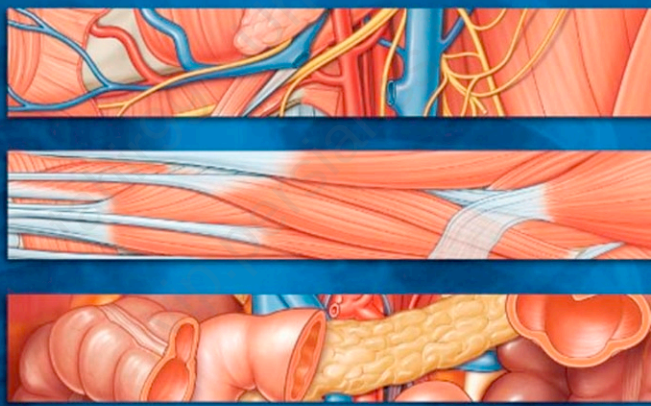
GRAY'S

ANATOMY

FOR STUDENTS **FLASH CARDS**

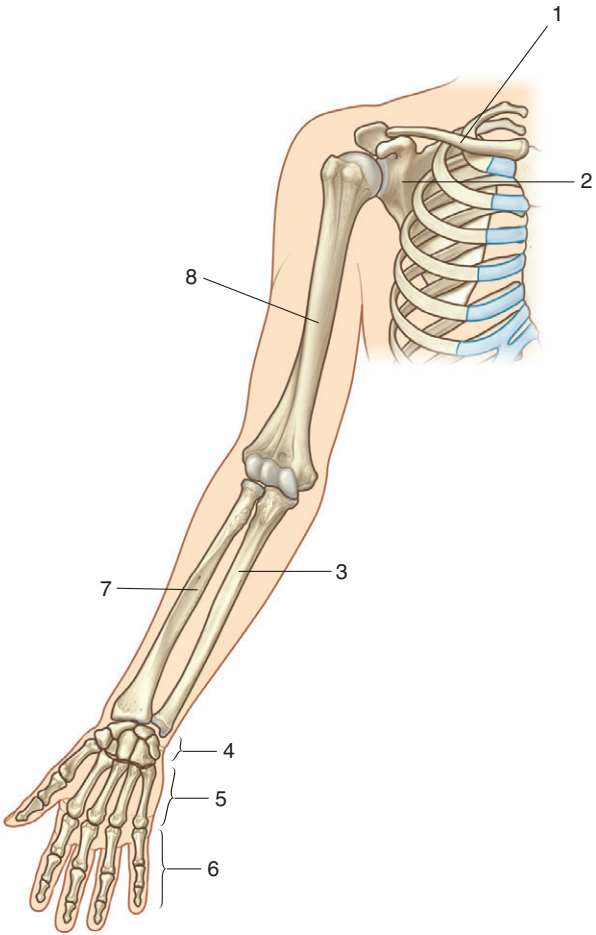
THIRD EDITION



Richard L. Drake
A. Wayne Vogl
Adam W. M. Mitchell

CHURCHILL
LIVINGSTONE
ELSEVIER

Identify the indicated bones.



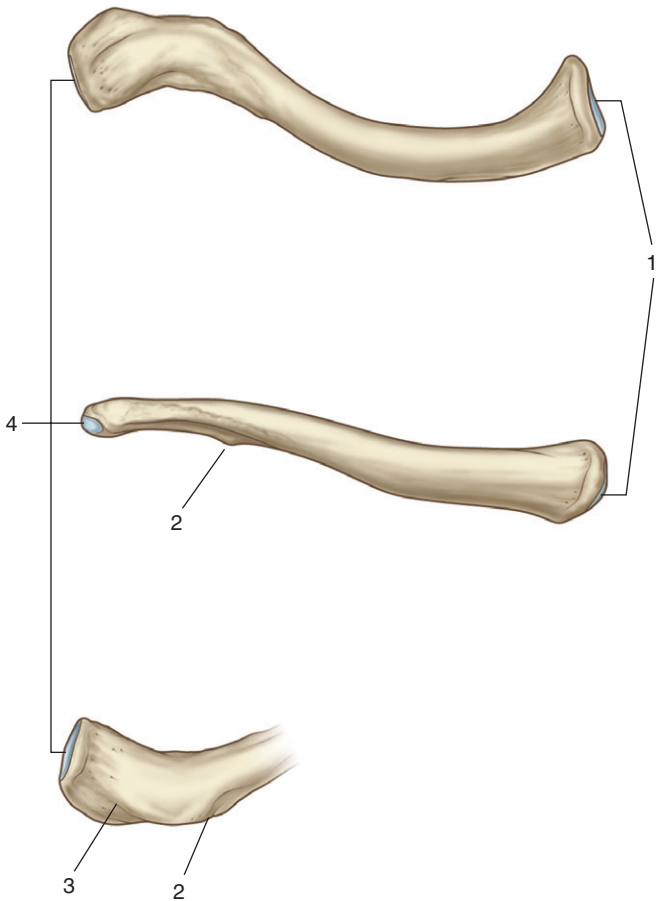
1. Clavicle
2. Scapula
3. Ulna
4. Carpals
5. Metacarpals
6. Phalanges
7. Radius
8. Humerus

IN THE CLINIC:

- **The clavicle is the only bony attachment between the upper limb and trunk. Because it is involved with transferring forces from the upper limb to the trunk, it can easily be fractured.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 690.*

Is this bone from the right or left side of the body? Identify the indicated features.



CLAVICLE

This bone is from the right side of the body.

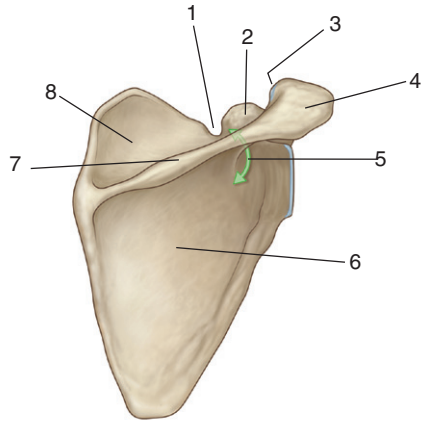
1. Surface for articulation with manubrium and first costal cartilage
2. Conoid tubercle
3. Trapezoid line
4. Surface for articulation with acromion

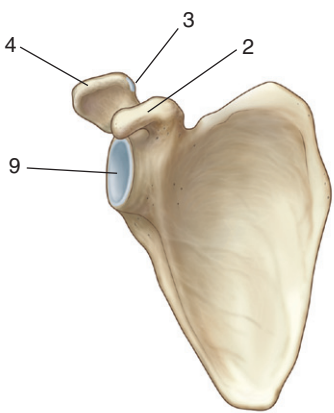
IN THE CLINIC:

- **The clavicle is usually fractured medial to the conoid tubercle because the middle third of the bone is not reinforced with ligaments or muscles.**
- **The anterosuperior surface of the clavicle is palpable along its length.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 702.*

Is this bone from the right or left side of the body? Identify the indicated features.





SCAPULA

This bone is from the right side of the body.

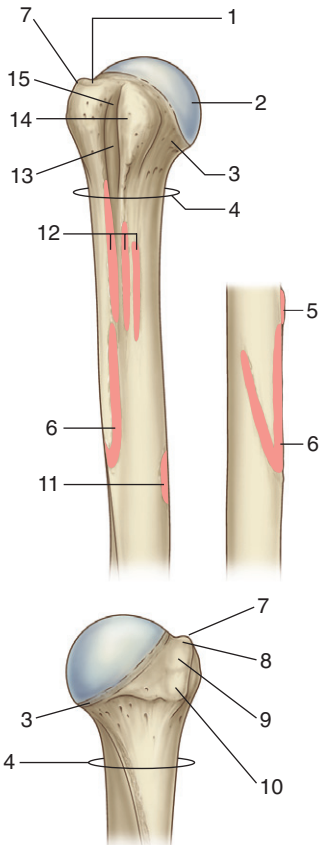
1. Suprascapular notch
2. Coracoid process
3. Articular surface for clavicle
4. Acromion
5. Greater scapular notch/spinoglenoid notch
6. Infraspinous fossa
7. Spine of scapula
8. Supraspinous fossa
9. Glenoid cavity

IN THE CLINIC:

- **The scapula is embedded in muscles and rarely fractured. The spine and acromion are palpable along their lengths. The inferior angle and medial margin also can easily be felt through the skin.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 703.*

Is this bone from the right or left side of the body? Identify the indicated features.



HUMERUS

This bone is from the right side of the body.

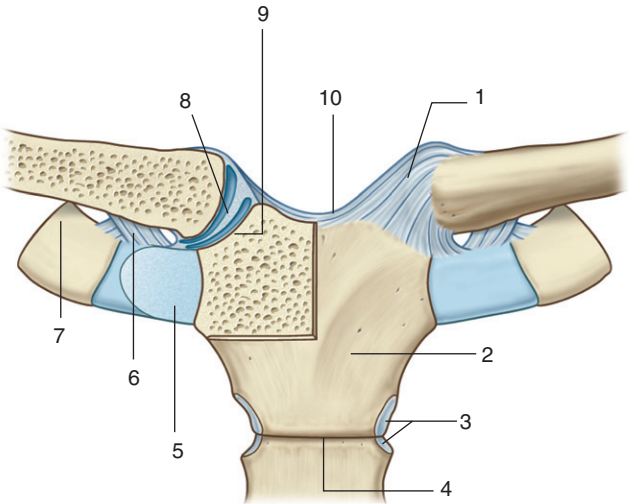
1. Superior facet on greater tubercle (attachment for supraspinatus muscle)
2. Head
3. Anatomical neck
4. Surgical neck
5. Attachment for pectoralis major muscle
6. Deltoid tuberosity (attachment for deltoid muscle)
7. Greater tubercle
8. Superior facet (attachment for supraspinatus muscle)
9. Middle facet (attachment for infraspinatus muscle)
10. Inferior facet (attachment for teres minor muscle)
11. Attachment for coracobrachialis muscle
12. Lateral lip, floor, and medial lip of intertubercular sulcus (attachment for pectoralis major, latissimus dorsi, and teres major muscles respectively)
13. Intertubercular sulcus
14. Lesser tubercle (attachment for subscapularis)
15. Intertubercular sulcus

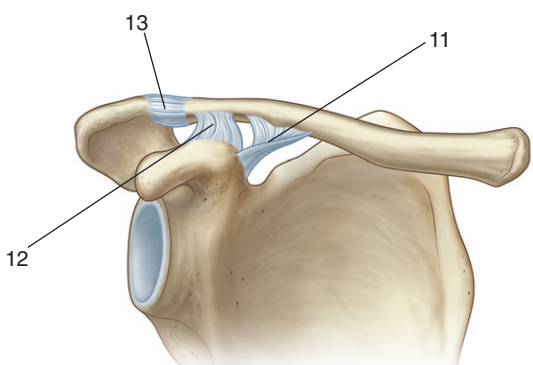
IN THE CLINIC:

- **The three most common sites of humeral fracture are (1) the surgical neck, (2) midshaft, and (3) supracondylar.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 704.*

Identify the indicated ligaments and structures.





STERNOCLAVICULAR AND ACROMIOCLAVICULAR JOINTS

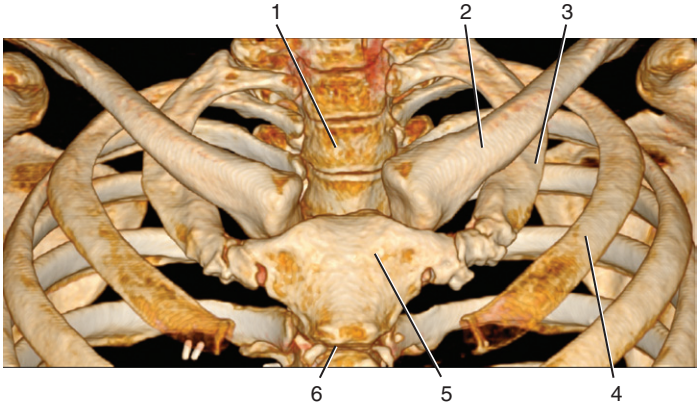
1. Anterior sternoclavicular ligament
2. Manubrium of sternum
3. Attachment site for rib II
4. Sternal angle
5. First costal cartilage
6. Costoclavicular ligament
7. Rib I
8. Articular disc (capsule and ligaments removed anteriorly to expose joint)
9. Clavicular notch
10. Interclavicular ligament
11. Conoid part of coracoclavicular ligament
12. Trapezoid part of coracoclavicular ligament
13. Acromioclavicular ligament

IN THE CLINIC:

- **The coracoclavicular ligament is a much stronger attachment between the scapula and clavicle than is the acromioclavicular joint. In a clavicular fracture medial to the coracoclavicular ligament, the "shoulder" droops.**

Figure from Gray's Anatomy for Students, *3rd edition, pp. 705-706.*

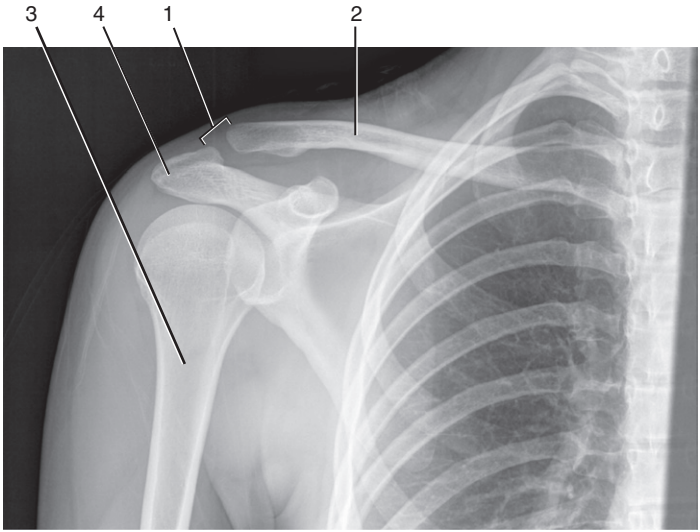
Identify the indicated structures.



1. Vertebral body of TII
2. Left clavicle
3. Rib I
4. Rib II
5. Manubrium of sternum
6. Sternal angle

Figure from Gray's Basic Anatomy, *p. 347.*

Identify the indicated structures.

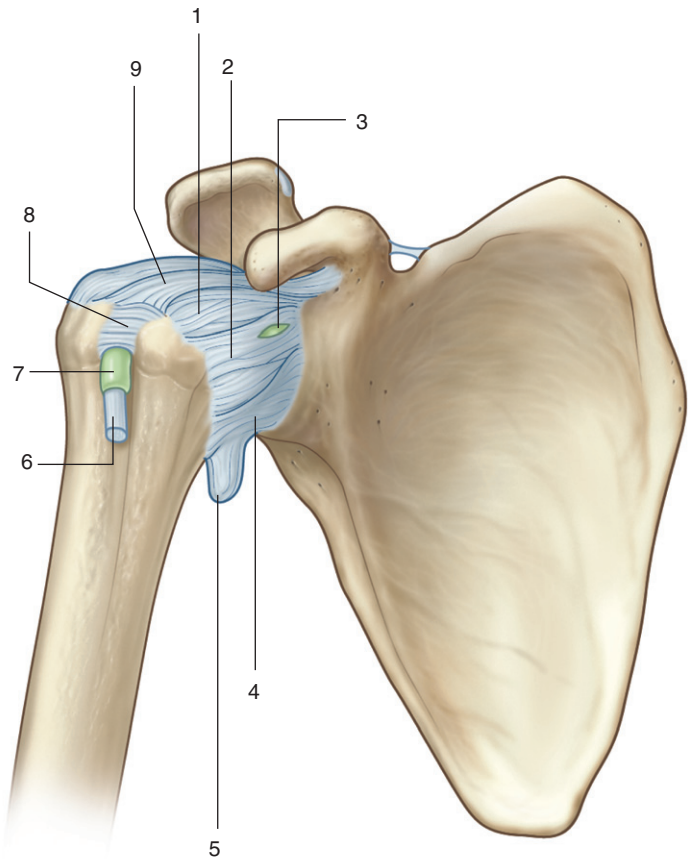


RADIOGRAPH: ACROMIOCLAVICULAR JOINT

1. **Acromioclavicular joint**
2. **Clavicle**
3. **Humerus**
4. **Acromion**

Figure from Gray's Basic Anatomy, *p. 347.*

Identify the indicated ligaments and associated structures.



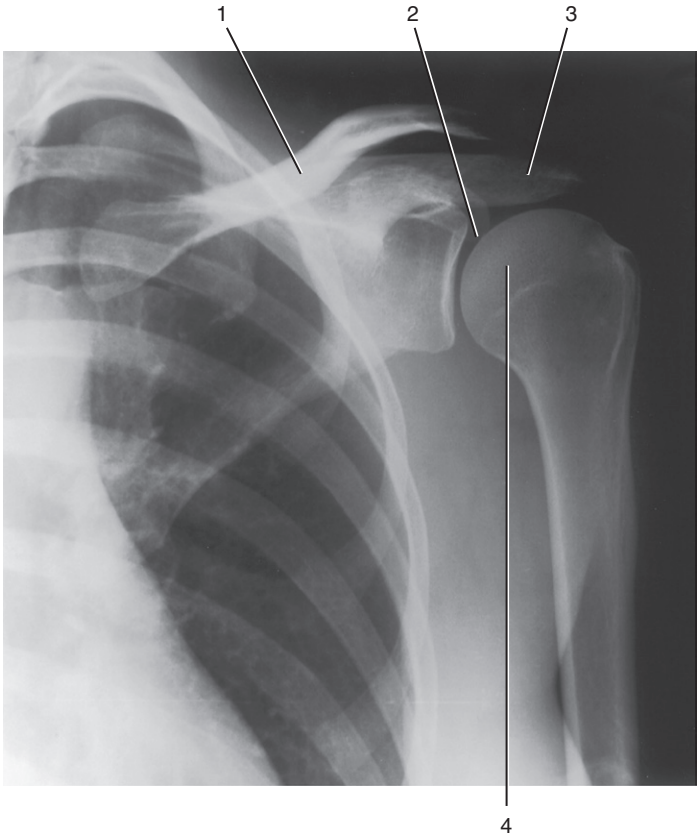
1. Superior glenohumeral ligament
2. Middle glenohumeral ligament
3. Aperture for subtendinous bursa of subscapularis muscle
4. Inferior glenohumeral ligament
5. Redundant capsule
6. Tendon of long head of biceps brachii muscle
7. Synovial sheath
8. Transverse humeral ligament
9. Coracohumeral ligament

IN THE CLINIC:

- **Much of the support for the glenohumeral joint is provided by the rotator cuff muscles and not ligaments. Dislocation of the humerus most often occurs inferiorly because this region has the least amount of support.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 708.*

Identify the indicated structures.

