

# SURGI- TOONS SURGICAL ANATOMY

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Mind-Mapped & Designed by:

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With Special  
Focus on  
Applied  
Anatomy!





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**first edition 2014  
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# ACKNOWLEDGMENT

I'd like to thank my Team  
who have worked to let this  
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# INDEX

## SURGICAL ANATOMY

Head and Neck: 8

Throat: 20

Abdomen: 28

Upper Limb: 52

Lower Limb: 68

Lymphatics: 74





# SURGI-TOONS

## HEAD & NECK



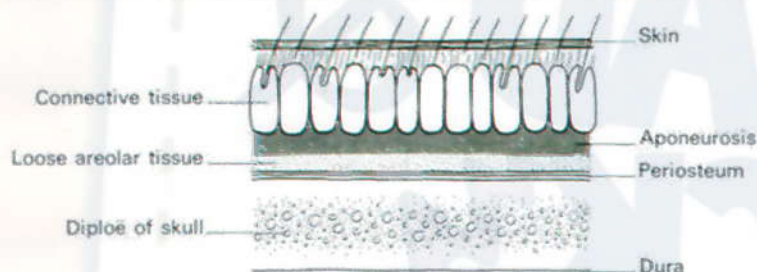
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# THE SCALP

## APPLIED ANATOMY

### LAYERS

SKIN	Rich in hair follicles & sebaceous glands
CONNECTIVE TISSUE	Blood vessels are located primarily in this layer
APONEUROSIS	Flat membrane
LOOSE AREOLAR CONNECTIVE TISSUE	Allows free mobility of the 1st 3 layers on the underlying periosteum
PERIOSTEUM	Loosely attached to the bones, but firmly attached to suture lines



### SURGICAL FLAPS OF SCALP DURING CRANIOTOMY

Comprise the superficial 3 layers. They are turned downwards & not upwards  
:: Nerves & vessels enter the scalp from periphery::

### VERY RICH BLOOD SUPPLY

- Wounds Bleed profusely.
- Wounds heal well; minimal debridement is required & wound infection is uncommon

### CONNECTIVE TISSUE

- When injecting local anesthetic, the tip of the needle should be inserted in this layer
- NO subcutaneous fat in scalp → no lipoma

### EXTENTION

- ✓ ANTERIORLY → Eye brows
- ✓ LATERALLY → Zygomatic arch
- ✓ POSTERIORLY → Superior nuchal line

### MUSCLES

- ✓ OCCIPITALIS: Attached to the skull (At superior nuchal line)
- ✓ FRONTALIS: Not attached to the skull

### THE PERIOSTEUM

Adheres to the suture lines of the skull; collections of pus or blood beneath this layer, therefore, outline the affected bone. This is particularly well seen in birth injuries involving the skull (cephalohaematoma)

### BLOOD & SENSORY NERVE SUPPLY

	SENSORY INNERVATION	ARTERIAL BLOOD SUPPLY
IN FRONT OF AURICLE	By trigeminal (5th) nerve 1. Supra-trochlear n. 2. Supra-orbital n. 3. Zygomatico-temporal n. 4. Auriculo-temporal n.	Branches of ophthalmic artery of the I.C.A: 1. Supra-trochlear artery. 2. Supra-orbital artery. Branches of E.C.A: 1. Superficial temporal artery.
BEHIND THE AURICLE	By cervical plexus 1. Great auricular n. 2. Lesser occipital n. 3. Greater occipital n. 4. 3rd occipital n.	Branches of E.C.A: Posterior auricular artery. Occipital artery.

### EMISSARY VEINS

Don't have valves and open in the loose areolar tissue; therefore, infection can be transmitted from the scalp to the cranial cavity. The layer of loose areolar tissue is known as the dangerous area of the scalp

### VENOUS DRAINAGE

- Supratrochlear vein
- Supraorbital vein
- Superficial temporal vein
- Maxillary vein
- Occipital vein

### LYMPHATIC DRAINAGE

- ✓ To the superficial circle of LNs around lower part of skull → deep LNs around carotid sheath

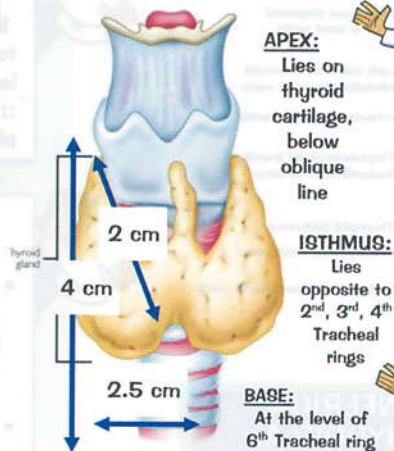


# THYROID GLAND

## APPLIED ANATOMY

### SITE & SHAPE

- Situated in the Lower part of the Neck, in Muscular triangle
- Butterfly in shape
- Formed of two lobes connected by an isthmus
- Weight: 20 - 25 gms
- Each lobe is PEAR in shape with:
  - **APEX:** At level of oblique line of thyroid cartilage
  - **BASE:** At the level of 4<sup>th</sup> or 5<sup>th</sup> Tracheal ring
- **ISTHMUS:** Connects the 2 Lobes at the level of 2<sup>nd</sup>, 3<sup>rd</sup> Tracheal rings
- **PYRAMIDAL LOBE:** May be present above the isthmus
- **CAPSULES:**
  - **TRUE CAPSULE** (From the stroma of gland)
  - **FALSE CAPSULE** (From Pre-tracheal fascia)



### PRETRACHEAL FASCIA

Is attached to Hyoid bone, Oblique line of Thyroid cartilage  
 :: During deglutition  
 → Gland moves up & down ::  
 ▪ This fascial attachment to the gland may result in downward extension "Plunging Goiter"

### PYRAMIDAL LOBE

Must be removed in Sistrunk's operation

### ANTERIOR RELATIONS:

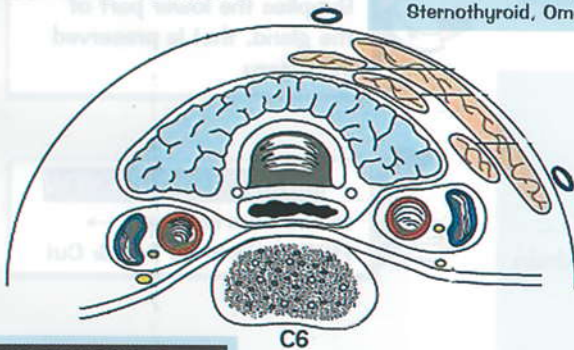
- Skin, SC tissue صفراء
- Platysma حمراء
- Investing layer of deep cervical fascia
- Sternomastoid
- STRAP MUSCLES (Sternohyoid, Sternothyroid, Omohyoid)

### STRAP MUSCLES

supplied by ansa cervicalis from Below

:: During thyroidectomy, cut the Muscles as HIGH as possible ::

### RELATIONS:



### POSTERIOR RELATIONS:

- Carotid Sheath (Carotid artery, IJV, Vagus N.)
- Ansa cervicalis
- Sympathetic chain

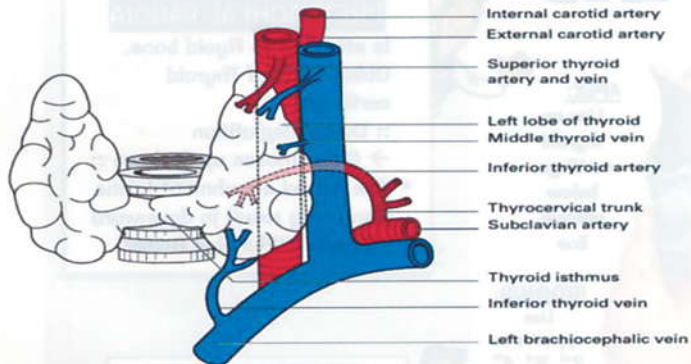
### MEDIAL RELATIONS:

- **UPPER PART:** Cricoid, Thyroid cartilage, Cricothyroid muscle, Inferior Constrictor Muscle
- **LOWER PART:** Oesophagus, Trachea, RLN

### MEDIAL RELATION

Dysphagia & Dyspnea may occur with its enlargement  
 Due to its relation to Trachea & Esophagus



**BLOOD SUPPLY:****APPLIED ANATOMY****SUPERIOR THYROID ARTERY**

Is **LIGATED WITHIN** the gland to avoid injury of external laryngeal N.  
 :: Injury → Loss of high pitched voice & Voice fatigue ::

**INFERIOR THYROID ARTERY**

- Should be **LIGATED AWAY FROM THE GLAND** to avoid injury of RLN.  
 :: Complete → الصوت النفس  
 Partial → النفس
- Ligate in continuity, do not cut (Slippery of ligature → Stump falls in chest → Hemothorax)

**THYROID IMA ARTERY**

Its cutting during thyroidectomy causes **SEVERE Bleeding**

**ACCESSORY BRANCHES**

Supplies the lower part of the gland, that is preserved in surgery

**MIDDLE THYROID VEIN**

Is the shortest vein → **FIRST** vein to be tied & Cut

**1- ARTERIES****SUPERIOR THYROID A.**

- 1<sup>st</sup> Branch of External Carotid artery
- Related to **EXTERNAL LARYNGEAL N.**

**INFERIOR THYROID A.**

- Branch of the **THYRO-CERVICAL TRUNK**
- Its **TERMINAL** branches are related to RLN

**THYROID IMA A.**

- Branch of Arch of Aorta or innominate artery
- Present in 1-3% of population

**ACCESSORY THYROID A.**

- In the Ligament of berry
- Supply lower part of the gland

**2- VEINS****SUPERIOR THYROID V.**

- Drain's into IJV

**MIDDLE THYROID V.**

- Drains into IJV

**INFERIOR THYROID V.**

- Crosses from the Isthmus to drain into the left Innominate vein (Brachiocephalic V.)

**3- LYMPHATICS****PERIPHERAL PART**

- To the upper & Lower deep cervical LNs

**MEDIAL PART**

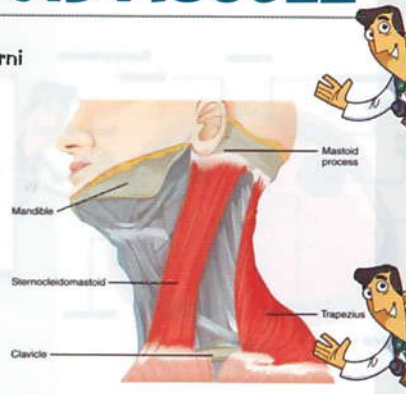
- Pre-tracheal LNs (**DELPHIAN**), Pre-Laryngeal LNs, Deep Cervical LNs

**DELPHIAN LNS**

In papillary thyroid carcinoma, Delphian LNs may enlarge before the gland.

# STERNOMASTOID MUSCLE APPLIED ANATOMY

- **2 ORIGINS:**
  - STERNAL HEAD: Manubrium sterni
  - CLAVICULAR HEAD: Clavicle
- **2 INSERTIONS:**
  - Mastoid process
  - Superior nuchal line
- **N. SUPPLY:** Spinal accessory nerve
- **ACTION:**
  - 2 muscles: Flexes the neck
  - 1 muscle: Bends head to same side & turns face to opposite side.



## 2 ORIGINS

A triangle is formed between 2 heads; where IJV lies "Can be entered by a needle"

## STERNOMASTOID

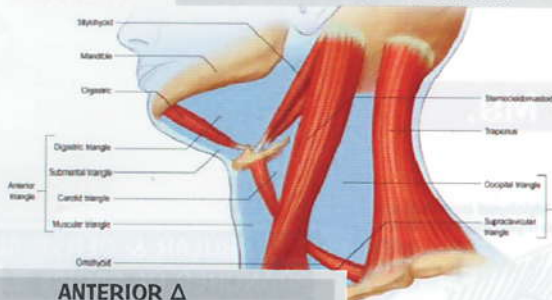
- Must be examined during examination of thyroid & parotid glands
- Must be relaxed to Examine Deep Cervical L.Ns
- Divides the neck into anterior & posterior triangles

# TRIANGLES OF THE NECK

## POSTERIOR Δ

### BOUNDARIES:

- ANT.: Post. border of sternomastoid ms.
- POST.: Ant. border of trapezius ms.
- BASE: Middle 1/3 of clavicle.



## ANTERIOR Δ

### BOUNDARIES:

- ANT.: Midline of the neck
- POST.: Ant. border of sternomastoid
- BASE: Lower border of the mandible

## Anterior Δ is subdivided into:

### CAROTID Δ

#### BOUNDARIES:

- ABOVE: Post. belly of digastric ms.
- POST.: Sternomastoid ms.
- ANT. & INF.: Superior. belly of omohyoid

### DIGASTRIC Δ

#### BOUNDARIES:

- ABOVE: Body of mandible
- ANT.: Ant. belly of digastric ms
- POST.: Post. belly of digastric ms

### SUBMENTAL Δ

#### BOUNDARIES:

- APEX: Symphysis menti
- BASE: Body of hyoid bone
- ON EACH SIDE: Ant. belly of digastric ms.

### MUSCULAR Δ

#### BOUNDARIES:

- ABOVE: Superior. belly of omohyoid
- ANT.: Middle line
- POST.: Sternomastoid ms.



## APPLIED ANATOMY



## COMPARTMENTS OF THE NECK

The **PARAVERTEBRAL FASCIA** divides the neck into:

**VISCERAL COMPARTMENT (anterior)**

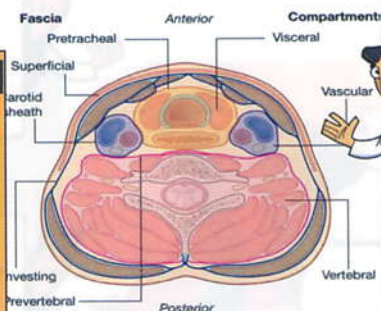
Larynx, Pharynx, Oesophagus, Trachea & hyoid bone.

**MUSCULAR COMPARTMENT (Post.)**

Vertebrae & Muscles which support & move head & neck

**VASCULAR COMPARTMENT (lateral)**

Common & Internal Carotid arteries, Internal jugular vein & Vagus nerve 'Present in carotid sheath'

**VISCERAL COMPARTMENT**

Any swelling within it causes pressure manifestations e.g. dysphagia, dyspnea etc.

## SUBMANDIBULAR GLAND

**SITE** → In the digastric triangle, partially below & partially deep to the mandible

## Divided into 2 parts

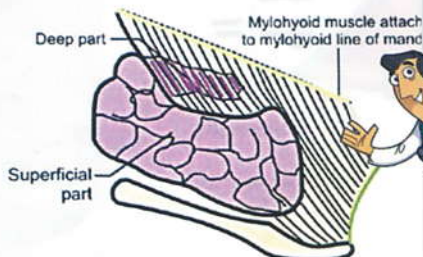
## IN RELATION TO MYLOHYOID MS.

**SUPERFICIAL PART**✓ **WEDGE SHAPE**✓ **EXTENSION:**

- **Posteriorly:** Mandible's angle
- **Superiorly:** Mylohyoid line of mandible
- **Inferiorly:** Overlaps the 2 bellies of digastric ms.

✓ **RELATIONS:**

- **Inferolateral surface:** Skin, superficial fascia & cervical branch of facial n.
- **Lateral surface:** Mandible & facial a.
- **Medial surface:** Related to 2 muscles (mylohyoid & hyoglossus ms) & 2 nerves (lingual & hypoglossal nerves)

**MANDIBULAR & CERVICAL BRANCHES OF FACIAL N.**

Skin is incised parallel to lower border of mandible, 5 cm below & in front of angle of mandible as not to injure them

**DEEP PART**

A small part lying deep to mylohyoid & superficial to hyoglossus

**DEEP PART**

- Doesn't ROLL over mandible
- Has intra-oral extension examined bimanually  
.. Differentiate it from Submandibular L.N...

**SUBMANDIBULAR DUCT "WARTON'S"**

- 5 cm long
- Has triple relation with lingual n. (lat. then below then medial to the nerve)
- Opens in floor of mouth, close to frenulum of the tongue

**DUCT**

Is More liable to **OBSTRUCTION & INFLAMMATION**





**NERVE SUPPLY**

- **SENSORY:** Lingual nerve
- **SYMPATHETIC:** Plexus around facial n.
- **PARASYMPATHETIC:**
  - It receives secreto-motor fibers from submandibular ganglion
  - Passes through chorda tympani from facial N.

**LYMPHATIC DRAINAGE**

- To submandibular & upper deep cervical L.Ns

**APPLIED ANATOMY**

# PAROTID GLAND

It is the largest salivary gland, which secretes serous fluid only

**SEROUS FLUID**

The nature of fluid secreted decrease the incidence of stones compared with submandibular gland

**SITE & SHAPE**

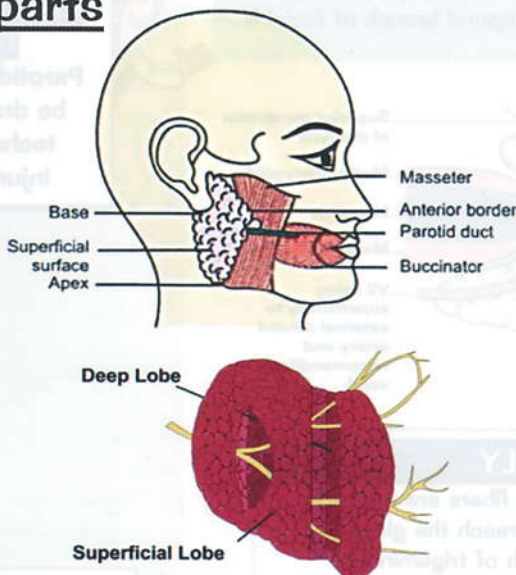
- ☑ Below the auricle, between the angle of the mandible & the sternomastoid
- ☑ Inverted pyramidal in shape

**Made of 2 parts****MAIN PART**

It's divided into superficial & deep parts by facial nerve

**ACCESSORY PART**

Semi-detached part of the gland, which lies just above the parotid duct

**PAROTID REGION**

Part of the face in front of the ear and below zygomatic arch

**DEEP PART**

Is examined from the oral cavity

**PAROTID DUCT**

- 5cm long, emerges from the anterior border.
- Runs superficial to masseter ms. then pierces the buccinator.
- Opens in vestibule of mouth, opposite upper 2nd molar tooth

**PAROTID DUCT**

Can be seen radiographically by injecting radiopaque contrast (Parotid Sialogram)

## SURFACES & RELATIONS OF THE MAIN PART

### POSTERO-MEDIAL SURFACE:

- Sternomastoid process
- Mastoid process
- Posterior belly of digastrics
- Styloid process & muscles attached to it.
- Carotid sheath & it's contents

### LATERAL SURFACE

#### SUPERFICIAL RELATIONS

Skin and Superficial fascia containing Parotid L.Ns, Great auricular n. & platysma

### LOWER END

Related to ... V. A. N. ...

- Retro-mandibular Vein
- External carotid Artery
- Cervical branch of facial Nerve

### ANTERO-MEDIAL SURFACE

#### BONE BETWEEN 2 MUSCLES

- Masseter muscle
- Mandible ( ramus )
- Medial pterygoid muscle

### ANTERIOR BORDER

#### Duct, Artery & facial Branches

- Temporal branch of facial nerve
- Zygomatic branch of facial nerve
- Transverse facial Artery
- Buccal branch of facial nerve
- Accessory part of the gland
- Parotid Duct
- Mandibular Branch of facial nerve

### UPPER END

Related to 3 Temporal

- Superficial temporal vessels
- Auriculo-temporal nerve
- Temporal branch of facial N.

## APPLIED ANATOMY

### FACIAL N.

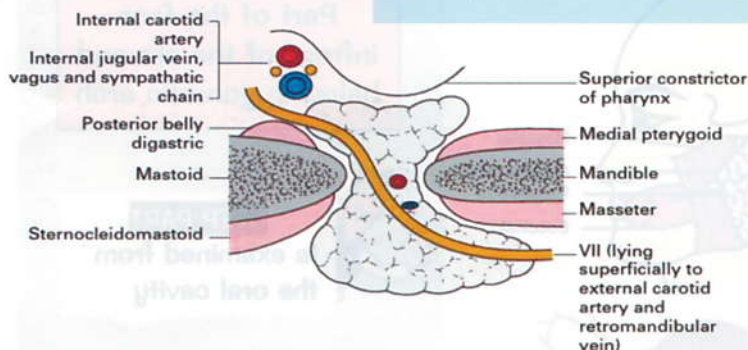
Must be examined in Parotid cases to exclude malignant infiltration

### STRUCTURES WITHIN THE GLAND (superficial to deep FRE)

- Facial nerve
- Retro-mandibular vein
- External carotid artery

### STRUCTURES WITHIN THE GLAND

Parotid abscess should be drained by Hilton technique to avoid injury of facial N.



### NERVE SUPPLY

- **PARASYMPATHATIC:** Secretomotor fibers are originally supplied by glossopharyngeal n. & reach the gland through the auriculotemporal branch of trigeminal N.
- **SYMPATHATIC:** Plexus around E.C.A
- **SENSORY:** Auriculotemporal nerve

### LYMPHATIC DRAINAGE

Superficial & deep parotid L.Ns (within the gland) then to upper deep cervical

### SUPERFICIAL & DEEP PAROTID L.Ns

This explains parotid enlargement in chronic endemic parotitis

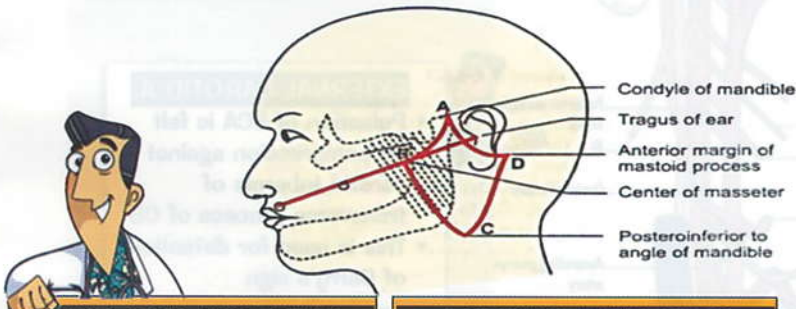


**BLOOD SUPPLY****ARTERIAL** → External carotid artery inside the gland**VENOUS** → Retro-mandibular vein above**APPLIED ANATOMY****CAPSULE**

Fibrous capsule (Parotid fascia) derived from investing deep fascia of the neck, with a defect from above

**DEFECT IN CAPSULE**

This explains elevation of **LOBULE** of ear during examination of **ENLARGED** Parotid gland

**SURFACE ANATOMY  
PAROTID GLAND**

- Head of the mandible
- Middle of masseter ms.
- 2 cm below & behind the angle of mandible
- Middle of mastoid process

**SURFACE ANATOMY  
PAROTID DUCT**

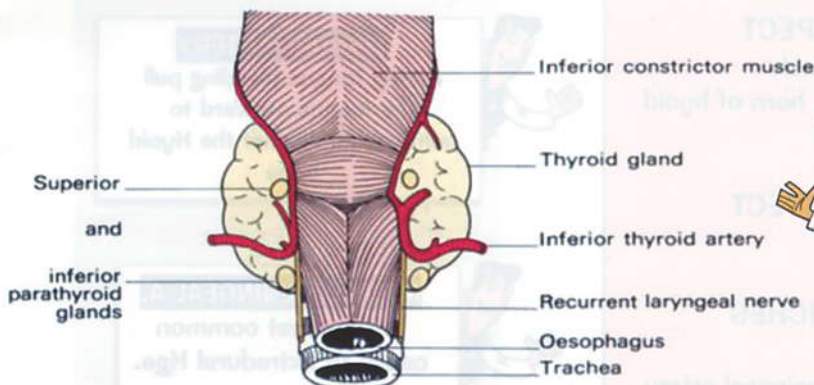
Corresponds to the middle 1/3 of a horizontal line drawn from the tragus of the ear to a point on the upper lip midway between the ala of the nose & the angle of the mouth

**PARATHYROID GLAND**

- ☒ **SIZE:** Each gland is about 0.5 cm
- ☒ **COLOR:** Yellowish brown
- ☒ **POSITION:** They are embedded in the back of the false capsule of thyroid (rarely in substance of the gland)
- ☒ **BLOOD SUPPLY:** Main supply is from Inferior thyroid artery

**ANATOMICAL FACT**

- **Superior** parathyroid is more constant in position (posterior to thyroid & above inferior thyroid a.)
- **Inferior** parathyroid may rarely be located in superior mediastinum

**PARATHYROID**

During subtotal thyroidectomy we preserve the postero-medial part as parathyroid gland is related to that part



# ARTERIES OF HEAD AND NECK

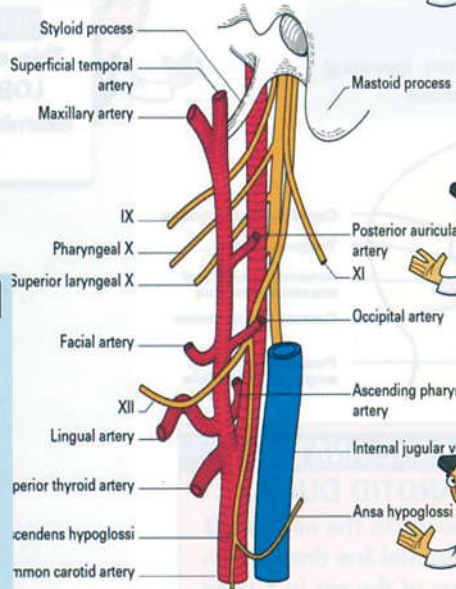
## APPLIED ANATOMY

### INTERNAL CAROTID A.

- **BEGINS** FROM C.C.A
- **COURSE:** Inside carotid sheath
- **END** In cranial cavity by dividing into ANTERIOR & MIDDLE CEREBRAL ARTERIES

### EXTERNAL CAROTID A.

- **BEGINS** From C.C.A
- **COURSE** Passes outside carotid sheath
- **END** At the level of the neck of mandible inside parotid gland by dividing into SUPERFICIAL TEMPORAL & MAXILLARY ARTERIES



### ANTERIOR AND MIDDLE CEREBRAL ARTERIES

These are Sites of A-V fistula bet. ICA & cavernous sinus leading to throbbing pain & pulsating proptosis

### EXTERNAL CAROTID A.

- Pulsation of ECA is felt by compression against carotid tubercle of transverse process of C6
- This is used for detection of Berry's sign

### SUPERFICIAL TEMPORAL A.

- Called "Anesthetist's a." as it's used to count pulse
- In malignant goiter, obstruction or displacement of carotid can occur leading to weakening of pulsation of superficial temporal a.

