AL MUSTAQBAL UNIVERSITY

College of Medicine / First Year

ANATOMY

(L8) VASCULATURE of Upper Limbs

Assist Prof. Dr. Abdulhusein Mizhir Almaamuri

Learning Objectives

By the end of this lecture, first-year medical students should be able to:

1. **Describe** the general organization of the vascular system of the upper limb.
2. **Trace** the arterial supply of the upper limb from the subclavian artery to the palmar arches.
3. **Identify** the axillary artery, its parts, and its major branches.
4. **Describe** the course and branches of the brachial artery.
5. **Differentiate** between the radial and ulnar arteries regarding course and distribution.
6. **Explain** the formation and functional importance of the superficial and deep palmar arches.
7. **Describe** the arterial anastomoses around the shoulder and elbow joints.
8. **Differentiate** between superficial and deep veins of the upper limb.
9. **Identify** the major superficial veins (cephalic, basilic, and median cubital veins) and describe their course and termination.
10. **Outline** the deep venous system of the upper limb and its relationship to accompanying arteries.
11. **Describe** the superficial and deep lymphatic drainage of the upper limb.
12. **Identify** the main groups of axillary lymph nodes and their areas of drainage.
13. **Explain** the pathway of lymph flow from the hand and upper limb to the central venous system.
14. **Recognize** important clinical correlations related to upper limb vessels and lymph nodes (e.g., axillary lymphadenopathy, collateral circulation).

VASCULATURE of Upper Limbs

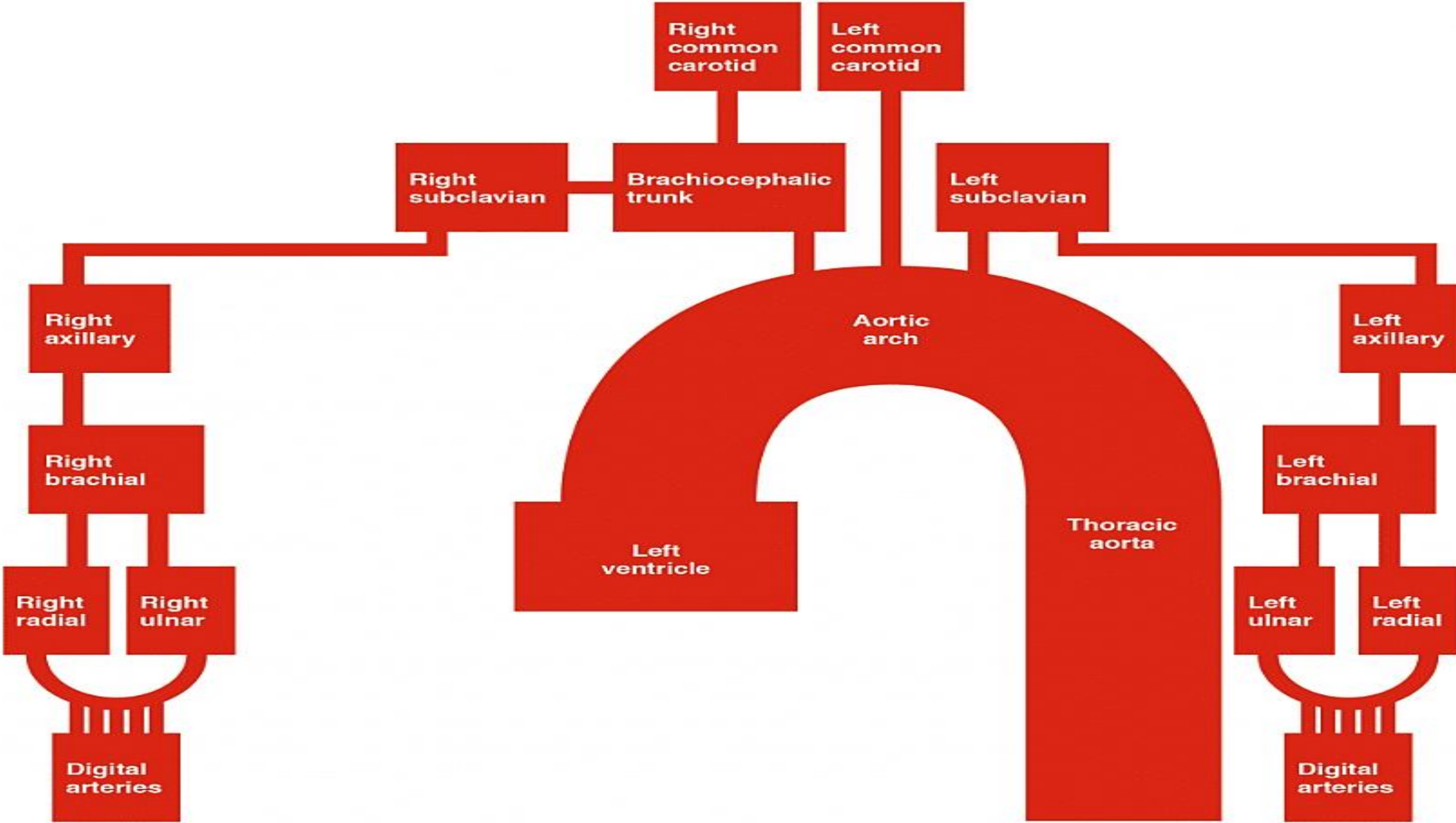
Arteries

The arterial supply to the upper limb begins as the **subclavian artery**, located in the root of the neck, continues as the **axillary artery**, which supplies the upper limb. On the right, the subclavian artery arises from the **brachiocephalic trunk**. On the left, it branches directly from **the arch of aorta**.

The subclavian artery travels laterally towards the axilla. It can be divided into three parts based on its position relative to the **anterior scalene muscle**:

First part, origin of the subclavian artery to the medial border of the anterior scalene.
Second part, posterior to the anterior scalene.
Third part, lateral border of anterior scalene to the lateral border of the first rib.

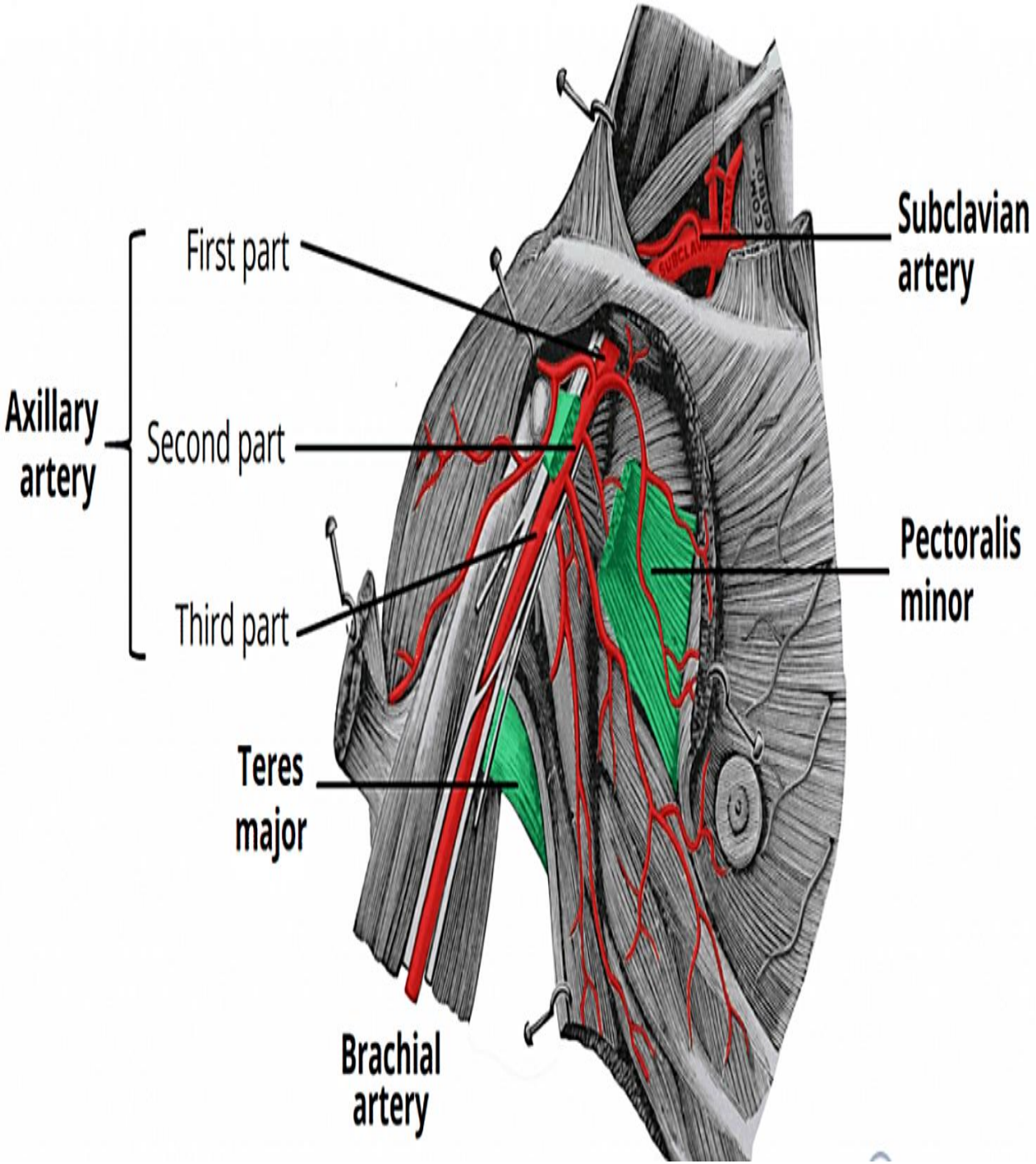
At the lateral border of the first rib, the subclavian artery enters the axilla – and is renamed the **axillary artery.**