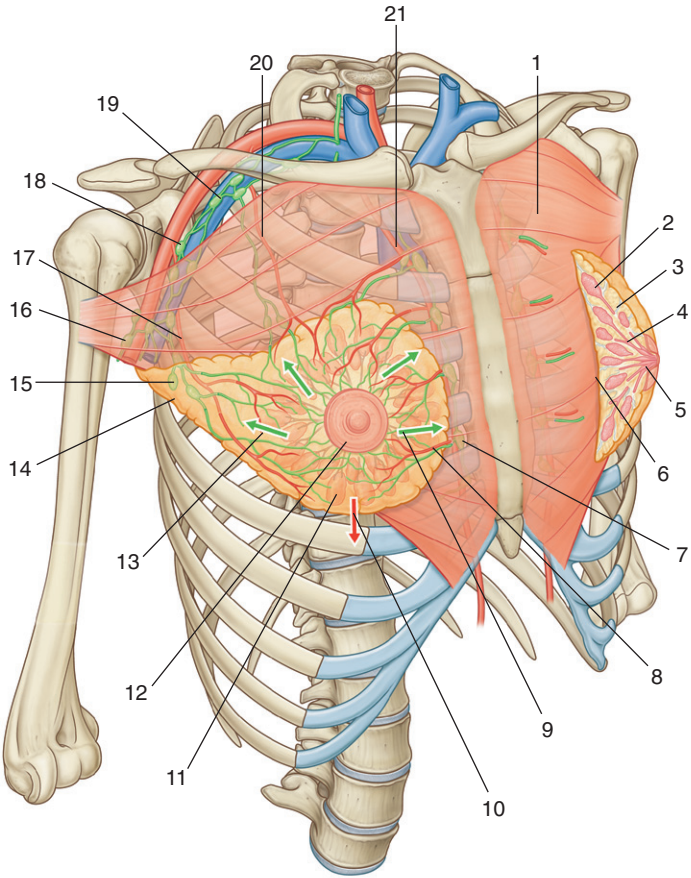


RADIOGRAPH: GLENOHUMERAL JOINT

1. Clavicle
2. Glenoid cavity
3. Acromion
4. Head of humerus

Figure from Gray's Basic Anatomy, *p. 348.*

Identify the indicated structures.



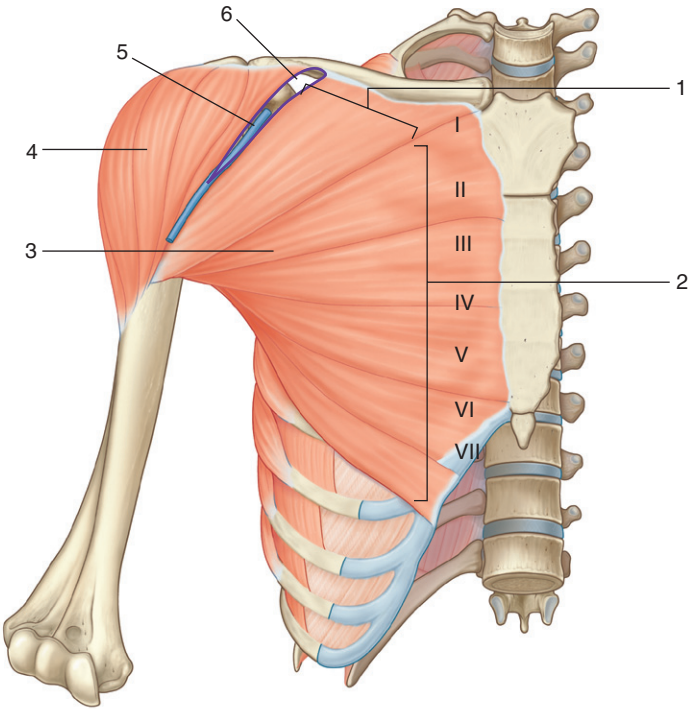
1. Pectoralis major muscle
2. Secretory lobule of mammary gland
3. Suspensory ligaments
4. Lactiferous ducts
5. Lactiferous sinuses
6. Retromammary space
7. Parasternal lymph nodes
8. Mammary branches of internal thoracic artery
9. Lymphatic and venous drainage passes from medial part of the breast parasternally
10. Lymphatic and venous drainage passes from inferior part of the breast into the anterior abdominal wall
11. Secretory lobules of mammary gland
12. Areola
13. Lymphatic and venous drainage passes from lateral and superior part of the breast into axilla
14. Axillary process of mammary gland
15. Pectoral axillary nodes
16. Lateral axillary nodes
17. Lateral thoracic artery
18. Central axillary nodes
19. Apical axillary nodes
20. Pectoral branch of thoraco-acromial artery
21. Internal thoracic artery

IN THE CLINIC:

- **Breast cancer is one of the most common cancers in women. One of the routes of metastatic spread is through lymphatic vessels that drain laterally into lymph nodes in the axilla and medially into nodes associated with the internal thoracic vessels.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 140.*

Identify the indicated muscles and vessel.



PECTORALIS MAJOR

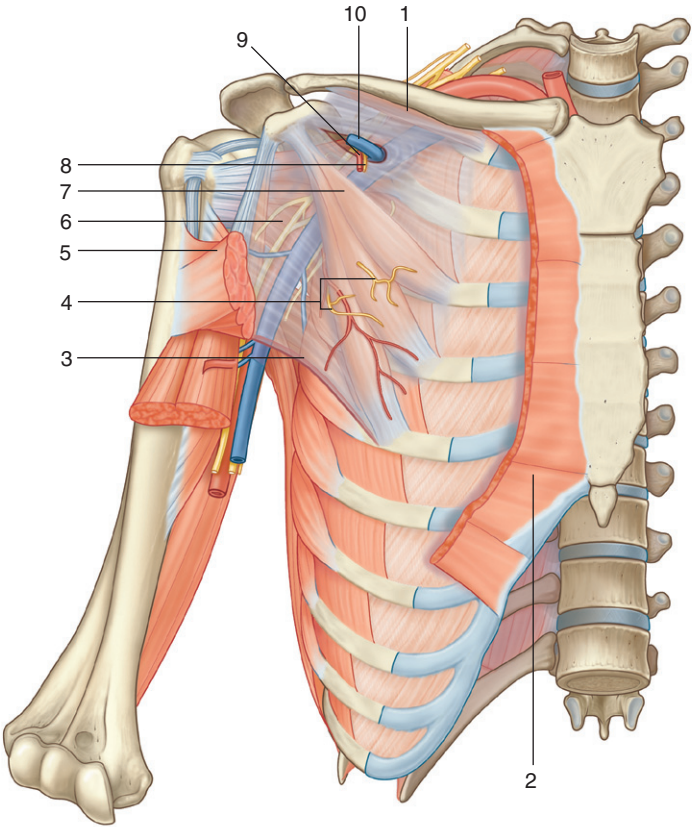
1. Clavicular head of pectoralis major muscle
2. Sternocostal head of pectoralis major muscle
3. Pectoralis major muscle
4. Deltoid muscle
5. Cephalic vein
6. Clavipectoral triangle

IN THE CLINIC:

- **The cephalic vein can be accessed for certain medical procedures in the clavipectoral triangle formed by the middle third of the clavicle, the deltoid muscle, and the pectoralis major muscle.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 724.*

Identify the indicated structures.



PECTORALIS MINOR: NERVES AND VESSELS

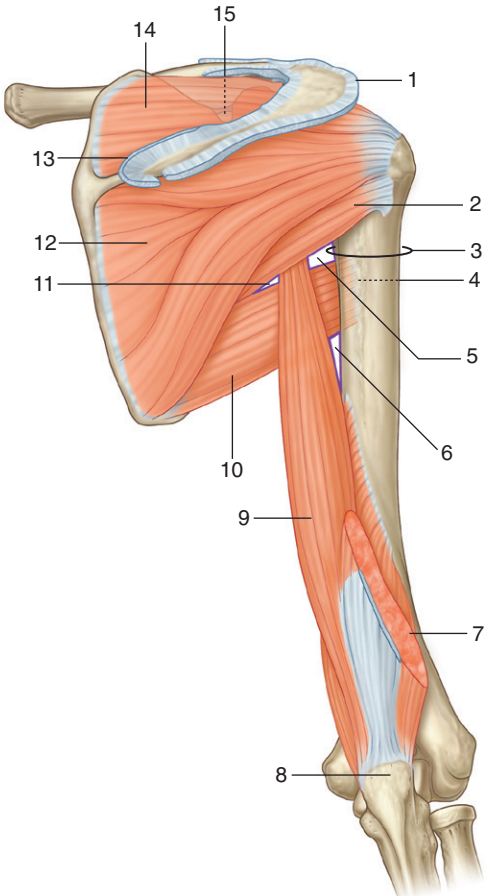
1. Subclavius muscle
2. Pectoralis major muscle
3. Attachment of fascia to floor of axilla
4. Medial pectoral nerves
5. Pectoralis major muscle (cut)
6. Clavipectoral fascia
7. Pectoralis minor muscle
8. Lateral pectoral nerve
9. Pectoral branch of thoraco-acromial artery
10. Cephalic vein

IN THE CLINIC:

- **During surgery, the pectoralis minor muscle is an important landmark. It lies immediately anterior to the cords of the brachial plexus and second part of the axillary artery. The thoraco-acromial artery is related to the upper or medial margin of the muscle, and the lateral thoracic artery is related to the lower or lateral margin.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 725.*

Identify the indicated muscles, spaces, and features.



POSTERIOR SCAPULAR REGION: MUSCLES

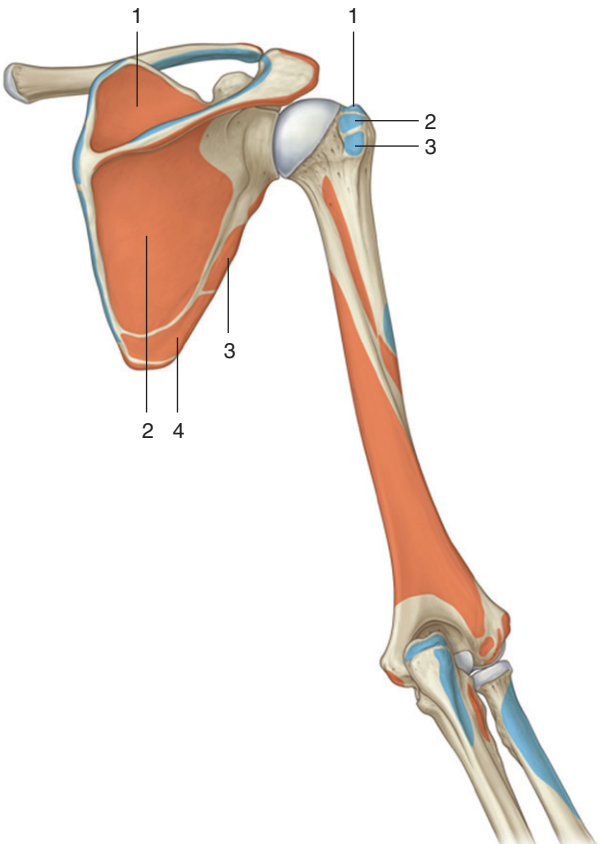
1. Cut edge of deltoid muscle
2. Teres minor muscle
3. Surgical neck of humerus
4. Medial lip of intertubercular sulcus
5. Quadrangular space
6. Triangular interval
7. Cut edge of lateral head of triceps brachii muscle
8. Olecranon
9. Long head of triceps brachii muscle
10. Teres major muscle
11. Triangular space
12. Infraspinatus muscle
13. Cut edge of trapezius muscle
14. Supraspinatus muscle
15. Suprascapular notch (foramen)

IN THE CLINIC:

- **The rotator cuff muscles are the supraspinatus muscle, the infraspinatus muscle, the teres minor muscle, and the subscapularis muscle. All except the subscapularis muscle are located in the posterior scapular region. Loss of function of the supraspinatus muscle leads to the inability to initiate abduction of the arm at the shoulder joint. Testing abduction and medial and lateral rotation of the humerus at the shoulder joint tests motor function mainly of spinal cord levels C5 and C6.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 716.*

Identify the muscles that attach to the areas indicated. What is the major function and innervation of each muscle?

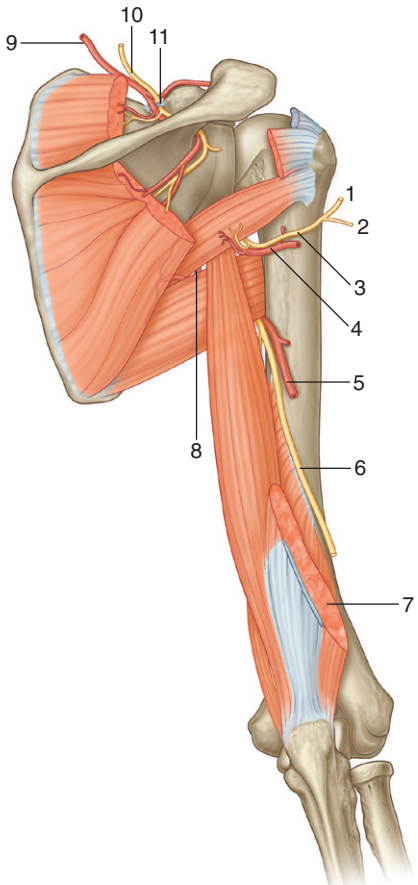


MUSCLES OF THE POSTERIOR SCAPULAR REGION (SPINAL SEGMENTS IN BOLD ARE THE MAJOR SEGMENTS INNERVATING THE MUSCLE)

Muscle	Origin	Insertion	Innervation	Function
1. Supraspinatus	Medial two thirds of the supraspinous fossa of the scapula and the deep fascia that covers the muscle	Most superior facet on the greater tubercle of the humerus	Suprascapular nerve (**C5**,C6)	**Rotator cuff muscle**; initiation of abduction of arm to 15 degrees at glenohumeral joint
2. Infraspinatus	Medial two thirds of the infraspinous fossa of the scapula and the deep fascia that covers the muscle	Middle facet on posterior surface of the greater tubercle of the humerus	Suprascapular nerve (**C5**,C6)	**Rotator cuff muscle**; lateral rotation of arm at the glenohumeral joint
3. Teres minor	Upper two thirds of a flattened strip of bone on the posterior surface of the scapula immediately adjacent to the lateral border of the scapula	Inferior facet on the posterior surface of the greater tubercle of the humerus	Axillary nerve (**C5**,C6)	**Rotator cuff muscle**; lateral rotation of arm at the glenohumeral joint
4. Teres major	Elongate oval area on the posterior surface of the inferior angle of the scapula	Medial lip of the intertubercular sulcus on the anterior surface of the humerus	Inferior subscapular nerve (**C5 to C7**)	Medial rotation and extension of the arm at the glenohumeral joint

Figure from Gray's Atlas of Anatomy, *2nd edition, p. 407.*

Identify the indicated arteries, nerves, and associated structures.



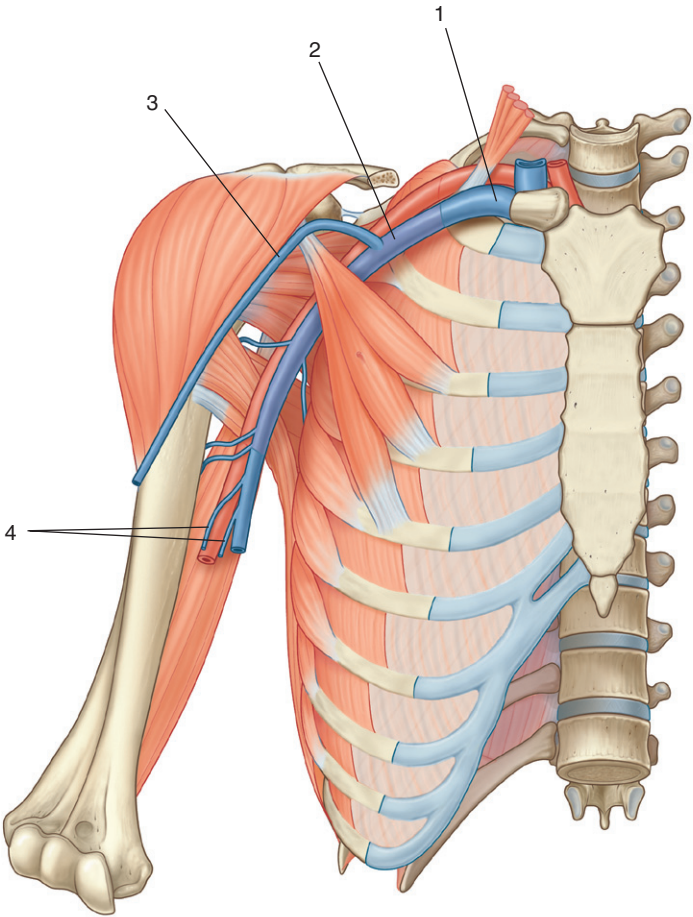
1. To deltoid muscle
2. To skin on lateral part of deltoid
3. Axillary nerve
4. Posterior circumflex humeral artery
5. Profunda brachii artery
6. Radial nerve
7. Cut edge of triceps brachii muscle
8. Circumflex scapular artery
9. Suprascapular artery
10. Suprascapular nerve
11. Superior transverse scapular ligament

IN THE CLINIC:

- **A complete lesion to the suprascapular nerve at the suprascapular foramen results in an inability to initiate abduction of the arm at the shoulder joint and to a reduced ability to externally rotate the arm at the shoulder joint.**
- **Fracture of the surgical neck of the humerus can endanger the axillary nerve and posterior circumflex humeral artery. Complete loss of the axillary nerve results in sensory loss over a small area of skin covering the lateral surface of the deltoid (and loss of function of the deltoid and the teres minor muscles).**
- **Fracture to the shaft of the humerus can endanger the radial nerve. A lesion to the radial nerve in the spiral groove results in sensory loss from skin over the dorsolateral aspect of the hand and also in wristdrop and loss of the ability to supinate when the elbow is extended. Depending on the exact site of the lesion, triceps function can be spared.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 718.*

Identify the indicated veins.



