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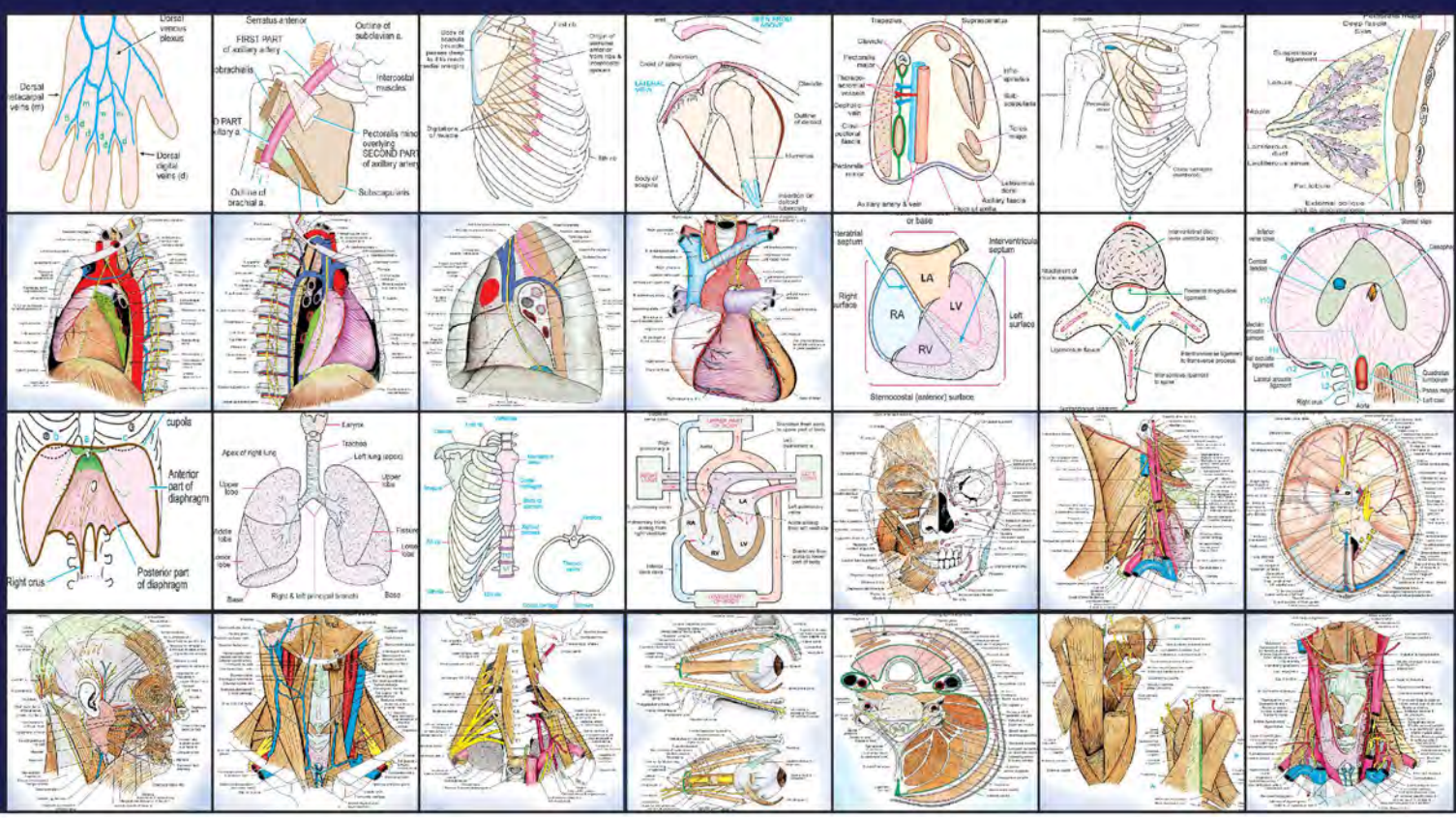
Inderbir Singh's Textbook of

ANATOMY

for AYUSH Students

(Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homeopathic Students)

Upper Extremity • Lower Extremity • Thorax • Abdomen and Pelvis
Head and Neck • Central Nervous System


Dorsal venous plexus
Dorsal digital veins (d)
Serratus anterior
FIRST PART of axillary artery
Intercostal muscles
Pectoralis minor overlying SECOND PART of axillary artery
Subscapularis
Outline of brachial a.
Outline of subclavian a.
Clavicle
Humerus
Trapezius
Supraspinatus
Deltoid
Teres major
Latissimus dorsi
Axillary fascia
Deep fascia
Biceps
Brachialis
Triceps
Brachioradialis
Extensor carpi radialis longus
Extensor carpi radialis brevis
Extensor digitorum
Extensor carpi ulnaris
Anconeus
Flexor carpi radialis
Palmaris longus
Flexor carpi ulnaris
Flexor digitorum superficialis
Abductor pollicis longus
Extensor pollicis brevis
Extensor pollicis longus
Extensor indicis
Abductor pollicis brevis
Flexor pollicis brevis
Opponens pollicis
Adductor pollicis
Flexor digitorum profundus
Flexor pollicis longus
Pronator quadratus
Extensor retinaculum
Abductor digiti minimi
Flexor digiti minimi brevis
Opponens digiti minimi
Lumbricals
Interossei
Flexor retinaculum
Abductor hallucis
Flexor hallucis brevis
Adductor hallucis
Flexor digitorum brevis
Quadratus plantae
Flexor digiti minimi brevis
Abductor digiti minimi
Tendon of flexor hallucis longus
Tendon of flexor digitorum longus
Tendon of tibialis posterior
Tendon of flexor digitorum brevis
Tendon of flexor hallucis brevis
Tendon of abductor hallucis
Tendon of flexor digitorum profundus
Tendon of flexor hallucis longus
Tendon of tibialis anterior
Tendon of extensor digitorum longus
Tendon of extensor hallucis longus
Tendon of extensor digitorum brevis
Tendon of extensor hallucis brevis
Tendon of peroneus longus
Tendon of peroneus brevis
Tendon of peroneus tertius

