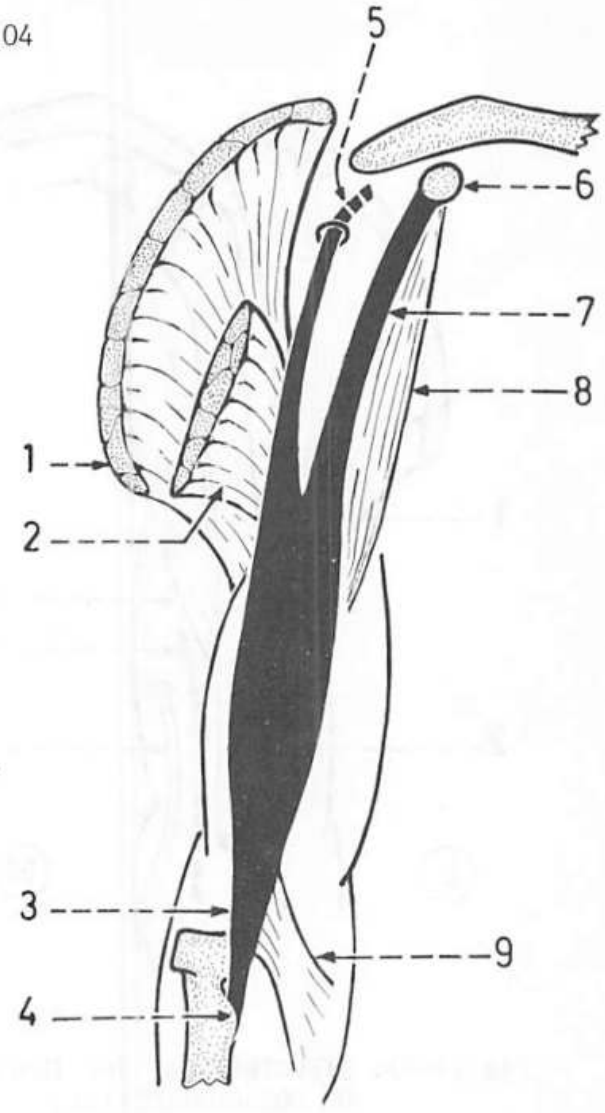


Fig.(169): BICEPS BRACHII MUSCLE

It arises by 2 heads (long and short) and is inserted by a tendon and an aponeurosis.

1. deltoid.
2. insertion of pectoralis major.
3. tendon of insertion of biceps (into radial tuberosity).
4. radial tuberosity.
5. long head of biceps (from supraglenoid tubercle).
6. coracoid process.
7. short head of biceps (from coracoid process).
8. coracobrachialis (fused with the short head of biceps).
9. bicipital aponeurosis (inserted into the deep fascia of forearm).

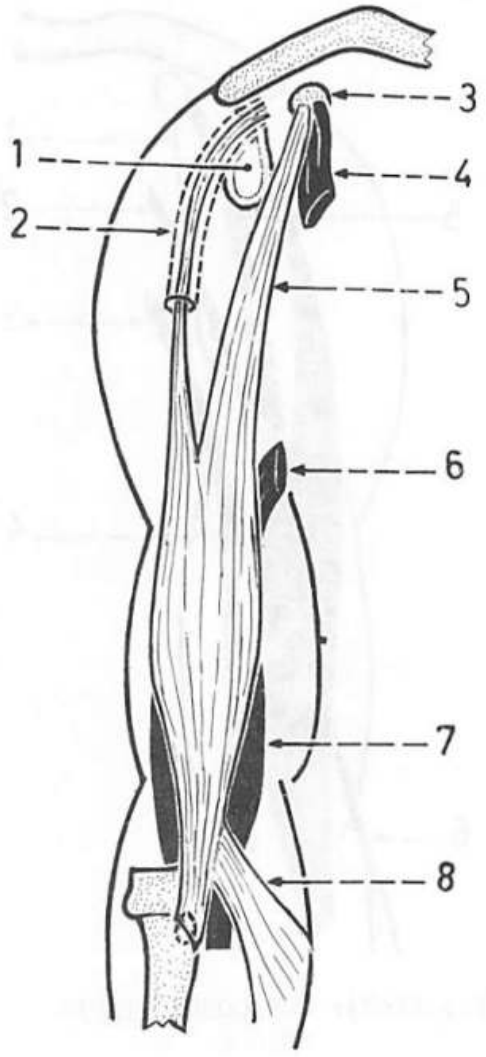


Fig.(170): RELATIONS OF BICEPS BRACHII

The muscle lies in front of the brachialis. Its long head lies in the intertubercular groove and within the cavity of the shoulder joint.

1. glenoid cavity.
2. tendon of long head (ensheathed by synovial membrane).
3. coracoid process.
4. origin of coracobrachialis.
5. short head of biceps.
6. insertion of coracobrachialis.
7. brachialis.
8. bicipital aponeurosis.

* The musculocutaneous nerve lies between the biceps and brachialis.

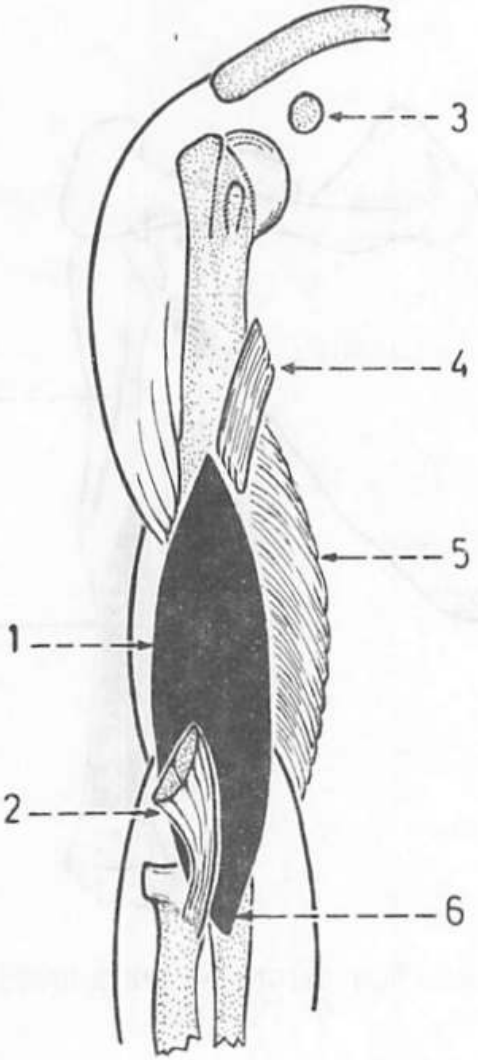


Fig.(171): BRACHIALIS MUSCLE

It arises from the front of the lower 1/2 of the humerus, and is inserted into the ulnar tuberosity and front of coronoid process.

1. brachialis.
2. biceps brachii (cut).
3. coracoid process.
4. insertion of coracobrachialis.
5. medial head of triceps.
6. insertion of brachialis (into ulnar tuberosity and front of coronoid process).

* Note that the brachialis is inserted into the ulna, while the biceps is inserted into the radius. Both of these muscles are flexors of the elbow.

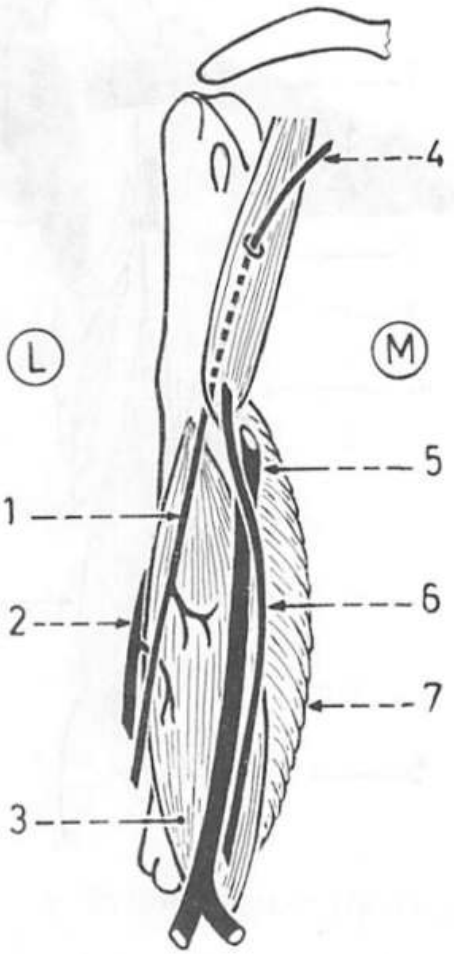


Fig.(172): RELATIONS OF BRACHIALIS

The muscle is related laterally to the radial nerve and profunda artery, and anteriorly to the musculocutaneous nerve, median nerve and the brachial artery.

1. musculocutaneous nerve (in front).
2. radial nerve (lateral).
3. brachialis.
4. musculocutaneous nerve piercing coracobrachialis.
5. brachial artery (in front).
6. median nerve (in front).
7. medial head of triceps.

* The median nerve crosses the brachial artery from lateral to medial at the insertion of coracobrachialis.

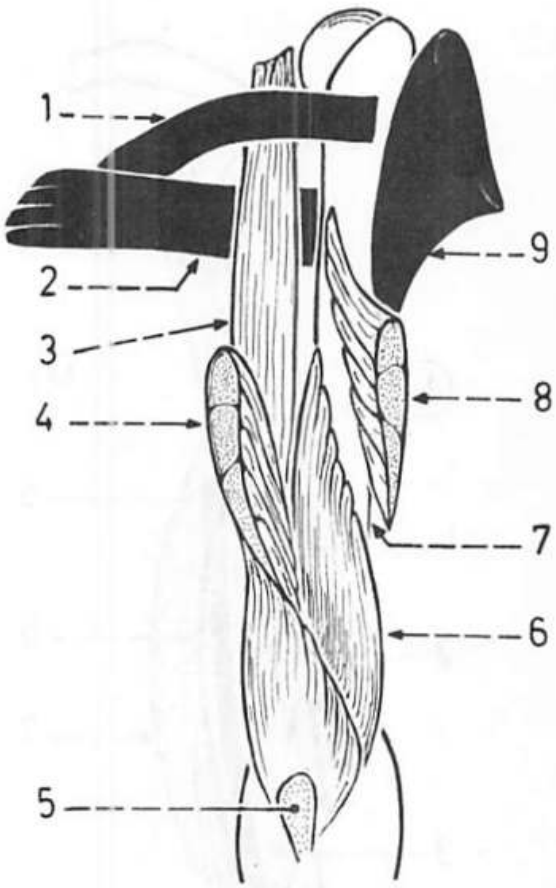


Fig.(173): TRICEPS MUSCLE

It lies on the back of the arm and arises by 3 heads (long, lateral and medial) and is inserted into the olecranon process of the ulna. The medial head is deep to both the long and lateral heads.

1. teres minor.
2. teres major.
3. long head of triceps (arises from the infraglenoid tubercle).
4. lateral head of triceps (cut).
5. olecranon process of ulna.
6. medial head of triceps (below and medial to the spiral groove).
7. spiral groove.
8. origin of lateral head of triceps (above and lateral to the spiral groove).
9. insertion of deltoid.

* The lateral head of triceps forms the roof of the spiral groove.

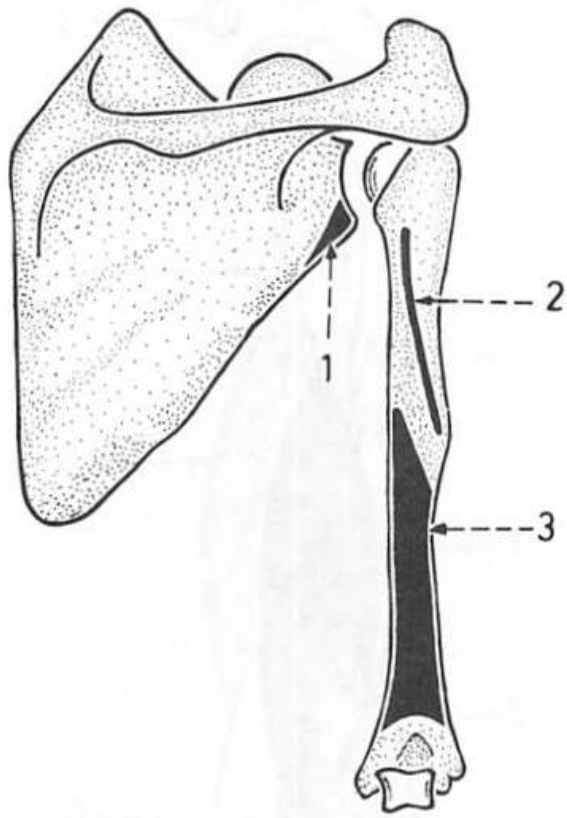


Fig.(174): ORIGIN OF THE 3 HEADS OF TRICEPS

1. origin of the long head of triceps from the infraglenoid tubercle.
2. origin of the lateral head of triceps from the upper lip of the spiral groove situated on the back of the upper 1/2 of the humerus.
3. origin of medial head from the back of the lower 1/2 of the humerus just below the spiral groove (this origin corresponds to the origin of the brachialis from the front of the lower 1/2 of the humerus.

* The lateral and medial heads are so called from their relation to the spiral groove, while the long head is the longest.

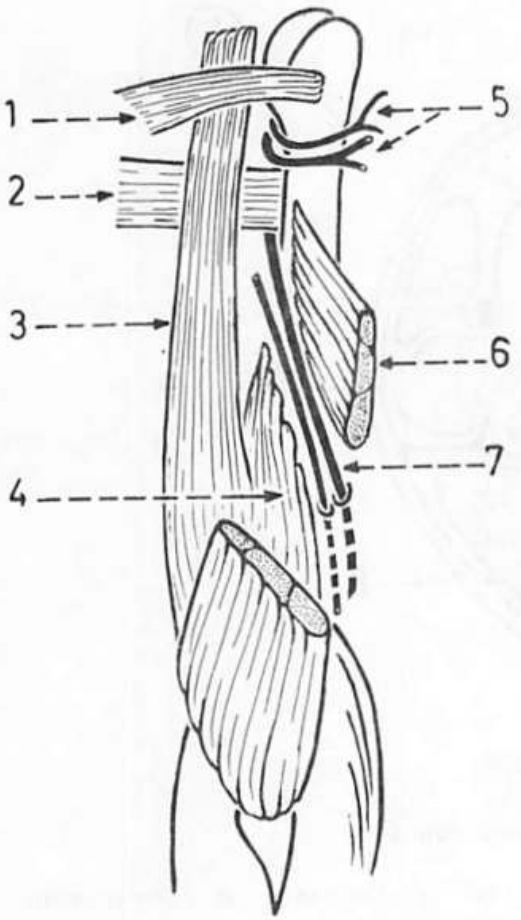


Fig.(175): NERVES AND VESSELS RELATED TO THE HEADS OF TRICEPS

The heads of the triceps are related to the radial and axillary nerves and their accompanying vessels.

1. teres minor.
2. teres major.
3. long head of triceps.
4. medial head of triceps (below the radial nerve and profunda brachii artery).
5. axillary nerve and posterior circumflex humeral artery (pass in the quadrangular space lateral to the long head).
6. lateral head (overlies the radial nerve and profunda artery).
7. radial nerve and profunda artery.

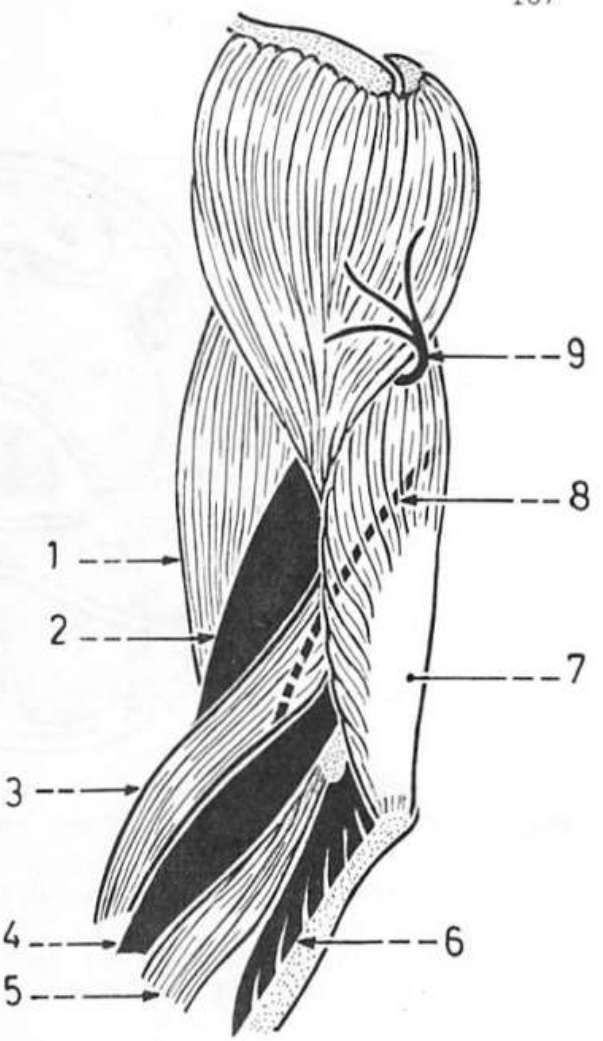


Fig.(176): LATERAL ASPECT OF LEFT ARM

1. biceps.
2. lateral margin of brachialis.
3. brachioradialis.
4. extensor carpi radialis longus.
5. extensor carpi radialis brevis.
6. anconeus (inserted into the upper 1/4 of the back of the ulna).
7. triceps.
8. line of the radial nerve on the back and lateral side of the arm (lst,it is deep to the lateral head of triceps, then comes on the lateral side of the brachialis).
9. upper lateral cutaneous nerve of arm (emerges round the posterior border of deltoid).

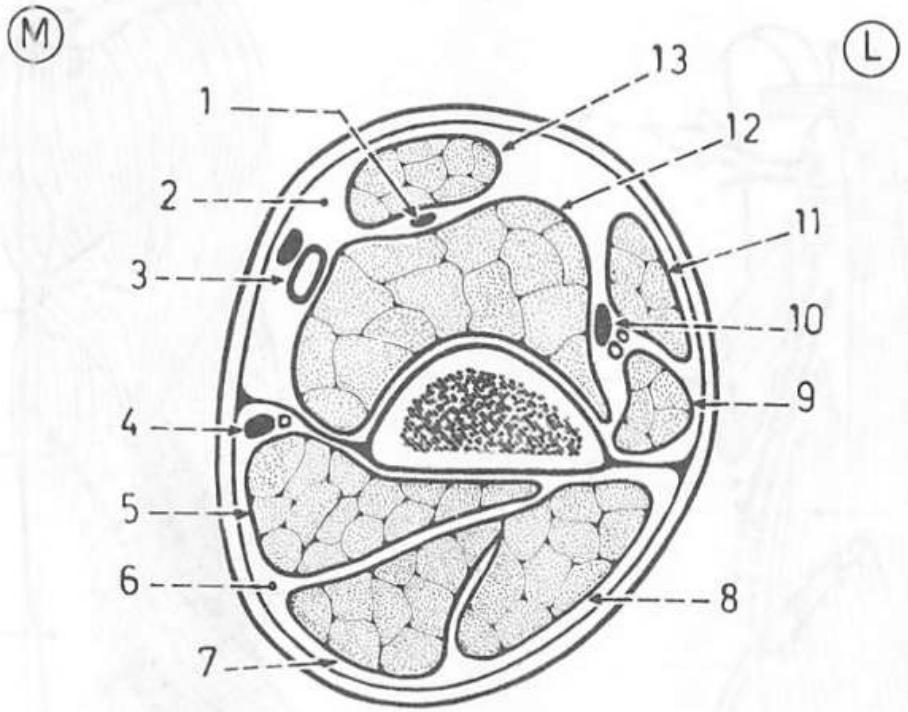


Fig.(177): T.S. IN THE LOWER PART OF LEFT ARM
(to show the relations of the main nerves and vessels to neighbouring muscles)

* The median nerve and brachial artery lie in the anterior compartment in front of the medial part of the brachialis.

* The musculocutaneous nerve lies in the anterior compartment between the biceps and brachialis.

* The radial nerve and profunda artery lie in the anterior compartment (after piercing the lateral intermuscular septum), on the lateral side of the brachialis.

* The ulnar nerve and superior ulnar collateral artery lie in the posterior compartment (after piercing the medial intermuscular septum), anterior to the medial head of triceps.

1. musculocutaneous nerve (between biceps and brachialis).
2. anterior compartment of arm.
3. median nerve and brachial artery (in front of medial part of brachialis).
4. ulnar nerve and superior ulnar collateral artery (in front of medial head of triceps).
5. medial head of triceps.
6. posterior compartment of arm.
7. long head of triceps.
8. lateral head of triceps.
9. extensor carpi radialis longus.
10. radial nerve and profunda artery (lateral to brachialis).
11. brachioradialis.
12. brachialis.
13. biceps.

BRACHIAL ARTERY

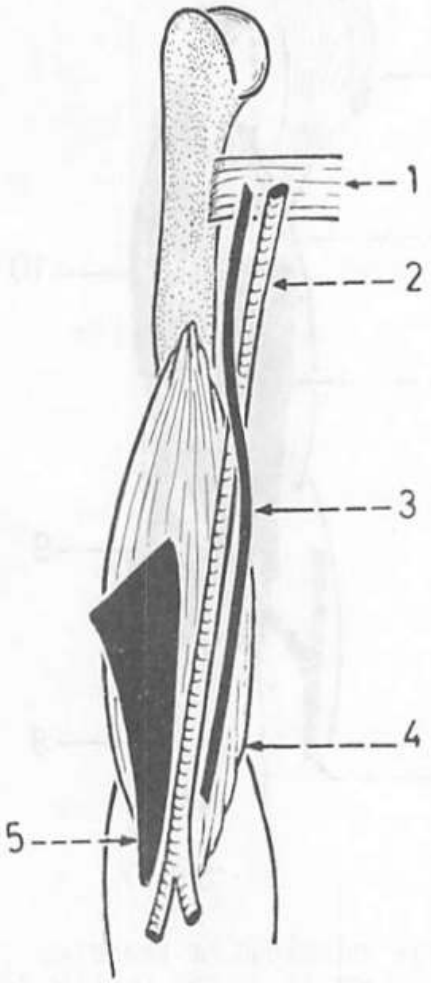


Fig.(178): COURSE OF BRACHIAL ARTERY

It begins at the lower border of teres major and courses on the medial side of the arm to end at the neck of the radius by dividing into radial and ulnar arteries.

1. teres major.
2. brachial artery.
3. median nerve.
4. brachialis (behind the artery).
5. tendon of biceps lateral to the end of the artery.

* The pulsations of the artery can be felt all through its course in the arm.

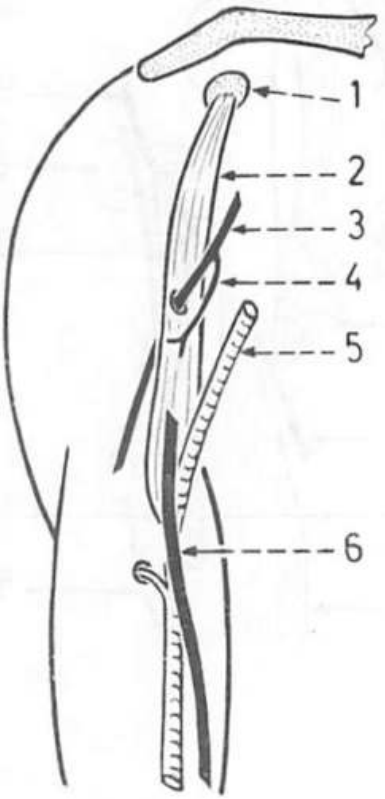


Fig.(179): RELATION OF BRACHIAL ARTERY TO THE MEDIAN NERVE

The median nerve is at lst lateral to the artery and crosses in front of it at the insertion of coracobrachialis to come medial to it.

1. coracoid process.
2. coracobrachialis.
3. musculocutaneous nerve.
4. nerve supply of coracobrachialis.
5. brachial artery.
6. median nerve crossing over the artery from lateral to medial. The nerve remains medial to the artery till the cubital fossa.

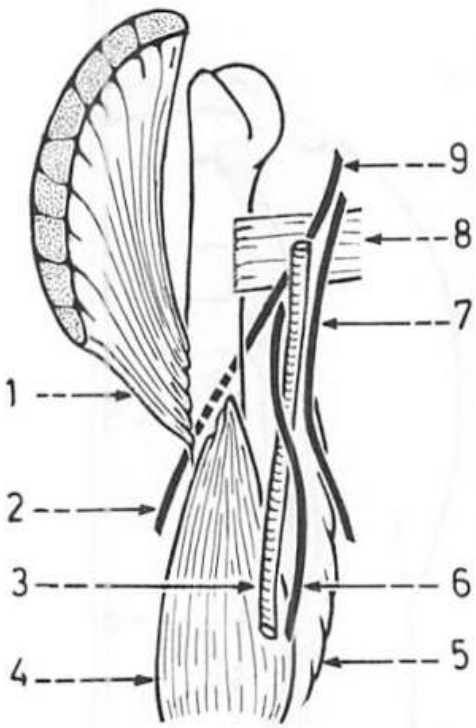


Fig.(180): NERVES RELATED TO THE BRACHIAL ARTERY

The upper part of the brachial artery is related to the radial nerve (posterior), median nerve (lateral) and ulnar nerve (medial). The lower part of the artery is only related to the median nerve.

1. deltoid.
2. radial nerve.
3. brachial artery.
4. brachialis.
5. medial head of triceps.
6. median nerve (medial to the lower part of the artery).
7. ulnar nerve.
8. teres major.
9. radial nerve in the axilla.

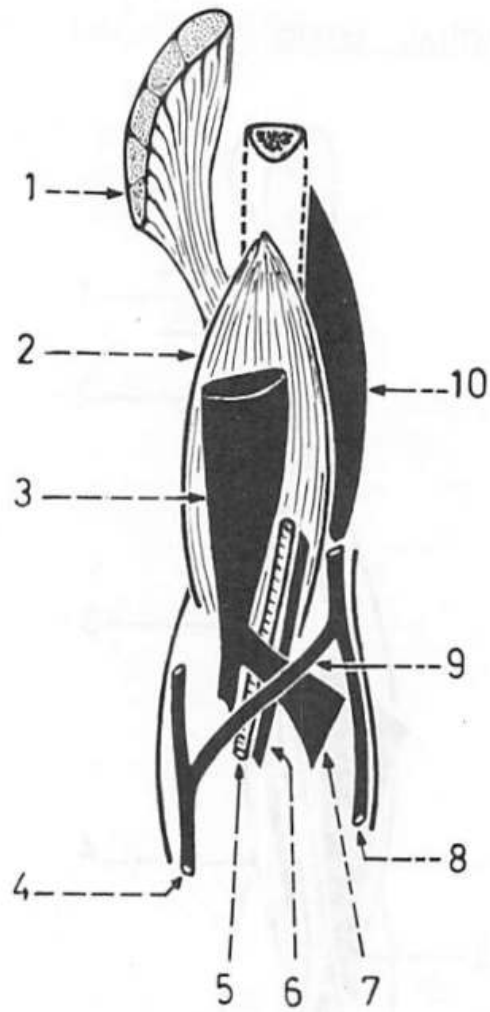


Fig.(181): RELATIONS OF BRACHIAL ARTERY IN THE CUBITAL FOSSA

The artery is related laterally to the tendon of biceps and medially to the median nerve. It is covered by the bicipital aponeurosis which separates it from the median cubital vein.

1. deltoid.
2. brachialis.
3. biceps brachii.
4. cephalic vein.
5. brachial artery.
6. median nerve.
7. bicipital aponeurosis.
8. basilic vein.
9. median cubital vein.
10. medial head of triceps.

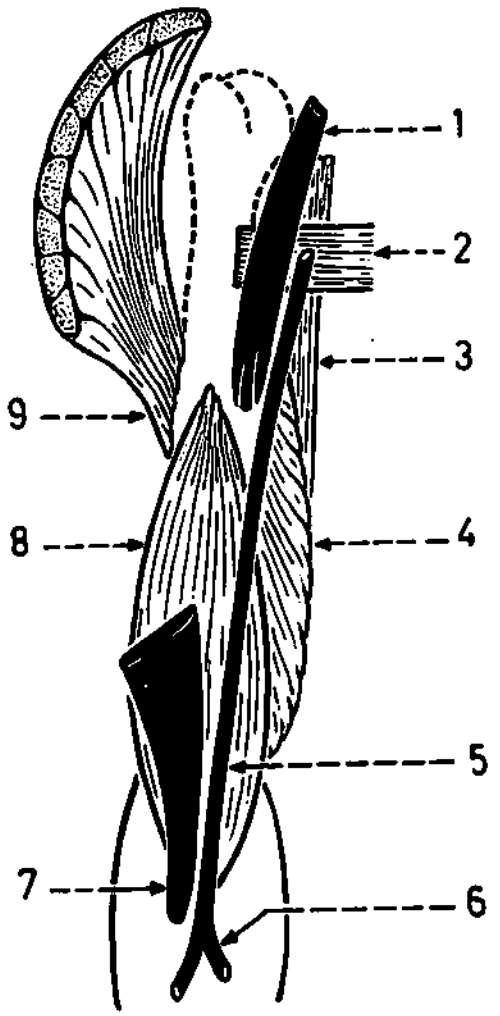


Fig.(182): MUSCLES RELATED TO BRACHIAL ARTERY

Laterally,the artery is related to the coracobrachialis above and the biceps below. Posteriorly, it is related to long head of triceps, medial head of triceps and brachialis (from above downwards).

1. coracobrachialis.
2. teres major.
3. long head of triceps.
4. medial head of triceps (seen from the front on the medial side of arm).
5. brachial artery.
6. terminal divisions of brachial artery.
7. tendon of biceps.
8. brachialis.
9. deltoid.

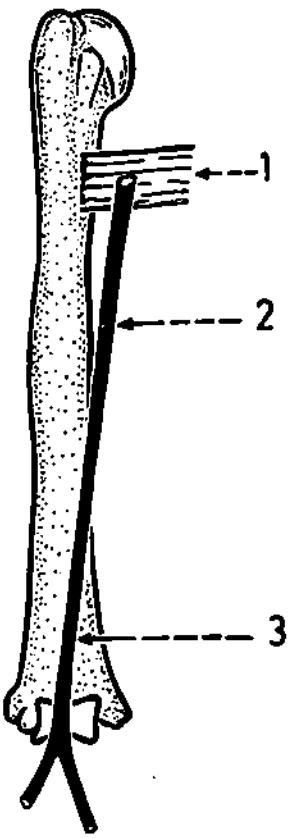


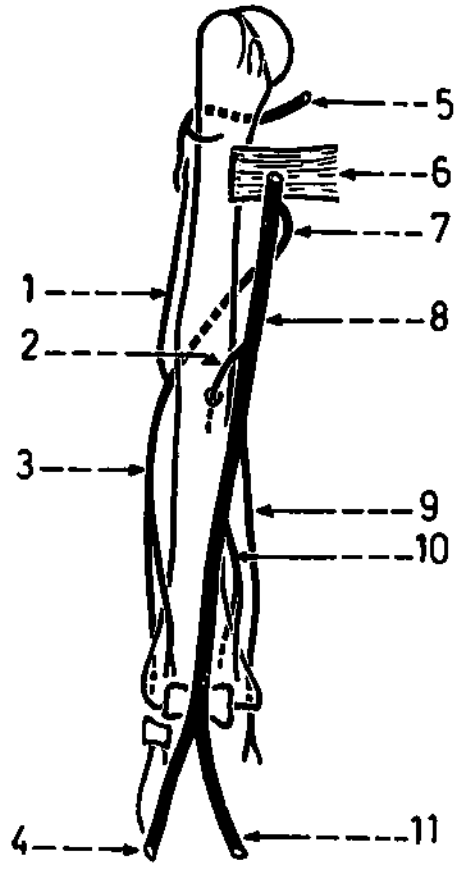
Fig.(183): RELATION OF THE BRACHIAL ARTERY TO THE HUMERUS

The artery is medial to the humerus above, but comes in front of it below. This is of clinical importance, to know the direction of compressing the artery against the bone to stop bleeding from the artery lower down. The artery is not in direct contact with the bone but is separated from it by muscles (mainly by the brachialis below).

1. teres major.
2. upper part of brachial artery (medial to the humerus).
3. lower part of brachial artery (in front of the humerus).

Fig.(184): BRANCHES OF BRACHIAL ARTERY

The brachial artery gives off: profunda brachii, nutrient, superior ulnar collateral and inferior ulnar collateral arteries in addition to its 2 terminal branches (radial and ulnar). With the exception of the nutrient artery which enters the humerus, each of the branches is accompanied by a nerve as follows: the profunda with the radial nerve, the 2 ulnar collaterals with the ulnar nerve and the 2 terminal divisions with the radial and ulnar nerves in the forearm.



1. ascending branch of profunda artery (anastomoses with the posterior circumflex humeral artery at the surgical neck of humerus).
2. nutrient artery (arises at the middle of the arm and enters the humerus at the insertion of the coracobrachialis.
3. descending branches (one anterior and one posterior to the lateral epicondyle).
4. radial artery.
5. posterior circumflex humeral artery.
6. teres major.
7. profunda brachii artery (the highest branch; enters the spiral groove with the radial nerve and divides on the lateral side of the arm into one ascending and 2 descending branches).
8. brachial artery.
9. superior ulnar collateral artery (arises shortly below the middle of the arm and accompanies the ulnar nerve to the back of the medial epicondyle).
10. inferior ulnar collateral artery (arises 5 cm above the elbow joint and also accompanies the ulnar nerve).
11. ulnar artery.

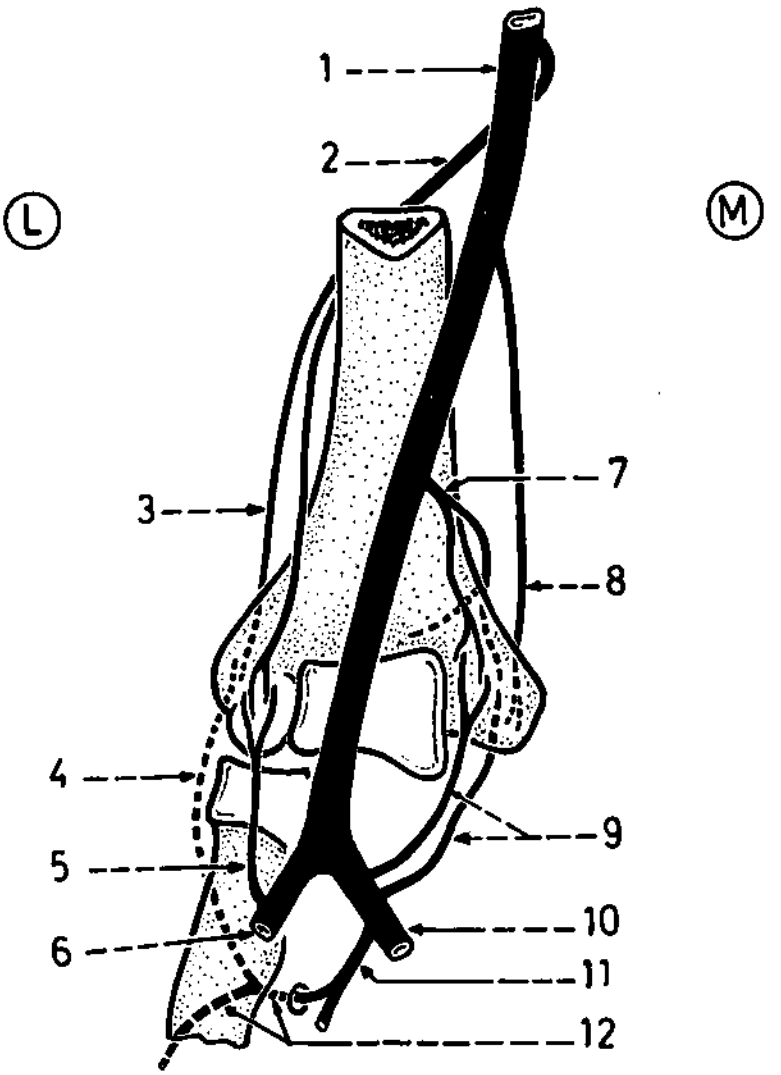


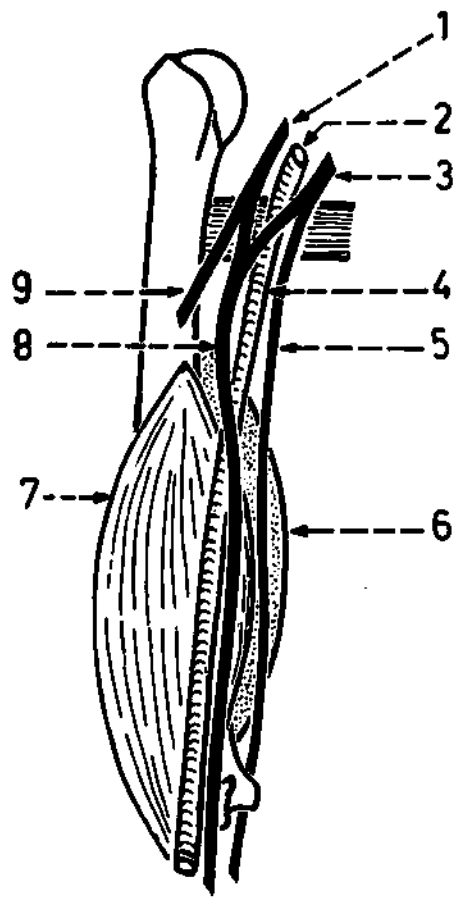
Fig.(185): ANASTOMOSIS AROUND THE ELBOW JOINT

It is the anastomosis between the brachial artery above the elbow joint, and both the radial and ulnar arteries just below the joint. From above the arteries are: superior and inferior ulnar collaterals (on medial side), and the 2 descending branches of the profunda (on lateral side). From below the arteries are: anterior and posterior ulnar recurrents of the ulnar artery (on medial side), and the radial recurrent branch of radial artery and the interosseous recurrent branch of the posterior interosseous artery (on lateral side).

1. brachial artery.
2. profunda artery.
3. descending branches of profunda.
4. interosseous recurrent artery.
5. radial recurrent artery.
6. radial artery.
7. inferior ulnar collateral artery.
8. superior ulnar collateral artery.
9. ulnar recurrent arteries.
10. ulnar artery.
11. common interosseous artery.
12. posterior interosseous artery.

NERVES OF THE ARM

Fig.(186): MEDIAN AND ULNAR NERVES IN THE ARM



The median nerve arises in the axilla by medial and lateral roots. It descends on the lateral side of the upper part of the brachial artery, crosses in front of it at the insertion of the coraco-brachialis and continues down-wards on the medial side of the artery as far as the cubital fossa.
The ulnar nerve arises in the axilla from the medial cord of the brachial plexus and runs along the medial side of the upper part of the brachial artery. At the insertion of the coracobrachialis, it pierces the medial intermuscular septum to enter the posterior com-partment of the arm where it descends as far as the back of the medial epicondyle.

1. lateral cord of brachial plexus.
2. 3rd part of axillary artery.
3. medial cord of brachial plexus.
4. upper part of brachial artery.
5. ulnar nerve.
6. medial head of triceps.
7. brachialis.
8. median nerve.
9. musculocutaneous nerve.

* Note that the median nerve at its origin from the medial and lateral cords gives the shape of the letter " M ". The limbs of the M are the musculocutaneous nerve, the 2 roots of median nerve and the ulnar nerve.

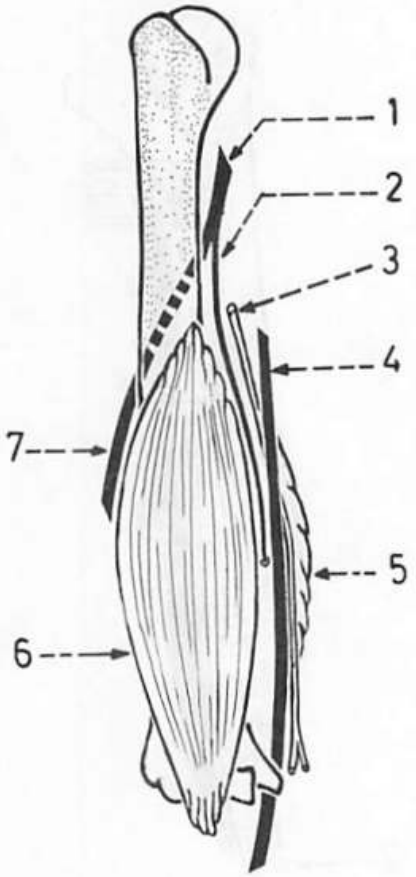


Fig.(187): ULNAR AND RADIAL NERVES IN THE ARM

At the middle of the arm the radial nerve enters the anterior compartment, while the ulnar nerve enters the posterior compartment. The ulnar nerve is accompanied by the ulnar collateral nerve and artery.

1. radial nerve in the axilla.
2. ulnar collateral nerve (nerve to medial head of triceps).
3. superior ulnar collateral artery.
4. ulnar nerve.
5. medial head of triceps (the ulnar nerve and ulnar collateral nerve run on its surface).
6. brachialis.
7. radial nerve on the lateral side of the arm (it pierces the lateral intermuscular septum to enter the anterior compartment).

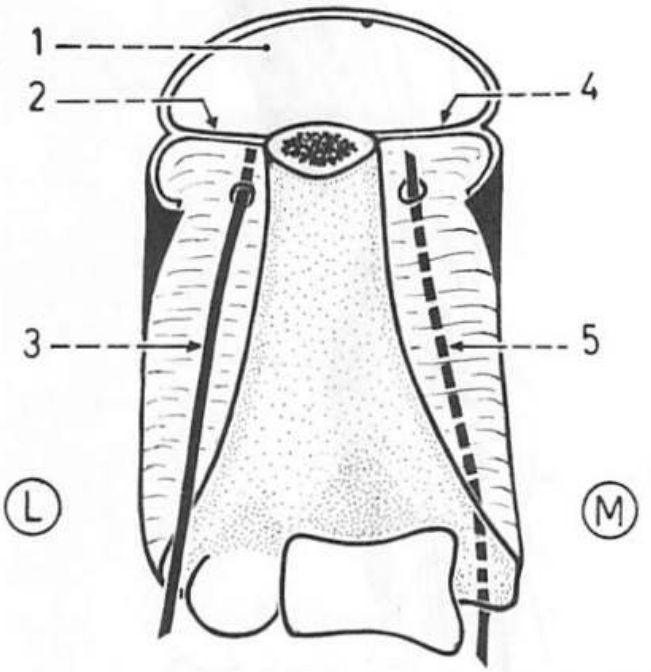


Fig.(188): ULNAR AND RADIAL NERVES PIERCING THE INTER-MUSCULAR SEPTA

At the middle of the arm the ulnar nerve pierces the medial intermuscular septum to enter the posterior compartment of the arm, while the radial nerve pierces the lateral inter-muscular septum to enter the anterior compartment (the reverse of the ulnar nerve).

1. posterior compartment of arm.
2. lateral intermuscular septum.
3. radial nerve (in the anterior compartment).
4. medial intermuscular septum.
5. ulnar nerve (in the posterior compartment).

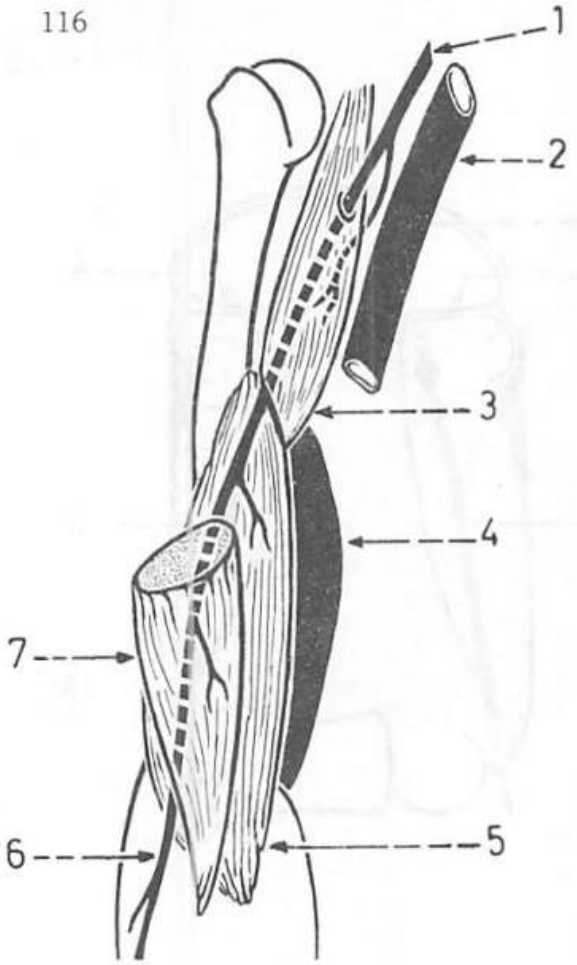


Fig.(189): MUSCULOCUTANEOUS NERVE

It arises from the lateral cord of brachial plexus and pierces the coracobrachialis to pass between the biceps and brachialis. It emerges just lateral to the tendon of the biceps to become the lateral cutaneous nerve of forearm.

1. musculocutaneous nerve (supplies the coracobrachialis before piercing it).
2. brachial artery.
3. coracobrachialis.
4. medial head of triceps.
5. brachialis.
6. lateral cutaneous nerve of forearm.
7. biceps.

* The nerve supplies the coraco-brachialis, biceps and brachialis.

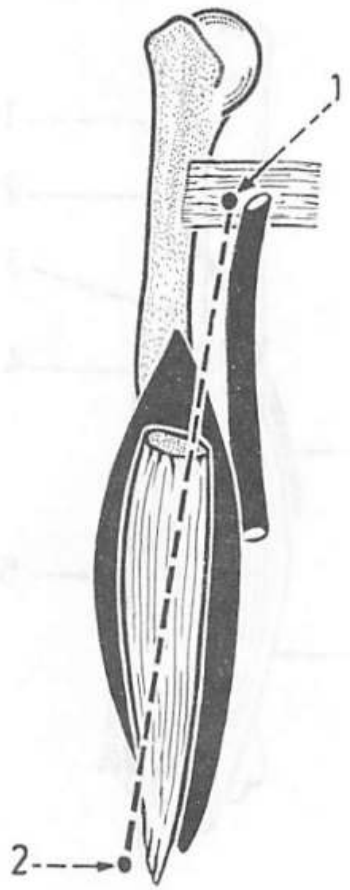


Fig.(190): SURFACE ANATOMY OF MUSCULOCUTANEOUS NERVE

It is represented by a line drawn downwards and laterally on the front of the arm between 2 points:

Point (1): where the pulsations of the axillary artery are felt (on the medial side of the arm).

Point (2): on the lower part of the arm at the lateral side of the tendon of insertion of the biceps.

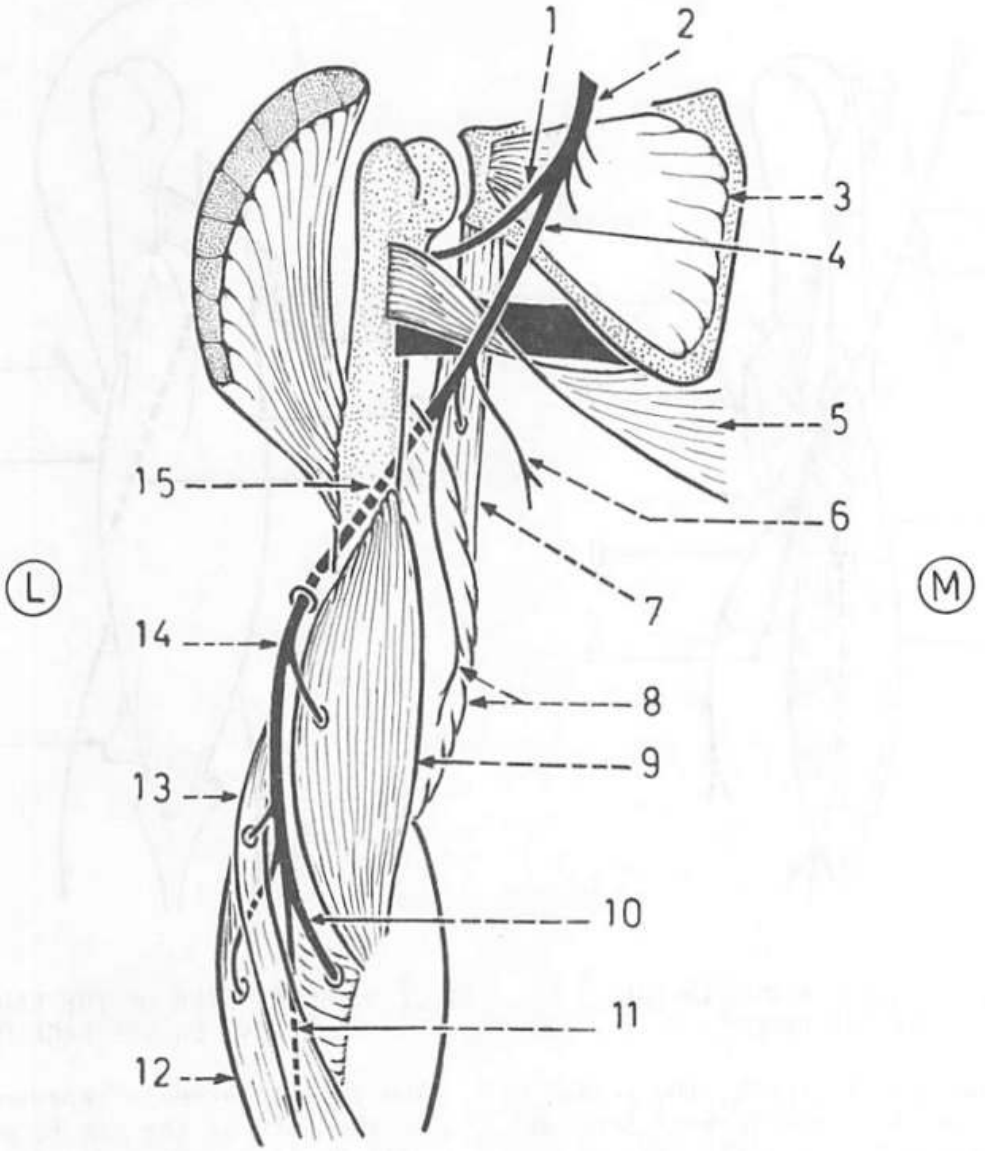


Fig.(191): RADIAL NERVE

It arises in the axilla from the posterior cord of brachial plexus and enters the spiral groove between the long and medial heads of triceps. It passes in the spiral groove on the middle of the back of the humerus and emerges on the lateral side of the arm where it enters the anterior compartment.

1. axillary nerve.
2. posterior cord.
3. subscapularis.
4. radial nerve in the axilla.
5. latissimus dorsi.
6. posterior cutaneous nerve of arm (arises in the axilla).
7. long head of triceps.
8. medial head of triceps and its nerve (ulnar collateral).
9. brachialis.
10. posterior interosseous nerve piercing the supinator.
11. superficial branch of radial nerve.
12. extensor carpi radialis longus.
13. brachioradialis.
14. radial nerve on the lateral side of arm.
15. radial nerve in the spiral groove.

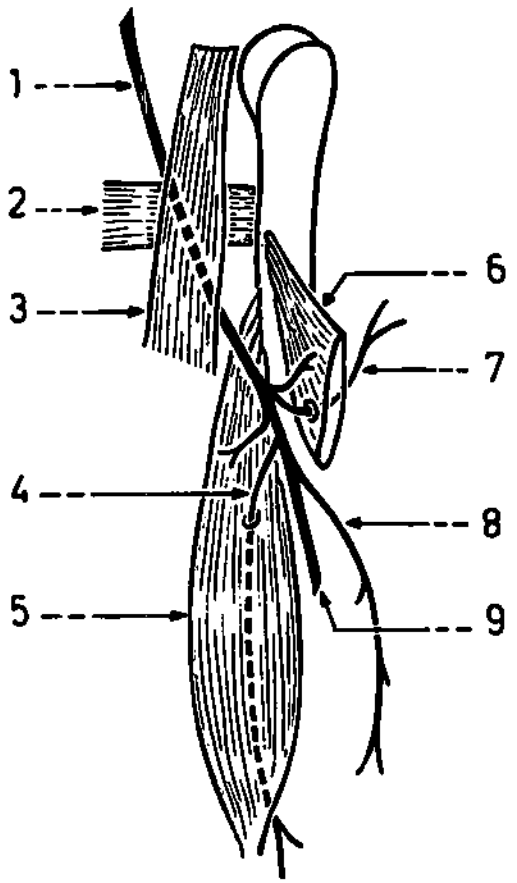


Fig.(192): RADIAL NERVE IN THE SPIRAL GROOVE

In the spiral groove, the nerve is covered by the lateral head of triceps and gives off muscular branches to lateral and medial heads of triceps and to anconeus, and 2 cutaneous branches (lower lateral cutaneous of arm and posterior cutaneous of forearm).

1. radial nerve in the axilla.
2. teres major.
3. long head of triceps.
4. nerve to anconeus. (passes down through the medial head to reach the anconeus).
5. medial head of triceps.
6. lateral head of triceps.
7. lower lateral cutaneous nerve of arm.
8. posterior cutaneous nerve of forearm.
9. radial nerve in spiral groove.

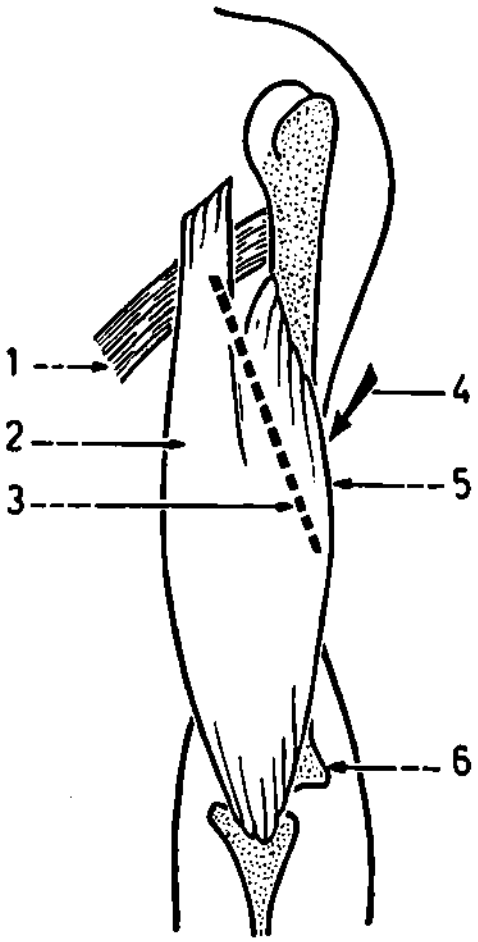


Fig.(193): THE LINE OF THE RADIAL NERVE ON THE BACK OF ARM

The radial nerve is represented on the back of the arm by an oblique line drawn across the lateral head of triceps. This line lies at the middle of the back of the arm, and accordingly, intramuscular injection should be at some distance below this line (at the lower 1/3 of the back of the arm to avoid injury to the radial nerve).

1. teres major.
2. long head of triceps.
3. line of the radial nerve in the spiral groove.
4. site of insertion of deltoid.
5. lateral head of triceps.
6. lateral epicondyle.

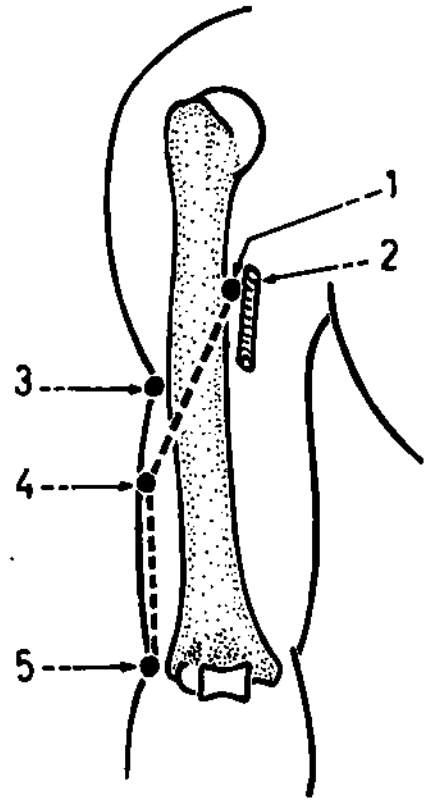


Fig.(194): SURFACE ANATOMY OF RADIAL NERVE IN THE ARM

The surface anatomy of the radial nerve in the arm describes its course in the spiral groove and on the lateral side of the arm.

* In the spiral groove: it corresponds to a line drawn downwards and laterally across the back of the arm between 2 points. A point at the beginning of the brachial artery on the medial side of the arm close to the posterior axillary fold, and a point at the junction of the upper 1/3 and lower 2/3 of a line extending from the deltoid tuberosity to the lateral epicondyle.

* On the lateral side of arm: it corresponds to a vertical line drawn from the lower point of the line representing the nerve in the spiral groove down to the front of the lateral epicondyle.

1. point at the beginning of the brachial artery.
2. brachial artery.
3. point at the deltoid tuberosity.
4. point at the junction of the upper 1/3 and lower 2/3 of a line between the deltoid tuberosity and the lateral epicondyle.
5. point at the lateral epicondyle.