### COMMON CAROTID A. (CCA)

- **BEGINS** Rt. from Innominate A., Lt. from Aortic arch
- **COURSE** Enters neck in Carotid sheath
- **END** At level of upper border of thyroid cartilage (bet. C3 & C4) By dividing into INTERNAL & EXTERNAL C.As

### BRANCHES OF EXTERNAL C.A

#### FROM MEDIAL ASPECT

- Ascending pharyngeal artery

#### FROM ANTERIOR ASPECT

- Superior thyroid artery: First branch
- Lingual artery: At level of greater horn of hyoid bone
- Facial artery: Deep & tortuous

#### FROM POSTERIOR ASPECT

- Occipital artery
- Posterior auricular artery

#### TWO TERMINAL BRANCHES

- Superficial temporal artery
- Maxillary artery: Gives Middle meningeal artery

### BIFURCATION OF C.C.A.

- Site of BARORECEPTORS  
→ hypersensitivity → "Carotid Sinus s"
- Site of CHEMORECEPTORS  
→ Origin of Carotid Body Tumour

### LINGUAL ARTERY

During tongue bleeding pull the tongue outward to compress it against the Hyoid bone

### MIDDLE MENINGEAL A.

Is the most common cause of extradural Hge.

# INTERNAL JUGULAR VEIN APPLIED ANATOMY

## BEGINS

At the jugular foramen as a continuation of the sigmoid sinus

## ENDS

By uniting with subclavian vein to form innominate vein behind the sternal end of the clavicle

## RELATIONS

- It lies inside the carotid sheath lateral to the internal & common carotid with vagus nerve in between.
- Passes in front of the thoracic duct on the left side.
- Runs alongside the chain of deep cervical LNs.
- Passes anterior to the phrenic nerve

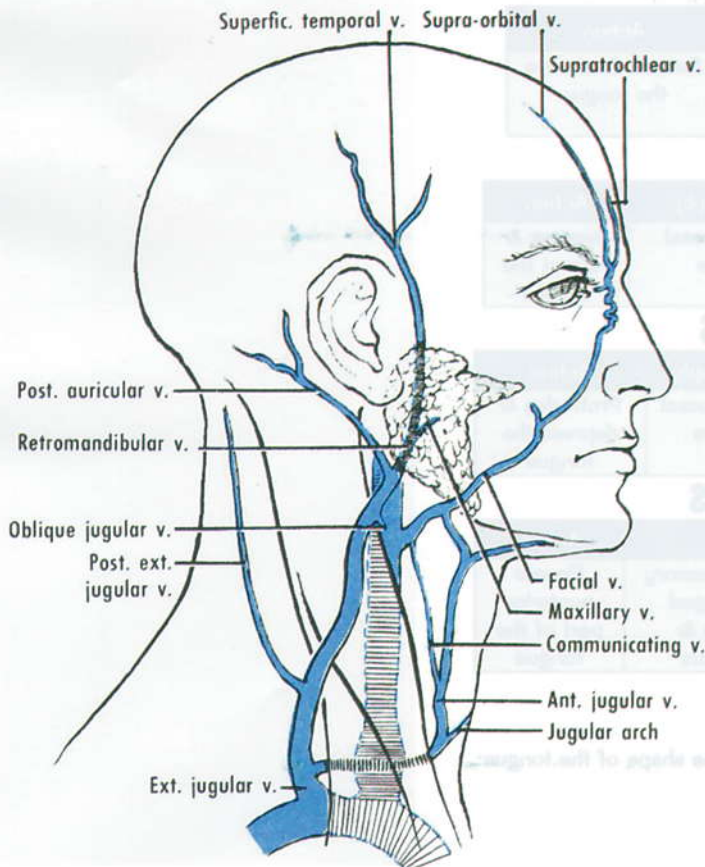
## TRIBUTORIES

- Inferior petrosal sinus.
- Jugular lymph trunk.
- Common facial vein.
- Lingual vein.
- Superior thyroid vein.
- Middle thyroid vein



## INTERNAL JUGULAR VEIN

is the Vein of central venous catheterization





# THE TONGUE

## APPLIED ANATOMY

It is a muscular organ covered by mucus membrane,  
lying in the floor of mouth & oropharynx

### PARTS

- A. **ROOT:**  
Through which muscles connect tongue to mandible & hyoid bone.
- B. **TIP & MARGINS:**
  - Lie opposite gum & teeth.
- C. **LOWER SURFACE:**
  - Facing the floor of mouth & shows:
    - Frenulum: Raised fold of mucosa in the midline.
    - Deep lingual veins: On either sides of the frenulum.
    - Fimbriated fold: Raised mucosal fold.
- D. **DORSUM OF THE TONGUE:**  
Divided by sulcus terminalis into 2 parts:
  - ☑ Anterior  $\frac{2}{3}$ : contains papillae without lymphoid follicles
  - ☑ Posterior  $\frac{1}{3}$ : contains lymphoid follicles without papillae

## MUSCLES OF THE TONGUE

### A. EXTRINSIC MUSCLES

#### ☐ STYLOGLOSSUS

Origin	Insertion	N. Supply	Action
Styloid process	Side & inferior aspect of the tongue	Hypoglossal nerve	Retract & elevate the tongue

#### ☐ HYOGLOSSUS

Origin	Insertion	N. Supply	Action
Body & greater horn of hyoid bone	Side & inferior aspect of the tongue	Hypoglossal nerve	Depress & retract the tongue

#### ☐ GENIOGLOSSUS

Origin	Insertion	N. Supply	Action
Genial tubercle of the mandible	Inferior aspect of the tongue & body of hyoid bone	Hypoglossal nerve	Protrudes & depress the tongue

#### ☐ PALATOGLOSSUS

Origin	Insertion	N. Supply	Action
Palatine aponeurosis of soft palate	Side of tongue	Cranial root of accessory nerve via pharyngeal branch of vagus & pharyngeal plexus	Elevate posterior part of the tongue

### B. INTRINSIC MUSCLES

They have no bony attachments. They change the shape of the tongue:

- Superior & inferior longitudinal.
- Transverse & vertical muscles.



**NERVE SUPPLY**→ **MOTOR:**

All muscles supplied by hypoglossal n. EXCEPT  
palatoglossus supplied by spinal accessory n.

→ **SENSORY:**1. Anterior.  $\frac{2}{3}$ :

- V cranial nerve → general sensation.
- VII cranial n. → taste sensation.

2. Posterior  $\frac{1}{3}$  and circumvallate papillae:

- IX cranial n. → general sensation & taste

**BLOOD SUPPLY**

1. Lingual artery (from external carotid)
2. Lingual vein (to IJV)

**LYMPHATIC DRAINAGE**

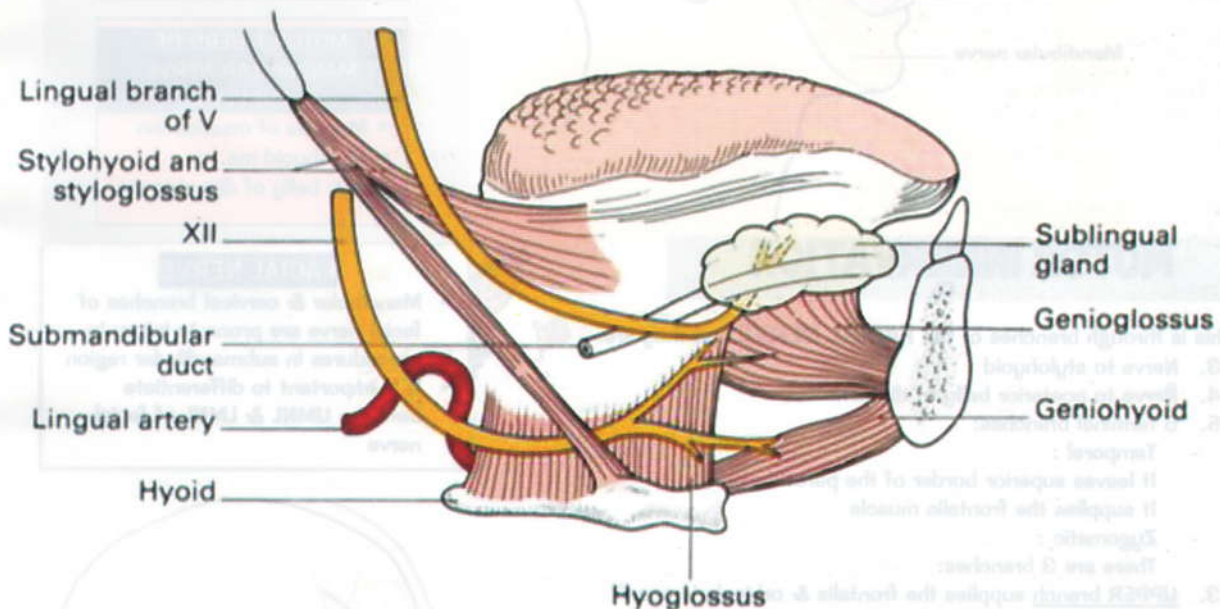
(See lymphatic system)

**APPLIED ANATOMY****TONGUE SENSATION**

Ulcer on tongue with involvement of lingual nerve can give rise to referred pain in the ear through auriculo-temporal nerve (both are branches of posterior division of mandibular nerve)

**LINGUAL ARTERY**

During tongue bleeding, we should pull tongue outwards as this causes compression on the lingual a. against the greater horn of hyoid bone.

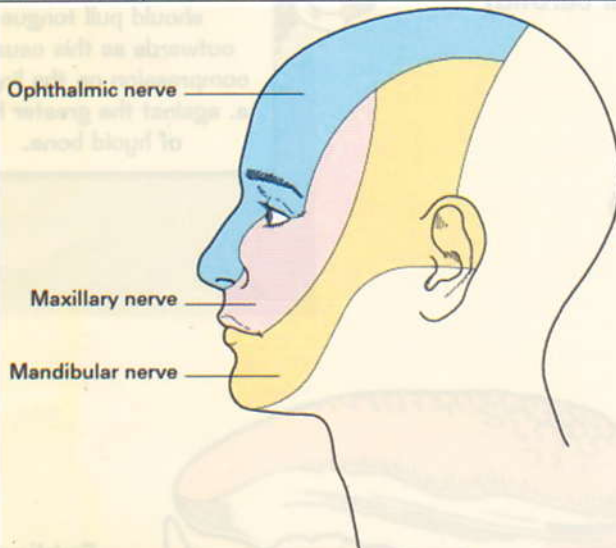


# NERVE SUPPLY OF THE FACE APPLIED ANATOMY

## SENSORY INNERVATION

This is via Trigeminal nerve (V) through the 3 terminal branches

Nerve	OPHTHALMIC	MAXILLARY	MANDIBULAR "MIXED"
Supplies	<ul style="list-style-type: none"> <li>Forehead</li> <li>Upper eye lid</li> <li>Dorsum of nose</li> </ul>	<ul style="list-style-type: none"> <li>Lower eye lid</li> <li>Upper part of cheek</li> <li>Upper lip</li> <li>Ala of nose</li> <li>Part of temporal region</li> <li>Maxillary teeth</li> <li>Nasal cavity</li> </ul>	<ul style="list-style-type: none"> <li>Skin over mandible</li> <li>Lower part of cheek</li> <li>Part of temple</li> <li>Part of ear</li> <li>Lower teeth</li> <li>Gingival mucosa</li> <li>Lower lip</li> </ul>



### SENSORY INNERVATION

- Trigeminal neuralgia may affect any one or more of the three divisions, giving rise to acute, episodic pain over the corresponding area
- Pain is frequently referred between branches, thus a patient with tongue carcinoma has ear ache. (Auriculotemporal nerve). Giving the classical picture of an old gentleman sitting in the outpatients department spitting blood and with a piece of cotton wool in his ear

### GREAT AURICULAR NERVE

It is derived from the anterior rami of 2<sup>nd</sup> & 3<sup>rd</sup> cervical nerves. It supplies the skin over the angle of the mandible

### MOTOR FIBERS OF MANDIBULAR NERVE SUPPLY

- Muscles of mastication
- Mylohyoid ms.
- Ant. belly of digastric ms.

## MOTOR INNERVATION

→ This is through branches of the **FACIAL NERVE** and they are:

- Nerve to stylohyoid
- Nerve to posterior belly of digastric
- 5 terminal branches:
  - Temporal :  
It leaves superior border of the parotid gland  
It supplies the frontalis muscle
  - Zygomatic :  
There are 3 branches:
  - UPPER branch supplies the frontalis & orbicularis oculi
  - MIDDLE branch supplies the superomedial part of orbicularis oculi
  - LOWER branch supplies the lip elevator & lower orbicularis oculi
  - Buccal:  
Runs above the parotid duct after leaving the parotid gland  
It supplies buccinator muscle of upper lip & nose
  - Mandibular:  
It exits the lower part of parotid gland  
It supplies lip depressors
  - Cervical:  
It supplies the platysma

### FACIAL NERVE

- Mandibular & cervical branches of facial nerve are prone to injury in procedures in submandibular region
- It is important to differentiate between UMNL & LMNL of facial nerve





# SURGI- TOONS

## THORAX



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# THORACIC DUCT

## APPLIED ANATOMY

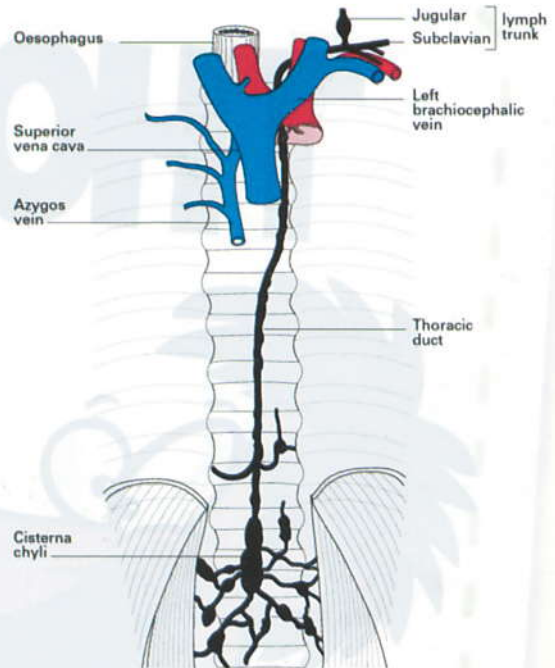
- 45 cm long.
- UPWARD CONTINUATION of the cisterna chyli.
- ENTERS the thorax through the aortic opening of the diaphragm between the azygos vein medially & aorta laterally
- ENDS at the confluence of Lt. subclavian vein & Lt. internal jugular vein
- DRAINS lymph from the body except Rt. upper limb, Rt. side of chest & Rt. half of head & neck

### THORACIC DUCT

May be damaged during block dissection of the neck, if noticed during operation the duct should be ligated & lymph finds its way into venous system by anastomosing channels. (If missed → chylos fistula in the neck)

### COURSE

- Ascends behind esophagus in the posterior mediastinum and crosses midline at T5.
- Lies superficial (anterior) to the posterior intercostal arteries, crossing azygos system, the dome of pleura, Lt. vertebral & Lt. subclavian artery.
- At the level of C7, it crosses laterally behind the carotid sheath & anterior to the vertebral vessels



# THE AZYGOS VEIN

### ORIGIN

- It is formed by the union of the ASCENDING LUMBAR VEIN with the SUBCOSTAL VEIN on the RIGHT SIDE at the level of the 12th thoracic vertebra

### COURSE

- Goes through the aortic opening of the diaphragm and passes upwards lying on the sides of vertebral bodies, Posterior to the oesophagus
- AT level of T4 it arches FORWARDS over the right lung & ends in Superior vena cava.

### TRIBUTARIES

- Lower 8 posterior intercostal veins
- Superior intercostal vein of the RIGHT SIDE
- Bronchial veins of the RIGHT LUNG
- Veins from the MIDDLE THIRD OF THE OESOPHAGUS
- The two HEMIAZYGOS veins JOIN it at the level of T7 & T8



### AZYGOS SYSTEM OF VEINS

- Consists of veins on each side of vertebral column
- These veins drain back, thoracic & abdominal wall & they are:
  - Azygos vein
  - Hemi-azygos veins
  - Accessory Hemi-azygos vein

# THE DIAPHRAGM

## APPLIED ANATOMY

### ORIGIN

STERNAL → Back of xiphoid process

COSTAL → Lower 6 costal cartilages

VERTEBRAL →

✓ **2 crura:**

- Rt. crus from front of upper 3 lumbar vertebrae.
- Lt. crus from front of upper 2 lumbar vertebrae.

✓ **5 arcuate ligaments:**

- 2 Lateral → bridges over quadratus lumborum muscle
- 2 Medial → bridges over psoas major muscle
- 1 Median

**INSERTION** Central Tendon

### DIAPHRAGMATIC OPENINGS

OPENING	LEVEL	STRUCTURES TRAVERSING
Caval opening	T 8, 1 inch to the Rt. inside central tendon	1. IVC 2. Rt. phrenic n 3. Lymph vessels
Esophageal opening	T 10, 1 inch to the Lt. inside Rt. crus	4. Esophagus 5. 2 vagi nerves 6. Esophageal vessels
Aortic opening	T 12, Midline behind median arcuate ligament	From Lt. to Rt. 7. Abd. Aorta 8. Azygos vein 9. Thoracic duct

### NERVE SUPPLY

2. **MOTOR:** Phrenic nerve (C4)

3. **SENSORY:**

4. - Central region → Phrenic nerve
5. - Peripheral region → lower six or seven intercostal nerves

### ACTION

- It is the chief muscle of inspiration (Involuntary)
- It can also be used voluntarily to increase pressure in the abdomen.
- Contraction of diaphragm assists in venous return to the heart.
- Contraction of Rt. crus helps in preventing regurgitation of food from stomach into the esophagus (pinch-cock mechanism)

### RELATIONS

**RELATIONS OF THE UPPER SURFACE:**

- Pleura & lung on both sides.
- Base of pericardium in the middle.

**RELATIONS OF THE LOWER SURFACE:**

- Liver, kidney & suprarenal gland (on both sides)
- Spleen & stomach (on the left)



### FORAMEN OF MORGAGNI OR MAGENDI

Between the sternal & costal origins of the diaphragm through which para-sternal (anterior) diaphragmatic hernia may develop

### FORAMEN OF BOCHDALEK

✓ Due to: persistent pleura-peritoneal canal.

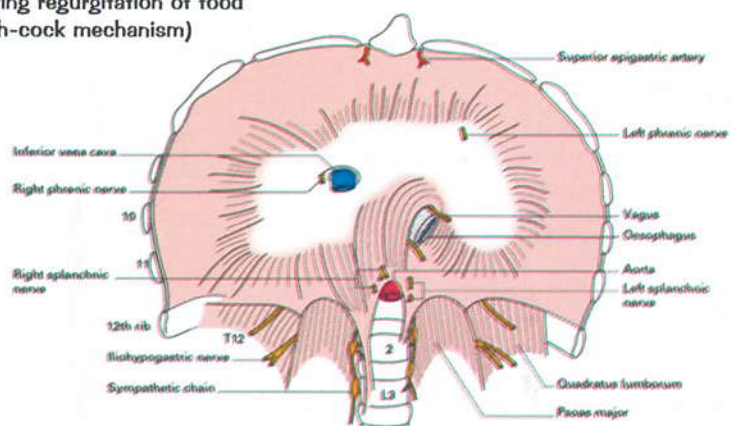
✓ Site: It is a triangular gap between the Lateral rib & the diaphragm.

✓ Posterior diaphragmatic hernia may develop through it



### NERVE SUPPLY

This explains referred pain from diaphragm to the shoulder



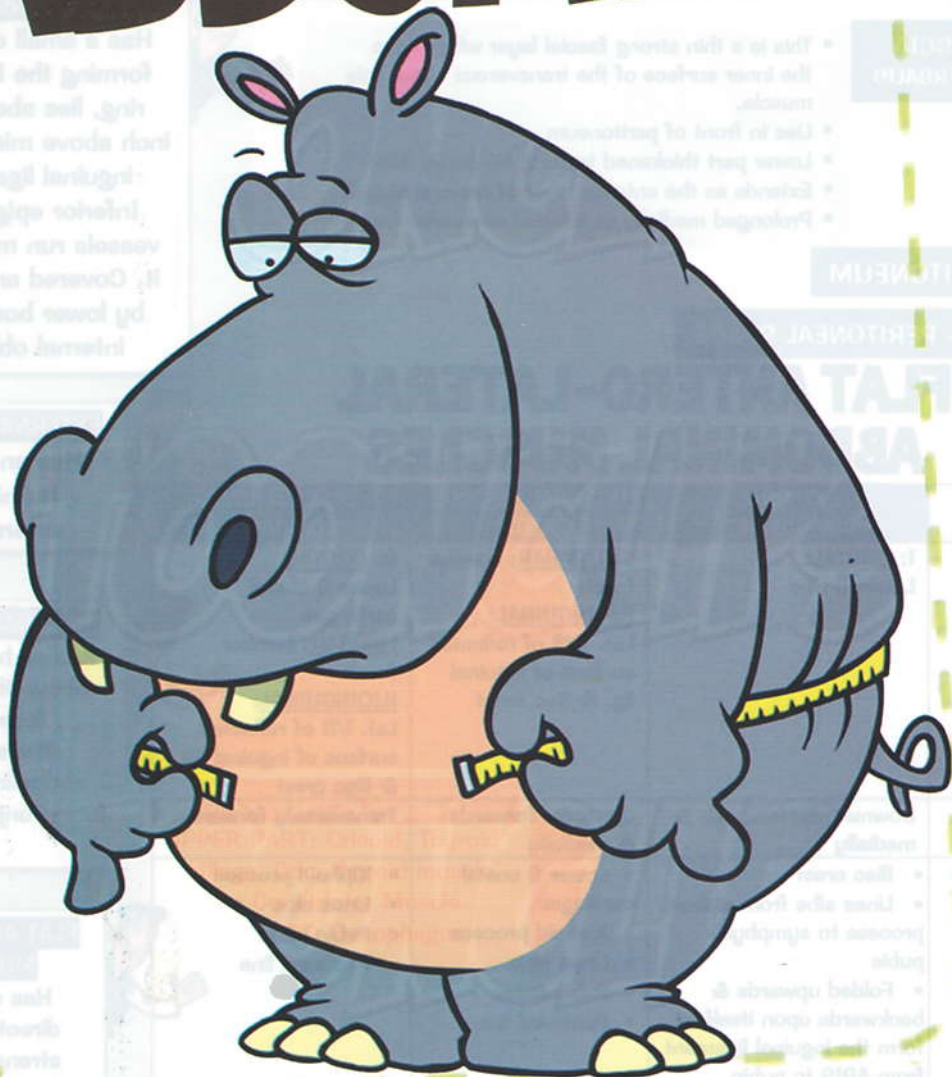
The diaphragm - inferior aspect. The three major orifices, from above downwards, transmit the inferior vena cava, esophagus and aorta.





# SURGI- TOONS

## ABDOMEN



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# ANTERIOR ABDOMINAL WALL

## APPLIED ANATOMY

### LAYERS:

#### 1- SKIN

##### Superficial fatty layer

- Called Camper's fascia
- Continuous with superficial fascia of adjoining parts of the body

##### Deep membranous layer

- Called Scarpa's fascia "Condensation of superficial fascia"
- Midway bet. umbilicus & symphysis pubis
- Attached to fascia lata finger breadth below ing. lig.