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3 CHAPTER

Pectoral Region, Axilla and Breast

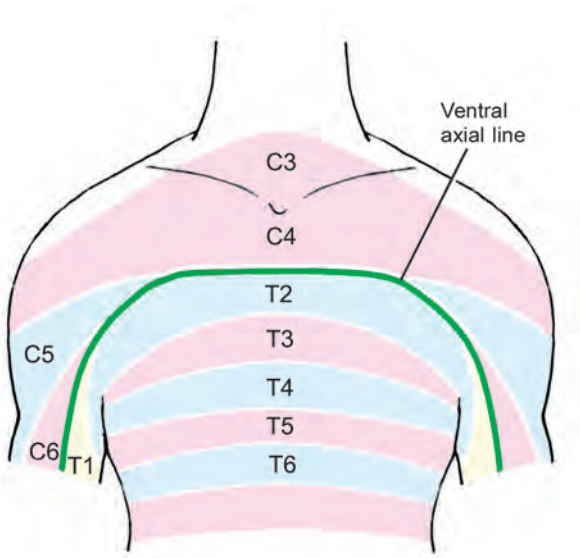
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THE PECTORAL REGION

The pectoral region lies on the front of the thorax. In the mature female the breasts lie over this region.

Spinal Segments and Dermatomes

1. Areas of skin supplied by individual spinal nerves are called ***dermatomes***.
2. As a rule, the arrangement of dermatomes is simple over the trunk, as successive horizontal strips of skin are supplied by each spinal nerve of the region (i.e., thoracic and lumbar nerves) (3.1).
3. However, the arrangement is unusual over the pectoral region.
   a. The skin of the upper part of the pectoral region is supplied by spinal segments C3 and C4 (upto the level of the sternal angle).
   b. The area just below the level of the sternal angle is supplied by segment T2.
   c. The explanation for this is to be found in the development of the upper limb.
      i. The limb has developed from the region of the trunk supplied by segments C5 to T1.
      ii. As the limb grows the areas of skin supplied from these segments get 'pulled away' into the limb leaving the area for segment C4 in direct continuity with that for segment T2.
4. Normally, the areas of skin supplied by adjoining spinal segments overlap. However, there is no overlap between the areas supplied by C4 and T2 for the reason explained above.



3.1: Dermatomes on the front of the thorax

CUTANEOUS NERVES OF THE PECTORAL REGION

Supraclavicular Nerves

1. The supraclavicular nerves (C3, 4) arise in the neck from the cervical plexus (as one ramus).
2. The origin lies deep to the sternocleidomastoid muscle. The nerve trunk runs downwards and backwards deep to this muscle and appears at its posterior border.
3. Here the trunk divides into three branches called the medial, intermediate and lateral supraclavicular nerves.
4. These branches descend over the posterior triangle of the neck giving some branches to the skin here.

5. They pierce the deep fascia a little above the clavicle and then run downwards across this bone to reach the pectoral region.
   a. The ***medial supraclavicular nerve*** supplies the skin of the upper and medial part of the thorax. A branch from the nerve supplies the sternoclavicular joint.
   b. The ***intermediate supraclavicular nerve*** supplies the skin over the upper part of the pectoralis major. The area of supply of the medial and intermediate supraclavicular nerves extends up to the level of the second rib.
   c. The ***lateral supraclavicular nerve*** supplies the skin over the shoulder.

Cutaneous Branches of Intercostal Nerves

1. Skin below the level of the sternal angle is supplied by ***anterior cutaneous branches*** of the 2nd to 6th intercostal nerves.
2. More laterally it is supplied by ***lateral cutaneous branches*** of the 3rd to 6th intercostal nerves.

MUSCLES OF THE PECTORAL REGION

The muscles belonging to the pectoral region proper are:

1. Pectoralis major (3.2 and 3.3)
2. Pectoralis minor (3.4 and 3.5)
3. Subclavius (3.4 and 3.6).

We also see two other muscles parts of which are seen in the region and are described here. These are:

1. Platysma
2. Serratus anterior (3.7 and 3.8).

The pectoralis major is described in 3.2 and shown in 3.3. The pectoralis minor is shown in 3.4 and described in 3.5. The subclavius is shown in 3.4 and described in 3.6.



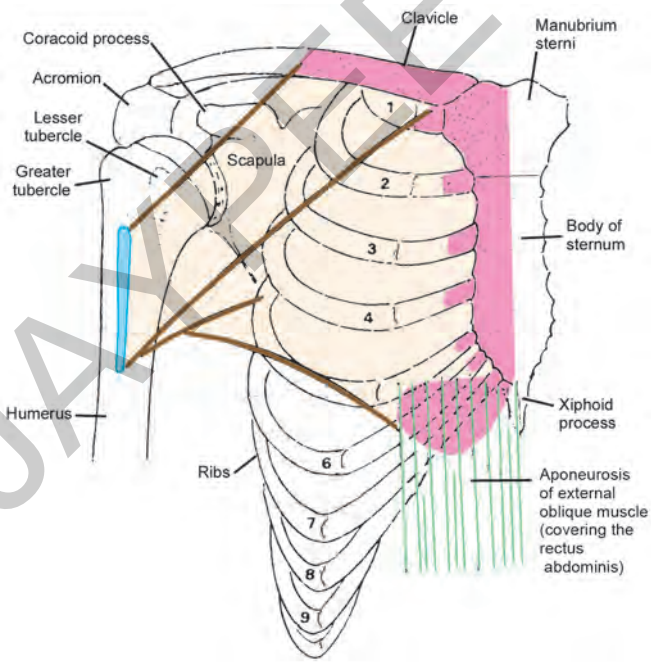
WANT TO KNOW MORE?

