AXILLA
&
BRACHIAL PLEXUS

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AXILLA
(ARMPIT)

Gateway to the upper limb

An area of transition between the neck and the arm.
Pyramidal space inferior to shoulder @ junction of arm & thorax

**Distribution center** for the neurovascular structures that serve the upper limb.

*Protected by the adducted upper limb.*
BLOOD COMES ARTERIES
BLOOD GOES VEINS
MUSCLES, VESSELS, SWEAT GLANDS INNERVATED NERVES
Axilla is formed by:

- Clavicle
- Scapula
- Upper thoracic wall
- Humerus & related muscles
Axilla is an irregularly shaped pyramidal space with:
- Four walls
- An inlet (apex)
- A floor (base)
Axillary inlet (Apex)

Cervico-axillary canal

passageway between neck and axilla

bounded by:
1st rib
Clavicle
Superior edge of the scapula

The arteries, veins, lymphatics, and nerves traverse this superior opening of the axilla to pass to or from the arm.
At the axillary inlet,

**Axillary vein- axillary artery--trunks of brachial plexus**
Anterior wall

- lateral part of the **pectoralis major muscle**,  
- underlying **pectoralis minor & subclavius muscles**,  
- **clavipectoral fascia**
Medial wall

Formed by the thoracic wall (1st-4th ribs and intercostal muscles) & the overlying **serratus anterior**.

The only major structure that passes directly through the medial wall and into the axilla: **intercostobrachial nerve**

*Lateral cutaneous branch of the second intercostal nerve (anterior ramus of T2)*
Lateral wall

- A narrow bony wall formed by
- Intertubercular groove in the humerus
Posterior wall

Bone framework is formed by the costal surface of the scapula.

Formed by scapula & subscapularis on anterior surface teres major & latissimus dorsi, inferiorly
Gateways in the posterior wall
From this distribution center, neurovascular structures pass

- **Superiorly** via cervico-axillary canal to (or from) the root of the neck.

- **Anteriorly** via clavipectoral triangle to pectoral region.

- **Inferiorly & laterally** into limb itself.
From this distribution center, neurovascular structures pass

- **Posteriorly via quadrangular space** to scapular region

- **Inferiorly & medially** along the thoracic wall to the inferiorly placed axioappendicular muscles (serratus anterior and latissimus dorsi).
Quadrangular space
Passageway for nerves & vessels passing between the axilla and the more posterior scapular and deltoid regions.
Quadrangular space

Viewed from anteriorly, boundaries formed by:

▲ Superior: inferior margin of the subscapularis muscle
▲ Lateral: surgical neck of the humerus
▲ Inferior: superior margin of the teres major muscle
▲ Medial: lateral margin of the long head of triceps brachii
Quadrangular space

Structures passing through:

- **Axillary nerve**
- **Posterior circumflex humeral artery & vein**
Triangular space
Area of communication between axilla and posterior scapular region
Triangular space  [Medial triangular space]

Viewed from anteriorly, formed by:

- medial margin of the **long head of the triceps brachii**
- superior margin of the **teres major muscle**
- inferior margin of the **subscapularis muscle**
Triangular space

Structures passing through:

**Circumflex scapular artery & vein**
Triangular interval  [Lateral triangular space]
formed by:
- lateral margin of the \textbf{long head of the triceps brachii}
- shaft of the humerus
- inferior margin of the \textbf{teres major muscle}
Triangular interval

Structures passing through

**Radial nerve** & **profunda brachii artery** (deep artery of arm) & **associated veins**
Floor (Base)

Formed by the
- Concave skin
- Subcutaneous tissue
- Axillary (deep) fascia

Bounded by the anterior and posterior axillary folds, the thoracic wall, and the medial aspect of the arm.

*The base is supported by the clavipectoral fascia.*
Anterior wall
- pectoralis major and minor muscles
- subclavius muscle
- clavicular fascia

Lateral wall
- intertubercular sulcus

Medial wall
- upper thoracic wall
- serratus anterior muscle

Posterior wall
- subscapularis, teres major and latissimus dorsi muscles, and long head of triceps brachii muscle

Floor
- skin of armpit
- open laterally into arm

Axillary sheath surrounding arteries, veins, nerves, and lymphatics

Apex of inlet

Inlet

Axilla

Skin on floor of axilla

Skin of arm
Contents of the axilla

- Axillary artery and its branches
- Axillary vein and its tributaries
- Lymph vessels and lymph nodes
- Brachial plexus

These structures are embedded in fat.
Proximally, the neurovascular structures are ensheathed in a sleeve-like extension of the cervical fascia, **axillary sheath**.
The space also contains the proximal parts of two muscles of the arm; **biceps brachii** & **coracobrachialis muscles** and axillary process of the breast.
Axillary artery
Supplies the walls of the axilla & related regions.