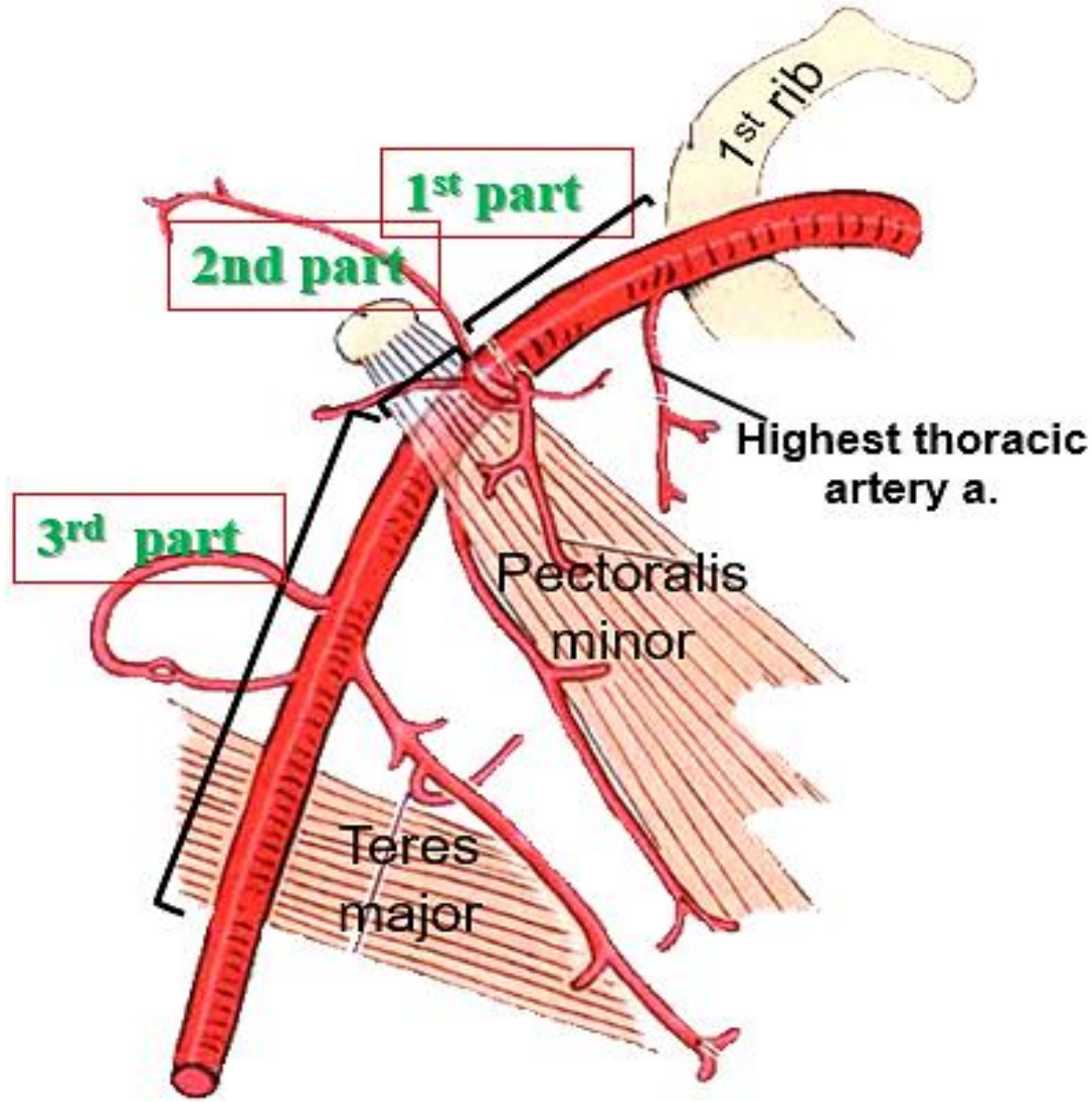

Right common carotid
Left common carotid
Right subclavian
Brachiocephalic trunk
Left subclavian
Right axillary
Aortic arch
Left axillary
Right brachial
Left brachial
Left ventricle
Thoracic aorta
Right radial
Right ulnar
Left ulnar
Left radial
Digital arteries
Digital arteries

Axillary Artery

The axillary artery begins at the lateral border of the **first rib** and ends at the lower border of the **teres major muscle**, where it continues as the **brachial artery** .Throughout its course, the artery is closely related to the **cords of the brachial plexus** and their branches and is enclosed with them in a connective tissue sheath called the **axillary sheath**. This sheath is continuous with the prevertebral fascia in the root of the neck. The pectoralis minor muscle crosses in front of the axillary artery and divides it into three parts.

First Part of Axillary Artery: This extends from the lateral border of the first rib to the upper border of the pectoralis minor.
Second Part of Axillary Artery: This lies deep to the pectoralis minor muscle.
Third Part of Axillary Artery: This extends from the lower border of the pectoralis minor to the lower border of the teres major.


Axillary artery
First part
Second part
Third part
Subclavian artery
Pectoralis minor
Teres major
Brachial artery


1st rib
1st part
2nd part
3rd part
Highest thoracic artery a.
Pectoralis minor
Teres major

Axillary Artery Branches

Typically, the axillary artery has six branches (see the table). Conveniently for memory, one branch comes from the first part of the artery, two branches from the second part, and three branches from the third part. However, the branching pattern is subject to much variation, and recognizing the target territories of the branches in order to verify the identities of the branches is important.

First Part	Second Part	Third Part
Superior thoracic artery	Thoracoacromial artery Lateral thoracic artery	Subscapular artery Anterior and posterior circumflex arteries

The anterior and posterior circumflex humeral arteries form an anastomotic network around the surgical neck of the humerus and can be damaged in cases of fracture. The posterior artery is the larger of the two and passes through the quadrangular space with the axillary nerve to reach the scapular region

At the lower border of the **teres major muscle**, the axillary artery is renamed the **brachial artery**

Arterial Anastomosis around Shoulder Joint

The extreme mobility of the shoulder joint may result in kinking of the axillary artery and a temporary occlusion of its lumen. To compensate for this, an important arterial anastomosis exists between the branches of **the subclavian artery and the axillary artery**, thus ensuring that an adequate blood flow takes place into the upper limb irrespective of the position of the arm

Branches from Subclavian Artery

The suprascapular artery is distributed to the supraspinous and infraspinous fossae of the scapula.

The superficial cervical artery gives off a deep branch that runs down the medial border of the scapula.

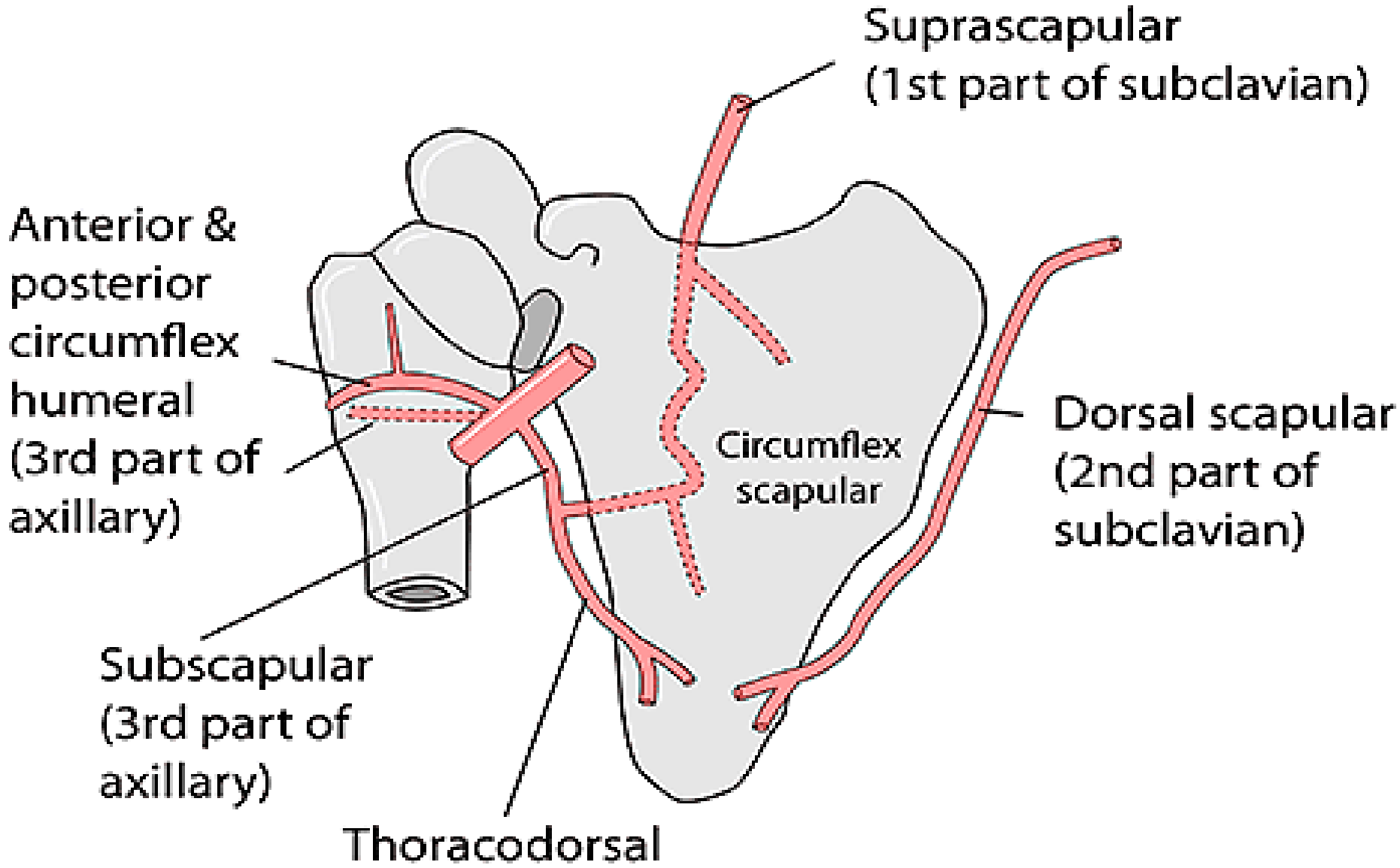
Branches from Axillary Artery

The subscapular artery and its circumflex scapular branch supply the subscapular and infraspinous fossae of the scapula, respectively.

Anterior circumflex humeral artery.

Posterior circumflex humeral artery.