Clavipectoral fascia

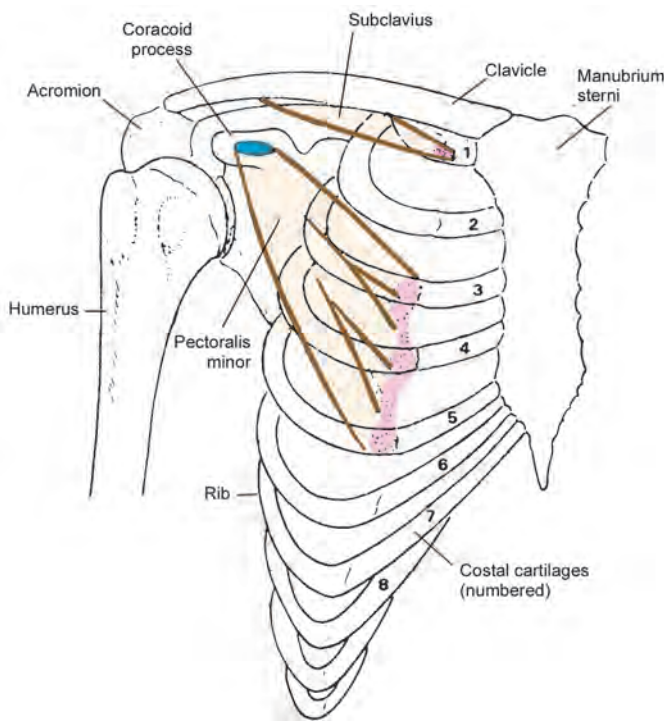
1. As its name implies the fascia fills the gap between the clavicle (above) and the medial edge of the pectoralis minor (below). Along with the latter it forms a partition that separates the upper part of the pectoralis major from the contents of the axilla.
2. Near its upper end the fascia splits to enclose the subclavius.
3. At the medial edge of the pectoralis minor it splits to enclose the pectoralis minor.
4. At the lower (lateral) edge of the pectoralis minor the fascia becomes continuous with the axillary fascia (forming the dome-shaped floor of the axilla). It helps to keep the axillary fascia raised up into the hollow of the axilla.
5. When traced medially, the fascia reaches the first and second ribs and the upper two intercostal spaces. Traced laterally, it reaches the coracoid process.
6. Between the coracoid process and the first rib it forms a thickened band called the ***costocoracoid ligament.***
7. The clavipectoral fascia is pierced by:
   a. The thoracoacromial artery and vein, the cephalic vein.
   b. The lateral pectoral nerve.
   c. Some lymphatics of the breast and pectoral region passing to the apical lymph nodes of the axilla also pass through it.

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3.2: Pectoralis major	
Origin	1. Clavicle: Medial half of anterior surface 2. Sternum: Anterior surface 3. Upper seven costal cartilages (medial parts) 4. Aponeurosis of external oblique muscle
Insertion	Lateral lip of intertubercular sulcus. The tendon of insertion is bilaminar. The anterior lamina receives the clavicular fibres and upper sternocostal fibres. The posterior lamina receives the lower fibres
Nerve supply	Lateral and medial pectoral nerves (C5, 6, 7, 8, T1)
Action	1. Adductor and medial rotator of arm 2. Flexion of the arm (clavicular fibres with anterior fibres of deltoid) 3. Extension of flexed arm (against resistance) (with latissimus dorsi) 4. When the arm is raised above the head and fixed, the muscle can raise the thorax (as in climbing) (helped by latissimus dorsi) 5. Helps in forced inspiration (arm has to be fixed)
Notes	1. Forms anterior fold of axilla 2. Mammary gland lies in front of it 3. The muscle is in front of the pectoralis minor, the clavipectoral fascia, and upper parts of biceps brachii, the coracobrachialis and serratus anterior



3.3: The pectoralis major



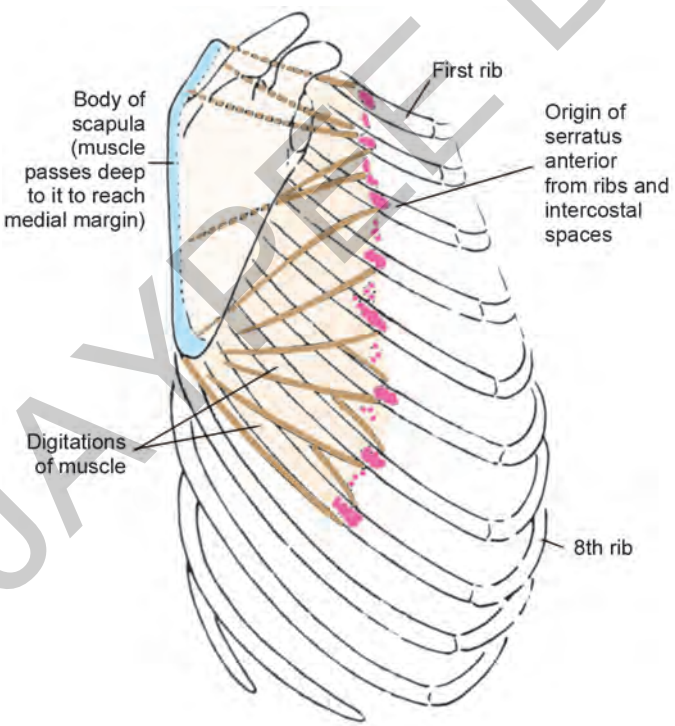
3.4: Attachments of the pectoralis minor and of the subclavius