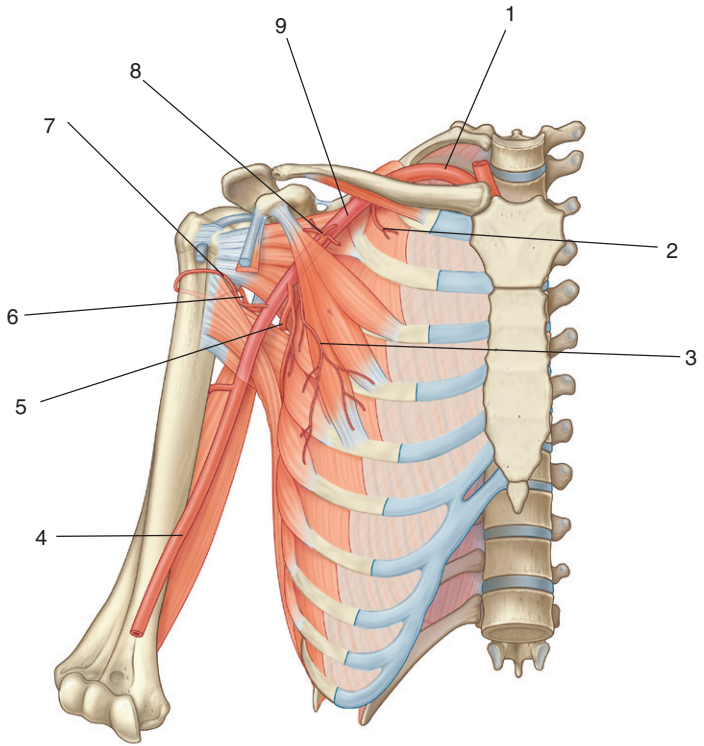
1. Subclavian vein
2. Axillary vein
3. Cephalic vein
4. Paired brachial veins

IN THE CLINIC:

- **The cephalic vein can be used to access the venous system. The vessel is located in the plane between the deltoid muscle and the pectoralis major muscle and passes deep through the clavipectoral triangle to join with the axillary vein.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 736.*

Identify the indicated arteries.



AXILLA: ARTERIES

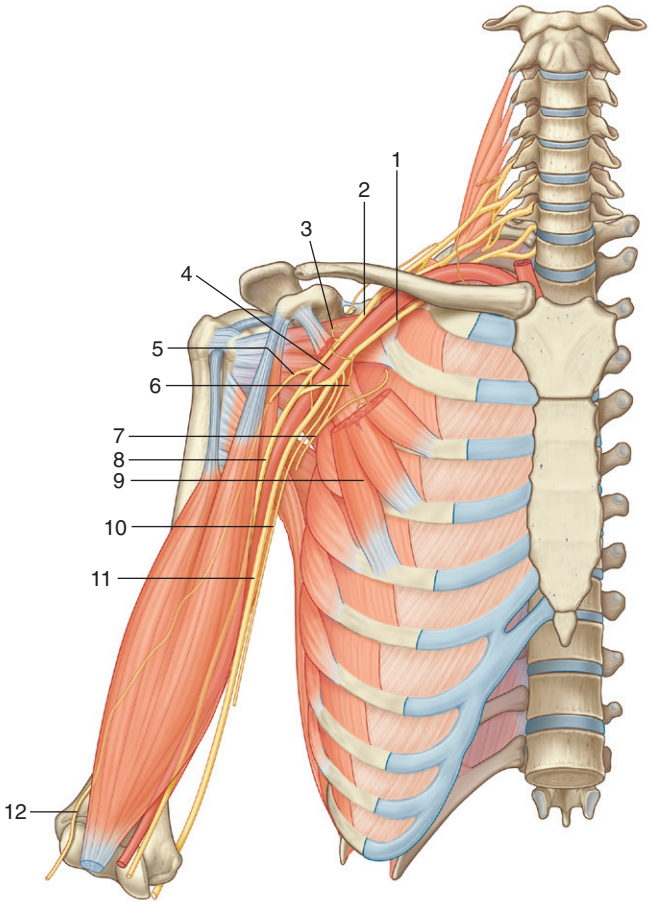
1. Subclavian artery
2. Superior thoracic artery
3. Lateral thoracic artery
4. Brachial artery
5. Subscapular artery
6. Posterior circumflex humeral artery
7. Anterior circumflex humeral artery
8. Thoraco-acromial artery
9. Axillary artery

IN THE CLINIC:

- **Branches from the subclavian, axillary, and brachial artery form an anastomotic network of vessels around the scapula and upper end of the humerus. These connections can serve to maintain blood flow to the upper limb when the axillary artery is interrupted between the origin of the branches that contribute to the anastomoses.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 734.*

Identify the indicated nerves and associated structures.

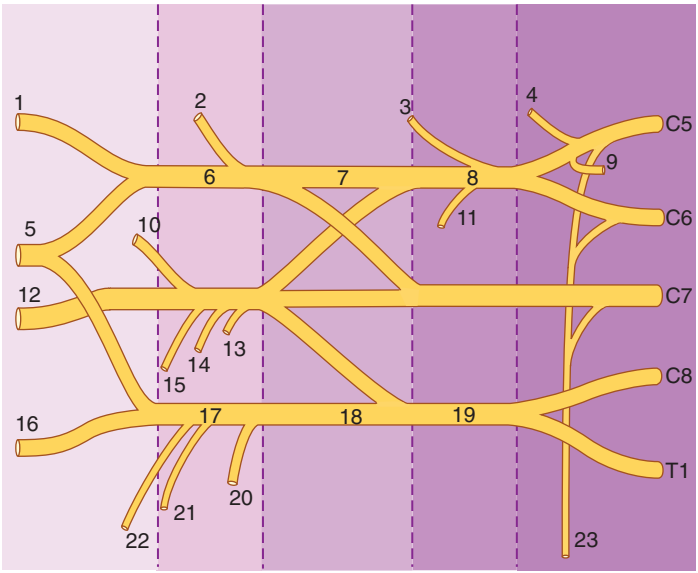


AXILLA: NERVES

1. Medial cord
2. Lateral cord
3. Lateral pectoral nerve
4. Axillary artery
5. Musculocutaneous nerve
6. Medial pectoral nerve
7. Medial cutaneous nerve of arm
8. Median nerve
9. Pectoralis minor muscle
10. Medial cutaneous nerve of forearm
11. Ulnar nerve
12. Lateral cutaneous nerve of forearm

Figure from Gray's Anatomy for Students, *3rd edition, p. 743.*

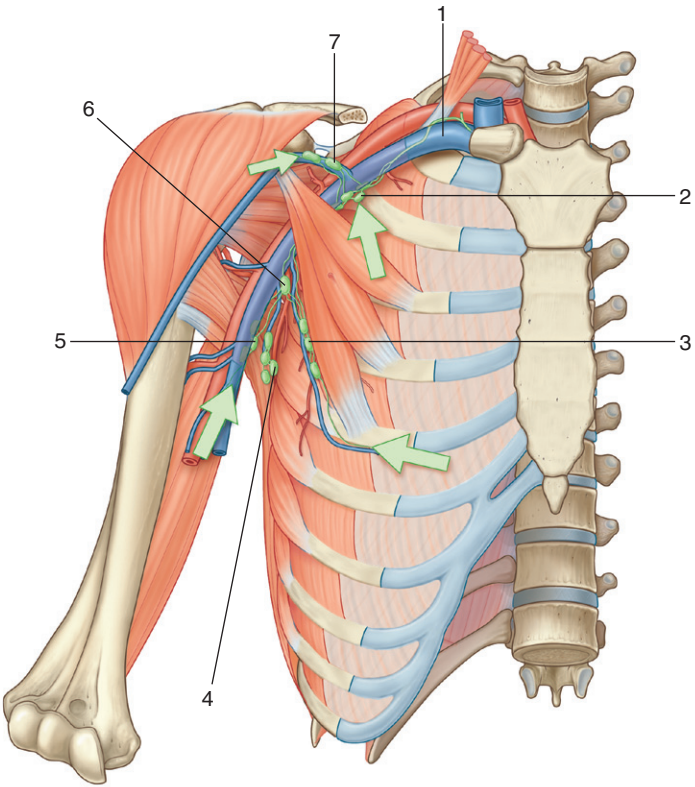
Identify the indicated parts of the brachial plexus.



1. Musculocutaneous nerve
2. Lateral pectoral nerve
3. Suprascapular nerve
4. Dorsal scapular nerve
5. Median nerve
6. Lateral cord
7. Anterior division of superior trunk
8. Superior trunk
9. Contribution to phrenic nerve
10. Axillary nerve
11. Nerve to subclavius
12. Radial nerve
13. Superior subscapular nerve
14. Thoracodorsal nerve
15. Inferior subscapular nerve
16. Ulnar nerve
17. Medial cord
18. Anterior division of inferior trunk
19. Inferior trunk
20. Medial pectoral nerve
21. Medial cutaneous nerve of arm
22. Medial cutaneous nerve of forearm
23. Long thoracic nerve

Figure from Gray's Anatomy for Students, *3rd edition, p. 740.*

Identify the indicated lymph nodes and vessels.



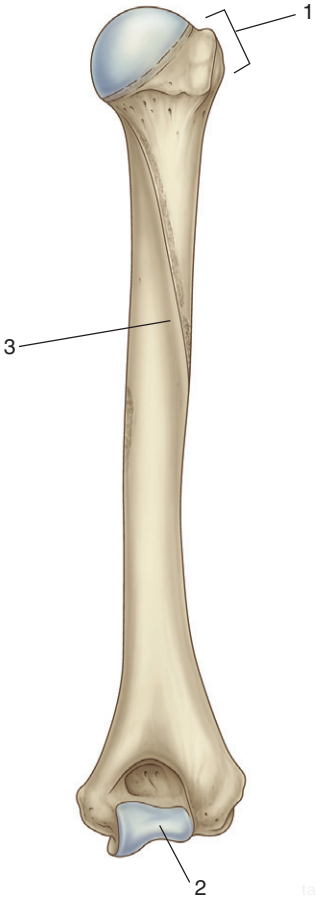
1. Right subclavian vein
2. Apical nodes
3. Pectoral nodes
4. Subscapular nodes
5. Humeral nodes
6. Central nodes
7. Infraclavicular nodes

IN THE CLINIC:

- **Lymph from the upper limb drains into axillary lymph nodes. Therefore, infections and some other pathologies in the upper limb can be detected by assessing changes in the size and texture of nodes in the axilla. Importantly, axillary nodes receive lymph from the lateral and superior parts of the breast. As a consequence, changes in axillary nodes may indicate a pathologic process in the breast.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 748.*

Is this humerus from the right or left side of the body? Identify the indicated features.



HUMERUS: POSTERIOR VIEW

It is from the right side of the body.

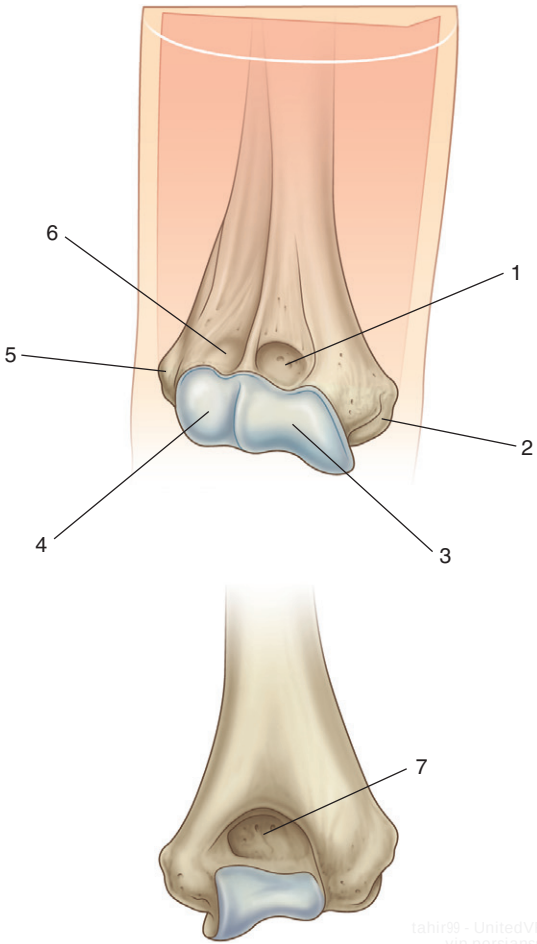
1. Greater tubercle
2. Trochlea
3. Radial groove

IN THE CLINIC:

- **The radial nerve lies in the radial groove on the posterior surface of the humerus. In this position, the nerve can be damaged when the shaft of the humerus is fractured.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 751.*

Identify the indicated features.



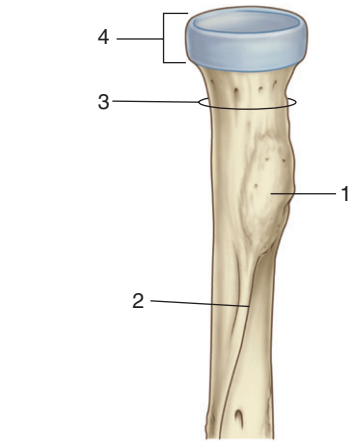
1. Coronoid fossa
2. Medial epicondyle
3. Trochlea
4. Capitulum
5. Lateral epicondyle
6. Radial fossa
7. Olecranon fossa

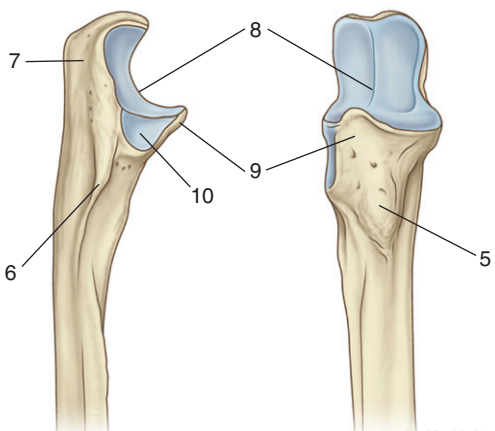
IN THE CLINIC:

- **The lateral and medial epicondyles are palpable landmarks at the elbow. The ulnar nerve passes posterior to the medial epicondyle and can be "rolled" against the bone at this site. Impact of the nerve against the medial epicondyle leads to a "pins and needles" sensation on the medial side of the hand; hence the term *funny bone* often is applied to the medial epicondyle.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 751.*

Are these bones from the right or left side of the body? Identify the bones. Identify the indicated features.





PROXIMAL END OF RADIUS AND ULNA

These bones are from the right side of the body. The first (upper) bone is the radius, and the second (lower) two are views of the ulna.

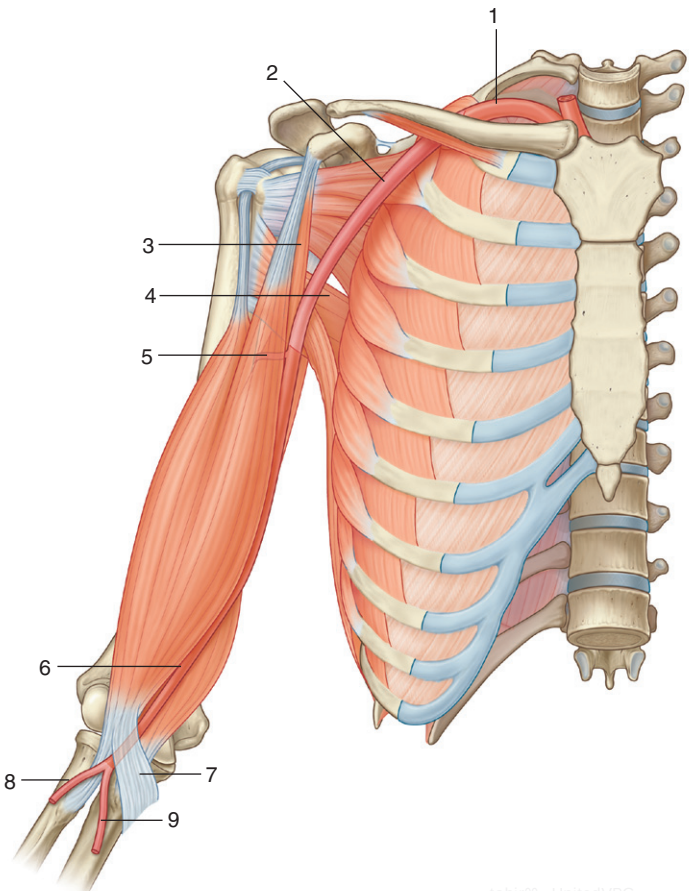
1. Radial tuberosity
2. Oblique line of radius
3. Neck of radius
4. Head of radius
5. Tuberosity of ulna
6. Supinator crest
7. Olecranon
8. Trochlear notch
9. Coronoid process
10. Radial notch

IN THE CLINIC:

- **The neck of the radius is a weak point and is often fractured.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 753.*

Identify the indicated arteries, muscles, and associated structures.