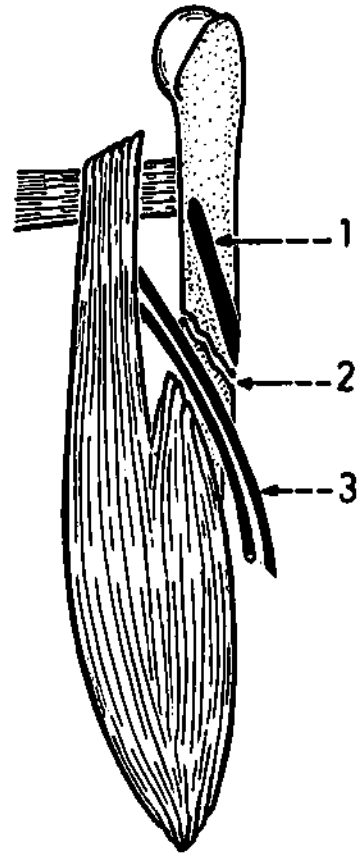


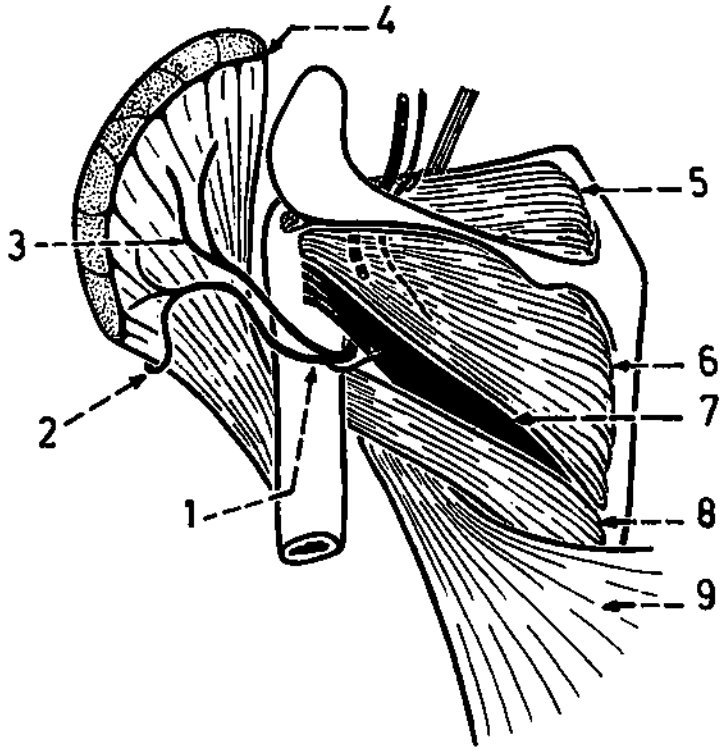
Fig.(195): FRACTURE AT THE MIDDLE OF THE HUMERUS

It may involve the radial nerve and the profunda artery.

1. origin of lateral head of triceps.
2. fracture at the middle of the humerus (at the spiral groove).
3. radial nerve and profunda artery.

Fig.(196): AXILLARY NERVE
(from behind)

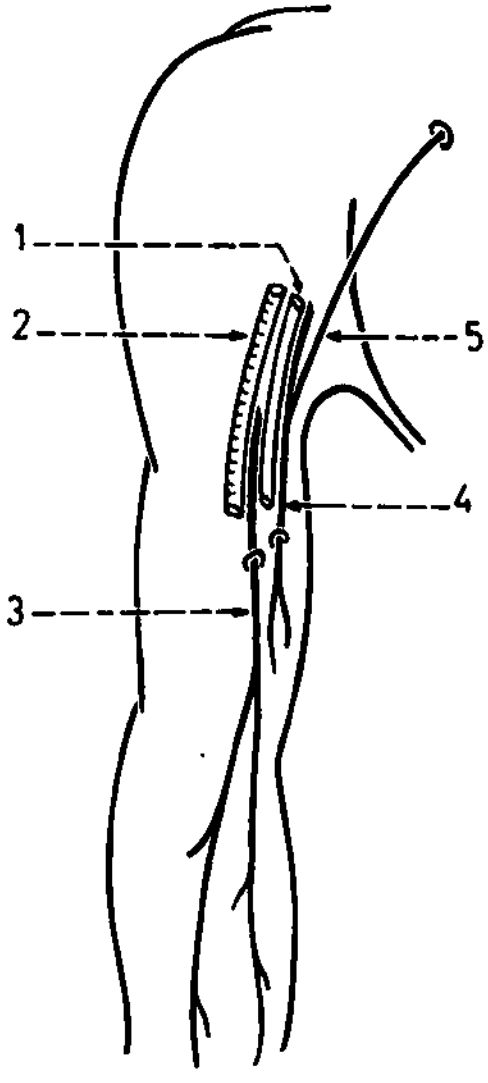
The nerve passes through the quadrangular space close to the articular capsule of the shoulder joint and winds backwards around the surgical neck of the humerus where it divides into anterior and posterior divisions. The posterior division continues around the posterior border of the deltoid as the upper lateral cutaneous nerve of arm.



1. posterior division of axillary nerve.
2. upper lateral cutaneous nerve of arm.
3. anterior division of axillary nerve.
4. anterior border of deltoid.
5. supraspinatus.
6. infraspinatus.
7. teres minor.
8. teres major.
9. latissimus dorsi.

Fig.(197): CUTANEOUS NERVES TO THE MEDIAL SIDE OF ARM AND FOREARM

The medial cutaneous nerve of arm is joined by the intercostobrachial nerve (T.2) and supplies the skin of the medial side of the lower 1/3 of arm. The medial cutaneous nerve of forearm divides above the elbow into anterior and posterior branches which descend in front of the medial epicondyle to supply the skin of the medial side of forearm.



1. axillary vein.
2. axillary artery.
3. medial cutaneous nerve of forearm.
4. medial cutaneous nerve of arm.
5. intercostobrachial nerve (T.2).

CUBITAL FOSSA

Fig.(198): BOUNDARIES OF CUBITAL FOSSA

The cubital fossa is the triangular hollow in front of the elbow joint. Its base is represented by a line extending between the 2 epicondyles. Its medial boundary is the lateral margin of pronator teres, and its lateral boundary is the medial margin of brachioradialis. Its apex is directed downwards and lies at the meeting of the medial and lateral boundaries. Its floor consists of the brachialis and supinator muscles.

1. brachialis.
2. line of the base of the fossa.
3. cubital fossa.
4. pronator teres.
5. apex of the fossa.
6. brachioradialis.
7. supinator.

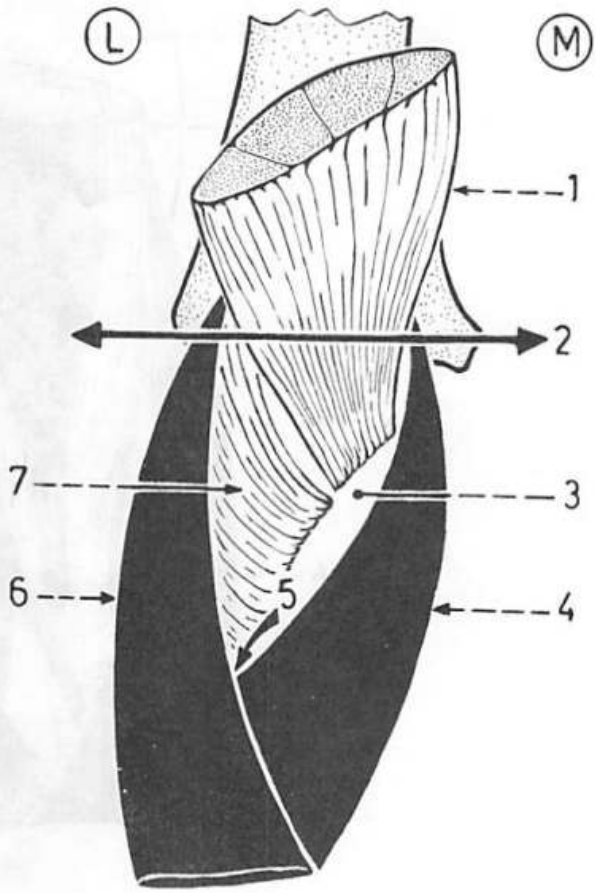
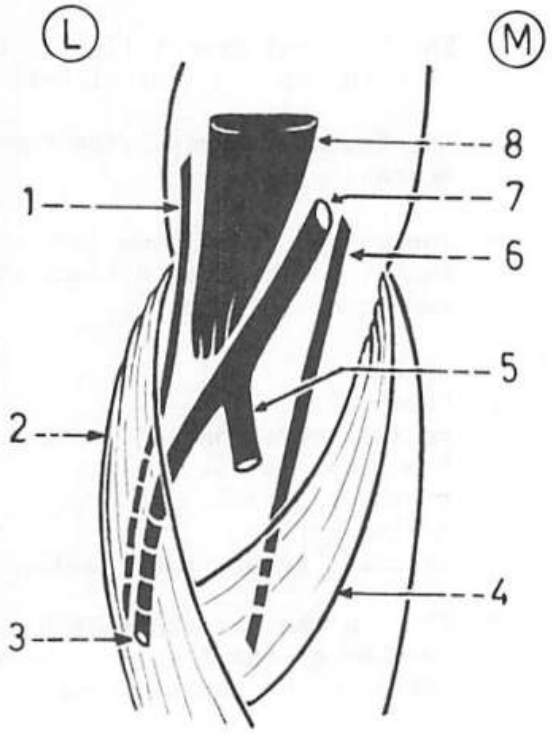


Fig.(199): CONTENTS OF CUBITAL FOSSA

The fossa contains the tendon of biceps, termination of the brachial artery and its 2 divisions (radial and ulnar), and parts of the median and radial nerves.

1. radial nerve.
2. brachioradialis.
3. radial artery (under cover of brachioradialis).
4. pronator teres.
5. ulnar artery.
6. median nerve.
7. brachial artery.
8. biceps.

* The contents of the cubital fossa are important relations in front of the elbow joint.



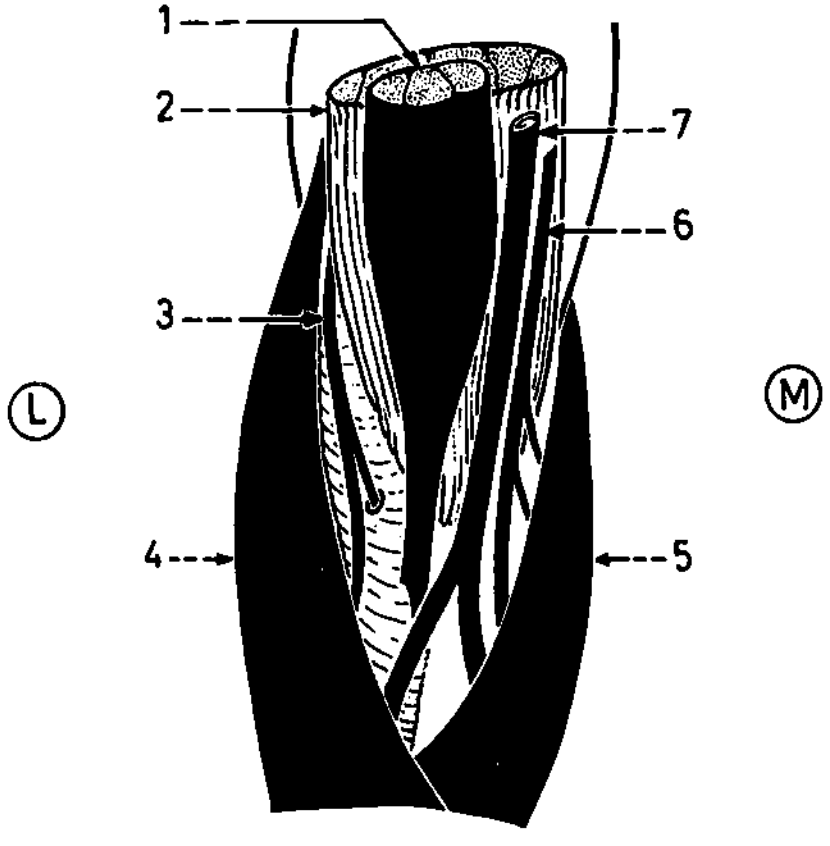


Fig.(200): RELATIONS OF THE CONTENTS OF CUBITAL FOSSA

* The brachial artery lies in the middle of the fossa and is separated from the median cubital vein by the bicipital aponeurosis.

* The brachialis separates the elbow joint from the brachial artery and median nerve.

* The median nerve lies just medial to the brachial artery, while the radial nerve lies in front of the supinator 1 cm lateral to the tendon of the biceps.

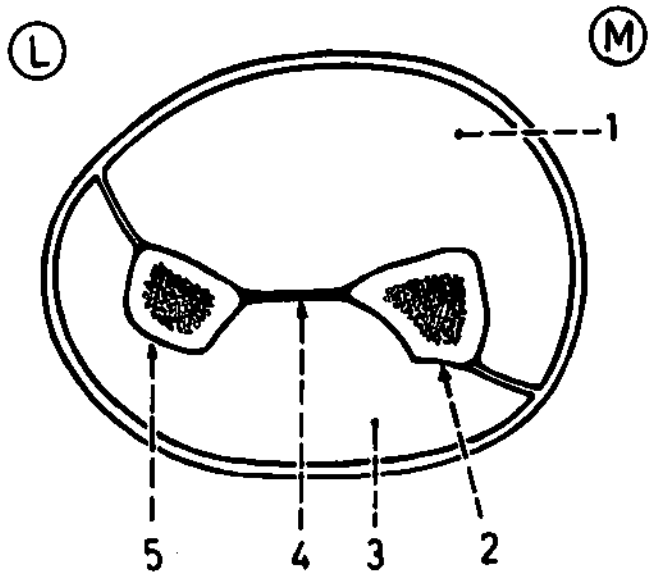
1. biceps.
2. brachialis.
3. radial nerve (on the surface of the supinator).
4. brachioradialis.
5. pronator teres.
6. median nerve.
7. brachial artery (just medial to the tendon of the biceps).

* The branches of the median nerve to the superficial group of flexor muscles of the front of the forearm are given off from the median nerve in the cubital fossa.

FOREARM

MUSCLES OF THE FRONT OF FOREARM

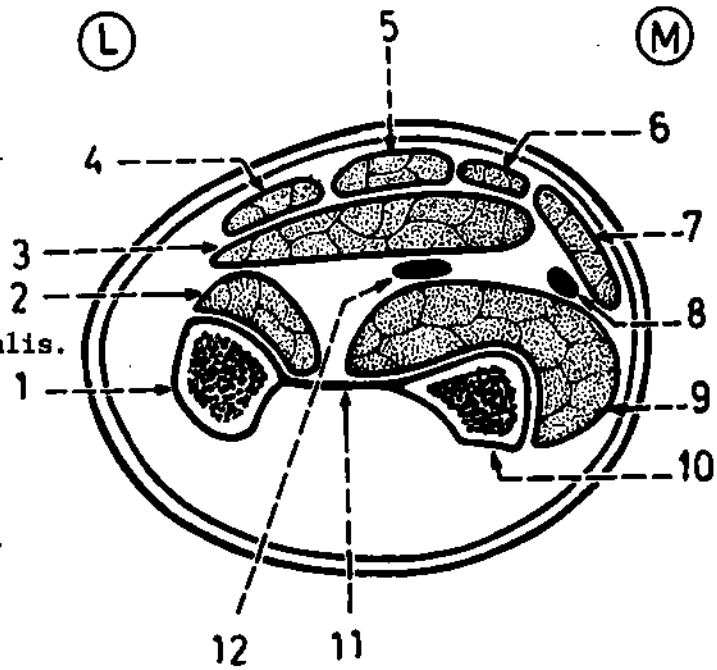
Fig.(201): COMPARTMENTS OF FOREARM



The forearm is divided into 2 compartments (anterior and posterior) by the radius and ulna,and the interosseous membrane. The anterior compartment lodges the flexor muscles,while the posterior compartment lodges the extensor muscles.

1. anterior compartment.
2. ulna (medial).
3. posterior compartment.
4. interosseous membrane.
5. radius (lateral).

Fig.(202): CONTENTS OF THE ANTERIOR COMPARTMENT OF THE FOREARM

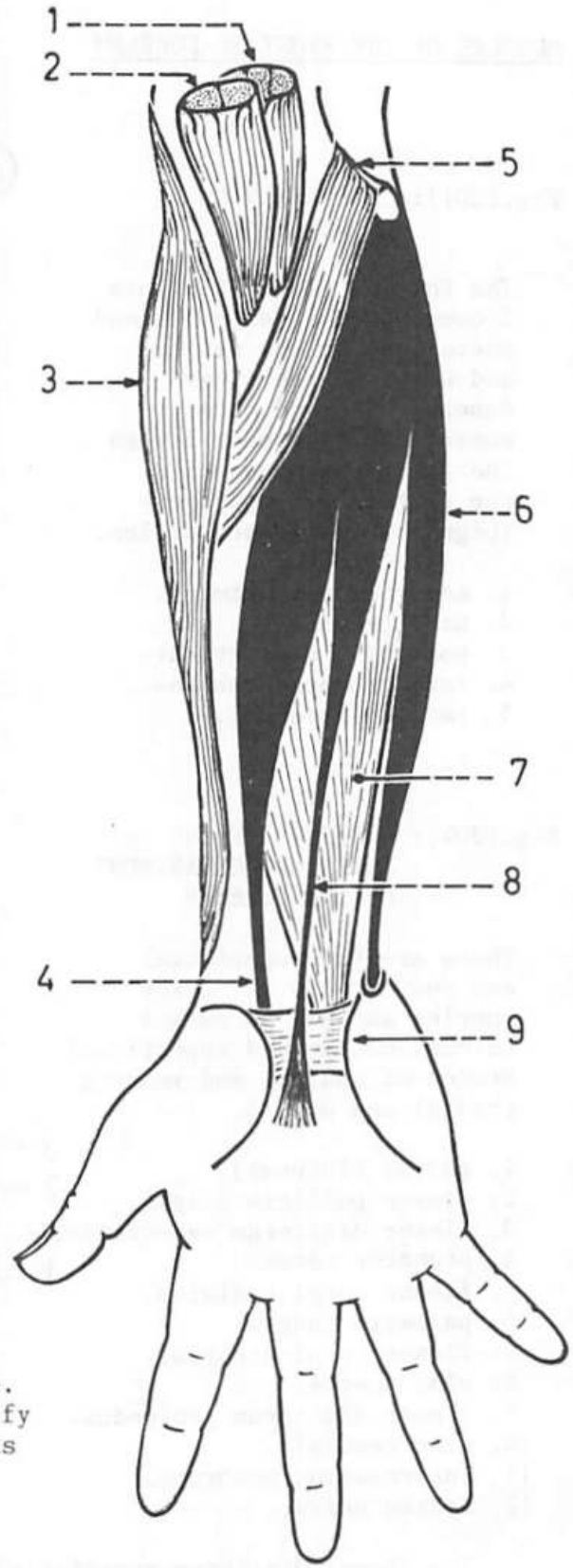


These are the superficial and deep groups of flexor muscles as well as nerves (ulnar, median and superficial branch of radial) and vessels (radial and ulnar).

1. radius (lateral).
2. flexor pollicis longus.
3. flexor digitorum superficialis.
4. pronator teres.
5. flexor carpi radialis.
6. palmaris longus.
7. flexor carpi ulnaris.
8. ulnar nerve.
9. flexor digitorum profundus.
10. ulna (medial).
11. interosseous membrane.
12. median nerve.

* The flexor digitorum superficialis lies deeper than the other superficial flexor muscles (pronator teres, flexor carpi radialis, palmaris longus and flexor carpi ulnaris).

Fig.(203): MUSCLES OF THE SUPERFICIAL FLEXOR GROUP OF FOREARM



These are 5 muscles: pronator teres, flexor carpi radialis, palmaris longus, flexor carpi ulnaris and flexor digitorum superficialis. It should be noted that the flexor digitorum superficialis does not lie on the same plane as the other 4 superficial flexor muscles, but it lies deeper to them forming an intermediate layer.

1. brachialis.
2. biceps brachii.
3. brachioradialis (belongs to the extensor muscles of forearm).
4. tendon of flexor carpi radialis (the most lateral tendon of the group, at the wrist).
5. pronator teres (ends at the middle of the lateral side of forearm).
6. flexor carpi ulnaris (the most medial of the group).
7. flexor digitorum superficialis (under cover of the other superficial flexors).
8. tendon of palmaris longus (lies midway between the tendon of flexor carpi radialis and that of flexor carpi ulnaris).
9. flexor retinaculum of the wrist.

* The superficial flexor muscles of forearm arise by a common origin from the front of the medial epicondyle of the humerus, but their tendons of insertion diverge. It is, therefore, easier to identify these muscles from their insertions rather than from their origin.

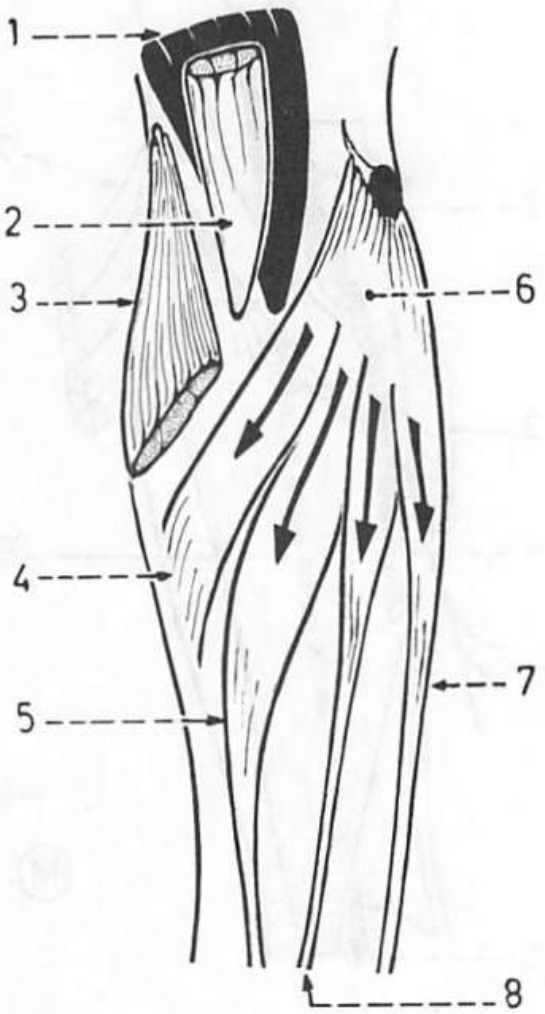


Fig.(204): ARRANGEMENT OF THE SUPERFICIAL FLEXOR MUSCLES OF THE FOREARM

These muscles are arranged from lateral to medial as follows: pronator teres, flexor carpi radialis, palmaris longus, and flexor carpi ulnaris; the flexor digitorum superficialis lies deep to all of them.

1. brachialis.
2. biceps brachii.
3. brachioradialis (cut).
4. pronator teres (the most lateral, the shortest and the most oblique; it forms the medial boundary of the cubital fossa).
5. flexor carpi radialis (just medial to the pronator teres and reaches down to the lateral side of the wrist).
6. common flexor origin.
7. flexor carpi ulnaris (the most medial and lies along the medial side of forearm; it is the only muscle of the group which is supplied by the ulnar nerve while the others are supplied by the median nerve).
8. palmaris longus (just medial to the flexor carpi radialis and its tendon crosses superficial to the flexor retinaculum; may be absent).

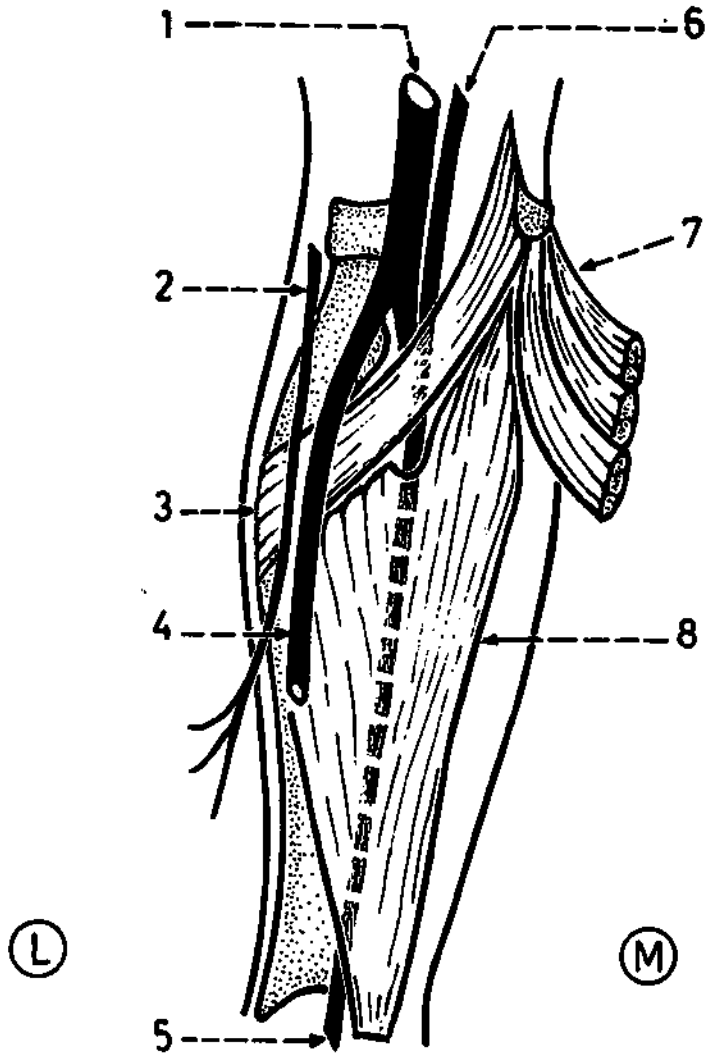


Fig.(205): PRONATOR TERES MUSCLE

It lies obliquely in the upper part of the front of the forearm,edge to edge with upper border of the flexor digitorum superficialis but on a more superficial plane. It arises by 2 heads: a large superficial humeral head (from the common flexor origin and adjoining part of medial supracondylar ridge) and a much smaller, deep ulnar head (from the medial side of the coronoid process). The 2 heads unite and are inserted together into the middle of the lateral surface of the radius at its maximum convexity.

1. brachial artery.
2. superficial branch of radial nerve (crosses over the insertion of pronator teres).
3. insertion of pronator teres.
4. radial artery (crosses superficial to the insertion of pronator teres).
5. median nerve emerging from under cover of the lateral border of the flexor digitorum superficialis.
6. median nerve (passes between the 2 heads of pronator teres to continue on the under surface of flexor digitorum superficialis).
7. common flexor origin (from the medial epicondyle).
8. flexor digitorum superficialis.

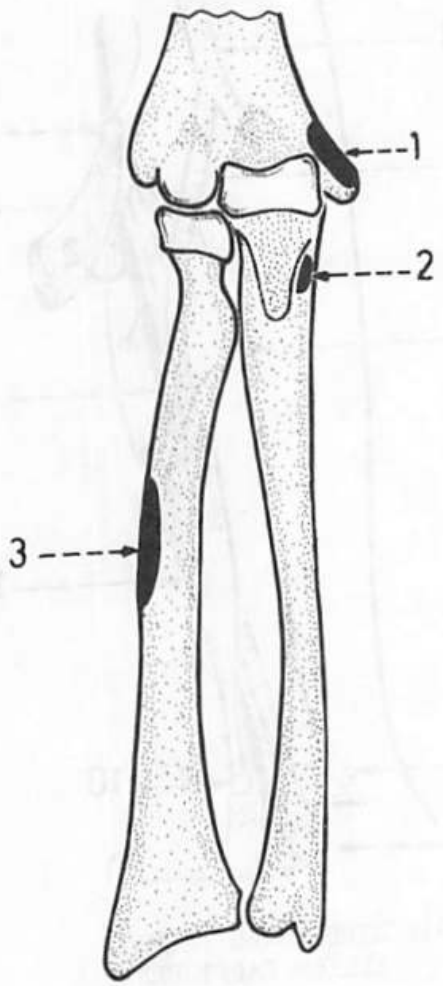


Fig.(206): BONY ATTACHMENTS OF PRONATOR TERES

1. origin of humeral head (from the front of medial epicondyle of the humerus and adjoining part of the medial supracondylar ridge).
2. origin of ulnar head (from the medial side of the coronoid process of the ulna).
3. insertion of pronator teres (into the middle of the lateral surface of the radius at its maximum convexity).

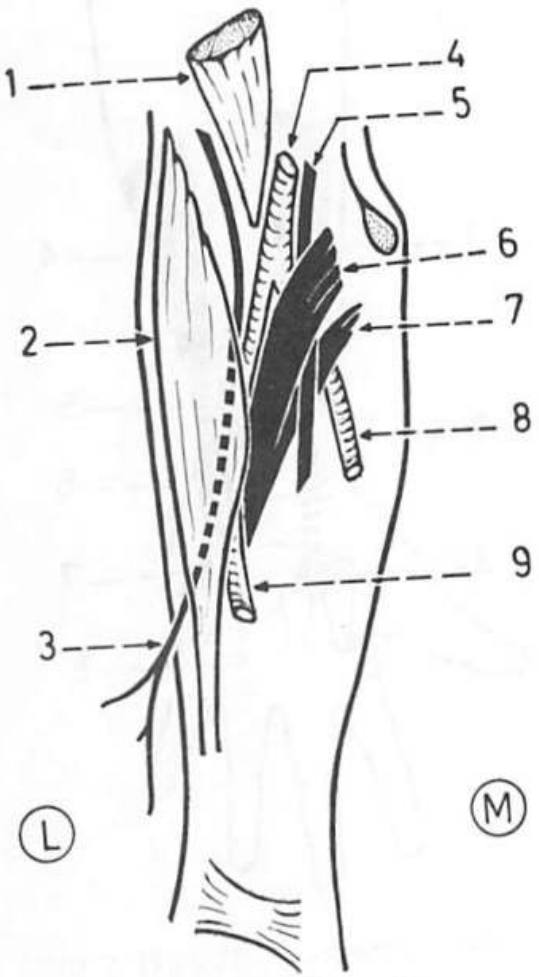


Fig.(207): RELATIONS OF PRONATOR TERES

The median nerve passes between the 2 heads of the muscle while the ulnar artery passes deep to the ulnar head. At its insertion, the muscle is crossed by the radial artery and superficial branch of radial nerve.

1. biceps brachii.
2. brachioradialis (overlaps the pronator teres at the apex of the cubital fossa).
3. superficial branch of radial nerve.
4. brachial artery.
5. median nerve.
6. superficial humeral head of the muscle.
7. deep ulnar head of the muscle.
8. ulnar artery (deep to the ulnar head).
9. radial artery.

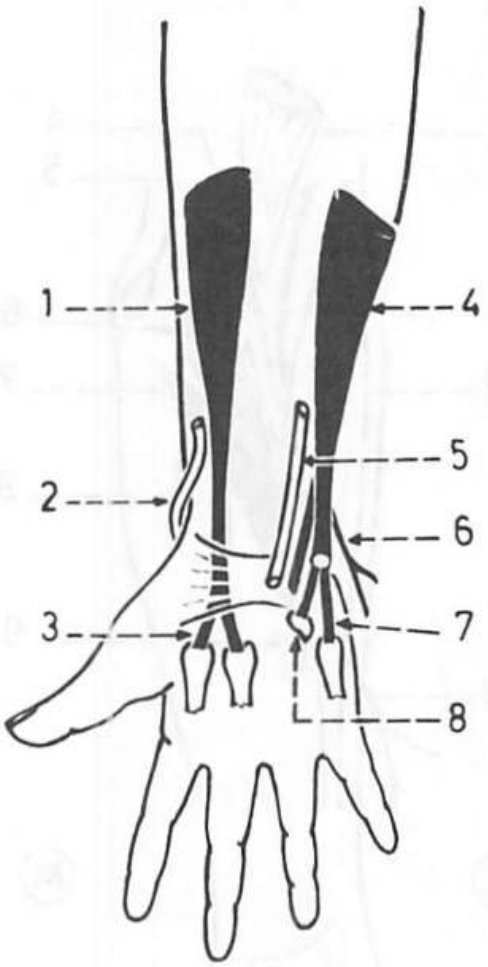


Fig.(208): TENDONS OF INSERTION OF THE 2 FLEXOR CARPI MUSCLES

The tendon of flexor carpi radialis passes through the lateral part of the flexor retinaculum to get inserted into the bases of 2nd and 3rd metacarpal bones.
The tendon of flexor carpi ulnaris is inserted into the pisiform bone and extends to the base of 5th metacarpal bone and the hamate as the piso-metacarpal and piso-hamate ligaments respectively.

1. flexor carpi radialis.
2. radial artery.
3. tendon of flexor carpi radialis.
4. flexor carpi ulnaris.
5. ulnar artery.
6. dorsal branch of ulnar nerve.
7. piso-metacarpal ligament.
8. hamate bone and piso-hamate ligament.

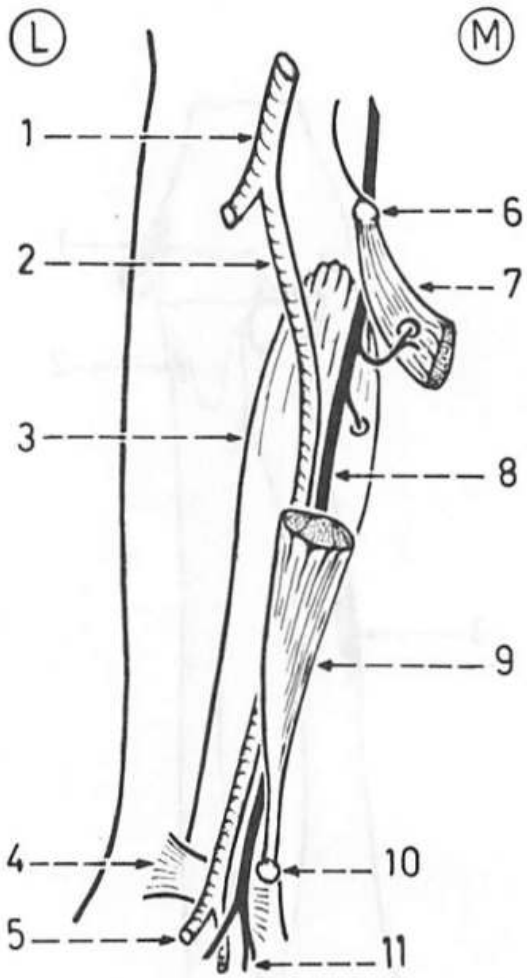


Fig.(209): STRUCTURES DEEP TO FLEXOR CARPI ULNARIS

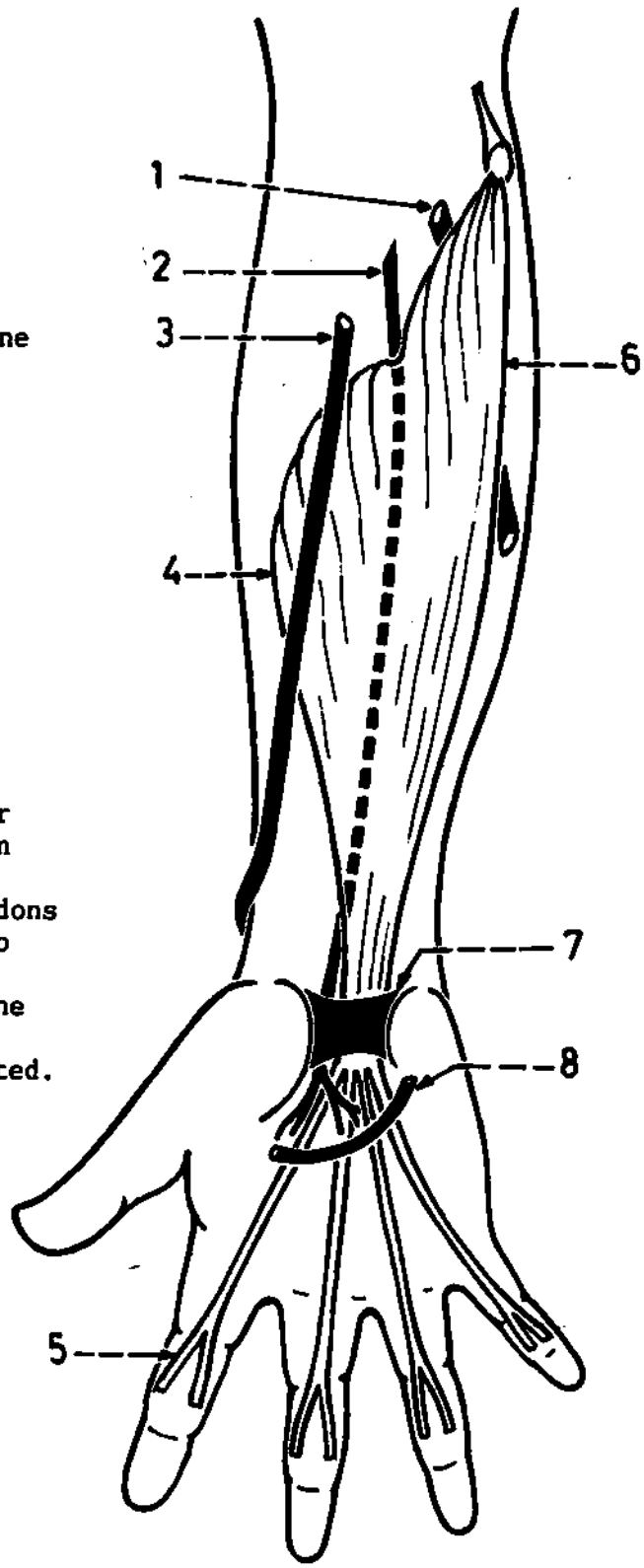
The flexor digitorum profundus lies deep to the flexor carpi ulnaris with the ulnar nerve and artery in between.

1. brachial artery.
2. ulnar artery.
3. flexor digitorum profundus.
4. flexor retinaculum (crossed by the ulnar nerve and artery).
5. termination of ulnar artery.
6. medial epicondyle.
7. flexor carpi ulnaris (gets its nerve supply near the elbow).
8. ulnar nerve.
9. flexor carpi ulnaris (cut).
10. pisiform bone.
11. termination of ulnar nerve.

Fig.(210): FLEXOR DIGITORUM SUPERFICIALIS MUSCLE

It lies in an intermediate plane between the other superficial muscles in front, and the deep group of flexors behind.
It arises by 2 heads (humero-ulnar and radial). The humero-ulnar head arises from the common flexor origin (from the medial epicondyle) and from the medial side of the coronoid process. The radial head arises by a linear origin from the oblique upper part of the anterior border of the radius.
The muscle has an oblique upper border beneath which the median nerve passes.
The muscle gives rise to 4 tendons of insertion which pass deep to the flexor retinaculum and diverge in the palm to reach the middle phalanges of the medial 4 fingers where they are inserted.

1. ulnar artery (deep to the humero-ulnar head).
2. median nerve (passes under cover of the muscle).
3. radial artery (superficial to the radial head).
4. radial head of the muscle.
5. insertion into the middle phalanx.
6. humero-ulnar head.
7. flexor retinaculum.
8. superficial palmar arch crossing superficial to the tendons of the muscle.



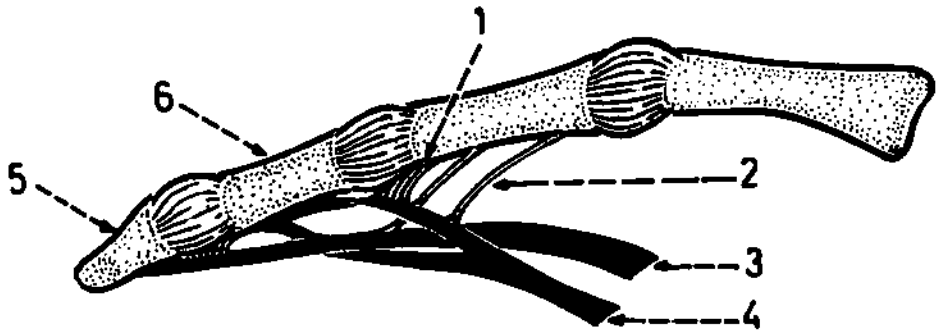


Fig.(211): INSERTIONS OF FLEXOR DIGITORUM SUPERFICIALIS AND PROFUNDUS

At the base of the proximal phalanx,each tendon of flexor digitorum superficialis splits to allow the passage of the tendon of flexor digitorum profundus. These tendons are anchored to the phalanges by long and short vascular fibrous bands called vincula longa and brevia.

1. vincula brevia.
2. vincula longa.
3. tendon of flexor digitorum profundus (inserted into the terminal phalanx).
4. tendon of flexor digitorum superficialis (inserted into the middle phalanx).
5. terminal phalanx.
6. middle phalanx.

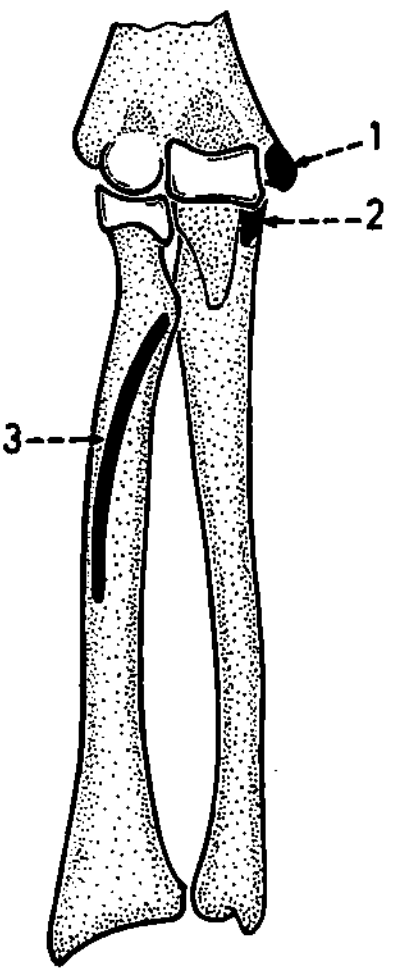


Fig.(212): BONY ATTACHMENTS OF FLEXOR DIGITORUM SUPERFICIALIS

1. humeral origin from the front of medial epicondyle (part of the common flexor origin).
2. ulnar origin from the upper part of the medial side of coronoid process of ulna.
3. radial origin from the upper oblique part of the anterior border of the radius (radial head).

* The humeral and ulnar origins form together the humero-ulnar head.

* Note that the origins of the muscle lie on an oblique line which extends from the medial epicondyle of the humerus (above and medial), to the radius (below and lateral).

Fig.(213): RELATIONS OF FLEXOR DIGITORUM SUPERFICIALIS TO THE MEDIAN NERVE

As the median nerve passes between the 2 heads of the pronator teres, it descends vertically in the mid-line of the forearm on the under surface of the flexor digitorum superficialis where it is accompanied by the median artery (slender branch). Just above the wrist, the median nerve emrges from under cover of the lateral border of the flexor digitorum superficialis, and here it lies in the interval between the tendons of the flexor carpi radialis and palmaris longus. It should be noted that the median nerve supplies the flexor digitorum superficialis as well as the other superficial flexor muscles (except the flexor carpi ulnaris) by branches which arise in the cubital fossa.

1. brachial artery.
2. brachioradialis (cut).
3. palmaris longus.
4. flexor carpi radialis.
5. median nerve above the wrist.
6. flexor retinaculum.
7. digital branches of median nerve.
8. median nerve in the cubital fossa.
9. pronator teres.
10. flexor digitorum superficialis.
11. median nerve deep to the flexor digitorum superficialis (here it gives off its anterior interosseous branch).
12. median artery (from the anterior interosseous artery).
13. pronator quadratus.

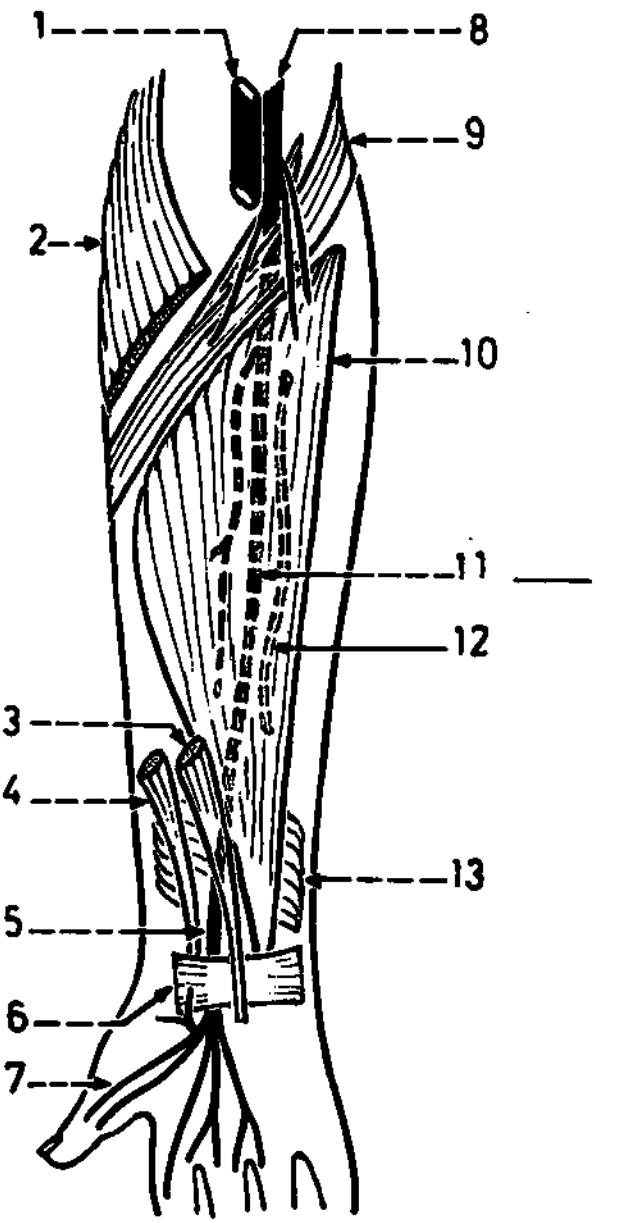
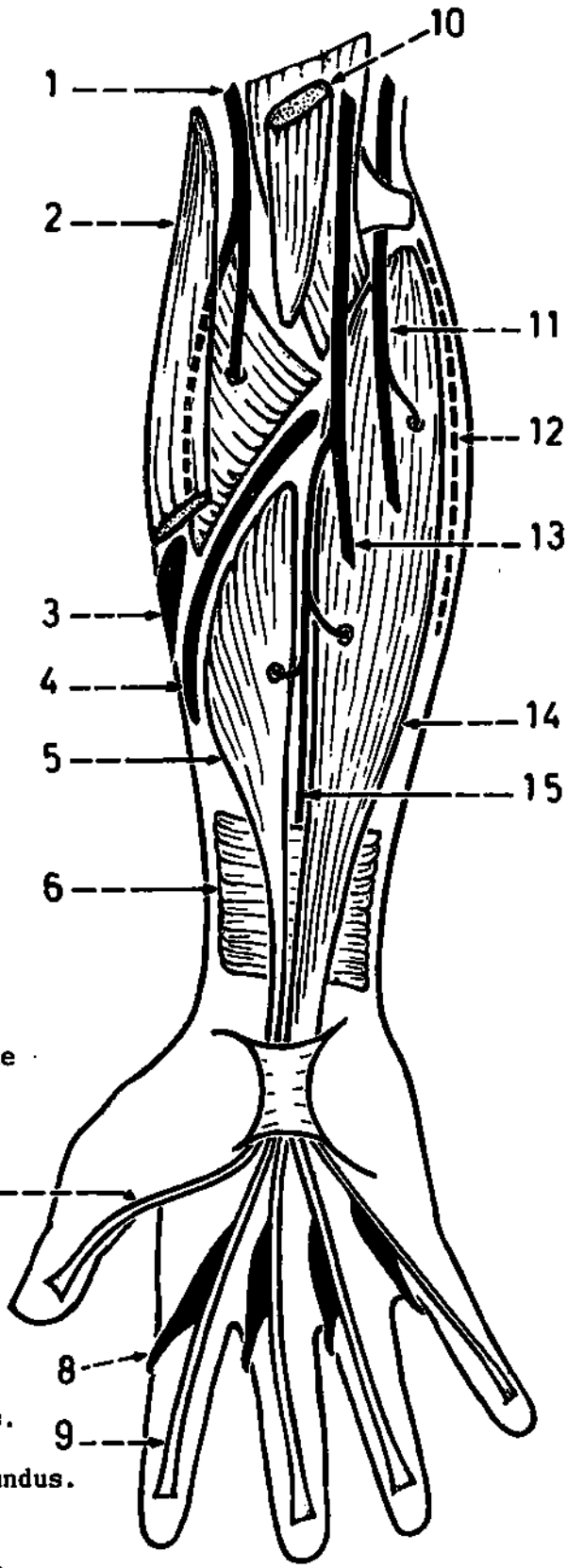


Fig.(214): MUSCLES OF THE DEEP GROUP OF FOREARM



These are 3 muscles: flexor digitorum profundus (in front of the ulna), flexor pollicis longus (in front of the radius) and pronator quadratus (in front of the lower 1/4 of both bones).

* The flexor digitorum profundus (profundus = deep) arises from the upper 3/4 of the anterior and medial surfaces of the ulna. It is inserted by 4 tendons into the terminal phalanges of the medial 4 fingers.

* The flexor pollicis longus (pollicis = related to the pollex or thumb) arises from the front of radius and is inserted into the base of the terminal phalanx of the thumb.

* The pronator quadratus (quadratus = with 4 sides) arises from the lower part of the ulna and is inserted into the lower part of the radius.

1. radial nerve.
2. brachioradialis.
3. insertion of pronator teres.
4. radial head of flexor digitorum superficialis.
5. flexor pollicis longus.
6. pronator quadratus (deep to the other 2 muscles).
7. tendon of flexor pollicis longus.
8. lumbrical muscle.
9. tendon of flexor digitorum profundus.
10. biceps brachii.
11. ulnar nerve.
12. aponeurosis common to the flexor and extensor carpi ulnaris.
13. median nerve.
14. flexor digitorum profundus.
15. anterior interosseous nerve (supplies the 3 deep muscles).

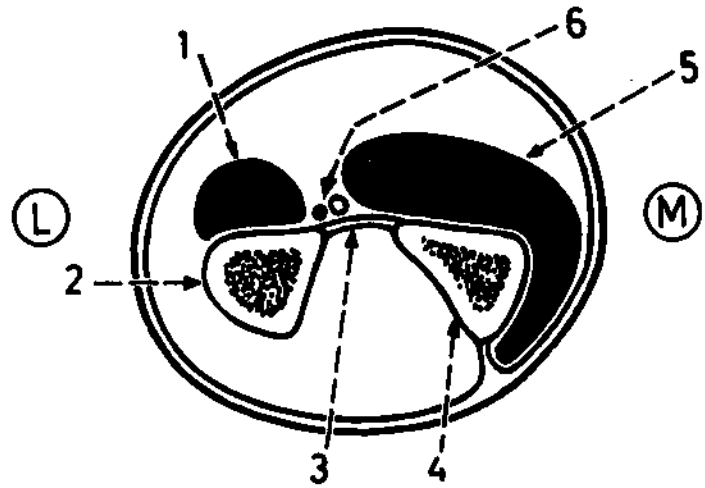


Fig.(215): T.S. IN RIGHT FOREARM TO SHOW THE 2 DEEP FLEXOR MUSCLES

These 2 deep flexor muscles are the flexor digitorum profundus (in relation to the ulna) and the flexor pollicis longus (in relation to the radius). The anterior interosseous nerve and artery lie between them.

1. flexor pollicis longus.
2. radius (lateral bone).
3. interosseous membrane.
4. ulna (medial bone).
5. flexor digitorum profundus (covers the anterior and medial surfaces of the bone).
6. anterior interosseous nerve and artery (in front of the interosseous membrane).

* This section shows that the flexor digitorum profundus forms the muscular bulge just medial to the posterior border of the ulna, on the medial side of forearm.

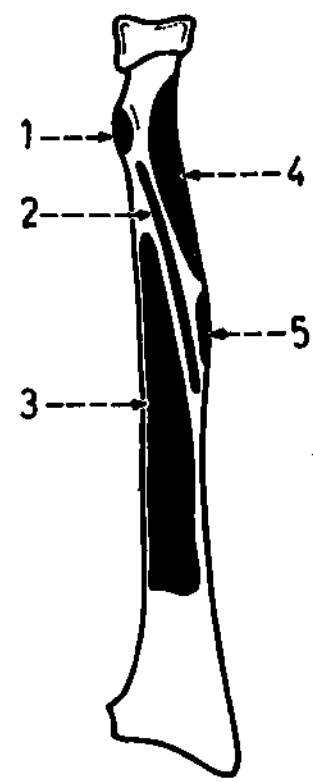


Fig.(216): ORIGIN OF FLEXOR POLLICIS LONGUS

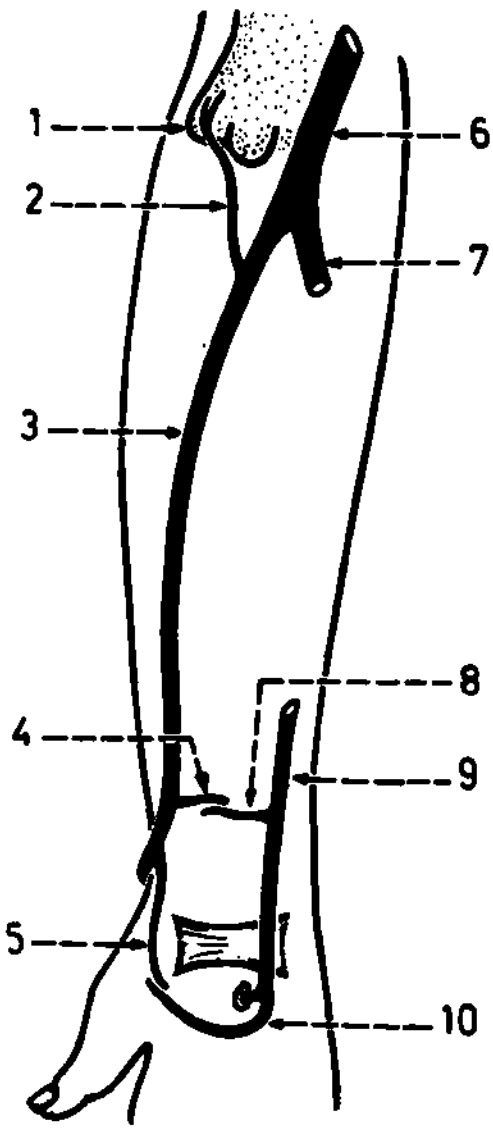
The origin of the flexor pollicis longus from the front of the radius lies just below the radial head of flexor digitorum superficialis which separates it from 2 insertions: the insertion of supinator and that of pronator teres.

1. insertion of biceps brachii.
2. origin of radial head of flexor digitorum superficialis.
3. origin of flexor pollicis longus.
4. insertion of supinator.
5. insertion of pronator teres.

RADIAL AND ULNAR ARTERIES IN THE FOREARM

Fig.(217): RADIAL ARTERY IN THE FOREARM

it begins opposite the neck of the radius as one of the 2 terminal divisions of the brachial artery. It descends along the lateral side of forearm, and winds backwards around the lateral side of the wrist to lie on the floor of the anatomical snuff-box on the dorsum of the hand. It gives off 3 named branches in the forearm: radial recurrent branch, palmar carpal branch and superficial palmar branch (from above downwards).



1. lateral epicondyle.
2. radial recurrent artery (ascends to the front of the lateral epicondyle).
3. radial artery in forearm.
4. palmar carpal branch (arises near the wrist and anastomoses with the palmar carpal branch of ulnar artery to form the anterior carpal arch).
5. superficial palmar branch (from the lowermost part of the radial artery in the forearm, and anastomoses with the termination of the superficial palmar arch).
6. brachial artery.
7. ulnar artery.
8. palmar carpal branch of ulnar artery.
9. ulnar artery.
10. superficial palmar arch.

* Note that the radial artery gives off its named branches from its uppermost and lowermost parts (near the elbow and wrist joints), but its intermediate part gives only unnamed muscular branches to the surrounding muscles. This is also true for the ulnar artery.

Fig.(218): DEEP RELATIONS OF RADIAL ARTERY

These are (from above downwards): tendon of biceps brachii, insertion of supinator, insertion of pronator teres, origin of radial head of flexor digitorum superficialis, origin of flexor pollicis longus, insertion of pronator quadratus and the front of lower end of radius (6 muscles and a bone).
Pulsations of the radial artery are felt in front of the lower end of the radius.

1. biceps brachii.
2. radial artery (cut to show its deep or posterior relations).
3. insertion of supinator.
4. insertion of pronator teres.
5. origin of flexor pollicis longus.
6. radial artery as it lies in front of the lower end of radius.
7. brachial artery.
8. flexor digitorum superficialis. (its radial head is crossed by the artery just below the pronator teres).
9. pronator quadratus.

* The muscles posterior to the artery separate it from the radius.

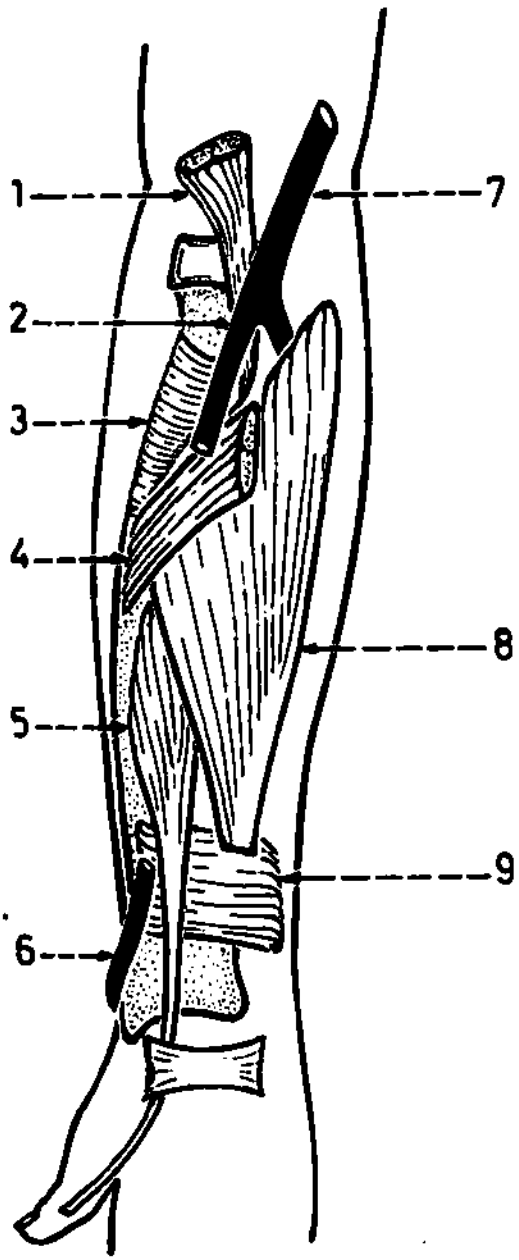


Fig.(219): SIDE RELATIONS OF RADIAL ARTERY

The artery is accompanied throughout its course by 2 venae comitantes. The superficial branch of radial nerve lies along the lateral side of the middle 1/3 of the artery. Lower down, the artery lies between the tendon of flexor carpi radialis medially and that of brachioradialis laterally.