ARTERIAL ANASTOMOSIS AROUND SHOULDER



Brachial Artery

The brachial artery begins at the lower border of the teres major muscle as a continuation of the axillary artery. It travels through the anterior compartment of the arm. However, its branches supply both the anterior and posterior compartments of the arm, and thus, the brachial artery supplies the entire arm. It terminates opposite the neck of the radius by dividing into the radial and ulnar arteries.

Branches

Muscular branches to the anterior compartment of the arm.

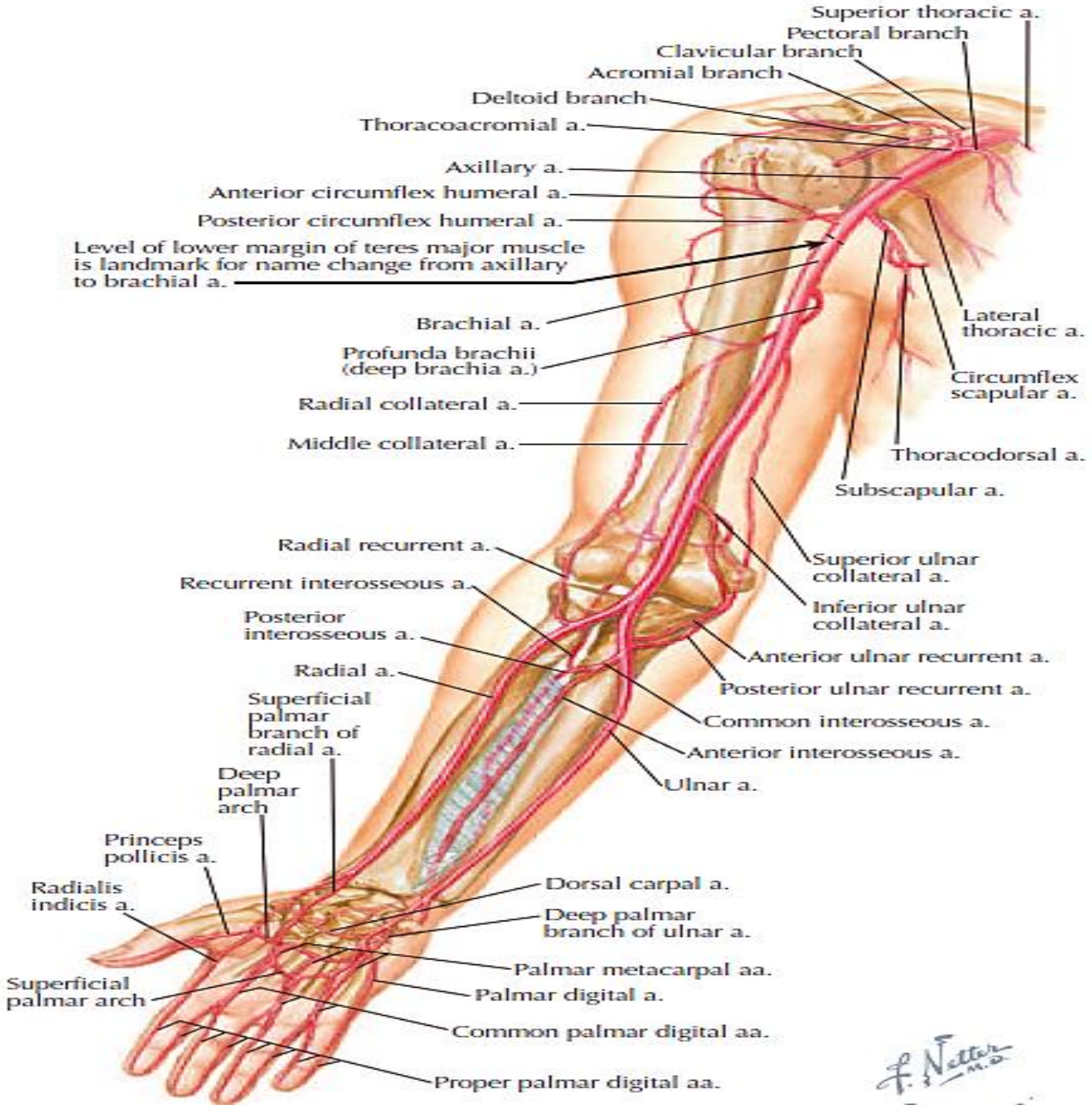
Nutrient artery to the humerus.

The profunda brachii (deep brachial) artery arises near the origin of the brachial artery, accompanies the radial nerve through the radial (spiral) groove of the humerus, and supplies the triceps muscle. It anastomoses with the radial recurrent artery (a branch of the radial artery) to form part of the collateral circulation around the elbow joint.

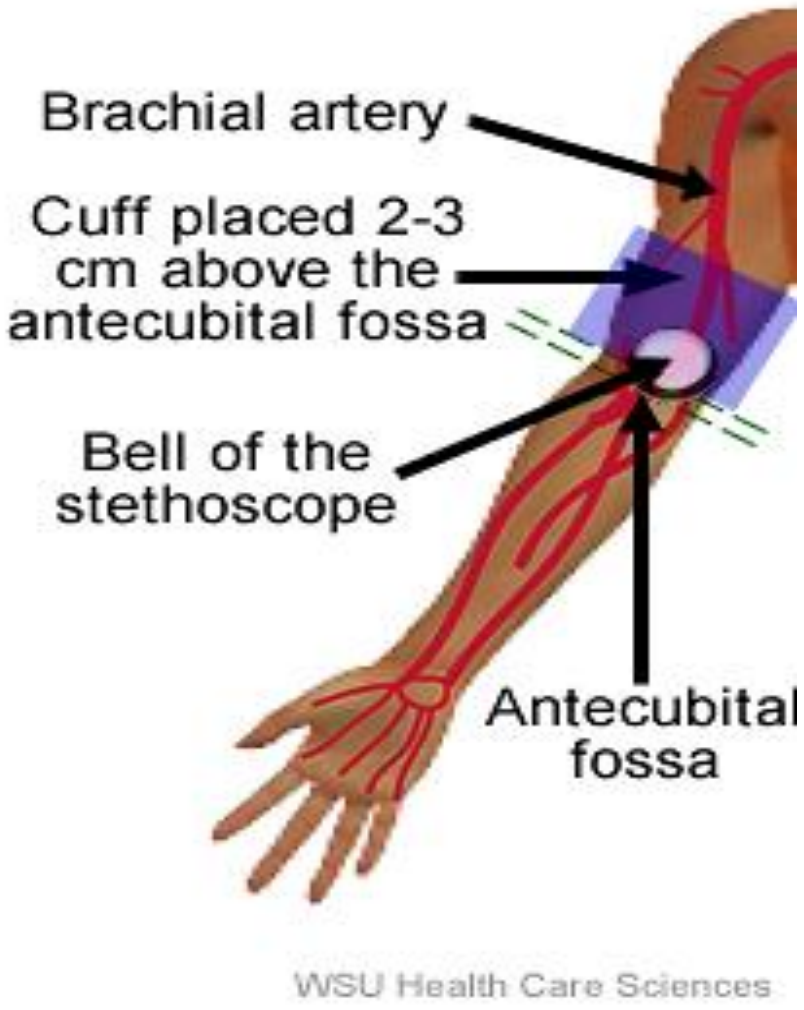
The superior ulnar collateral artery arises near the middle of the arm and follows the ulnar nerve posterior to the medial epicondyle. It anastomoses with the posterior ulnar recurrent artery (a branch of the ulnar artery) to form part of the collateral circulation around the elbow joint.

The inferior ulnar collateral artery arises near the termination of the brachial artery and passes anterior to the medial epicondyle. It anastomoses with the anterior ulnar recurrent artery (a branch of the ulnar artery) to form part of the collateral circulation around the elbow join.

Arteries of Upper Limb



Blood Pressure Measurement



Ulnar Artery

The ulnar artery is the larger of the two terminal branches of the brachial arter. It begins in the cubital fossa at the level of the neck of the radius. It descends through the medial (ulnar) aspect of the anterior compartment of the forearm and enters the palm superficial to the flexor retinaculum in company with the ulnar nerve. It ends by forming the superficial palmar arch, often anastomosing with the superficial palmar branch of the radial artery.

Ulnar Artery in Forearm

In the proximal forearm, the ulnar artery lies deep to most of the flexor muscles. More distally, it becomes superficial and lies between the tendons of the flexor carpi ulnaris and the tendons of the flexor digitorum superficialis. As the artery crosses over the flexor retinaculum, it lies just lateral to the pisiform bone and is covered only by skin and fascia, making this a good site for taking the ulnar pulse.

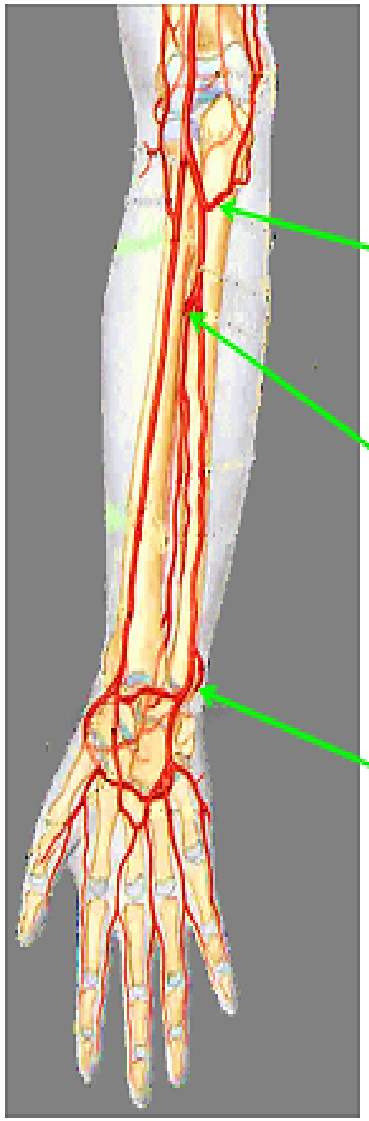
Forearm Branches

Muscular branches to neighboring muscles.

Anterior and posterior ulnar recurrent branches that take part in the arterial anastomoses around the elbow joint.

Branches that take part in the arterial anastomosis around the wrist joint.