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3.5: Pectoralis minor	
Origin	1. 3rd, 4th and 5th ribs (near junction with costal cartilages) 2. Fascia covering intercostal spaces
Insertion	Coracoid process of scapula. (medial border and upper surface)
Nerve supply	Lateral and medial pectoral nerves (C6, 7, 8)
Action	1. Forward movement of scapula (along with serratus anterior) 2. Backward rotation of scapula (along with levator scapulae and rhomboids) 3. Helps in forced respiration (if the scapula is fixed by the person tightly holding a horizontal bar)
Notes	1. It separates the pectoralis major from the contents of the axilla 2. It lies in front of the axilary artery and is used to divide the artery into first, second and third parts 3. It is attached to the clavicle by the clavipectoral fascia

3.6: Subclavius	
Origin	Clavicle: into groove on middle-third of inferior surface
Insertion	Clavicle: into groove on middle-third of inferior surface
Nerve supply	Nerve to subclavius (C5, 6) arising from Erb's point (on upper trunk of brachial plexus)
Action	1. Depression of clavicle 2. Keeps medial end of clavicle pressed against articular disc of sternoclavicular joint, and smoothens movements

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3.7: Scheme to show the attachments of the serratus anterior

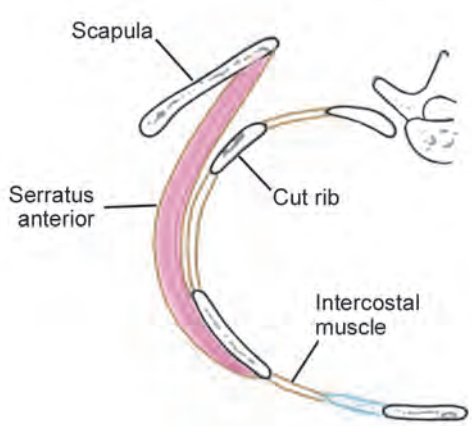


Fig. 3.8: Schematic diagram to show the relationship of the serratus anterior to the thoracic wall and to the scapula

Platysma

1. This muscle lies in superficial fascia.
2. The platysma arises from the deep fascia over the upper part of the pectoralis major and the anterior part of the deltoid.
3. The fibres form a broad sheet that passes upwards and forwards across the clavicle to enter the neck.
   a. It passes upwards and forwards to reach the lower border of the mandible.
   b. Here it merges with superficial muscle in the lower part of the face.

The ***serratus anterior*** is shown in 3.7 and is described in 3.9.

3.9: Serratus anterior

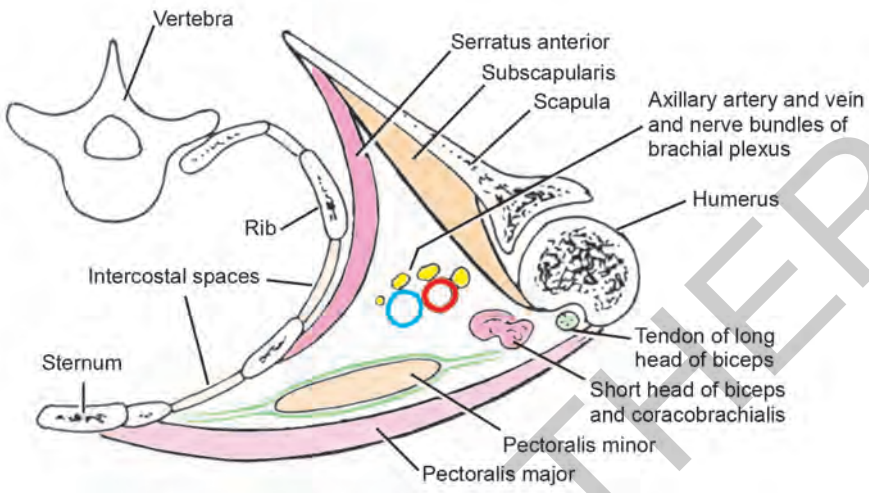
Origin	Upper eight or nine ribs (outer surfaces)
Insertion	Costal surface of scapula (along medial border)
Nerve supply	Long thoracic nerve (branch from roots C5, 6, 7 of brachial plexus).
Action	1. Pulls scapula forwards around chest wall (with pectoralis minor). As a result the upper limb moves forwards as in giving a blow. 2. Forward rotation of scapula (with trapezius). The glenoid cavity is turned upwards and leads to overhead abduction of the arm.
Clinical Notes	The muscle is tested by making the patient place his palms against a wall and pushing against it. If the muscle is paralysed the medial margin of the scapula is lifted off from the ribs. This is called winging of the scapula. Overhead abduction of the arm is not possible.

THE AXILLA

The axilla is the region of the armpit. Its boundaries are as follows (3.10):

1. The ***anterior wall*** is formed by the pectoralis major, the pectoralis minor and the clavipectoral fascia. The ***anterior fold*** of the axillla is formed mainly by the pectoralis major.
2. The ***posterior wall*** is formed by muscles lying in front of the scapula.
   a. In the upper part there is the subscapularis.
   b. Lower down there are the teres major and the latissimus dorsi.
   c. Note that the latissimus dorsi winds round the lower margin of the teres major, the two together form the thick ***posterior fold*** of the axilla.
3. The ***medial wall*** is formed by the upper few ribs and intercostal spaces. They are covered by the upper part of the serratus anterior.
4. The ***lateral wall*** is formed by the humerus in the region of the intertubercular sulcus.
5. If we cut a coronal section through the axilla we see that it is conical.
   a. The ***base*** of the cone faces downwards and corresponds to the floor of the axilla.
   b. The ***floor*** is formed by axillary fascia, covered by skin. The axillary fascia has an aperture through which the axillary tail of the breast enters the axilla.
   c. The ***apex*** of the axilla faces upwards and somewhat medially and lies at the level of the outer border of the first rib.
      i. Behind the apex there is the upper border of the scapula, and in front of it there is the clavicle.
      ii. These three structures form the boundaries of an opening through which the axillary vessels and the brachial plexus pass from the neck into the axilla.
      iii. The opening is, therefore, called the ***cervicoaxillary canal***.
6. The ***contents of the axilla*** are the axillary artery and vein, and the axillary lymph nodes. The remaining space is filled with fat. We will consider these contents one by one.

