Easy Anatomy for Exam Preparation

MBBS, BHMS, BAMS, BSC (Nursing), BPT, BSc (MLT), B Pharm/D Pharm

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Contents

PART - 1

1

Head and Brain

HEAD AND BRAIN TWO MARKS QUESTIONS

Q. 1 Name the surfaces of cerebral hemisphere.

Ans. Cerebral hemisphere has the following three surfaces:

a. A convex Superolateral surface
b. A flat and vertical Medial surface and
c. An irregular Inferior surface

Q. 2 Two parts of Corpus Callosum

Ans. Corpus Callosum has the following parts:

a. The Genu: It is the anterior end of Corpus Callosum
b. The rostrum: It is directed downwards and backwards from the Genu
c. Trunk: It is a middle part, between the Genu and Splenium of Corpus Callosum
d. The Splenium: It is the posterior end forming the thickest part of corpus Callosum

Q. 3 Two parts of internal capsule

Ans. The internal capsule is divided into the following parts:

a. Anterior limb: It lies between the head of the caudate nucleus and the lentiform nucleus
b. Posterior limb: It lies between the thalamus and the lentiform nucleus
c. Genu: It is a bend between the anterior and posterior limbs
d. The retrolentiform part: It lies behind the lentiform nucleus
e. The sublentiform part: It lies below the lentiform nucleus

Q. 4 Blood supply of cerebrum

Ans. Cerebrum is supplied by the following branches of the internal carotid artery:

a. Ophthalmic artery
b. Anterior cerebral artery
c. Middle cerebral artery
d. Posterior communicating artery

Q. 5 Name two functional areas of superolateral surface of cerebral hemisphere

Ans. Superolateral surface of cerebrum have following functional areas

a. Motor area is located in the precentral gyrus
b. Premotor area is located just anterior to the motor area
c. The sensory areas is located in the postcentral gyrus
d. The motor speech area is located in the inferior frontal gyrus

Q. 6 Any two contents of cavernous sinus

MNEMONIC – O TOM CA

O TAM - lateral wall of sinus

a. **CA** -within sinus
b. O for Oculomotor nerve
c. T for Trochlear nerve
d. O for Ophthalmic branch of trigeminal nerve
e. M for Maxillary branch of trigeminal nerve
f. C for Internal carotid artery

g. A for Abducens nerve

Ans. Cavernous sinus contents following structures

a. At lateral wall

- Oculomotor nerve
- Trochlear nerve
- Ophthalmic branch of trigeminal nerve
- Maxillary branch of trigeminal nerve

b. Within sinus

- C for Internal carotid artery
- A for Abducens nerve

Q. 7 Nuclei in the cerebellum

MNEMONIC

Due to **Global** warning about **Embolic** attach, I am running **Fast** and had **Dent** on my car

a. Global for Nucleus Globosus
b. Embolic for Nucleus Emboliformis
c. Fast for Nucleus Fastigii and
d. Dent for Nucleus Dentatus

Ans. There are four nuclei in the grey matter of cerebellum, they are as follows:

a. Nucleus Globosus
b. Nucleus Emboliformis
c. Nucleus Fastigii and Nucleus Dentatus

Q. 8 Any two ercenters in Hypothalamus:

MNEMONIC

a. Anterior HOT tea,
b. Those students **sleep** who are **behind** (posterior) in the class
c. Average student **satisfy** in **Middle** rank
d. Feed Laddu

- H for Heat regulation
- O for Osmoregulation
- T for Thirst center
- Sleep for sleep center
- Behind for posterior
- Satisfy for Satiety center
- Middle for medial region
- Feed for Feeding center
- Laddu for lateral region

Ans. Following centers are in hypothalamus

- Heat regulation, Osmoregulation and Thirst centre are situated in anterior region
- Sleep centre is at posterior region
- Satiety centre at medial region and
- Feeding centre at lateral region of hypothalamus

Q. 9 Any two ascending tracts of spinal cord

Two Spinothalamic and two spinocerebellar tracts

MNEMONIC

Arvind **L**ook **T**ight, **P**ravin **A**gain **C**omment **F**or **G**low and **C**loths

a. A for Anterior
b. L for lateral
c. T for thalamic
d. A + T = Anterior Thalamic
e. L + T = Lateral Thalamic
f. P for posterior
g. A for anterior
h. P + C = Posterior Cerebellar
i. A + C = Anterior Cerebellar
j. C for Cerebellar
k. F for fasciculus
l. G for Gracilus
m. C for cuneatus
n. F + G = Fasciculus Gracilus
o. F + C = Fasciculus cuneatus

Ans. The tracts going to the higher center through the spinal cord are known as ascending tracts. They are

a. Lateral Spinothalamic tract
b. Anterior Spinothalamic Tract
c. Posterior Spinocerebellar tract
d. Anterior Spinocerebellar tract
e. Fasciculus Gracilus
f. Fasciculus cuneatus

Q. 10 Any two descending tracts of spinal cord

MNEMONIC

I drive a Honda **CRV TO** D mart

a. C for Corticospinal tract

b. R for Rubrospinal Tract
c. V for Vestibulospinal tract
d. T for Tectospinal tract
e. O for Olivospinal tract
f. D for descending tracts

Ans. The tract originating from the brain and descending downwards through the spinal cord are:

a. Corticospinal tract
b. Rubrospinal Tract
c. Vestibulospinal tract
d. Tectospinal tract
e. Olivospinal tract

Q. 11 Any two nuclei seen in T.S. of medulla

There are twelve cranial nerves. First two are inside the cranium. Apply the rule of 4 4 2 for soccer.

Brain steam consists of Medulla at the lower, Pons at the middle, and Midbrain at the top.

First 4 cranial nerve nuclei for Medulla, second 4 cranial nerve nuclei for Pons, and the last 2 cranial nerve nuclei for midbrain. Starts from the 12th cranial nerve and ends with the 3rd cranial nerve.

Medulla consists of 12th, 11th, 10th, and 9th cranial nerve nuclei.

Pons consists of 8th, 7th, 6th, and 5th cranial nerve nuclei whereas

Midbrain consists of 4th and 5th cranial nerve nuclei.

Ans. The medulla, a lower part of the brain stem consists of four cranial nerve nuclei. They are as follows:

a. Nucleus for glossopharyngeal nerve
b. Nucleus for Vagus nerve
c. Nucleus for Accessory Nerve and
d. Nucleus for Hypoglossal Nerve

Q. 12 Any two nuclei seen in T.S. of midbrain

There are twelve cranial nerves. First two are inside the cranium. Apply the rule of 4 4 2 for soccer.

Brain steam consist Medulla at the lower, Pons at the middle and Midbrain at the top

First 4 cranial nerve nuclei for Medulla, second 4 cranial nerve nuclei for Pons, and the last 2 cranial nerve nuclei for midbrain. Starts from the 12th cranial nerve and ends with the 3rd cranial nerve.

Medulla consists of 12th, 11th, 10th, and 9th cranial nerve nuclei.

Pons consists 8th, 7th, 6th and 5th cranial nerve nuclei whereas Midbrain consists of 4th and 5th cranial nerve nuclei.

Ans. The midbrain, an upper part of brain stem consists of two cranial nerve nuclei. They are as follows:

a. Nucleus for Oculomotor nerve and
b. Nucleus for Trochlear nerve

Q. 13 Any two nuclei seen in T.S. of Pons

There are twelve cranial nerves. First two are inside the cranium. Apply the rule of 4 4 2 for soccer.

Brain steam consist Medulla at the lower, Pons at the middle and Midbrain at the top

First 4 cranial nerve nuclei for Medulla, second 4 cranial nerve nuclei for Pons, and the last 2 cranial nerve nuclei for the midbrain. Starts with 12th cranial nerve and ends with the 3rd cranial nerve.

Medulla consists of 12th, 11th, 10th, and 9th cranial nerve nuclei.

Pons consists 8th, 7th, 6th and 5th cranial nerve nuclei whereas

Midbrain consists of 4th and 5th cranial nerve nuclei.

Ans. The Pons, a middle part of brain stem consist of four cranial nerve nuclei. They are as follows

a. Nucleus for Vestibulochoclear nerve
b. Nucleus for Facial nerve
c. Nucleus for Abducens Nerve and
d. Nucleus for Trigeminal nerve

Q. 14 Any two folds of dura matter

Meningeal layer of the dura mater gets folded in four folds.

Ans. Following are the folds of dura mater:

a. Falxcerebri: A fold between two

cerebral hemispheres

b. FalxCerebelli: A fold between two Cerebellar hemispheres

c. Tentorium Cerebelli: A partition between cerebrum and cerebellum

d. Diaphragmatic Sellae: A fold rounding the pituitary gland

Q. 15 Any two nerve related to Nucleus Tractus Solitarius
MNEMONIC

You are asking about **N**ucleus **T**ractus **S**olitarius i.e. NTC. Very tasty

a. N for ninth cranial nerve

b. T for tenth cranial nerve

c. S for seventh cranial nerve

d. Taste sensation for all three nerves

Ans. The nerves related to the nucleus Tractus Solitarius are:

a. Ninth is Glossopharyngeal nerve,

b. Tenth is Vagus nerve and

c. Seventh is facial nerve

9^{th}, 10^{th}, and 7^{th} cranial nerves are related to the nucleus Tractus solitarius for taste function.

Q. 16 Any two ventricles of the brain

Ans. Ventricles of the brain are a communicating network of cavities, located within the brain parenchyma, filled with cerebrospinal fluid.The ventricular system is composed of four ventricles.

Two lateral ventricles right and left each in respective cerebral hemisphere

The third ventricle is situated in between the right and left thalamus and

The fourth ventricle lies within the brainstem at the junction between the pons and medulla oblongata.

Q. 17 Any two structures in the floor of the fourth ventricle
MNEMONIC

The fourth ventricle is at the junction of pons and medulla. Remember the rule of 4, 4, and 2. Four cranial nerve nuclei are in pons and four in medulla. 5^{th}, 6^{th}, 7^{th}, and 8^{th} cranial nerve nuclei are in Pons whereas 9^{th} 10^{th} 11^{th}, and 12^{th} cranial nerve nuclei are in medulla. These can be visible on the floor of the fourth ventricle.

a. 7^{th} nerve is facial, it takes a turn around the 6^{th} nerve, that turn is Facial Colliculus

b. 8^{th} nerve is Vestobulochoclear nerve – having vestibular and cochlear nuclei

c. 10^{th} nerve is the vagus nerve.

d. 12^{th} nerve is the hypoglossal nerve

Ans. Floor of fourth ventricle shows following structures

a. Median sulcus

b. Elevated portion on either side of sulcus is Medial eminence

c. A depressed portion Superior fovea

d. Facial colliculus

e. Hypoglossal triangle

f. Vestibular area

g. Vagal triangle

Q. 18 Name any two layers of meninges.

Ans. Brain and spinal cord are covered with three layers. Those three meninges are

a. Dura mater: an outermost thick la layer

b. Arachnoid mater: a middle layer thin transparent payer and

c. Pia mater: a thin vascular inner layer

Q. 19 Any two layers of scalp
MNEMONIC – SCALP

a. S for Skin

b. C for Connective tissue

c. A for Aponeurosis

d. L for Loose connective tissue

e. P for Pericranium or Outer periosteum of the skull

Ans. Scalp consists of five layers. From outer to inner they are

a. Skin

b. Connective tissue

c. Aponeurosis

d. Loose connective tissue

e. Pericranium or Outer periosteum of the skull

HEAD AND BRAIN FIVE MARKS QUESTIONS

Q. 1 Floor of Fourth Ventricle

Ans. INTRODUCTION

- The cavity of the hindbrain is called the fourth ventricle.
- It is the last and the lowest ventricle of the cerebrum.
- It is a tent-shaped ventricle situated between Pons and medulla in front and cerebellum behind.
- Its roof contains three apertures.
- The floor of the fourth ventricle is also called as rhomboid fossa.

FORMATION

The floor is formed by

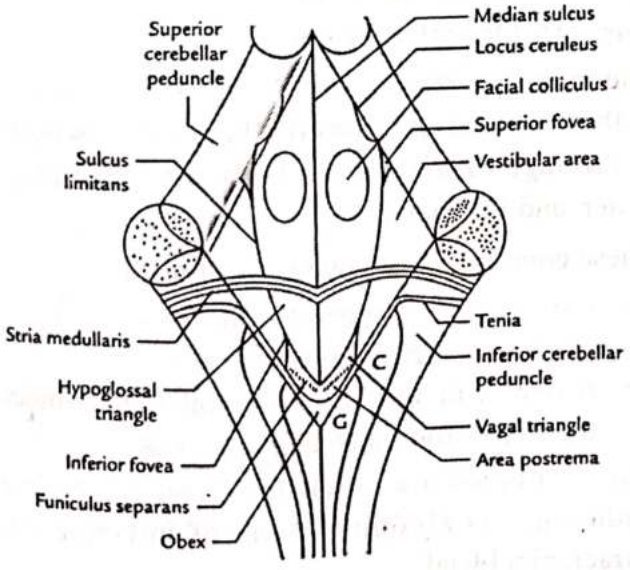
- The posterior surface of the Pons and
- The posterior surface of the open part of the medulla

FEATURES

Following features are seen in the floor of the fourth ventricle

Features in floor

a. Median sulcus – It divides the ventricle into two halves, right and left.



b. Median eminence – It is an elevation on either side of the median line.

c. Sulcus limitans – It is a sulcus lateral to the median eminence.

Features in relation to sulcus limitans:

a. Superior fovea – It is depression just lateral to the facial colliculus.

b. Inferior fovea – It is a depression that lies just above the Vagal triangle.

Features in relation to median eminence:

a. Striamedullares – These are the transverse lines running across the floor of the fourth ventricle.

b. Facial colliculus – It is an elevation produced by the underlying nucleus of Abducens nerve due to winding the fibers of the facial nerve around it.

c. Hypoglossal triangle – It is present at the lower part of the eminence

d. Vagal triangle – It lies between the hypoglossal triangle and vestibular area and below the inferior fovea.

e. Vestibular area – It lies lateral to the fovea.

Q. 2 Medulla at the Level of Pyramidal Decussation

Ans. INTRODUCTION

- The medulla oblongata is a funnel-shaped structure that constitutes the terminal portion of the brainstem.
- It lies in the posterior cranial fossa, below the tentorium cerebelli.
- It continues as a spinal cord.

At Pyramidal decussation

- It is the major decussation point of the descending motor fibers.
- Approximately 75% of motor fibers of the anterior corticospinal tract or pyramid cross diagonally and posteriorly and forms the lateral corticospinal tract.
- At this level, the central portion of the medulla contains gray matter, while the outer portions consist of white matter.
- The posterior white matter contains the fasciculus gracillis towards the medial

region and the fasciculus cuneatus towards the lateral aspect.

- The part of gray matter that extends up to this region is the nucleus gracillis and nucleus cuneatus respectively.
- The posterior and anterior Spinocerebellar tracts are located laterally and the lateral Spinothalamic tract is situated between them.
- The large trigeminal nucleus and spinal tract of the trigeminal nerve are found posterior to these tracts.

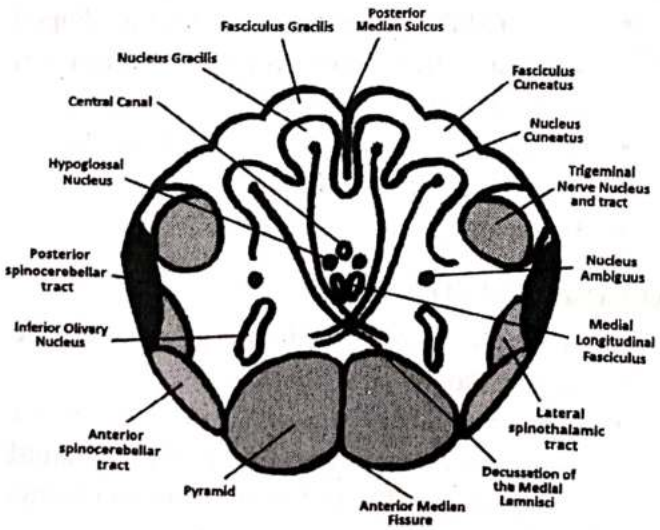
Q. 3 Medulla at the Level of Sensory Decussation

Ans. INTRODUCTION

- The medulla oblongata is a funnel-shaped structure that constitutes, the terminal portion of the brainstem.
- It lies in the posterior cranial fossa, below the tentorium cerebelli.
- It continues as = spinal cord.

At sensory decussation

- The sensory decussation at this level forms the medial lemniscus.



- The fibers from the nucleus gracillis and nucleus cuneatus around and anterior to the central gray matter form the medial lemniscus.
- Lateral to the medial lemniscus, the trigeminal nucleus, and spinal tract of trigeminal nerve are present.
- The posterior and anterior Spinocerebellar tracts are located laterally and the lateral Spinothalamic tract is situated between them.
- The hypoglossal nucleus and the medial longitudinal bundles are seen at the central part.
- The nucleus tractussolitarius is seen with nucleus ambiguous that is located more laterally

Between this structure and the pyramids, there is an inferior olivary nucleus.

a. Fasciculus gracallis *b.* Fasciculus cuneatus *c.* Spinal tract of trigeminal nerve, *d.* Nucleus tractussolitarius, *e.* Dorsal nucleus of vagus, *f.* Hypoglossal nucleus, *g.* Dorsal and ventral Spinocerebellar tracts, *g.* Lateral Spinothalamic tract, *i.* Inferior olivary nucleus, *j.* Medial lemniscus *k.* Pyramid, *l.* Nucleus of Spinal tract of trigeminal nerve,

Mnemonic- Central gray matter nuclei from below upward are **High-Value Teddy**

a. H for hypoglossal
b. V for vagus and
c. T for tractussolitarius

Q. 4 Meninges of Brain

Ans. INTRODUCTION

The meninges refer to the membranous coverings of the brain and spinal cord. There are three layers of meninges, known as the Dura mater, Arachnoid mater, and Pia mater.

These coverings have two major functions:

- Provide a supportive framework for the cerebral and cranial vasculature.
- Along with the cerebrospinal fluid protects the CNS from mechanical damage.

The meninges are often involved in cerebral pathology, as a common site of infection and intracranial bleed.

Dura Mater

i. The dura mater is the outermost layer of the

meninges, lying directly underneath the bones of the skull and vertebral column. It is thick, tough, and inextensible.

ii. Within the cranial cavity, the dura contains two connective tissue sheets:

a. Periosteal layer – It lines the inner surface of the bones of the cranium

b. Meningeal layer – It is deep to the periosteal layer inside the cranial cavity. It is the only layer present in the vertebral column. Between these two layers, the dural venous sinuses are located.

- They are responsible for the venous vasculature of the cranium, draining into the internal jugular vein.
- In some areas within the skull, the Meningeal layer of the dura mater folds inwards as dural reflections. They divide the brain, and the cranial cavity into several compartments.

There are four folds of the meningeal layer of the dura mater:

i. ***Falxcerebri***
ii. ***FalxCerebelli***
iii. ***Tentorium Cerebelli***
iv. ***DiaphramaticaSellae***

i. *Falxcerebri*

It is a sickle-shaped fold of dura mater.

It separates the right from the left cerebral hemisphere.

It encloses the superior sagittal sinus.

ii. *Falx Cerebelli*

a. It is a small sickle-shaped fold of dura mater.

b. It partly separates two Cerebellar hemispheres.

c. It encloses the occipital sinus.

iii. *Tentorium Cerebelli*

a. It is a tent-shaped fold of dura mater.

b. It separates the Cerebral hemispheres from the hindbrain and lower part of the midbrain.

c. It encloses transverse sinus and superior petrosal sinus.

iv. *DiaphramaticaSellae*

a. It is a small circular and horizontal fold

b. The stalk of the pituitary gland passes through the central aperture of diaphramaticaSellae

c. It encloses anterior and posterior intercavernous sinus.

d. The dura mater receives its own vasculature; primarily from the middle Meningeal artery and vein. It is innervated by the trigeminal nerve.

Arachnoid Mater

- The Arachnoid mater is the middle layer of the meninges, lying directly underneath the dura mater.
- It consists of layers of connective tissue, is avascular, and does not receive any innervations.
- Underneath the Arachnoid is a space known as the sub-Arachnoid space.
- It contains cerebrospinal fluid which acts to cushion the brain.
- The small projections of the Arachnoid mater into the dura mater known as Arachnoid granulations
- These granulations help to re-enter CSF into the circulation via the dural venous sinuses.

Pia Mater

- The Pia mater is located underneath the sub-Arachnoid space.
- It is very thin, and it is tightly adhered to the surface of the brain and spinal cord.
- It dips into various sulci and other irregular surfaces of the brain.
- It is better defined around the brainstem.
- It is highly vascularised, with blood vessels perforating through the membrane to supply the underlying neural tissue.

Applied Anatomy

Meningitis

- Meningitis refers to inflammation of the meninges. It is usually caused by pathogens but can be drug-induced.
- Bacteria like Neisseria meningitidis and Streptococcus pneumonia are the most common infective causes.

Extra dural Haematoma

- A haematoma is a collection of blood. As the cranial cavity is effectively a closed box, a haematoma can cause a rapid increase in intracranial pressure.
- Death will be the result if left untreated.

Q. 5 Extrapyramidal system

Ans. INTRODUCTION

- A collection of nerve fibers connecting two masses of gray matter within the central nervous system is referred to as a tract, system, or pathway.
- They are often referred to as fasciculi or lemnisci.
- The Extrapyramidal pathway or system is an important part of the motor system of the body.
- It is descending motor pathway, whose fibers pass through the tegmentum rather than the medullary pyramid.
- The Extrapyramidal pathway is actively involved in the initiation and selective activation of movements, along with their coordination.
- The extrapyramidal system is polysynaptic in nature with many synapses within the brainstem.

COMPONENTS

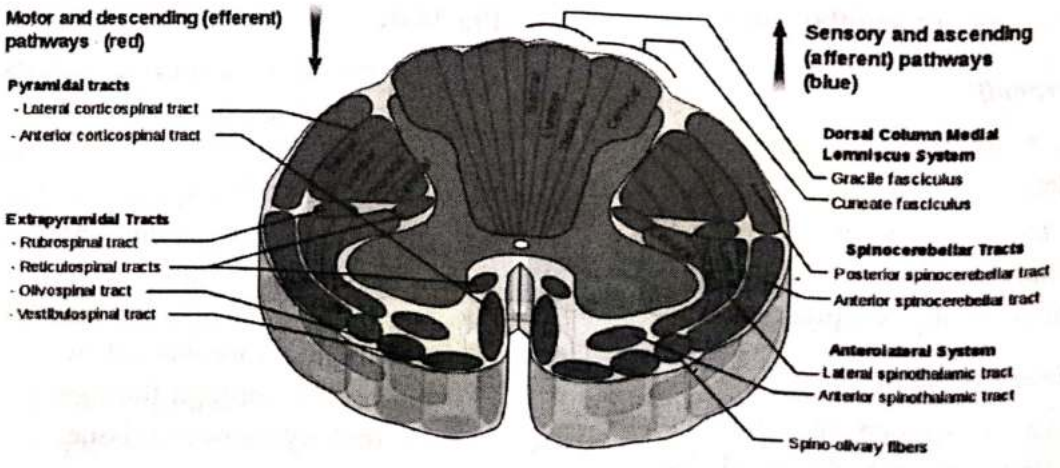
Most of the descending pathways from the cerebrum, cerebellum and brainstem are running towards the spinal cord, without coursing through the pyramids of the medulla are considered parts of the Extrapyramidal System. These tracts include:

i. ***Rubrospinal tracts***
ii. ***Tectospinal tracts***
iii. ***Reticulospinal tracts (lateral and medial) and***
iv. *Lateral and medial* ***Vestibulospinal tracts***

i. Rubrospinal tracts

Course

- Fibers originating from the red nucleus in the upper part of the midbrain course to the spinal cord, as Rubrospinal tracts.
- The fibers decussate to the opposite side in the lower part of the tegmentum of the midbrain.
- These crossing fibers constitute a decussation termed as the anterior tegmental decussation.
- The Extrapyramidal part of the Rubrospinal tract descends through the pons and the medulla to enter the lateral funiculus of the spinal cord.
- The tract lies immediately anterior to the lateral corticospinal tract (pyramidal tract).



Functions

- It acts as a motor modulator
- It plays an important role in postural movements and also in the perception of pain.

ii. Tectospinal tracts

Course

- Fibers originating from the superior colliculus of the midbrain.
- The fibers decussate to the opposite side in the lower part of the tegmentum of the midbrain.
- These crossing fibers constitute a decussation termed as the posterior tegmental decussation.
- Fibers of the tract synapse with motor neurons of the cervical muscles and mediate reflex postural movements.
- The fibers descend through the pons and the medulla to enter the spinal cord.
- The fibers terminate in the anterior funiculus of the spinal cord

Function

The Tectospinal tract work as an efferent pathway for visual reflexes

iii. Reticulospinal tracts

Course

- There are two Reticulospinal tracts lateral and medial.
- The lateral Reticulospinal tract, originates in the ventrolateral part of the reticular formation of the Pons.
- Then it crosses in the medulla.
- Reachesthe opposite side of the medulla and runs inferiorly in the lateral funiculus of the spinal cord.
- The medial Reticulospinal tracts originates in the medial parts of the reticular formations of the pons and the medulla,
- Pontine fibers of these tracts travel in the anterior funiculus and are mainly uncrossed.
- Medullary fibers travel in the anterior and lateral funiculus as crossed and uncrossed.

Functions

- The lateral Reticulospinal tract is associated with motor functions and in the control of pain perception whereas
- The medial Reticulospinal tract is mainly concerned with posture.

iv. Vestibulospinal tracts

Course

- There are two Vestibulospinal tracts lateral and medial.
- The medial Vestibulospinal tract originates in the medial vestibular nucleus.
- Then the fibres decussate as the tracts descend through the medulla to terminate in the anterior funiculus within the cervical region of the spinal cord.
- The lateral Vestibulospinal tract, originate in the lateral vestibular nucleus
- The fibres lie with the ventral grey column of the spinal cord in the anterior funiculus.
- They terminate without crossing as they course through the medulla.

Functions

- The axons of medial Vestibulospinal tract inhibit motor neurons of the neck and the axial muscles whereas
- The lateral Vestibulospinal tract is particularly important for the balancing of movements.

Applied Anatomy

a. Damage to the Extrapyramidal system leads to different forms of movement and cognitive disorders. The majority of such movement disorders are classically described as dyskinesia.

b. Disorders seen with many types of extrapyramidal diseases are:

- Parkinson's disease
- Non-spastic cerebral palsy
- Huntington's disease

Q. 6 Write a short note on CORPUS CALLOSUM

Ans. DEFINITION

It is the largest commissure of the brain which connects two cerebral hemispheres

PARTS

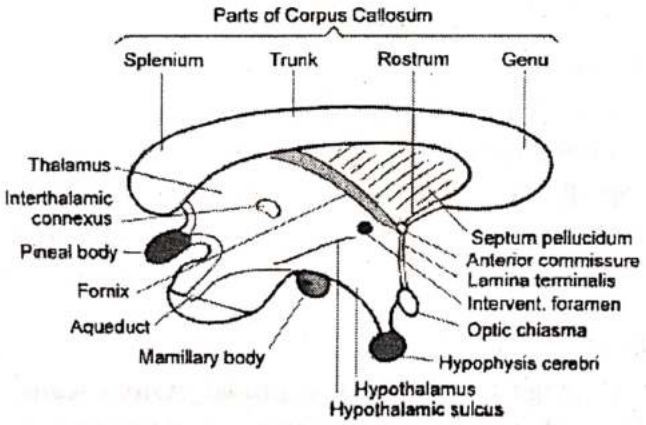
The corpus callosum is divided into four parts: genu, rostrum, body/trunk, and splenium

i. Genu

a. The genu is the anterior end of the corpus callosum.
b. It is cms behind the frontal lobe
c. Anteriorly it is related to the anterior cerebral artery
d. Posteriorly it is related to the posterior horn of the lateral ventricle.

ii. Rostrum

a. It is directed downward and backward from genu.
b. It ends by joining the lamina terminalis, in front of the anterior commissure.
c. Superiorly it is related to the anterior horn of the lateral ventricle



d. Inferiorly it is related to the longitudinal striae.

iii. Trunk or body

a. It is the middle part of the corpus callosum.
b. It lies between genu and splenium
c. Its superior surface is convex from before backwards and concave from side to side.
d. Its inferior surface is concave from before backwards and convex from side to side.
e. It is related to the anterior cerebral arteries and lower border of falxcerebri.
f. It provides attachment to the septum pellucidum and the fornix.

iv. Splenium

a. The splenium is the posterior end of the corpus callosum
b. It lies 6 cm in the occipital lobe.
c. It has two surfaces inferior and superior respectively
d. Its inferior surface is related to tela choroidea of the third ventricle, the pulvinar, the pineal body, and the tectum of the midbrain.

Its superior surface is related to the inferior sagittal sinus and flax cerebri.

Fibers of corpus callosum

- Rostrum connects the orbital surfaces of the two frontal lobes
- The two frontal lobes are connected with the fibers of genu are known as forceps minor.
- The two occipital lobes are connected with the fibers of splenium are known as forceps major.
- The tapetum is formed by some fibers from the trunk and splenium of the corpus callosum.

FUNCTIONS

Corpus callosum helps in the coordinating activities of two cerebral hemispheres.

Applied Anatomy

- **Agenesis of the corpus callosum-** This is a rare congenital disorder and is defined as the partial or complete absence of the corpus callosum.
- **Corpus callosum impingement syndrome-** Impingement of the corpus callosum fibers on the inferior free margin of the falxcerebri. It usually results from longstanding hydrocephalus Ischemia occurs and eventually causes atrophy.

Q. 7 Write a short note on the Cerebellum

Ans. INTRODUCTION

The cerebellum, known as the "little brain", is a structure of the central nervous system. It has an important role in the coordination of voluntary movements.

ANATOMICAL LOCATION

- The cerebellum is located at the back of the brain, immediately inferior to the occipital and temporal lobes.
- It lies in the posterior cranial fossa.
- It is separated from the cerebrum by a tent-shaped fold of dura mater known as the Tentorium cerebelli.
- It lies posterior to the Pons.
- The fourth ventricle is in-between cerebellum and Pons.

RELATIONS

- Anteriorly - related to Fourth ventricle, Pons and Medulla
- Posteroinferiorly - related to squamous part of occipital bone and
- Superiorly - related to Tentorium Cerebelli

EXTERNAL FEATURES

i. *Divisions*

a. The cerebellum consists of two hemispheres. They are connected by a narrow midline area called Vermis.

b. It has superior and inferior surfaces. The superior surface is convex. Two hemispheres continue at the superior surface.

c. Inferior surface shows a deep median notch called vallecula. The vallecula separates two hemispheres.

d. Anterior aspect of the cerebellum is marked by a deep notch, where Pons and medulla are lodged. The posterior surface has a narrow and deep notch where Falx Cerebelli lies.

ii. *Fissures*

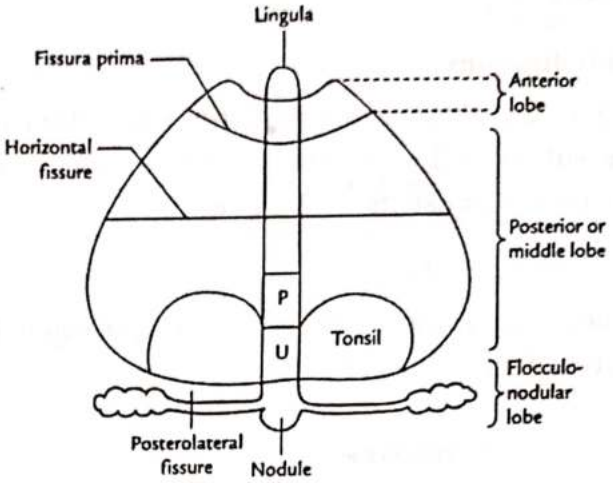
There are two fissures – the primary fissure and posterolateral fissure which divides the cerebellum into three lobes.

iii. *Parts of cerebellum*

a. The cerebellum is subdivided into numerous small parts by fissures.

b. The horizontal fissure separates the superior surface from the inferior surface.

c. The primary fissure separates the anterior lobe from the middle lobe.



d. The posterolateral fissure separates the middle lobe from the flocculonodular lobe.

Cerebellar hemispheres

Each Cerebellar hemisphere is divided into 8 parts Those are

- Ala,
- Quadrangular lobule,
- Simple lobule,
- Superior semilunar lobule,
- Inferior semilunar lobule,
- Biventral lobule,
- Tonsil and
- Flocculus

MNEMONIC

All Qualified Staff Should Supply Information By The Floppy

Vermis

Vermis is divided into the following nine parts

- Lingula,
- Central lobule,
- Culmen,
- Declive,
- Folium,
- Tuber,
- Pyramid,
- Uvula and

- Nodule

MNEMONIC

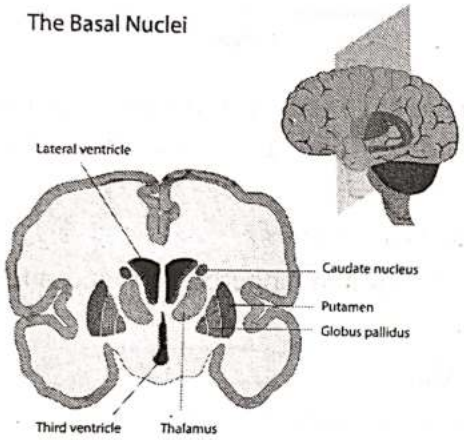
Lal Chand Could Die For Terelian Pant Un Necessarily

Sub divisions

There are three ways that the cerebellum can be subdivided – anatomical lobes, zones, and functional divisions

Anatomical Lobes

Three anatomical lobes can be distinguished in the cerebellum;



- The anterior lobe - it lies on the anterior part of the superior surface. It is separated from the middle Lobe by fissura prima.
- The middle or posterior lobe - It is the largest of three lobes. It lies between the fissura prima and the posterolateral fissure.
- The flocculonodular lobe - It is the smallest lobe of the cerebellum. It lies on the inferior surface in front of the posterolateral fissure.

Zones

There are three Cerebellar zones.

- Vermis - In the midline of the cerebellum is the Vermis.
- Intermediate zone- Either side of the Vermis is the intermediate zone.
- Lateral hemispheres-Lateral to the intermediate zone is the lateral hemispheres. There is no difference in gross structure between the lateral hemispheres and intermediate zones

Functional Divisions

The cerebellum can also be divided by function. There are three functional areas of the cerebellum.

- *The cerebrocerebellum*
  Cerebrocerebellum is the largest division, formed by lateral hemispheres. It is involved in planning movements and motor learning. It receives inputs from the cerebral cortex and pontine nuclei and sends outputs to the thalamus and red nucleus. This area also regulates coordination of muscle activation and is important in visually guided movements.
- *The spinocerebellum*
  The spinocerebellum is comprised of the anterior lobe, pyramid, and uvula of the Vermis. It controls tone, posture, and crude movements of limbs. It also receives proprioceptive information.
- *The vestibulocerebellum*
  Vestibulocerebellum is concerned with the flocculonodular lobe. It is involved in controlling axial muscles and bilateral movements used by location and maintenance of equilibrium. It receives inputs from the vestibular system and sends outputs back to the vestibular nuclei.

Internal structures

Like other structures in the central nervous system, the cerebellum consists of gray matter and white matter:

- Gray matter – It is located on the surface of the cerebellum. It is tightly folded, forming the Cerebellar cortex.
- White matter – It is located underneath the Cerebellar cortex.

Cerebellar Nuclei

Gray matter consists of four Cerebellar nuclei

- Dentate nucleus

- Emboliform nucleus,
- Globose nucleus, and
- Fastigii nucleus

MNEMONIC nuclei of cerebellum – Due to **Global** warning about **Embolic** attach, I am running **Fast** and had **Dent** on my car

Vasculature

The cerebellum receives its blood supply from three paired arteries:

- Superior Cerebellar artery (SCA)
- Anterior inferior Cerebellar artery (AICA)
- Posterior inferior Cerebellar artery (PICA)

Venous drainage of the cerebellum is by the superior and inferior cerebellar veins.

Applied Anatomy

Cerebellar Syndrome

Cerebellar lesion gives rise to symptoms and signs which together constitute the Cerebellar syndrome.

It is characterized by:

- Muscular hypotonia
- Intention tremors
- Not able to perform rapid and regular alternative movements
- Nystagmus
- Scanning speech

Q. 8 Midbrain at the Level Of Inferior Colliculus

Ans. INTRODUCTION

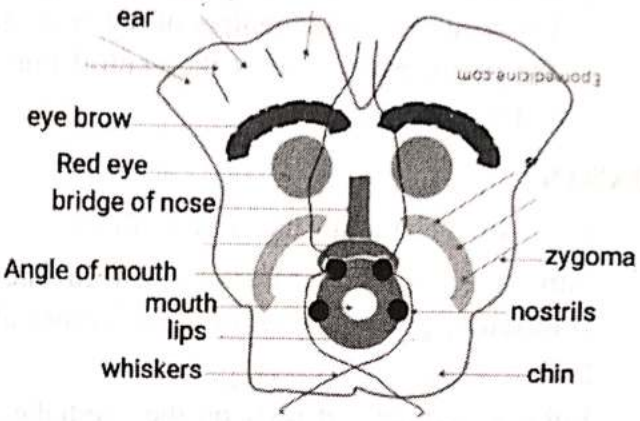
- The midbrain is the most superior of the three regions of the brainstem.
- It acts as a connecting channel between the forebrain above and the pons and cerebellum below.
- Midbrain can be studied with the help of two transverse sections one at the level of the inferior colliculus and another at the level of the superior colliculus.

Level of the Inferior Colliculus

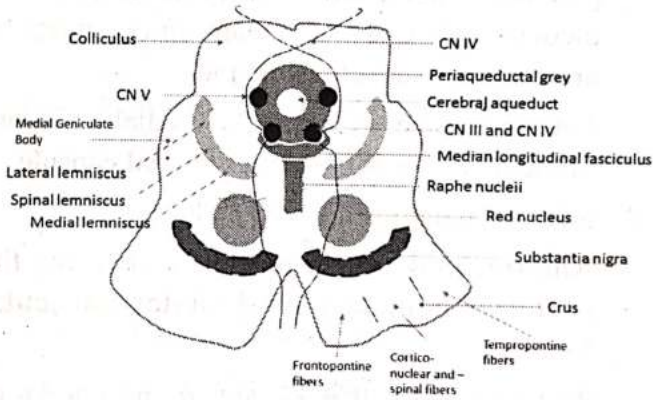
The anterolateral surface of the midbrain shows the paired crus cerebri.

Following four fiber tracts run within the crus:

- Frontopontinefibers
- Corticospinal fibers
- Corticobulbar fibers and
- Temporopontinefibers.
- Posteriorly there is the substantia nigra.



The tegmentum is located posterior to the substantia nigra.



- The cerebral aqueduct is located at the midline and is surrounded by central gray matter. Within the gray matter lies the Mesencephalic nucleus as well as the trochlear nucleus. Anteriorly the medial longitudinal bundle is seen. Between the central gray matter and the substantia nigra there are four lemnisci. From anterior to posterior they are the medial, spinal, trigeminal, and lateral lemnisci.
- At the posterior-most part there is a tectum with inferior colliculus.

Q. 9 Write a short note on THALAMUS.

Ans. INTRODUCTION

- Thalamus is a large mass of grey matter

situated in the lateral wall of the third ventricle.

- Thalamus is ideally situated at the core of the diencephalon, deep to the cerebral cortex. Thalamus **relays** and **integrates** a read of **motor** and **sensory** impulses between the higher centers of the brain and the peripheries, so it is the central hub of our nervous system.

PARTS

i. *Surfaces* – Thalamus has four surfaces

Superior surface – it is divided into lateral ventricular part and Medial extra ventricular part

Inferior surface – it rests on the subthalamus and hypothalamus

Medial surface – It forms the posterosuperior part of the lateral wall of the third ventricle. The medial surface of two thalami interconnect by an interthalamic adhesion and

Lateral surface –It forms the medial boundary of the posterior limb of the internal capsule

ii. *Ends* – Thalamus has two ends

Anterior end – it is narrow and forms the posterior boundary of the interventricular foramen.

Posterior end – It is expanded and known as pulvinar

RELATIONS – Thalamus had following relations

- Anterior: Anteriorly thalamus is related tointerventricular foramen of Monro and internal cerebral vein
- Posteriorly: Posteriorly it is related to stria terminals, Choroid plexus of third ventricle, internal cerebral vein, caudate nuclei, internal capsule and Splenium of Corpus Callosum
- *Medially:* Medially it is related to the third ventricle
- *Inferiorly:* Inferiorly it is related to hypothalamus, cerebral aqueduct, tegmentum

Nuclei of thalamus

i. Thalamus has many nuclei for variable functions.

ii. Most of these cell bodies are located in the larger lateral part of the thalamus.

iii. Thalamus has the following nuclei:

a. Anterior nucleus

- The anterior nucleus isfound between the short limbs of the internal medullary lamina of the thalamus.
- These nuclei organize emotion and recent memory.

b. Medial nucleus

- It is situated in the medial part of the thalamus.
- This group lies in the medial segment of the thalamus. There are three nuclei.
- These clusters of nuclei are responsible for integrating special olfactory, somatic and visceral afferent information with emotions.

c. Lateral nucleus

It lies in the dorsolateral part of the thalamus.

d. Ventral nucleus

- It lies in the ventrolateral part of the thalamus
- Ventral nuclei are subdivided into three groups, anterior, intermediate, and posterior groups respectively.
- The posterior group of ventral nuclei is further subdivided into posterolateral and posteromedial groups.

e. Intralaminar group

It includes centromedian nuclei, Midline nuclei, and reticular nuclei

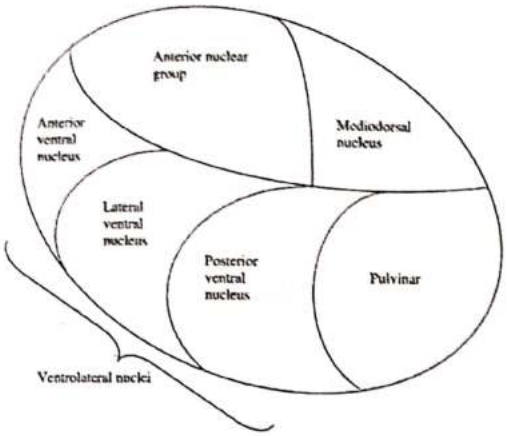
f. The reticular nuclei

This group is thought to aid in the cortical regulation of thalamic activity.

g. Medial and lateral geniculate bodies

The medial and lateral geniculate bodies are also considered nuclei of the thalamus.

Medial geniculate body is for auditory path and lateral geniculate body for reflex movement of eye-head and neck in response to visual stimuli.



ARTERIAL SUPPLY

- The primary blood supply of the thalamus is from the posterior cerebral artery.
- Contributing branches from the posterior communicating artery also supply the thalamus after passing through the posterior perforated substance.

TRACTS

The following tracts are in relation with the thalamus:

- The ventral Spinothalamic
- The lateral Spinothalamic and
- The dorsal column-medial lemniscus pathway

FUNCTIONS

Thalamus performs the following functions:

- Receive afferent impulses from the body
- It receives Extraoceptive and proprioceptive impulses
- It also receive visual and auditory impulses
- The receives sense of taste

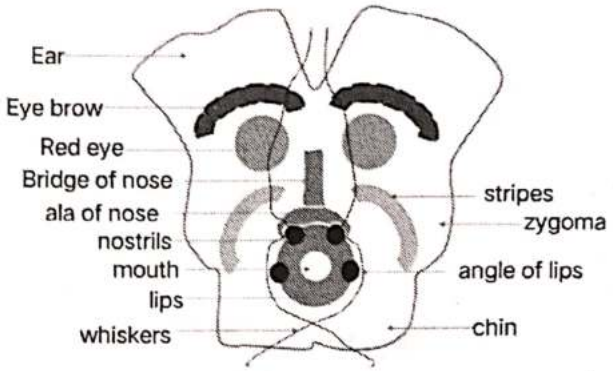
Applied Anatomy

Vascular accidents of that thalamus can also produce ataxic choreoathetosis

Q. 10. Midbrain at the Level Of Superior Colliculus

Ans. INTRODUCTION

The midbrain is the most superior of the three regions of the brainstem.



It acts as a connecting channel between the forebrain above and the pons and cerebellum below.

Midbrain can be studied with the help of two transverse sections one at the level of the inferior colliculus and another at the level of the superior colliculus.

Level of the Inferior Colliculus

i. The anterolateral surface of the midbrain shows the paired crus cerebri.

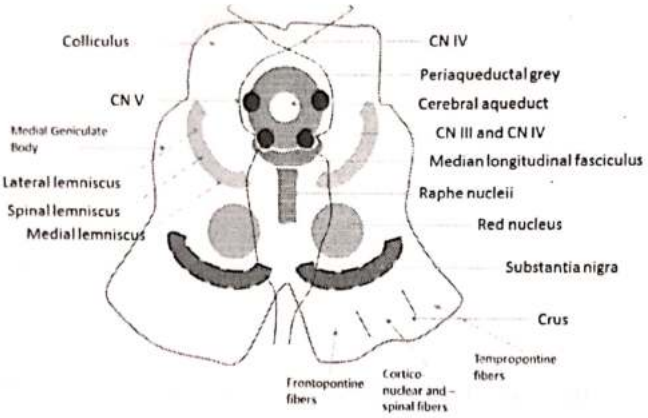
ii. Following four fiber tracts run within the crus:

a. Frontopontinefibers
b. Corticospinal fibers
c. Corticobulbar fibers and
d. Temporopontinefibers.

- Posteriorly there is the substantia nigra.
- The tegmentum is located posterior to the substantia nigra.
- The cerebral aqueduct is located at the midline and is surrounded by central gray matter.
- Within the gray matter lies the oculomotor nucleus. The central portion shows large pair of red nuclei.
- Anteriorly the medial longitudinal bundle is seen. Between the central gray matter and the substantia nigra

there are four lemnisci.

- From anterior to posterior they are the medial, spinal, trigeminal lemnisci whereas the lateral lemniscus is not seen at this level.



- At the posterior most part there is tectum with superior colliculus.

Q. 11. Third Ventricle

Ans. INTRODUCTION

There are four cavities lies within the brain for the production of cerebrospinal fluid (CSF). These four cavities constitute the ventricular system; the first and second ventricles, in each cerebral hemisphere are known as the lateral ventricles; a medially situated cavity lying between the cerebral hemispheres is known as the third ventricle, a cavity lies at the level of the brainstem is known as fourth ventricle

Definition

The third ventricle is a median cleft between two thalami.

BOUNDARIES

Third ventricle has:

i. Anterior wall
ii. Posterior wall
iii. Lateral wall
iv. Roof and
v. Floor

i. Anterior Wall

The anterior wall of the third ventricle is formed by

a. Lamina terminalis
b. Anterior commissure and
c. Anterior column of fornix

ii. Posterior Wall

The posterior wall is formed by:

a. Pineal body
b. Posterior commissure and
c. Cerebral aqueduct

iii. Lateral Wall

The lateral wall is formed by:

a. Medial surface of thalamus
b. Hypothalamus and
c. The hypothalamic sulcus

iv. Roof

The roof is formed by:

The ependyma lining the undersurface of the tela choroidea of the third ventricle

v. Floor

The floor of the third ventricle is formed by:

MNEMONIC – Tegale Mam Infused Optic Tube Posteriorly

- T for Tegmentum of the midbrain
- M for Mamillary bodies
- I for Infundibulum
- O for Optic chiasma
- T for Tubercinerium
- P for Posterior perforated substance

COMMUNICATIONS

i. Interventricular foramen

Anterosuperiorly, on each side, it communicates with the lateral ventricle through interventricular foramen or foramen of Monro

ii. Cerebral aqueduct

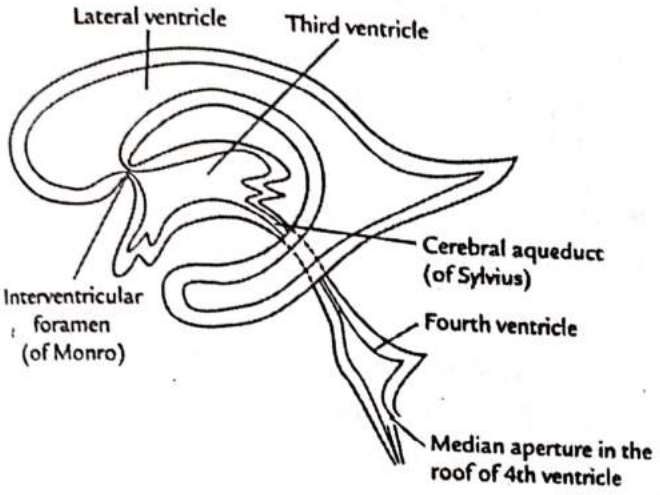
Posteroinferiorly, in the median plane, communicates with the fourth ventricle through the cerebral aqueduct.

RECESSES

There are the following three extended cavities of

the third ventricle

- Supraspinal recess



- Pineal recess and
- Infundibular recess

Choroid plexuses and Telachoroidea

- The tela choroidea of the third ventricle originates from branches of the internal carotid artery and gives rise to the choroid plexus.
- The choroid plexus is a complex of vessels, bulging into the ventricular space, that actively secretes plasma, electrolytes, nutrients, and small proteins through fenestrations.
- The third ventricle has two choroid plexuses running parallel to each other, one on either side of the mid-line.
- These choroid plexuses and the tela choroidea function to produce the cerebrospinal fluid (CSF), which fills the subarachnoid space and ventricular system.

Applied Anatomy

i. ***Ventriculography***

It is a tracing method used to study the ventricular system in living subjects. In this procedure, radiographs are taken after injecting a radio-opaque dye into the ventricular system. Parts of the ventricles can also be seen using computed tomography (CT) scans and magnetic resonance imaging.

ii. ***Hydrocephalus***

Hydrocephalus is one of the well-known clinical conditions associated with ventricular system malformations. In this condition, there is an abnormal accumulation of CSF in the central nervous system (CNS) due to a disturbance of CSF flow or absorption. This leads to increased intracranial pressure.

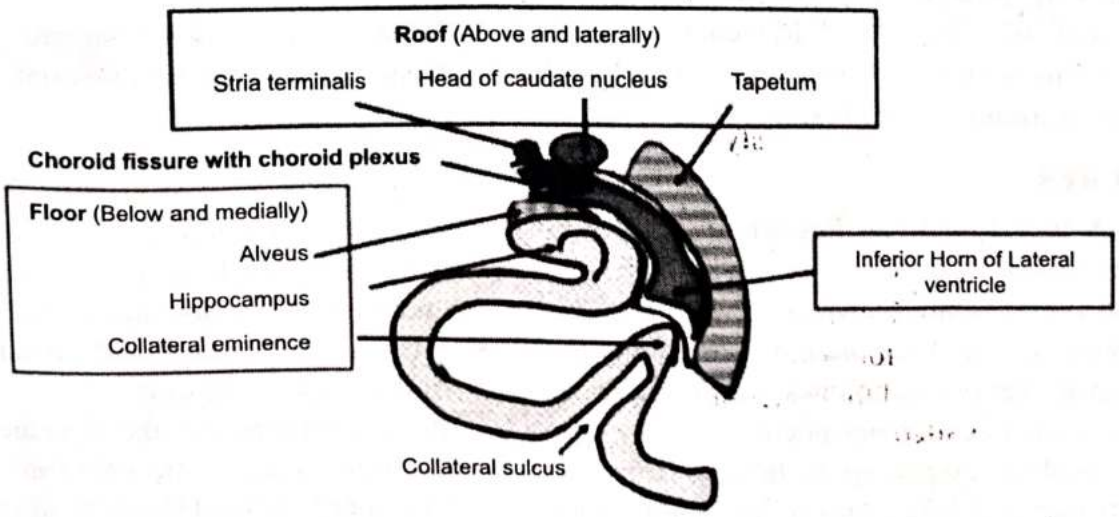
iii. ***The third ventricle is a narrow space that can easily be obstructed by local brain tumors.***

Q. 12. Write a short note on Lateral Ventricle.

Ans. INTRODUCTION

The ventricular system is a well-organized interconnecting system spanning every region of the brain.

The channels connecting the lateral ventricles to the third (the midline ventricle) are called the



interventricular foramen (or foramen of Monro).

The cerebral aqueduct connects the third and fourth ventricles.

The system is then made continuous with the central canal of the spinal cord, which originates from the floor of the fourth ventricle.

DEFINITION

- The lateral ventricles are the largest in the series of four interconnecting fluid-filled cavities within the brain. These cavities and their interconnecting channels, constitute the cerebral ventricular system.
- The other two cavities of this system are the third and fourth ventricles, while the cerebral aqueduct of Sylvius is one of the interconnecting channels, and it ensures the communication between the third and fourth ventricle.

Choroidal plexus

- The CSF is secreted by the choroid plexuses located within the lateral, third, and fourth ventricles alone, but reaches the entire ventricular system and beyond by flowing from the lateral to the third ventricle through the foramen of Monro.
- It then flows through the cerebral aqueduct into the fourth ventricle, and from there into the central canal starting just inferior to the fourth ventricle.
- The CSF finally leaves the fourth ventricle through the foramen of Magendie and the foramina of Luschka to reach the subarachnoid space surrounding the brain.

FEATURES

- Each lateral ventricle lies within a cerebral hemisphere.
- The lateral ventricle, when viewed from the lateral aspects of the brain, has a roughly C–shaped profile that follows the arrangement and shape of each hemisphere.
- It has three extensions in frontal, temporal, and occipital lobes known as frontal horn or anterior horn, temporal horn or inferior horn, and occipital horn or posterior horn respectively.
- Thus, the lateral ventricles span the cerebrum, including the occipital, frontal, and parietal lobes.

PARTS

The lateral ventricle has a: body or central part and

Three extensions, namely the

a. Anterior Horn,
b. Posterior horn and
c. Inferior horn.

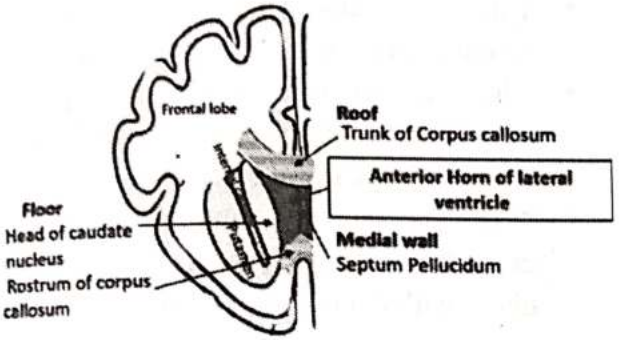
Body or central part

- The central part of the lateral ventricle is elongated anteroposteriorly.
- Anteriorly, it becomes continuous with the anterior horn at the level of the interventricular foramen.
- Posteriorly, the body reaches the splenium of the corpus callosum.
- It is triangular in cross-section.
- It has a roof, floor, and medial wall
- The roof and floor meet on the lateral aspects.
- The roof is formed by the trunk of the corpus callosum whereas
- The medial wall is formed by the septum pellucidum and the body of the fornix.
- The medial part of the floor is formed mainly by the thalamus and the lateral part by the caudate nucleus.
- Between these two structures are the stria terminals and the thalamostriate veins.

Anterior Horn

- The anterior horn of the lateral ventricle lies anterior to the central part or body.
- This extension is triangular in cross-section and has a roof, floor, and medial wall.
- It is closed anteriorly by the genu and rostrum of the corpus callosum.
- Its roof is formed by the most anterior part of the trunk of the corpus callosum.
- The floor is formed by the head of the caudate

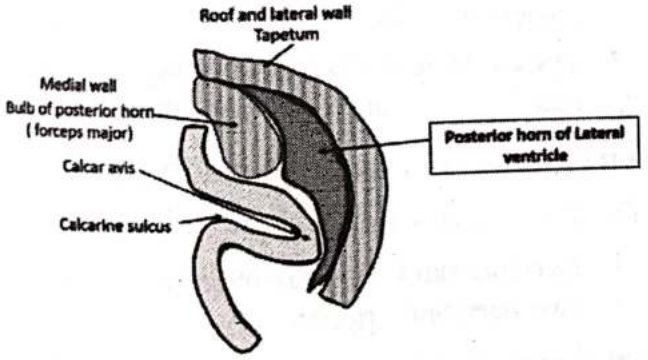
nucleus and the upper surface of the rostrum of the corpus Callosum.



- The medial wall is formed by the septum pellucidum.

Posterior horn

- The posterior horn of the lateral ventricle extends posteromedially into the occipital lobe.
- It has a roof, lateral wall , and medial wall.
- The roof and lateral wall are formed by the tapetum.
- The medial wall shows two elevations, one superior and the other inferior and referred to as the calcar avis.



- Superior to calcar avis there is a structure called the bulb of the posterior horn.
- This bulb is formed by fibres of the forceps major as they run backwards from the splenium of the corpus callosum.

Inferior Horn

- The inferior horn is the largest component of the lateral ventricle.
- It begins at the posterior end of the central region and runs anteroinferior into the temporal lobe.
- It has an anterior end that reaches close to the uncus of the cerebrum.
- It has a roof and a floor.
- The roof of the inferior horn is formed mainly by the tapetum of the corpus callosum and the cauda of the caudate nucleus.
- The floor of the inferior horn is formed mainly by the hippocampus.
- In cross-section, the inferior horn has a narrow cavity which is bounded above, and laterally, by the roof, and below, and medially by the floor.

Applied Anatomy

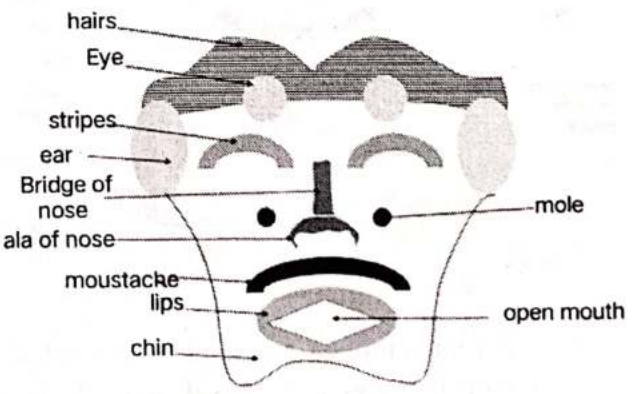
Ventriculomegaly

It is a condition in which the lateral ventricle becomes abnormally enlarged. It is closely associated with mental disorders such as brain pressure inducing hydrocephalus, Alzheimer's disease, dementia, schizophrenia, and bipolar disorder.

Q. 13. The Section Lower Part of Pons

Ans. INTRODUCTION

The pons is the largest part of the brainstem, located above the medulla and below the midbrain. It is a bridge between the upper and lower part of the brain.



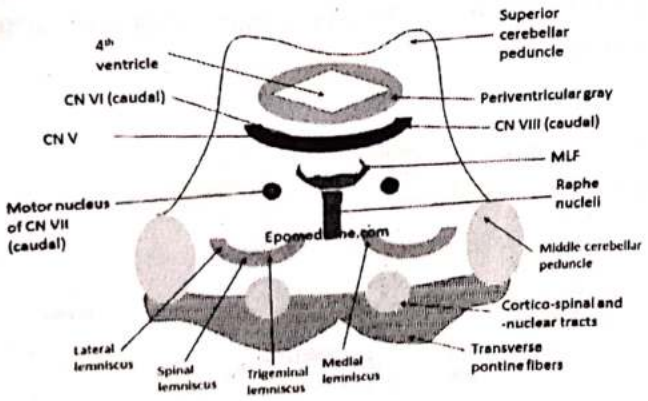
- The pons houses important cranial nerve nuclei.
- The main sensory nucleus and the trigeminal

motor nucleus are situated in the pons.

- The nuclei of Abducens and facial nerve are placed in the pons.
- The cochlear and the vestibular nuclei are placed at the dorsolateral aspect of the pons.

Lower part of pons

- This section shows Abducens and vestibular nuclei closely related to the floor of the fourth ventricle.
- At a deeper level in the lateral part of the reticular formation, there is the spinal nucleus of the trigeminal nerve and the facial nucleus from lateral to medial.
- The dorsal and ventral cochlear nuclei lie dorsally and ventrally to the inferior cerebellar peduncle.
- The fibers arising from the facial nucleus follow an unusual course. They first run backward and medially to reach the lower pole of the Abducens nucleus. They then ascend on the medial side of that nucleus. Then the fibers of the facial nerve turn forwards and laterally passing above the upper pole of the Abducens nucleus. The Abducens nucleus and the facial nerve fibers looping around it together form a surface elevation, the facial colliculus which is seen in the floor of the fourth ventricle.



- All four lemnisci are seen from medial to lateral just above the basal part. Those are the medial, spinal, trigeminal, and lateral lemnisci.
- The vestibular nuclei occupy the lateral position. The lower part of pons shows Olivary nuclei.

Q. 14. Circle of Willis

Ans. INTRODUCTION

- Circle of Willis is a combined name given to the arteries which supply the brain.
- The brain receives its arterial supply from two pairs of vessels, the vertebral arteries, and internal carotid arteries.
- These vessels are interconnected in the cranial cavity to form a cerebral arterial circle called a circle of Willis.

LOCATION

- The circle of Willis lies in the interpeduncular fossa at the base of the brain.
- Its location is near to the pituitary stalk, optic chiasm, and hypothalamus.
- It is named after a physician Thomas Willis.
- Anatomy of the circle of Willis
- The Circle of Willis is an arterial ring just at the base of the brain (around eye level).
- It is formed by the anastomosis between the two internal carotid arteries and the two vertebral arteries.
- The anterior communicating, anterior cerebral, internal carotid, posterior communicating, posterior cerebral, and basilar arteries all contribute to the circle.
- The circle of Willis is formed between the two major arteries and other contributing arteries

ARTERIES OF CIRCLE OF WILLIS:

The main arteries are

- Two Internal Carotid Arteries
- Two vertebral arteries.

Other contributing arteries of the circle of Willis are

- The anterior communicating artery.
- Anterior cerebral arteries.
- Internal carotid arteries.
- Posterior communicating arteries.
- Posterior cerebral arteries
- Basilar arteries

FORMATION OF CIRCLE OF WILLIS:

- Common carotid arteries give rise to internal carotid arteries.

- The left and right internal carotid arteries give rise to left and right posterior communicating arteries it gives its terminal branches called anterior and middle cerebral arteries.
- The two vertebral arteries enter the cranial cavity through the foramen magnum and just inferior to the Pons fuse to form the basilar artery.
- The basilar artery gives rise to posterior cerebral arteries.
- The anterior communicating artery connects the two anterior cerebral arteries.
- The middle cerebral arteries which supplies the brain, are not taking part in the formation of circle of Willis.
- The circle of Willis allows blood that enters by either internal carotid or vertebral arteries to be distributed to any part of both cerebral hemispheres.
- Cortical and central branches arise from the circle and supply the brain substance.

FUNCTION OF THE CIRCLE OF WILLIS:

- The circle of Willis is a very important anastomotic structure in the brain that provides blood supply to the fore-brain and hind-brain.
- This network of arteries provides blood to be distributed to both hemispheres from the internal carotid arteries or vertebral arteries.
- The circle of Willis provides safety to the brain.
- The circle of Willis allows blood to pass blood if an artery is occluded on either side.
- This function allows collateral circulation to the affected side.
- The circle of Willis has an important role in autoregulation of the blood coming from the vessels of the circle of Willis.

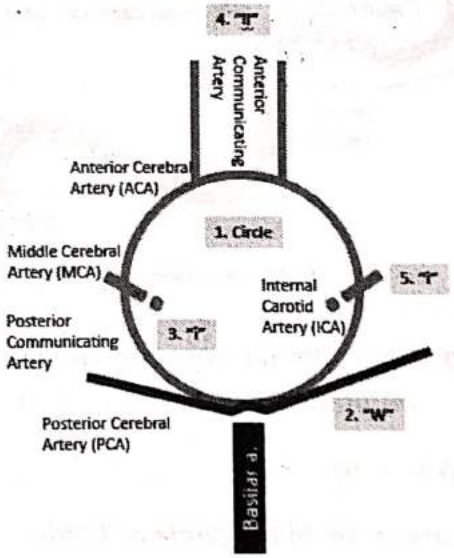
EASY DRAW CIRCLE OF WILLIS:

The circle of Willis receives blood from

- Vertebrobasilar system
  The basilar artery gives off
  Posterior Cerebral arteries and posterior communicating arteries
- Internal Carotid artery system
  Gives off other arteries of the Circle of Willis

Step-wise instructions for drawing the circle of Willis:

i. Draw a Circle – The circle of Willis is a circle of arteries.
Write the "Willis" around this circle:
Each word of Wills represent particular artery
The word W for Posterior Cerebral Artery, they are two, one on each side.
The word i for Middle cerebral artery, they are two.
The word ll for Anterior Cerebral artery, they are also two.
The two times word s for intracranial course and course through sinus of internal carotid artery.



ii. Write a large "W" below the circle – this represents Posterior Cerebral Arteries which arises from a single basilar artery.

iii. Write a horizontal "i" at the sides of the circle – this represents Middle Cerebral Artery outside the circle and Internal Cerebral Artery inside the circle.

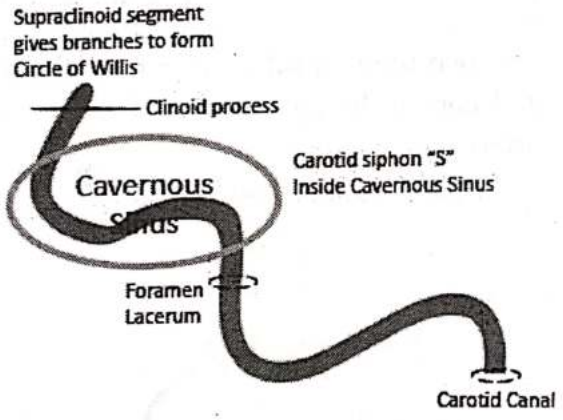
iv. Write "l l" at the superior of the circle – this represents the Anterior Cerebral Arteries along with the part of the circle between the MCA-ICA and Anterior communicating artery.

v. Stepwise instructions to draw the intra-cranial course of Internal Carotid Artery:

a. Write a horizontal "S" – starting from the carotid canal and ending in foramen lacerum.

b. Write another horizontal "S" beginning from the end of previous "S"

- Starting from foramen lacerum and then
- Forming "S" shaped carotid siphon within cavernous sinus and then
- Ending at the level of anterior clinoid process



6. "S" – Horizontal (one over another)

- Supraclinoid segment of ICA gives off branches to form Circle of Willis

Applied Anatomy

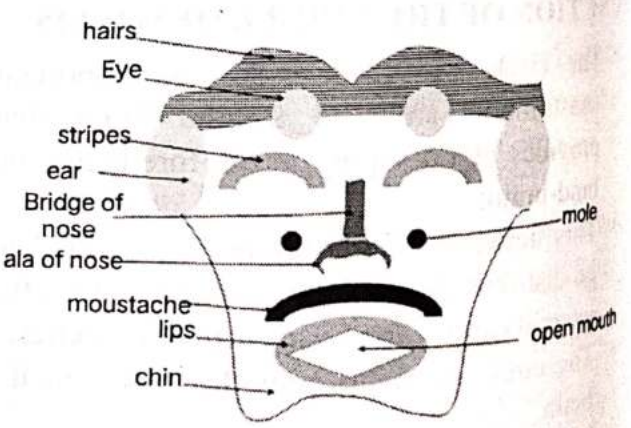
Cerebral aneurysm in the circle of Willis

- Congenital aneurysms occur most commonly at the site where two arteries join in the formation of the circle of Willis.
- At the aneurysm site, there is a deficiency in the tunica media layer of the vessel and this is complicated by the development of atheroma, which so weakens the arterial wall that a local dilatation occurs.
- This local dilatation may press on neighbouring structures and produce signs or symptoms or may suddenly rupture into the subarachnoid space.
- Bleed in subarachnoid space results in severe pain.
- Death may occur quickly, or the patient may survive the first bleeding only to die a few days or weeks later.
- Clipping or ligating the neck of an aneurysm gives the best chance of recovery.

Q. 15 The Section Upper Part of Pons

Ans. INTRODUCTION

- The pons is the largest part of the brainstem, located above the medulla and below the midbrain.
- It is a bridge between the upper and lower part of the brain.
- The pons houses important cranial nerve nuclei.
- The main sensory nucleus and the trigeminal motor nucleus are situated in the pons.
- The nuclei of Abducens and facial nerve are placed in the pons.

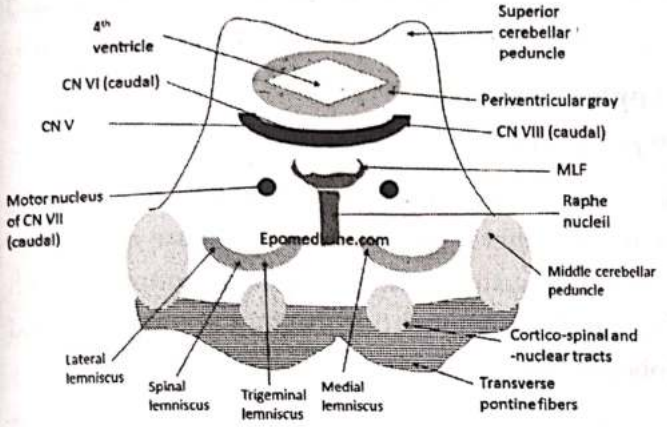


- The cochlear and vestibular nuclei are placed at the dorsolateral aspect of the pons.

Upper part of the pons

- At this level, the dorsal part is bounded laterally by the superior cerebellar peduncles.
- Medial to each superior cerebellar peduncle there is the main sensory nucleus of the trigeminal nerve.
- More medially there is the motor nucleus of the same nerve.
- The superior olivary nucleus extends to this

level but is less prominent.

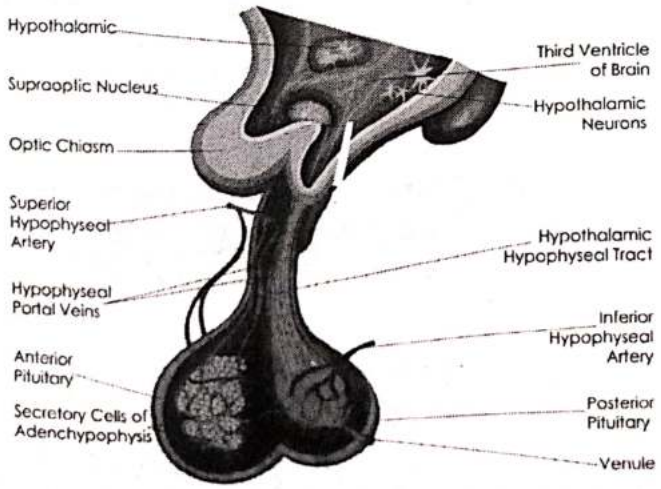


- All four lemnisci are seen from medial to lateral just above the basal part. Those are the medial, spinal, trigeminal, and lateral lemnisci.

Q.15 Hypophysis Cerebri / Pituitary Gland

Ans. INTRODUCTION

- The Hypophysiscerebri is a small endocrine gland situated in relation to the base of the skull.
- It is the master of the endocrine glands.
- The gland lies in hypophyseal fossa.
- The fossa is roofed by diaphragma sallae, a fold of dura mater.
- The gland is oval in shape and it measures 8mm anteroposteriorly and 12mm transversely.



- The weight of the gland is 500gm.

RELATIONS

i. Superiorly

a. It is related to the following structures: (DOTI)
b. Diaphragmasallae
c. Optic chiasma
d. Tuber cinereum and
e. Infundibular recess of third ventricle

ii. Inferiorly

a. It is related to the flowing structures:
b. Mnemonic - (Vikram Host Soon)
c. Venous channels lining floor of hypophyseal fossa
d. Hypophyseal fossa and
e. Sphenoid air sinus

iii. Each side

On each side, it is related to the cavernous sinus with its contents.

DIVISIONS

- The gland has two parts, adenohypophysis, and neurohypophysis.
- The adenohypophysis is subdivided into the anterior lobe, intermediate lobe, and tubular lobe.
- The neurohypophysis is subdivided into the posterior lobe, Infundibular stem, and median eminence of tuber cinereum.

HISTOLOGY

- The anterior lobe is made up of acidophils, basophils, and chromophobic cells.
- The intermediate lobe is made up of basophils and chromophobic cells and
- The posterior lobe is made up of nonmyelinated fibers and modified neurological cells.

HORMONES

- The anterior lobe growth hormone, lactogenic hormone, TSH, FSH, and LH

- The intermediate lobe secretes melanocyte-stimulating hormone and
- The posterior lobe secretes vasopressin and oxytocin hormones.