**Before:** Subclavian artery
**After:** Brachial artery

From **lateral border of 1st rib**
to

Inferior border of **teres major**
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.

If this sheath is traced upward into the root of the neck, it is seen to be continuous with the prevertebral fascia.
Separated into 3 parts by the pectoralis minor muscle:

**1st part**
proximal to pectoralis minor
medial part of pectoralis minor & lateral part of first rib

**2nd part**
posterior to pectoralis minor

**3rd part**
distal to pectoralis minor
from lateral part of pectoralis minor to inferior border of teres major
6 branches of axillary artery

1 branch (1st part)
**superior thoracic artery**

2 branches (2nd part)
**thoraco-acromial artery & lateral thoracic artery**

3 branches (3nd part)
**subscapular artery, anterior circumflex humeral artery, posterior circumflex humeral artery**
Branches of the lateral thoracic artery contribute to the vascular supply of the breast.
Subscapular artery, largest branch of the axillary artery, terminates by dividing into: **circumflex scapular & thoracodorsal arteries**.

The anterior circumflex humeral artery anastomoses with the posterior circumflex humeral artery. Along with these two arteries, the circumflex scapular artery and throcadorsal artery participate in the anastomoses around the scapula.
Axillary vein

**Before:** Basilic vein  **After:** Subclavian vein

From inferior border of teres major to lateral border of 1st rib
Tributaries of the axillary vein generally follow the branches of the axillary artery.

Other tributaries include brachial veins & cephalic vein.
Lymphatics in the axilla

Drainage from
- Upper limb
- An extensive area on the adjacent trunk
  Regions of the upper back & shoulder, lower neck, chest, upper anterolateral abdominal wall
- Drainage from ~ 75% of the mammary gland.
The 20-30 axillary nodes are divided into 5 groups - on the basis of location.

The groups are arranged in a manner that reflects the pyramidal shape of the axilla.

**Humeral (lateral) nodes**
**Pectoral (anterior) nodes**
**Subscapular (posterior) nodes**

**Central nodes**

**Apical nodes**
Efferent vessels from the apical group traverse the cervico-axillary canal.
Efferent vessels from the apical group converge to form the **subclavian lymphatic trunk**, which usually joins the venous system at the junction between **right subclavian vein** & **right internal jugular vein** in the neck.
In some cases, the superolateral region of breast may pass around the margin of pectoral muscle and enters the axilla.

This axillary process rarely reaches as high as the apex of the axilla.
In metastatic cancer of the apical group, the nodes often adhere to the **axillary vein**, which may necessitate excision of part of this vessel.

Enlargement of the apical nodes may obstruct the cephalic vein superior to the pectoralis minor.
The examination of the axillary lymph nodes always forms part of the clinical examination of the breast.

With the patient standing or sitting, he or she is asked to place the hand of the side to be examined on the hip and push hard medially. This action of adduction of the shoulder joint causes the pectoralis major muscle to contract maximally so that it becomes hard like a board. The examiner then palpates the axillary nodes.
a somatic nerve plexus - upper limb
formed by intercommunications among ventral rami of
lower 4 cervical nerves (C5 - C8) & T1
responsible for motor innervation to all of muscles of upper limb
exception trapezius.
supplies all of the cutaneous innervation of the upper limb

- area of the axilla (armpit) (intercostobrachial nerve)
- an area just above the point of shoulder (supraclavicular nerves)
- dorsal scapular area (cutaneous branches of dorsal rami)

communicates with the sympathetic nervous system.
The nerves entering the upper limb provide the following important functions:

- **Sensory innervation to skin & deep structures (e.g. joints)**
- **Motor innervation to the muscles**
- **Influence over the diameters of the blood vessels by the sympathetic vasomotor nerves**
- **Sympathetic secretomotor supply to the sweat glands.**
At the root of the neck, the nerves form the Brachial plexus.

Nerve fibers derived from different segments of the spinal cord are arranged and distributed efficiently in various parts of the upper limb.
begins in the neck and extends into the axilla.

Almost all branches of the brachial plexus arise in the axilla (after the plexus has crossed the 1st rib).

"Randy Travis Drinks Cold Beer"
Roots, Trunks, Divisions, Cords

Branches
- Alternatively:
"Read The Damn Cadaver Book!"
- Alternatively:
"Real Texans Drink Coors Beer".
Originates in the neck, passes laterally and inferiorly over rib I, and enters the axilla.
The parts of the brachial plexus, from medial to lateral, are roots, trunks, divisions, and cords.