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3.10: Transverse section through the axilla to show its walls

THE AXILLARY ARTERY

1. The axillary artery is a continuation of the subclavian artery.
2. It begins at the outer border of the first rib and ends at the lower border of the teres major (by becoming the brachial artery).
3. The artery is crossed by the pectoralis minor. This divides it into first, second and third parts.

The artery has numerous relationships that are given below.

Relationship to Muscles

(See 3.11 and 3.12)

1. The first part of the artery rests (posteriorly) on the muscles of the first intercostal space and the upper part of the serratus anterior.
2. The second part and the upper portion of the third part of the artery lie on the subscapularis muscle. The lower portion of the third part lies on the teres major muscle and the tendon of the latissimus dorsi.
3. The entire artery (except its lowermost part) is overlapped by the pectoralis major.
4. The second part is also covered by the pectoralis minor.
5. The first part is also covered by the clavipectoral fascia (which extends from the pectoralis minor to the clavicle).
6. The coracobrachialis is lateral to the second and third parts of the artery.
7. In addition to muscles the artery is covered superficially by superficial and deep fascia and by skin. Part of the platysma is present in the superficial fascia.

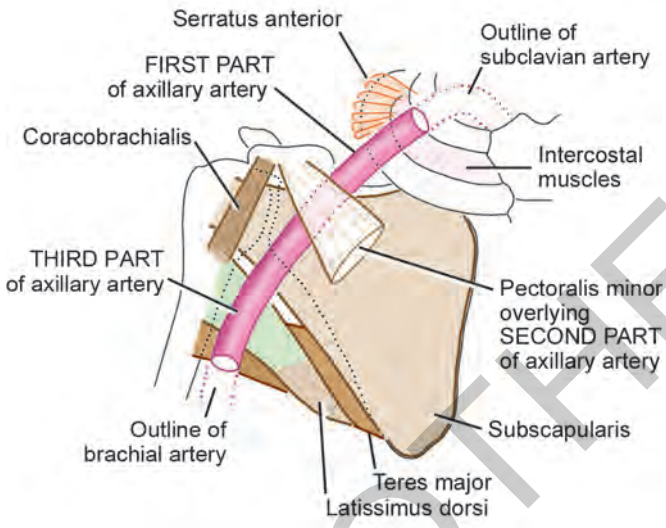
Relationship to Veins

1. The axillary artery is accompanied by the axillary vein: the vein lies anteromedial to the artery (3.15).
2. The first part of the artery is crossed by two tributaries of the axillary vein, namely the cephalic vein and the thoracoacromial vein.

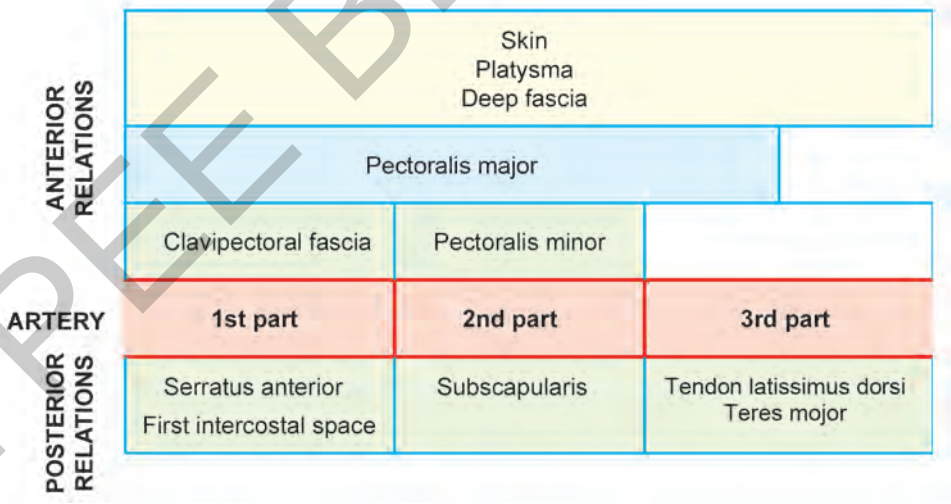
Relationship to Brachial Plexus

1. The first and second parts of the artery are related to the cords of the plexus; and the third part of the artery to their branches (3.13).
2. The first part of the artery is also related to the lateral pectoral nerve that crosses anterior to the artery; and to the medial pectoral nerve that lies behind it. A loop passing in front of the artery joins the two nerves.

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3.11: Muscles related to the axillary artery



3.12: Anterior and posterior relations of the axillary artery

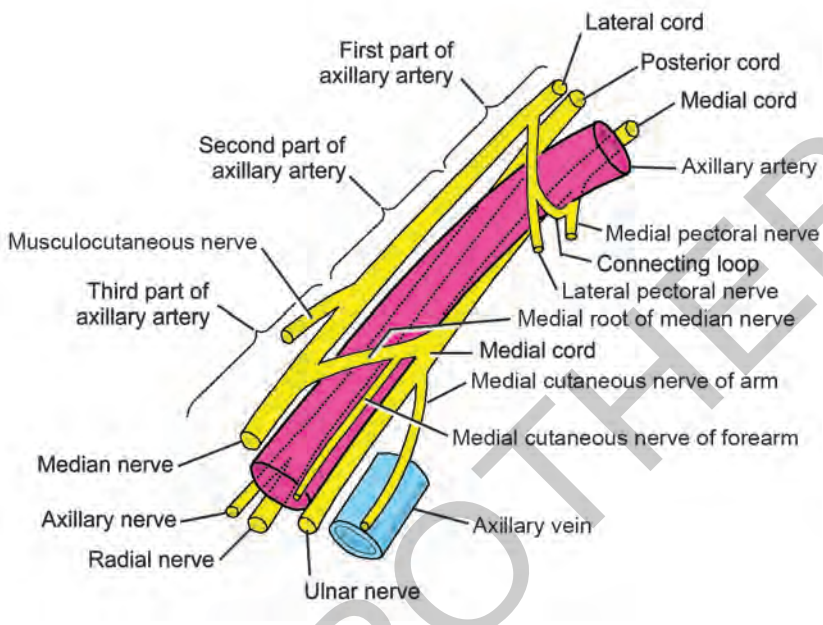
3. The third part of the artery is crossed anteriorly by the medial root of the median nerve as the latter passes laterally to join the lateral root.