ARTERIAL SUPPLY

It is supplied by the following branches of the internal carotid artery

- Superior hypophyseal artery on each side
- Inferior hypophyseal artery on each side

VENOUS DRAINAGE

Short veins emerge from the surface of the gland and drain into neighbouring dural venous sinuses.

Applied Anatomy

Pituitary Tumours

It is an overgrowth of the gland. It represents with the general symptoms of pressure effect over surrounding structures and special symptoms with type and involvement of the functioning cells and lobes of the gland.

HEAD AND BRAIN TEN MARKS QUESTIONS

Q.1 The Inner Ear

Ans. INTRODUCTION

The ear can be divided into three parts: the outer ear, middle ear , and inner ear.

The inner ear is the innermost part of the ear.

The inner ear houses the Vestibulocochlear organs.

LOCATION

- The inner ear is located within the petrous part of the temporal bone.
- It lies between the middle ear and the internal acoustic meatus, which lie laterally and medially respectively.

COMPONENTS

The inner ear has two main components – the bony labyrinth and membranous labyrinth

i. Bony labyrinth

a. The bony labyrinth consists of a series of bony cavities within the petrous part of the temporal bone.

b. It is composed of the cochlea, vestibule, and three semi-circular canals.

c. All these structures are lined internally with periosteum and contain a fluid called perilymph

ii. Membranous labyrinth

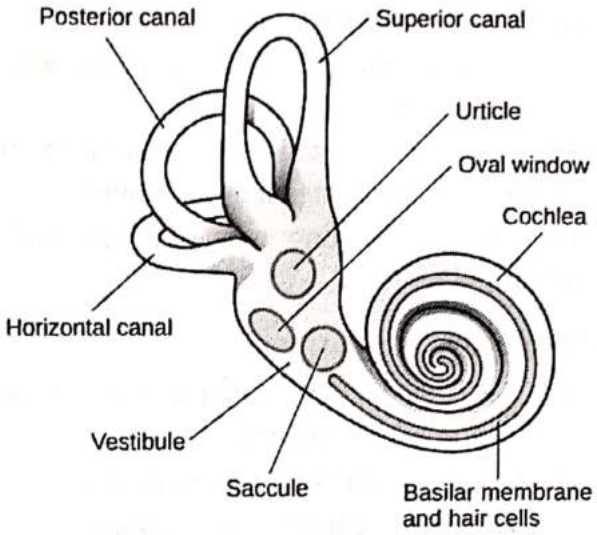
a. The membranous labyrinth lies within the bony labyrinth.

b. It consists of the cochlear duct, semi-circular ducts, utricle, and the Saccule.

c. The membranous labyrinth is filled with a fluid called endolymph

Vestibule

- The vestibule is the central part of the bony labyrinth. It is separated from the middle ear by the oval window.
- It communicates in two directions, anterior and posterior.



- It communicates anteriorly with the cochlea and posteriorly with the semi-circular canals.
- The two parts of the membranous labyrinth; the Saccule and utricle, are located within the vestibule

Cochlea

- The cochlea houses the cochlea duct of the membranous labyrinth – the auditory part of the inner ear.
- It twists upon itself around a central portion of bone called the modiolus.
- This twist produces a cone shape points in an anterolateral direction.
- Branches from the cochlear portion of the Vestibulocochlear are found at the base of the modiolus.
- Extending outwards from the modiolus is a ledge of bone known as spiral lamina, which attaches to the cochlear duct, holding it in position.
- The presence of the cochlear duct creates two perilymph-filled chambers above and below
- Scala Vestibuli: Located superiorly to the cochlear duct. As its name suggests, it is continuous with the vestibule.
- Scala tympani: Located inferiorly to the cochlear duct. It terminates at the round window

Semi-circular Canal

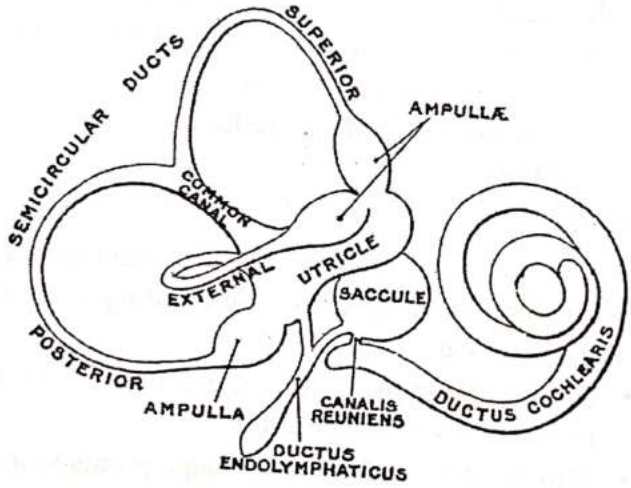
- There are three semi-circular canals; anterior,

lateral and posterior.

- They contain the semi-circular ducts, which are responsible for balance
- The canals are situated superoposterior to the vestibule, at right angles to each other.
- They have a swelling at one end, known as the ampulla

Cochlear duct

- The cochlear duct is located within the bony scaffolding of the cochlea.
- The cochlear duct is triangular in shape.
- It is held in place by the spiral lamina.



- The duct creates two canals. One above the duct is Scala Vestibuli and another below the duct is Scala tympani.
- The lateral wall of the cochlear duct is formed by thickened periosteum, known as the spiral ligament.
- The roof of the cochlear duct is formed by the vestibular membrane
- The floor of the duct is formed by a basilar membrane.
- The basilar membrane houses the epithelial cells of hearing – the Organ of Corti.

Saccule and utricle

- The Saccule and utricle are two membranous sacs located in the vestibule. They are organs of balance.
- The utricle is the larger of the two, receiving the three semi-circular ducts. The Saccule is globular in shape and receives the cochlear.
- The Saccule detects movement or acceleration of the head in the vertical plane whereas The Utricles detects movement or acceleration of the head in the horizontal planes.

Semi-Circular duct

- The semi-circular ducts are located within the semi-circular canals
- Upon movement of the head, the flow of endolymph within the ducts changes speed and direction.
- The change in speed is detected by sensory receptors in the ampullae of the semi-circular canals
- The signal is then sent to the brain to complete the processing of balance.

OPENINGS

- The inner ear has two openings, an oval window, and a round window, into the middle ear, both covered by membranes.
- The oval window lies between the middle ear and the vestibule and
- The round window separates the middle ear from the Scala tympani

FUNCTIONS

The inner ear has two main functions:

- To convert mechanical signals from the middle ear into electrical signals, this can transfer information to the auditory pathway in the brain.
- To maintain balance by detecting position and motion.

BLOOD SUPPLY

The bony labyrinth receives its blood supply from the following three arteries:

Anterior tympanic branch,
Petrosal branch and
Stylomastoid branch

- The membranous labyrinth is supplied by the labyrinthine artery, a branch of the inferior Cerebellar artery

- Venous drainage of the inner ear is through the labyrinthine vein, which empties into the sigmoid sinus or inferior petrosal sinus.

NERVE SUPPLY

- The inner ear is innervated by the Vestibulocochlear nerve.
- It enters the inner ear via the internal acoustic meatus, where it divides into the vestibular nerve for balance and the cochlear nerve for hearing.

Applied Anatomy

Meniere's disease is a disorder of the inner ear, characterised by episodes of vertigo, low-pitched tinnitus, and hearing loss.

Q.2 The Cavernous Sinus

Ans. DEFINITION

- The cavernous sinus is a paired dural venous sinus located within the cranial cavity.
- It is divided by septa into small 'caves – from which it gets its name.
- Each cavernous sinus has a close anatomical relationship with several key structures in the head and is the most clinically important venous sinus.

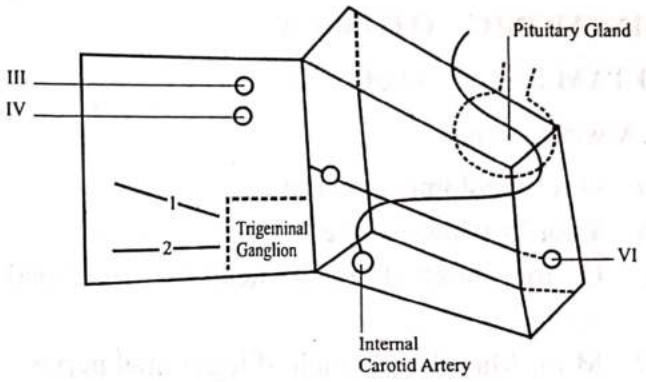
ANATOMICAL LOCATION

- The cavernous sinuses are located within the middle cranial fossa, on either side of the sella turcica of the sphenoid bone.
- They are enclosed by the endosteal and Meningeal layers of the dura mater.

BORDERS

The borders of the cavernous sinus are as follows:

- Anterior Border
  It is formed by superior orbital fissure
- Posterior Border
  It is formed petrous part of the temporal bone
- Medial Border
  It is formed by the body of sphenoid bone
- Lateral Border
  It is formed by the meningeal layer of the dura mater running from the roof to the floor of the middle cranial fossa.
- Roof
  It is formed by the meningeal layer of the dura matter that attaches to the anterior and middle clinoid processes of the sphenoid bone.



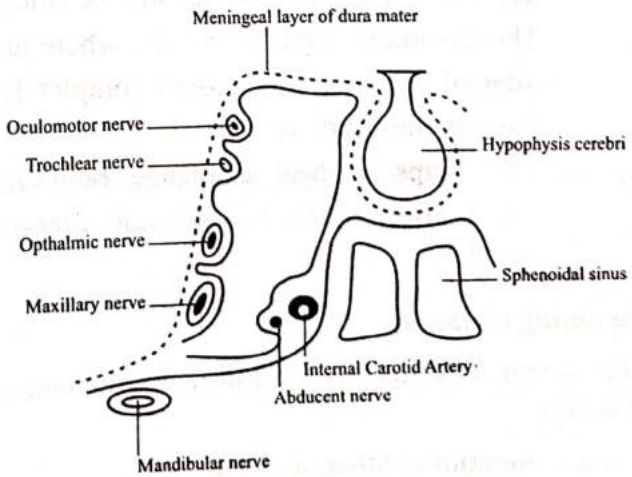
- Floor
  It is formed by the endosteal layer of the dura mater that overlies the base of the greater wing of the sphenoid bone.

CONTENTS

Several important structures are passing through the cavernous sinus to enter the orbit.

They can be sub-classified into two groups

- Travel through the sinus
- Travel through the lateral wall of the sinus
- Structures passing through the sinus are



- Internal Carotid artery and
- Abducens nerve

- Structures passing the lateral wall of sinus are:
  - Oculomotor nerve
  - Trochlear nerve
  - Ophthalmic nerve
  - Maxillary nerve
  - Trigeminal ganglion

MNEMONIC – OTOM CA

O TAM lateral wall of sinus

CA within sinus

a. O for Oculomotor nerve
b. T for Trochlear nerve
c. O for Ophthalmic branch of trigeminal nerve
d. M for Maxillary branch of trigeminal nerve
e. C for Internal carotid artery
f. A for Abducens nerve

At lateral wall

- Oculomotor nerve
- Trochlear nerve
- Ophthalmic branch of trigeminal nerve
- Maxillary branch of trigeminal nerve

Within sinus

- C for Internal carotid artery
- A for Abducens nerve
  - Only the Mandibular branch of the trigeminal nerve remain outside the sinus
  - The cavernous sinus is the site where an internal carotid artery passes completely through the structure.
  - This helps in heat exchange between warm arterial blood and cool venous blood.

Incoming channels

The cavernous sinus has the following incoming channels:

a. Superior ophthalmic vein
b. A branch of inferior ophthalmic vein and
c. A central vein of the retina

COMMUNICATIONS

The cavernous sinus drain into:

- The transverse sinus through superior petrosal sinus
- The internal jugular vein through the inferior petrosal sinus
- The pterygoid plexus of veins through the emissary veins
- The facial vein through superior ophthalmic vein and
- The right and left cavernous sinus communicates with each other through the anterior and posterior intercavernous sinuses.

Applied Anatomy

Cavernous sinus thrombosis

- Cavernous sinus thrombosis refers to the formation of a clot within the sinus
- The most common cause of CST is an infection that typically spreads from extracranial locations such as paranasal sinuses or danger one of the face.

Q.2 The Middle Ear

Ans. INTRODUCTION

- The ear can be split into three parts; external, middle, and inner.
- The middle ear is a narrow air-filled space that lies within the temporal bone.
- It extends from the tympanic membrane to the lateral wall of the inner ear.

SHAPE

- The middle ear is shaped like a cube.
- Its lateral and medial walls are large whereas anterior and posterior walls are narrow.
- Its vertical and anteroposterior diameters are about 15 mm.
- The middle ear looks biconcave with its lateral and medial wall are 6 mm apart near the roof, 2mm apart in the center and 4mm apart near the floor from each other.

PARTS

- The cavity of the middle ear can be subdivided into two parts, the Tympanic cavity proper and the epitympanic recess.
- The Tympanic cavity lies opposite the tympanic membrane whereas the epitympanic recess lies above the level of the tympanic membrane.

COMMUNICATIONS

- The middle ear has anterior and posterior communications.
- Anteriorly it communicates with Nasopharynx through the auditory tube whereas posteriorly it communicates with the Mastoid antrum and cell through the aditus to the mastoid antrum.

BOUNDARIES

The middle ear is visualised as a rectangular box, with a roof and floor, medial and lateral walls, and anterior and posterior walls.

i. ***Roof***

It is also known as a tegmental wall.

It is formed by a thin bony plate of temporal bone known as tegma tympani.

It separates the middle ear from the middle cranial fossa.

ii. ***Floor***

It is also known as the jugular wall.

It is also formed by a thin plate of bone that separates the middle ear from the internal jugular vein.

iii. ***Lateral wall***

It is also known as a membranous wall.

It is made up of the tympanic membrane and partly by squamous temporal bone.

iv. ***Medial wall***

It is also known as the Labyrinthine wall.

It is formed by the lateral wall of the internal ear.

It separates the middle ear from the inner ear.

v. ***Anterior wall***

It is also known as the carotid wall.

It is made up of a thin bony plate

It separates the middle ear from the internal carotid artery.

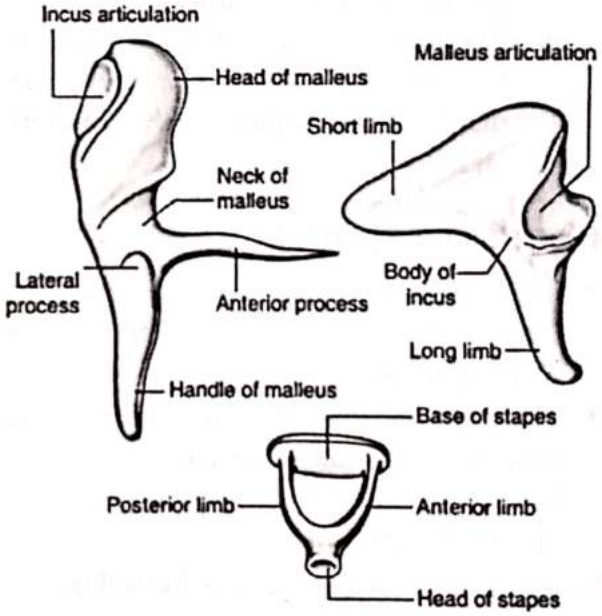
vi. ***Posterior wall***

It is also known as the mastoid wall.

It isa bony partition between the tympanic cavity and the mastoid air cells.

BONES

- It bones of the middle ear are known as auditory Ossicles.
- There are three Ossicles Malleus, Incus and Stapes.
- They are connected in a chain-like manner.
- They link the tympanic membrane to the oval window of the inner ear.



i. ***Malleus***

a. The Malleus is the largest and most lateral Ossicle of the middle ear.

b. It consists of a rounded head, neck, anterior process, lateral process, and a handle.

c. It is attached to the tympanic membrane, via the handle.

d. The head of the Malleus lies in the epitympanic recess, where it articulates with the next auditory Incus.

ii. Incus

a. The Incus is an anvil-shaped Ossicle of the middle ear.
b. It looks like molar teeth.
c. It consists of body and a long process.
d. It articular surface of the body articulates with Malleus whereas its long limb joins with the stapes.

iii. Stapes

a. The stapes is the smallest bone in the human body.
b. It is stirrup-shaped, with a head, two limbs, and a base.
c. It joins the Incus to the oval window of the inner ear.
d. The head articulates with the Incus, and the base joins the oval window.
e. The main function of the middle ear is to transmit vibrations from the tympanic membrane to the inner ear via the auditory Ossicles.

MUSCLES OF MIDDLE EAR

- There are two muscles that serve a protective function in the middle ear; the tensor tympani and Stapedius.
- These muscles contract in response to loud noise to inhibit the vibrations of the Malleus, Incus, and stapes, to reduce the transmission of sound to the inner ear.

This action is known as the acoustic reflex.

i. Tensor tympani

The tensor tympani originate from the auditory tube and attaches to the handle of the Malleus.

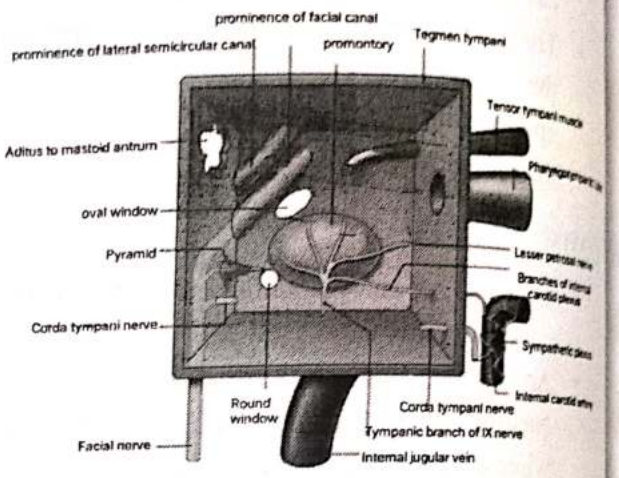
It is innervated by the tensor tympani nerve, a branch of the Mandibular nerve.

ii. Stapedius

The Stapedius muscle attaches to the stapes and is innervated by the facial nerve. ++

The mastoid air cells

- The mastoid air cells are located posterior to the epitympanic recess.
- They are a collection of air-filled spaces in the mastoid process of the temporal bone. The cells are contained within a cavity called the mastoid antrum.



- The mastoid antrum communicates with the middle ear via the aditus to mastoid antrum
- The mastoid air cells act as a 'buffer system' of air.

Auditory Tube

- The auditory tube is also known as the Eustachian tube.
- It is a cartilaginous and bony tube that connects the middle ear to the Nasopharynx.
- It acts to equalize the pressure of the middle ear to that of the external auditory meatus.

Special Features

- Tegma tympani bone creates canal for tensor tympani muscle.
- The tympanic canaliculus, near the medial wall of the floor, transmits the tympanic branch of the Glossopharyngeal nerve.
- The upper part of anterior wall bears the opening of canal for the tensor tympani muscle.
- A thick bone at the inferior wall of the anterior wall also forms the posterior wall of the carotid canal.
- Processuscochleariformis is a curved bony extension of the septum canal and auditory tube
- Posterior wall shows

  - An opening for communication with mastoid antrum
  - A fossa for short process of Incus known as Fossa Incudis
  - A conical projection pyramid
- Medial wall shows
- A round bulging produced by cochlea known as Promontory
- A oval opening known as Fenestra vestibuli
- A round opening known as Fenestra Cochleae

ARTERIAL SUPPLY

The middle ear is supplied by

- Anterior tympanic branch of maxillary artery
- Posterior tympanic artery
- Superior tympanic artery
- Inferior tympanic artery

NERVE SUPPLY

Nerve supply is derived from the tympanic nerve plexus formed by branches of the Glossopharyngeal nerve and sympathetic plexus.

APPLIED ANATOMY

Otitis media with effusion is commonly known as glue ear. It arises from persistent dysfunction of the auditory tube. If the auditory tube is unable to equalise middle ear pressure due to blockage, inflammation, genetic mutation

2 Face

FACE TWO MARKS QUESTIONS

Q. 1 Any two branches of facial artery

Ans. Terminal branches of the facial nerve are:

a. Temporal
b Zygomatic
c. Buccal
d. Marginal Mandibular and
e. Cervical

Q. 2 Any two symptoms of Bell's palsy
MNEMONIC – BELL'S Palsy

a. B for Blink reflex abnormal
b. E for Earache
c. L for Lacrimation
d. L for Loss of taste
e. S for Sudden onset
f. Palsy for paralysis of facial nerve

Ans. Bell's palsy is paralysis of the facial nerve with the following symptoms:

a. Blink reflex abnormal
b. Earache
c. Lacrimation
d. Loss of taste
e. Sudden onset

Q. 3 Name the muscles forming floor of mouth

Ans. Floor of mouth is formed by the following muscles:

a. Mylohyoid
b. Geniohyoid and
c. Hyoglossus

Q. 4 Name any four paranasal air sinuses

Ans. Paranasal air sinuses are a group of four paired air-filled spaces surrounding the nasal cavity. They are:

a. Maxillary sinuses located under the eyes
b. Frontal sinuses located above the eyes
c. Ethmoidal sinuses located between the eyes and
d. Sphenoidal sinuses located behind the eyes

Q. 5 Any two structures passing through the parotid gland

Ans. The structure passes through the parotid gland from medial to lateral are:

a. External carotid artery – It enters the gland through its posteromedial surface
b. Retromandibular vein is formed within the gland by the union of the superficial temporal and maxillary veins.
c. The Facial nerve enters the gland through the upper part of its posteromedial surface.

Q. 6 Any two bones of lateral wall of nose

Ans. The skeleton of the lateral wall of the nose is partly bone, partly cartilaginous, and partly made up of only soft tissue. The bones forming the lateral wall of the nose are:

a. Nasal bone
b. Frontal process of maxilla
c. Lacrimal bone
d. Labyrinth of ethmoidal bone with superior and middle conchae
e. Inferior nasal concha

f. Perpendicular plate of palatine bone
g. Medial pterygoid plate

Q. 7 Any two cartilages of lateral wall of nose

Ans. The skeleton of the lateral wall of nose is partly bone, partly cartilaginous, and partly made up of only soft tissue. The cartilages forming the lateral wall of the nose are

a. Superior nasal cartilage
b. Inferior nasal cartilage and
c. 3 to 4 small cartilages of the ala

Q. 8 Any two contents of middle ear

Ans. Middle ear contains three Ossicles, two muscles, Nerves Vessels, and Ear ligaments.

a. Ossicles – Malleus, Incus, and Stapes are three Ossicles in the middle ear
b. Muscles – Tensor tympani and Stapedius are two muscles in the middle ear
c. Nerves – Corda tympani and are the nerves in the middle ear
d. Vessels that supply and drain the middle ear

Q. 9 Any two contents of the inner ear

Ans. Inner ear consists of the temporal bone. It consists of a bone labyrinth surrounded by a membranous labyrinth. Both labyrinths consist of three parts each. Following are the contents of the inner ear

Bony labyrinth – The bony labyrinth consists of three parts

a. Anteriorly placed Cochlea
b. Middle positioned Vestibule and
c. Posteriorly placed Semicircular canal

Membranous labyrinth – The membranous labyrinth consists of three parts

d. Anteriorly placed Spiral duct of Cochlea
e. Middle positioned Utricles and Saccule the organs of static balance and Posteriorly placed semicircular duct

Q. 9 Name any two tongue papillae

Ans. Tongue papillae are projections of mucus membrane. They are of following three types:

a. Vallate or Circumvallate Papillae
b. Fungiform Papillae
c. Filiform Papillae

Q. 11 Any two intrinsic muscles of the tongue MNEMONIC – LG TV

a. LG for LonGitudinal
b. T for Transverse
c. V for Vertical

Ans. There are three intrinsic muscles of the tongue, they are as follows

a. Longitudinal
b. Transverse and
c. Vertical

Q. 12 Any two muscles of the middle ear – MNEMONIC – SirfTum

a. S for Stapedius and
b. T for Tensor tympani

Ans. There are two muscles of the middle ear:

a. Stapedius and
b. Tensor tympani

Q. 13. Name extrinsic muscles of tongue

Ans. Middle fibrous septum divides tongue into two halves. Each half contains four intrinsic and four extrinsic muscles. Following are the extrinsic muscles

a. Genioglossus
b. Hyoglossus
c. Styloglossus and
d. Palatoglossus

Q. 14. Nerves for extraocular muscles

Ans. The seven extraocular muscles are supplied by three cranial nerves

a. The Superior oblique is supplied by the Trochlear nerve
b. The lateral rectus is supplied by the Abducens nerve and
c. The remaining five muscles are

supplied by Oculomotor nerve

Q. 15. Names of ear Ossicles

Ans. There are three small bones in the middle ear known as ear Ossicles. They are:

a. A hammer-shaped bone "Malleus"
b. An anvil-shaped bone "Incus" and
c. A stirrup-shaped bone "Stapes"

Q.16 Any four extraocular muscles

Ans. There are seven extraocular muscles

a. Four recti
- Superior Recti,
- Inferior recti,
- Medial recti and
- Lateral recti

b. Two obliqui
- Superior oblique
- Inferior oblique

c. The Levatorpalpebraesuperioris

Q. 17 Origin of recti muscles of eyeball

Ans. All four recti muscles arise from a common annular tendon or tendinous ring.
The ring is attached to the orbital surface of the apex of the orbit

Q. 18 Any two sinuses drain in middle meatus
MNEMONIC – FAME

a. F for Frontal sinus
b. A for Anterior ethmoidal sinus
c. M for Maxillary sinus and
d. E for Ethmoidal Middle sinus

Ans. Four sinuses drain in the middle meatus, they are as follows:

a. Frontal sinus
b. Anterior ethmoidal sinus
c. Maxillary sinus and
d. Ethmoidal Middle sinus

Q. 19 Name muscles causing smile on face.

Ans. The muscles used to smile are:

a. Zygomaticus major
b. Zygomaticus minor
c. Orbicularis oculi
d. Levatorlabiisuperioris
e. Levatorangulioris and
f. Risorius

Q. 20 Nerve innervations of extraocular muscles
MNEMONIC – LR6SO4 rest 3

a. LR – lateral rectus
b. 6 – 6th cranial nerve i.e. Abducens
c. SO – Superior Oblique
d. 4 – 4th cranial nerve i.e. Trochlear
e. 3 – 3rd cranial nerve i.e. oculomotor nerve

Ans. Lateral rectus is supplied by Abducens nerve, Superior Oblique is supplied by Trochlear nerve and all other muscles are supplied by the oculomotor nerve.

Q. 21 Any two intrinsic muscles of tongue
MNEMONIC – LG TV

a. LG for LonGitudinal
b. T for Transverse
c. V for Vertical

Ans. There are three intrinsic muscles of tongue, they are as follows

a. Longitudinal
b. Transverse and
c. Vertical

Q. 22 Any two muscles of middle ear –
MNEMONIC – SirfTum

a. S for Stapedius and
b. T for Tensor tympani

Ans. There are two muscles of the middle ear:

a. Stapedius and
b. Tensor tympani

Q. 23 Any two nerves supplying muscles of middle ear
MNEMONIC – SirFTuM

a. Take S and F from Sirf
b. S for Stapedius
c. F for Facial
d. Stapedius is supplied by Facial nerve
e. Take T and M from TuM

f. T for Tensor tympani a
g. M for Mandibular branch of trigeminal nerve
h. Tensor tympani is supplied by Mandibular branch of trigeminal nerve

Ans. There are two nerves supplying the muscles of the middle ear:
The facial nerve supplies the Stapedius muscles whereas the Mandibular branch of the trigeminal nerve supplies the Tensor tympani muscle.

Q. 24 Parts of lacrimal apparatus

Ans. Lacrimal apparatus is made up of the following parts:
a. Lacrimal gland
b. Conjunctival sac
c. Lacrimal Puncta
d. Lacrimal canaliculi
e. Lacrimal sac and
f. Nasolacrimal duct

Q. 25 Any two layers of retina
MNEMONIC – In New Generation It is Only Ophthalmologist Examine Patients Retina

a. I for Inner limiting membrane
b. N for Nerve fiber layer
c. G for Ganglion cell
d. I for Inner Plexiform layer
e. I for Inner nuclear layer
f. O for outer plexiform layer
g. O for outer nuclear layer
h. E for External limiting membrane
i. P for Photoreceptors i.e. rods and cons
j. R for reticular pigmented layer

There are two plexifroms inner and outer; there are two limiting membranes external and internal also two nuclear layers inner and outer. The retina is for vision, so there must be nerve fiber, which means a layer for nerve fibers. Nerve fibers are having ganglion, a layer of the ganglion cells. Vision is by means of Rods and cons, means a layer of rods and cons. All nine layers can be remembered with logic and the last layer is the pigment layer.

Ans. Retina is having the following ten layers
a. Inner limiting membrane
b. Nerve fiber layer
c. Ganglion cell
d. Inner Plexiform layer
e. Inner nuclear layer
f. Outer Plexiform layer
g. Outer nuclear layer
h. External limiting membrane
i. Photoreceptors i.e. rods and cons
j. Reticular pigmented layer

Q. 26 Name muscles causing frowning expression of face.

Ans. The muscles causing frowning expression are
a. Orbicularis oculi
b. Platysma
c. Corrugator supercilli
d. Procerus and
e. Orbicularis oris

Q. 27 Name the divisions of trigeminal nerve.

Ans. Following are three major branches of trigeminal nerve:
a. Ophthalmic nerve
b. Maxillary nerve and
c. Mandibular nerve

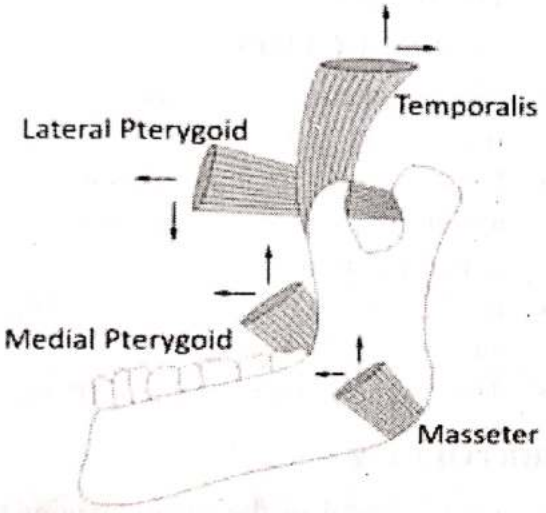
FACE TEN MARKS QUESTIONS

Q. 1 Muscles of Mastication

Ans. The muscles of mastication move the mandible during mastication.

There are four muscles for mastication. They are as follows:

i. Masseter
ii. Temporalis
iii. Lateral pterygoid
iv. Medial pterygoid and

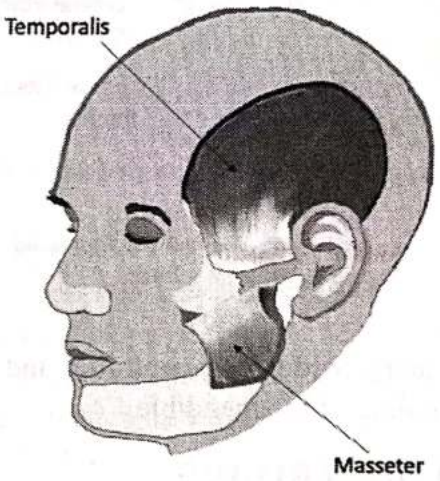


i. MASSETER

a. It is a quadrilateral muscle that covers the lateral surface of the ramus of the mandible.
b. It has three layers, superficial, middle, and deep layers.
c. All the layers are originating from the Zygomatic arch and are inserted on the ramus of the mandible.
d. Its superficial layer originates from the anterior two-third of the lower border of the Zygomatic arch and adjoining Zygomatic process and inserted on the lower part of the lateral surface of the ramus of the mandible.
e. Its middle layer originates from the anterior one-third of the deep surface and posterior one-third of the lower border of the Zygomatic arch and is inserted on the middle part of the ramus of the mandible.
f. Its deeper layer originates from the deep surface of the Zygomatic arch and is inserted on the upper part of the ramus and coronoid process of the mandible.
g. It is supplied by the masseteric nerve, a deep branch of the Mandibular nerve.
h. It helps to close the mouth by elevating the mandible.

ii. TEMPORALIS

a. It is fan-shaped muscle, fills the temporal fossa
b. It has two originates from temporal fossa and temporal fascia



c. Its inserted on margins and deep surface of the coronoid process and anterior border of the ramus of the mandible.
d. It is supplied by the temporal branch of the Mandibular nerve.
e. It elevates, retracts, and helps in the side grinding of the mandible.

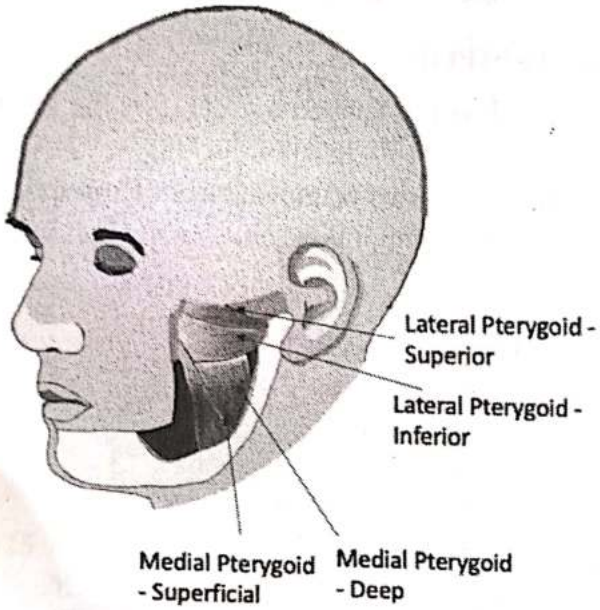
iii. LATERAL PTERYGOID

a. It is a short conical-shaped muscle.
b. It has upper and lower heads.
c. Its upper head originates from the infratemporal surface and crest of the greater wing of the sphenoid bone and is inserted on the pterygoid fossa on

the anterior surface of the neck of the mandible.

d. Its lower head originates from the lateral surface of the lateral pterygoid plate and is inserted on the anterior margin of the articular disc and capsule of TMJ.

e. It is supplied by a branch from the Mandibular nerve.



f. It helps to depress, protrude, and in the grinding of the mandible.

iv. MEDIAL PTERYGOID

a. It is a quadrilateral muscle.

b. It has a small superficial and deep head.

c. Its superficial head originates from the tuberosity of the maxilla and adjoining bone and is inserted on the rough area on the medial surface of the angle and adjoining ramus of the mandible.

d. Its deep head originates from the medial surface of the lateral pterygoid plate and palatine bone and is inserted on the rough area on the medial surface of the angle and adjoining ramus of the mandible.

e. It is supplied by the nerve to medial pterygoid, a branch of the Mandibular nerve.

f. It helps to elevate andprotrude the mandible.

Remembering tips

- All muscles are supplied by the Mandibular nerve.
- Two muscles Masseter and medial pterygoid are quadrilateral in shape
- Three muscles except the lateral pterygoid elevate the mandible. No LE
- All muscles except Masseter protrude the mandible. No MP
- Temporalis and lateral pterygoid grind the TMJ

Q. 2 The Tongue

Ans. INTRODUCTION

- The tongue is an organ of deglutition, speech, and gestation.
- Under normal circumstances, the tongue is a pink, muscular organ located within the oral cavity proper.
- It is kept moist by the products of the major and minor salivary glands.
- The tongue is approximately 10 cm long.

EMBRYOLOGY

- Development of the tongue begins toward the end of the fourth gestational week.
- The anterior two-third of the tongue is known as the oral part, and the posterior third is the pharyngeal part.
- The oral part originates from the first pharyngeal arch, while the pharyngeal part arises from the third and fourth pharyngeal arches.
- The oral part of the tongue has lingual papillae and taste buds, while the pharyngeal part has lingual tonsils and taste buds.

EXTERNAL FEATURES

The tongue has three parts tip, body, and root respectively.

Tip

- The tips or apex of the tongue is the most anterior and most mobile aspect.

- It rests behind the incisor teeth.

Body

- The tip is followed by the next part, the body of the tongue.
- It has two surfaces, dorsal and ventral.

i. Dorsal surface

a. The dorsal or superior surface is curved and rough.
b. The dorsal surface is divided into two parts by a faint V-shaped groove.
c. The anterior two third of the dorsal surface is oral part where as the posterior one-third is the pharyngeal part.
d. The meeting point of V on the dorsal surface is known as the foramen caecum.
e. The margins of the oral part are free and in contact with gum and teeth.
f. The dorsal surface is populated with taste buds and lingual papillae.
g. The posterior surface of the pharyngeal part is known as the base of the tongue.
h. The mucous membrane of the pharyngeal part has many lymphoid follicles that are collectively known as lingual tonsils.

ii. Ventral Surface

a. Its ventral or inferior surface is smooth.
b. It is attached to the floor of the oral cavity by the lingual frenulum.
c. On either side of the frenulum, there is prominence produced by deep lingual veins.
d. More laterally there is a fold called Plica Fimbriata.

Base or Root

- The root of the tongue is the most posterior part.
- The root is attached to the mandible and soft palate above and to the hyoid bone below.
- It is populated by the lingual tonsils along with foliate papillae.

RELATIONS

Tongue has the following relations:

- Anterior and lateral – Anteriorly and laterally it is related to teeth
- Superior – Superiorly it is related to hard and soft palates
- Inferior – Inferiorly it is related to mucosa of the floor of the oral cavity, sublingual salivary glands, posterior wall of Oropharynx
- Posterior – Posteriorly tongue is related to epiglottis, pharyngeal inlet
- Lateral – Laterally it is related to palatoglossal and palatopharyngeal arches

MUSCLES

- The tongue is chiefly a muscular organ with some amount of fatty and fibrous tissue distributed throughout its substance.
- The tongue is separated by the middle fibrous septum into two half.
- Each half contains four intrinsic and four extrinsic muscles.
- The group of muscles which extends outside the tongue to fix it to surrounding bony structures are known as extrinsic muscles.
- The other set of muscles are confined to each half of the tongue and contribute to altering the shapes are known as the intrinsic muscles.

Intrinsic Tongue Muscles

- The intrinsic tongue muscles are responsible for adjusting the shape and orientation.
- It is made up of the following four paired muscles.
  - Superior Longitudinal
  - Inferior longitudinal
  - Transverse and
  - Vertical
- The intrinsic muscles occupy the upper part of the tongue and are attached to the submucous fibrous layer and to the median fibrous septum.
- They alter the shape of the tongue.
- Superior longitudinal muscle lies beneath

the mucous membrane of the tongue which shortens the tongue and makes its dorsum concave.

- Inferior longitudinal muscle is a narrow band lying close to the inferior surface of the tongue between two extrinsic muscles Genioglossus and Hyoglossus respectively. It also shortens the tongue and makes its dorsum convex.
- The transverse muscle extends from the median septum to the margins of the tongue. It makes the tongue narrow and elongated.
- The vertical muscle is at the borders of the anterior part of the tongue. It makes the tongue broad and flattened.

Extrinsic muscles of tongue

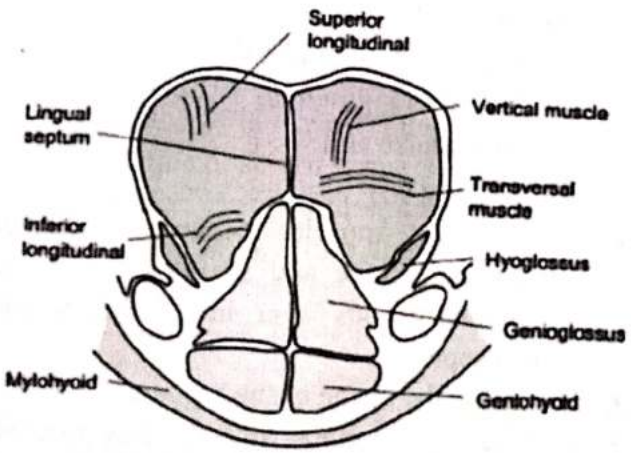
The extrinsic muscles extend outside the tongue and fix it to the surrounding bony structures.

There are the following four extrinsic muscles:

i. Genioglossus
ii. Hyoglossus
iii. Styloglossus and
iv. Palatoglossus

i. Genioglossus

a. The Genioglossus is fan-shaped muscle forming the main bulk of the tongue.
b. It connects the tongue to the mandible.
c. It originates from the superior mental spine of the mandible.
d. It inserts on the entire length of the dorsum of the tongue, lingual aponeurosis, and the body of the hyoid bone.



e. It is innervated by the hypoglossal nerve
f. It helps in depression and protrusion of tongue. It also deviate the tongue contra laterally.

ii. Hyoglossus

a. The Hyoglossus is the extrinsic muscle that connects the tongue with the hyoid bone.
b. It originates from the whole length of the greater cornua and lateral part of the body of the hyoid bone.
c. It is inserted on side of the tongue.
d. It is innervated by the hypoglossal nerve
e. It depresses and retracts the tongue.

iii. Styloglossus

a. The Styloglossus connects the tongue with the styloid process of the temporal bone.
b. It originates from the anterolateral aspect of the styloid process of the temporal bone and the stylomandibular ligament.
c. It has a longitudinal part and an oblique part.
d. Its longitudinal part inserts by blends with inferior longitudinal muscle whereas its oblique part blends with Hyoglossus muscle.
e. It is innervated by the hypoglossal nerve.

iv. Palatoglossus

a. The Palatoglossus connects the tongue with the soft palate.
b. It originates from the palatine aponeurosis of the soft palate.
c. It inserts on lateral margins of the tongue and blends with intrinsic muscles of the tongue. It is innervated by the vagus nerve the tenth cranialnerve.

Lingual Papillae

There are four types of lingual papillae found on the surface of the human tongue. These four papillae are:

i. Filiform papillae

ii. *Fungiform papillae*
iii. *Foliate papillae and*
iv. *Circumvallate papillae*

i. *Filiform papillae*

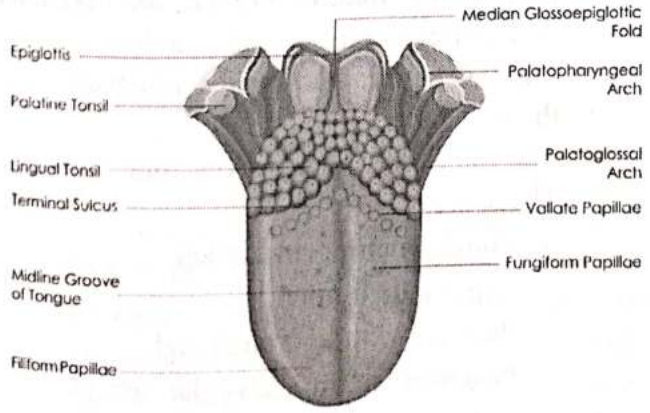
a. Filiform papillae are the most abundant of the four types of papillae.
b. They are stretched conical, grey-white papillae.
c. They are covered in a heavy coat of keratinized Squamous epithelium.
d. These papillae make the dorsum of the tongue rough; hence provide friction to allow movement of the food bolus during chewing.
e. Filiform papillae do not possess taste buds.

ii. *Fungiform papillae*

a. Fungiform papillae are weakly keratinized and less abundant than the filiform papillae.
b. These are mushroom-shaped papillae
c. These papillae are scattered across the entire dorsal surface of the tongue.
d. These highly vascular papillae contain a few taste buds on the apical aspect.

iii. *Foliate papillae*

a. Foliate papillae appear as bilaterally paired, parallel, longitudinal slits on the posterolateral margin of the tongue, near the sulcus terminalis.



b. The mucosa of foliate papillae is non-keratinized
c. These papillae are populated with numerous taste buds.

iv. *Circumvallate papillae*

a. Circumvallate papillae are organized linearly, as a set of four to six large papillae anterior to each limb of the sulcus terminalis
b. In the longitudinal section, these papillae shows characteristic furrow.

BLOOD SUPPLY AND LYMPHATIC DRAINAGE

Arteries

Arterial blood supply of the tongue is chiefly derived from the lingual artery, a branch of the external carotid artery.

Veins

The deep lingual vein is the largest and principal vein of the tongue.

Lymphatic drainage

- The tip of the tongue drains into Submental nodes.
- Right and left anterior two-third half drains into same-sided submandibular nodes.
- Posterior one-third of tongue drains into jugulo- omohyoid nodes

NERVE SUPPLY

The tongue has both motor and sensory nerve supply.

i. *Motor nerves*

a. All the intrinsic and extrinsic muscles except the Palatoglossus are supplied by the hypoglossal nerve.
b. The palatoglossal is supplied by the cranial root of the accessory nerve.

ii. *Sensory nerves*

a. Lingual nerve for general sensation
b. Corda tympani is for taste of anterior two-third except Vallate papillae.
c. Glossopharyngeal for both, general sensation and taste of posterior one-third

of tongue

d. Vagus supplies the posterior most part of the tongue.

Applied Anatomy

Pierre Robin Syndrome

A particular pharyngeal arch defect causes glossoptosis among other symptoms. This particular defect causes the tongue to be displaced posteriorly and may cause airway obstruction or apnea.

Q. 4 Trigeminal Nerve

Ans. INTRODUCTION

- The trigeminal nerve is the principal regulator of the sensory functions of the head.
- It is the fifth of twelve pairs of the cranial nerve.
- It has four nuclei that send fibers to form its tracts and is associated with three separate branches.
- It has three divisions

DIVISIONS

- As the name, tri gemi is self-explanatory in that it has three branches.
- Each branch of the nerve is responsible for a specific region of the face and transmits specific impulses. The three divisions of the trigeminal nerve are:
  Ophthalmic division
  Maxillary division and
  Mandibular division

The word **MOM** can be used to remember three branches of the trigeminal nerve.

Ophthalmic division

- The ophthalmic branch is the first division of the trigeminal nerve.
- It is a purely sensory nerve that carries afferent stimuli of pain, light touch, and temperature from the upper eyelids and supraorbital region of the face, up to the vertex of the head.
- The nerve also acts as a conductor for sympathetic fibers that require access to the ciliary body, lacrimal glands, cornea, and conjunctiva of the eye.
- The ophthalmic branch also carries fibers arising from the dura mater of the anterior cranial fossa, the frontal sinus, and the superior aspect of the nasal cavity.
- The ophthalmic nerve gives main three divisions. Those are:
  - The nasociliary nerve,
  - The frontal nerve, and
  - The lacrimal nerve
- The word NFL (National football leg) is MNEMONIC for these three branches.
- The nerves unite within the superior orbital fissure to form the ophthalmic division.
- Once formed, the ophthalmic nerve also receives its meningeal tributary from the dura of the anterior cranial fossa.
- Ophthalmic division Supplies Eyes, conjunctiva, lacrimal gland, nasal cavity, frontal sinus, ethmoidal cells, falxcerebri, dura mater of the anterior cranial fossa, superior parts of tentorium cerebelli, upper eyelid, dorsum of the nose, anterior part of the scalp.
- It is the motor nerve for the Muscles of mastication, Mylohyoid, anterior belly of digastric, tensor tympani muscles.

Maxillary division

- Like the ophthalmic branch, the maxillary division of the trigeminal nerve is a purely sensory entity that carries impulses from the mid-face.
- The maxillary nerve gives four branches. Those are:
  - Middle meningeal branch
  - Zygomatic branch,
  - Pterygopalatine branch and
  - Posterior superior alveolar nerves
- Maxillary nerve supplies dura mater of the middle cranial fossa; mucosa of the Nasopharynx, palate, nasal cavity, and

Nasopharynx; teeth and upper jaw; skin over the side of the nose, lower eyelid, cheek, and upper lip

Mandibular division

- The last of the three trigeminal branches is the Mandibular division.
- As the largest component, it carries both sensory and motor stimuli.
- The sensory branches supply the lower third of the face, excluding the angle of the mandible (supplied by the second and third cervical segments). Although it carries sensory modalities from the mouth and gingiva, it does not carry special afferent stimuli (i.e. taste).
- Mandibular division gives following branches
  - Deep temporal nerve
  - Nerve to the medial pterygoid muscle
  - Nerve to the lateral pterygoid muscle
  - Masseteric nerve
  - Nerve to the tensor velipalatini muscle
- Mandibular nerve Supplies Buccal skin, anterior two-thirds of the tongue, temporal region; mastication muscles, Mylohyoid muscle and anterior belly of the digastric muscle

Nuclei

Among the twelve cranial nerves within the human body, only the trigeminal nerve is associated with four nuclei, these nuclei are the:

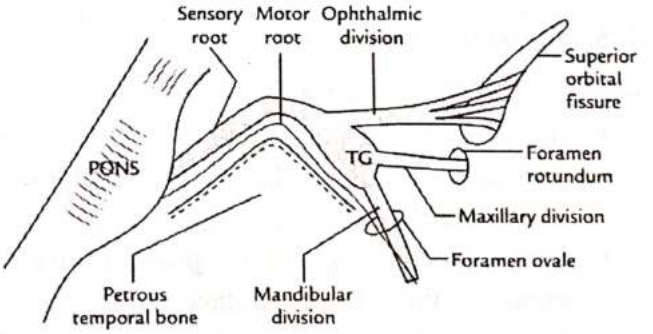
- Mesencephalic nucleus - This nucleus is responsible for processing proprioception – which is the body's ability to detect the spatial orientation of varying body parts with respect to itself and the surrounding structures.
- Primary sensory nucleus – It is proprioceptive in function. Other large fibers carrying discriminative touch impulses, as well as other axons carrying light touch terminate in the main sensory nucleus.
- Motor nucleus - The motor nucleus innervates the muscles of mastication include the pterygoid muscles, the Masseter, and Temporalis. It also supplies the Mylohyoid, anterior belly of the digastric, tensor tympani, and the tensor velipalatini muscles.
- Spinal nucleus- This is concerned with sensory information from the ophthalmic, maxillary, and sensory components of the Mandibular divisions of the trigeminal nerve. The sensory stimuli like light, touch, pain, and temperature are transmitted by these fibers from the face up to the vortex of the head.

Intracranial Course

i. Unit in posterior cranial fossa

a. The three branches of the trigeminal nerve unite within a shallow depression on the posteromedial side of the middle cranial fossa known as Meckel's cave.

b. This union forms the trigeminal ganglion.



ii. In Pons

a. From trigeminal ganglion, the fibers travel superomedially toward the Pons.

b. Here both sensory and motor divisions of the nerve pierce the lateral surface of the Pons near the superior pontine sulcus.

c. Inside the Pons, half of the sensory fibers will divide into ascending and descending groups.

d. The ascending groups will move toward the Mesencephalic nucleus, while the

descending group will join the spinal trigeminal nucleus.

iii. Nuclei

The remaining sensory fibers will travel dorsomedially toward the main sensory nucleus, while the motor fibers will take a similar course to reach the motor nucleus.

SUMMERY

The trigeminal nerve is a mixed cranial nerve that has both sensory and motor functions

There are three divisions of the trigeminal nerve:

- Ophthalmic
- Maxillary and
- Mandibular

The acronym MOM can be used to recall the three branches of the trigeminal nerve.

There are four nuclei associated with the trigeminal nerve:

- Main sensory nucleus
- Mesencephalic nucleus
- Spinal trigeminal nucleus and
- Motor nucleus

Q. 5 Lacrimal Apparatus

Ans. INTRODUCTION

- The structures concerned with secretion and drainage of the lacrimal or tear fluid constitute the lacrimal apparatus.
- The lacrimal apparatus produce tears, channels them to the surface of the eye to maintain moisture, and flush debris and waste material from the ocular surface.

ANATOMY AND PARTS

The lacrimal apparatus is made of two ducts, two sacs one gland, one Puncta, and one canal. The lacrimal apparatus is made up of following parts:

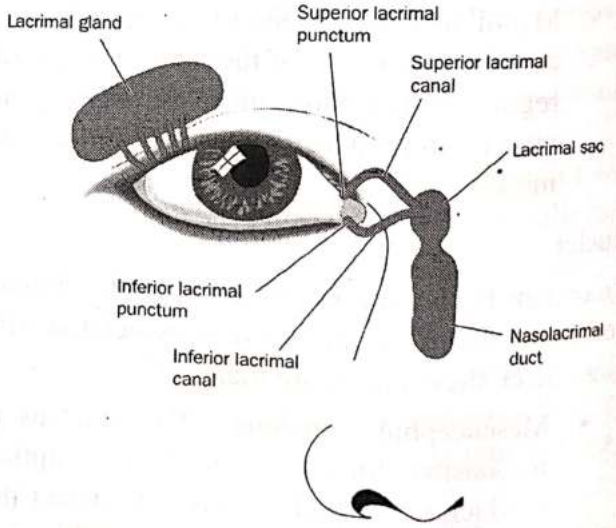
i. ***Lacrimal gland and its ducts***
ii. ***Conjunctival sac***
iii. ***Lacrimal Puncta and***
iv. ***Lacrimal canaliculi***
v. ***Lacrimal sac and***
vi. ***Nasolacrimal duct***

i. Lacrimal Gland

a. It is a serous gland about the size of an almond chiefly situated within the lacrimal fossa.
b. The gland is divided into two sections anatomically, the orbital part and the palpebral part.
c. The orbital portion is rounder and deeper that forms around four ducts.
d. These are the small palpebral portion that lies closer to the eye,
e. The lacrimal duct pierces the conjunctiva of the upper lid and opens into the Conjunctival sac near the superior fornix.
f. Lacrimal fluid flows into the Conjunctival sac to lubricate the front of the eye and the deep surface of the lids.
g. Periodical blinking helps to spread the fluid over the eye.

ii. Conjunctival sac

There are two forms of conjunctiva palpebral and bulbar.



The conjunctiva lining the deep surfaces of the eyelids is called as palpebral conjunctiva, whereas,

The conjunctiva lining the front of the eyeball is called as bulbar conjunctiva.

The potential space between the palpebral and bulbar conjunctiva is known as the Conjunctival sac. Superior and inferior Conjunctival fornices are

the lines where palpebral conjunctiva of upper and lower lids reflects onto the eyeball.

iii. Lacrimal Puncta and lacrimal canaliculi

a. The joining part or opening between the Conjunctival sac and lacrimal canaliculi is known as lacrimal Puncta.
b. There are two lacrimal canaliculi that start at Puncta.
c. It is 10 mm long.
d. Each canaliculus has one vertical and a horizontal part.
e. The vertical part of canaliculi is 2mm long whereas the horizontal part is 8mm long.
f. At the bend, there is dilatation known as Ampulla.
g. Both canaliculi open into the lateral wall of the lacrimal sac.

iv. lacrimal sac

a. It is membranous sac
b. It is 12mm long and 5mm wide.
c. Its upper end is blind and the lower end continues with the Nasolacrimal duct.

v. Nasolacrimal Duct

a. It is a membranous passage of 18mm long
b. It starts at the lower end of the lacrimal sac.
c. It opens into the inferior meatus of the nose.
d. Its opening is guarded by the valve of Hasner.

BLOOD SUPPLY

The blood supply to the Lacrimal gland is by the lacrimal branch of the ophthalmic artery

NERVE SUPPLY

The sensory innervation to the lacrimal gland is via the lacrimal nerve. This is a branch of the ophthalmic nerve (in turn derived from the trigeminal nerve).

Applied Anatomy

- Dry eye is due to obstruction of the Nasolacrimal duct.
- Acute dacryoadenitis – typically due to a viral and bacterial infection such as mumps, Epstein-Barr virus, staphylococcus, and gonococcus.
- Chronic dacryoadenitis – usually due to a non-infectious inflammatory condition such as sarcoidosis or thyroid eye disease associated with Grave's disease.

Q. 6 Facial Nerve

Ans. INTRODUCTION

- One of the most important ways we non-verbally communicate with each other is by facial expression. A lift of an eyebrow, the wrinkling of a nose, or the slight twinge of the corner of the mouth are our time to time expression and can tell us quite bits.
- The facial nerve is a vital nerve for facial expression, which allows us to partake in this form of communication, and it is aptly named the facial nerve.
- The facial nerve, the seventh cranial nerve, is a complex structure containing many fiber types with a variety of functions, including motor, sensory, and autonomic.

FIBERS

- The facial nerve contains many different types of fibers, including general sensory (afferent) fibers, special sensory fibers, visceral/autonomic motor (efferent) fibers, and somatic motor fibers.
- **General sensory fibers** in the facial nerve are responsible for transmitting signals to the brain from the external acoustic meatus, as well as the skin over the mastoid and lateral pinna.
- **Special sensory fibers** in the facial nerve are responsible for receiving and transmitting taste information from the anterior two-thirds of the tongue.
- **Visceral/autonomic motor fibers** in the facial nerve are responsible for innervating

the lacrimal gland, submandibular gland, sublingual gland. These fibers also innervate mucous membranes of the nasal cavity and hard and soft palate, allowing for the production of tears, saliva, etc.

- **Somatic motor** fibers in the facial nerve are responsible for innervating the muscles of facial expression and muscles in the scalp, as well as the Stapedius muscle of the ear, the posterior belly of the digastric muscle, and the stylohyoid muscle.

ORIGIN AND COURSE

i. Brainstem

a. The motor root of the facial nerve lies in the facial (motor) nerve nucleus in the Pons of the brainstem.

b. The motor nucleus receives input from the primary motor cortex of the cerebrum and the ophthalmic division of the trigeminal nerve.

c. In the Pons, the fibers travel towards the floor of the fourth ventricle and go around the Abducens nucleus, and descend downwards.

d. The facial nerve emerges from the lateral surface of the brainstem at the pontine-medullary junction between the VI and VIII nerves.

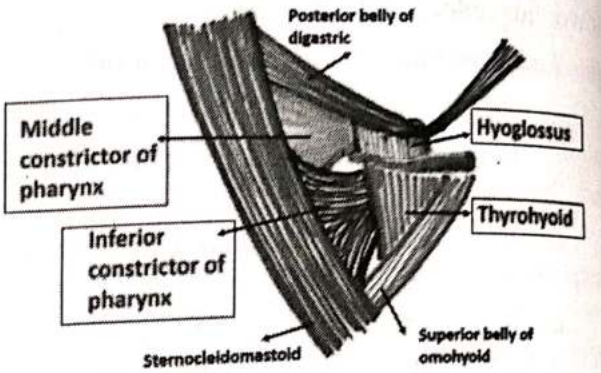
e. The motor root travels with the nervus intermedius and enters the internal auditory meatus of the temporal bone accompanied by the Vestibulocochlear nerve.

b. Middle ear

a. The facial nerve roots then enter the facial canal in the petrous part of the temporal bone.

b. In the facial canal, the small sensory and large motor roots fuse and form the facial nerve.

c. This union of both sensory and motor fibers form the geniculate ganglion.



d. At the geniculate ganglion, the facial nerve gives off the greater petrosal nerve, which eventually carries preganglionic parasympathetic fibers to the lacrimal gland for stimulating Lacrimation.

e. The greater petrosal nerve joins with the deep petrosal nerve to become the nerve of the pterygoid canal.

f. The greater petrosal nerves contain parasympathetic fibers for the Pterygopalatine ganglion and taste fibers.

g. In the middle ear, it travels through the bony canal.

h. In the bony canal, it gives two more branches emerge: the nerve to Stapedius and the branch to chorda tympani.

i. The nerve to Stapedius innervates the Stapedius muscle.

j. The chorda tympani branch leaves the facial nerve above the Stylomastoid foramen and is responsible for transmitting taste sensation from the anterior two-thirds of the tongue.

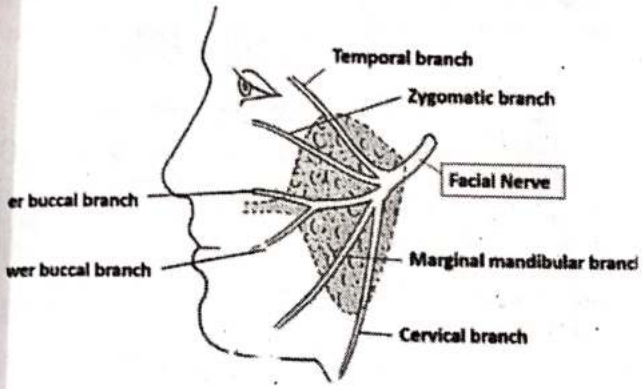
k. The chorda tympani branch is also efferent to the submandibular ganglion which is responsible for innervating the submandibular gland, stimulating salivary secretions.

l. The facial nerve exits skull via the Stylomastoid foramen.

m. Near the foramen, it gives off the posterior auricular nerve, nerves to the posterior belly of the digastric , and the nerve to

stylohyoid.

n. The posterior auricular nerve supplies the occipital belly of the occipitofrontalis muscle and some of the auricular muscles whereas the other two branches supply the concerned muscle.



c. Parotid Gland

a. After exit through the Stylomastoid foramen, the nerve then enters the parotid gland at its upper border of the posteromedial surface.

b. It divides into the parotid gland and gives off five terminal branches the temporal, the zygomatic, the buccal, the marginal mandibular, and the cervical.

BRANCHES OF FACIAL NERVE

- Posterior auricular nerve
- Branch to posterior digastric belly,
- Branch to Stylomastoid muscle,
- Temporal branch,
- Zygomatic branch,
- Buccal branch,
- Marginal Mandibular branch and
- Cervical branch

INNERVATIONS

The facial nerve has following motor-sensory and parasympathetic innervations

i. **Motor**

Motor innervations for

a. Facial expression muscles,

b. Posterior belly of digastric muscle,

c. Stylohyoid muscle,

d. Stapedius muscle

ii. **Special sensory:**

Sensory innervations from the taste of anterior two-thirds of the tongue

iii. **Parasympathetic:**

Parasympathetic innervations to submandibular gland, sublingual gland, lacrimal glands

Applied anatomy

Facial nerve palsy

- Can be associated with a variety of etiologies and syndromes. Additional symptoms depend on the level at which the lesion occurs. Although most facial nerve palsies are considered idiopathic, common causes include infection, trauma, iatrogenic injury, and neoplasia.
- Bell's palsy is the most common form of peripheral facial nerve palsy. It presents with sudden onset of impairment of facial expression, typically on one side. It is frequently preceded by periauricular paraesthesia or otalgia and may be associated with dry eyes, xerostomia, tinnitus, and hyperacusis

Q. 7 Temporomandibular Joint

Ans. INTRODUCTION

- It is a joint between the temporal bone and mandible.
- It is a synovial joint of the condylar variety.

ARTICULAR SURFACES

- It has upper and lower articular surfaces
- The upper articular surface is formed by articular eminence and the anterior part of the Mandibular fossa of the temporal bone.
- The lower articular surface is formed by the head of the mandible.
- There is one partition between two surfaces known as intraarticular disc.

LIGAMENTS

The temporomandibular joint is strengthened and supported by the following four ligaments:

- Fibrous capsule
- The Temporomandibular or lateral ligament
- The sphenomandibular ligament and
- The stylomandibular ligament

Fibrous Capsule

- It is attached above to three parts of the temporal bone, articular tubercle, the circumference of Mandibular fossa and squamotympanic fissure respectively, and below to the neck of the mandible.
- The capsule is loose above the intraarticular disc and tight below it.
- It is lined by a synovial membrane.

Temporomandibular ligament

- It is a laterally placed ligament, helps to reinforce and strengthen the capsular ligament.
- It is attached above to the articular tubercle and below to the posterolateral aspect of the neck of the mandible.

The sphenomandibular ligament

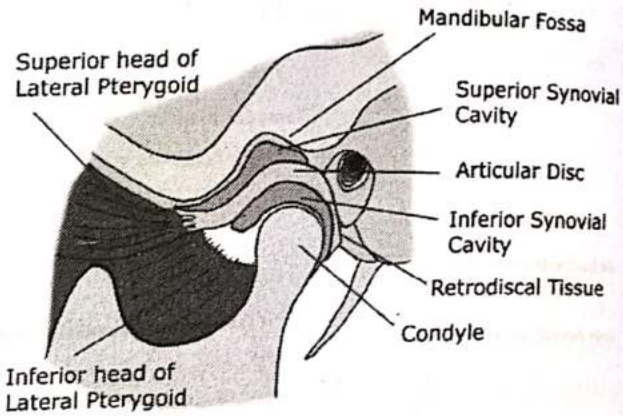
- It is an accessory ligament of the joint.
- It is attached superiorly to the spine of the sphenoid bone and inferiorly to the lingula of the Mandibular foramen.

The stylomandibular ligament

- It is also accessory ligament of joint
- It is attached above to the lateral surface of the styloid process and below to the angle and posterior border of the ramus of the mandible.

Articular disc

- Intraarticular disc is an oval fibrous plate
- This plate divides the joint into upper and lower compartments.
- The disc has a concavo-convex superior surface and concave inferior surface. The disc is composed of
  - An anterior extension
  - Anterior thick band
  - Intermediate zone
  - Posterior thick band and
  - Bilaminar region



RELATIONS OF JOINT

The Temporomandibular joint has the following relations

i. Lateral

Laterally it is related to:

a. Skin and fascia,
b. Parotid gland and
c. Temporal branches of facial nerve

ii. Medial

Medially it is related to:

a. Tympanic plate
b. Spine of sphenoid bone
c. Auriculotemporal and chorda tympani nerves and
d. Middle Meningeal artery

iii. Anterior

Anteriorly it is related to:

a. Lateral pterygoid muscle and
b. Masseteric nerves and blood vessels

iv. Posterior

Posteriorly it is related to:

a. Parotid gland
b. Superficial temporal vessels and
c. Auriculotemporal nerve

v. *Superior*

Superiorly it is related to:

a. Middle cranial fossa and
b. Middle Meningeal vessels

vi. *Inferior*

Inferiorly it is related to:

a. Maxillary artery and
b. Maxillary vein

BLOOD SUPPLY

TMJ is supplied by branches from superficial temporal and maxillary arteries.

NERVE SUPPLY

TMJ is supplied by:

- Auriculotemporal nerve and
- Masseteric nerve

MOVEMENTS

Following are the movements of TMJ

- Depression – It is mainly brought about by the lateral pterygoid muscle.
- Elevation – It is brought about by the Masseter muscle
- Protrusion – It is done by both medial and lateral pterygoid muscles
- Retraction – It is produced by posterior fibers of the Temporalis muscle.

Applied anatomy

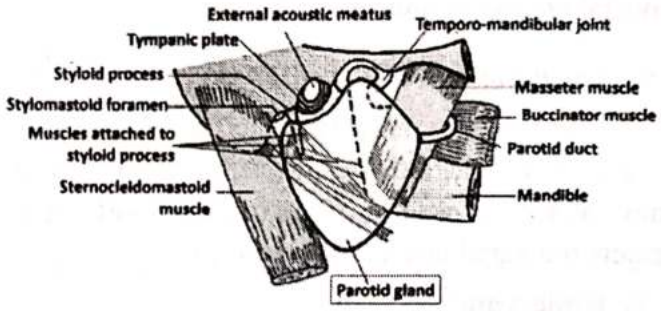
Dislocation of mandible

During excessive opening of mouth, the head of mandible of one or both sides slips anteriorly into infratemporal fossa results in inability to close the mouth

Q. 7 The Parotid Gland

Ans. INTRODUCTION

- The salivary glands a subtype of exocrine glands secrete saliva, which has protective, digestive, and lubricating properties. There are three main salivary glands, submandibular, sublingual, and parotid gland.
- The parotid gland is the major salivary gland among all three.
- The parotid gland is situated in the periauricular area on the side of the face.
- The weight of the gland is around 15 – 30 grams.
- The gland is irregular in shape.
- It looks like an inverted pyramid.



EXTERNAL FEATURES

The gland looks like a three-sided pyramid.

The gland has an apex and four surfaces and three borders.

The surfaces are

i. Superior part or base of gland
ii. Superficial surface
iii. Anteromedial surface and
iv. Posteromedial surface

i. Apex

a. The apex of the gland is overlapped by the posterior belly of the digastric muscle.
b. The cervical branch of facial nerve and two divisions of Retromandibular vein emerge through it.

ii. The base

a. The small and concave base is the most superior part of the gland.
b. It is related to the cartilaginous part of the external acoustic meatus and posterior surface of the Temporomandibular joint.

iii. Superficial surface

The superficial surface is the largest of all four

surfaces. It is covered by the investing layer of the deep cervical fascia, posterior fibers of the Platysma, fibers of the great auricular nerve, and skin.

iv. The anteromedial surface

It is grooved by the posterior border of the ramus of the mandible. It is related to the Masseter muscle, lateral surface of the temporomandibular joint, posterior border of the ramus of the mandible, and medial pterygoid muscle.

v. The posteromedial surface

It is moulded to the mastoid and styloid process. It is related to the mastoid process, sternocleidomastoid muscle, styloid process, the external carotid artery enters the gland through this surface.

The borders are:

i. Anterior border
ii. Posterior border and
iii. Medial edge or border

i. Anterior border

a. The anterior border extends from the anterior part of the superior surface to the apex. It separates the superficial surface from the anteromedial surface.

b. The following structures emerge at this border:

- The parotid duct
- Most of the terminal branches of facial nerve and
- Transverse facial vessels.

ii. Posterior border

a. The posterior border separates the superficial surface from the posteromedial surface.

b. It overlaps sternocleidomastoid muscle.

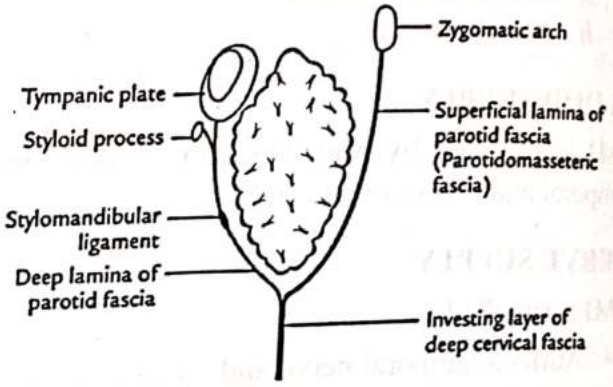
c. Medial border

a. The medial border separates the anteromedial surface from the posteromedial surface.

b. It is related to the lateral wall of the pharynx.

Parotid Capsule

- The investing layer of the deep cervical fascia forms a capsule for the gland. The fascia splits into superficial and deep lamina to enclose the gland.



- The superficial lamina is attached to the zygomatic arch.
- The superficial lamina is thick and adherent to the gland.
- The deep lamina is thin and is attached to the styloid process of the mandible and tympanic plate.
- The thickened portion of the deep lamina forms the stylomandibular ligament.

STRUCTURES PASSING THROUGH THE PAROTID GLAND

i. Arteries

The external carotid artery passes through and divides within the substance of the parotid gland. It passes through the posteromedial aspect of the gland; it gives off the maxillary artery, as well as the superficial temporal artery.

ii. Vein

The superficial temporal vein and maxillary vein unite and form the Retromandibular vein. It passes caudally toward the apex of the gland, where it leaves posteriorly to divide into anterior and posterior branches. The anterior division joins the facial vein, while the posterior division joins the posterior auricular vein.

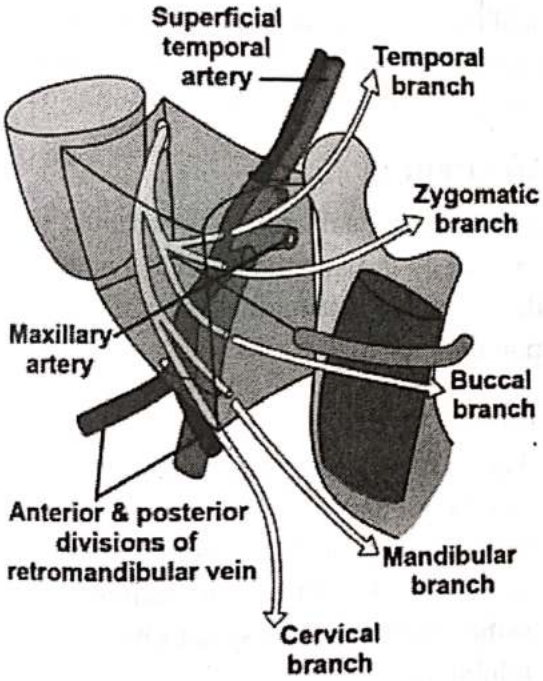
iii. Nerve

The facial nerve enters the posterior border of the parotid gland after leaving the Stylomastoid foramen. Within the substance of the gland, divides into its terminal branches.

Parotid Duct (Stensen Duct)

The parotid duct is roughly 7 cm x 3 mm long.

It emerges from the middle of the anterior border of the gland.



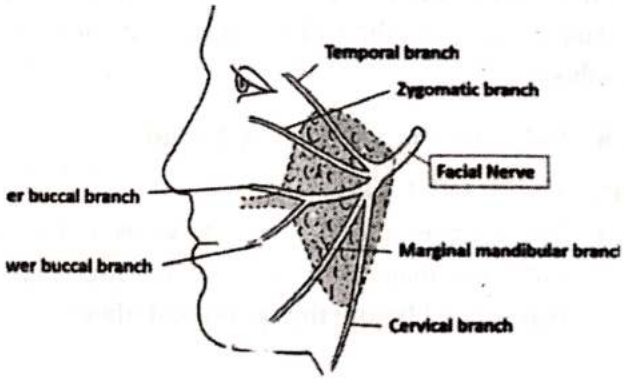
The parotid duct is superiorly related with the accessory parotid gland, upper buccal branch of the facial nerve, and transverse facial vessels whereas inferiorly related with the lower buccal branch of the facial nerve.