1. radial artery.
2. superficial branch of radial nerve.
3. brachioradialis (the superficial branch of radial nerve winds backwards under cover of this muscle).
4. brachial artery.
5. ulnar artery.
6. venae comitantes (these are 2 veins which run on each side of the artery).
7. flexor carpi radialis (medial to the artery).

* It should be noted that the upper part of the radial artery is overlapped by one muscle which is the brachioradialis, but its lower part (1/3) is superficial and its pulsations can easily be felt. Here, the tendon of brachioradialis lies lateral to the artery.

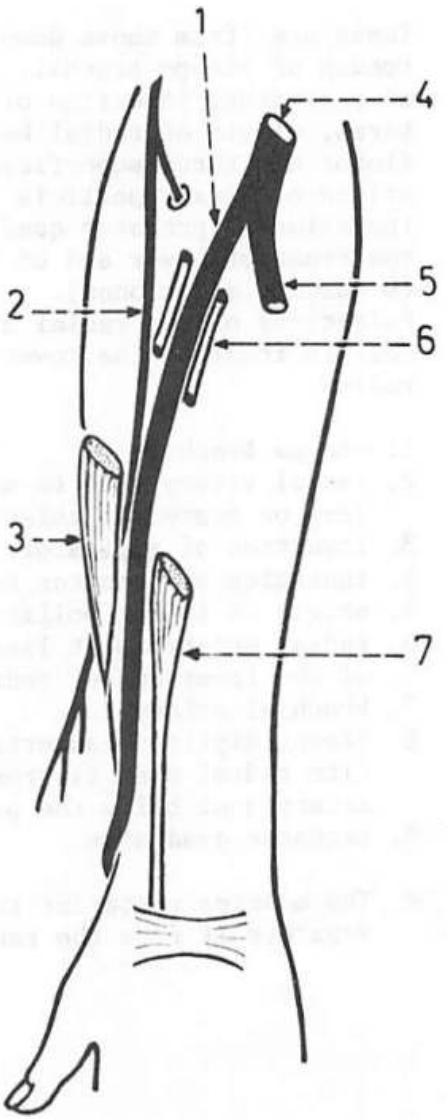


Fig.(220): ULNAR ARTERY IN THE FOREARM

It arises from the brachial artery opposite the neck of radius and is the larger of its 2 terminal branches. It has an upper oblique part which runs downwards and medially till the junction of the upper 1/3 and lower 2/3 of the medial side of forearm, and has a vertical part which runs downwards to the wrist. At the wrist,it crosses over the flexor retinaculum just lateral to the pisiform bone. Here, it divides into 2 terminal divisions (superficial and deep).

1. flexor retinaculum.
2. deep terminal division of ulnar artery.
3. brachial artery.
4. upper oblique part of ulnar artery (in upper 1/3 of forearm).
5. lower vertical part of ulnar artery (in lower 2/3 of forearm).
6. tendon of flexor carpi ulnaris (just medial to the artery).
7. pisiform bone (just medial to the artery).
8. superficial division of ulnar artery.

* The ulnar nerve accompanies the ulnar artery in its lower 2/3 but is separated from its upper 1/3 by a wide interval due to the oblique upper part of the ulnar artery.

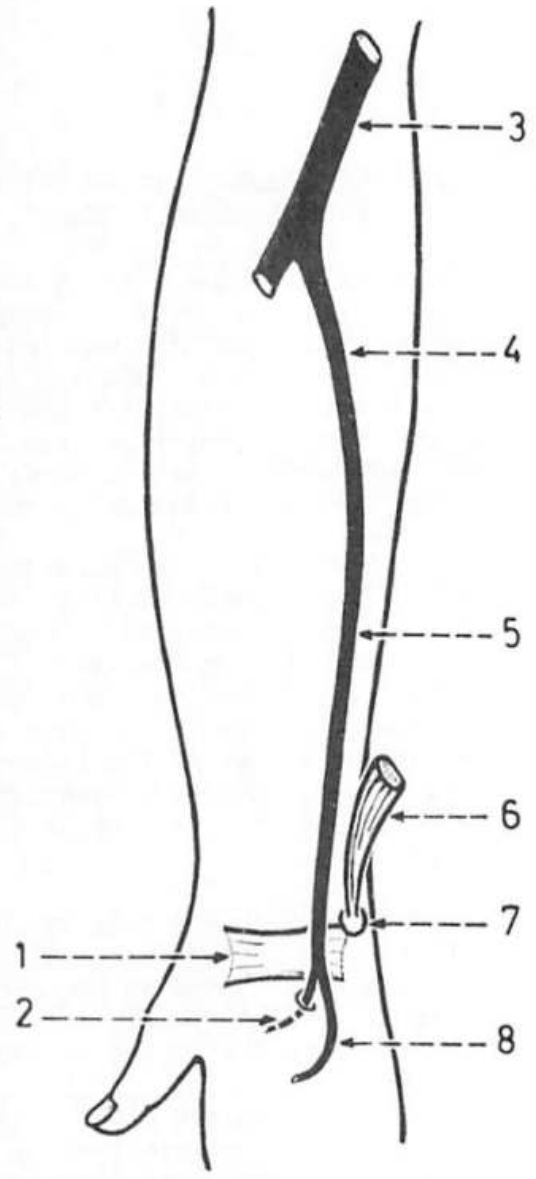
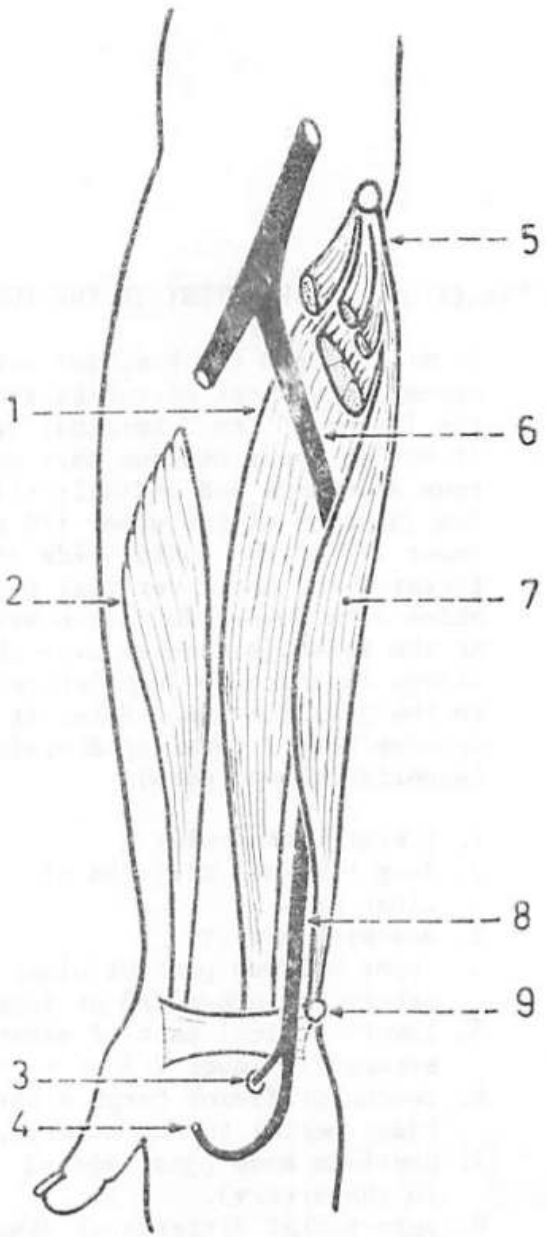


Fig.(221): RELATIONS OF ULNAR ARTERY TO MUSCLES OF FOREARM

In the upper oblique part of its course, the ulnar artery is deeply placed under cover of 5 muscles: pronator teres (the 2 heads), flexor carpi radialis, palmaris longus, flexor digitorum superficialis and flexor carpi ulnaris. Here, it lies over the flexor digitorum profundus.
In the middle 1/3 of forearm, the artery lies between the flexor carpi ulnaris superficially and the flexor digitorum profundus deeply.
In the lower 1/3 of forearm, the artery emerges from under cover of the lateral border of the flexor carpi ulnaris to become superficial, i.e. to be covered only by skin and fascia.



1. flexor digitorum profundus (lies deep to the artery all through its course in the forearm).
2. flexor pollicis longus.
3. deep terminal division of ulnar artery.
4. superficial palmar arch.
5. common flexor origin showing 4 of the superficial flexor muscles (they lie superficial to the oblique upper part of the artery).
6. oblique upper part of ulnar artery.
7. flexor carpi ulnaris (superficial to the middle 1/3 of the artery).
8. lower 1/3 of ulnar artery(superficial).
9. pisiform bone.

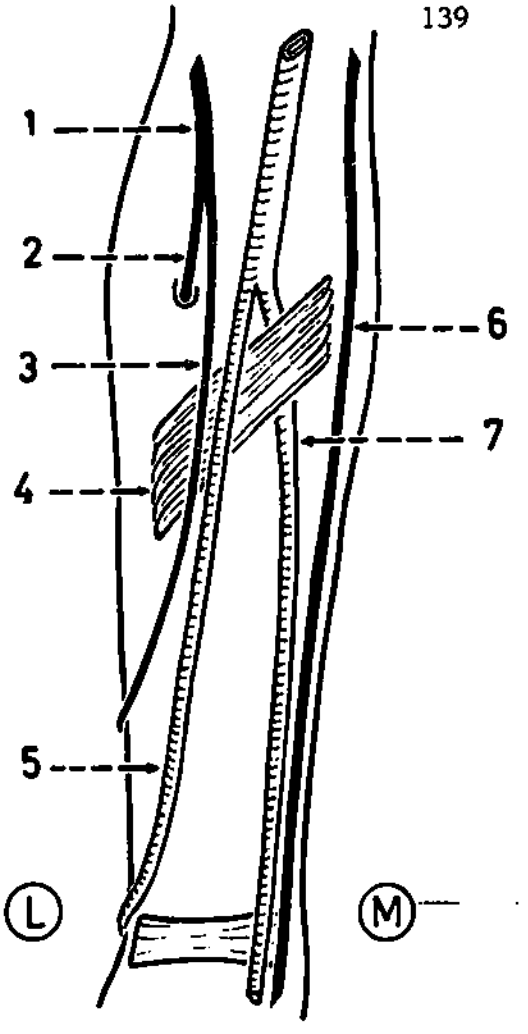


Fig.(222): RELATIONS OF THE RADIAL AND ULNAR ARTERIES TO THE CORRESPONDING NERVES

The radial nerve (its superficial branch) comes in close relation to the middle 1/3 of the radial artery, while the ulnar nerve comes in close relation to the lower 2/3 of the ulnar artery. The 2 nerves lie to the outside of the corresponding arteries, i.e. the radial nerve is lateral to its artery while the ulnar nerve is medial to its artery; this is because the arteries begin in the cubital fossa and diverge towards the sides of the forearm to meet the corresponding nerves.

1. radial nerve.
2. posterior interosseous nerve.
3. superficial branch of radial nerve.
4. pronator teres.
5. radial artery.
6. ulnar nerve.
7. ulnar artery.

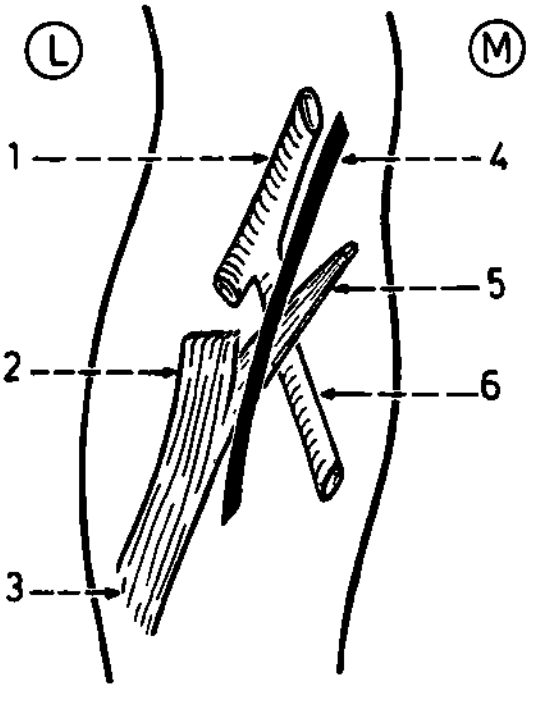
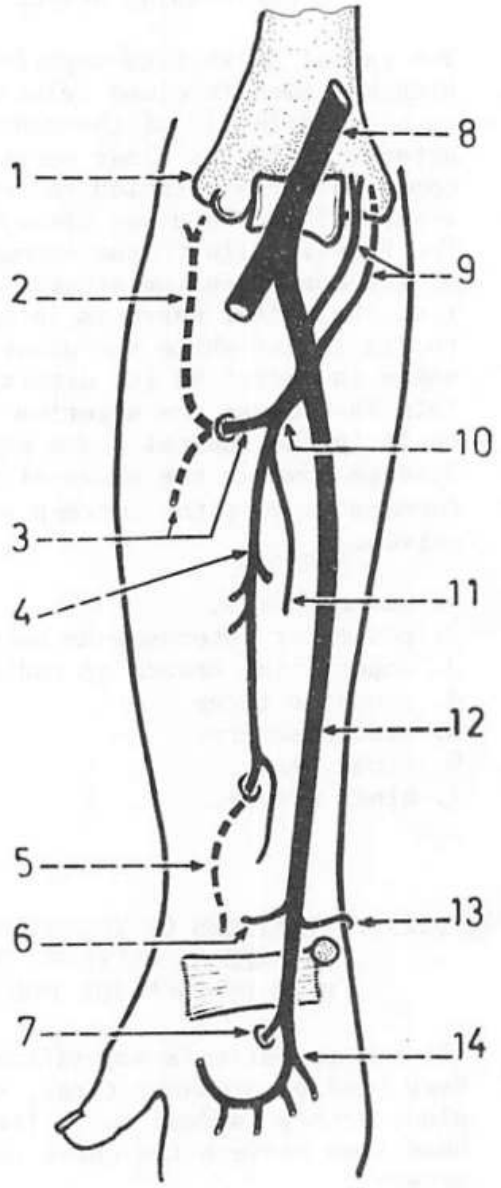


Fig.(223): RELATIONS OF THE ULNAR ARTERY AND MEDIAN NERVE TO THE DEEP HEAD OF PRONATOR TERES

The median nerve is superficial to the deep head of pronator teres, while the ulnar artery is deep to it (the deep head lies between the nerve and the artery).

1. brachial artery.
2. superficial head of pronator teres.
3. insertion of pronator teres.
4. median nerve.
5. deep (ulnar) head of pronator teres.
6. ulnar artery (the deepest).

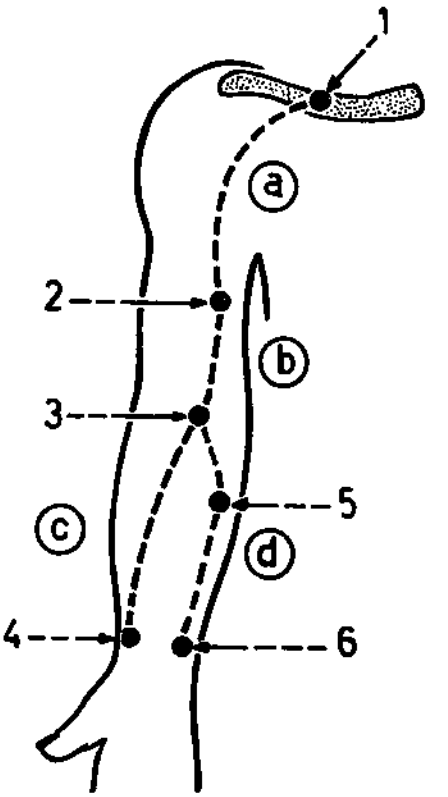
Fig.(224): BRANCHES OF ULNAR ARTERY IN THE FOREARM



The ulnar artery gives off its named branches close to the elbow and close to the wrist, but in the intermediate part it gives off unnamed muscular branches to the neighbouring muscles. Close to the elbow,it gives off: anterior ulnar recurrent (to the front of medial epicondyle), posterior ulnar recurrent (to the back of medial epicondyle) and common interosseous (divides into anterior interosseous artery which descends on the front of the interosseous membrane and posterior interosseous artery which descends on the back of the forearm).
Close to the wrist, it gives off: palmar carpal branch (to the front of the carpus) and dorsal carpal branch (to the back of the carpus).
On the flexor retinaculum the ulnar artery ends by dividing into superficial and deep divisions.

1. lateral epicondyle.
2. interosseous recurrent branch (from the posterior interosseous artery).
3. posterior interosseous artery.
4. anterior interosseous artery.
5. termination of anterior interosseous artery (on the back of forearm).
6. palmar carpal branch.
7. deep terminal division.
8. brachial artery.
9. anterior and posterior ulnar recurrent arteries.
10. common interosseous artery.
11. median artery.
12. ulnar artery.
13. dorsal carpal branch.
14. superficial terminal division (forms the superficial palmar arch).

Fig.(225): SURFACE ANATOMY OF ARTERIES OF UPPER LIMB



(a) Axillary artery:
Is represented by a line drawn from the midclavicular point (1) to a point (2) where its pulsations are felt on the medial side of the arm, at the posterior axillary fold.

(b) Brachial artery:
Is represented by a line drawn from point (2) to point (3) at the midpoint of the cubital fossa just medial to the tendon of the biceps brachii muscle.

(c) Radial artery:
Is represented by a line drawn from point (3) to the front of the lower end of the radius where its pulsations are felt (point 4).

(d) Ulnar artery:
Is represented by a line drawn from point (3) which corresponds to the midpoint of the cubital fossa to a point (5) at the junction of the upper 1/3 with the lower 2/3 of the medial border of the forearm (this is the oblique part of the artery). The vertical part of the artery is represented by a vertical line drawn from point (5) down to point (6) which lies just lateral to the pisiform bone.

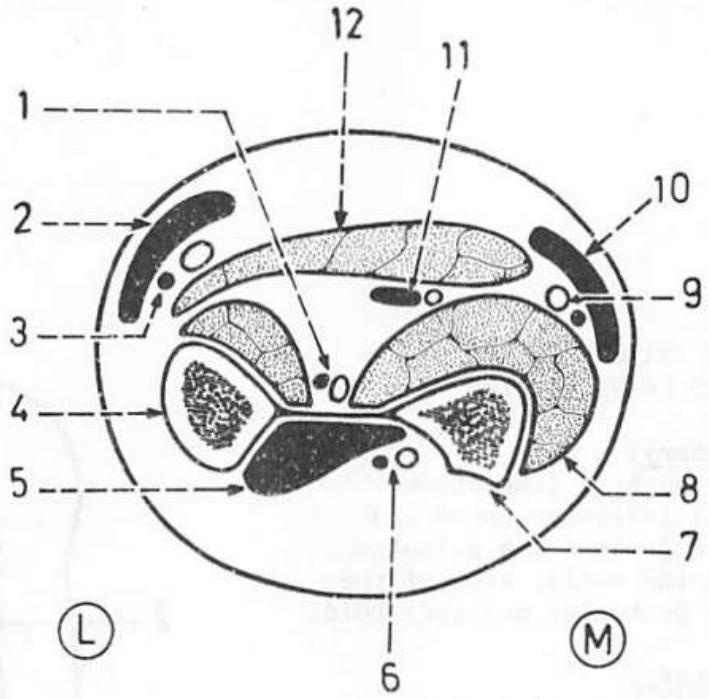


Fig.(226): ARRANGEMENT OF VESSELS AND NERVES IN THE FOREARM
(T.S. in right forearm)

The nerves and vessels in the forearm are: radial nerve and artery, median nerve and artery, ulnar nerve and artery, anterior interosseous nerve and artery and posterior interosseous nerve and artery.

1. anterior interosseous nerve and artery (lie on the front of the interosseous membrane between the flexor digitorum longus and flexor pollicis longus).
2. brachioradialis.
3. superficial branch of radial nerve and radial artery (under cover of brachioradialis on the lateral side of forearm).
4. radius.
5. abductor pollicis longus (lies directly on the interosseous membrane).
6. posterior interosseous nerve and artery (in the posterior compartment and are separated from the interosseous membrane by the deep group of extensor muscles).
7. ulna.
8. flexor digitorum profundus.
9. ulnar nerve and artery (between the flexor carpi ulnaris and flexor digitorum profundus, on the medial side of forearm).
10. flexor carpi ulnaris.
11. median nerve and median artery (lie under cover of the flexor digitorum superficialis, between it and the flexor digitorum profundus; the median artery is a slender artery which arises from the anterior interosseous artery).
12. flexor digitorum superficialis.

NERVES OF THE FOREARM

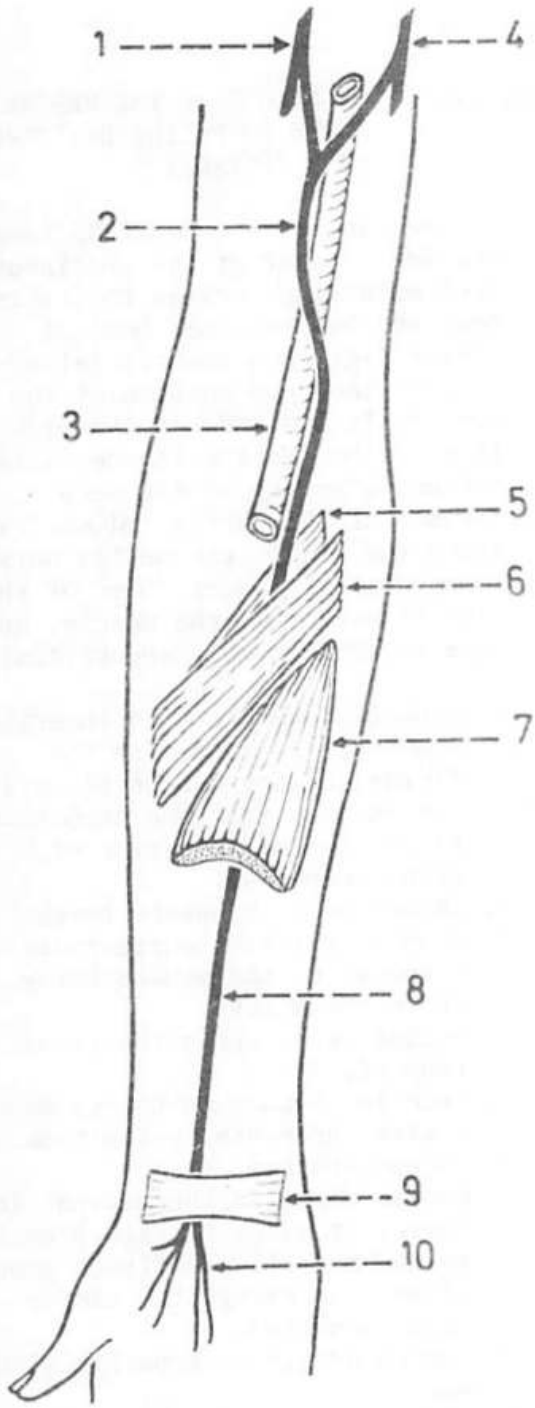


Fig.(227): COURSE OF MEDIAN NERVE

The median nerve arises in the axilla by medial and lateral roots from the medial and lateral cords respectively. It descends lateral to the 3rd part of axillary artery and upper part of the brachial artery. It then crosses in front of the brachial artery from lateral to medial at the insertion of the coracobrachialis. It continues along the medial side of the lower part of the brachial artery down to the cubital fossa. The nerve enters the forearm by passing between the 2 heads of pronator teres to gain the deep surface of the flexor digitorum superficialis to which it is adherent. At the wrist, it passes under cover of the flexor retinaculum to enter the palm where it ends by giving off its digital branches.

1. lateral cord of brachial plexus.
2. median nerve in the arm.
3. brachial artery.
4. medial cord of brachial plexus.
5. deep head of pronator teres.
6. superficial head of pronator teres.
7. flexor digitorum superficialis.
8. median nerve in the forearm (descends in the midline).
9. flexor retinaculum.
10. digital branches of median nerve.

Fig.(228): RELATIONS OF THE MEDIAN NERVE TO FLEXOR DIGITORUM SUPERFICIALIS

The median nerve enters the forearm under cover of the tendinous arch extending between the radial head and humero-ulnar head of flexor digitorum superficialis to gain the deep surface of the muscle. It descends in the midline of the forearm (hence called median) adherent to the deep surface of the muscle. About 5 cm above the wrist, the median nerve comes out from under cover of the lateral border of the muscle, and here it becomes more superficial.

1. supinator muscle (its insertion lies edge to edge with the flexor digitorum superficialis, and extends from the insertion of biceps to the insertion of pronator teres).
2. insertion of pronator teres.
3. tendon of flexor carpi radialis (lateral to the median nerve above the wrist).
4. median nerve above the wrist (superficial).
5. muscular branch to thenar muscles.
6. digital branches to the thumb.
7. biceps brachii.
8. median nerve in the cubital fossa (here, it gives off its branches to the superficial flexor group of muscles except the flexor carpi ulnaris).
9. common origin of superficial flexor muscles.
10. tendinous arch between the 2 heads of flexor digitorum superficialis.
11. flexor digitorum superficialis.
12. palmar cutaneous branch of median nerve (arises a short distance above the flexor retinaculum).
13. digital branches of median nerve.

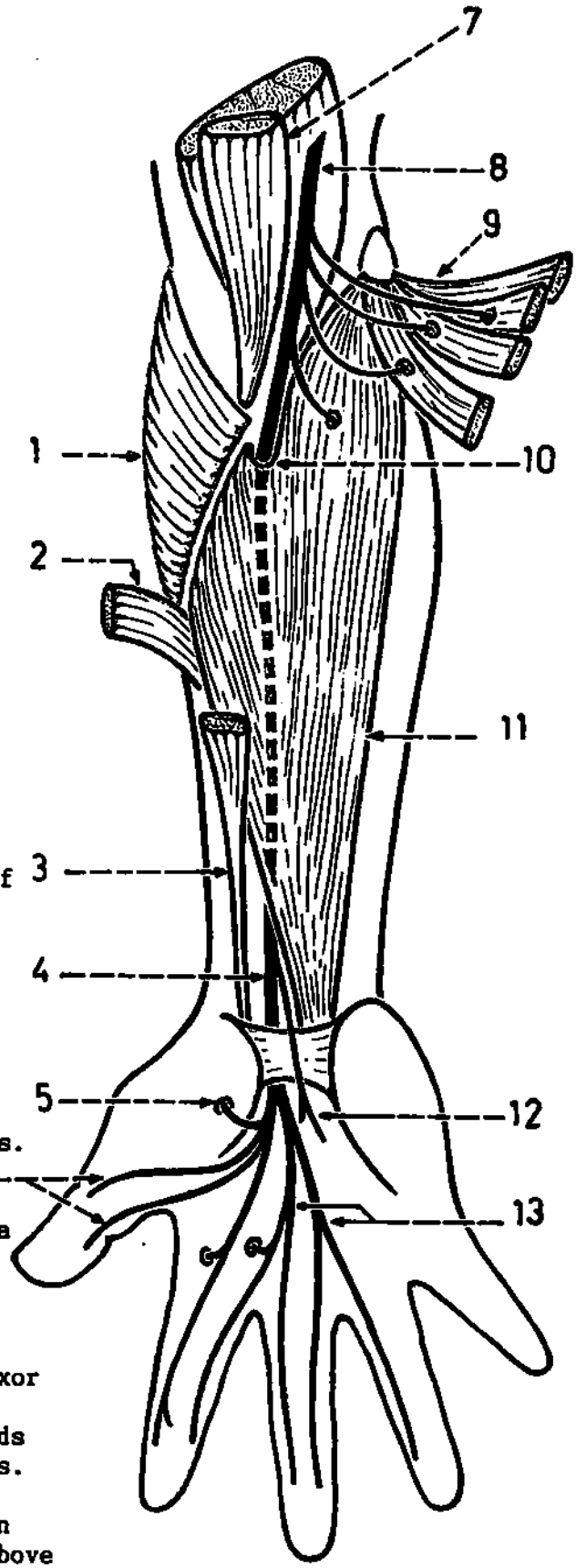
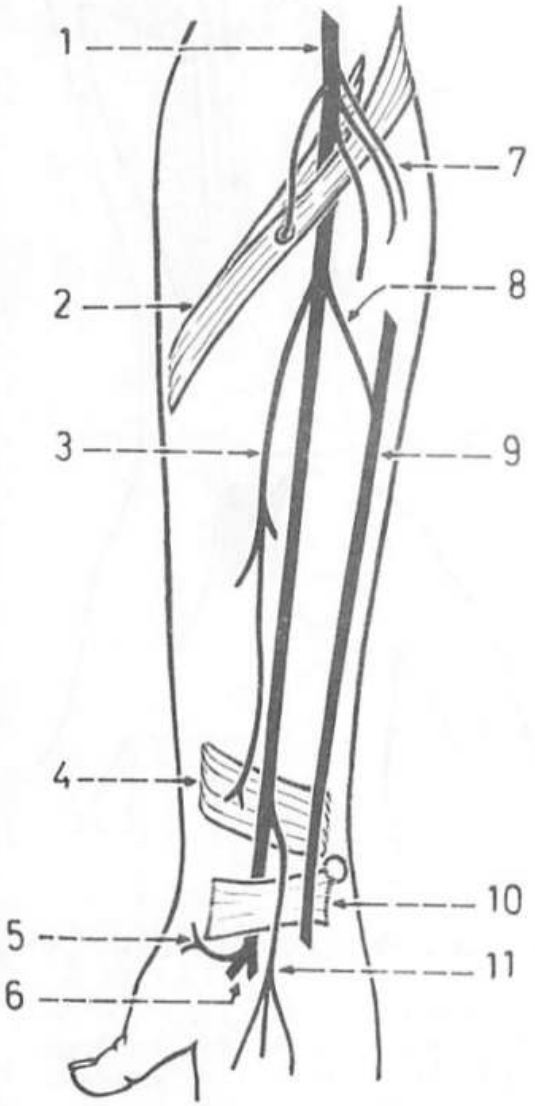


Fig.(229): BRANCHES OF THE MEDIAN NERVE IN THE FOREARM



The median nerve gives off the following branches in the forearm and cubital fossa: muscular branches to the superficial flexor group of muscles except the flexor carpi ulnaris (arise in the cubital fossa near the elbow joint), anterior interosseous nerve (arises in the upper part of the forearm just below the pronator teres), communicating branch with the ulnar nerve (in the upper part of forearm) and palmar cutaneous branch (arises a short distance above the wrist).

1. median nerve in the cubital fossa.
2. pronator teres.
3. anterior interosseous nerve (supplies the lateral 1/2 of flexor digitorum profundus, flexor pollicis longus and pronator quadratus).
4. pronator quadratus.
5. muscular branch to thenar muscles (arises just distal to the flexor retinaculum).
6. terminal divisions of median nerve in the palm.
7. muscular branches to the superficial flexor muscles.
8. communicating branch with the ulnar nerve (carries fibres of C.7 from the median nerve to the ulnar nerve).
9. ulnar nerve.
10. flexor retinaculum.
11. palmar cutaneous branch of median nerve (arises a short distance above the wrist and descends in front of the flexor retinaculum to supply the skin of the central part of the palm and that over the thenar eminence).

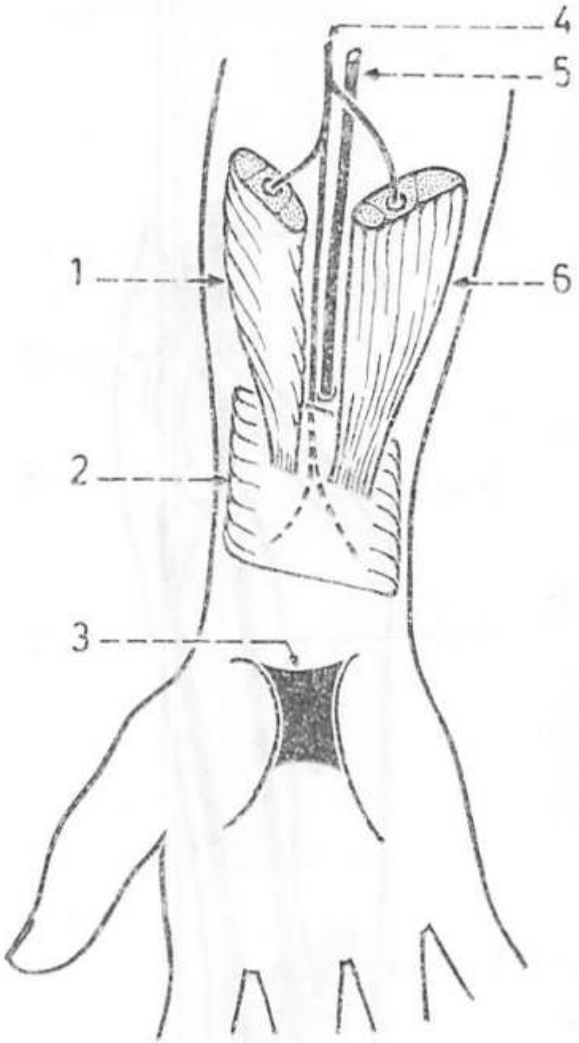


Fig.(230): ANTERIOR INTEROSSEOUS NERVE

It descends on the front of the interosseous membrane in company with the anterior interosseous artery, between the flexor digitorum longus and the flexor pollicis longus. It disappears deep to the pronator quadratus. It supplies these 3 muscles.

1. flexor pollicis longus.
2. pronator quadratus.
3. flexor retinaculum.
4. anterior interosseous nerve.
5. anterior interosseous artery.
6. flexor digitorum profundus.

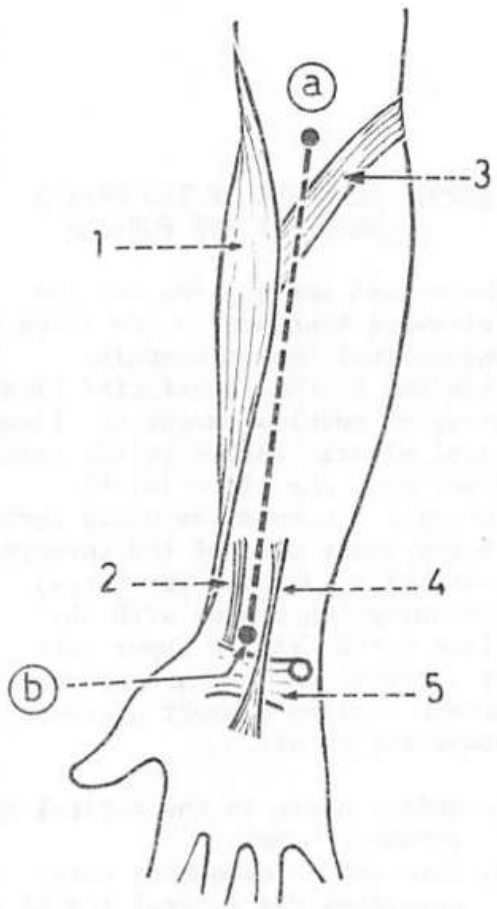


Fig.(231): SURFACE ANATOMY OF MEDIAN NERVE IN THE FOREARM

It is represented by a vertical line drawn along the middle of the front of forearm between 2 points:

Point (a) : at the midpoint of the cubital fossa.

Point (b) : at the midpoint of the wrist between the tendons of palmaris longus and flexor carpi radialis.

1. brachioradialis.
2. tendon of flexor carpi radialis.
3. pronator teres.
4. tendon of palmaris longus.
5. flexor retinaculum.

Fig.(232): COURSE OF ULNAR NERVE

It arises in the axilla from the medial cord of brachial plexus and descends to the back of the medial epicondyle. It enters the forearm between the 2 heads of the flexor carpi ulnaris and descends vertically along the medial side of the forearm, between the flexor carpi ulnaris superficially and the flexor digitorum profundus deeply.
At the wrist, the nerve crosses over the flexor retinaculum just lateral to the pisiform bone where it divides into superficial and deep divisions.

1. brachial artery.
2. ulnar artery.
3. palmar cutaneous branch of ulnar nerve.
4. ulnar nerve in the arm.
5. medial epicondyle (with the nerve on its posterior surface).
6. ulnar nerve in the forearm.
7. dorsal cutaneous branch of ulnar nerve.
8. pisiform bone (just medial to the ulnar nerve.
9. deep terminal division of ulnar nerve.
10. branches of the superficial terminal division of the ulnar nerve.

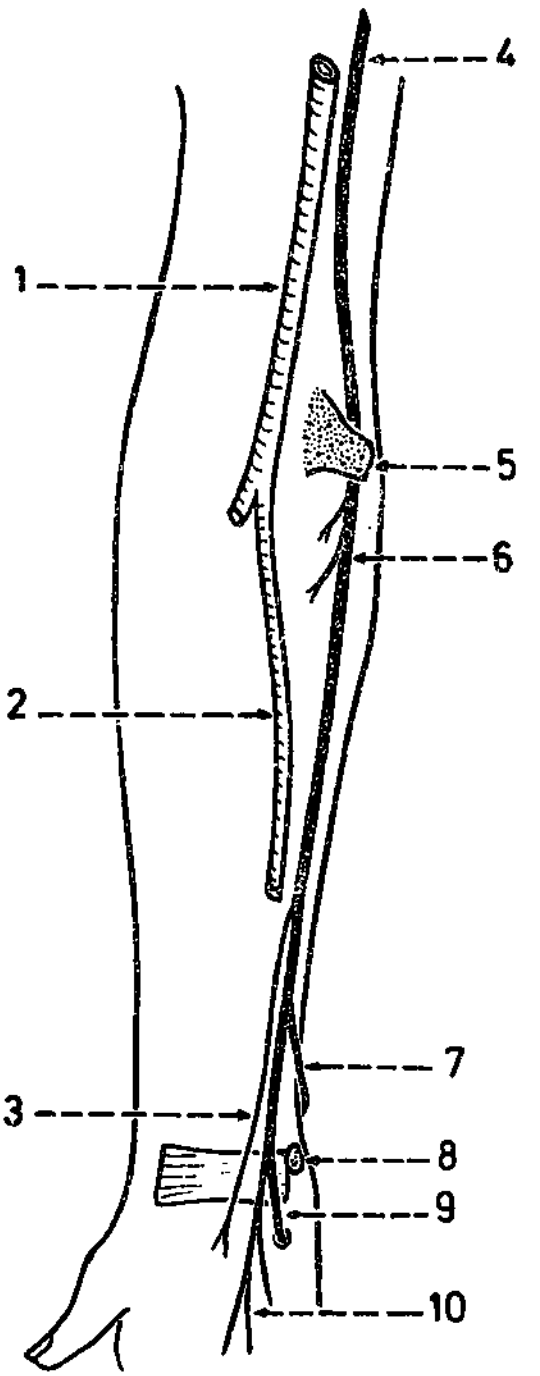
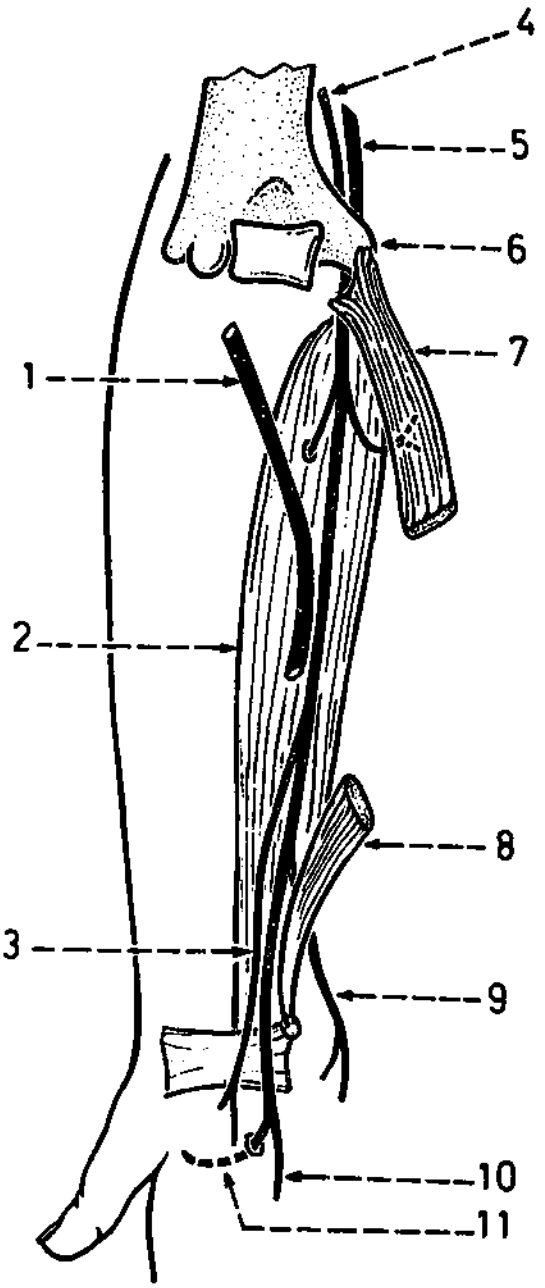


Fig.(233): RELATIONS AND BRANCHES OF ULNAR NERVE

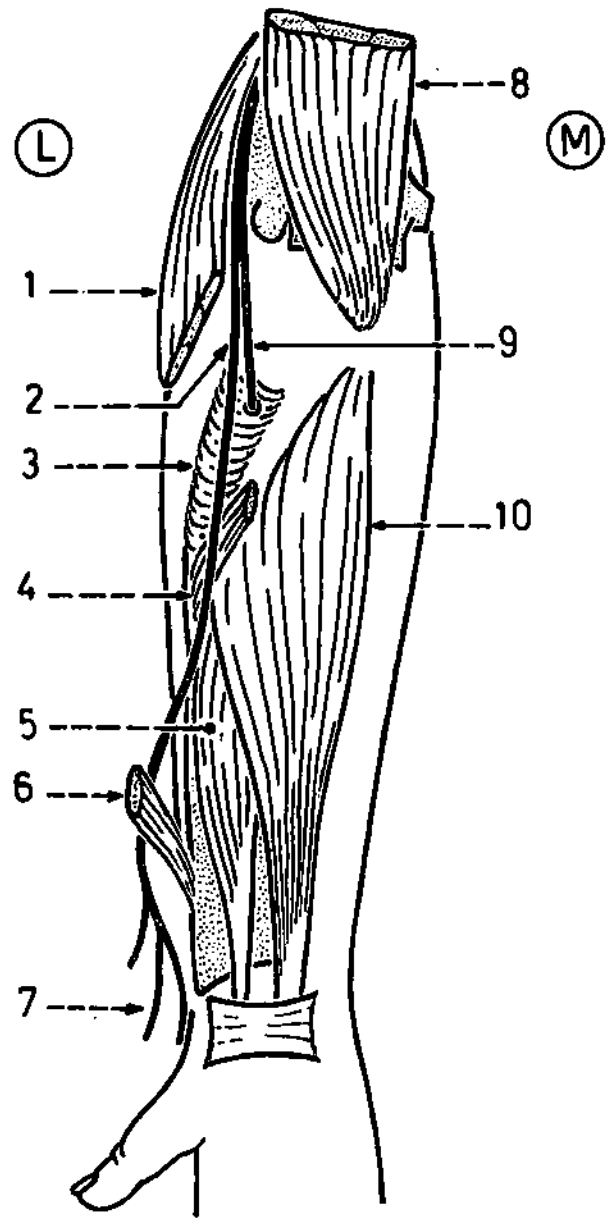


The ulnar nerve lies over the flexor digitorum profundus all through its course in the forearm, with the ulnar artery along its lateral side in its lower 2/3. However, the upper 1/3 of the nerve is separated from the oblique upper part of the artery by a wide interval.
The flexor carpi ulnaris covers the upper 2/3 of the ulnar nerve, but the lower 1/3 of the nerve emerges from under cover of the lateral border of the muscle to become superficial, together with the ulnar artery.
On the flexor retinaculum the ulnar nerve lies between the pisiform bone medially and the ulnar artery laterally.
The ulnar nerve gives off muscular branches from its upper part near the elbow and cutaneous branches from its lower part near the wrist.

1. ulnar artery.
2. flexor digitorum profundus.
3. palmar cutaneous branch (arises at the middle of forearm and descends in front of the flexor retinaculum).
4. superior ulnar collateral artery.
5. ulnar nerve.
6. medial epicondyle.
7. flexor carpi ulnaris (gets its nerve supply near the elbow).
8. flexor carpi ulnaris medial to the ulnar nerve.
9. dorsal cutaneous branch (arises about 5 cm above the wrist and winds backwards to reach the dorsum of the hand).
10. superficial division of ulnar nerve.
11. deep division of ulnar nerve (accompanies the deep palmar arch).

Fig.(234): COURSE OF RADIAL NERVE IN THE FOREARM

The radial nerve enters the forearm in front of the lateral epicondyle between the brachialis medially and the brachioradialis and extensor carpi radialis longus laterally. Here, it gives off the posterior interosseous nerve (deep branch of radial) and continues downwards as the superficial branch of radial. At the junction of the lower 1/3 and upper 2/3 of forearm, the superficial branch of radial (sensory) winds backwards from under cover of the brachioradialis to reach the dorsum of the hand.
In the forearm, the superficial branch of radial nerve comes lateral to the radial artery and is covered by one muscle which is the brachioradialis.



1. brachioradialis.
2. superficial branch of radial nerve.
3. supinator.
4. insertion of pronator teres.
5. flexor pollicis longus.
6. tendon of brachioradialis.
7. terminal digital branches of radial nerve.
8. brachialis.
9. posterior interosseous nerve (pierces the supinator to appear on the back of the forearm; its part in the cubital fossa is also called deep branch of radial nerve).
10. flexor digitorum superficialis.

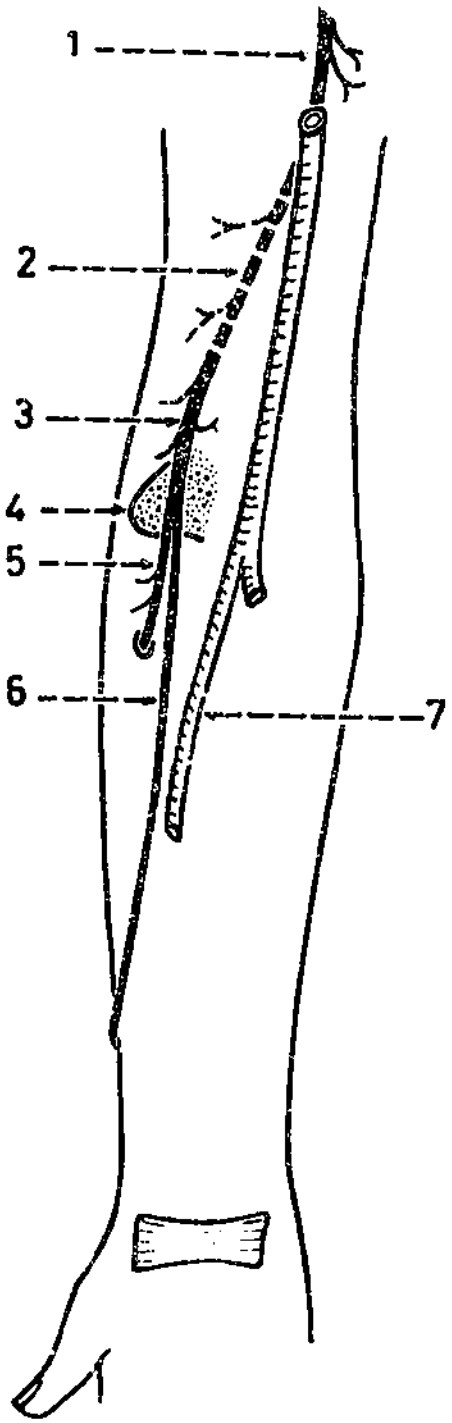


Fig.(235): RELATIONS OF RADIAL NERVE TO LATERAL EPICONDYLE AND RADIAL ARTERY

1. radial nerve in the axilla.
2. radial nerve in the spiral groove.
3. radial nerve on the lateral side of arm.
4. lateral epicondyle.
5. posterior interosseous nerve.
6. superficial branch of radial nerve.
7. radial artery.

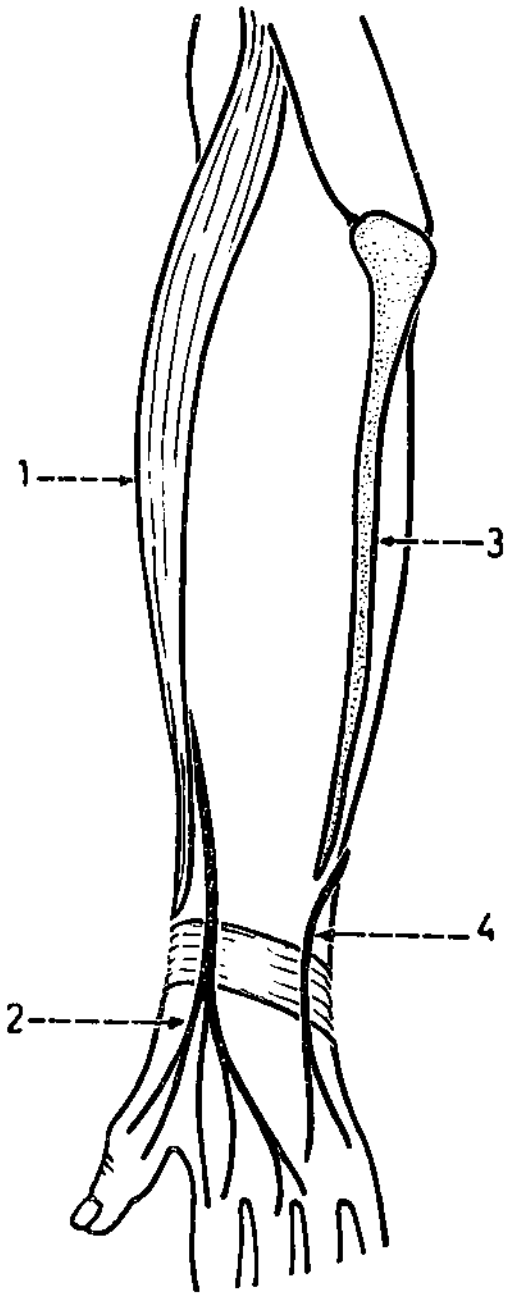


Fig.(236): TERMINAL BRANCHES OF RADIAL NERVE AND DORSAL CUTANEOUS BRANCH OF ULNAR NERVE

1. brachioradialis.
2. terminal branches of radial nerve.
3. posterior border of ulna.
4. dorsal cutaneous branch of ulnar nerve.

* These 2 nerves supply the skin of the dorsum of the hand.

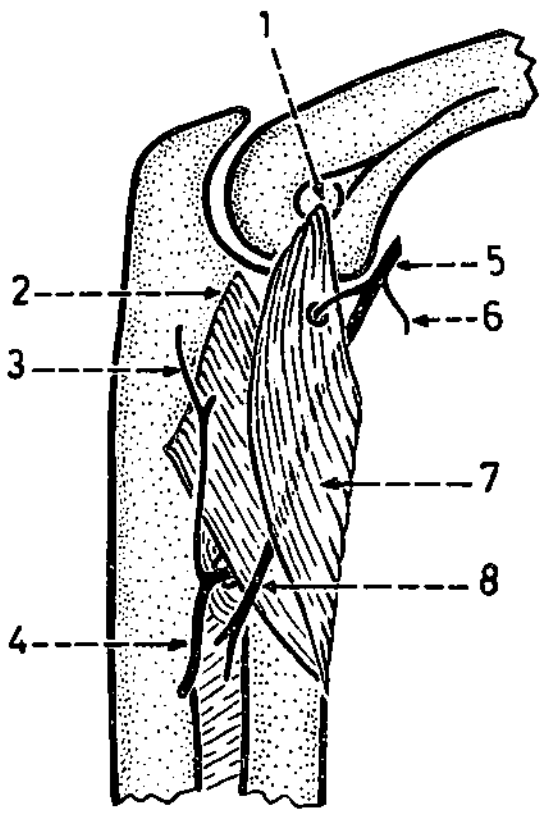


Fig.(237): POSTERIOR INTEROSSEOUS NERVE AS IT PIERCES THE SUPINATOR MUSCLE

The posterior interosseous nerve arises from the radial nerve in front of the lateral epicondyle and pierces the supinator muscle in the cubital fossa. Before it pierces the muscle, it supplies the supinator and the extensor carpi radialis brevis. It passes through the supinator lateral to the upper 1/3 of the radius.

1. lateral epicondyle.
2. deep part of supinator (from the supinator crest of ulna).
3. interosseous recurrent branch.
4. posterior interosseous artery (on the back of forearm).
5. posterior interosseous nerve in in the cubital fossa (supplies the supinator and extensor carpi radialis brevis).
6. branch to extensor carpi radialis brevis.
7. superficial head of supinator.
8. posterior interosseous nerve (on the back of forearm).

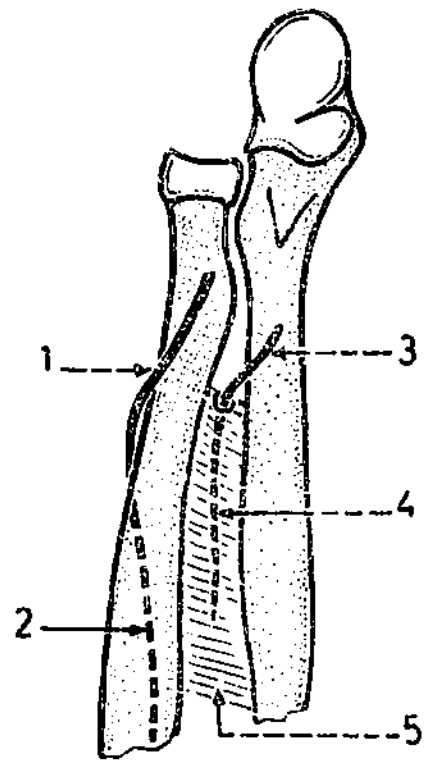


Fig.(238): RELATIONS OF THE POSTERIOR INTEROSSEOUS NERVE AND ARTERY TO THE UPPER 1/3 OF THE RADIUS

The posterior interosseous nerve winds backwards on the lateral side of the upper 1/3 of the radius, while the corresponding artery does the same but on the medial side of the bone. Both the nerve and the artery are liable to injury in fracture of the upper 1/3 of the bone.

1. posterior interosseous nerve on the lateral side of radius.
2. posterior interosseous nerve on the back of forearm.
3. posterior interosseous artery as it pierces the interosseous membrane.
4. posterior interosseous artery on the back of forearm.
5. interosseous membrane.

* The upper 1/3 of the radius lies between the nerve and the artery.

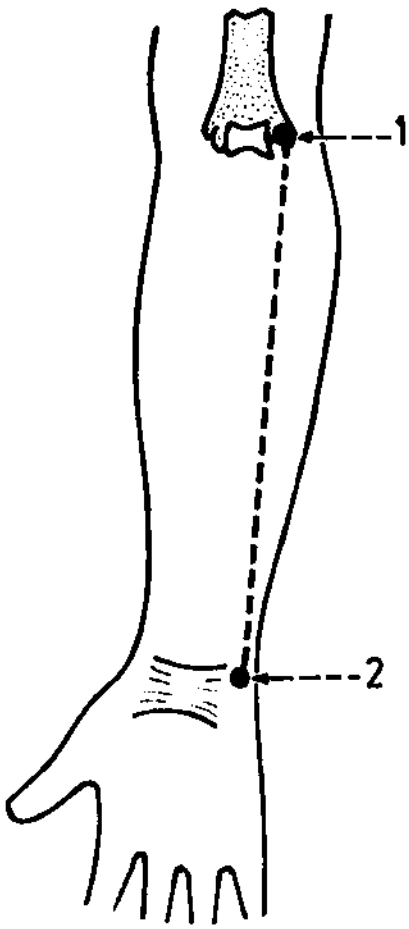


Fig.(239): SURFACE ANATOMY OF ULNAR NERVE IN THE FOREARM

It is represented by a vertical line drawn on the medial side of the forearm from the medial epicondyle (point 1) to the pisiform bone (point 2).

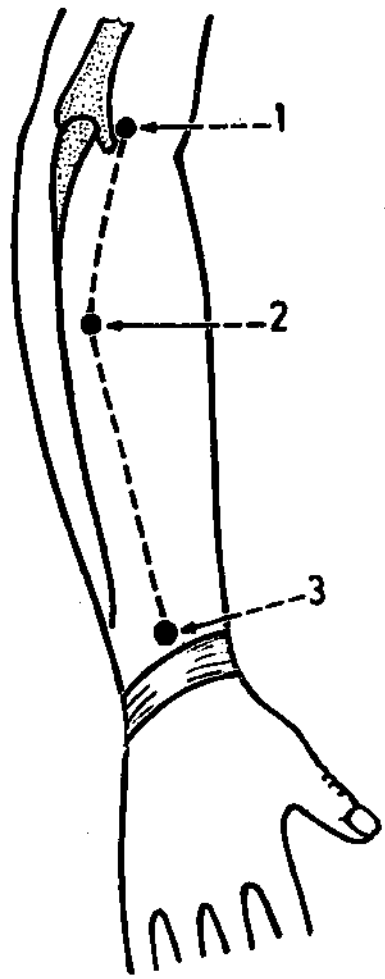


Fig.(240): SURFACE ANATOMY OF THE POSTERIOR INTEROSSEOUS NERVE

It is represented by a line on the back of the forearm drawn through 3 points:

Point (1): corresponds to the lateral epicondyle, 1 cm lateral to the tendon of biceps.

Point (2): lies on the back of forearm at the junction of the upper 1/3 with the lower 2/3 of a line extending from the head of radius to the dorsal tubercle on the back of the lower end of radius.

Point (3): corresponds to the dorsal tubercle of the lower end of radius.