The common interosseous artery arises from the upper part of the ulnar artery and, after a brief course, divides into the **anterior and posterior interosseous arteries**. The interosseous arteries pass distally on the anterior and posterior surfaces of the interosseous membrane, respectively. They provide **nutrient arteries to the radius and ulna**, supply adjacent muscles in the anterior and posterior compartments, and end by taking part in the anastomosis around the wrist joint.



Ulnar Artery: Branches

- Muscular .
- Recurrent branch for anastomosis around the elbow joint.
- Common interosseous artery, which gives anterior and posterior interosseous arteries.
- Branch to anastomoses around the wrist joint.

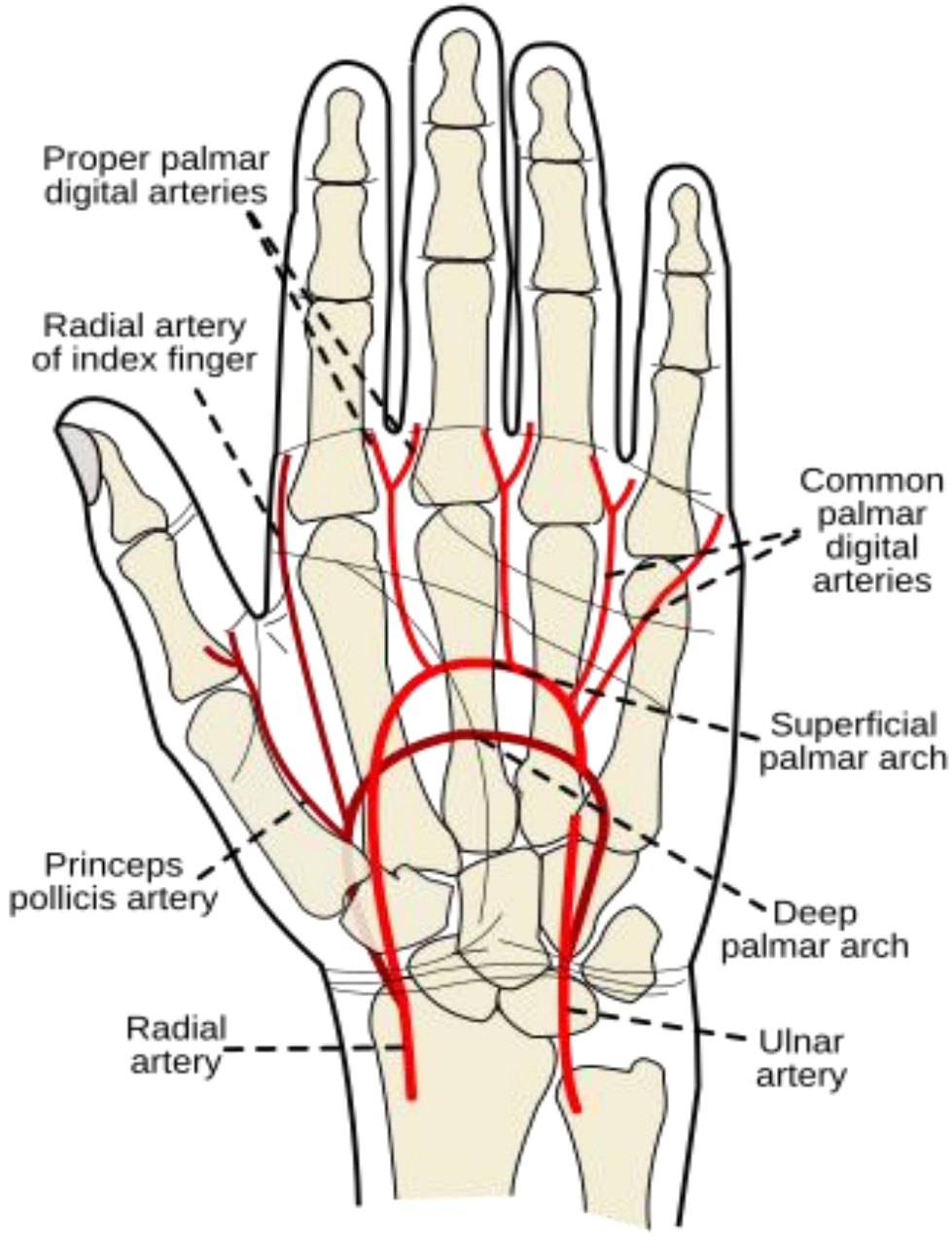
Ulnar Artery in Hand

The ulnar artery enters the hand superficial to the flexor retinaculum on the lateral side of the ulnar nerve and the pisiform bone.

The artery gives off a **deep palmar branch** and then continues into the palm as the **superficial palmar arch**. On entering the palm, the superficial palmar arch curves laterally deep to the palmar aponeurosis and superficial to the long flexor tendons. The arch is completed on the lateral side by anastomosing with the **superficial palmar branch** of the **radial artery**. The curve of the arch lies across the palm, level with the distal border of the fully extended thumb.

The superficial arch gives rise to three common palmar digital arteries. Each common artery divides into two proper palmar digital arteries that supply adjacent sides of two digits.

The deep palmar branch of the ulnar artery arises superficial to the flexor retinaculum, passes deep between the abductor digiti minimi and the flexor digiti minimi, and joins the radial artery to complete the deep palmar arch



Radial Artery

The radial artery is the smaller of the two terminal branches of the brachial Artery. It begins in the cubital fossa at the level of the neck of the radius and descends through the lateral (radial) aspect of the anterior compartment of the forearm. It ends by forming the deep palmar arch in the hand, often anastomosing with the deep palmar branch of the ulnar artery.

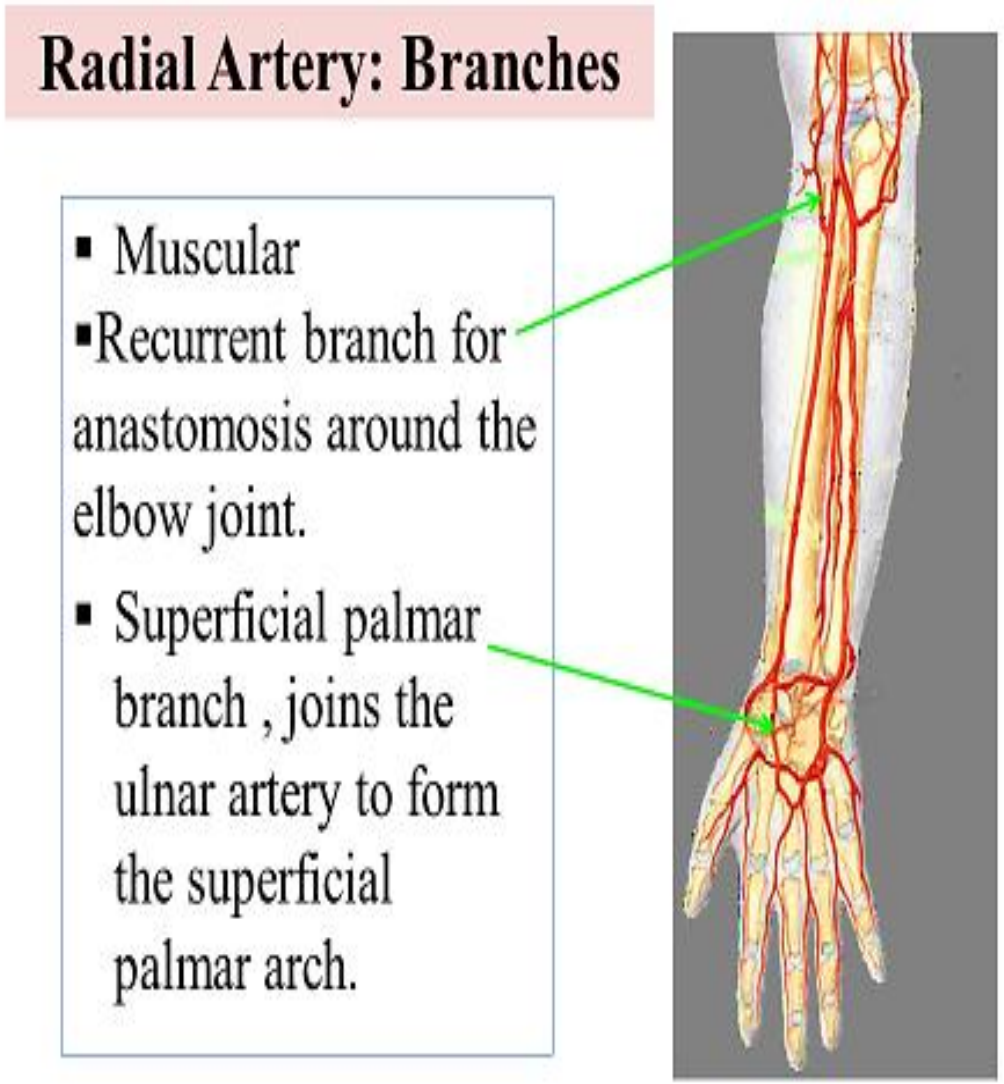
Radial Artery in Forearm

In the proximal forearm, the radial artery lies deep to the brachioradialis muscle. In the middle third of its course, it runs medial to the superficial branch of the radial nerve. In the distal forearm, the radial artery lies on the anterior surface of the radius, between the tendons of the brachioradialis and flexor carpi radialis muscles, and is covered only by skin and fascia. This is the ideal site for taking the radial pulse.

Forearm Branches

Muscular branches to neighboring muscles.

The radial recurrent artery takes part in the arterial anastomosis around the elbow joint. **The superficial palmar branch** arises just proximal to the wrist, enters the palm of the hand, and joins the ulnar artery to complete the superficial palmar arch.



The arterial supply of the hand

It is primarily fed by the **radial** and **ulnar** arteries, which form two interconnected loops—the **superficial** and **deep palmar arches**. This "double-loop" system ensures that if one artery is compressed (like when you're gripping a tool), blood can still reach the fingertips from the other side.

1. The Major Contributors

Before the arches form, the two main arteries of the forearm enter the hand through distinct pathways:

Ulnar Artery: Enters the palm via Guyon's canal (medial side). It is the primary contributor to the superficial palmar arch.