The duct then makes an abrupt right turn to cross the buccinator muscle and associated buccal mucosa.

The duct runs forwards for a short distance between the buccinator and the oral mucosa and opens into the vestibule of the mouth.

BLOOD SUPPLY

The arteries and veins that traverse the substance of the parotid gland are also responsible for supplying and draining the organ.



The arterial supply arises from branches of the external carotid artery, while the venous drainage is via the Retromandibular vein.

LYMPHATIC DRAINAGE

Lymphatic fluid drains to the superior deep cervical lymph nodes.

NERVE SUPPLY

The gland is innervated by parasympathetic, sympathetic, and sensory nerve supply.

- The parasympathetic supply is via the lesser petrosal nerve, a branch of the Glossopharyngeal nerve.
- The sympathetic supply is derived from the adjacent sympathetic plexus of the carotid sheath.
- The sensory nerve comes from the Auriculotemporal nerve.

Applied Anatomy

Parotid gland Stones

The Calculi or stones in the salivary gland are more common in the submandibular gland than the parotid gland. The presence of the stone obstructs the flow of saliva from the gland leading to acute swelling with meals. The swelling usually resolves about an hour after the onset of symptoms.

Parotid Gland Inflammation

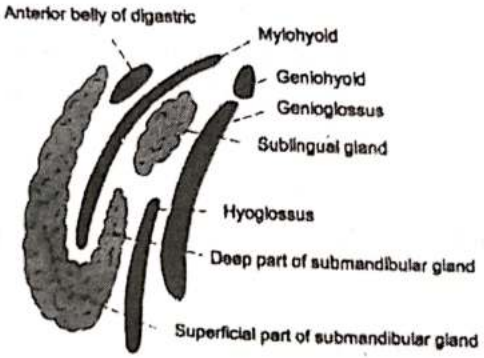
Both infectious and non-infectious inflammatory processes can affect the parotid glands. Historically, the mumps infection – caused by the mumps

rubulavirus (a paramyxovirus) – was notorious for causing painful swelling of the parotid glands in childhood.

Q. 8 Submandibular Salivary Gland

Ans. INTRODUCTION

- The submandibular gland is the second of the three major salivary glands, after the parotid and before the sublingual gland.



- It is situated in the anterior part of the digastric triangle of the neck and makes up part of the floor of the oral cavity.
- The gland is about the size of a walnut.
- It is roughly J shaped

PARTS

The Mylohyoid muscle runs through the lobules of the gland and divides the gland into superficial and deep parts.

- The superficial portion of the submandibular gland can be seen in the digastric triangle of the neck and is covered by the investing layer of deep cervical fascia. The superficial part has inferior, lateral, and medial surfaces.
- The deep portion of the submandibular gland limits the inferior aspect of the oral cavity. The deep part is small in size. It lies deep to the Mylohyoid and superficial to the Hyoglossus and Stylohyoid muscles.

Submandibular duct

- The submandibular duct which connects the gland with the oral cavity proper is known as Wharton's duct.
- It is thin-walled duct about 5 cm long.
- It emerges at the anterior end of the deep part of the gland and runs forwards on the Hyoglossus muscle.
- It opens on the floor of the mouth at the lingual papilla, which can be found on either side of the lingual frenulum.

HISTOLOGY

This glandular mass is responsible for the production of 70% of the over salivary output. It secretes both serous and mucinous saliva, although the majority of it is serous, with a 3:2 ratio in its favour.

BLOOD SUPPLY

The facial and lingual arteries contribute to the blood supply of the submandibular gland and in turn, their venous drainage is provided by the corresponding veins.

INNERVATIONS

- The secretory mechanism of the submandibular gland is regulated directly by the parasympathetic nervous system by which it is stimulated, and indirectly by the sympathetic nervous system by which it is inhibited.
- These exact fibers include presynaptic fibers from the facial nerve via the chorda tympani to the submandibular ganglion and postsynaptic fibers from cells in the submandibular ganglion that together make up the parasympathetic secretomotor fibers.
- The vasoconstrictive sympathetic fibers stir from the superior cervical ganglion.

APPLIED ANATOMY

Sialoliths or Salivary stones

Salivary stones can occur in all of the major salivary -glands but can be seen most frequently in the submandibular gland. Since this is the gland that provides the majority of the salivary product, it stands to reason that the salivary contents are most

likely to accumulate within it or its duct if there is an imbalance in the contents or a disruption of the saliva flow.

Q. 8 The Lateral Wall of Nose

Ans. INTRODUCTION

- The lateral wall of the nose is irregular.
- This irregularity is due to three shelf-like bony projections known as conchae.
- The lateral wall separates the nose
  - From the orbit above
  - From the maxillary air sinus below and
  - From lacrimal groove and Nasolacrimal canal in front.

PARTS

The lateral wall can be divided into the following three parts:

- The vestibule - is a small depressed area in the anterior part.
- The atrium and
- Conchae and meatuses

Skeleton of lateral wall

The skeleton is partly bony, partly cartilaginous, and partly made up of only soft tissue.

i. Bony part

It is formed from before backward by the following bones

a. Nasal
b. Maxilla – frontal process
c. Lacrimal
d. Ethmoid Labyrinth with superior and middle conchae
e. Inferior nasal concha
f. Palatine bone – perpendicular plate
g. Medial pterygoid plate.

ii. Cartilaginous Part

It is formed by

a. Superior Nasal cartilage
b. Inferior Nasal cartilage and
c. Three or four small cartilages of ala.

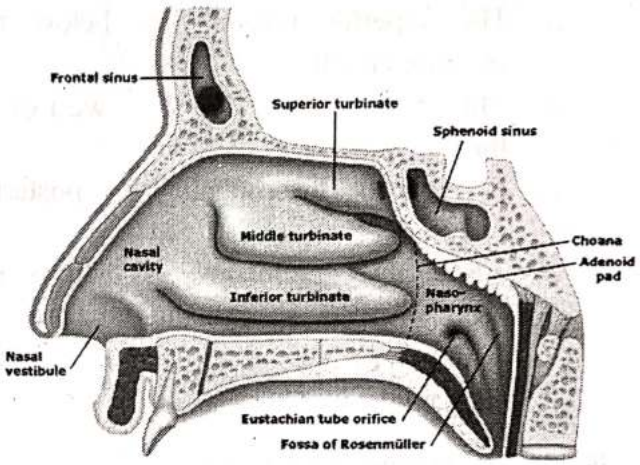
iii. Cutaneous part

It is formed by fibro-fatty tissue which is covered by skin.

Conchae

The nasal conchae are curved bony overhanging projections directed downwards and medially.

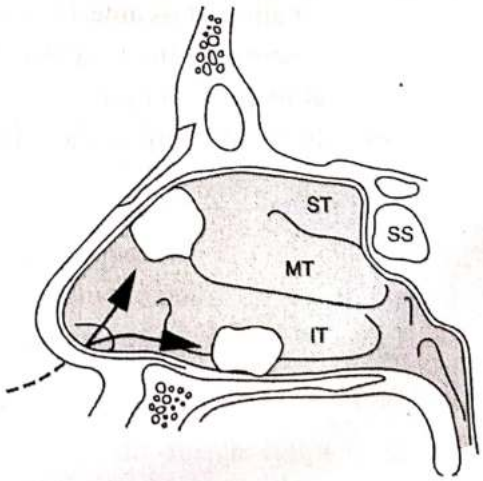
There are three nasal conchae



- Superior concha is smallest conchae. It is a projection from the medial surface of the ethmoidal labyrinth. It is situated just above the posterior part of the middle concha
- Middle concha is also a projection from the medial surface of the ethmoidal labyrinth whereas
- Inferior concha is an independent bone.

Meatuses

- The meatuses of the nose are the passages beneath the overhanging conchae.



- Each meatus communicates freely with the nasal cavity properly.
- There are three meatuses

i. Superior meatus
ii. Middle meatus and
iii. Inferior meatus

i. Superior meatus

a. The superior meatus lies below the superior concha.
b. This is the shortest and shallowest of all three meatuses.
c. It receives the opening of posterior ethmoidal air sinuses.
d. Above the superior meatus, there is one recess called sphenoethmoidal recess, which receives the opening of the Sphenoidal air sinus.

ii. Middle meatus

a. The middle meatus lies underneath the middle concha.
b. It shows the following features
- Ethmoidal bulla, a rounded elevation produced by the underlying middle ethmoidal air sinus. It shows an opening of the middle ethmoidal sinus at its upper margin.
- Hiatus semilunaris, a deep semilunar sulcus below bulla. It shows the opening of the frontal air sinus at its anterior part and the opening of the maxillary air sinus at its posterior part.
- Infundibulum, a short passage at the anterior end of the hiatus.

iii. Inferior meatus.

a. The inferior meatus lies underneath the inferior concha.
b. It is the largest of all three meatuses.
c. The Nasolacrimal duct opens in it at the junction of anterior one third and posterior two-third.

This opening is guarded by Hasner's valve.

BLOOD SUPPLY

- The anterosuperior quadrant of the lateral wall is supplied by the anterior ethmoidal artery
- The anteroinferior quadrant of the lateral wall is supplied by the branches from facial and great palatine arteries.
- The posterosuperior quadrant of the lateral wall is supplied by the sphenopalatine artery whereas
- The posteroinferior quadrant of the lateral wall is supplied by the branches from greater palatine artery

NERVE SUPPLY

- The lateral wall of the nose has a general and special sensory nerve supply
- The general sensory nerves are derived from the branches of the trigeminal nerve whereas the special sensory nerve is a nerve for smell, the olfactory nerve.

Applied Anatomy

- Common cold
- Sinusitis, special maxillary sinusitis
- Allergic rhinitis with hypertrophy of mucosa over inferior nasal concha.

3

Neck

NECK TWO MARKS QUESTIONS

Q. 1 Blood supply of thyroid gland

Ans. Thyroid gland is supplied by

a. Superior thyroid artery a branch of the external carotid artery and

b. Inferior thyroid artery a branch of the thyrocervical trunk

Q. 2 Two parts of pharynx

Ans. The pharynx is divided into the following three parts:

a. Oropharynx

b. Nasopharynx and

c. Laryngopharynx

Q. 3 Two muscles of muscular triangle of neck

Ans. Muscular triangle is a division of anterior triangle. It contain the infrahyoid muscles. Those are as follows

a. Sternohyoid

b. Sternothyroid

c. Thyrohyoid and

d. Omohyoid

Q. 4 Two branches of the external carotid artery

Ans. External carotid artery gives eight branches which are grouped as follows

i. Anterior Group – It includes

a. Superior thyroid artery

b. Lingual artery and

c. Facial artery

ii. Posterior Group – It includes

a. Occipital artery and

b. Posterior auricular artery

iii. Medial group – It includes only

Ascending pharyngeal artery

iv. Terminal Group – It includes

a. Maxillary artery and

b. Superficial temporal artery

Q. 5 Name cartilages of larynx

Ans. Larynx contains nine cartilages, of which three are paired and three are unpaired

i. Unpaired cartilages are

a. Thyroid cartilage

b. Cricoid cartilage and

c. Epiglottic cartilage

ii. Paired cartilages are

a. Arytenoid

b. Corniculate and

c. Cuneiform

Q. 6 Any two extrinsic muscles of larynx

Ans. The extrinsic muscles act to move the larynx superiorly and inferiorly. They are comprised of the suprahyoid infrahyoid muscles and stylopharyngeus. Following are the extrinsic muscles of the larynx

a. Stylohyoid

b. Mylohyoid

c. Geniohyoid

d. Sternohyoid

e. Sternothyroid

f. Thyrohyoid

g. Omohyoid and

h. Stylopharyngeus

Q. 7 Any two intrinsic muscles of larynx

Ans. The intrinsic muscle helps to control the

shape of rima glottidis and the length of the vocal folds are as follows

a. Cricothyroid
b. Thyroarytenoid
c. Posterior Cricoarytenoid
d. Lateral Cricoarytenoid
e. Transverse Arytenoid and
f. Oblique Arytenoid

Q. 8 Any two contents of carotid sheath MNEMONIC - I S ee 10 CC dextrose in IV

Ans. Following are the contents of the carotid sheath:

a. Internal Carotid Artery
b. 10th cranial nerve Vagus
c. Common Carotid artery and
d. Internal jugular Vein

Q. 9 Any two contents of carotid triangle Use the same trick as for carotid sheath contents

Ans. Following are the contents of the carotid triangle:

a. Internal Carotid Artery
b. 10th cranial nerve Vagus
c. Common Carotid artery and
d. Internal jugular Vein

Q. 10 Any two boundaries of anterior triangle of neck

Ans. Anterior triangle of neck boundaries are as follows:

a. Lateral – lateral boundary is formed by sternocleidomastoid muscle
b. Medial - Medial boundary is formed by the anterior midline of the neck
c. Superior - Superior boundary is formed by the Inferior border of mandible

Q. 11 Any two boundaries of Submental triangle of the neck

Ans. Submental triangle, a division of anterior triangle of neck is having following boundaries:

a. Lateral – anterior belly of digastric muscle
b. Medial – Midline of anterior neck
c. Inferior – Hyoid bone
d. Floor – Mylohyoid muscle
e. Roof – Skin and superficial fascia

Q. 12 Any two boundaries of the carotid triangle of the neck

Ans. Carotid triangle, an important division of the anterior triangle of neck is having the following boundaries:

a. Anterior – Anterior belly of omohyoid muscle
b. Posterior - sternocleidomastoid muscle
c. Superior – Posterior belly of digastric muscle
d. Roof – Investing layer of deep cervical fascia
e. Floor – Hyoglossus muscle, Inferior constructor of pharynx, thyrohyoid muscle and middle constrictor of pharynx

Q. 13 Any two boundaries of muscular triangle of neck

Ans. Muscular triangle, a division of anterior triangle of neck is having following boundaries:

a. Superior – Anterior belly of omohyoid muscle
b. Infero lateral - sternocleidomastoid muscle
c. Medial –Midline of the neck
d. Floor – Prevertebral fascia and Prevertebral muscles, Sternohyoid and sternothyroid muscles
e. Roof – Investing layer of deep fascia, sternohyoid and cricothyroid muscles

Q. 14 Any two boundaries of posterior triangle of neck

Ans. Posterior triangle of neck boundaries are as follows:

a. Anterior – Sternocleidomastoid muscle
b. Posterior – anterior border of trapezius muscle

c. Inferior – clavicle

Q. 15 Any two boundaries of digastric triangle of neck

Ans. Digastric triangle, a division of anterior triangle of neck is having following boundaries:

a. Superior – Mandible and the line joining mastoid to angle of mandible
b. Posterior – Posterior belly of digastric muscle and stylohyoid muscle
c. Anterior – anterior belly of digastric muscle

Q. 16 Any two suprahyoid muscles

Ans. There are four suprahyoid muscles. They are:

a. Stylohyoid,
b. Mylohyoid,
c. Geniohyoid and
d. Digastric

Q. 17 Any two infrahyoid muscles

Ans. There are four infrahyoid muscles. They are:

a. Sternothyroid
b. Sternohyoid
c. Omohyoid and
d. Thyrohyoid

Q. 18 Any two tributaries of external Jugular vein

MNEMONIC – PAST

a. P for Posterior external jugular
b. A for Anterior jugular vein
c. S for Suprascapular vein
d. T for Transverse cervical vein

Ans. There are four tributaries of external jugular vein:

a. Posterior external jugular
b. Anterior jugular vein
c. Suprascapular vein
d. Transverse cervical vein

NECK TEN MARKS QUESTIONS

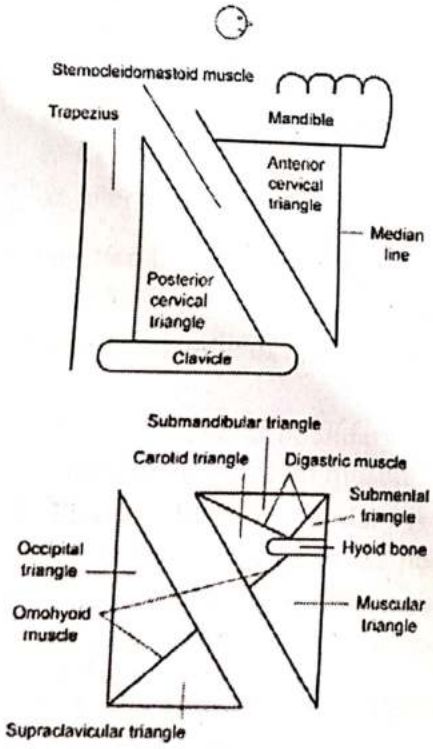
Q. 1 Carotid or Superior Carotid Triangle

Ans. DEFINITION

- The anterior triangle of neck is subdivided into four sub triangles.
- The carotid triangle is the most important sub-division of the anterior triangle.

BOUNDARIES

- It has three boundaries, one roof, and a floor.
- It is bounded
  - Behind by the Sternocleidomastoid;
  - Below by the superior belly of the Omohyoid;
  - Above by the Stylohyoid and the posterior belly of the Digastric.
  - The roof is formed by the integument, superficial fascia, Platysma, and deep fascia; ramifying in which are branches of the facial and cutaneous cervical nerves. And



  - Its floor is formed by parts of the Thyrohyoid, Hyoglossus, and the Medial and inferior Constrictors of the pharynx.

CONTENTS

The carotid triangle contains arteries, veins, and nerves

i. Arteries

a. the upper part of the common carotid artery

b. The external and internal carotid at the upper border of the thyroid cartilage. The Sternocleidomastoid overlaps these vessels. The external carotid artery is anterior to the internal one.

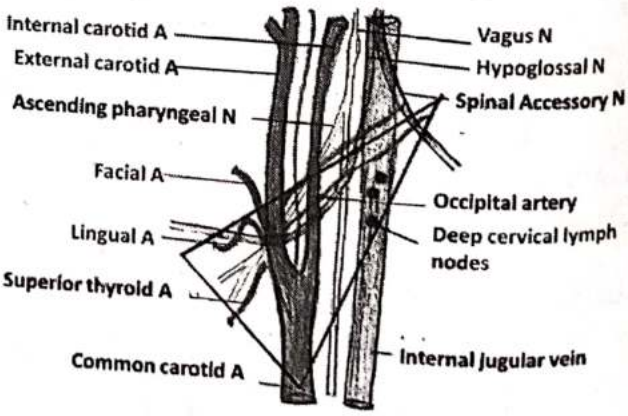
c. The following branches of the external carotid are also met within this space:

- The superior thyroid, running forward and downward;
- the lingual, directly forward;
- the external maxillary, forward and upward;
- the occipital, backward; and
- the ascending pharyngeal, directly upward on the medial side of the internal carotid

ii. Veins

a. The internal jugular lies on the lateral side of the common and internal carotid arteries; and

Contents of Carotid Triangle



b. The draining veins of the internal jugular vein respectively –

a. the superior thyroid vein,
b. the lingual vein,
c. common facial vein,

d. ascending pharyngeal vein, and
e. sometimes the occipital vein

iii. Nerves

MNEMONIC – Good Van Has good Accessories

G for Glossopharyngeal nerve
V for vagus nerve
H for hypoglossal nerve and
A for accessory nerve

The nerves in this space are the following:

a. The descending ramus of the hypoglossal nerve.
b. The hypoglossal nerve crosses both the internal and external carotids above, curving around the origin of the occipital artery.
c. The vagus nerve which lies within the carotid sheath, between the artery and vein, and behind both,
d. The sympathetic trunk lies behind the carotid sheath.
e. The accessory nerve which runs on the lateral side of the vessels for a short distance and finally it pierces the Sternocleidomastoid to reach the posterior triangle.
f. The internal branch of the superior laryngeal nerve is seen on the medial side of the external carotid, just below the hyoid bone.
g. The external branch of the superior laryngeal nerve.
h. The upper portion of the larynx and lower portion of the pharynx are also found in the front part of this space.

Q. 2 The LARYNX

Ans. INTRODUCTION

- The larynx is an intricate anatomical complex in the neck comprised of many different soft and hard tissues like cartilages, muscles, bones.
- The larynx is an organ for the production of voice or phonation.
- The larynx is also an air passage.

SITUATION

- The larynx is situated in the midline of the neck extends from the root of the tongue to the trachea.
- It is situated at the level of the third to the sixth cervical vertebrae.
- The larynx connects the pharynx to the trachea.

CONSTITUTION

- The larynx is made up of a skeletal framework of cartilages.
- These cartilages are connected by joints, ligaments, and membranes.
- The cartilages are moved by a number of muscles.
- The cavity of the larynx is lined by mucous membrane.

Cartilages

The larynx is composed of nine cartilages of which three are paired and three are unpaired.

Unpaired cartilages – There are three unpaired cartilages:

- Thyroid cartilage
- Cricoid cartilage and
- Epiglottis

Paired cartilages following are the paired cartilages:

- Arytenoid
- Corniculate and
- cuneiform

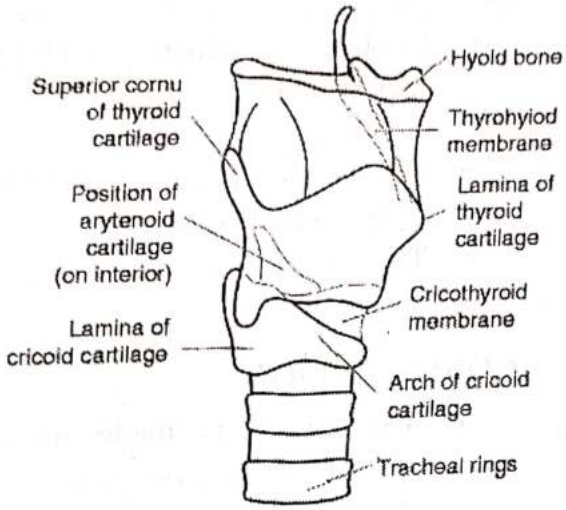
The cartilages are again divided into two categories, hyaline and elastic.

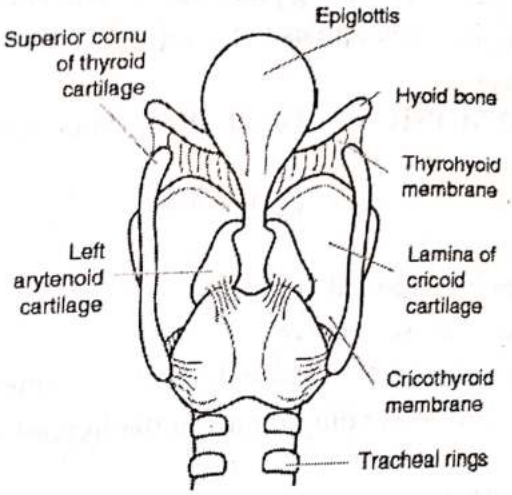
The hyaline cartilages consist of two unpaired and one paired cartilage:

- Thyroid cartilage
- Cricoid cartilage
- Arytenoid cartilage

The elastic cartilages are consists of two paired and one unpaired cartilages:

- Epiglottis
- Corniculate cartilage
- Cuneiform cartilage





Thyroid cartilage

- Thyroid cartilage is V-shaped cartilage.
- The limbs of V are called as the lamina.
- The laminas are quadrilateral in shape.
- Each lamina has three borders anterior, posterior and inferior borders two surfaces outer and inner.
- Anterior border of two laminae fuse together at the lower parts and forms laryngeal prominence.
- Posterior border of the lamina has two horns, known as cornua, the superior and inferior cornua.
- Inferior border of the lamina is convex in front and concave behind.
- Thyroid cartilage forms one joint, gives attachment to one ligament and two muscles.
- Inferior cornua of lamina articulate with Cricoid cartilage and forms Cricothyroid joint.
- The superior cornua of lamina connect with greater cornua of hyoid bone with the help of lateral thyrohyoid ligament.
- Thyrohyoid and inferior constrictor of pharynx these two muscles are attached to the oblique line on the outer surface of the lamina.

Cricoid cartilage

- It is a ring-shaped cartilage below the thyroid cartilage.
- It has two parts anterior and posterior.
- The anterior part is known as the arch whereas the posterior part is known as the lamina.
- The Cricoid cartilage forms two joints one with thyroid cartilage and the second with Arytenoid cartilage, known as cricothyroid and Cricoarytenoid joints respectively.

Epiglottis

- It is a leaf-shaped cartilage.
- It had two ends, the upper and lower end.
- It had two surfaces, anterior and posterior surface.
- It had two margins, right and left margin.
- The lower end of the epiglottis attaches to the thyroid cartilage.
- Both margins provide attachment to the Aryepiglottic folds.

Arytenoid cartilage

- These are two small pyramid-shaped cartilages.
- They are lying on the upper border of the lamina of Cricoid cartilage.
- It has an apex and a base.
- It has three surfaces, anterolateral, medial, and posterior surface.
- It prolongs and forms two processes, anteriorly it forms the vocal process and laterally it forms the muscular process.

DIVISIONS

Like the pharynx, the larynx is divided up into three regions:

- the vestibule
- the ventricle
- the infraglottic area

LARYNGEAL JOINTS

There are two synovial laryngeal joints. Both are formed by Cricoid cartilage, one with thyroid cartilage and the second with Arytenoid cartilage.

The Cricothyroid joint and Cricoarytenoid joint

Cricothyroid

- It is a synovial joint between the inferior cornua of the thyroid cartilage and the sides of the Cricoid cartilage.
- It permits two movements, the rotatory movement around a transverse axis and gliding movements in all directions.

Cricoarytenoid

- It is a synovial joint between the base of the Arytenoid cartilage and the upper border of the lamina of the Cricoid cartilage.
- It permits two movements, the rotatory movements around a vertical axis and also gliding movements in all directions.

MEMBRANES OF LARYNX

There are two membranes of the larynx, one is extrinsic and another is intrinsic

The thyrohyoid membrane

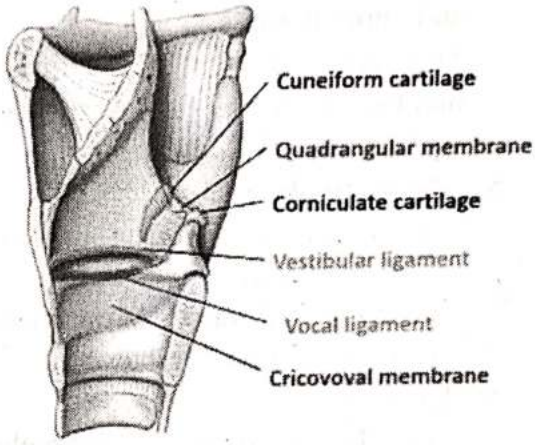
- It is an extrinsic membrane of the larynx.
- The thyrohyoid membrane connects the thyroid cartilage to the hyoid bone.
- Its medial and lateral parts are thickened and form the respective thyrohyoid ligaments.
- Its thickened medial part of the membrane forms a lateral thyrohyoid ligament.
- Its thickened lateral part of the membrane forms lateral thyrohyoid ligament.

Fibroelastic membrane

- It is the intrinsic membrane of the larynx.
- It is placed just outside the mucous membrane of the larynx.
- It is divided into two parts by the sinus of the larynx.
- The part above the sinus is known as the quadrate membrane.
- The part below the sinus is called as conus elasticus.

LIGAMENTS OF LARYNX

- The ligaments of the larynx are derived from the membranes of the larynx.



- The ligaments of the larynx are categorized according to their function.
- They are mainly subdivided into extrinsic and intrinsic groups.

The major **extrinsic ligaments** are:

i. ***The lateral Thyrohyoid ligaments***
   a. There are two lateral thyrohyoid ligaments.
   b. They originate from the thyrohyoid membrane.
   c. Thicken lateral part of the membrane forms lateral thyrohyoid ligament.

ii. ***The median thyrohyoid ligament***
   a. It is a single ligament.
   b. The median thyrohyoid ligament originates from the thyrohyoid membrane.
   c. Thick medial part of the membrane forms the lateral thyrohyoid ligament.

iii. ***The hyoepiglottic ligament***

The hyoepiglottic ligament connects the upper end of the epiglottic cartilage to the hyoid bone.

iv. The Cricotracheal ligament

a. The Cricotracheal ligament connects the Cricoid cartilage to the upper end of the trachea.
b. The major intrinsic ligaments are:
c. The larynx has three intrinsic ligaments or folds.

- The Aryepiglottic fold
  The quadrate membrane has lower and upper borders.
  The upper borders of the quadrate membrane form the Aryepiglottic fold.
- The vestibular fold
  The quadrate membrane has lower and upper borders.
  The lower free borders of the quadrate membrane forms vestibular fold
- The vocal fold
  The lower part of Fibroelastic membrane is conus elasticus
  The upper free border of conus elasticus forms the vocal fold.

MUSCLES

There are intrinsic and extrinsic muscles of the larynx, which for different functions. Those are as follows

i. Intrinsic muscles are:

a. Cricothyroid muscle
b. Posterior Cricoarytenoid muscle
c. Lateral Cricoarytenoid muscle
d. Transverse Arytenoid muscle
e. Oblique Arytenoid muscle and
f. Thyroarytenoid muscle

ii. Extrinsic muscles are:

a. Sternothyroid muscle
b. Omohyoid muscle
c. Sternohyoid muscle
d. Inferior constrictor muscle
e. Thyrohyoid muscle
f. Digastric muscle
g. Stylohyoid muscle
h. Mylohyoid muscle
i. Geniohyoid muscle
j. Hyoglossus muscle and
k. Genioglossus muscle

Cavity of larynx

- It extends from the inlet of the larynx to the lower border of Cricoid cartilage.
- There are two folds of mucous membrane with the cavity.
- The upper fold is known as the vestibular fold whereas the lower fold is known as the vocal fold.
- These two folds divide the larynx into three parts, the vestibule, the sinus, and the infraglottic part.
- The part above the vestibular fold is the vestibule of the larynx.
- The part between these two folds is sinus of larynx.,
- The third part which is below the vocal folds known as the infraglottic part.

BLOOD SUPPLY OF LARYNX

- The arterial supply of the larynx is provided by the superior laryngeal artery and the inferior laryngeal artery.
- The venous drainage is managed by the superior laryngeal vein and the inferior laryngeal vein.

NERVE SUPPLY

Internal laryngeal, recurrent laryngeal, external laryngeal nerves all branches of the vagus nerve. CN X are for the motor and sensory functions of the larynx.

FUNCTIONS

- It functions like a filter that detains all the molecules larger than 6nm and prevents them to reach the lungs and cause mechanical damage to them.
- It also houses the vocal folds and adjusts the pitch and the volume, which is essential when it comes to phonation.

Applied Anatomy

Laryngitis

Laryngitis is a very common ailment that occurs when the mucosa of the larynx and the vocal cords become inflamed. This results in the temporary partial or complete loss of the patient's voice because the vocal cords become

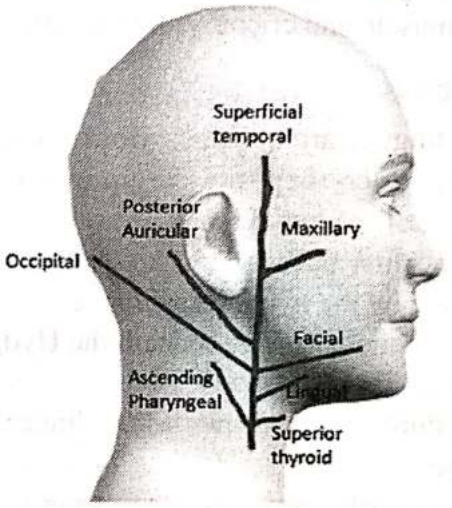
Q. 3 External Carotid Artery

Ans. INTRODUCTION

- The external carotid artery is one of the two main divisions of the common carotid artery. The common carotid artery arises from the aortic arch on the left side and the Brachiocephalic artery on the right side of the body. Then it ascends in the carotid triangle of the neck and lies within the carotid sheath.
- In the carotid triangle, it bifurcates at the level of the thyroid cartilage into external and internal carotid arteries.
- The external carotid artery gives branches to the neck region and supplies the external structures of the head and face.

COURSE AND RELATIONS

- The external carotid artery begins in the carotid triangle of the neck at the level of the upper border of the thyroid cartilage.
- It runs upward, laterally, and slightly backward.
- It terminates at the level of the neck of the mandible by dividing into maxillary and superficial temporal arteries.
- Due to a slightly curved course, it is anteromedial to the internal carotid artery in its lower part and anterolateral to it in its upper part.
- In the carotid triangle, it is superficial and lies under the anterior border of the sternocleidomastoid muscle.
- Anteriorly, the artery is covered by the skin, the superficial fascia, the Platysma, the deep cervical fascia, and the sternocleidomastoid muscle.
- Posterosuperiorly, the internal and external branches of the carotid are separated by the Styloglossus muscle.
- Medially the gland is related to the hyoid bone, the wall of the pharynx, the superior laryngeal nerve, and the parotid gland surround the artery.
- Above the carotid triangle, the artery lies deep in the substance of the parotid gland.



- Superior thyroid
- Ascending pharyngeal
- Lingual
- Occipital
- Facial
- posterior auricular
- Maxillary
- superficial temporal

BRANCHES

External carotid artery gives off eight branches which may be grouped as follows

- Anterior – Superior thyroid, lingual and facial branches
- Posterior – Occipital, posterior auricular
- Medial – Ascending pharyngeal
- Terminal – Maxillary, superficial temporal

Remember S, A, L, F, O, P, M

MNEMONIC – Salman Ali Likes Film On Political Media Studio

Superior Thyroid Artery

- The superior thyroid artery arises from the external carotid artery just below the level of the greater cornua of the hyoid bone.
- Then it passes deep to three long infrahyoid muscles and reaches the upper pole of the lateral lobe of the thyroid gland.
- The superior thyroid artery gives a superior laryngeal artery that supplies the larynx.
- It also gives sternocleidomastoid branch for that muscle and cricothyroid branch.

Lingual Artery

- The lingual artery arises from the external carotid artery opposite the tip of the greater cornua of the hyoid bone.
- It's the first part in the carotid triangle it is crossed by the hypoglossal nerve.
- The second part runs beneath the Hyoglossus muscles.
- The third part is known as the lingual artery proper.
- The fourth part of the artery travels horizontally underthe surface of the tongue.
- It branches into the deep lingual and sublingual arteries which supply the intrinsic muscles of the tongue and the floor of the mouth.

Facial Artery

- The facial artery runs around the middle of the mandible and then it enters the face.
- It gives branches to the tonsil, palate, and submandibular glands.

Occipital Artery

- The occipital artery arises from the posterior aspect of the external carotid artery. In the carotid triangle, it gives two branches to the sternocleidomastoid muscle.
- It passes deep to the posterior belly of the digastric muscle to supply the posterior region of the scalp.

Posterior Auricular Artery

- The posterior auricular artery arises from the posterior aspect of the external carotid artery.
- It runs behind the external acoustic meatus and the mastoid process.
- It supplies the back of the auricle, skin over the mastoid process, middle ear, mastoid antrum and mastoid air cells, and facial nerve.

Ascending Pharyngeal Artery

- The ascending pharyngeal artery is a small branch arising from the medial aspect of the external carotid artery.
- It gives meningeal branches.

Maxillary Artery

The maxillary artery is the large terminal branch of the external carotid artery.

It gives flowing branches to:

- the external acoustic meatus
- the tympanic membrane
- the dura mater
- the calvaria
- the mandible
- the gingiva
- the teeth
- the temporal muscle
- the pterygoid muscle
- the Masseter muscle
- the buccinator muscle

Superficial Temporal Artery

- The superficial temporal artery begins behind the neck of the mandible.
- It supplies only the temporal region of the scalp.

Applied Anatomy

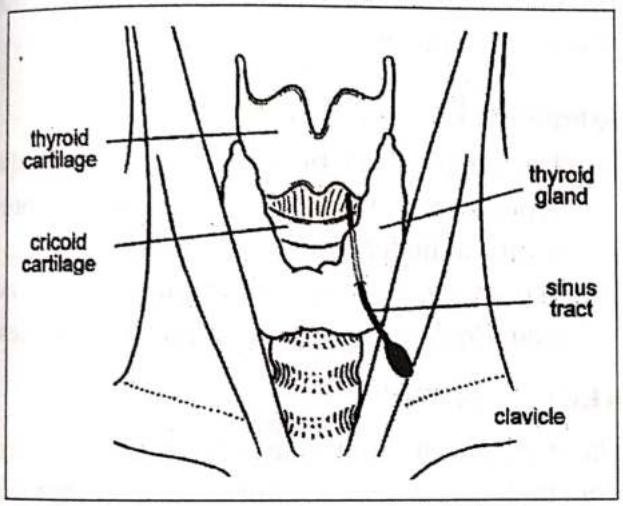
Carotid artery disease

Carotid artery disease is a disorder of the common carotid artery or either of its main divisions. It occurs when plaque-like growths start to form in these major arteries and limit the amount of blood that flows to the head and neck region. This ailment can become extremely serious because it can cause ischemia to vital organs such as the brain and it also increases the risk of clot formation.

Q. 4 Thyroid Gland

Ans. INTRODUCTION

- The thyroid gland is an endocrine organ located in the anterior and lateral parts of the neck.
- Thyroid gland produces thyroid hormones which are useful and regulate the basal metabolism of the body.



- It also regulates growth and play important role in calcium metabolism.
- The thyroid gland Secretes thyroid hormones T3 and T4 that regulates body metabolism and the calcitonin, a hormone for calcium homeostasis.
- The thyroid gland is a butterfly-shaped vascular, red-brown endocrine gland.
- It is made up of a central isthmus that connects the right and left lobes of the organ inferomedially.
- Accessory thyroid glands are sometimes found as small detached masses of thyroid tissue in the vicinity of the lobes or above the isthmus.

SITUATION AND EXTENT

- The gland extends from the level of the 5th cervical vertebra to the first thoracic vertebra.
- Each lobe extends from the middle of the thyroid cartilage to the fourth or fifth tracheal ring.
- The isthmus extends from the second to the fourth tracheal ring.

DIMENSIONS AND WEIGHT

- On average, the gland weighs between 15 to 25 g and is the largest of the endocrine glands.
- Each lobe measures about 5 cm × 2.5 cm × 2.5 cm.
- The isthmus measures about 1.2 cm × 1.2 cm.

Capsule of thyroid

- The thyroid gland has a true and false capsule.
- The true capsule is peripheral condensation of the connective tissue of the gland. A dense capillary network is present deep to the true capsule.
- The false capsule is derived from the deep cervical fascia. It is thin along the posterior border of the lobes but thick on the inner surface of the gland. This thick portion forms the suspensory ligament of the gland.

RELATIONS

The lobes of the gland are conical in shape, having

- Apex,
- Base,
- Three surfaces – lateral, medial, and posterolateral.
- Two borders – anterior and posterior
  - The apex is directed superolaterally. It is limited superiorly by the attachment of the sternothyroid to the oblique line of the thyroid cartilage.
  - The base of the lobe is on the level with the 4th or 5th tracheal ring
  - The lateral surface is convex. It is covered by the sternohyoid, sternothyroid, superior belly of omohyoid, and anterior border of the sternocleidomastoid muscle.
  - The medial surface is related to trachea and oesophagus, two muscles inferior constrictor and cricothyroid, and two nerves external laryngeal and recurrent laryngeal.

- The posterolateral surface is related to the carotid sheath and overlaps the common carotid artery.
- The anterior border of the gland is thin whereas the posterior border is thick.
- The isthmus connects two lobes has two surfaces anterior and posterior, two borders superior and inferior.

HISTOLOGY AND FUNCTIONS

- The thyroid gland stores its hormones in the follicles, instead of sending them directly into the blood.
- The follicles group together and form the lobules.
- The lobule forms the parenchyma of each lobe of the thyroid.
- The lobules are separated by septae. The septae acts as a conducting path for neurovascular and lymphatic structures.
- The thyroid gland is made up of two secretory cells, follicular and parafollicular.
- The follicular cells secrete triiodothyronin (T3) and tetraiodothyronin (T4). These two hormones stimulate basal metabolic rate.
- The parafollicular cells secrete thyrocalcitonin, which promotes deposition of calcium salt in skeletal and other tissues.

ARTERIAL SUPPLY

- The superior thyroid artery and the inferior thyroid artery bring oxygenated, nutrient-rich blood to the thyroid gland.
- The superior thyroid artery arising from the external carotid artery and inferior thyroid artery originates from the thyrocervical branch of the subclavian artery.

Venous Drainage

The thyroid is drained by the superior, middle and inferior thyroid veins.

Lymphatic Drainage

- The lymph from the upper part reaches the upper deep cervical lymph nodes through pre-laryngeal nodes.
- The lymph from the lower part of the gland drains to the lower deep cervical lymph nodes.

NERVE SUPPLY

The nerves to thyroid glands are mainly derived from middle cervical ganglion and partly from the superior and inferior cervical ganglion.

Applied anatomy

Ectopic thyroid

It is developmental abnormality of the thyroid gland. This occurs when thyroid tissue is found anywhere along the path of migration from the foramen caecum and not with the thyroid as a whole in its final destination.

4

Pectoral Region

PECTORAL REGION TWO MARKS QUESTIONS

Q. 1 Origin & insertion of Pectoralis major muscle.

Ans. The Pectoralis major muscle

a. Originates from

Anterior surface of medial two-third of clavicle

Anterior surface of manubrium and sternum

Second to sixth costal cartilages

Aponeurosis of the external oblique muscle

b. Inserted by bilaminar tendon on the lateral lip of the bicipital groove

Origin & insertion of Pectoralis minor muscle

Q. 2 Origin & insertion of Pectoralis minor muscle

Ans. The Pectoralis minor muscle:

a. Originates from 3rd, 4th and 5th ribs near the costochondral junction Innervating fascia covering external intercostal muscles

b. Inserted on medial border and upper surface of coracoid process of scapula

Q. 3 Any two features of clavicle

Ans. Following are the features of the clavicle:

a. It is the only long bone that lies horizontally

b. It is subcutaneous throughout its course

c. It is first bone to start ossifying

d. There is no medullary cavity in clavicle

Q. 4 Any two contents of Posterior mediastinum
MNEMONIC – there are four birds, three GOOSE and one DUCK

a. GOOSE – Esophagoose (Esophagus)

b. GOOSE – VaGOOSE (Vagus)

c. GOOSE – AzyGOOSE (Azygos vein)

d. DUCK – Thoracic DUCK (Thoracic duct)

Ans. Following are the contents of the posterior mediastinum:

a. Esophagus

b. Vagus nerve

c. Azygos vein and

d. Thoracic duct

Q. 5 Any two contents of Superior Mediastinum
MNEMONIC – Keep BATS in TENT

a. B for Brachiocephalic Vein

b. A for Arch of Aorta

c. T for Thymus

d. S for Superior vena cava

e. T for Trachea

f. E for Esophagus

g. N for Nerves (Vagus and Phrenic)

h. T for Thoracic duct

Ans. Superior mediastinum contains the following structures:

a. Brachiocephalic Vein

b. Arch of Aorta

c. Thymus

d. Superior vena cava

e. Trachea

f. Esophagus
g. Vagus nerve
h. Phrenic nerve and
i. Thoracic duct

Q. 6 Any two Structures piercing clavipectoral fascia.

Ans. Following five structures pierce the clavipectoral fascia:

a. Cephalic vein
b. Thoracoacromial artery
c. Thoracoacromial vein
d. Lymphatics and
e. Pectoral nerve

PECTORAL REGION TEN MARKS QUESTIONS

Q. 1 Anatomy of Breast

Ans. DEFINITION AND INTRODUCTION

- The breast is a specialized sweat gland. It secretes milk.
- It is well developed in females but rudimentary in males.

Type

It is an apocrine gland.

Location

It is located at the pectoral region in the superficial fascia.

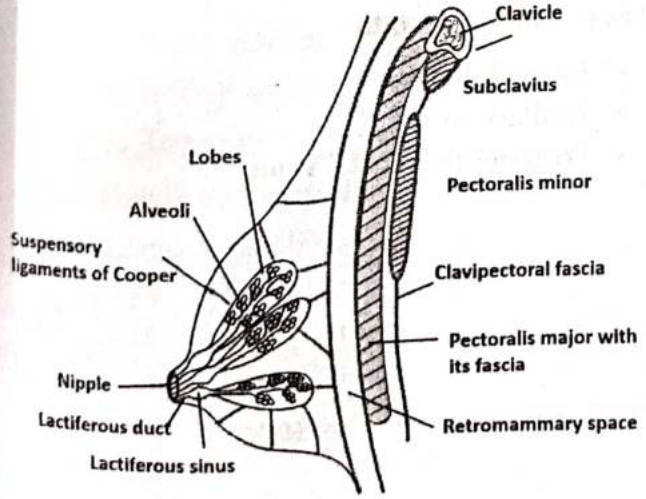
The axillary tail of the breast pierces deep fascia and lies in the axilla.

Shape

It is hemispherical in young adult females and pendulous in later age.

Extents

- Vertically it extends from 2nd to 6th ribs.
- Horizontally it extends from lateral sternal border up to mid axillary line.
- A big part of the gland lies in the superficial fascia.



- Axillary tail pierces deep fascia and extends to axilla at 3rd rib level.

Deep relations

It is related from outwards to inside to:

- Retromammary space of loose areolar tissue which helps for free mobility of the breast
- Deep fascia covering the Pectoralis major muscle
- Deep inside are Pectoralis minor, serratus anterior, and external oblique muscles.

Structures of breast

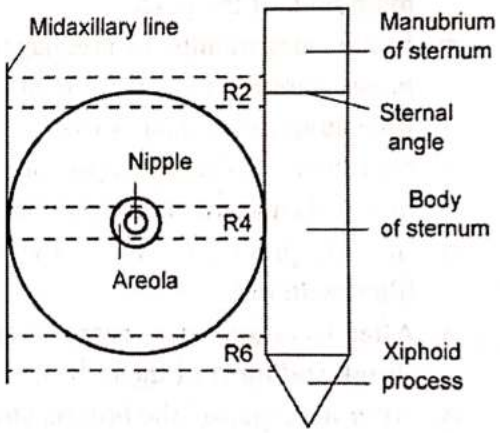
Breast structures are divided into three subdivisions Skin, Parenchyma, and Stroma:

i. Skin

Skin is the outer part of the breast. It consists of:

a. Nipple

- The nipple is located at the 4th intercostal space.



- It is pierced by 15-20 lactiferous ducts It contain circular and longitudinal smooth muscle fibers and modified sweat and sebaceous gland
- It is rich in nerve supply

b. Areola

- It is the pigmented area around the nipple
- It is rich in modified sebaceous glands
- The oily secretions of the gland prevents cracking of the nipple and areola

ii. Parenchyma

The layer of parenchyma consists of

- Glandular tissue made up of branching ducts and terminal secretor lobules
- 15-20 lobes radiating out from the nipple
- Lactiferous duct from each lobe enlarged into lactiferous sinus
- Lactiferous sinus opens into nipples

iii. Stroma

It is the supporting frame of the breast. It consists of fibrous and fatty Stroma

a. Fibrous Stroma

- It forms septa.
- Suspensory ligaments of cooper which separates the lobes and suspend gland to pectoral fascia

b. Fatty Stroma

- A variable amount of fat forms the main bulk of the gland.
- In the early months of pregnancy, the breast rapidly increases in size and branching in the duct system.
- Secretory alveoli begin at duct terminals and fill connective tissue.
- In early pregnancy, these alveoli are filled with milk.
- After lactation ends, secretor alveoli shrink and most of them disappear.
- After menopause, the breasts atrophy.

LYMPHATIC DRAINAGE

- The breast is drained by principal lymph nodes and other lymph nodes:
- Principal lymph nodes are:
  - Anterior, posterior, lateral, central apical group of axillary lymph no and
  - Internal mammary nodes
- Other lymph nodes are:
  - Supraclavicular nodes
  - Cephalic nodes
  - Posterior intercostal nodes
  - Subdiaphragmatic nodes and
  - Subperitoneal lymph plexuses

Usually, malignancy spread through lymphat and hence important during surgical removal malignancy.

ARTERIAL SUPPLY

Breast is supplied by following arteries:

- Perforating branch of internal carotid artery
- Lateral thoracic artery
- Superior thoracic artery
- Acromiothoracic artery and
- Lateral branch of posterior intercostal artery

VENOUS DRAINAGE

Superficial veins of the breast drains into:

- Internal thoracic and
- Superficial veins of lower neck

Deep veins drains into:

- Internal thoracic
- Axillary and
- Posterior intercostal veins

5

Upper Limb Muscles

UPPER LIMB MUSCLES TWO MARKS QUESTIONS

Q. 1 Any two rotator cuff muscles
MNEMONIC – SITS

a. S for Supraspinatus
b. I for Infraspinatus
c. T for Teres minor
d. S for Subscapularis

Ans. There are four rotator cuff muscles.

a. Supraspinatus
b. Infraspinatus
c. Teres minor
d. Subscapularis

Q. 2 Name the muscles attached to greater tubercle of humerus.

Ans. Following three rotator cuff muscles are attached to the greater tubercle of the humerus:

a. Supraspinatus
b. Infraspinatus and
c. Teres minor

Q. 3 Origin and insertion of Coracobrachialis

Ans. Coracobrachialis is the muscle of upper limb. It

a. Originate from tip of coracoid process with short head of biceps brachii
b. Inserts on middle 5 cm of the medial border of the humerus.

Q. 4 Any two muscles of flexor compartment of forearm
MNEMONIC – PFPF FDS

Flexor compartment of forearm consists following muscles:

a. Pronator teres
b. Flexor carpi radialis
c. Palmaris longus
d. Flexor carpi ulnaris and
e. Flexor digitorumsuperficialis
f. Tendons which passes deep to flexor retinaculum

Ans. The tendons of the following muscles passes deep to the flexor retinaculum:

a. Four tendons of flexor digitorum superficialis
b. Four tendons of the flexor digitorum pro fund us
c. The tendon of the flexor pollicis longus
c. The tendon of the flexor carpi radialis

Q. 5 Muscles inserted on deltoid tuberosity with its nerve supply

Ans. A deltoid tuberosity is a V-shaped raised portion at the anterolateral aspect of the shaft of the humerus.

A fan-shaped deltoid is inserted on the deltoid tuberosity of the humerus.

The deltoid muscle is supplied by the Axillary nerve.

Q. 6 Muscles of shoulder region

Ans. The shoulder region is covered by the following muscles:

i. Rotator cuff group of four muscles includes
  a. Supraspinatus

b. Infraspinatus
c. Subscapularis and
e. Teres minor

ii. Group of muscles surrounding the rotator cuff includes
a. Deltoid
b. Coracobrachialis
c. Serratus anterior
d. Pectoralis major
d. Pectoralis Minor

Q. 9 What is supination and pronation?

Ans. Pronation and supination are the movements of the radioulnar joint. The wheel-like rotation of head of radius enables supination and pronation
a. Supination is the rotation of the hand or forearm so that the surface of the palm is facing upwards or towards the front
b. Pronation is the rotation of the hand or forearm so that the surface of the palm is facing downwards or towards the back

Q. 10 Two muscles responsible for pronation

Ans. Following muscles are responsible for pronation:
a. Pronator teres and
b. Pronator quadratus for pronation of the forearm

Q. 11 Origin and insertion of Coracobrachialis

Ans. Coracobrachialis
a. Originates from the tip of the coracoid process with the short head of biceps brachii muscle
b. It inserts on the middle 5cm of the medial border of the humerus

Q. 12 Muscles attached to supraglenoid and infraglenoid tubercles of scapula

Ans. Following are the muscles attached to the glenoid tubercles of the scapula:
a. Long head of biceps brachii are attached to the supraglenoid tubercle and
b. Long head of the triceps is attached to the infraglenoid tubercle

Q. 13 Muscles attached to superior angle of scapula

Ans. The superior angle of the scapula is covered by trapezius muscle.
The superior angle provides attachment for
a. Levator scapulae muscle towards the dorsal aspect and
b. Omohyoid muscle towards the coastal aspect

Q. 14 Muscles attached to inferior angle of scapula

Ans. The inferior angle is covered by the latissimus dorsi muscle, and the last few digitations of the serratus anterior are taking origin from the coastal aspect of the inferior angle of the scapula.

Q. 15 Name of muscles responsible for abduction of wrist

Ans. Abduction means bringing the joint towards the outer side or the radial side. It is also known as radial deviation.
Following muscles are responsible for abduction of wrist:
a. Flexor carpi radialis
b. Extensor carpi radialislongus
c. Extensor carpi radialisbravis
d. Abductor pollicislongus and
e. Extensor Pollicis brevis

Q. 16 Name of muscles responsible for flexion of wrist

Ans. Following muscles are responsible for flexion of the wrist joint:
a. Flexor carpi radialis
b. Flexor carpi ulnaris and
c. Palmaris longus

Q. 17 Name of muscles responsible for extension of wrist

Ans. Following muscles are responsible for the extension of the wrist joint:
a. Extensor carpi radialislongus
b. Extensor carpi radialis brevis

c. Extensor carpi ulnaris

Q. 18 Name of muscles responsible for adduction of wrist

Ans. Adduction means bringing the joint towards the body or towards the ulnar side. It is also known as ulnar deviation.

Following muscles are responsible for adduction of wrist:

a. Flexor carpi ulnaris and

b. Extensor carpi ulnaris

Q. 19 Any two muscles supplied by musculocutaneous nerve
MNEMONIC - BBC

Ans. Musculocutaneous nerve supplies the following muscles:

a. Coracobrachialis

b. Biceps brachii, both long and short heads

c. Brachialis

Q. 20 Two muscles supplied by Radial nerve
MNEMONIC – BEST muscles

a. B for Brachioradialis

b. E for Extensors

c. S for Supinator

d. T for Triceps

Ans. Radial nerve supplies the following muscles:

a. Brachioradialis

b. Extensors

c. Supinator

d. Triceps

Q. 21 Any two muscles responsible for flexion of elbow joint
MNEMONIC – Three B bend the elbow. These three B are

a. Brachialis,

b. Biceps and

c. Brachioradialis

Ans. The muscle flex the elbow joint are

a. Brachialis,

b. Biceps and

c. Brachioradialis

Q. 22 Any two intrinsic muscles of Palmar surface of hand
MNEMONIC – Thee times A and two times OF

a. A for Abductor PollicisLongus

b. A for Adductor Pollicis

c. A for Abductor digiti minimi

d. O for OpponensPollicis

e. F for Flexor digiti minimi

f. O for Opponensdigitiminimi

g. F for Flexor Pollicisbravis

Ans. Following are the intrinsic muscles of the hand:

a. Abductor PollicisLongus

b. Adductor Pollicis

c. Abductor digitiminimi

d. OpponensPollicis

e. Flexor digitiminimi

f. Opponensdigitiminimi

f. Flexor Pollicisbravis

Q. 23 Any two wrist extensor muscles
MNEMONIC - Apply rule of 3 i.e. 3 extensors, two for radial side and one for ulnar side and all are carpi.

Ans. The extensor muscles of the wrist are:

a. Extensor carpi radialisbravis,

b. Extensor carpi radialislongus and

c. Extensor carpi ulnaris

Q. 24 Any two finger extensor muscles (Apply rule of 3 i.e. 3 extensors)

Ans. The extensor muscles for finger are:

a. Extensor digitorum (for all four fingers)

b. Extensor indicis (for index finger) and

c. Extensor digiti minimi (for little finger)

Q. 25 Extensor muscles of thumb
(Apply the rule of 3, they are three Pollicis out of which two extensors and one abductor)

Ans. The extensor muscles for the thumb are:

a. Extensor Pollicislongus

b. Extensor Pollicis brevis

c. Abductor Pollicislongus

Q. 26 Any two flexor muscles of forearm
MNEMONIC - Use the trick PFPF to remember the muscles:

a. P- Pronator teres
b. F- Flexor carpi radialis
c. P- Palmaris Longus
d. F- Flexor carpi ulnaris

Ans. Following are flexor muscles of the forearm:

a. Pronator teres
b. Flexor carpi radialis
c. Palmaris Longus
d. Flexor carpi ulnaris

MUSCLES OF SHOULDER JOINT- A story of cricket; it was a tough match between India and Pakistan. On the last ball of Pravin Banger, Pakistan Cricket Board give tip to umpire in front of pretty tall lady, irritated Pravin eat tomato as he loves it. It is the best story to remember the Medial rotator, lateral rotator, flexor, and extensor and adductor muscles of the shoulder joint.

Q. 27 Any two muscles for flexion of shoulder joint
MNEMONIC – Pakistan Cricket Board:

a. P for Pectoralis Major
b. C for Coracobrachialis
c. B for Biceps and
d. AD for Anterior Deltoid

Ans. Following four muscles are flexors of the shoulder joint:

a. Pectoralis Major
b. Coracobrachialis
c. Biceps and
d. Anterior Deltoid

Q. 28 Any two muscles for extension of shoulder joint
MNEMONIC – Praveen Love Tomato:

a. P for Posterior deltoid
b. L for Latissimus dorsi and
c. T for Teres major

Ans. Following three muscles are extensors:

a. Posterior deltoid
b. Latissimus dorsi and
c. Teres major

Q. 29 Any two muscles for lateral rotation of shoulder joint
MNEMONIC – TIP to waiter

a. T for Teres minor
b. I for Infraspinatus and
c. P for Posterior deltoid

Ans. Following three muscles are lateral rotator

a. Teres minor
b. Infraspinatus and
c. Posterior deltoid

Q. 30 Any two muscles for Adduction of shoulder joint
MNEMONIC – Pretty Tall Lady

a. P for Pectoralis Major
b. T for Teres muscles
c. L for Latissimus dorsi

Ans. Following four muscles are adductors:

a. Pectoralis Major
b. Teres muscles – teres major and teres minor
c. Latissimus dorsi

Q. 31 Any two muscles for Medial Rotation of shoulder joint
MNEMONIC – LAST

a. L for Latissimus dorsi
b. A for Anterior deltoid
c. S for Subscapularis and
d. T for Teres Major

Ans. Following four muscles are medial rotators of the shoulder joint:

a. Latissimus dorsi
b. Anterior deltoid
c. Subscapularis and
d. Teres Major

Q. 32 Name the Hypothenar muscles.

Ans. Hypothenar is a group of three muscles of the palm which control the motion of the little finger. Those minimi muscles are:

a. Abductor digiti minimi

b. Flexor digiti minimi brevis and
c. Opponens digiti minimi

Q. 33 Nerve supply of Brachialis

Ans. The brachialis is the muscle of the arm. It is supplied by:
a. Musculocutaneous nerve for motor functions and
b. Radial nerve for proprioceptive role

Q. 34 Nerve supply of Deltoid muscle

Ans. Deltoid muscle is supplied by Axillary nerve with root value C5, C6

Q. 35 Any two muscles attached near bicipital groove

MNEMONIC - A Lady between Two Majors
a. Lady is Latissimus dorsi
b. Majors are Teres major and
c. Pectoralis Major

Ans. Following are the muscles attached near the bicipital groove:
a. Teres major attached to medial lip of groove
b. Pectoralis Major attached to lateral lip of groove whereas
c. Latissimus dorsi is on the floor of the groove between two majors.

Q. 36 What is bicipital aponeurosis?

Ans. Bicipital aponeurosis is
a. A broad aponeurosis of the biceps brachii muscle.
b. It is located in the cubital fossa of the elbow joint
c. It originates from distal insertion of biceps brachii muscle
d. It separates the superficial structures from deep structures in the cubital fossa

Q. 37 Any two structures related with surgical neck of humerus

Ans. Axillary nerve and posterior circumflex humeral artery are the structures related to the surgical neck of the humerus.

Q. 38 Define anatomical and surgical neck of humerus

Ans. Definition of surgical neck
a. Anatomical neck – The line separating the head from the rest of the upper end of the humerus is called as Anatomical neck
b. Surgical neck – The narrow line separating the upper end of the humerus from the shaft is called as the Surgical neck.

Q. 39 Actions of elbow joint

Ans. Elbow joint has following two movements
i. Flexion –It is brought by 3 B
a. Brachialis
b. Biceps brachii and
c. Brachioradialis
ii. Extension –It is brought by AT
a. Anconeus and
b. Triceps brachii

Q. 40 Name the extensors of elbow

Ans. Extension of elbow joint is brought by following two muscles:
a. Triceps brachii and
b. Anconeus

UPPER LIMB MUSCLES FIVE MARKS QUESTIONS

Q. 1 Supinator Muscle

Ans. INTRODUCTION

It is the muscle of the forearm. It takes part with brachialis in the formation of the floor of the cubital fossa.

ORIGIN

Supinator is the muscle of the forearm. It originates from the following locations near the elbow joint.

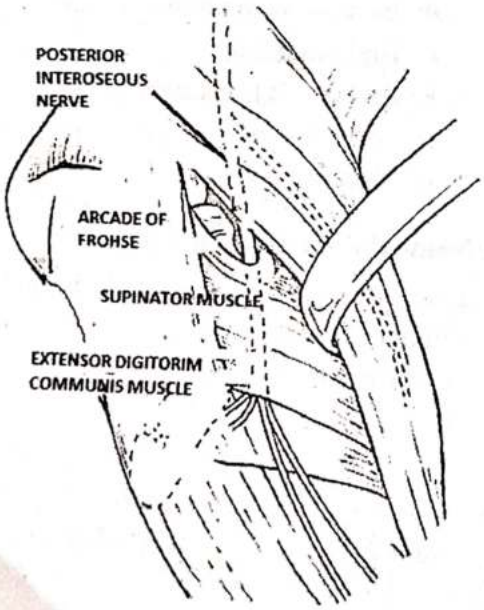
- Lateral epicondyle of humerus
- Supinator crest of ulna
- Radial collateral ligament and
- Annular ligament of superior radioulnar joint

INSERTION

It inserts on neck and whole shaft of upper one-third of radius

INNERVATIONS

- The Supinator muscle is innervated by the radial nerve.



- The radial nerve is made up of nerve fibers from the C5, C6, C7, C8, and T1 nerves.
- The branch of the radial nerve that innervates the Supinator muscle is made up of the C6, C7, and C8 nerves.

Action

It helps in the supination of the forearm when the elbow is extended

Q. 2 Deltoid Muscle

Ans. INTRODUCTION

It is a most superficial, triangular-shaped muscle, with its apex pointing distally along the humerus. It is the spanning muscle of the glenohumeral joint.

ORIGIN

Deltoid has three places of its origin, from two bones clavicle and scapula respectively. This very broad origin functionally is divided into three separate parts: Anterior Clavicular part, middle Acromial part, and posterior scapular part.

- Clavicular Head – It is also known as the anterior part of the muscle. These fibers originate from lateral 1/3 of the clavicle.
- Acromial Head – It is also known as the middle part of the muscle. These fibers originate around the acromion process of the scapula.
- Scapular Head – It is also known as the posterior part of the muscle. These fibers originate along with the lateral 1/3 of the spine of the scapula.

Insertion

All the fibers from three origins unit together and are finally inserted on the deltoid tuberosity located approximately halfway down the lateral part of the shaft of the humerus.

Functions –

Shoulder joint Stability during rest

During resting of the upper limb by the side of the body, the deltoid contracts produce a line of force, to prevent movement of the shoulder joint. Hence the deltoid is the stabiliser of the shoulder joint.

Shoulder joint Stability during motion

During the movement of the shoulder joint, associated with rotator cuff muscles, the Deltoid helps to hold the head of the humerus in the glenoid

to stabilize the glenohumeral joint.

Abduction at the glenohumeral joint

The deltoid is one of the main abductors of the arm. It works with the Supraspinatus muscle for abduction. All three parts of the deltoid muscle contract simultaneously for the abduction of the arm. However, the middle fibers of the muscle are helpful for the movement, and anterior and posterior fibres function to guide the arm through the abduction motion.

Flexion at the glenohumeral joint

Flexion is the forward motion of the arm. The anterior or Clavicular, fibers of the muscle play an active during flexion at the glenohumeral joint.

Internal rotation at the glenohumeral joint

Again the Clavicular fibers are active during internal/medial rotation of the glenohumeral joint.

Extension at the glenohumeral joint

The extension is the backward motion of the arm. The posterior or scapular, fibers of the muscle are active during extension at the glenohumeral joint.

External rotation at the glenohumeral joint

In addition to the extension, posterior fibers also assist in external (or lateral) rotation of the arm.

NERVE SUPPLY

The deltoid muscle is innervated by one of the main branches of the brachial plexus, the axillary nerve (C5, 6). The Axillary nerve branches from the posterior cord of the brachial plexus in the axilla and run posterior to the humerus, around the surgical neck of the humerus.

Applied Anatomy

The cutaneous branch of the Axillary nerve (superior lateral cutaneous nerve of the arm) supplies an area of skin overlying the deltoid muscle and can be a clinical manifestation of damage to the Axillary nerve.

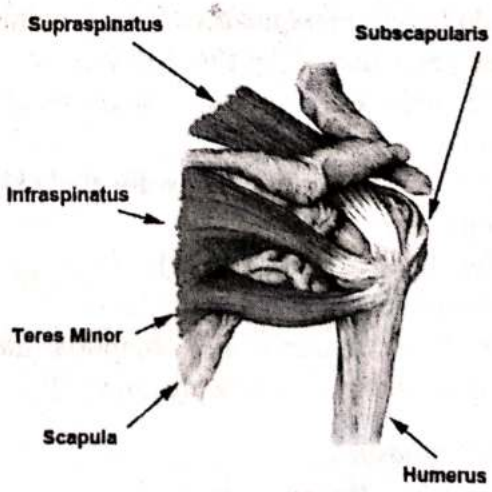
Q. 3 Rotator Cuff Muscles
MNEMONIC – SITS

Ans. INTRODUCTION

- Group of muscles which help to stabilize the shoulder joint and center the humeral head in the joint socket are known as rotator cuff muscles.
- They are four muscles Supraspinatus, Infraspinatus, Teres minor and Subscapularis.
- All these four muscles have their origin from a scapula and insertion over the tubercle of the humerus.
- There are two tubercles at the upper part of the humerus, the greater and lesser. The greater tubercle is towards the posterior aspect of the bone where as the lesser is towards the anterior aspect.
- Out of four muscles, three muscles (Supraspinatus, Infraspinatus and teres minor) originating from the posterior aspect of the scapula are inserted on posteriorly situated greater tubercle of the humerus, and
- The muscle (Subscapularis) originating from the anterior aspect of the scapula is inserted on the anteriorly situated lesser tubercle of the humerus.

ORIGIN AND INSERTIONS

All four rotator cuff muscles originate from the scapula and insert on the humerus.



- Supraspinatus – The Supraspinatus has its origin in the supraspinal fossa of scapula. The fibres run laterally and are inserted on the greater tubercle of the humerus.
- Infraspinatus – The Infraspinatus has its origin from Infraspinatus fossa of the scapula. The fibres run laterally and insert on the greater tubercle of the humerus.
- Teres Minor – The teres minor muscle originates from the lateral border of the scapula and inserts on the greater tubercle of the humerus.
- Subscapularis – It is a very important muscle for the internal rotation of the humerus. It arises from the subscapular fossa of the scapula and inserts on the lesser tubercle of the humerus.

FUNCTIONS

- As the name rotators cuff itself explain that these muscles play a major role in the internal and external rotation of the upper limb in the shoulder joint.
- The rotator cuff muscles help to stabilize and centralise the humeral head in the glenoid cavity.
- These four muscles tighten the shoulder joint capsule preventing the pinch during joint movement.
- The Supraspinatus muscle initiates the abduction of the arm.
- The Infraspinatus is a strong external rotator muscle
- Additional Infraspinatus assists for abduction and adduction of the shoulder joint.
- The teres minor muscle helps in external rotation
- The teres minor also helps for the adduction of the arm.
- The Subscapularis muscle is a powerful internal rotator of the shoulder.
- The Subscapularis also supports the arm during abduction and adduction.

Applied Anatomy

cuff tear

It is an example of a traumatic lesion of the rotator cuff where it comes to a rupture of one or more tendons up to the point of a complete tear of the rotator cuff muscles. Often those ruptures have been preceded by degenerative changes in the rotator cuff.

Q. 4 Flexors of Wrist Joint

Ans. DEFINITION

- Wrist flexor refers to closing the angle at the wrist joint.
- Wrist flexor is the group of six muscles.
- All these muscles directly or indirectly help in closing the angle of the hand.

MUSCLES

Out of six muscles, five muscles are with the FLEXOR name and one is the Palmaris longus.

Following are flexor muscles of the wrist joint:

- Flexor digitorum superficialis – Middle phalanx
- Flexor digitorumprofundus Distal phalanx
- Flexor carpi radialis,
- Flexor carpi ulnaris
- Flexor pollicislongus and
- Palmaris longus.

Flexor digitorum superficialis

Origin

It has two places of origin Humeroulnar head and Radial Head

i. Humeroulnar Head

The fibers originates from:

a. Medial epicondyle of humerus and
b. Medial border of coronoid process of ulna

ii. Radial Head

The fibers originates from:

Anterior oblique line of shaft of radius

Insertion

- The muscle divides into four tendons.
- Each tendon again divides into two strips.
- The strips are inserted on the sides of the middle phalanx of the 2nd to 5th digits.

Action

It flexes the middle phalanx of fingers and assists in flexing the proximal phalanx and wrist joint.

Flexor digitorum profundus

Origin

It has four places of origin. Three places from the ulna and one from the interosseous membrane. Fibers originates from:

- Upper three fourth of the anterior and medial surface of the shaft of the ulna
- Upper three fourth of posterior border of ulna
- Medial surface of olecranon and coronoid process of ulna
- Adjoining part of the anterior surface of the interosseous membrane

Insertion

- The muscle form four tendons for medial four digits
- Tendons enter the ulnar bursa of palm deep through the flexor retinaculum
- Then tendons perforate the tendon of flexor digitorum super ficialis
- Each tendon inserts on the palmer surface of base of distal phalanx

Action

It flexes the distal phalanx of fingers and assists in flexing the joints of digits, fingers and the wrist

Flexor carpi radialis

Origin

It originates from the medial epicondyle of the humerus.

Insertion

It inserts at the base of second and third metacarpal bones.

Action

It flexes and abducts the hand at the wrist joint.

Flexor carpi ulnaris

Origin

It has three origins

- From medial epicondyle of the humerus,
- From Medial aspect of the olecranon process of ulna, and
- From posterior border of ulna

Insertion

It inserts on

- Pisiform bone
- The insertion prolongs to hook of hamate and also to
- The base of the fifth metacarpal bone

Action

It flexes and adducts the hand at wrist joint

Flexor pollicislongus

Origin

It has two origins. It originates from

- Upper three fourth of anterior surface of shaft of radius
- Adjoining part of the anterior surface of the interosseous membrane

Insertion

- The tendon passes deep to the flexor retinaculum and enters the palm
- Inserted on palmer surface of the distal phalanx of the thumb

Action

It flexes the distal phalanx of the thumb and continuous action helps in the flexion of the proximal joint crossed by the tendon.

Palmaris longus

Origin

It originates from the medial epicondyle of the humerus

Insertion

It inserts at flexor retinaculum and palmer aponeurosis

Action

It flexes the wrist joint

6

Upper Limb Nerves

UPPER LIMB NERVES TWO MARKS QUESTIONS

Q. 1 Any two muscles supplied by median nerve
MNEMONIC – Ladies areOppo Android Fan

a. L for Lumbricals (1st and 2nd)
b. O for Opponens
c. A for Abductor PollicisBravis
d. F for Flexor Pollicis Brevis

Ans. The muscles supplied by the median nerve are as follows

a. Lumbricals (1st and 2nd)
b. Opponens
c. Abductor Pollicis Bravis
d. Flexor Pollicis Brevis

Q. 2 Any two muscles supplied by radial nerve
MNEMONIC -TAB Super 2 Cars, Aurangabad (Abd) Police PoliceInsisted 2 Digit numbers

a. T for triceps muscle
b. A for Anconeus muscle
c. B for Brachioradialis Muscle
d. S – Supinator
e. 2 C – Carpi radialislongus and Carpi radialis brevis (both are extensors)
f. A for Abductor poll longus
g. P – Poll brevis (extensor)
h. P – Poll longus (extensor)
i. I – Indicis
j. 2 D – Digitorum (extensor) and Digitiminimi

Ans. Radial nerve supply following muscles

a. Triceps muscle
b. Anconeus muscle
c. Brachioradialis Muscle
d. Supinator
e. Carpi radialislongus (extensor)
f. Carpi radialis brevis (extensor)
g. Abductor poll longus
h. Poll brevis (extensor)
i. Poll longus (extensor)
j. Indicis
k. Digitorum (extensor) and
l. Digitiminimi

Q. 3 Any two muscles supplied by Ulnar nerve

Ans. Ulnar nerve supplies the following muscles of forearm and hand

a. Forearm – following muscles of the forearm are supplied by the ulnar nerve
- Medial half of flexor digitorumprofundus and
- Flexor carpi ulnaris

b. Hand – following muscles of the hand are supplied by the ulnar nerve
- Palmaris brevis,
- Muscles of Hypothenar eminence,
- Medial two lumbricals and
- Adductor Pollicis

Q. 4 Any two muscles supplied by Axillary nerve
MNEMONIC – Arts Teachers Diploma

a. A for axillary nerve
b. T for teres minor and
c. D for deltoid muscle

Ans. Axillary nerve supplies

a. Teres minor and

b. Deltoid muscles

Q. 5 Any two muscles supplied by musculocutaneous nerve
MNEMONIC – BBC news

a. B for Biceps brachii

b. B for Brachialis

c. C for Coracobrachialis

Ans. Musculocutaneous nerve supplies the following muscles:

a. Biceps brachii

b. Brachialis

c. Coracobrachialis

Q. 6 Any two branches of brachial plexus

Ans. Brachial plexus is composed of 5 roots, 3 trunks, 6 divisions, 3 cords, and terminal branches.