#### 2- SUPERFICIAL FASCIA

#### 3- MUSCLES

##### Flat antero-lateral abdominal muscles

- External oblique muscle
- Internal oblique muscle
- Transversus abdominis muscle

##### Rectus abdominis muscle

#### 4- FASCIA TRANSVERSALIS

- This is a thin strong fascial layer which lines the inner surface of the transversus abdominis muscle.
- Lies in front of peritoneum
- Lower part thickened to form ilio-pubic tract
- Extends as the anterior layer of femoral sheath
- Prolonged medially as internal spermatic fascia

#### 5- PERITONEUM

#### 6- PRE- PERITONEAL SPACE

## FLAT ANTERO-LATERAL ABDOMINAL MUSCLES

Muscle	EXTERNAL OBLIQUE MS.	INTERNAL OBLIQUE MS.	TRANSVERSUS ABDOMINIS MS.
Origin	1: <b>COSTAL:</b> Lower 8 ribs	2: <b>LUMBAR:</b> Lumbar fascia <b>ILIOINGUINAL:</b> Lat. 2/3 of reflected surface of inguinal lig. & iliac crest	3: <b>COSTAL:</b> Lower 6 costal cartilages <b>LUMBAR:</b> Lumbar fascia <b>ILIOINGUINAL:</b> Lat. 1/3 of reflected surface of inguinal lig. & iliac crest
Direction	Downwards, forwards & medially	upwards, forwards & medially	Transversely forward
Insertion	<ul style="list-style-type: none"> <li>Iliac crest</li> <li>Linea alba from xiphoid process to symphysis pubis</li> <li>Folded upwards &amp; backwards upon itself to form the inguinal ligament from ASIS to pubic tubercle</li> </ul>	<ul style="list-style-type: none"> <li>Lower 6 costal cartilages</li> <li>Xiphoid process</li> <li>Linea alba</li> <li>Pubic crest</li> <li>Pectineal line</li> </ul>	<ul style="list-style-type: none"> <li>Xiphoid process</li> <li>Linea alba</li> <li>Pubic crest</li> <li>Pectineal line</li> </ul>
N. supply	Lower 6 thoracic and first lumbar nerves		

### SUPERFICIAL PERINEAL FASCIA

- Called Colles' fascia
- Continuation of Scarpa's fascia below superficial inguinal ring
- Forms envelope like around penis & scrotum

### DEEP FASCIA

No Deep fascia to allow

- Free resp. movement
- Pregnancy
- Gastric fullness

### FASCIA TRANSVERSALIS

Has a small opening forming the Internal ring, lies about 1/2 inch above midpoint of inguinal ligament  
Inferior epigastric vessels run medial to it. Covered anteriorly by lower border of internal oblique

### EXTERNAL OBLIQUE

Has an opening forming the external ring

### INTERNAL OBLIQUE

Arches horizontally above the cord & fuses with Transversus abdominis ms. to form Conjoint tendon

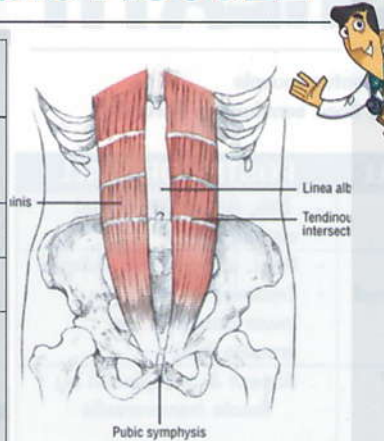
### FLAT ABDOMINAL MUSCLES

Has different directions that strengthen the anterior abdominal wall



# RECTUS ABDOMINIS MUSCLE APPLIED ANATOMY

Origin	1) Pubic crest 2) Symphysis pubis
Insertion	1) Xiphoid process 2) 5th, 6th & 7th Costal cartilages
Action	Flexion of the trunk
Nerve supply	Lower 6 thoracic nerves
Imp. Features	<ul style="list-style-type: none"> <li>It is divided into segments by 3-4 tendinous intersections which are adherent to anterior rectus sheath</li> <li>Each rectus muscle is enveloped in a fibrous sheath called "Rectus sheath"</li> <li>It's lateral border is called linea semilunaris</li> </ul>



## RECTUS ABDOMINIS

- MUST be divided  
:: IN KOCHER INCISION ::
- Is displaced laterally  
:: IN PARA-MEDIAN INCISION ::  
as it receives it's nerve supply from the lateral side
- Hematoma of rectus abdominis is localized because of tendinous intersections

## CONJOINT TENDON

- Formed by fusion of both internal oblique & transversus abdominis muscles
- It is attached to pubic crest & medial part of pectineal line
- It forms & strengthen the medial part of the posterior wall of inguinal canal
- Nerve supply: Ilio-inguinal nerve

## CONJOINT TENDON

- It's weakness predisposes to direct inguinal hernia
- It prevents direct inguinal hernia from descending to the scrotum, So it's defect causes descent of direct inguinal hernia to the scrotum (Funicular type)
- Injury of ilio-inguinal n. during appendectomy in grid iron incision with Rutherford extension causes paralysis of conjoint tendon resulting in Direct inguinal hernia (Paralytic type)

## INGUINAL LIGAMENT

- Formed by the lower border of external oblique aponeurosis between pubic tubercle & ASIS being folded backward upon itself.
- Points on inguinal ligament:
  - Mid inguinal point: Point midway between ASIS & symphysis pubis, It's the surface anatomy of external iliac a.
  - Mid-point of inguinal ligament: Point midway between ASIS & pubic tubercle. Internal ring 1/2 inch above it.

## INGUINAL LIGAMENT

- Mid-inguinal point:  
→ Surface anatomy of external iliac a.
- Mid-point of inguinal ligament:  
→ Landmark to reach internal ring



# RECTUS SHEATH

## APPLIED ANATOMY

- **DEFINITION:** Envelope-like sheath for rectus muscle
- **SITE:** Between linea alba (medially) & linea semilunaris (laterally)
- **FORMATION**

	ANTERIOR WALL	POSTERIOR WALL
Above costal margin	- Ext. oblique	- 5th, 6th, & 7th costal cartilages
From costal margin to midway bet. umbilicus & GP	- Ext. oblique. - Ant. layer of internal oblique.	- Post. layer of int. oblique - Transversus abd. (its lower border is the arcuate line)
Below the level midway between umbilicus & GP	- External oblique. - Internal oblique. - Transversus abd.	Absent & is replaced by fascia transversalis

### CONTENTS

2 MUSCLES	4 VESSELS	6 NERVES
- Rectus abdominis - Pyramidalis	- Sup. Epigastric vessels - Inf. Epigastric vessels	- Lower 5 intercostal ns. - Subcostal nerve (T12)

### ARCULATE LINE

A Crescentic line that is situated between upper  $\frac{3}{4}$  & lower  $\frac{1}{4}$  of post. Wall of rectus sheath

### FASCIA LATA

Causes arching of the inguinal ligament downwards

### FASCIA LATA

You must bend the legs during abdominal examination to relax the fascia lata & therefore relax the abdominal muscles

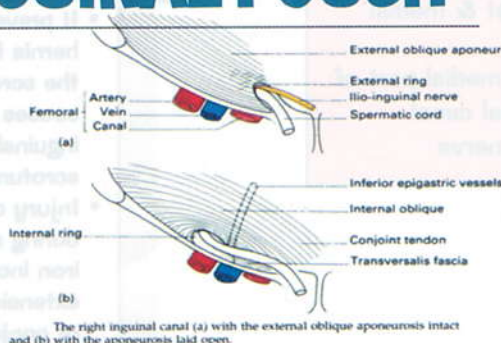
# INGUINAL CANAL "DEEP INGUINAL POUCH"

### DEVELOPMENT

Develops by the passage of the testis from the abdomen to the scrotum

### DEFINITION

An oblique intermuscular in the lower anterior abdominal wall transmitting spermatic cord (in Male) or round ligament (in Females)



### SITE, LENGTH & DIRECTION

In the lower & lateral part of anterior abdominal wall. 4 cm in adults.  
Oblique downwards, forwards & medial

### WALLS OF INGUINAL CANAL

ANTERIOR WALL	POSTERIOR WALL
a. External oblique. b. Fibers of the internal oblique. c. Transversus abdominis.	a. Fascia transversalis b. Conjoint tendon (In its medial $\frac{1}{2}$ only)
ROOF	FLOOR
a. Arching fibers of the Int. oblique b. Transversus abdominis muscle	a. Inguinal ligament (its medial $\frac{1}{2}$ )

### CONTENTS

MALE	FEMALE
- Ilio-inguinal nerve - Spermatic cord	- Ilio-inguinal nerve - Round ligament

### PROTECTIVE MECHANISM OF THE INGUINAL CANAL

1. Obliquity of the inguinal canal. The attachment of the deep inguinal ring to the posterior surface of the transversus muscle. So, the contraction of the muscle pulls the ring upwards & laterally thus increasing the obliquity of the canal.
2. Strong fascia transversalis supporting the posterior wall.
3. Superficial inguinal ring supported by conjoint tendon posteriorly.
4. Deep inguinal ring supported by fascia transversalis & internal oblique muscle in front of it.
5. Shutter mechanism; in which contraction of the arching fibers of the transversus abdominis cover a part of the internal ring with cough.
6. Cremasteric mechanism; contraction of spermatic ms. plugs the superficial inguinal ring.
7. Valvular mechanism; Contraction of external oblique tightens its aponeurosis & narrows superficial inguinal ring



# TRIANGLE OF HASSELBACH

## "HASSELBACH'S TRIANGLE"

- It is a part of the posterior wall of the inguinal canal
- It is divided by lateral umbilical ligament into medial and lateral parts

### BOUNDARIES

- **LATERAL:** Inferior epigastric vessels
- **MEDIAL:** Lateral border of rectus sheath
- **INFERIOR:** Inguinal ligament (only medial 1/2)

## APPLIED ANATOMY

### TRIANGLE OF HASSELBACH

- Weakness in it predisposes to direct inguinal hernia

# ABDOMINAL AORTA

## ORIGIN

- At the aortic opening in the diaphragm opposite the lower border of T12 in the median plane behind the median arcuate ligament & between the Rt. & Lt. crura.

## TERMINATION

- At L4 vertebra slightly to the left by dividing into 2 terminal branches (2 common iliac arteries)

## RELATIONS

## BRANCHES

### 3 PAIRED BRANCHES TO GLANDS

1. Middle suprarenal a.
2. Renal artery a. (L2).
3. Gonadal lower border of L2.

### 3 SINGLE BRANCHES TO GIT VISCERA

1. **Celiac trunk**  
At upper border of L1
2. **SUP. mesenteric a.**  
At lower border of L1.
3. **INF. mesenteric A.** At L3

### 3 TERMINAL BRANCHES

1. Rt. common iliac a.
2. Lt. common iliac a.
3. Median sacral a.

### POSTERIOR:

- It lies directly anterior to L1-L4

### ON IT'S LEFT SIDE:

Sympathetic chain Is Closely related.

### ON IT'S RIGHT SIDE

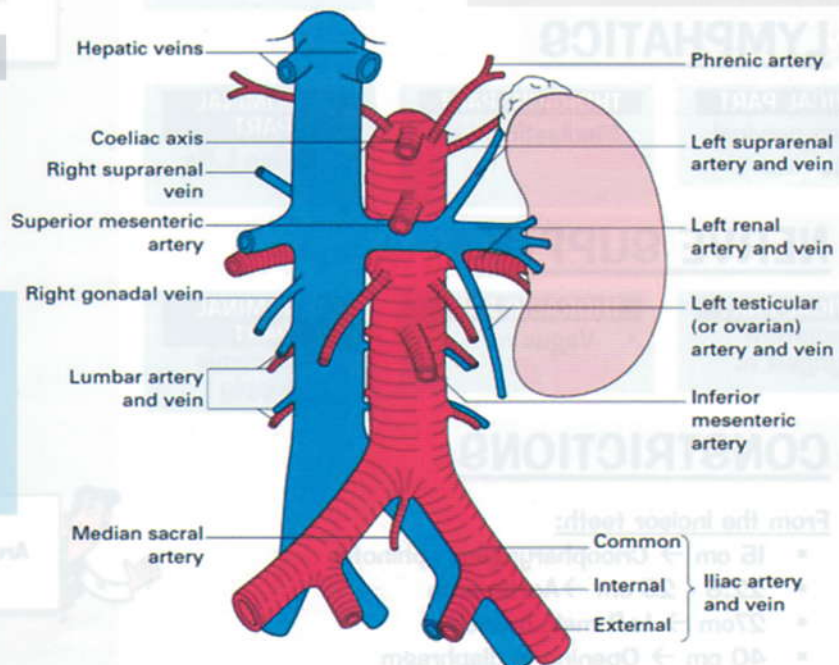
IVC & cisterna chyli

### ABDOMINAL AORTA

Is most common site of blood vessels aneurysm specially infra-renal

### TERMINATION SITE

Is the site of "LERICHE SYNDROME"





# THE ESOPHAGUS

## APPLIED ANATOMY

### COURSE & RELATIONS

- It's a muscular tube (25 cm)
- Extending from the pharynx at the level of the 6th cervical vertebra to the stomach
- IN NECK:** Lies behind the trachea
- IN MEDIASTINUM:** Passes behind left bronchus then behind pericardial sac.
- REACHES THE ABDOMEN:**
  - Through the esophageal hiatus
  - One inch to the left of the middle line
  - At the level of the body of the tenth thoracic vertebra
- IN ABDOMEN:**
  - It's of variable length
  - Ends at the gastro-esophageal junction
  - Covered by peritoneum anterior only.

### MEDIASTINAL RELATION

Behind PERICARDIAL SAC 90

used in:

- Trans-esophageal ECHO
- Assessment of severity of Left atrial enlargement

### ABDOMINAL PART

Site of Columnar metaplasia → **BARRET'S ESOPHAGUS**

### BLOOD SUPPLY:

#### 1- ARTERIES

##### INFERIOR THYROID ARTERY

- Upper part

##### ESOPHAGEAL BRANCHES FROM THE AORTA

- Middle part

##### ESOPHAGEAL BRANCHES OF THE LEFT GASTRIC ARTERY

- Lower part

##### ESOPHAGEAL BRANCHES OF THE LEFT GASTRIC ARTERY

Are small vessels which can easily be dissected in trans-hiatal esophagectomy

#### 2- VEINS

##### UPPER PART

- To brachio-cephalic veins

##### MIDDLE PART

- To azygous (Rt. side)
- Hemiazygos (Lt. side)

##### LOWER PART

To left gastric vein then portal vein

##### LOWER ESOPHAGEAL VEINS

share in portosystemic anastomosis resulting in varices in portal hypertension

#### 3- LYMPHATICS

##### CERVICAL PART

- Deep cervical L.Ns

##### THORACIC PART

Mediastinal LNs

##### ABDOMINAL PART

- Celiac L.Ns

#### 4- NERVE SUPPLY

##### CERVICAL PART

Recurrent laryngeal n.

##### THORACIC PART

- Vagus n.

##### ABDOMINAL PART

Autonomic supply

#### 5- CONSTRICTIONS

From the incisor teeth:

- 15 cm → Cricopharyngeus sphincter
- 22.5 - 25 cm → Aortic arch
- 27cm → Left main bronchus
- 40 cm → Opening in diaphragm

### CONSTRICTIONS

Are sites of foreign body impaction



# THE STOMACH

## APPLIED ANATOMY

- It lies in the left hypochondrium, epigastric & umbilical regions.
- It's completely covered by peritoneum

### ORIFICES

#### CARDIAC ORIFICE

- At the level of T10, 1 inch to the left of the midline.
- At 40-45 cm from incisors in endoscopy

#### PYLORIC ORIFICE

At the level of L1, 1/2 inch to the right of the midline

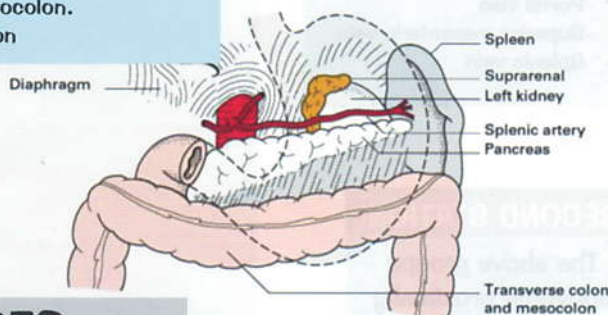
### SURFACES

#### POSTERIOR

- Lt. Crus of diaphragm
- Lt. Kidney.
- Spleen (separated by greater sac)
- Splenic artery
- Lt. Suprarenal gland.
- Body of pancreas.
- Transverse mesocolon.
- Transverse colon

#### ANTERIOR

Related to the liver, diaphragm, & ant abdominal wall



### PARTS

#### 1. CARDIA

Lies immediately below the entrance of the esophagus

#### 2. FUNDUS

Above the level of cardia

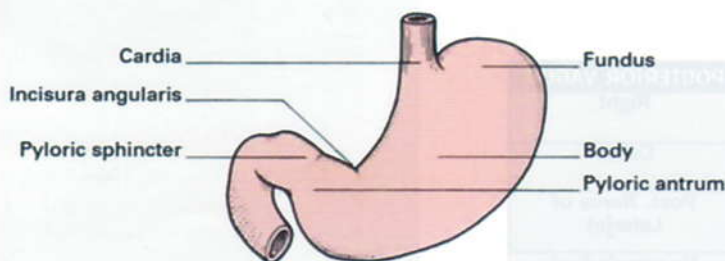
#### 3. PYLORIC PORTION

- It consists of 3 parts

PYLORIC ANTRUM	PYLORIC CANAL	PYLORIC SPHINCTER
proximal dilated part	distal narrow part	at the end of the stomach

#### 4. BODY

Between the fundus & the pyloric portion



#### PYLORIS

Identified at operation by:

- Pre-pyloric vein of Mayo between Rt. gastric and Rt. gastro-epiploic veins.
- Feeling its thickness.

#### POSTERIOR RELATION

- Posterior gastric ulcer or cancer → Erodes pancreas
- Ulceration into splenic a. (Direct posterior relation) → Hge.

#### FACTORS CONTROLLING COMPETENCE OF CARDIA

- Angle of Hiss: Acute → valvular effect between left side of esophagus & fundus.
- Lower part of esophagus (5 cm) is intra-abdominal → closed on rise of abdominal pressure.
- Rosette-shaped mucosal folds of lower end → bulging in the lumen.
- Pinch-cock effect of Rt. crus of diaphragm.
- Phrenico-esophageal ligament: Keeping the intra-abdominal part in place.
- Continuous release of acetylcholine → lower end relaxes only on swallowing.
- Pressure at lower 5 cm of esophagus is 8 - 25 mmHg while the intra-gastric pressure is 7 mmHg, thus, no reflux occurs

#### FUNCTIONAL DIVISION

The important division lies between the antrum & the body:

- THE BODY:**  
Secretes HCL, pepsinogen, mucus & intrinsic factor (Acidic)
- THE ANTRUM:**  
Secretes gastrin hormone & mucus (Alkaline)



## BLOOD SUPPLY:

## APPLIED ANATOMY

### 1- ARTERIES

Supplied by branches of celiac trunk (foregut)

#### ALONG THE LESSER CURVATURE

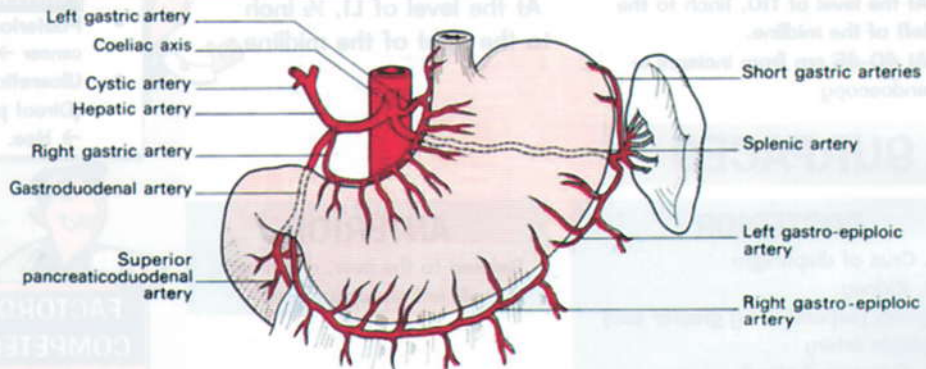
- Rt. gastric → From hepatic a
- Lt. gastric → From celiac trunk

#### ALONG THE GREATER CURVATURE

- Rt. gastro-epiploic → from gastro-duodenal a.
- Lt. gastro-epiploic → from splenic a.

#### AT THE FUNDUS

Short gastric arteries → From splenic a. & passing through gastrosplenic lig.



### 2- VEINS

(Portal + anastomosis with esophageal veins)

- |   |    |                          |
|---|----|--------------------------|
| 1. Rt. & Lt. gastric                              | TO | Portal vein              |
| 2. Rt. gastro-epiploic vein                       | TO | Superior mesenteric vein |
| 3. Lt. gastro-epiploic vein & short gastric veins | TO | Splenic vein             |

### 3- LYMPHATICS

#### FIRST STATION

##### PROXIMAL 1/2

1. Lt. gastric L.Ns
2. Splenic L.Ns

##### ANTRUM

1. Rt. gastric L.Ns
2. Subpyloric L.Ns

##### GREATER CURVATURE

Lymph nodes along the gastro-epiploic arch

#### SECOND STATION

The above groups converge proximally to end in the celiac L.Ns or Superior mesenteric L.Ns

### 4- NERVE SUPPLY

#### SYMPATHETIC

From greater splanchnic nerves then to celiac ganglion. Afferent fibres carry visceral pain

#### PARASYMPATHETIC (SECRETOMOTOR)

	ANTERIOR VAGUS	POSTERIOR VAGUS
Site in chest	Left	Right
Branches in abdomen	Hepatic	Celiac
Continues as..	Ant. nerve of Laterjet	Post. Nerve of Laterjet
Ends by	Crow's foot	No crow's foot

# THE LIVER

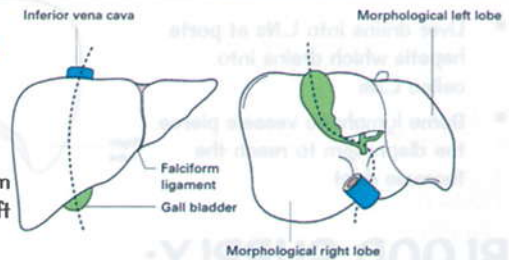
## APPLIED ANATOMY

It's the largest solid organ in the body, It weighs 1200- 1800 gms in adults.

### SITE & SHAPE

(On visceral surface)

- wedge shaped
- In right hypochondrium & epigastrium
- Extends to Right lumbar & part of left hypochondrium



## LOBES OF THE LIVER

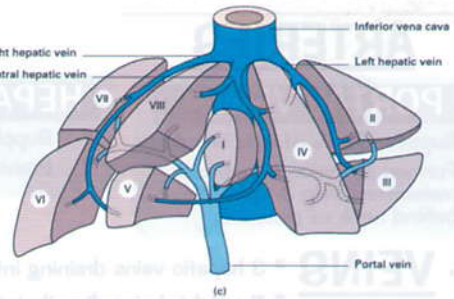
### ANATOMICAL LOBES

Divided into large right & small left lobes by:

- Anterior & Superiorly → Falciform ligament (On parietal surface)
- Inferiorly → ligamentum teres
- Posteriorly → ligamentum venosum

### SURGICAL LOBES

- ❖ The liver is divided into almost two equal lobes by middle hepatic vein. [plane of division lies to the right of falciform ligament & passes from gall bladder fossa to inferior vena cava]
- ❖ Each lobe of the two lobes is supplied by a separate branch of hepatic a., portal v. & separate bile duct.
- ❖ There are three hepatic veins:
  - Rt. hepatic v. drains from Rt. lobe
  - Lt. hepatic v. drains from Lt. lobe
  - Middle hepatic vein drains from both lobes
- ❖ Hepatic vein & its tributaries divide the lobe into 4 sectors & sectors into 8 segments.
- ❖ Segments are numbered from 1-8



### SURGICAL LOBES

Each segment has its own artery, vein & duct → can be removed separately  
:: SEGMENTECTOMY ::



## SURFACES & RELATIONS

Formed of PARIETAL surface & VISCERAL surface separated from below by sharp lower border

### PARIETAL SURFACE

- Related to the diaphragm separating it from lungs, pleural cavities, heart & lower right ribs.
- Related to the anterior abdominal wall.
- IVC indents into its posterior aspect.

### VISCERAL SURFACE

- LEFT PART:  
Related to abdominal esophagus & anterior surface of the stomach
- FURTHER TO THE RIGHT:  
Related to gall bladder (adherent to undersurface of the liver "gall bladder fossa")  
Gall bladder & quadrate lobe related to 1st & 2nd part of duodenum & Hepatic flexure of colon
- RIGHT PART:  
Bears the renal impression which is caused by rt. kidney & suprarenal gland.

### CAUDATE LOBE

- This is segment one
- Lies just behind the porta hepatis.
- Has a special status as it's supplied by hepatic a. & portal v. branches from both sides, and is drained directly by multiple small veins into the inferior vena cava

### QUADRATE LOBE

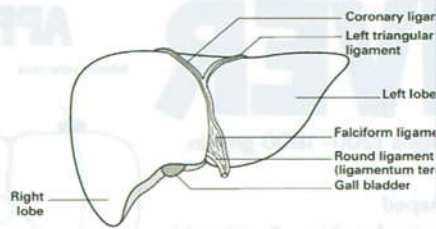
- Part of liver between the round ligament & gall bladder fossa



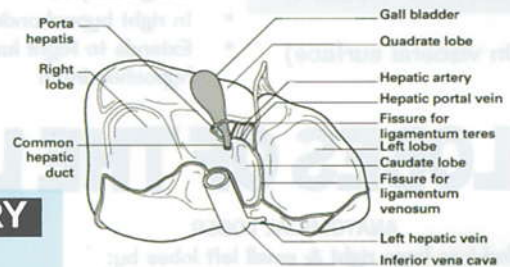


## LYMPHATICS

- Liver drains into L.Ns at porta hepatis which drains into celiac L.Ns
- Some lymphatic vessels pierce the diaphragm to reach the thoracic duct



## APPLIED ANATOMY



## BLOOD SUPPLY:

### 1- ARTERIES

#### PORTAL VEIN

- Supplies 70 % of liver blood
- Formed by union of superior mesenteric vein & splenic vein behind neck of pancreas

#### HEPATIC ARTERY

- Supplies 30 %
- Branch from celiac trunk

- ### 2- VEINS
- 3 hepatic veins draining into inferior vena cava (IVC).
  - The right drains directly into IVC while left & middle unite to form short trunk before draining to IVC.

# PERITONEAL COVERING & FOLDS

Formed of PARIETAL surface & VISCERAL surface separated from below by sharp lower border

#### PERITONEAL COVERING

The parietal surface is covered by peritoneum except:

- Small bare area lying between superior & inferior layers of Coronary ligaments
- Fossa of gall bladder
- IVC groove
- Porta hepatis

#### PERITONEAL FOLDS

##### • FALCIFORM LIGAMENT:

- Related to abdominal esophagus & anterior surface of the stomach

##### • RT. & LT. TRIANGULAR LIGAMENTS

##### • UPPER & LOWER CORONARY LIGAMENTS

##### • LESSER OMENTUM:

Connects the lesser curvature of the stomach to visceral surface of the liver. Has a free right border which contains:

1. CBD → Anterior & to the right
2. Hepatic a. → Anterior & to the left
3. Portal v. → Posterior

As they reach the liver they all divide into right & left branches & enter the hilum of the liver [Known as porta hepatis]

# GALL BLADDER

## APPLIED ANATOMY

### SITE & SHAPE & CAPACITY

- Pyriform in shape
- 30 -50 ml.
- Lies in fossa of gall bladder on the visceral surface of the liver at the plane dividing it into 2 surgical lobes

### PARTS

#### FUNDUS

- Covered by peritoneum all around.
- At angle of 9th costal margin.