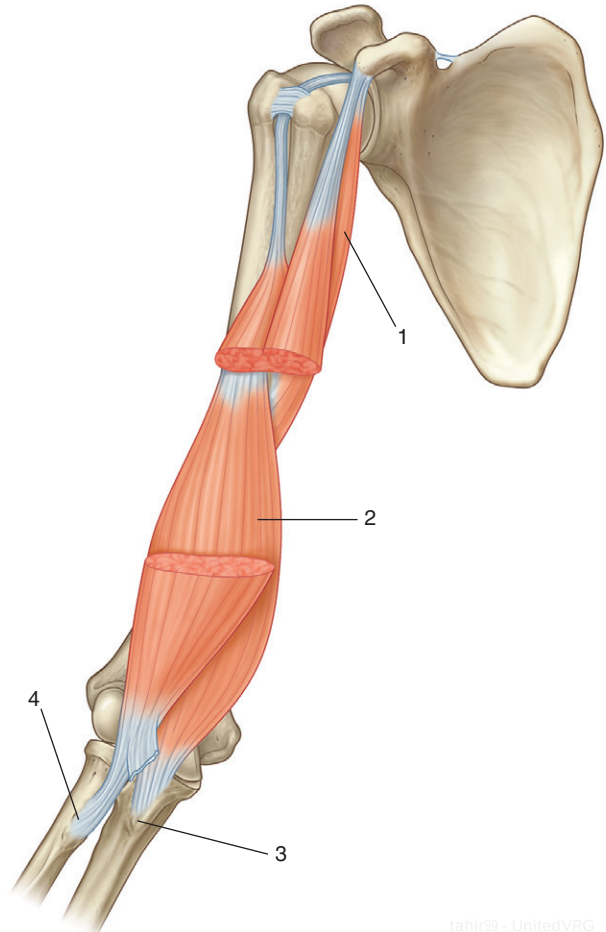
1. Subclavian artery
2. Axillary artery
3. Coracobrachialis muscle
4. Teres major muscle
5. Profunda brachii artery
6. Brachial artery
7. Bicipital aponeurosis
8. Radial artery
9. Ulnar artery

IN THE CLINIC:

- **A "tap" on the tendon of the biceps brachii muscle at the elbow tests predominantly spinal cord segment C6.**
- **The biceps tendon is a palpable landmark at the elbow. Immediately medial to the inferior aspect of the muscle and to the tendon is the brachial artery. A stethoscope is placed over the brachial artery in the cubital fossa when taking a blood pressure reading.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 757.*

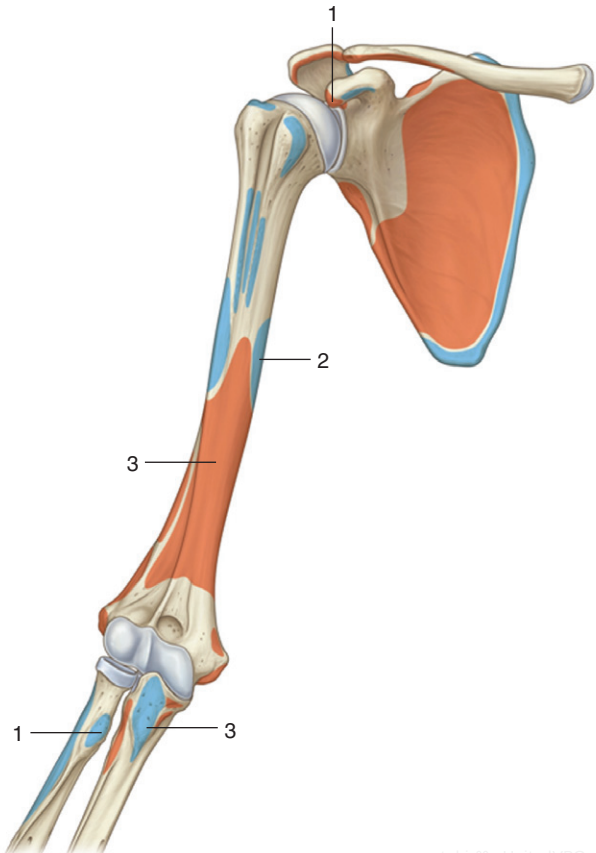
Identify the indicated muscles and related features.



1. Coracobrachialis muscle
2. Brachialis muscle
3. Tuberosity of ulna
4. Radial tuberosity

Figure from Gray's Anatomy for Students, *3rd edition, p. 760.*

Identify the muscles that attach to the areas indicated. What is the major function and innervation of each muscle?

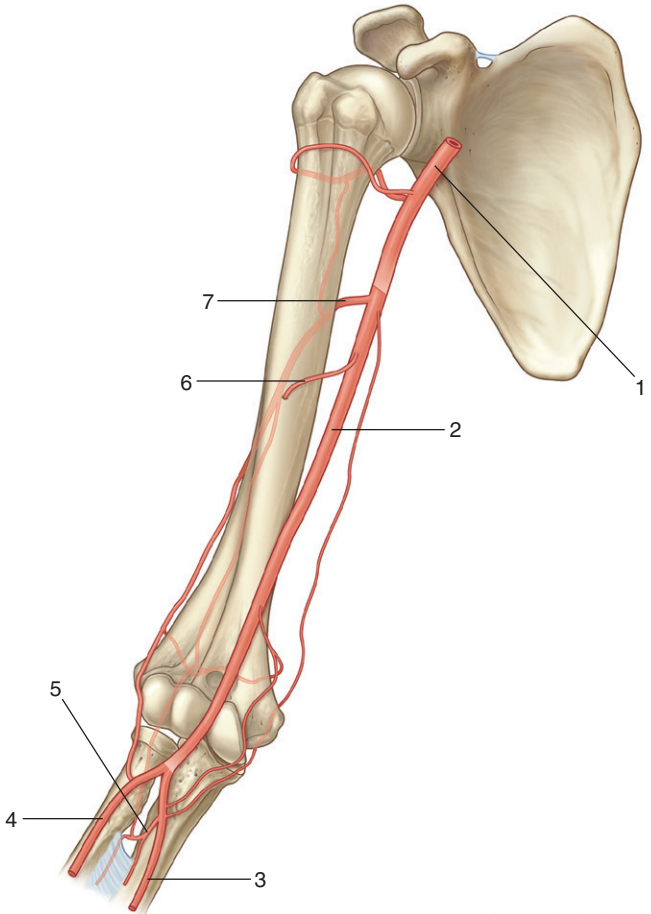


MUSCLES OF THE ANTERIOR COMPARTMENT OF THE ARM (SPINAL SEGMENTS IN BOLD ARE THE MAJOR SEGMENTS INNERVATING THE MUSCLE)

Muscle	Origin	Insertion	Innervation	Function
1. Biceps brachii	Long head—supraglenoid tubercle of scapula; short head—apex of coracoid process	Radial tuberosity	Musculocutaneous nerve (**C5**,**C6**)	Powerful flexor of the forearm at the elbow joint and supinator of the forearm; accessory flexor of the arm at the glenohumeral joint
2. Coracobrachialis	Apex of coracoid process	Linear roughening on mid-shaft of humerus on medial side	Musculocutaneous nerve (**C5**,**C6**,**C7**)	Flexor of the arm at the glenohumeral joint
3. Brachialis	Anterior aspect of humerus (medial and lateral surfaces) and adjacent intermuscular septae	Tuberosity of the ulna	Musculocutaneous nerve (C5,**C6**); (small contribution by the radial nerve [C7] to lateral part of muscle)	Powerful flexor of the forearm at the elbow joint

Figure from Gray's Atlas of Anatomy, *2nd edition, p. 407.*

Identify the indicated arteries.

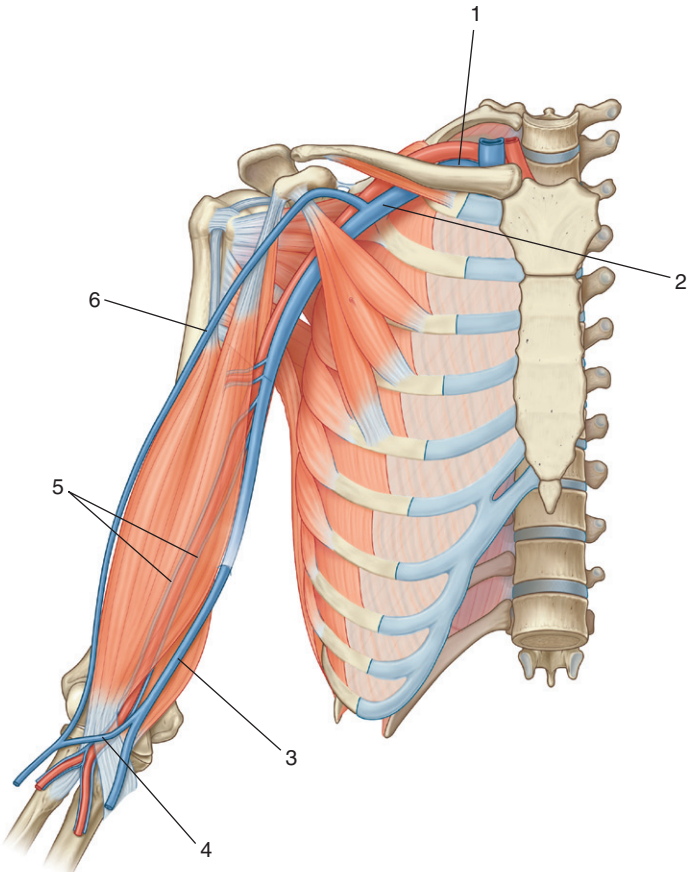


ARM ANTERIOR COMPARTMENT: ARTERIES

1. Axillary artery
2. Brachial artery
3. Ulnar artery
4. Radial artery
5. Common interosseous artery
6. Humeral nutrient artery
7. Profunda brachii artery

Figure from Gray's Anatomy for Students, *3rd edition, p. 758.*

Identify the indicated veins.



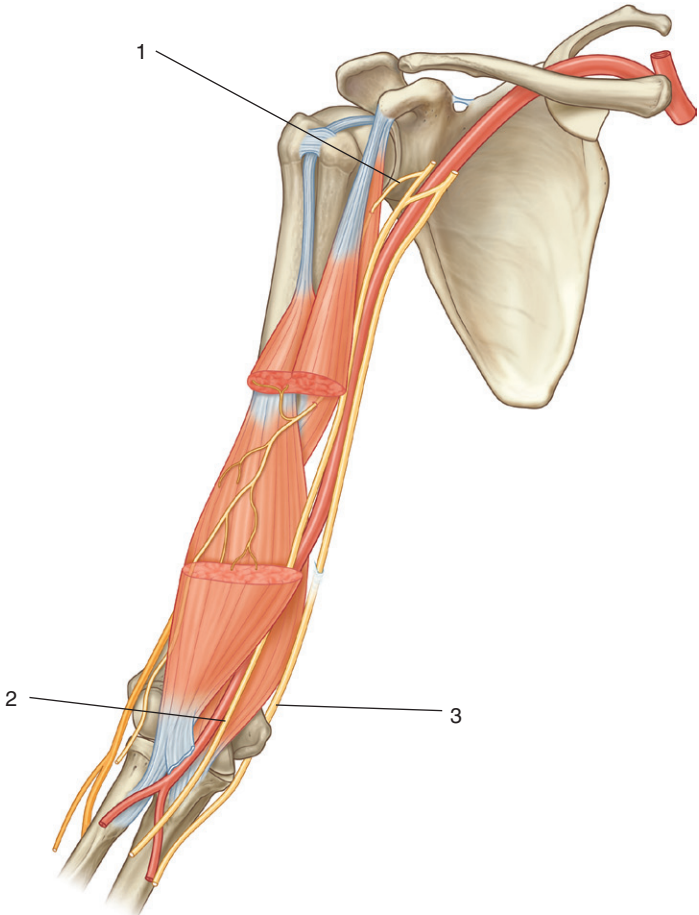
1. Subclavian vein
2. Axillary vein
3. Basilic vein
4. Median cubital vein
5. Paired brachial veins
6. Cephalic vein

IN THE CLINIC:

• The median cubital vein is often used for taking blood samples.

Figure from Gray's Anatomy for Students, *3rd edition, p. 759.*

Identify the indicated nerves.



ARM ANTERIOR COMPARTMENT: NERVES

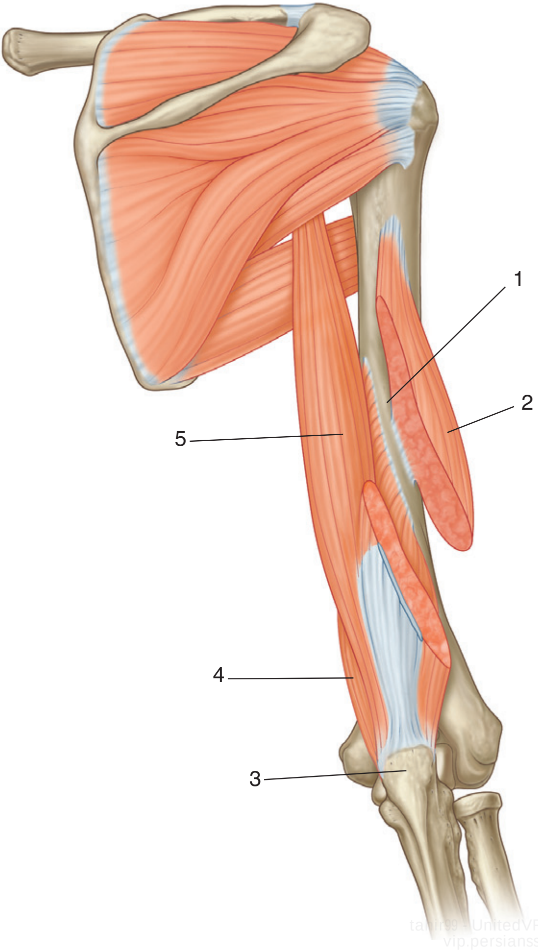
1. Musculocutaneous nerve
2. Median nerve
3. Ulnar nerve

IN THE CLINIC:

- **All muscles in the anterior compartment of the arm are supplied by the musculocutaneous nerve. The nerve ends as the lateral cutaneous nerve of the forearm.**
- **The musculocutaneous nerve originates from the lateral cord of the brachial plexus and contains nerve fibers from spinal cord segments C5, C6, and C7.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 760.*

Identify the indicated muscles and features.



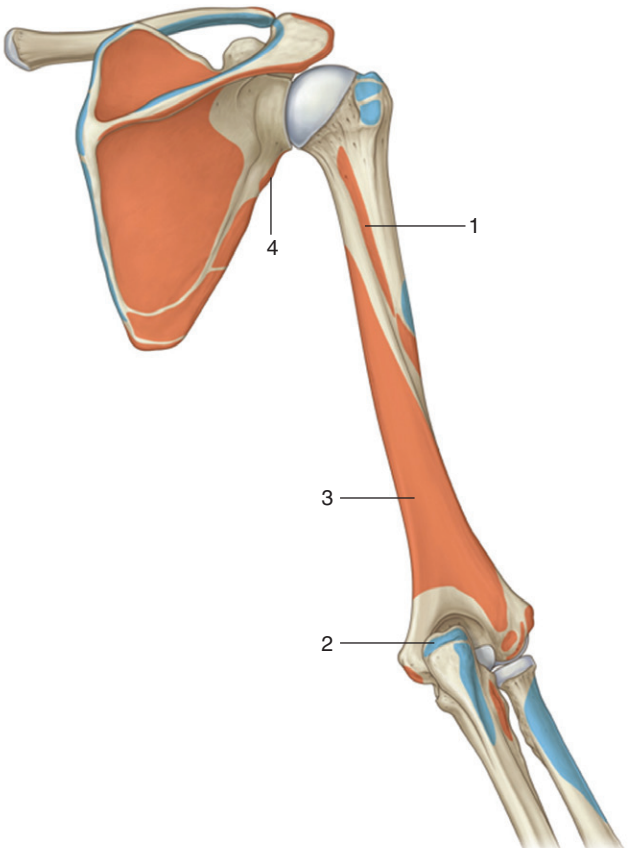
1. Radial groove
2. Lateral head of triceps brachii muscle
3. Olecranon
4. Medial head of triceps brachii muscle
5. Long head of triceps brachii muscle

IN THE CLINIC:

- **A "tap" on the tendon of the triceps brachii muscle tests mainly spinal cord segment C7.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 755.*

Identify the muscles that attach to the areas indicated. What is the major function and innervation of each muscle?

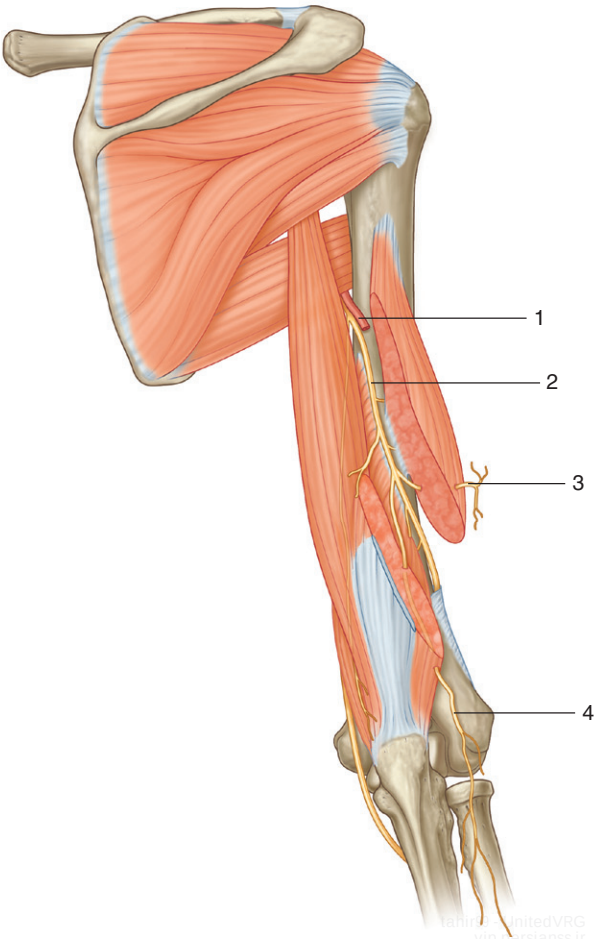


MUSCLE OF THE POSTERIOR COMPARTMENT OF THE ARM (SPINAL SEGMENTS INDICATED IN BOLD ARE THE MAJOR SEGMENTS INNERVATING THE MUSCLE)

Muscle	Origin	Insertion	Innervation	Function
2. Triceps brachii	1. Lateral head: posterior surface of humerus 3. Medial head: posterior surface of humerus 4. Long head: infraglenoid tubercle of scapula	Olecranon	Radial nerve (C6,**C7**,C8)	Extension of the forearm at the elbow joint. Long head can also extend and adduct the arm at the shoulder joint

Figure from Gray's Atlas of Anatomy. *2nd edition, p. 407.*

Identify the indicated nerves and arteries.