The terminal branches of brachial plexus are MARMU

a. M – Musculocutaneous nerve

b. A – Axillary nerve

c. R – Radial nerve

d. M – Median nerve and

e. U – Ulnar nerve

Q. 7 Any two branches of posterior cord of brachial plexus
MNEMONIC – Branches of cords can be memorized as follows:
LML Vespa, M4U and ULNAR

a. Lateral Cord – LML Vespa

- L for Lateral Pectoral Nerve
- M for musculocutaneous nerve
- L for Lateral root of median nerve

b. Medial Cord – M4U Four times M and U

- M for Medial pectoral nerve
- M for Medial cutaneous nerve of arm
- M for Medial cutaneous nerve of forearm
- M for Medial root of median nerve
- U for Ulnar nerve

c. Posterior Cord – ULNAR

- U for upper subscapular nerve
- L for lower subscapular nerve
- N for nerve to latissimus dorsi
- A for Axillary nerve and
- R for Radial nerve

Ans. Brachial plexus have three cords lateral, medial and posterior cord. The posterior cord of brachial plexus gives five branches as follows ULNAR

a. Upper subscapular nerve

b. Lower subscapular nerve

c. Nerve to latissimus dorsi

d. Axillary nerve

e. Radial nerve

Q. 8 Any two branches of the lateral cord of brachial plexus
MNEMONIC – Branches of cords can be memorized as follows:
Lateral Cord – LML Vespa

a. L for Lateral Pectoral Nerve

b. M for musculocutaneous nerve

c. L for Lateral root of median nerve

Ans. Brachial plexus have three cords lateral, medial and posterior cord.

The lateral cord of brachial plexus gives three branches as follows:

a. Lateral Pectoral Nerve

b. Musculocutaneous nerve

c. Lateral root of median nerve

Q. 9 Any two branches of medial cord of brachial plexus
MNEMONIC – Branches of medial cords can be memorized as follows:
M4U Four times M and U

Ans. Brachial plexus have three cords lateral, medial and posterior cord.

The medial cord of the brachial plexus gives five branches as follows:

a. M for Medial pectoral nerve

b. M for Medial cutaneous nerve of arm

c. M for Medial cutaneous nerve of

forearm

d. M for Medial root of median nerve

e. U for Ulnar nerve

Q. 10 Any two branches of root of brachial plexus

Ans. There are five roots of brachial plexus C5, C6, C7, C8, and T1 respectively. Root gives the following branches:

a. Long thoracic nerve

b. Dorsal Scapular nerve

c. Branch to phrenic nerve

Q. 11 What is klumpke's paralysis?

Ans. Klumpke's paralysis is a form of paralysis resulting from injury to the eighth cervical and first thoracic nerve roots of the lower trunk of the brachial plexus. This involves the muscles of the forearm and hand.

Q. 12 Name of musician nerve and labours nerve

Ans. The median nerve is known as the workman's nerve or labourer's nerve whereas the ulnar nerve is known as the musician's nerve.

Q. 13 Name muscles supplied by ulnar nerve in forearm

Ans. The ulnar nerve supplies muscle in the forearm and the hand.

a. Forearm – The ulnar nerve supplies the following muscles in the forearm:

- Flexor carpi ulnaris
- Flexor digitorumprofundus (medial half)

b. Hand – The ulnar nerve supplies the following muscles in the hand:

- The intrinsic hand muscles
- Hypothenar muscles (a group of muscles associated with the little fingers)
- Medial two lumbricals
- Adductor pollicis
- Palmar and dorsal interossei of the hand
- Palmaris brevis

Q. 14 What is the root value of brachial plexus?

Ans. Root values of brachial plexus are four cervical and one thoracic i.e. C5, C6, C7, C8 and T1

UPPER LIMB NERVES FIVE MARKS QUESTIONS

Q. 1 The Median Nerve

Ans. INTRODUCTION

- Median nerve is a branch of the brachial plexus.
- It is a major peripheral nerve of the upper limb.

ORIGIN

- Median nerve originates from C5 – T1 roots of the brachial plexus.
- Lateral root of the median nerve is from the lateral cord (C5-C7) of the brachial plexus and the medial root of the median nerve is from the medial cord (C8-T1) of the brachial plexus.
- These two roots units and give origin to the median nerve.

COURSE

- Lateral and medial root of brachial plexus units to form median nerve in the axilla.
- From the axilla, the nerve descends down the arm.
- At the beginning of the arm, it is lateral to the brachial artery.
- At the middle of the arm, the nerve crosses over the brachial artery and becomes situated medially.
- The median nerve leaves the arm and enters the anterior compartment of the forearm via the cubital fossa.
- In the forearm, the nerve travels between two flexor muscles, flexor digitorum profundus and flexor digitorum superficialis muscles.

BRANCHES

In the forearm, it gives off two major branches.

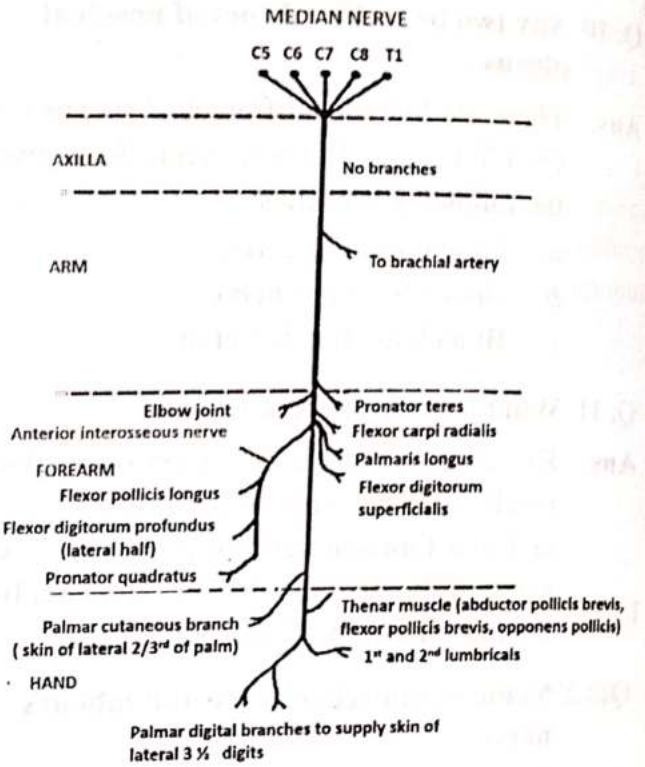
i. Anterior interosseous nerve

It supplies the deep muscles in the anterior forearm.

ii. Palmar cutaneous nerve

It innervates the skin of the lateral palm.

After giving off the anterior interosseous and palmer cutaneous branches, the median nerve leaves the forearm.



It enters in the hand via the carpal tunnel.

It terminates by dividing into two branches:

iii. Recurrent branch –

It innervates the thenar muscles.

iv. Palmar digital branch –

It innervates the palmar surface and fingertips of the lateral three and half digits. Also innervates the lateral two lumbrical muscles.

Functions

The median nerve performs motor and sensory functions.

i. Motor function –

a. It innervates the flexor and pronator muscles of the anterior compartment of the forearm.

b. It supplies innervations to the thenar muscles and lateral two lumbricals.

ii. Sensory functions –

Median nerve gives a palmar cutaneous branch,

which innervates the lateral aspect of the palm, and a digital cutaneous branch which innervates the lateral three and half fingers on the anterior surface of the hand.

Applied Anatomy

Carpel Tunnel Syndrome (CTS)

Compression of the median nerve within the carpal tunnel leads to carpal tunnel syndrome.

Numbness, tingling, and pain in the distribution of median nerve are the clinical features of carpal tunnel syndrome.

Q. 2 The Axillary Nerve

Ans. INTRODUCTION

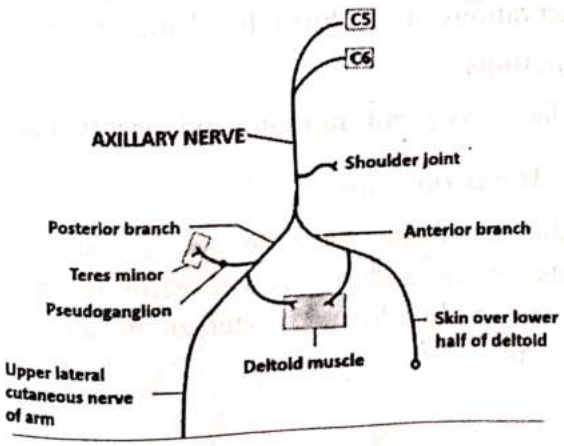
- Axillary nerve is a branch of the brachial plexus.
- It is a major peripheral nerve of the upper limb.
- It runs through the upper part of the axilla even though it does not supply any structure there.
- It courses around the surgical neck of the humerus so it is also known as the circumflex nerve.

ORIGIN

- Axillary nerve originates from C5 and C6 roots of brachial plexus.
- It is a smaller terminal branch of posterior cord of brachial plexus.

COURSE

- It is formed within the axilla.



- It is a direct continuation of the posterior cord of the brachial plexus.
- In the axilla, it is located posterior to the axillary artery and anterior to the Subscapularis muscle.
- It exits the axilla at the inferior border of the Subscapularis via the quadrangular space with posterior circumflex humeral artery and vein.
- The nerve then passes medially to the surgical neck of the humerus and divides into three terminal branches:

BRANCHES

i. Posterior terminal branch –

a. It provides motor innervations to the posterior aspect of the deltoid muscle and teres minor.

b. It also innervates the skin over the inferior part of the deltoid as the upper lateral cutaneous nerve of the arm.

ii. Anterior terminal branch –

a. It winds around the surgical neck of the humerus and provides motor innervates to the anterior aspect of the deltoid muscle.

b. It terminates with cutaneous branches to the anterior and anterolateral shoulder.

iii. Articular branch –

It supplies the glenohumeral joint

INNERVATIONS

The axillary nerve innervates only two muscles of the upper limb Deltoid and teres minor

FUNCTIONS

Axillary nerve performs motor and sensory functions.

i. Motor function

It innervates the Deltoid and teres minor of upper limb

ii. Sensory functions

Axillary nerve gives upper lateral cutaneous nerve,

which innervates the skin over the inferior part of the deltoid.

APPLIED ANATOMY

Damage to axillary nerve by direct trauma to shoulder joint or proximal part of humerus leads the patient unable to abduct the upper limb. The paralyzed deltoid muscle gets atrophied give the flattened appearance to the shoulder joint.

Q. 3 Radial Nerve

Ans. INTRODUCTION

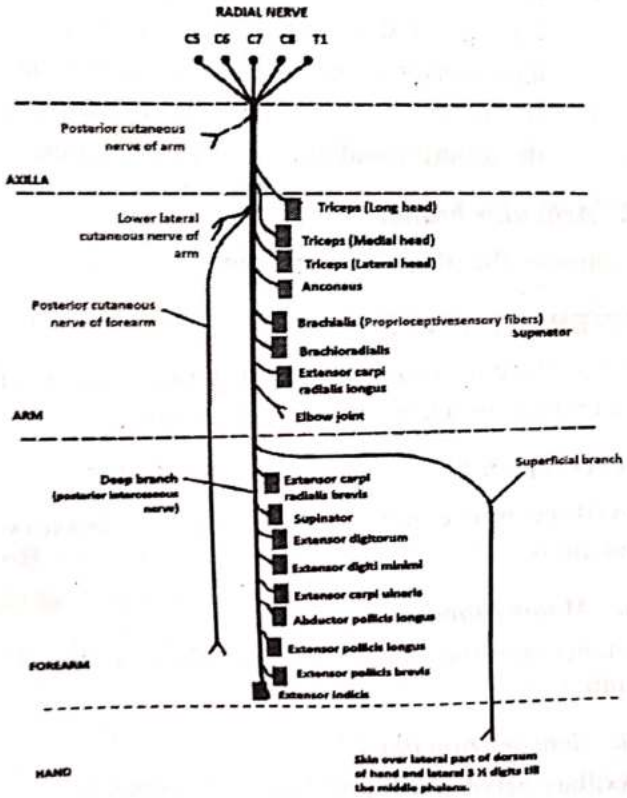
- Radial nerve is the thickest branch of the brachial plexus.
- It is a major peripheral nerve of the upper limb.

ORIGIN

Radial nerve originates from the C5-C8 and T1 roots of the brachial plexus.

COURSE

- Radial nerve is the terminal continuation of the brachial plexus.



- The nerve arises in the axilla region. It is situated posterior to the axillary artery.
- It exits the axilla inferiorly and supplies branches to the long and lateral heads of triceps brachii.
- The radial nerve then descends the arm traveling in a shallow depression within the surface of the humerus, known as the radial groove.
- As it descends, the radial nerve wraps around the humerus laterally and supplies a branch to the medial head of the triceps brachii.
- During much of its course within the arm, it is accompanied by the deep branch of the brachial artery.
- In the arm, it not only innervates the triceps for extension of the arm at the elbow but it also gives rise to branches that supply the Brachioradialis and extensor carpi radialislongus.
- To enter the forearm, the radial nerve travels anterior to the lateral epicondyle of the humerus, through the cubital fossa. The nerve then terminates by dividing into two branches:

BRANCHES

i. Deep Branch

It is a motor branch, innervates the muscles in the posterior compartment of the forearm.

ii. Superficial Branch

It is a sensory branch. It contributes to the cutaneous innervations of the dorsal hand and fingers.

Functions

Radial nerve performs motor and sensory functions.

i. Motor function

Radial nerve innervates the muscles located in the posterior arm and posterior forearm. It innervates the triceps brachii and extensor muscles in the forearm.

ii. Sensory functions

Radial nerve innervates most of the skin of the posterior side of the forearm the dorsal surface of the lateral side of the palm and the dorsal surface of the lateral three and half digits.

There are four branches of the radial nerve. Three branches arise in the upper arm and one in the forearm.

a. Lower lateral cutaneous nerve of the arm – It innervates the lateral aspect of the arm, inferior to the insertion of the deltoid muscle.

b. Posterior cutaneous nerve of the arm – It innervates the posterior surface of the arm.

c. Posterior cutaneous nerve of the forearm – It innervates a strip of skin down the middle of the posterior forearm.

d. Superficial branch – It is the terminal division of the radial nerve. It innervates the dorsal surface of the lateral three and a half digits and the associated area on the back of the hand.

Applied Anatomy

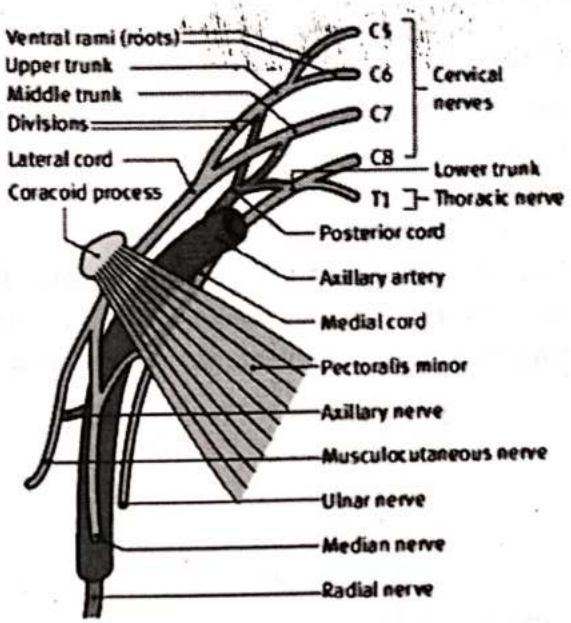
Injury to radial nerve is categorized into four groups based on site of injury.

Dislocation of the shoulder joint and fracture of the proximal humerus can damage the radial nerve in the axilla. In this condition, patient is unable to extend at the forearm, wrist, and fingers also there is loss of sensation over the lateral and posterior arm, posterior forearm, and dorsal surface of the lateral three and a half digits.

Q. 4 The Ulnar Nerve

Ans. INTRODUCTION

- Ulnar nerve is a branch of brachial plexus.
- It is known as a musician's nerve.
- It is the main nerve of the hand.
- It lies superficial to flexor retinaculum.
- It terminates by dividing into two, superficial and deep branches.



ORIGIN

- Ulnar nerve originates from C8 and T1 roots of the brachial plexus.
- It also gets fibers of C7 from the lateral root of the median nerve.
- It runs along the medial or ulnar side.

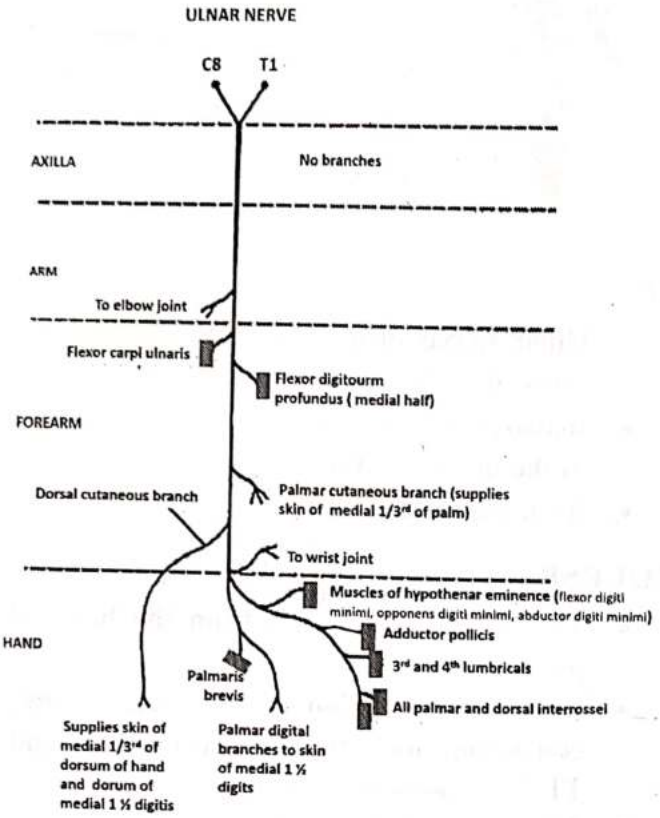
COURSE

- The ulnar nerve arises from the brachial plexus.
- It is a continuation of the medial cord, containing fibres from spinal roots C8 and T1.
- After arising from the brachial plexus, the ulnar nerve descends down the medial aspect of the upper arm.
- At the elbow, it passes posterior to the medial epicondyle of the humerus and gives rise to an articular branch that supplies the elbow joint.
- The ulnar nerve is palpable and vulnerable to injury at the medial epicondyle.
- In the forearm, the ulnar nerve pierces the two heads of the flexor carpi ulnaris, and travels deep to the muscle, alongside the ulna.

BRANCHES

Three main branches arise in the forearm:

- Muscular branch – It innervates two muscles in the anterior compartment of the forearm.
- Palmar cutaneous branch – It innervates the medial half of the palm.
- Dorsal cutaneous branch – It innervates the dorsal surface of the medial one and a half fingers and the associated dorsal hand area.



- At the wrist, the ulnar nerve travels superficially to the flexor retinaculum and medial to the ulnar artery.
- It enters the hand via the ulnar canal (Guyon's canal).
- In the hand, the nerve terminates by giving rise to superficial and deep branches.

FUNCTIONS

It performs both motor and sensory functions.

i. Motor Functions

The ulnar nerve innervates muscles in the anterior compartment of the forearm, and the hand.

In Anterior Forearm

- In the anterior forearm, the muscular branch of the ulnar nerve supplies two muscles:
- Flexor carpi ulnaris – It helps for flexion and adduction of the hand at the wrist joint.
- Flexor digitorum profundus (medial half) – It helps for flexion of the ring and little fingers at the distal interphalangeal joint.

MNEMONIC - Flex Cardiac tonic is medical digitalis

a. Flex for flexor group
b. Cardiac for carpi
c. Medical for medial half
d. Digitalis for digitorum

All the remaining muscles in the anterior forearm are innervated by the median nerve.

In Hand

The majority of the intrinsic hand muscles are innervated by the deep branch of the ulnar nerve:

- Hypothenar muscles (a group of muscles associated with the little finger)
- Medial two lumbricals
- Adductor pollicis
- Palmar and dorsal interossei of the hand
- Palmaris brevis

The other muscles in the hand (such as the thenar eminence) are innervated by the median nerve.

Sensory Functions

Sensory fibers of the ulnar nerve innervates the anterior and posterior surfaces of the medial one and half fingers and the associated palm area.

Applied Anatomy

Froment's Sign

It is a test for ulnar nerve palsy, especially paralysis of the adductor pollicis muscle. The patient is asked to hold a piece of paper between the thumb and index finger. The paper is pulled out and the patient is not able to hold the paper. Patient is not able to adduct the thumb instead he flexes it to maintain the hold on paper.

Q. 5 Musculocutaneous Nerve

Ans. INTRODUCTION

- It is terminal branch of the lateral cord of the brachial plexus.
- It is the motor nerve for muscles of anterior compartment of the arm and sensory nerve for the lateral aspect of the forearm.

ORIGIN

Musculocutaneous nerve originates from C5, C6 and C7 roots of the brachial plexus.

COURSE

- Musculocutaneous nerve originates from the lateral cord of the brachial plexus.
- It leaves the axilla and pierces the Coracobrachialis muscle near its point of insertion on the humerus.
- At this level the nerve gives branches to the Coracobrachialis muscle.
- Then the nerve passes down the flexor compartment of the upper arm.
- Here it remains superficial to Brachialis muscle and deep to biceps brachii.
- It innervates both these muscles.
- It also gives articular branches to the humerus and the elbow joint.
- The nerve then pierces the deep fascia lateral to biceps brachii to emerge, lateral to the biceps tendon and Brachioradialis.
- In the forearm, it continues as the lateral cutaneous nerve and provides sensory innervations to the lateral aspect of the forearm.

FUNCTIONS

It performs both motor and sensory functions.

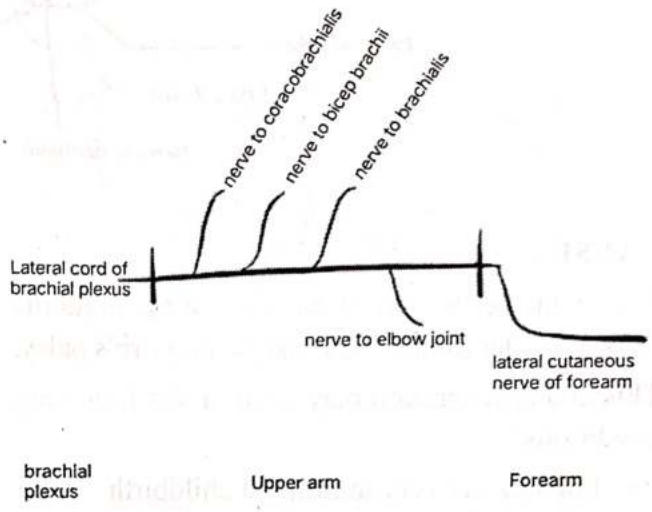
Motor Functions

It supplies three muscles in the anterior compartment of the arm. The Coracobrachialis, Brachioradialis and Biceps Brachii are three muscles supplied by this nerve.

MNEMONIC to remember is BBC

Sensory function

It is the sensory nerve for lateral aspect of the forearm. A branch of the lateral cutaneous nerve supplies the lateral aspect of the forearm.



Applied Anatomy

Injury to nerve

As the nerve is well protected within the axilla, injury is uncommon. The penetrating trauma to the axilla may injure the nerve. Injury leads to weak flexion of the shoulder and elbow joint. It also presents with loss of sensation at the lateral aspect of the forearm.

Q. 6 Erb's Paralysis / Erb-Duchenne Palsy

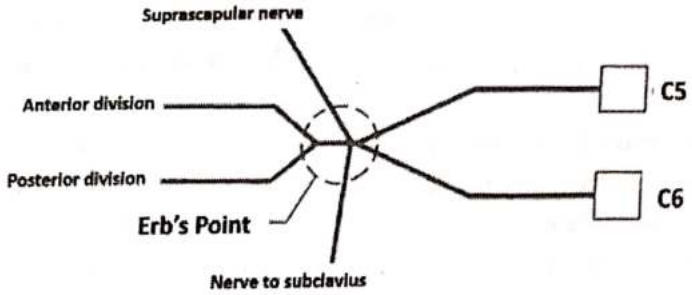
Ans. DEFINITION

It is the paralytic condition due to lesion at Erb's point.

Erb's Point

It is the region on the upper trunk of the brachial plexus where:

- There is union of two roots – ventral rami of C5and C6
- It divides into two divisions – anterior and posterior
- It provide origin to two nerves – Suprascapular and nerve to Subclavian
- Site of lesion – The Erb's point at the upper trunk of the brachial plexus.



CAUSE

The undue separation of the head of the humerus from shoulder joint is the cause behind Erb's palsy.

This undue separation may occur in the following conditions:

- Forceps delivery in difficult childbirth
- Fall on shoulder

Position of the Upper limb

- It appears like a policemen's or waiter taking tip .
- The arm is adducted and medially rotated.
- The forearm is extended and pronated.

Motor Loss

- The muscles paralyzed are Supraspinatus, Deltoid, Infraspinatus, Teres Minor, Brachialis, Brachioradialis, Biceps brachii and Supinator.
- The paralysis of Supraspinatus and deltoid results in loss of abduction of the arm
- Paralysis of Infraspinatus and teres minor muscles results in loss of lateral rotation of the arm.
- The paralysis of Biceps brachii, Brachialis, Brachioradialis results in loss of flexion of the forearm.
- Paralysis of biceps brachii and Supinator results in loss of supination of the forearm.

Sensory Loss

There is loss of sensations from the skin over the lower part of the Deltoid muscle.

UPPER LIMB NERVES TW TWENTY MARS QUESTIONS

Q. 1 The Median Nerve

Ans. DEFINITION

- Median nerve is a branch of the brachial plexus.
- It is a major peripheral nerve of the upper limb.
- It is closely related to the brachial artery throughout its course.
- It is the main nerve of the front of the forearm.
- It also supplies the muscles of thenar eminence.
- It controls coarse movements of the hand, as it supplies most of the long muscles of the front of the forearm. It is therefore called "labourer's nerve".

ORIGIN

- Median nerve originates from C5 – T1 roots of the brachial plexus.
- Lateral root of median nerve is from lateral cord (C5-C7) of the brachial plexus and medial root of median nerve is from medial cord (C8-T1) of the brachial plexus.
- These two roots units and give origin to median nerve.

COURSE

The median nerve starts in axilla, then enter the arm, passing through cubital fossa it enter in the forearm,

Axilla

Lateral and medial root of brachial plexus units to form median nerve in axilla.

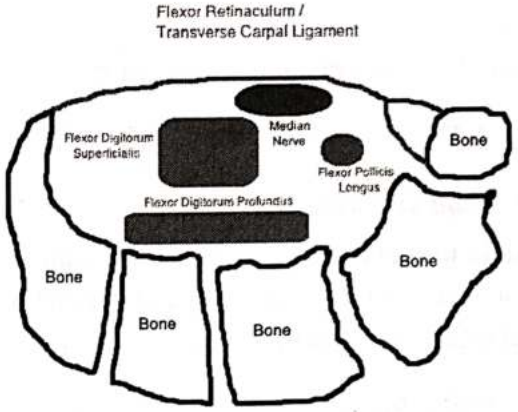
Arm

From the axilla the nerve descends down the arm.

Median nerve is closely related to the brachial artery throughout its course in the arm.

In the beginning it is lateral to the brachial artery then the nerve crosses over the brachial artery from lateral to medial and becomes situated medially.

The median nerve gives off a branch to the pronator teres muscle just above the elbow joint.it also gives a vascular branch to the brachial artery.



Cubital fossa

- The median nerve leaves the arm and enters the anterior compartment of the forearm via the cubital fossa.
- In the cubital fossa. it lies on the medial side.
- Here it gives three branches to the flexor muscles of forearm.
- It leaves the fossa by passing between two head of the pronator teres muscle.

Forearm

- The medial nerve passes between two heads of the pronator teres muscle and enters the forearm.
- It lies in the central position. In the forearm, the nerve travels between two flexor muscles, flexor digitorum profundus and flexor digitorum superficialis muscles.
- It leaves the muscle, flexor digitorum superficialis, along its lateral border.
- Then it is placed deep and lateral to the Palmaris longus muscle.
- In the forearm, it gives off two major branches.

Flexor retinaculum

- The median nerve enters the flexor retinaculum from the forearm.
- It lies deep to into the flexor retinaculum.

- From here it is to enter in the palm.

Palm

In the palm, it lies medial to the muscles of thenar eminence.

It ends with it end branches in the palm.

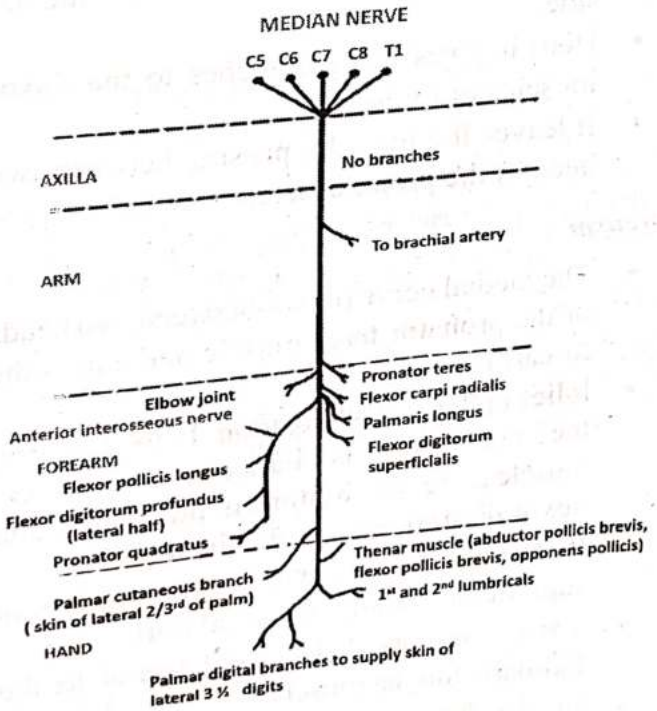
BRANCHES

i. In Axilla and arm

The median nerve gives a muscular branch for pronator teres muscle and a vascular branch for brachial artery in the arm.

ii. In cubital fossa

The median nerve gives three muscular branches for flexor carpi radialis, flexor digitorum superficialis and Palmaris longus muscles and one articular branch for the elbow joint.



iii. In the forearm

a. The median nerve gives anterior interosseous muscular branch for lateral half of flexor digitorumprofundus, pronator quadratus and flexor pollicis longus.

b. It also gives a cutaneous branch for the lateral two-third of the palm.

iv. In the palm

In palm it gives muscular branches for abductor pollicis brevis, flexor pollicis brevis, opponens pollicis and 1st and 2ndlumbricals.

It gives cutaneous branches for lateral and medial side of the thumb, lateral side of the index finger, adjacent sides of index and middle finger and adjacent sides of middle and ring finger.

It also gives articular and vascular branches to the joints of hand.

Anterior interosseous nerve

It supplies the deep muscles in the anterior forearm.

Palmar cutaneous nerve

It innervates the skin of the lateral palm.

Recurrent branch

It innervates the thenar muscles.

Palmar digital branch

It innervates the palmar surface and fingertips of the lateral three and half digits. Also innervates the lateral two lumbrical muscles.

FUNCTIONS

Median nerve performs motor and sensory functions.

Motor function

- It innervates the flexor and pronator muscles of the anterior compartment of the forearm.
- It supplies innervations to the thenar muscles and lateral two lumbricals

Sensory functions –

Median nerve gives palmar cutaneous branch, which innervates the lateral aspect of the palm and digital cutaneous branch which innervates the lateral three and half fingers on the anterior surface of hand.

Applied Anatomy

Carpal Tunnel Syndrome (CTS)

Compression of median nerve within the carpal tunnel leads to carpal tunnel syndrome.

Numbness, tingling and pain in the distribution of median nerve are the clinical features of carpal tunnel syndrome.

Remember

- Median nerve is closely related to the brachial artery throughout its course.
- It leaves the fossa by passing between two heads of pronator teres muscle.
- Both pronators are supplied by median nerve
- Median nerve hand innervation MNEMONIC sentence is "The LOAF muscles of hand"
- Root value of median nerve is FIVE MICE means C5, C6 C7, C8 and T1. Root value of median nerve is all fives roots of brachial plexus c5 c6 c7 c8 and T1

Q. 2 Describe in Detail the Brachial Plexus

Ans. INTRODUCTION

- The brachial plexus (plexus brachialis) is a somatic nerve plexus formed by inter-communications among the ventral rami (roots) of the lower 4 cervical nerves (C5-C8) and the first thoracic nerve (T1).
- The plexus is responsible for the motor innervations of all of the muscles of the upper extremity, with the exception of the trapezius and Levator scapula.

LOCATION

Brachial plexus is divided into two parts: supraclavicular and infraclavicular

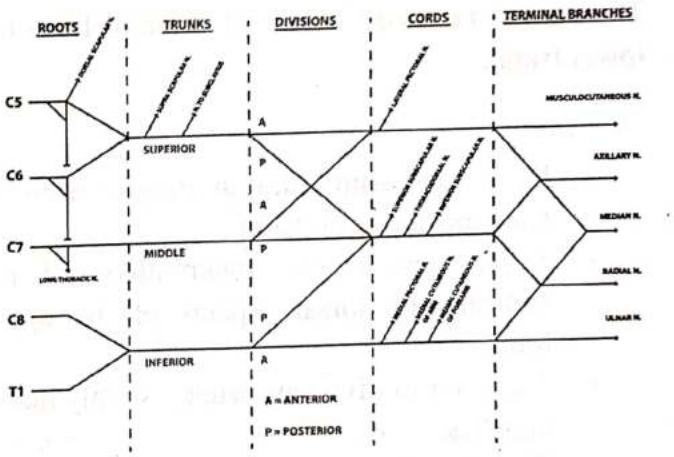
- Supraclavicular part – It lies in the posterior triangle of the neck. It comprises of roots and trunks of brachial plexus
- Infraclavicular part – It lies in the axilla. It comprises of cords of brachial plexus.

Brachial plexus architecture

- The brachial plexus is subdivided into roots, trunks, divisions, cords, and branches.
- Typically, the brachial plexus is composed of 5 roots, 3 trunks, 6 divisions, 3 cords, and terminal branches, as seen in the image below.

i. Roots

a. The ventral rami of spinal nerves C5 to T1 are referred to as the "roots" of the plexus. The typical spinal nerve root results from the confluence of the ventral nerve rootlets originating in the anterior horn cells of the spinal cord and the dorsal nerve rootlets that join the spinal ganglion in the region of the intervertebral foramen.



b. The roots emerge from the transverse processes of the cervical vertebrae immediately posterior to the vertebral artery and travel towards transverse foramina.

c. Roots give following branches

- *Dorsal scapular nerve (C5) and*
- *Long thoracic nerve (C5, C6, C7)*

ii. Trunks

a. Shortly after emerging from the intervertebral foramina, the 5 roots (C5-T1) unite to form 3 trunks.

b. The trunks of the brachial plexus pass between the anterior and middle scalene muscles.

Upper Trunk.

- The ventral rami of C5 and C6 unite to form the upper trunk.
- Upper trunk gives suprascapular nerve and the nerve to the Subclavius
- The suprascapular nerve contributes sensory fibers to the shoulder joint and provides motor innervations to the Supraspinatus and Infraspinatus muscles.
- The nerve to Subclavius is especially for Subclavius muscle of the pectoral region.

Middle Trunk

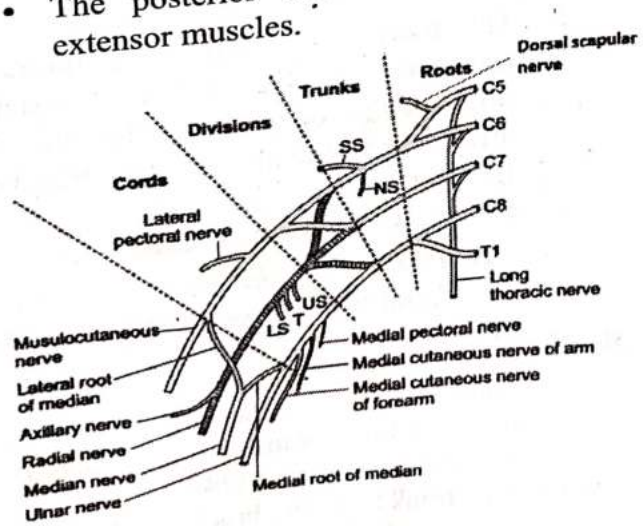
The ventral ramus of C7 continues as the middle trunk.

Lower Trunk

The ventral rami of C8 and T1 unite to form the lower trunk.

Divisions

- Each trunk splits into an anterior division and a posterior division.
- These separate the innervations of the ventral and dorsal aspects of the upper limb.
- The anterior divisions usually supply flexor muscles.
- The posterior divisions usually supply extensor muscles.



Cords

- The cords are referred to as the lateral, posterior, and medial cord, according to their relationship with the axillary artery, as seen in the image below.
- The cords pass over the first rib close to the dome of the lung and continue under the clavicle immediately posterior to the subclavian artery.

a. Lateral Cord

The anterior divisions of the upper and middle trunks unite to form the lateral cord.

It gives origin to the lateral pectoral nerve (C5, C6, and C7).

b. Medial Cord

- The anterior division of the lower trunk forms the medial cord.
- The medial cord gives off following nerves
- Medial pectoral nerve (C8, T1),
- The medial cutaneous nerve of forearm (T1), and
- The medial cutaneous nerve of arm (C8, T1)

c. Posterior Cord

- The posterior divisions from each of the 3 trunks unite to form the posterior cord.
- The posterior cord gives the following nerves:
- The upper and lower subscapular nerves (C7, C8 and C5, C6, respectively) - These nerves leave the posterior cord and descend behind the axillary artery to supply the Subscapularis and teres major muscles.
- The nerve to the latissimus dorsi (also known as the middle subscapular nerve, C6, C7, C8) - Which supply the latissimus dorsi also arises from the posterior cord.

i. Musculocutaneous nerve branch

a. The musculocutaneous nerve is a mixed nerve containing sensory and motor axons.

b. It is derived from the lateral cord.

c. It leaves the brachial plexus sheath high in

the axilla at the level of the lower border of the teres major muscle and passes into the Coracobrachialis muscle.

d. It innervates the muscles in the flexor compartment of the arm and carries sensation from the lateral (radial) side of the forearm.

ii. Ulnar nerve branch

a. The ulnar nerve is derived from the medial cord.

b. Motor innervations are mainly to intrinsic muscles of the hand.

c. Sensory innervations are to the medial (ulnar) 1.5 digits (little finger, half of the ring finger).

iii. Median nerve branch

a. The median nerve is derived from the lateral and medial cords.

b. Motor innervations are to most flexor muscles in the forearm and intrinsic muscles of the thumb (thenar muscles).

c. Sensory innervations are to the lateral (radial) 3.5 digits (thumb, index and middle fingers, half of the ring finger).

iv. Axillary nerve branch

a. The axillary nerve is derived from the posterior cord.

b. The axillary nerve leaves the brachial plexus at the lower border of the Subscapularis muscle and continues along the inferior and posterior surface of the axillary artery as the radial nerve.

c. The axillary nerve serves as motor innervations to the deltoid and teres minor muscles, as seen in the image below. These act at the glenohumeral joint.

d. Sensory innervation is from the skin just below the point of the shoulder.

e. The axillary nerve continues as the superior lateral brachial cutaneous nerve of the arm.

v. Radial nerve branch

a. The radial nerve is also derived from the posterior cord.

b. It continues along the posterior and inferior surface of the axillary artery.

c. It innervates the extensor muscles of the elbow, wrist, and fingers, as seen in the image above.

d. Sensory innervation is from the skin on the dorsum of the hand on the radial side.

e. Blood Supply of the Brachial Plexus

f. The blood supply of the brachial plexus is based largely on the subclavian (which becomes the axillary) artery and its branches, and variations exist.

g. Generally, the vessels involved are the vertebral, the ascending and deep cervical, and the superior intercostal arteries.

h. The cord and rootlets of the cervical nerves are supplied by the anterior and posterior spinal branches of the vertebral artery.

i. The trunks of the plexus are supplied by muscular branches of the ascending and deep cervical arteries and superior intercostals, and occasionally by the subclavian itself.

Applied Anatomy

Nerve injuries vary in severity from a mild stretch to the nerve root tearing away from the spinal cord and include the following:

Avulsion

The nerve is torn away from its attachment at the spinal cord; this is the most severe type of injury

Rupture

The nerve is torn, but not at the spinal cord attachment

Neuroma

Scar tissue has grown around the injury site, putting pressure on the injured nerve and preventing the nerve from sending signals to the muscles

Neurapraxia

The nerve has been stretched and damaged but

not torn.

The brachial plexus injuries lead to

Erb's palsy,

Klumpke's palsy,

Thoracic outlet syndrome,

Burner syndrome, and

Parsonage- Turner syndrome

Q. 3 Describe in Detail the Ulnar Nerve

Ans. INTRODUCTION

- Ulnar nerve is a branch of brachial plexus.
- It is known as the musician's nerve.
- It is the main nerve of the hand.
- It runs medial to brachial artery up to the level of insertion of the Coracobrachialis muscle.
- Then it pierces the medial Intermuscular septum and enters the posterior compartment of the arm.
- At the wrist, it lies superficial to flexor retinaculum.
- Like radial nerve, it is also terminate by dividing into two, superficial and deep branches.

ORIGIN

- Ulnar nerve originates from C8 and T1 roots of brachial plexus.
- It also gets fibers of C7 from the lateral root of median nerve.
- Posterior divisions of the lower trunk form the medial cord.
- This medial cord gives origin to ulnar nerves.
- It runs along the medial or ulnar side.

COURSE

i. In arm

a. After formation from the medial cord of brachial plexus, it enters the arm.

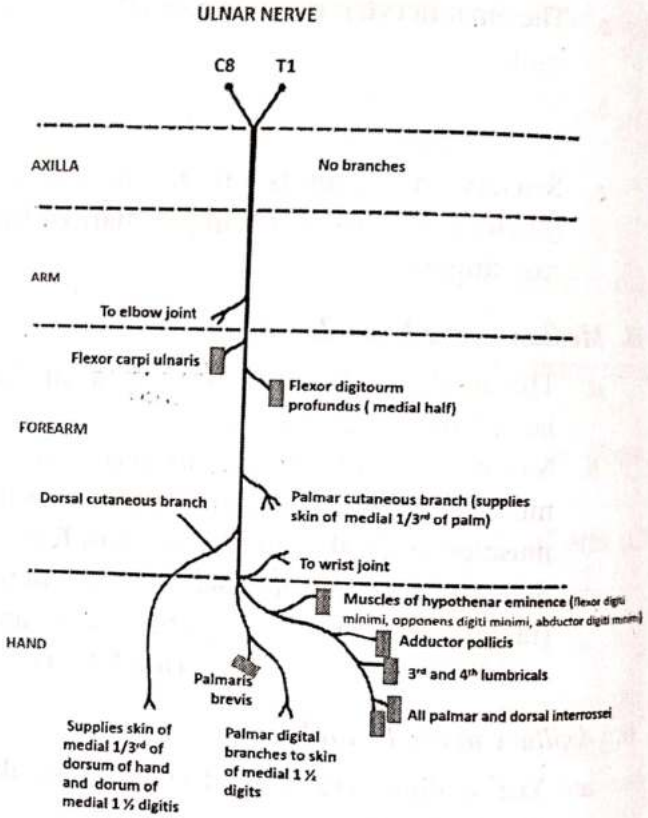
b. It runs on the medial side of the brachial artery up to the level of insertion of the Coracobrachialis muscle.

c. Then it pierces the medial Intermuscular septum and enters the posterior compartment of the arm.

d. Here it is accompanied by ulnar collateral vessels.

e. The ulnar nerve arises from the brachial plexus.

f. The ulnar nerve gives no branches in the arm.



ii. At elbow and forearm

a. At the elbow, it lies behind the medial epicondyle of the humerus.

b. It passes between the two heads of flexor carpi ulnaris to enter the forearm.

c. In the forearm it runs between the flexor digitorum profundus medially and the flexor digitorum superficialis laterally.

e. It gives muscular branch for medial half of flexor digitorum profundus and flexor carpi ulnaris.

f. It gives cutaneous branches, dorsal cutaneous for the medial half of dorsum of the hand, palmar cutaneous for medial one-third of palm.

iii. At wrist

a. At the wrist, the ulnar neurovascular bundle lies between the flexor carpi ulnaris and the flexor digitorum superficialis muscles.

b. The bundle enters the palm by passing superficial to the flexor retinaculum.

iv. In palm

a. In the palm, the nerve divides into superficial and deep terminal branches.

b. The superficial terminal branch supplies the Palmaris brevis muscle and divides into two digital branches for the medial one and a half fingers.

c. The deep terminal branch runs with the deep branch of the ulnar artery.

d. It passes backward between the abductor and flexor digitiminimi muscles.

e. Then again it passes between opponens digiti and fifth metacarpal bone.

f. It ends by supplying the adductor pollicis muscle.

BRANCHES

Three main branches arise in the forearm:

a. Muscular branch– It innervates two muscles in the anterior compartment of the forearm.

b. Palmar cutaneous branch – It innervates the medial half of the palm.

c. Dorsal cutaneous branch – It innervates the dorsal surface of the medial one and a half fingers and the associated dorsal hand area.

- At the wrist, the ulnar nerve travels superficially to the flexor retinaculum and medial to the ulnar artery.
- It enters the hand via the ulnar canal (Guyon's canal).
- In the hand, the nerve terminates by giving rise to superficial and deep branches.

FUNCTIONS

It performs both motor and sensory functions.

Motor Functions

The ulnar nerve innervates muscles in the anterior compartment of the forearm, and the hand.

In Anterior Forearm

- In the anterior forearm, the muscular branch of the ulnar nerve supplies two muscles:
- Flexor carpi ulnaris – It helps for flexion and adduction of the hand at the wrist joint.
- Flexor digitorum profundus (medial half) – It helps for flexion of the ring and little fingers at the distal interphalangeal joint.

MNEMONIC - Flex Cardiac tonic is medical digitalis

- Flex for flexor group
- Cardiac for carpi
- Medical for medial half
- Digitalis for digitorum

All the remaining muscles in the anterior forearm are innervated by the median nerve.

In Hand

a. The majority of the intrinsic hand muscles are innervated by the deep branch of the ulnar nerve:

b. Hypothenar muscles (a group of muscles associated with the little finger)

- Medial two lumbricals
- Adductor pollicis
- Palmar and dorsal interossei of the hand
- Palmaris brevis
  - The other muscles in the hand (such as the thenar eminence) are innervated by the median nerve.
  - Sensory Functions
  - Sensory fibers of the ulnar nerve innervates the anterior and posterior surfaces of the medial one and a half fingers and the associated palm area.

Applied Anatomy

Froment's Sign

It is a test for ulnar nerve palsy, especially paralysis of the adductor pollicis muscle. The patient is asked

to hold a piece of paper between the thumb and index finger. The paper is pulled out and the patient is not able to hold the paper. The patient is not able to adduct the thumb instead he flexes it to maintain the hold on paper.

Q. 3 Describe in Detail the Radial Nerve

Ans. INTRODUCTION

- Radial nerve is the thickest branch of the brachial plexus.
- It is also known as musculospiral nerve.
- It is a major peripheral nerve of the upper limb.
- At the beginning of the brachial artery, it lies posterior to the artery.
- Then it leaves the artery by entering in the radial groove.
- In the radial groove, it is accompanied by a branch of the brachial artery, the Profundabrachii artery.
- In the arm it appears again on the front side, lies between brachialis and Brachioradialis and extensor carpi radialis longus muscles.
- It descends across the lateral epicondyle into the cubital fossa.
- In the cubital fossa, it terminates into superficial and deep branch just below the level of lateral epicondyle.

ORIGIN

- Radial nerve originates from C5-C8 and T1 roots of the brachial plexus.
- Posterior divisions of all three trunks form the posterior cord.
- This posterior cord gives origin to radial and axillary nerves.

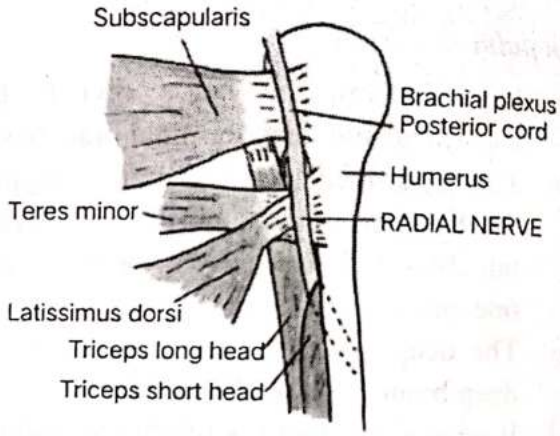
COURSE

- Radial nerve is a continuation of the brachial plexus.
- It arises in the axilla, and then it enters the arm, then after passing through the cubital fossa it enters in the forearm.

In axilla

- The nerve arises from posterior cord of the brachial plexus in the axilla region.
- It is situated posterior to the axillary artery.
- During its exit, it gives branches to the long and lateral heads of triceps brachii.
- Also it gives posterior cutaneous nerve.

It leaves the axilla and enters the arm.



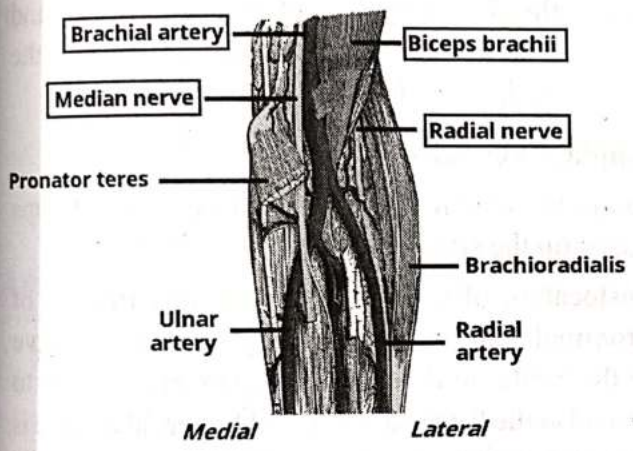
Arm

- In the arm, the radial nerve has a spiral course.
- At the beginning, it remains posterior to the brachial artery.
- Then it leaves the artery by entering the radial groove.
- In the radial groove, it is accompanied by a branch of the brachial artery, the Profundabrachii artery.
- Then in the lower part, it appears again on the front side of the arm, lies between brachialis; and Brachioradialis and extensor carpi radialis longus muscles.
- Then it reaches the capitulum of humerus.
- In the radial groove, it gives muscular branches to the lateral and medial head of triceps brachii and anconeus muscles and cutaneous branch; posterior cutaneous nerve of forearm and lower lateral nerve of the arm. It also gives a vascular branch to Profunda brachii artery.
- At the lateral side of the arm it gives muscular branches to Brachioradialis, extensor carpi radialis longus and lateral part of brachialis muscles It also gives terminal branches, superficial and deep

interosseous branches.

In cubital fossa

- The nerve enters the lateral side of cubital fossa.
- Here it terminates into superficial and deep divisions.
- The deep division gives nerve to extensor carpi radialis brevis and Supinator muscles.
- Then it passes between two heads of Supinator muscle to enter the back of the forearm.



- The superficial division gives cutaneous branches for the lateral side of the forearm and vascular branch for the radial vessels.
- The superficial division leaves the fossa to enter the lateral side of the front of the forearm.

In forearm

- The superficial division reaches the lateral side of the forearm.
- At the junction of the upper two-third and lower one-third the superficial division turns laterally to reach the posterolateral aspect of the forearm.
- The deep division of radial nerve enters the back of the forearm.
- It descends up to the extensor retinaculum.
- The deep division gives muscular branches for abductor pollicis longus, extensor pollicis brevis, extensor pollicis longus, extensor digitorum, extensor indicis, extensor digiti minimi and extensor carpi ulnaris muscles.

Wrist and dorsum of hand

- The superficial division descends till the anatomical snuff box to reach dorsum of the hand.
- The superficial division suppliesthe skin of the lateral half of the dorsum of hand and lateral two and a half digits.
- The deep division passes through the extensor retinaculum and reaches the back of the wrist.
- The deep division supplies the neighboring joints.

  MNEMONIC –Muscular branches of deep division
- Arun Pundalik Lad (APL) and Eknath Pundalik Lad (EPL) are close friends of EknathPundalik Band (EPB).
- Ekta Deshmukh (ED) and EktaImandar (EI) are intimate friends of EktaChaburaoUbale (ECU) and Ekta Dambar Mane (EDM) .
- From first sentence
- APL for abductor pollicis longus
- EPL for extensor pollicis longus
- EPB for extensor pollicis brevis
- From second sentence
- ED for extensor digitorum
- EI for extensor indicis
- ECU for extensor carpi ulnaris and
- EDM extensor digiti minimi

BRANCHES

Deep Branch

It is a motor branch, innervates the muscles in the posterior compartment of the forearm.

Superficial Branch

It is a sensory branch. It contributes to the cutaneous innervations of the dorsal hand and fingers.

Functions

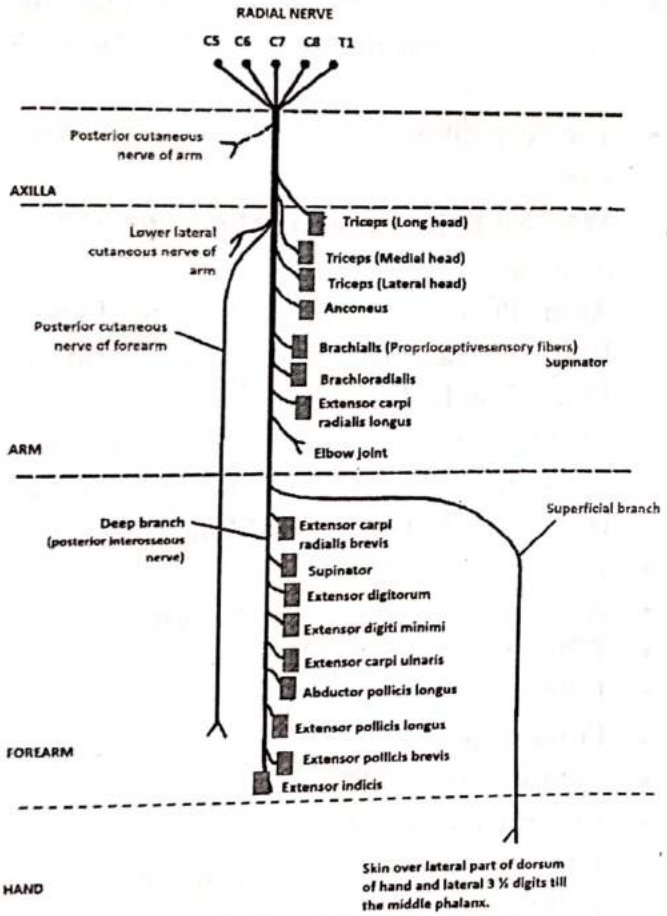
Radial nerve performs motor and sensory functions.

Motor function

Radial nerve innervates the muscles located in the posterior arm and posterior forearm. It innervates the triceps brachii and extensor muscles in the forearm.

Sensory functions

Radial nerve innervates most of the skin of the posterior side of the forearm the dorsal surface of the lateral side of the palm and the dorsal surface of the lateral three and half digits.



There are four branches of the radial nerve. Three branches arise in the upper arm and one in the forearm.

- Lower lateral cutaneous nerve of the arm – It innervates the lateral aspect of the arm, inferior to the insertion of deltoid muscle.
- Posterior cutaneous nerve of the arm – It innervates the posterior surface of the arm.
- Posterior cutaneous nerve of the forearm – It innervates a strip of skin down the middle of the posterior forearm.
- Superficial branch – It is the terminal division of the radial nerve. It innervates the dorsal surface of the lateral three and a half digits and the associated area on the back of the hand.

Applied Anatomy

Injury to radial nerve is categorized in four groups based on the site of injury.

Dislocation of the shoulder joint and fracture of proximal humerus can damage the radial nerve in the axilla. In this condition patient is unable to extend at the forearm, wrist and fingers also there is loss of sensation over the lateral and posterior arm, posterior forearm and dorsal surface of the lateral three and a half digits.

7

Upper Limb Blood Vessels

UPPER LIMB BLOOD VESSELS TWO MARKS QUESTIONS

Q. 1 Any two branches of brachial artery MNEMONIC is I Am Pretty Smart and collateral

I stand for inferior, A stands for anterior, P stands for posterior and S stands for Superior. All are collaterals.

Ans. Following are the branches of the brachial artery:

a. Inferior ulnar collateral artery goes with
b. Anterior ulnar collateral artery
c. Posterior collateral ulnar artery goes with
d. Superior ulnar collateral artery

Q. 2 Any four branches of ulnar artery

Ans. Following are the branches of the ulnar artery:

a. Anterior ulnar recurrent artery
b. Posterior ulnar recurrent artery
c. Common interosseous artery including anterior and posterior interosseous arteries
d. Muscular branches for the medial muscles of forearm
e. Palmar and dorsal carpal branches

Q. 3 Name any two branches of Axillary artery
MNEMONIC – LASPAS

a. L for Lateral thoracic artery
b. A for Acromiothoracic artery
c. S for Superior thoracic artery
d. P for Posterior circumflex humeral artery
e. A for Anterior circumflex humeral artery
f. S for Subscapular artery

Ans. Axillary artery gives following branches:

a. Lateral thoracic artery
b. Acromiothoracic artery
c. Superior thoracic artery
d. Posterior circumflex humeral artery
e. Anterior circumflex humeral artery
f. Subscapular artery

Q. 4 Two branches of Profundabrachii artery

Ans. Profundabrachii artery is a large posteromedial branch of the brachial artery. It divides into following two branches:

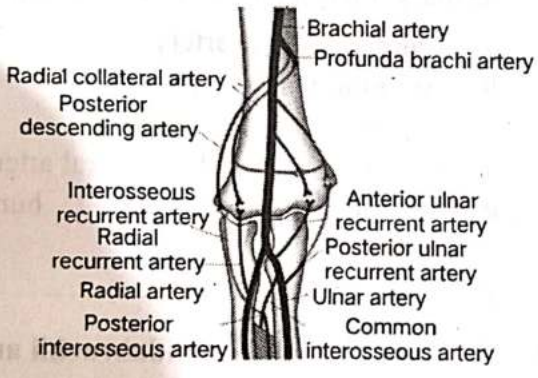
a. Middle Collateral artery it is also known as the posterior descending artery and
b. Radial Collateral artery it is also known as the anterior descending artery

UPPER LIMB BLOOD VESSELS FIVE MARKS QUESTIONS

Q. 1 Anastomoses Around Elbow Joint

Ans. Introduction

- The Brachial artery gives Profundabrachii artery, Superior ulnar collateral artery, and Inferior ulnar collateral artery in the arm and two terminal arteries radial and ulnar near the elbow joint.
- The Profundabrachii artery also known as the deep brachial artery is the largest branch of the brachial artery at the posteromedial aspect of the arm.
- The Profundabrachii artery lies in the radial or spiral groove with the radial nerve.
- The ProfundaBrachii artery gives anterior and posterior descending branches.
- The anterior descending branch is also known as radial collateral whereas the posterior descending branch is known as middle collateral.



- In the same way the ulnar artery in the forearm gives a large branch known as Common interosseous artery and ulnar recurrent arteries.
- This common interosseous artery again gives anterior and posterior interosseous branches. The posterior interosseous artery gives interosseous recurrent branch.
- The ulnar recurrent arteries are anterior ulnar and posterior ulnar recurrent arteries.
- The radial artery in the forearm gives radial recurrent for anastomoses.
- Two branches from brachial artery, Inferior ulnar collateral artery and superior ulnar collateral artery, two branches from Profundabrachii, anterior descending branch, posterior descending, one branch each from radial, radial recurrent artery and three branches from the ulnar artery, interosseous recurrent branch of Posterior interosseous, anterior ulnar recurrent and posterior ulnar recurrent are taking part in the formation of Anastomoses.

Definition

- The anastomoses at the elbow joint are the linking of the brachial artery with the upper ends of radial and ulnar arteries.
- The main purpose of anastomoses is to supply the ligaments and bones of the elbow joint.

Sub divisions of anastomoses

The Anastomoses can be divided into four subdivisions:

In front of the lateral epicondyle

In front of the lateral epicondyle of humerus, the anterior descending branch of Profunda brachii artery anastomoses with radial recurrent branch of the radial artery.

Behind the lateral epicondyle

Behind the lateral epicondyle of the humerus, the posterior descending branch of Profundabrachii artery anastomoses with the interosseous recurrent branch of the posterior interosseous artery

In front of medial epicondyle

In front of the medial epicondyle of the humerus, the inferior ulnar collateral branch of the brachial artery anastomoses with the anterior ulnar recurrent branch of the ulnar artery.

Behind the medial epicondyle

Behind the medial epicondyle of humerus, the superior ulnar collateral branch of the brachial artery anastomoses with the posterior ulnar recurrent branch of the ulnar artery.

Collateral means descending arteries and recurrent means ascending arteries

UPPER LIMB BLOOD VESSELS TWENTY MARKS QUESTIONS

Q. 1 Axillary Artery

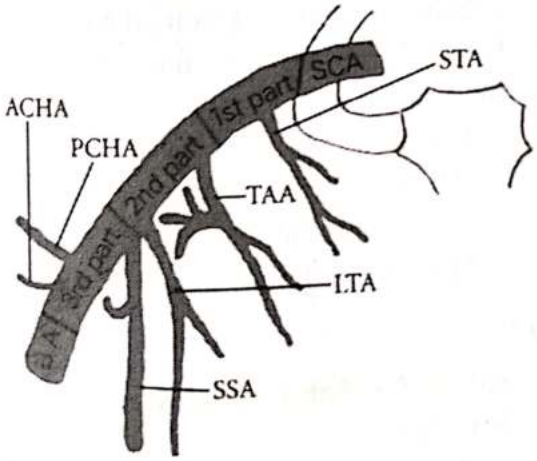
Ans. INTRODUCTION

- It is the continuation of the subclavian artery, in axilla it is renamed the axillary artery once it passes the lateral border of the first rib.
- It extends from outer border of the first rib to the lower border of teres major muscle. After that it continue as brachial artery.
- The Pectoralis minor muscle crosses the artery and divides it into three parts.
  - First part, superior to Pectoralis minor
  - Second part, posterior to Pectoralis minor and
  - Third part, inferior to Pectoralis minor.

RELATIONS OF AXILLARY ARTERY

- Each part of the axillary artery has anterior, posterior, medial and lateral relations.
- Anterior relations of all three parts skin, superficial fascia, and deep fascia are common.

Parts and branches of Axillary artery



- Medially axillary vein is common for all three parts.
- Muscles are related to posterior and lateral parts of the axillary artery.

Relations of First part

Anterior

Anteriorly the first part is related to one muscle, one artery, one vein and two nerves. The relations are as follows:

- Skin
- Superficial fascia
- Deep Fascia
- Clavicular part of Pectoralis Major Muscle
- Supraclavicular, lateral pectoral nerves
- Thoracoacromial artery and cephalic vein

Posterior

Posteriorly the first part is related to one major muscle, one cord of brachial plexus and two nerves. The relations are as follows:

- First intercostal space
- External intercostal muscle
- First two digitations of serratus anterior muscle
- Medial cord of brachial plexus
- The nerve to serratus anterior muscle
- Medial pectoral nerve

Lateral

Laterally the first part is related to:

- Lateral cord of brachial plexus and
- Posterior cord of brachial plexus

Medial

First part is medially related to the axillary vein.

Relations of Second part

Anterior

Anteriorly the second part is related to:

- Skin
- Superficial fascia
- Deep Fascia
- Pectoralis Major Muscle
- Pectoralis Minor Muscle

Posterior

Posteriorly the second part is related to:

- Posterior cord of brachial plexus
- Subscapularis muscle

Lateral

Laterally the second part is related to:

- Lateral cord of brachial plexus and
- Coracobrachialis muscle

Medial

The second part is medially related to:

- Medial cord of brachial plexus
- Medial pectoral nerve and
- Axillary vein

Relations of Third part

Anterior

Anteriorly the third part is related to:

- Skin
- Superficial fascia
- Deep Fascia
- Pectoralis Major Muscle and
- Medial root of median nerve at the upper part

Posterior

Posteriorly the third part is related to:

- Radial nerve
- Axillary nerve
- Subscapularis muscle
- Tendon of latissimus dorsi and the teres major muscle

Lateral

Laterally the third part is related to:

- Coracobrachialis muscle
- Musculocutaneous nerve
- Lateral root of median nerve and
- Trunk of median nerve

Medial

Medially the third part is related to:

- Axillary vein
- Medial cutaneous nerve of forearm
- Medial cutaneous nerve of arm and
- Ulnar nerve

Branches of Axillary Artery

MNEMONIC for branches of axillary artery:

Supriya, Lata and Sabita are three sisters. Supriya is intelligent teacher. She motivated and expertise Lata for teaching. Now Supriya and Lata are teaching using Cool PAD to Sabita the subjects Communication, technology, arts and politics. It is the perfect story to memorize the branches of axillary artery.

From above story takes the following words.

- Supriya is already intelligent. So Supriya for the branches from first part of the axillary artery.
- She motivated Lata and Teaches used Cool PAD. So Lata, Teaches and Cool PAD are for the branches from second part of the axillary artery
- Both are teaching Sabita, the subjects Communication, technology, arts and politics. So Sabita, Communication, technology, arts and politics are for the branches from third part of the axillary artery.

It can be summarized as:

First part

Supriya for Superior thoracic artery,

Second Part

- Lata for Lateral thoracic artery
- Teaches for thoracoacromial artery
- Cool PAD – for four branches of thoracoacromial artery
  - Cool for Clavicular branch,
  - P for pectoral branch,
  - A for Acromial branch and
  - D for deltoid branch,

Third Part

- Sabita for Subscapular artery gives two branches
  - Communication for circumflex scapular artery and
  - Technology for Thoracodorsal artery
- Arts for anterior circumflex artery
- politics for posterior circumflex artery

The axillary artery supplies the upper limb and is divided into three parts: the region proximal

to Pectoralis minor, the region beneath it, and the region distal to it.

First Part

The first section gives rise to the superior thoracic artery, which supplies the first and second intercostal spaces.

Second Part

The second part gives rise to the lateral thoracic artery and the thoracoacromial artery.

The thoracoacromial artery has four branches:

- Pectoral branch,
- Acromial branch,
- Clavicular branch, and
- Deltoid branch

The pectoral branch supplies the pectoral muscles

The Acromial branch supplies the deltoid

The Clavicular branch supplies the Subclavius and the sternoclavicular joint.

The deltoid branch runs in the deltopectoral groove and supplies the deltoid and Pectoralis major muscles.

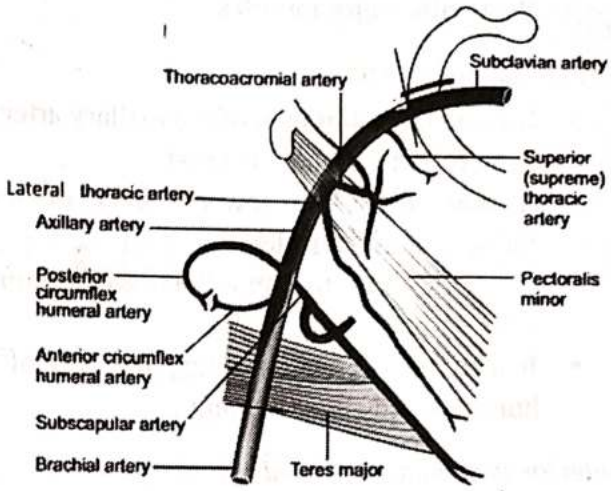
Third Part

The third part gives rise to

- The subscapular artery,
- The anterior circumflex humeral artery, and
- The posterior circumflex humeral arteries
  - The subscapular artery supplies the Latissimus dorsi and Serratus anterior muscles.
  - It also supplies the surrounding muscles of humerus and shoulder joint.
  - The anterior and posterior circumflex humeral arteries supply the muscles near the surgical neck of the humerus.

Superior thoracic artery

- It is very small branch that arises from the first part of the axillary artery.
- It runs downwards, forwards and medially.
- It passes between Pectoralis major and minor.



- It supplies Thoracic wall, Pectoralis major and Pectoralis minor muscles.

Lateral thoracic artery

- It is a branch of the second part of the axillary artery.
- It runs in close relation with the anterior group of axillary lymph nodes.
- It supplies lateral structures of thorax and breast.

Thoracoacromial artery

It is a branch of the second part of the axillary artery.

The thoracoacromial artery gives rise to four branches:

- Pectoral branch,
- Acromial branch,
- Clavicular branch, and
- Deltoid branch

The pectoral branch passes between the pectoral muscles and supplies the pectoral muscles as well as the breast.

- The Acromial branch crosses the coracoid process and ends with joining anastomoses over the acromion. It supplies the deltoid muscle.
- The Clavicular branch runs superomedially, deep to the Pectoralis major. It supplies the Subclavius and the sternoclavicular joint.
- The deltoid branch runs in the deltopectoral

groove and supplies the deltoid and Pectoralis major muscles.

The subscapular artery

- It is the largest branch of the axillary artery that arises from the third part.
- It runs along the lower border of the Subscapularis muscle.
- It supplies the Latissimus dorsi and Serratus anterior muscles.
- It also supplies surrounding muscles of , humerus and shoulder joint

Anterior circumflex humeral artery

- It is a small branch of the third part of the axillary artery.
- It arises at the lower border of the Subscapularis muscle.
- It anastomoses with posterior circumflex artery, to form arterial circle at surgical neck of the humerus.
- It supplies the head of humerus, glenohumeral joint, Teres major and teres minor muscles and deltoid muscle.

Posterior circumflex humeral artery

- It is a large branch of the third part of axillary artery.
- It also arises at the lower border of the Subscapularis muscle.
- It passes through quadrangular Intermuscular space.
- It ends by anastomoses with anterior circumflex artery, to form arterial circle at surgical neck of the humerus
- It supplies the glenohumeral joint, muscles bounding the quadrangular Space and deltoid muscle.

Applied Anatomy

Axillary artery pulsations can be felt against the lower part of the lateral wall of the axilla.

In case of bleeding from distal part of the upper limb, the artery can be effectively compressed against the humerus in the lower part of the lateral wall of the axilla, which helps to keep the bleeding in check.

8

Upper Limb Joints

UPPER LIMB JOINTSTWO MARKS QUESTIONS

Q. 1 Actions of wrist joint

Ans. The wrist joint has the following movements:

a. Flexion
b. Extension
c. Abduction or Radial deviation
d. Adduction or ulnar deviation
e. Circumduction

Q. 2 Actions of elbow joint

Ans. Elbow joint has following two movements

Flexion – It is brought by 3 B

a. Brachialis
b. Biceps brachii and
c. Brachioradialis

Extension – It is brought by AT

a. Anconeus and
b. Triceps brachii

Q. 3 Names any four carpel bones

MNEMONIC – She Looks Too Pretty Try To Catch Her

a. **S** for Scaphoid
b. **L** for Lunate
c. **T** for Triquetrum
d. **P** for Pisiform
e. **T** for Trapezium
f. **T** for Trapezoid
g. **C** for Capitate and
h. **H** for Hamate

Ans. There are eight carpal bones. They are as follows:

a. Scaphoid
b. Lunate
c. Triquetrum
d. Pisiform
e. Trapezium
f. Trapezoid
g. Capitate and
h. Hamate

Q. 4 Muscles of shoulder region

Ans. Shoulder region is covered by the following muscles:

Rotator cuff group of four muscles includes

a. Supraspinatus
b. Infraspinatus
c. Subscapularis and
d. Teres minor

Group of muscles surrounding the rotator cuff includes

a. Deltoid
b. Coracobrachialis
c. Serratus anterior
d. Pectoralis major
e. Pectoralis Minor

Q. 5 Muscles attached to inferior angle of scapula

Ans. The inferior angle is covered by latissimus dorsi muscle, and the last few digitations of serratus anterior are taking origin from coastal aspect of the inferior angle of scapula.