Radial Artery: Passes through the anatomical snuffbox to the dorsal side of the hand before piercing between the heads of the first dorsal interosseous muscle to reach the deep palm. It is the primary contributor to the deep palmar arch.

2. The Palmar Arches

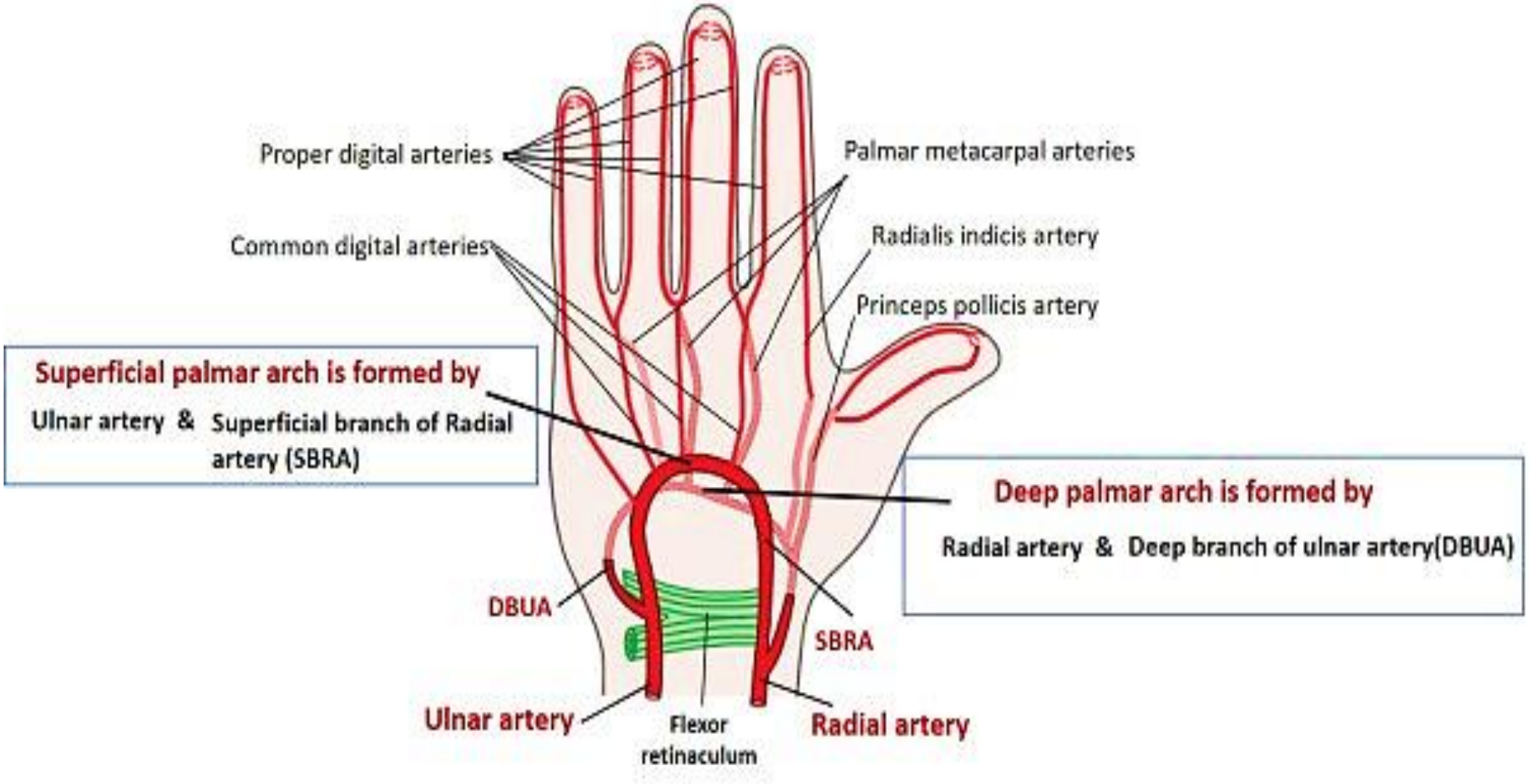
The Superficial Palmar Arch: Located just deep to the palmar aponeurosis (the thick tissue in the palm), this arch is more distal than its deep counterpart.

Formation: Mainly the terminal branch of the ulnar artery, completed by a superficial branch of the radial artery.

Branches: It gives off common palmar digital arteries, which eventually split into proper palmar digital arteries to supply the sides of the fingers.

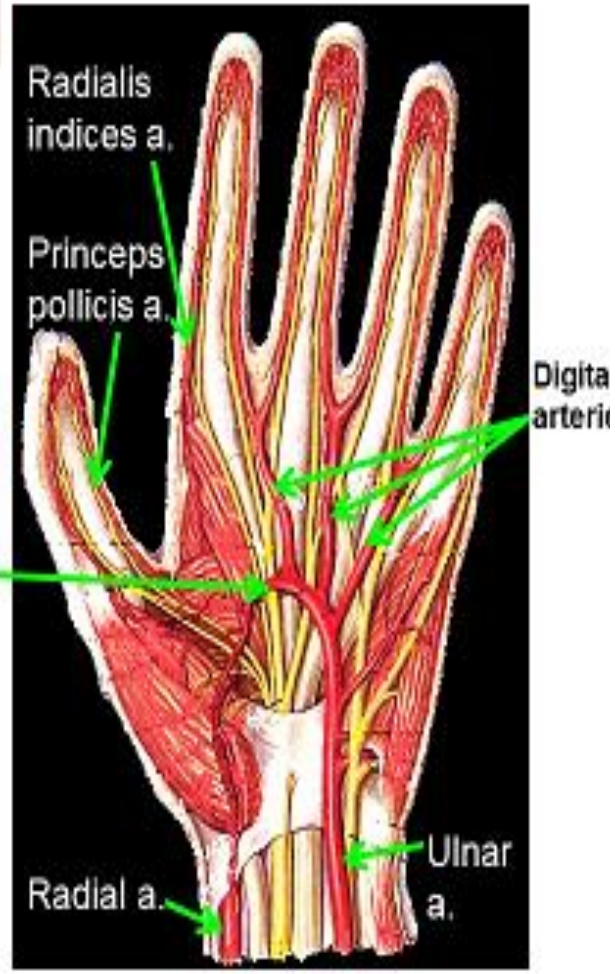
The superficial palmar arch is more distal than the deep palmar arch.

The Deep Palmar Arch: This arch lies across the bases of the metacarpal bones, deep to the flexor tendons.
Formation: Mainly the terminal part of the radial artery, completed by the deep branch of the ulnar artery.
Branches: It gives off palmar metacarpal arteries and the princeps pollicis artery (the main supply to the thumb) and the radialis indicis artery (supply to the index finger).