Branches of the Axillary Artery

Branch of First Part

1. Superior thoracic artery

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3.13: Relations of axillary artery to cords and branches of the brachial plexus

Branches of Second Part

2. Thoracoacromial artery
3. Lateral thoracic artery

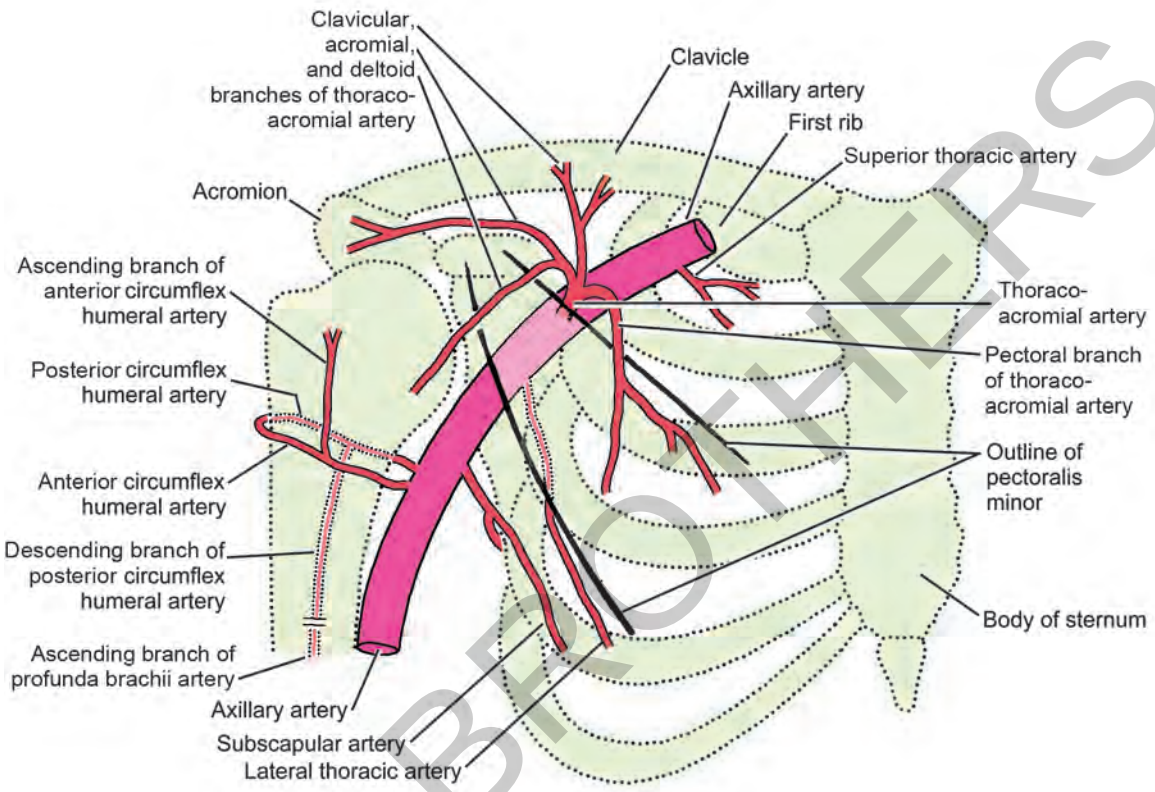
Branches of Third Part

4. Subscapular artery
5. Anterior circumflex humeral artery
6. Posterior circumflex humeral artery.

These are described below.

1. The ***superior thoracic artery*** arises from the first part of the axillary artery. It supplies the pectoral muscles and part of the thoracic wall (3.14).
2. The ***thoracoacromial artery*** arises from the second part of the axillary artery deep to the medial margin of the pectoralis minor. It runs upwards and becomes superficial by piercing the clavipectoral fascia. It divides into four branches: pectoral, acromial, clavicular and deltoid.
   a. The ***pectoral branch*** descends between the pectoral muscles, supplying them and the chest wall.
   b. The ***acromial branch*** passes laterally. It first lies deep to the deltoid muscle and then pierces it to reach the acromion where it anastomoses with various other arteries.
   c. The ***clavicular branch*** runs upwards to supply the subclavius and the sternoclavicular joint.
   d. The ***deltoid branch*** runs laterally in the groove between the deltoid and the pectoralis major.
3. The ***lateral thoracic artery*** runs downwards near the lateral margin of the pectoralis minor supplying pectoral muscles, the serratus anterior and the axillary lymph nodes. In the female it gives off prominent branches to the breast.
4. The ***subscapular artery*** runs downwards along the lateral border of the scapula supplying muscles in the region and anastomosing with various other arteries. In its lower part it is accompanied by the nerve to the latissimus dorsi.
   a. The artery gives off a large ***circumflex scapular*** branch.

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3.14: Branches of the axillary artery

b. This branch winds round the lateral border of the scapula passing backwards through the triangular space.
c. It gives branches to muscles on both the ventral and dorsal aspects of the scapula. It takes part in forming the anastomoses round the scapula.