Q. 6 Name of muscles responsible for abduction of wrist

Ans. Abduction means bringing the joint towards the outer side or towards the radial side. It is also known as radial deviation.

Following muscles are responsible for abduction of wrist:

a. Flexor carpi radialis
b. Extensor carpi radialislongus
c. Extensor carpi radialisbravis
d. Abductor pollicislongus and
e. Extensor Pollicis brevis

Q. 7 Name of muscles responsible for flexion of wrist

Ans. Following muscles are responsible for flexion of the wrist joint:

a. Flexor carpi radialis
b. Palmaris longus
c. Flexor carpi ulnaris and

Q. 8 Name of muscles responsible for extension of wrist

Ans. Following muscles are responsible for extension of the wrist joint

a. Extensor carpi radialislongus
b. Extensor carpi radialis brevis
c. Extensor carpi ulnaris

Q. 9 Name of muscles responsible for adduction of wrist

Ans. Adduction means bringing the joint towards the body or towards the ulnar side. It is also known as ulnar deviation.

Following muscles are responsible for adduction of wrist:

a. Flexor carpi ulnaris and
b. Extensor carpi ulnaris

Q. 10 Any two muscles responsible for flexion of elbow joint

MNEMONIC – Three B bend the elbow. These three B are:

a. Brachialis,
b. Biceps and
c. Brachioradialis

Ans. The muscles that flex the elbow joint are:

a. Brachialis,
b. Biceps and
c. Brachioradialis

Q. 11 Muscles attached to supraglenoid and infraglenoid tubercles of scapula

Ans. Following are the muscles attached to the glenoid tubercles of scapula:

a. Long head of biceps brachii at attached to supraglenoid tubercle and
b. Long head of triceps is attached to infraglenoid tubercle

Q. 12 Any two wrist extensor muscles

MNEMONIC – Apply rule of 3 i.e. 3 extensors, two for radial side and one for ulnar side and all are carpi.

Ans. The extensor muscles of wrist are:

a. Extensor carpi radialisbravis,
b. Extensor carpi radialislongus and
c. Extensor carpi ulnaris

Q. 13 Any two extensor muscles for fingers

(Apply rule of 3 i.e. 3 extensors)

Ans. The extensor muscles for fingers are:

a. Extensor digitorum (for all four fingers)
b. Extensor indicis (for index finger) and
c. Extensor digitiminimi (for little finger)

Q. 14 Extensor muscles of thumb

(Apply the rule of 3, they are three Pollicis out of which two extensors and one abductor)

Ans. The extensor muscles for thumb are:

a. Extensor Pollicislongus
b. Extensor Pollicis brevis
c. Abductor Pollicislongus

MUSCLES OF SHOULDER JOINT – A story of cricket; it was a tough match between India and Pakistan. On the last ball of Pravin Banger, Pakistan Cricket Board give tip to umpire in front of pretty tall lady, irritated Pravin eat tomato as he loves it. It is best story to remember the Medial rotator, lateral

rotator, flexor, and extensor and adductor muscles of shoulder joint.

Q. 15 Any two muscles for flexion of shoulder joint

MNEMONIC – Pakistan Cricket BoArD

a. P for Pectoralis Major
b. C for Coracobrachialis
c. B for Biceps and
d. AD for Anterior Deltoid

Ans. Following four muscles are flexors of the shoulder joint:

a. Pectoralis Major
b. Coracobrachialis
c. Biceps and
d. Anterior Deltoid

Q. 16 Any two muscles for extension of shoulder joint

MNEMONIC – Praveen Love Tomato

a. P for Posterior deltoid
b. L for Latissimus dorsi and
c. T for Teres major

Ans. Following three muscles are extensors of the shoulder joint:

a. Posterior deltoid
b. Latissimus dorsi and
c. Teres major

Q. 17 Any two muscles for lateral rotation of shoulder joint

MNEMONIC – TIP to wetter

a. T for Teres minor
b. I for Infraspinatus and
c. P for Posterior deltoid

Ans. Following three muscles are the lateral rotators:

a. Teres minor
b. Infraspinatus and
c. Posterior deltoid

Q. 18 Any two muscles for Adduction of shoulder joint

MNEMONIC – Pretty Tall Lady

a. P for Pectoralis Major
b. T for Teres muscles
c. L for Latissimus dorsi

Ans. Following four muscles are the adductors:

a. Pectoralis Major
b. Latissimus dorsi
c. Teres muscles – teres major and teres minor

Q. 19 Any two muscles for Medial Rotation of shoulder joint

MNEMONIC – LAST

a. L for Latissimus dorsi
b. S for Subscapularis and
c. A for Anterior deltoid
d. T for Teres Major

Ans. Following four muscles are medial rotators of the shoulder joint:

a. Latissimus dorsi
b. Subscapularis and
c. Anterior deltoid
d. Teres Major

Q. 20 Names any four carpel bones

MNEMONIC – She Looks Too Pretty Try To Catch Her

a. S for Scaphoid
b. L for Lunate
c. T for Triquetrum
d. P for Pisiform
e. T for Trapezium
f. T for Trapezoid
g. C for Capitate and
h. H for Hamate

Ans. There are eight carpel bones. They are as follows:

a. Scaphoid
b. Lunate
c. Triquetrum
d. Pisiform
e. Trapezium
f. Trapezoid
g. Capitate and
h. Hamate

UPPER LIMB JOINTS TWENTY MARKS QUESTIONS

Q. 1 Anatomy of Shoulder Joint

Ans. INTRODUCTION

- Shoulder is composed of four joints, namely glenohumeral joint, acromioclavicular joint, sternoclavicular joint and scapulothoracic joint.
- Commonly, shoulder joint refers to glenohumeral joint, the major joint of shoulder but can also include acromioclavicular joint.
- Shoulder joint is the most mobile joint in the human body and responsible for movements of arm and scapula.
- The instability of this most mobile joint is compensated by rotator cuff muscles, tendons, ligaments, and the glenoid labrum.

BONES OF SHOULDER JOINT

The shoulder is composed of the bones scapula, clavicle and humerus.

Scapula

The scapula is a thin triangular bone that functions mainly as a site for muscle attachment and origin.

It takes part in formation of glenohumeral, acromioclavicular and scapulothoracic joint. It also provides origin to rotator cuff muscles.

Clavicle

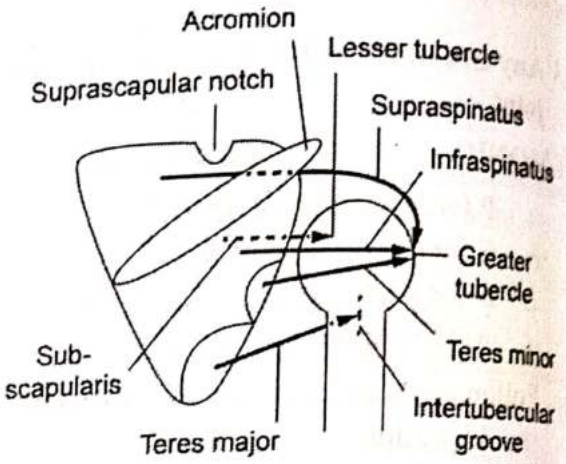
The clavicle is an S-shaped bone and has two articulations, the sternoclavicular joint and the acromioclavicular joint and connects the trunk with upper limb.

Humeral head

Head of the humerus forms the proximal articular surface of the humerus that articulates against the shallow glenoid cavity.

Only one-fourth of the head makes contact with the glenoid cavity.

Glenoid labrum is a fibrocartilaginous ring attached to the outer rim of the glenoid cavity, provides additional depth and stability.



Joints of Shoulder

There are three joints of the shoulder- glenohumeral, acromioclavicular, and sternoclavicular joints.

i. Sternoclavicular joint

a. This joint is formed by the medial end of the clavicle with the manubrium or topmost portion of the sternum.

b. The costoclavicular ligament is the main stabilizer of the joint.

c. The sternoclavicular joint is the sole connection between the axial skeleton and the upper extremity.

d. The sternoclavicular joint allows 30-35 degrees of upward elevation, 35 degrees of anteroposterior movement, and 44-50 degrees of rotation about the long axis of the clavicle.

ii. Acromioclavicular Joint

a. The acromioclavicular joint is the sole joint of acromion, clavicle and scapula [via acromion process].

b. The joint, a diarthrodial joint itself has a little movement.

c. It is held together by its joint capsule and the coracoacromial ligaments: the trapezoid and coronoid ligaments.

iii. Glenohumeral Joint

a. The glenohumeral joint is a ball-and-socket synovial joint formed by the articular surfaces of the glenoid cavity

and the head of the humerus.

b. It is the main joint of the shoulder and allows the arm to rotate in a circular fashion or to hinge out and up away from the body.

c. The shoulder joint is very mobile because glenoid fossa is shallow but this also adds to the instability of the shoulder.

d. The glenoid cavity depth is increased by a rim of fibrocartilage called glenoid labrum which is composed of dense fibrous tissue.

e. The average depth of the glenoid cavity is 2.5 mm, but the labrum serves to increase this depth. Capsule of the glenohumeral joint the joint and attaches to the scapula, humerus, and head of the biceps.

f. It is lined by a thin, smooth synovial membrane. Coracohumeral ligament attaches the coracoid process of the scapula to the greater tubercle of the humerus. Glenohumeral ligaments are three ligaments that attach the lesser tubercle of the humerus to

iv. *Scapulothoracic Joint*

a. The scapulothoracic joint is not a true joint.

b. Scapulothoracic articulation is formed by the convex surface of the posterior thoracic cage and the concave surface of the anterior scapula and its movements are determined by the integrity of sternoclavicular and acromioclavicular joints.

LIGAMENTS OF SHOULDER

i. *Coracoclavicular ligaments*

a. There are two Coracoclavicular ligaments – conoid and trapezoid which maintain the articulation of the clavicle with the coracoid process of the scapula.

b. Coracoclavicular ligaments are the primary restraint to superior and posterior acromioclavicular dislocation.

ii. *Glenohumeral Ligaments*

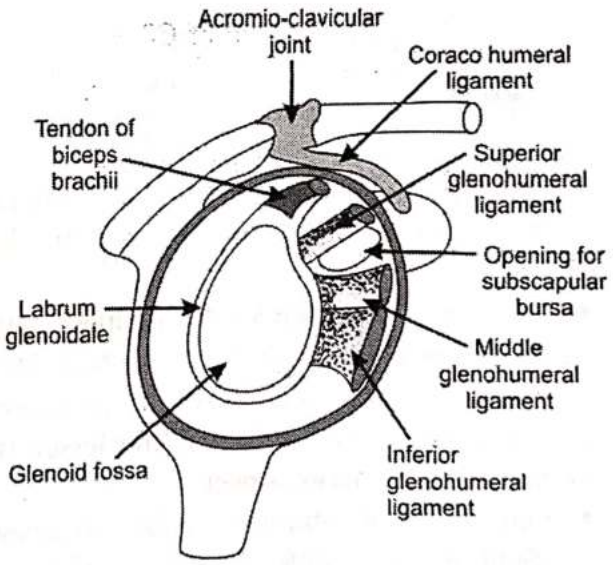
a. There are three glenohumeral ligaments, Superior glenohumeral ligament, Middle glenohumeral ligament and Inferior glenohumeral ligament.

b. These ligaments are the point of weakness in the capsule which is a common site of anterior dislocation of the humeral head.

iii. *Coracohumeral Ligament*

a. The Coracohumeral ligament originates on the base and lateral border of the coracoid process of the scapula and inserts on the greater tubercle.

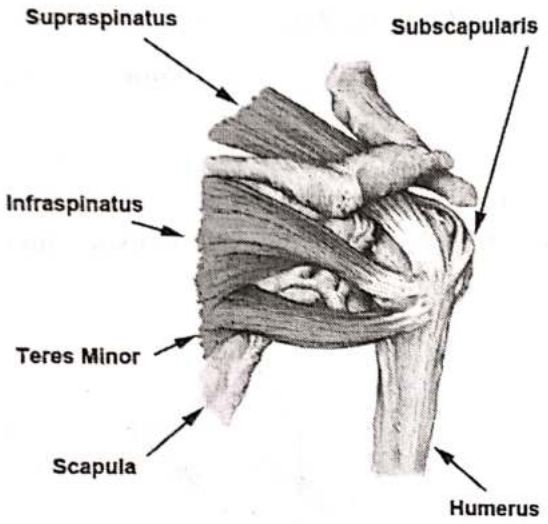
b. It appears to have a suspensory function of the humeral head.



- Acromion
- Clavicle,
- Coracoid,
- Supraspinatus tendon,
- Infraspinatus tendon,
- Teres minor tendon,
- Subscapularis tendon,
- Glenoid labrum,
- Subacromial bursa,
- Subcoracoid bursa,
- Coracoacromial ligament,
- Labrobicipital complex.

Rotator cuff Muscles

- Group of muscles which help to stabilize the shoulder joint and center the humeral head in the joint socket are known as rotator cuff muscles.
- They are four muscles Supraspinatus, Infraspinatus, Teres minor and Subscapularis.



- All these four muscles have their origin from scapula and insertion over the tubercle of humerus.
- There are two tubercles at the upper part of the humerus, the greater and lesser. The greater tubercle is towards the posterior aspect of the bone whereas the lesser is towards the anterior aspect.
- Out of four muscles three muscles (Supraspinatus, Infraspinatus and teres minor) originating from the posterior aspect of the scapula are inserted on posteriorly situated greater tubercle of the humerus.
- The muscle (Subscapularis) originating from the anterior aspect of the scapula is inserted on the anteriorly situated lesser tubercle of the humerus.

All four rotator cuff muscles originate from the scapula and insert on humerus.

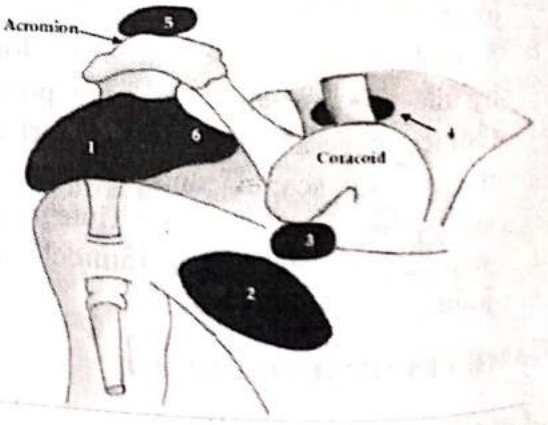
- Supraspinatus – The Supraspinatus has its origin in the supraspinal fossa of scapula. The fibres run laterally and inserted on the greater tubercle of the humerus.
- Infraspinatus – The Infraspinatus has its origin from Infraspinatus fossa of the scapula. The fibres run laterally and insert on the greater tubercle of the humerus.
- Teres Minor – The teres minor muscle originates from the lateral border of the scapula and inserts on the greater tubercle of the humerus.
- Subscapularis – It is a very important muscle for the internal rotation of the humerus. It arises from the subscapular fossa of the scapula and inserts on the lesser tubercle of the humerus.

Capsule and Bursae of Shoulder Joint

The joint capsule is a lax fibrous sheath that extends from the anatomical neck of the humerus to the border of the glenoid fossa.

- Subacromialsubdeltoid bursa
- Subscapular recess
- Subcoracoid bursa
- Coracoclavicular bursa
- Supracromial bursa
- Medial extension of Subacromialsubdeltoid bursa

:romialsubdeltoid bursa



- The joint capsule is lined by a synovial membrane and produces synovial fluid to reduce friction between the articular surfaces. Bursa is a synovial fluid-filled sac that acts as a cushion between tendons and other joint structures.
- Subacromial bursa is located inferior to the

deltoid and acromion, and superior to the Supraspinatus tendon and the joint capsule.

- Subscapular bursa is located between the Subscapularis tendon and the scapula.
- It reduces wear and tear on the tendon during movement at the shoulder joint.

MOVEMENTS OF SHOULDER

- The Sternoclavicular joint, acromioclavicular joint, glenohumeral joint and scapulothoracic joint work together to carry out movements of the shoulder joint.
- The majority of motion occurs at the glenohumeral and scapulothoracic joints and a rhythm between these two is present.
- During the motion, the shoulder is stabilized by static stabilizers [bony structures, labrum, GH ligaments, and joint capsule] and dynamic stabilizers [rotator cuff [the Supraspinatus, Infraspinatus, Subscapularis, and teres minor]; and scapular stabilizers [i.e. teres major, rhomboids, serratus anterior, trapezius, Levator scapulae].

MUSCLES OF SHOULDER JOINT – A story of cricket; it was a tough match between India and Pakistan. On the last ball of Pravin Banger, Pakistan Cricket Board give tip to umpire in front of pretty tall lady, irritated Pravin eat tomato as he loves it. It is best story to remember the Medial rotator, lateral rotator, flexor, and extensor and adductor muscles of shoulder joint.

For flexion Pakistan Cricket BoArDfrom the above story:

a. P for Pectoralis Major
b. C for Coracobrachialis
c. B for Biceps and
d. AD for Anterior Deltoid

For extension Praveen Love Tomato from the above story:

a. P for Posterior deltoid
b. L for Latissimus dorsi and
c. T for Teres major

For lateral rotation TIP to wetter from above story:

a. T for Teres minor
b. I for Infraspinatus and
c. P for Posterior deltoid

For adduction Pretty Tall Lady from above story:

a. Pretty Tall Lady
b. P for Pectoralis Major
c. T for Teres muscles
d. L for Latissimus dorsi

For Medial Rotation LAST from above story:

a. L for Latissimus dorsi
b. A for Anterior deltoid
c. S for Subscapularis and
d. T for Teres Major

The following are different movements of the shoulder joint:

- Arm Flexion: - The humerus is rotated out of the plane of the torso so that it points forward. Pectoralis major, Coracobrachialis, biceps brachii and anterior fibers of the deltoid are the main muscles that are involved.
- Arm Extension: - The humerus is rotated out of the plane of the torso so that it point backwards. Latissimus dorsi and teres major, long head of triceps, posterior fibers of the deltoid are the main muscles that are involved.
- Arm Abduction: - Arm abduction occurs when the arms are held at the sides, parallel to the length of the torso, and are then raised in the plane of the torso. This movement may be broken down into two parts: True abduction of the arm, which takes the humerus from parallel to the spine to perpendicular; and upward rotation of the scapula, which raises the humerus above the shoulders until it point's straight upwards. Supraspinatus (first 15 degrees) and deltoid act to abduct whereas upward rotation of the scapula is by trapezius and serratus anterior.
- Arm Adduction: - Arm adduction is the opposite motion of arm abduction. It can be broken down into two parts, downward rotation of the scapula and true adduction of

the arm. Downward rotation of the scapula is caused by Pectoralis minor, Pectoralis major, Subclaviusand latissimus dorsi whereas true adduction is caused by teres major and the lowest fibers of the deltoid.

- Medial rotation of the arm: - Medial rotation turns the arm inwards. When the elbow is held at a 90-degree angle and the fingers are extended so they are parallel to the ground. Medial rotation occurs when the arm is rotated at the shoulder so that the fingers change from pointing straight forward to pointing across the body. Subscapularis, latissimus dorsi, teres major, Pectoralis major, anterior fibers of deltoid are the main muscles.
- Lateral rotation of the arm: - The opposite of medial rotation of the arm. Muscles used are Infraspinatus and teres minor, posterior fibers of the deltoid.
- Arm Circumduction: - Movement of the shoulder in a circular motion so that if the elbow and fingers are fully extended the subject draws a circle in the air lateral to the body. Pectoralis major, Subscapularis, Coracobrachialis, biceps brachii, Supraspinatus, deltoid, latissimus dorsi, teres major and minor, Infraspinatus, long head of triceps are the muscles used in Various combinations of the foregoing movement i.e. flexion, extension, adduction and abduction. A movement of the arm in circular motion as in cricket bowling is an example of Circumduction of the shoulder.
- Horizontal Extension: - This movement is opposite of the previous movement. Lateral movement away from the midline of the body in a horizontal plane; moving the upper arm away from the chest. Deltoid, Infraspinatus and teres minor participate in this movement.
- Horizontal Flexion: - Horizontal adduction is the medial movement toward the midline of the body in a horizontal plane. It moves the upper arm toward and across the chest. The muscles involved are Pectoralis major and Coracobrachialis.
- Scapular Elevation: - The scapula is raised in a shrugging motion by use of Levator scapulae, the upper fibers of the trapezius.
- Scapular Depression: - The scapula is lowered from elevation. The scapulae may be depressed so that the angle formed by the neck and shoulders is obtuse, giving the appearance of "slumped" shoulders. Muscles used are Pectoralis minor, lower fibers of the trapezius, Subclavius, latissimus dorsi.

BLOOD SUPPLY

Shoulder joint is supplied by:

- Anterior circumflex humeral artery
- Anterior circumflex humeral artery
- Suprascapular vessels and
- Subscapular vessels

NERVE SUPPLY

Shoulder joint is supplied by the following nerves:

- Axillary nerve
- Musculocutaneous nerve and
- Suprascapular nerve

Applied Anatomy

Dislocation of shoulder joint

The shoulder joint is more prone to dislocation than any other joint of body. This is due to the laxity of the capsule and the disproportionate area of the articular surfaces. Dislocation usually occurs when the arm is abducted. The dislocation endangers the axillary nerve which is closely related to the lower part of the joint capsule.

Frozen Shoulder

The two layers of synovial membrane become adherent to each other leads to cause frozen shoulder. Clinically patient complaints of progressively increasing shoulder pain, stiffness in the joint and restriction of all movements.

Q. 2 Anatomy of Elbow Joint

Ans. INTRODUCTION

- The elbow joint is a synovial joint of a hinge type of upper limb between the arm and the forearm.
- It is the point of articulation between three bones, the humerus of the arm and the radius and ulna of the forearm.
- The elbow joint is a term used for humeroradial and Humeroulnar joints. It also includes a superior radioulnar joint.
- The elbow joint is a synovial as well as a compound joint.
- The articular surfaces of the bones at the elbow joint are separated from each other by a layer of hyaline cartilage.
- The highly viscous synovial fluid helps for the smooth motion of the joint.

BONES OF THE JOINT

There are three bones that comprise the elbow joint:

- The humerus
- The radius and
- The ulna.

ARTICULAR SURFACES

i. Upper

a. The capitulum and trochlea of the humerus are the upper articular surfaces of the joint.

b. The radial and coronoid fossa also play an important role in the elbow joint.

c. The radial fossa just above the capitulum allows the fitting of radial head during extreme flexion.

d. The coronoid fossa just above the trochlea allows the fitting of the coronoid process of ulna during extreme flexion.

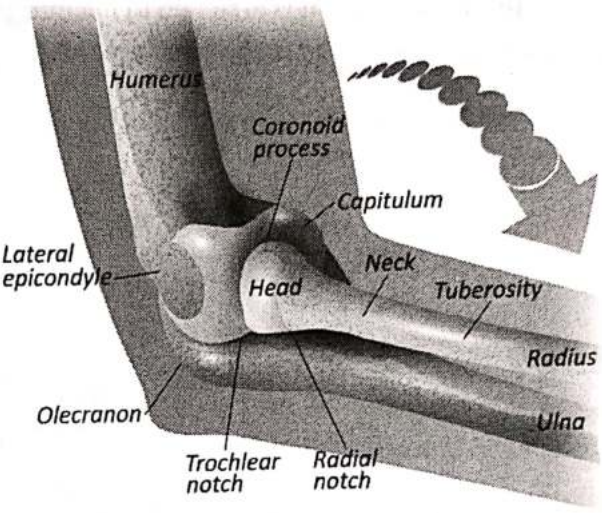
ii. Lower

a. Radius and ulna articulate with the humerus.

b. The upper surface of the head of the radius articulates with the capitulum on the lateral aspect of the distal end of the humerus to form the humeroradial joint.

c. The Trochlear notch of the proximal ulna articulates with the trochlear on the medial aspect of the distal end of the humerus to form the Humeroulnar joint.

d. The Humeroulnar and the humeroradial joints are the joints that give the elbow its characteristic hinge like properties.



e. The elbow joint is continuous with the superior or proximal radioulnar joint.

f. The proximal radioulnar joint is the articulation between the circumferential head of the radius and a fibro-osseous ring formed by the radial groove of the ulna and the annular ligament that hold the head of the radius in this groove.

g. The proximal radioulnar joint is functionally a pivot joint, allowing a rotational movement of the radius on the ulna.

h. The humeroradial, Humeroulnar and superior radioulnar joints are together known as cubital articulations.

i. Ligaments of the Elbow joint

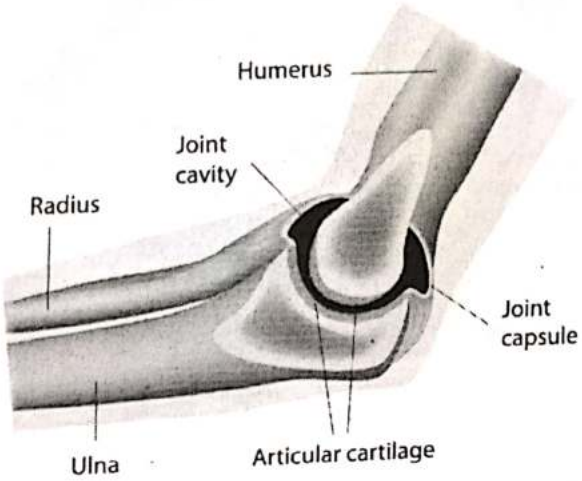
j. There are a collection of ligaments that connect the bones forming the elbow joint to each other for the stability of the joint.

There are three main ligaments of the elbow joint. Annular ligament is a supporting ligament for elbow joint.

i. Capsular ligament
ii. Ulnar collateral ligament and
iii. Radial collateral ligament

i. Capsular Ligament

a. Superiorly, it is attached to the lower end of humerus in such a way that the capitulum, the trochlea, the radial fossa, the coronoid fossa and the olecranon fossa are covered by the capsule.
Inferomedially, it is attached to the margin of the Trochlear notch of the ulna.



b. Inferolaterally, it is attached to the annular ligament of the superior radioulnar joint.

ii. Ulnar collateral ligament

a. The ulnar collateral ligament extends from the medial epicondyle of the humerus to the coronoid process of the ulna.
b. It connects the ulna with the humerus.
c. It is triangular in shape.
d. It is composed of three parts: an anterior, a posterior and an inferior band.

iii. Radial collateral ligament

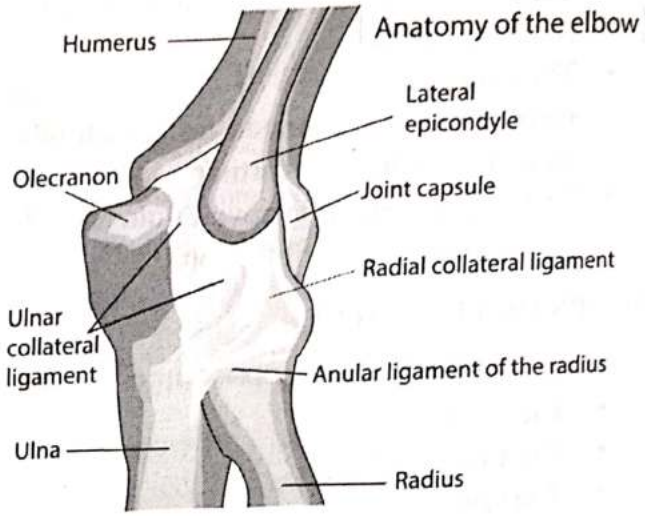
a. The radial collateral ligament is a fan-shaped band.
b. It has a low attachment to the lateral epicondyle of the humerus.
c. The distal fibers blend with the annular ligament that encloses the head of the radius, as well as with the fibers of the Supinator and the extensor carpi radialis brevis muscles.

iv. Annular ligament

The annular ligament reinforces the joint by holding the radius and ulna together at their proximal articulation.

RELATIONS OF JOINT

- Anteriorly it is related to the median nerve, brachial artery, brachialis muscle and tendon of biceps brachii muscle.
- Posteriorly it is related with Triceps brachii and Anconeus muscles.



- Laterally it is related with Supinator, extensor radialis brevis and other common extensor muscles.
- Medially it s related to Ulnar nerve, flexor carpi ulnaris and common flexor muscles.

BLOOD SUPPLY

The blood supply of the elbow joint is derived from anastomoses around the joint.

NERVE SUPPLY

The joint receives the braches from following nerves:

- Ulnar nerve
- Median nerve
- Radial nerve and
- Musculocutaneous nerve

MOVEMENTS

As the elbow joint is a hinge joint, movement is in only one plane. The movements at the elbow joint

involve movement of the forearm at the elbow joint.

Only two movements occur at the elbow joint:

i. *Flexion and*
ii. *Extension*

i. Flexion

The flexion of the forearm at the elbow joint involves decreasing the angle between the forearm and the arm at the elbow joint.

The flexion is brought about by following muscles

- Brachialis
- Biceps brachii and
- Brachioradialis

ii. Extension

The extension involves increasing the angle between the arm and forearm.

The extension is produced by

- Triceps brachii and
- Anconeus

Applied Anatomy

Fracture

Common injuries to the elbow joint include fractures of the bony structures contributing to the joint.

Epicondylitis

Epicondylitis is inflammation of the soft tissues surrounding the epicondyle of the humerus. It typically occurs due to overuse of the flexor and extensor muscles of the forearm. Pain is localized around the epicondylar region. Tennis players typically get Epicondylitis on the lateral epicondyle whereas golfers usually have it on the medial epicondyle.

Arthritis

Arthritis can occur at the elbow joint and is usually more severe in the dominant limb of the patients.

Q. 3 Anatomy of Wrist Joint

Ans. INTRODUCTION

The wrist joint is crucial for the functioning of the upper limb, primarily the hand.

The wrist joint is also known as the radiocarpal joint.

The wrist joint connects the forearm to the hand.

It is a synovial joint of ellipsoid variety between the lower end of radius and articular disc of the lower radioulnar joint proximally and three lateral bones of proximal row of carpus distally.

The distal radioulnar joint, Intercarpal joint and mid carpal joint are associating joint with the wrist joint.

The radiocarpal joint

The wrist joint is a complex joint. But the main articulation is of radius with scaphoid and lunate. This joint is known as the Radioulnar joint.

Articular surfaces

Upper

- Inferior surface of the lower end of the radius and
- Articular disc of the inferior radioulnar joint.

Lower – Three carpal bones

- Scaphoid
- Lunate and
- Triquetral

Articulation

The radius articulates with the scaphoid laterally and the Lunate medially.

MNEMONIC

The scaphoid has a cashew nut-shaped appearance with a narrowing in its center, like a waist.

The Lunate is connected to the scaphoid via the scapholunate ligament, and provides stability to the radiocarpal joint.

The medial most bone of the proximal carpal row is the Triquetrum. It lies medial to the Lunate. The Triquetrum is not directly articulate; it has the strongest connection to the ulna.

MNEMONIC

The distal Radioulnar joint

The radius and ulna form two joints, one at the upper part and second at the lower part. The lower part articulation is known as the distal radioulnar joint.

Articular surfaces

Medial

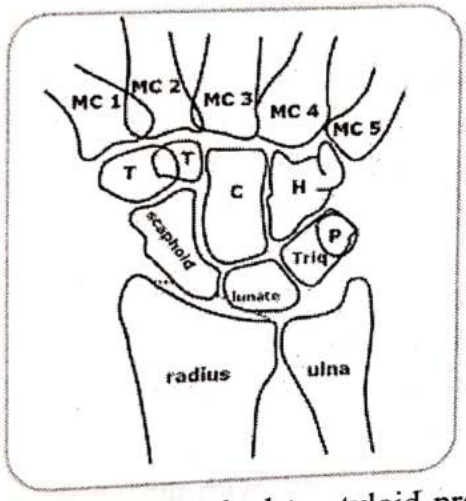
Head of ulna

Lateral

Ulnar notch of radius

Articulation

- The head of the ulna gets fitted in the ulnar notch of the radius and forms the joint.
- This joint is strengthened by an articular disc.
- The fibrocartilaginous articular disc is triangular in shape.



- The disc is attached to styloid process of the ulna and base of the lower margin of the ulnar notch.

The midcarpal joint

- The mid carpal joint is between the proximal and distal row of the carpus.
- The joint communicates with the Intercarpal joint superiorly and with the Intercarpal, carpometacarpal and intermetacarpal inferiorly.
- The midcarpal joint permits movements between the two rows of the carpus.

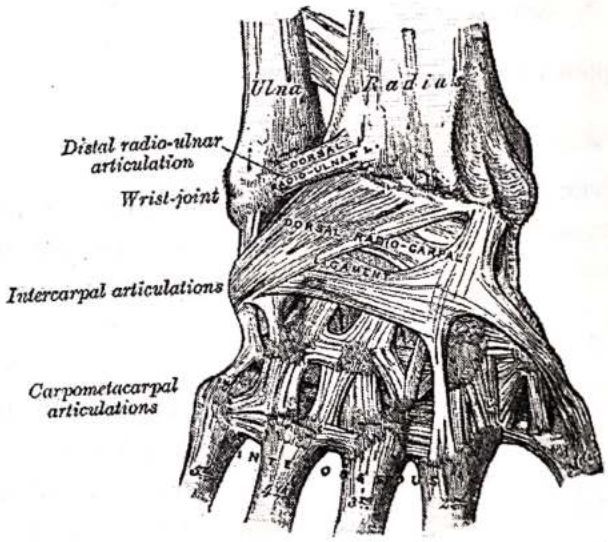
Ligaments

The wrist joint is strengthening by the ligament covering the joint; palmar sided and dorsal side ligaments and ligaments at lateral aspect of joint. Following are the ligaments of the wrist joint:

i. Articular capsule
ii. Palmar radiocarpal ligament
iii. Palmar ulnocarpal ligament
iv. Dorsal radiocarpal ligament
v. Radial collateral ligament and
vi. Ulnar collateral ligament

i. The articular Capsule

a. It surrounds the joint.
b. It attached above to the lower end of the radius and ulna
c. It is attached below to the proximal row of carpal bones.
d. The recessus sacciformis is a protrusion of synovial membrane, lies in front of the styloid process of the ulna and in front of the articular disc.



e. The fibrous capsule or articular capsule is strengthened by all other ligaments.

ii. The Palmar radiocarpal ligament

a. There two ligaments on the Palmar aspect of the wrist joint, Palmar radiocarpal ligament Palmar ulnocarpal ligament
b. The Palmar radiocarpal ligament is a broadband.
c. It is an intracapsular ligament
d. It starts above from the anterior margin of the lower end of the radius and its styloid

process.
e. It runs down and medially.
f. It ends by attaching below to the anterior surfaces of scaphoid, Lunate and Triquetral bone.

iii. *The Palmar ulnocarpal ligament.*

a. There two ligaments on the Palmar aspect of the wrist joint, Palmar radiocarpal ligament Palmar ulnocarpal ligament.
b. The Palmar ulnocarpal ligament is a rounded fasciculus.
c. It is an intracapsular ligament.
d. It begins above from the base of the styloid process of the ulna and anterior margin of the articular disc.
e. It runs downwards and laterally.
f. It ends by attaching to the Lunate and Triquetral bone.

iv. *The dorsal radiocarpal ligament*

a. The dorsal radiocarpal ligament is the only ligament on the dorsal aspect of the joint.
b. It begins above from the posterior margin of the lower end of the radius.
c. It runs downwards and medially.
d. It ends by attaching below with the dorsal surface of scaphoid, Lunate and Triquetral bone.

v. *Radial collateral ligament*

a. It is one of the laterally placed ligament.
b. It extends from tip of the styloid process of the radius to the lateral side of the scaphoid bone.

vi. *Ulnar collateral ligament*

a. It is one of the laterally placed ligament.
b. It extends from the tip of the styloid process of the ulna to the Triquetral and Pisiform bone.

RELATIONS

The wrist joint is related

- Anteriorly to the long flexor tendons with their synovial sheaths and median nerve
- Posteriorly to the extensor tendons of the wrist and fingers with their synovial sheaths and
- Laterally to the radial artery.

BLOOD SUPPLY

The wrist joint is supplied by anterior and posterior carpal arches

NERVE SUPPLY

The wrist joint is supplied by anterior and posterior interosseous nerves

MOVEMENTS

- The movements at the radiocarpal joint are accompanied by movements at the midcarpal joint.
- The midcarpal joint is anatomically separate from the radiocarpal joint.
- The movements of both joints help each other.

Flexion

- In flexion, the largest movement occurs at the capitolunate segment of the midcarpal joint.
- The muscles that cross the joint at its anterior side are helpful for flexion of the wrist.
- The muscles for flexion are flexor carpi radialis and flexor carpi ulnaris and Palmaris longus. The movements are assisted by flexor digitorum superficialis, flexor digitorum profundus and Palmaris longus

Extension

- In extension, the movement occurs mainly at the wrist joint.
- The muscles that cross the wrist joint on its posterior side are helpful for extension of the wrist.
- The muscles for extension are extensor carpi radialislongus and brevis, extensor

carpi ulnaris, and extensor digitorum.

Abduction

- The abduction is also known as radial deviation.
- In abduction, the movement occurs mainly at the midcarpal joint.
- The muscles for abduction are the extensor carpi radialis longus and brevis as well as flexor carpi radialis, abductor pollicis longus and extensor pollicis brevis.

Adduction

- The abduction is also known as ulnar deviation.
- In adduction movement occurs mainly at the wrist joint.
- The flexor and extensor carpi ulnaris are the main adductors of the wrist joint.

Applied Anatomy

Scaphoid fracture

- Due to narrowing of the scaphoid at central part is most frequently fractured.
- The blood supply enters via its distal pole and flows proximally.
- As a result, a scaphoid fracture will cause the proximal segment to undergo avascular necrosis.
- Clinically it present with tenderness in the anatomical snuffbox.
- This requires urgent surgical treatment.

Terry Thomas sign

- This is a rupture of the scapholunate ligament.
- It is named after a famous comedian, who had a gap between his front two upper incisors.

Fractures of the wrist - Colle's fracture

- This is the commonest fracture when a person falls onto an outstretched hand.
- There is a fracture of the radius and dorsal displacement of the distal fragment.
- This gives it a 'dinner fork' like a deformity.

Carpal tunnel syndrome

- Carpal tunnel syndrome is caused by median nerve compression within the carpal tunnel.
- The carpals form the floor of the tunnel.

9

Upper Limb Spaces

UPPER LIMB SPACES TWO MARKS QUESTIONS

Q. 1 Formation of medial and lateral wall of axilla

Ans. The medial and lateral wall of the axilla are formed by:Medial wall - The medial wall is formed by upper four ribs and intercostal muscles, the upper four digits of the serratus anterior.

Lateral wall – The lateral wall is made by the intertubercular sulcus (groove) of the humerus with long head of triceps brachii and short head of biceps brachii and Coracobrachialis muscles.

Q. 2 Name boundaries of Triangle of auscultation

Ans. Triangle of auscultation is situated along the medial border of the scapula. Its boundaries are as follows:

a. Superior and medial – Superiorly and medially it is bounded by the inferior portion of trapezius muscle

b. Inferior – Inferiorly it is bounded by latissimus dorsi muscle

c. Lateral – Laterally it is bounded by medial border of the scapula

Q. 3 What are the contents of Radial Groove?

Ans. Radial groove is a broad but shallow depression on the lateral border of the shaft of humerus. Radial groove contains:

a. Radial nerve and

b. Deep radial artery

Q. 4 Name contents of Anatomical snuff box

Ans. Anatomical snuff box contains:

a. Radial artery

b. The cephalic vein and superficial branch of radial nerve are also present in the roof of the snuff box.

Q. 5 Any two structures passing superficial to flexor retinaculum

Ans. Following are the structures at the wrist joint which are superficial to the flexor retinaculum.

a. The Palmar cutaneous branch of the median nerve

b. Tendon of Palmaris longus

c. The Palmar cutaneous branch of the median nerve

d. The ulnar vessels

e. The ulnar nerve

Q. 6 Boundaries of cubital fossa

Ans. Cubital fossa has the following boundaries:

a. Base – It is formed by an imaginary line joining the medial and lateral epicondyle.

b. Apex – It is formed by the point where pronator teres meets Brachioradialis.

c. Medial boundary – It is formed by the lateral border of pronator teres.

d. Lateral boundary – It is formed by the medial border of Brachioradialis.

e. Roof – Roof is formed by

- Skin,
- Superficial fascia containing
- Lateral cutaneous nerve of forearm
- Medial cutaneous nerve of forearm

- Median cubital vein
- Bicipital Aponeurosis

f. Floor - Floor of cubital fossa is formed by Brachialis and Supinator muscles

Q. 7 Any two contents of cubital fossa

MNEMONIC – My Boss Throw Red Pocket. From medial to lateral

a. **M** – Median nerve
b. **B** – Brachial artery
c. **T** – Tendon of biceps
d. **R** – Radial nerve
e. **P** – Posterior interosseous branch of radial nerve

Ans. Cubital Fossa, a triangular-shaped depressed area on the anterior surface of the elbow joint, has following contents from medial to lateral

a. Median nerve
b. Brachial artery
c. Tendon of biceps
d. Radial nerve and
e. Posterior interosseous branch of radial nerve

Q. 8 Any two contents of axilla

Ans. The contents of the axilla are:

a. The axillary artery and its branches
b. The axillary vein and its tributaries
c. Axillary lymph nodes
d. Axillary tail of mammary gland
e. Cords of brachial plexus
f. Long thoracic nerve
g. Intercostobrachial nerve
h. Axillary fat and areolar tissue

Q. 9 Name muscles in the floor of the cubital fossa

MNEMONIC – Bachelor of Science BSc

a. B for brachialis
b. S for Supinator and
c. C for cubital fossa

Ans. Floor of the cubital fossa is formed by:

a. Brachialis and
b. Supinator muscles

Q. 10 Any two causes of Carpal tunnel syndrome

MNEMONIC – MEDIAN TRAP

a. **M** for Myxoedema
b. **E** for Edema premenstrually
c. **D** for Diabetes
d. **I** for Idiopathic
e. **A** for Acromegaly
f. **T** for Trauma
g. **R** for Rheumatoid arthritis
h. **A** for Amyloidosis
i. **P** for Pregnancy

Ans. Following are the causes behind carpal tunnel syndrome:

a. Myxoedema
b. Edema premenstrually
c. Diabetes
d. Idiopathic
e. Acromegaly
f. Trauma
g. Rheumatoid arthritis
h. Amyloidosis
i. Pregnancy

Q. 11 Any two Structures piercing clavipectoral fascia.

Ans. Following five structures pierce the clavipectoral fascia:

a. Cephalic vein
b. Thoracoacromial artery
c. Thoracoacromial vein
e. Lymphatics and
f. Pectoral nerve

Q. 12 Tendons which passes deep to flexor retinaculum

Ans. The tendon of the following muscles passes deep to the flexor retinaculum:

a. Four tendons of flexor digitorumsuperficialis
b. Four tendons of the flexor digitorumprofundus
c. The tendon of the flexor pollicislongus

e. The tendon of the flexor carpi radialis

Q. 13 What is bicipital aponeurosis?

Ans. Bicipital aponeurosis is:

a. A broad aponeurosis of the biceps brachii muscle.
b. It is located in the cubital fossa of the elbow joint
c. It originates from distal insertion of biceps brachii muscle
d. It separates the superficial structures from deep structures in the cubital fossa

Q. 14 Any two structures passing superficial to flexor retinaculum

Ans. Following are the structures at the wrist joint which are superficial to flexor retinaculum:

a. The Palmar cutaneous branch of the median nerve
b. Tendon of Palmaris longus
c. The Palmar cutaneous branch of the median nerve
d. The ulnar vessels
e. The ulnar nerve

Q. 15 Formation of medial and lateral wall of axilla

Ans. The medial and lateral wall of the axilla are formed as below:

Medial wall - The medial wall is formed by the upper four ribs and intercostal muscles, the upper four digits of the serratus anterior and

Lateral wall - The lateral wall is made by the intertubercular sulcus (groove) of the humerus with long head of triceps brachii and short head of biceps brachii and Coracobrachialis muscles.

UPPER LIMB SPACES FIVE MARKS QUESTIONS

Q. 1 Cubital Fossa

Ans. Cubital Fossa, a triangular-shaped depressed area on the anterior surface of the elbow joint, has the following

DEFINITION AND LOCATION

It is a triangular-shaped depressed region located in front of the elbow joint.

BOUNDARIES

Cubital fossa has following boundaries

a. Base – It is formed by an imaginary line joining the medial and lateral epicondyle.

b. Apex – It is formed by the point where pronator teres meets Brachioradialis.

c. Medial boundary – It is formed by the lateral border of pronator teres.

d. Lateral boundary – It is formed by the medial border of the Brachioradialis.

e. Roof – Roof is formed by:

- Skin,
- Superficial fascia containing
- Lateral cutaneous nerve of forearm
- Medial cutaneous nerve of forearm
- Median cubital vein
- Bicipital Aponeurosis

f. Floor - The floor of the cubital fossa is formed by Brachialis and Supinator muscles.

CONTENTS

Cubital fossa contains following structures from medial to lateral:

a. Median nerve
b. Brachial artery and its terminal branches – radial and ulnar arteries
c. Tendon of biceps brachii
d. Superficial branch of radial nerve

MNEMONIC for the contents – My Boss Throw Red Pocket

From medial to lateral:

M – Median nerve

B – Brachial artery

T – Tendon of biceps

R – Radial nerve

P – Posterior interosseous branch of radial nerve

So the contents from medial to lateral are:

a. Median nerve
b. Brachial artery
c. Tendon of biceps
d. Radial nerve and
e. Posterior interosseous branch of radial nerve

Applied anatomy

a. The median cubital vein present in the roof of the cubital fossa is the vein of choice for venipuncture because: It is connected to the deep vein by the perforator vein, therefore it does not slip. Bicipital aponeurosis in the roof of the cubital fossa is deep to the median cubital vein and during venipuncture protects the underlying brachial artery and median nerve.

b. Blood pressure can be recorded by auscultating the brachial artery in the cubital fossa.

Q. 2 Anatomical Snuff Box

Ans. DEFINITION

It is a triangular depression seen on the lateral aspect of the dorsum of the hand during extension of the thumb.

BOUNDARIES

It is bounded by:

- Laterally by the tendons of abductor pollicis longus and extensor pollicis brevis.
- Medially by the tendon of extensor pollicis longus.
- Roof of the snuff box is formed by skin and superficial fascia.
- Floor is formed by scaphoid and trapezium bones

- Proximally it is limited by the styloid process of the radius.

CONTENTS

Anatomical snuff box contains:

- Radial artery is the main content
- The cephalic vein and superficial branch of the radial nerve are also present in the roof of the snuff box.

Applied Anatomy

- Tenderness in anatomical snuff box indicates fracture of scaphoid bone
- Cephalic vein is often used for giving intravenous fluids
- Pulsation of radial artery can be felt here

Q.3 Radial Groove

Ans. DEFINITION

It is a broad but shallow oblique depression located on the lateral border of the humerus.

FEATURES

- It passes around the shaft of the humerus
- It lies between the humeral attachments of the lateral and medial heads of the triceps brachii.
- It is spiral in shape hence known as spiral groove.
- As this groove is in between two heads of triceps muscle is it termed as the musculospiral groove.
- It is a depressed portion on the radius so also known as the radial sulcus.
- The radial nerve and deep brachial artery course within the groove.

CONTENTS

The radial Groove contains:

- Radial Nerve
- Deep Brachial Artery

Applied Anatomy

Thus a fracture in the middle of the radius could easily damage the radial nerve.

Q.4 Intramuscular Spaces in Scapular Region

Ans. There are two Intermuscular spaces in the scapular region, which can be clearly viewed from behind after reflecting the posterior part of the deltoid muscle. One space is of quadrangular shape whereas the other is triangular.

i. Quadrangular subscapular space –

BOUNDARIES

This space is bound by 4 sides which are as follows:

Superior

Superiorly it is bounded by two muscles,

a. Teres major and
b. Subscapularis and by a capsule in between these two muscle,
c. Capsule of shoulder joint

Inferior:

Inferiorly it is bounded by teres major.

Medial:

Medially it is bounded by the Long head of the triceps.

Lateral:

Laterally it is bounded by surgical neck of the humerus.

Structures passing through space -

- Axillary nerve,
- Posterior circumflex humeral artery and
- Posterior circumflex humeral vein are passing through quadrangular subscapular space.

ii. Triangular subscapular space –

There are two triangular subscapular spaces,

a. ***Upper triangular space and***
b. ***Lower triangular space***

a. ***Upper Triangular space***

Upper Triangular Subscapular space is bound by 3 sides that are as follows:

Superior:

Superiorly it is bounded by Teres minor muscle.

Lateral:

Laterally it is bounded by the Long head of the triceps.

Inferior:

Inferiorly it is bounded by Teres major.

Circumflex scapular artery passes through upper triangular space

Lower triangular space

Lower Triangular Subscapular space is bound by 3 sides that are as follows:

Superior

Superiorly it is bounded by Teres major muscle.

Medial

Medially it is bounded by the Long head of the triceps.

Lateral

Laterally it is bounded by the Shaft of humerus.

The Radial nerve, Profundabrachii artery and vein are passing through the lower triangular space.

Q. 5 Carpal Tunnel and Syndrome

Ans. DEFINITION

- Carpal Tunnel is an osseofibrous tunnel formed posteriorly by the concave Palmer surface of the carpals and bounded anteriorly by the flexor retinaculum.
- The flexor retinaculum is a thick fibrous band (modification of deep fascia) that is attached laterally to the scaphoid & crest of the trapezium and medially to the pisiform and hook of the hamate.
- Structures passing through Carpel tunnel
- The structures passing through the carpal tunnel are:
  - Median nerve.
  - Four tendons of flexor digitorum superficialis muscle
  - Four tendons of flexor digitorum profundus muscle (All these flexor tendons are enclosed in a common synovial sheath, referred to as the ulnar bursa.
  - Tendon of Flexor pollicis longus which has its own synovial sheath, is named as a radial bursa.
  - The tendon of flexor carpi radialis passes through a separate canal in the lateral part of the flexor retinaculum in the groove on the trapezium.

Structures passing above the flexor retinaculum

The structures passing above the flexor retinaculum from lateral to medial are:

- Palmar cutaneous branch of the median nerve
- Tendon of Palmaris longus
- Palmar cutaneous branch of ulnar nerve
- Ulnar artery
- Ulnar nerve

Carpal tunnel syndrome

Definition

Carpal tunnel syndrome is caused by compression of the median nerve in the carpal tunnel.

CAUSES

Causes for compression of median nerve in the carpal tunnel can be:

- Osteoarthritis involving carpal bones
- Dislocation of Lunate bone.
- Tendosynovitis –inflammation of synovial sheaths of long flexor tendons.
- Myxedema fluid retention in pregnancy.

MNEMONIC – MEDIAN TRAP

a. M for Myxoedema
b. E for Edema premenstrually
c. D for Diabetes
d. I for Idiopathic
e. A for Agromegaly
f. T for Trauma
g. R for Rheumatoid arthritis
h. A for Amyloidosis
i. P for Pregnancy

CLINICAL FEATURES

The characteristic clinical features include:

- Motor loss: weakness and wasting of thenar muscles which are supplied by median nerve, as a result, the thumb cannot be opposed and remains adducted (adductor pollicis is supplied by ulnar nerve) this is called 'Ape thumb deformity'. Index and middle fingers lag behind while making the fist due to paralysis of 1st and 2nd lumbricals (supplied by median nerve).
- Sensory loss: Tingling or numbness in the skin/loss of sensations over palmar surface of lateral 31/2 digits including nail bed and distal phalanges on the dorsum of hand that are supplied by the median nerve. There is no sensory loss in the skin over thenar eminence, as it is supplied by a palmer cutaneous branch of the median nerve which passes above the flexor retinaculum.
- Vasomotor changes: Skin over the palmer surface of lateral 31/2 digits of hand feels warmer due to arteriolar dilation,, and drier due to absence of sweating. This occurs due to loss of sympathetic innervations (postganglionic sympathetic fibers which accompany the median nerve)

Q. 6 Palmar Aponeurosis

Ans. ### DEFINITION

Palmar aponeurosis is a triangular condensation of deep fascia in the central part of the palm that overlies the long flexor tendons. It is made up of a superficial layer of longitudinal fibers and a deep layer of transverse fibers.

FEATURES

- It is also called as palmer fascia
- It is continuous proximally with the flexor retinaculum and tendon of Palmaris longus and on either side with the thinner fascia covering the thenar and Hypothenar muscles.
- It widens distally in the hand and divides into four longitudinal strips which attach to the bases of the proximal phalanges where they become continuous with the fibrous digital flexor sheaths.
- It invests the muscles of the palm

Portions

Palmar aponeurosis consists of central, lateral, and medial portions.

i. ***Central triangular portion***
ii. ***Lateral peripheral portion and***
iii. ***Medial peripheral portion***

i. The central triangular portion

a. It occupies the middle of the palm .
b. It has great strength and thickness.
c. It has an apex that continues with the distal border of flexor retinaculum and receives the expanded tendon of the Palmaris longus.
d. It has a base that divides below into four slips, one for each finger.
e. Each slip gives off superficial and deep fibers to the skin of the palm and finger.
f. The superficial fibers of slip are to the skin of the palm and finger.
g. The deeper part of each slip subdivides into two processes, which are inserted into the fibrous sheaths of the flexor tendons.
h. The central part of the palmer aponeurosis is intimately bound to the integument by dense fibroareolar tissue forming the superficial palmar fascia and gives origin by its medial margin to the Palmaris brevis muscle.

ii and iii. The lateral and medial peripheral portions of Palmar aponeurosis

a. Both lateral and medial portions of Palmer aponeurosis are thin and fibrous.
b. The lateral portion covers the radial side, the muscles of the ball of the thumb.
c. The medial portion covers the ulnar side the muscles of the little finger.
d. Both portions are continuous with the central portion and with the fascia on the

dorsum of the hand.

Functions of palmer aponeurosis

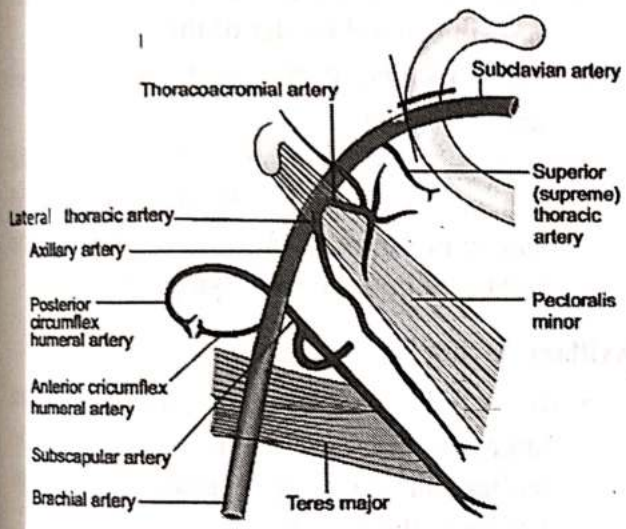
- Provides firm attachment to overlying skin
- It helps to form the ridges in the palm which in turn helps to increase friction so that we can grasp objects firmly
- Protects underlying structures
- Provides attachment to muscles

UPPER LIMB SPACES TWENTY MARKS QUESTIONS

Q. 1 Axilla

Ans. INTRODUCTION

- The axilla is a four sided pyramidal space situated between the superior portion of the arm and upper part of the lateral thorax wall.
- It is an important region, both in terms of neurovascular and clinical relevance.



Anatomical Borders

This four-sided pyramidal space has the following boundaries:

Apex

- It is directed upwards and medially. It is formed by the cervicoaxillary canal through which it communicates with the posterior triangle of the neck.
- The borders of the apex are made by the lateral surface of the first rib, the posterior surface of the clavicle, and the superior margin of the scapula.

Anterior wall

The anterior wall is formed by the posterior border of Pectoralis major and clavipectoral fascia enclosing Pectoralis minor and Subclavius muscles.

Posterior wall

The posterior wall is formed by the Subclavius, teres major and the latissimus dorsi.

Medial wall

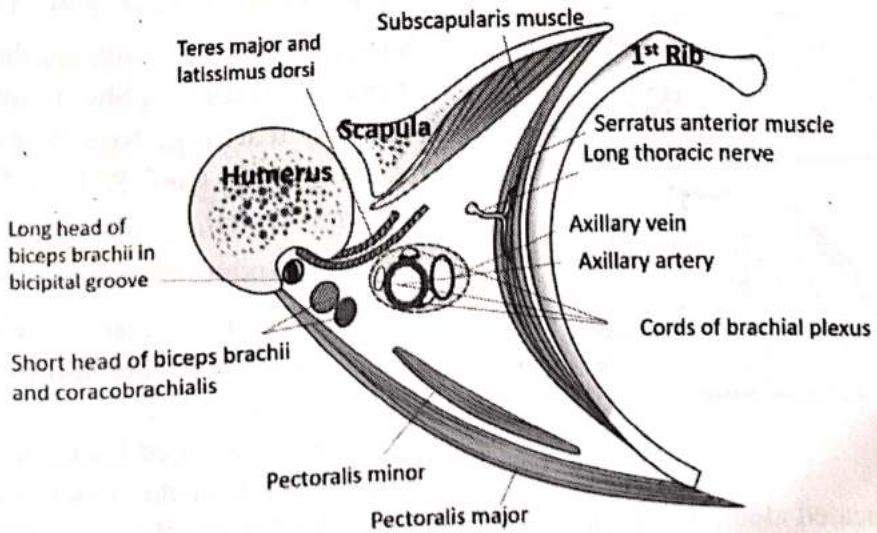
The medial wall is created by the upper four ribs and intercostal muscles, the upper four digits of the serratus anterior

Lateral wall

The lateral wall is made by the intertubercular sulcus (groove) of the humerus with long head of triceps brachii and short head of biceps brachii and Coracobrachialis muscles.

Floor

The floor, or base, of the axilla is formed by skin superficial fascia and dome-shaped the axillary



fascia.

CONTENTS

The contents of the axilla are:

a. The axillary artery and its branches
b. The axillary vein and its tributaries
c. Axillary lymph nodes
d. Axillary tail of mammary gland
e. Cords of brachial plexus
f. Long thoracic nerve
g. Intercostobrachial nerve
h. Axillary fat and areolar tissue

Group of Axillary lymph nodes

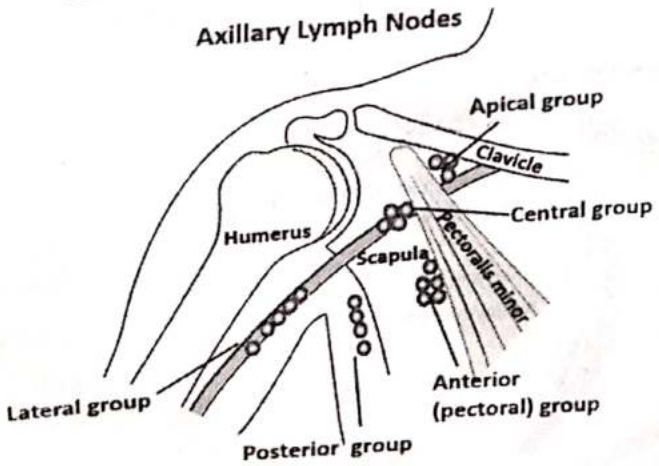
There are five groups of axillary lymph nodes which are as follows:

Anterior / Pectoral Group

They are located along the lower border of the Pectoralis minor muscle. They receive lymph from the lateral quadrants of the mammary glands and anterolateral abdominal wall above the level of the umbilicus.

Posterior/Subscapular Group

- They are located in front of the Subscapularis muscle.
- They receive superficial lymph vessels from the back, till the level of iliac crests.



Lateral Group

- They are located along the medial sides of the axillary vein.
- They receive most of the lymph from the upper limb except the lateral side of the hand, forearm, and arm.

Central Group

- They are located in the center of the axilla.
- They receive lymph from the above three groups.

Apical Group

- They are located at the apex of the axilla near the lateral border of the 1st rib.
- They receive lymph from all the other axillary nodes.
- Apical nodes drain lymph into the subclavian lymph trunk which on the left side drains into the thoracic duct and on the right side into the right lymphatic duct.

Axillary Artery

- It is the continuation of the subclavian artery, in the axilla it is renamed as the axillary artery once it passes the lateral border of the first rib.
- The Pectoralis minor muscle crosses the artery and divides it into three parts.
  - First part, superior to Pectoralis minor
  - Second part, posterior to Pectoralis minor and
  - Third part, inferior to Pectoralis minor.

MNEMONIC branches of axillary artery

Supriya, Lata and Sabita are three sisters. Supriya is intelligent teacher. She motivated and expertise Lata for teaching. Now Supriya and Lata are teaching using Cool PAD to Sabita the subjects Communication, technology, arts and politics.

From above story take the following words:

a. Supriya is already intelligent. So Supriya for the branches from the first part of the axillary artery.
b. She motivated Lata and Teaches used Cool PAD. So Lata, Teaches and Cool PAD are for the branches from the second part of the axillary artery

c. Both are teaching Sabita, the subjects Communication, technology, arts and politics. So Sabita, Communication, technology, arts and politics are for the branches from the third part of the axillary artery.

It can be summarized as below:

i. *First part*

Supriya for Superior thoracic artery,

ii. *Second Part*

a. Lata for Lateral thoracic artery
b. Teaches for thoracoacromial artery
c. Cool PAD – for four branches of thoracoacromial artery
   - Cool for Clavicular branch,
   - P for pectoral branch,
   - A for Acromial branch and
   - D for deltoid branch,

iii. *Third Part*

a. Sabita for Subscapular artery gives two branches,
   - Communication for circumflex scapular artery and
   - Technology for Thoracodorsal artery

b. Arts for anterior circumflex artery
c. politics for posterior circumflex artery

The axillary artery supplies the upper limb and is divided into three parts: the region proximal to Pectoralis minor, the region beneath it, and the region distal to it.

First Part

The first section gives rise to the superior thoracic artery, which supplies the first and second intercostal spaces.

Second Part

The second part gives rise to the lateral thoracic artery and the thoracoacromial artery.

The thoracoacromial artery has four branches:

- Pectoral branch,
- Acromial branch,
- Clavicular branch, and
- Deltoid branch

The pectoral branch supplies the pectoral muscles.

The Acromial branch supplies the deltoid.

The Clavicular branch supplies Subclavius and the sternoclavicular joint.

The deltoid branch runs in the deltopectoral groove and supplies the deltoid and Pectoralis major muscles.

Third Part

The third part gives rise to

- The subscapular artery,
- The anterior circumflex humeral artery, and
- The posterior circumflex humeral arteries
  - The subscapular artery supplies the Supraspinatus and the Infraspinatus muscles.
  - The anterior and posterior circumflex humeral arteries supplies the muscles near the surgical neck of the humerus.

Axillary Vein

The axillary vein drains the upper limb and is formed by the unification of the basilic and brachial veins.

Applied Anatomy

The safe site to place the incision is midway between the anterior and posterior margins of the base of the axilla, close to the medial wall.

Anatomy I - 1

1. Course and year : First BHMS (2015)
2. Subject Code : 04111A
3. Subject (PSP) : ANATOMY
   (TT) : ANATOMY
4. Paper : I
5. Total marks : 100
6. Total time : 3 hrs

Q. 1 Write a short answer (any ten out of fifteen)

a. Name any two parts of Corpus Callosum
b. Name any two muscles supplied by median nerve
c. Name any two branches of lateral cord of brachial plexus
d. Name any two rotator cuff muscles
e. Name any two muscles responsible for flexion of wrist
f. Name any two lateral rotators of shoulder joint
g. What is the nerve supply of Deltoid muscle
h. Name any two actions of wrist joint
i. Name any two contents of Radial Groove
j. Name any two branches of Profundabrachii artery
k. Name of musician nerve and labours nerve
l. Name any two symptoms of Bell's palsy
m. Name any two muscles forming floor of mouth
n. Name any two muscles of muscular triangle of neck
o. Name any two branches of external carotid artery

Q. 2 Write short answer (any four out of six)

a. The floor of fourth ventricle
b. Midbrain at the level of superior colliculus
c. Circle of Willis
d. Rubrospinal tract
e. Hypothalamus
f. Internal capsule

Q. 3 Write short answer (any four out of six)

a. Flexors of wrist joint
b. Palmar aponeurosis
c. Deltoid muscle
d. The ulnar nerve in hand
e. Cubital fossa
f. Erb's Palsy

Q. 4 Write long answer (two out of four)

a. Describe gross anatomy of scalp
b. Describe gross anatomy of lacrimal apparatus
c. Describe gross anatomy of muscles of mastication
d. Describe gross anatomy of posterior triangle of neck

Q. 5 Describe in detail the wrist joint

Q. 6 Describe in detail radial artery

Q. 7 Describe in detail median nerve

Anatomy I - 2

1. Course and year : First BHMS (2015)
2. Subject Code : 04111A
3. Subject (PSP) : ANATOMY
   (TT) : ANATOMY
4. Paper : I
5. Total marks : 100
6. Total time : 3 hrs

Q.1 Write a short answer (any ten out of fifteen)

a. Name any two paranasal air sinuses
b. Name any two muscles supplied by ulnar nerve
c. Name any two parts of internal capsule
d. Name any two branches of root of brachial plexus
e. Name any two muscles attached to greater tubercle of humerus.
f. Name any two muscles responsible for extension of wrist
g. Name any two muscles attached near bicipital groove
h. Name any two structures passing superficial to flexor retinaculum
i. Name any two structures passing through parotid gland
j. Name any two contents of Anatomical snuff box
k. Name structures forming medial and lateral wall of axilla
l. Name the muscles attached to greater tubercle of humerus.
m. Name any two extrinsic muscles of larynx
n. Name any two contents of carotid sheath
o. Name any two muscles for flexion of shoulder joint

Q.2 Write a short answer (any four out of six)

a. Medulla at the level of pyramidal decussation
b. Third ventricle
c. Pituitary gland
d. Corpus callosum
e. Internal capsule
f. Folds of dura mater

Q. 3 Write short answer (any four out of six)

a. Rotator cuff muscles
b. Intramuscular spaces in scapular region
c. Flexors of the wrist joint
d. Brachial artery in arm
e. Carpel tunnel syndrome causes and symptoms
f. Tennis elbow

Q. 4 Write long answer (two out of four)

a. Describe gross anatomy of submandibular gland
b. Describe gross anatomy of inner ear
c. Describe gross anatomy of tongue
d. Describe gross anatomy of lateral wall of nose

Q. 5 Write down in detail the elbow joint

Q. 6 Write down in detail the Axillary artery

Q. 7 Write down in brief about brachial plexus and describe in detail the ulnar nerve

Anatomy I - 3

1. Course and year : First BHMS (2015)
2. Subject Code : 04111A
3. Subject (PSP) : ANATOMY
   (TT) : ANATOMY
4. Paper : I
5. Total marks : 100
6. Total time : 3 hrs

Q. 1 Write a short answer (any ten out of fifteen)

a. Any two muscles supplied by Axillary nerve
b. Any two centre in Hypothalamus
c. What is klumpke's paralysis?
d. Name any two muscles of flexor compartment of forearm
e. Name any two intrinsic muscles of Palmar surface of hand
f. Name any two muscles for Adduction of shoulder joint
g. Name any two muscles supplied by ulnar nerve in forearm
h. Name any two actions of elbow joint
i. Name any two branches of posterior cord of brachial plexus
j. Any two branches of lateral cord of brachial plexus
k. Name of musician nerve and labours nerve
l. Name any two cartilages of lateral wall of nose
m. Name any two tongue papillae
n. Name any two boundaries of carotid triangle of neck
o. Name any two infrahyoid muscles

Q. 2 Write short answer (any four out of six)

a. Corpus callosum
b. The section of lower part of pons
c. Circle of Willis
d. Pituitary gland
e. Cerebellum
f. Blood supply of cerebrum

Q. 3 Write short answer (any four out of six)

a. Carpel tunnel syndrome
b. Radial groove
c. Anatomical snuff box
d. Musculocutaneous nerve
e. Erb's palsy
f. Deltoid muscle

Q. 4 Write long answers (two out of four)

a. Describe gross anatomy of temporomandibular joint
b. Describe gross anatomy of larynx
c. Describe gross anatomy of external carotid artery
d. Describe gross anatomy of cavernous sinus

Q. 5 Write down in detail the wrist joint

Q. 6 Write down in detail brachial artery in arm and ulnar artery in forearm

Q. 7 Describe in detail the Brachial plexus with ulnar nerve

Anatomy I - 4

1. Course and year : First BHMS (2015)
2. Subject Code : 04111A
3. Subject (PSP) : ANATOMY
   (TT) : ANATOMY
4. Paper : I
5. Total marks : 100
6. Total time : 3 hrs

Q.1 Write a short answer (any ten out of fifteen)

a. Name any two muscles supplied by musculocutaneous nerve
b. Name any two nuclei in the cerebellum
c. Name any two branches of brachial artery
d. Name any two muscles responsible for pronation
e. Name any two extensor muscles of thumb
f. Name any two muscles for extension of shoulder joint
g. What is the root value of brachial plexus?
h. Name any two structures related with surgical neck of humerus
i. Name the muscles attached to greater tubercle of humerus.
j. Name any two muscles of flexor compartment of forearm
k. Name origin & insertion of Pectoralis major muscle.
l. Name any two contents of middle ear
m. Name any two parts of pharynx
n. Name any two boundaries of Submental triangle of neck
o. Name any two suprahyoid muscles

Q.2 Write a short answer (any four out of six)

a. Meninges of brain
b. Midbrain at the level of inferior colliculus
c. Lateral ventricle of brain
d. Pyramidal tracts
e. Dural venous sinuses
f. Cerebrum anatomy

Q. 3 Write a short answer (any four out of six)

a. Supinator muscle
b. Musculocutaneous nerve
c. Axillary lymph node
d. Anatomical snuff box
e. Flexor muscles of shoulder joint
f. Movements of wrist joint

Q. 4 Write long answers (any two out of four)

a. Describe anatomy of inner ear
b. Describe parotid gland anatomy
c. Describe carotid triangle
d. Describe facial nerve

Q. 5 Write in detail about the elbow joint with the following headings

a. articular,
b. ligaments,
c. muscles and bursa
d. Applied anatomy

Q.6 Describe in detail the axilla with axillary artery

Q.7 Describe in detail the Brachial plexus

Anatomy I - 5

1. Course and year : First BHMS (2015)
2. Subject Code : 04111A
3. Subject (PSP) : ANATOMY
   (TT) : ANATOMY
4. Paper : I
5. Total marks : 100
6. Total time : 3 hrs

Q. 1 Write a short answer (any ten out of fifteen)

a. Any two descending tracts of spinal cord
b. Name any two branches of Axillary artery
c. Name any two muscles responsible for abduction of wrist
d. Name any two muscles of Middle ear
e. Name any two suprahyoid muscles
f. Name any two flexor muscles of forearm
g. Name any two Medial Rotators of shoulder joint
h. Name any two causes of Carpel tunnel syndrome
i. Name any two contents of carotid triangle
j. Name any two contents of cubital fossa
k. Name any two muscles for extension of shoulder joint
l. Any two branches of medial cord of brachial plexus
m. Name the muscles attached to greater tubercle of humerus.
n. Name any two boundaries of muscular triangle of neck
o. Any two branches of brachial plexus

Q. 2 Write a short answer (any four out of six)

a. Extrapyramidal system
b. The Cerebellum
c. The section of upper part of pons
d. Pituitary gland
e. Internal capsule
f. Internal carotid artery

Q. 3 Write a short answer (any four out of six)

a. Palmar aponeurosis
b. The axillary nerve
c. Cubital fossa
d. Anatomical snuff box
e. Radial artery in forearm
f. Froment's Sign

Q. 4 Write long answers (any two out of four)

a. Describe gross anatomy of parotid gland
b. Describe extraocular muscles of eyeball
c. Describe Cavernous Sinus anatomy
d. Describe trigeminal nerve

Q. 5 Describe shoulder joint in detail with following head

a. Articulation
b. Ligaments and bursa
c. Muscles of joint
d. Applied anatomy

Q. 6 Describe in detail the brachial artery with its branches

Q. 7 Write in brief the brachial plexus and describe in detail median nerve

PART - 2

1 Thorax

THORAX TWO MARKS QUESTIONS

Q. 1 Total no. of true ribs.

Ans. The ribs attached to the sternum are known as true ribs or sternal ribs. The first seven ribs are true ribs.

Q. 2 Total no. of false ribs.

Ans. The ribs which do not directly connect to the sternum are known as false ribs. The lower five ribs are known as false ribs.

Q. 3 Total no. of floating ribs.

Ans. The rib which does not attach to the sternum or other ribs is known as a floating rib. Last The last two ribs are floating ribs.