#### NECK

- Forms an S shaped curve.
- Connected to cystic duct

#### BODY

- In contact with 1st part of duodenum
- Occupies the GB fossa.

#### INFUNDIBULUM

- Is the angulated post. Portion of the body of gall bladder.
- When dilated called "Hartman's Pouch".

#### BLOOD SUPPLY

Gangrene is RARE d.t. 2<sup>nd</sup> rich blood supply coming from liver bed

#### CYSTIC ARTERY

Maybe very short when Rt. hepatic or common hepatic artery take a tortuous course "CATERPILLAR" → In such cases, clamping the cystic a. during gall bladder surgery is difficult & the Rt. hepatic a. may be mistaken as cystic a. and ligated

### BLOOD SUPPLY:

#### 1- ARTERIES

##### CYSTIC A.

A branch of Rt. hepatic artery passing in the triangle of Calot

##### ACCESSORY CYSTIC A.

If present  
(from Rt. or Lt. hepatic A. or common hepatic A.)

#### 2- VEINS

- Small veins → directly enter the liver bed.
- cystic veins → Into right branch of portal vein.

#### 3- LYMPHATICS

Cystic LN of Lund at the junction of cystic duct & CHD → to celiac LN

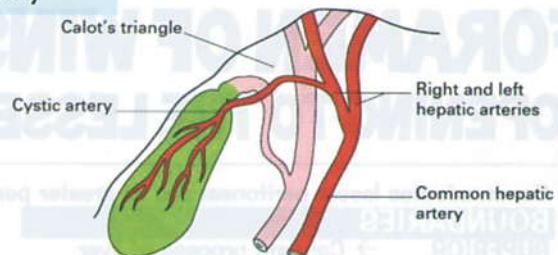
#### 4- NERVE

##### AUTONOMIC

- SYMPATHETIC →  
From T7-9  
(Pain is referred to inferior angle of Rt. scapula)
- PARASYMPATHETIC →  
Hepatic branch of anterior vagus  
(Pain referred to stomach)

##### SENSORY

By the Rt. phrenic C3,4,5  
(The same segments as the supra-clavicular nerves →  
So pain in gall bladder is referred to Rt. shoulder)

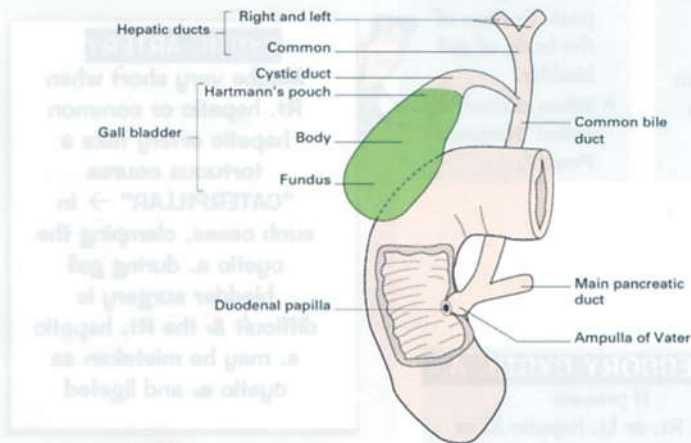
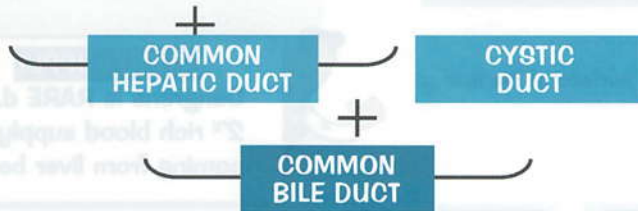




# EXTRA-HEPATIC BILIARY PASSAGES

RT. HEPATIC DUCT

LT. HEPATIC DUCT



## APPLIED ANATOMY



### CYSTIC DUCT

- Length → 2-3 cm
- Diameter → 2-3 mm
- Its mucosa is thrown into crescentic folds called spiral valve of Heister

### COMMON BILE DUCT

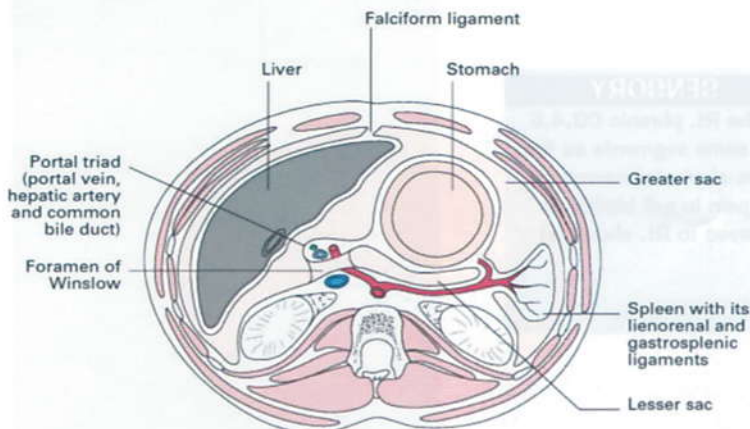
- Length → 8-10 cm "3-4 inches"
- Diameter:
  - 6 mm by U/S
  - 8 mm by cholangiography
- Parts →
  - Supra duodenal part
  - Intra pancreatic part
  - Retro duodenal part
  - Intra duodenal part
- Either unites with the pancreatic duct to end together or each opens separately
- Ends at the ampulla of vater in the 2nd part of the duodenum
- Opening is surrounded by sphincter of Oddi

## FORAMEN OF WINSLOW (OPENING TO THE LESSER SAC)

Communicates lesser peritoneal sac to greater peritoneal sac

### BOUNDARIES

- |                  |                            |
|------------------|----------------------------|
| <b>SUPERIOR</b>  | → Caudate process of liver |
| <b>INFERIOR</b>  | → 1st part of duodenum     |
| <b>POSTERIOR</b> | → IVC                      |



### FORAMEN OF WINSLOW

- During cholecystectomy, control of bleeding from cystic artery is achieved by Pringles maneuver → Put the index finger of the Lt. hand in the foramen of Winslow & compress the free border of lesser omentum against the thumb → compression of hepatic artery.
- Site of exposure of supra-duodenal portion of CBD for removal of stones.
- A site for internal hernia (epiplocele) where the foramen represents the defect



# THE SPLEEN

## APPLIED ANATOMY

- It weighs 80 - 300 gms.
- Lies in the left hypochondrium deep to the 9th, 10th & 11th ribs
- It's long axis is parallel to the 10th rib
- Has a notch on it's anterior border

### ANTERIOR NOTCH

Differentiates it from the left kidney

## SURFACES

### PARIETAL

- Convex
- In contact with the diaphragm
- Through the diaphragm it's related to pleura & thin inferior border of left lung

Surface related to stomach across lesser sac

Splenic artery

Tail of pancreas

Splenic fl

Left kidney

### PARIENTAL RELATIONS

Injury of spleen may lead to injury of Vital structures (e.g. Diaphragm, Pleura, Lung) due to close relations

### VISCERAL

- Related to:
- Stomach
  - Colon
  - Left kidney
  - Tail of pancreas at hilum of the spleen

### PERITONEAL COVERING

- It's completely covered by peritoneum "Intraperitoneal organ"
- Is fixed firmly to the splenic capsule
- Two peritoneal folds hang the spleen at it's hilum:  
1-Gasto-splenic ligament  
2-lieno-renal ligament

### VISCERAL RELATIONS

Special care should be addressed when clamping it in order to preserve tail of pancreas during "

## LIGAMENTS

### GASTRO-SPLENIC LIGAMENT

- Attached to the hilum of the spleen
- Transmits short gastric vessels which are branches of splenic or gastro-epiploic vessels

### LIENO-RENAL LIGAMENT

- Attached to the hilum of the spleen
- Transmits the blood vessels to the spleen & tail of pancreas

### PHRENICO-COLIC LIGAMENT

- From splenic flexure of the colon to the diaphragm
- Lower pole of the spleen is in contact with it, which is one of its main supports

### PHRENICO-COLIC LIGAMENT

Pushes the spleen to Rt. iliac fossa when enlarged

## BLOOD SUPPLY:

### SPLenic ARTERY

A branch of celiac trunk but may arise from aorta or superior mesenteric artery  
Has a tortuous course above the upper border of pancreas  
Divides into superior & inferior terminal branches that enter the splenic hilum

### SPLenic VEIN

Runs along posterior surface of pancreas below the level of splenic artery  
Receives the inferior mesenteric vein  
Joins the superior mesenteric vein behind neck of pancreas to form portal vein

### SPLenic ARTERY

It's tortuous course allows contraction of spleen & respiratory movement

## LYMPHATICS

Lymphatic vessels that drain to L.Ns of the hilum



# PANCREAS

## APPLIED ANATOMY

During development, the two segments may completely surround the 2<sup>nd</sup> part of the duodenum → ANNULAR PANCREAS

### PARTS & RELATIONS

A retroperitoneal organ formed of the following parts Head, neck, body & Tail

#### HEAD

- Lies within the concavity of the duodenum "c"
- Has a hook like process called uncinate process where superior mesenteric vessels lies in front of it & emerges at the lower border of the pancreas
- Posterior to it
  1. Common bile duct (CBD)
  2. Inferior vena cava

#### NECK

- Posterior to it: junction between superior mesenteric vein & splenic v to form portal v.

#### BODY

- Anterior to it: Lesser sac "separating it from posterior surface of the stomach"
- Posterior to it: Splenic vein & aorta
- Splenic artery runs to the left just above the body

#### TAIL

Related to splenic hilum & splenic vessels

### DUCTS

#### MAIN PANCREATIC DUCT "Duct of wirsung"

- Joins the CBD at ampulla of Vater
- Opens in the middle of the medial surface of 2<sup>nd</sup> part of the
- Duodenum on major duodenal papilla
- The common opening is surrounded by sphincter of oddi

#### ACCESSORY PANCREATIC DUCT "Duct of santorini"

- May join main duct or opens separately above it on minor duodenal papilla

Due to its deep position. Clinical examination is not reliable & diagnosis is dependent on Lab. & radiological investigations

#### RETROPERITONEAL

The only organ that never becomes content in the sac of a hernia

#### POSTERIOR RELATION IS CBD

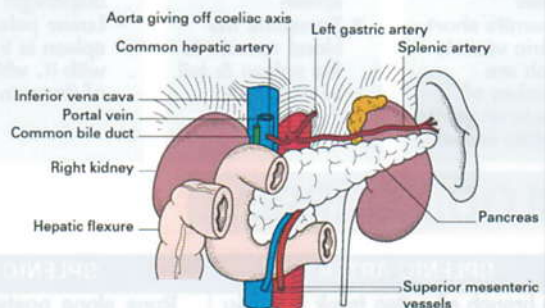
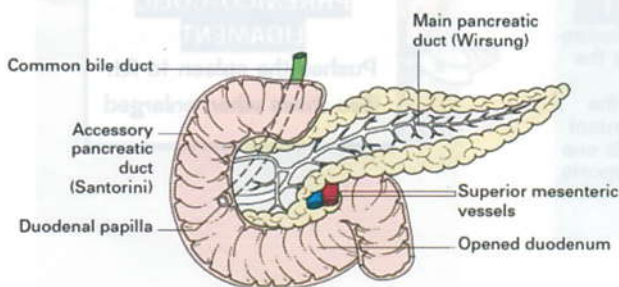
90 in cancer head of pancreas → CBD obstruction → obstructive jaundice

#### ANTERIOR RELATION OF BODY

Perforation of POSTERIOR GASTRIC ULCER may lead to PANCREATIC PSEUDOCYST

#### PANCREATIC DUCT

Joins CBD, that's why stones are a cause of acute pancreatitis



### BLOOD SUPPLY:

#### 1- ARTERIES

Superior & inferior pancreatico-duodenal arteries

- Forms an arcade that lies in concavity of duodenum "C"
- Supplies the head & duodenum
- Branches of splenic arteries
- Supplies the rest of pancreas

#### 2- VEINS

Drains to corresponding veins ending in portal vein

#### SUPERIOR & SUPERIOR & INFERIOR PANCREATICO-DUODENAL ARTERIES

Supplies also the duodenum so it's removed in Whipple's operation



# APPENDIX

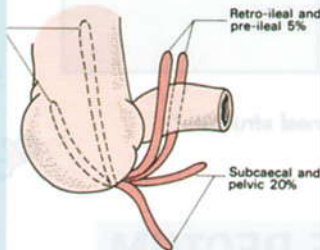
## APPLIED ANATOMY

### SITE, SIZE & SHAPE

- Blind ended hollow muscular tube
- Arises at caecum at convergence of taeniae coli
- Measures between 7.5 -10 cm

### SITE, SIZE & SHAPE

- The base of appendix is fixed
- The relation of the tip to caecum is variable:
  1. Retro-caecal (74%)
  2. Pelvic (21%)
  3. Para-caecal (2%)
  4. Sub-caecal (1.5%)
  5. Pre-ileal (1%)
  6. Post-ileal (0.5%)



#### CONVERGENCE OF TAENIAE COLI

Used as a guide to appendix in appendectomy

#### TIP VARIABILITY

- gives some difference in the clinical picture of acute appendicitis
- In appendectomy we open over the surface anatomy of the base.

#### MORE VARIABILITY

The location of caecum is not always in right iliac fossa because the ascending colon may be:

1. Too short making the caecum Sub-hepatic
2. Too long making the caecum in the Pelvis

## PERITONEAL COVERINGS

The appendix is completely covered by peritoneum & has a mesoappendix which stops shortly at tip of appendix

## NERVE SUPPLY

T 10 supplies the peritoneal covering of the appendix

#### NERVE SUPPLY

That's why pain in acute appendicitis starts around the umbilicus "Visceral pain"

## BLOOD SUPPLY

ARTERIAL SUPPLY	VENOUS DRAINAGE
One or two appendicular arteries	Appendicular vein
Run in the meso-appendix, closely applied to the wall distally	Drains into superior mesenteric vein then to portal vein

#### APPENDICULAR ARTERY

It's the ONLY blood supply  
→ RAPID development of gangrene & perforation

## HISTOLOGY

### 1. MUCOSA

Similar to colonic mucosa formed of columnar epithelium with goblet cells. crypts are present but fewer & shorter

### 2. SUBMUCOSA

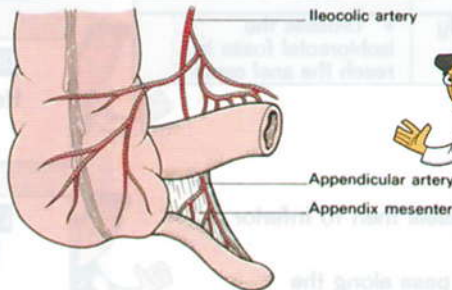
Rich in lymphoid tissue which becomes atrophied with age.

### 3. MUSCULOSA

Thin & formed of two complete layers, circular & longitudinal muscles.

### 4. SEROSA

Completely covered by peritoneum



#### ATROPHY OF LYMPHOID TISSUE

SO Acute appendicitis in old age → must suspect cancer

#### SURFACE ANATOMY

The base of the appendix lies at McBurney's point

It's a point at junction of lateral 1/3 & medial 2/3 of a line extending from ASIS to the Umbilicus

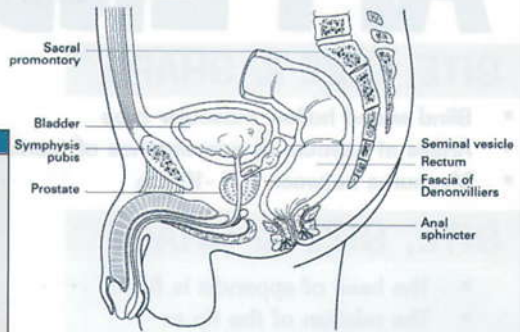


# THE RECTUM

## APPLIED ANATOMY

**BEGINS** Opposite to S3 at rectosigmoid junction  
**END** At anorectal junction at the level of the pelvic floor  
**LENGTH** 12-15 cm  
**SHAPE:**

Anteroposteriorly	Side to Side	Ampulla of the rectum
Concave anteriorly bec. it follows the concavity of the sacrum	Concave 1st to the right, then to the left then to right again. Opposite to the bending the mucosa forms mucosal folds which are called Valves of Houston	The distal part of the rectum, which acts as a reservoir because of its characteristic distensibility



### PERITONEUM

Partially covered by peritoneum "Retroperitoneal structure"  
 → Upper third → Front & sides  
 → Middle third → Front  
 → Lower third → Not covered

### LOWER THIRD

Not covered by peritoneum →  
 No transcolomic implantation

### FASCIA AROUND THE RECTUM

LATERAL LIGAMENT	FASCIA OF WALDEYER	FASCIA OF DENONVILLIERS
<ul style="list-style-type: none"> <li>- Gives attachment between the rectum &amp; side walls of the pelvis</li> <li>• Contains the middle rectal vessels</li> </ul>	<ul style="list-style-type: none"> <li>- Posterior to the rectum</li> <li>• It loosely bound the rectum to sacrum</li> <li>• Pelvic plexus of autonomic nerves lies behind the fascia</li> </ul>	<ul style="list-style-type: none"> <li>• Anterior to the rectum</li> <li>• It's a tough fascia</li> <li>• Separates it from the back of urinary bladder &amp; prostate in males</li> </ul>

### The Rectum has NO

1. Teniae coli
2. Haustrations
3. Mesentery

**SUPERIOR** vein is portal while **MIDDLE & INFERIOR** are systemic

### BLOOD SUPPLY:

SUPERIOR RECTAL ARTERY & VEIN	LT. & RT. MIDDLE RECTAL A. & V.	LT. & RT. INFERIOR RECTAL ARTERY & VEIN
<ul style="list-style-type: none"> <li>• Direct continuation of inferior mesenteric artery &amp; vein</li> <li>• Gives branches at 3,7,12</li> </ul>	<ul style="list-style-type: none"> <li>• From internal iliac artery &amp; vein</li> <li>• Runs medially in the lateral rectal ligament</li> </ul>	<ul style="list-style-type: none"> <li>• From internal pudendal artery &amp; vein</li> <li>• Crosses the ischioanal fossa to reach the anal canal</li> </ul>

Site of Porto-systemic circulation leading to varices

### SUPERIOR RECTAL VEIN

Its branches are site of mother piles

### LYMPHATICS

- Usually in upwards direction
- To L.Ns along the superior rectal vessels then to Inferior mesenteric L.Ns
- To a minor extent, some lymphatics pass along the middle rectal vessels to internal iliac L.Ns

### LYMPHATIC SPREAD IN UPWARD DIRECTION

SO  
 Removal of 2 cm BELOW the tumor is enough in cancer rectum



# ANAL CANAL

## APPLIED ANATOMY

### BEGINS

At the level of the pelvic floor, As the rectum passes through pelvic floor it ends by turning backwards at right angle forming the anal canal

### END

### LENGTH

3-4 cm

### COURSE

Continues downwards & backwards, surrounded by three concentric cylinders of muscles these are the two internal & external sphincters & a thin longitudinal ms. layer between them

### RELATIONS

It's cushioned on either sides by fat-filled ischiorectal fossa

### DENTATE LINE

Is the appearance as the anal crypts join each other, anal glands open on the anal crypts that are circumferentially arranged

## MUCOSA OF THE ANAL CANAL

Dentate line "which is an important surgical land mark" divides the anal canal into 2 parts:

	ABOVE DENTATE LINE	BELOW DENTATE LINE
Development	Hindgut	Proctodeum = Ectoderm
Lining	Cubical epithelium which changes gradually upwards to columnar epithelium at rectum	Modified skin lacking hair follicles & sweat glands. Called anoderm
Nerve supply	Visceral, not sensitive to pain	Somatic, sensitive to pain
Blood supply	Superior rectal vessels (portal)	Middle & inferior rectal vessels (system)
Lymphatic drainage	Superior rectal L.Ns	Superficial inguinal L.Ns then to Deep L.Ns
Columns of Morgagni (Elevated mucosa)	Present	Absent
Color	Pink	Parchment-like

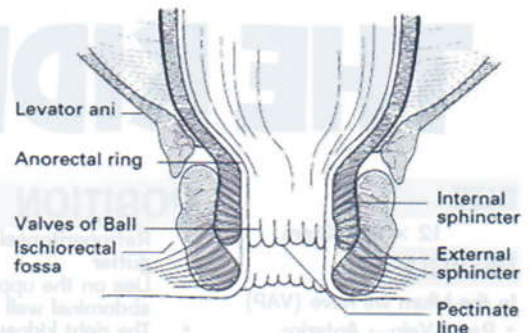


### CORRUGATION OF PERIANAL SKIN

Is caused by corrugators cutis ani ms. "Lowest fibres of the longitudinal muscle"

## ANAL SPHINCTERS

INTERNAL SPHINCTER	EXTERNAL SPHINCTER
Involuntary muscle	Voluntary muscle
Thickened continuation of the circular muscle coat of the rectum	Forms the outer most muscular cylinder
Surrounds the anal canal for a distance about 2.5 cm	Innervated by pudendal n. (9,2,3,4)
2.5 mm in thickness & white in color	Pink in color
Spasm in it plays a major role in pathology of anal fissure & perianal suppuration	Attached post. to coccyx & ant. to midperineal point in males & fuses with the sphincter of vaginae in females



### ANORECTAL RING

It's injury leads to faecal incontinence

## ANORECTAL RING

- Surrounds anorectal junction
- Composed of joining of :
  - Puborectalis part of levator ani
  - Upper part of internal & external sphincter

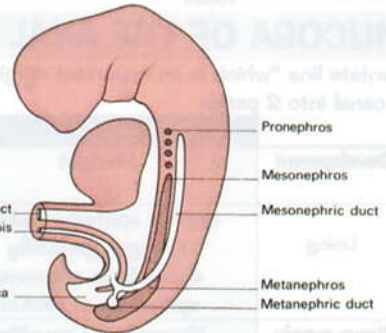
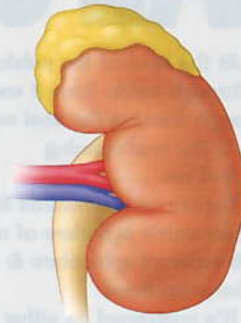




# SUPRARENAL GLAND

## APPLIED ANATOMY

	RIGHT	LEFT
SITE	Higher, upper pole of kidney	Lower, reaching hilum of kidney
SHAPE	Triangular	Semi-lunar
ANT. RELATION	Rt. Lobe of the liver	Lesser sac of stomach
POST. RELATION	Rt. crus of diaphragm	Lt. crus of diaphragm
V. DRAINAGE	Rt. suprarenal vein to IVC	Lt. suprarenal v. to lt. renal v.
ARTERIAL SUPPLY	<ul style="list-style-type: none"> <li>Arteries don't enter through the hilum</li> <li>3 arteries to each gland               <ol style="list-style-type: none"> <li>Superior suprarenal a. → from inferior phrenic a.</li> <li>Middle suprarenal a. → from the abdominal aorta (main supply)</li> <li>Inferior suprarenal a. → from renal a.</li> </ol> </li> </ul>	



### DEVELOPMENT OF THE KIDNEY & URETER

#### URETERIC BUD:

- Arises from mesonephric duct.
- Grows upwards retroperitoneally.
- Forms ureter, pelvis, calyces & collecting tubules.
- Will be capped by metanephron which forms glomeruli & nephric tubules which establish continuity with collecting tubules.

#### ASCENT & ROTATION:

- Starts developing in the pelvis
- Later ascend to the loin
- As it ascends it rotates: first the pelvis is ant. & calyces is post. THEN pelvis is medial & calyces is lateral

#### KIDNEY DEVELOPMENT

- Failure of fusion of mesonephric with metanephric duct → leads to **CONGENITAL POLYCYSTIC KIDNEY**

# THE KIDNEY

#### SIZE

12 × 6 × 3 cm

#### PEDICLE

In the hilum we have (VAP)

- Renal Vein → Anterior
- Renal Artery → Middle
- Pelvis of ureter → Posterior

#### POSITION

- Retroperitoneal organ, in paravertebral gutter
- Lies on the upper part of posterior abdominal wall
- The right kidney is lower than the left by 0.5 inch because of the pressure of the liver

#### HILUM (VAP)

- In **NEPHROLITHOTOMY** we open the **POSTERIOR** surface.
- In **HYPERNEPHROMA** we open the **ANTERIOR** surface

	RT. KIDNEY	LT. KIDNEY
Upper pole	Lower border of T12	Upper border of T12
Lower pole	lower border of L3	Upper border of L3



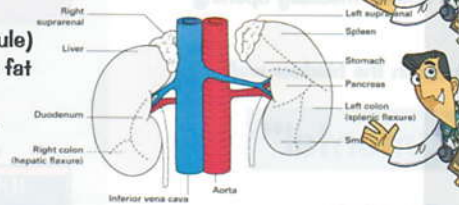
**BLOOD SUPPLY**

- A. Arterial supply: Renal artery (branch of abdominal aorta at L1/2)  
 B. V. drainage: Renal vein (drains into IVC)

**CAPSULE**

From within outwards:

- 1) Fibrous capsule (True capsule)
- 2) Fatty capsule: Peri-nephric fat
- 3) Fascia of Zuker- candle or Gerota or peri-renal capsule (False capsule)
- 4) Paranephric fat

**APPLIED ANATOMY**

**RENAL ARTERY STENOSIS**  
 leads to 2<sup>nd</sup> SYSTEMIC  
 HYPERTENSION

In closed trauma → **RENAL**  
**FASCIA** → TAMPONADE →  
 CONTROL BLEEDING

**RELATIONS**

	RT. KIDNEY	LT. KIDNEY
Anterior relations	1. Suprarenal 2. Second part of duodenum 3. Rt. colic flexure 4. Small intestine 5. Rt. lobe of liver	Stomach bed 1. Suprarenal 2. Stomach 3. Small intestine 4. Splenic flexure 5. Spleen 6. Splenic vessels & pancreas
Posterior relations	4 Muscles 1. Diaphragm 2. Quadratus lumborum 3. Psoas major 4. Transversus abdominis	4 Neurovascular structures 1. Subcostal vessels 2. Subcostal nerve 3. Iliohypogastric nerve 4. Ilioinguinal nerve

**SURFACE ANATOMY**  
"Morris parallelogram"

- Bounded by 4 lines on the back of the patient:  
 → 2 vertical lines: 3 & 9 cm from median plane  
 → 2 horizontal lines: at level of T11 & L3
- The centre of the hilum lies opposite to the lower border of L1 spine, 6 cm from median plane.