BACK OF THE FOREARM

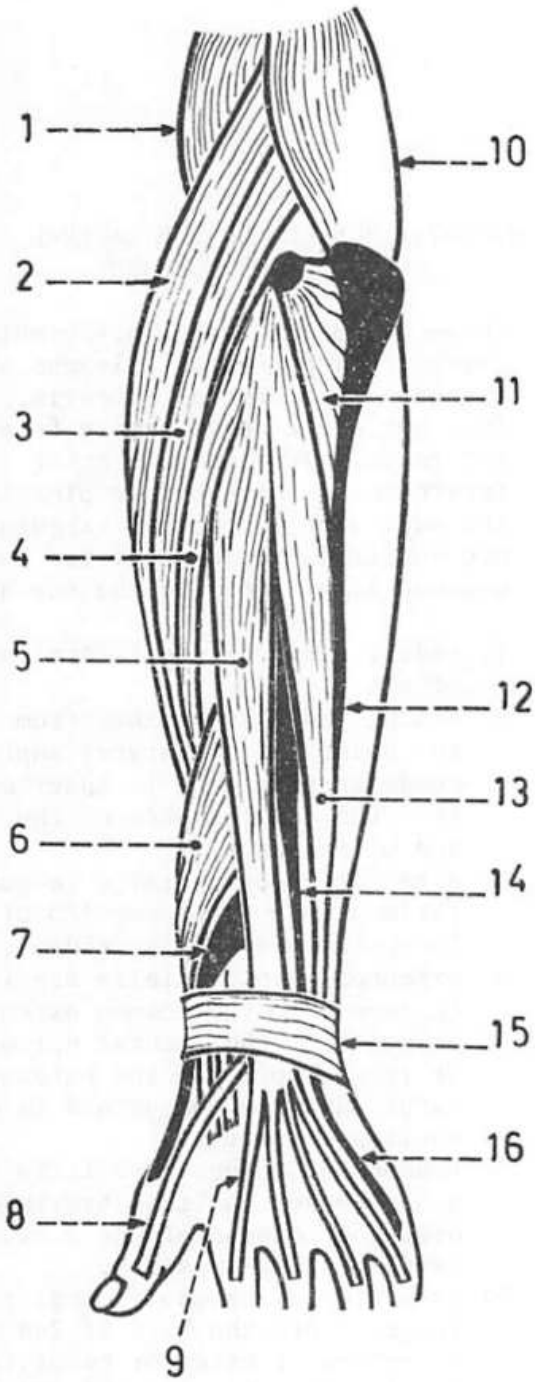


Fig.(241): SUPERFICIAL GROUP OF THE MUSCLES OF THE BACK OF FOREARM

These are 7 muscles which arise from the lateral supracondylar ridge of the humerus and by a common extensor origin from the lateral epicondyle. These muscles are as follows (from lateral to medial): brachioradialis, extensor carpi radialis longus, extensor carpi radialis brevis, extensor digitorum, extensor digiti minimi, extensor carpi ulnaris and anconeus.

1. brachialis.
2. brachioradialis (most lateral and forms the lateral boundary of the cubital fossa).
3. extensor carpi radialis longus.
4. extensor carpi radialis brevis.
5. extensor digitorum (the middle muscle of the group).
6. abductor pollicis longus (one of the deep group).
7. extensor pollicis brevis (one of the deep group).
8. tendon of extensor pollicis longus (one of the deep group).
9. one of the 4 tendons of the extensor digitorum (to the index finger).
10. triceps.
11. anconeus (inserted into the upper 1/4 of the posterior surface of the ulna).
12. posterior border of the ulna.
13. extensor carpi ulnaris.
14. extensor digiti minimi.
15. extensor retinaculum.
16. tendon of extensor digiti minimi alongside the tendon of the extensor digitorum to the little finger.

* The middle muscle of the group (extensor digitorum) goes to the digits, the peripheral 2 muscles (brachioradialis and anconeus) are inserted into the radius and ulna, while the muscles in between(carpi) are inserted into the bases of metacarpal bones.

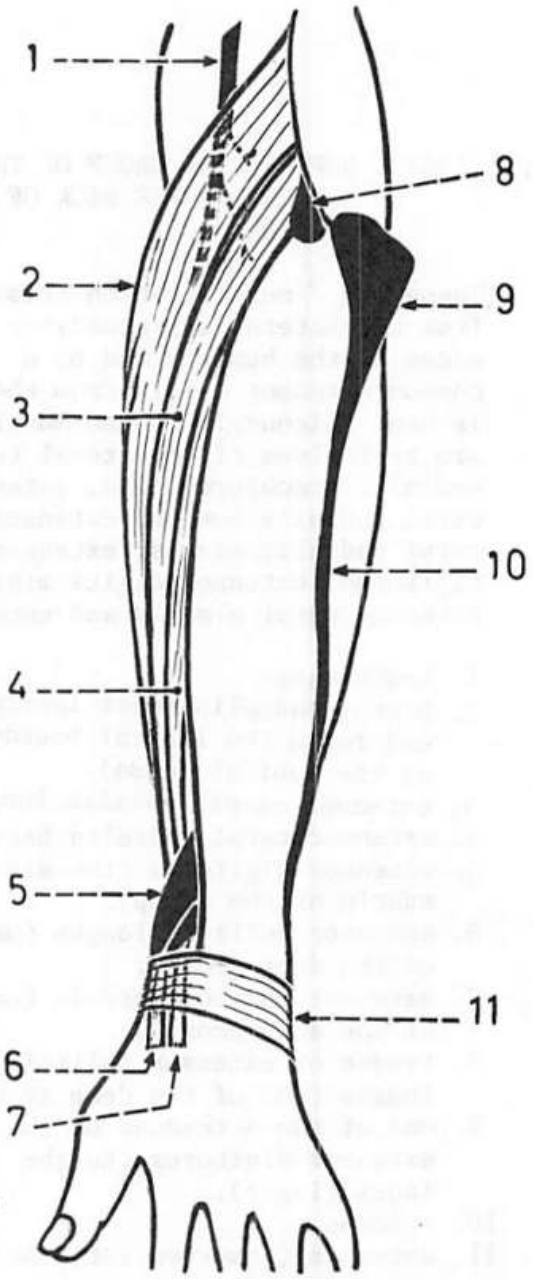


Fig.(242): MUSCLES ON THE LATERAL BORDER OF FOREARM

These are 3 muscles: brachioradialis, extensor carpi radialis longus and extensor carpi radialis brevis. They get their nerve supply from the radial nerve and posterior interosseous nerve before piercing the supinator (all other extensors are supplied by the posterior interosseous after piercing the supinator).

1. radial nerve on the lateral side of arm.
2. brachioradialis (arises from the upper 2/3 of lateral supracondylar ridge and is inserted into the lateral side of the lower end of radius).
3. extensor carpi radialis longus (arises from the lower 1/3 of lateral supracondylar ridge).
4. extensor carpi radialis brevis (arises from the common extensor origin from the lateral epicondyle; it is shorter than the extensor carpi radialis longus and is deep to it all through).
5. tendons of abductor pollicis longus and extensor pollicis brevis crossing over the tendons of the 2 extensor carpi radialis muscles.
6. insertion of extensor carpi radialis longus (into the base of 2nd metacarpal).
7. insertion of extensor carpi radialis brevis (into the base of 3rd metacarpal).
8. lateral epicondyle.
9. olecranon.
10. posterior border of ulna.
11. extensor retinaculum.

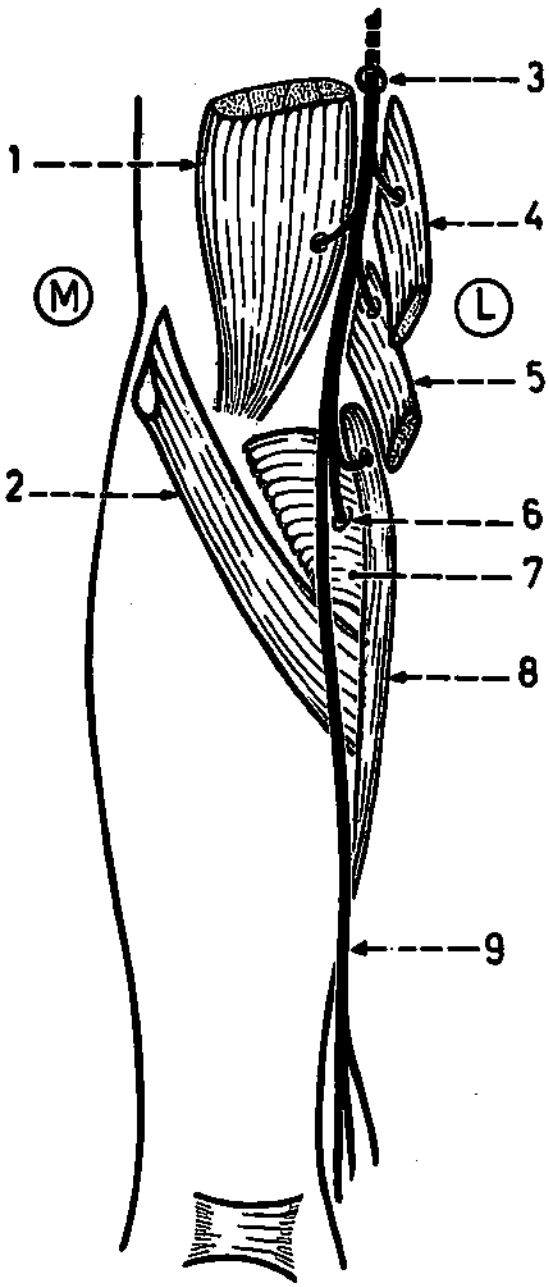


Fig.(243): NERVE SUPPLY OF BRACHIO-RADIALIS AND THE TWO EXTENSOR CAPPI RADIALIS

1. brachialis.
2. pronator teres.
3. radial nerve on the lateral side of arm.
4. brachioradialis.
5. extensor carpi radialis longus.
6. posterior interosseous nerve.
7. supinator.
8. extensor carpi radialis brevis.
9. superficial branch of radial nerve.

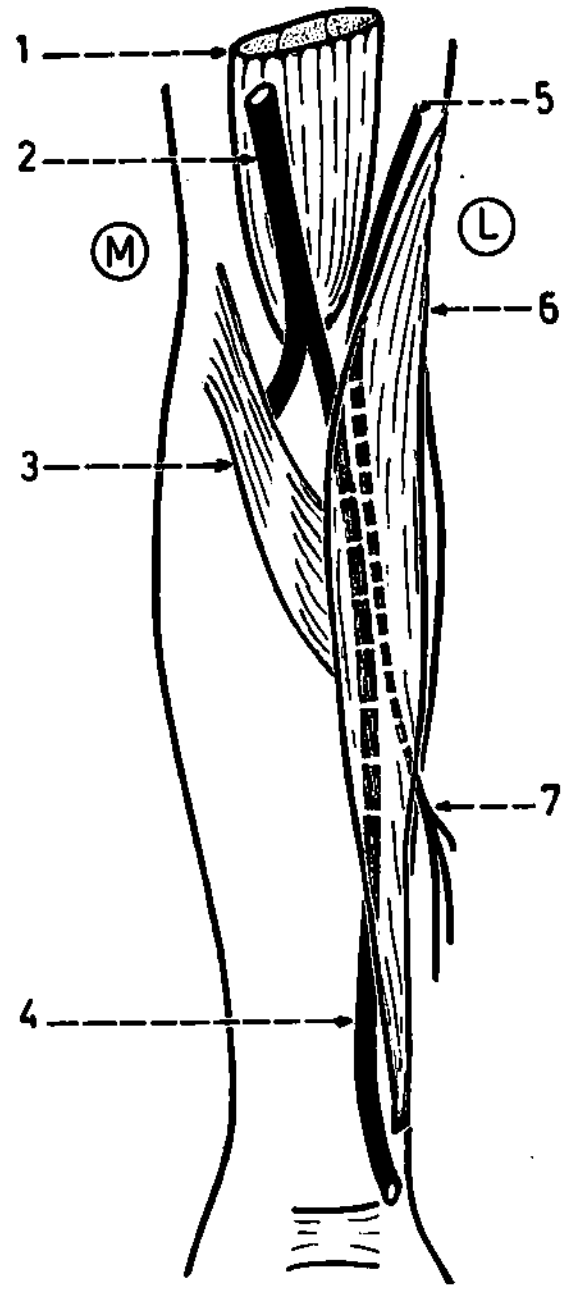


Fig.(244): DEEP RELATIONS OF BRACHIORADIALIS

These are the radial artery and superficial branch of radial nerve.

1. brachialis.
2. brachial artery.
3. pronator teres.
4. radial artery.
5. radial nerve on the lateral side of arm.
6. brachioradialis.
7. termination of the radial nerve.

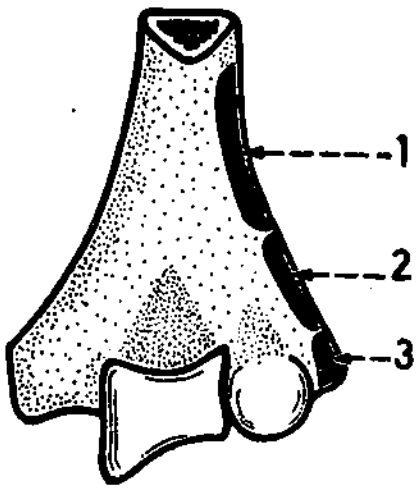


Fig.(245): BONY ORIGIN OF BRACHIORADIALIS AND THE TWO RADIAL EXTENSORS OF THE WRIST

1. origin of brachioradialis: from the upper 2/3 of the lateral supracondylar ridge.
2. origin of extensor carpi radialis longus: from the lower 1/3 of the lateral supracondylar ridge.
3. origin of extensor carpi radialis brevis: from the front of the lateral epicondyle by the common extensor tendon.

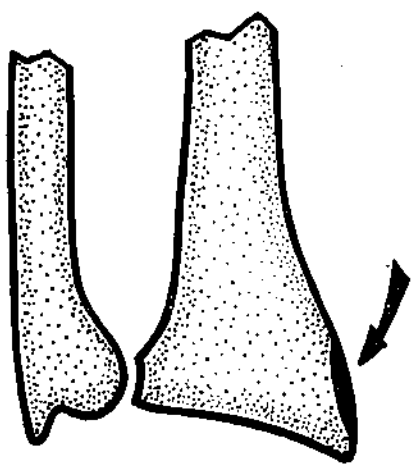
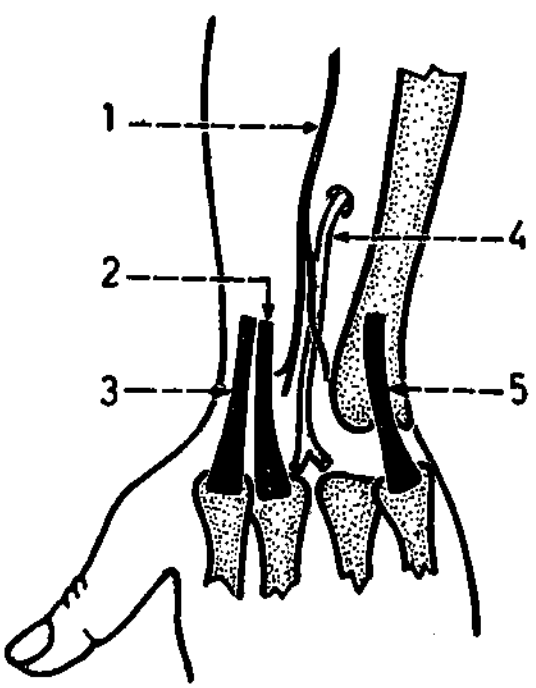


Fig.(246): INSERTION OF BRACHIORADIALIS

It is inserted into the lateral side of the lower end of the radius, just above the styloid process (arrow).

Fig.(247): INSERTIONS OF THE THREE EXTENSORS OF THE WRIST

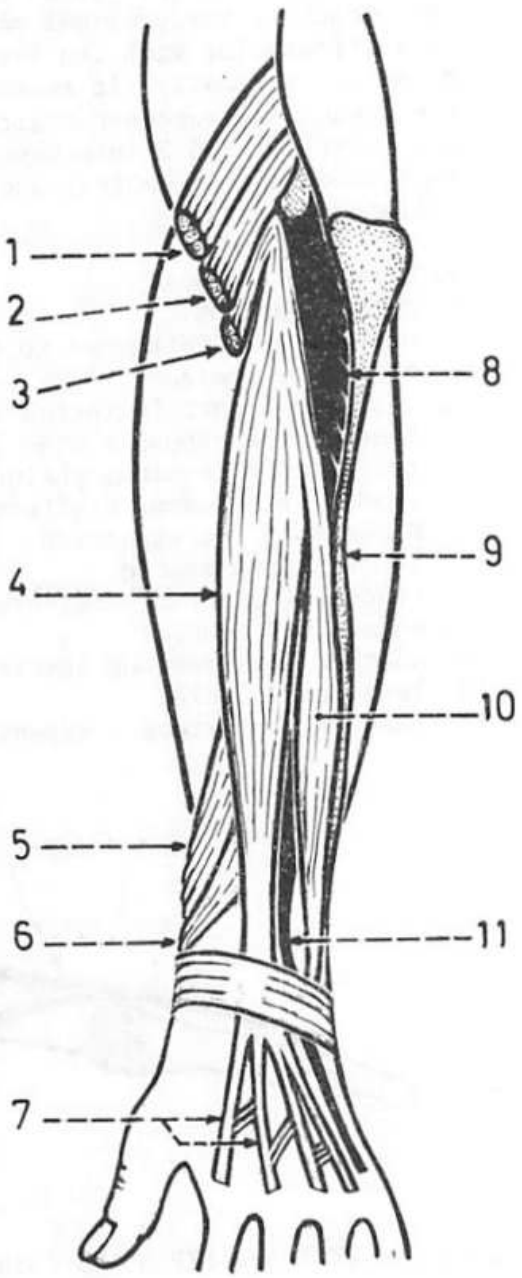
The extensors of the wrist are: extensor carpi radialis longus, extensor carpi radialis brevis and extensor carpi ulnaris.



1. posterior interosseous nerve.
2. tendon of extensor carpi radialis brevis (inserted into the base of 3rd metacarpal).
3. tendon of extensor carpi radialis longus (inserted into the base of 2nd metacarpal).
4. termination of the anterior interosseous artery (runs on the lower part of the back of forearm).
5. tendon of extensor carpi ulnaris (inserted into the base of 5th metacarpal).

* The insertions of the 2 radial extensors on the back correspond to the insertion of the flexor carpi radialis on the front.

Fig.(248): EXTENSOR DIGITORUM,
EXTENSOR DIGITI MINIMI,
EXTENSOR CARPI ULNARIS
AND ANCONEUS

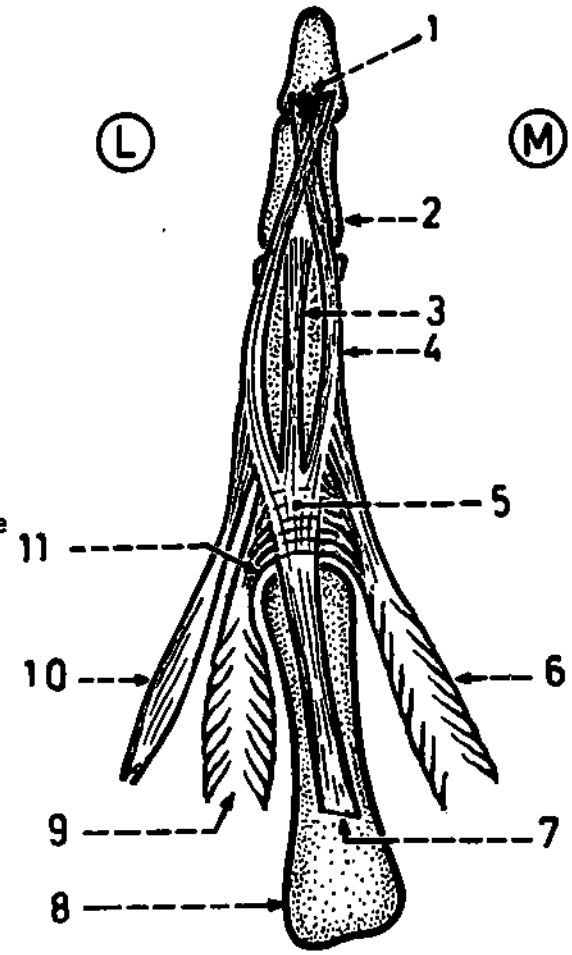


1. brachioradialis (cut).
2. extensor carpi radialis longus (cut).
3. extensor carpi radialis brevis (cut).
4. extensor digitorum (arises from the lateral epicondyle by the common extensor tendon and divides below into 4 tendons which are inserted into the back of medial 4 fingers by extensor expansions, see fig. 249).
5. abductor pollicis longus (one of the deep group and winds round the lower part of the lateral border of forearm).
6. extensor pollicis brevis (one of the deep group and passes just below and parallel to the abductor pollicis longus).
7. tendons of the extensor digitorum (interconnected with fibrous bands; each tendon joins the extensor expansion situated on the dorsum of the proximal phalanx, see fig.249).
8. anconeus (a triangular muscle which arises from the back of the lateral epicondyle and is inserted into the lateral side of olecranon and upper 1/4 of the posterior surface of the ulna; it is the shortest muscle and the most medial of the superficial group).
9. posterior border of ulna.
10. extensor carpi ulnaris (descends along the ulna, arises by the common extensor tendon and is inserted into the base of 5th metacarpal).
11. extensor digiti minimi (a partially separated part from the extensor digitorum muscle and its tendon joins the extensor expansion of the little finger).

Fig.(249): EXTENSOR EXPANSION
(dorsal digital expansion)

It is a fibrous sheet which covers the dorsum of the proximal phalanx. It is triangular with its base directed proximally. It receives the tendons of extensor digitorum, one lumbrical and 2 interossei. It divides into a central and 2 collateral parts.

1. terminal phalanx.
2. middle phalanx.
3. central part (attached to the base of middle phalanx).
4. collateral part (attached with that of the opposite side into the base of terminal phalanx).
5. tendon of extensor digitorum traversing the expansion.
6. interosseous muscle.
7. tendon of extensor digitorum.
8. metacarpal bone.
9. another interosseous muscle.
10. lumbrical muscle.
11. base of the extensor expansion.



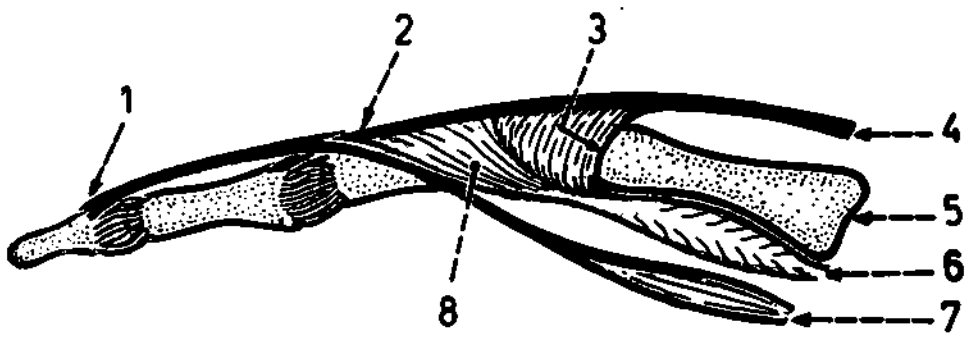
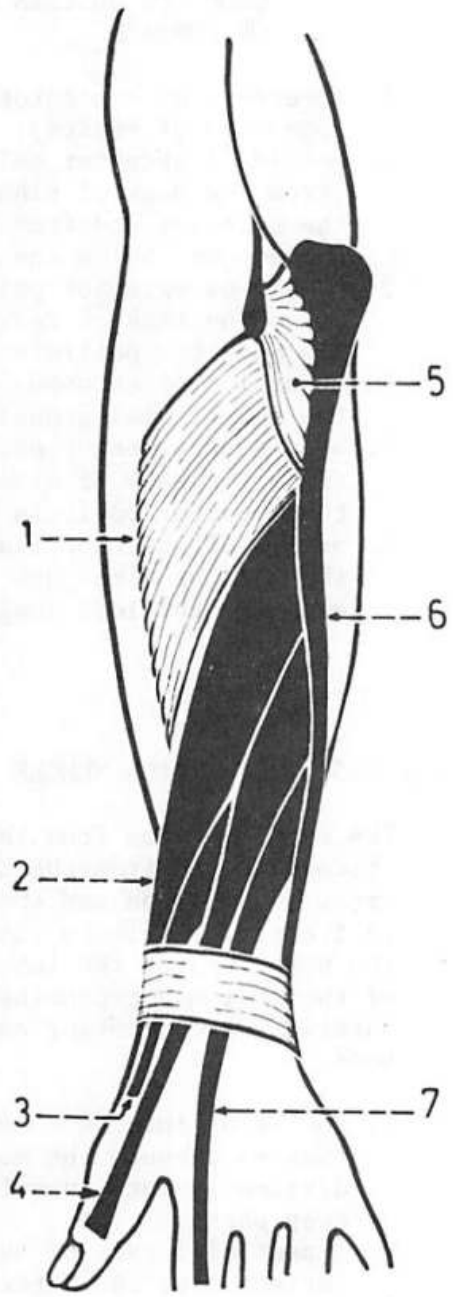


Fig.(250): EXTENSOR EXPANSION (side view)

1. attachment of the collateral parts into the base of terminal phalanx.
2. attachment of the central part into the base of middle phalanx.
3. base of the extensor expansion.
4. tendon of extensor digitorum (traverses the expansion).
5. metacarpal bone.
6. interosseous muscle.
7. lumbrical muscle (attached to the lateral margin of the expansion).
8. side of the extensor expansion (covers the proximal phalanx).

Fig.(251): DEEP GROUP OF THE MUSCLES OF THE BACK OF FOREARM

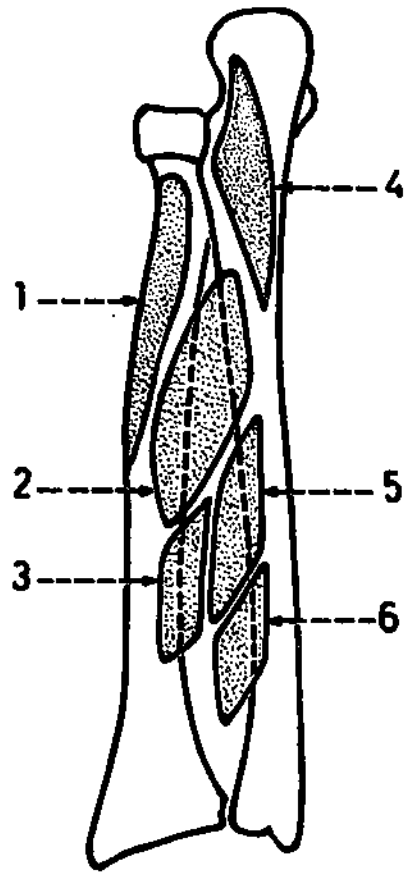


These are 5 muscles: supinator, abductor pollicis longus, extensor pollicis longus, extensor pollicis brevis and extensor indices.
The supinator is the uppermost of the group. The abductor pollicis longus lies immediately below the supinator and edge to edge with its lower border. The 2 extensors of the thumb lie below the abductor pollicis longus and their fleshy origins lie side by side,with the extensor pollicis longus originating from the ulna while the brevis originating from the radius.
The extensor indices originates from the ulna just below the extensor pollicis longus.

1. supinator (see fig.253).
2. abductor pollicis longus (arises from the back of the ulna just below the anconeus and from the back of the radius just below the supinator; it is inserted into the base of the 1st metacarpal bone).
3. extensor pollicis brevis (arises from the back of the radius below the abductor pollicis longus and is inserted into the base of the proximal phalanx of the thumb).
4. extensor pollicis longus (arises from the back of the ulna below the abductor pollicis longus and is inserted into the base of the terminal phalanx of the thumb).
5. anconeus (one of the superficial group).
6. posterior border of ulna.
7. extensor indices (arises from the back of ulna just below the extensor pollicis longus and its tendon of insertion joins the extensor expansion of the index).

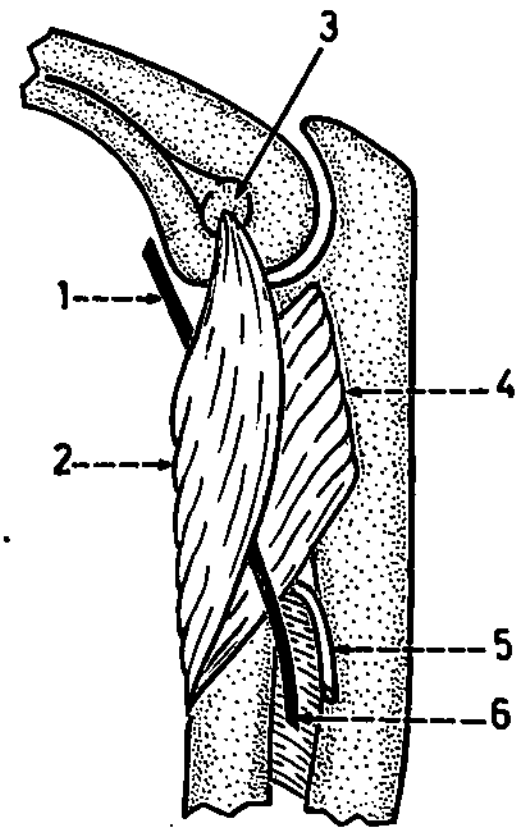
* Note that more muscles arise from the ulna,which is relatively fixed,than from the radius.

Fig.(252): BONY ATTACHMENTS OF THE DEEP GROUP OF MUSCLES ON THE BACK OF FOREARM



1. insertion of supinator (into the upper 1/3 of radius).
2. origin of abductor pollicis longus (from the back of ulna, just below the anconeus and from the back of radius just below the supinator).
3. origin of extensor pollicis brevis (from the back of radius just below the abductor pollicis longus).
4. insertion of anconeus (belongs to the superficial group).
5. origin of extensor pollicis longus (from the back of ulna just below the abductor pollicis longus).
6. origin of extensor indices (from the back of ulna just below the extensor pollicis longus).

Fig.(253): SUPINATOR MUSCLE



The muscle arises from the lateral epicondyle and from the supinator crest of the ulna and the depression in front of it. It is inserted into the upper 1/3 of the lateral surface of the radius encroaching on the anterior and posterior aspects of the bone.

1. posterior interosseous nerve (passes through the muscle and divides it into superficial and deep parts).
2. superficial part of supinator (arises from the lateral epicondyle).
3. lateral epicondyle.
4. deep part of supinator (arises from the supinator crest of the ulna and the fossa in front of it).
5. posterior interosseous artery (emerges just below the supinator).
6. posterior interosseous nerve (emerges just above the lower border of the supinator).

Fig.(254): ANATOMICAL SNUFF-BOX

It is a hollow on the lateral side of the wrist and is bounded by: the tendons of the abductor pollicis longus and extensor pollicis brevis laterally, and by the tendon of the extensor pollicis longus medially. The radial artery crosses its floor and the terminal digital branches of the radial nerve cross its roof.

1. superficial branch of radial nerve.
2. abductor pollicis longus.
3. extensor pollicis brevis.
4. extensor pollicis longus.
5. radial artery (disappears between the 2 heads of the 1st dorsal interosseous muscle).

* The floor of the anatomical snuff-box is formed by the scaphoid and trapezium.

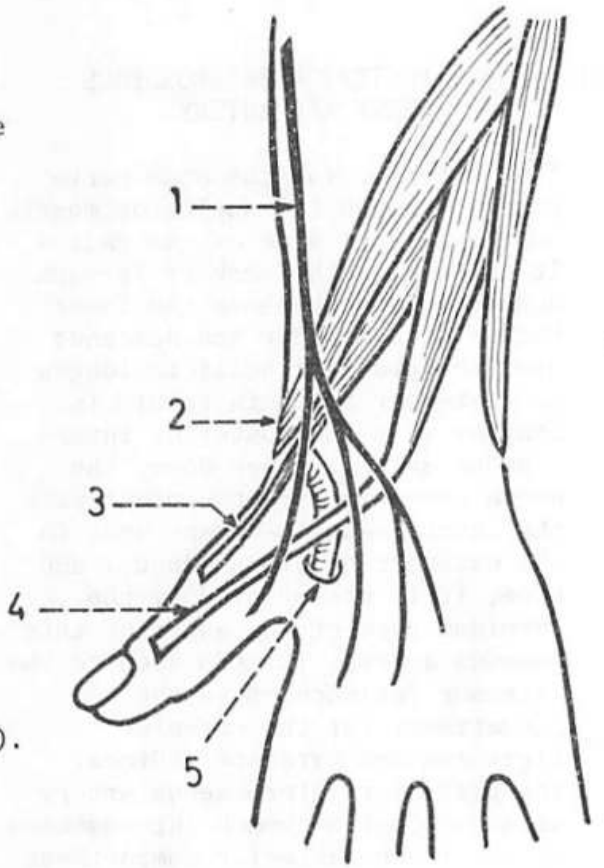


Fig.(255): RELATIONS OF THE LOWER PARTS OF THE EXTENSORS CARPI RADIALIS LONGUS AND BREVIS

The tendons of the extensor carpi radialis longus and extensor carpi radialis brevis are crossed by 3 muscles: tendons of abductor pollicis longus and extensor pollicis brevis (at the lower 1/4 of forearm) and tendon of extensor pollicis longus (very close to their insertion).

1. posterior interosseous nerve. (deep to the extensor pollicis longus).
2. extensor carpi radialis brevis.
3. extensor carpi radialis longus.
4. abductor pollicis longus.
5. extensor pollicis brevis.
6. extensor pollicis longus.
7. extensor indices.
8. extensor carpi ulnaris.

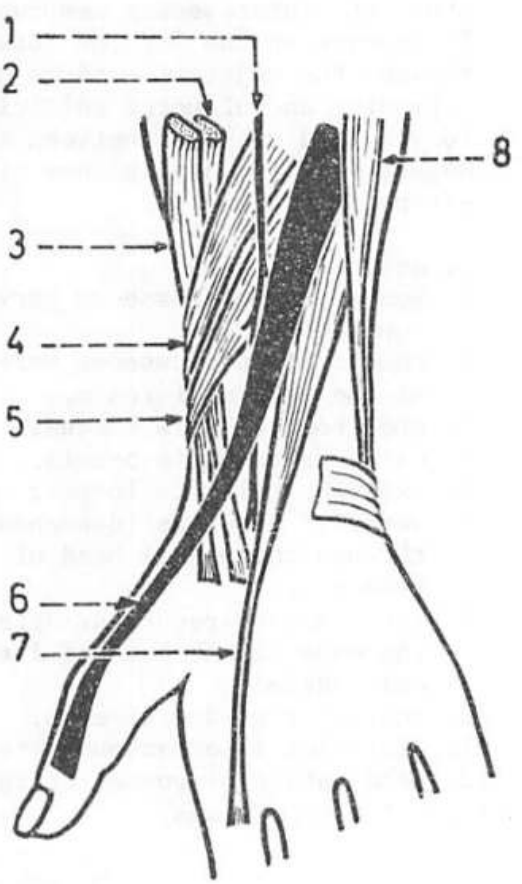
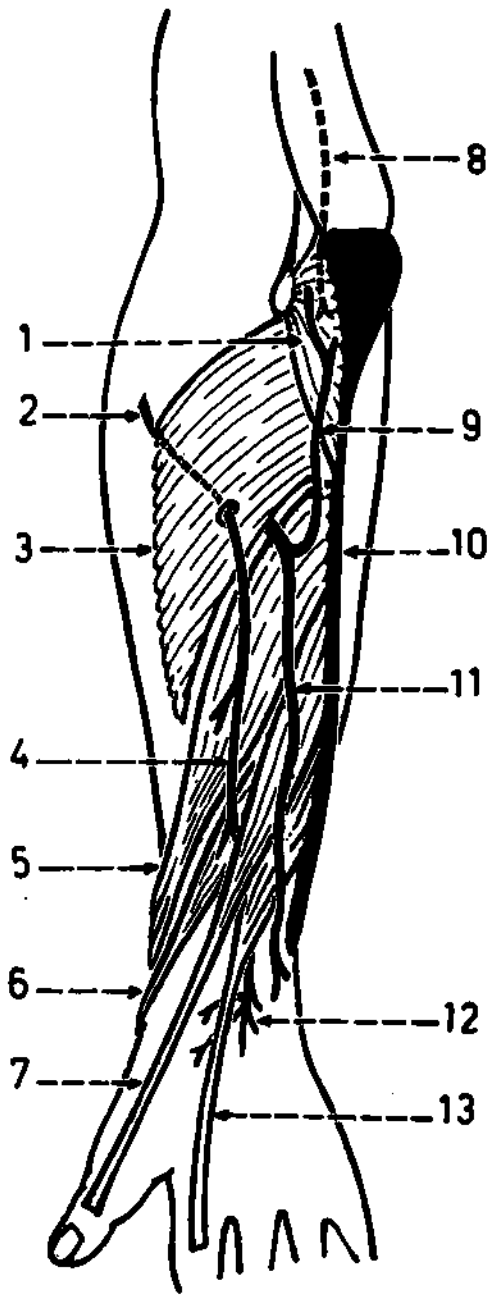


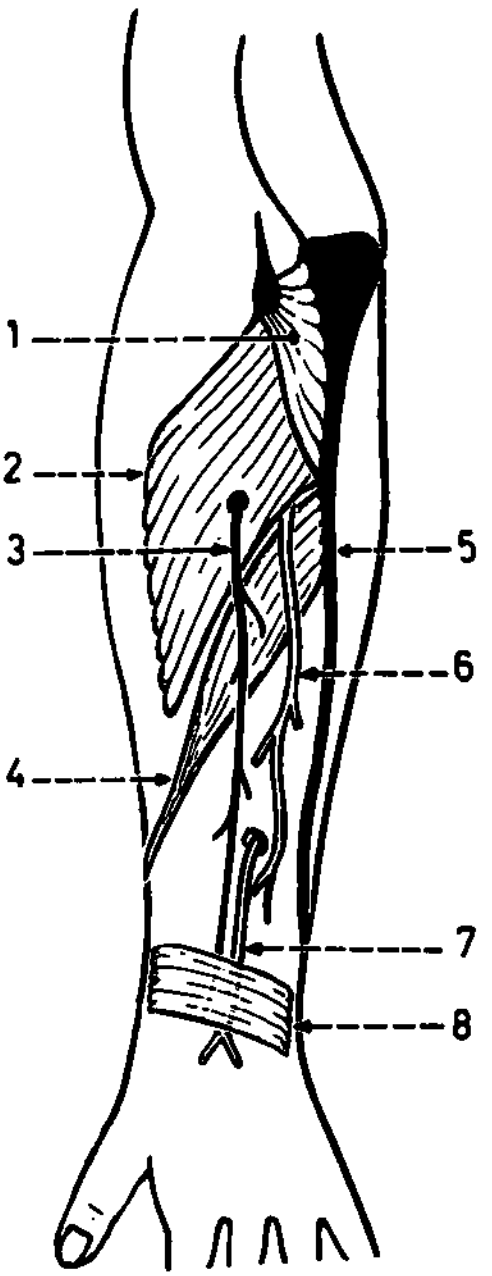
Fig.(256): POSTERIOR INTEROSSEOUS NERVE AND ARTERY

The posterior interosseous nerve passes through the supinator muscle on the lateral side of the radius. It appears on the back of forearm a short distance above the lower border of supinator and descends over the abductor pollicis longus and extensor pollicis brevis in company with the posterior interosseous artery. lower down, the nerve comes in direct contact with the interosseous membrane deep to the extensor pollicis longus, and here, it is accompanied by the terminal part of the anterior interosseous artery. It ends deep to the extensor retinaculum in the compartment for the extensor digitorum and extensor indices.
The posterior interosseous artery arises from the common interosseous artery in the anterior compartment of forearm and passes backwards above the interosseous membrane. It appears on the back of forearm between the adjacent borders of the supinator and abductor pollicis longus, and descends between the superficial and deep groups of extensor muscles.



1. anconeus muscle.
2. posterior interosseous nerve.
3. supinator.
4. posterior interosseous nerve on the back of forearm.
5. abductor pollicis longus.
6. extensor pollicis brevis.
7. extensor pollicis longus.
8. nerve to anconeus (descends through the medial head of triceps).
9. interosseous recurrent artery (ascends to the back of lateral epicondyle).
10. posterior border of ulna.
11. posterior interosseous artery.
12. termination of posterior interosseous nerve.
13. extensor indices.

Fig.(257): ANTERIOR AND POSTERIOR INTEROSSEOUS ARTERIES



The anterior interosseous artery reaches the back of forearm by piercing the interosseous membrane at the upper border of pronator quadratus. On the back of forearm, it descends in company with the posterior interosseous nerve and ends deep to the extensor retinaculum where it joins the dorsal carpal arch. It anastomoses with the termination of the posterior interosseous artery.

1. anconeus.
2. supinator.
3. posterior interosseous nerve (is accompanied by the posterior interosseous artery above, and by the anterior interosseous artery below; the nerve is lateral to the arteries).
4. abductor pollicis longus (separates the posterior interosseous nerve and artery from the interosseous membrane).
5. posterior border of ulna.
6. posterior interosseous artery (medial to the posterior interosseous nerve)
7. termination of the anterior interosseous artery (lies directly on the interosseous membrane).
8. extensor retinaculum.

H A N D

RETINACULA OF THE WRIST

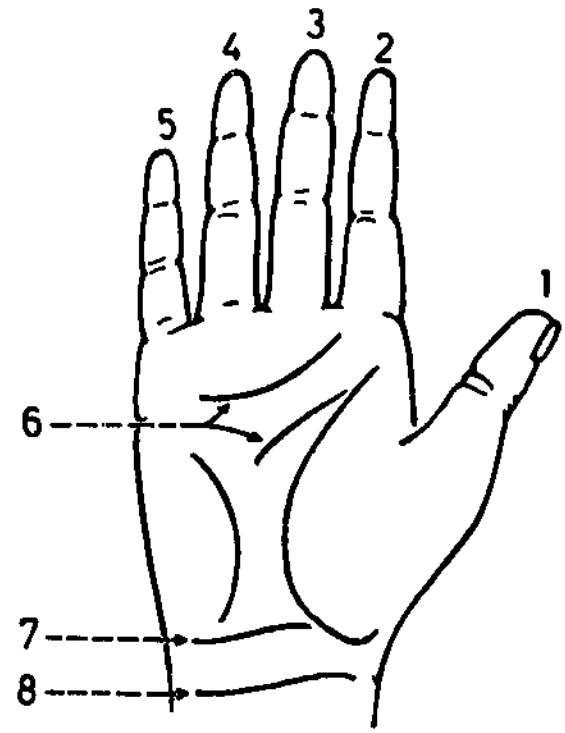


Fig.(258): CREASES OF THE HAND

The hand shows 2 flexion creases which run transversely across the palm, and 2 other creases at the junction of the forearm with the hand. At the crease, the skin is firmly fixed to the underlying subcutaneous tissue.

1. 1st finger or thumb (pollex).
2. 2nd finger or index finger.
3. 3rd finger or middle finger.
4. 4th finger or ring finger.
5. 5th finger or little finger.
6. transverse creases of the palm.
7. distal crease of the wrist.
8. proximal crease of the wrist.

* The distal crease of the wrist corresponds to the proximal border of the flexor retinaculum.

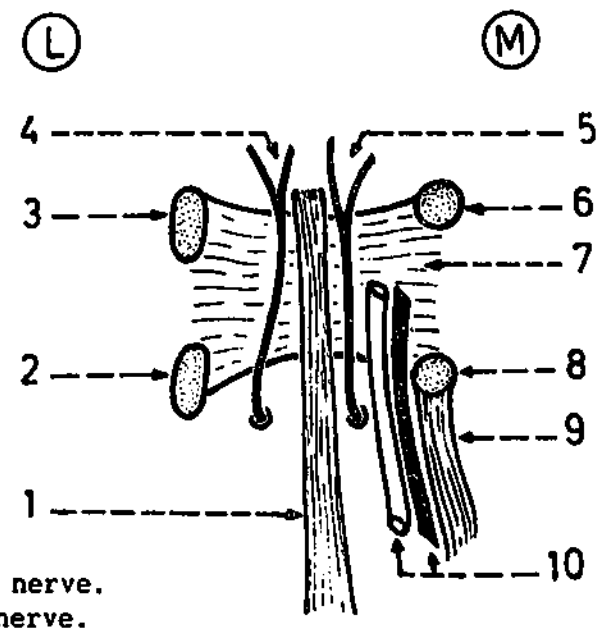


Fig.(259): FLEXOR RETINACULUM OF LEFT WRIST

The flexor retinaculum is a thickened fibrous band in front of the concavity of the carpus. It is attached medially to the pisiform and hook of the hamate, and laterally to the tubercle of the scaphoid and tubercle of the trapezium. It is crossed by: ulnar nerve, ulnar artery, palmar cutaneous branches of the median and ulnar nerves and tendon of palmaris longus.

1. palmaris longus.
2. tubercle of scaphoid.
3. tubercle of trapezium.
4. palmar cutaneous branch of median nerve.
5. palmar cutaneous branch of ulnar nerve.
6. hook of the hamate.
7. flexor retinaculum.
8. pisiform bone.
9. tendon of flexor carpi ulnaris.
10. ulnar nerve and artery.

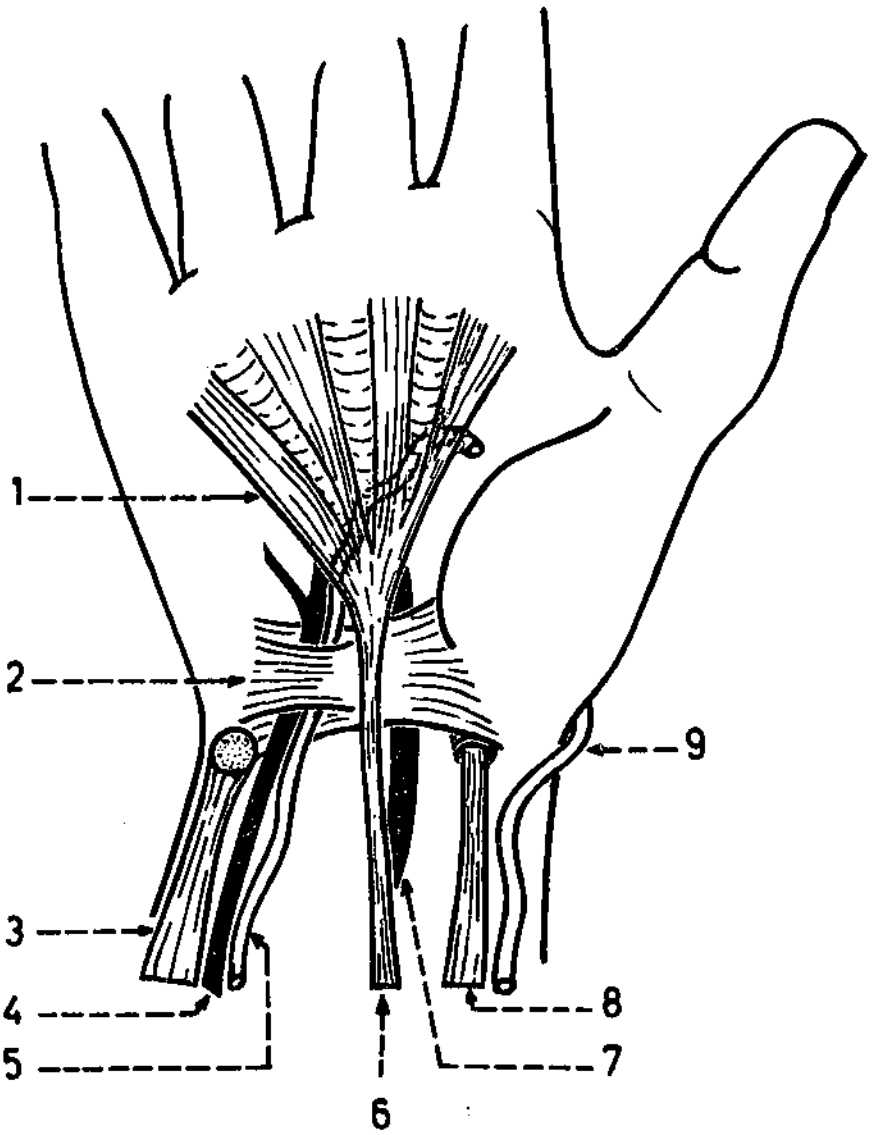


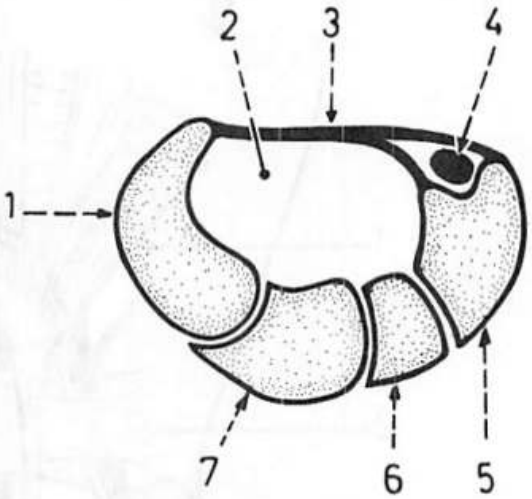
Fig.(260): RELATIONS OF THE ULNAR AND MEDIAN NERVES TO THE FLEXOR RETINACULUM

The ulnar nerve and artery cross over the medial part of the retinaculum where they are covered by a thin superficial part of the retinaculum, thus appear to pass through it. The median nerve passes deep to the retinaculum (through the carpal tunnel).

1. palmar aponeurosis.
2. flexor retinaculum (its medial part is splitted by the ulnar nerve and artery).
3. tendon of flexor carpi ulnaris(a guide to the pisiform bone).
4. ulnar nerve (superficial to the retinaculum).
5. ulnar artery (superficial to the retinaculum).
6. tendon of palmaris longus (crosses superficial to the retinaculum).
7. median nerve (just above the wrist, it lies between the tendons of palmaris longus and flexor carpi radialis; it passes underneath the flexor retinaculum).
8. tendon of flexor carpi radialis (passes through the lateral end of the retinaculum in a special compartment).
9. radial artery (winds backwards to the back of the hand).

Fig.(261): CARPAL TUNNEL

The flexor retinaculum converts the concavity of the carpus into the carpal tunnel. It is to be noted that the flexor retinaculum is attached to the edges of the carpal concavity which are formed by the pisiform and hook of the hamate medially, and by the tubercle of scaphoid and tubercle of trapezium laterally (4 bony points).



1. hamate.
2. carpal tunnel.
3. flexor retinaculum splitted laterally to enclose the tendon of flexor carpi radialis.
4. tendon of flexor carpi radialis (situated in a special compartment in front of the trapezium).
5. trapezium.
6. trapezoid.
7. capitate.

* The hamate, capitate, trapezium and trapezoid form the distal row of the carpal bones.

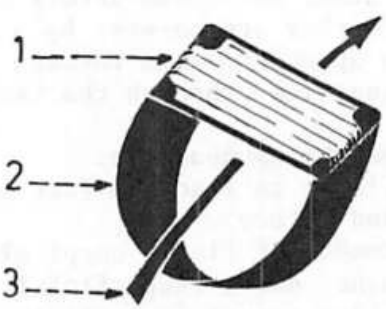
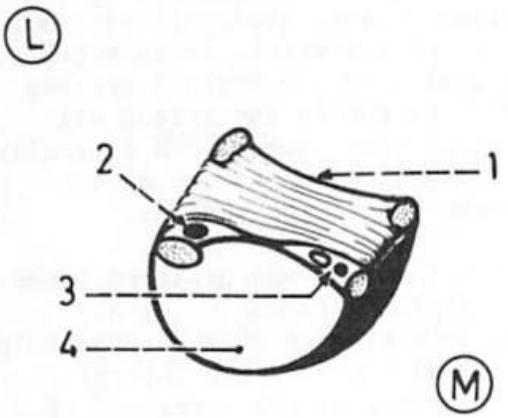


Fig.(262): FLEXOR RETINACULUM FORMING THE ROOF OF THE CARPAL TUNNEL

1. flexor retinaculum attached to the lateral and medial edges of the the carpal tunnel.
2. carpal concavity.
3. arrow in the carpal tunnel.

Fig.(263): STRUCTURES PASSING THROUGH THE FLEXOR RETINACULUM

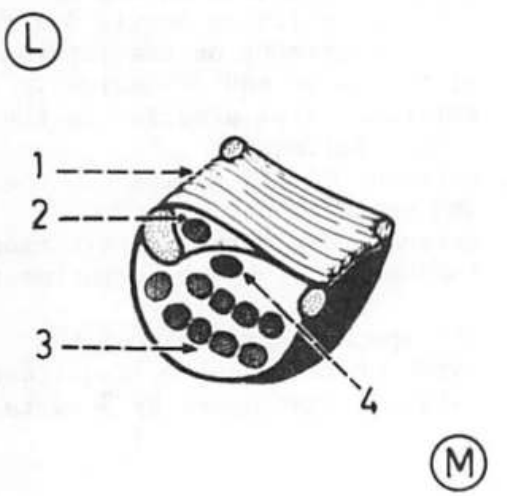
The tendon of the flexor carpi radialis splits the lateral part of the flexor retinaculum to lie in a special compartment, while the ulnar nerve and vessels split its medial part into a thin superficial layer and a thick deep layer. It is common teaching that the ulnar nerve and vessels cross superficial to the flexor retinaculum.



1. flexor retinaculum.
2. tendon of flexor carpi radialis.
3. ulnar nerve and artery.
4. carpal tunnel.

Fig.(264): CONTENTS OF THE CARPAL TUNNEL

The carpal tunnel transmits the median nerve and the tendons of 3 muscles: flexor digitorum superficialis, flexor digitorum profundus and flexor pollicis longus. Note that the tendon of the flexor carpi radialis is not a content of the carpal tunnel.



1. flexor retinaculum.
2. tendon of flexor carpi radialis (in the lateral part of the retinaculum).
3. tendons of the 3 long flexor muscles (flexor digitorum superficialis, flexor digitorum profundus and flexor pollicis longus).
4. median nerve (directly under cover of the retinaculum).

Fig.(265): BONY ATTACHMENTS OF THE EXTENSOR RETINACULUM

The extensor retinaculum of the wrist extends obliquely across the back of the wrist. It is attached medially to the styloid process of ulna and to the triquetral and pisiform bones, and laterally to the anterior border of the lower end of the radius.

1. triquetral and pisiform bones.
2. styloid process of ulna.
3. lateral edge of the retinaculum winding round the lateral surface of the lower end of radius to get attached to its anterior border.

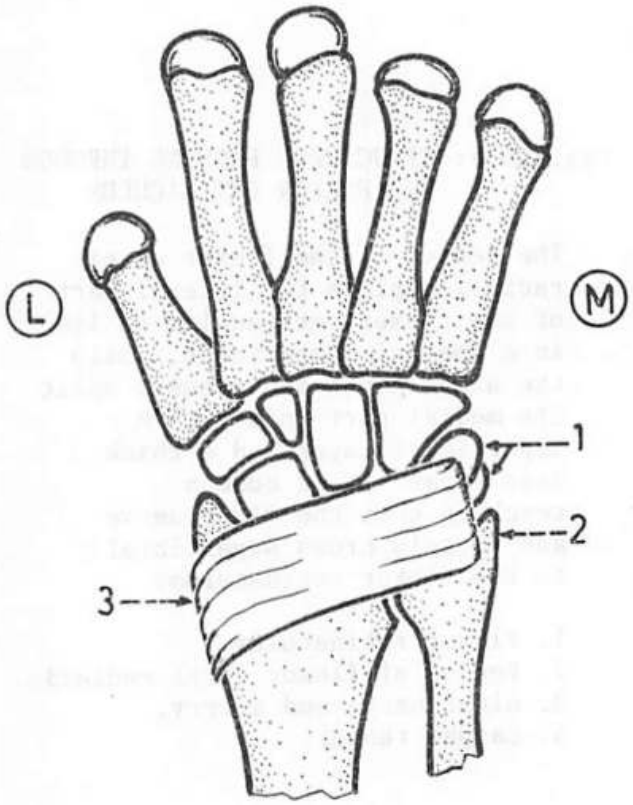
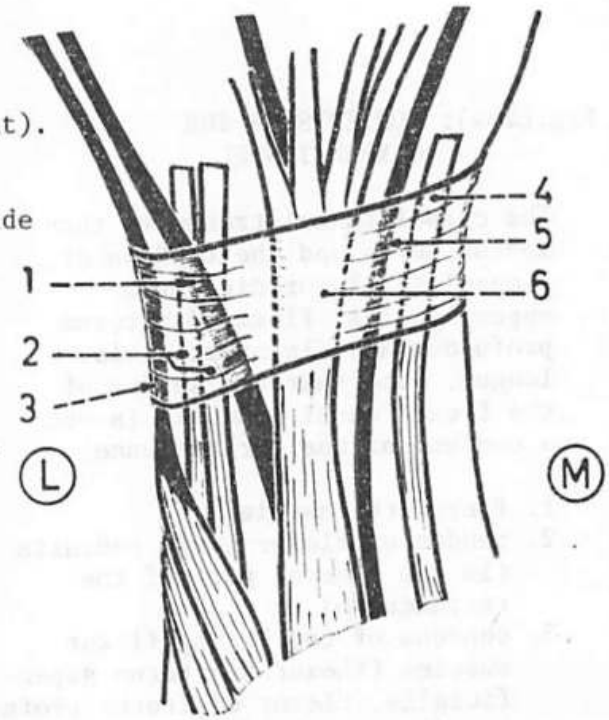


Fig.(266): TENDONS UNDER COVER OF THE EXTENSOR RETINACULUM

1. extensor pollicis longus (in the 3rd compartment).
2. extensor carpi radialis longus and brevis (in the 2nd compartment).
3. abductor pollicis longus and extensor pollicis brevis (in the 1st compartment on the lateral side of the lower end of radius).
4. extensor carpi ulnaris (in the 6th compartment).
5. extensor digiti minimi (in the 5th compartment).
6. extensor digitorum and extensor indices (in the 4th compartment).

* The space under cover of the extensor retinaculum is divided into 6 compartments by 5 septa.



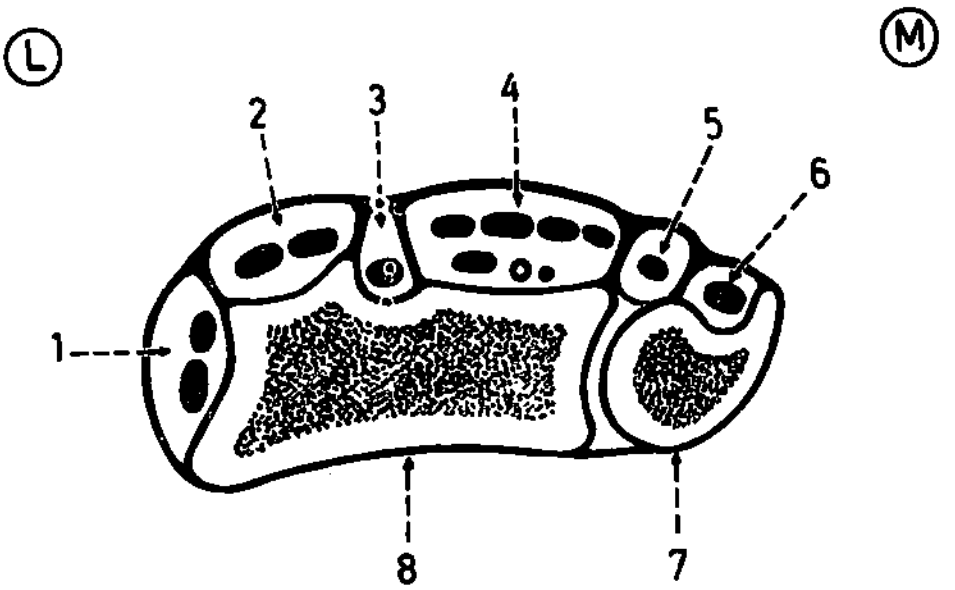


Fig.(267): COMPARTMENTS DEEP TO THE EXTENSOR RETINACULUM (T.S.)