Q. 4 Total no. of atypical ribs.

Ans. The ribs which have features not common to all ribs are known as atypical ribs. Rib 1, 2, 10, 11 and 12 are atypical ribs

Q. 5 Total no. of vertebra.

Ans. Vertebral column consists of 3 vertebrae. Seven cervical, twelve thoracic, five lumbar, five fused sacral, and four fused coccygeal vertebrae

Q. 6 Which is the principle principal muscle of respiration?

Ans. The diaphragm, a thin dome dome-shaped muscle that separates the abdominal cavity from the thoracic cavity is the principal muscle of respiration.

Q. 7 Which muscle separates thoracic and abdominal cavity?

Ans. The diaphragm, a thin dome dome-shaped muscle separates the abdominal cavity from the thoracic cavity.

Q. 8 Above downwards what are the structures passing through right hilum?

Ans. Following structures are there in the root of hilum of the right lung

a. Pulmonary artery and vein
b. Bronchial artery and vein
c. Lymphatics and
d. Areolar tissue

Q. 9 Which lung may have azygos lobe?

Ans. The azygos lobe is a normal anatomical variation of the upper lobe of the right lung. It is seen in 1% of the population.

Q. 10 How many bronchopulmonary segments are there in the right lung?

Ans. There are ten broncho-pulmonary segments in right lung. Three segments in the superior lobe, two segments in the middle lobe, and five segments in the inferior lobe.

Q. 11 How many bronchopulmonary segments are there in the left lung?

Ans. There are nine broncho-pulmonary segments in the left lung. Four segments in the upper lobe and five segments in the lower lobe

Q. 12 What are the major openings of the diaphragm?

Ans. The diaphragm has the following three openings.

Aortic Hiatus – it is thea most dorsal opening which contains the aorta, azygos vein and thoracic duct

Oesophageal Hiatus – It contains the

oesophagus, dorsal and ventral vagal trunks.

Caval Foramen – It lies within the central tendinous portion of the diaphragm and contain the inferior vena cava

Q. 13 What are the vertebral levels of different diaphragmatic opening?

Ans. Following are the vertebral levels of diaphragmatic openings

a. The inferior vena cava passes at T8 vertebral level,
b. Oesophagus and vagus passes at T10 and
c. Azygos and thoracic duct passes at T2 vertebral level and
d. Aortic Hiatus at T12 vertebral level

Q. 14 What are the valves of the heart?

Ans. The heart has four valves.

a. Mitral valve
b. Tricuspid Valve
c. Aortic valve and
d. Pulmonary valve

The Mitral valve and tricuspid valve controls the blood flow from the atria to the ventricles.

The Aortic and pulmonary valves control the blood flow out of the heart.

Q. 15 Ligamentumarteiosum attached to which two structures?

Ans. At the superior end the Ligamentumarteiosum is attached to the aorta at the final part of the aortic arch whereas at the inferior end it is attached to the top of the left pulmonary artery.

Q. 16 What are the sinuses present in the pericardium?

Ans. There are two pericardial sinuses Transverse and Oblique

The transverse sinus is a transverse recess behind the ascending aorta and pulmonary trunk and in front of the superior vena cava and superior pulmonary vein.

The Oblique sinus is akin to the lesser sac supporting the stomach.

Q. 17 AV node present beneath which triangle?

Ans. AV node is located at the center of Koch's triangle.

Koch's triangle is enclosed by the septal leaflet of the tricuspid valve, the coronary sinus, and the membranous part of the interatrial septum

Q. 18 Crux is the meeting point of which vessels?

Ans. Crux cordis or crux of heart is a meeting point of coronary sinus and posterior interventricular sulcus.

Q. 19 What are the branches of arch of aorta?

Ans. The arch of aorta has the following three branches

a. The Brachiocephalic trunk
b. Left common carotid artery and
c. Left subclavian artery

Q. 20 Write the names of major structures piercing the diaphragm.

Ans. Following major structures are piercing the diaphragm

a. oesophagus,
b. inferior vena cava and
c. descending aorta

Q. 21 Write the names of structures forming boundaries of superior mediastinum.

Ans. Following are the boundaries of superior mediastinum

a. Superiorly it is bounded by thoracic inlet
b. Inferiorly by an imaginary plane passing through the sternal angle in front, and the lower border of the body of the fourth thoracic vertebra behind. Upper opening of thorax
c. Anteriorly it is bounded by manubrium sterni and
d. Posteriorly it is bounded by upper four thoracic vertebral bodies

Q. 22 Name the contents of hilum of the right lung

Ans. The hilum of right lung contents

a. Pulmonary artery and vein
b. Bronchial artery and vein
c. Lymphatics
d. Areolar tissue

Q. 23 Name the recesses of pleura.

Ans. The two recesses of pleura are

a. Costodiaphragmatic recesses and
b. Costomediastinal recesses

Q. 24 Write lobes and fissures of right lung

Ans. The right lung has three lobes and two fissures

a. Lobes
Upper lobe
Middle lobe and
Lower lobe
b. Fissures
Oblique fissure and
Horizontal fissure

Q. 25 Name the tributaries of Hemiazygos Vein

Ans. The tributaries of hemiazygos vein are

a. Intercostal vein
b. Left subcostal vein and
c. Lumbar vein

Q. 26 Name the structures opening in right atrium

Ans. Following structures open in right atrium

a. Superior vena cava
b. Inferior vena cava
c. Coronary sinus
d. Cardiac vein

Q. 27 Name any four contents of posterior mediastinum

Ans. Posterior mediastinum contents

a. Oesophagus
b. Thoracic duct
c. Vagus nerve
d. Hemiazygos vein and
e. Lymph node

Q. 28 Name subdivisions of pericardium

Ans. The pericardium is subdivided into

a. serous pericardium,
b. fibrous pericardium,
c. visceral pericardium,
d. parietal pericardium

Q. 29 Name 2 contents of middle mediastinum

Ans The middle mediastinum contents following structures

a. Heart and its vessels,
b. Lymph node
c. Trachea and
d. Cardiac nerves

Q. 30 Mention contents of superior mediastinum.

Ans. Superior mediastinum contents

a. many organs,
b. vessels,
c. nerves,
d. thymus,
e. trachea and
f. oesophagus

Q. 31 Write any four differences between right lung &and left lung

Ans. Following are differential points between right and left lung

a. Right lung is wider and shorter whereas left lung is narrow and long
b. Right lung is having three lobes whereas left lung is having two lobes
c. Right lung is having two bronchi whereas left lung is having only one bronchi
d. Right lung is having two fissures whereas left lung is having only one fissure

Q. 32 Write any four differences between right ventricle & and left ventricle of the heart.

Ans. Following are the differences between right and left ventricle

a. Right ventricle is comprises a thin wall whereas left ventricle comprises

a thick wall

b. The right ventricular cavity is crescentic in shape and that of left ventricle is circular in shape

c. Right ventricle pumps the blood to the lungs through the pulmonary trunk whereas left ventricle pumps the blood to the lungs through aorta

d. Right ventricle receives deoxygenated blood from right atrium whereas the left ventricle receives oxygenated blood from left atrium.

Q. 33 Posterior relations of Left root of lung

Ans. Left root off lung has following posterior relations

a. Vagus nerve
b. posterior pulmonary plexus and
c. Descending thoracic aorta

Q. 34 What are the structures in the intercostal spaces?

Ans. The following structures are in the intercostal spaces

a. Intercostal muscles
b. Intercostal arteries
c. Intercostal veins
d. Intercostal lymph nodes and
e. Intercostal nerves

Q. 35 Anterior relations of right root of lung

Ans. Right root of lung has following anterior relations

a. Phrenic nerve
b. Pericardiacophrenic vessels
c. Anterior pulmonary plexus
d. Superior vena cava and
e. A part of right atrium

Q. 36 Name any 2 intercostal muscles

Ans. There are three intercostal muscles

a. The external intercostal muscle
b. The internal intercostal muscle and
c. The transverse thoracis thoracicmuscle

Q. 37 Name the layers of pericardium

Ans. Pericardium consists of two layers

a. Fibrous Pericardium and
b. Serous pericardium

Q. 38 Name elements of conducting system of heart

Ans. The cardiac conducting system is composed of following main elements which are as follows

a. Sinoatrial node
b. Atrioventricular node
c. Bundle of His
d. Purkinje fibers

Q. 39 Any two structures of tracheobronchial tree

Ans. Following structures together forms the tracheobronchial tree

a. Trachea
b. Bronchi and
c. Bronchioles

Q. 40 Any two anterior relations of trachea

Ans. Anteriorly trachea is related with following structures

a. The aortic arch,
b. The brachiocephalic artery
c. The left common carotid artery.
d. Left brachiocephalic vein

Q. 41 Any two branches of left coronary artery

Ans. The left coronary artery gives following branches

a. Anterior interventricular branch
b. Circumflex branch
c. Posterior interventricular branch

Q. 42 Any two branches of right coronary artery

Ans. The right coronary artery gives following branches

a. Anterior atrial branch
b. Posterior atrial branch
c. Lateral atrial branch
d. Anterior ventricular branch

Q. 43 Any two tributaries of azygos vein

Ans. Following are the tributaries of azygos vein

a. Right superior intercostal vein
b. right posterior intercostal veins
c. Hemiazygos vein
d. Accessory hemiazygos vein
e. Right bronchial vein

Q. 44 Any 2 trunks draining into the thoracic duct

Ans. The thoracic duct drains lymph from the right and left descending thoracic lymph trunks

THORAX FIVE MARKS QUESTIONS

Q. 1 Bronchopulmonary segments.

Ans. INTRODUCTION

- The lungs are the main part of the respiratory system.
- It helps to fulfill the continuous demand of oxygen of every cell within the human body to supply oxygen and also helps to remove waste gases like carbon dioxide.
- The capillary-alveoli interface is the functional unit of the lung and the lung is divided into segments.
- The bronchopulmonary segments are the largest functional divisions of the anatomical lobes of the lung.
- Each bronchopulmonary segment receives its own air and blood supply.

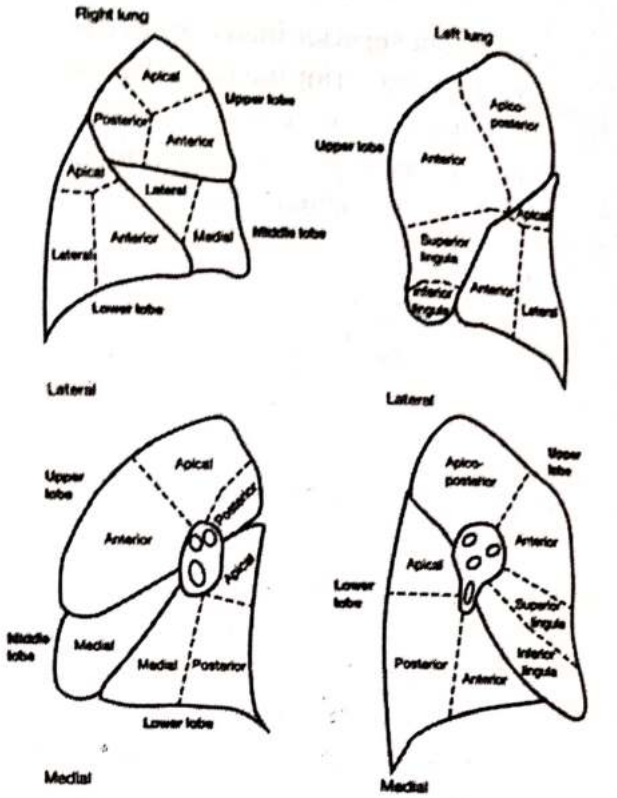
ANATOMY

- The lungs are further subdivided into bronchopulmonary segments.
- They are variablein right and left lung.
- There are ten bronchopulmonary segments in the right lung and roughly eight to nine in the left lung.
- Each bronchopulmonary segment is served by corresponding branches of the bronchial tree, along with their own arterial supply.
- The segments are separated from each other by the venous and lymphatic vessels pass through the intervening septae and the bands of connective tissue.
- There is a difference between the bronchopulmonary segment of right and left lung.

A. Right bronchopulmonary segments

- The right lung has three lobes superior, middle and inferior respectively.
- There are ten bronchopulmonary segments located within the right lung.
- Three segments are in the superior lobe two in the middle lobe and five in inferior lobe.

i. ***Superior lobe***- The superior lobe of the right lung has three bronchopulmonary segments:



a. Apical segment- The apical segment is formed in the pinnacle of the superior lobe.

b. Posterior segment - The posterior segment is located below and posterior to the apical segment. The posterior segment is limited inferiorly by the posterosuperior part of the right oblique fissure and the posterior part of the horizontal fissure.

c. Anterior segment- The anterior segment is located anterior to the posterior segment and anteroinferior to the apical segment. The anterior is limited inferiorly by the horizontal fissure.

ii. ***Middle lobe*** - The middle lobe of the right lung has two segments:

a. Lateral segment

b. Medial segment.

- The lateral segment is best represented on the costal surface of the lung.
- The superficial boundary of the medial segment wraps around the anterior border of the lung.

- The medial segment tapers at the hilum and is superiorly related to the oblique fissure.

iii. ***Inferior Lobe*** - The inferior lobe of the right lung has five bronchopulmonary segments:

a. Superior segment-The superior segment is represented on both the costal and mediastinal surfaces of the right lung.

b. Medial basal segment- The medial basal segment is best represented on the mediastinal surface of the lung.

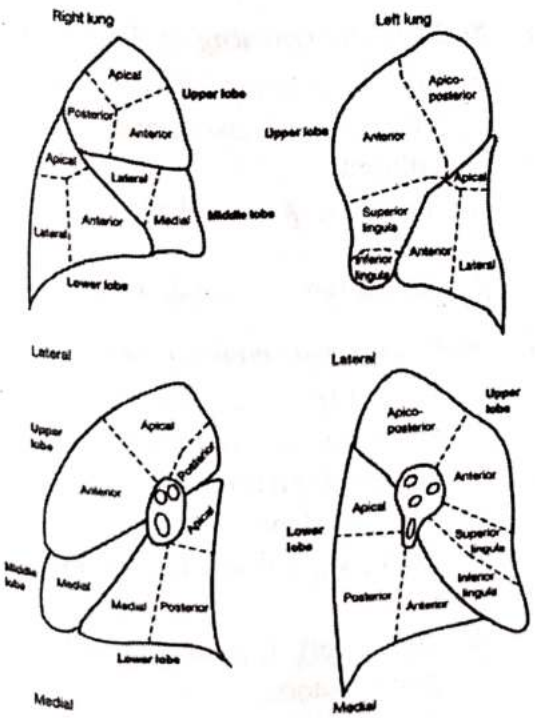
c. Posterior basal segment- The posterior basal segment is posteriorly related to the medial basal segment.

d. Lateral basal segment- The lateral basal segment is adjoining the posterior basal segment around the posterior border of the lung

e. Anterior basal segment- The anterior basal segment is limited anteriorly by the caudal part of the oblique fissure and is juxtaposed with the lateral basal segment posteriorly.

B. Left bronchopulmonary segments

- The left lung has two lobes superior and inferior respectively.



- There are eight to nine bronchopulmonary segments located within the left lung.
- Four segments are in the superior lobe and four to five in inferior lobe.

i. ***Superior Lobe*** - The superior lobe of the left lung contains four bronchopulmonary segments

a. Apicoposterior segment- The apicoposterior segment is formed by the fusion of the apical and posterior segments. It is limited posteroinferiorly by the superior aspect of the left oblique fissure.

b. Anterior segment- The anterior segment is adjacent to the apicoposterior segmentof the superior lobe.

c. Lingular segment - The lingular lobe of the left lung is analogous to the middle lobe of the right lung. There are two bronchopulmonary segments in lingular lobe as in the middle lobe of the right lung. These two bronchopulmonary segments are :

- Superior segment
- inferiorlingular segment

The superior lingular segment is located between the caudal boundary of the anterior segment and the superior boundary of the inferior lingular segment.

The inferior lingular segment is located inferior boundary of the superior lingular segment and it is inferiorly limited by the inferior half of the oblique fissure.

Both superior and inferior segments are anterior to the hilum of the left lung

ii. ***Inferior Lobe*** - The bronchopulmonary segments of the left inferior lobe are almost the same asthat of its right inferior lobe.

There are four (instead of five) segments on the inferior lobe

a. anteromedial basal segment,

b. superior segment,

c. inferior segment and
d. lateral segment

- The anteromedial basal segment is formed by fusion of the anterior basal and medial basal segments.
- The superior, posterior basal and lateral basal segments maintain the same relative positions as observed in the right lung.

Q. 2 Thoracic duct.

Ans. INTRODUCTION

- The thoracic duct is the largest lymphatic vessel in the human body.
- The thoracic duct is also known as van Hoorne's canal
- It is approximately 40 cm in length in adults and approximately 5 mm in width at its abdominal origin.
- About 75% of the lymph from the entire body, aside from the right upper limb, right breast, right lung, and right side of the head and neck, passes through the thoracic duct.

CHARACTERISTICS, COURSE, AND LOCATION

i. ***Extension*** - The thoracic duct extends from the twelfth thoracic vertebra to the root of the neck.

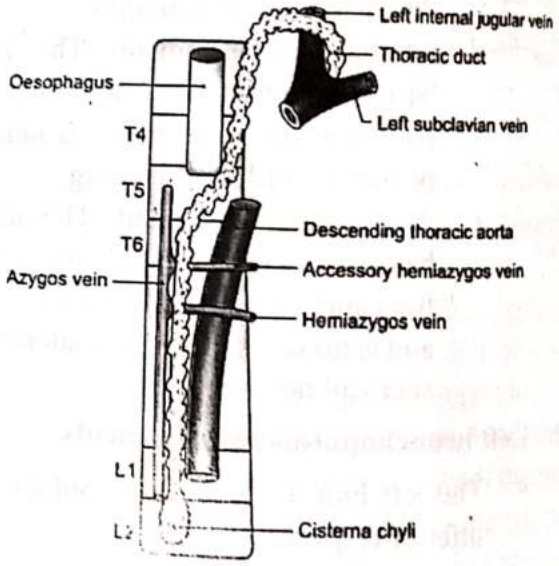
ii. ***Formation***- The abdominal confluence of left and right lumbar and intestinal lymph trunks forms the thoracic duct between the twelfth thoracic and second lumbar vertebrae.

iii. ***Course*** - The thoracic duct enters the thorax through the aortic opening.

a. Then duct ascends, through the posterior mediastinum, between the thoracic aorta on the left, and the azygos vein on the right.
b. Further, it crosses from right to left side.
c. From this point, the duct passes through the superior mediastinum along the left edge of the oesophagus and reaches the neck.
d. In the neck, it arches laterally at the level of the transverse process of the seventh cervical vertebra.
e. Finally, it descends in front of the first part of subclavian artery and ends by opening into the angle of junction between the left subclavian and left internal jugular vein.
f. There is a bicuspid valvelocated at the junction of the thoracic duct with the draining vein, which prevents the backflow of venous blood into the lymphatic system.

RELATIONS

Relations of thoracic duct are studied at different level with its course and they are as follows



i. ***At the aortic Opening of the diaphragm:***

a. Anteriorly it is related with diaphragm
b. Posteriorly it is related with vertebral column
c. To the right it is related with azygos vein and
d. To the left, it is related with the aorta

ii. ***In the posterior mediastinum:***

a. Anteriorly it is related with diaphragm, Oesophagus, and right pleural recess
b. Posteriorly it is related with right posterior intercostal arteries
c. To the right it is related with azygos vein and
d. To the left, it is related with descending thoracic aorta

iii. ***In the superior mediastinum:***

a. Anteriorly it is related with the arch of aorta and the origin of left subclavian artery
b. Posteriorly it is related with vertebral column
c. To the right, it is related with oesophagus and
d. To the left, it is related with pleura

iv. ***In the neck:***

a. The arch formed by the thoracic duct above the clavicle has following relations
b. Anteriorly it is related with left common carotid artery, left vagus nerve, and left internal jugular vein
c. Posteriorly it is related tothevertebral artery and vein, sympathetic trunk and its branches, left phrenic nerve, medial border of scalenus anterior muscle, and the first part of the subclavian artery.

TRIBUTARIES

- The thoracic duct drains lymph from the right and left descending thoracic lymph trunks
- The duct also receives lymph from intercostal spaces 1 to 5 via the upper intercostal lymph trunks.
- Additional tributaries of the thoracic duct are:
  - Mediastinal lymph trunks
  - Left jugular trunk,
  - Left broncho mediastinal trunk and
  - Left subclavian trunk

VARIATIONS

- The thoracic duct occasionally divides into a right and left duct, with the left entering the venous system as normal, and the right draining into the right subclavian vein.
- The duct may also drain into the left internal jugular vein, or into the left brachiocephalic vein.

Applied anatomy

i. *Chylothorax*

a. Chylothorax is the condition of leakage of chyle into pleura cavity due to rupture of the thoracic duct.
b. The aetiology of this condition includes traumatic and non-traumatic causes.
c. Traumaticcauses are surgery radiation, penetrating wounds, and forceful emesis or cough whereas
d. Non-traumatic causes include malignancies, other diseases such as tuberculosis, sarcoidosis, and superior vena cava obstruction.

ii. *Virchow's node*

a. Virchow's node is a large lymph node in the left supraclavicular area that drains the lymph from the gut.
b. When it is enlarged, it can be one of the earliest signs of intra-abdominal malignancy, usually a gastric carcinoma following the migration of tumor emboli through the thoracic duct.
c. It is located in the venous angle, at the junction of the left subclavian vein and the thoracic duct.

Q. 3 Azygos venous system

Ans. INTRODUCTION

- The venous systemlocated on either side of the vertebral column which drains the viscera within the mediastinum, as well as the back and thoracoabdominal walls is known as the azygos venous system.
- This system consists of the azygos vein and its two main tributaries: the hemiazygos vein and the accessory hemiazygos vein.
- It drains the thoracic wall and the upper lumbar region.
- It is an important connecting channel between superior and inferior vena cava.

FORMATION

The azygos vein is formed by the union of the lumbar azygos, right subcostal and right ascending lumbar veins.

i. ***The lumbar azygos vein***

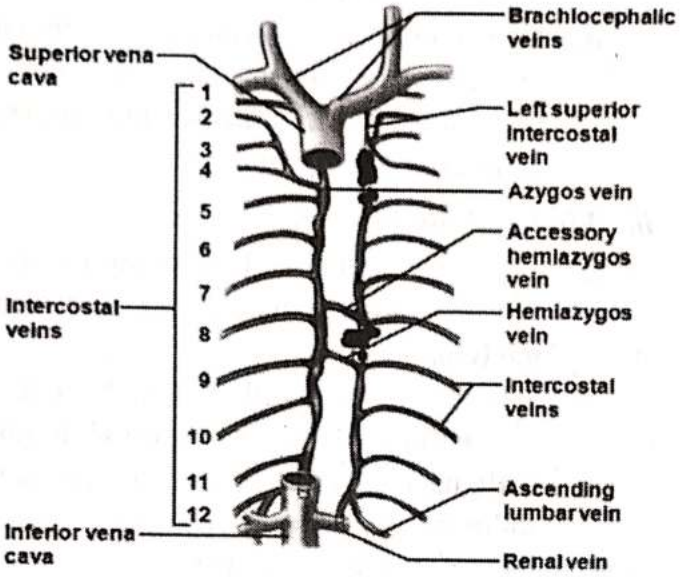
a. The lumbar azygos vein may be considered as the abdominal part of the

azygos vein.

b. It lies to the right of the lumbar vertebrae.

c. Its lower end communicates with the inferior vena cava.

ii. Right subcostal vein



The right subcostal vein accompanies the right subcostal artery.

iii. The ascending lumbar vein

a. The ascending lumbar vein is formed by vertical anastomoses that connect the lumbar veins.

b. The azygos vein may be formed by the union of the right subcostal and ascending lumbar veins.

COURSE

- The azygos vein enters the thorax by passing through the aortic opening of the diaphragm
- The azygos vein then ascends up to the fourth thoracic vertebra
- It arches forwards over the root of the right lung and
- Finally, it ends by joining the posterior aspect of the superior vena cava before it pierces the pericardium

RELATIONS

The azygos vein has anterior, posterior, right and left relations:

i. Anterior relation- Oesophagus is anteriorly related with azygos vein

ii. Posterior relations- Azygos vein has following posterior relations:

a. Lower eight thoracic vertebrae

b. Right posterior intercostal arteries

iii. The right relations - To the right azygos vein is related with:

a. Right lung and pleura

b. Greater splanchnic nerve

iv. The left relations- To the left azygos vein is related with

a. Thoracic duct and aorta in lower part and

b. Oesophagus, trachea, and vagus in its upper part

TRIBUTARIES

Following are the tributaries of azygos vein:

- Right superior intercostal vein formed by union of the second, third and fourth posterior intercostal veins
- Fifth to eleventh right posterior intercostal veins
- Hemiazygos vein at the level of the lower border oftheeighth thoracic vertebra.
- Accessory hemiazygos vein at the level of the upper border of an eighth thoracic vertebra.
- Right bronchial vein, near the terminal end of the azygos vein.
- Several oesophageal, mediastinal, pericardial veins.

The hemiazygos vein and the accessory hemiazygos vein are also referred to as tributaries of the azygos vein.

Hemiazygos vein

- The hemiazygos vein is often connected to the left renal vein.
- It is formed by the oesophageal and mediastinal tributaries, the common trunk of the left ascending lumbar vein and left subcostal vein, and by the lower three posterior intercostal veins.
- It ascends anterior to the vertebral column

before crossing the column posterior to the aorta, oesophagus, and thoracic duct at the level of the eighth thoracic vertebra.

Accessory hemiazygos vein

- The accessory hemiazygos vein is formed by veins from the fourth to eighth intercostal spaces and sometimes by the left bronchial veins.
- It descends to the left of the vertebral column before crossing the seventh thoracic vertebra, where it joins with the azygos vein. Sometimes it joins the hemiazygos vein and, in this case, their common trunk drains into the azygos vein.

Applied anatomy

i. Laceration

a. Laceration or ruptures of the azygos vein may occur in blunt trauma to the thorax as a result of a motor vehicle accident or a fall from a height.

b. Rupture of the vein usually occurs at its arch, just proximal to where it joins the superior vena cava.

c. Damage to the vein can result in a haemothorax.

d. In this condition, a thoracotomy is usually indicated, which involves an incision to the chest wall to allow drainage of the blood within the pleural space.

ii. Aneurysm

a. An aneurysm of the azygos vein is very rare and usually causes no symptoms.

b. They are usually detected on a chest X-ray as an abnormal mediastinal mass.

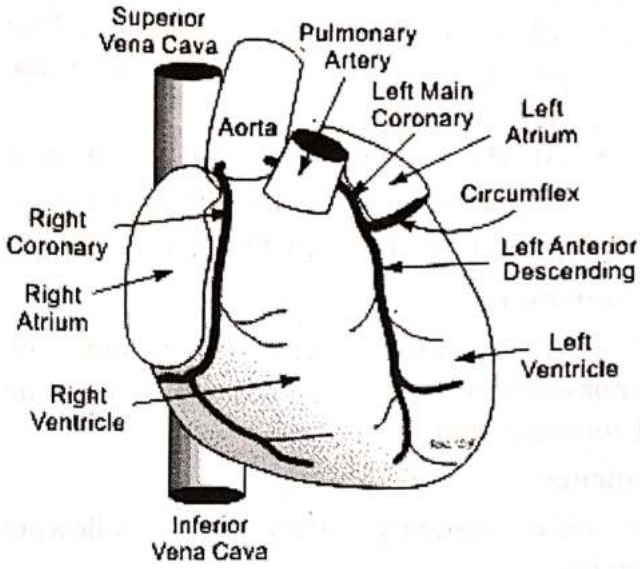
c. They can occur as a result of inferior vena cava obstruction, portal hypertension, and congestive heartfailure.

d. Surgical intervention is indicated when there is a risk of rupture or pulmonary embolism

Q. 4 **Blood supply of the heart**

Ans. **INTRODUCTION**

- The heart is a muscular, four-chambered organ that is responsible for distributing blood throughout the body.



- The continuous activity of the heart creates a large demand for nutrients to be delivered to cardiac tissue and for waste to be removed.
- In order to maintain optimum cardiac performance and homeostasis, the heart has a network of blood vessels known as the coronary vessels that take nutrient-rich blood to the heart tissue; as well as coronary veins that removes waste products from the cardiac myocytes.
- The heart is supplied by two coronary arteries, right and left arising from the ascending aorta.
- Both coronary arteries run in the coronary sulcus.

i. Right coronary artery

The right coronary artery is smaller than the left coronary artery.

Origin

The right coronary artery arises from the anterior aortic sinus of ascending aorta.

Course

- After its origin, it passes forwards and to the right to emerge on the surface of the heart between the root of the pulmonary trunk and the right auricle.

- It then runs downwards in the right anterior coronary sulcus to the junction of the right and inferior border of the heart.
- Then it reaches the diaphragmatic surface of the heart, by winding around the inferior border.
- At the diaphragmatic surface, it runs backwards and to the left in the right posterior interventricular groove.

Termination

The right coronary artery terminates by anastomosing with the circumflex branch of the left coronary artery at the crux.

Branches

The right coronary artery gives following branches:

- Anterior atrial branch
- Posterior atrial branch
- Lateral atrial branch
- Right conus branch
- Anterior ventricular branch
- Posterior ventricular branch
- Right marginal artery
- Posterior interventricular branch

Supply

The right coronary artery supplies:

- The right atrium
- Great part of right ventricle
- A small part of the left ventricle
- Posterior one-third of the interventricular septum
- Whole the conducting system of the heart except a part of left branch of AV bundle.

ii. Left Coronary artery

The left coronary artery is larger than the right coronary artery.

Origin

The left coronary arises from the left posterior aortic sinus of ascending aorta.

Course

- After its origin, it passes forwards and to the left to emerge on the surface of the heart between the pulmonary trunk and the left auricle.
- Then it continues as a circumflex artery.
- It then runs to the left in the left anterior coronary sulcus.
- It winds around the left border of the heart and continues in the left posterior coronary sulcus.

Termination

The left coronary terminates by anastomosing with the right coronary artery near the posterior interventricular groove.

Branches

The left coronary artery gives following branches:

- Anterior interventricular branch
- Anterior ventricular artery from Anterior interventricular branch
- Septal artery from Anterior interventricular branch
- Left conus artery from Anterior interventricular branch
- Circumflex branch
- Left marginal artery from circumflex branch
- Anterior ventricular artery from circumflex branch
- Posterior ventricular Artery from circumflex branch
- Anterior atrial branch from circumflex branch
- Lateral atrial branch from circumflex branch
- Posterior atrial branch from circumflex branch
- Posterior interventricular branch

Supply

The left coronary artery supplies

- The left atrium
- Great part of left ventricle
- A small part of right ventricle
- Anterior part of the interventricular septum
- A part of left branch of AV bundle.

Collateral circulation

There are two anastomoses of coronary artery for effective collateral circulation:

i. ***Cardiac anastomoses*** – The right and left coronary arteries anastomose with each other in the myocardium

ii. ***Extracardiac anastomoses*** – The coronary arteries also anastomose with other arteries. They are following

a. Vasa vasorum of the aorta
b. Vasa vasorum of pulmonary arteries
c. Internal thoracic arteries
d. Bronchial arteries and
e. Pericardiacophrenic arteries

Applied anatomy

i. ***Coronary thrombosis***

a. The thrombosis of coronary arteries is the cause of sudden death in a person's past middle life.
b. This is due to myocardial infarction and ventricular fibrillation.

ii. ***Angina pectoris***

The incomplete obstruction due to spasms of the coronary artery causes angina pectoris.

Q.5 Describe in detail the Middle and Superior Mediastinum Mediastinum

MIDDLE MEDIASTINUM

Ans. INTRODUCTION

Mediastinum is the middle space left in the thoracic cavity in between the lungs

It is most important contents are the heart, main blood vessels, trachea, bronchi, and the important nerves.

The mediastinum is Anterior bounded by Sternum, posteriorly bythe Vertebral column, Superiorly by Thoracic inlet,Inferiorly by Diaphragm,and on each side by Mediastinal pleura.

Divisions

The Mediastinum is mainly divided into two divisions

- The superior mediastinum and
- The inferior mediastinum.

The inferior mediastinum is further divided into the anterior, middle and posterior mediastinum

The superior mediastinum is separated from the inferior by an imaginary plane passing through the sternal angle anteriorly and the lower body of the fourth vertebra posteriorly.

The area in front of the pericardium is the anterior mediastinum.

The area behind the pericardium is the posterior mediastinum.

The pericardium and its contents form the middle mediastinum.

Definition

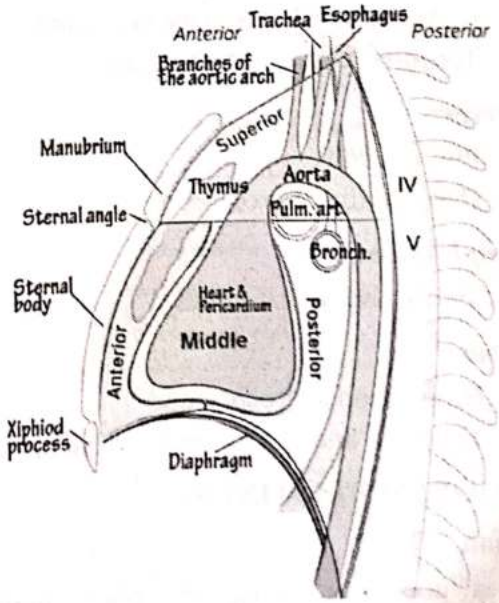
Middle mediastinum is one of the subdivisions of the inferior mediastinum.

The middle mediastinum is occupied by the pericardium and its contents, along with the phrenic nerves and Pericardiacophrenic vessels.

Boundaries

i. Anterior

Anteriorly it is bounded by Sternopericardial ligaments



ii. Posterior

Posteriorly it is bounded by Oesophagus, descending thoracic aortal and azygos vein

iii. On each side

On each side, it is bounded by Mediastinal pleura

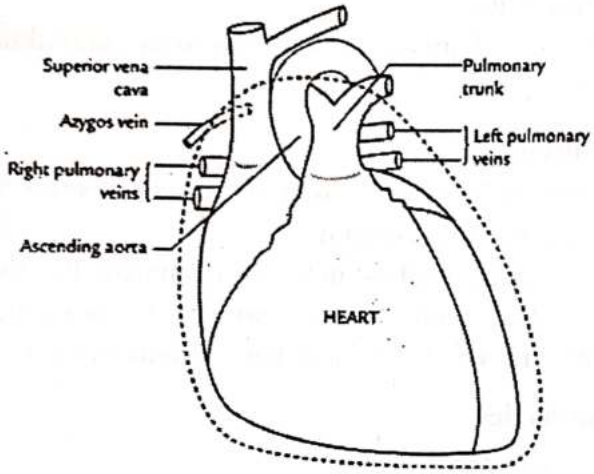
Contents

The middle mediastinum contains the following structures

i. Heart enclosed in pericardium

ii. Arteries:

a. Ascending aorta,
b. pulmonary trunk,
c. two pulmonary arteries



iii. Veins:

a. Lower half of the superior vena cava,
b. right and left pulmonary veins and
c. Terminal part of azygos vein

iv. Nerves:

a. Phrenic and
b. Deep cardiac plexus.

v. Lymph nodes:

a. Tracheobronchial nodes

vi. Tubes:

a. Bifurcation of trachea and
b. The right and left principal bronchi.

SUPERIOR MEDIASTINUM

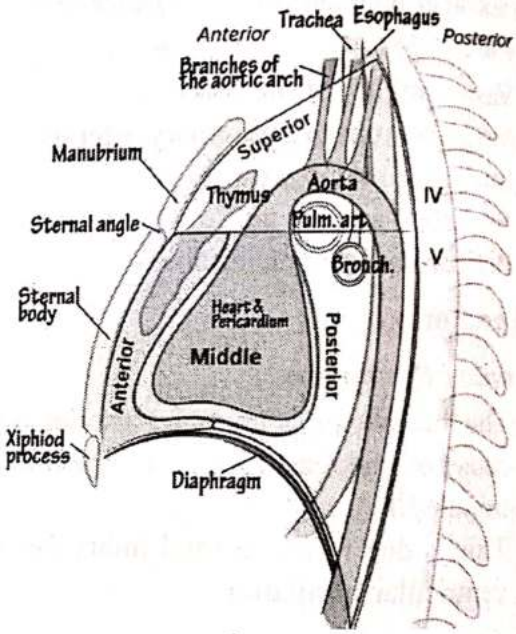
Definition

The area above an imaginary plane passing through the sternal angle anteriorly and the lower body of fourth vertebra posteriorly is known as superior mediastinum.

Boundaries

Superior mediastinum has anterior, posterior, superior, inferior boundaries and it is also bounded on each side.

- Anteriorly: Anteriorly superior mediastinum is bounded by Manubrium sterni
- Posteriorly: Posteriorly superior mediastinum is bounded by Upper four thoracic vertebrae



- Superiorly: Superiorly superior mediastinum is bounded by plane of the thoracic inlet
- Inferiorly: Inferiorly superior mediastinum is bounded by an imaginary plane passing through the sternal angle in front, and the lower border of the body of the fourth thoracic vertebra behind.
- On each side: On each side superior mediastinum is bounded by Mediastinal pleura.

Contents

Superior mediastinum contents following structures:

i. Tubes

a. Superior mediastinum contents
b. Trachea and
c. Oesophagus

ii. Muscles: Superior mediastinum contents following muscles

a. Sternohyoid

b. Sternothyroid
c. Lower ends of longuscolli

iii. ***Arteries:*** Superior mediastinum contains following arteries:
a. Arch of aorta,
b. Brachiocephalic artery,
c. Left common carotid artery and
d. Left subclavian artery

iv. ***Veins:*** Superior mediastinum contents following arteries
a. Right and left brachiocephalic veins,
b. Upper half of the superior vena cava and
c. Left superior intercostal vein.

v. ***Nerves:*** Superior mediastinum contents following nerves
a. Vagus,
b. Phrenic,
c. Cardiac nerves of both sides and
d. Left recurrent laryngeal nerve.

vi. ***Thymus***
vii. ***Thoracic duct***
viii. ***Lymph nodes:*** Superior mediastinum contains following lymph nodes:
a. Paratracheal,
b. Brachiocephalic, and
c. Tracheobronchial.

Q. 6 Describe in detail the Inferior Mediastinum.

Ans. Definition

The area below an imaginary plane passing through the sternal angle anteriorly and the lower body of fourth vertebra posteriorly is known as inferior mediastinum.

Divisions

The inferior mediastinum is divided into-

i. ***Anterior,***
ii. ***Middle and***
iii. ***Posterior Mediastinum***

i. Anterior Mediastinum

Introduction

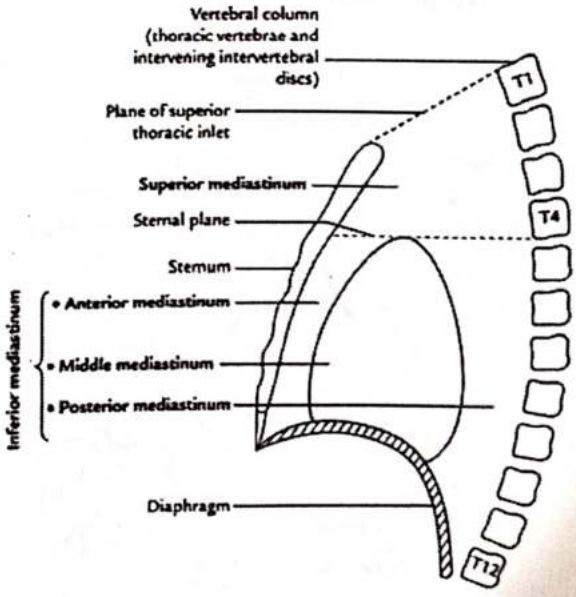
- Anterior mediastinum is a very narrow space in front of the pericardium.
- It is overlapped by the thin anterior borders of both lungs.
- It is continuous through the superior mediastinum with the pretracheal space of the neck.

Boundaries

Anterior mediastinum has anterior, posterior, superior, inferior boundaries and it is also bounded on each side.

- Anteriorly: Anteriorly anterior mediastinum is bounded by thebody of sternum.
- Posteriorly: Posteriorly anterior mediastinum is bounded by Pericardium
- Superiorly: Superiorly anterior mediastinum is bounded by Imaginary plane separating the mediastinum from the inferior mediastinum
- Inferiorly: Superior surface of diaphragm
- On each side : On each side anterior mediastinum is bounded by Mediastinal pleura

Contents



The anterior mediastinum contains following structures:

- Areolar tissue
- Lower part of thymus gland.

- Sternopericardial ligaments
- Lymph nodes with lymphatics
- Small mediastinal branches of the internal artery and
  - The lowest part of the thymus

ii. *Middle Mediastinum*

Introduction

- Middle mediastinum is one of the subdivisions of inferior mediastinum.
- Middle mediastinum is occupied by the pericardium and its contents, along with the phrenic nerves and Pericardiacophrenic vessels.

Boundaries

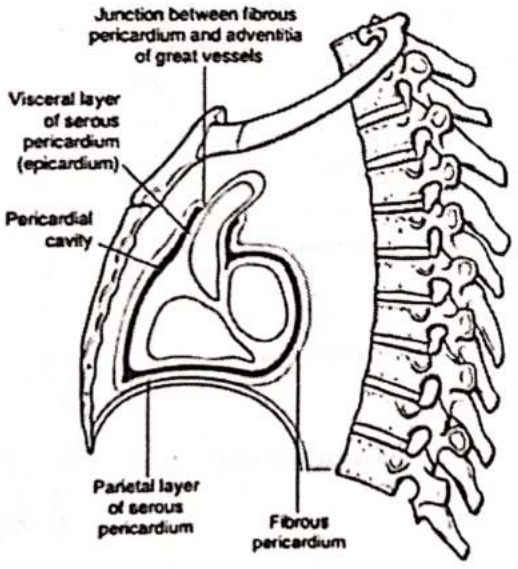
- Anteriorly: Sternopericardial ligaments
- Posteriorly: Oesophagus, descending thoracic aortal and azygos vein
- On each side: Mediastinal pleura

Contents

i. Heart enclosed in the pericardium

ii. Arteries:

a. Ascending aorta
b. pulmonary trunk
c. two pulmonary arteries



iii. Veins:

a. Lower half of the superior vena cava,
b. right and left pulmonary veins and
c. Terminal part of azygos vein

iv. Nerves:

a. Phrenic and
b. Deep cardiac plexus.

v. Lymph nodes:

Tracheobronchial nodes

vi. Tubes:

a. Bifurcation of trachea and
b. The right and left principal bronchi.

POSTERIOR MEDIASTINUM

Introduction

Posterior mediastinum is one of the subdivisions of inferior mediastinum.

Boundaries

Anteriorly:

- Pericardium,
- Bifurcation of trachea,
- Pulmonary vessels, and
- Posterior part of the upper surface of the diaphragm.

Posteriorly:

- Lower eight thoracic vertebrae and intervening discs.
- On each side:
- Mediastinal pleura

Contents

- Oesophagus
- Arteries:

The descending thoracic aorta and its branches

i. Veins:

a. Azygos vein,
b. hemiazygos vein, and
c. Accessory hemiazygos vein

ii. Nerves:

a. Vagus nerve,
b. splanchnic nerves, greater, lesser, and least, arising from the lower eight thoracic ganglia of the sympathetic chain

iii. Lymph nodes and lymphatics:

a. Posterior mediastinal lymph nodes lying alongside the aorta.
b. The thoracic duct

Applied anatomy

Mediastinal syndrome

i. Compression of mediastinal structures by a tumor gives rise to a group of symptoms known as Mediastinal syndrome

ii. It present with following symptoms

   a. Obstruction of superior vena cava gives rise to engorgement of veins in the upper half of body.
   b. Pressure over trachea causes dyspnoea and cough
   c. Pressure on oesophagus causes dysphagia
   d. Pressure on left recurrent laryngeal nerve gives rise to hoarseness of voice

iii. The common causes of mediastinal syndrome are bronchogenic carcinoma, Hodgkin's disease, and dilatation of aorta.

Q.7 Describe in detail trachea.

Ans. INTRODUCTION

- The trachea is a cartilaginous hollow tubular structures of the middle respiratory tract.
- It is more commonly known as the windpipe.
- It connects the inferior margin of the larynx with the lower respiratory tract or the lungs.
- It continues from the larynx ends at the point of bifurcates into the two major bronchi at the level of the fourth to the seventh thoracicvertebrae.
- It is wider at lower margin where it divides.

EXTENSION

The trachea extends from lower border of Cricoid cartilage opposite to the sixth cervical vertebraup to the lower border of sixth thoracicvertebrae.

Length

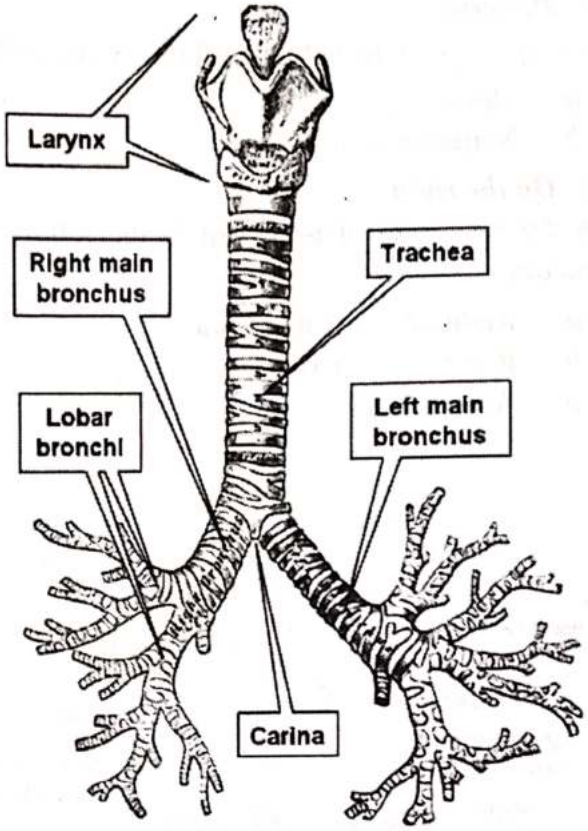
The trachea is approximately ten to fifteen centimeters long

Diameter

Its external diameter is two cmsin males and 1.5 cms in females.

COURSE

- It starts at the level ofthe sixth cervical vertebra.



- Then it descends into the thoracic cavity just anterior to the oesophagus.
- It enters in superior mediastinum and bifurcates with a slight deviation to the right, creating the right and left main bronchus.
- The trachea remain as a median structure

RELATIONS

i. **Anterior**

Anteriorly it is related to the following structures:

   a. The aortic arch,
   b. The brachiocephalic artery
   c. The left common carotid artery.
   d. Manubrium sterni
   e. Sternothyroid muscle
   f. Remains of thymus
   g. Left brachiocephalic vein

h. Inferior thyroid vein
i. Deep cardiac plexus and
j. Some lymph nodes

ii. Posterior

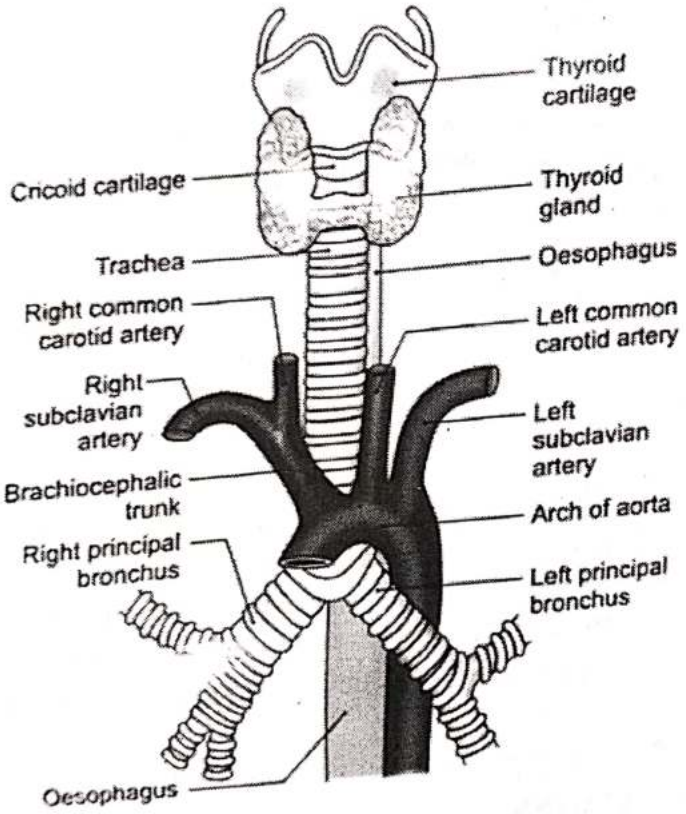
Posteriorly it is related to the following structures

a. Oesophagus and
b. Vertebral column

iii. On the right

On the right side, it is related to the following structures

a. Right lung and its pleura
b. Right vagus nerve and
c. Azygos vein



iv. On the left

On the left side, it is related to the following structures:

a. Arch of aorta
b. Left common carotid artery
c. Left subclavian artery
d. Left recurrent laryngeal nerve

STRUCTURES

- The trachea is comprised of approximately fifteen to twenty C-shaped hyaline cartilages.
- These cartilages provide structural rigidity to the trachea and its internal longitudinal elastic fibers enable it to stretch and shift inferiorly during inspiration.
- Towards the posterior aspect, there is a gap that is closed by a fibroelastic membrane and contains transversely arranged smooth muscles known as trachealis.
- The lumen of trachea is lined by ciliated columnar epithelium and contains mucous and serous glands.

Arterial supply

The trachea is supplied by the inferior thyroid arteries

Venous drainage

The trachea drains into the left brachiocephalic vein

Nerve supply

- The trachea is innervated by both sympathetic and parasympathetic fibers.
- Pain sensation is governed by the sensory fibers of the vagus nerve.

Applied anatomy

i. Choking

a. Two non-pathological but serious ailments of the trachea include choking and a tracheal foreign body.
b. Choking could be due to the accidental inspiration of food or fluid into the laryngeal inlet.
c. The coughing reflex helps to remove these remnants.
d. An actual foreign body that ends up in the trachea however is much more serious.

ii. Congenital birth defect

a. Congenital birth defects of the trachea include tracheal agenesisand a tracheoesophageal fistula.
b. In Tracheal agenesis, the trachea fails to develop and has fatal consequences.
c. The tracheal fistula is an embryonic malformation where the trachea and the

esophagusareconnectedwith each other.

d. Food swallowed can pass into the trachea and has serious consequences if left untreated.

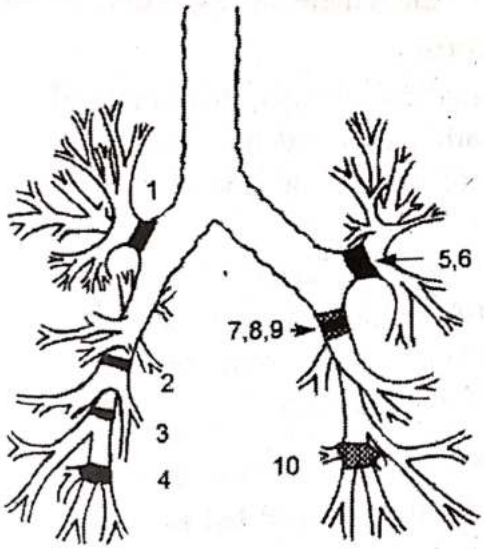
Q.8 Write in detail about Tracheobronchial Tree.

Ans. INTRODUCTION

- The trachea, bronchi and bronchioles form the tracheobronchial tree.
- The tracheobronchial tree is a system of airways that allow the passage of air into the lungs, where gaseous exchange occurs.
- These airways are located in the neck and thorax.

STRUCTURES

Following structures together forms the tracheobronchial tree



i. Trachea
ii. Bronchi and
iii. Bronchioles

i. Trachea

a. The trachea is the beginning of the tracheobronchial tree.

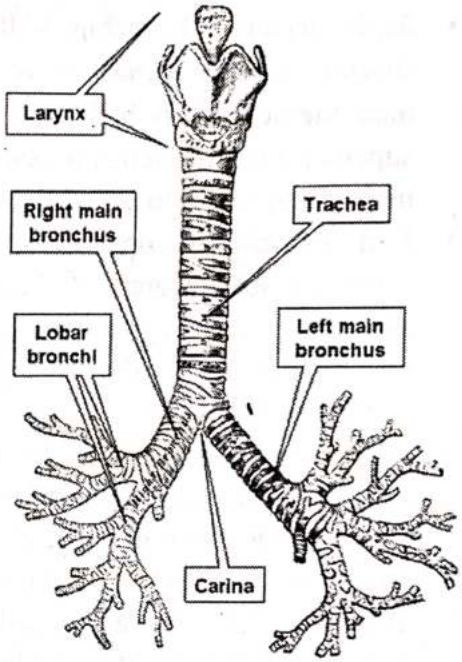
b. It arises at the lower border of Cricoid cartilage in the neck, as a continuation of the larynx.

c. It travels inferiorly into the superior mediastinum.

d. It bifurcates at the level of the sternal angle and forms the right and left main bronchi.

e. The trachea is comprised of approximately fifteen to twenty C-shaped hyaline cartilages.

f. These cartilages provide structural rigidity to the trachea and its internal longitudinal elastic fibers enable it to stretch and shift inferiorly during inspiration.



g. Towards the posterior aspect, there is a gap that is closed by a fibroelastic membrane and contains transversely arranged smooth muscles known as trachealis.

h. The lumen of trachea is lined by ciliated columnar epithelium and contains mucous and serous glands.

i. The trachea receives sensory innervation from the recurrent laryngeal nerve.

j. Arterial supply comes from the tracheal branches of the inferior thyroid artery, while the venous drainage is via the brachiocephalic, azygos, and accessory hemiazygos veins.

ii. Bronchi

a. At the level of the sternal angle, the trachea bifurcates into the right and left main bronchi.

b. The main bronchi undergo further branching to produce the secondary

bronchi.

c. Each secondary bronchus supplies a lobe of the lung and gives rise to several segmental bronchi.

d. Along with branches of the pulmonary artery and veins, the main bronchi make up the roots of the lungs.

Divisions

- Right principal bronchus – It is wider, shorter, and descends more vertically than the left main bronchus. The right superior lobar bronchus arises from right main bronchus before it enters the hilum.
- Left principal bronchus – It passes inferiorly to the arch of the aorta, and anteriorly to the thoracic aorta and oesophagus, and finally reaches the hilum of the left lung.
- Lobar bronchi -Within the lungs, the main bronchus gives secondary branches known as lobar bronchi. Each secondary bronchus supplies a lobe of the lung, thus there are 3 lobar bronchi in right lung and two left lobar bronchi in left lung.
- Segmental bronchi -The lobar bronchi then bifurcate into several segmental bronchi. Each segmental bronchi supply bronchopulmonarysegment.
- Bronchopulmonary segments -Bronchopulmonary segments are subdivisions of the lobes and act as the functional unit of the lungs.

Structure

- The structures of bronchi are very similar to that of the trachea only differences are seen in the shape of their cartilage.
- In the main bronchi, cartilage rings completely encircle the lumen.
- However, in the smaller lobar and segmental bronchi cartilage is found only in crescent shapes.

Blood supply

Blood supply to the bronchi is from branches of the bronchial arteries, while venous drainage is into the bronchial veins.

Neurovascular Supply

The bronchi derive innervation from pulmonary branches of the vagus nerve.

iii. Bronchioles

a. The segmental bronchi undergo further branching to form numerous smaller airways known as bronchioles.

b. The conducting bronchioles transport air but lack glands and are not involved in gaseous exchange.

c. These conducting bronchioles then end as terminal bronchioles.

d. These terminal bronchioles finally ends into respiratory bronchioles

e. The alveoli are the main functioning unit of the respiratory system extending from the lumens of respiratory bronchioles.

Structure

The smallest airways, bronchioles do not contain any cartilage or mucus-secreting goblet cells but they are served for smooth functioning by club cells.

These smooth club cells produce surfactant lipoprotein which helps in preventing the walls of the small airways from sticking together during the act of expiration.

Alveoli

Alveoli are tiny air-filled pockets with thin walls for of gaseous exchange in the lungs.

There are around 300 million alveoli in adult lungs, providing a large surface area for adequate gas

Applied anatomy

Asthma

Asthma is a chronic inflammatory disorder of the airways, characterised by hypersensitivity, reversible outflow obstruction, and bronchospasm. There is a remodeling of the small airways, causing increased smooth muscle thickness around the bronchioles, damaged epithelium, and a thickened basement membrane.

Q. 9 Describe in detail Oesophagus.

Ans.

INTRODUCTION

- The oesophagus is a fibromuscular tube
- It transports food from the pharynx to the stomach.

Length

The oesophagus is approximately 25cm in length.

Extension

It originates at the inferior border of the Cricoid cartilage about the level of C6 cervical vertebra and extends to the cardiac orifice of the stomach up to T11 thoracic vertebra.

COURSE

- The oesophagus begins in the neck, at the level of C6.
- Here, it is continuous superiorly with the laryngeal part of the pharynx i.e. the Laryngopharynx.
- It descends downward into the superior mediastinum of the thorax.
- It is positioned between the trachea and the vertebral bodies of T1 to T4.
- It then enters the abdomen via an opening in the right crus of the diaphragm known as oesophageal hiatus.
- The oesophageal hiatus is at the level of tenth thoracic vertebra.
- The abdominal portion of the oesophagus is approximately 1.25cm long.
- It terminates by joining the cardiac orifice of the stomach at the level of T11 vertebra.

STRUCTURES

The oesophagus shares a similar structure with many of the organs in the alimentary tract.

The oesophagus has the following layers:

- Adventitia- It is the outer layer of the oesophagus made up of connective tissue.
- Muscle layer- The muscular layer consists of an outer layer of longitudinal muscle and an inner layer of circular muscle. The outer muscular layer varies in every third part of the oesophagus. The superiorone-third of themuscular layer shows voluntary striated muscle The middle one-third of themuscular layer shows voluntary striated and smooth muscle whereas
- Submucosa layer- This layer is below the muscular layer
- Mucosa- The mucosal layer is composed of non-keratinised stratified squamous epithelium

Oesophageal Sphincters

- There are two sphincters present in the oesophagus, known as the upper and lower oesophageal sphincters.
- They act to prevent the entry of air and the reflux of gastric contents respectively.

i. Upper Oesophageal Sphincter

a. The upper sphincter is an anatomical, striated muscle sphincter at the junction between the pharynx and oesophagus.

b. It is produced by the cricopharyngeus muscle.

c. Normally, it is constricted to prevent the entrance of air into the oesophagus.

ii. Lower Oesophageal Sphincter

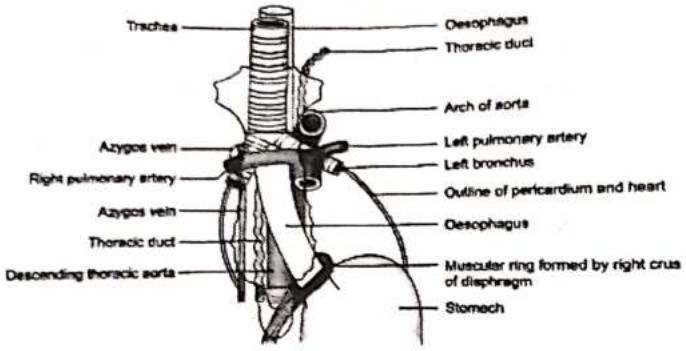
a. The lower oesophageal sphincter is a physiological sphincter located in the gastro-oesophageal junction.

b. The gastro-oesophageal junction is situated to the left of the T11 vertebra and is marked by the change from oesophageal to the gastric mucosa.

c. During oesophageal peristalsis, the sphincter is relaxed to allow food to enter the stomach. Otherwise, at rest, the function of this sphincter is to prevent the reflux of acidic gastric contents into the oesophagus.

RELATIONS

The anatomical relations of the oesophagus gives rise to four physiological constrictions in its lumen – these are the areas where food/foreign objects are most likely to become stuck. They can be remembered using the first four alphabets ABCD



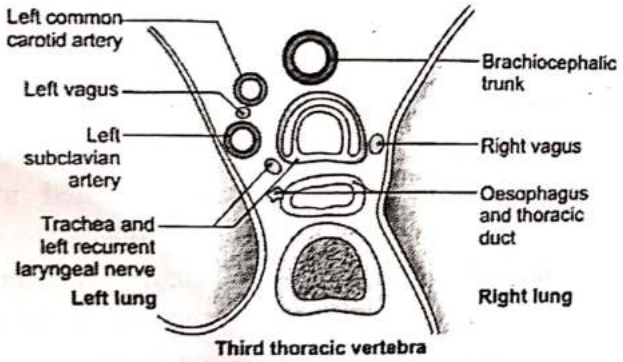
A for Arch of aorta
B for Bronchus
C for Cricoid cartilage and
D for Diaphragmatic hiatus

Relations of the oesophagus can be studied at its three subdivisions

i. Cervical part
ii. Thoracic part and
iii. Abdominal part

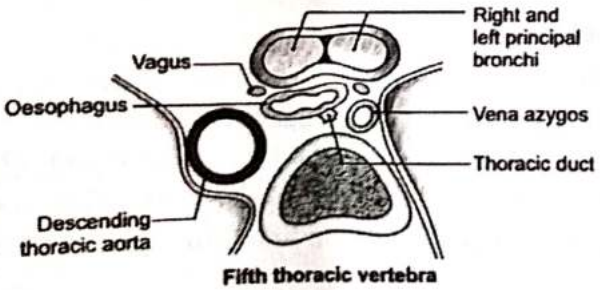
i. Cervical and Thoracic part

a. Cervical and thoracic part have following relations



b. Anteriorly it is related with the trachea, left recurrent laryngeal nerve, and pericardium

c. Posteriorly it is related with the thoracic duct, thoracic vertebral bodies, descending aorta, and azygos vein



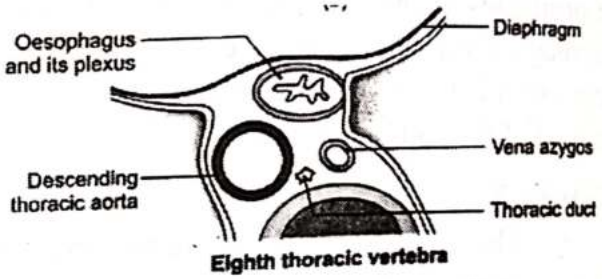
d. To the right, it is related with Pleura and terminal part of azygos vein

e. To the left, it is related with the subclavian artery, arch of aorta and thoracic duct

ii. Abdominal part

The abdominal part of oesophagus is having following relations:

a. Anteriorly it is related with the left vagus nerve and posterior surface of the heart



b. Posteriorly it is related with the right vagus nerve and left crus of the diaphragm

BLOOD SUPPLY

i. Thoracic

a. The thoracic part of the oesophagus receives its arterial supply from the branches of the thoracic aorta and the inferior thyroid artery.

b. Venous drainage of the thoracic part is into the systemic circulation which occurs via branches of the azygos veins and the inferior thyroid vein.

ii. Abdominal

a. The abdominal oesophagus is supplied by the left gastric artery and left inferior phrenic artery.

b. This part of the oesophagus has a mixed venous drainage via two routes:

- To the portal circulation via left gastric vein
- To the systemic circulation via the azygos vein.

NERVE SUPPLY

The oesophagus is innervated by the oesophageal plexus, which is formed by a combination of the parasympathetic vagal trunks and sympathetic fibers from the cervical and thoracic sympathetic

trunks.

Applied anatomy

i. ***Barrett's oesophagus***

a. Barrett's oesophagus refers to the metaplasia of lower oesophageal squamous epithelium to gastric columnar epithelium.

b. It is usually caused by chronic acid exposure as a result of malfunctioning of the lower oesophageal sphincter.

c. The acid irritates the oesophageal epithelium, leading to metaplastic changes.

d. The most common symptom is a long-term burning sensation

ii. ***Oesophageal carcinomas***

a. Around 2% of malignancies in the UK are oesophageal carcinomas. The clinical features of this carcinoma are

b. Dysphagia – Difficulty swallowing. It becomes progressively worse over time as the tumor increases in size, restricting the passage of food

c. Weight loss

iii. ***Oesophageal varices***

a. Oesophageal varices are abnormally dilated sub-mucosal veins (in the wall of the oesophagus) that lie within this anastomosis.

b. They are usually produced when the pressure in the portal system increases beyond normal, a state known as portal hypertension.

c. Portal hypertension most commonly occurs secondary to chronic liver diseases, such as cirrhosis or an obstruction in the portal vein.

Q. 10 Write about Conducting System of Heart

Ans. INTRODUCTION

- The heart generates its own electrical impulses and has its own specialised devised pathway that helps in spreading an action potential through the cardiac muscle.
- This cardiac conduction system is a collection of nodes and specialised conduction cells that initiate and coordinate the contraction of the heart muscle.
- The Sinoatrial node, Atrioventricular node, Atrioventricular bundle (bundle of His), and Purkinje fibers collectively form the conductive system of the heart.

Components of the Cardiac Conduction System

The cardiac conduction system is composed of following main elements which are:

i. Sinoatrial node
ii. Atrioventricular node
iii. Bundle of His
iv. Purkinje fibers

i. Sinoatrial node

a. The Sinoatrial node is the pacemaker of the heart and is situated superior to the sulcus terminalis of the right atrium, next to the opening of the superior vena cava.

b. This special myocardial tissue that is difficult to distinguish histologically from the surrounding cardiac muscle propagates the electrical impulses and therefore governs the sinus rhythmfrom minute to minute.

c. If this node should fail, the atrioventricular node can undertake the role of pacemaker.

d. The Sinoatrial (SA) node is a collection of specialised cells (pacemaker cells), and is located in the upper wall of the right atrium, at the junction where the superior vena cava enters.

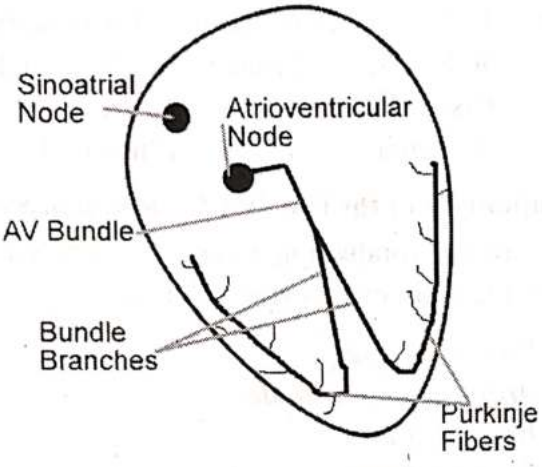
e. These pacemaker cells can spontaneously generate electrical impulses.

f. The wave of excitation created by the SA node spreads via gap junctions across both atria, resulting in atrial contraction (atrial systole) with blood moving from the atria into the ventricles.

g. The rate at which the SA node generates impulses is influenced by the autonomic nervous system.

The sympathetic nervous system helps to increase the firing rate of the SA node, and thus increases heart rate.

Cardiac Conduction System



The parasympathetic nervous system decreases the firing rate of the SA node, and thus decreases heart rate.

ii. *Atrioventricular Node*

a. The atrioventricular node is also located in the right atrium at a level that places it posteroinferiorly to the interatrial septum and next to the septal cusp of the tricuspid valve.

b. It picks up and continues the action potentials produced by the Sinoatrial node and in some cases will even propagate a few of its own.

c. It covers the atria of the heart, just as the Sinoatrial node does.

d. After the electrical impulse spread across the atria, they converge at the atrioventricular node – located within the atrioventricular septum, near the opening of the coronary sinus.

e. The AV node delays the impulses by approximately 120ms, to ensure that the atria have enough time to fully eject blood into the ventricles before ventricular systole.

f. The wave of excitation then passes from the atrioventricular node into the atrioventricular bundle.

iii. *Atrioventricular Bundle or Bundle of His*

a. The bundle of His is a specialised bundle of cardiac muscle fibers, which is seated within the interatrial septum.

- These fibers run along the interventricular septum to the apex of the heart, where they branch further as conducting (Purkinje) fibers that extend into the myocardium of the ventricles.
- The right side has a single bundle that reaches the apex of the right ventricle before curving around it and traveling back along the right side of the heart.

b. The left side has an anterior and a posterior division. The anterior divisioncuts across the left ventricle by running through its anterosuperior wall, while the posterior divisionbehaves as the right bundle does and circles the left side of the heart after reaching its apex.

c. The atrioventricular bundle (bundle of His) is a continuation of the specialised tissue of the AV node and serves to transmit the electrical impulse from the AV node to the Purkinje fibers of the ventricles.

d. It descends down the membranous part of the interventricular septum.

e. It divides into two main bundles: right and left bundle branches.

f. Right bundle branch conducts the impulse to the Purkinje fibers of the right ventricle

g. Left bundle branch conducts the impulse to the Purkinje fibers of the left ventricle.

iv. *Purkinje Fibers*

a. The terminal strands of nervous tissue are known as the purkinjefibers and these are responsible for making sure that every small group of cells is reached by an electrical stimulus to produce maximum muscular contraction.

b. The Purkinje fibers are a network of specialised cells.

c. They have abundant of glycogen and

have extensive gap junctions.

d. These cells are located in the subendocardial surface of the ventricular walls and can rapidly transmit cardiac action potentials from the atrioventricular bundle to the myocardium of the ventricles.

e. This rapid conduction allows coordinated ventricular contraction (ventricular systole) and blood is moved from the right and left ventricles to the pulmonary artery and aorta respectively.

Applied Anatomy

i. Cardiac arrhythmia

Cardiac arrhythmia occurs when the sinoatrial node produces action potentials that fail or exceed the normal range of a sinus rhythm which is between sixty to one hundred beats per minute.

ii. Sinus bradycardia

It is observed when the electrical impulses occur less than sixty times in a minute.

iii. Sinus tachycardia

It is a condition where the electrical impulse generated is hundred times in a minute. The sinus tachycardia in athletes is due to vigorous exercise, so it is not seen to be pathological, but rather as an effort to keep the body in its natural homeostasis by compensating for prolonged increased activity.

Q. 11 Describe Pericardium in detail

Ans. INTRODUCTION

- The pericardium is the membrane that encloses the heart and the roots of the major heart vessels.
- It protects the heart andprevents its friction during heart contractions

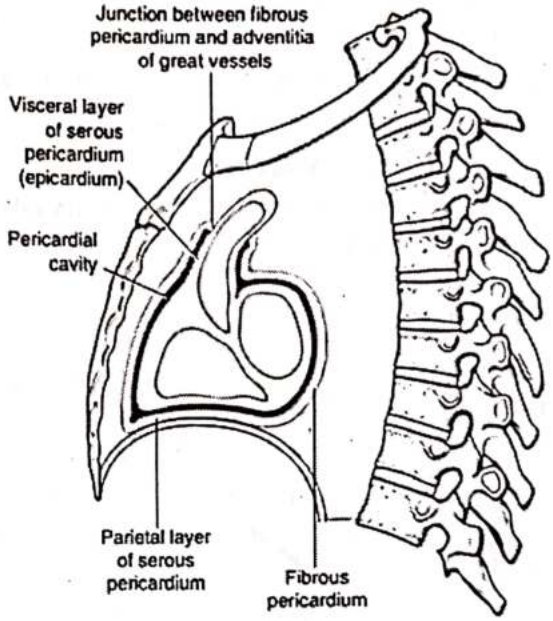
LAYERS

Pericardium consists of two layers

i. Fibrous Pericardium and
ii. Serous pericardium

i. Fibrous pericardium

a. Fibrous layer is an outer layer of the pericardium. It is a dense irregular sac.



b. It consists of thick fibrous connective tissue and defines the borders of the middle mediastinum.

c. The fibrous pericardium has a base, apex, anterior and posterior borders.

d. The base of the fibrous layer lies over the diaphragm and is attached to the central tendon of the diaphragm by the pericardiacophrenic ligament.

e. The apex of the fibrous pericardium is continuous with the tunica adventitia of the large vessels that leave the heart.

f. Its posterior border is related by loose connective tissue to the structures of the posterior mediastinum, whereas

g. The anterior border lays directly on the posterior surface of the sternum to which it is attached by the sternopericardial ligaments.

h. The attachment of the pericardium to the surrounding structures helps to fix the position of the heart to prevent its excessive distension and also provides protection.

ii. Serous pericardium

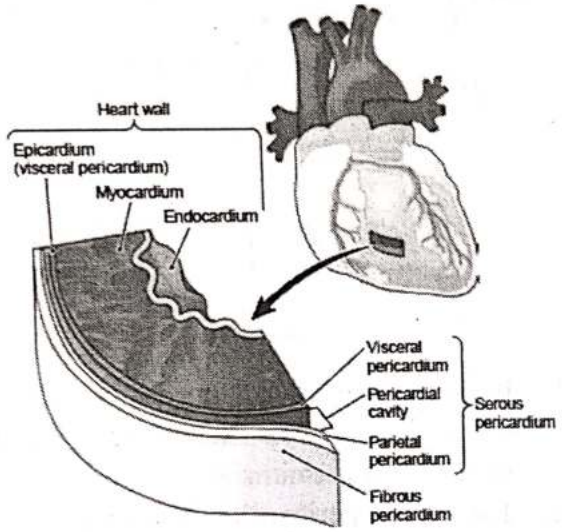
a. The serous pericardium is in a much

closer relationship with the heart.

b. The serous pericardium is a thin serous membrane.

c. Like all serous membranes, it consists of two layers:

- The outer parietal layer that lays directly onto the inner surface of the fibrous pericardium
- The inner visceral layer directly covers the heart.