**STABILITY OF THE KIDNEY**

- 1-It's position in the para-vertebral gutter
- 2-It's fascial & fatty capsules
- 3-Renal vessels connecting kidney to Aorta & IVC

# THE URETER

**BEGIN** At pelvi-ureteric junction, in front of the tip of transverse Process of L1

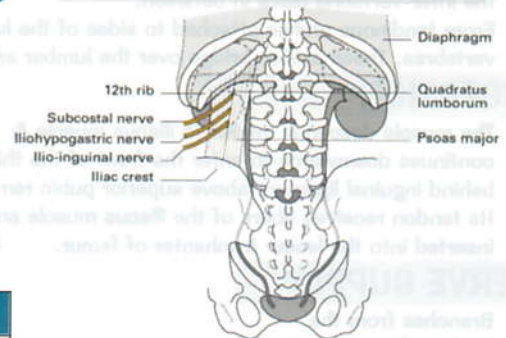
**END** Opening into posterosuperior angle of the urinary bladder

**SITES OF URETERIC CONSTRICTIONS**

- 1) Pelvi-ureteric junction (L2)
- 2) Inlet of pelvis (Bifurcation of common iliac)
- 3) Ischial spine

**COURSE** It's divided into 3 parts A) Abdominal B) Pelvic C) Intramural  
 Abdominal part: It's 12.5 cm long

	RIGHT URETER	LEFT URETER
Course	<ul style="list-style-type: none"> <li>• Each ureter descends vertically behind peritoneum of the posterior abdominal wall</li> <li>• Opposite the tips of transverse processes of lower 4 lumbar vertebrae</li> <li>• The same course in both ♂ &amp; ♀</li> </ul>	
Post. relation	<ul style="list-style-type: none"> <li>• Medial border of psoas major</li> <li>• Genito-femoral nerve on it.</li> <li>• Tips of transverse processes of the lower 4 lumbar vertebrae</li> </ul>	
Ant. relation	<ul style="list-style-type: none"> <li>• 3rd part of the duodenum</li> <li>• 3 arteries: Rt. gonadal, Rt. colic &amp; ileo-colic.</li> </ul>	<ul style="list-style-type: none"> <li>• 3 arteries: Lt. gonadal, upper &amp; lower Lt. Colic</li> </ul>
	3 structures related to mesentery: <ul style="list-style-type: none"> <li>• Its root</li> <li>• Sup. mesenteric vessels</li> <li>• coils of ileum</li> </ul>	It passes behind the fossa intersigmoidae. <ul style="list-style-type: none"> <li>• Sigmoid mesocolon</li> <li>• Coils of sigmoid colon</li> </ul>





- A. PELVIC PART:** It's 12.5 cm long
- It enters the pelvis by crossing in front of the bifurcation of common iliac artery (at the sacroiliac joint).
  - It runs downwards & backwards on the side of pelvic wall till it reaches ischial spine
  - At the level of ischial spine, it curves antero-medially opening in urinary bladder
- B. INTRAMURAL PART:**  
It is 2 cm long, runs on oblique course in the bladder wall

## BLOOD SUPPLY "Segmental"

- UPPER  $\frac{1}{3}$  → renal artery.
- MIDDLE  $\frac{1}{3}$  → gonadal, aorta & common iliac arteries
- LOWER  $\frac{1}{3}$  → vesical artery in male & uterine artery in female

# PSOAS MAJOR

## ORIGIN

- Front of the transverse processes of all lumbar vertebrae.
- By 5 digitations, each of which arises from the sides of the bodies of each 2 adjacent lumbar vertebrae and the inter-vertebral discs in between.
- From tendinous arches attached to sides of the lumbar vertebrae. These arches bridge over the lumbar arteries

## INSERTION

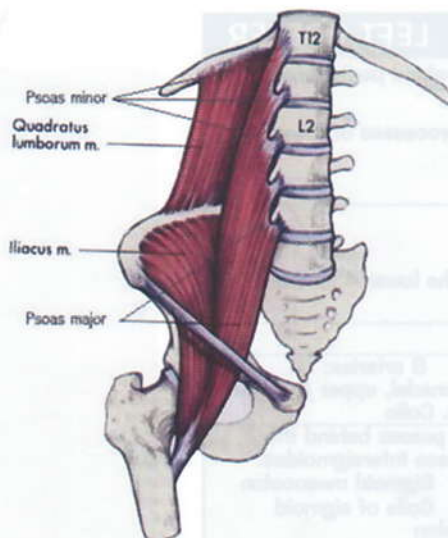
- The muscle descends medial to iliacus muscle & continues downwards to enter the front of the thigh behind inguinal ligament above superior pubic ramus.
- Its tendon receives fibers of the iliacus muscle and is inserted into the lesser trochanter of femur.

## NERVE SUPPLY

- Branches from the lumbar plexus (L 1, 2, 3)

## ACTION

- It flexes the thigh and rotates it medially
- Acting from below, the muscle bends the trunk forwards



## APPLIED ANATOMY

The course differs between males & females



### IDENTIFICATION DURING OPERATION

- It appears as thick muscular tube with longitudinal blood vessel along its wall
- It shows peristalsis & gives urine on aspiration
- It crosses in front of the bifurcation of the common iliac a.

## PSOAS MAJOR

### a. PSOAS SIGN:

- In acute appendicitis, there is spasm of psoas major ms. → flexion deformity.
- Hyperextension of the limb leads to abdominal pain (psoas sign)

### b. PSOAS ABSCESS:

- Produces cross fluctuation (DD: mass in the Rt. iliac fossa & mass in the femoral triangle)

### c. OBLITERATED PSOAS SHADOW IN X-RAY FILM:

- Rupture spleen.
- Peri-nephric abscess.

### d. IN FRACTURE NECK OF THE FEMUR

The muscle rotates the thigh laterally (not medially)

# COELIAC TRUNK

## APPLIED ANATOMY

It is the artery of foregut, Supplies the gut above the level of ampulla of Vater

### COELIAC TRUNK

May cause fatal bleeding in perforated DU.

### BRANCHES

#### LEFT GASTRIC ARTERY

Its branches include:

- Esophageal branches
- Gastric branches

#### SPLENIC ARTERY

Its branches include →

- PANCREAS**  
:: Pancreatic branches for body & tail ::
- STOMACH**  
:: Short gastric as., Lt. gastro-epiploic a.::
- TERMINAL BRANCHES** to the spleen

#### HEPATIC ARTERY

Its branches include →

- Right Gastric artery
- Supra-duodenal artery
- Left hepatic artery
- Right hepatic artery
- Gastro-duodenal artery

## SUPERIOR MESENTERIC ARTERY

- Arises from the front of abdominal aorta at the level of lower border of L1
- It supplies the midgut from the level of ampulla of Vater till the Rt.  $\frac{2}{3}$  of the transverse colon

### BRANCHES

#### 1. INFERIOR PANCREATODUODENAL ARTERY

#### 2. JEJUNAL & ILEAL BRANCHES (12-15)

#### 3. ILEO-COLIC ARTERY

Its branches include →

- Ileal branches.
- Appendicular branches (Continuation of the ileo-colic a.).
- Anterior caecal & posterior caecal branches to the caecum.
- Ascending branches anastomose with the descending branches of the Rt. colic

#### 4. RIGHT COLIC ARTERY

Its branches include →

- Descending branches anastomose with ascending branch of ileocolic.
- Ascending branches anastomose with the Rt. branches of the middle colic a.

#### 5. MIDDLE COLIC ARTERY

Its branches include →

- Rt. branch anastomoses with ascending branches of Rt. colic.
- Lt. Branch anastomoses with ascending branches of superior Lt. Colic artery.

### BRANCHES OF S.M.A

During colectomy, we ligate arteries arising from Rt. side of SMA; which are the middle colic, Rt. colic & ileocolic, while those arising from Lt. side; which are jejunal & ileal branches are kept; to avoid ischemia of jejunum & ileum

## INFERIOR MESENTERIC ARTERY

- Arise from the front of abdominal aorta at the level of lower border of L3.
- It supplies the hindgut from lateral  $\frac{1}{3}$  of the transverse colon to the upper  $\frac{1}{2}$  of the anal canal

### BRANCHES

#### 1. LEFT COLIC ARTERY

Its branches include →

- Ascending branches anastomose with the Lt. Branches of the middle colic.
- Descending branches anastomose with sigmoid branches

#### 2. SIGMOID BRANCHES

#### 3. SUPERIOR RECTAL ARTERY

- It supplies the rectum & upper  $\frac{1}{2}$  of anal canal.
- It is a continuation of the inferior mesenteric artery & anastomoses with the middle & inferior rectal arteries



# INFERIOR VENA CAVA

## APPLIED ANATOMY

### BEGINS

- At the lower border of L5 by union of the 2 common iliac veins behind the Rt. common iliac artery

### COURSE

- It ascends on the right side of the abdominal aorta.
- It is closely related to the Rt. sympathetic trunk

### END

- It pierces the central tendon of the diaphragm to open into the right atrium.

### TRIBUTARIES

The 3 tributaries of origin are The 2 common iliac veins & Median sacral vein

→ Others:

1. Phrenic vein.
2. Hepatic veins.
3. Rt. suprarenal vein.
4. Renal vein.
5. Rt. gonadal vein. (Testicular or ovarian)
6. Pairs of lumbar veins

# PORTAL VEIN

- Formed by union of SUPERIOR MESENTERIC VEIN & SPLENIC VEIN behind neck of pancreas

### COURSE

- It begins in front of the IVC.
- It ascends behind 1st part of the duodenum.
- It ascends in the free margin of the hepato-duodenal ligament (lesser omentum) behind CBD to the right & the proper hepatic artery to the left.
- It ends at the porta hepatis

Normally pressure in systemic veins is lower than portal vein

**PORTAL PRESSURE**  
If increases it leads to  
**PORTAL HTN.**

### LENGTH

- 3 inches

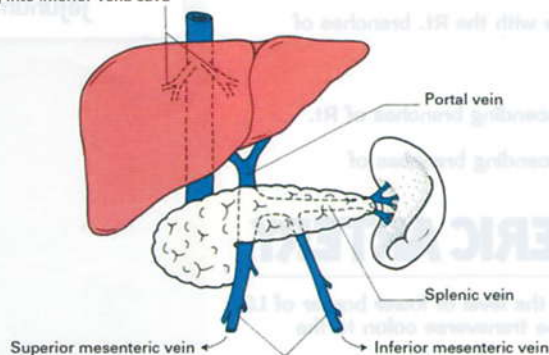
### DIAMETER

- 0.8 – 1.2 cm

### PRESSURE

- 10 – 20 cm H<sub>2</sub>O
- (7 – 11 mmHg)

Right and left hepatic veins  
draining into inferior vena cava



### DIRECT TRIBUTARIES

- Lt. and Rt. gastric veins.
- Small pancreatic & duodenal veins.
- Para-umbilical veins into left branch of portal vein.
- Splenic v.
- SMV.
- Cystic vein

# THE SCROTUM

- Pouch in which lie the testes and their coverings.
- The skin of the scrotum is thin, pigmented and marked by a longitudinal median raphe.
- It is rich with sebaceous glands
- The subcutaneous tissue contains no fat but does contain the involuntary dartos muscle



## APPLIED ANATOMY

### THE SCROTUM

- Common site for sebaceous cysts
- NOT site of lipoma
- The lax tissues of the scrotum and its dependent position cause it to fill readily with oedema fluid in cardiac or renal failure. Such a condition must be carefully differentiated from extravasation or from a scrotal swelling

# THE TESTIS

### SIZE

- Testis is an ovoid structure 4 - 5 cm in length & 2.5 - 3.5 cm in width

### SHAPE

- It is oval in shape, having 2 borders (anterior & posterior), 2 ends (upper & lower) & 2 surfaces (lateral & medial).

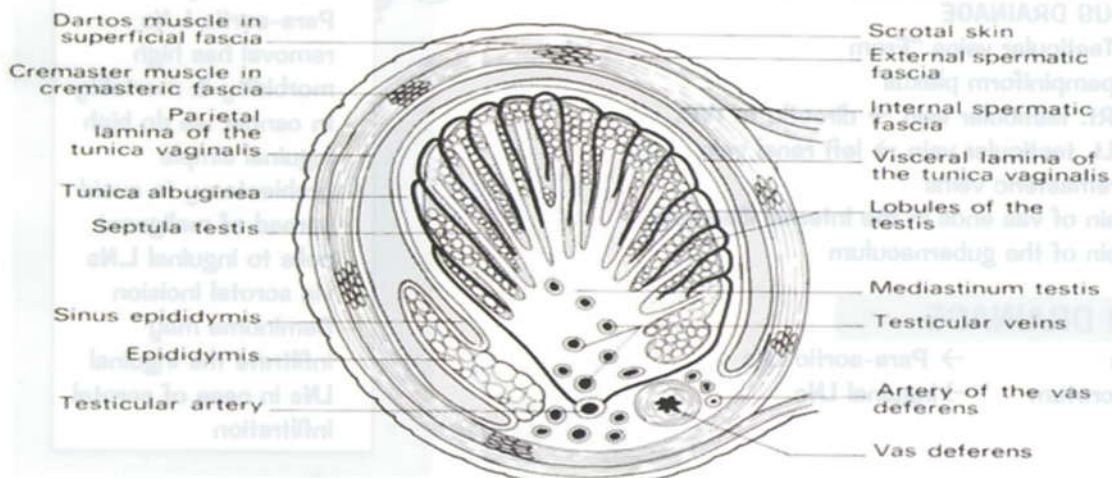
### RELATIONS

Its posterior border is related to

- Epididymis: laterally
- Vas deferens: medially

### COVERINGS OF THE TESTIS

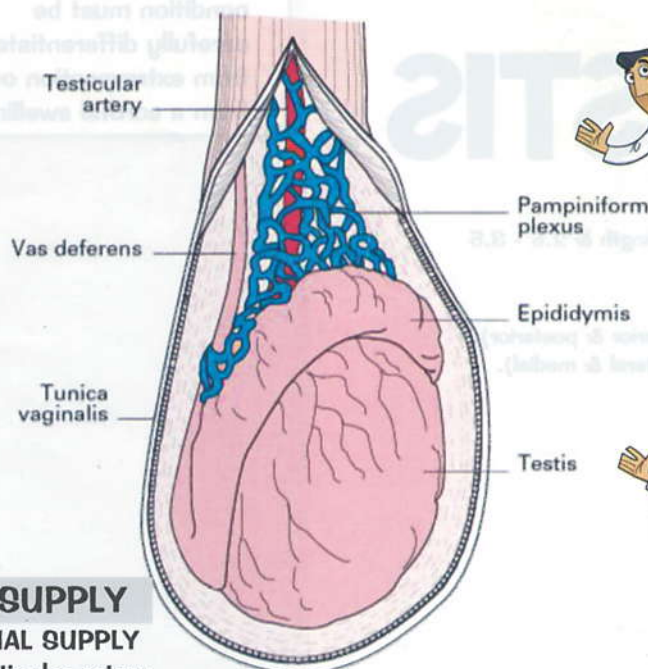
1. Skin
2. Dartos muscle
3. Colle's fascia
4. External spermatic fascia
5. Cremasteric muscle & fascia
6. Internal spermatic fascia
7. Tunica vaginalis (parietal & visceral layers)
8. Tunica albuginea (fibrous capsule)





**APPLIED ANATOMY****STRUCTURE**

- The testis is covered by thick fibrous layer (tunica albuginea), which is thickened posteriorly to form the mediastinum testis.
- It sends septa that divide the testis into 400 spaces, each contains 2-4 seminiferous tubules which are 60 cm in length.
- The seminiferous tubules open into rete testis in the mediastinum testis.
- The rete testis forms the vasa efferentia (15-20).
- The seminiferous tubules are surrounded by vascular connective tissue contains Leydig cells that secrete testosterone

**ARTERY OF VAS**

It may be efficient to maintain the testicular viability when the testicular artery is divided.

**LT. TESTICULAR VEIN → LEFT RENAL VEIN**

One of the theories explaining occurrence of varicocele much more on the left side

**BLOOD SUPPLY****✓ ARTERIAL SUPPLY**

- 1- Testicular artery (From the Aorta)
- 2- Artery to vas (From inferior vesical artery)

**✓ VENOUS DRAINAGE**

- 1- Testicular veins "From pampiniform plexus"
  - Rt. testicular vein → directly to IVC.
  - Lt. testicular vein → left renal vein
- 2- Cremasteric veins
- 3- Vein of vas ends in the internal iliac vein.
- 4- Vein of the gubernaculum

**LYMPH DRAINAGE**

- ✓ Testis → Para-aortic LNs
- ✓ The scrotum → inguinal LNs

**LYMPH DRAINAGE**

- No radical orchiectomy because Para-aortic L.Ns removal has high morbidity & mortality
- In cancer we do high inguinal simple orchiectomy to avoid spread of malignant cells to inguinal L.Ns via scrotal incision
- Seminoma may infiltrate the inguinal LNs in case of scrotal infiltration

# SPERMATIC CORD

## APPLIED

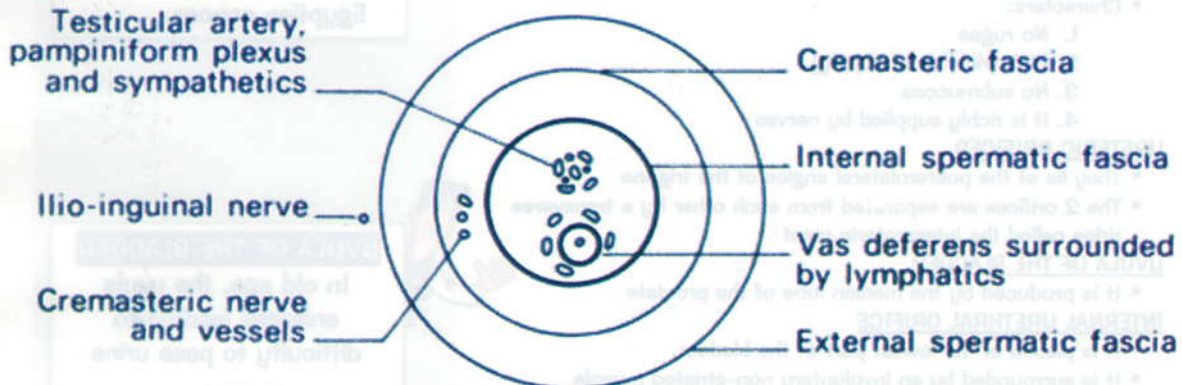
### CONTENTS

3 ARTERIES	3 NERVES	3 STRUCTURES
1. Testicular	1. Genital branch of Genito-femoral n.	1. Pampiniform plexus.
2. Cremasteric	2. Sympathetic ns. around testicular a.	2. Vas deferens.
3. Artery of vas.	3. Sympathetic ns. around artery of vas.	3. Obliterated processus vaginalis (Vestige)

Ilio-inguinal nerve is a content of the inguinal canal and NOT the spermatic cord

### COVERINGS

- External spermatic fascia → from external oblique.
- Cremasteric muscles → from internal oblique & transversus abdominis.
- Internal spermatic fascia → from fascia transversalis



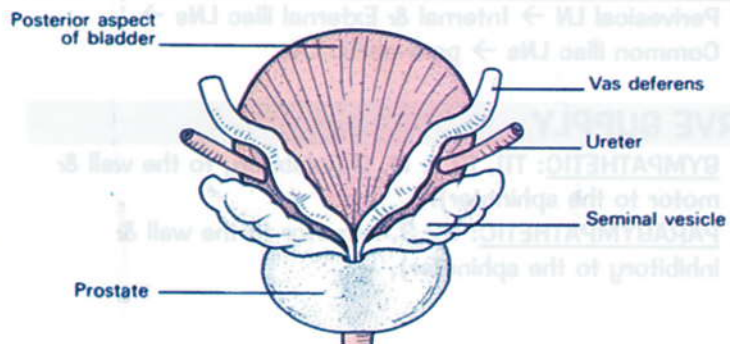
# URINARY BLADDER

### SITE

- ✓ **AT BIRTH:** It lies in the abdominal cavity (Pelviabdominal organ)
- ✓ **IN ADULT:** It occupies the anterior part of the pelvis (Pelvic organ), when it is full it expand upward into the abdominal cavity

### 4 ANGLES

- ✓ **APEX** → Attached to median umbilical ligament.
- ✓ **NECK** → Lying on prostate (♂) or pelvic fascia (♀), it gives the urethra, surrounded by smooth muscle fibers constituting the sphincter vesicae
- ✓ **2 POSTERO-SUPERIOR ANGLES** → Receiving the 2 ureters



### PERITONEAL COVERING

- ✓ **Male** → Superior surface & upper of base
- ✓ **Female** → Superior surface ONLY



**RELATIONS**

- ✓ **ANTERIOR**
  - Male: puboprostatic ligament.
  - Female: pubovesical ligament.
- ✓ **INFEROLATERAL SURFACE**
  - Pubis, retropubic fat, obturator internus & levator ani muscles
- ✓ **SUPERIOR SURFACE**
  - Male: Coils of ileum & pelvic colon.
  - Female: The uterus & retrovesical pouch
- ✓ **POSTERIOR SURFACE**
  - Male: 2 seminal vesicles, 2 vasa deferentia & rectum.
  - Female: Cervix & vagina

**APPLIED****CAVITY OF THE BLADDER**

- ✓ **TRIGONE**
  - Triangular part of the base between the 2 openings of the ureter & the opening of the urethra
  - Characters:
    1. No rugae
    2. Pink (rich blood supply)
    3. No submucosa
    4. It is richly supplied by nerves
- ✓ **URETERIC ORIFICES**
  - They lie at the posterolateral angles of the trigone
  - The 2 orifices are separated from each other by a transverse ridge called the interureteric crest
- ✓ **UVULA OF THE BLADDER**
  - It is produced by the median lobe of the prostate
- ✓ **INTERNAL URETHRAL ORIFICE**
  - It is placed at the lowest part of the bladder.
  - It is surrounded by an involuntary non-striated muscle forming the sphincter vesicae
- ✓ **INTRAMURAL PART OF THE URETER**
  - The lowermost part of the ureter passes obliquely through the wall of the bladder; this part is called the intramural part

**TRIGONE CHARACTERS**

- Rich in blood supply → 90 stone → Hematuria
- No submucosa → No bilharziasis → No Egyptian cancer

**UVULA OF THE BLADDER**

In old age, the uvula enlarges leading to difficulty to pass urine

**INTRAMURAL PART**

Its oblique course is a factor in preventing regurgitation of urine into ureter when the bladder is distended

**BLOOD SUPPLY**

- ✓ **VESICAL ARTERIES** → From internal iliac a.
- ✓ **VESICAL VEINS** → Internal iliac vein

**LYMPH DRAINAGE**

- ✓ **Perivesical LN** → Internal & External iliac LNs → Common iliac LNs → para-aortic LNs

**NERVE SUPPLY**

- ✓ **SYMPATHETIC**: T11, 12 & L1, 2 (inhibitory to the wall & motor to the sphincter).
- ✓ **PARASYMPATHETIC**: 9, 2, 3, 4 (motor to the wall & inhibitory to the sphincter).

# SURGI- TOONS

## UPPER LIMB



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# MUSCLES OF THE SHOULDER APPLIED ANATOMY

## PECTORALIS MAJOR

- **ORIGIN:**
  - Clavicular head: medial ½ of front of the clavicle
  - Sternocostal head:
    - Ant. Surface of the sternum, Upper 6 costo-chondral junction,
    - External oblique aponeurosis.
- **INSERTION:** Lateral lip of the bicipital groove of the humerus
- **NERVE SUPPLY:** Medial and lateral pectoral nerves
- **ACTION:**
  - Whole muscle: Adducts and rotates the arm medially.
  - Clavicular head: Flexes the extended arm.
  - Sternocostal head: Extends the flexed arm.



### PECTORALIS MAJOR

- Is absent in Poland §.
- In radical mastectomy (RM) we remove the sterno-costal head but we preserve the clavicular head (to protect the cephalic v. & prevent infraclavicular hollowness)
- In modified RM only the pectoral fascia is removed while the ms. is preserved.

## PECTORALIS MINOR

- **ORIGIN:** 3rd, 4th & 5th ribs
- **INSERTION:** Coracoid process of scapula
- **NERVE SUPPLY:** Medial pectoral nerves
- **ACTION:** Protraction (Draws the scapula forwards)

### PECTORALIS MINOR

- It divides the axillary artery into 3 parts.
- It divides the axillary lymph nodes to 3 groups
- It is removed in RM to open the axilla (The door to the axilla)
- It is retracted or cut for clearance of the axilla in modified RM

## DELTOID

- **ORIGIN:**
  - 1-Ant. border of lat. ½ of clavicle,
  - 2-Lat. border of acromion
  - 3- Crest of the spine of the scapula.
- **INSERTION:** Deltoid tuberosity of the humerus.
- **NERVE SUPPLY:** Axillary n. (circumflex n.)
- **ACTION:**
  - Ant. fibers: Flex. & med. rotation of arm
  - Post. fibers: Ext. and lat. rotation of arm.
  - Middle fibres: Abduction of arm from 15° to 90°.