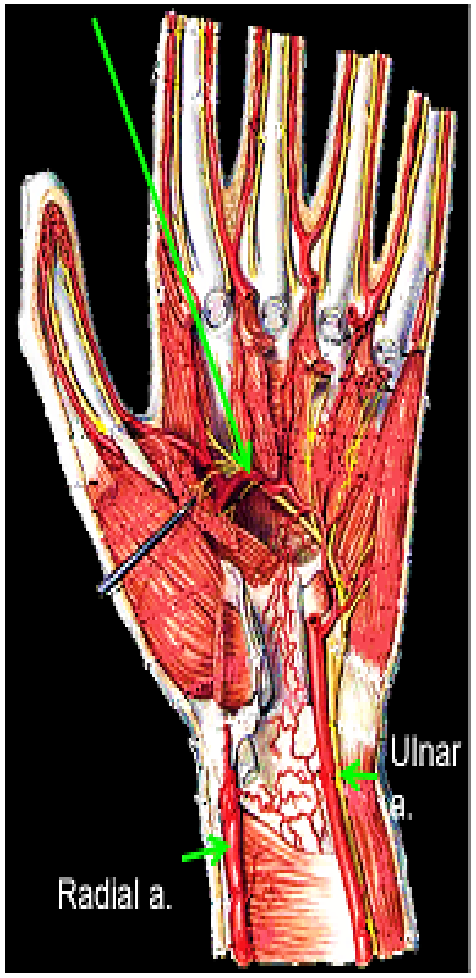
The Superficial Palmar Arch

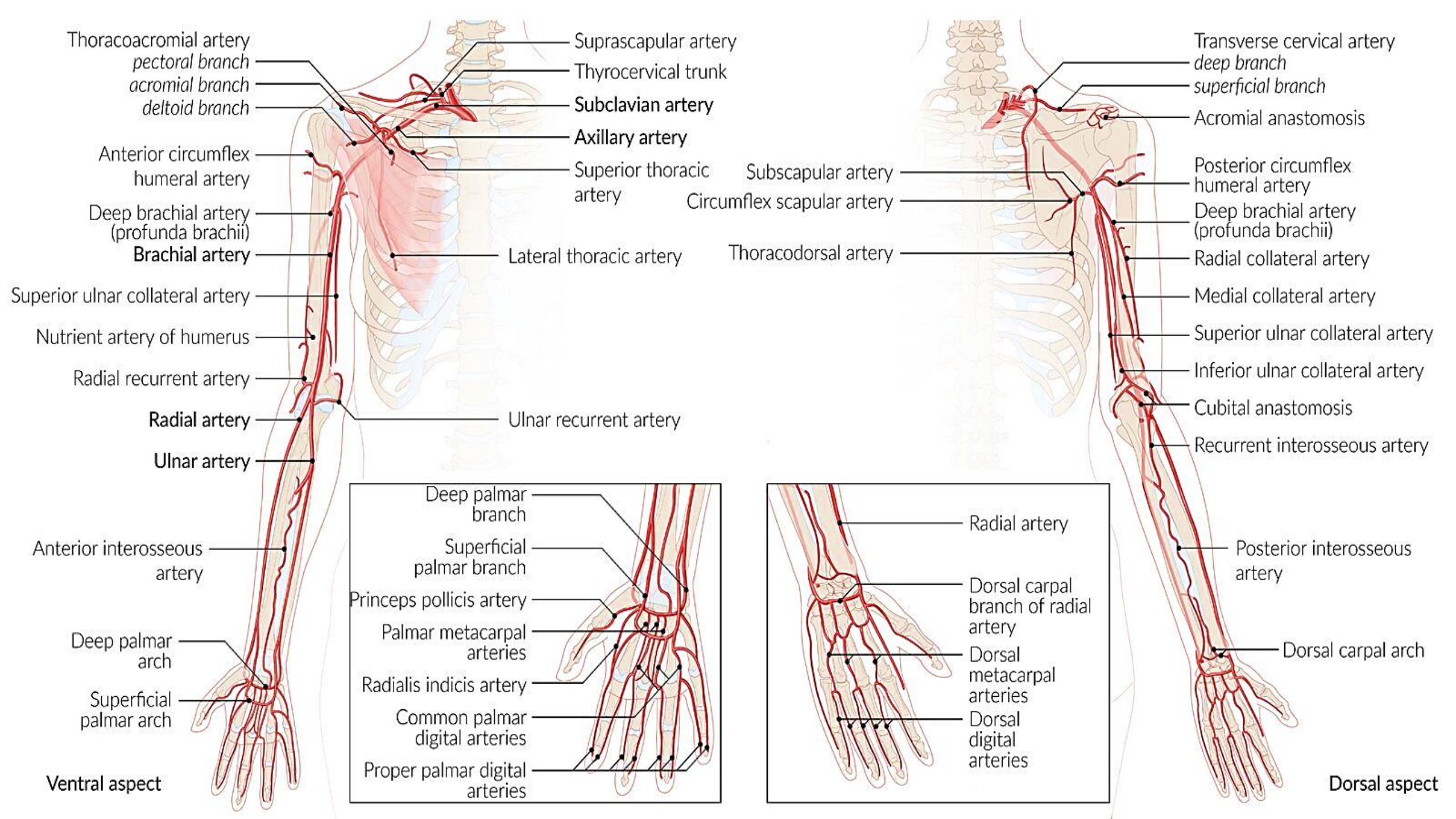
- Is the direct continuation of the ulnar artery, as it curves laterally behind the palmar aponeurosis.
- Is completed by branch from the radial artery.
- Lies approximately at the level of the distal border of the extended thumb.
- Gives: digital arteries from its convexity to supply the fingers.



The Deep Palmar Arch

- Is a continuation of the radial artery as it curves medially beneath long flexor tendons , in front of the metacarpal bones and interosseous muscles.
- Is completed on the medial side by deep branch of ulnar artery.
- Lies at a level of the proximal border of extended thumb.
- It sends branches:
  - superiorly to share in anastomosis around the wrist joint &
  - inferiorly to join branches of the superficial palmar arch.



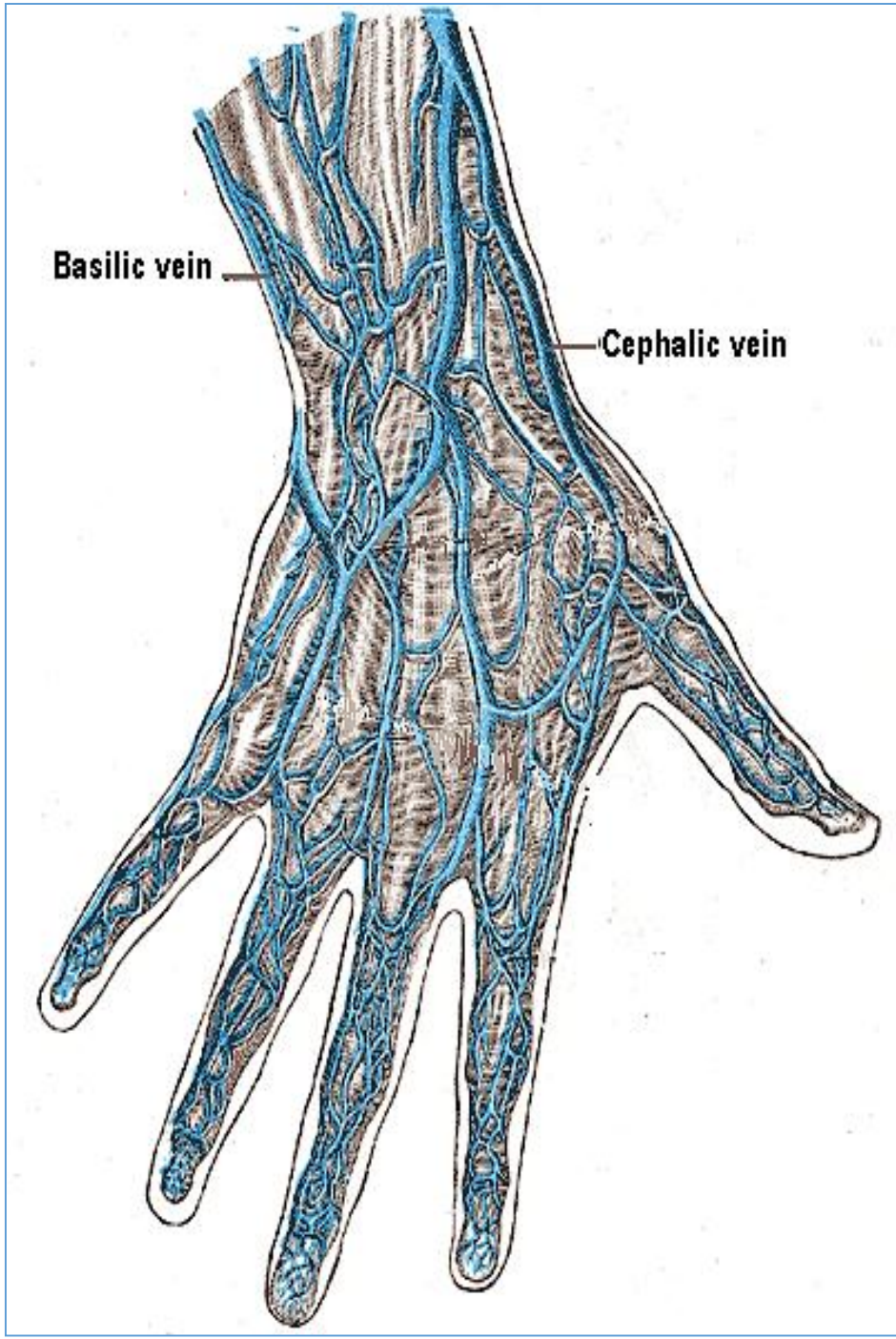

Thoracoacromial artery
pectoral branch
acromial branch
deltoid branch
Anterior circumflex humeral artery
Deep brachial artery (profunda brachii)
Brachial artery
Superior ulnar collateral artery
Nutrient artery of humerus
Radial recurrent artery
Radial artery
Ulnar artery
Anterior interosseous artery
Deep palmar arch
Superficial palmar arch
Suprascapular artery
Thyrocervical trunk
Subclavian artery
Axillary artery
Superior thoracic artery
Lateral thoracic artery
Ulnar recurrent artery
Ventral aspect
Deep palmar branch
Superficial palmar branch
Princeps pollicis artery
Palmar metacarpal arteries
Radialis indicis artery
Common palmar digital arteries
Proper palmar digital arteries
Transverse cervical artery
deep branch
superficial branch
Acromial anastomosis
Subscapular artery
Circumflex scapular artery
Thoracodorsal artery
Posterior circumflex humeral artery
Deep brachial artery (profunda brachii)
Radial collateral artery
Medial collateral artery
Superior ulnar collateral artery
Inferior ulnar collateral artery
Cubital anastomosis
Recurrent interosseous artery
Posterior interosseous artery
Dorsal carpal arch
Dorsal aspect
Radial artery
Dorsal carpal branch of radial artery
Dorsal metacarpal arteries
Dorsal digital arteries

Veins

The veins of the upper limb can be divided into two groups: superficial and deep. The deep veins comprise the venae comitantes and the axillary vein. The venae comitantes are usually paired and accompany the large and medium-sized arteries.

Superficial Veins

The superficial veins of the upper limb lie in the superficial fascia. The superficial venous network begins with the **dorsal venous arch** in the dorsum of the hand. This arch lies proximal to the metacarpophalangeal joints. The greater part of the blood from the whole hand drains into the arch, which receives digital veins and freely communicates with the deep veins of the palm through the interosseous spaces. The dorsal venous arch drains into the **cephalic and basilic veins** at its lateral and medial ends, respectively.



Cephalic Vein

The cephalic vein arises from the lateral side of the dorsal venous arch on the back of the hand and winds around the lateral border of the forearm. It then ascends into the cubital fossa and up the front of the arm in the superficial fascia on the lateral side of the biceps. It dives into the deltopectoral triangle, pierces the clavipectoral fascia, and terminates by draining into the **axillary vein**. As the cephalic vein passes up the upper limb, it receives a variable number of tributaries from the lateral and posterior surfaces of the limb. The **median cubital vein**, a branch of the cephalic vein in the cubital fossa, runs upward and medially and joins the **basilic vein**. The median cubital vein is normally present, but the form in which it connects the cephalic and basilic veins is subject to variation. In the cubital fossa, the median cubital vein crosses over the brachial artery and the median nerve, but it is separated from them by the bicipital aponeurosis.