5. The ***anterior circumflex humeral artery*** runs laterally in front of the surgical neck of the humerus.
   a. It anastomoses with the posterior circumflex humeral artery (see below) to form an arterial circle round the neck.
   b. It gives off a branch that ascends in the intertubercular sulcus to the shoulder joint.
   6. The ***posterior circumflex humeral artery*** runs backwards (accompanied by the axillary nerve) through the quadrangular space.
      a. It then passes laterally behind the surgical neck of the humerus to anastomose with the anterior circumflex humeral artery.
      b. It gives off a descending branch that anastomoses with a branch of the profunda brachii artery.



CLINICAL CORRELATION

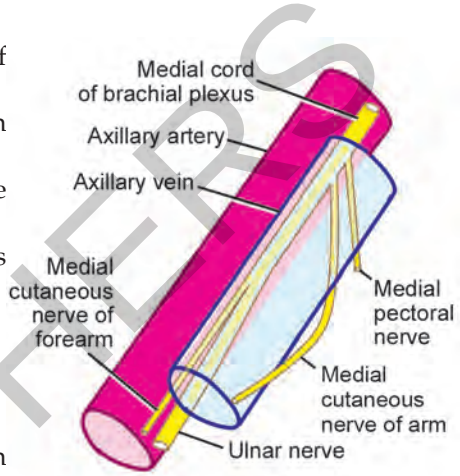
1. To stop bleeding, pressure can be applied over the axillary artery near its lower end.
   a. Pressure is applied laterally, at a level just above the lower border of the posterior fold of the axilla.
   b. The artery is compressed against the humerus.
2. The artery can also be compressed against the first rib but this is difficult.
3. The anastomoses around the scapula links the subclavian artery with the third part of the axillary artery and serves to maintain circulation in case of blockage of the axillary artery. The collateral circulation is effective in gradual obstruction, but in sudden ligation it is inadequate.

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THE AXILLARY VEIN

The axillary vein accompanies the axillary artery through the axilla.

1. It is formed at the lower border of the teres major by joining together of the venae comitantes of the brachial artery and the basilic vein.
2. It ends at the outer border of the first rib by becoming continuous with the subclavian vein.
3. The axillary vein receives the cephalic vein and veins accompanying the branches of the axillary artery.
4. The vein lies medial to the axillary artery. The following structures intervene between the artery and vein (3.15):
   a. Medial cord of the brachial plexus.
   b. Medial pectoral nerve.
   c. Ulnar nerve.
   d. Medial cutaneous nerve of the forearm.
5. The medial cutaneous nerve of the arm is medial to the axillary vein (3.15).



3.15: Some relations of the axillary vein



CLINICAL CORRELATION

1. Fracture of the clavicle may damage a vein that runs across it and connects the upper part of the cephalic vein (deltopectoral vein) with the external jugular vein (lying in the neck). In case of injury to the axillary vein (or surgical removal of a segment) this communication helps to maintain venous drainage of the upper limb.
2. Direct injury to the axillary vein is dangerous. Bleeding is profuse. There is the risk of air being sucked into the vein producing air emboli.

LYMPH NODES AND LYMPHATIC DRAINAGE

Before taking up the lymph nodes and lymphatic drainage of the upper limb it is desirable to consider certain facts about the lymphatic system in general.

1. When circulating blood reaches the capillaries, part of its fluid content passes through them into the surrounding tissue as tissue fluid.
   a. Most of this tissue fluid re-enters the capillaries at their venous ends.
   b. Some of it is, however, returned to the circulation through ***lymphatic vessels***.
2. These vessels begin as lymphatic capillaries that drain into larger lymph vessels.
   a. Along the course of these lymph vessels there are groups of ***lymph nodes***.
   b. These nodes consist predominantly of lymphoid tissue.
   c. The lymph vessels and lymphatic nodes together constitute the ***lymphatic system***.
3. Lymph vessels are difficult to see and require special techniques for their visualization. Lymph nodes are small bean-like structures that are usually present in groups.
4. The lymphatic system includes other organs consisting predominantly of lymphoid tissue.
   a. Spleen.
   b. Thymus.
   c. Bone marrow.
   d. Tonsils and other aggregations of lymphoid tissue present in relation to the alimentary tract.

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CLINICAL CORRELATION

1. Apart from the transport of fluid the lymphatic system is concerned with the following:
   a. Production of blood cells.
   b. Removal of unwanted material (including dead cells and bacteria) by phagocytosis.
   c. Immune responses against foreign proteins including bacteria.
2. Lymph nodes are not normally palpable in the living subject.
   a. However, they often become enlarged in disease (particularly by infection, or by malignancy, in the area from which they receive lymph).
   b. They then become palpable; and examination of these nodes provides valuable information regarding the presence and spread of disease.
   c. It is, therefore, of importance for the medical student to know the lymphatic drainage of different organs and regions of the body.
3. Infection in any part of the upper limb can lead to ***lymphadenitis*** or ***lymphangitis***.
4. Infection from the fingers and palm can pass to the dorsum of the hand through lymphatics and can produce oedema, or an abscess there.

LYMPH NODES OF UPPER LIMB

As the lymph nodes draining the upper limb lie mainly in the axilla it is convenient to give a complete account of the lymph nodes and lymphatic drainage of the upper limb here.

The Lymph Nodes

1. The chief lymph nodes of the upper limb are located in the axilla: these ***axillary lymph nodes*** are considered below.
2. One or two ***supratrochlear nodes*** lie just above the medial epicondyle of the humerus, along the basilic vein.
3. One or two ***infraclavicular nodes*** lie just below the clavicle, along the cephalic vein, in the groove between the pectoralis major and the clavicle.
4. Some isolated nodes are scattered along the main blood vessels of the limb.