### DELTOID

Injury of axillary nerve causes paralysis of deltoid ms. (Manifested by: flat shoulder deformity & failure of abduction from 15 -90) & loss of sensation over lower ½ of deltoid ms.

## LATISSIMUS DORSI

- **ORIGIN:**
  - 1-Lower 6 thoracic spines.
  - 2- Lumbar fascia
  - 3-Post. part of iliac crest.
  - 4-Lower 3-4 ribs.
  - 4-Inf. Angle of scapula
- **INSERTION:** Floor of bicipital groove of the humerus.
- **NERVE SUPPLY:** N. to latissimus dorsi (Thoraco-dorsal nerve)
- **ACTION:**
  - Extension, adduction & medial rotation of the arm.
  - Used in climbing and swimming



### LATISSIMUS DORSI

During mastectomy we preserve nerve to latissimus dorsi to use the ms. as a myocutaneous flap

# MUSCLES OF THE FOREARM

## APPLIED ANATOMY

### A. SUPERFICIAL GROUP

- Pronator teres
  - Flexor carpi radialis
  - Palmaris longus
  - Flexor digit. Superficialis
  - Flexor carpi ulnaris
- Arise by a common tendon from the front of medial epicondyle of humerus (common flexor origin CFO)
  - They are flexors of the elbow + the name
  - Supplied by median n. except flexor carpi ulnaris by ulnar n.



#### PRONATOR TERES

Median nerve may be compressed bet. the two heads of Pronator Teres (By post-traumatic fibrosis)

### PRONATOR TERES:

Origin	(1) humeral head: CFO (2) ulnar head: Coronoid process of the ulna
Insertion	Pronator tuberosity of the radius
Nerve Supply	Median n. (passes between it's 2 heads)
Action	Pronation

### FLEXOR CARPI RADIALIS:

Origin	CFO
Insertion	Bases of the 2nd & 3rd metacarpal bones
Nerve Supply	Median n.
Action	1-Flexion of elbow 2-flexion & abduction of wrist

### PALMARIS LONGUS: (MAY BE ABSENT)

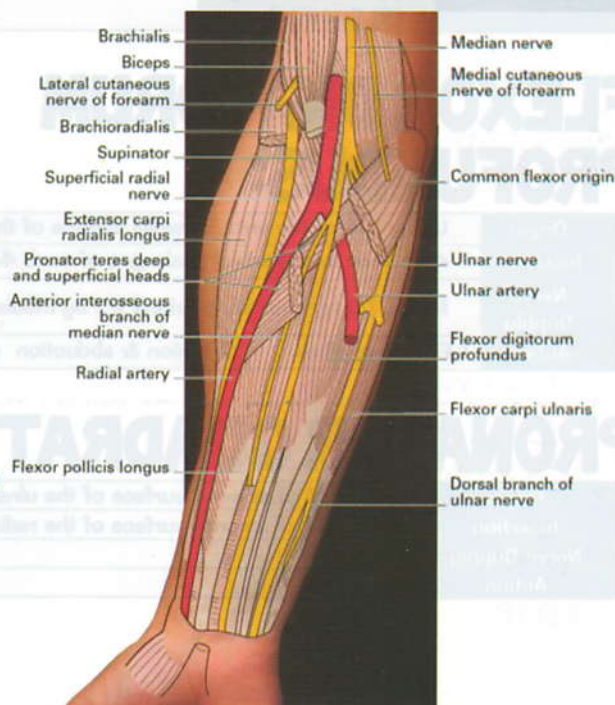
Origin	CFO
Insertion	Bases of the 2nd & 3rd metacarpal bones
Nerve Supply	Median n.
Action	1-Flexion of elbow 2-flexion & abduction of wrist

### FLEXOR DIGIT. SUPERFICIALIS:

Origin	(1) Humero-ulnar head: CFO & coronoid process of ulna (2) Radial head: Anterior oblique line of the radius
Insertion	4 tendons ; each splits to attach to sides of middle phalanx of medial 4 fingers
Nerve Supply	Median n.
Action	Flexion of: elbow, wrist, M.P. & proximal I.P. joints.

### FLEXOR CARPI ULNARIS:

Origin	(1) humeral head: CFO (2) Ulna: Posterior border of the ulna
Insertion	Pisiform bone & base of the 5th metacarpal bone.
Nerve Supply	Ulnar n.
Action	1-Flexion of elbow 2-flexion & adduction of wrist





**B. DEEP GROUP****APPLIED ANATOMY**

- Flexor pollicis longus
- Flexor digitorum profundus
- Pronator quadratus

**FLEXOR POLLICIS LONGUS:**

Origin	Upper 2/3 of the anterior surface of the radius
Insertion	Base of the terminal phalanx of the thumb
Nerve Supply	Anterior interosseus nerve
Action	(1) Flexion of all joints of the thumb (2) flexion of wrist

**FLEXOR DIGITORUM PROFUNDUS:**

Origin	Upper 2/3 of the ant. & medial surface of the ulna
Insertion	4 tendons into terminal phalanges of med. 4 fingers
Nerve Supply	Medial 1/2 by ulnar N. & lateral 1/2 by median n.
Action	1-Flexion of elbow      2-flexion & abduction of wrist

**PRONATOR QUADRATUS:**

Origin	Lower 1/4 of anterior surface of the ulna
Insertion	Lower 1/4 of anterior surface of the radius
Nerve Supply	Median n.
Action	Pronation

**MUSCLES OF THE BACK OF FOREARM****APPLIED ANATOMY****A. SUPERFICIAL GROUP****BRACHIORADIALIS:**

Origin	Upper 2/3 of lateral supracondylar ridge of Hum.
Insertion	Bases of the styloid process of the radius
Nerve Supply	Radial n.
Action	1-Initiates pronation & supination 2-Flexes midprone forearm

**ARRANGED FROM  
LATERAL TO MEDIAL AS  
FOLLOWS:**

- Brachioradialis
- Ext. carpi radialis longus
- Extensor carpi radialis brevis
- Extensor digitorum
- Extensor digiti minimi
- Extensor carpi ulnaris
- Anconeus

**EXTENSOR CARPI RADIALIS LONGUS:**

Origin	Upper 2/3 of lateral supracondylar ridge of Hum.
Insertion	Base of the 2nd metacarpal bone (dorsal aspect)
Nerve Supply	Radial n.
Action	Extension & radial deviation of the wrist

**EXTENSOR CARPI RADIALIS BREVIS:**

Origin	Front of the lat. epicondyle (common extensor origin(C.O.E))
Insertion	Base of the 3rd metacarpal bone
Nerve Supply	Posterior interosseous n.
Action	Extension & radial deviation of the wrist

**EXTENSOR DIGITORUM:**

Origin	C.E.O
Insertion	4 tendons into extensor expansion of med. 4 fingers
Nerve Supply	Posterior interosseous n.
Action	1-Extension of wrist 2-Extension of medial 4 fingers

**EXTENSOR DIGITI MINIMI:**

Origin	C.E.O
Insertion	Extensor expansion of the little finger
Nerve Supply	Posterior interosseous n.
Action	Extension of the little finger

**EXTENSOR CARPI ULNARIS:**

Origin	(1) C.E.O (2) Posterior border of the ulna
Insertion	Base of the 5th metacarpal bone
Nerve Supply	Posterior interosseous n.
Action	1-Extension & ulnar deviation of the wrist

**ANCONEUS:**

Origin	Back of the lateral epicondyle of the humerus
Insertion	Upper 1/4 of the post. border of the ulna
Nerve Supply	Radial n.
Action	Extension of the elbow



## B. DEEP GROUP

5 muscles all supplied by Posterior interosseous nerve

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

## APPLIED ANATOMY

### SUPINATOR:

Origin	Supinator fossa of the ulna.
Insertion	Posterior surface of the radius.
Action	Supination of extended forearm

### ABDUCTOR POLLICIS LONGUS:

Origin	Posterior surface of radius, ulna & interosseous membrane
Insertion	Lateral base of the 1st metacarpal bone
Action	Abduction of the thumb

### EXTENSOR POLLICIS BREVIS:

Origin	Posterior surface of radius & interosseous membrane
Insertion	Base of the proximal phalanx of the thumb.
Action	Extension of the proximal phalanx of the thumb.

### EXTENSOR POLLICIS LONGUS:

Origin	Posterior surface of ulna & interosseous membrane
Insertion	Base of the terminal phalanx of the thumb.
Action	Extension of all joints of the thumb

### EXTENSOR INDICIS:

Origin	Back of lower part of ulna & interosseous membrane
Insertion	Extensor expansion of the index finger
Action	Extension of the index finger

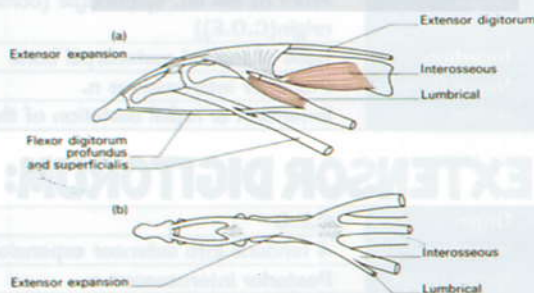


Fig. 133 The tendons of a finger: (a) Lateral view; (b) Dorsal (posterior) view.

## MUSCLES OF THE HAND

Muscle	Origin	Insertion	Action
Lumbricals	Tendons of flexor digitorum profundus	Base of proximal phalanx	Flexes MPJ Extends IPJ
Interossei	Metacarpal bones	Extensor expansion	Extension of IPJ Palmar → adduction of IPJ (Pad) Dorsal → abduction of IPJ (Dab)
Lumbricals + Interossei → Writing Position (Flexion In MP Joint + Extension Of IP Joint)			

### Nerve Supply:

The Ulnar nerve supplies all the intrinsic muscles of the hand except the 3 muscles of thenar eminence + lumbricals 1 & 2 (Supplied by median nerve).

These include:

#### Lateral group (4 muscles):

3 Thenar muscles (Abductor pollicis brevis, Flexor pollicis brevis, & Opponens pollicis)  
+ 1 muscle deep to them (Adductor pollicis).

#### Medial group (4 muscles):

3 hypothenar muscles (Abductor digiti minimi, flexor digiti minimi & opponens digiti minimi)  
+ 1 muscle superficial to them (Palmaris brevis).

#### Central:

4 lumbricals  
4 palmar interossei  
4 dorsal interossei



# THE CUBITAL FOSSA APPLIED ANATOMY

## Boundaries:

- Base "Above": an imaginary line passing bet. the 2 epicondyles of the humerus.
- Laterally: the brachioradialis muscle
- Medially: the pronator teres muscle.
- Apex: Meeting of lat. & med. Borders.

## Floor:

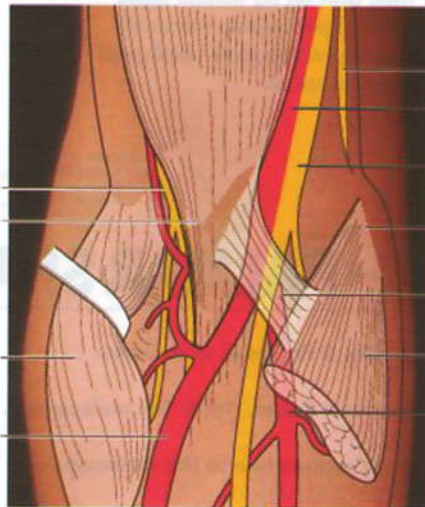
1. Brachialis ms.
2. Supinator ms.



## CUBITAL FOSSA

One of its contents is Median cubital vein, this vein Used for I.V injection

Radial nerve  
Biceps tendon  
Brachioradialis  
Radial artery



Ulnar nerve  
Brachial artery  
Median nerve  
Common flexor origin  
Bicipital aponeurosis  
Pronator teres  
Ulnar artery

# FLEXOR RETINACULUM

**Site:** Thick fibrous band stretches distal to wrist joint

## Attachments:

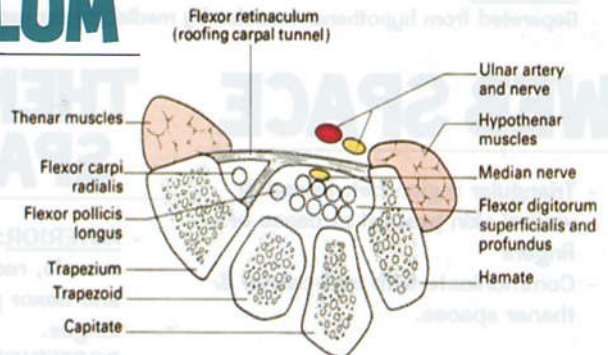
- Medially: Attached to pisiform bone & hook of hamate
- Laterally: Tubercle of scaphoid bone & crest of trapezium

## Superficial to it: " 2 ulnar & 2 palmar "

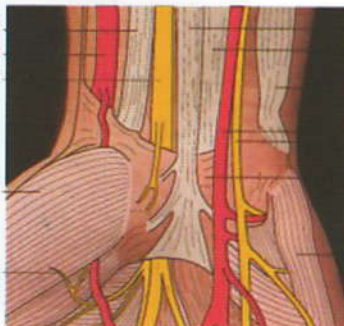
1. Ulnar n.
2. Ulnar vs.
3. tendon of Palmaris longus ms.
4. Palmar cutaneous branch of ulnar & median nerves

## Deep to it: " The carpal tunnel containing "

- Flexor digitorum superficialis
- Flexor digitorum profundus tendon
- Flexor pollicis longus tendon
- Flexor carpi radialis tendon & it's synovial sheath (special canal)
- Median n.
- Ulnar bursa (Encloses tendons of superficialis & profundus)
- Radial bursa (Encloses tendon of flexor pollicis longus)



Flexor carpi radialis  
Radial artery  
Median nerve



Palmaris longus  
Flexor digitorum superficialis  
Flexor carpi ulnaris

Ulnar artery and nerve  
Flexor retinaculum

Hypothenar muscles

Thenar muscles

Recurrent motor branch of median nerve



## PALMAR CUTANEOUS BRANCH OF MEDIAN N.

In carpal tunnel syndrome sensation in is preserved over palm as palmar cutaneous branch of median n. passes superficial to flexor retinaculum



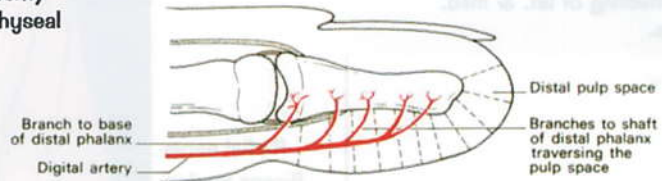
# SPACES OF THE HAND APPLIED ANATOMY

## PULP SPACE

- It is a subcutaneous compartment related to palmar surface of distal phalanx
- Divided into loculi filled with fat by fibrous septa extending from the skin to periosteum (content)
- Contains also digital artery which gives epiphyseal branch before entering the space.



- Incision should be deepened to divide all septa
- Osteomyelitis affects distal phalanx except epiphysis giving parrot peak deformity



## DEEP MID- PALMAR SPACE

- **ANTERIOR:**  
Flexor tendon of the medial 3 fingers & ulnar bursa.
- **POSTERIOR:**  
Fascia covering the interossei & 3rd, 4th & 5th metacarpals.
- **LATERAL:**  
Fibrous band from palmar aponeurosis to 3rd metacarpal.
- **DISTALLY:**  
3 lumbrical canals to the medial 3 webs.
- **MEDIALY:**  
Separated from hypothenar muscles by medial palmar septum.

## WEB SPACE

- Triangular region bet. Dorsal & ventral skin present at bases of fingers
- Communicate with mid-palmar & thenar spaces.

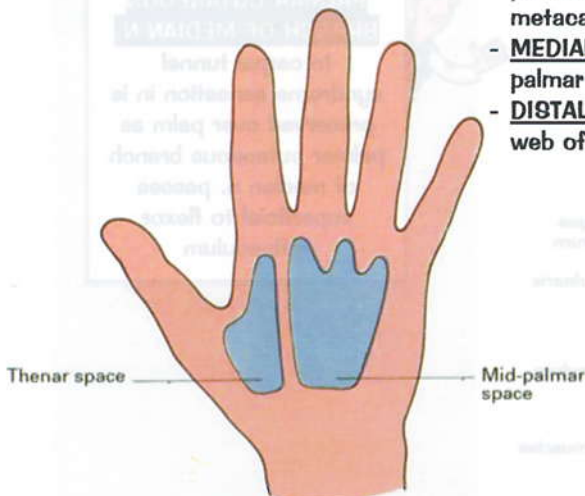
## THENAR SPACE

- **ANTERIOR:** thenar muscle, radial bursa, and flexor pollicis longus.
- **POSTERIOR:** adductor pollicis & 2nd & 3rd metacarpals.
- **MEDIALY:** deep mid palmar space
- **DISTALLY:** extends to web of the thumb.



### WEB SPACE

When infected, infection spread to the mid-palmar & thenar spaces.



# SYNOVIAL SHEATH

## APPLIED ANATOMY

### SYNOVIAL SHEATH OF MIDDLE 3 FINGERS:

- Each finger of these has a separate synovial sheath
- Proximal end: At level of metacarpo-phalangeal joint "dilated cul-de-sac"
- Distal end: At base of distal phalanx
- Encloses the flexor tendons



**"DILATED CUL-DE-SAC"**

Is the Site of Incision in infection

### RADIAL BURSA

- Smaller
- **DISTALLY** connected with synovial sheath of the thumb
- **PROXIMALLY** runs below the flexor retinaculum; extends 1" in forearm
- **ENVELOPS** the tendon of flexor pollicis longus
- **CONTINUE** with synovial sheath of the thumb



### ULNAR BURSA

- Larger
- **DISTALLY** connected with synovial sheath of the little finger
- **PROXIMALLY** runs below the flexor retinaculum; extends 1" in forearm
- **ENVELOPS** flexor tendons of medial 4 fingers
- **CONTINUE** with synovial sheath of the little finger

## ANASTOMOSIS AROUND SCAPULA

### 1ST PART OF THE SUBCLAVIAN ARTERY:

Both arise from thyro-cervical trunk.

- Supra-scapular artery.
- Deep branches of transverse cervical artery.

### 3RD PART OF THE AXILLARY ARTERY:

- Sub-scapular artery.
- Circumflex scapular artery (branch from sub-scapular artery).





# BRACHIAL PLEXUS

## APPLIED ANATOMY

### ROOTS:

C5, C6,  
C7, C8, T1

### DIVISIONS

Each trunk divides into  
anterior & posterior divisions

### TRUNKS

Upper: Union of  
C5 & C6

Middle: C7 ONLY

Lower: Union of  
C8 & T1

### CORDS

Lateral: Union of anterior divisions of  
upper & middle trunks (C5, C6, C7)

Medial: Anterior division of lower trunk

Posterior: Union of posterior divisions of  
the 3 trunks.

### BRACHIAL PLEXUS

Injury (see neurosurgery  
book. P. 150)

## BRANCHES OF BRACHIAL PLEXUS:

#### A. Roots:

- 1) N. to rhomboids (C5)
- 2) N. to serratus ant. (C5,C6,C7)

#### B. Upper trunk branches:

- 1) Suprascapular n. (C5,C6)
- 2) N. to subclavius (C5,C6)

#### C. Branches of lateral cord:

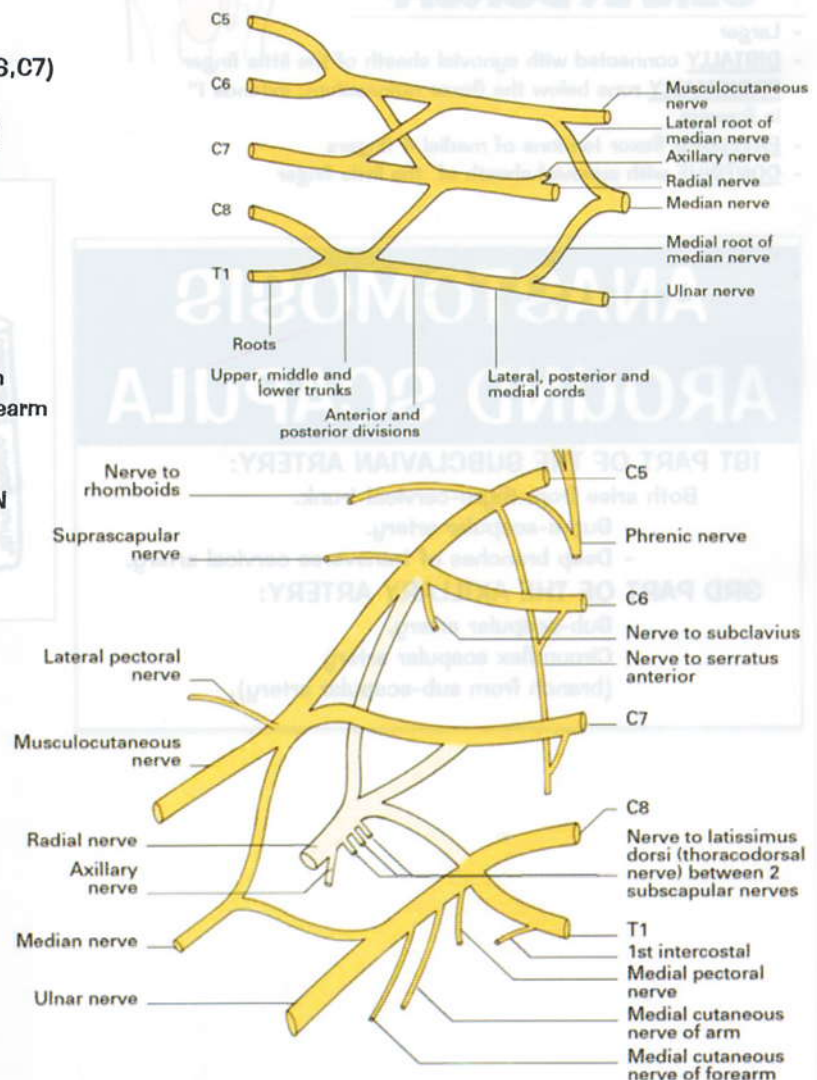
- 1) Lat. pectoral n.
- 2) Musculocutaneous n.
- 3) Lat. root of median n.

#### D. Branches of medial cord:

- 1) Med. pectoral n.
- 2) Med. cutaneous n. of arm
- 3) Med. cutaneous n. of forearm
- 4) Ulnar n.
- 5) Med. root of median n.

#### E. Branches of posterior cord: (ULN)

- 1) Upper subscapular n.
- 2) Lower subscapular n.
- 3) N. to latissimus dorsi



## RADIAL NERVE

### COURSE & RELATIONS

- In Axilla: Arises from posterior cord (C5,6,7,8,T1) behind 3rd part of axillary a.
- In Arm: It pierces the lateral inter-muscular septum to enter the anterior compartment on lateral side of arm
- In Forearm: It pierces supinator ms. through Posterior interosseous n.
- At wrist: The nerve winds around lateral side of radius to reach the back of the hand crossing over the anatomical snuff box & superficial to extensor retinaculum

## ULNAR NERVE

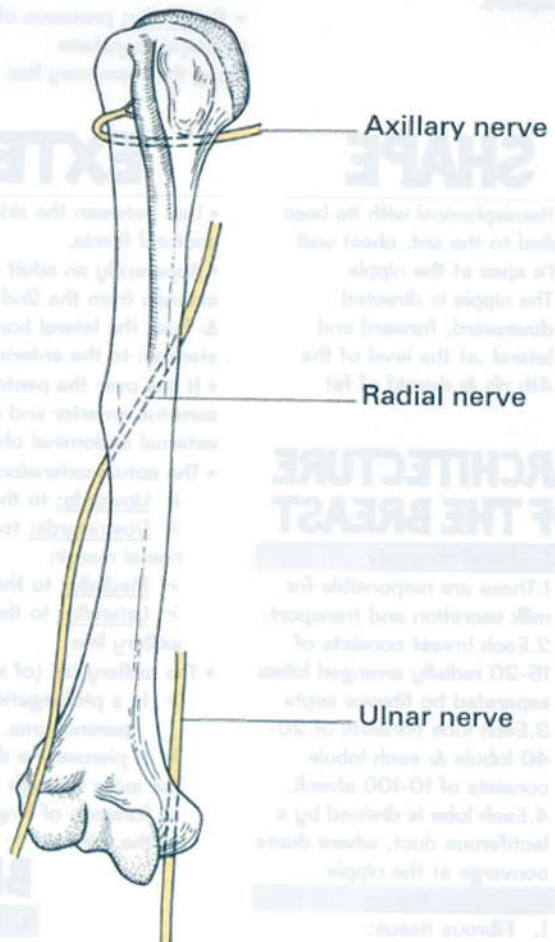
### COURSE & RELATIONS

- In Axilla: Arises from medial cord of brachial plexus (C7,8,T1) between 3rd part of axillary a. & axillary v. It descends medial to axillary a.
- In Arm: Till the insertion of coracobrachialis where it deviates medially & downwards to pierce the medial inter-muscular septum, to reach posterior compartment of the arm
- In Forearm: It passes between 2 heads of flexor carpi ulnaris & flexor digitorum profundus.
- At wrist: Continues downwards superficial to flexor retinaculum.