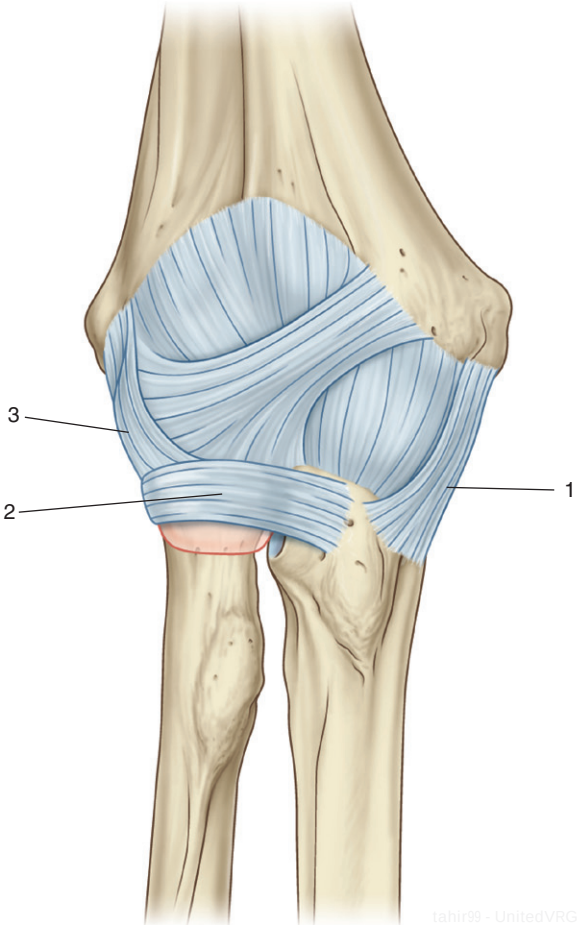
1. Profunda brachii artery
2. Radial nerve
3. Inferior lateral cutaneous nerve of arm
4. Posterior cutaneous nerve of forearm

IN THE CLINIC:

- **The radial nerve and profunda brachii artery lie in the radial groove on the posterior surface of the humerus. Fractures to the shaft of the humerus can damage the radial nerve and the associated artery. A lesion to the radial nerve in the radial groove leads to wristdrop and loss of sensation on the dorsolateral surface of the hand.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 762*

Identify the indicated ligaments.



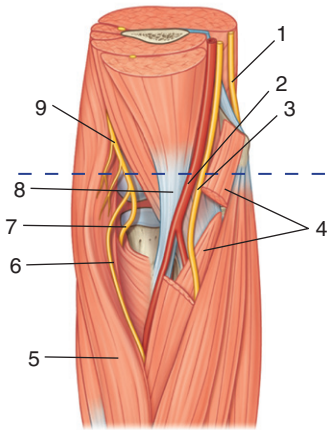
1. Ulnar collateral ligament
2. Annular ligament
3. Radial collateral ligament

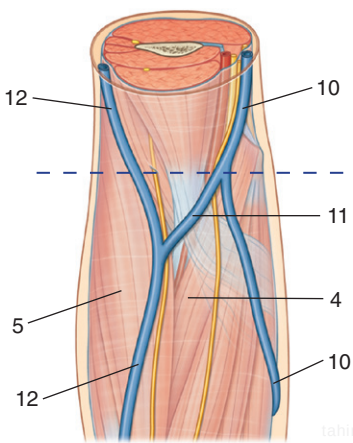
IN THE CLINIC:

- **In children, a sharp "pull" on the forearm can dislocate the head of the radius from the annular ligament.**
- **The neck of the radius is a common site of fracture. Damage to the associated joint capsule and repair of the fracture can lead to a "tightening" of the capsule and a reduced range of movement of the elbow joint after recovery.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 765*

Identify the indicated structures.





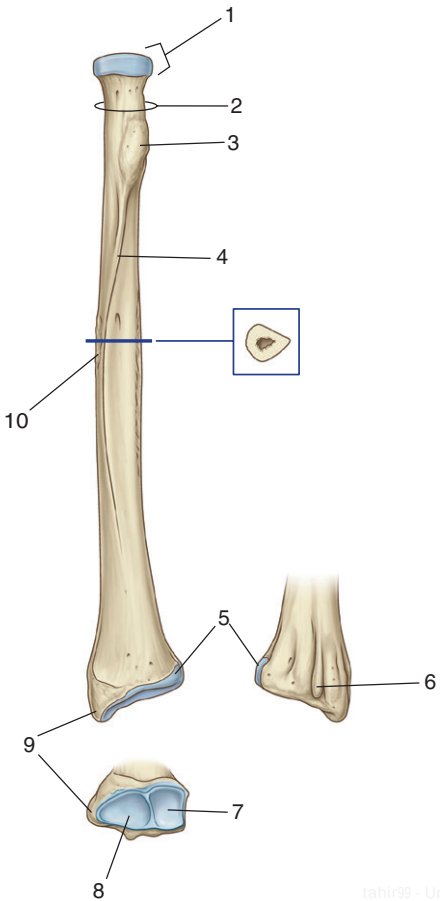
1. Ulnar nerve
2. Brachial artery
3. Median nerve
4. Pronator teres muscle
5. Brachioradialis muscle
6. Superficial branch of radial nerve
7. Deep branch of radial nerve
8. Tendon of biceps brachii muscle
9. Radial nerve
10. Basilic vein
11. Median cubital vein
12. Cephalic vein

IN THE CLINIC:

- **The pulse of the brachial artery can be felt immediately medial to the tendon of biceps brachii muscle in the cubital fossa. This also is where a stethoscope is placed when taking a blood pressure measurement.**
- **Blood is often extracted from the median cubital vein. The vein is separated from the brachial artery and median nerve by the bicipital aponeurosis.**
- **The ulnar nerve is accessible to trauma as it passes posterior to the medial epicondyle.**
- **The radial nerve is covered by the medial edge of the brachioradialis muscle that forms the lateral boundary of the cubital fossa.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 769.*

Is this radius from the right or left side of the body? Identify the indicated features.



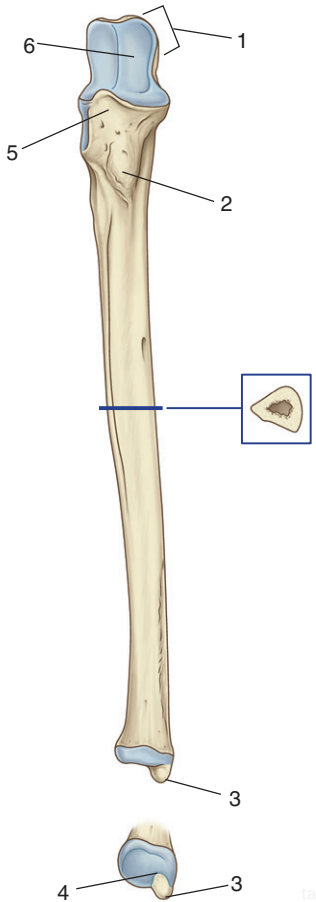
RADIUS

This bone is from the right side of the body.

1. Radial head
2. Radial neck
3. Radial tuberosity
4. Oblique line
5. Ulnar notch
6. Dorsal tubercle
7. Facet for articulation with lunate bone
8. Facet for articulation with scaphoid bone
9. Radial styloid process
10. Roughening for attachment of pronator teres

Figure from Gray's Anatomy for Students, *3rd edition, p. 772.*

Is this ulna from the right or the left side of the body? Identify the indicated features.



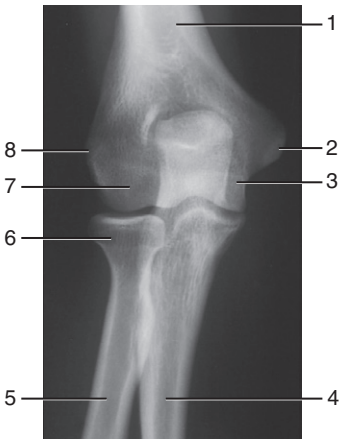
ULNA

This bone is from the right side of the body.

1. **Olecranon**
2. **Tuberosity of ulna**
3. **Ulnar styloid process**
4. **Attachment of articular disc**
5. **Coronoid process**
6. **Trochlear notch**

Figure from Gray's Anatomy for Students, *3rd edition, p. 773.*

Identify the indicated structures.



A

B

1. Humerus
2. Medial epicondyle
3. Trochlea
4. Ulna
5. Radius
6. Head of radius
7. Capitulum
8. Lateral epicondyle
9. Radial tuberosity
10. Captulum
11. Humerus
12. Olecranon
13. Trochlear notch
14. Coronoid process

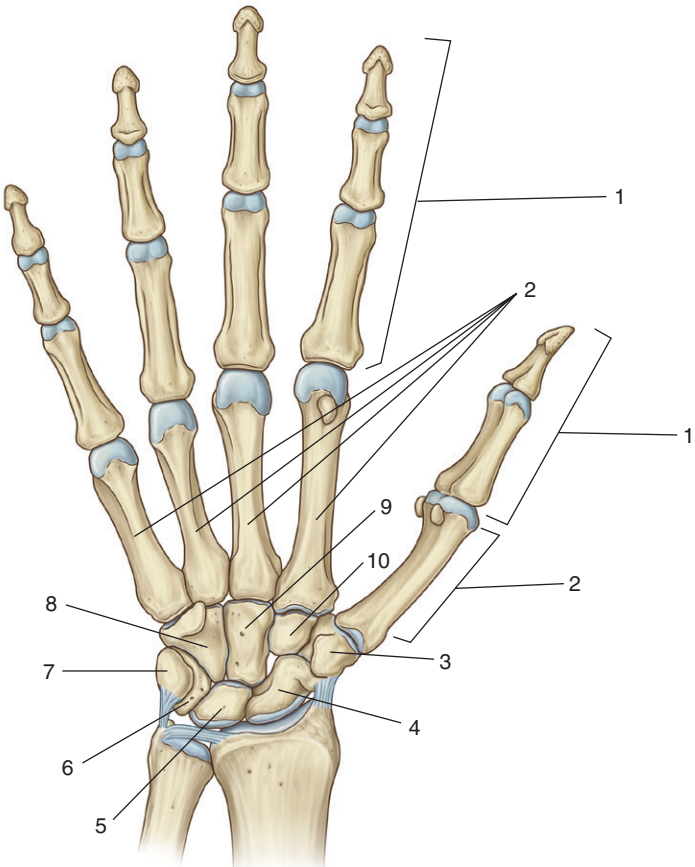
Figure from Gray's Basic Anatomy, *p. 379.*

Identify the indicated structures.

1. **Humerus**
2. **Radius**
3. **Ulna**

Figure from Gray's Basic Anatomy, *p. 382.*

Identify the indicated bones.



1. Phalanges
2. Metacarpals
3. Trapezium
4. Scaphoid
5. Lunate
6. Triquetrum
7. Pisiform
8. Hamate
9. Capitate
10. Trapezoid

IN THE CLINIC:

- **The most common carpal injury is a fracture across the waist of the scaphoid bone. In some individuals, this results in necrosis of the proximal part of the bone because blood supply to this region is via a branch from the radial artery that enters through the distal part of the bone.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 794.*

Identify the indicated structures.

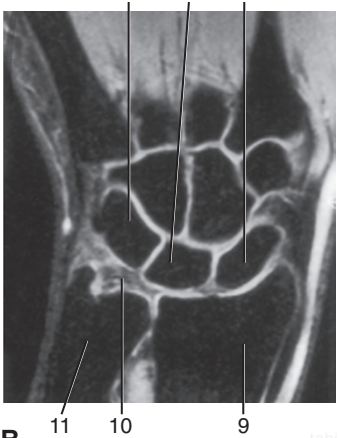
RADIOGRAPH: WRIST

1. Pisiform
2. Hamate
3. Capitate
4. Trapezoid
5. Trapezium
6. Scaphoid
7. Radius
8. Lunate
9. Triquetrum
10. Ulna

Figure from Gray's Basic Anatomy, *p. 398.*

Identify the indicated structures.

A

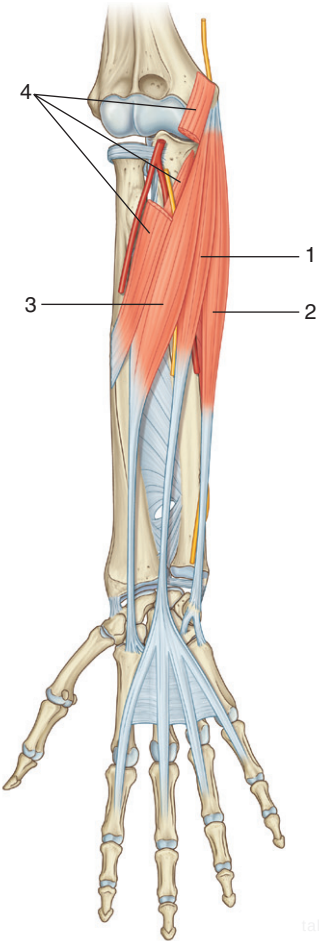


B

1. Phalanges
2. Metacarpals
3. Carpal bones
4. Ulna
5. Radius
6. Triquetrum
7. Lunate
8. Scaphoid
9. Radius
10. Articular disc
11. Ulna

Figure from Gray's Basic Anatomy, *p. 396.*

Identify the indicated muscles.



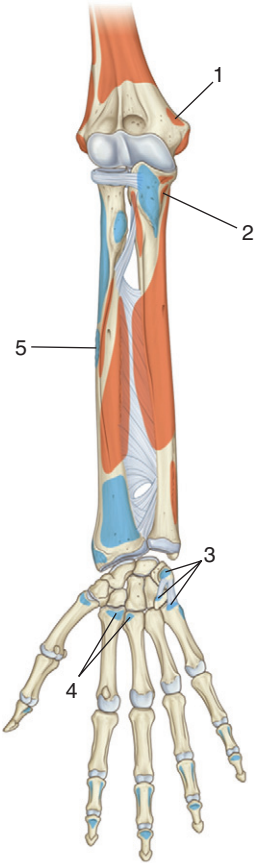
1. Palmaris longus muscle
2. Flexor carpi ulnaris muscle
3. Flexor carpi radialis muscle
4. Pronator teres muscle

IN THE CLINIC:

- **The palmaris longus muscle is absent in about 15% of the population.**
- **The flexor carpi ulnaris muscle is innervated by the ulnar nerve. The three other muscles of the superficial layer of flexor muscles are innervated by the median nerve.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 778.*

Identify the muscles that attach to the areas indicated. What is the major function and innervation of each muscle?

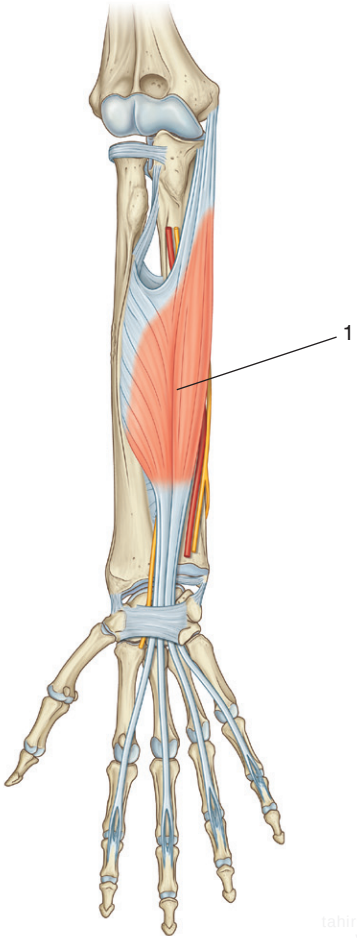


SUPERFICIAL LAYER OF MUSCLES IN THE ANTERIOR COMPARTMENT OF THE FOREARM (SPINAL SEGMENTS INDICATED IN BOLD ARE THE MAJOR SEGMENTS INNERVATING THE MUSCLE)

Muscle	Origin	Insertion	Innervation	Function
1-2 and 5. Pronator teres	Humeral head—medial epicondyle and adjacent supra-epicondylar ridge; ulnar head—medial side of coronoid process	Roughening on lateral surface, mid-shaft, of radius	Median nerve (**C6**,**C7**)	Pronation
3. Flexor carpi ulnaris	Humeral head—medial epicondyle of humerus; ulnar head—olecranon and posterior border of ulna	Pisiform bone, and then via pisohamate and pisometacarpal ligaments into the hamate and base of metacarpal V	Ulnar nerve (C7,**C8**, T1)	Flexes and adducts the wrist joint
4. Flexor carpi radialis	Medial epicondyle of humerus	Base of metacarpals II and III	Median nerve (**C6**,**C7**)	Flexes and abducts the wrist

Figure from Gray's Atlas of Anatomy, *2nd edition, p. 430.*

Identify the indicated muscle.