Basilic Vein

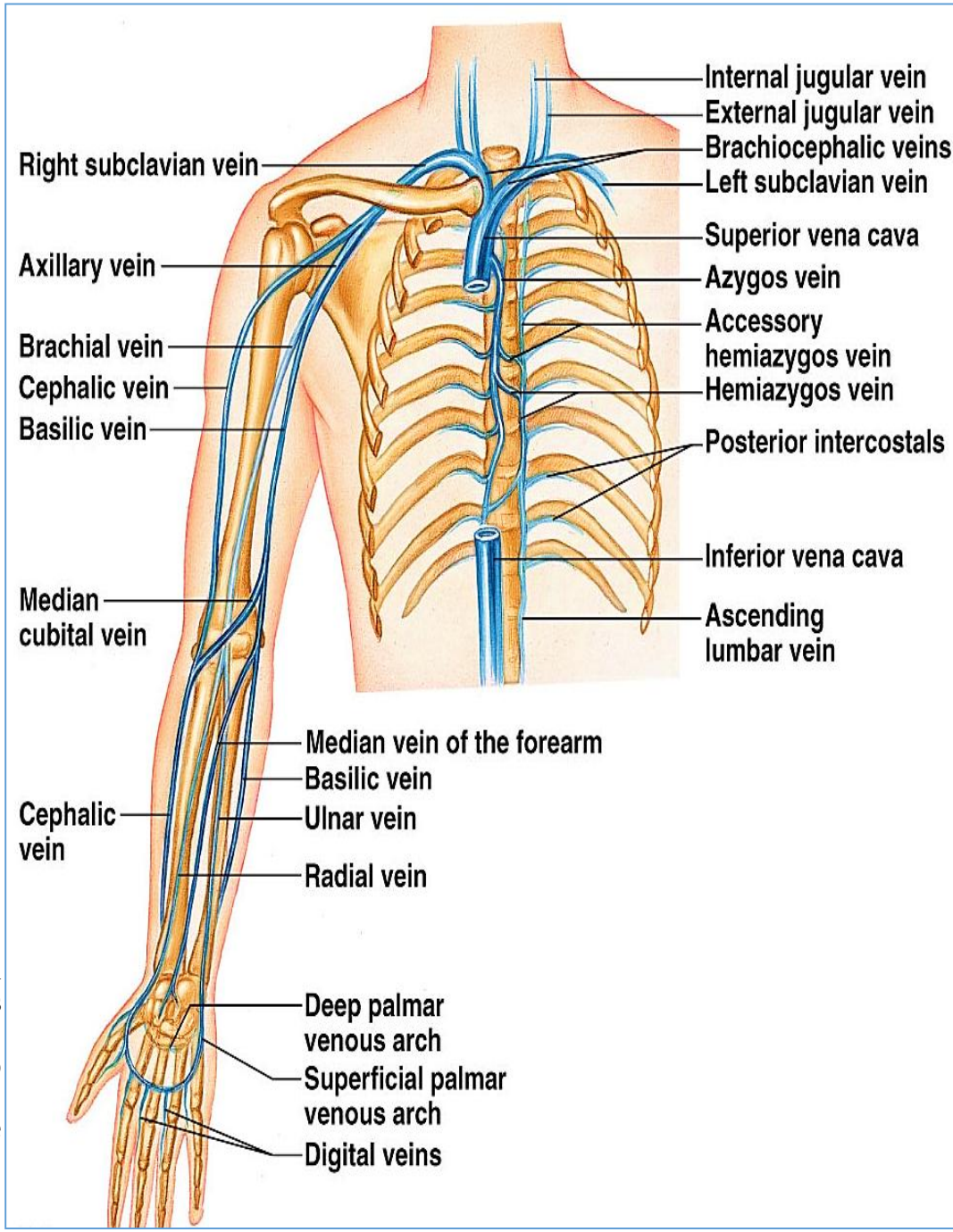
The basilic vein arises from the medial side of the dorsal venous arch on the back of the hand and winds around the medial border of the forearm. It then ascends into the cubital fossa and up the front of the arm in the superficial fascia on the medial side of the biceps. Halfway up the arm, it pierces the deep fascia and at the lower border of the teres major joins the venae comitantes of the brachial artery to form the axillary vein on the medial side of the biceps.

Axillary Vein

The axillary vein is formed at the lower border of the teres major muscle by the union of the venae comitantes of the brachial artery and the basilic vein. It runs upward on the medial side of the axillary artery and ends at the lateral border of the first rib by becoming the subclavian vein. The axillary vein receives tributaries, which correspond to the branches of the axillary artery and the cephalic vein.

Nerve Supply of Veins

Like the arteries, the smooth muscle in the wall of the veins is innervated by sympathetic postganglionic nerve fibers that provide vasomotor tone. The origin of these fibers is similar to those of the arteries.



The Venae Comitantes (The "Accompanying Veins")

The term **venae comitantes** (Latin for "accompanying veins") describes a specific arrangement where two or more small veins wrap around a single artery. In the arm, the deep veins—specifically the **radial**, **ulnar**, and **brachial** veins—exist as these pairs.

- **The "Heat Exchange" Benefit:** Because they are tightly bound to the artery, they use the warmth of the arterial blood to heat the cooler blood returning from the extremities (counter-current heat exchange).
- **The "Pump" Benefit:** As the artery pulsates with every heartbeat, it physically squeezes the surrounding venae comitantes, helping "pump" venous blood back toward the heart against gravity.

LYMPH

The lymph vessels in the upper limb ultimately drain into an extensive network of axillary lymph nodes.

Axillary Lymph Nodes

The axillary lymph nodes (20 to 30 in number) collect lymph from a large territory. These nodes drain lymph vessels from the lateral quadrants of the breast, the superficial lymph vessels from the thoracoabdominal walls above the level of the umbilicus, the skin of the back above the level of the iliac crests, and the vessels from the upper limb. The lymph nodes are arranged in six groups:

Anterior (pectoral) group: Lying along the lower border of the pectoralis minor, deep to the pectoralis major, these nodes receive lymph vessels from the lateral quadrants of the breast and superficial vessels from the anterolateral abdominal wall above the level of the umbilicus.

Posterior (subscapular) group: Lying in front of the subscapularis muscle, these nodes receive superficial lymph vessels from the back, down as far as the level of the iliac crests.

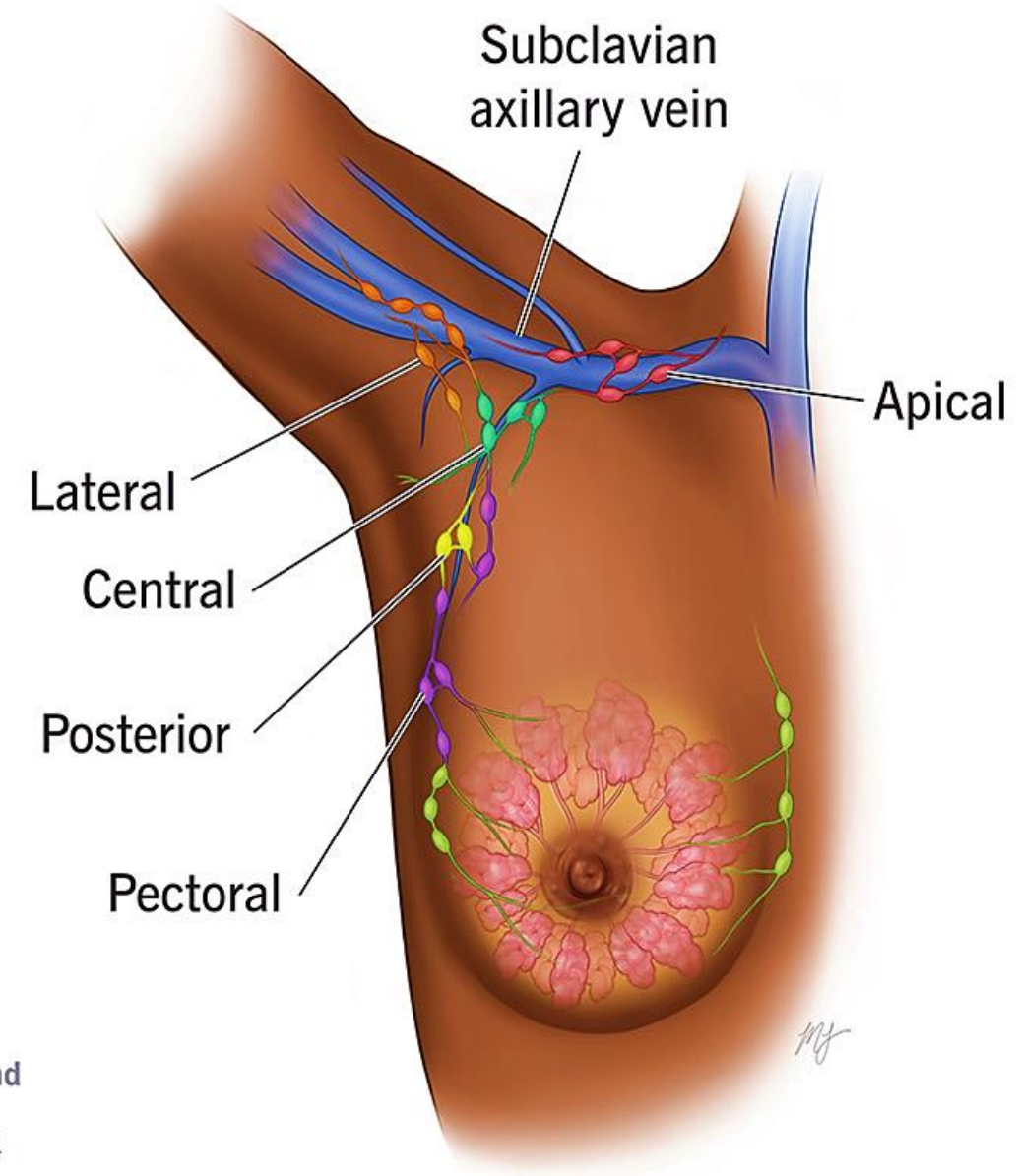
Lateral group: Lying along the medial side of the axillary vein, these nodes receive most of the lymph vessels of the upper limb (except those superficial vessels draining the lateral side, (see infraclavicular nodes, below).

Central group: Lying in the center of the axilla, in the axillary fat deep to the pectoralis minor, these nodes receive lymph from the above three groups.