## MEDIAN NERVE

### COURSE & RELATIONS

- In Axilla: Arises from medial & lateral cord of brachial plexus (C5,6,7,8,T1). It passes lateral to axillary a.
- In Arm: It crosses in front of brachial a. from lateral to medial. It lies medial to biceps, anterior to brachialis & triceps.
- In Forearm: It leaves the cubital fossa by passing between 2 heads of pronator teres.
- At wrist: The nerve enters the carpal tunnel immediately under flexor retinaculum.



## MOTOR & SENSORY SUPPLY

See neurosurgery book

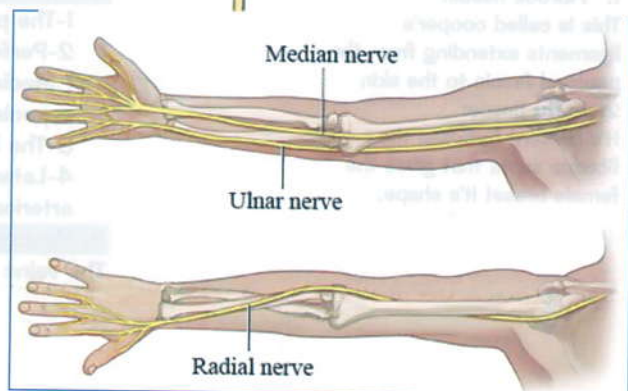
Surgical importance:

Nerve injury

::See neurosurgery book::

P. 140 "Radial nerve injury"

P. 144 "Ulnar & Median n. injury"





# THE BREAST

## APPLIED ANATOMY

### NIPPLE DIRECTION

This direction is changed when there is a pathological condition in the breast

### DEVOID OF FAT

Not a site of lipoma

### RELATION TO MUSCLES

Must examine these muscles in determining the mobility of breast swelling.

### INTERCOSTAL VEINS

Drain into azygous (rt. side) and hemi-azygous (lt. side) and communicate with valveless vertebral venous plexus, this explains axial skeleton deposits in cancer breast.

### RADIAL LOBES ARRANGMENT

So incision of draining a breast abscess is made radial incision to avoid injury of multiple ducts

### DUCTS CONVERGANCE AT AREOLA

So incision must not reach the areola

### COOPER'S LIGAMENTS

Any fibrosis affecting these ligaments results in dimpling to the skin of the breast

## DEVELOPMENT

- A modified sweat gland
- It arises from the milk lines, which extends from the axillae to the groins. Only the middle part of the upper third persists to form the breast while the rest disappears.

## CONGENITAL ANOMALIES

- **Micromastia:** abnormally small breast
- **Macromastia:** abnormally large breast
- **Polymastia:** presence of accessory breast(s) anywhere along the mammary line
- **Polythelia:** presence of accessory nipple(s) anywhere along the mammary line

## SHAPE

- Hemispherical with its base applied to the ant. chest wall & its apex at the nipple
- The nipple is directed downward, forward and lateral, at the level of the 4th rib & devoid of fat

## EXTENT

- Lies between the skin and the pectoral fascia.
- Apparently an adult female breast extends from the 2nd to the 6th rib & from the lateral border of the sternum to the anterior axillary line
- It lies over the pectoralis major, serratus anterior and aponeurosis of external abdominal oblique muscle
- The actual extension of the breast is
  - **Upwards:** to the clavicle
  - **Downwards:** to below the costal margin
  - **Medially:** to the middle line
  - **Laterally:** to the posterior axillary line
- The axillary tail (of spence):
  - Is a prolongation of the parenchyma.
  - It pierces the deep fascia of the axilla through a defect known as foramen of langer at the level of the third rib

## ARCHITECTURE OF THE BREAST

### A. Epithelial element:

1. These are responsible for milk secretion and transport.
2. Each breast consists of 15-20 radially arranged lobes separated by fibrous septa
3. Each lobe consists of 20-40 lobule & each lobule consists of 10-100 alveoli.
4. Each lobe is drained by a lactiferous duct, where ducts converge at the nipple

### B. Connective tissue:

#### 1. Fibrous tissue:

This is called Cooper's ligaments extending from the pectoral fascia to the skin

#### 2. Fatty tissue:

It's present between the fibrous septa that gives the female breast its shape.

## BLOOD SUPPLY OF THE BREAST

### A. Arterial supply:

- 1-The pectoral branch of the acromiothoracic artery
- 2-Perforating branches from internal mammary a., (Medial perforators) the 2nd, 3rd and 4th branches are especially large to supply the medial side of the breast.
- 3-The lateral thoracic artery
- 4-Lateral branches from the posterior intercostal arteries (Lateral perforators)

### B. Venous drainage:

The veins of the breast drains into

1. axillary v.
2. internal thoracic v.
3. intercostal v.

# LYMPHATIC DRAINAGE

## • AXILLARY NODES:

These receives about 75% of breast lymph. They are average 35 nodes.

1-Anterior 2-Posterior 3-Lateral 4-Central 5-Apical GROUPS

The posterior and lateral groups don't drain the breast directly, however they are potential sites of breast cancer spread as they have a lot of connections with the anterior group

## • INTERNAL MAMMARY NODES:

They are 3 or 4 lymph nodes. They receive part of the lymph from the medial side of the breast.

## • LYMPH NODES OF ROTTER:

Few lymphatics pierce the pectoralis major ms. to reach lymph nodes of Rotter then reaches the posterior intercostal veins.

## • LYMPHATIC SPREAD:

- ✓ After lymph reaches either the internal mammary or the axillary nodes, it reaches the jugulosubclavian venous (if obstructed, lymph will pass retrograde to the supraclavicular nodes)
- ✓ Lymph channels cross the diaphragm reaching the liver lymphatics.
- ✓ Lymphatics from the lower inner quadrant pierce the rectus sheath to reach peritoneal lymphatic plexus

❖ The axillary Lymph nodes may be classified into 3 levels:

L.Ns above the level of pectoralis minor: apical L.Ns

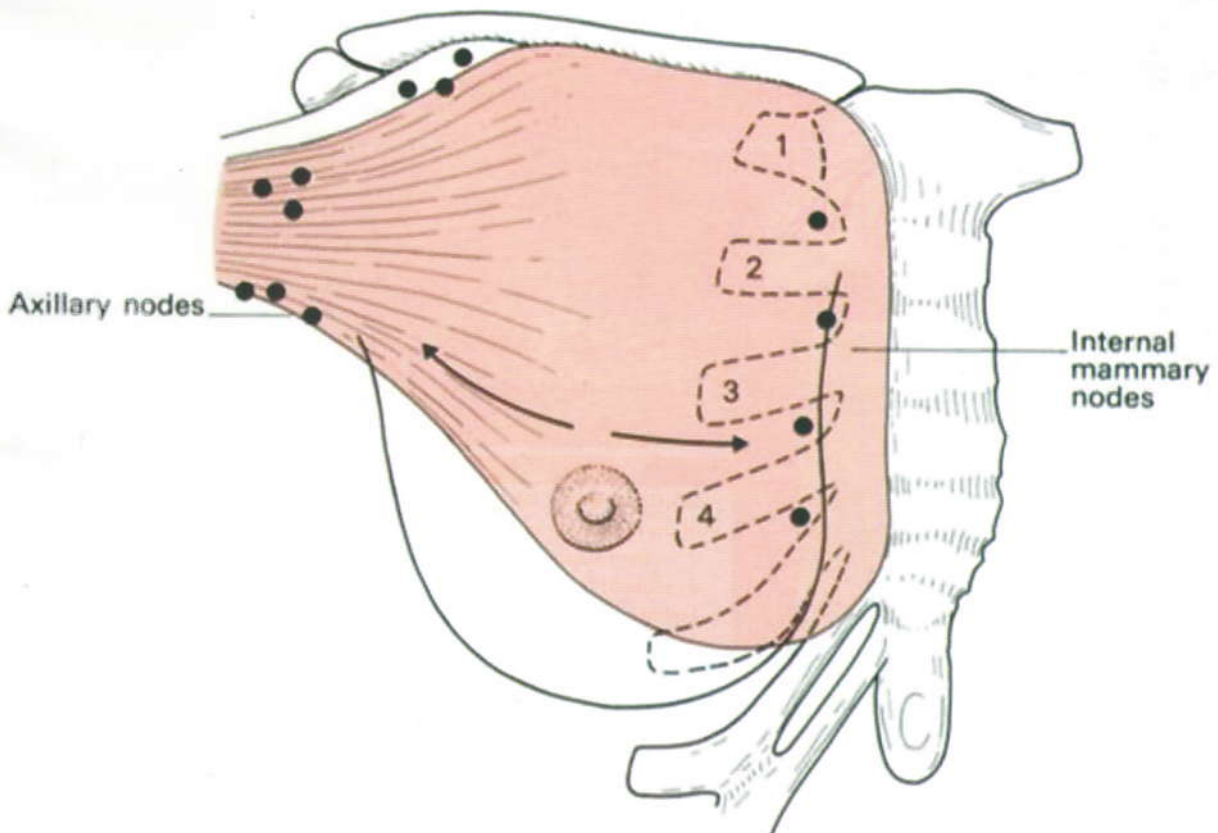
L.Ns deep to pectoralis minor: central L.Ns

L.Ns below the level of pectoralis minor: ant., post. and lateral L.Ns

# APPLIED ANATOMY

## LYMPH NODES

- Its affection is used to determine the prognosis after mastectomy.
- The first node to receive the lymph intra-operative is called "SENTINEL LYMPH NODE" and is excised and sent to the pathologist to determine lymph node infiltration.





# APPLIED ANATOMY

**SENTINEL LYMPH NODE**

- The first node to receive the lymphatic drainage is called the "SENTINEL LYMPH NODE" and is excised and sent to the pathologist to determine lymph node metastasis.

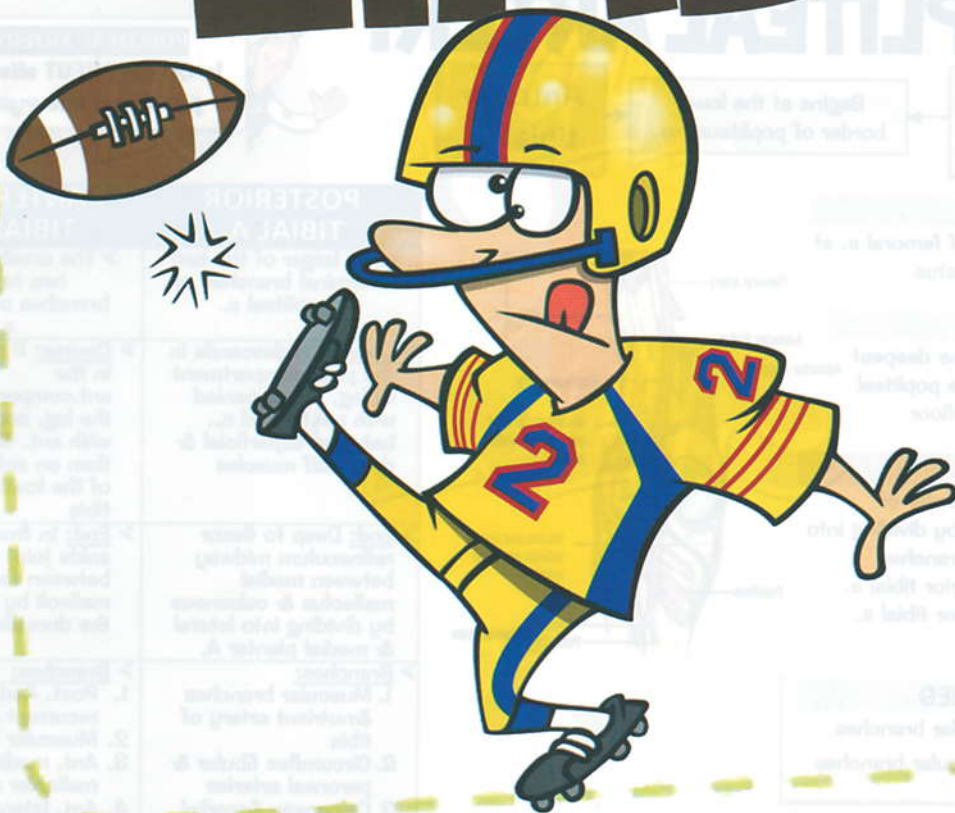


# LYMPHATIC DRAINAGE

- **AXILLARY NODES**  
These nodes are about 75% of breast lymph. They are arranged in a pattern of 1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100-101-102-103-104-105-106-107-108-109-110-111-112-113-114-115-116-117-118-119-120-121-122-123-124-125-126-127-128-129-130-131-132-133-134-135-136-137-138-139-140-141-142-143-144-145-146-147-148-149-150-151-152-153-154-155-156-157-158-159-160-161-162-163-164-165-166-167-168-169-170-171-172-173-174-175-176-177-178-179-180-181-182-183-184-185-186-187-188-189-190-191-192-193-194-195-196-197-198-199-200-201-202-203-204-205-206-207-208-209-210-211-212-213-214-215-216-217-218-219-220-221-222-223-224-225-226-227-228-229-230-231-232-233-234-235-236-237-238-239-240-241-242-243-244-245-246-247-248-249-250-251-252-253-254-255-256-257-258-259-260-261-262-263-264-265-266-267-268-269-270-271-272-273-274-275-276-277-278-279-280-281-282-283-284-285-286-287-288-289-290-291-292-293-294-295-296-297-298-299-300-301-302-303-304-305-306-307-308-309-310-311-312-313-314-315-316-317-318-319-320-321-322-323-324-325-326-327-328-329-330-331-332-333-334-335-336-337-338-339-340-341-342-343-344-345-346-347-348-349-350-351-352-353-354-355-356-357-358-359-360-361-362-363-364-365-366-367-368-369-370-371-372-373-374-375-376-377-378-379-380-381-382-383-384-385-386-387-388-389-390-391-392-393-394-395-396-397-398-399-400-401-402-403-404-405-406-407-408-409-410-411-412-413-414-415-416-417-418-419-420-421-422-423-424-425-426-427-428-429-430-431-432-433-434-435-436-437-438-439-440-441-442-443-444-445-446-447-448-449-450-451-452-453-454-455-456-457-458-459-460-461-462-463-464-465-466-467-468-469-470-471-472-473-474-475-476-477-478-479-480-481-482-483-484-485-486-487-488-489-490-491-492-493-494-495-496-497-498-499-500-501-502-503-504-505-506-507-508-509-510-511-512-513-514-515-516-517-518-519-520-521-522-523-524-525-526-527-528-529-530-531-532-533-534-535-536-537-538-539-540-541-542-543-544-545-546-547-548-549-550-551-552-553-554-555-556-557-558-559-560-561-562-563-564-565-566-567-568-569-570-571-572-573-574-575-576-577-578-579-580-581-582-583-584-585-586-587-588-589-590-591-592-593-594-595-596-597-598-599-600-601-602-603-604-605-606-607-608-609-610-611-612-613-614-615-616-617-618-619-620-621-622-623-624-625-626-627-628-629-630-631-632-633-634-635-636-637-638-639-640-641-642-643-644-645-646-647-648-649-650-651-652-653-654-655-656-657-658-659-660-661-662-663-664-665-666-667-668-669-670-671-672-673-674-675-676-677-678-679-680-681-682-683-684-685-686-687-688-689-690-691-692-693-694-695-696-697-698-699-700-701-702-703-704-705-706-707-708-709-710-711-712-713-714-715-716-717-718-719-720-721-722-723-724-725-726-727-728-729-730-731-732-733-734-735-736-737-738-739-740-741-742-743-744-745-746-747-748-749-750-751-752-753-754-755-756-757-758-759-760-761-762-763-764-765-766-767-768-769-770-771-772-773-774-775-776-777-778-779-780-781-782-783-784-785-786-787-788-789-790-791-792-793-794-795-796-797-798-799-800-801-802-803-804-805-806-807-808-809-810-811-812-813-814-815-816-817-818-819-820-821-822-823-824-825-826-827-828-829-830-831-832-833-834-835-836-837-838-839-840-841-842-843-844-845-846-847-848-849-850-851-852-853-854-855-856-857-858-859-860-861-862-863-864-865-866-867-868-869-870-871-872-873-874-875-876-877-878-879-880-881-882-883-884-885-886-887-888-889-890-891-892-893-894-895-896-897-898-899-900-901-902-903-904-905-906-907-908-909-910-911-912-913-914-915-916-917-918-919-920-921-922-923-924-925-926-927-928-929-930-931-932-933-934-935-936-937-938-939-940-941-942-943-944-945-946-947-948-949-950-951-952-953-954-955-956-957-958-959-960-961-962-963-964-965-966-967-968-969-970-971-972-973-974-975-976-977-978-979-980-981-982-983-984-985-986-987-988-989-990-991-992-993-994-995-996-997-998-999-1000-1001-1002-1003-1004-1005-1006-1007-1008-1009-1010-1011-1012-1013-1014-1015-1016-1017-1018-1019-1020-1021-1022-1023-1024-1025-1026-1027-1028-1029-1030-1031-1032-1033-1034-1035-1036-1037-1038-1039-1040-1041-1042-1043-1044-1045-1046-1047-1048-1049-1050-1051-1052-1053-1054-1055-1056-1057-1058-1059-1060-1061-1062-1063-1064-1065-1066-1067-1068-1069-1070-1071-1072-1073-1074-1075-1076-1077-1078-1079-1080-1081-1082-1083-1084-1085-1086-1087-1088-1089-1090-1091-1092-1093-1094-1095-1096-1097-1098-1099-1100-1101-1102-1103-1104-1105-1106-1107-1108-1109-1110-1111-1112-1113-1114-1115-1116-1117-1118-1119-1120-1121-1122-1123-1124-1125-1126-1127-1128-1129-1130-1131-1132-1133-1134-1135-1136-1137-1138-1139-1140-1141-1142-1143-1144-1145-1146-1147-1148-1149-1150-1151-1152-1153-1154-1155-1156-1157-1158-1159-1160-1161-1162-1163-1164-1165-1166-1167-1168-1169-1170-1171-1172-1173-1174-1175-1176-1177-1178-1179-1180-1181-1182-1183-1184-1185-1186-1187-1188-1189-1190-1191-1192-1193-1194-1195-1196-1197-1198-1199-1200-1201-1202-1203-1204-1205-1206-1207-1208-1209-1210-1211-1212-1213-1214-1215-1216-1217-1218-1219-1220-1221-12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# SURGI- TOONS

## LOWER LIMB



*Michael Safwat*  
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# FEMORAL ARTERY

## APPLIED ANATOMY

### BEGINNING

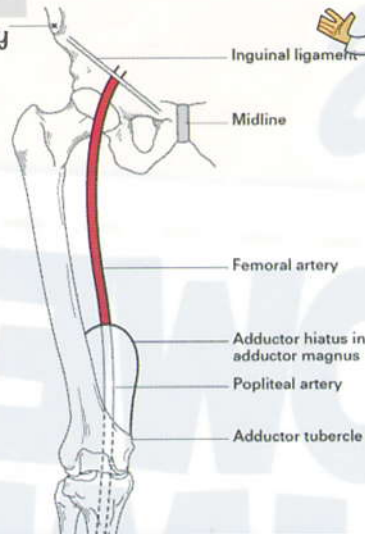
- Continuation of external iliac artery
- At midinguinal point
- Behind the inguinal ligament

### COURSE

- Upper 1/2: Superficial in femoral Δ
- Lower 1/2: Deep in subsartorial canal

### END

- By becoming popliteal artery
- By passing through the opening of adductor magnus ms.
- Between the upper 2/3 and lower 1/3 of the thigh



#### FEMORAL ARTERY

- Pulsation is felt at Midinguinal point
- Weak FEMORAL pulse with normal RADIAL pulse → Coarctation of Aorta
- Atherosclerosis → Weak or Absent pulse
- Artery of DYE injection since it's Superficial in position

## BRANCHES

SUPERFICIAL	DEEP
<ul style="list-style-type: none"> <li>▪ Superficial external pudendal a.</li> <li>▪ Superficial epigastric a.</li> <li>▪ Superficial circumflex iliac a.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Deep external pudendal a.</li> <li>▪ Deep femoral a. (profunda femoris a.)</li> <li>▪ Descending genicular a.</li> </ul>

# POPLITEAL ARTERY

Posterior tibial A.

Begins at the lower border of popliteus ms.

Anterior tibial A.

#### POPLITEAL ARTERY

Is COMMONEST site for peripheral aneurysm

### BEGINNING

Continuation of femoral a. at adductor hiatus

### COURSE

Descends as the deepest structure in the popliteal fossa over it's floor

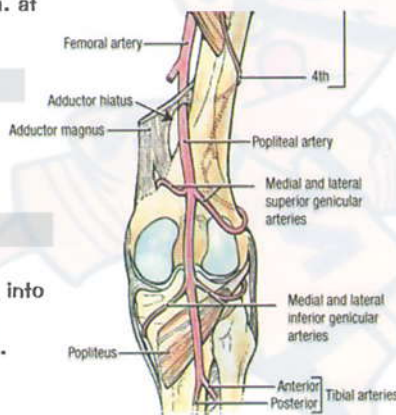
### END

At the lower border of popliteus ms. by dividing into two terminal branches

- 1- Posterior tibial a.
- 2- Anterior tibial a.

### BRANCHES

- Muscular branches
- 5 genicular branches



#### POSTERIOR TIBIAL A.

- The larger of the two terminal branches of popliteal a.

- **Course:** It descends in the post. compartment of leg, accompanied with post. tibial n., between superficial & deep calf muscles

- **End:** Deep to flexor retinaculum midway between medial malleolus & calcaneus by dividing into lateral & medial plantar A.

- **Branches:**
  1. Muscular branches & nutrient artery of tibia
  2. Circumflex fibular & peroneal arteries
  3. Calcaneal & medial malleolar arteries

#### ANTERIOR TIBIAL A.

- The smaller of the two terminal branches of popliteal a.

- **Course:** It descends in the ant. compartment of the leg, accompanied with ant. tibial n., then on ant. surface of the lower end of tibia

- **End:** In front of the ankle joint midway between the 2 malleoli by becoming the dorsalis pedis A.

- **Branches:**
  1. Post. And ant. tibial recurrent arteries
  2. Muscular branches
  3. Ant. medial malleolar artery
  4. Ant. lateral malleolar artery
  5. Circumflex fibular artery



# DORSALIS PEDIS ARTERY

## APPLIED ANATOMY

### BEGINNING

As a direct continuation of anterior Tibial a. in front of ankle joint

### COURSE

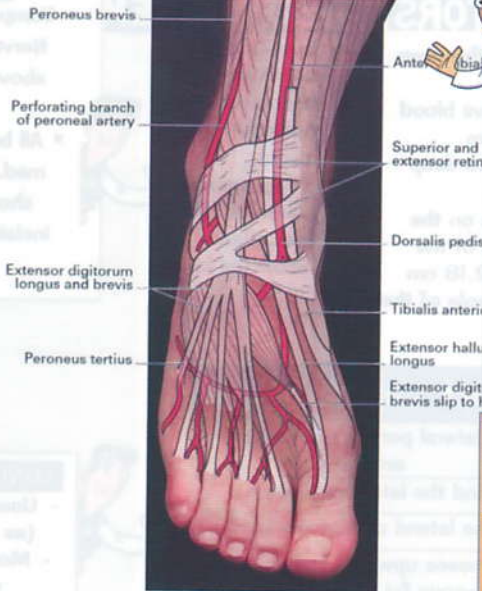
- Runs on the dorsum of the foot between the tendon of ext. hallucis longus medially & ext. digitorum longus laterally.
- Pierces the 1st dorsal interosseous ms. to reach sole of foot

### BRANCHES

- Medial & lateral tarsal arteries.
- 1st dorsal metatarsal artery.
- Arcuate artery (gives the 2nd, 3rd & 4th metatarsal A.)

### END

- In the sole by completing the planter arterial arch



### DORSALIS PEDIS A.

Is absent in 15 % of people and the arterial supply of the dorsum of the foot is carried out by perforating br. of peroneal a.



## CRUCIATE ANASTOMOSIS OF THE THIGH

This anastomosis is placed on the back of the thigh a short distance below the greater trochanter and looks like a cross.

It has 2 limbs: horizontal & vertical

- Upper descending limb → Superior & inferior gluteal arteries.
- Lower ascending limb → 1st perforating artery.
- Medial horizontal limb → transverse branches of medial circumflex femoral artery.
- Lateral horizontal limb → transverse branches of lateral circumflex femoral artery.

# ARTERIES OF THE SOLE

### 1-LATERAL PLANTER A:

- It's the larger branch of the 2 terminal branches of the posterior tibial a.
- Ends by forming the planter arch which ends by joining dorsalis pedis A. At the 1st interosseous space.
- Branches are muscular, planter metatarsal arteries & Med. calcaneal a.

### 2-MEDIAL PLANTER A:

- It's the smaller of the 2 terminal branches of the posterior tibial a.
- It runs along the medial side of the sole.

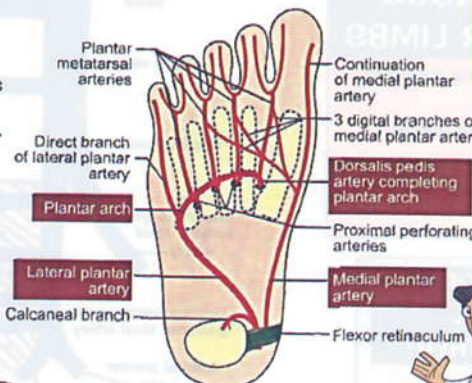


Fig. 99.10: Plantar arteries and plantar arterial arch

### CRUCIATE ANASTOMOSIS OF THE THIGH

It connects internal iliac a. with femoral a. So, if external iliac a. is obstructed, internal iliac a. can supply the thigh.

## ANASTOMOSIS AROUND KNEE JOINT

It's a relatively poor anastomosis between the following arteries:

- Descending genicular branch of femoral artery.
- Descending branch of the lateral circumflex femoral artery.
- 5 genicular branches from popliteal artery.
- Anterior and posterior tibial recurrent branches from the anterior tibial artery.