- The inner visceral layer thatcovers the heart is also called the epicardium.
- Histologically the serous pericardium consists of a layer of squamous mesothelium supported by a loose connective tissue which helps to permit theneurovasculature structures.

CAVITY

- Between the parietal and visceral layers, there is a cavity known as the pericardial cavity.
- This potential space is filled with 15 - 50 millilitres of serous pericardial fluid which is secreted by pericardial cells.
- This thin fluid helps to reduce friction between the parietal and visceral layers during heart contractions

RELATIONS

Pericardium has following relations:

i. Superior

Superiorly it is continuous with the tunica adventitia of the great heart vessels

ii. Inferior

Inferiorly it is attached to the central tendon of the diaphragm

iii. Anterior

Anteriorly it is attached to the posterior surface of the sternum whereas

iv. Posterior

Posteriorly it is related to the content of the posterior mediastinum

REFLECTIONS

- The layers of the pericardium are separated, but at two places the parietal layer of the serous pericardium reflects toward the visceral and fuses with it, forming dead ends which are known as cul-de-sacs. These dead ends help to keep the pericardial cavity closed.
- These two reflections are at the following places:
- Superiorly the dead-end forms surrounding the arteries, aorta and pulmonary trunk and
- Posteriorly the dead-end forms surrounding the veins, superior vena cava, inferior vena cava, and pulmonary veins.

Pericardial sinuses

The two reflections of the pericardium forms the pericardial sinuses.

i. Oblique pericardial sinus

a. The cul-de-sac is formed around the posterior reflection of the pericardium.

b. It is J-shaped and located behind the left atrium.

c. It is called the oblique pericardial sinus.

ii. Transverse pericardial sinus

a. The passage between the anterior and posterior reflections is known as the transverse pericardial sinus.

b. It lies superior to the left atrium.

ARTERIAL SUPPLY

Following is the arterial supply of pericardium:

a. The pericardiacophrenic artery- The

arterial supply of the pericardium comes predominantly from the pericardiacophrenic artery, a branch of the internal thoracic artery).

b. The musculophrenic artery, a terminal branch of the internal thoracic,

c. Bronchial,

d. Oesophageal and

e. Superior phrenic arteries

All three are the branches of the thoracic aorta which contributes to their role.

VENOUS DRAINAGE

Deoxygenated blood is drained via various tributaries into:

- The azygos venous system and
- The pericardiacophrenic veins, the tributaries of the brachiocephalic vein.

NERVE SUPPLY

The pericardium has the following three main sources of nerve supply:

- Phrenic nerves (C3-C5) for somatic afferent functions like pain, temperature.
- The sympathetic trunk provides postganglionic vasomotor fibers and
- The vagus nerve butIts function is uncertain

Applied Anatomy

Pericardial effusion

- It is the excess accumulation of fluid in the pericardial cavity. Normally the amount of serous pericardial fluid between the serous layers has a physiological range of 15 - 50 millilitres.
- In some cases, the amount of pericardial fluid can exceed this range. This is mostly due to pericardial inflammation and is called pericardial effusion.
- Depending on the cause, the content of the excessive fluid is different. In conditions like congestive cardiac failure, hypoalbuminemia the serous characteristic fluid collects in the cavity.
- On the other hand, if the pericardial discharge contains blood, it usually indicates that there is an ongoing heart malignancy (which is very rare - the rarest malignancy of the humans), aortic dissection, or even a rupture of the myocardium.

Q. 12 Describe in detail the diaphragm.

Ans. INTRODUCTION

- The diaphragm is a double-domed sheet of skeletal muscle, located at the inferior-most aspect of the rib cage.
- The diaphragm separates the thoracic cavity from the abdominal cavity and
- The contraction and relaxation of the diaphragm alter the volume of the thoracic cavity and the lungs, producing inspiration and expiration.

LOCATION

- The diaphragm is located at the inferior most aspect of the thoracic cage.
- It forms the floor of the thoracic cavity as well as the roof of the abdominal cavity

ATTACHMENTS

i. The attachments of the diaphragm can be divided into peripheral and central attachments.

a. Peripheral attachments:
The diaphragm is peripherally attached :

- Posteriorly to the lumbar vertebrae and arcuate ligaments.
- on both sides with Costal cartilages of seventh to tenth ribs
- It has direct attachments with eleventh and twelfth ribs on both sides.
- Anteriorly to the Xiphoid process of sternum

b. Central attachment

- The muscle fibers of the diaphragm combine to form a central tendon.
- This central tendon ascends to fuse with the inferior surface of the fibrous pericardium.

- On either side of the pericardium, the diaphragm ascends to form left and right domes.

Crura or crus of diaphragm

ii. The tendinous parts of the diaphragm that arises from the vertebrae are known as the right and left Crus of the diaphragm.

a. Right crus - The right crus arise from L1-L3 and their intervertebral discs. Some fibers from the right crus surround the oesophageal opening, acting as a physiological sphincter to prevent reflux of gastric contents into the oesophagus.

b. Left crus -The left crus Arises from L1-L2 and their intervertebral discs.

PATHWAYS THROUGH THE DIAPHRAGM

- The diaphragm divides the thoracic and abdominal cavities.
- Thus, any structures that pass between the two cavities will pierce the diaphragm.
- There are three major and several small openings for three major structures.

i. Major openings

These openings are termed as hiatuses.

There are as follows:

a. Caval Hiatus or opening
- Inferior vena cava and
- Terminal branches of the right phrenic nerve are passing through the caval opening.

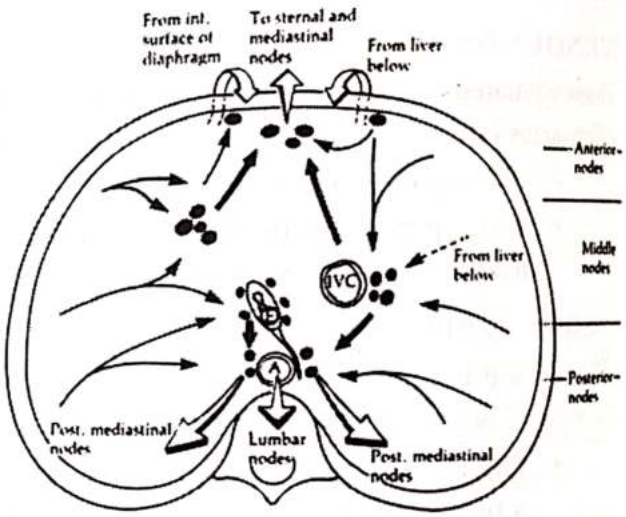
b. Oesophageal Hiatus or opening
- Oesophagus,
- Right and left vagus nerves and
- Oesophageal branches of the left gastric artery are passing through Oesophageal opening

c. Aortic Hiatus or opening
- Aorta
- Thoracic duct and
- Azygos vein are passing through the aortic opening

ii. Small Openings

There are small openings for:

a. Superior epigastric artery
b. Musculophrenic artery
c. Opening for lower intercostal nerves
d. Opening for lower intercostal vessels
e. Opening for lower subcostal nerves
f. Opening for lower subcostal vessels
g. Opening for greater and lesser phrenic nerves
h. Opening for left phrenic nerve



ACTION

- The diaphragm is the primary muscle of respiration.
- During inspiration, it contracts and flattens, increasing the vertical diameter of the thoracic cavity. This produces lung expansion, and the air is drawn in.
- During expiration, the diaphragm passively relaxes and returns to its original dome shape. This reduces the volume of the thoracic cavity

ARTERIAL SUPPLY

- The major part of the diaphragm is supplied by the inferior phrenic artery, a branch of the abdominal aorta.
- The remaining part is supplied by the superior phrenic, pericardiacophrenic, and musculophrenic arteries.

VENOUS DRAINAGE

- The draining veins follow the same course as

abovementioned arteries.

NERVE SUPPLY

- Half of the diaphragm receives motor innervation from the phrenic nerve.
- The left half of the diaphragm is innervated by the left phrenic nerve and the right half by the right phrenic nerve.

Applied anatomy

Diaphragmatic paralysis is due to an interruption in its nervesupply. This can occur in the phrenic nerve, cervical spinal cord, or brainstem. It is most often due to a lesion of the phrenic nerve

Q.13 Describe in detail the Thoracic Inlet

Ans. INTRODUCTION

The narrow upper end of the thorax which is continuous with the neck is known as the inlet or superior aperture of thorax.

BOUNDARIES

The inlet boundaries are as follows:

i. ***Anterior*** - Anteriorly it is bounded by the upper border of the manubrium sterni
ii. ***Posterior*** - Posteriorly it is bounded by the superior surface of the body of the first thoracic vertebra
iii. ***Side***- On each side, it is bounded by first rib and its cartilage.

POSITION

- The plane of the inlet is directed downwards and forwards with an obliquity of about 45 degrees.
- The anterior part lies 3.7 cm below the posterior part of the inlet.

PARTITIONS

- The cleft divides the inlet into two parts, right and left halves.
- Each half is covered by fascia.
- This fascia is triangular in shape.
- This fascia provides rigidity to the thoracic inlet.
- The apex of the fascia is attached to the tip of the transverse process of the seventh vertebra and the base of the fascia is attached to the inner border of the first rib and its cartilages.

Structures passing through the inlet of the thorax

Following structures are passing through the inlet:

i. Viscera
ii. Large vessels
iii. Smaller vessels
iv. Nerves
v. Muscles

i. Viscera

Following viscera's are passing through inlet of thorax:

- Trachea
- Oesophagus
- Apices of the lungs

ii. Large vessels

Following large vessels are passing through thoracic inlet:

a. Brachiocephalic artery passes on the right side of the inlet.
b. Left common carotid and left subclavian artery passes on the left side of the inlet.
c. Right, and left brachiocephalic veins are also passing through the inlet.

iii. Smaller vessels

Following Small vessels are passing through thoracic inlet:

a. Right and left internal thoracic arteries
b. Right and left superior intercostal arteries
c. Right and left first posterior intercostal veins and
d. Inferior thyroid veins are passing through the inlet of the thorax.

iv. Nerves

Following nerves are passing through thoracic inlet:

a. Right and left phrenic nerves
b. Right and left vagus nerves
c. Right and left sympathetic trunks and

d. Right and left first thoracic nerves are passing through the inlet of the thorax

v. Muscles

Following muscles are passing through the thoracic inlet:

a. Sternohyoid
b. Sternothyroid and
c. Longuscolli

Q. 14 Describe in detail the Root of lungs.

Ans. DEFINITION

- Root of lung is a short, broad pedicle thatconnects the medial surface of the lung to the mediastinum.
- It is formed by structures thateither enter or leave the lungs at the hilum.

LOCATION

- The root of lungs lies opposite to the body of fifth, sixth, and seventh thoracic vertebrae

CONTENTS

- There is a difference between right and left roots.
- The root is made up of the following structures:
  - Principal bronchi on the left side
  - Eparterial and Hyparterial bronchi on the right side.
  - One pulmonary artery on both sides
  - Two pulmonary veins, superior and inferior on both sides
  - One bronchial artery on the right side
  - Two bronchial arteries on the left side
  - Bronchial veins on both side
  - Anterior pulmonary plexus of nerves on both sides
  - Posterior pulmonary plexus of nerves on both sides
  - Lymphatics of lung on both sides
  - Bronchopulmonary lymph nodes on both sides
  - Areolar tissue on both sides

ARRANGEMENT OF STRUCTURES IN THE ROOT

The arrangements of structures are in two ways, one from anterior to posterior direction and another from above downward direction.

i. From anterior to posterior

a. It is similar on the two sides.
b. Following three structures are same in both roots.
  - Superior pulmonary vein is most anterior
  - Pulmonary artery at the middle position and
  - Bronchus at the posterior aspect

ii. From above downwards

It is different on the two sides

Right side

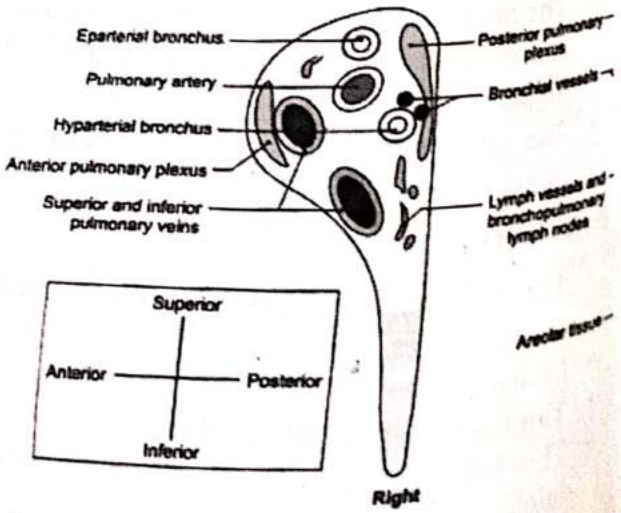
a. Eparterial bronchus
b. Pulmonary artery
c. Hyparterial bronchus and
d. Inferior pulmonary vein

Left side

a. Pulmonary artery
b. Bronchus and
c. Inferior pulmonary vein

Relations of the root

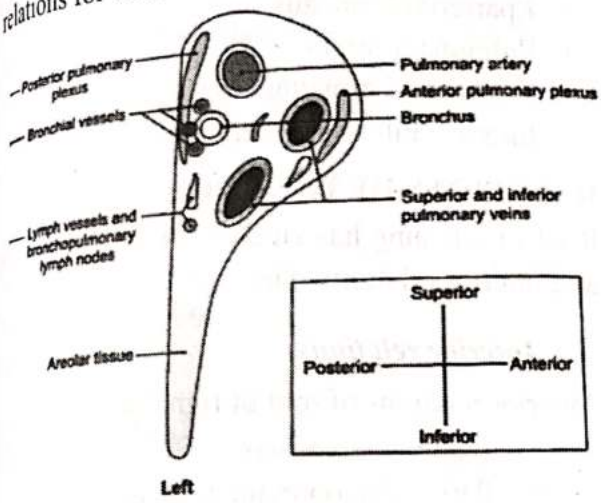
Root of lungs has anterior, posterior, superior, and inferior relations. They are as follows:



i. Anterior relations

The Phrenic nerve, Pericardiacophrenic vessels.

and anterior pulmonary plexus are common relations for both roots.



a. Right root of lung has following anterior relations:

- Phrenic nerve
- Pericardiacophrenic vessels
- Anterior pulmonary plexus
- Superior vena cava and
- A part of right atrium

b. Left root of lung has following anterior relations

- Phrenic nerve
- Pericardiacophrenic vessels and
- Anterior pulmonary plexus

ii. Posterior relations

The vagus nerve and posterior pulmonary plexus are common relations for both roots.

a. Right root of lung has the following posterior relations:

- Vagus nerve
- Posterior pulmonary plexus

b. Left root of lung has the following posterior relations :

- Vagus nerve
- Posterior pulmonary plexus and
- Descending thoracic aorta

iii. Superior relations

Superiorly both roots have different relations. They are as follows:

a. Right root has superior relation with Terminal part of azygos vein

b. Left root has superior relation with Arch of aorta

***iv.* Inferior relations**

Inferiorly both roots have same relations and that is with pulmonary ligament.

Q. 15 Describe in detail the Root of left lung.

Ans. ARRANGEMENTOFSTRUCTURESIN THE ROOT

The arrangements of structures are in two ways, one from anterior to posterior direction and another from above downward direction

From anterior to posterior

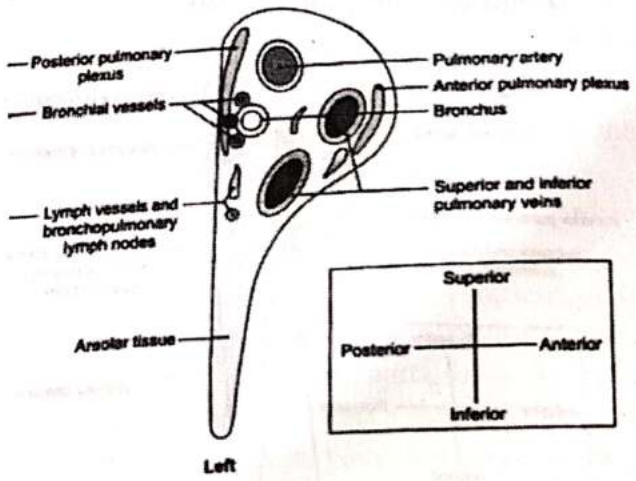
Following three structures are in root of left lung from anterior to posterior:

a. Superior pulmonary vein is most anterior
b. Pulmonary artery at the middle position and
c. Bronchus at the posterior aspect

i. From above downwards

Following three structures are in root of left lung from above downwards.

a. Pulmonary artery
b. Bronchus and
c. Inferior pulmonary vein



RELATIONS OF THE ROOT

Root of left lung has anterior, posterior, superior and inferior relations. They are as follows

ii. ***Anterior relations*** - Anterior relations of root of left lung are
   a. Phrenic nerve
   b. Pericardiacophrenic vessels and
   c. Anterior pulmonary plexus

iii. ***Posterior relations*** - Posterior relations of root of left lung are
   a. Vagus nerve
   b. Posterior pulmonary plexus and
   c. Descending thoracic aorta

iii. ***Superior relations***- Left root has superior relation with Arch of aorta

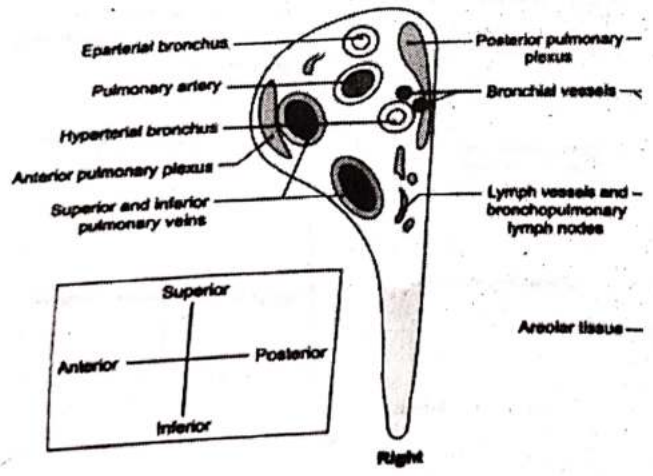
iv. ***Inferior relations***- Inferiorly rootofleft lung is related topulmonary ligament.

Q. 17 Describe in detail the Root of right lungs.

Ans. ARRANGEMENTOFSTRUCTURESIN THE ROOT

The arrangements of structures are in two ways, one from anterior to posterior direction and another from above downward direction.

- From anterior to posterior
  Following three structures are in root of right lung from anterior to posterior:
- Superior pulmonary vein is most anterior
- Pulmonary artery at the middle position and
- Bronchus at the posterior aspect



- From above downwards

Following three structures are in root of right lung from above downwards:

- Eparterial bronchus
- Pulmonary artery
- Hyparterial bronchus and
- Inferior pulmonary vein

RELATIONS OF THE ROOT

Root of left lung has anterior, posterior, superior, and inferior relations. They are as follows

i. Anterior relations

Anterior relations of root of right lung are:
   a. Phrenic nerve
   b. Pericardiacophrenic vessels
   c. Anterior pulmonary plexus
   d. Superior vena cava and
   e. A part of right atrium

ii. Posterior relations

Posterior relations of root of right lung are:
   a. Vagus nerve
   b. posterior pulmonary plexus

iii. Superior relations

Right root has superior relation with terminal part of the azygos vein

iv. Inferior relations

Inferiorly root ofright lung is related topulmonary ligament.

Q. 18 Describe external features of left lung

Ans. INTRODUCTION

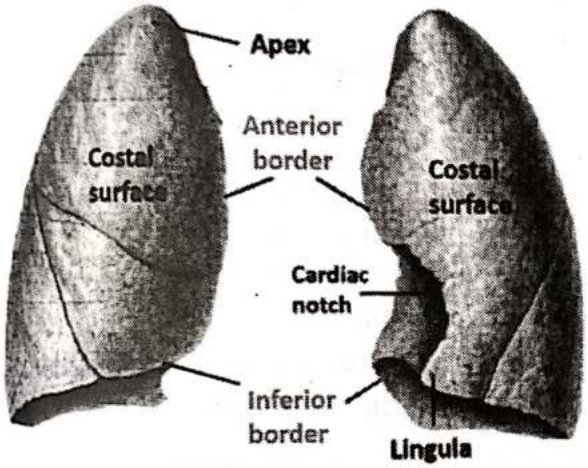
- The lungs are spongy, expandable organs; paired organs of the respiratory systemthat occupy the thoracic cavity.
- Each lung occupies the respective hemithorax and the space between two lungs is called the mediastinum. The left lung weighs about 565 gram whereas right lung weighs about 625 grams.
- The adult lung has a dark, mottled appearance that is reflective of the filtration of carbon-based moieties from the airway whereas the lungs of a new-born are light pink.

- The left lung is smaller than the right lung.
- It has one fissure and two lobes.

EXTERNAL FEATURES OF LEFT LUNG

Left lung has following external features:

i. *Apex*
ii. *Base*
iii. *Three borders*
iv. *Two surfaces*
v. *Fissures and Lobes and*
vi. *Hilum*



i. *Apex*

a. The apex is the highest point of the lung.
b. It extends into the thoracic inlet.
c. It is a dome-shaped part of the lung that protrudes above the first costal cartilage.
d. It reaches nearly 2.5 cm above the medial one-third of the clavicle.
e. It is covered by the cervical pleura, suprapleural membrane and is grooved by the subclavian artery on the medial side and anteriorly.

ii. *Base*

a. The base is semilunar and concave.
b. It rests on the diaphragm which separates it from left lobe of liver, the fundus of the stomach, and the spleen.

iii. *Borders*

The left lung has three borders, anterior, posterior, and inferior border.

a. Anterior border

- The anterior border is very thin.
- It is shorter than the posterior border.
- It shows a wide cardiac notch below the level of the fourth costal cartilage.

b. Posterior border

- The posterior border is thick and ill-defined.
- It corresponds to the medial margins of the heads of the ribs.
- It extends from the seventh cervical spine to the tenth thoracic spine.

c. Inferior border

- The inferior border separates the base from the costal and medial surfaces.

iv. *Surfaces*

The left lung has two surfaces, costal surface and medial surface.

a. Costal surface

- The costal surface is large and convex.
- It is in contact with the costal pleura and overlying thoracic wall.

b. Medial surface

- The medial surface of the left lung is divided into posterior or vertebral part and anterior or mediastinal part.
- The vertebral part is related to the vertebral bodies,' intervertebral discs, the posterior intercostal vessels, and the splanchnic nerves.
- The mediastinal part is related to the mediastinal septum.
- The medial part shows the cardiac impression, the hilum.
- It is related totheleft ventricle, left auricle, pulmonary trunk, arch of aorta, descending thoracic aorta, left subclavian vein, thoracic duct, oesophagus, left brachiocephalic vein, left vagus nerve, left phrenic nerve, and left recurrent nerve.

v. *Fissures and Lobes*

a. Fissures

- The left lung has one fissure the oblique fissure.
- The oblique fissure cuts into the whole thickness of the lung except at the hilum.
- It passes obliquely downwards and forwards crossing the posterior border about 6 cm below the apex and inferior border about 5 cm from the median plane.
- The oblique fissure divides the left lung into two lobes.

b. Lobes

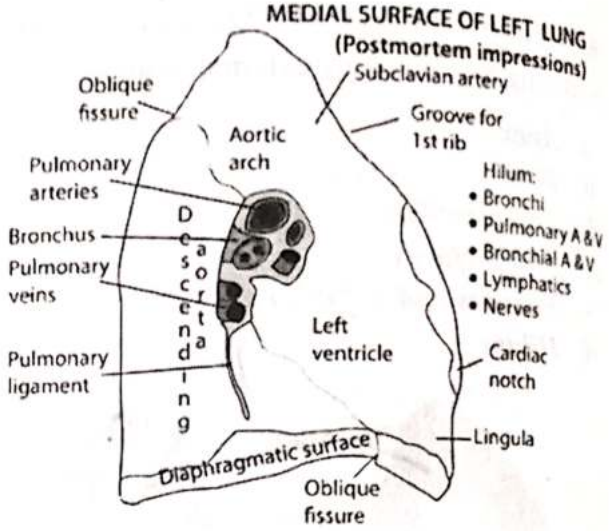
- The left lung is divided into two lobes by oblique fissure, superior and inferior lobes..
- The superior lobe is anterosuperior to the fissure whereas the inferior lobe is posteroinferior to the oblique fissure.
- The inferior lobe is much larger than the superior lobe.
- The major part of the left lung base, a majority of the posterior border, and the lower posterior part of the medial and lateral surfaces are formed by the inferior lobe.
- The superior lobe includes the apex, and most of the costal and medial surfaces, and the entire anterior border.
- The superior lobe also includes the cardiac notch and the associated lingula found in that area.

vi. Hilum of left lung

a. The hilum of left lung is inferior and anterior to the aortic arch and thoracic aorta respectively.

b. Following structures are present in the hilum of left lung.

- Pulmonary artery - The pulmonary artery is the most superior structure within the left hilum.
- Principal bronchus - The principal bronchus is immediately below the pulmonary artery.
- Inferior pulmonary vein - The inferior pulmonary vein is below the principal bronchus.



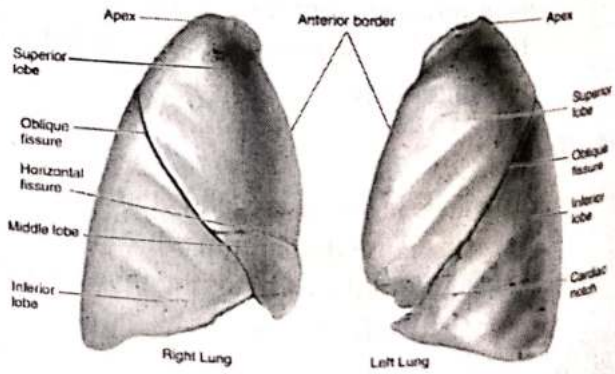
- Superior pulmonary vein - The superior pulmonary vein is anteroinferior to the pulmonary artery and anterior to the principal bronchus.

Q. 19 Describe external features of right lung

Ans. The right lung is bigger than the left lung. It has two fissures and three lobes.

RIGHT LUNG HAS FOLLOWING EXTERNAL FEATURES:

i. Apex
ii. Base
iii. Three borders
iv. Two surfaces
v. Fissures and Lobes and
vi. Hilum



***i.* Apex**

a. The apex is the highest point of the lung.

b. It extends into the thoracic inlet.

c. It is a dome-shaped part of the lung that protrudes above the first costal cartilage.
d. It reaches nearly 2.5 cm above the medial one-third of the clavicle.
e. It is covered by the cervical pleura, suprapleural membrane and is grooved by the subclavian artery on the medial side and anteriorly.

ii. *Base*

a. The base is semilunar and concave.
b. It rests on the diaphragm which separates it from the right lobe of the liver.

iii. *Borders*

The right lung has three borders, anterior, posterior, and inferior border.

a. *Anterior border*

- The anterior border is very thin.
- It is shorter than the posterior border.

b. *Posterior border*

- The posterior border is thick and ill defined.
- It corresponds to the medial margins of the heads of the ribs.
- It extends from seventh cervical spine to the tenth thoracic spine.

c. *Inferior border*

- The inferior border separates the base from the costal and medial surfaces.

iv. *Surfaces*

The right lung has two surfaces, costal surface and medial surface

a. *Costal surface*

- The costal surface is large and convex.
- It is in contact with the costal pleura and overlying thoracic wall.

b. *Medial surface*

- The medial surface of the right lung is divided into posterior or vertebral part and anterior or mediastinal part.
- The vertebral part is related to the vertebral bodies, intervertebral discs, the posterior intercostal vessels, and the splanchnic nerves.
- The mediastinal part is related to the mediastinal septum.
- The medial part shows the cardiac impression, the hilum.
- It is related totheright atrium and auricle, a small part of right ventricle, superior vena cava, lower part of right brachiocephalic vein, azygos vein, oesophagus, inferior vena cava, trachea, right vagus nerve, and right phrenic nerve.

v. ***Fissures and Lobes***

a. *Fissures*

- The right lung has two fissures the oblique and horizontal fissure.
- The oblique fissure cuts into the whole thickness of the lung except at the hilum.
- It passes obliquely downwards and forwards crossing the posterior border about 6 cm below the apex and inferior border about 5 cm from the median plane.
- The horizontal fissure passes from the anterior border up to the oblique fissure and separates the middle lobe from the upper lobe.

b. *Lobes*

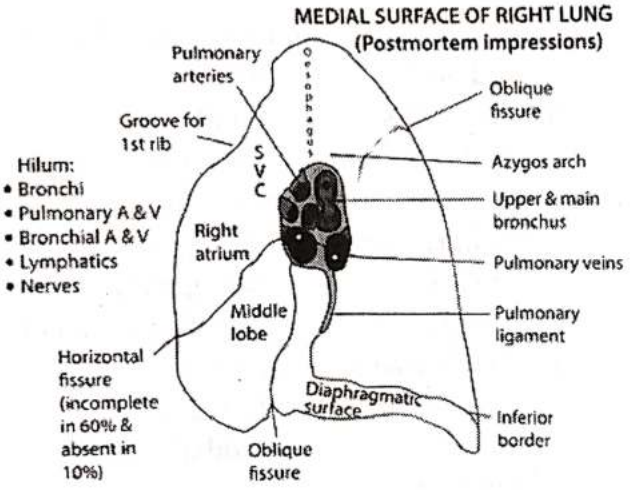
- The right lung is divided into three lobes by two fissures, superior, middle and inferior lobes.
- The superior lobe of the right lung is located above the horizontal fissure and anterosuperior to the oblique fissure.
- The superior lobe contains the apex, the majority of the upper part of the costal surface, and the upper part of the medial surface as well.
- The middle lobe is the smallest of the three right lung lobes.
- It is caudally related to the horizontal fissure and anterior to the oblique fissure.
- It is cuneiform in shape and involves the anterior basal aspect of the lung, the

anteroinferior part of the costal surface, and the inferior region of the anterior border.

- The inferior lobe accounts for the majority of the lung surface volume. It is situated behind the oblique fissure.
- This lobe includes the posteroinferior parts of the costal and medial surfaces and the entire lung base that is posterior to the oblique fissure.

vi. Hilum of right lung

a. The hilum of the right lung is inferior and anterior to the aortic arch and thoracic aorta respectively.



b. The right hilum is caudally related to the terminal azygos vein and posteriorly related to the right atrium and superior vena cava.

Following structures are present in the hilum of the right lung:

a. Pulmonary artery - The pulmonary artery is in between the Eparterial and Hyparterial bronchus

b. Eparterial bronchus - It is the most superior structure within the right hilum.

c. Hyparterial bronchus -The Hyparterial bronchus is below the pulmonary artery

d. Inferior pulmonary vein - The inferior pulmonary vein is below the Hyparterial bronchus.

e. Superior pulmonary vein - The superior pulmonary vein is anteroinferior to the pulmonary artery and anterior to the Hyparterial bronchus.

Q. 20 Openings in the Diaphragm.

Ans. INTRODUCTION

- The outlet of the thorax is closed by a large musculotendinous partition known as the diaphragm.
- The diaphragm has three large and several small openings for passing the important structures from thorax to abdomen and vice versa.

Openings of diaphragm

The openings of the diaphragm are divided into two groups, large group and small group

i. Large Openings

There are three large openings in the diaphragm. These three openings are:

a. Vena caval opening
b. Oesophageal opening and
c. Aortic opening

a. Vena caval opening

- It is the opening specially formed for inferior vena cava.
- It is situated at the junction of the right and the left median leaflet of central tendon.
- It is at the level of T8 vertebra.
- It is quadrilateral in shape
- The inferior vena cava is the prime structure passing through this opening associated with two more structures, the right phrenic nerve, and lymphatics of the liver.

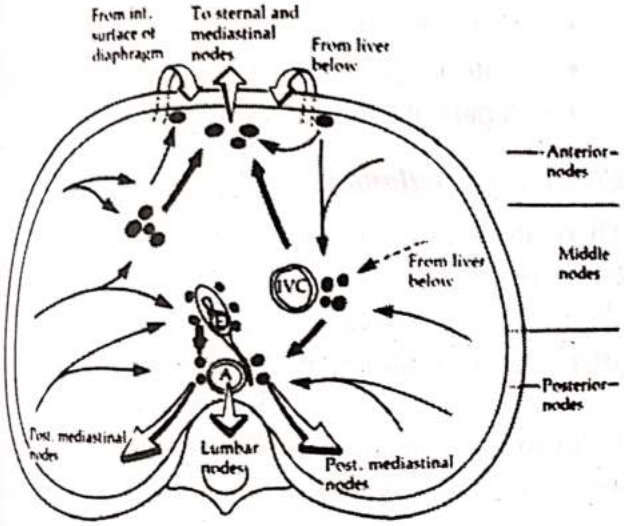
b. Oesophageal opening

- It is the opening for the oesophagus.
- It is situated at the splitting of the right crus of diaphragm.
- It is at the level of T10 vertebra.
- It is elliptical in shape
- oesophagus is the prime structure passing

through this opening associated with both vagal trunks and left gastric vessels.

c. *Aortic opening*

- It is the opening for the descending aorta.
- It is situated behind the median arcuate ligament.
- It is at the level of T10 vertebra.
- It is elliptical in shape
- The aorta is the prime structure passing through this opening associated with both thoracic duct and azygos vein.



ii. *Small Openings*

There are small openings for:

a. Superior epigastric artery
b. Musculophrenic artery
c. Opening for lower intercostal nerves
d. Opening for lower intercostal vessels
e. Opening for lower subcostal nerves
f. Opening for lower subcostal vessels
g. Opening for greater and lesser phrenic nerves
h. Opening for left phrenic nerve

Q. 21 Describe coronary circulation

Ans. INTRODUCTION

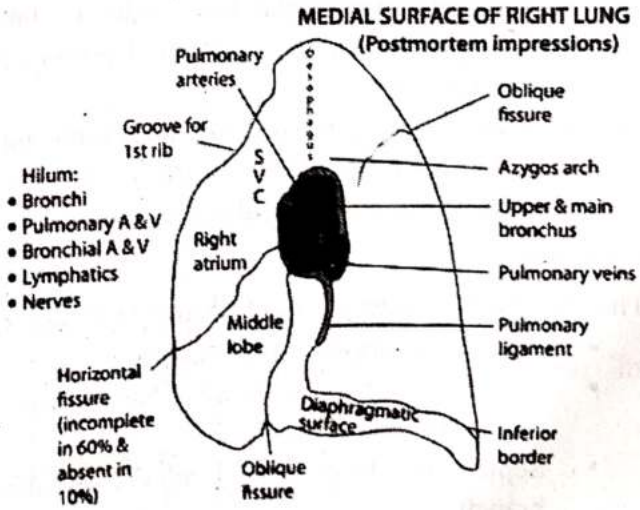
The heart is supplied by two coronary arteries, right and left arising from the ascending aorta. Both coronary arteries run in the coronary sulcus.

i. *Right coronary artery*

a. The right coronary artery is smaller than the left coronary artery.
b. It arises from the anterior aortic sinus of ascending aorta.
c. After its origin, it passes forwards and to the right to emerge on the surface of the heart between the root of the pulmonary trunk and the right auricle.
d. It then runs downwards in the right anterior coronary sulcus to the junction of the right and inferior border of the heart.
e. Then it reaches the diaphragmatic surface of the heart, by winding around the inferior border.
f. At the diaphragmatic surface, it runs backwards and to the left in the right posterior interventricular groove.
g. Finally, it terminates by anastomosing with the circumflex branch of the left coronary artery at the crux.

Branches

The right coronary artery gives following branches:



a. Anterior atrial branch
b. Posterior atrial branch
c. Lateral atrial branch
d. Right conus branch
e. Anterior ventricular branch
f. Posterior ventricular branch
g. Right marginal artery
h. Posterior interventricular branch

Circulation

The right coronary artery supplies:

- The right atrium
- A great part of right ventricle
- A small part of left ventricle
- Posterior one-third of the inter ventricular septum
- Whole of the conducting system of the heart except a part of the left branch of the AV bundle.

ii. Left Coronary artery

a. The left coronary artery is larger than the right coronary artery.

b. It arises from the left posterior aortic sinus of ascending aorta.

c. After its origin, it passes forwards and to the left to emerge on the surface of the heart between the pulmonary trunk and the left auricle.

d. Then it continues as the circumflex artery.

e. It then runs to the left in the left anterior coronary sulcus.

f. It winds around the left border of the heart and continues in the left posterior coronary sulcus.

g. Finally, it terminates by anastomosing with the right coronary artery near the posterior interventricular groove.

Branches

The left coronary artery gives following branches:

- Anterior interventricular branch
- Anterior ventricular artery from Anterior interventricular branch
- Septal artery from Anterior interventricular branch
- Left conus artery from Anterior interventricular branch
- Circumflex branch
- Left marginal artery from circumflex branch
- Anterior ventricular artery from circumflex branch
- Posterior ventricular Artery from circumflex branch
- Anterior atrial branch from circumflex branch
- Lateral atrial branch from circumflex branch
- Posterior atrial branch from circumflex branch
- Posterior interventricular branch

Circulation

The left coronary artery supplies:

- The left atrium
- Great part of left ventricle
- A small part of right ventricle
- Anterior part of the interventricular septum
- A part of left branch of AV bundle.

Collateral circulation

There are two anastomoses of coronary artery for effective collateral circulation:

Cardiac anastomoses – The right and left coronary arteries anastomose with each other in the myocardium

Extracardiac anastomoses – The coronary arteries also anastomose with other arteries. They are :

- Vasa vasorum of the aorta
- Vasa vasorum of pulmonary arteries
- Internal thoracic arteries
- Bronchial arteries and
- Pericardiacophrenic arteries

Applied anatomy

i. Coronary thrombosis

a. The thrombosis of the coronary arteries is the cause of sudden death in person's past middle life. This is due to myocardial infarction and ventricular fibrillation.

ii. Angina pectoris

a. The incomplete obstruction due to spasms of the coronary artery causes angina pectoris.

Q. 22 Write a note on Intercostal Space.

Ans. INTRODUCTION

- Theskeletal framework of the wall of the thorax is formed by the thoracic cage.

- The gaps between the ribs are called as Intercostal spaces.
- There are nine intercostal spaces anteriorly and eleven intercostal spaces posteriorly.
- The spaces contain the intercostal muscles, nerves, arteries, veins, and investing fascia.

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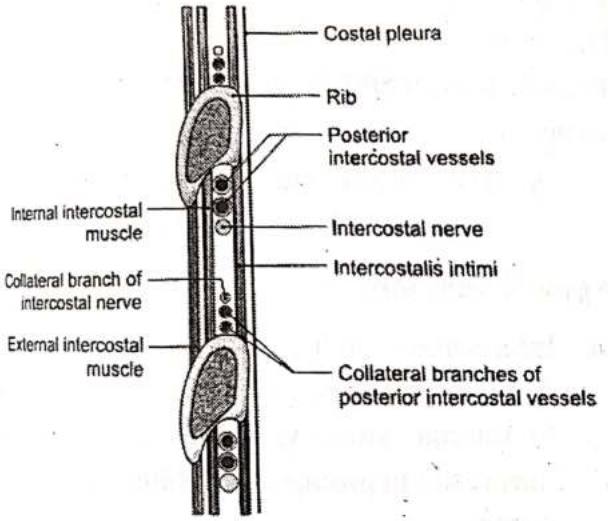
The following structures are present in the intercostal spaces:



i. ***Intercostal muscles***
ii. ***Intercostal arteries***
iii. ***Intercostal veins***
iv. ***Intercostal lymph nodes***
v. ***Intercostal nerves***

i. *Intercostal muscles*

There are three intercostal muscles:

a. *The external intercostal muscle-*
   - The external intercostal muscle extends from the tubercle of the rib posteriorly to the costochondral junction anteriorly.
   - In the anterior part of the intercostal space, the fibers of external intercostal muscle run downwards, forwards, and medially in front

b. *The internal intercostal muscle -*
   - The internal intercostal muscle extends from the lateral border of the sternum to the angle of the rib.
   - In the anterior part of intercostal space, the fibers of the internal intercostal muscle run downwards, backwards, and laterally.
   - The fibers of the internal intercostal muscle are running at the right angle to the external intercostal muscle

c. *The transverse thoracicmuscle*
   - The transverse thoracicmuscle also extends from the lateral border of the sternum to the angle of the rib.
   - In the anterior part of intercostal space, the fibers of transverse thoracicmuscle run downwards, backwards, and laterally.
   - The fibers of transverse thoracic muscle are running at a right angle to the external intercostal muscle

ii. *Intercostal arteries*

Each intercostal space contains

a. One posterior intercostal artery with its collateral branch -
b. Two anterior intercostal arteries
   - Each anterior intercostal space contains two anterior intercostal arteries.
   - Two anterior intercostal arteries end by anastomosing with the respective posterior intercostal arteries and with collateral branches of posterior intercostal arteries.

iii. *Intercostal veins*

Each intercostal space contains:

- One posterior intercostal vein with its collateral branch and
- Two anterior intercostal veins

a. Posterior Intercostal Vein
   - There is one posterior intercostal vein and one collateral vein in each intercostal space.
   - Each vein accompanies the corresponding artery and lies superior to it. (VAN).
   - The first right-sided posterior intercostal vein terminates in the right brachiocephalic vein whereas the first left-sided posterior intercostal vein terminates in the left

brachiocephalic vein.

- The second, third, and fourth right-sided posterior intercostal veins join and form the right superior intercostal vein which drains into the azygos vein whereas the second, third and fourth left-sided posterior intercostal veins join and form the left superior intercostal vein which drains into the left brachiocephalic vein
- The fifth, sixth, seventh and eight right-sided posterior intercostal veins drain into the azygos vein whereas the fifth, sixth, seventh, and eight left-sided posterior intercostal veins drain into accessory hemiazygos vein
- The ninth, tenth and eleventh right-sided posterior intercostal veins drain into the azygos vein whereas the ninth, tenth and eleventh left-sided posterior intercostal veins drain into the hemiazygos vein

b. Anterior intercostal vein

- There are two anterior intercostal veins in each of the upper nine spaces.
- Each vein accompanies the corresponding artery and lies superior to it. (VAN)
- The upper three anterior intercostal veins drain into the internal thoracic vein.
- The fourth, fifth and sixth anterior intercostal veins drain into venous components accompanying internal thoracic artery
- The seventh, eighth and ninth anterior intercostal veins drain into venous components accompanying internal musculophrenic artery

c. Intercostal lymph nodes

- Lymphatics from the anterior part of spaces pass to the anterior intercostal nodes whereas lymphatics from the posterior parts of the spaces pass to the posterior intercostal nodes

d. Intercostal nerves

The anterior primary rami of thoracic one to thoracic eleven spinal nerves form the intercostal nerve.

- The intercostal nerve remains most inferior in the intercostal space. (VAN)

Applied anatomy

a. Intercostal hernia

A defect in the intercostal muscle, secondary to trauma, surgery, and congenital defects, may result in prolapse of the lung or abdominal organs.

b. Intercostal flaps

Neoplasm, trauma, infection, and congenital causes of damaged or necrotic tissue in the thorax involve complicated surgical repair. Mobilizing strips of the intercostal muscles, along with their blood supply can facilitate the repair of damaged tissue by transplanting healthy, vascularised, tissue into a compromised area.

2

Lower Limb

LOWER LIMB TWO MARKS QUESTIONS

Q. 1 Name the divisions of the sciatic nerve

Ans. The divisions of the sciatic nerve are:

a. tibial nerve
b. Common peroneal nerve

Q. 2 Name ligaments of ankle joint.

Ans. Following are the ligaments of the ankle joint

a. Fibrous capsule
b. Medial ligament and
c. Lateral ligament

Q. 3 Name any two content of popliteal Fossa.

Ans. The contents of popliteal fossa are :

a. Popliteal artery and its branches
b. Tibial nerve and its branches
c. Popliteal vein and its tributaries
d. Common peroneal nerve anditsbranches

Q. 4 Write origin and insertion of sartorius muscle.

Ans. Following are the attachments of sartorius muscle

Origin: It originates from:

a. anterior superior iliac spine and
b. Upper half of the notch below the spine

Insertion: - It inserts on the upper part of the medial surface of the shaft of the tibia in front of insertions of the gracilisand the semitendinosus

Q. 5 Name two contents of adductor canal

Ans. Following are the contents of adductor canal:

a. Femoral artery,
b. Femoral vein
c. Saphenous nerve and
d. Nerve to vastusMedialis

Q. 6 Name the muscles supplied by sciatic nerve.

Ans. The sciatic nerve supplies:

a. biceps femoris
b. semitendinosus
c. semimembranosus
d. adductor magnus

Q. 7 Name the muscles forming quadriceps femoris

Ans. The quadriceps femoris is formed by following four muscles:

a. rectus femoris
b. vastuslateralis
c. vastusmedialis and
d. vastusintermedius

Q. 8 Name the branches of dorsalis pedis artery.

Ans. The dorsalis pedis artery gives the following branches:

a. Medial tarsal artery
b. Lateral tarsal artery
c. Deep plantar artery
d. Anterior tibial artery

Q. 9 Name the bones forming knee joint.

Ans. Following bones participate in the formation of knee joint:

a. femur
b. tibia and
c. Patella

Q. 10 Write any four ligament of Hip joint

Ans. The ligaments of hip joint are:

a. Iliofemoral ligament
b. Pubofemoral ligament
c. Ischiofemoral ligament
d. Acetabular ligament

Q. 11 Write the names of muscles producing locking and unlocking of knee joint.

Ans. The locking of knee joint is performed by vastusmedialis.

The unlocking of knee joint is performed by popliteus muscle

Q. 12 Write the names of muscles of the anterior compartment of leg.

Ans. The muscles of anterior compartment of leg are :

a. Tibialis anterior
b. Extensordigitorumlongus
c. Extensorhallucislongus and
d. Fibularistertius

Q. 13 Name the structures passing deep to flexor retinaculum of ankle joint.

Ans. Following structures are passing deep to flexor retinaculum of ankle joint

a. tendon of tibialis posterior
b. tendon of flexor digitorumlongus
c. posterior tibial artery and its branches

Q. 14 Name the hamstring muscles.

Ans. Hamstring muscles are:

a. Biceps femoris
b. Semitendinosus
c. Semimembranosus

Q.15 Name the branches of popliteal artery.

Ans. Following are the branches of popliteal artery:

a. Anterior tibial artery
b. Posterior tibial artery
c. Medial genicular artery
d. Sural artery

Q. 16 Mention ligaments of ankle joint.

Ans. Following are the ligaments of ankle joint:

a. fibrous capsule
b. medial ligament
c. Lateral ligament

Q. 17 Mention muscles supplied by femoral nerve.

Ans. Following muscles are supplied by femoral nerve :

a. Quadriceps femoris
b. Pectineus

Q. 18 Mention the muscles of posterior compartment of the leg.

Ans. The muscles of posterior compartment of the leg are :

a. Popliteus
b. Tibialis posterior
c. Flexor hallucislongus
d. Flexor digitorumlongus

Q. 19 Mention the muscles in the second layer of the sole of foot.

Ans. The second layer of the sole of foot contents:

a. Tendons of flexor digitorumlongus
b. Tendons of Lumbricals
c. Tendons of flexor hallucislongus
d. Tendons offlexordigitorumaccessorius

Q. 20 Mention the muscles forming boundaries of the adductor canal.

Ans. Following are the boundaries ofthe adductor canal:

a. Anterior boundary is formed by vastusmedialis
b. Posterior boundary is formed by adductor longusand adductor magnus
c. roof and medial boundaries are formed by the sartorius

Q. 21 Name the muscles of quadriceps femoris group.

Ans. The quadriceps femoris' means 'four-headed femoral muscle'.

The group consists of four muscles namely:

a. the midline located rectus femoris,
b. laterally placed vastuslateralis,
c. medially situated vastusmedialis, and
d. Deeply placed vastusintermedius.

All of the muscles of the quadriceps muscle group converge to form a common tendon known as the quadriceps tendon.

Q. 22 Name branches of deep fibular nerve

Ans. The deep fibular nerve supplies

a. Extensor digitorumlongus muscle
b. Extensor hallucislongus muscle,
c. Peroneus tertius muscle and Tibialis anterior muscle

Q. 23 Any four branches of tibial nerve.

Ans. Tibial nerve gives following branches :

a. The geniculate branches for knee joint
b. The geniculate branches for Tibiofibular joint
c. The nerve to peroneus longus muscle and
d. The nerve to peroneus brevis muscle.

Q. 24 Any four contents of popliteal fossa

Ans. Popliteal fossa contains:

a. Tibial nerve
b. Common fibular nerve
c. Popliteal artery
d. The popliteal vein

Q. 25 Name branches of femoral artery

Ans. The femoral artery gives six branches, five branches in the femoral triangle and one branch in the adductor canal.

a. Superficial epigastric artery
b. Superficial circumflex iliac artery
c. Superficial external pudendal artery
d. Deep external pudendal artery
e. Profundafemoris and
f. Descending genicular artery

Q. 26 Write down the external rotators of knee.

Ans. Following are the external rotator of knee:

a. The obturator internus
b. The obturator externus
c. The superior gemellus
d. The inferior gemellus
e. The quadratusfemoris muscle and
f. The piriformis muscle

Q. 27 Write down the internal rotators of hip.

Ans. The internal rotator muscles of hipare:

a. The gluteus medius and
b. The gluteus minimus muscles.
c. The adductor magnus.

Q. 28 Name the adductor muscles of hip.

Ans. Following are the adductors of hip:

a. The adductor longus
b. The adductor brevis
c. The adductor magnus
d. The pectineus
e. The gracillis and
f. The quadratusfemoris

Q. 29 Name the abductor muscles of hip.

Ans. Following muscles are the hip abductor

a. The gluteus medius
b. The gluteus minimus and
c. The piriformis

Q. 30 Name the extensor muscles of hip.

Ans. Following muscles are the hip extensors

a. The gluteus maximus
b. The biceps femoris
c. The semimembranosus
d. The semitendinosus

Q. 31 Ligaments of hip joint.

Ans. The hip joint is supported by the following ligaments.

The ligaments are in two groups:

i. Outer group and
ii. Inner group

i. The outer ligaments of hip joint are:

a. The Iliofemoral ligament
b. The Ischiofemoral ligament
c. The Pubofemoral ligament

ii. The inner ligaments of hip joint are:

a. The transverse acetabular ligament
b. Ligament of head of femur

Q. 31 Name the ligaments of Ankle joint.

Ans. Ankle joint has the following ligaments:

a. Anterior talofibular ligament,
b. Posterior talofibular ligament,
c. Tibiocalcaneal part of deltoid ligament,
d. Tibionavicular part of deltoid ligament,
e. Tibiotalar part of deltoid ligament and
f. Fibular collateral ligament

Q. 32 Name contents of femoral triangle.

Ans. The femoral triangle contains the following structures

a. Femoral nerve
b. Femoral artery
c. Femoral vein
d. Lymphatics

Q. 33 Name any 2 bones participating in the formation of the transverse arch.

Ans. The transverse arch consists of the following bones:

a. The five metatarsals
b. The cuboid and
c. The cuneiform bones

Q. 34 Name any 2 muscles supporting the lateral longitudinal arch.

Ans. The following muscles are playing important role in maintaining the arch:

a. The fibularislongus tendon
b. Lateral two tendons of flexor digitorumlongus assisted by flexor accessories
c. Abductor digitiminimi
d. Lateral half of flexor digitorum brevis
e. Fibularis brevis
f. Fibularistertius

Q. 35 Name any 2 ligaments of the lateral longitudinal arch.

Ans. Following are the ligaments of the lateral longitudinal arch:

a. The plantar aponeurosis
b. The long plantar ligament
c. The short plantar ligament

Q. 36 Name any 2 bones participating in the formation of the lateral longitudinal arch.

Ans. The lateral longitudinal arch is formed by the following bones:

a. Calcaneus
b. The cuboid
c. The fourth and fifth metatarsals

Q. 37 Name any 2 muscles supporting the medial longitudinal arch.

Ans. Muscles in the foot also help support the medial longitudinal arch. These muscles are:

a. Flexor hallucislongus
b. Flexor digitorumlongus
c. Abductor hallucis
d. Flexor digitorum brevis
e. Tibialis posterior

Q. 38 Name any 2 ligaments of the medial longitudinal arch.

Ans. Following are the ligaments of the medial longitudinal arch:

a. Plantar aponeurosis
b. Spring ligament
c. The talocalcaneal ligament
d. The anterior fibers of the deltoid ligament

Q. 39 Name any 2 bones participating in the formation of the medial longitudinal arch.

Ans. The bones participating in the formation of the medial longitudinal arch are the following:

a. The medial three metatarsals up to their heads
b. The sesamoid bones
c. The three cuneiforms
d. The navicular
e. The talus and
f. The calcaneus

Q. 40 Name any 2 tributaries of great saphenous vein.

Ans. Following are the tributaries of great saphenous vein:

a. The medial marginal vein
b. The small saphenous vein
c. The perforating veins
d. Accessory saphenous vein and
e. Anterior femoral cutaneous vein

Q. 41 Names the bones forming the lower ankle joint.

Ans. The lower ankle joint helps the articular surfaces to glide upon each other so that the cartilage surfaces can move freely.
The following bones form the lower ankle joint:

a. Talus
b. Calcaneus and
c. Navicular

Q. 42 Names the bones forming the upper ankle joint.

The upper ankle joint is a hinge variety of joint helping in stretching and bending of the foot.

The upper ankle joint is composed of the three bones:

a. Fibula
b. Tibia and
c. Talus

Q. 43 Name any 2 quadriceps femoris muscles.

Ans. The name 'quadriceps femoris' means four femoral muscle group.

The group consists of four muscles, the midline located rectus femoris, laterally placed vastuslateralis, medially situated vastusmedialis, and deeply placed vastusintermedius.

Q. 44 Write two special features of fascia lata.

Ans. Following are the features of fascia lata:

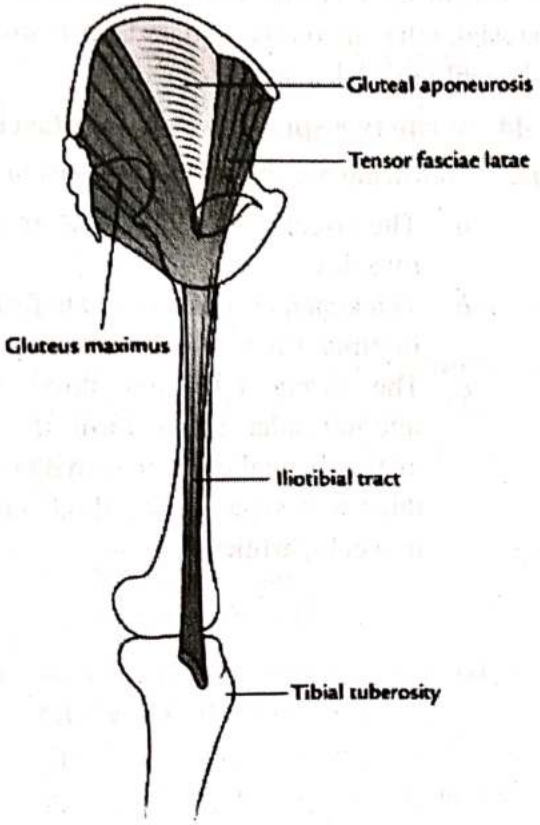
a. The fascia lata encloses the large thigh muscles.
b. Thickened part of fascia lata forms the iliotibial tract.
c. The fascia lata and three fascial intermuscular septa form the walls of the muscular compartments of the thigh and separate the thigh muscles into compartments.

LOWER LIMB FIVE MARKS QUESTIONS

Q. 1 Write a short note on Iliotibial tract.

Ans. INTRODUCTION

- The iliotibial tract is also known asiliotibial band.
- It is a large five- centimetre wide thick band of fascia lata that runs down at the lateral surface of the thigh.



- It is a continuation of the tensor fascia
- It helps to stabilize the hip and knee joints.

ATTACHMENTS

The iliotibial tract has two attachments superior and inferior:

i. Superior attachment

- Superiorly the tract split into two layers superficial and deep lamina.
- The superficial lamina is attached to the tubercle of iliac crest whereas
- The deep lamina is attached to the capsule of the hip joint

ii. Inferior attachment

- Inferiorly the tract is attached to a smooth area on the anterior surface of the lateral condyle of tibia.

IMPORTANCE

The importance of the iliotibial tract is as follows:

a. Two muscles, gluteus maximus and tensor fascia latae are inserted into the upper part of the tract.

b. It helps to stabilise the knee both in extension and in partial flexion.

c. The tract is also the main support of the knee against gravity

NERVE SUPPLY

The tensor fascia lata is supplied by the superior gluteal nerve.

Applied anatomy

Iliotibial band syndrome

- The iliotibial band friction is the common cause of knee pain arising from chronic inflammation due to intense physical activity, such as long-distance running.
- The typical patient is young and physically active, usually a long-distance runner or cyclist.
- Continued activity can result in the inflamed bursa near the lateral femoral epicondyle and pain is due to repetitive friction of the band against the epicondyle during knee movements.

Q. 2 Write a short note on Anterior tibial artery.

Ans. INTRODUCTION

- The anterior tibial artery is the main artery of the leg.
- It supplies to the anterior compartment of the leg and dorsal surface of the foot.

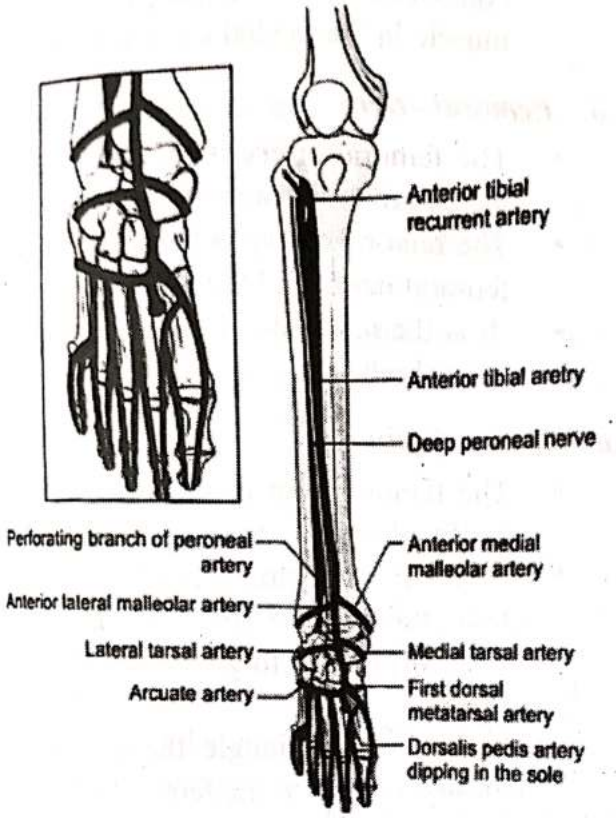
ORIGIN

The anterior tibial artery originates from the popliteal artery.

It is a small branch of the popliteal artery.

COURSE

- The artery begins at the distal end of the popliteus muscle posterior to the tibia.



- Then it passes anterior to the popliteus muscle.
- Then it passes through an oval opening at the superior aspect of the interosseous membrane and lies between the tibia and fibula.
- The artery then descends between the tibialis anterior and extensor digitorumlongus muscles.

RELATIONS

- The artery is crossed from lateral to medial by the tendon of the extensor hallucislongus muscle.
- In the upper one-third of leg, the artery lays between the tibialis anterior and extensor digitorumlongus muscles.
- In the middle one- third it lays between tibialis anterior and extensor hallucislongus muscles.
- In the lower one- third it lays between extensor hallucislongus and extensor digitorumlongus muscles.

BRANCHES

The branches of the anterior tibial artery are:

- Posterior tibial recurrent artery
- Anterior tibial recurrent artery
- Muscular branches
- Anterior medial malleolar artery
- Anterior lateral malleolar artery and
- Dorsalis pedis artery

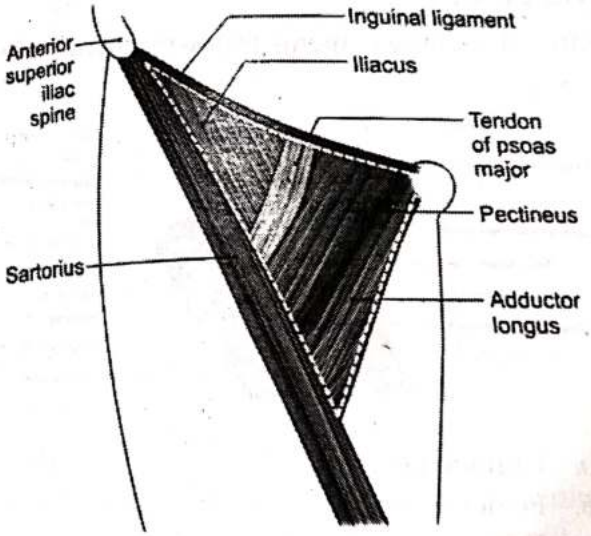
Applied anatomy

As the artery passes medial to the fibular neck it becomes vulnerable to damage during a tibial osteotomy.

Q. 3 Write a short note on Femoral Triangle

Ans. INTRODUCTION

- The femoral triangle is a wedge-shaped area formed by a depression between the muscles of the thigh.



- It is located on the medial aspect of the proximal part of the thigh.
- It is the site of the passage of the main blood vessels between the pelvis and lower limb.
- The large nerves supplying the thigh also pass through the femoral triangle.

BOUNDARIES

Following are the boundaries of the femoral triangle:

a. Lateral boundary - The femoral triangle is laterally bounded by sartorius muscle

b. Medial boundary - It medially bounded by adductor longus muscle

c. Base - The base of the triangle is formed by the inguinal ligament

d. Apex - The apex of the femoral triangle is directed downward.It is formed by the meeting point of medial and lateral boundaries

e. Floor -The medial aspect of the floor is formed by adductor longus and pectineus muscle and the lateral aspect of the floor is formed by psoas major and iliacus muscles.

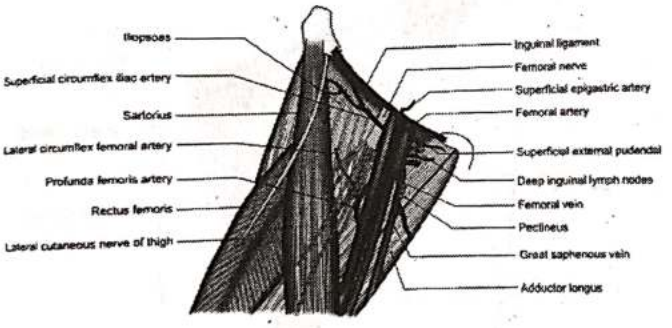
f. Roof -The roof of triangle is formed by skin, superficial and deep fascia.

MNEMONIC: Use the word SAIL

S for sartorius, lateral border
A for adductor longus, medial border and
IL for inguinal ligament, the base

CONTENTS

Femoral triangle contents following structures:



a. Femoral nerve
b. Femoral artery
c. Femoral vein
d. Lymphatics

The word NAVEL is used to orientate the contents of the femoral triangle from lateral to medial as follows:

N for femoral nerve
A for femoral artery
V for femoral vein
E for empty space of femoral canal and
L for lymphatics

i. Femoral nerve

- The femoral nerve is the most lateral of the contents in the femoral triangle.
- It supplies the sartorius, rectus femoris, vastuslateralis, vastusintermedius, and vastusmedialis muscles in the anterior compartment of the thigh, and the pectineus muscle in the medial compartment.

ii. Femoral artery

- The femoral artery is the continuation of the external iliac artery.
- The femoral artery is located between the femoral nerve and the femoral vein.
- It is the main blood vessel supplying the lower limb.

iii. Femoral vein

- The femoral vein is a continuation of the popliteal vein.
- It enters the thigh from the popliteal fossa through the adductor canal, passing superiorly in the thigh towards the femoral triangle.
- In the femoral triangle, the femoral vein is located medial to the femoral artery.

Femoral sheath

- The contents of the femoral triangle except the femoral nerve are enclosed in a wrapping of fascia called the femoral sheath.
- The femoral sheath is a funnel-shaped sleeve of fascia enclosing the upper three to four centimetres of femoral vessels.
- It continues superiorly with the transversalis fascia and iliac fascia of the abdomen.
- The femoral sheath has anterior and posterior walls.
- The anterior wall of the sheath is formed by fascia transversalis and the posterior wall is formed by fascia iliaca.
- Inferiorly the sheath merges with connective tissue around the femoral vessels.
- The femoral sheath is divided into lateral, intermediate, and medial compartments.
- The lateral compartment contains

the femoral artery, the intermediate compartment contains femoral vein and medial compartment contains the lymphatic vessels.

Femoral canal

- Femoral canal is the medial compartment of the femoral sheath.
- Femoral canal is conical in shape.
- It is about 1.5 cm long and about 1.5 cm wide at its base.
- The femoral canal contains a lymph node of Cloquet, lymphatics, and a small amount of areolar tissue.

Applied anatomy

i. *Femoral Pulse*

- The femoral pulse can be palpated through the skin in the femoral triangle.
- The pulse can be located on the medial aspect of the proximal thigh at the mid-inguinal point.
- The artery can be used for drawing arterial blood when the pressure in the radial and ulnar arteries is too low to locate the arteries.

ii. *Catheterization*

- The femoral triangle is used as a site for vascular catheterization for a number of interventional and corrective procedures.
- Catheterization of the femoral vessels provides access to the ipsilateral and contralateral lower limb, the vessels of the abdomen and thorax, as well as the cerebral arteries.

Q. 4 Write a short note on Femoral nerve.

Ans.

INTRODUCTION

- The femoral nerve is the chief nerve of the anterior compartment of the thigh.
- The saphenous nerve, cutaneous branch of femoral nerve, extends to the medial side of the leg and medial border of the foot till the ball of the big toe.

Root value

Dorsal division of ventral rami of L2, L3, and L4 segments of spinal cord gives origin to the femoral nerve.

COURSE

- The femoral nerve emerges lateral to the psoas major muscle in the abdomen.
- It passes downwards between the psoas major and iliacus muscles.
- Then it descends to pass beneath the inguinal ligament at approximately its mid-point. It passes through the femoral triangle lateral to the femoral artery and vein.
- It is not a content of femoral sheath as its formation is behind fascia iliaca.

TERMINATION

- It ends by dividing into two divisions 2.5 cm below the inguinal ligament.
- Both divisions end with a number of branches.
- Lateral circumflex artery lies in between two divisions of the nerve.

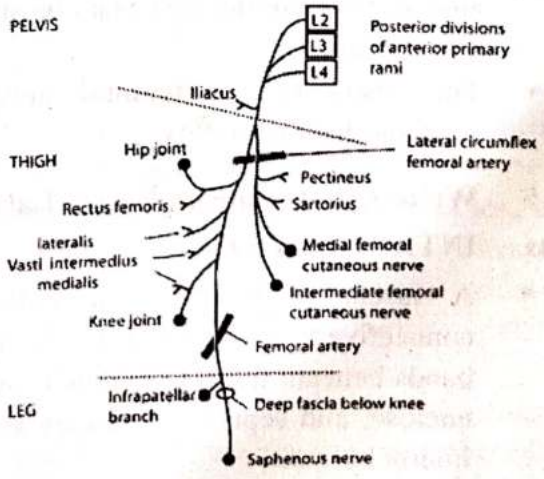
DIVISIONS

The femoral nerve divides into two divisions beneath the inguinal ligament, deep and superficial branches.

Branches

Femoral nerve gives following muscular, cutaneous, articular, and vascular branches.

FEMORAL NERVE



i. Muscular branches

a. The sartorius is supplied by anterior division of nerve
b. Rectus femoris is supplied by anterior division of nerve
c. Three vasti are supplied by anterior division of nerve
d. The articularis genu is also supplied by the anterior division of nerve
e. The quadriceps is supplied by the deep branch of the nerve.

ii. Cutaneous branches

a. The Intermediate and the medial cutaneous nerves are the cutaneous branches from anterior division
b. The saphenous nerve is a branch of posterior division.

iii. Articular branches

a. Nerve to the rectus femoris supplies the hip joint
b. Nerve to vasti supplies the knee joint

iv. Vascular branches

The femoral nerve supplies the femoral artery and its branches.

Applied anatomy

Femoral nerve damage

- The femoral nerve can be damaged during penetrating trauma to the thigh.
- It can also be damaged during hip operations, particularly the anterior approach where the nerve can be stretched and damaged.
- The fibers of the femoral nerve also mediate the knee reflex.

Q. 5 Write a short note on Fascia Lata.

Ans. INTRODUCTION

- A fascia is primarily a collagenous connective tissuefiber that forms sheets or bands beneath the skin to attach, stabilize, enclose, and separates muscles and other internal organs.
- Fasciae are very similar to ligaments, aponeuroses, and tendons as they are all made up of collagen fibers.
- Fascia lata is the deep fascia of the thigh. It is especially strong, investing the thigh like an elastic stocking.
- The fascia lata encloses the muscles and forms the outer limit of the fascial compartments of the thigh, that is, it limits the outward expansion of contracting muscles, making muscular contraction more efficient in compressing veins to push blood towards the heart.
- Although the fascia lata encloses the thigh muscles and form the outer limits, it is internally separated by intermuscular septa.

ATTACHMENTS

i. Superior

a. Anteriorly with the inguinal ligament, pubic arch, body of pubis, and pubic tubercle
b. The membranous layer of subcutaneous tissue or superficial fascia of the inferior abdominal wall
c. Laterally and posteriorly with the iliac crest
d. The sacrum, coccyx, sacrotuberous ligament, and ischial tuberosity/ ischiopubic ramus (branch)

ii. Inferior

a. The fascia lata is attached to the condyle of the femur and tibia, the head of the fibula, and the sides of the patella
b. The fascia lata is also attached to the deep fascia of the leg, inferior to the knee joint.
c. This deep fascia of the leg is called the crural fascia.
d. The crural fascia is a continuation of the fascia lata.

SPECIAL FEATURES

a. The fascia lata encloses the large thigh muscles.

b. Thickened part of fascia lata forms the iliotibial tract.

c. Theiliotibial tract is the shared aponeurosis of the tensor fasciae lata and gluteus maximus muscles.

d. The fascia lata and three fascial intermuscular septa form the walls of the muscular compartments of the thigh and separate the thigh muscles into three compartments. The compartments are:
   - The anterior
   - The medial and
   - The posterior

e. The fascia lata is marked by an important opening or hiatus called the saphenous opening. The great saphenous vein traverses the fascia lata through this opening.

NERVE SUPPLY

The fascia lata is innervated bythefollowing nerves:

- Ilioinguinal nerve
- Femoral branch of the genitofemoral nerve
- Medial, intermediate, and lateral femoral cutaneous nerves
- Cutaneous branch of the obturator nerve

BLOOD SUPPLY

- The fascia lata is pierced and supplied by:
- The superficial iliac circumflex artery
- The superficial epigastric artery
- The superficial external pudendal artery traverses the saphenous opening of fascia lata.

VENOUS DRAINAGE

The venous drainage of fascia latais in the perforating veins of the great saphenous vein.

LYMPHATIC DRAINAGE

The lymphatic drainage of the fascia lata is by lymph vessels thatempty into the vertical group of lymph nodes lying lateral to the termination of the long saphenous vein.

Applied anatomy

i. Transplantation

The fascia lata has been reported to be a major source of fascia used for reconstruction surgery, like the management of ptosis of the upper eyelids.

ii. Fasciotomy

a. Fasciotomy is usually performed to relieve the pressure in the compartment(s) that occurred due to hemorrhages, oedema, and inflammation of the thigh muscles by trauma.

b. A Fasciotomy is simply the incision of an overlying fascia or septum, usually to relieve the pressure in fascial compartments.

Q. 6 Write short note on Quadriceps femoris muscle

Ans. INTRODUCTION

- Quadriceps femoris is a group of muscles located in the anterior compartment or extensor compartment of the thigh.
- These muscles are the great extensors of the knee joint.
- The quadriceps femorisform the bulk of the anterior thigh and cover almost all of the anterior and both lateral and medial sides of the femur.
- This powerful muscle group is essential for motions such as walking, running, jumping, and climbing.
- They also assist in flexion of the thigh at the knee joint and stabilising the patella during movement.