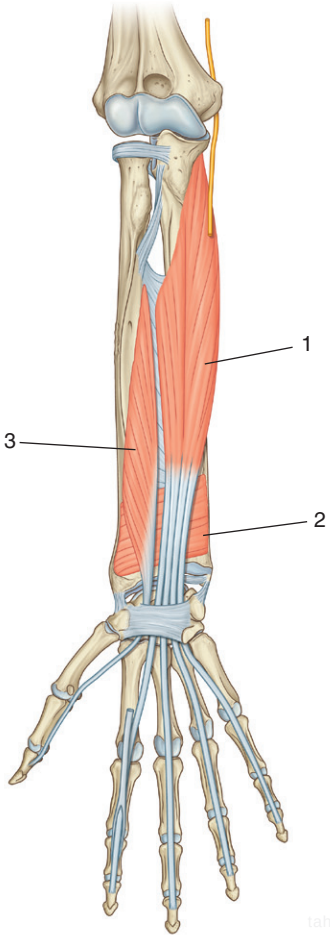


FOREARM ANTERIOR COMPARTMENT: MUSCLES, SECOND LAYER

1. **Flexor digitorum superficialis muscle**

Figure from Gray's Anatomy for Students, *3rd edition, p.780.*

Identify the indicated muscles.



FOREARM ANTERIOR COMPARTMENT: MUSCLES, THIRD LAYER

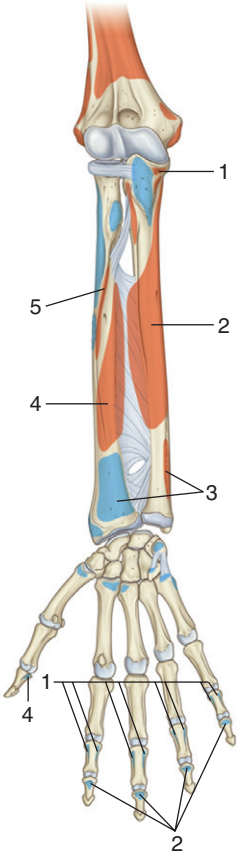
1. Flexor digitorum profundus muscle
2. Pronator quadratus muscle
3. Flexor pollicis longus muscle

IN THE CLINIC:

- **Loss of function of the flexor digitorum profundus muscle results in loss of the ability to flex the distal interphalangeal joints of digits two to five.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 780.*

Identify the muscles that attach to the areas indicated. What is the major function and innervation of each muscle?

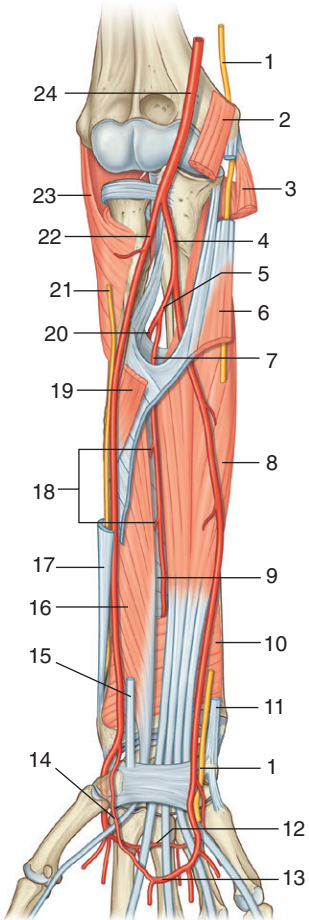


INTERMEDIATE AND DEEP LAYERS OF MUSCLES IN THE ANTERIOR COMPARTMENT OF THE FOREARM (SPINAL SEGMENTS INDICATED IN BOLD ARE THE MAJOR SEGMENTS INNERVATING THE MUSCLE)

Muscle	Origin	Insertion	Innervation	Function
1 and 5. Flexor digitorum superficialis	1. Humero-ulnar head: medial epicondyle of humerus and adjacent margin of coronoid process 5. Radial head: oblique line of radius	Four tendons, which attach to the palmar surfaces of the middle phalanges of the index, middle, ring, and little fingers	Median nerve (**C8**,T1)	Flexes proximal interphalangeal joints of the index, middle, ring, and little fingers; can also flex metacarpophalangeal joints of the same fingers and the wrist joint
2. Flexor digitorum profundus	Anterior and medial surfaces of ulna and anterior medial half of interosseous membrane	Four tendons, which attach to the palmar surfaces of the distal phalanges of the index, middle, ring, and little fingers	Lateral half by median nerve (anterior interosseous nerve); medial half by ulnar nerve (**C8**,T1)	Flexes distal interphalangeal joints of the index, middle, ring, and little fingers; can also flex metacarpophalangeal joints of the same fingers and the wrist joint
3. Pronator quadratus	Linear ridge on distal anterior surface of ulna	Distal anterior surface of radius	Median nerve (anterior interosseous nerve) (C7,**C8**)	Pronation
4. Flexor pollicis longus	Anterior surface of radius and radial half of interosseous membrane	Palmar surface of base of distal phalanx of thumb	Median nerve (anterior interosseous nerve) (C7,**C8**)	Flexes interphalangeal joint of the thumb; can also flex metacarpophalangeal joint of the thumb

Figure from Gray's Atlas of Anatomy, *2nd edition, p. 430.*

Identify the indicated structures.



FOREARM ANTERIOR COMPARTMENT: ARTERIES

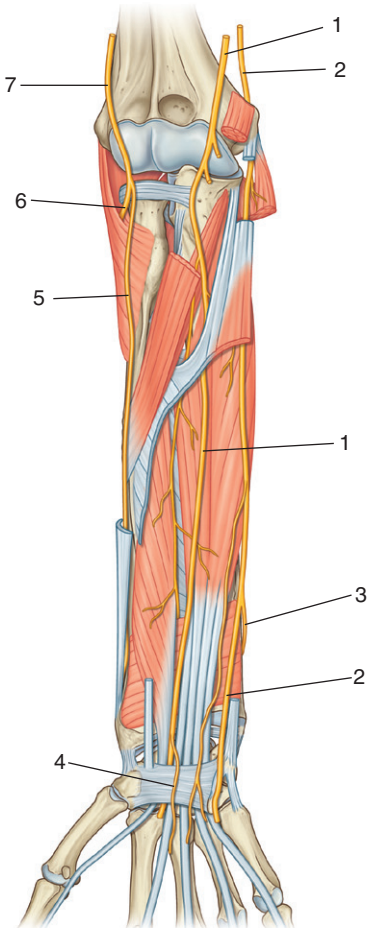
1. Ulnar nerve
2. Humeral head of pronator teres muscle
3. Flexor carpi ulnaris muscle (cut)
4. Ulnar artery
5. Common interosseous artery muscle
6. Flexor digitorum superficialis muscle (cut)
7. Anterior interosseous artery
8. Flexor digitorum profundus muscle
9. Interosseous membrane
10. Pronator quadratus muscle
11. Flexor carpi ulnaris tendon (cut)
12. Deep palmar arch
13. Superficial palmar arch
14. Superficial palmar branch of radial artery
15. Flexor carpi radialis tendon (cut)
16. Flexor pollicis longus muscle
17. Brachioradialis tendon (cut)
18. Perforating branches of anterior interosseous artery
19. Pronator teres muscle (cut)
20. Posterior interosseous artery
21. Superficial branch of radial nerve
22. Radial artery
23. Supinator muscle
24. Brachial artery

IN THE CLINIC:

- **The pulse of the radial artery in the distal forearm can be felt immediately lateral to the tendon of the flexor carpi radialis.**
- **The pulse of the ulnar artery in the distal forearm is more difficult to palpate because it is under the lateral lip of the flexor carpi ulnaris muscle.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 782.*

Identify the indicated nerves.



FOREARM ANTERIOR COMPARTMENT: NERVES

1. Median nerve
2. Ulnar nerve
3. Dorsal branch of ulnar nerve
4. Palmar branch of median nerve
5. Superficial branch of radial nerve
6. Deep branch of radial nerve
7. Radial nerve

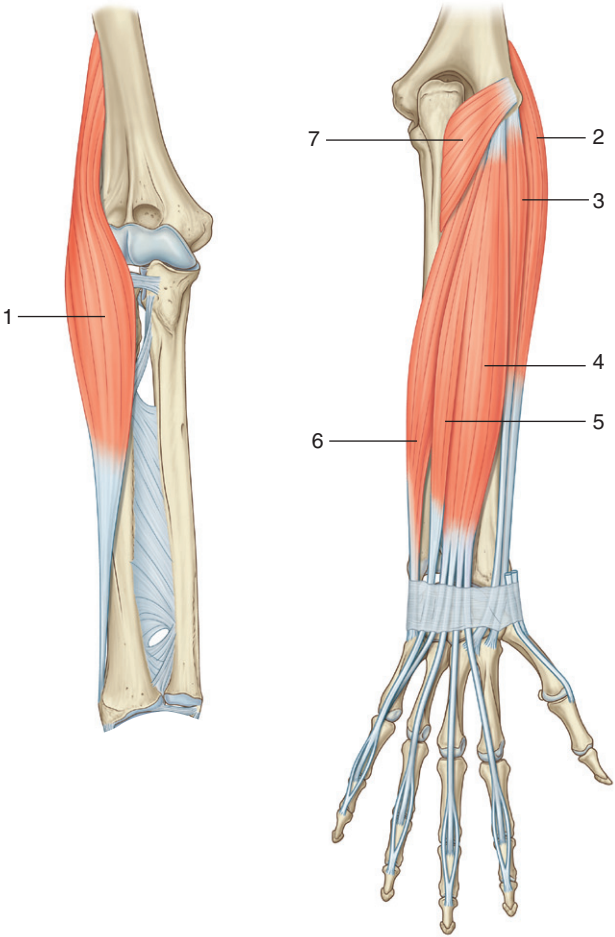
IN THE CLINIC:

- **All muscles in the anterior compartment of the forearm are innervated by the median nerve except for the flexor carpi ulnaris muscle and the medial half of the flexor digitorum profundus muscle.**

- **Carpal tunnel syndrome results from compression of the median nerve in the carpal tunnel. In this syndrome, the palmar branch is spared. If the function of the palmar branch is compromised, then the lesion to the median nerve is proximal to the wrist.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 784.*

Identify the indicated muscles.

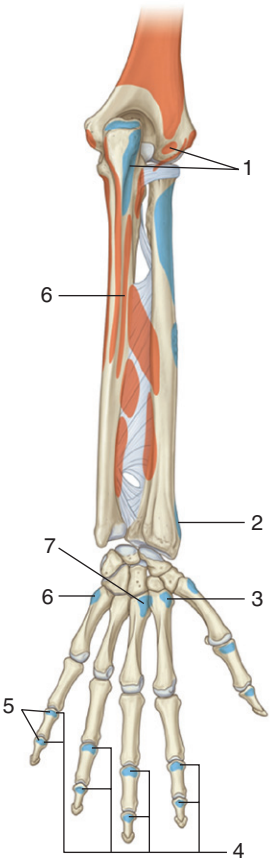


FOREARM POSTERIOR COMPARTMENT: MUSCLES, SUPERFICIAL LAYER

1. Brachioradialis muscle
2. Extensor carpi radialis longus muscle
3. Extensor carpi radialis brevis muscle
4. Extensor digitorum muscle
5. Extensor digiti minimi muscle
6. Extensor carpi ulnaris muscle
7. Anconeus muscle

Figure from Gray's Anatomy for Students, *3rd edition, p.7866.*

Identify the muscles that attach to the areas indicated. What is the major function and innervation of each muscle?

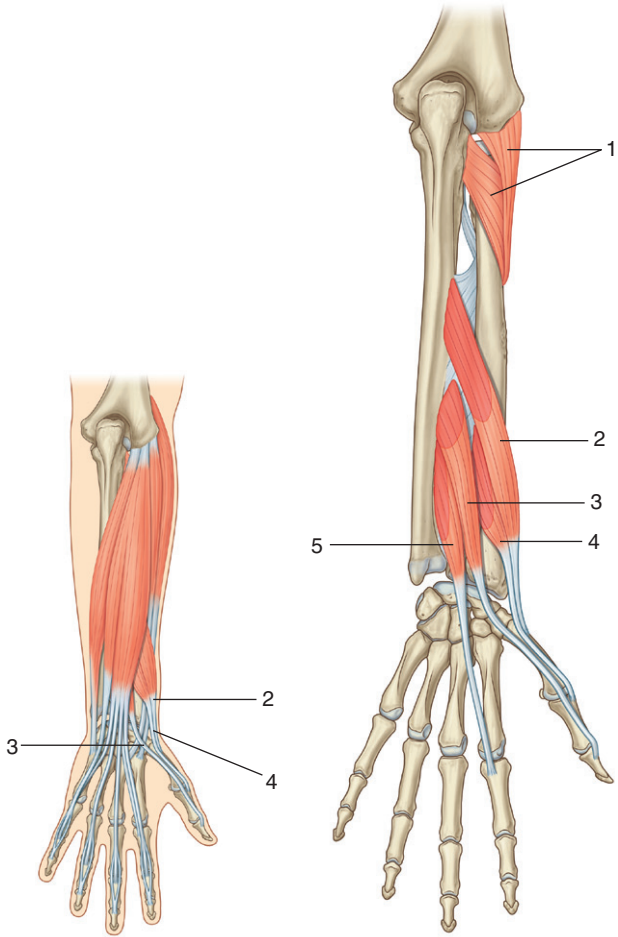


SUPERFICIAL LAYER OF MUSCLES IN THE POSTERIOR COMPARTMENT OF THE FOREARM (SPINAL SEGMENTS INDICATED IN BOLD ARE THE MAJOR SEGMENTS INNERVATING THE MUSCLE)

Muscle	Origin	Insertion	Innervation	Function
1. Anconeus	Lateral epicondyle of humerus	Olecranon and proximal posterior surface of ulna	Radial nerve (**C6 to C8**) (via branch to medial head of triceps brachii)	Abduction of the ulna in pronation; accessory extensor of the elbow joint
2. Brachio-radialis	Proximal part of lateral supra-epicondylar ridge of humerus and adjacent intermuscular septum	Lateral surface of distal end of radius	Radial nerve (C5,**C6**) before division into superficial and deep branches	Accessory flexor of elbow joint when forearm is midpronated
3. Extensor carpi radialis longus	Distal part of lateral supra-epicondylar ridge of humerus and adjacent intermuscular septum	Dorsal surface of base of metacarpal II	Radial nerve (**C6**,C7) before division into superficial and deep branches	Extends and abducts the wrist
4. Extensor digitorum	Lateral epicondyle of humerus and adjacent intermuscular septum and deep fascia	Four tendons, which insert via "extensor hoods" into the dorsal aspects of the bases of the middle and distal phalanges of the index, middle, ring, and little fingers	Posterior interosseous nerve (**C7**,C8)	Extends the index, middle, ring, and little fingers; can also extend the wrist
5. Extensor digiti minimi	Lateral epicondyle of humerus and adjacent intermuscular septum together with extensor digitorum	Extensor hood of the little finger	Posterior interosseous nerve (**C7**,C8)	Extends the little finger
6. Extensor carpi ulnaris	Lateral epicondyle of humerus and posterior border of ulna	Tubercle on the base of the medial side of metacarpal V	Posterior interosseous nerve (**C7**,C8)	Extends and adducts the wrist
7. Extensor carpi radialis brevis	Lateral epicondyle of humerus and adjacent intermuscular septum	Dorsal surface of base of metacarpals II and III	Deep branch of radial nerve (**C7**,C8) before penetrating supinator muscle	Extends and abducts the wrist

Figure from Gray's Atlas of Anatomy, *2nd edition, p. 430.*

Identify the indicated muscles.



FOREARM POSTERIOR COMPARTMENT: OUTCROPPING MUSCLES

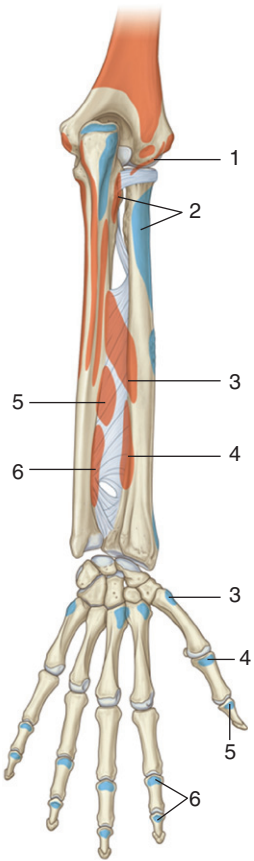
1. Supinator muscle
2. Abductor pollicis longus muscle
3. Extensor pollicis longus muscle
4. Extensor pollicis brevis muscle
5. Extensor indicis muscle

IN THE CLINIC:

- **The tendons of the abductor pollicis longus, extensor pollicis brevis, and extensor pollicis longus demarcate the anatomical snuffbox.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 789.*

Identify the muscles that attach to the areas indicated. What is the major function and innervation of each muscle?

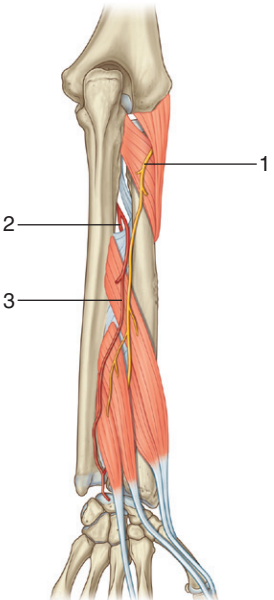


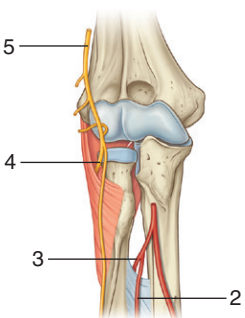
Deep Layer of Muscles in the Posterior Compartment of the Forearm (Spinal Segments Indicated in Bold Are the Major Segments Innervating the Muscle)

Muscle	Origin	Insertion	Innervation	Function
1 and 2. Supinator	1. Superficial part: lateral epicondyle of humerus, radial collateral and annular ligaments 2. Deep part: supinator crest of the ulna	Lateral surface of radius superior to the anterior oblique line	Posterior interosseous nerve (**C6**,C7)	Supination
3. Abductor pollicis longus	Posterior surfaces of ulna and radius (distal to the attachments of supinator and anconeus), and intervening interosseous membrane	Lateral side of base of metacarpal I	Posterior interosseous nerve (**C7**,C8)	Abducts carpometacarpal joint of thumb; accessory extensor of the thumb
4. Extensor pollicis brevis	Posterior surface of radius (distal to abductor pollicis longus) and the adjacent interosseous membrane	Dorsal surface of base of proximal phalanx of the thumb	Posterior interosseous nerve (**C7**,C8)	Extends metacarpophalangeal joint of the thumb; can also extend the carpometacarpal joint of the thumb
5. Extensor pollicis longus	Posterior surface of ulna (distal to the abductor pollicis longus) and the adjacent interosseous membrane	Dorsal surface of base of distal phalanx of thumb	Posterior interosseous nerve (**C7**,C8)	Extends interphalangeal joint of the thumb; can also extend carpometacarpal and metacarpophalangeal joints of the thumb
6. Extensor indicis	Posterior surface of ulna (distal to extensor pollicis longus) and adjacent interosseous membrane	Extensor hood of index finger	Posterior interosseous nerve (**C7**,C8)	Extends index finger

Figure from Gray's Atlas of Anatomy, *2nd edition, p. 430.*

Identify the indicated nerves and arteries.