# VENOUS SYSTEM OF THE LOWER LIMB APPLIED ANATOMY

## SUPERFICIAL SYSTEM

Long saphenous

Short saphenous

## PERFORATORS

- Perforates the deep fascia
- Valves allows blood to pass from superficial to deep system
- Perforators on the medial side of the leg are 6,12,18 cm above the sole of the foot

## DEEP SYSTEM

- Intra and inter-muscular veins
- Accompany the corresponding artery
- Often run as paired venae comitantes below the knee

## SCIATIC NERVE

- Companion artery of Sciatic Nerve Should be ligated in above knee amputation to avoid bleeding
- All branches emerge from med. side except nerve to short head of biceps so incision is done on the Lat. side

Long saphenous	Short saphenous
From medial part of the venous arch	From lateral part of the venous arch
In front of the medial malleolus	Behind the lateral malleolus
In the medial side of the leg	In the lateral side of the leg
Runs behind the medial border of the tibia towards the knee, lying a hand breadth behind the medial border of the patella	Passes upwards in the subcutaneous fat along the midline of the calf
It accompanies the saphenous nerve in the leg	It accompanies the sural nerve
Joins the femoral vein at the saphenous opening 4 cm below & lateral to the pubic tubercle	Joins the popliteal vein in the middle of popliteal fossa

## LONG SAPHENOUS VEIN

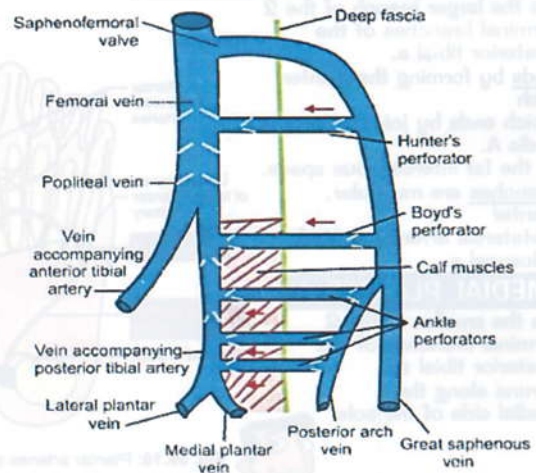
- Used in CABG Operation (as CORONARY GRAFT)
- Most common site for venous cut-down
- Might be injured during "Stripping Operation"

## FACTORS THAT HELP VENOUS RETURN FROM THE LOWER LIMBS

1. The muscle pump which needs strong muscles and intact deep fascia
2. Transmitted arterial pulsations to the venae comitantes
3. The unidirectional valves
4. The negative intrathoracic pressure

## THE SKIN OF THE LOWER PART OF THE LEG IS DRAINED BY SPECIAL PERFORATORS WHICH ARE EITHER:

- A. Indirect perforators
- B. Direct perforators



## FEMORAL VEIN

- Accompanies femoral artery through opening in adductor magnus.
- In the adductor canal: saphenous nerve passes from lateral to medial superficial to it.
- Passes anterior to the upper attachment of the pectineus muscle

## ORIGIN

Largest branch of sacral plexus

## APPLIED ANATOMY

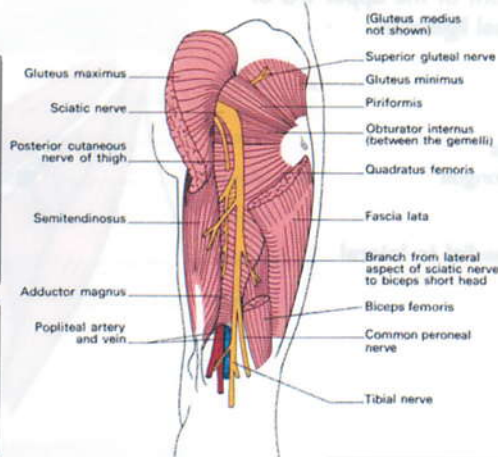
**COURSE**

Leaves the pelvis through greater sciatic foramen below the piriformis & descends in the gluteal region

**END**

By dividing into

- Lateral popliteal n.
- Medial popliteal n.



Dissection of the sciatic nerve in the thigh and popliteal fossa (right side). Note that gluteus medius has been removed to show the otherwise completely hidden gluteus minimus.

**Blood Supply**

- Companion artery of sciatic nerve (Br. Of inf. Gluteal a.)

**Branches**

- Muscular branches to:
  - 1-Biceps femoris
  - 2-Semimembranosus
  - 3-Semitendinosus
  - 4-Ischial part of adductor magnus
- 2 terminal divisions

## MUSCLES OF THE FRONT OF THE THIGH

### QUADRICEPS FEMORIS MUSCLE

**ORIGIN**

It's formed of 4 heads: rectus femoris and 3 vasti:

1. **RECTUS FEMORIS:**
  - **Straight head:** Anterior inferior iliac spine
  - **Reflected head:** Groove above acetabulum
2. **VASTUS LATERALIS:**
  - Lateral lip of the linea aspra
3. **VASTUS INTERMEDIUS:**
  - Upper 2/3 of the anterior and lateral surface of the femur
4. **VASTUS MEDIALIS:**
  - Medial lip of the linea aspra

**INSERTION**

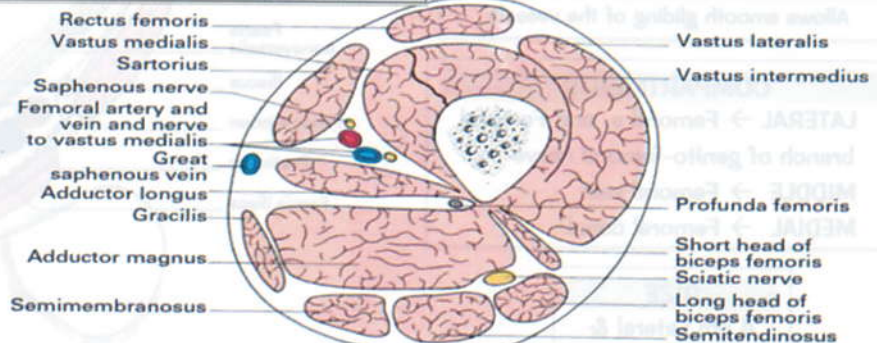
By a common tendon into the patella

**NERVE SUPPLY**

Femoral nerve

**ACTION**

- The whole muscle is the main extensor of the knee
- The rectus femoris is also a powerful flexor of the hip





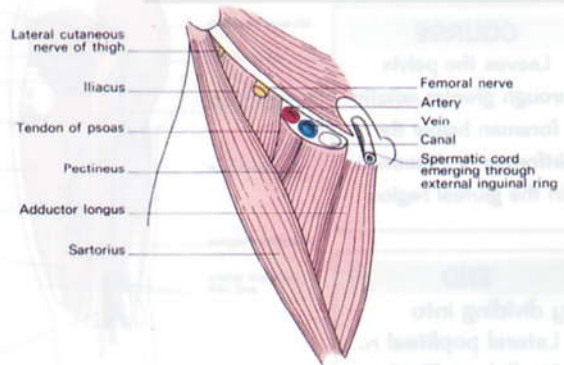
# FEMORAL TRIANGLE

## APPLIED ANATOMY

It is a sub-fascial space occupying the front of the upper 1/3 of the thigh just below the inguinal ligament

### I. BOUNDARIES:

- 1-Base: Inguinal ligament
- 2-Lateral: Medial border of sartorius
- 3-Medial: Medial border of adductor longus
- 4-Apex: Meeting of Sartorius & adductor longus

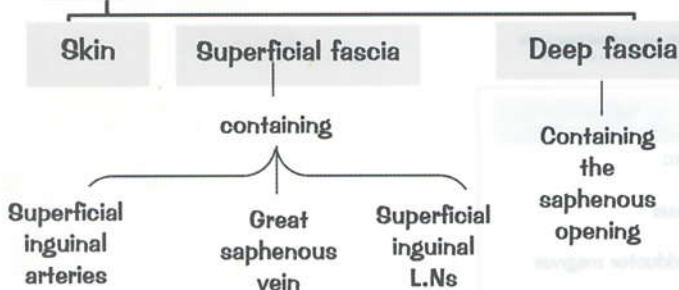


### II. FLOOR:

Composed of four muscles arranged from medial to lateral

- 1-Adductor longus
- 2-Pectineus
- 3-Psoas major
- 4-Iliacus

### III. ROOF: FORMED OF:



### IV. CONTENTS:

- 1-Femoral Vein 2-Femoral artery 3-Femoral nerve
- 4-Femoral sheath 5-Deep inguinal L.Ns

# FEMORAL SHEATH

### DEFINITION

Funnel shaped fascia enclosing the upper 4 cm of femoral vessels

### FUNCTION

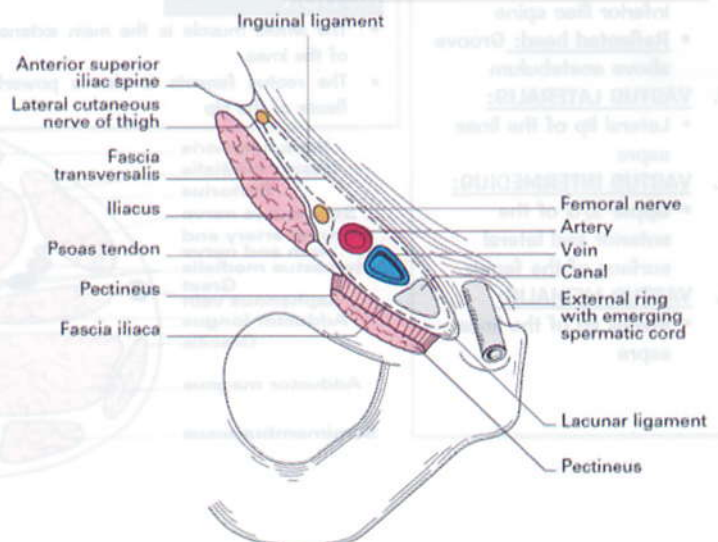
Allows smooth gliding of the vessels

### COMPARTMENTS

LATERAL → Femoral a. and Femoral branch of genito-femoral nerve  
MIDDLE → Femoral vein  
MEDIAL → Femoral canal

### SIZE

4 cm Lateral & 1 cm Medial



# POPLITEAL FOSSA

## APPLIED ANATOMY

### BOUNDARIES

UPPER LATERAL	Biceps femoris
UPPER MEDIAL	Semitendinosus & Semimembranosus muscles
LOWER LATERAL	Lateral head of Gastrocnemius & Plantaris muscles
LOWER MEDIAL	Medial head of Gastrocnemius

**POPLITEAL ARTERY**  
COMMONEST site of  
peripheral arterial  
aneurysm

### ROOF

- Skin
- Superficial fascia
- Popliteal fascia  
(Deep fascia of the roof)

### FLOOR

- Popliteal surface of femur
- Back of the capsule of the knee joint
- Fascia covering the popliteus muscle

### CONTENTS

1. Lateral popliteal nerve
2. Medial popliteal nerve
3. Popliteal artery
4. Popliteal vein
5. Termination of the posterior cutaneous nerve of the thigh
6. Popliteal lymph nodes

### D.D OF MASS IN POPLITEAL FOSSA

- SKIN & SOFT TISSUE → Lipoma, Sebaceous cyst
- VEIN → Varicosities of short saphenous vein
- ARTERY → Popliteal aneurysm
- LYMPH NODE → 2<sup>nd</sup> to foot infection
- KNEE JOINT → Semi-membranous, Baker's cyst
- BONES → Tumor of lower femur or upper tibia

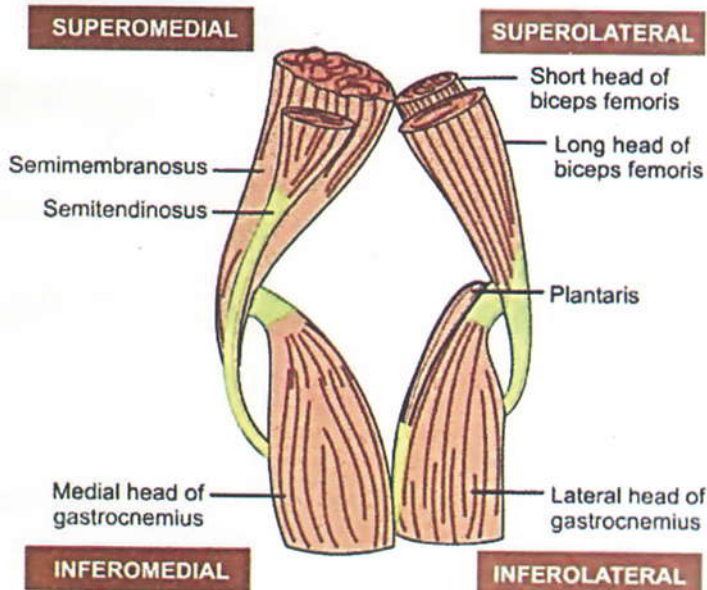


Fig. 96.1: Boundaries of right popliteal fossa



# POPLITEAL FOSSA

COMMONEST site of peripheral arterial aneurysm

## BOUNDARIES

UPPER LATERAL	Biceps femoris
UPPER MEDIAL	Semitendinosus & Semimembranosus muscles
LOWER LATERAL	Lateral head of Gastrocnemius & Plantar muscles
LOWER MEDIAL	Medial head of Gastrocnemius

## FLOOR

- Popliteal surface of tibia
- Back of the capsule of the knee joint
- Tarsus covering the popliteal vessels

## ROOF

- Skin
- Superficial fascia
- Popliteal fascia
- (Deep fascia of the foot)

## CONTENT

1. Lateral popliteal nerve
2. Medial popliteal nerve
3. Popliteal artery
4. Popliteal vein
5. Termination of the posterior tibial nerve of the thigh
6. Popliteal lymph nodes

## POPLITEAL FORAMEN

- Size & location -> 2-3 cm x 1 cm
- Site -> Anterior to the knee joint
- Depth -> 2-3 cm
- Shape -> Triangular
- Size -> 2-3 cm x 1 cm
- Location -> Anterior to the knee joint
- Shape -> Triangular
- Size -> 2-3 cm x 1 cm
- Location -> Anterior to the knee joint

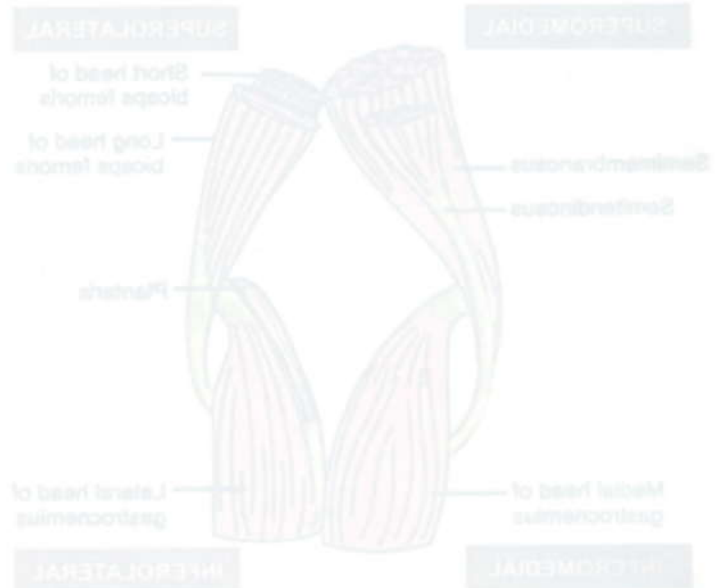


Fig. 98.1: Boundaries of right popliteal fossa

# SURGI- TOONS

## LYMPHATIC SYSTEM



*Michael Safwat*  
M.B.Ch - Ain shams university



# LYMPH NODES OF HEAD & NECK

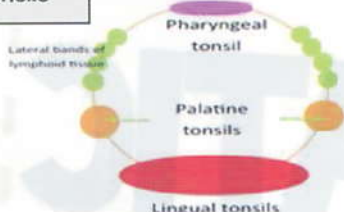
## CIRCULAR

### INNER RING

- 1- Pharyngeal (Adenoid)
- 2- Tubal tonsils
- 3- Palatine tonsils
- 4- Lingual tonsils

### OUTER RING

- 1- Submental
- 2- Submandibular
- 3- Preauricular
- 4- Postauricular
- 5- Occipital



## VERTICAL

### SUPERFICIAL CERVICAL

- Superficial to the deep fascia
- Runs with external jugular vein.
- Draining the parotid and lower part of ear

### DEEP CERVICAL

#### UPPER

#### LOWER

- Deep to the deep fascia
- Runs with internal jugular vein
- Separated from each others by superior belly of omohyoid muscle

## APPLIED ANATOMY



### DO YOU KNOW THAT!!

- Total lymph nodes of the body are about 800 L.Ns, 300 of them are in the NECK.
- Most common cause of cervical L.N enlargement is T.B.
- The left supraclavicular L.N is called "Virchow's Node"

L.N	SITE	DRAINAGE AREA
SUBMENTAL	Submental triangle	1) Middle part of lower lip 2) Tip of the tongue 3) Floor of the mouth
SUBMANDIBULAR	Submandibular region	1) Upper lip 2) Angle of the mouth 3) Outer part of lower lip 4) Side of the tongue
PREAURICULAR	In front of the tragus	1) Outer surface of the pinna 2) Side of the scalp
POSTAURICULAR	On the mastoid process	1) Back of the pinna 2) Temporal region of the scalp
OCCIPITAL	Bet. mastoid process & occiput	1) Back of the scalp 2) Back of the neck

### ➤ THE DEEP CERVICAL GROUP HAS 2 NAMED L.Ns:

1. Jugulo-digastric → drains the tonsil
2. Jugulo-omohyoid → drains the tip of the tongue

### ➤ THE EFFERENT FROM THE DEEP CERVICAL GOES TO:

1. Rt. side → left jugular lymph duct → right lymph trunk.
2. Lt. side → right jugular lymph duct → thoracic duct.

### OTHER DEEP CERVICAL L.Ns:

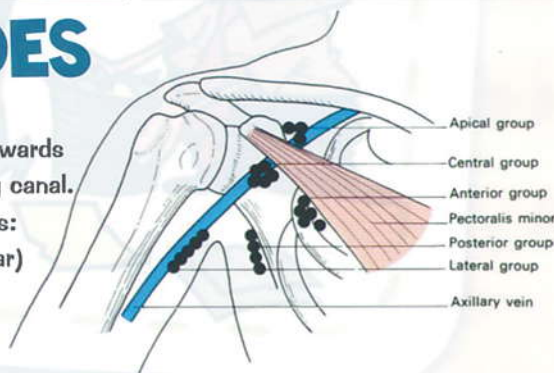
- At middle line: pretracheal, prelaryngeal L.Ns
- Retropharyngeal L.N
- Supraclavicular L.N

### LEFT SUPRACLAVICULAR L.N

Is of great surgical importance as it enlarges in visceral malignancy "Troisier's sign"

## AXILLARY LYMPH NODES

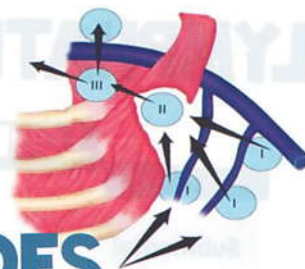
- The axilla is a pyramid with 4 walls, apex and a base.
- This pyramid is oblique so that the apex is directed upwards and medially and is continuous with the cervicoaxillary canal.
- The lymph nodes are arranged on the walls in 5 groups:
  1. Anterior (pectoral)
  2. Posterior (subscapular)
  3. Medial (central)
  4. Lateral (humeral)
  5. Apical (infraclavicular)





THE AXILLARY LYMPH NODES MAY BE CLASSIFIED INTO 3 LEVELS:

- > LEVEL I → L.Ns BELOW THE LEVEL OF PECTORALIS MINOR: ANT. POST. AND LATERAL L.Ns
- > LEVEL II → L.Ns DEEP TO PECTORALIS MINOR: CENTRAL L.Ns
- > LEVEL III → L.Ns ABOVE THE LEVEL OF PECTORALIS MINOR: APICAL L.Ns



Superficial to the deep fascia of the thigh

## INGUINAL LYMPH NODES

### SUPERFICIAL INGUINAL LNS

#### VERTICAL GROUP

Side of the upper part of saphenous v.

#### HORIZONTAL GROUP

Below and parallel to the inguinal ligament

### DEEP INGUINAL LNS

Around the upper part of the femoral vein

## LYMPH NODES OF THE ABDOMEN & PELVIS

### PARIETAL

- Lying behind peritoneum and in relation to large blood vessels
- These are divided into:
  1. External iliac nodes
  2. Internal iliac nodes
  3. Common iliac nodes
  4. Sacral nodes
- V. para-aortic nodes

### VISCERAL

- Lying along the side of visceral vessels.
- These are many groups e.g: coeliac, gastric, hepatic, inferior mesenteric etc.

## LYMPH NODES OF THE THORAX

### PARIETAL

- Lying in relation to the thoracic walls.
- These are divided into 4 groups:
  1. Anterior (Internal mammary nodes)
  2. Posterior (Posterior mediastinal nodes)
  3. Lateral (Intercostal nodes)
  4. Inferior (Diaphragmatic nodes)

### VISCERAL

- Lying in relation to thoracic viscera.
- They include:
  1. Superior mediastinal nodes
  2. Peri-tracheo-bronchial nodes

## LYMPH NODES OF THE TONGUE

### ANTERIOR 2/3

#### TIP

Submental

#### SIDES

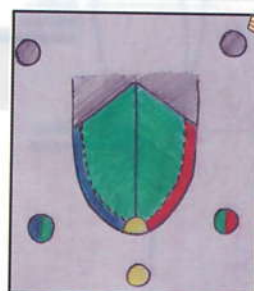
Ipsilateral submandibular

#### MIDDLE

Submandibular on both sides

### POSTERIOR 2/3

Deep Cervical LNs



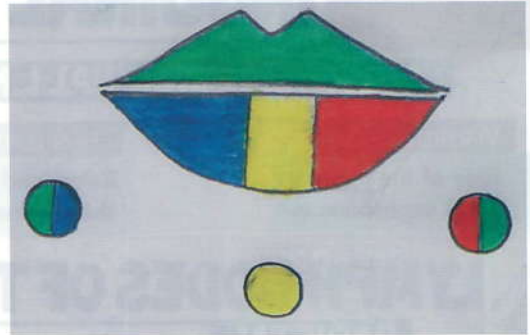
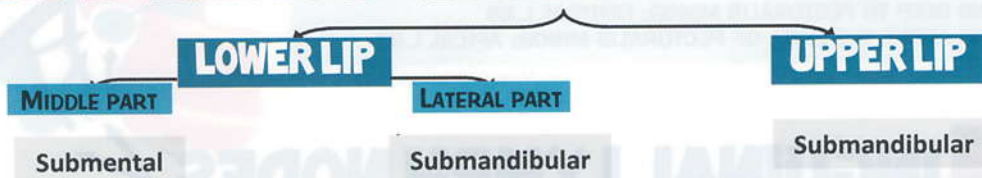
## APPLIED ANATOMY

### TONGUE L.Ns

Lymphatics pierce the floor of the mouth to reach submental & submandibular L.Ns BUT it's NOT affected by lymphatic spread in malignancy (L.Ns are involved by embolization NOT permeation)



# LYMPHATIC DRAINAGE OF THE LIPS



## Watershed Lines:

- These are three lines
  1. At the level of the clavicle
  2. At the level of the umbilicus
  3. Midline

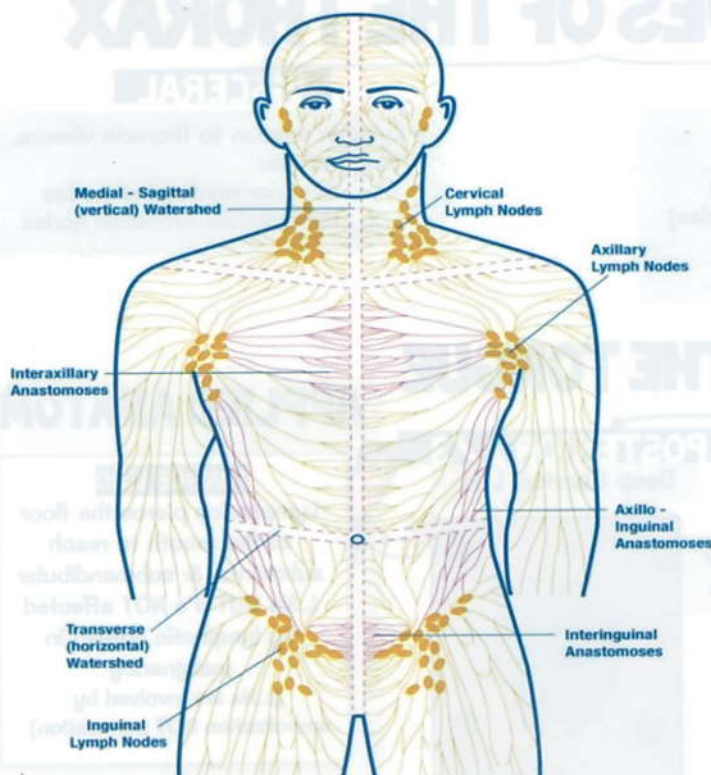
- ABOVE THE CLAVICLE DRAINS IN CERVICAL L.Ns
- BELOW THE UMBILICUS DRAINS IN INGUINAL L.Ns
- IN BETWEEN DRAINS IN AXILLARY L.Ns

## APPLIED ANATOMY



### WATERSHED LINES

used surgically to assess the exposure area in clinical examination :: we expose till watershed line of L.Ns group examined



# OTHER **TITLES** BY THE **AUTHOR**

Surgitoons

Textbook of General surgery

Textbook of GIT surgery

Textbook of Special surgery

Surgical operations

Surgical instruments

Surgical Radiology



**SURGI-  
TOONS**