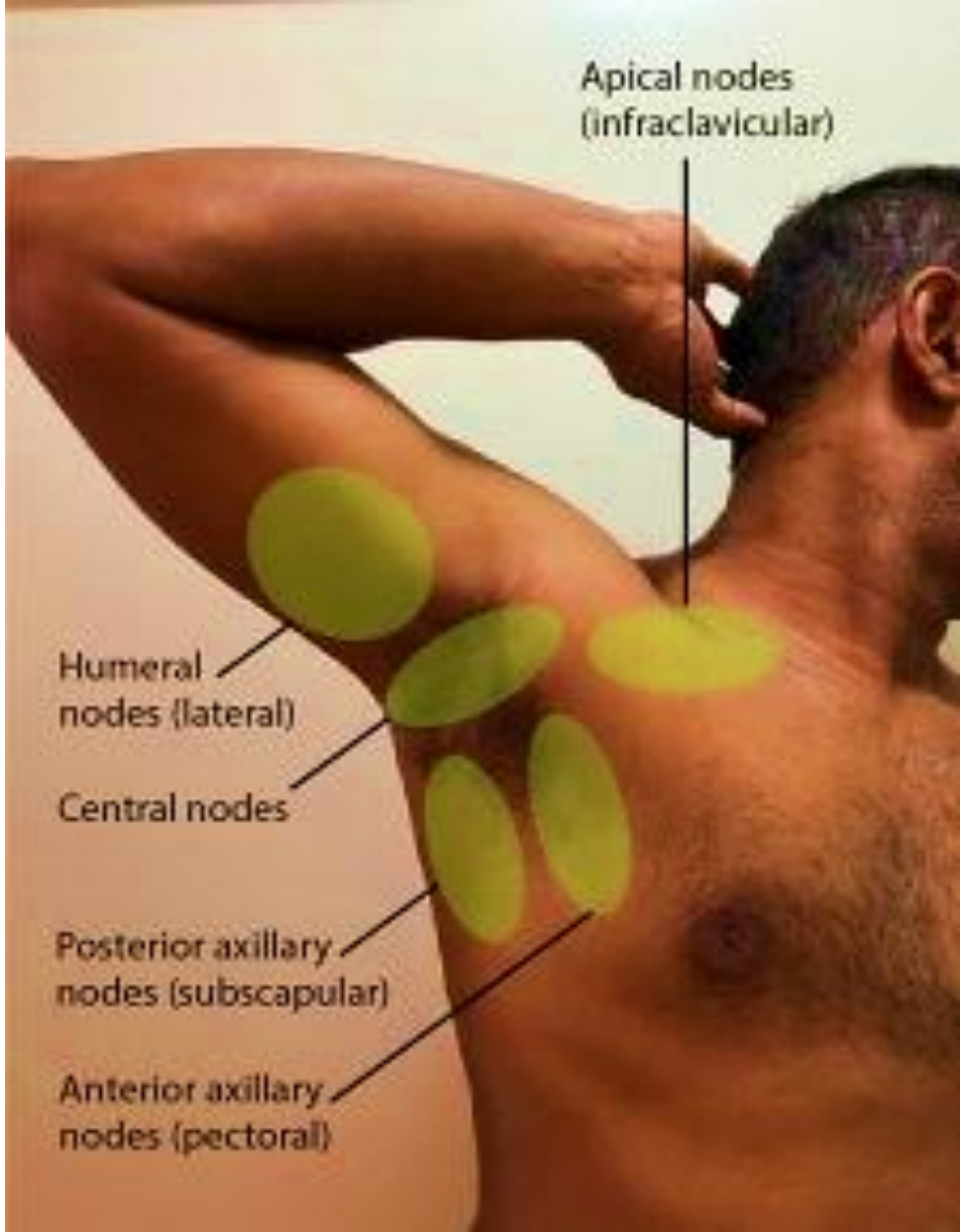
Infraclavicular (deltopectoral) group: These nodes are not strictly axillary nodes because they are located outside the axilla. They lie in the deltopectoral groove between the deltoid and pectoralis major muscles
and receive superficial lymph vessels from the lateral side of the hand, forearm, and arm.

Apical group: Lying at the apex of the axilla at the lateral border of the first rib, these nodes receive the efferent lymph vessels from all the other axillary nodes.

Axillary lymph nodes

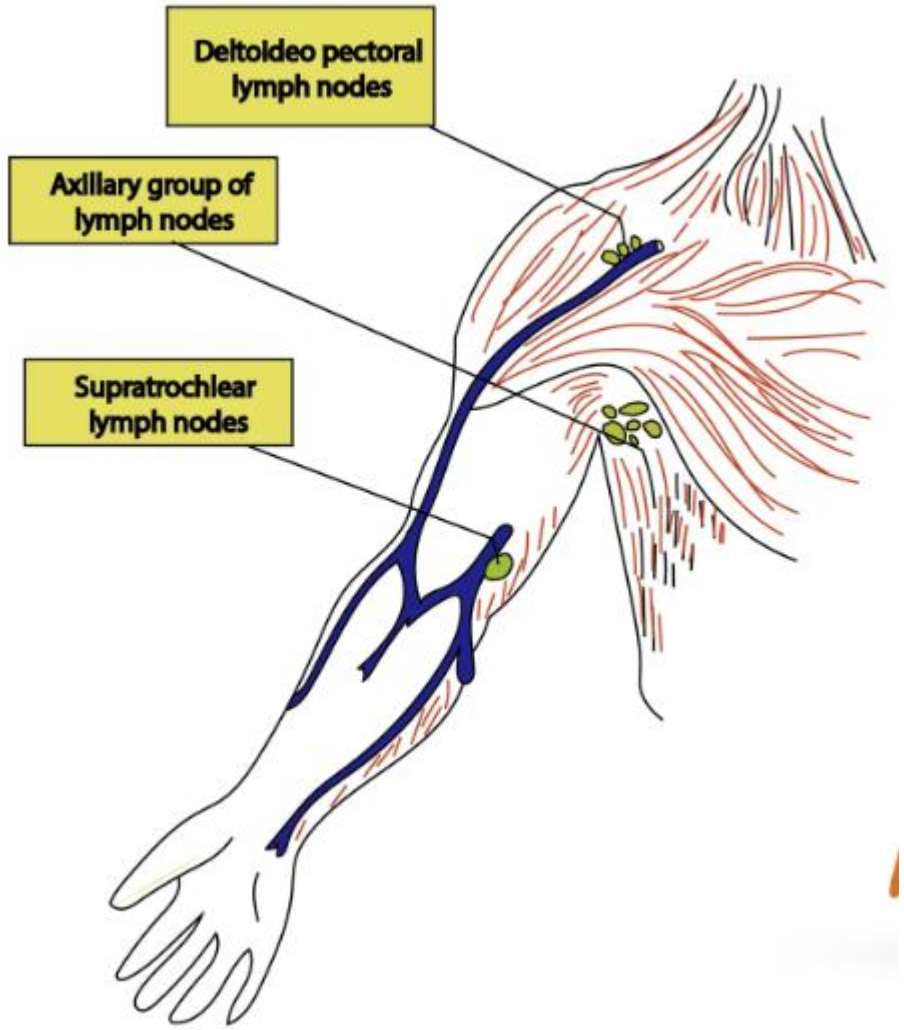


Cleveland Clinic



Supratrochlear lymph node:

The superficial vessels from the medial fingers and the medial areas of the hand and forearm follow the basilic vein to the cubital fossa. Here, some of the vessels drain into the supratrochlear lymph node, whereas others bypass the node and accompany the basilic vein to the axilla, where they drain into the lateral group of axillary nodes. The supratrochlear lymph node lies in the superficial fascia over the upper part of the cubital fossa, above the trochlea. The efferent vessels from the supratrochlear node also drain into the lateral axillary nodes.



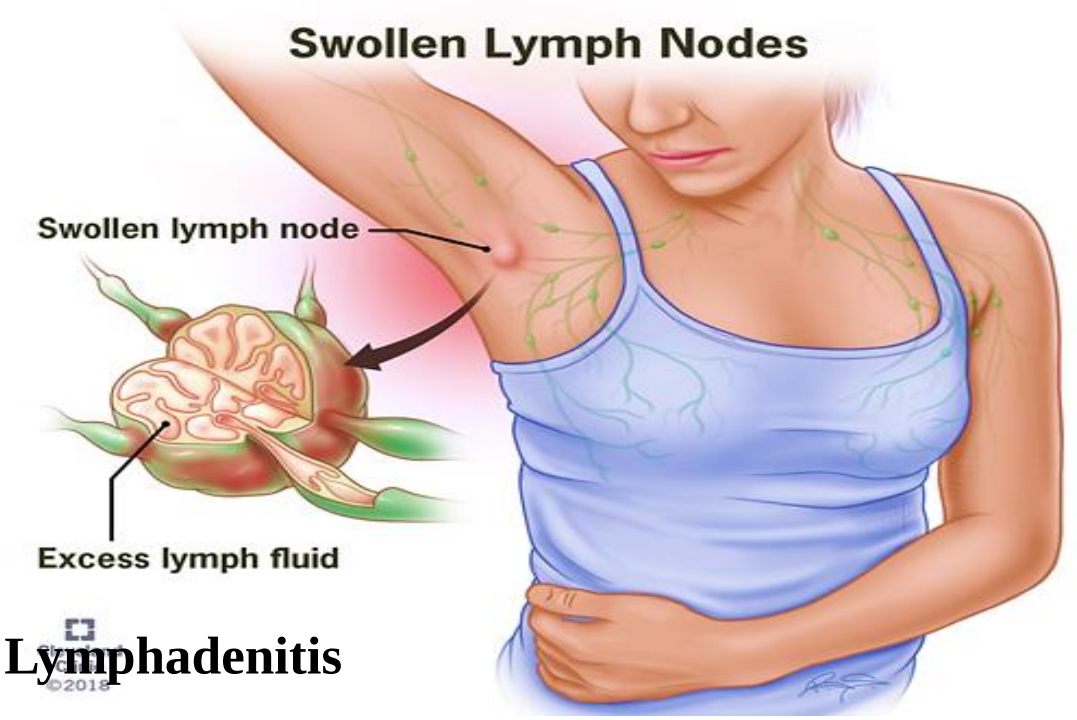
Clinical Notes

Lymphangitis

Infection of the lymph vessels (lymphangitis) of the arm is common. Red streaks along the course of the lymph vessels are characteristic of the condition. The lymph vessels from the thumb and index finger and the lateral part of the hand follow the cephalic vein to the infraclavicular group of axillary nodes; those from the middle, ring, and little fingers and from the medial part of the hand follow the basilic vein to the supratrochlear node, which lies in the superficial fascia just above the medial epicondyle of the humerus and thence to the lateral group of axillary nodes.

Lymphadenitis

Once the infection reaches the lymph nodes, they become enlarged and tender, a condition known as lymphadenitisMost of the lymph vessels from the fingers and palm pass to the dorsum of the hand before passing up into the forearm. This explains the frequency of inflammatory edema, or even abscess formation, which may occur on the dorsum of the hand after infection of the fingers or palm.



Lymphadenitis

THANK YOU!