All major nerves that innervate the upper limb originate from the brachial plexus, mostly from the cords.
main branches | cords | divisions | trunks | roots | anterior rami
--- | --- | --- | --- | --- | ---
C5 | 6 | 7 | 8 | T1

lateral | upper | middle | lower | medial

axilla | posterior triangle of neck
Red: Anterior division
Blue: Posterior division

"Randy Travis Drinks Cold Beer"

Roots
Trunks
Divisions
Cords

Branches
· Alternatively: "Read The Damn Cadaver Book!"
· Alternatively: "Real Texans Drink Coors Beer"
Proximal posterior to the subclavian artery in the neck

More distal regions surround the axillary artery

The roots of the plexus usually pass through the gap between anterior & middle scalene muscles.
ROOTS

Anterior rami of C5 to C8, and most of T1.

The roots & trunks enter the the neck by passing between the anterior scalene and middle scalene muscles.

Close to their origin, the roots receive gray rami communicantes from the sympathetic trunk. These carry postganglionic sympathetic fibers onto the roots for distribution to the periphery.
In the inferior part of the neck, the roots of the brachial plexus unite to form three trunks:

- **Superior trunk** formed by union of C5 & C6 roots
- **Middle trunk** a continuation of C7 root
- **Inferior trunk** formed by the union of C8 & T1 roots

The inferior trunk lies on rib I posterior to the subclavian artery; the middle and superior trunks are more superior in position.
Each trunk divides into: **anterior & posterior divisions** as the plexus passes through the cervicoaxillary canal posterior to the clavicle.

**Anterior divisions of the trunks** supply **anterior (flexor) compartments** of the upper limb. **Posterior divisions of the trunks** supply **posterior (extensor) compartments**.

No peripheral nerves originate directly from the divisions of the brachial plexus.
The three cords of the brachial plexus originate from the divisions and are related to the second part of the axillary artery.
Lateral cord
Union of anterior divisions of upper & middle trunks (C5-C7)

Medial cord
Continuation of anterior division of inferior trunk (C8-T1)

Posterior cord
Union of all three posterior divisions (C5 to T1)
Branches of the roots

**Dorsal scapular nerve**  (C5 root of the brachial plexus) innervates **rhomboid major and minor muscles**

**Long thoracic nerve**  (anterior rami of C5 to C7) innervates **serratus anterior muscle**
Branches of the trunks
The only branches from the trunks of the brachial plexus are 2 nerves; originate from the superior trunk.

**Suprascapular nerve** (C5 & C6) innervates **supraspinatus & infraspinatus muscles**

**The nerve to subclavius muscle** (C5 & C6) innervates **subclavius muscle**
Branches of the lateral cord

Lateral pectoral nerve pectoralis major muscle

Lateral pectoral
Origin: Lateral cord
Spinal segments: C5 to C7

Function: motor
Pectoralis major
Branches of the lateral cord
Musculocutaneous nerve

Coracobrachialis
Biceps brachii
Brachialis
All 3 flexor muscles @ anterior compartment of the arm
Terminates as lateral cutaneous nerve of forearm.
Branches of the lateral cord

Lateral root of median nerve

- Largest terminal branch of the lateral cord
- Passes medially to join a similar branch from the medial cord to form the **median nerve**.

1. Lateral cord
2. Posterior cord
3. Medial cord
4. Lateral root of median nerve
5. Medial root of median nerve
6. Radial nerve
7. Ulnar nerve
8. Median nerve
Branches of the medial cord

1) **Medial pectoral nerve**
   pectoralis major & minor

2) **Medial cutaneous nerve of arm**
   (*medial brachial cutaneous nerve*)
   medial 1/3 of distal arm

3) **Medial cutaneous nerve of forearm**
   (*medial antebrachial cutaneous nerve*)
   medial surface of the forearm down to the wrist

4) **Ulnar nerve**

5) **Median nerve**
Musculocutaneous nerve, lateral root of the median nerve, median nerve, medial root of the median nerve, ulnar nerve form an **M** over the **third part of the axillary artery**.

This feature, together with penetration of the coracobrachialis muscle by the musculocutaneous nerve, can be used to identify components of the brachial plexus in the axilla.
Branches of the posterior cord

1) Superior subscapular nerve subscapularis muscle

2) Thoracodorsal nerve latissimus dorsi

3) Inferior subscapular nerve subscapularis & teres major

4) Axillary nerve deltoid and teres minor

5) Radial nerve

All these nerves except the radial nerve innervate muscles associated with the posterior wall of the axilla; the radial nerve passes into the arm and forearm.