FOREARM POSTERIOR COMPARTMENT: NERVES AND ARTERIES

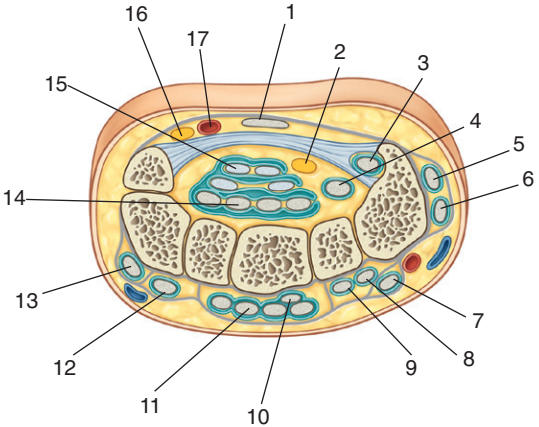
1. Posterior interosseous nerve
2. Anterior interosseous artery
3. Posterior interosseous artery
4. Deep branch of radial nerve
5. Radial nerve

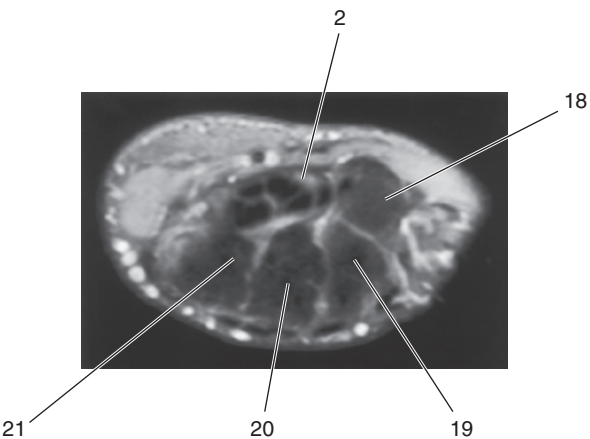
IN THE CLINIC:

- **A lesion to the radial nerve in the radial groove of the humerus results in wristdrop.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 791.*

Identify the indicated tendons, vessels, nerves, and carpal bones.





HAND: CROSS SECTION THROUGH WRIST

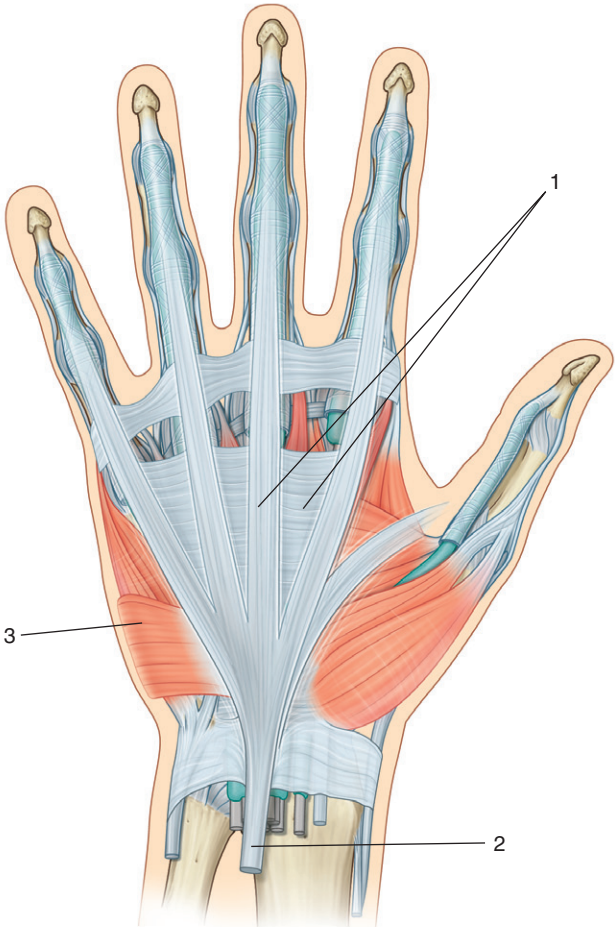
1. Palmaris longus
2. Median nerve
3. Flexor carpi radialis
4. Flexor pollicis longus
5. Abductor pollicis longus
6. Extensor pollicis brevis
7. Extensor pollicis longus
8. Extensor carpi radialis longus
9. Extensor carpi radialis brevis
10. Extensor indicis
11. Extensor digitorum
12. Extensor digiti minimi
13. Extensor carpi ulnaris
14. Flexor digitorum profundus
15. Flexor digitorum superficialis
16. Ulnar nerve
17. Ulnar artery
18. Trapezium
19. Trapezoid
20. Capitate
21. Hamate

IN THE CLINIC:

- **Nine tendons and the median nerve pass through the carpal tunnel. Compression of the median nerve in the carpal tunnel leads to carpal tunnel syndrome.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 799.*

Identify the indicated structures.

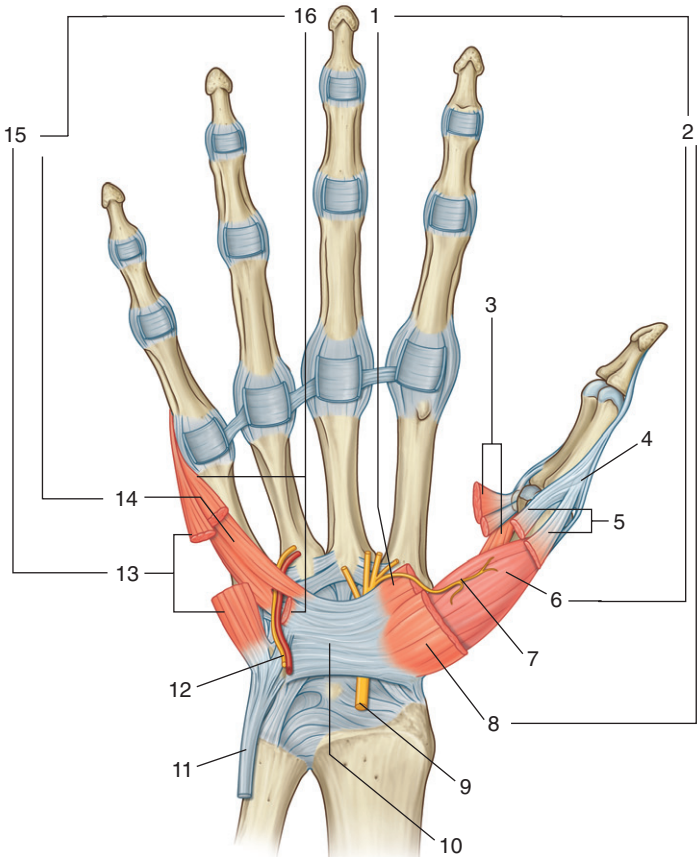


HAND: SUPERFICIAL PALM

1. **Palmar aponeurosis**
2. **Palmaris longus tendon**
3. **Palmaris brevis muscle**

Figure from Gray's Anatomy for Students, *3rd edition, p. 800.*

Identify the indicated muscles and nerves.



1. Flexor pollicis brevis muscle
2. Three thenar muscles
3. Adductor pollicis and first palmar interosseous muscles insert into medial side of extensor hood
4. Extensor hood
5. Flexor pollicis brevis and abductor pollicis brevis muscles insert into lateral side of extensor hood
6. Opponens pollicis muscle
7. Recurrent branch of median nerve
8. Abductor pollicis brevis muscle
9. Median nerve
10. Flexor retinaculum
11. Flexor carpi ulnaris muscle
12. Deep branch of ulnar nerve
13. Abductor digiti minimi muscle
14. Opponens digiti minimi muscle
15. Three hypothenar muscles
16. Flexor digiti minimi brevis muscle

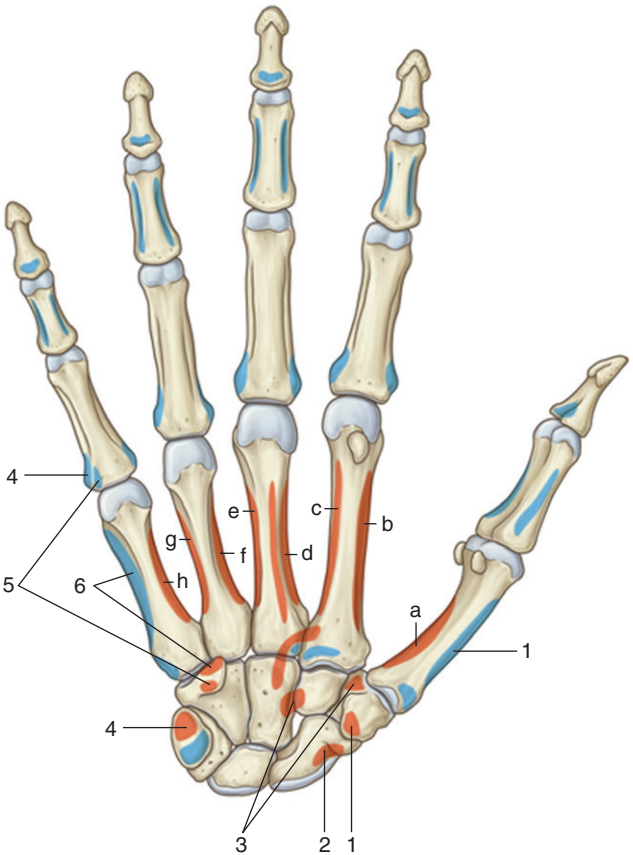
IN THE CLINIC:

- **The three thenar muscles are innervated by the recurrent branch of the median nerve. In carpal tunnel syndrome, the thenar eminence becomes reduced in size and function of the muscles is compromised.**

- **The recurrent branch of the median nerve can be severed in knife wounds in which the blade cuts across the base of the thenar eminence.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 806.*

Identify the muscles that attach to the areas indicated. What is the major function and innervation of each muscle?

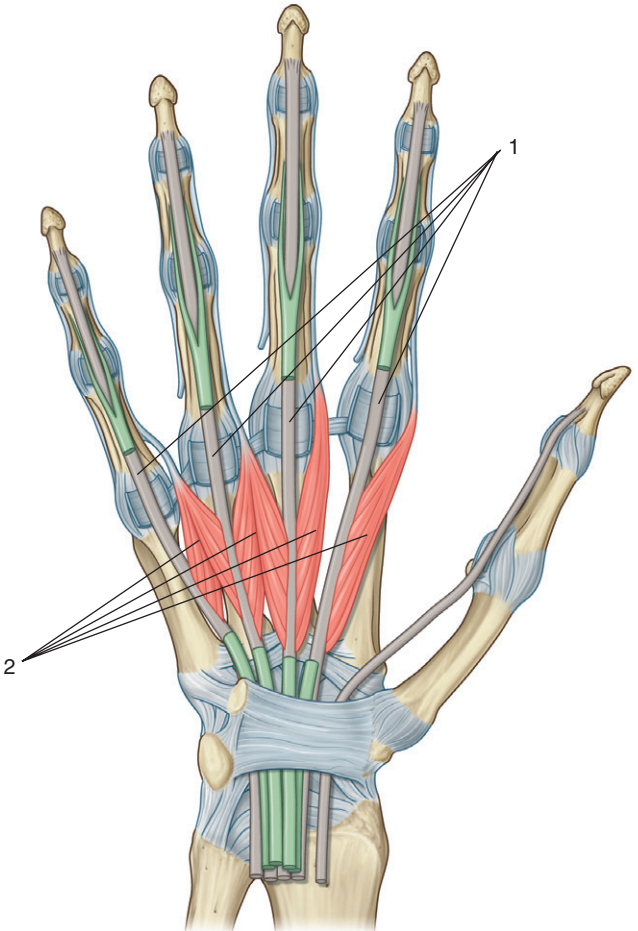


THENAR AND HYPOTHENAR MUSCLES OF THE HAND (SPINAL SEGMENTS INDICATED IN BOLD ARE THE MAJOR SEGMENTS INNERVATING THE MUSCLE)

Muscles	Origin	Insertion	Innervation	Function
Thenar Muscles				
1. Opponens pollicis	Tubercle of trapezium and flexor retinaculum	Lateral margin and adjacent palmar surface of metacarpal I	Recurrent branch of median nerve (C8,**T1**)	Medially rotates thumb
2. Abductor pollicis brevis	Tubercles of scaphoid and trapezium and adjacent flexor retinaculum	Proximal phalanx and extensor hood of thumb	Recurrent branch of median nerve (C8,**T1**)	Abducts thumb at metacarpophalangeal joint
3. Flexor pollicis brevis	Tubercle of the trapezium and flexor retinaculum	Proximal phalanx of the thumb	Recurrent branch of median nerve (C8,**T1**)	Flexes thumb at metacarpophalangeal joint
Hypothenar Muscles				
4. Abductor digiti minimi	Pisiform, the pisohamate ligament, and tendon of flexor carpi ulnaris	Proximal phalanx of little finger	Deep branch of ulnar nerve (C8,**T1**)	Abducts little finger at metacarpophalangeal joint
5. Flexor digiti minimi brevis	Hook of the hamate and flexor retinaculum	Proximal phalanx of little finger	Deep branch of ulnar nerve (C8,**T1**)	Flexes little finger at metacarpophalangeal joint
6. Opponens digiti minimi	Hook of hamate and flexor retinaculum	Medial aspect of metacarpal V	Deep branch of ulnar nerve (C8,**T1**)	Laterally rotates metacarpal V

Figure from Gray's Atlas of Anatomy, *2nd edition, p. 442.*

Identify the indicated muscles and tendons.



LUMBRICALS

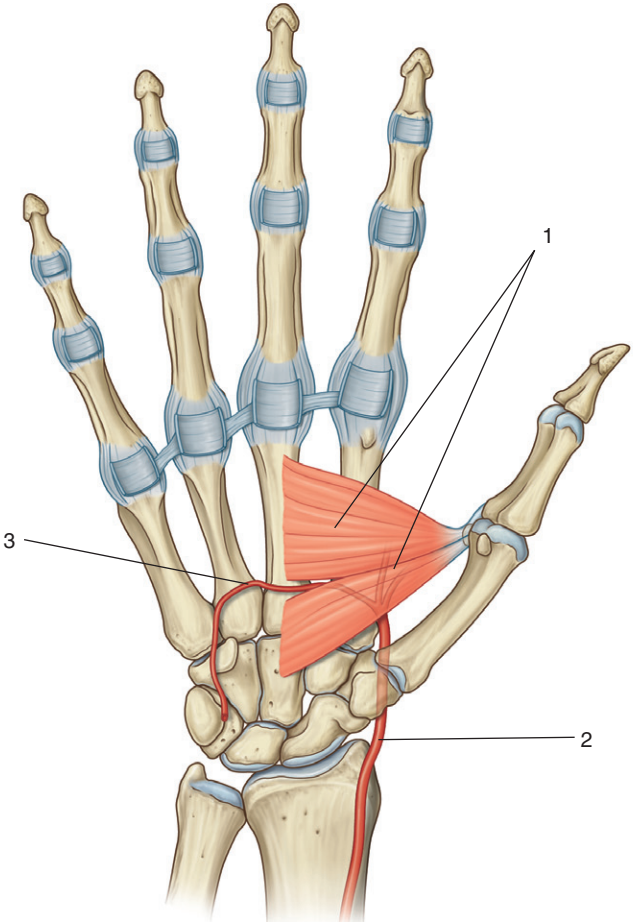
1. Tendons of flexor digitorum profundus muscle
2. Lumbrical muscles

IN THE CLINIC:

- **The lumbrical muscles flex the metacarpophalangeal joints and extend the interphalangeal joints. Loss of function of the lumbrical muscles contributes to "clawing" of the hand.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 807.*

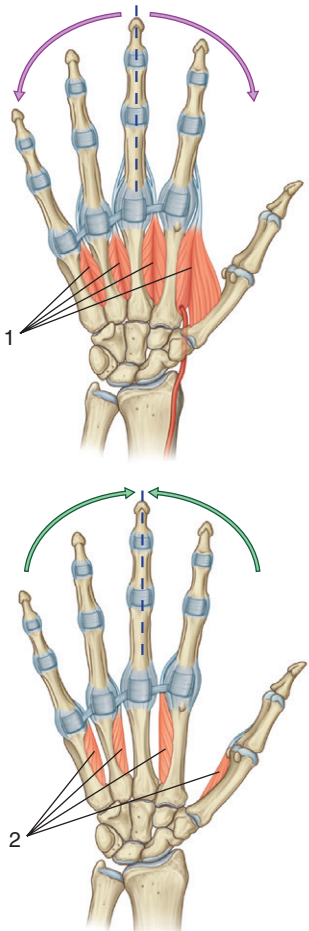
Identify the indicated muscle and arteries.



1. **Adductor pollicis muscle**
2. **Radial artery**
3. **Deep palmar arch**

Figure from Gray's Anatomy for Students, *3rd edition, p. 811.*

Identify the indicated muscles.