The space deep to the extensor retinaculum is divided into 6 compartments or tunnels by 5 fibrous septa which extend between the retinaculum and back of the lower end of the radius and ulna.

1. 1st compartment: lies on the lateral side of the lower end of radius and transmits the tendons of abductor pollicis longus and extensor pollicis brevis.
2. 2nd compartment: lies on the lateral part of the back of the lower end of radius and transmits the tendons of the extensor carpi radialis longus and the extensor carpi radialis brevis.
3. 3rd compartment: lies just medial to the dorsal tubercle of the radius and transmits the tendon of the extensor pollicis longus.
4. 4th compartment: is the largest and lies medial to the 3rd compartment. It transmits the tendons of the extensor digitorum and extensor indices, in addition to the anterior interosseous artery and posterior interosseous nerve. It is the only compartment which contains a nerve and an artery.
5. 5th compartment: lies opposite the interval between the radius and the ulna and transmits the tendon of extensor digiti minimi.
6. 6th compartment: lies between the head and the styloid process of the ulna and transmits the tendon of extensor carpi ulnaris.
7. lower end of ulna.
8. lower end of radius.

PALMAR APONEUROSIS AND FASCIAL SPACES OF THE HAND

Fig.(268): PALMAR APONEUROSIS

It is a thickened triangular part of the deep fascia of the palm. Its apex is continuous with the tendon of the palmaris longus, while its base divides into 4 slips for the medial 4 fingers. Each slip subdivides into 2 processes which fuse with the entrance of the fibrous flexor sheath.

1. most lateral slip of palmar aponeurosis.
2. palmar digital nerves.
3. apex of palmar aponeurosis.
4. flexor retinaculum.
5. tendon of palmaris longus.
6. ulnar nerve.
7. base of palmar aponeurosis divided into 4 slips.

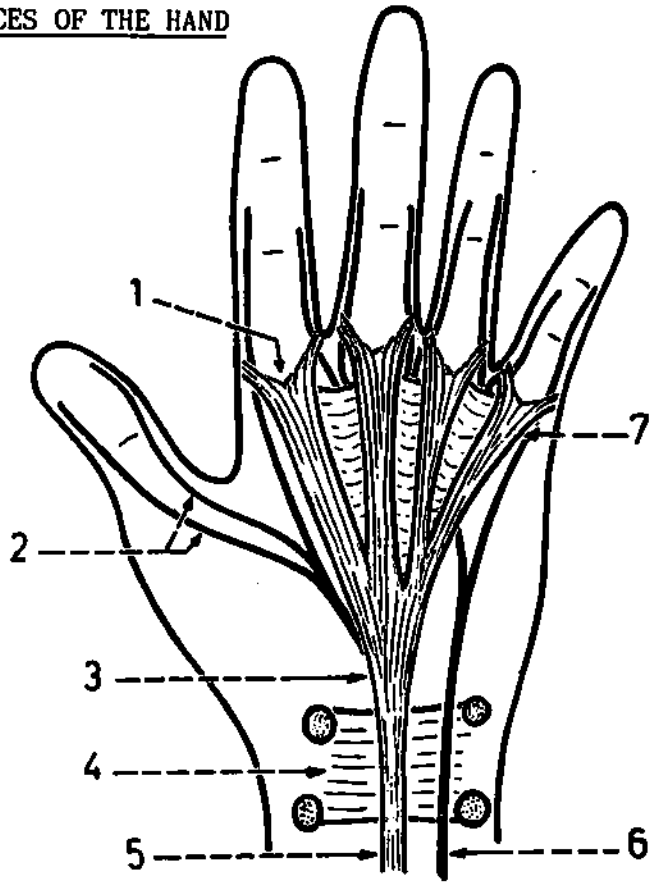
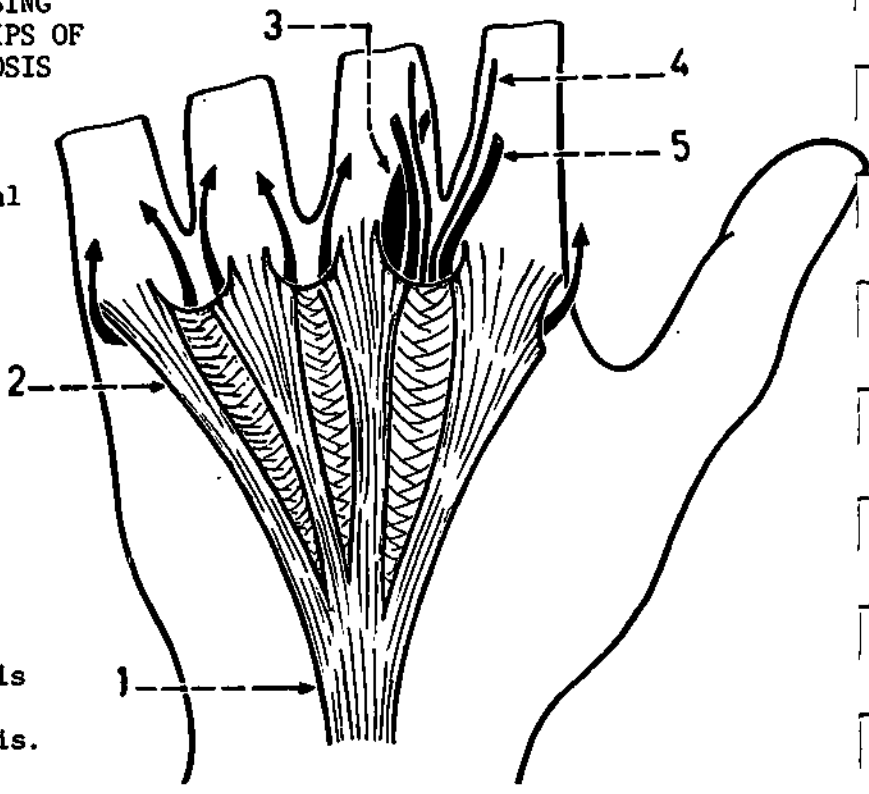


Fig.(269): STRUCTURES PASSING BETWEEN THE SLIPS OF PALMAR APONEUROSIS

These are the digital vessels and nerves and tendons of lumbrical muscles.

1. apex of palmar aponeurosis.
2. base of palmar aponeurosis.
3. tendon of lumbrical muscle.
4. palmar digital nerve.
5. palmar digital artery.

* The arrows emerge through the intervals between the 4 slips of palmar aponeurosis.



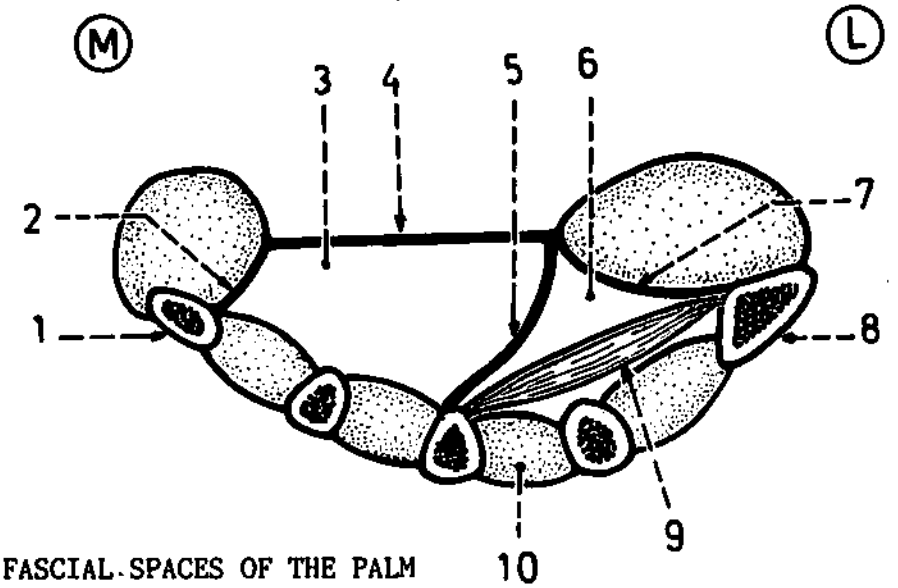


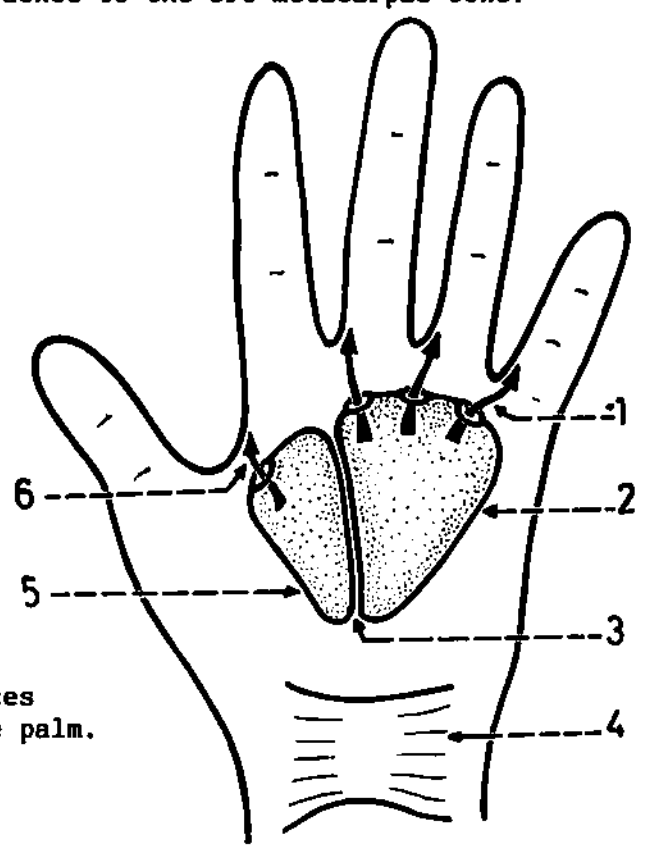
Fig.(270): FASCIAL SPACES OF THE PALM

The central part of the palm is bounded by the palmar aponeurosis which forms its roof and by the medial and lateral septa which form its sides. This central part is subdivided by an intermediate septum into the mid-palmar space medially and the thenar space laterally.

1. 5th metacarpal bone.
2. medial septum.
3. mid-palmar space(medial).
4. palmar aponeurosis.
5. intermediate septum.
6. thenar space (lateral).
7. lateral septum.
8. 1st metacarpal bone.
9. adductor pollicis.
10. dorsal interosseous muscle.

* The intermediate septum is attached to the 3rd metacarpal bone.

Fig.(271): THENAR AND MID-PALMAR SPACES



The thenar space lies lateral to the intermediate septum, while the mid-palmar space lies medial to it.

1. the mid-palmar space communicates with the webs between the medial 4 fingers.
2. mid-palmar space.
3. intermediate septum.
4. flexor retinaculum.
5. thenar space.
6. the thenar space communicates with the web of the thumb.

* The thenar and mid-palmar spaces occupy the central part of the palm.

Fig.(272): FASCIAL SPACES OF THE PALM

* Level (A-A):

This is a proximal level very close to the flexor retinaculum. At this level there is the common synovial sheath enclosing the long flexor tendons, and the intermediate palmar septum is not present.
In this section, the palmar aponeurosis gives medial and lateral septa from its medial and lateral margins respectively. The medial septum extends to the 5th metacarpal bone separating the medial (hypothenar) compartment from the intermediate (central) compartment, while the lateral septum extends to the 1st metacarpal bone separating the lateral compartment (for the thenar muscles) from the intermediate compartment.
The intermediate compartment contains the following structures (from superficial to deep): superficial palmar arch, palmar digital nerves, long flexor tendons surrounded by the common synovial sheath and the deep palmar arch together with the deep branch of ulnar nerve.

1. common synovial sheath.
2. superficial palmar arch (just beneath the palmar aponeurosis).
3. palmar aponeurosis.
4. tendon of flexor pollicis longus.
5. lateral septum.
6. lateral compartment of the palm.
7. 1st metacarpal bone.
8. adductor pollicis muscle.
9. deep palmar arch together with deep branch of ulnar nerve(deepest).
10. 5th metacarpal bone.
11. medial septum.
12. medial compartment of the palm.

* Level (B-B):

This level lies across the palm distal to the common synovial sheath where the intermediate palmar septum is present. The intermediate palmar septum passes to the 3rd metacarpal bone and divides the intermediate compartment into 2 fascial spaces: thenar space laterally, and mid-palmar space medially.
The thenar space contains the flexor tendons of the index, 1st lumbrical muscle and digital nerves and vessels to the lateral 1½ fingers. The mid-palmar space contains the flexor tendons of the medial 3 fingers and the related lumbrical muscles, and digital vessels and nerves for the medial 3½ fingers.

1. long flexor tendons for medial 3 fingers.
2. palmar digital vessels.
3. palmar digital nerves.
4. palmar digital nerves and vessels for lateral 1½ fingers
5. tendon of flexor pollicis longus.
6. lateral compartment of the palm.
7. adductor pollicis muscle.
8. thenar space.
9. flexor tendons for the index finger.
10. 3rd metacarpal bone.
11. intermediate septum.
12. mid-palmar space.
13. medial compartment of the palm.

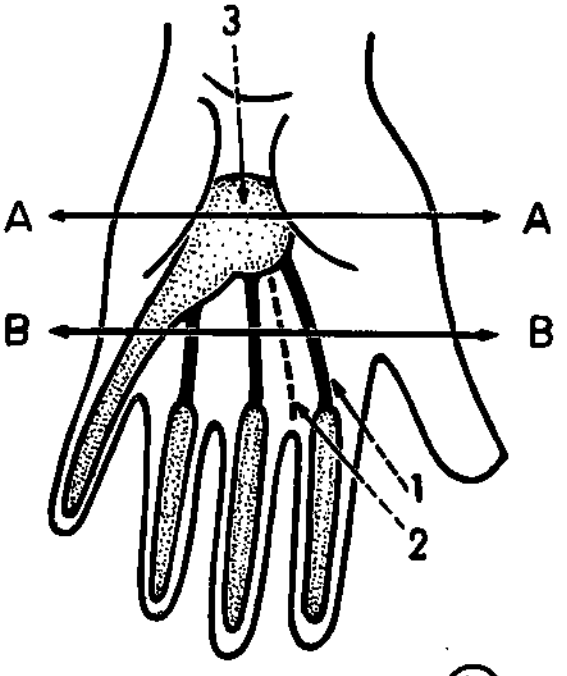


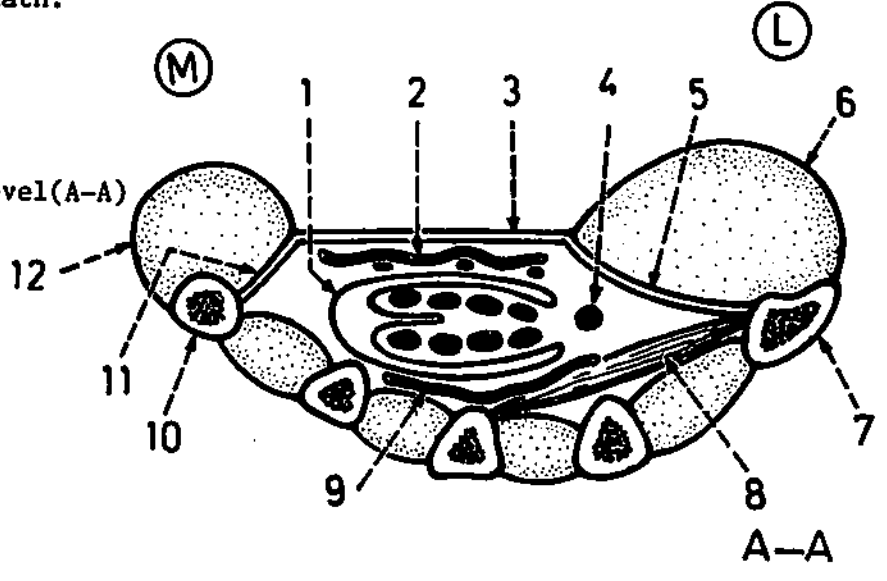
Fig.(272): FASCIAL SPACES OF THE PALM AT 2 LEVELS

* level(A-A): situated at the level of the common synovial sheath.

* level(B-B): situated distal to the common synovial sheath and where the intermediate palmar septum is present.

1. flexor tendons (superficialis and profundus) for the index finger.
2. intermediate palmar septum.
3. common synovial sheath.

T.S. in the palm at level(A-A)
(see page 172)



T.S. in the palm at level(B-B)
(see page 172)

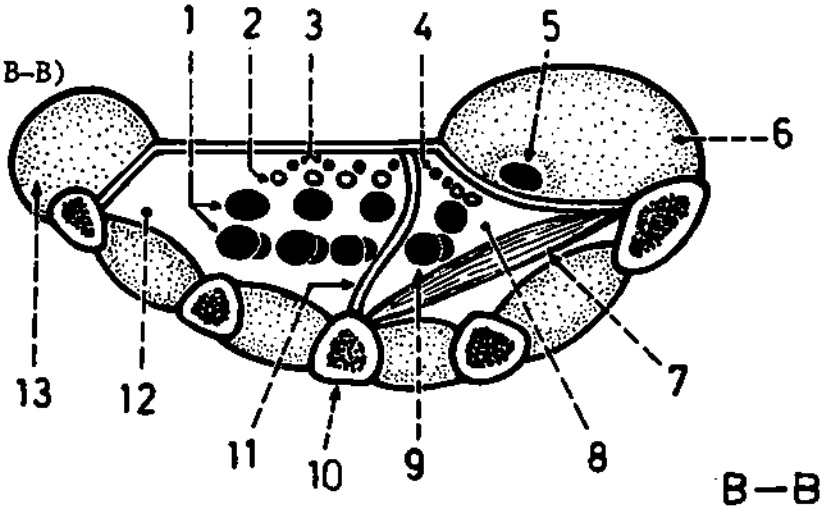


Fig.(273): INSERTIONS OF THE LONG FLEXOR TENDONS OF THE DIGITS

1. insertion of flexor digitorum superficialis (the tendon is splitted by that of flexor digitorum profundus, and is inserted into the middle phalanx).
2. insertion of flexor digitorum profundus (into the base of distal phalanx).
3. pulp space (lies over the palmar surface of the terminal phalanx, distal to the fibrous flexor sheath).
4. fibrous flexor sheath (surrounds the long flexor tendons).
5. palmar digital artery.
6. palmar digital nerve (in front of the artery).

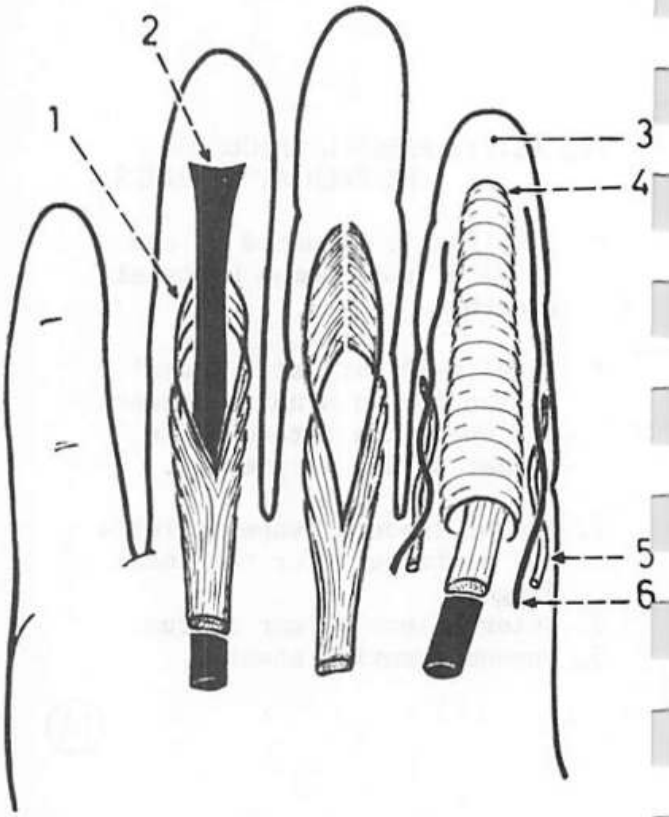
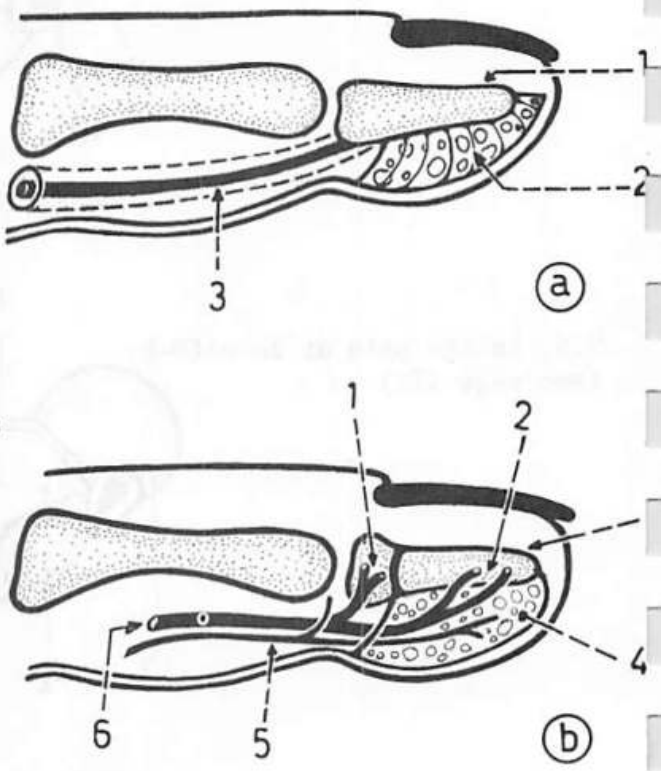


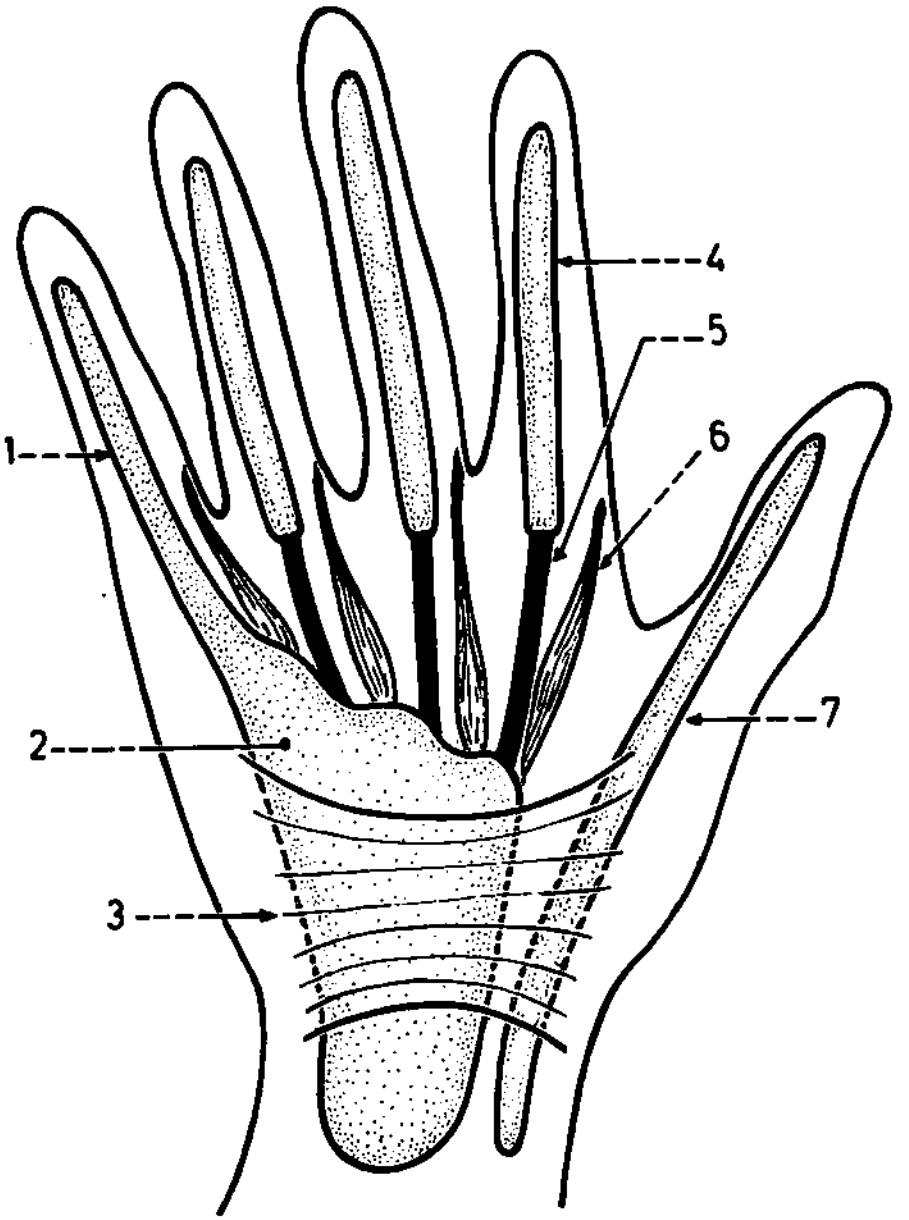
Fig.(274): PULP SPACE

It lies over the palmar surface of the distal 3/4 of the terminal phalanx, between the bone and the deep fascia. It is traversed by strong fibrous septa and by branches from the digital arteries to supply the distal phalanx.

(a) The space is traversed by fibrous septa.
1. distal phalanx.
2. septa dividing the space into numerous loculi.
3. tendon of flexor digitorum profundus surrounded by its synovial sheath.

(b) The space is traversed by digital nerves and vessels.
1. branch to the epiphysis of the bone.
2. branches to the distal 3/4 of the terminal phalanx.
3. terminal phalanx.
4. pulp space.
5. palmar digital nerve.
6. palmar digital artery.



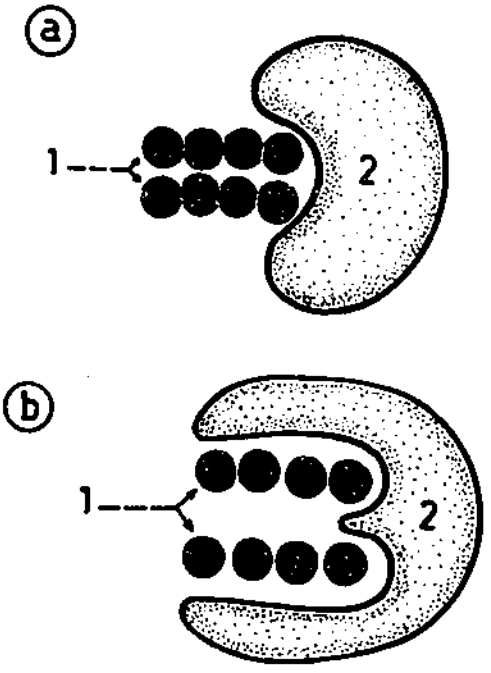


.(275): SYNOVIAL SHEATHS IN THE PALM OF THE HAND

1. synovial sheath of the little finger (continuous with the common synovial sheath).
2. common synovial sheath (ulnar bursa; envelops the 8 tendons of the flexor digitorum superficialis and profundus; it extends from the middle of the palm distally to 2½ cm above the flexor retinaculum proximally).
3. flexor retinaculum (overlies the common synovial sheath and the sheath for flexor pollicis longus).
4. sheath for the index finger (extends from the base of distal phalanx to the level of the head of the metacarpal bone).
5. flexor tendons of the index finger (not enveloped by synovial sheath in the middle of the palm).
6. 1st lumbrical muscle.
7. synovial sheath for the flexor pollicis longus (radial bursa; communicates with the common synovial sheath in 50% of subjects).

· The sheaths for the index, middle and ring fingers do not communicate with the common synovial sheath.

Fig.(276): COMMON SYNOVIAL SHEATH (T.S.)



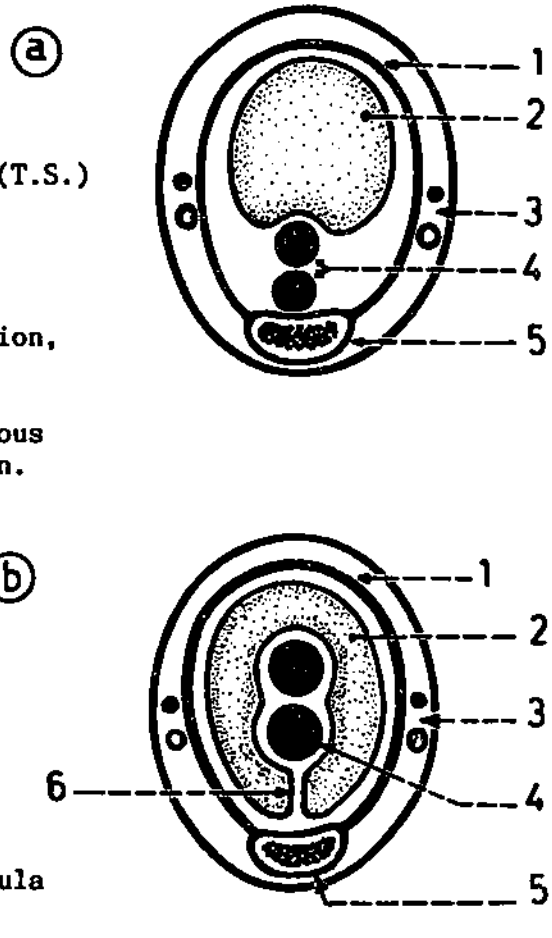
The common synovial sheath appears as a closed sac which has been invaginated from its lateral side by the 4 tendons of the flexor digitorum superficialis and the 4 tendons of the flexor digitorum profundus.

(a) Before invagination.

(b) After invagination.

1. long flexor tendons.
2. common synovial sheath.

Fig.(277): SYNOVIAL SHEATH OF THE LONG FLEXOR TENDONS IN THE FINGER (T.S.)



The tendons of the flexor digitorum superficialis and profundus invaginate the synovial sheath which appears as a closed tube. As a result of invagination, the wall of the synovial tube becomes. divided into 2 parts: a part enclosing the tendons and a part lining the fibrous flexor sheath, with a cavity in between.

(a) Before invagination.

(b) After invagination.

1. fibrous flexor sheath.
2. cavity of synovial sheath.
3. palmar digital nerve and artery (outside the fibrous flexor sheath).
4. long flexor tendons.
5. T.S. in a phalanx.
6. mesotendon which forms the vincula brevia or vincula longa.

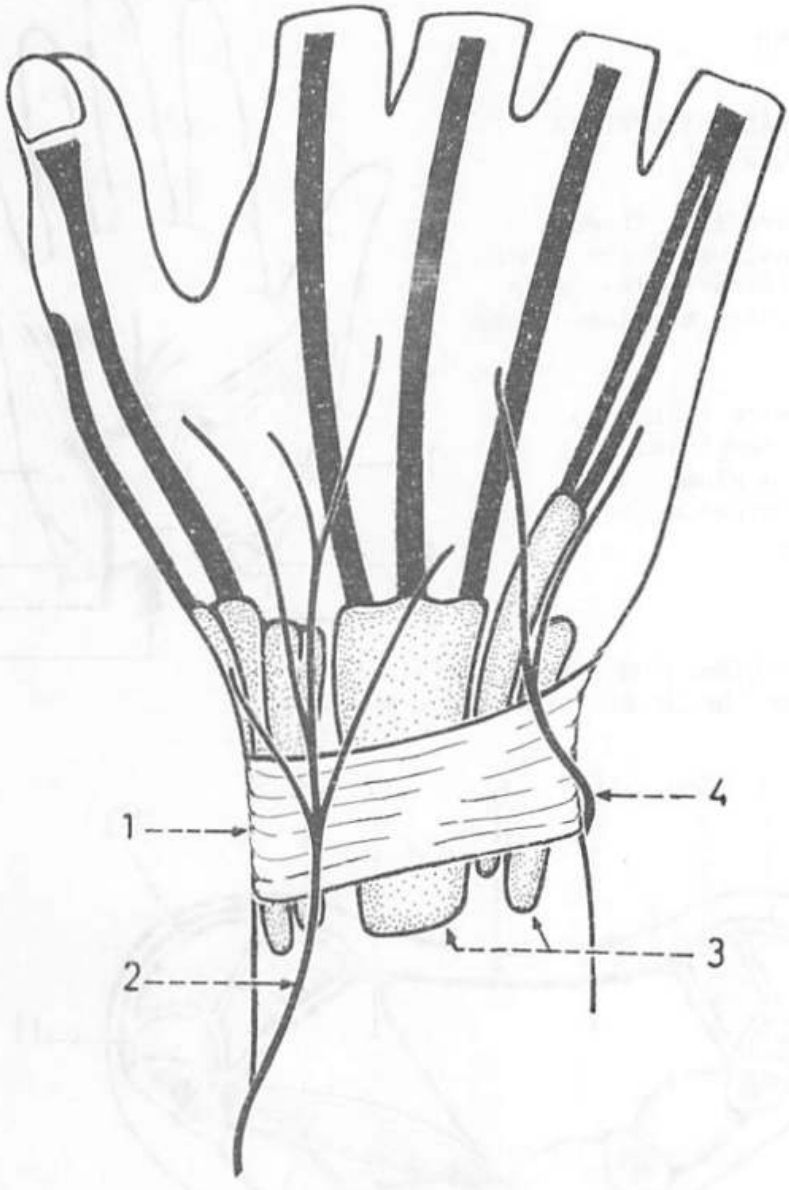


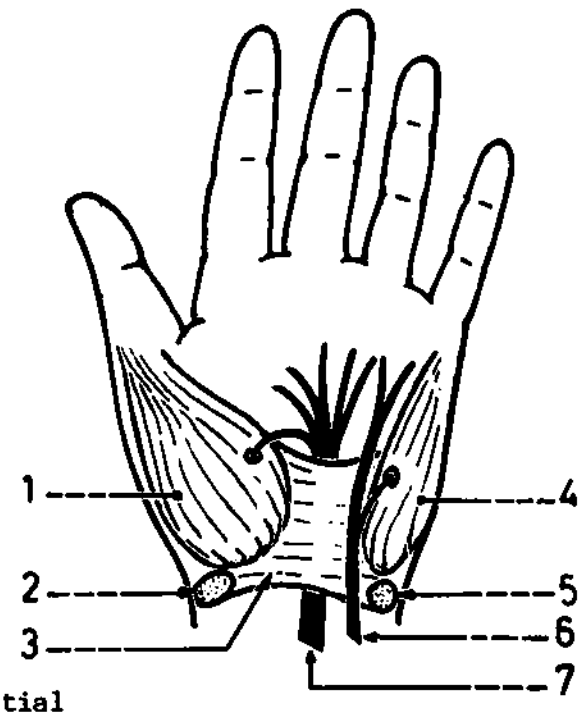
Fig.(278): SYNOVIAL SHEATHS ON THE BACK OF THE WRIST

The synovial sheaths surround the extensor tendons as they pass deep to the extensor retinaculum. These sheaths start a short distance (1 cm) above the extensor retinaculum down to the proximal 1/3 of the metacarpal bones.

1. extensor retinaculum (overlying the extensor tendons and their synovial sheaths).
2. termination of the superficial branch of radial nerve (crosses the lateral part of the extensor retinaculum).
3. synovial sheaths of extensor tendons.
4. dorsal cutaneous branch of the ulnar nerve (crosses the medial part of the extensor retinaculum).

MUSCLES OF THE HAND

Fig.(279): THENAR AND HYPOTHENAR EMINENCES



The thenar eminence is formed by the short muscles of the thumb, while the hypothenar eminence is formed by the short muscles of the little finger.

1. thenar eminence (lateral).
2. tubercle of scaphoid.
3. flexor retinaculum.
4. hypothenar eminence (medial).
5. pisiform bone.
6. ulnar nerve.
7. median nerve.

* The flexor retinaculum gives partial origin to the thenar and hypothenar muscles.

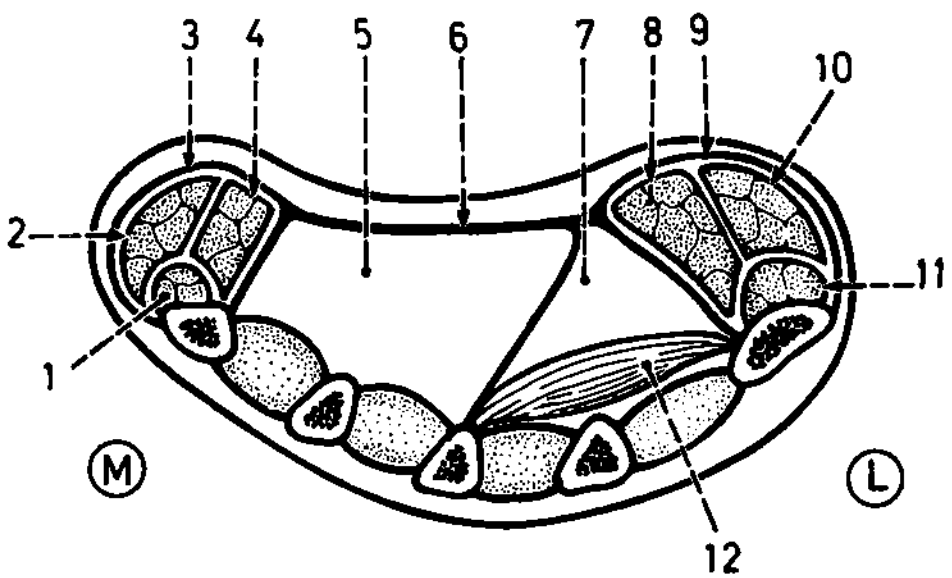


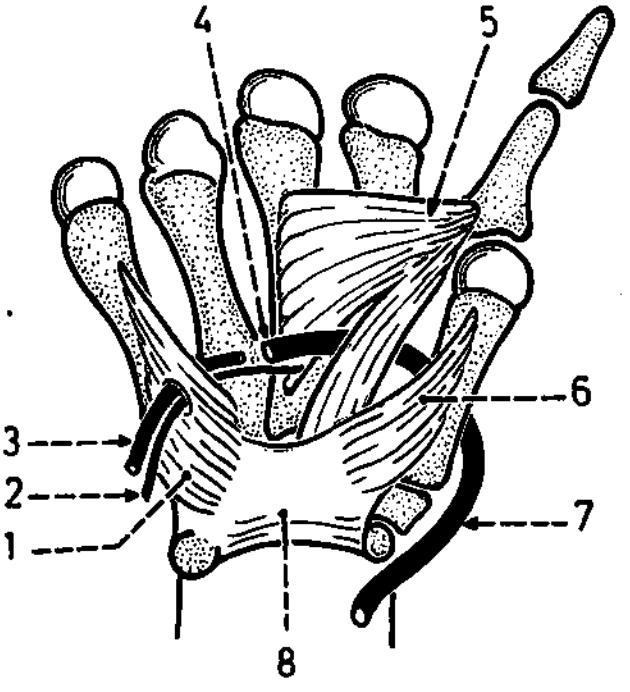
Fig.(280): THENAR AND HYPOTHENAR COMPARTMENTS (T.S.)

Each compartment contains an abductor, a short flexor and an opponens muscle.

1. opponens digiti minimi (deep).
2. abductor digiti minimi.
3. hypothenar eminence.
4. flexor digiti minimi.
5. mid-palmar space.
6. palmar aponeurosis.
7. thenar space.
8. flexor pollicis brevis.
9. thenar eminence.
10. abductor pollicis brevis.
11. opponens pollicis (deeper to the other 2 muscles).
12. adductor pollicis (in the floor of the thenar space).

* Note that the palm is divided into 3 compartments: thenar compartment (lateral), hypothenar compartment (medial) and intermediate compartment (in between).

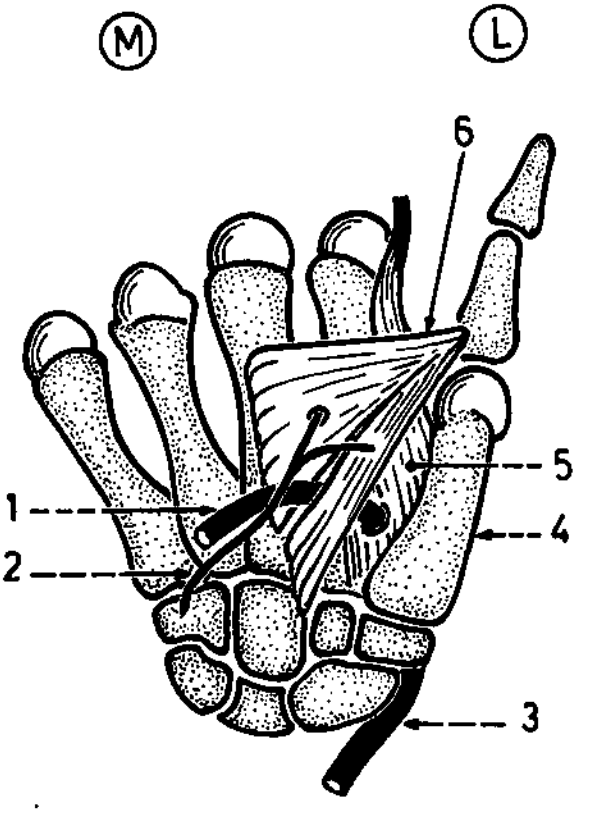
Fig.(281): OPPONENS POLLICIS AND OPPONENS DIGITI MINIMI



1. opponens digiti minimi (inserted into the 5th metacarpal).
2. deep branch of ulnar nerve.
3. deep branch of ulnar artery.
4. deep palmar arch.
5. adductor pollicis (its transverse head arises from the 3rd metacarpal).
6. opponens pollicis (inserted into the 1st metacarpal).
7. radial artery.
8. flexor retinaculum (gives partial origin to the 2 opponens muscles).

* The opponens digiti minimi is traversed by the deep branches of ulnar artery and nerve, while the adductor pollicis is traversed by the radial artery.

Fig.(282): ADDUCTOR POLLICIS



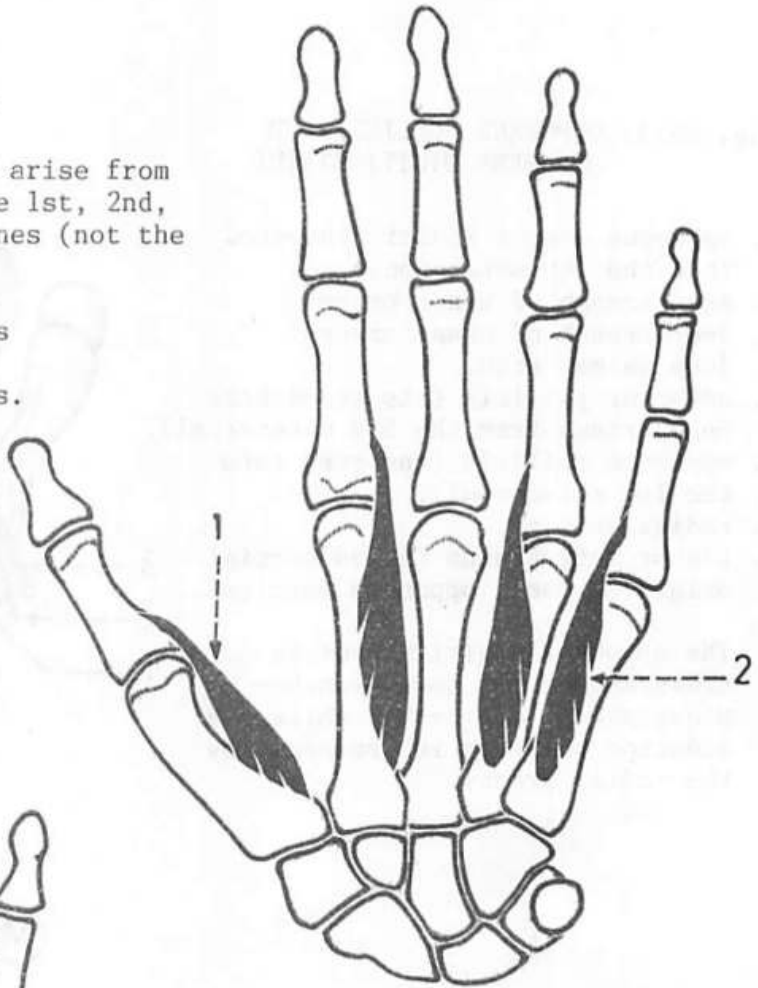
It is a triangular muscle which lies in front of the 1st dorsal interosseous muscle. It arises by 2 heads: oblique head (from the capitate bone and bases of 2nd and 3rd metacarpals) and transverse head (from the 3rd metacarpal). It is traversed by the deep palmar arch.

1. deep palmar arch.
2. deep branch of ulnar nerve (ends in the adductor pollicis).
3. radial artery.
4. 1st metacarpal.
5. 1st dorsal interosseous muscle.
6. adductor pollicis (inserted into the medial side of the base of the proximal phalanx of the thumb).

Fig.(283): PALMAR INTEROSSEI

These are 4 muscles which arise from the palmar surfaces of the 1st, 2nd, 4th and 5th metacarpal bones (not the 3rd).

1. 1st palmar interosseous (may be absent).
2. 4th palmar interosseous.



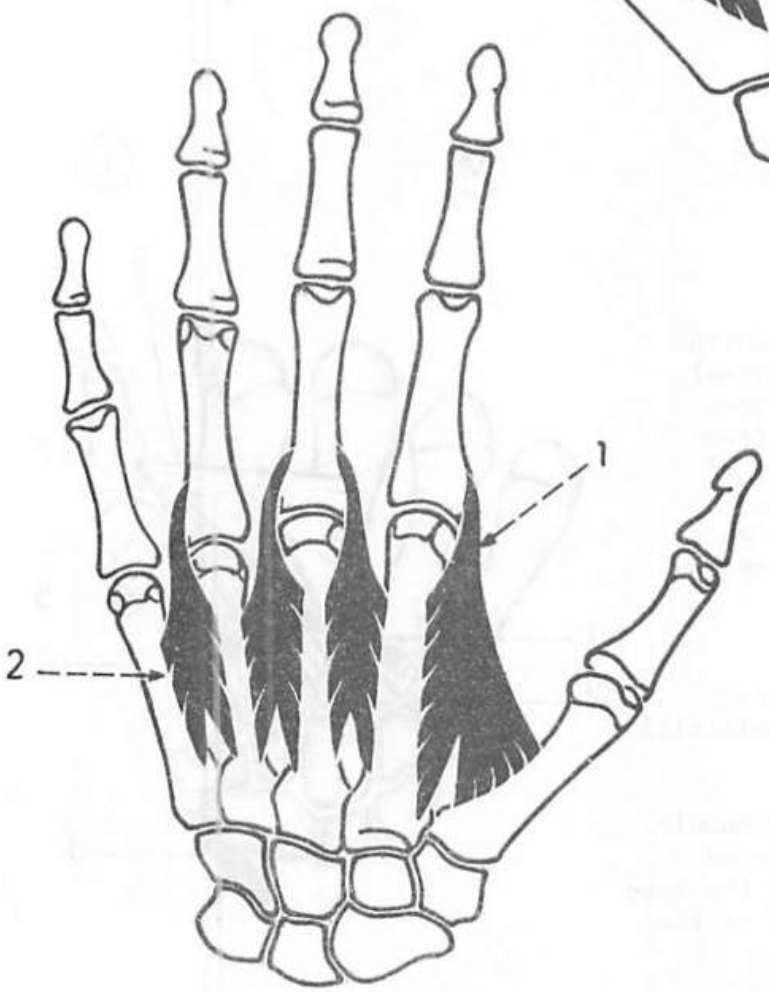


Fig.(284): DORSAL INTEROSSEI

These are 4 muscles each of which arises from the adjacent sides of two metacarpal bones, thus filling the inter-metacarpal spaces.

1. 1st dorsal interosseous.
2. 4th dorsal interosseous.

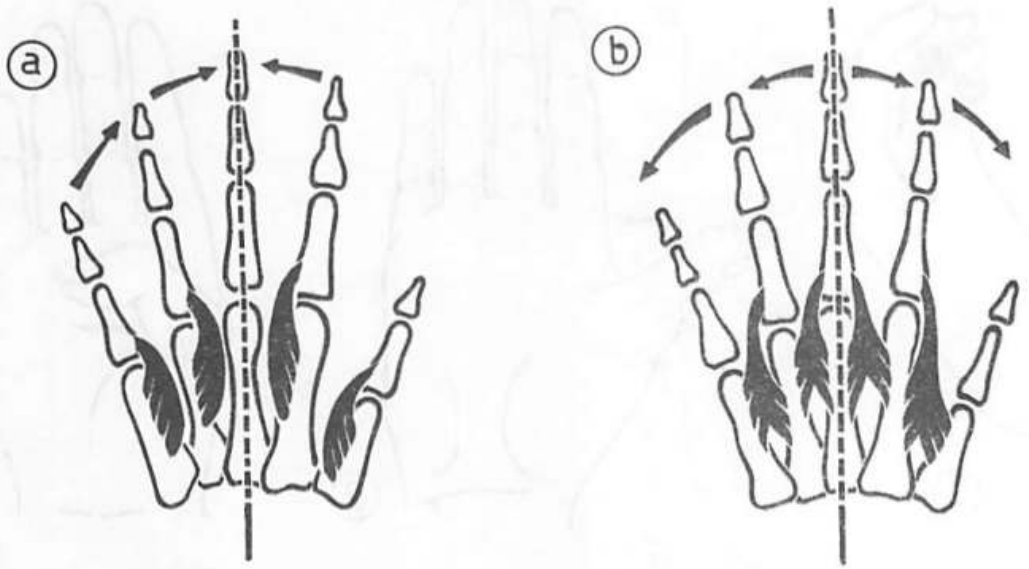


Fig.(285): ADDUCTION AND ABDUCTION OF THE FINGERS BY THE INTEROSSEI

The palmar interossei adduct the fingers, while the dorsal interossei abduct them. Adduction and abduction of the medial 4 fingers takes place around an axis which passes through the middle finger.

(a) Adduction of the fingers by palmar interossei.

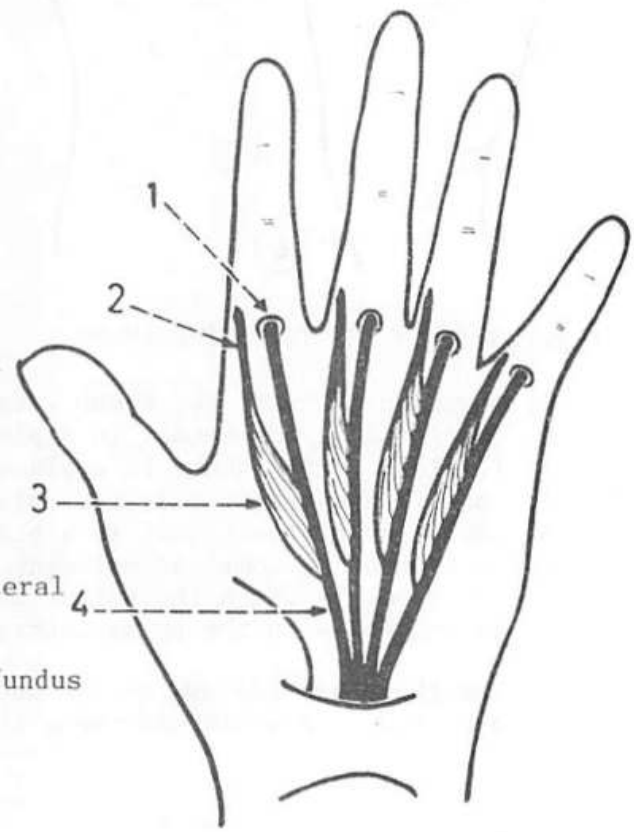
(b) Abduction of the fingers by dorsal interossei.

* Note that the middle finger has 2 dorsal interossei and no palmar interossei; therefore,its movement to either side is abduction.

Fig.(286): LUMBRICAL MUSCLES

These are 4 slender muscles which arise from the tendons of the flexor digitorum profundus in the palm. Each muscle passes along the lateral side of the corresponding metacarpo-phalangeal phalangeal joint to be inserted into the lateral margin of the extensor expansion.

1. entrance of the fibrous flexor sheath.
2. tendon of 1st lumbrical (on lateral side of M/P joint).
3. 1st lumbrical muscle.
4. tendon of flexor digitorum profundus (to the index finger).



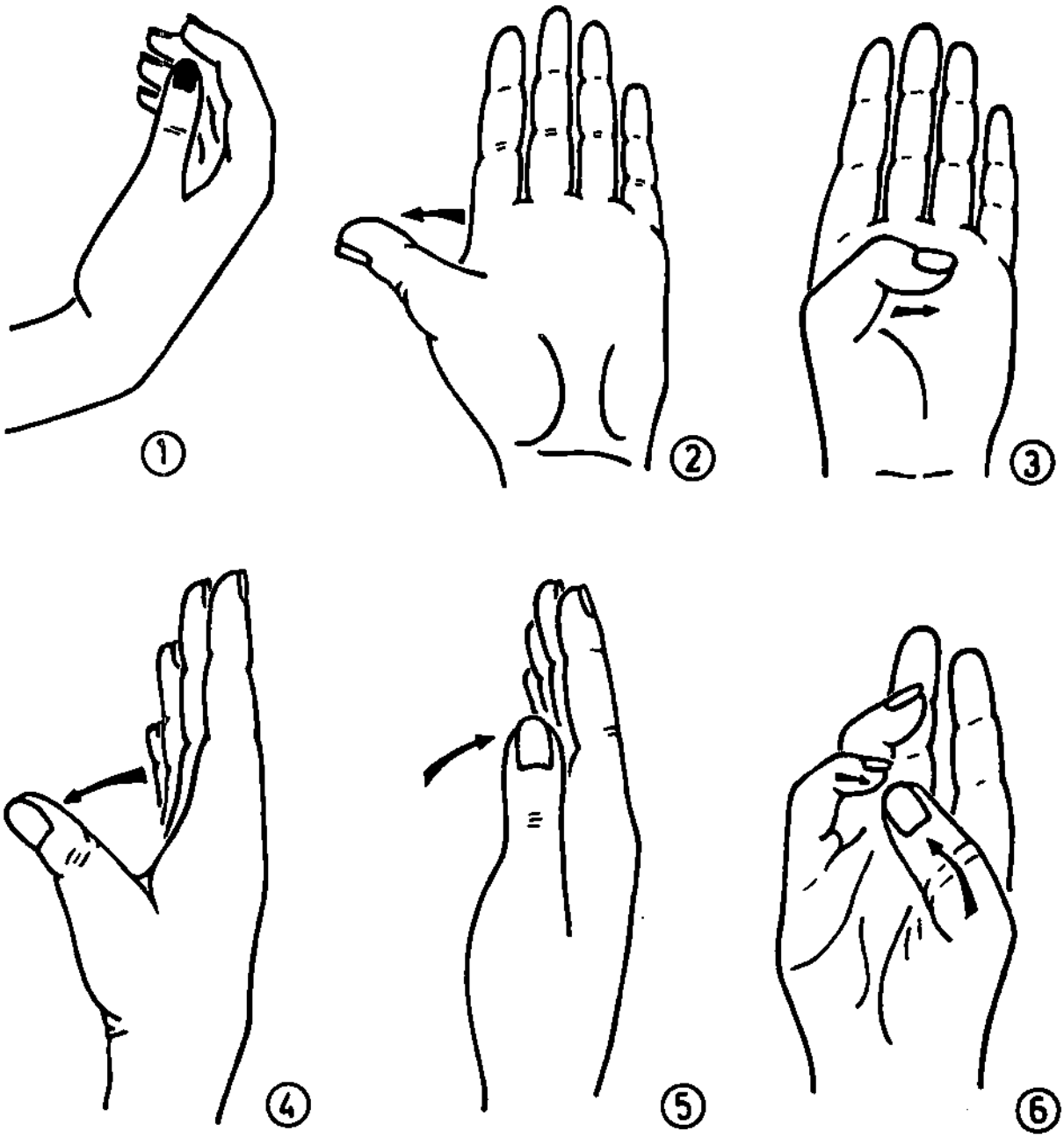
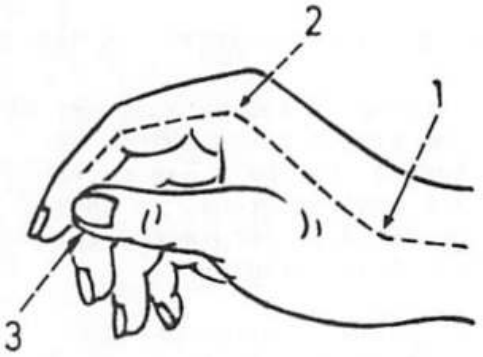


Fig.(287): MOVEMENTS OF THE THUMB

1. position of rest: the thumb lies in a plane anterior to that of the palm.
2. extension of the thumb: in a plane parallel to that of the palm.
3. flexion of the thumb: in a plane parallel to that of the palm.
4. abduction of the thumb: in a plane perpendicular to that of the palm.
5. adduction of the thumb: in a plane perpendicular to that of the palm.
6. opposition: a combined movement of flexion and medial rotation of the thumb by which the palmar surface of the tip of the thumb is brought in contact with the palmar surfaces of the tips of the other fingers.

* The thumb has its own set of muscles (called pollicis),and has its own movements which provide a firm grip.

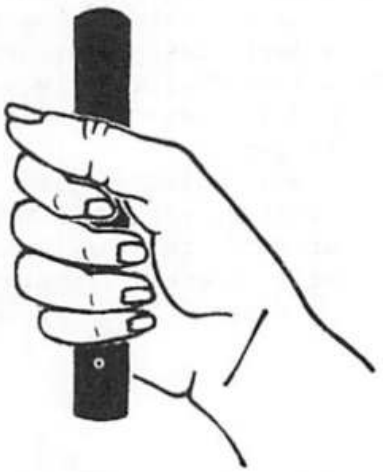
Fig.(288): POSITION OF THE HAND AT REST



The hand is half-extended at the wrist, the medial 4 fingers are slightly flexed and the thumb lies in a plane anterior to that of the palm and comes in contact with the lateral border of the distal part of the index finger.