The Axillary Lymph Nodes

These are divided into the following groups (3.17):

1. The ***lateral group*** of nodes lies along the axillary vein.
2. The ***anterior (or pectoral) group*** of nodes lies along the lateral thoracic vessels i.e., along the lower border of the pectoralis minor.
3. The ***posterior (or subscapular) group*** of nodes lies along the course of the subscapular vessels.
   Note that the lateral, anterior and posterior groups lie on the corresponding walls of the axilla.
4. The ***central group*** of nodes lies in the centre of the axilla embedded in fat.
5. The ***apical group*** is so called because it lies near the apex of the axilla.

The areas of drainage of these groups are shown in 3.16.



WANT TO KNOW MORE?

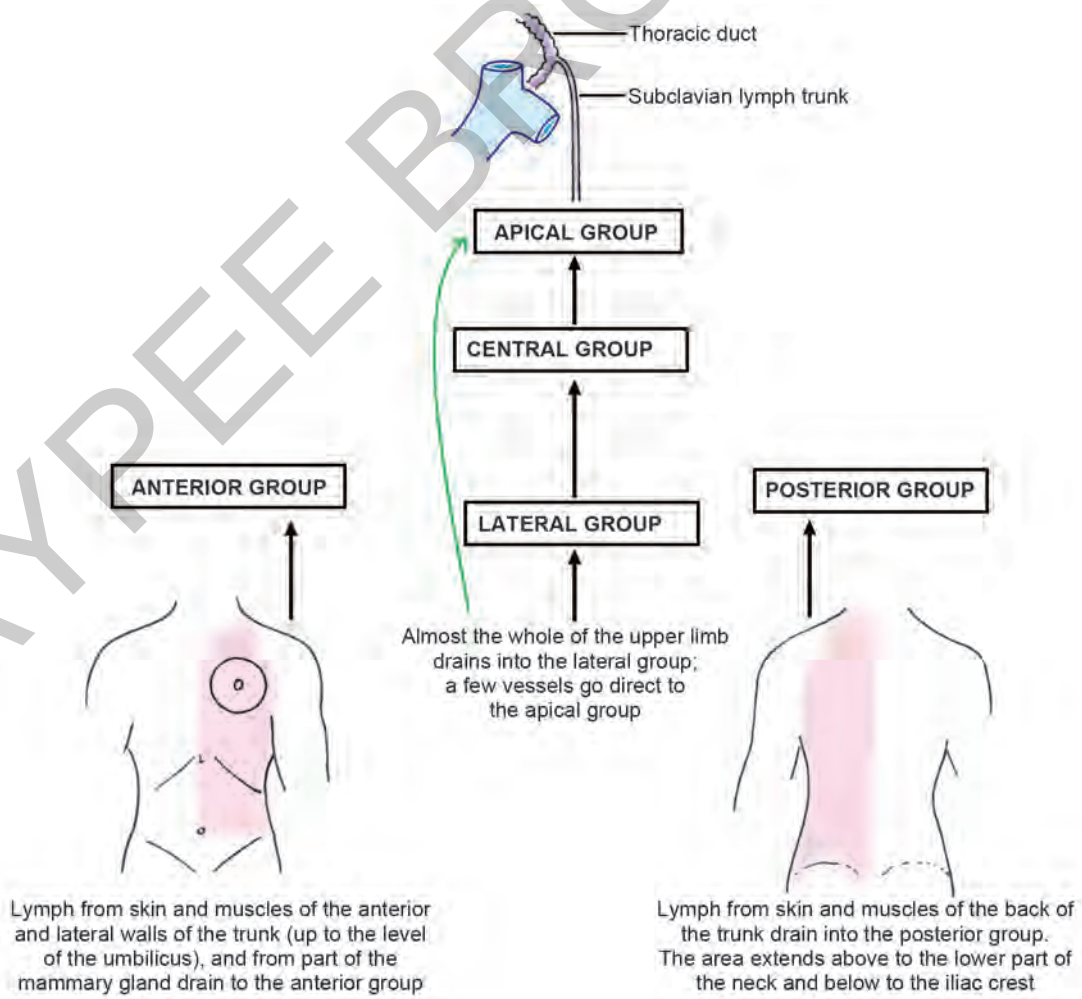
Lymphatic Drainage of The Upper Limb

Most of the lymphatic vessels of the limbs are superficial (3.18).

1. Plexuses on the palm and the dorsum of the hand give rise to vessels that ascend into the forearm on both its ventral and dorsal aspects.

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2. The vessels on the dorsal side of the forearm gradually wind round its medial and lateral borders and join the vessels in front. All these vessels that collect on the front of the forearm can be divided into medial, intermediate and lateral sets.
3. The medial vessels run along the basilic vein; the intermediate set along the median vein of the forearm; and the lateral set along the cephalic vein.
4. After crossing the elbow the vessels of the intermediate and lateral sets also turn medially to join those of the medial set. Ultimately almost all of them end in the lateral group of axillary lymph nodes.
5. Some of the lymphatic vessels running along the basilic vein end in the supratochlear nodes from which new vessels arise to take their place. Some vessels of the lateral set continue upwards along the cephalic vein and end in the infraclavicular nodes.
6. The deep vessels of the limb run along the main arteries (radial, ulnar, interosseous, brachial) and their venae comitantes. Like the superficial vessels these also end in the lateral group of axillary nodes. The lateral group of axillary nodes are, therefore, the main nodes of the upper limb.
7. Lymph from the lateral group drains into the central group of axillary nodes; and from them to the apical group (3.16).
8. The subclavian lymphatic trunk arises from the apical group and conveys the lymph to the thoracic duct (on the left side) or to the right lymphatic duct through which it reaches the bloodstream.



3.16: Scheme to show areas drained by the axillary lymph nodes

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