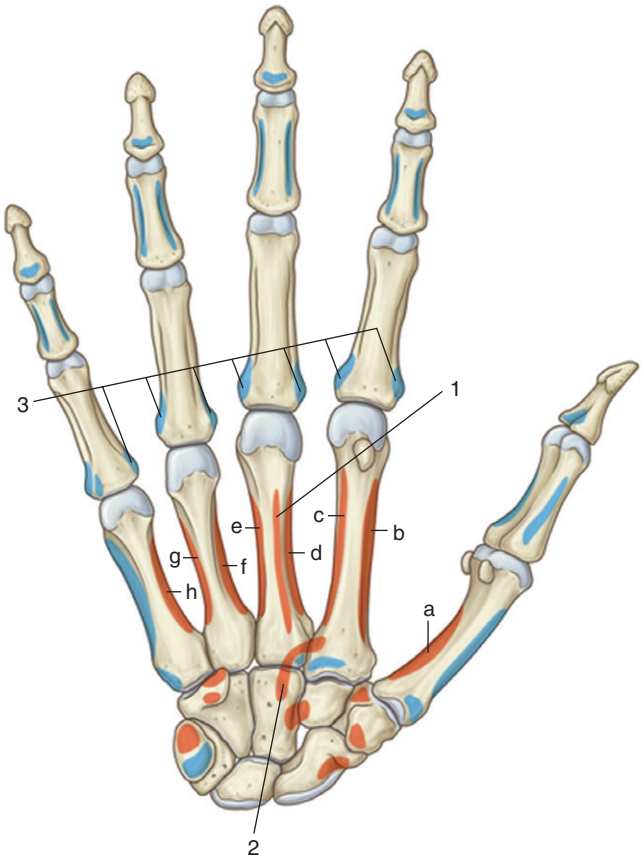
1. Dorsal interossei
2. Palmar interossei

IN THE CLINIC:

- **The dorsal interossei abduct the second to fourth digits, and the palmar interossei adduct the second, fourth, and fifth digits relative to the third digit. All are innervated by the deep branch of the ulnar nerve. The ability to adduct the digits against resistance is used as a test motor function of the deep branch of the ulnar nerve.**
- **The palmar interosseous muscle associated with the thumb is rudimentary. When present it is often considered part of either adductor pollicis or flexor pollicis brevis.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 804.*

Identify the muscles that attach to the areas indicated. What is the major function and innervation of each muscle?

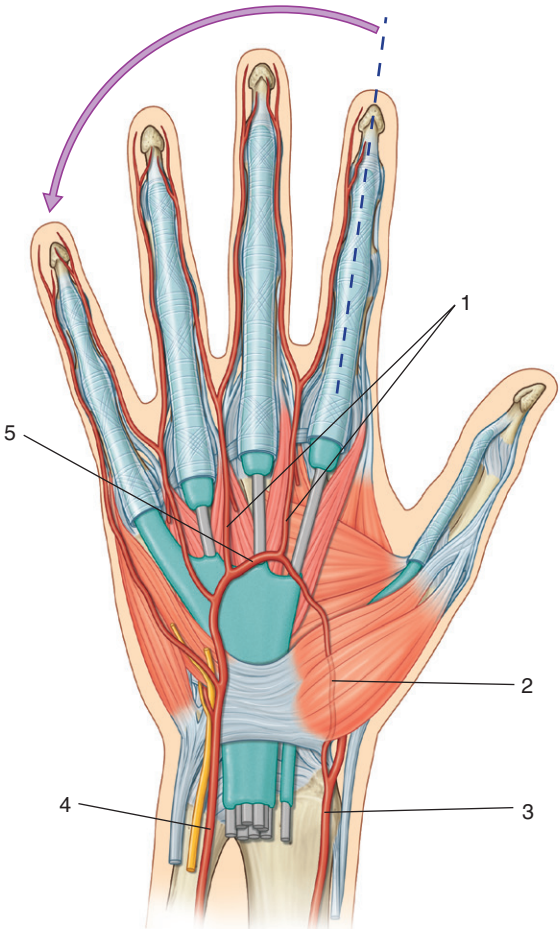


INTRINSIC MUSCLES OF THE HAND (SPINAL SEGMENTS INDICATED IN BOLD ARE THE MAJOR SEGMENTS INNERVATING THE MUSCLE)

Muscles	Origin	Insertion	Innervation	Function
1 and 2. Adductor pollicis	1. Transverse head: metacarpal III 2. Oblique head: capitate and bases of metacarpals II and III	Base of proximal phalanx and extensor hood of thumb	Deep branch of ulnar nerve (C8,**T1**)	Adducts thumb
3. Dorsal interossei (four muscles)	Adjacent sides of metacarpals	Extensor hood and base of proximal phalanges of index, middle, and ring fingers	Deep branch of ulnar nerve (C8,**T1**)	Abduction of index, middle, and ring fingers at the metacarpophalangeal joints
3. Palmar interossei (four muscles)	Sides of metacarpals	Extensor hoods of the thumb, index, ring, and little fingers and the proximal phalanx of thumb	Deep branch of ulnar nerve (C8,**T1**)	Adduction of the thumb, index, ring, and little fingers at the metacarpophalangeal joints

Figure from Gray's Atlas of Anatomy, *2nd edition, p. 442.*

Identify the indicated arteries.



SUPERFICIAL PALMAR ARCH

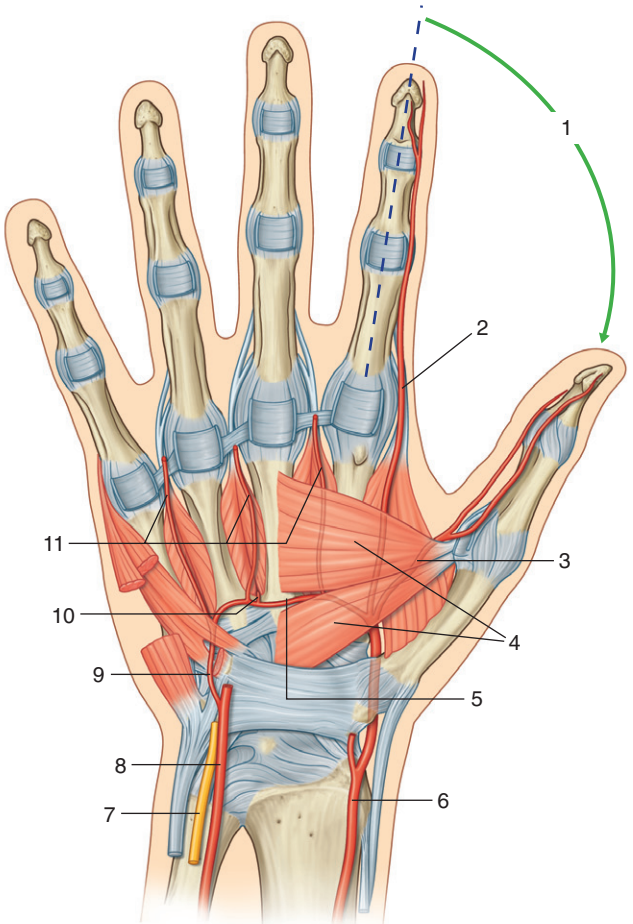
1. Common palmar digital arteries
2. Palmar branch of radial artery
3. Radial artery
4. Ulnar artery
5. Superficial palmar arch

IN THE CLINIC:

- **The ulnar artery is the predominant supply of the medial three and one-half digits via the superficial palmar arch. The radial artery supplies mainly the thumb and lateral half of the index finger.**
- **Allen's test is used to assess adequate anastomoses between the radial and ulnar arteries.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 812.*

Identify the indicated arteries and associated features.



DEEP PALMAR ARCH

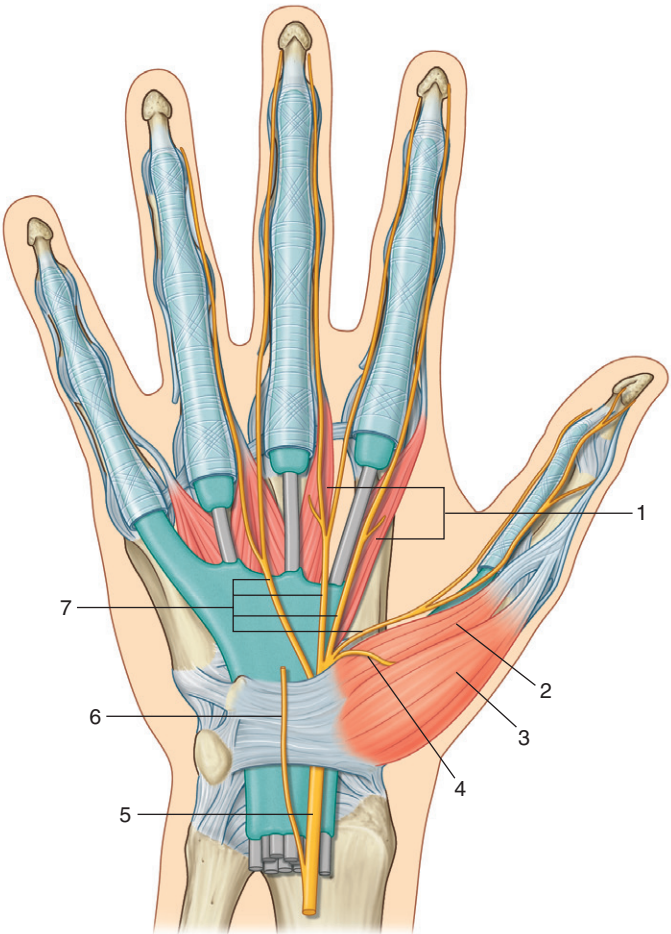
1. Region supplied mainly by radial artery
2. Radialis indicis artery
3. Princeps pollicis artery
4. Adductor pollicis muscle
5. Deep palmar arch
6. Radial artery
7. Ulnar nerve
8. Ulnar artery
9. Deep branch of ulnar artery
10. Perforating artery
11. Palmar metacarpal arteries

IN THE CLINIC:

- **Interruption of the radial artery could lead to loss of blood supply to the thumb and lateral half of the index finger if anastomoses with the ulnar artery are not sufficient to maintain supply.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 813.*

Identify the indicated nerves and muscles.



1. Lateral two lumbrical muscles
2. Flexor pollicis brevis muscle
3. Abductor pollicis brevis muscle
4. Recurrent branch (of median nerve)
5. Median nerve
6. Palmar branch (of median nerve)
7. Common palmer digital nerves

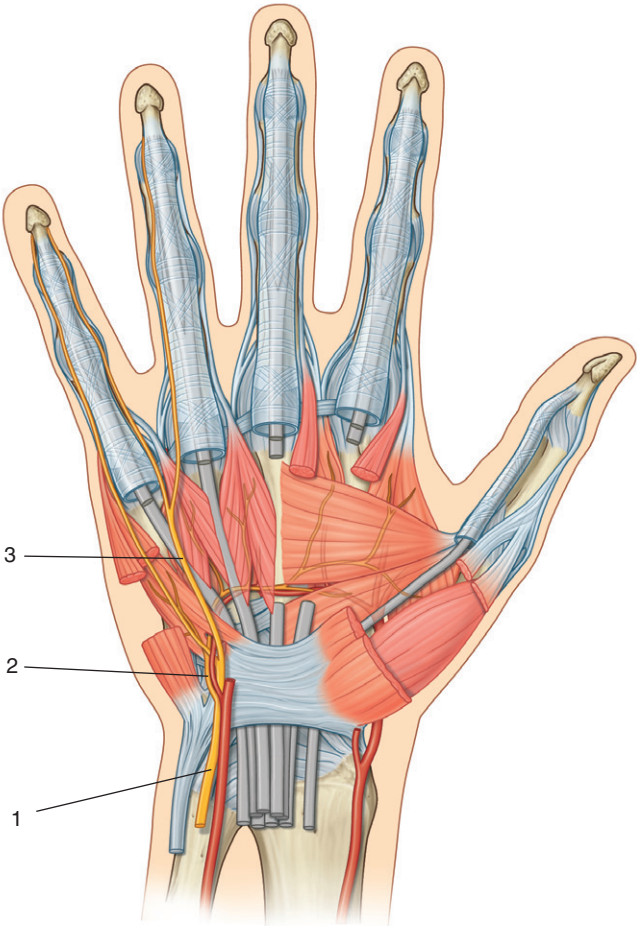
IN THE CLINIC:

- **In the hand, the median nerve supplies motor innervation to the three thenar muscles and the two lateral lumbricals. It also carries general sensory information from the palmar aspect of the lateral three and one-half digits.**

- **In carpal tunnel syndrome, general sensory innervation from the central area of the palm and wrist is spared because the nerve (palmar branch of the median nerve) that innervates this region originates from the median nerve in the distal forearm and travels into the hand superficial to the carpal tunnel.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 817.*

Identify the indicated nerves.



ULNAR NERVE

1. Ulnar nerve
2. Deep branch of the ulnar nerve
3. Superficial branch of the ulnar nerve

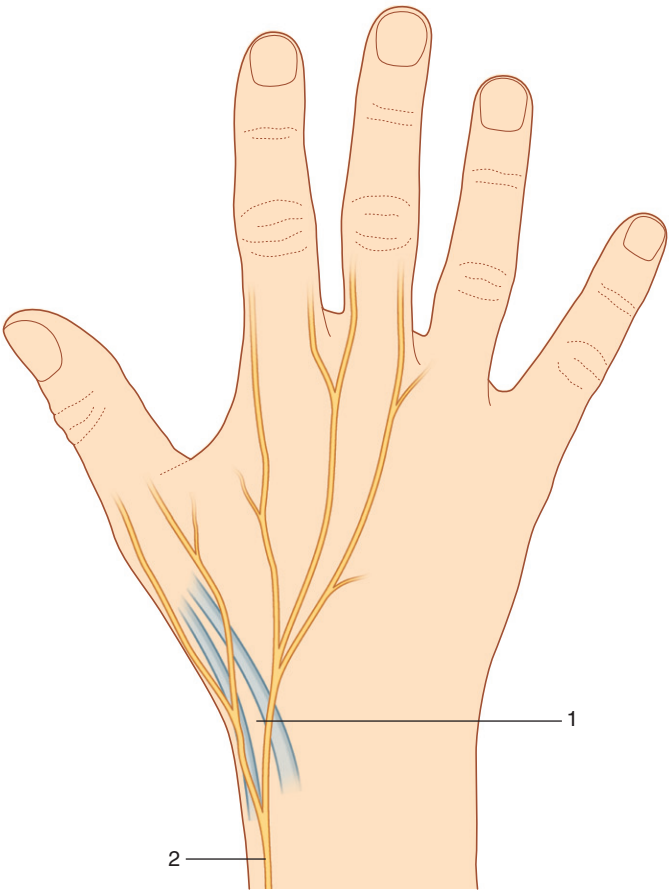
IN THE CLINIC:

- **All intrinsic muscles of the hand are innervated by the ulnar nerve, except for the three thenar muscles and two lateral lumbricals, which are innervated by the median nerve. The deep branch of the ulnar nerve supplies most of the muscles except for the palmaris brevis muscle, which is supplied by the superficial branch. The ulnar nerve (via the superficial branch) carries cutaneous innervation from the palmar aspect of the medial one and one-half digits.**

- **Loss of function of the ulnar nerve leads to "clawing" of the hand, particularly of the medial digits.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 815.*

Identify the indicated region and nerve.



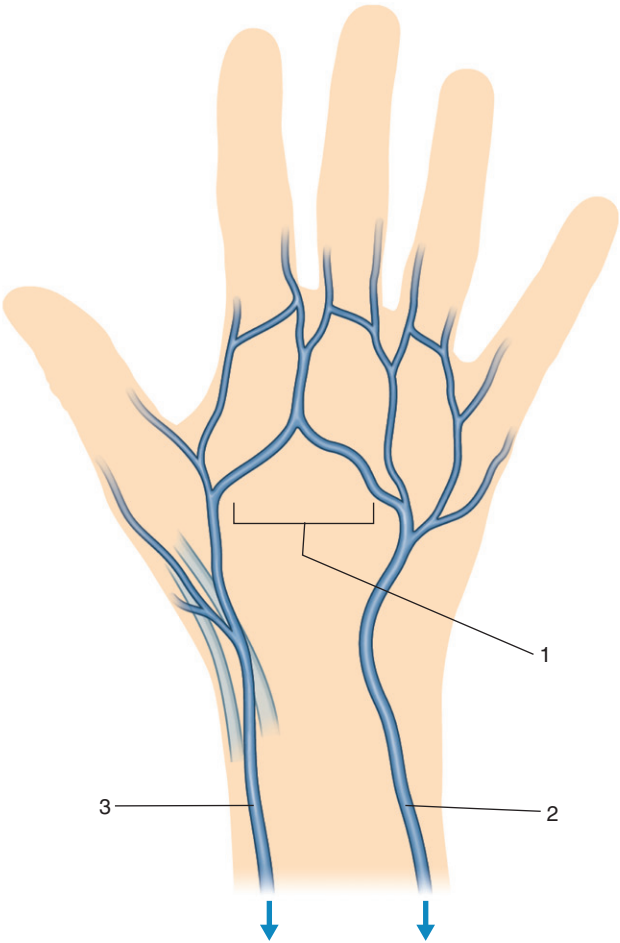
1. Anatomical snuffbox
2. Superficial branch (of radial nerve)

IN THE CLINIC:

- **A lesion of the superficial branch of the radial nerve results in loss of cutaneous innervation over the lateral side of the dorsal surface of the hand and over the thenar eminence. The radial nerve does not supply any of the intrinsic muscles in the hand.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 818.*

Identify the indicated veins.



DORSAL VENOUS ARCH

1. Dorsal venous network
2. Basilic vein
3. Cephalic vein

IN THE CLINIC:

- **Superficial veins on the dorsal aspect of the hand are often visible and can be accessed for numerous procedures.**

Figure from Gray's Anatomy for Students, *3rd edition, p. 814.*