1. half-extended wrist.
2. slightly flexed fingers.
3. thumb in contact with the distal part of the index finger.

Fig.(289): POWER GRIP



It occurs in holding an object firmly.

Fig.(290): PRECISION GRIP

It occurs in holding an object precisely as in holding a pencil in writing. The object is held between the tips of the thumb and index. The middle finger shares in this grip, but the others do not share.

ARTERIES OF THE HAND

Fig.(291): ULNAR ARTERY IN THE HAND

It crosses the medial part of the flexor retinaculum just lateral to the ulnar nerve and pisiform bone. It ends by dividing into superficial and deep divisions.

1. palmar digital nerves.
2. deep branch of ulnar artery.
3. ulnar nerve.
4. superficial branch of ulnar artery (continues as the superficial palmar arch).
5. palmar digital artery to the medial side of the little finger.
6. common palmar digital artery (divides into 2 palmar digital arteries for the contiguous sides of 2 adjacent fingers).
7. 2 palmar digital arteries.

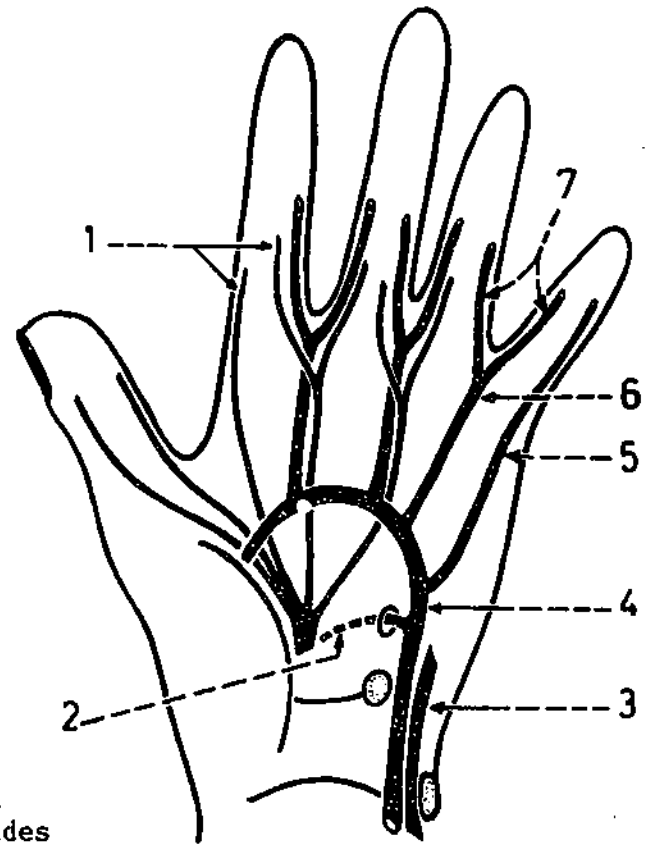


Fig.(292): SUPERFICIAL PALMAR ARCH

It is the continuation of the superficial branch of the ulnar artery. It curves laterally across the palm with its convexity directed distally, and ends by joining the superficial palmar branch of the radial artery. It lies directly under cover of the palmar aponeurosis and superficial to the digital branches of the median nerve.

1. palmar digital artery.
2. palmar digital nerve.
3. common palmar digital artery.
4. digital branches of median nerve.
5. superficial palmar arch.
6. superficial palmar branch of radial artery.
7. radial artery.
8. median nerve.
9. ulnar artery.
10. ulnar nerve.

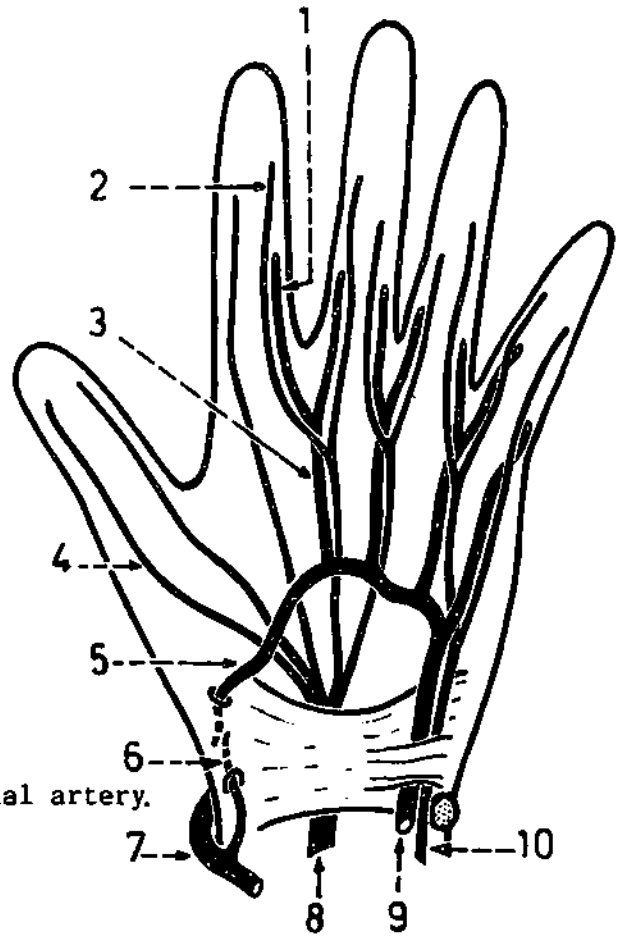


Fig.(293): BRANCHES OF SUPERFICIAL PALMAR ARCH

It gives off 3 common palmar digital arteries (to the medial 3 spaces) and a palamr digital artery to the medial side of the little finger.

1. superficial palmar artery (from radial artery).
2. ulnar artery.
3. palmar digital artery to medial side of little finger.
4. 3rd common palmar digital artery (to the 4th space).
5. palmar digital artery.
6. communication with the corresponding palmar metacarpal artery (from the deep palmar arch).
7. superficial palmar arch.
8. thenar eminence.
9. radial artery.

* Each common palmar digital artery is joined by the corresponding palmar metacarpal artery from the deep arch, and then divides into a pair of palmar digital arteries.

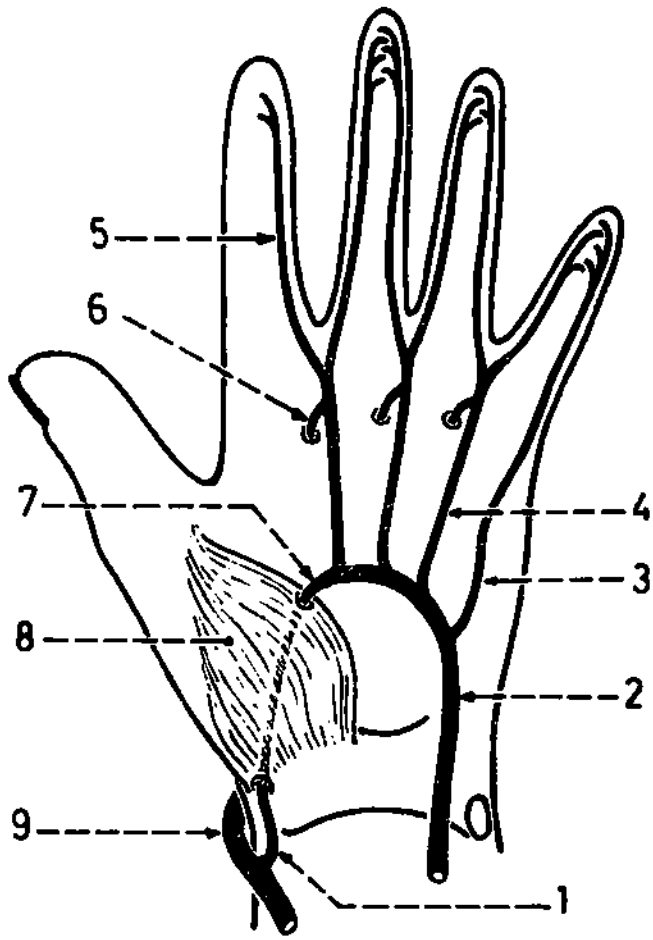


Fig.(294): COURSE OF RADIAL ARTERY IN THE HAND

The radial artery winds backwards on the lateral side of the wrist to reach the back of the hand. It then passes between the 2 heads of the 1st dorsal interosseous muscle to enter the palm of the hand. It traverses the adductor pollicis and forms the deep palmar arch.

1. radial artery.
2. opponens pollicis.
3. 1st dorsal interosseous.
4. adductor pollicis.
5. deep palmar arch.
6. opponens digiti minimi.
7. deep branch of ulnar rtery.

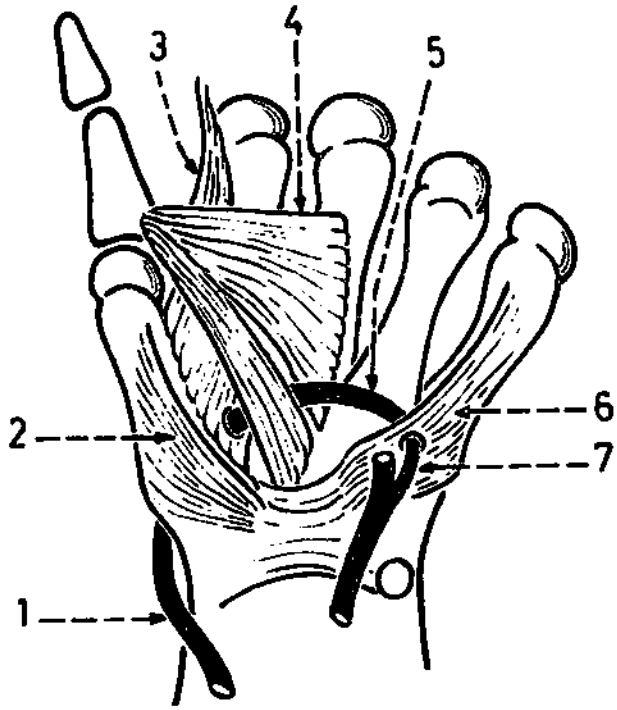


Fig.(295): RADIAL ARTERY ON THE DORSUM OF THE HAND

The radial artery winds backwards on the lateral side of the wrist to reach the dorsum of the hand. Here , it lies in the anatomical snuff-box. It then enters the palm of the hand by passing between the 2 heads of the 1st dorsal interosseous muscle.

1. dorsal digital artery.
2. dorsal metacarpal artery.
3. dorsal carpal arch (gives off 3 dorsal metacarpal arteries).
4. 1st dorsal metacarpal artery (directly from the radial artery).
5. dorsal digital artery to the radial side of the thumb.
6. tendon of extensor pollicis longus.
7. tendon of extensor pollicis brevis.
8. tendon of abductor pollicis longus.
9. radial artery in the anatomical snuff-box.

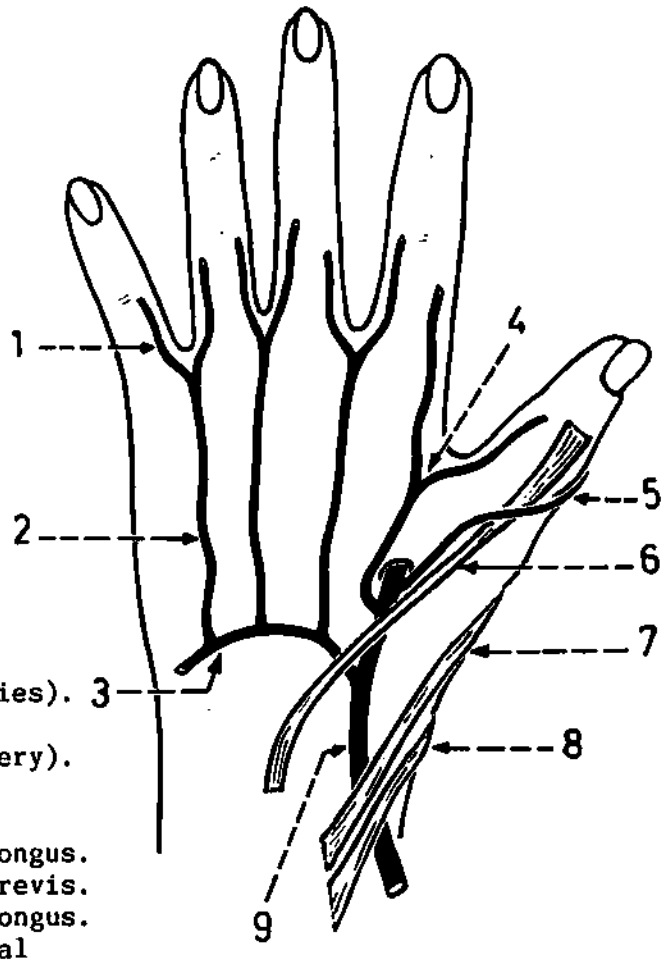


Fig.(296): RADIAL ARTERY IN THE PALM OF THE HAND

The artery enters the palm between the 2 heads of 1st dorsal interosseous and pierces the adductor pollicis to become the deep palmar arch.
In the palm,it gives off: princeps pollicis, radialis indicis, 3 palmar metacarpal and 3 perforating branches.

1. radialis indicis (to the index).
2. palmar digital artery.
3. princeps pollicis (to the thumb).
4. radial artery winding backwards.
5. deep palmar arch.
6. ulnar artery.
7. 3rd palmar metacarpal artery.
8. 3rd common palmar digital artery (from superficial palmar arch).

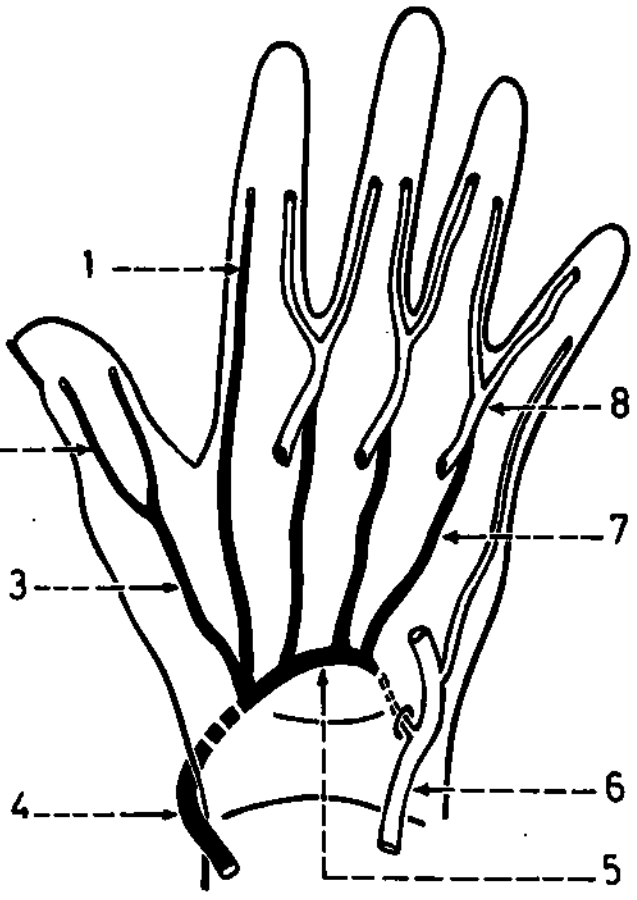
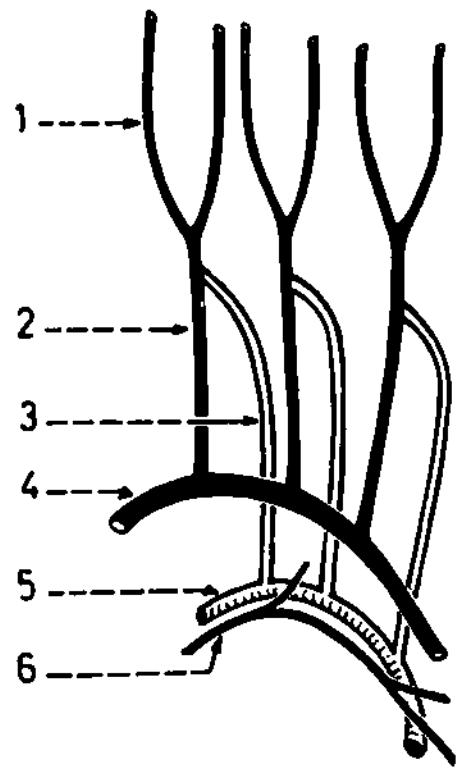


Fig.(297): SUPERFICIAL AND DEEP PALMAR ARCHES

The superficial arch is formed mainly by the ulnar artery and lies superficial to the long flexor tendons, while the deep arch is formed mainly by the radial artery and lies deep to these tendons. The superficial arch gives off 3 common palmar digital arteries which are joined by the 3 palmar metacarpal arteries (from the deep arch) at the level of the M/P joints.

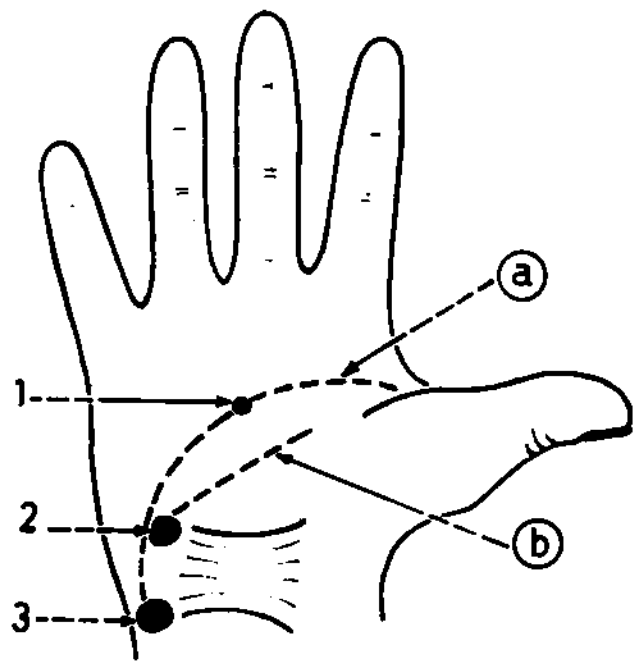


1. palmar digital artery.
2. 1st common palmar digital artery (from superficial arch).
3. 1st palmar metacarpal artery (from deep palmar arch, and joins the common palmar digital artery).
4. superficial palmar arch.
5. deep palmar arch.
6. deep branch of ulnar nerve (in the concavity of the deep arch).

Fig.(298): SURFACE ANATOMY OF THE PALMAR ARCHES

(a)The superficial palmar arch is represented by a line drawn across the palm from the distal border of the outstretched (extended) thumb as far as the midline of the palm. The line then continues proximally to the pisiform bone passing just medial to the hook of the hamate.

(b)The deep palmar arch corresponds to a straight line 4 cm long drawn from the hook of the hamate towards the lateral side of the hand. It lies 1 cm proximal to the superficial palmar arch.



1. point at the midline of the palm.
2. hook of the hamate.
3. pisiform bone.

NERVES OF THE HAND

Fig.(299): MEDIAN NERVE IN THE HAND

The median nerve enters the hand deep to the lateral part of the flexor retinaculum. It ends at the distal border of the retinaculum by dividing into medial and lateral divisions. These 2 divisions give off palmar digital branches to the lateral $3\frac{1}{2}$ fingers. These branches run deep to the superficial palmar arch.

1. palmar digital branches to the thumb.
2. medial and lateral divisions of the median nerve.
3. radial artery.
4. median nerve passing deep to the flexor retinaculum.
5. ulnar artery.
6. ulnar nerve.
7. pisiform bone.
8. superficial palmar arch.
9. palmar digital nerve.

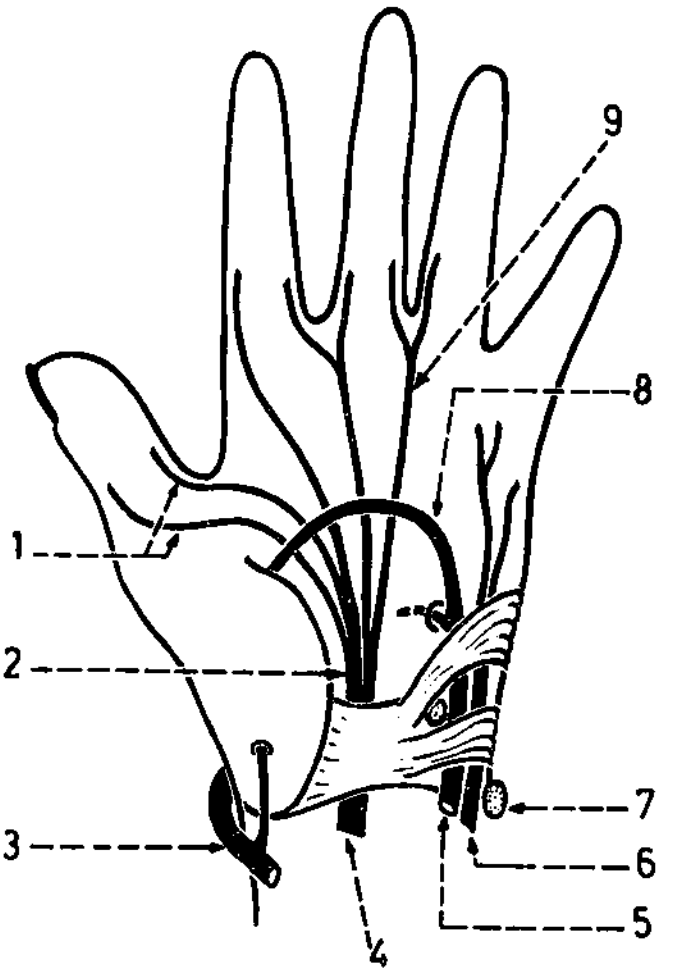


Fig.(300): BRANCHES OF MEDIAN NERVE IN THE PALM

The median nerve gives off muscular branches to the thenar muscles and the lateral 2 lumbricals, and 5 palmar digital nerves to the lateral $3\frac{1}{2}$ fingers.

1. palmar digital branches to the thumb.
2. muscular branch to thenar muscles (arises at the distal border of flexor retinaculum).
3. median nerve.
4. ulnar artery.
5. ulnar nerve.
6. palmar digital nerve.
7. palmar aponeurosis.
8. branches to the lateral 2 lumbricals.

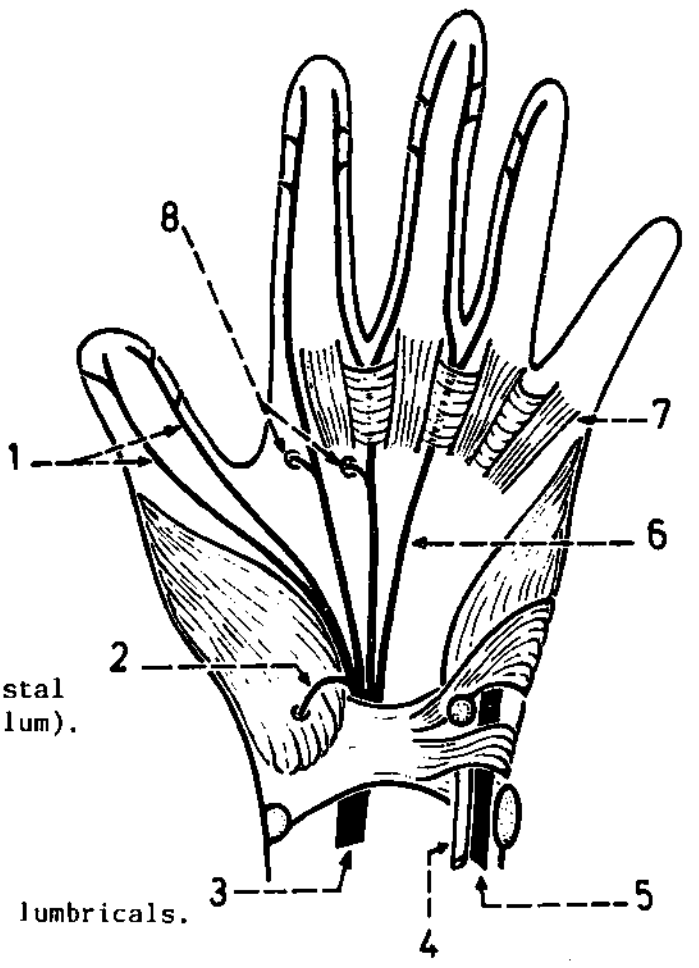


Fig.(301): ULNAR NERVE IN THE HAND

The ulnar nerve enters the hand in front of the flexor retinaculum just lateral to the pisiform bone. It is covered by a thin superficial part of the retinaculum and by the palmaris brevis. Here,it divides into superficial and deep divisions. The ulnar artery is lateral to the nerve.

1. flexor retinaculum.
2. hook of the hamate.
3. tubercle of scaphoid.
4. median nerve.
5. palmar digital nerve(from the ulnar).
6. communication between the median and ulnar nerves.
7. superficial division of ulnar nerve.
8. palmaris brevis.
9. superficial part of flexor retinaculum.
10. pisiform bone.
11. ulnar nerve.
12. ulnar artery.

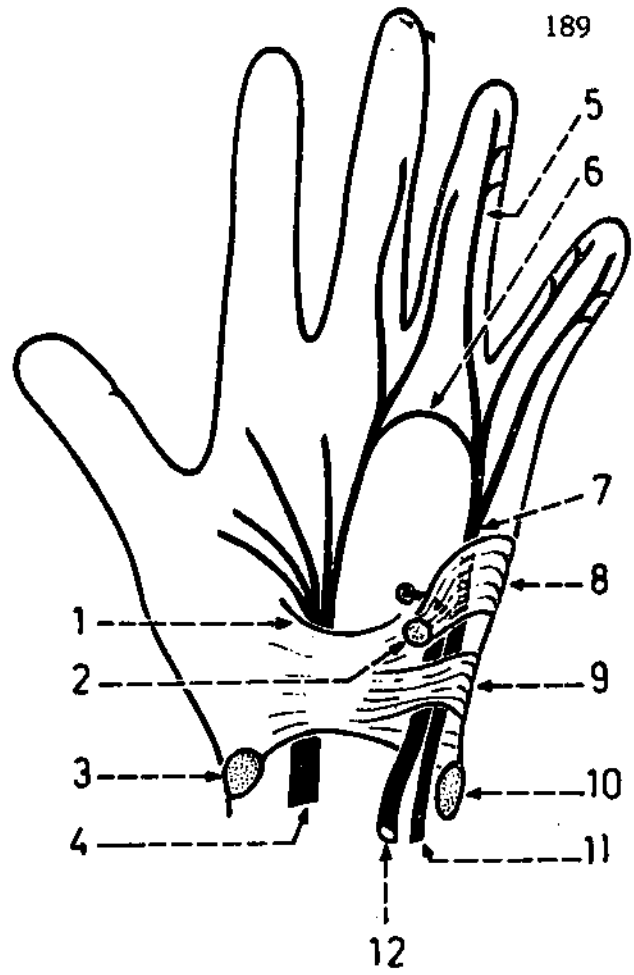
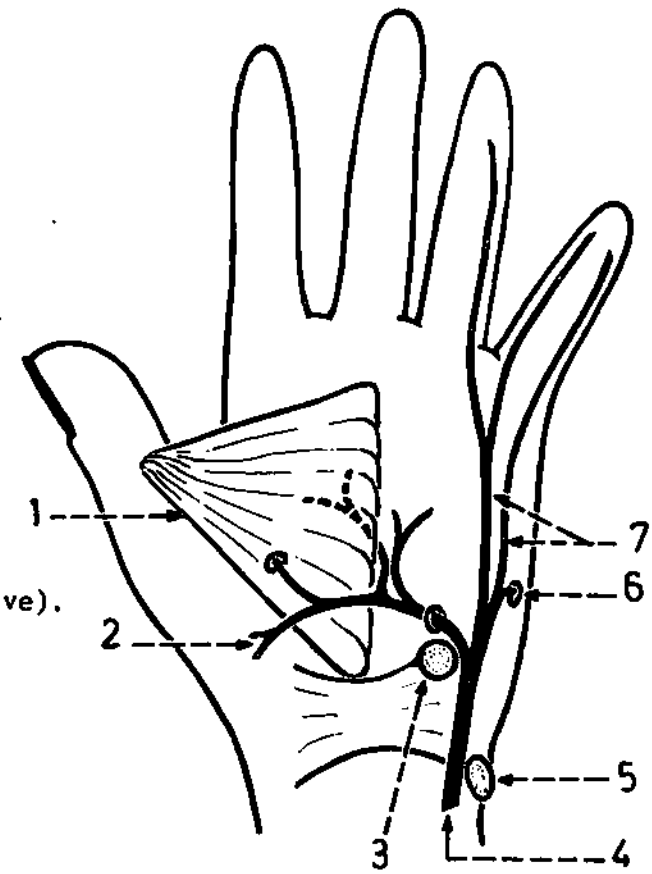


Fig.(302): BRANCHES OF ULNAR NERVE IN THE PALM

The ulnar nerve gives muscular branches to all small muscles of the hand except the thenar muscles and the lateral 2 lumbricals. It also gives off palmar digital branches to the medial 1½ fingers.

1. adductor pollicis.
2. deep branch of ulnar nerve.
3. hook of the hamate (in close contact with the beginning of the deep branch of ulnar nerve).
4. ulnar nerve.
5. pisiform bone.
6. branch to palmaris brevis.
7. palmar digital branches to the medial 1½ fingers.



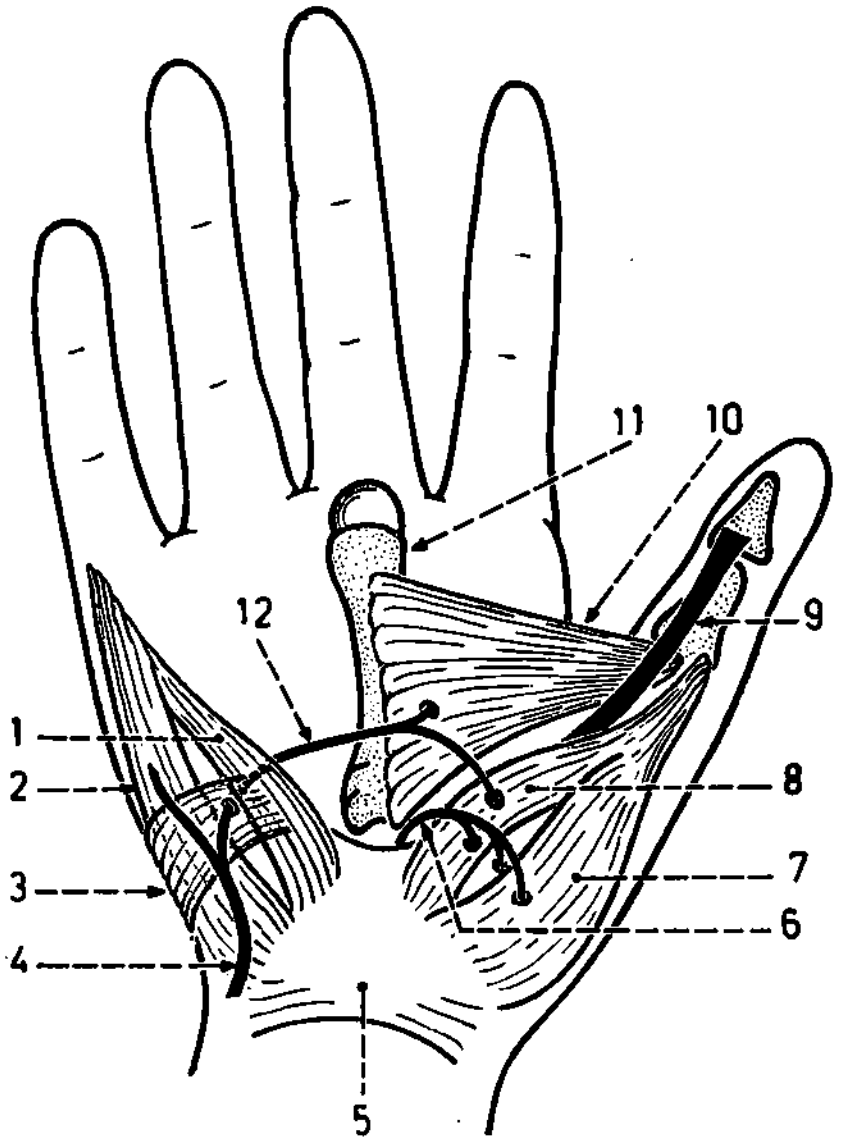


Fig.(303): COURSE OF THE DEEP BRANCH OF ULNAR NERVE

It passes backwards between the abductor digiti minimi and flexor digiti minimi, and then pierces the opponens digiti minimi to run laterally deep to the long flexor tendons. It lies in the concavity of the deep palmar arch, and ends in the substance of the adductor pollicis.

1. flexor digiti minimi.
2. abductor digiti minimi.
3. palmaris brevis.
4. ulnar nerve.
5. flexor retinaculum.
6. branch from median nerve to thenar muscle.
7. abductor pollicis brevis.
8. flexor pollicis brevis.
9. flexor pollicis longus.
10. adductor pollicis.
11. 3rd metacarpal bone.
12. deep branch of ulnar nerve.

* The flexor pollicis brevis gets nerve supply from both the median and ulnar nerves.

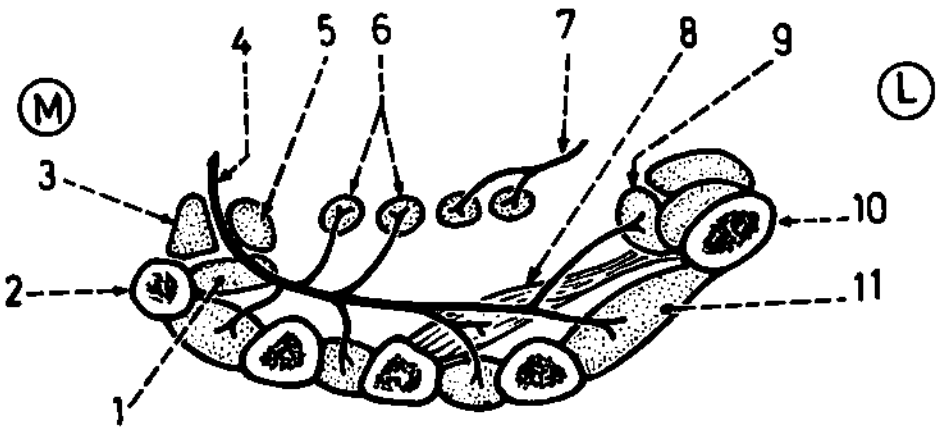


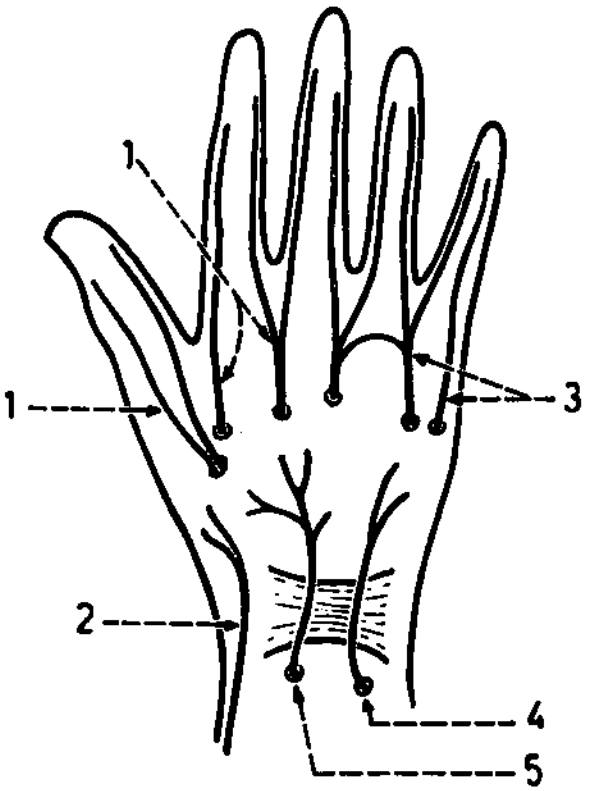
Fig.(304): COURSE AND DISTRIBUTION OF THE DEEP BRANCH OF ULNAR NERVE

The deep branch of ulnar nerve passes deeply through the hypothenar eminence in company with the deep branch of the ulnar artery. At 1st, it lies between the abductor digiti minimi and flexor digiti minimi to reach the opponens digiti minimi through which it passes. It winds round the hook of the hamate (here, it is exposed to injury from fracture of the bone) and continues laterally deep to the long flexor tendons. It ends in the substance of the adductor pollicis.
It is wholly muscular and it is the main supply for most of the small muscles of the hand. It supplies the following muscles: the 3 hypothenar muscles, all interossei, the medial 2 lumbricals, adductor pollicis and gives off an extra branch to the flexor pollicis brevis.

1. opponens digiti minimi (pierced by the deep branch of ulnar nerve).
2. 5th metacarpal bone.
3. abductor digiti minimi.
4. deep branch of ulnar nerve.
5. flexor digiti minimi.
6. medial 2 lumbricals (the 3rd and 4th).
7. branches to the lateral 2 lumbricals (the 1st and 2nd) from the median nerve.
8. adductor pollicis.
9. flexor pollicis brevis.
10. 1st metacarpal bone.
11. 1st dorsal interosseous muscle.

* It is clear that the ulnar nerve is the main supply to the muscles of the hand, and its injury leads to a deformity called "claw-hand".

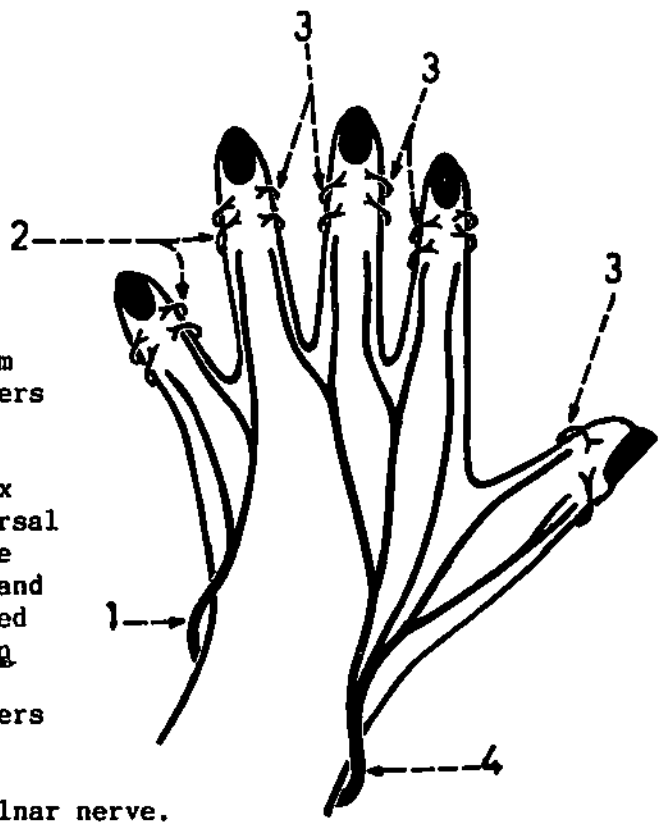
Fig.(305): CUTANEOUS NERVE SUPPLY OF THE PALMAR ASPECT OF THE HAND



The palmar aspect of the hand is supplied by the median nerve (for lateral 2/3 of the palm and lateral 3½ fingers), and by the ulnar nerve (for medial 1/3 of the palm and medial 1½ fingers). The lateral cutaneous nerve of forearm supplies a limited area of skin at the base of the thenar eminence.

1. palmar digital branches of median nerve to the lateral 3½ fingers.
2. termination of lateral cutaneous nerve of forearm.
3. palmar digital branches of ulnar nerve to the medial 1½ fingers.
4. palmar cutaneous branch of ulnar nerve (crosses the flexor retinaculum).
5. palmar cutaneous branch of median nerve (crosses the flexor retinaculum).

Fig.(306): CUTANEOUS NERVE SUPPLY OF THE DORSAL ASPECT OF THE HAND



The skin on the dorsum of the hand is supplied by the radial nerve (lateral 2/3 of the dorsum of the hand and lateral 3½ fingers as far as the proximal inter-phalangeal joints). The skin on the dorsum of the distal phalanx of the thumb and that on the dorsal surface of the distal and middle phalanges of the index, middle and ½ of the ring finger is supplied by the median nerve. The skin on the medial 1/3 of the dorsum of the hand and the medial 1½ fingers is supplied by the ulnar nerve.

1. dorsal cutaneous branch of ulnar nerve.
2. branches from the superficial branch of ulnar nerve(coming from the front).
3. branches from the median nerve.
4. termination of the superficial branch of radial nerve.

Fig.(307): SKIN AREAS OF THE PALMAR ASPECT OF THE HAND SUPPLIED BY CUTANEOUS NERVES

1. area supplied by median nerve (lateral 2/3 of the palm and lateral 3½ fingers).
2. area supplied by lateral cutaneous nerve of forearm (at the base of the thenar eminence).
3. area supplied by the ulnar nerve (medial 1/3 of the palm and medial 1½ fingers).

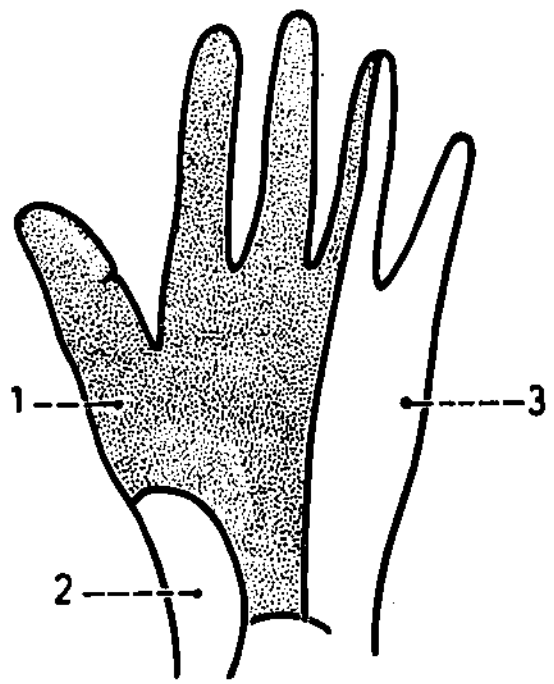
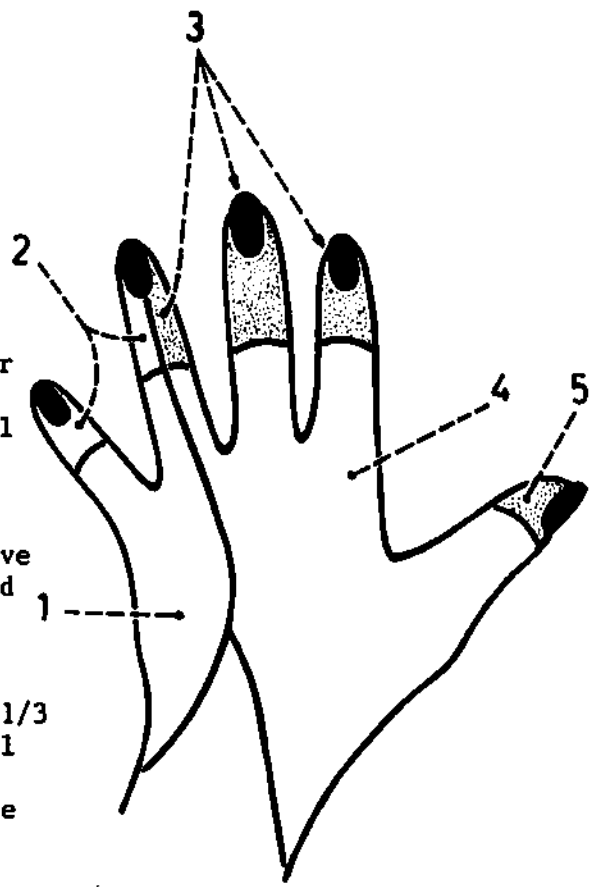


Fig.(308): SKIN AREAS OF THE DORSUM OF THE HAND SUPPLIED BY CUTANEOUS NERVES

1. area supplied by the dorsal cutaneous branch of ulnar nerve (medial 1/3 of the dorsum of the hand and medial 1½ fingers as far as the middle phalanx).
2. areas supplied by the superficial branch of ulnar nerve (dorsal aspects of the distal and middle phalanges of medial 1½ fingers).
3. areas supplied by the median nerve (dorsal aspects of the distal and middle phalanges of the index, middle and 1/2 of ring finger).
4. area supplied by the superficial branch of radial nerve (lateral 1/3 of the dorsum of hand and lateral 3½ fingers).
5. area supplied by the median nerve (dorsal aspect of the distal phalanx of the thumb).



SUPERFICIAL VEINS

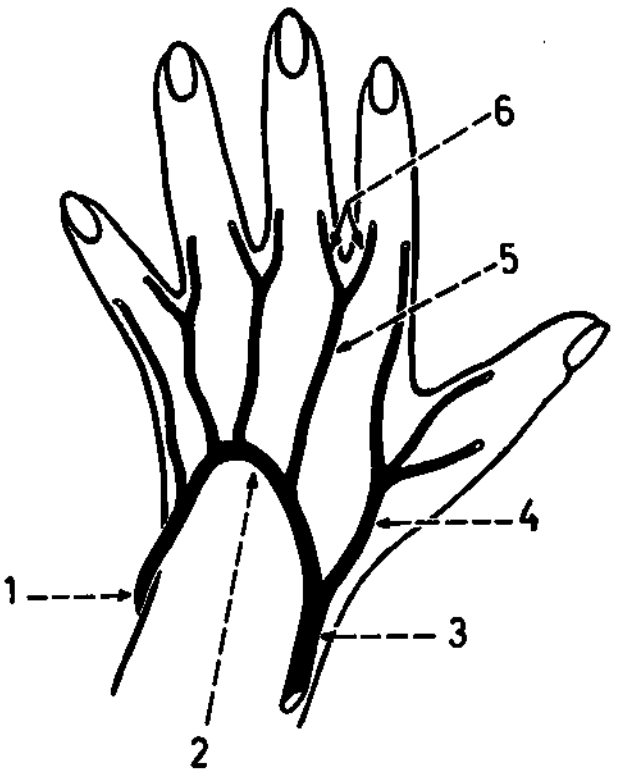


Fig.(309): DORSAL VENOUS ARCH

The dorsal venous arch (or network) lies at the middle of the dorsum of the hand. Its medial end forms the beginning of the basilic vein, while its lateral end forms the beginning of the cephalic vein. It receives 3 dorsal metacarpal veins, each of which is formed by the union of 2 dorsal digital veins from the sides of 2 adjacent fingers.

1. beginning of basilic vein.
2. dorsal venous arch.
3. beginning of cephalic vein (on the lateral side of the lower end of radius).
4. vein draining the thumb and radial side of the index finger.
5. dorsal metacarpal vein.
6. dorsal digital veins.

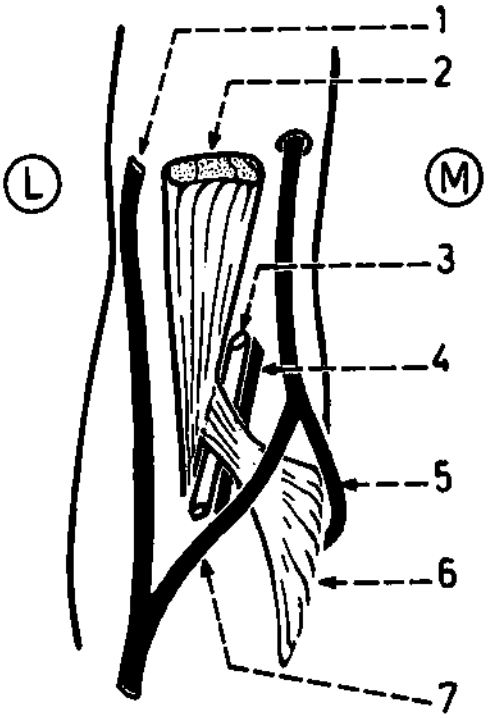


Fig.(310): MEDIAN CUBITAL VEIN

It arises from the cephalic vein just below the elbow, and passes upwards and medially to join the basilic vein just above the elbow. The bicipital aponeurosis separates the median cubital vein from both the median nerve and brachial artery.

1. cephalic vein (on the lateral side of the arm).
2. biceps brachii muscle.
3. brachial artery.
4. median nerve in the cubital fossa.
5. basilic vein (on the medial side of the arm).
6. bicipital aponeurosis.
7. median cubital vein (connects the cephalic and basilic veins).

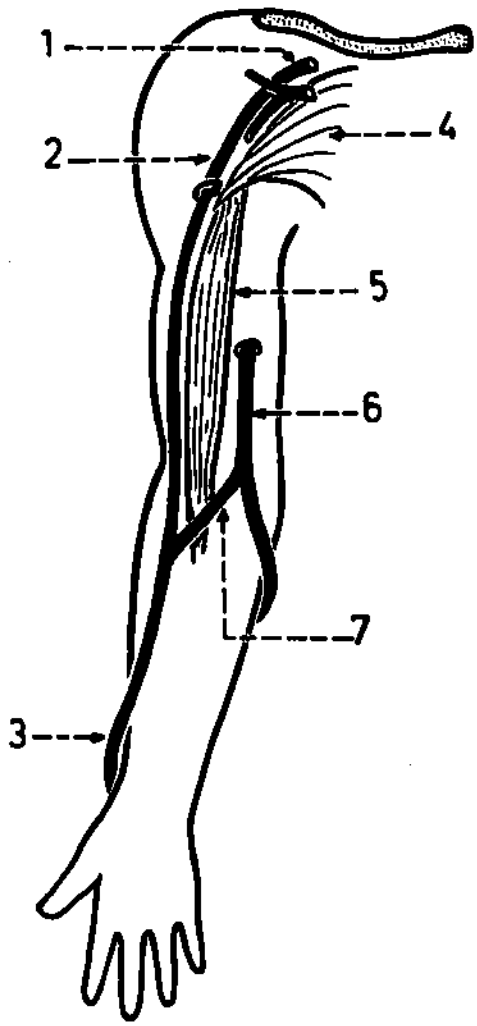


Fig.(311): CEPHALIC VEIN

It begins as a continuation of the lateral end of the dorsal venous arch and winds round the lateral border of the forearm to reach the front of the elbow. It then ascends along the lateral margin of the biceps, enters the delto-pectoral groove and pierces the clavipectoral fascia to end in the axillary vein.

1. cephalic vein at the clavi-pectoral fascia.
2. cephalic vein in delto-pectoral groove.
3. cephalic vein at the lateral side of lower end of radius.
4. pectoralis major.
5. biceps brachii.
6. basilic vein.
7. median cubital vein.

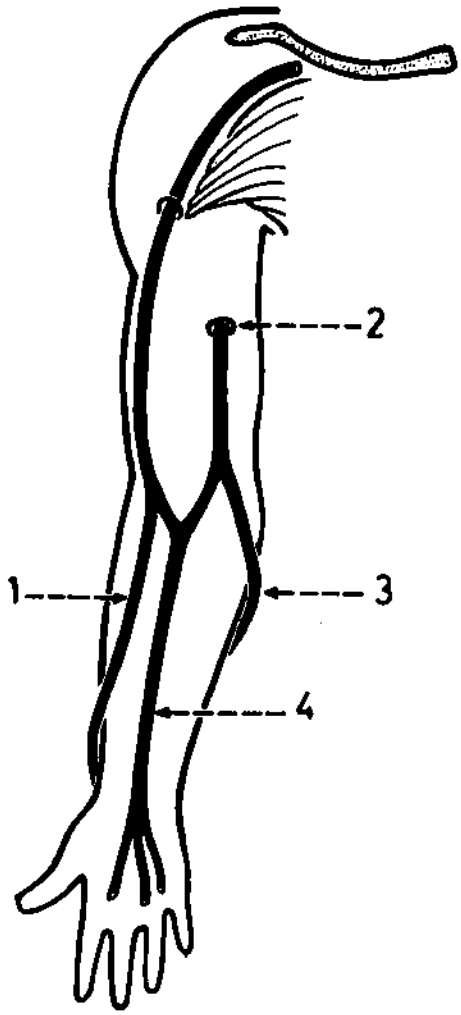


Fig.(312): BASILIC VEIN

It begins as a continuation of the medial end of the dorsal venous arch and ascends along the medial side of forearm. It then ascends along the medial margin of the biceps and pierces the deep fascia at the middle of the arm. It is joined by the veins accompanying the brachial artery to form the axillary vein.

1. cephalic vein.
2. basilic vein where it pierces the deep fascia of the arm.
3. basilic vein winding forwards on the medial side of forearm.
4. median vein of forearm (begins at the palmar surface of the hand and ascends in the midline of the front of the forearm.

LYMPHATIC DRAINAGE

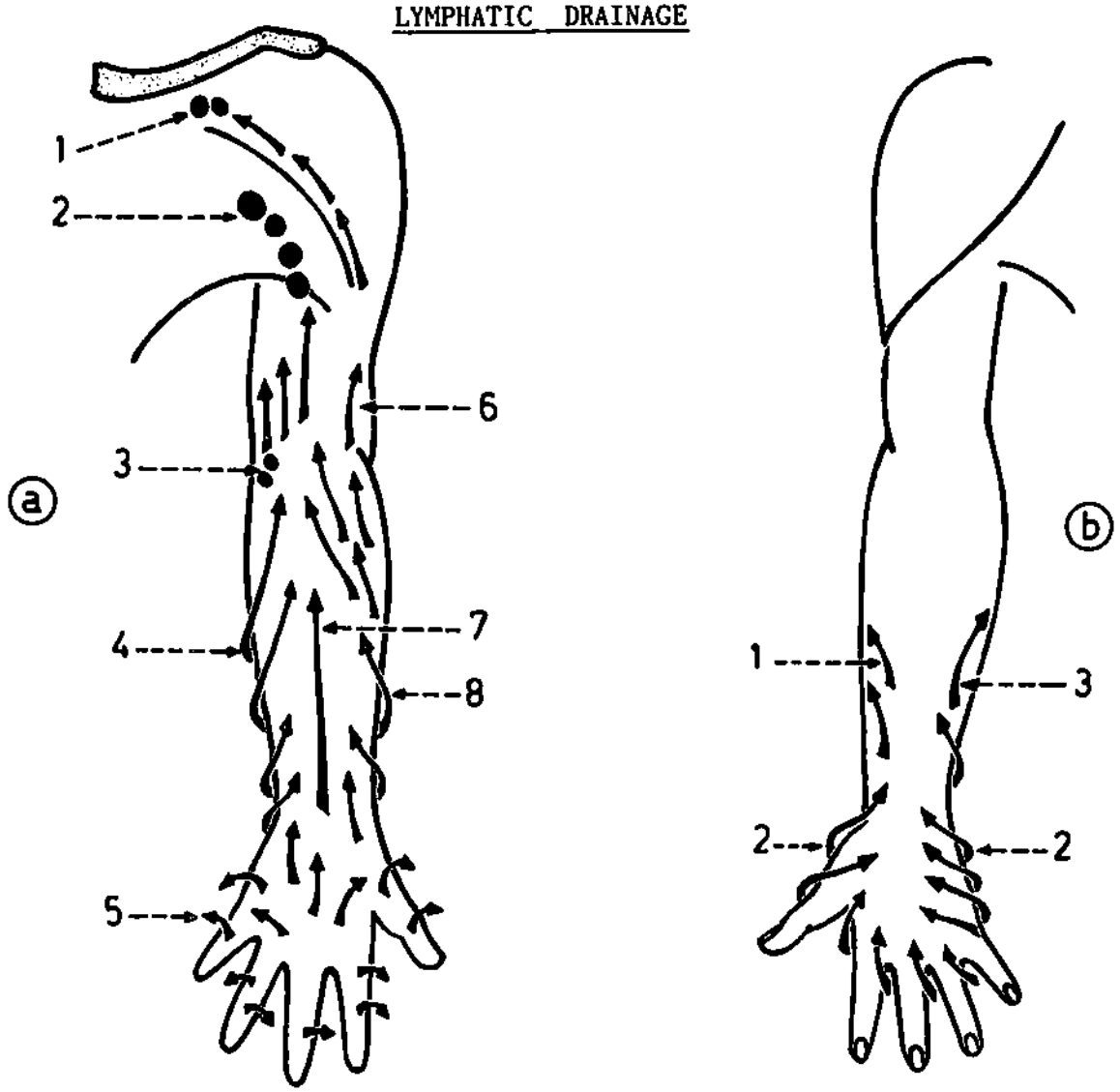


Fig.(313): LYMPH VESSELS OF THE UPPER LIMB

The lymphatic vessels begin in a plexus in the skin of the palm and wind backwards to end in a plexus on the dorsum of the hand. From the dorsal plexus, lymph vessels ascend along the medial and lateral borders of the forearm and arm in company with the basilic and cephalic veins respectively. Most of the vessels pass to the medial side of the arm to end in the lateral group of axillary nodes, while few vessels continue along the cephalic vein to the delto-pectoral nodes.

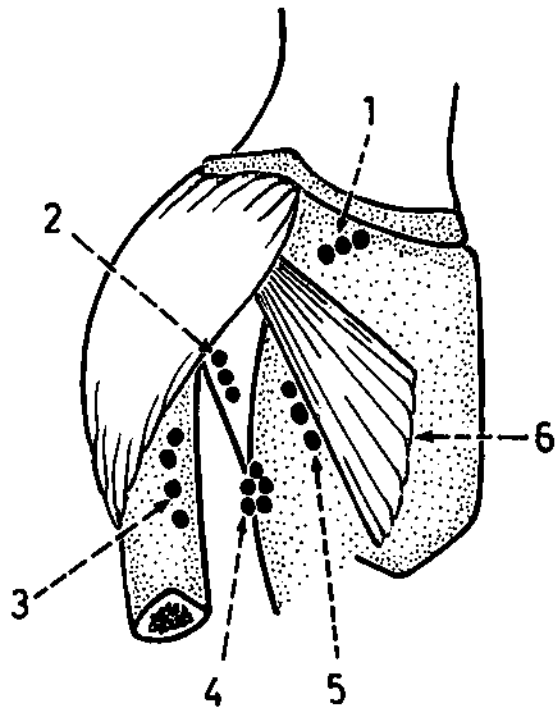
(a) Front of upper limb:

1. delto-pectoral nodes.
2. lateral group of axillary nodes.
3. supratrochlear nodes.
4. vessels along the basilic vein.
5. vessels winding backwards.
6. vessels along the cephalic vein.
7. vessels on the front of forearm.
8. vessels along the cephalic vein.

(b) Back of upper limb:

1. vessels along the cephalic vein.
2. vessels winding backwards to the dorsum of the hand.
3. vessels along the basilic vein.

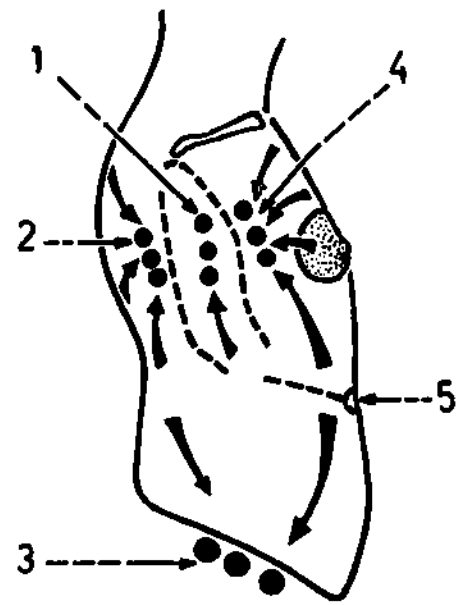
Fig.(314): AXILLARY LYMPH NODES



These are 5 groups of nodes which are situated in relation to the boundaries of the axilla. These groups are: apical, pectoral, central, lateral and subscapular.

1. apical group (at the apex of the axilla).
2. subscapular or posterior group (on the posterior wall of the axilla).
3. lateral group (along the brachial and axillary veins on the lateral wall of the axilla).
4. central group (in the centre of the axilla near its floor; they can be felt if enlarged).
5. pectoral or anterior group (along the lower border of pectoralis minor).
6. pectoralis minor.

Fig.(315): LYMPH DRAINAGE OF THE SKIN OF THE TRUNK



The skin of the upper part of the trunk above the level of the umbilicus (front and back) drains into the axillary lymph nodes, while the skin of the trunk below the umbilicus drains into the superficial inguinal nodes.

1. lateral group of axillary nodes (drains the upper limb).
2. subscapular or posterior group of axillary nodes (drains the skin of the back).
3. superficial inguinal nodes (drains the skin below the umbilicus).
4. pectoral group of axillary nodes (drains the skin of pectoral region and mammary gland).
5. umbilicus.

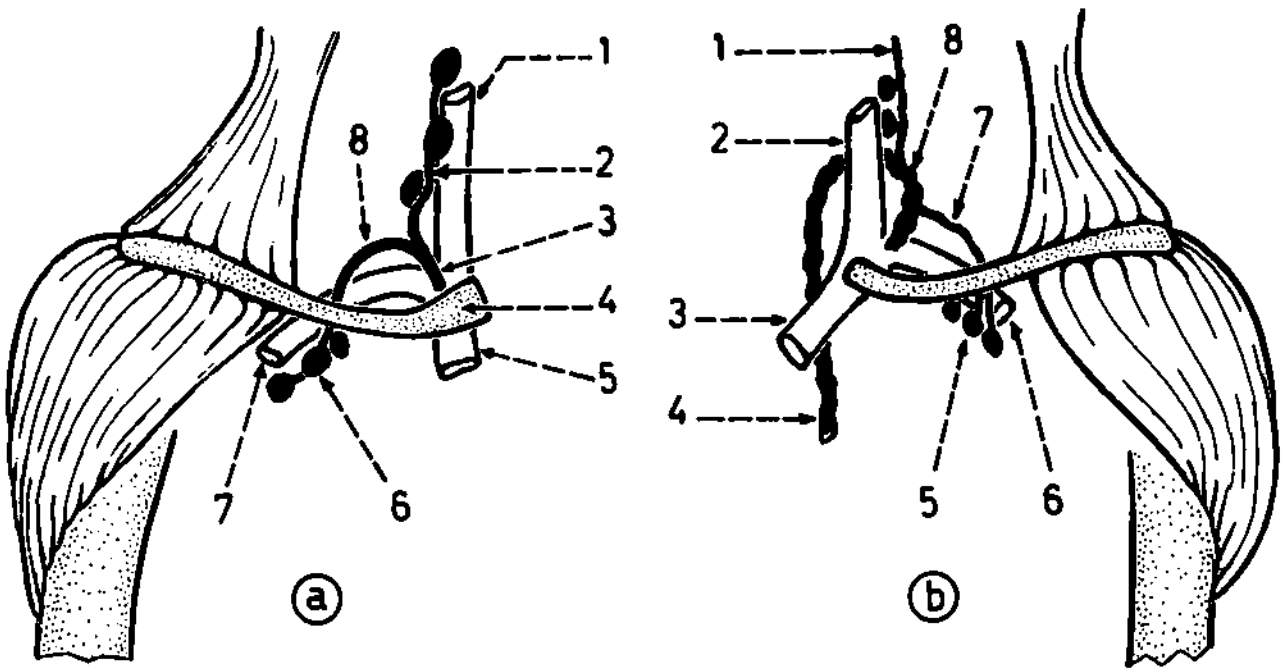


Fig.(316): FINAL LYMPHATIC DRAINAGE OF THE UPPER LIMB

The final lymphatic drainage of the upper limb reaches the apical group of axillary nodes from which efferent vessels arise and form the subclavian lymph trunk. This trunk joins the jugular lymph trunk (from the head and neck) to form the right lymphatic duct on the right side, or it ends directly into the thoracic duct on the left side. The right lymphatic duct (on the right side) and the thoracic duct (on the left side) open into the junction of the internal jugular vein and the subclavian vein.

(a) <u>On the right side</u>:

1. internal jugular vein.
2. jugular lymph trunk.
3. right lymphatic duct.
4. clavicle.
5. right innominate vein.
6. apical group of axillary nodes.
7. axillary vein (continues as the subclavian vein).
8. subclavian lymph trunk.

(b) <u>On the left side</u>:

1. jugular lymph trunk.
2. internal jugular vein.
3. left innominate vein.
4. thoracic duct in the chest.
5. apical group of axillary nodes.
6. axillary vein.
7. subclavian lymph trunk (opens into the thoracic duct).
8. thoracic duct in the root of the neck.

ARTERIES OF UPPER LIMB

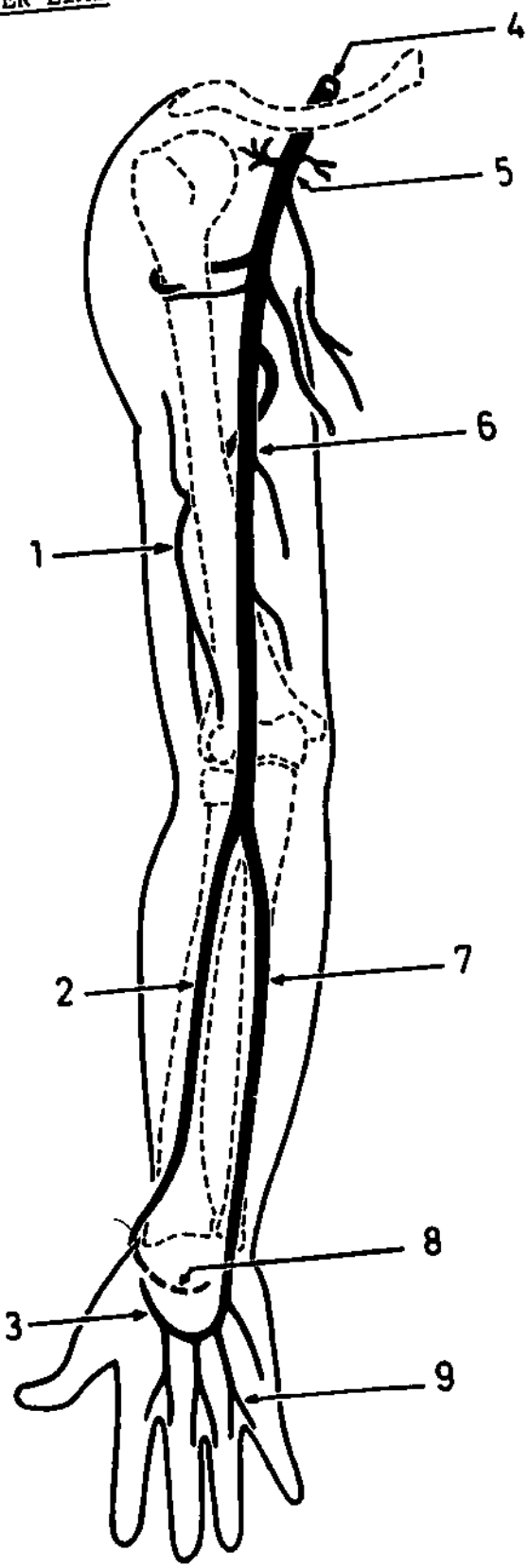


Fig.(317): ARTERIES OF THE UPPER LIMB (from the front)

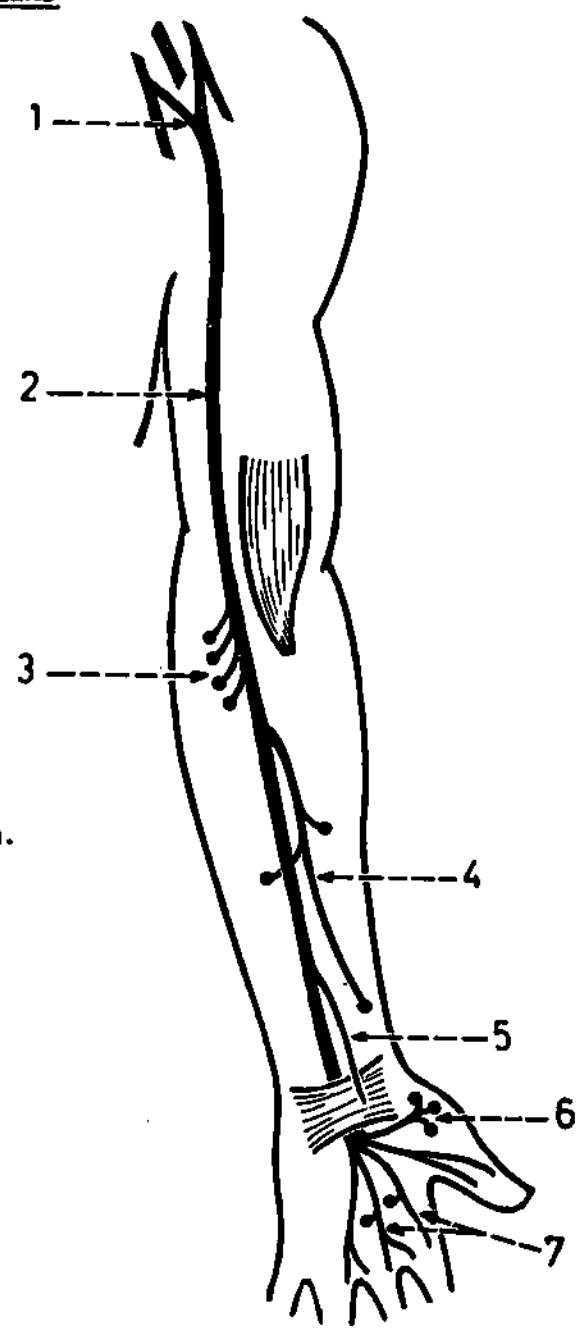
These are: axillary, brachial, radial and ulnar arteries.

1. profunda brachii artery (on the lateral side of the arm).
2. radial artery (along the radius).
3. superficial palmar arch.
4. subclavian artery (above the clavicle).
5. axillary artery (in the axilla).
6. brachial artery (in the brachium; brachium = arm).
7. ulnar artery (along the ulna).
8. deep palmar arch (continuation of the radial artery).
9. palmar digital artery.

Fig.(318): MEDIAN NERVE

1. origin of median nerve (from the medial and lateral cords of brachial plexus in the axilla).
2. median nerve in the arm (no branches).
3. branches of median nerve in the cubital fossa (to pronator teres, flexor carpi radialis, palmaris longus and flexor digitorum superficialis).
4. anterior interosseous nerve (supplies flexor pollicis longus, pronator quadratus and lateral 1/2 of flexor digitorum profundus).
5. palmar cutaneous branch.
6. branch to the 3 thenar muscles.
7. branches to the lateral 2 lumbricals.

* Most of the branches of the median nerve to muscles arise in the forearm.



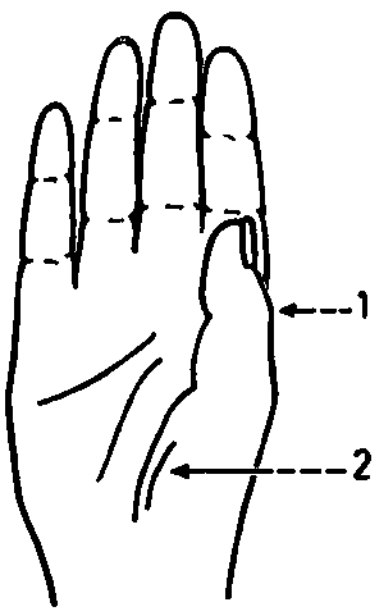


Fig.(319): APE-HAND

This is the deformity of the hand in case of injury to the median nerve (like the hand of a monkey).

1. thumb adducted to the other fingers (by the intact adductor pollicis).
2. wasted thenar eminence (due to paralysis of thenar muscles).

Fig.(320): ULNAR NERVE

1. origin of ulnar nerve (from the medial cord of brachial plexus in the axilla).
2. ulnar nerve in the arm (no branches).
3. ulnar nerve in the forearm (supplies the flexor carpi ulnaris and medial 1/2 of flexor digitorum profundus; these branches arise near the elbow).
4. dorsal cutaneous branch (to the dorsum of the hand).
5. branches to the palmaris brevis and the 3 hypothenar muscles.
6. palmar cutaneous branch.
7. branches to all interossei, adductor pollicis and the medial 2 lumbricals.

* Most of the branches of the ulnar nerve to muscles arise in the hand.

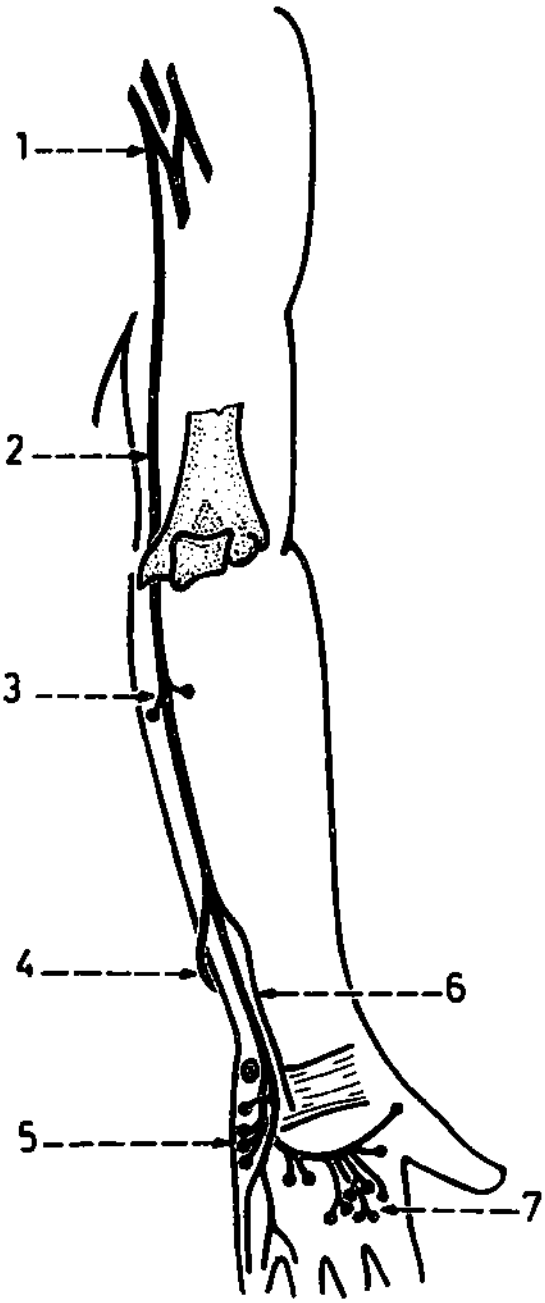
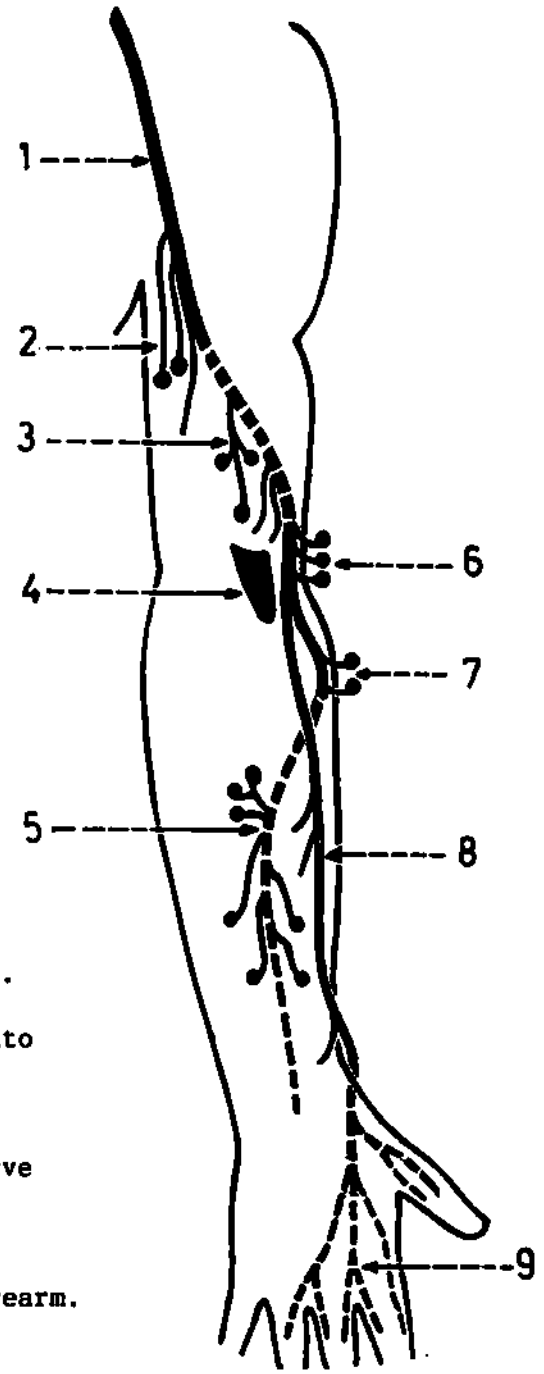


Fig.(321): CLAW-HAND

This is the deformity of the hand in case of injury to the ulnar nerve (like the claw of the bird).

1. the medial 2 fingers are flexed at the I/P joints and extended at the M/P joints.
2. the index and middle fingers are less affected because the lateral 2 lumbricals are supplied by the median nerve.

Fig.(322): RADIAL NERVE (from the front)



1. radial nerve in the axilla (arises from the posterior cord of brachial plexus).
2. branches of radial nerve in the axilla (muscular to the long and medial heads of triceps, and the posterior cutaneous nerve of arm).
3. branches of radial nerve in the spiral groove (muscular to the medial and lateral heads of triceps and to anconeus, and 2 cutaneous branches: lower lateral cutaneous nerve of arm and posterior cutaneous nerve of forearm).
4. insertion of brachialis.
5. branches of the posterior interosseous nerves on the back of the forearm (to all extensor group except the brachioradialis, extensor carpi radialis longus and brevis).
6. branches of radial nerve on the lateral side of arm (to brachioradialis, extensor carpi radialis longus and lateral 1/2 of brachialis).
7. branches of posterior interosseous nerve in the cubital fossa (to supinato and extensor carpi radialis brevis).
8. superficial branch of radial nerve (purely sensory).
9. dorsal digital branches of radial nerve (on the back of the hand).

* Most of the muscular branches of the radial nerve arise in the arm and forearm.

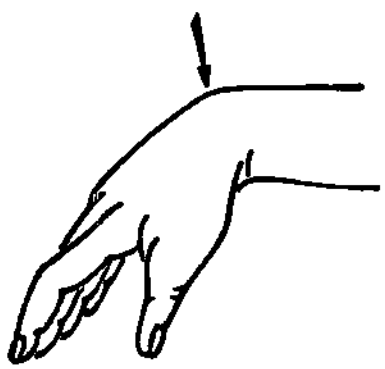


Fig.(323): WRIST-DROP

This is the deformity of the hand in case of injury to the radial nerve above the level of origin of its posterior interosseous branch. The hand cannot be extended and drops at the wrist (arrow).

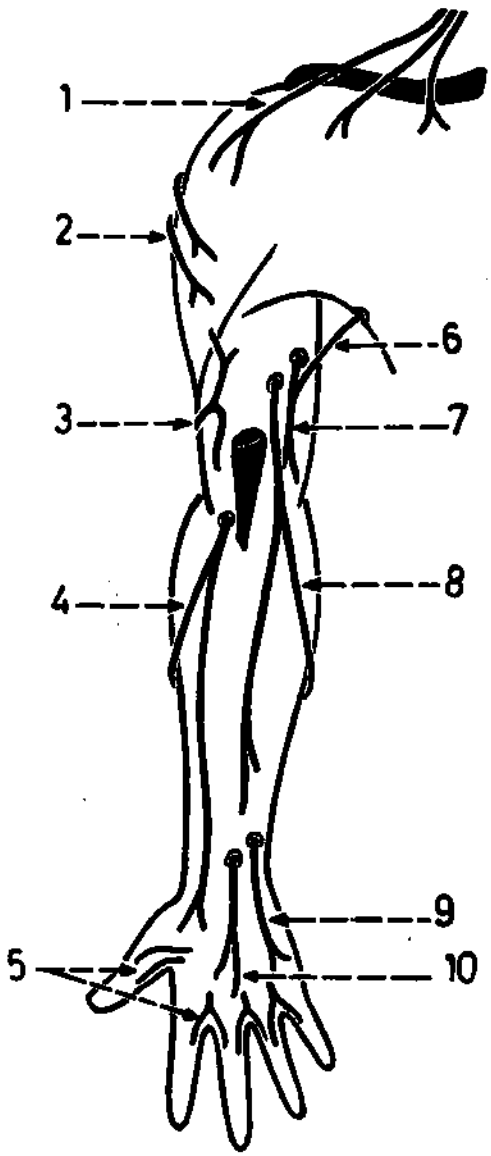


Fig.(324): CUTANEOUS NERVES ON THE FRONT OF UPPER LIMB

1. lateral supraclavicular nerve.
2. upper lateral cutaneous nerve of arm.
3. lower lateral cutaneous nerve of arm.
4. lateral cutaneous nerve of forearm.
5. palmar digital branches.
6. intercostobrachial nerve.
7. medial cutaneous nerve of arm.
8. medial cutaneous nerve of forearm.
9. palmar cutaneous branch of ulnar nerve.
10. palmar cutaneous branch of median nerve.

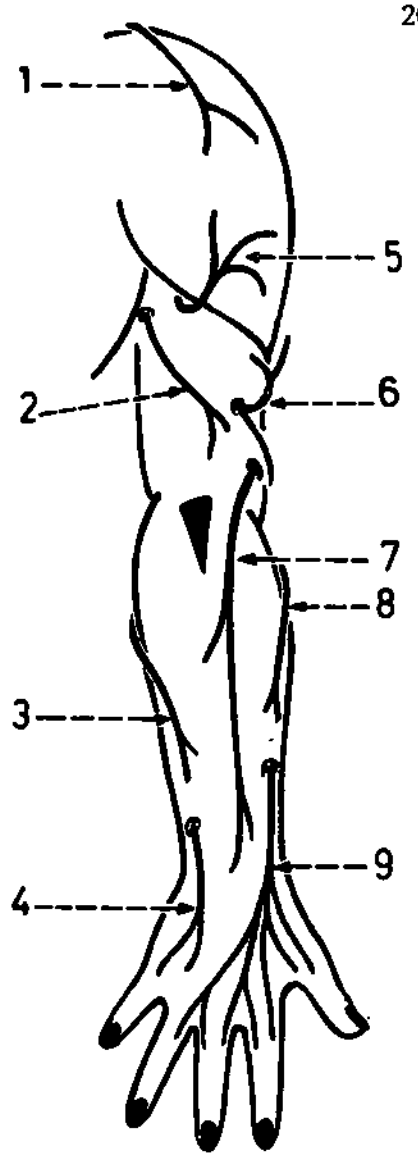


Fig.(325): CUTANEOUS NERVES ON THE BACK OF UPPER LIMB

1. lateral supraclavicular nerve.
2. posterior cutaneous nerve of arm.
3. medial cutaneous nerve of forearm (posterior division).
4. dorsal carpal branch of ulnar nerve.
5. upper lateral cutaneous nerve of arm.
6. lower lateral cutaneous nerve of arm.
7. posterior cutaneous nerve of forearm.
8. lateral cutaneous nerve of forearm.
9. superficial branch of radial nerve.

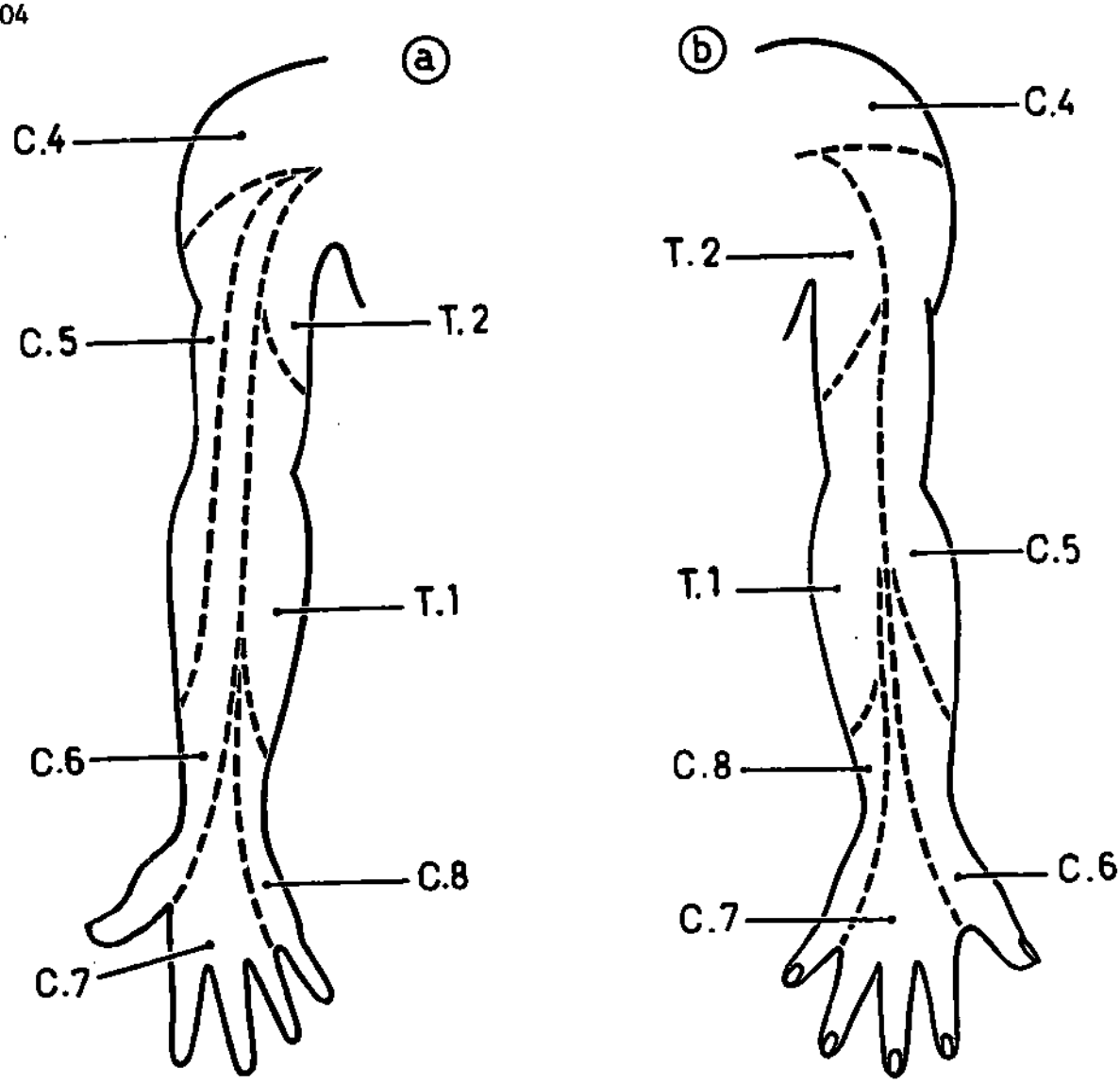


Fig.(326): SEGMENTAL DISTRIBUTION OF THE LOWER 5 CERVICAL AND UPPER 2 THORACIC NERVES TO THE SKIN OF UPPER LIMB

(a) Anterior surface.
(b) posterior surface.

** Segmental distribution of nerves means that each spinal nerve supplies a specific segment of skin; this segment of skin is called a dermatome.

** Note that the lateral border of the upper limb is supplied by C.4,5,6 while the medial border of the limb is supplied by C.8 and T.1,2. The hand is supplied by 3 segments (C.6,7,8); C.6 for the thumb, C.8 for the little finger and C.7 for the central part of the hand and the middle 3 fingers.

JOINTS

SHOULDER GIRDLE

JOINTS RELATED TO THE CLAVICLE

(acromio-clavicular and sterno-clavicular joints)

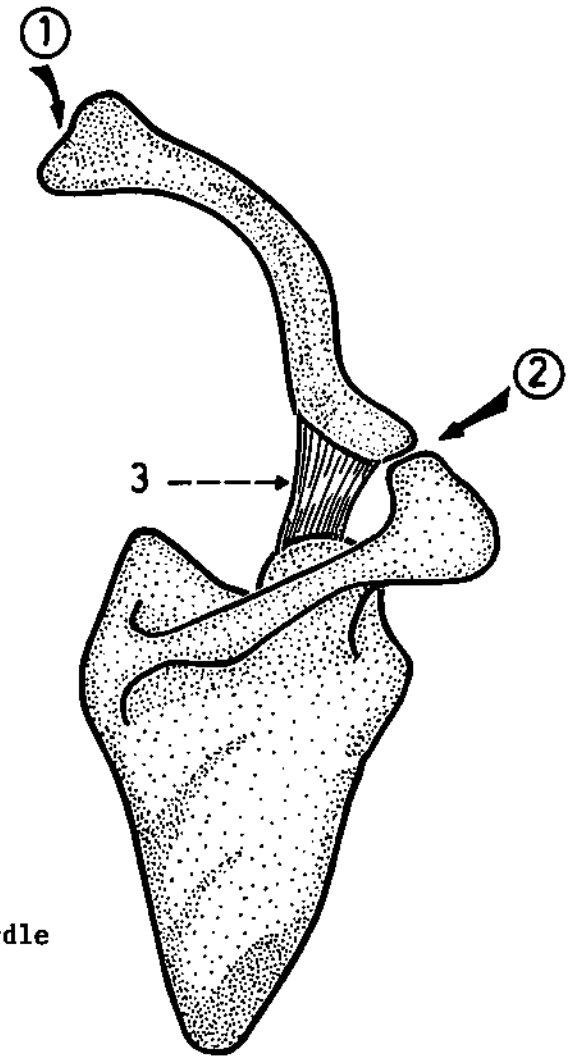


Fig.(327): ACROMIO-CLAVICULAR JOINT

It is a synovial joint of the plane type between the lateral end of the clavicle and medial margin of acromion. Its long axis lies in the antero-posterior plane and is supported mainly by the coraco-clavicular ligament.

1. medial end of the clavicle (forms the sterno-clavicular joint).
2. acromio-clavicular joint.
3. coraco-clavicular ligament.

* Note that the shoulder girdle consists of the scapula and clavicle which articulate together at the acromio-clavicular joint. The shoulder girdle articulates with the axial skeleton (manubrium sterni) by the medial end of the clavicle at the sterno-clavicular joint.

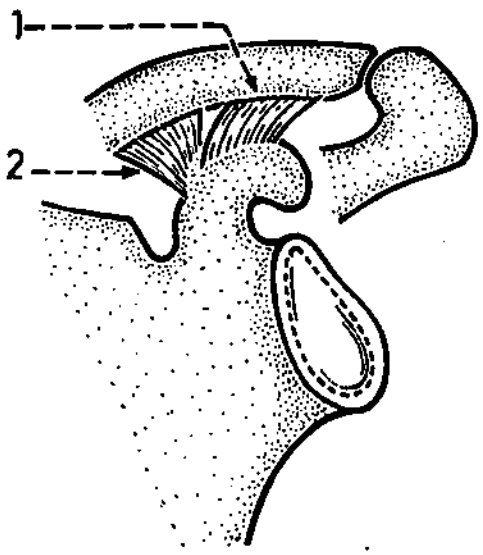


Fig.(328): CORACO-CLAVICULAR LIGAMENT

It is the main ligament connecting the scapula to the clavicle. It extends from the under surface of the lateral part of the clavicle to the root and upper surface of the coracoid process of the scapula. It consists of conoid part and trapezoid part.

1. trapezoid part (attached to the trapezoid ridge of the clavicle).
2. conoid part (attached to the conoid tubercle of the clavicle)

* If the coraco-clavicular ligament is torn, the scapula falls down from the clavicle.

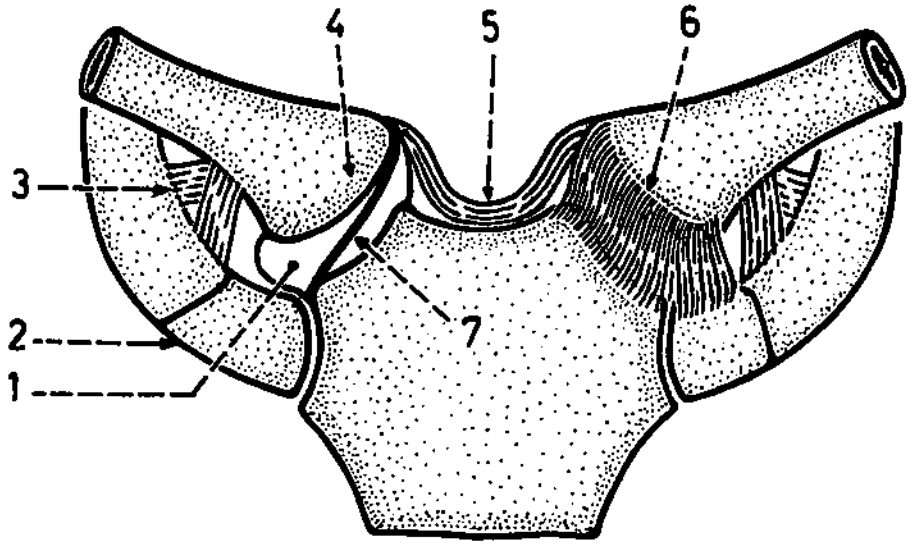


Fig.(329): STERNO-CLAVICULAR JOINT

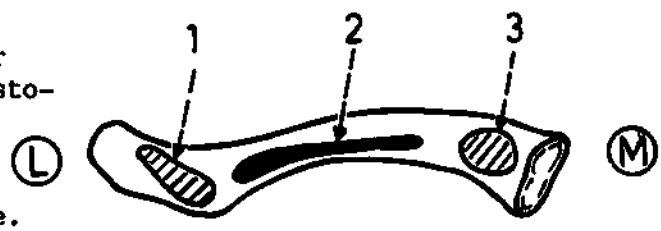
It is a synovial joint which resembles the ball-and-socket variety. The ball is formed by the medial end of the clavicle, while the socket is formed by both the clavicular notch of the manubrium sterni and the 1st costal cartilage. The joint cavity is completely divided into 2 compartments by an articular disc. Its ligaments are: anterior and posterior sterno-clavicular, interclavicular and costo-clavicular ligaments.

1. cavity of sterno-clavicular joint.
2. 1st costal cartilage.
3. costo-clavicular ligament (from the 1st rib to the under surface of the medial end of the clavicle).
4. medial end of the clavicle.
5. interclavicular ligament (extends between the medial ends of the 2 clavicles.
6. anterior sterno-clavicular ligament (covers the anterior surface of the joint).
7. articular disc (extends from the upper edge of the medial end of the clavicle above, to the junction between the 1st costal cartilage and the manubrium sterni below).

* This joint is very stable owing to its strong ligaments and its articular disc and therefore, its dislocation is very rare.

Fig.(330): LIGAMENTS ATTACHED TO THE INFERIOR SURFACE OF THE CLAVICLE

These are the coraco-clavicular ligament laterally, and the costo-clavicular ligament medially.



1. coraco-clavicular ligament.
2. groove for subclavius muscle.
3. costo-clavicular ligament.

MOVEMENTS OF THE SCAPULA

Fig.(331): ELEVATION OF THE SCAPULA

The whole scapula moves upwards.
It is performed by the upper fibres of the trapezius and by the levator scapulae.

1. upper fibres of trapezius.
2. levator scapulae.

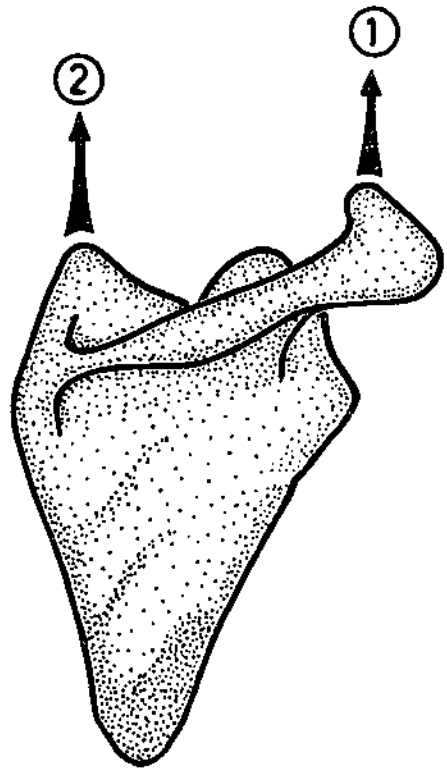


Fig.(332): DEPRESSION OF THE SCAPULA

The whole scapula moves downwards.
It is carried out by pectoralis minor and lower fibres of trapezius.

1. pectoralis minor.
2. lower fibres of trapezius.

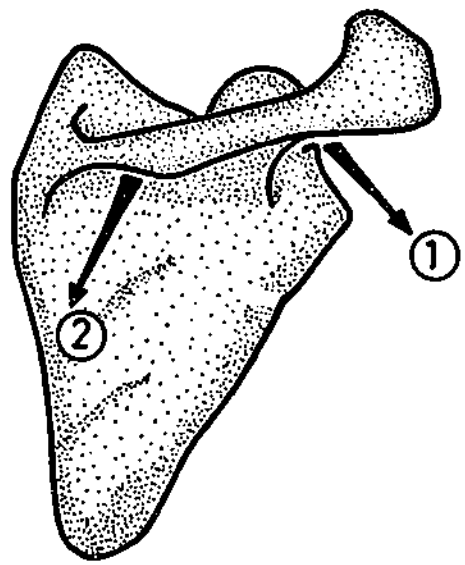
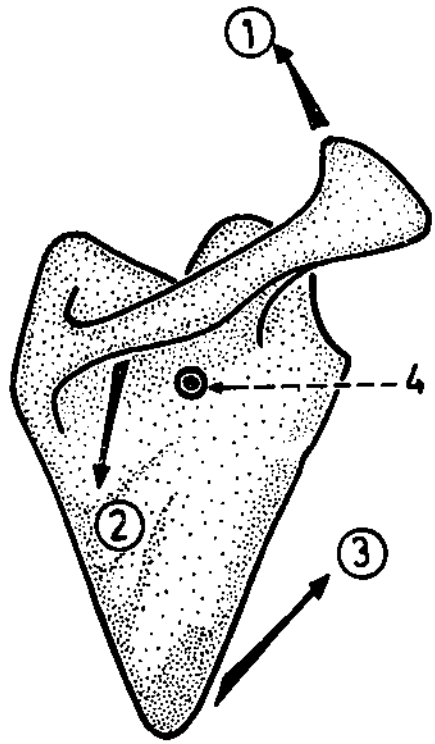


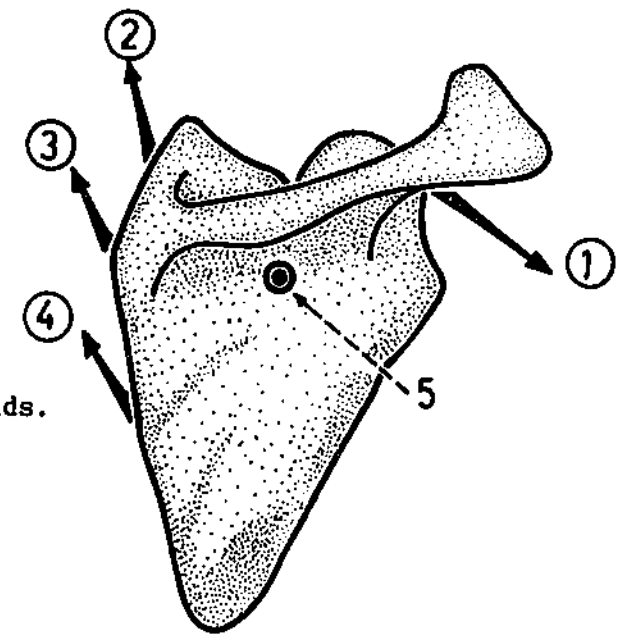
Fig.(333): LATERAL ROTATION OF THE SCAPULA



It is the movement by which the inferior angle of the scapula rotates laterally around an axis passing through the centre of the scapula. It can also be described as upward rotation because the glenoid cavity moves upwards during this rotation. It is performed by the upper fibres of the trapezius, lower fibres of the trapezius and lower 5 digitations of the serratus anterior.

1. upper fibres of the trapezius.
2. lower fibres of the trapezius.
3. lower 5 digitations of the serratus anterior.
4. axis through the centre of the scapula.

Fig.(334): MEDIAL ROTATION OF THE SCAPULA



It is the movement by which the inferior angle of the scapula rotates medially around an axis passing through the centre of the scapula. It can also be described as downward rotation because the glenoid cavity moves downwards during this rotation. It is performed by the pectoralis minor, levator scapulae and the 2 rhomboids.

1. pectoralis minor.
2. levator scapulae.
3. rhomboideus minor.
4. rhomboideus major.
5. axis through the centre of the scapula.

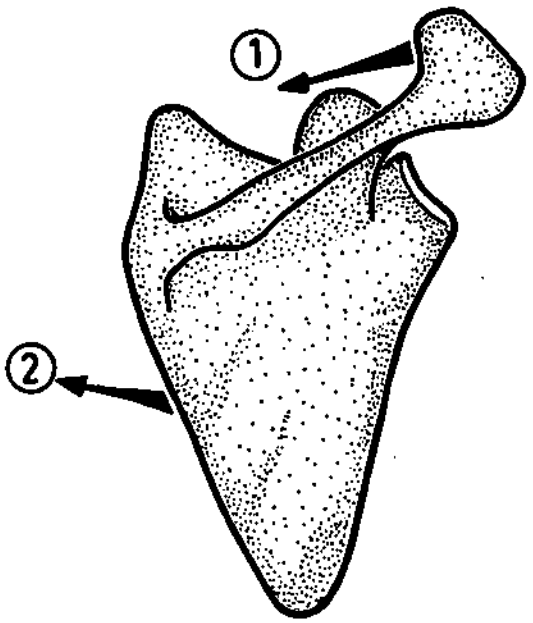


Fig.(335): RETRACTION OF THE SCAPULA

It is the movement by which the scapula is drawn backwards towards the vertebral column. It is performed by the middle fibres of the trapezius and the 2 rhomboids.

1. middle fibres of trapezius.
2. rhombodeus minor and major.

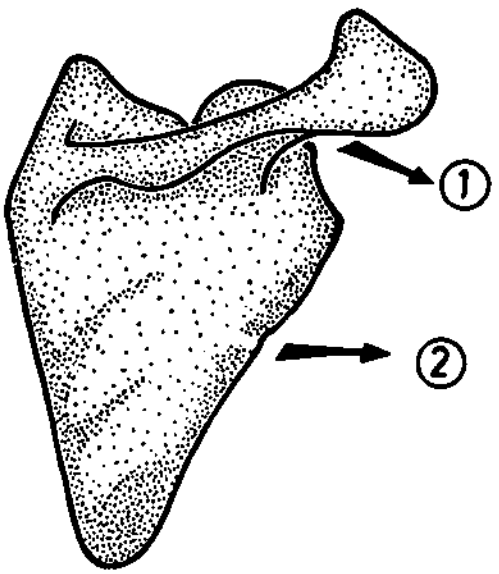


Fig.(336): PROTRACTION OF THE SCAPULA

It is the movement by which the scapula is drawn forwards on the side of the chest. it is performed by the pectoralis minor and the whole mass of the serratus anterior.

1. pectoralis minor.
2. the whole serratur anterior.

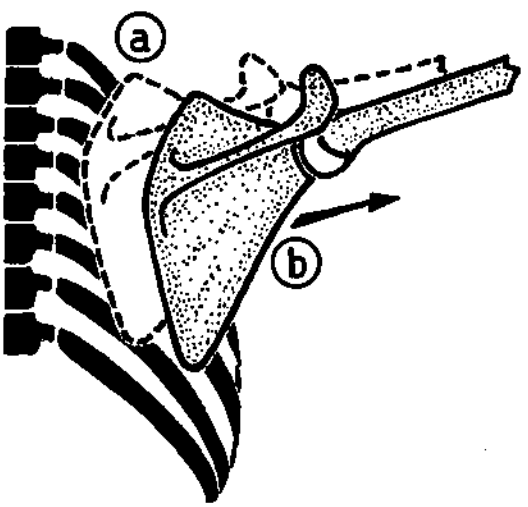


Fig.(337): POSITION OF THE SCAPULA IN PROTRACTION

(a) Scapula in the anatomical position.

(b) Scapula in the protracted position.

SHOULDER JOINT

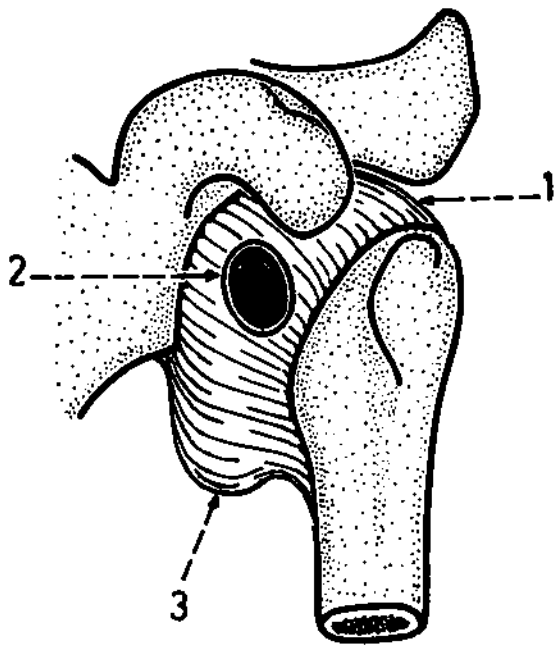


Fig.(338): CAPSULE OF SHOULDER JOINT

It is attached medially to the circumference of the glenoid cavity and laterally to the anatomical neck of the humerus except on the medial side where the capsule descends for more than 1 cm on the surgical neck of the humerus. The capsule has a large anterior perforation through which the joint cavity communicates with the bursa deep to the subscapularis muscle.

1. upper part of the capsule.
2. perforation in the anterior part of the capsule.
3. lower part of the capsule (redundent with the arm in the anatomical position but it stretches when the arm is abducted).

* It should be noted that the shoulder joint is a synovial joint of the ball-and-socket variety. It is formed by the head of the humerus and the glenoid cavity of the scapula.

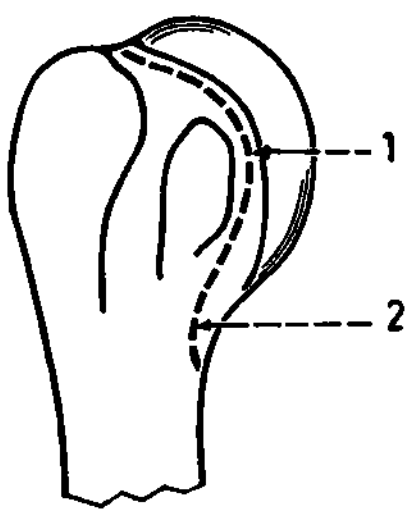
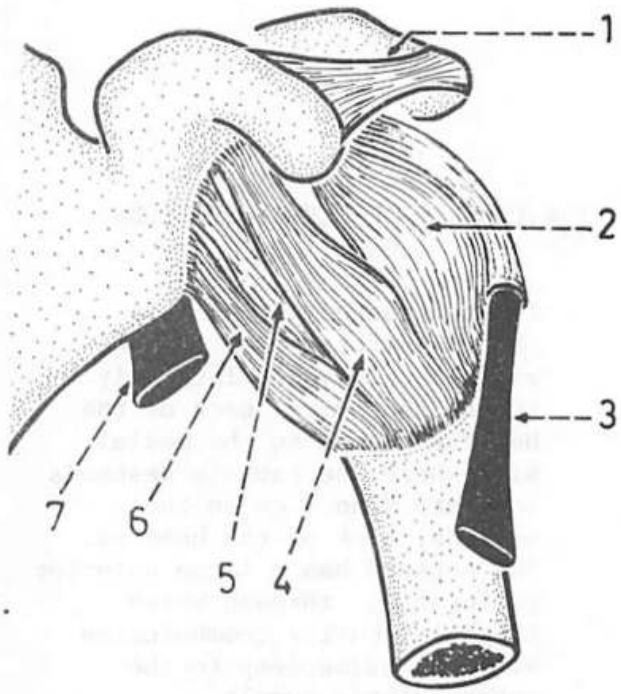


Fig.(339): ATTACHMENT OF THE CAPSULE OF SHOULDER JOINT TO THE UPPER END OF HUMERUS

1. attachemnt of the capsule to the anatomical neck.
2. attachment of the capsule to the medial side of the surgical neck.

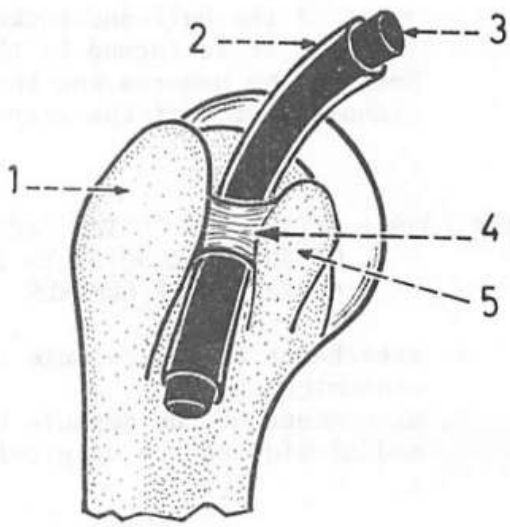
Fig.(340): LIGAMENTS OF SHOULDER JOINT



These ligaments are: coraco-humeral, gleno-humeral and transverse humeral ligaments. The coraco-humeral ligament covers the upper part of the capsule, while the gleno-humeral ligaments (superior, middle and inferior) blend with the front of the capsule. The transverse humeral ligament stretches between the lesser and greater tubercles.

1. coraco-acromial ligament (above the shoulder joint).
2. coraco-humeral ligament (from the root of coracoid process to the greater tubercle).
3. long head of biceps (enters the joint cavity).
4. superior gleno-humeral ligament (from the medial margin of glenoid cavity to the lesser tubercle).
5. middle gleno-humeral ligament (from the medial margin of glenoid cavity to the lesser tubercle).
6. inferior gleno-humeral ligament (from the medial margin of glenoid cavity to the lower part of the anatomical neck).
7. long head of triceps (attached to the infraglenoid tubercle and supports the capsule from below).

Fig.(341): TRANSVERSE HUMERAL LIGAMENT



It stretches between the lesser and greater tubercle of the humerus, bridging over the tendon of long head of biceps.

1. greater tubercle.
2. synovial sheath enclosing the tendon of long head of biceps.
3. tendon of long head of biceps.
4. transverse humeral ligament.
5. lesser tubercle.

Fig.(342): SYNOVIAL MEMBRANE OF SHOULDER JOINT

It lines the fibrous capsule of the joint from which it is reflected on the medial side of the surgical neck of the humerus. It does not cover the articular surfaces.

1. supraspinatus (blends with the upper part of the capsule).
2. joint cavity.
3. synovial membrane reflected on the surgical neck.
4. lower part of the capsule.
5. axillary nerve.
6. posterior circumflex humeral artery (in contact with the surgical neck).
7. deltoid muscle.
8. subacromial bursa (separated from the shoulder joint by the tendon of supraspinatus).
9. acromion.

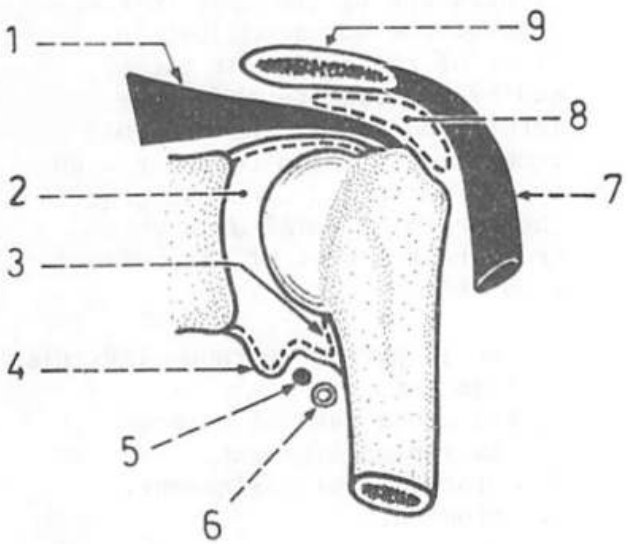


Fig.(343): TUBULAR SHEATH OF SYNOVIAL MEMBRANE AROUND THE TENDON OF LONG HEAD OF BICEPS

As the tendon of the long head of biceps traverses the cavity of the joint, it is enveloped by a tubular sheath of synovial membrane.

1. tendon of long head of biceps (emerging from the joint cavity).
2. transverse humeral ligament (bridging over the tendon).
3. tubular sheath of synovial membrane around the tendon of long head of biceps.
4. supraglenoid tubercle (gives origin to the long head of biceps).
5. lower part of the capsule.
6. long head of triceps (from the infraglenoid tubercle).
7. axillary nerve and posterior circumflex humeral artery (related to the lower part of the capsule).

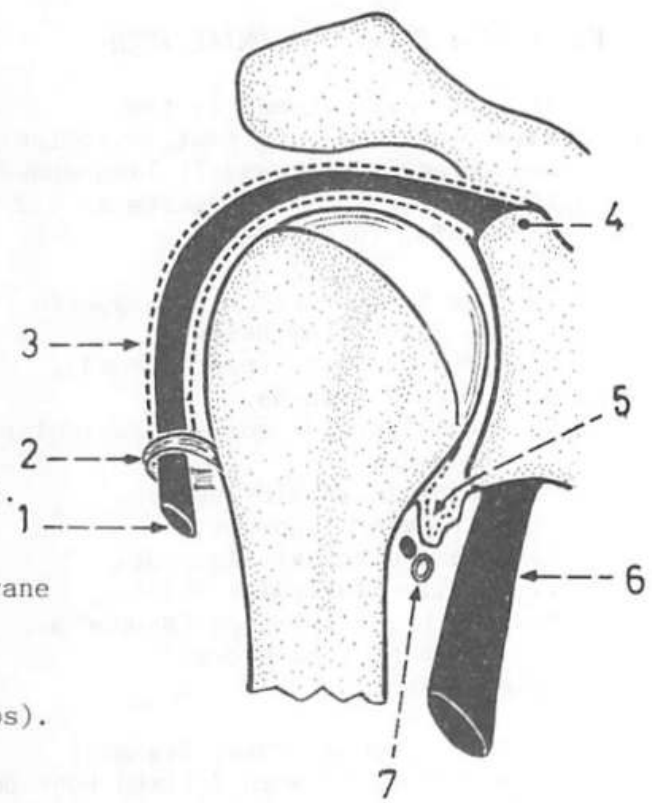
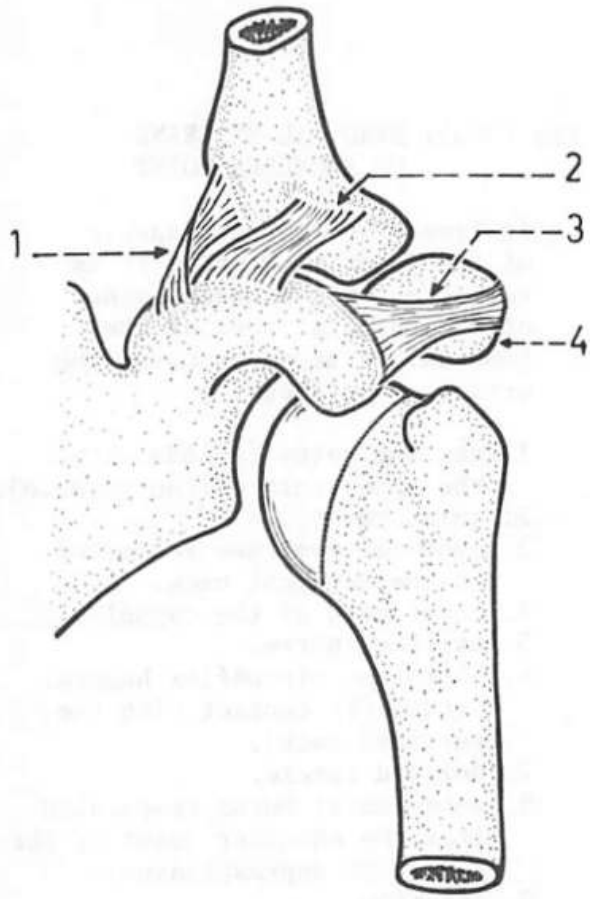


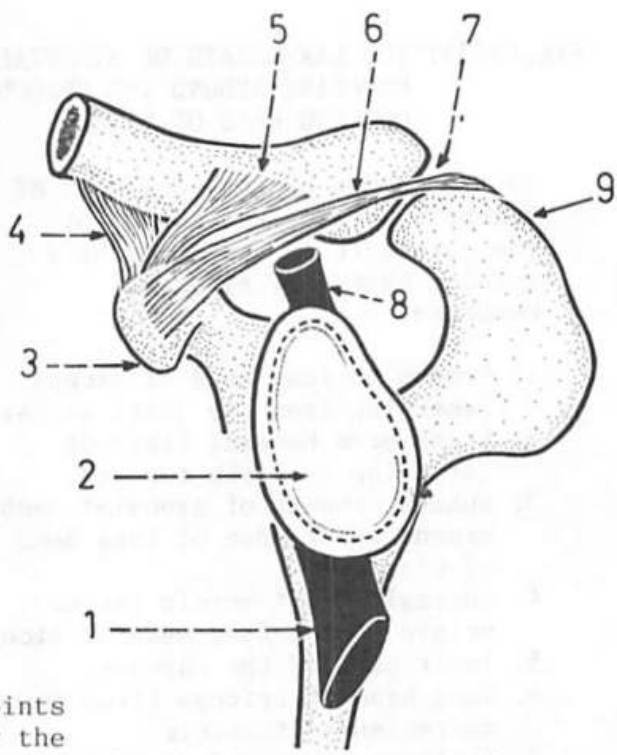
Fig.(344): CORACO-ACROMIAL LIGAMENT



It is a triangular ligament which is attached by its apex to the edge of the acromion just in front of the articular facet, and by its base to the whole lateral border of the coracoid process. It forms together with the acromion and coracoid process the coraco-acromial arch which protects the head of the humerus from above.

1. conoid part of coraco-clavicular ligament.
2. trapezoid part of coraco-clavicular ligament.
3. coraco-acromial ligament.
4. acromion.

Fig.(345): CORACO-ACROMIAL ARCH



It is an arch formed by the coraco-acromial ligament, acromion and coracoid process. It lies above the shoulder joint and acts as a 2ry socket for that joint.

1. long head of triceps (supports the joint from below).
2. glenoid cavity (pear-shaped).
3. coracoid process.
4. conoid part of coraco-clavicular ligament.
5. trapezoid part of coraco-clavicular ligament.
6. coraco-acromial ligament.
7. acromio-clavicular joint.
8. long head of biceps (supports the joint from above).
9. acromion.

* The coraco-acromial ligament stretches between 2 fixed bony points thus, it acts as a 2ry socket for the shoulder joint, while the coraco-clavicular ligament is attached to the movable lateral part of the clavicle, and thus it supports the acromio-clavicular joint.

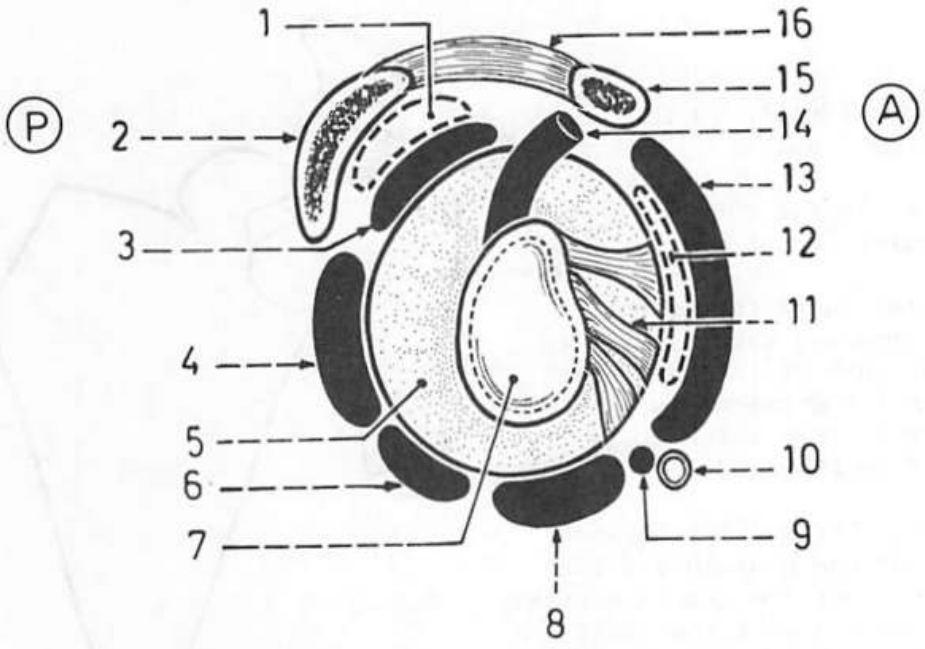


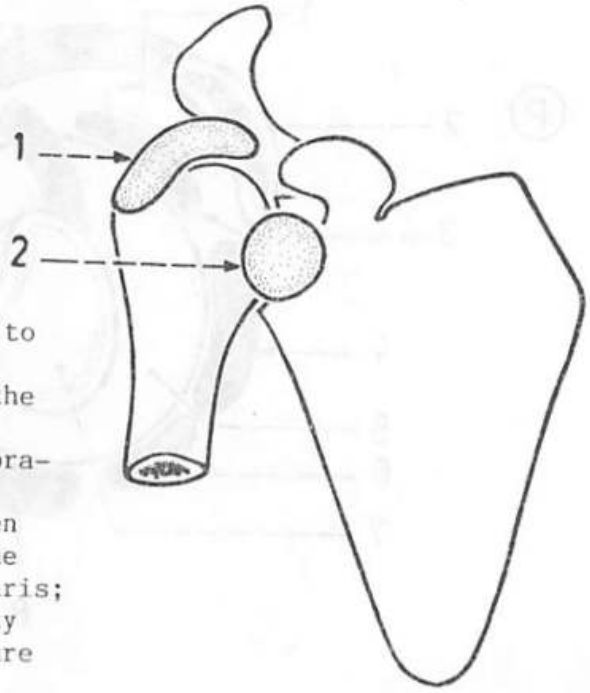
Fig.(346): RELATIONS OF THE SHOULDER JOINT

It is related to muscles (supraspinatus, infraspinatus, teres minor, long head of triceps, subscapularis and long head of biceps), bursae (subscapular and subacromial), posterior circumflex humeral artery and axillary nerve. With the exception of the long head of biceps which traverses the joint cavity, all other related muscles are closely applied and adherent to the capsule of the joint and thus they play an essential role in the support of the joint.

1. subacromial bursa (between the acromion and the supraspinatus tendon).
2. acromion.
3. tendon of supraspinatus (above the joint).
4. tendon of infraspinatus (behind the joint).
5. capsule of the joint.
6. tendon of teres minor (behind the joint).
7. glenoid cavity.
8. long head of triceps (below the joint).
9. axillary nerve.
10. posterior circumflex humeral artery.
11. glenohumeral ligaments (superior, middle and inferior,as seen from inside the joint).
12. subscapular bursa (deep to subscapularis).
13. tendon of subscapularis (in front of the joint).
14. tendon of long head of biceps (inside the joint).
15. coracoid process.
16. coraco-acromial ligament.

* The related muscles are arranged as follows: one inside, one above and one below, one in front and 2 behind.

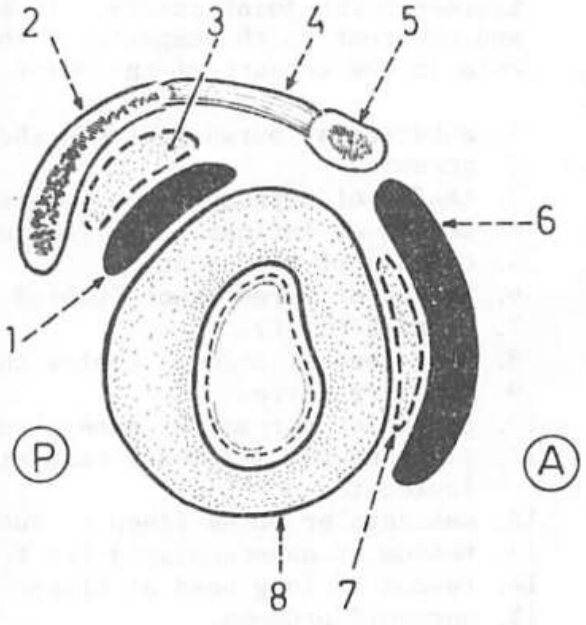
Fig.(347): BURSAE RELATED TO THE SHOULDER JOINT



These are mainly the subacromial and subscapular bursae.

1. subscromial bursa (underneath the acromion and extends deep to the upper part of the deltoid; it does not communicate with the joint cavity from which it is separated by the tendon of supra-spinatus).
2. subscapular bursa (lies between the neck of the scapula and the lateral part of the subscapularis; it communicates with the cavity of the joint through an aperture in the front of the capsule).

Fig.(348): BURSAE RELATED TO THE SHOULDER JOINT (in section)



1. tendon of supraspinatus (above the joint).
2. acromion.
3. subacromial bursa.
4. coraco-acromial ligament (part of the coraco-acromial arch).
5. coracoid process.
6. subscapularis (in front of the joint).
7. subscapular bursa.
8. capsule of shoulder joint (the joint is open).

Fig.(349): ROTATOR MUSCLE CUFF

It is a cuff formed by 4 muscles (supraspinatus, infraspinatus, teres minor and subscapularis) which surround the joint and blend with its capsule from above, behind and in front. They help in the stability of the shoulder joint.

1. supraspinatus (above the joint).
2. infraspinatus (behind the joint).
3. teres minor (behind the joint).
4. subscapularis (in front of the joint)

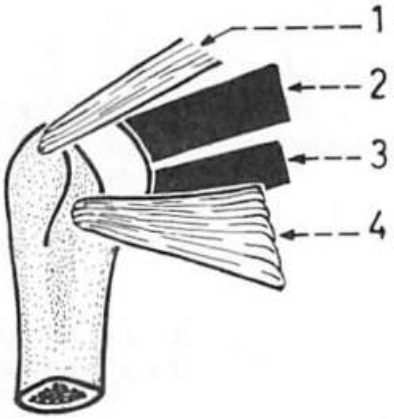
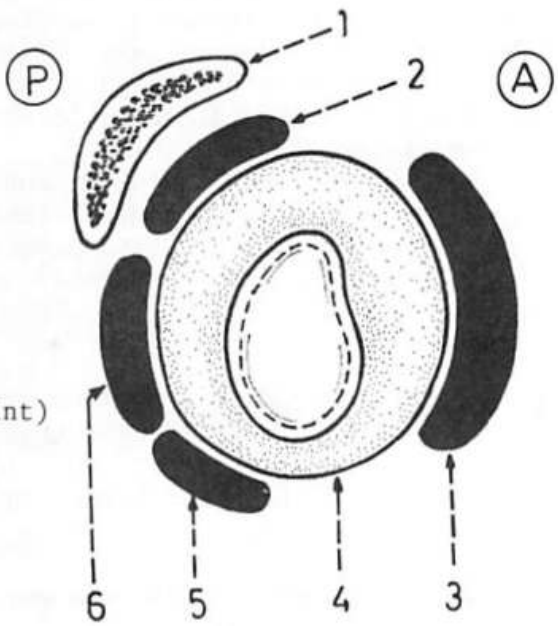


Fig.(350): ROTATOR MUSCLE CUFF (in section)

The members of the muscle cuff form a ring surrounding the capsule of the shoulder joint, that is why they are described to form a cuff.

1. acromion.
2. supraspinatus (above the joint).
3. subscapularis (in front of the joint)
4. capsule of the joint.
5. teres minor (behind the joint).
6. infraspinatus (behind the joint).



MOVEMENTS AT THE SHOULDER JOINT

The shoulder joint is a ball-and-socket variety,and thus it is capable of flexion, extension, adduction, abduction, rotation and circumduction. It has a wide range of movement due to the large size of the head of humerus as compared with the shallow glenoid cavity and to the laxity of the fibrous capsule.

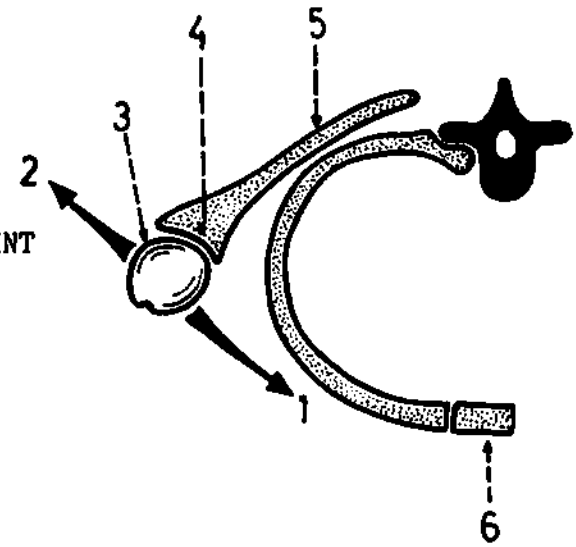


Fig.(351): DIRECTION OF FLEXION AND EXTENSION AT THE SHOULDER JOINT

Flexion and extension take place at right angle to the plane of the scapula; in flexion the arm is carried forwards across the front of the chest, while in extension the arm is carried backwards.

1. direction of flexion (forwards to the front of the chest).
2. direction of extension (backwards).
3. head of the humerus (articulating with the glenoid cavity).
4. glenoid cavity (directed forwards and laterally).
5. body of the scapula in section (movements of the shoulder take place in relation to its plane).
6. sternum (front of the chest).

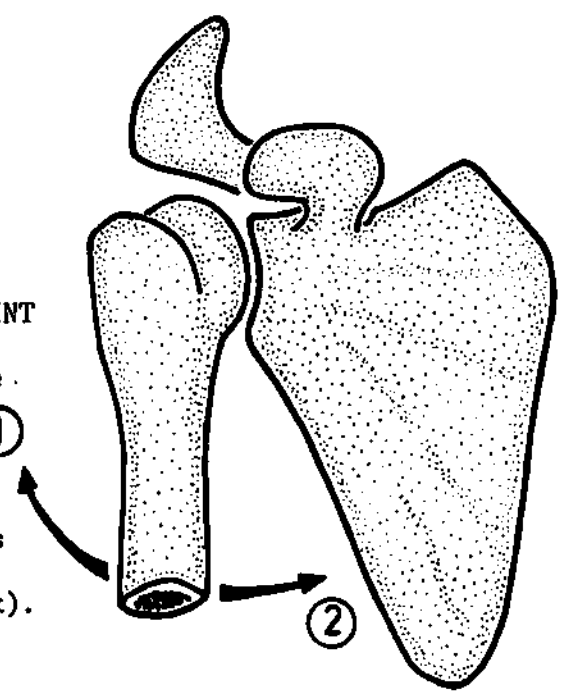


Fig.(352): DIRECTION OF ADDUCTION AND ABDUCTION AT THE SHOULDER JOINT

Adduction and abduction occur in the plane of the scapula.

1. abduction (carries the arm away from the scapula).
2. adduction (carries the arm towards the scapula, and as a result the arm comes by the side of the trunk).

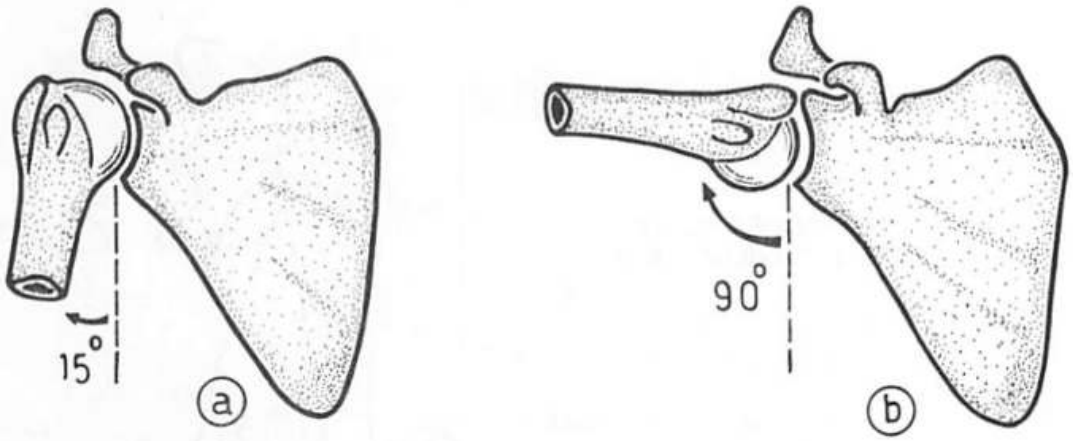


Fig.(353): ABDUCTION AT THE SHOULDER JOINT

Abduction takes place in the plane of the scapula up to 90° from the trunk. Further abduction more than 90° as in raising the arm above the head takes place by upward rotation of the scapula.

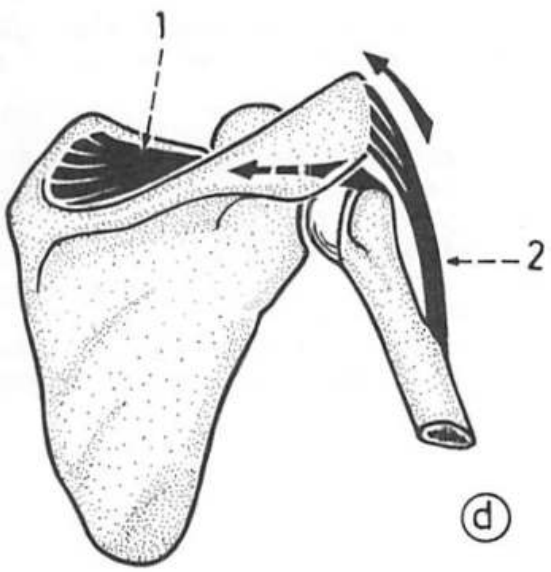
(a) Abduction to 15° (by supra-spinatus).

(b) Abduction to 90° (by deltoid).

(c) Raising the arm above the head (lateral or upward rotation of the scapula by upper fibres of trapezius and lower 5 digitations of serratus anterior).

(d) Abduction by supraspinatus and deltoid.

1. supraspinatus (abducts the arm up to 15°).
2. deltoid (abducts the arm from 15° to 90°).



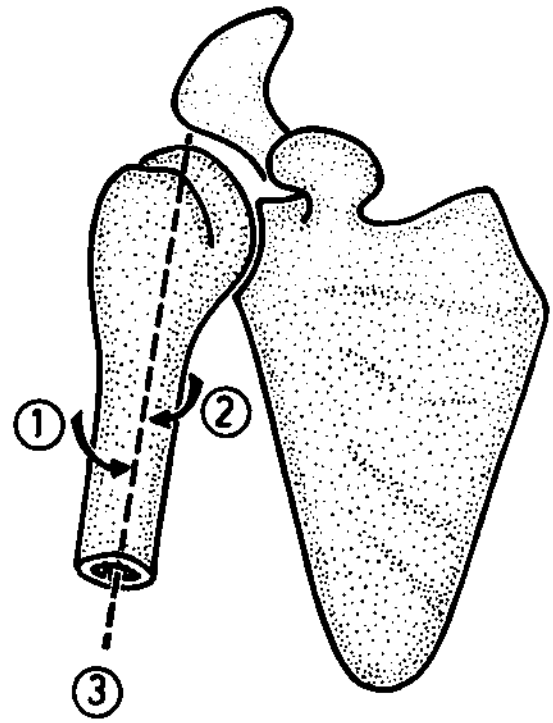


Fig.(354): ROTATION OF THE ARM AT THE SHOULDER JOINT

Rotation takes place around a vertical axis passing through the humerus.
Rotation may be towards the medial side (medial rotation) or towards the lateral side (lateral rotation).

1. medial rotation.
2. lateral rotation.
3. vertical axis passing through the humerus around which medial and lateral rotation take place.

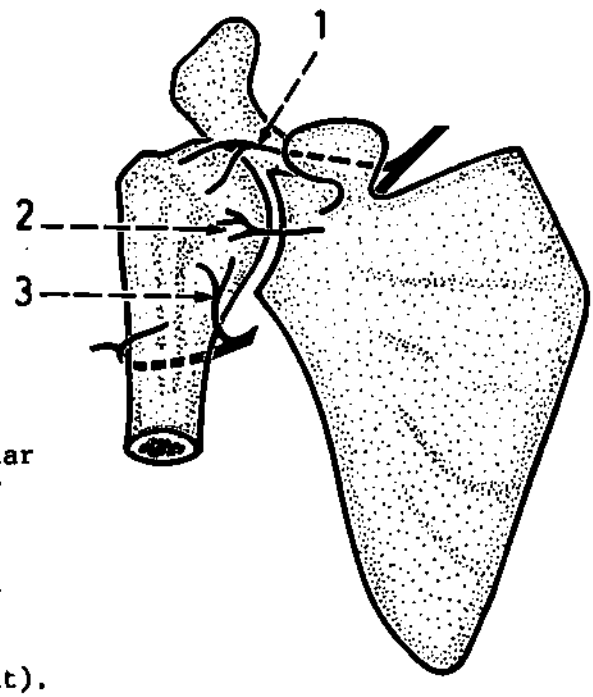
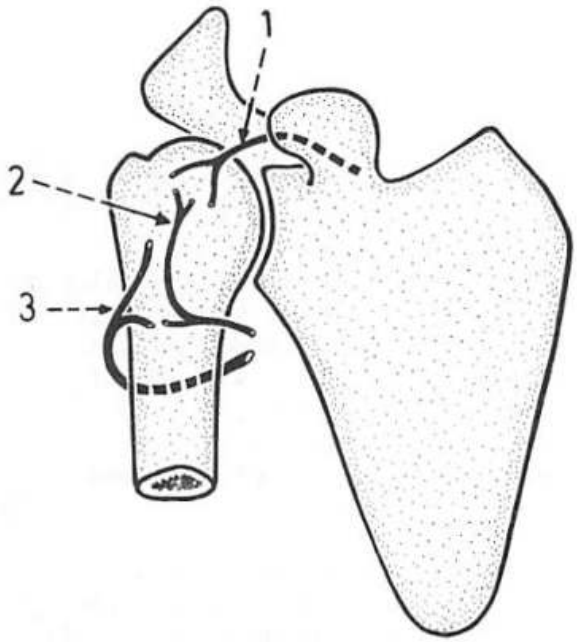


Fig.(355): NERVES SUPPLYING THE SHOULDER JOINT

These are derived from the axillary, suprascapular and lateral pectoral nerves.

1. articular branch from suprascapular nerve (for superior and posterior parts of the joint).
2. articular branch from lateral pectoral nerve (for anterior part of the joint).
3. articular branch from axillary nerve (for lower part of the joint).

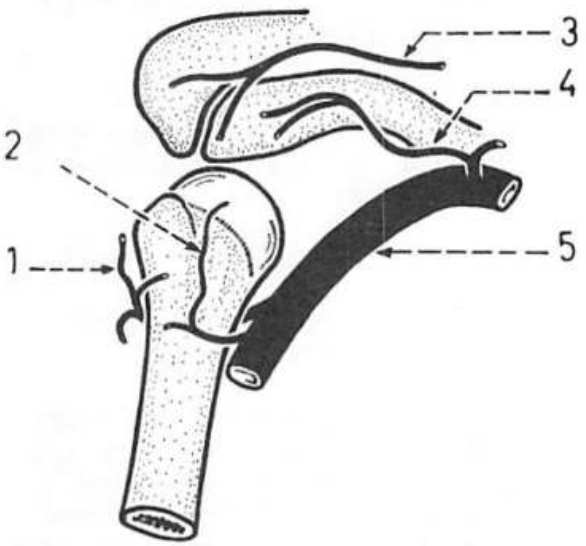
Fig.(356): ARTERIES SUPPLYING THE SHOULDER JOINT



These are the suprascapular artery as well as the anterior and posterior circumflex humeral arteries.

1. articular branch from the suprascapular artery.
2. ascending branch from the anterior circumflex humeral artery.
3. articular branch from the posterior circumflex humeral artery.

Fig.(357): ANASTOMOSIS AROUND THE SHOULDER JOINT



The arteries sharing in the anastomosis around the shoulder joint are: suprascapular artery, acromial branch of thoraco-acromial artery, anterior circumflex humeral and posterior circumflex humeral arteries.

1. posterior circumflex humeral artery (from 3rd part of axillary artery).
2. ascending branch of anterior circumflex humeral artery (from 3rd part of axillary artery).
3. suprascapular artery (from subclavian artery).
4. acromial branch of thoraco-acromial artery (from 2nd part of axillary artery).
5. axillary artery.

ELBOW JOINT

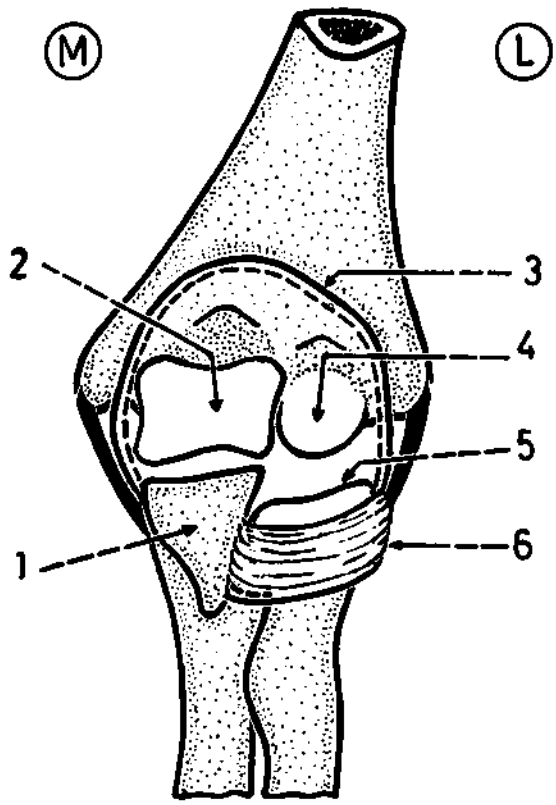


Fig.(358): ARTICULATING BONES OF ELBOW JOINT

The elbow joint is a synovial joint of the hinge variety. It is formed by the trochlea and capitulum of the lower end of the humerus (above), and by the trochlear notch of ulna and upper surface of the head of radius (below).

1. coronoid process of ulna.
2. trochlea (articulates with the trochlear notch of ulna).
3. line of attachment of the capsule of elbow joint with its lining synovial membrane.
4. capitulum (articulates with the upper surface of the head of radius).
5. upper surface of the head of radius.
6. annular ligament (winding round the circumference of the head of radius).

* Note that the cavity of the elbow joint is continuous with that of the superior radio-ulnar joint.

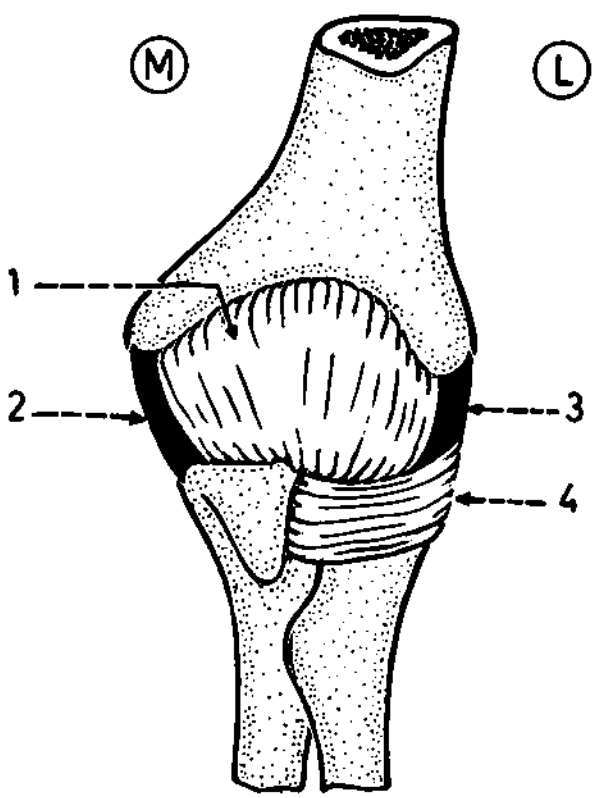


Fig.(359): CAPSULE OF ELBOW JOINT (anterior aspect)

It is attached above to the lower end of the humerus just above the coronoid, radial and olecranon fossae, and below to the margins of the olecranon, coronoid process and the annular ligament.

1. capsule of the joint.
2. ulnar collateral ligament.
3. radial collateral ligament.
4. annular ligament.

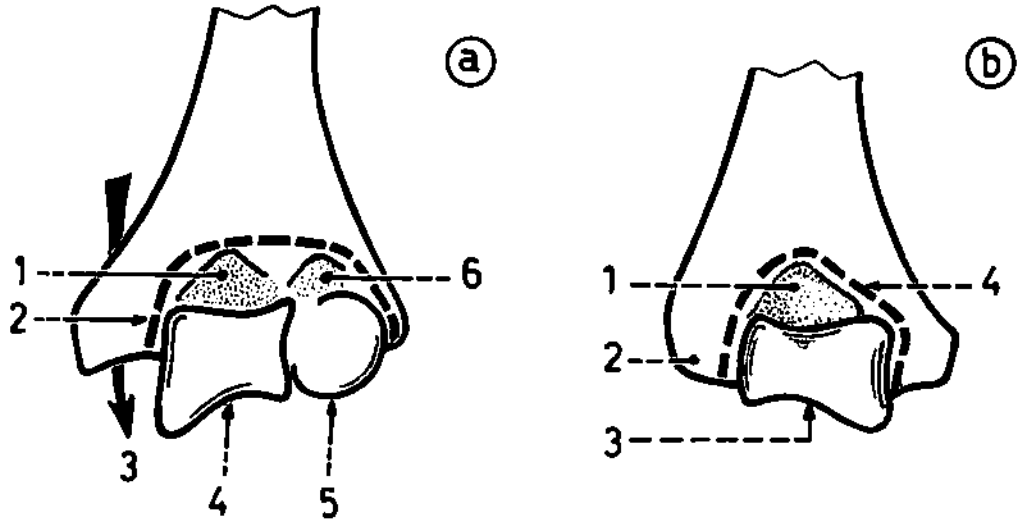


Fig.(360): ATTACHMENT OF THE CAPSULE OF ELBOW JOINT TO THE LOWER END OF HUMERUS

(a) Anterior aspect: the capsule is attached just above the coronoid and radial fossae and to the roots of the medial and lateral epicondyles.

1. coronoid fossa.
2. line of the capsule.
3. arrow representing the ulnar nerve.
4. trochlea.
5. capitulum.
6. radial fossa.

(b) Posterior aspect: the capsule is attached just above the olecranon fossa and to roots of the medial and lateral epicondyles very close to the trochlea.

1. olecranon fossa.
2. back of lateral epicondyle.
3. trochlea.
4. line of the capsule.

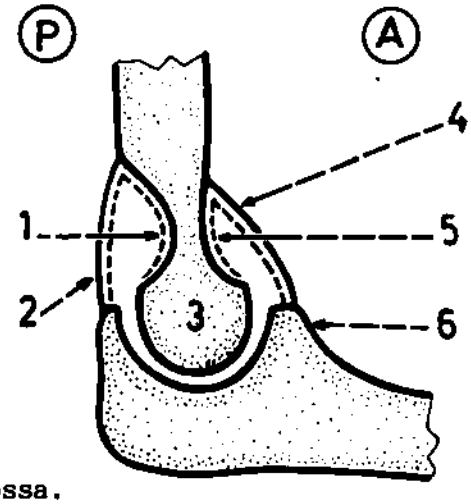


Fig.(361): ATTACHMENT OF THE CAPSULE OF ELBOW JOINT (side view)

1. synovial membrane lining the olecranon fossa.
2. back of the capsule (from the humerus to the margin of the olecranon).
3. trochlea.
4. front of the capsule (from the humerus to the margin of coronoid process).
5. synovial membrane lining the coronoid fossa.
6. coronoid process.

* Note the thin bone separating the coronoid fossa from the olecranon fossa; it may be perforated.

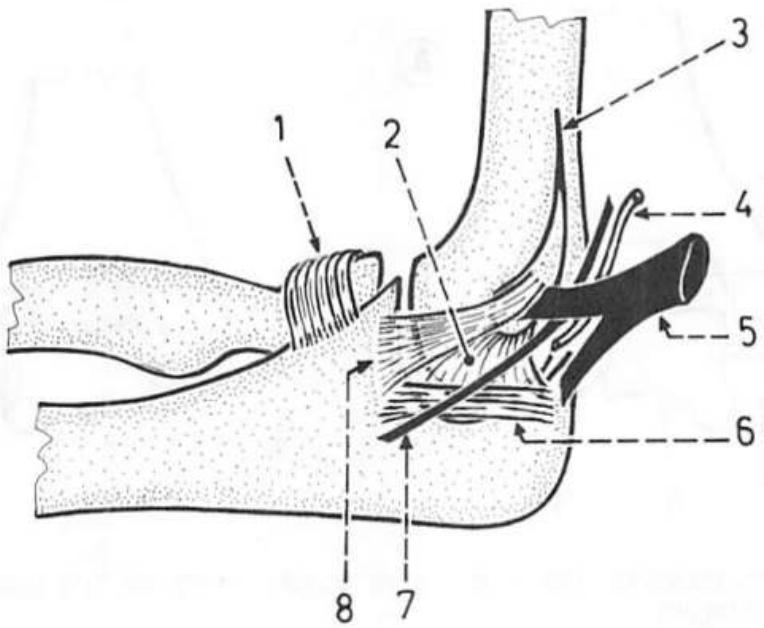


Fig.(362): ULNAR COLLATERAL LIGAMENT OF ELBOW JOINT

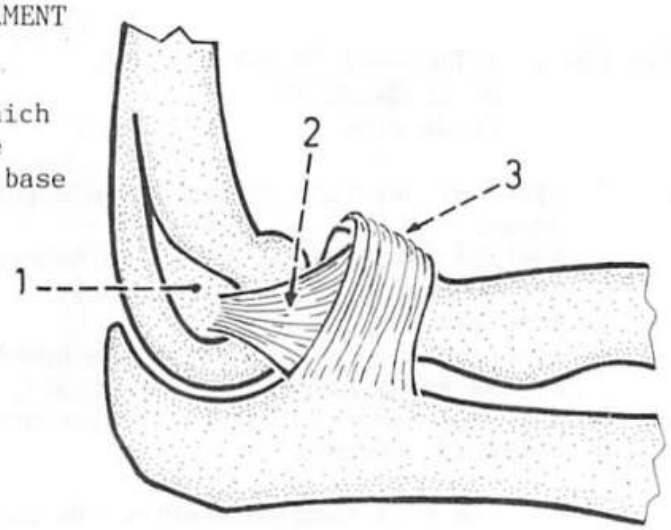
It is a triangular ligament which is attached by its apex to the medial epicondyle and by its base to the medial margins of the olecranon and coronoid processes. Its base is thickened forming an oblique band. The ligament is crossed by the ulnar nerve on its way to the forearm.

1. annular ligament.
2. ulnar collateral ligament.
3. medial supracondylar ridge of humerus.
4. superior ulnar collateral artery.
5. origin of flexor carpi ulnaris (by 2 heads).
6. oblique band (thickened base of the ligament).
7. ulnar nerve.
8. thickened anterior border of the ligament.

Fig.(363): RADIAL COLLATERAL LIGAMENT OF ELBOW JOINT

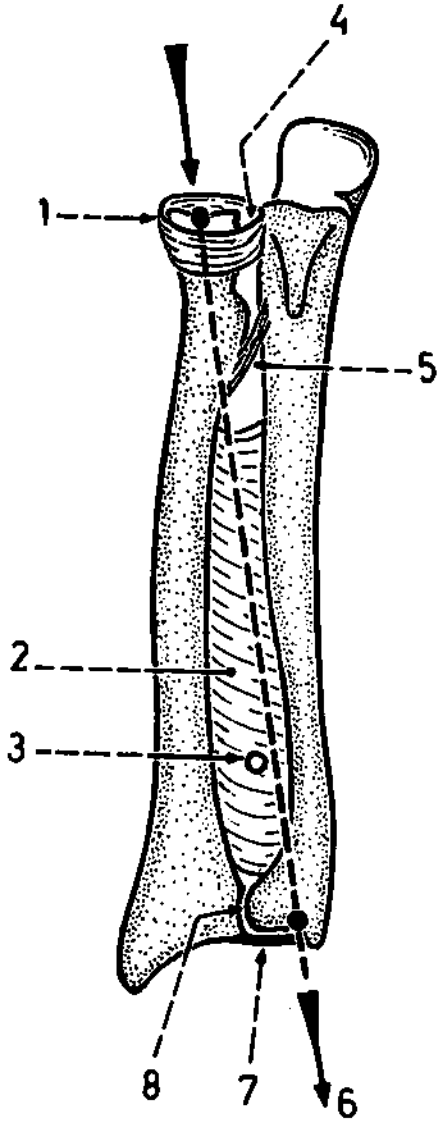
It is a triangular ligament which is attached by its apex to the lateral epicondyle and by its base to the margin of the annular ligament.

1. lateral epicondyle.
2. radial collateral ligament.
3. annular ligament.



RADIO-ULNAR JOINTS

Fig.(364): RADIO-ULNAR JOINTS AND INTEROSSEOUS MEMBRANE



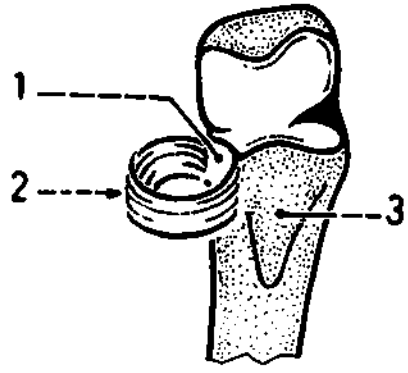
The radius and ulna articulate together at the superior and inferior radio-ulnar joints and are connected together by the oblique cord and the interosseous membrane.

1. annular ligament (encircling the head of radius).
2. interosseous membrane (its fibres run downwards and medially from the radius to the ulna).
3. perforation for the anterior interosseous artery.
4. superior radio-ulnar joint (between the circumference of the head of radius and the radial notch of the ulna).
5. oblique cord (extends upwards and medially from the radius a little below its tuberosity to the lateral side of the tuberosity of ulna).
6. axis of pronation and supination (passes obliquely from the centre of the head of radius to the point of attachment of the articular disc to the root of the styloid process of ulna).
7. articular disc.
8. inferior radio-ulnar joint (between the head of ulna and the ulnar notch of radius).

* The superior and inferior radio-ulnar joints are synovial joints of the pivot type. They allow pronation and supination movements.

* In pronation the radius, together with the hand, moves to lie obliquely in front of the ulna which is fixed at the trochlear notch. In supination, the radius lies lateral to and parallel with the ulna.

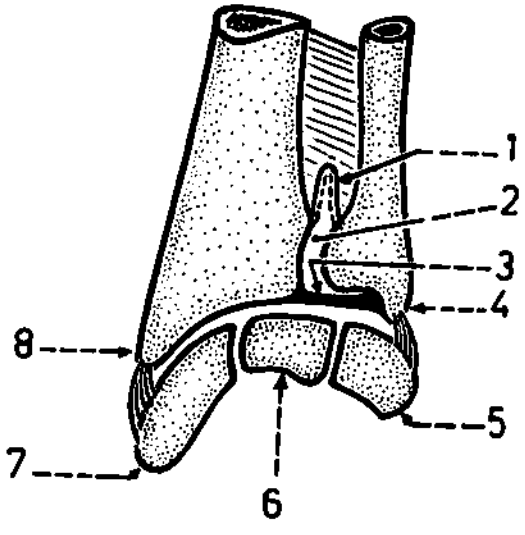
Fig.(365): ANNULAR LIGAMENT



It is attached by its anterior and posterior ends to the anterior and posterior margins of the radial notch of the ulna respectively,thus forming a complete ring in which the head of the radius rotates during pronation and supination.

1. radial notch of ulna.
2. annular ligament.
3. ulnar tuberosity.

Fig.(366): INFERIOR RADIO-ULNAR JOINT



It is formed by the head of the ulna and the ulnar notch of the lower end of radius. The 2 bones are firmly held together by the articular disc. The capsule of the joint projects upwards as a small pouch called recessus sacciformis.

1. recessus sacciformis.
2. cavity of inferior radio-ulnar joint.
3. articular disc (separates the head of ulna and the cavity of the joint from the lunate and triquetral bones).
4. styloid process of ulna.
5. triquetral bone.
6. lunate bone.
7. scaphoid bone.
8. styloid process of radius.

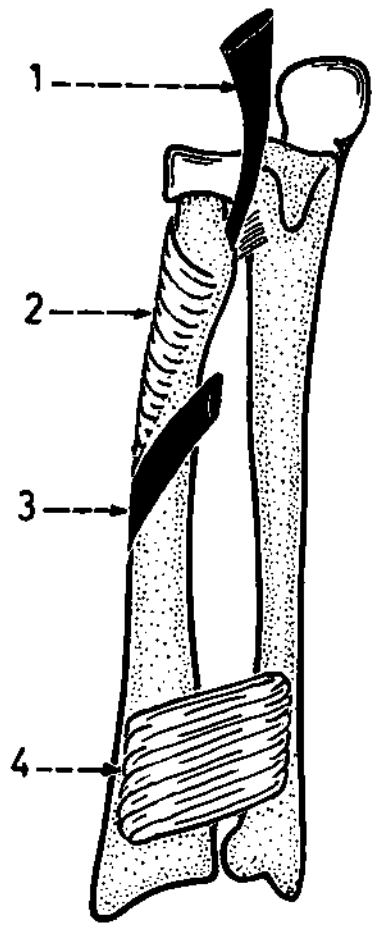


Fig.(367): MUSCLES PRODUCING PRONATION AND SUPINATION

Pronation is produced by pronator teres and pronator quadratus, while supination is produced by biceps brachii and supinator (note that the biceps is a strong supinator).

1. biceps brachii.
2. supinator.
3. pronator teres.
4. pronator quadratus.

* Note that the brachioradialis helps to bring the fully supinated forearm to the mid-prone position, and the fully pronated forearm to the mid-prone position.

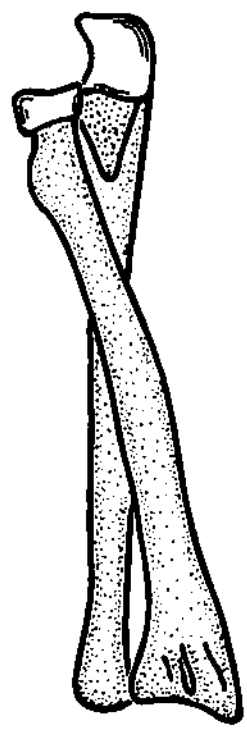


Fig.(368): THE TWO BONES OF FOREARM IN THE POSITION OF PRONATION

In this position, the radius crosses obliquely in front of the ulna (X-shaped arrangement). In the supine position the 2 bones are parallel with each other.

WRIST JOINT

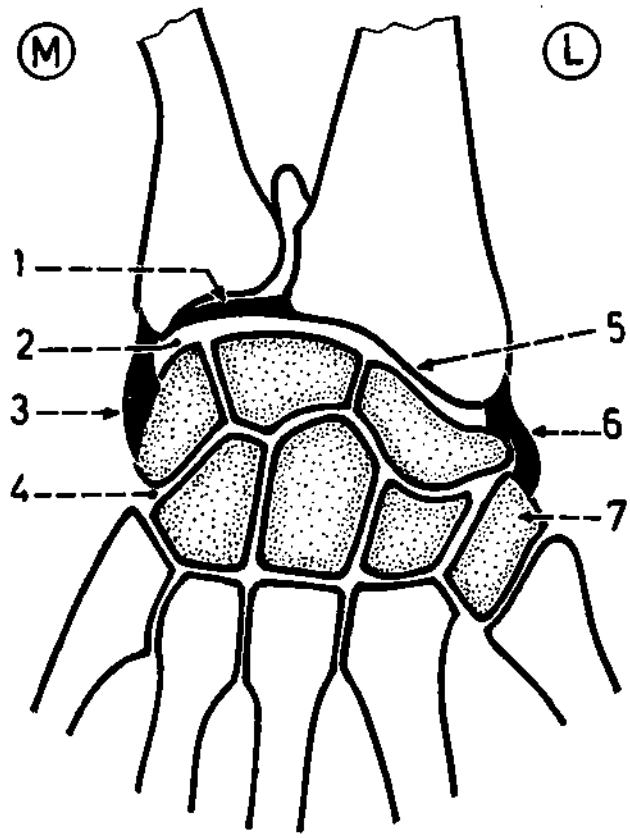


Fig.(369): RADIO-CARPAL AND MID-CARPAL JOINTS

* The radio-carpal (wrist joint) is a synovial joint of the ellipsoid type. It is formed proximally by the distal end of radius and the articular disc, and distally by the scaphoid, lunate and triquetral bones. The articular disc separates the head of the ulna from the cavity of the joint.
* The mid-carpal joint lies between the proximal row and distal row of the carpal bones. In the medial part of the joint the hamate and the head of capitate form a convexity which articulates with the concavity formed by the triquetral, lunate and scaphoid. However, in the lateral part of the joint the trapezium and trapezoid articulate with the lateral part of the scaphoid forming a modified plane joint.

1. articular disc.
2. cavity of radio-carpal joint.
3. ulnar collateral ligament.
4. cavity of mid-carpal joint.
5. lower end of radius.
6. radial collateral ligament.
7. trapezium.

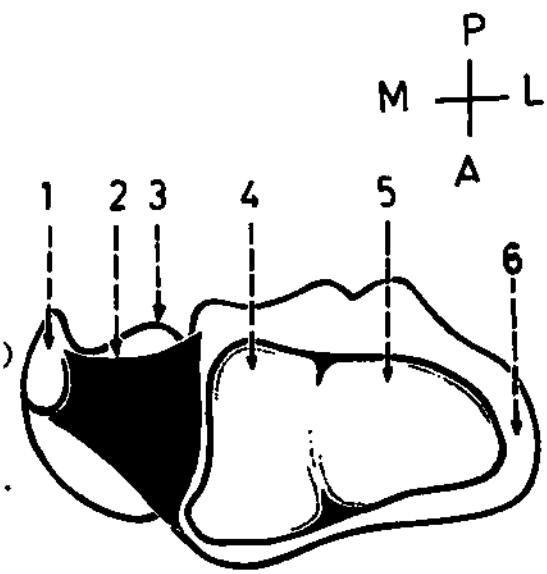
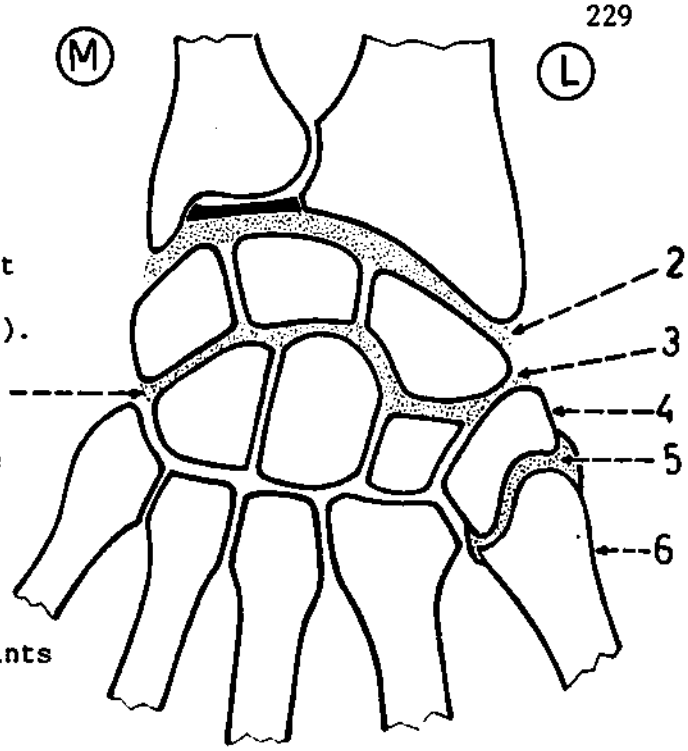


Fig.(370): PROXIMAL ARTICULAR SURFACE OF RADIO-CARPAL JOINT (from below)

1. styloid process of ulna.
2. articular disc.
3. head of ulna (excluded by the disc).
4. area for the lunate.
5. area for the scaphoid.
6. styloid process of radius.

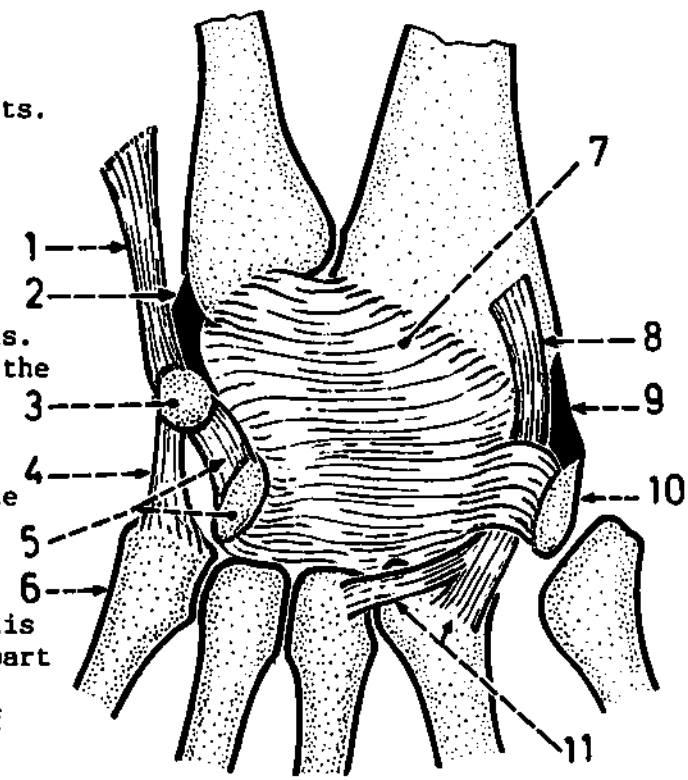
Fig.(371): RADIO-CARPAL, MID-CARPAL AND 1st CARPO-METACARPAL JOINTS



1. medial 2/3 of mid-carpal joint (ellipsoid).
2. radio-carpal joint (ellipsoid).
3. lateral 1/3 of mid-carpal joint (plane).
4. trapezium.
5. carpo-metacarpal joint of the thumb (saddle, i.e. concavo-convex).
6. 1st metacarpal bone (of the thumb).

* Note that each of these 3 joints belongs to a special variety of synovial joints.

Fig.(372): PALMAR SURFACE OF THE CAPSULE OF THE WRIST JOINT



It forms the floor of the carpal tunnel and it covers both the radio-carpal and mid-carpal joints. Laterally, it is closely related to the tendon of flexor carpi radialis and medially to the insertion of the flexor carpi ulnaris.

1. tendon of flexor carpi ulnaris.
2. ulnar collateral ligament of the wrist.
3. pisiform bone.
4. piso-metacarpal ligament.
5. hook of hamate and piso-hamate ligament.
6. base of 5th metacarpal bone.
7. capsule of wrist joint.
8. tendon of flexor carpi radialis passing through the lateral part of flexor retinaculum.
9. radial collateral ligament of the wrist.
10. trapezium.
11. insertion of flexor carpi radialis into the bases of the 2nd and 3rd metacarpals.

Fig.(373): ANASTOMOSIS ON THE FRONT OF WRIST JOINT

The arteries sharing in this anastomosis are: palmar carpal branch of radial, palmar carpal branch of ulnar, a branch from the anterior interosseous artery and an ascending branch from the deep palmar arch.

1. anterior interosseous artery (giving a descending branch in front of the lower part of interosseous membrane).
2. palmar carpal branch of radial artery.
3. radial artery.
4. deep palmar arch.
5. ascending branch from the deep palmar arch.
6. ulnar artery (gives off palmar carpal branch).

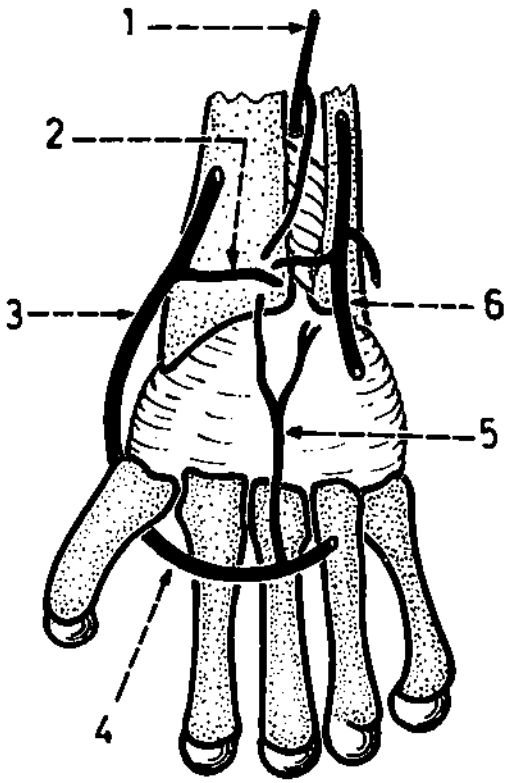
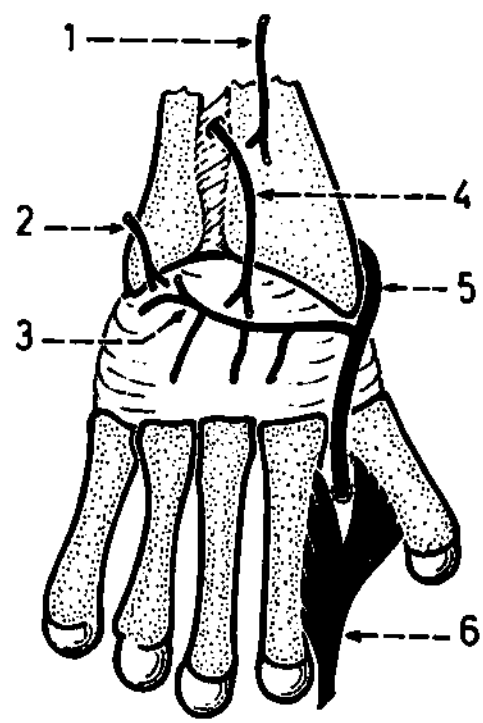


Fig.(374): ANASTOMOSIS ON THE BACK OF WRIST JOINT

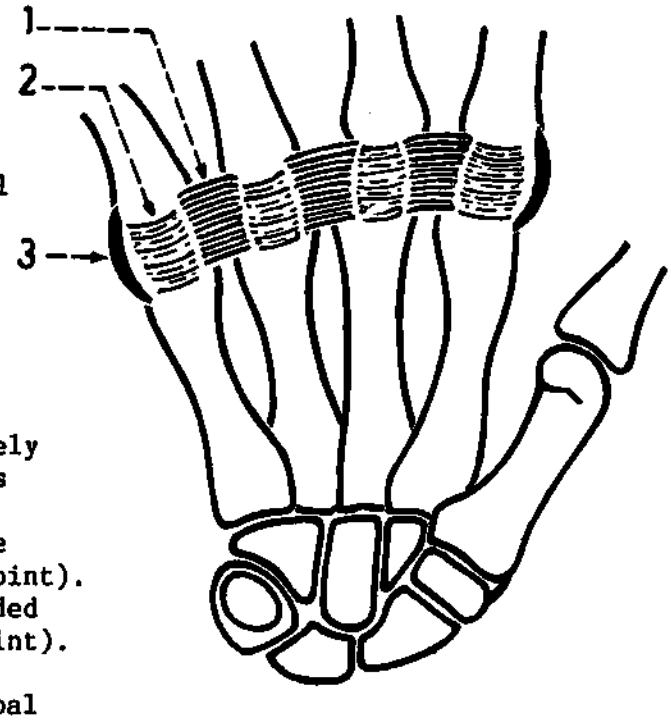
The arteries sharing in this anastomosis are: dorsal carpal branch of radial, dorsal carpal branch of ulnar, anterior interosseous artery and posterior interosseous artery.

1. posterior interosseous artery (joins the termination of the anterior interosseous artery).
2. dorsal carpal branch of ulnar artery.
3. dorsal carpal arch (formed by the union of the dorsal carpal branch of radial with that of the ulnar).
4. termination of the anterior interosseous artery.
5. radial artery.
6. 1st dorsal interosseous muscle.



JOINTS of FINGERS

Fig.(375): METACARPO-PHALANGEAL JOINTS

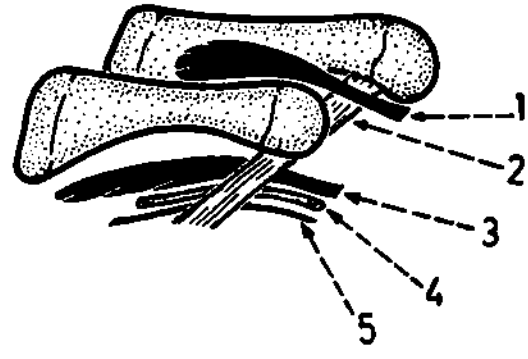


These are ellipsoid joints between the heads of metacarpal bones and the bases of the proximal phalanges. Their ligaments are: palmar, deep transverse metacarpal and collateral ligaments.

1. deep transverse metacarpal ligament (extends transversely between the palmar ligaments of 2 adjacent M/P joints).
2. palmar ligament (lies on the palmar surface of the M/P joint).
3. collateral ligament (a rounded cord on each side of the joint).

* The deep transverse metacarpal ligaments hold the heads of metacarpal bones together.

Fig.(376): RELATIONS OF THE DEEP TRANSVERSE METACARPAL LIGAMENTS

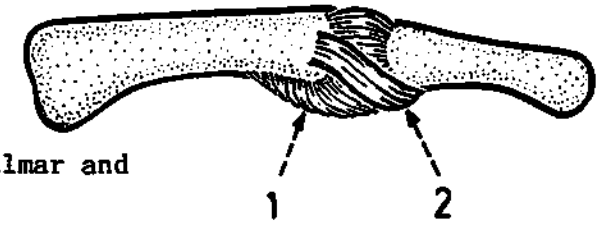


These ligaments are related posteriorly to the tendons of interosseous muscles, and anteriorly to the lumbrical muscles as well as to the palmar digital vessels and nerves.

1. tendon of an interosseous muscle (posterior to the ligament).
2. deep transverse metacarpal ligament.
3. tendon of lumbrical muscle (anterior to the ligament).
4. palmar digital artery.
5. palmar digital nerve.

* Note that there is no deep transverse metacarpal ligament between the thumb and index finger.

Fig.(377): INTERPHALANGEAL JOINT



It is a hinge joint having one palmar and 2 collateral ligaments.

1. palmar ligament (on the front).
2. collateral ligament (cord-like; one on each side).

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