MUSCLES

- The name 'quadriceps femoris' means 'four headed femoral muscle'.
- The group consists of four muscles, the midline located rectus femoris, laterally placed vastuslateralis, medially situated vastusmedialis, and deeply placed vastusintermedius.
- All of the muscles of the quadriceps muscle group converge to form a common

tendon known as the quadriceps tendon.

Quadriceps Tendon

- It is a common tendon of all four muscles.
- The quadriceps tendon inserts onto the base of the patella.
- Distal to the patella, it continues as the patellar ligament.
- All the muscles contributing to the quadriceps femoris muscle insert onto the tibial tuberosity via this tendon.

i. Rectus Femoris

a. The rectus femoris is the only muscle in the quadriceps femoris group that crosses both the hip and knee joints.
b. It is a fusiform muscle.

Origin

It has the following two heads of origin:

a. The straight head originates from the anterior inferior iliac spine and
b. The reflected head originates from a groove on the ilium above the acetabulum

Insertion

a. The distal fibers of the muscle end as a flat aponeurosis that narrows into a thick flat tendon and inserts onto the base of the patella.
b. This forms the superficial central part of the quadriceps tendon.

ii. Vastusmedialis

The Vastusmedialis covers most of the medial aspect of the femur.

Origin

Vastusmedialis originates from:

a. The lower part of the intertrochanteric line,
b. The spiral line,
c. The medial lip of the lineaaspera,
d. The proximal part of the medial supracondylar line, and
e. The medial intermuscular septum.

Course

The fibers pass inferiorly and anteriorly becoming aponeurosis.

It is partially deep to the rectus femoris and sartorius muscles.

It forms the medial wall of the adductor canal in the middle part of the thigh.

Insertion

It inserts onto the medial aspect of the patella and quadriceps tendon.

iii. Vastuslateralis

The vastuslateralis is the largest component of the quadriceps femoris group, forming the bulk of the lateral thigh.

Origin

It originates from:

a. the upper part of the intertrochanteric line
b. the anterior and inferior borders of the greater trochanter,
c. the lateral lip of the gluteal tuberosity, and
d. the proximal half of the lateral lip of thelineaaspera .

Course

It lies lateral to vastusintermedius muscle and it is separated from the biceps femoris muscle by lateral Intermuscular septum.

It is covered proximally by the deep fascia of the thigh and the aponeurotic attachments of the tensor fasciae latae and gluteus maximus muscles.

Insertion

Its fibers converge on a flat tendon that inserts onto the base and lateral aspect of the patella and blends with the fibers of the quadriceps tendon. It then goes on to insert onto thetibial tuberosity via the patellar ligament.

iv. Vastusintermedius

Origin

The vastusintermedius muscle arises from:

a. the anterior and lateral surfaces of the proximal two-thirds of the femoral shaft and

b. From the distal part of the lateral intermuscular septum.

Course

Its fibers form an aponeurosis that forms the deep part of the quadriceps tendon.

Insertion

a. It forms the aponeurosis and is also attached to the lateral aspect of the patella and the lateral condyle of the tibia.
b. The fibers of vastusintermedius are appeared to be fused with vastusmedialis muscles but are separated from each other by a narrow cleft that extends from the medial border of the patella.
c. During its course, it is almost entirely covered by the quadriceps femoris muscles. The lateral part of the vastusintermedius remains superficial to the vastuslateralis muscle.

NERVE SUPPLY

All four muscles of the quadriceps group are innervated by branches of the femoral nerve (L2-L4)

BLOOD SUPPLY

a. The blood supply to the rectus femoris muscle is derived from the artery of the quadriceps, a branch of theprofundafemoris artery, and the lateral circumflex humeral artery.
b. The vastusmedialis is supplied by the superior, middle, and inferior branches of the superficial branch of the femoral artery and the minor branches from the profundafemoris and genicular arteries.
c. The vastuslateralis is supplied by branches of the lateral circumflex femoral artery and the first perforating branch of the profunda femoris artery.
d. The vastusintermedius is supplied bybranches of the Profunda femoris artery.

VENOUS DRAINAGE

Venous drainage of all four muscles is by the venous components to the profunda femoris vein.

Action

a. All four muscles are producing extension of the left knee joint.
b. As the rectus femoris crosses both the hip and knee joint, it acts at both of these joints. It produces flexion of the thigh at the hip joint and extension of the leg at the knee joint, thus it is sometimes referred to as the 'kicking muscle'.

Q. 7 Write a short note on Dorsalis pedis artery.

Ans. INTRODUCTION

- The dorsalis pedis artery is the chief palpable artery of the dorsum of the foot.
- It is commonly palpated in patients with vaso-occlusive diseases of the lower limb.
- It is a continuation of the anterior tibial artery on the dorsum of the foot.

ORIGIN

The anterior tibial artery continues as the dorsalis pedis artery.

COURSE

- The artery runs along the medial side of the dorsum of the foot.
- It reaches the proximal end of the first intermetatarsal space.
- From here it enters the sole.
- Finally in sole it completes the plantar arch.

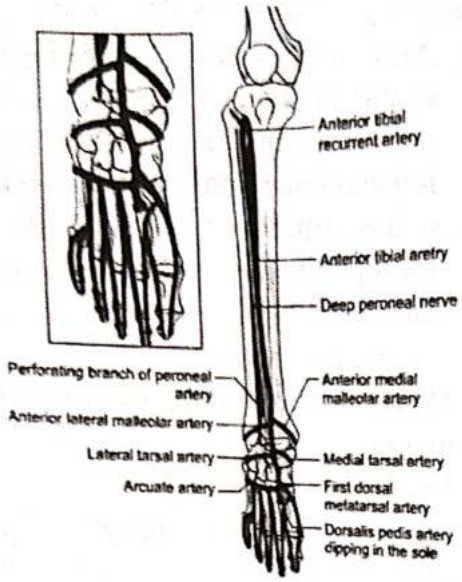
BRANCHES AND DISTRIBUTION

The dorsalis pedis artery gives the following branches:

- The lateral tarsal artery
- The medial tarsal artery
- The arcuate artery and
- The first dorsal metatarsal artery

i. The lateral tarsal artery

a. The lateral tarsal artery is larger than the medial tarsal artery.
b. It arises over the navicular bone.
c. It passes deep to the extensor digitorum brevis and it ends in the lateral malleolar network.



d. It supplies the extensor digitorum brevis muscle and neighbouring intertarsal joints.

ii. The medial tarsal artery

a. The medial tarsal artery is smaller than the lateral tarsal artery.
b. The medial tarsal branches are two to three small twigs.
c. The twig joins the medial malleolar network.
d. It supplies the intertarsal joints.

iii. The arcuate artery

a. The arcuate artery is a large branch of dorsalis pedis artery.
b. It arises opposite the medial cuneiform bone.
c. It runs laterally over the base of metatarsal bones.
d. It runs deep to the tendons of the extensor digitorumlongus and the extensor digitorum brevis.
e. It ends by anastomosing with the lateral tarsal and lateral plantar arteries.
f. It gives second, third, and fourth dorsal metatarsal arteries.

iv. The first dorsal metatarsal artery

a. The first dorsal metatarsal artery arises just before the dorsalis pedis artery dips into the sole.
b. It gives a branch to the medial side of the big toe.
c. It again divides into two branches for adjacent sides of the first and second toes.

Q. 8 Write a short note on Adductor canal

Ans. INTRODUCTION

- Adductor canal is an intramuscular space situated on the medial side of the middle one-third of the thigh.
- It is known as Hunter's canal by the name of anatomist John Hunter.
- It is overlapped by the sartorius muscle so it is also known as subsartorial canal.

EXTENT

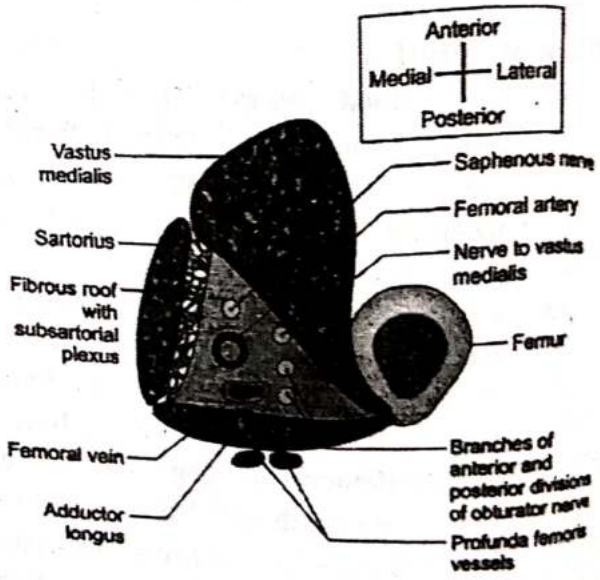
The adductor canal extends from the apex of the femoral triangle above to the tendinous opening in the adductor magnus below.

SHAPE

The adductor canal is triangular on cross-section.

BOUNDARIES

The adductor canal has following three walls.



i. Anterolateral wall
ii. Posteromedial wall or floor and
iii. Medial wall or roof

i. Anterolateral wall: The anterolateral wall of the canal is formed by the vastusmedialis muscle

ii. Posteromedial wall: The posteromedial

wall of the canal is formed by two muscles, the adductor longus above and the adductor magnus below.

c. ***Medial wall:*** The medial wall or roof of the adductor canal is formed by a strong fibrous membrane joining the anterolateral and posteromedial walls. The roof is overlapped by sartorius muscle.

CONTENTS

The adductor canal contains following structures

i. ***Femoral artery***
ii. ***Femoral vein***
iii. ***Saphenous nerve***
iv. ***The nerve to the vastusmedialis and***
v. ***Branches of two divisions of obturator nerve***

i. Femoral artery

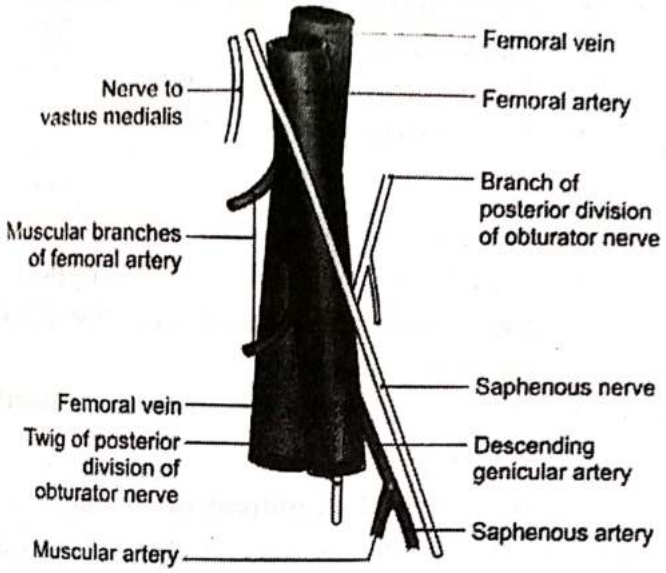
- The femoral artery enters the canal at the apex of the femoral triangle.
- In the canal, the femoral artery gives muscular branches and a descending genicular branch.
- The descending genicular artery divides into two branches, superficial saphenous branch, and deep muscular branch.
- The femoral artery lives the canal through the opening in the adductor magnus muscle and continue as a popliteal artery.

ii. Femoral vein

- The femoral artery is the upward continuation of the popliteal vein from the popliteal fossa.
- In the upper part of the canal, it lies posterior to the femoral artery whereas in the lower part of the canal it lies lateral to the femoral artery.

iii. The saphenous nerve

- In the canal, the saphenous nerve crosses the femoral artery anteriorly from lateral to medial side.
- It leaves the canal with the saphenous artery by piercing the fibrous roof.



iv. The nerve to vastusmedialis

- The nerve to vastusmedialis lies lateral to the femoral artery and enters the vastusmedialis in the upper part of the canal.

v. Branches of two divisions of obturator nerve

- The anterior and posterior divisions of obturator nerve lie in the - canal.
- The anterior division emerges at the lower border of the adductor canal whereas the posterior division runs on the anterior surface of the adductor magnus muscle and ends by supplying the knee joint.

Q. 9 Write a short note on Gluteus maximus muscle.

Ans. INTRODUCTION

- The gluteus maximus is the large, quadrilateral powerful muscle of the gluteal region.
- It covers mainly the posterior surface of the pelvis.
- It iscomprised of red muscle fibers.

ORIGIN

- Out slop of dorsal surface of iliac crest
- Posterior gluteal line
- Posterior part of gluteal surface of ilium behind the posterior gluteal line
- Aponeurosis of erector spiane muscle

- Dorsal surface of lower part of sacrum
- Sides of coccyx
- Sacrotuberous ligament and
- Fascia covering gluteus medius

INSERTION

The muscle inserts at two places:

- The deep fibers of the lower part of the muscle are inserted into the gluteal tuberosity of the femur
- The greater part of the muscle is inserted on the iliotibial tract.

Structures covered by gluteus maximus

The flowing structures include muscles, vessels, nerves, bones, joints, ligaments of joints, and bursae are covered by gluteus maximus muscle.

i. Muscles

a. Two Gluteus, medius and minimus
b. Two obturator, internus and externus
c. Two gemelli, superior and inferior
d. Four hamstring origin from ischial tuberosity
e. Insertion of upper pubic fibers of adductor magnus.
f. Reflected head of rectus femoris
g. Piriformis
h. Quadratusfemoris

MNEMONIC - Godrej Office General Head Arranged Rich Party for Queen.
Godrej for two gluteus muscles
Office for two obturator muscles
General for two gemelli muscles
Head for hamstring four muscles
Arranged for adductor magnus muscle
Rich for rectus femoris Party for Piriformis muscle and
Queen for Quadratusfemoris muscle

ii. Vessels

a. Two gluteal vessels, superior and inferior
b. Two anastomoses, trochanteric and cruciate
c. Internal pudendal vessels

iii. Nerves

a. Two Gluteal nerves, superior and infe
b. Two Muscular nerves, nerve to obtur internus and quadratusfemoris muscle
c. Sciatic nerve and
d. Pudendal nerve

iv. Bones

a. Ilium
b. Ischium
c. Sacral and coccyx
d. Upper end of femur
e. Greater trochanter of femur

v. Joints

a. Hip joint and
b. Sacroiliac joint

vi. Ligaments

a. Sacrotuberous ligament
b. Sacrospinous ligament and
c. Ischiofemoral ligament

vii. Bursae

a. Trochanteric bursa of gluteus maximus
b. Bursa between gluteus maximus and vastuslateralis and
c. Bursa over the ischial tuberosity

Nerve supply

The gluteus maximus is supplied by the inferior gluteal nerve.

Action

- It is the chief extensor of the thigh at the hip joint
- It is a lateral rotator of the thigh
- It is an adductor of the thigh
- It helps to stabilise the knee joint

Q. 10 Write a short note on Ligaments of ankle joint.

Ans. INTRODUCTION

- The ankle joint is the lowermost joint of the lower extremities.
- This synovial type of joint is of hinge variety.
- This joint is supported by muscles and

ligaments.

LIGAMENTS OF ANKLE JOINT

The ankle joint is supported by following ligaments:

i. ***Fibrous capsule***
ii. ***The Medial or deltoid ligament and***
iii. ***The lateral ligament***

i. *Fibrous capsule*

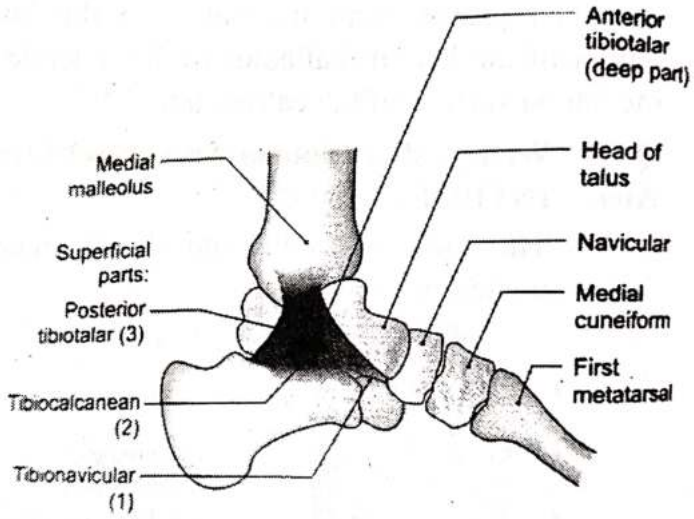
a. The fibrous capsule surrounds the joint but it is weak anteriorly and posteriorly.
b. It attached all the around the margins with two exceptions.
c. Posterosuperiorly it is attached to the inferior transverse tibiofibular ligament.
d. Anteroinferiorly it is attached to the dorsum of the neck of the talus at the same distance from the trochlear surface.
e. The anterior and posterior parts of the capsule are loose and thin to allow hinge movements.
f. On each side, the fibrous capsule is supported by strong collateral ligaments.
g. The fibrous capsule is lined by a synovial membrane.

ii. *Medial ligaments*

a. The medial or deltoid ligament is a very strong ligament present on the medial side of the ankle joint.
b. The ligament has superficial and deep parts.
c. At the upper level, both superficial and deep ligaments commonly attach to the apex and margins of the medial malleolus.
d. The lower part of the ligament is attached at different places.
e. The lower attachments divide the deltoid ligament inthefollowing parts.
   - Tibionaviculapart of deltoid ligament,
   - Tibiocalcaneal part of deltoid ligament
   - Posterior tibiotalar part of deltoid ligament
   - Anterior tibiotalar part of deltoid ligament

- *Tibionavicular part of deltoid ligament*
  - The Tibionaviculapart is the anterior fibers of the superficial part of the deltoid ligament.
- They are attached to the tuberosity of the navicular bone and to the medial margin of the spring ligament.

- *Tibiocalcaneal part of deltoid ligament*
  - The tibiocalcaneal part is the middle fibers of the superficial part of the deltoid ligament.
  - They are attached to the whole length of the sustentaculumtali.



- *Posterior tibiotalar part of deltoid ligament*
  - The Posterior tibiotalar part is the posterior fibers of the superficial part of the deltoid ligament.
  - They are attached to the medial tubercle of the posterior process of the talus.

- *Anterior tibiotalar part of deltoid ligament*

The anterior tibiotalar part is the fiber of the deep part of the deltoid ligament.
It is attached to the anterior part of the medial surface of the talus.

iii. *Lateral ligaments*

The lateral ligaments of the ankle consist of the following three bands:

a. Anterior talofibular ligament
b. Posterior talofibular ligament and
c. Calcaneofibular ligament

a. Anterior talofibular ligament

The anterior talofibular ligament is a flat band that passes from the anterior margin of the lateral malleolus to the neck of the talus.

b. Posterior talofibular ligament

The posterior talofibular ligament passes from the lower part of the malleolar fossa of the fibula to the lateral tubercle of the talus.

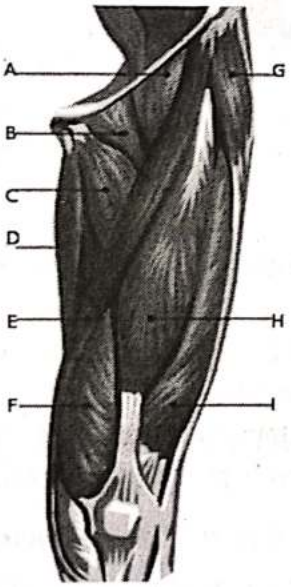
c. Calcaneofibular ligament

The calcaneofibular ligament is a long rounded cord that passes from the notch on the lower border of the lateral malleolus to the tubercle on the lateral surface of the calcaneum.

Q. 11 Write a short note on Sartorius Muscle.

Ans. INTRODUCTION

- The sartorius is the muscle of anterior compartment of thigh.



A iliopsoas
B Pectineus
C Adductor longus
D Gracilis
E Sartorius
F Vastus medialis
G Tenor fascia lata
H Rectus femoris
I Vastus lateralis

- It is a long narrow ribbon-like muscle in the body.
- It is known as the tailor's muscle.

ORIGIN

The sartorius originates from:

a. Anterior superior iliac spine and
b. Upper half of the notch below the spine

COURSE

The fibers of muscle run downwards and medially across the thigh.

INSERTION

It inserts on the upper part of the medial surface of the shaft of tibia in front of the insertions of the gracilis and the semitendinosus.

Nerve supply

It is supplied by femoral nerve

Action

a. The sartorius is abductor and medial rotator of the thigh
b. It is a flexor of leg at the knee joint

LOWER LIMB TEN MARKS QUESTIONS

Q. 1 Describe the Ankle joint in detail.

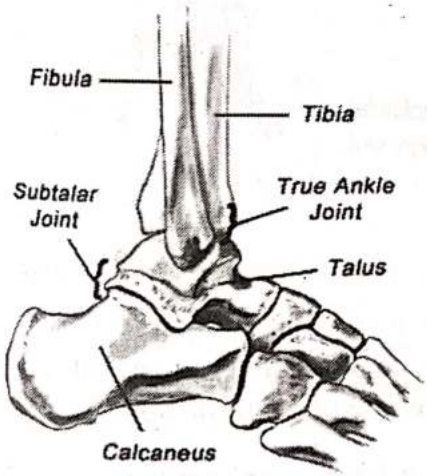
Ans. INTRODUCTION

The ankle joint is a connection between the foot and lower leg for dorsiflexion and plantar flexion of the foot, as well as the pronation and supination under a certain degree.

ARTICULATIONS

The following bones participate in the formation of ankle joint:

a. Fibula
b. Tibia
c. Talus
d. calcaneus
e. navicular



These five bones form two joints, the upper ankle joint and lower ankle joint.

i. Upper ankle joint

The upper ankle joint is a hinge variety of joint that helps in stretching and bending ofthe foot. The upper ankle joint is composed of the three bones:

a. Fibula
b. Tibia and
c. Talus

ii. Lower ankle joint

The lower ankle joint helps for articular surfaces to glide upon each other so that the cartilage surfaces can move freely.

The following bones form the lower ankle joint:

a. Talus
b. Calcaneus and
c. Navicular

- The articulation of bone at the front and backside of the joint varies.
- The front part of the lower ankle joint is an articulation between the talus, calcaneus, and navicular bone. It is called talocalcaneonavicular articulation.
- The back part of the lower ankle joint is an articulation between the talus and calcaneus and is called the subtalar joint.

LIGAMENTS OF ANKLE JOINT

The ankle joint is supported by the following ligaments:

- Fibrous capsule
- The Medial or deltoid ligament and
- The lateral ligament .

i. Fibrous capsule

a. The fibrous capsule surrounds the joint but it is weak anteriorly and posteriorly.
b. It attached all around the margins with two exceptions.
c. Posterosuperiorly it is attached to the inferior transverse tibiofibular ligament.
d. Anteroinferiorly it is attached to the dorsum of the neck of the talus at the same distance from the trochlear surface.
e. The anterior and posterior parts of the capsule are loose and thin to allow hinge movements.
f. On each side, the fibrous capsule is supported by strong collateral ligaments.
g. The fibrous capsule is lined by a synovial membrane.

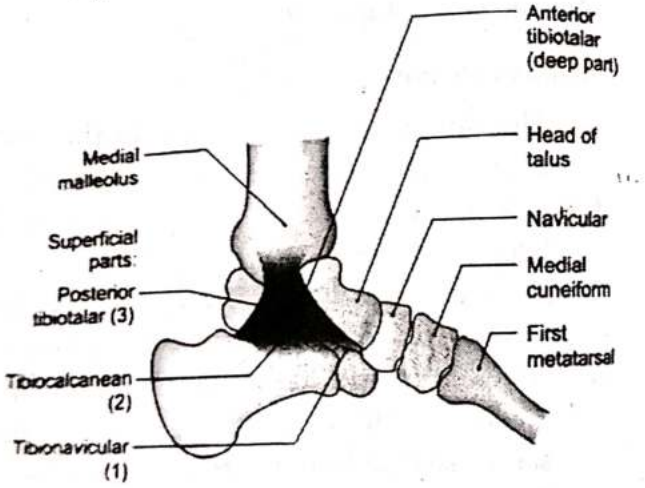
ii. Medial ligaments

a. The medial or deltoid ligament is a very strong ligament present on the medial side of the ankle joint.

b. The ligament has superficial and deep parts.
c. At the upper level, both superficial and deep ligaments commonly attach to the apex and margins of the medial malleolus.
d. The lower part of the ligament is attached at different places.
e. The lower attachments divide the deltoid ligament in following parts:
- Tibionaviculapart of deltoid ligament,
- Tibiocalcaneal part of deltoid ligament,
- Posterior tibiotalar part of deltoid ligament
- Anterior tibiotalar part of deltoid ligament

iii. Tibionaviculapart of deltoid ligament

a. The Tibionaviculapart is the anterior fibers of the superficial part of the deltoid ligament.



b. They are attached to the tuberosity of the navicular bone and to the medial margin of the spring ligament.

iv. Tibiocalcaneal part of deltoid ligament

a. The tibiocalcaneal part is the middle fibers of the superficial part of the deltoid ligament.
b. They are attached to the whole length of the sustentaculumtali.

v. Posterior tibiotalar part of deltoid ligament

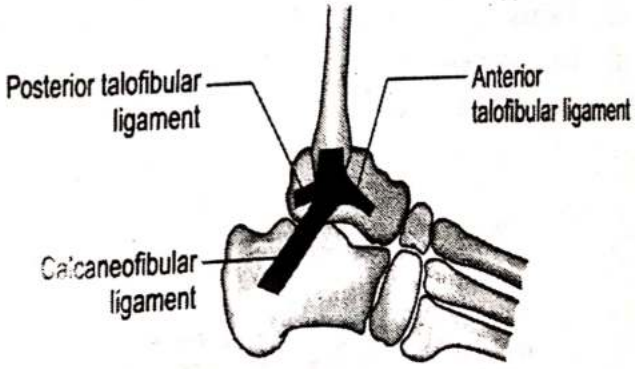
a. The Posterior tibiotalar part is the posterior fibers of the superficial part of the deltoid ligament.
b. They are attached to the medial tubercle of the posterior process of the talus.

vi. Anterior tibiotalar part of deltoid ligament

a. The anterior tibiotalar part is the fiber of the deep part of the deltoid ligament.
b. It is attached to the anterior part of the medial surface of the talus.

vii. Lateral ligaments

The lateral ligaments of the ankle consist of the following three bands:



a. Anterior talofibular ligament

The anterior talofibular ligament is a flat band that passes from the anterior margin of the lateral malleolus to the neck of the talus.

b. Posterior talofibular ligament

The posterior talofibular ligament passes from the lower part of the malleolar fossa of the fibula to the lateral tubercle of the talus.

c. Calcaneofibular ligament

The calcaneofibular ligament is a long rounded cord that passes from the notch on the lower border of the lateral malleolus to the tubercle on the lateral surface of the calcaneum.

RELATION OF ANKLE JOINT

The ankle joint has anterior, posteromedial, and posterolateral relations as follows:

i. Anterior relations

Anteriorly from medial to lateral side, the ankle

joint is related to:

a. Tibialis anterior
b. Extensor hallucislongus
c. Anterior tibial vessels
d. The deep peroneal nerve
e. Extensor digitorumlongus and
f. Peroneus tertius

ii. *Posteromedial relations*

Posteromedially from medial to lateral side the ankle joint is related to:

a. Tibialis posterior
b. Flexor digitorumlongus
c. Posterior tibial vessels
d. The tibial nerve and
e. Flexor hallucislongus

iii. *Posterolateral relations*

Posterolaterally the ankle joint is related to

a. Peroneus longus
b. Peroneus brevis

FUNCTIONS

- The lower ankle joint permits two movements: Pronation and
- Supination of the foot
- The upper ankle joint permits dorsiflexion and plantar flexion.

Q.2 Describe Great Saphenous Vein in detail.

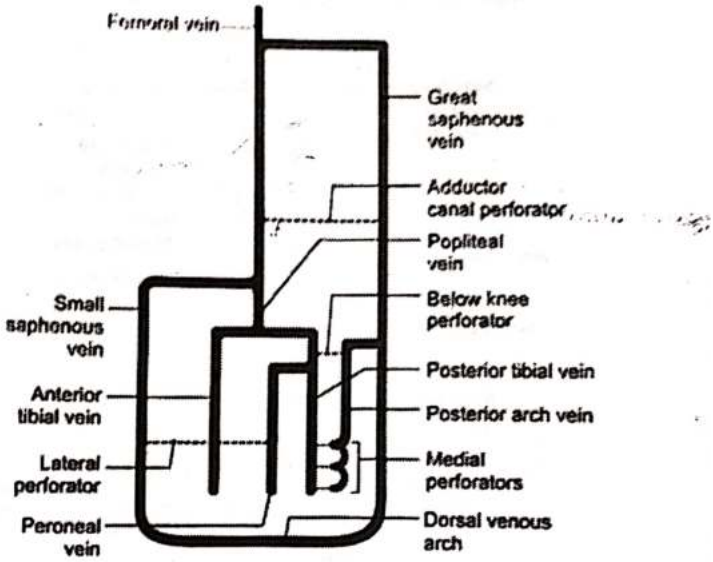
Ans. INTRODUCTION

- The great saphenous vein is a large superficial vein of the lower limb.
- It drains into the femoral vein, which is the medial most structure in the femoral triangle.
- The point at which it drains into the femoral vein is known as the saphenofemoral junction.

ORIGIN AND COURSE

i. *In the leg and thigh*

a. The great saphenous vein originates from the dorsal vein of the hallux, which merges with the dorsal venous arch of the foot.
b. The vein then runs anterior to the medial malleolus.
c. The vein ascends the medial surface of the leg and then runs posterior to the medial epicondyle of the femur.



d. It then runs upward in the thigh and passes over the medial surface of the thigh.
e. In the thigh, it is accompanied by branches of the medial femoral cutaneous nerves.
f. At the knee, in the leg, and the foot the vein is closely related to the saphenous artery, a branch of the descending genicular artery.
g. The great saphenous vein then passes through an opening in the fascia lata i.e. the saphenous opening.
h. It continues as an arch to join the femoral vein within the medial region of the femoral triangle.

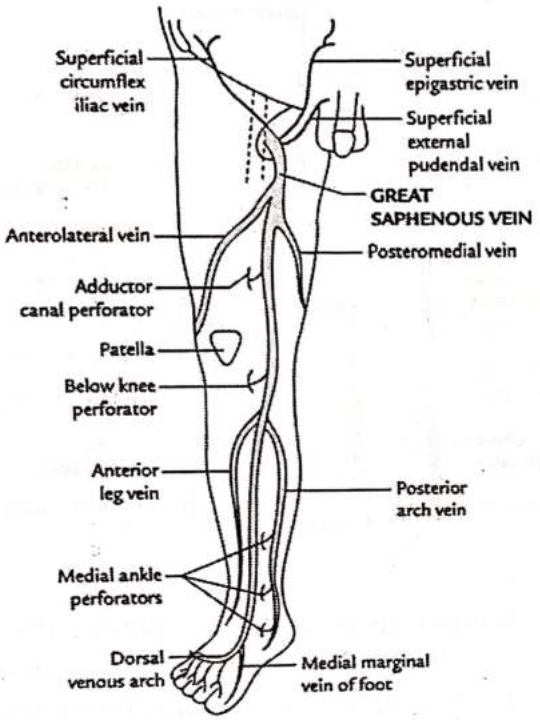
ii. *In the femoral triangle*

a. The great saphenous vein is the medial most structure in the femoral triangle.
b. Lateral to the vein there is space that allows the expansion of the vein during increases venous return.
c. The femoral artery is situated on the lateral side of the great saphenous vein.
d. The most lateral structure in the femoral

triangle is the femoral nerve.

e. There are numerous valves in this vein that ensure blood flows in the correct direction.

f. The joining point of the saphenous vein and the femoral vein is known as the saphenofemoral junction.



g. There is a valve covering the saphenofemoral junction and separates the superficial and deep venous systems.

TRIBUTARIES

The greater saphenous vein receives the following smaller veins from the ankle and foot:

a. The medial marginal vein which drains the sole of the foot,

b. The small saphenous vein collects the venous blood from the lower region of the leg.

c. The perforating veins work as a connected path between the long saphenous vein with the short saphenous vein and with deep veins.

d. In thigh, it receives the following tributaries:

- posteromedial or accessory saphenous vein,
- anterolateral or anterior femoral cutaneous vein and
- Peri-inguinal veins includes superficial epigastric, superficial circumflex iliac and superficial external pudendal veins.
- In the thigh, it also receives branches from the common femoral vein.

e. It receives connecting branches from the popliteal vein.

Applied Anatomy

i. Coronary artery bypass

a. The saphenous vein can be removed from the leg, and sutured into the heart to bypass a blockage of the coronary arteries.

b. This procedure is known as a heart bypass, and the patient is put on cardiopulmonary bypass during the procedure.

ii. Thrombophlebitis

a. This condition is characterised by the formation of a thrombus along with inflammation in the superficial veins and involves thegreat saphenous vein in many cases.

b. There is a wide range of predisposing factors including prolonged immobilisation, trauma, malignancies like pancreatic cancer, etc.

c. Patients usually present with a tender erythematous area, overlying the superficial vein, a distended vein may be visible proximal to the thrombus.

iii. Varicose veins

a. The deeps veins are separated by means of series of valves from superficially placed greater saphenous vein.

b. These valves ensure blood flows from the superficial system to the deep system i.e. prevents backflow.

c. The incompetence of these valves results in varicose veins, which are engorged tortuous veins that can be tender to the

touch.

Q.3 Write in detail about the Hip Joint.

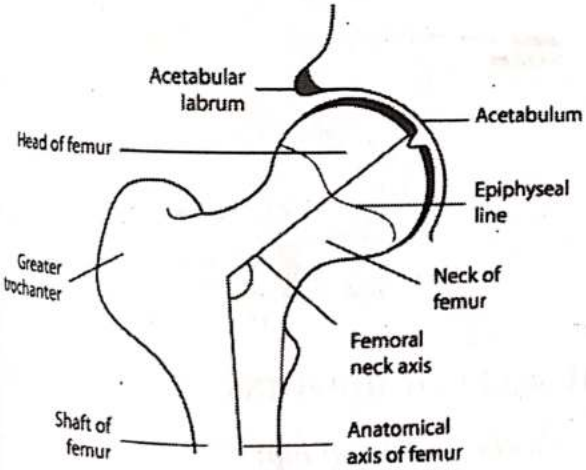
Ans. INTRODUCTION

- The hip joint is a ball and socket type of synovial joint.
- The ball of the hip joint is comprised of the head of the femurwhereas the concavity of the socket is created by the acetabulum, which is a cup-like depression within the pelvic bone.
- The hip joint helps to support the body weight in both standing and running or walking conditions.

BONES

The following two bones participate in the formation of hip joint:

i. *The head of the femur and*
ii. *The acetabulum of Pelvis*



Head of femur

a. The head is the proximal part of the femur.
b. It is joined by the neck with the shaft.

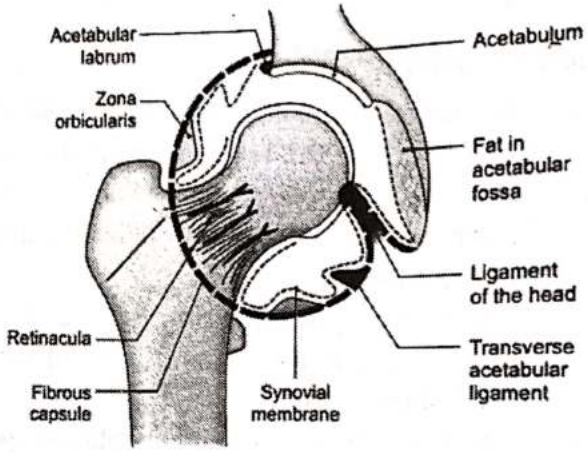
Acetabulum of pelvis

a. The acetabulum is the female part of the hip joint.
b. Acetabulum is the part of the pelvis formed by all three bones, the ilium, the ischium, and the pubis of the pelvis.
c. The bony rim of the acetabulum is partially surrounded by a fibrocartilaginous ring known as the labrum.

The rest of the bony rim is completed by the transverse acetabular ligament.

JOINT CAPSULE

- The capsule of the hip joint isa strong fibrous covering.
- But it is also loose enough to accommodate a range of movements.



- At the upper level, it is attached to the acetabular labrum and the transverse acetabular ligament, and with the intertrochanteric line of the femur at the lower level.
- The proximal two-third of the neck of the femur is encapsulated by the joint capsule and the distal third of the femur remains outside the capsule.
- The iliofemoral ligament, the pubofemoral ligament, and the ischiofemoral ligament help to strengthen the joint capsule.

LIGAMENTS

The hip joint is supported by the ligaments.The ligaments are in two groups:

i. Outer group
ii. Inner group

i. Outer group

The outer ligaments of the hip joint are:

i. The Iliofemoral ligament
ii. The Ischiofemoral ligament and
iii. The Pubofemoral ligament
i. The Iliofemoral ligament

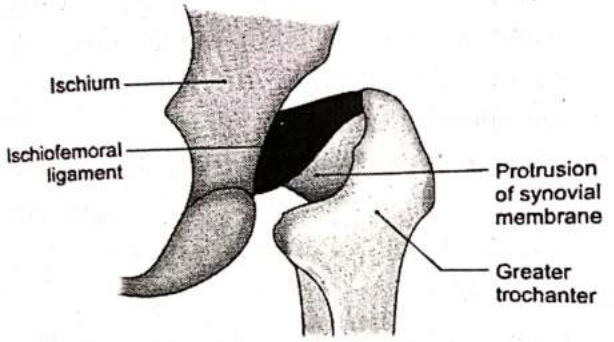
a. The iliofemoral ligament is superiorly attached to the anterior inferior iliac spine and the acetabulum whereas it is inferiorly attached to the intertrochanteric line.
b. It is a Y-shaped ligament.
c. It prevents hyperextension of the hip joint.

ii. The ischiofemoral ligament

a. The ischiofemoral ligament originates from the rim of the acetabulum.
b. Then it turns laterally.
c. Finally, it inserts on the inferomedial aspect of the greater trochanter.
d. It prevents hyperextension of the hip and also fixates the femoral head in the acetabulum
e. It prevents excessive medial rotation of the thigh.

iii. Pubofemoral ligament

a. The pubofemoral ligament arises from the pubic ramus and merges inferolaterally into the iliofemoral ligament.



b. This ligament tightens during extension and abduction in order to limit the lateral movement.

ii. Inner ligaments

The inner ligaments of the hip joint are:

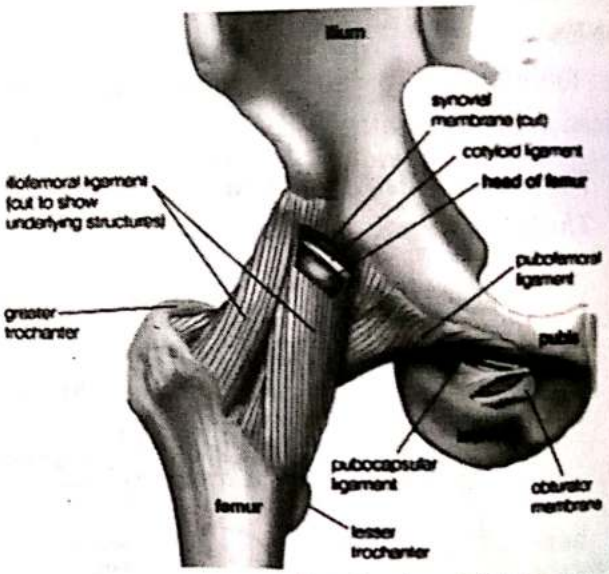
a. The transverse acetabular ligament
b. Ligament of head of the femur

a. The transverse acetabular ligament

- The transverse acetabular ligament starts at the acetabular notch and joins up with the inferior ends of the labrum.
- This ligament completes the acetabular ring.

b. The ligament of the head of the femur

- The ligament of the head of the femur is situated within the capsule but is extrasynovial.
- It arises from the acetabular notch and inserts upon the fovea of the femur. The artery supplying the head of the femur runs within the ligament.



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MUSCLES OF HIP JOINT

i. Flexor muscles of hip:

Following muscles are the hip flexors:

a. Iliopsoas
b. Sartorius
c. Rectus femoris
d. tensor fascia latae

ii. Extensor of the hip:

Following muscles are the hip extensors:

a. The gluteus maximus
b. The biceps femoris
c. The semimembranosus
d. The semitendinosus

iii. Abductor of the hip:

Following muscles are the hip abductor:

a. The gluteus medius
b. The gluteus minimus and
c. The piriformis

iv. *Adductors of hip*

Following are the adductors of the hip:

a. The adductor longus
b. The adductor brevis
c. The adductor magnus
d. The pectineus
e. The gracillis and
f. The quadratusfemoris

v. *Internal rotator of hip*

The internal rotator muscles are:

a. The gluteus medius
b. The gluteus minimus muscles and in addition adductor muscles
c. Adductor magnus.

vi. *External rotator of hip*

Following are the external rotator of the hip:

a. The obturator internus
b. The obturator externus
c. The superior gemellus
d. The inferior gemellus
e. The quadratusfemoris muscle and
f. The piriformis muscle

BLOOD SUPPLY

The hip joint is supplied by medial and lateral circumflex arteries, braches of the deep branch of the femoral artery.

NERVE SUPPLY

The joint is supplied by the femoral nerve, the anterior division of the obturator nerve, the articular branch of the sciatic nerve, and the superior gluteal nerve.

Applied anatomy

Perthes disease

- It is a condition of avascular necrosis which is mostly found in children.
- The condition affects the head of the femur, when there is inadequate perfusion to the epiphysis, causing the bone to become necrotic.

Q. 4 Write in detail about the Arches of foot.

Ans. INTRODUCTION

- The foot is the region of the body distal to the leg and consists of 28 bones.
- These bones are arranged into longitudinal and transverse arches with the support of various muscles and ligaments.
- There are three arches in the foot, which are referred to as:

i. Medial longitudinal arch
ii. Lateral longitudinal arch
iii. Transverse arch

These arches have an important role in standing, walking, and running.

i. Medial longitudinal arch

a. The medial longitudinal arch is higher than the lateral longitudinal arch.
b. It is visible between the heel of the footproximally and the medial three metatarsophalangeal joints distally.

Bones

The bones participating in the formation of the medial longitudinal arch are the following:

a. The medial three metatarsals up to their heads
b. The sesamoid bones
c. The three cuneiforms
d. The navicular
e. The talus and
f. The calcaneus

Pillars

a. The arch consists of two pillars anterior and posterior.
b. The anterior pillar consists of the medial three metatarsal heads whilst the tuberosity of the calcaneus forms the posterior pillar.

Ligaments

a. The supporting ligaments provide more stability than the bones of the arch.
b. Following are the ligaments of the medial

longitudinal arch:

- Plantar aponeurosis: One of these ligamentous structures, the plantar aponeurosis, acts as a supporting beam between the two pillars.
- Spring ligament: Another important structure, the spring ligament, supports the head of the talus.
- The talocalcaneal ligament: The talocalcaneal ligament providesstability for this arch

c. The anterior fibers of the deltoid ligament : The deltoid ligament also provides stability for this arch.

Muscles

Muscles in the foot also help to support the medial longitudinal arch. These muscles are:

a. Flexor hallucislongus
b. Flexor digitorumlongus
c. Abductor hallucis
d. Flexor digitorum brevis
e. Tibialis posterior, which is the most important muscle in the maintenance of the arch as damage to its tendon results in the collapse of the arch.

The tibialis posterior and anterior muscles help to raise the medial border of the arch whilst the flexor hallucislongus acts as a bowstring.

ii. Lateral longitudinal arch

a. The lateral longitudinal arch is lower than the medial longitudinal arch.
b. It is less prominent than the medial longitudinal arch.

Bones

The lateral longitudinal arch is formed by the following bones:

a. calcaneus
b. The cuboid
c. The fourth and fifth metatarsals

Pillars

a. Like the medial longitudinal arch, the lateral arch also consists of two pillars, anterior and posterior pillars, which help support the arch.
b. The anterior pillar consists of the fourth and fifth metatarsal heads whilst the calcaneus forms the posterior pillar.
c. The main contributor to the stabilisation of the arch is the fibularislongus tendon.

Ligaments

a. The supporting ligaments provide more stability than the bones of the arch.
b. Following are the ligaments of the lateral longitudinal arch:
   - The plantar aponeurosis
   - The long plantar ligament
   - The short plantar ligament,
c. The long and short plantar ligaments act as bowstrings beneath the arch.

Muscles

The following muscles are playing important role in maintaining the arch:

a. The fibularislongus tendon
b. Lateral two tendons of flexor digitorumlongus assisted by flexor accessories
c. Abductor digitiminimi
d. Lateral half of flexor digitorum brevis
e. Fibularis brevis
f. Fibularistertius

TRANSVERSE ARCH

The transverse arch runs in a coronal plane.

Bones

a. The transverse arch consists of the following bones:
   - The five metatarsal bases
   - The cuboid and
   - The cuneiform bones
b. The intermediate and lateral cuneiforms are wedge-shaped which aids in the maintenance of the arch.
c. The medial and lateral longitudinal arches act as pillars for the transverse arch.

Ligaments

a. The important ligaments of this arch are

the ligaments between the cuneiforms and bases of the five metatarsal bones.
b. The deep transverse ligaments with other muscles help to stabilise the arch.

Muscles

a. The curvature of the arch is mainly maintained by the fibularislongus tendon, assisted by the tibialis posterior tendon.
b. The deep transverse ligaments, the transverse head of the adductor longus, and the fibularislongus tendon, also help to stabilise this arch.

Functions of the arches

i. *Weight-bearing*

a. The arches of the foot have an important role in weight-bearing.
b. During standing, the weight of the body is distributed throughout the bones in the foot by the arches.
c. The weight is transmitted from the tibia to the talus, before being transmitted posteriorly to the calcaneus.
d. It is also transmitted anteriorly to the navicular, cuneiforms, and metatarsals.
e. The lateral longitudinal arch is mostly involved in transmitting this weight and makes more contact with the ground than the medial one.

ii. *Movements*

a. The medial longitudinal arch also has an important role in shock absorption and propulsion during walking, running, and jumping.
b. The arch acts asa springboard, as its anterior pillar is the point of take-off during these activities.
c. The process of walking is referred to as the gait cycle and this consists of two phases: a stance phase and a swing phase.
d. During the stance phase, the forefoot pronates which flattens the medial longitudinal arch and the transverse arch.
e. During the swing phase, the hindfoot supinates which causes the medial longitudinal arch to elevate.

Applied anatomy

i. Pes planus

a. Pes planus is a condition of an excessively flat foot.
b. It may be physiological or pathological.
c. When it is pathological, it can cause stiffness and pain inthe foot. The Windlass Test helps to confirm the pathological pes planus. In pathological pes planus, there is no accentuation of the medial longitudinal arch as a result of this movement.
d. Arthritis of tarsometatarsal, talocalcaneal and subtalar joints, as well as damage to the tibialis posterior tendon or to the spring ligament, are the causes of this condition

ii. Pes Cavus

a. Opposite to the pes planus is a condition of an excessively arched foot is known as pes cavus, or clawfoot.
b. This usually occurs as a result of a neurological disorder such as Charcot-Marie-Tooth disease and poliomyelitis.
c. In Charcot-Marie-Tooth disease, the fibularislongus muscle is overactive, resulting in plantar hyperflexion of the first metatarsal.
d. This results in hindfootvarus, where the calcaneus is adducted and rotated under the talus

Q. 5 Write the Anatomy of Obturator Nerve.

Ans. INTRODUCTION

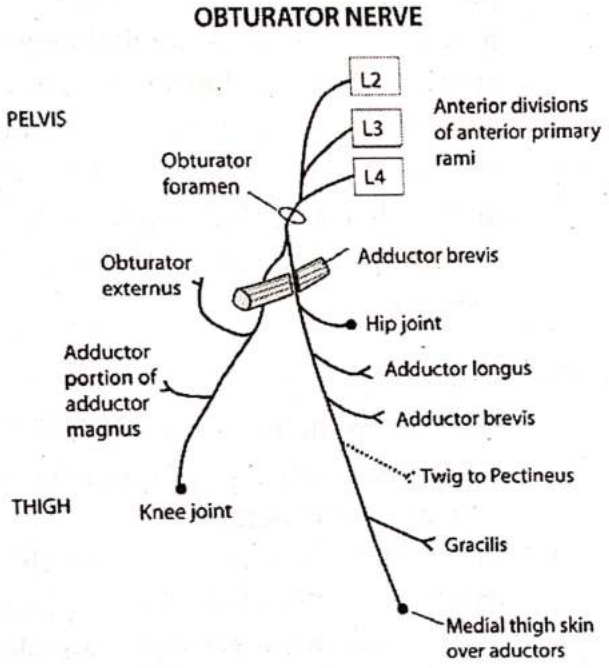
The obturator nerve is a major peripheral nerve of the lower limb.

Root value

- The obturator nerve is formed from the lumbar plexus.
- It arises from the anterior divisions of L2, L3, and L4 segments of the spinal cord.

Anatomical Course

- After its formation, the obturator nerve descends through the fibers of the psoas major and emerges from its medial border.
- It then travels posteriorly to the common iliac arteries and laterally along the pelvic wall to reach the upper part of the obturator foramen of the pelvis.
- The obturator nerve enters the medial thigh via the obturator canal.
- It then divides into anterior and posterior branches:



Divisions

The Obturator nerve is divided into two divisions:

i. Anterior division and
ii. Posterior division

i. Anterior division

a. It passes downwards in front of the obturator externus.
b. Then it lies between pectineus and adductor longus and adductor brevis posteriorly.
c. It supplies the adductor longus, adductor brevis, and gracilis muscles.
d. It then pierces the fascia lata to become the cutaneous branch of the obturator nerve.

ii. Posterior division:

a. It pierces the obturator externus muscle and passes behind the adductor brevis and in front of the adductor magnus.
b. It supplies the obturator externus and adductor magnus muscles.

Branches

The obturator nerve gives the following branches:

i. Muscular branches
ii. Articular branches and
iii. Vascular and cutaneous branches

i. Muscular branches

The following muscular branches arise from the anterior and posterior division of obturator nerve:

a. Anterior division

The anterior division gives muscular branches for the following muscles:

- Branch for pectineus muscle
- Branch for adductor longus muscle
- Branch for adductor brevis muscle and
- Branch for gracilis muscle

b. Posterior division

The posterior division gives muscular branches for following muscles

- Branch for Obturator externus muscle
- Branch for adductor magnus muscle

ii. Articular branches

a. Anterior division: The anterior division gives articular branches for the hip joint.
b. Posterior division: The posterior division gives articular branches for the knee joint.

iii. Vascular and cutaneous branches

a. Anterior division: The anterior division gives vascular branches femoral artery and cutaneous branch for medial side of the thigh
b. Posterior division: The posterior division gives an arterial branch for the popliteal artery.

Functions

a. Motor function: The obturator nerve supplies all the muscles in the medial compartment of the thigh except the hamstring part of the adductor magnus
b. Sensory Function: The cutaneous branch of the obturator nerve supplies the skin of the middle part of the medial thigh.

Applied anatomy

Damage to obturator nerve

- Symptoms include numbness and paraesthesia on the medial aspect of the thigh and weakness in adduction of the thigh.
- Alternatively, the patient could present with posture and gait problems due to the loss of adduction.

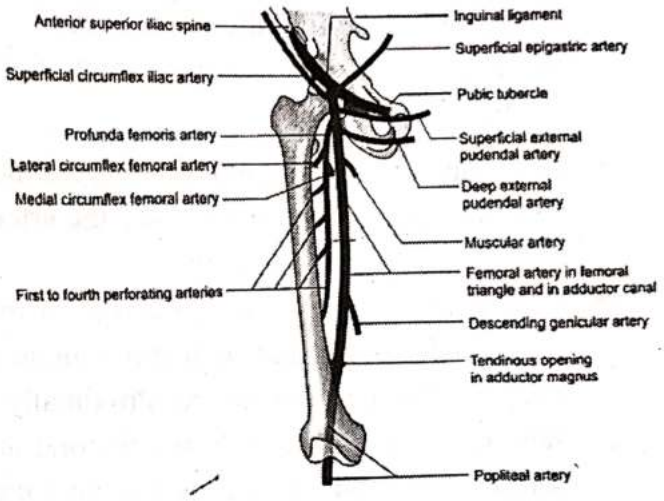
Q. 6 Describe in detail the Femoral Artery.

Ans. INTRODUCTION

- The femoral artery is a continuation of the external iliac artery and constitutes the major blood supply to the lower limb.
- In the thigh, the femoral artery passes through the femoral triangle, a wedge-shaped depression formed by muscles in the upper thigh.
- In the femoral triangle, the femoral artery is enclosed in a femoral sheath with the femoral vein. The femoral artery and its branches supply most of the thigh as well as the entirety of the leg and the foot.

COURSE

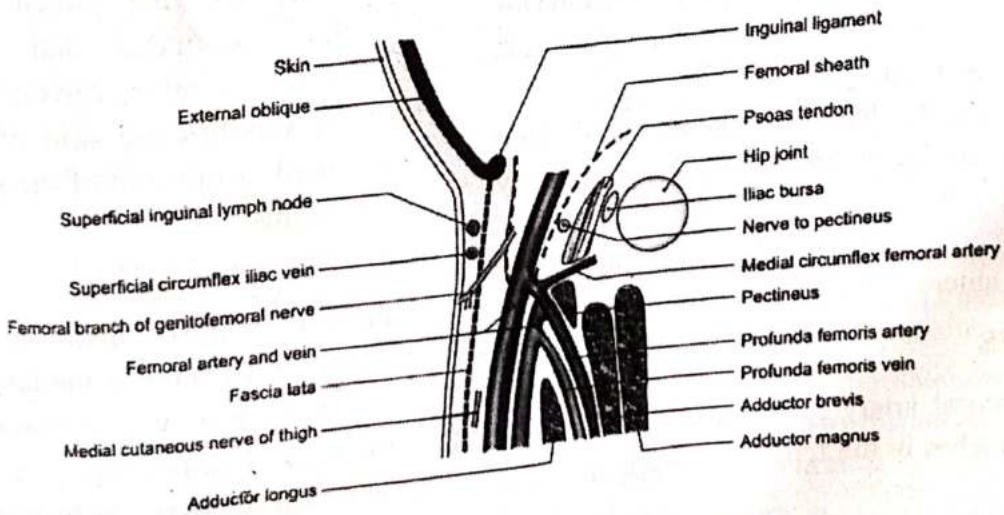
- Midway between the anterior superior iliac spine and the pubic symphysis, the external iliac artery passes under the inguinal ligament into the femoral triangle and becomes the femoral artery.



- The artery then travels down the anteromedial aspect of the thigh before it passes through the adductor or subsartorial canal.
- When the femoral artery passes through the adductor hiatus it becomes the popliteal artery.

RELATIONS

- The relations of the femoral artery to other structures inside the femoral triangle and inside the adductor canal are important in clinical practice.



a. Inside femoral triangle

Within the femoral triangle, the femoral artery is located deep to the:

- Skin
- Superficial fascia
- Superficial inguinal lymph nodes
- Fascia lata
- Superficial circumflex iliac vein
- The femoral branch of the genitofemoral nerve

- At the apex of the femoral triangle, the medial femoral cutaneous nerve crosses the artery in a lateral to medial direction.
- Within the triangle, the tendons of psoas major, pectineus, and adductor longus pass deep to the femoral artery. Proximally, the femoral vein is medial to the femoral artery within the sheath. At the apex of the triangle, the vein is found deep to the artery. Within the adductor canal, the femoral artery is located deep to the:
  - Skin
  - Superficial fascia
  - Deep fascia
  - Sartorius muscle
- The artery is superficial to the adductor magnus and adductor longus muscles.
- Both the saphenous nerve and femoral vein vary in their location in relation to the femoral artery.
- The saphenous nerve is initially found lateral to the femoral artery but is also found anterior and then medial to the nerve as it travels through the canal.
- Proximally, the femoral vein is found deep to the artery but is found lateral to the artery distally.
- The vastusmedialis muscle and its nerve are located anterolateral to the femoral artery.

BRANCHES

- The femoral artery gives total six branches five branches in the femoral triangle and one branch in the adductor canal.
- These branches are described below.
  - Superficial epigastric artery: The superficial epigastric artery arises from the femoral artery, 1 cm distal to the inguinal ligament. It travels through the cribriform fascia and ascends towards the umbilicus within the abdominal superficial fascia. It supplies the skin, superficial fascia, and superficial inguinal lymph nodes.
  - Superficial circumflex iliac artery: The superficial circumflex iliac artery is the smallest branch of the femoral artery. It arises near the superficial epigastric artery. Lateral to the saphenous opening, the artery passes through the fascia lata before coursing towards the anterior superior iliac spine. Like the superficial epigastric artery, it supplies the skin, superficial fascia, and superficial inguinal lymph nodes.
  - Superficial external pudendal artery: The superficial external pudendal artery arises near the superficial epigastric and superficial circumflex iliac arteries. It travels through the cribriform fascia before crossing the spermatic cord deep to the long saphenous vein. It supplies the lower abdominal skin as well as the penile, scrotal, or labial skin.
  - Deep external pudendal artery: The deep external pudendal artery crosses the pectineus and adductor longus muscles before traversing the fascia lata. It supplies the skin of the perineum as well as the skin of the scrotum or labium majus.
  - Profundafemoris:

- Profundafemoris, also known as the deep artery of the thigh is the largest branch of the femoral artery, which arises 3.5 cm distal to the inguinal ligament.
- The Profundafemoris is initially found lateral

to the femoral artery before it passes deep to it towards the medial aspect of the femur.
- It travels between the pectineus and adductor longus muscles before passing between the adductor longus and adductor brevis muscles.
- It then descends between the adductor longus and adductor magnus muscles before it pierces the adductor magnus to anastomose with the muscular branches of the popliteal artery.
- The Profundafemoris is the main blood supply to the muscles that extend, flex, and adduct the thigh.

- Descending genicular artery:

- Descending genicular artery is the most distal branch of the femoral artery, which arises just proximal to the adductor opening within the adductor canal.
- It descends within the vastusmedialis muscle to the medial aspect of the knee.
- Here, it anastomoses with the medial superior genicular artery.
- Branches of this artery supply the vastusmedialis and adductor magnus muscles as well as the proximomedial skin of the thigh.

Applied anatomy

Femoral pulse

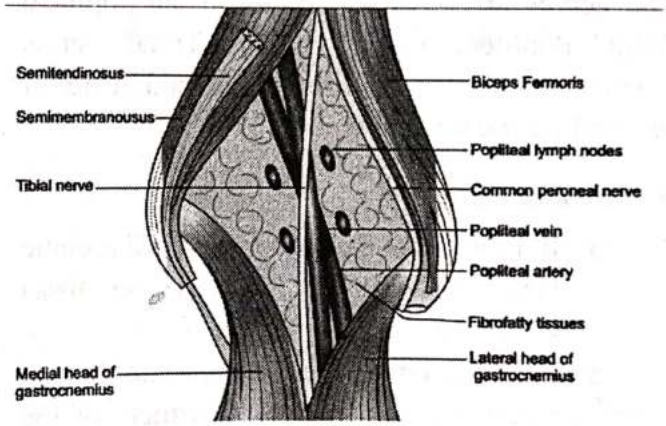
a. As the femoral artery is relatively superficial within the femoral triangle, the femoral pulse is usually easily palpated. It can be palpated midway between the anterior superior iliac spine and pubic symphysis, just inferior to the inguinal ligament. If the pulse is diminished, this may indicate partial occlusion of the common iliac artery or the external iliac artery.

b. Cannulation
The femoral artery is a common site for cannulation as it provides access to the heart as well as to various vessels. Coronary artery angioplasty is a common intervention used in coronary artery disease, which involves cannulation of the femoral artery.

Q. 6 Write the Anatomy of Popliteal Fossa.

Ans. INTRODUCTION

- The popliteal fossa is a diamond-shaped depression located posterior to the knee joint.
- It is 2.5 cm wide and mainly consists of fat tissue.
- Important nerves and vessels pass from the thigh to the leg by traversing through this fossa and the muscles of the thigh and the leg form its boundaries.



BOUNDARIES

- Popliteal fossa has four boundaries, a floor, and a roof. Following are the boundaries of popliteal fossa.
  - Superomedial – Superomedially the popliteal fossa is bounded by the semimembranosus and semitendinosus muscles.
  - Superolateral- Superolaterally the popliteal fossa is bounded by the biceps femoris muscle
  - Inferomedial – Inferomedially its bounded by the medial head of the gastrocnemius muscle.
  - Inferolateral – Inferolaterally popliteal fossa is bounded by the lateral head of the gastrocnemius muscle.

- The floor - The floor of the popliteal fossa is formed by the capsule of the knee joint, the distal part of the femur, the proximal portion of the tibia,and the popliteus muscle also forms the floor.
- The roof - The roof of the popliteal fossa is formed by popliteal fascia, which is continuous with the fascia lata superiorly and the fascia crusis inferiorly. This dense fascia is reinforced by transverse fibers and forms a protective sheath for the structures passing through the fossa.

Contents

The popliteal fossa contains nerves, arteries, veins, and lymph nodes.

*a.*Nerves

The nerves are most superficial in the popliteal fossa. Popliteal fossa contains Tibial nerve, Common fibular nerve, sural nerve, and posterior femoral cutaneous nerve.

b. Tibial nerve

- It is a large medial branch ofthesciatic nerve that passes through the fossa inferiorly.
- It lies deep to theplantaris muscle and enters the posterior compartment of the leg.
- In the popliteal fossa, the tibial nerve and its branches supply the soleus muscle, gastrocnemius muscle, plantaris muscle, and popliteus muscles.

c. Common fibular nerve

- Common fibular nerve is another branch of the sciatic nerve, that traverses the fossa close to the medial border of the biceps femoris muscle.
- It remains superficial to the lateral head of the gastrocnemius muscle and exits the fossa.
- It then crosses the posterior aspect of the head of the fibula before it winds around the neck of the fibula and divides into its terminal branches.

ii. Blood vessels

- Blood vessels are located deep to the nerves within the poplitealfossa. The popliteal fossa contains the popliteal artery, the popliteal vein, and the short saphenous vein.
- The popliteal vessels are held together by dense areolar tissue.

a. Popliteal artery

- The popliteal artery is a branch of the femoral artery.
- It enters the popliteal fossa by passing under the semimembranosus muscle.
- It lays inferolaterally in the fossa before entering the posterior compartment of the leg.
- The popliteal artery gives five genicular arteries, which supply the ligaments and capsule of the knee joint.

These genicular arteries are:

- superior medial genicular
- superior lateral genicular
- middle genicular
- inferior medial genicular
- inferior lateral genicular

- These arteries anastomose to form the genicular anastomosis, a collateral circulation surrounding the knee joint.
- The muscular branches of the popliteal artery supply the soleus, gastrocnemius, plantaris , and hamstring muscles.

b. Popliteal vein

- The popliteal veinisacontinuation of the posterior tibial vein.
- It lies superficial to the popliteal artery within the fibrous sheath.
- After it exits the fossa superiorly, it becomes the femoral vein.

c. Short saphenous vein

- The short saphenous vein travels superiorly in the posterior aspect of the leg from the lateral part of the dorsal venous arch, before entering the popliteal

fossa.

- It travels within the popliteal fascia before penetrating it and anastomosing with the popliteal vein.

Lymph nodes

There are two main groups of lymph nodes located within the popliteal fossa: the superficial popliteal and the deep popliteal.

- Superficial: The superficial popliteal lymph nodes lie within the subcutaneous tissue and receive lymph from the lymphatic vessels accompanying the short saphenous vein.
- Deep: The deep popliteal lymph nodes surround the popliteal vessels and receive lymph from the superficial popliteal lymph nodes as well as from the leg and the foot. The lymph from these nodes then drains into the deep inguinal lymph nodes.

Applied Anatomy

Popliteal pulse

a. Palpation of the popliteal pulse is usually performed with the knee flexed position.
b. The pulse is best felt in the inferior part of the fossa but may be difficult to find because of the deep location of the popliteal artery.
c. A loss of the popliteal pulse can indicate femoral artery obstruction.

Popliteal abscess

a. An abscess, or tumour, located within the popliteal fossa usually results in severe pain due to the strength and resistance of the popliteal fascia.
b. Because of this, popliteal abscesses usually spread superiorly and inferiorly from the popliteal fossa.

Q.7 **Write the Anatomy of Sciatic nerve.**

Ans. **INTRODUCTION**

The sciatic nerve is the largestbranch of the lumbosacral plexus.

- The sciatic nerve is formed by the anterior and posterior divisions of nerve roots L4, L5, S1, S2, and S3.
- The sciatic nerve is considered as the nerve of the lower limb, as it supplies the posterior compartment of the thigh leg and the foot.

ROOT

The sciatic nerve is formed by the lumbosacral trunk (L4 and L5) and the sacral outflow from S1 to S3.

COURSE

- The nerve travels inferiorly, on the pelvic surface of theischiococcgeus muscle.
- It lies posterior to the internal pudendal artery.
- The superior gluteal artery lies between the lumbosacral trunk and the S1 segment and the inferior gluteal artery lies between the S2 and S3 segments of the sciatic nerve.
- After leaving the pelvic cavity, it passes through the greater sciatic foramen to enter the gluteal region.
- In the gluteal region, it lies deep to the gluteus maximus muscle.
- It arises in the region at a slight inferolateral angle, deep to the inferior border of the piriformis and the inferior gluteal artery.
- It travels superior to the gemelli, obturator internus, and quadratusfemoris muscles.
- It is more vertical at the level of the ischial tuberosity.
- Then it enters the thigh.
- It travels deep to the long head of biceps femoris,semitendinosus, and semimembranosus muscles and it remainssuperficial to the hamstring component of the adductor magnus muscle.
- At the apex of the popliteal fossa, the sciatic nerve divides into its tibial and common fibular branches.

- These two nerves travel laterally to the popliteal vessels in the fossa.
- In the fossa, the common fibular nerve is more lateral than the tibial nerve.

Branches

The sciatic nerve gives following branches:

i. Branches from Trunk
ii. Tibial nerve
iii. Common fibular nerve

i. Branches from trunk

a. The trunk of the sciatic nerve supplies the proximal parts of the semitendinosus, semimembranosus, short head of biceps femoris, and the ischial component of adductor magnus muscle.

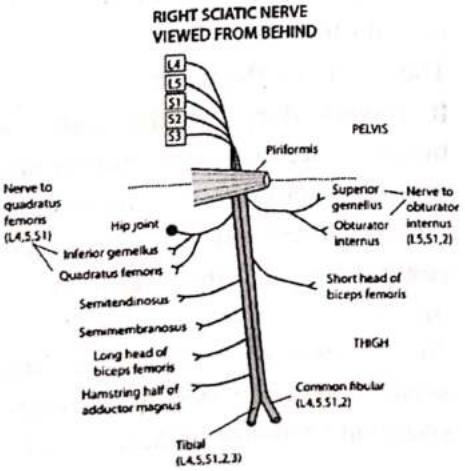
b. The long head of biceps femoris, semimembranosus, semitendinosus, and adductor magnus are also supplied by the tibial branch, and the short head of biceps femoris by the common fibular division of the sciatic nerve.

c. The tibial and common fibular nerves also provide motor supply to the leg and foot along its caudal route, which will now be discussed.

ii. Tibial nerve

a. The tibial branch of the sciatic nerve is composed of anterior nerve fibers from the lumbosacral trunk and S1 – S3.

b. The tibial nerve is the nerve of the flexor compartment of the leg



c. Tibial nerve gives the following branches:

- In the popliteal fossa
- In the calf
- At flex or retinaculum
- In the foot

- **In the popliteal fossatibial nerve gives the following branches:**
  - The genicular branches to the knee joint
  - The muscular branch to soleus muscle,
  - The muscular branch to plantaris muscle,
  - The muscular branch to popliteus muscle and
  - The muscular branch to gastrocnemius muscle.

Mnemonic: Keep special protection group (SPG commando) perfect
K for knee branch
S for soleus muscle branch
P for plantaris muscle branch
G for gastrocnemius muscle branch and
P for popliteus muscle branch

- After exiting the popliteal fossa the tibial nerve crosses the tibial vein and lies between the vein and its artery on the superficial surface of the popliteus muscle.
- The nerve pierces the tendinous arch of the soleus and goes into the deep compartment of the posterior leg.

- **In the calf, it supplies the following muscles:**
  - The flexor digitorum
  - The hallucislongus,
  - The tibialis posterior and
  - The soleus.

Then it passes deep to the flexor retinaculum.

- **At flexor retinaculum, the tibial nerve gives medial calcaneal cutaneous branches while traveling under the flexor retinaculum.**
- **In the foot the nerve divides into a medial and a lateral plantar nerve.**
  - Medial plantar nerve : The medial plantar branch supplies the medial sole and the medial plantar aspect of 3 1/2 toes.

It also supplies with abductor hallucis, flexor digitorum brevis, flexor hallucis brevis, and the first lumbrical.

- Lateral plantar nerve: The lateral plantar nerve innervates the rest of the foot muscles along with the remaining part of the sole.

iii. Common fibular nerve

a. The common fibular branch of the sciatic nerve is composed of posterior nerve fibers from the lumbosacral trunk and roots S1 and S2.

b. The common fibular nerve is the nerve of the extensor and peroneal compartments of the leg and the dorsum of the foot.

Branches

Tibial nerve gives following branches:

i. *In the popliteal fossa*
ii. *In the calf*
iii. *At flexor retinaculum*
iv. *In the foot*

i. ***In the popliteal fossa:*** In the popliteal fossa, the common fibular nerve gives geniculate branches for:

a. The knee joint
b. Tibiofibular joint

ii. ***In the leg:*** The common fibular nerve enters in the anterior compartment of the leg by crossing over the plantaris and the lateral head of the gastrocnemius. In the leg, it divides into superficial and deep branches:

a. The superficial branch which supplies:
- The skin of the lower third of the leg.
- The peroneus longus muscle and
- The peroneus brevis muscle.
- The medial aspect of the great toe and second interdigital cleft
- The third and fourth clefts

b. The deep fibular nerve which supplies :
- Extensor digitorumlongus muscle
- Extensor hallucislongus muscle,
- Peroneus tertius muscle and
- Tibialis anterior muscle

Applied anatomy

i. Sciatic nerve injury

a. The sciatic nerve is most commonly injured by misplaced injections to the gluteal region. Extreme trauma can also result in injury to the nerve.

b. Damage to the nerve will result in hamstring paralysis as well as the loss of innervation to the muscles of the leg and foot.

c. The most obvious clinical signs will be the inability to plantarflex or dorsiflex the foot.

ii. Common fibular / common peroneal nerve injury

a. Fracture of the neck of the fibula is the most common way to injure the common peroneal nerve.

b. The loss of innervation to the extensor muscles of the leg will result in a classic foot drop.

c. The patient makes a conscious effort to raise the foot while walking so that the toes aren't dragged on the ground.

3

Abdomen

ABDOMEN TWO MARKS QUESTIONS

Q. 1 Name the parts of large intestine.

Ans. Following are the parts of the Large intestine

a. Caecum,
b. Vermiform appendix,
c. Transverse colon,
d. Ascending colon,
e. Descending colon,
f. Sigmoid colon,
g. Rectum and
h. Anal canal

Q. 2 Name two structures passing through the inguinal ring in females.

Ans. These two structures pass through the inguinal ring in females:

a. round ligament of uterus
b. Ilioinguinal nerve

Q. 3 Name two arteries supplying the pancreas.

Ans. Following arteries supply the pancreas

a. splenic artery,
b. superior pancreaticoduodenal artery,
c. inferior pancreaticoduodenal artery

Q. 4 Name the branches of the abdominal aorta.

Ans. the branches of the abdominal aorta are:

a. Ventral branch:coeliac trunk
b. Lateral branch:renal arteries
c. Dorsal branch:lumbar arteries
d. Terminal branch:iliac arteries

Q. 5 Name the structures of stomach bed.

Ans. Stomach bed is formed by the following structures:

a. pancreas,
b. spleen,
c. left kidney,
d. left suprarenal gland,
e. diaphragm,
f. transverse colon and
g. mesocolon

Q. 6 Name the parts of the pancreas.

Ans. Following are the four parts of pancreas:

a. Head,
b. neck,
c. body and
d. tail

Q. 7 Mention different positions of vermiform Appendix.

Ans. vermiform Appendix is having following positions

a. pelvic,
b. Subcecal,
c. Retroileal,
d. Ectopic and
e. Retrocecal

Q. 8 Write the contents of rectus sheath.

Ans. Rectus sheath contents:

a. Rectus abdominis and
b. Pyramidalis

Q. 9 Write visceral relations of the spleen.

Ans. Spleen has the following visceral relations:

a. fundus of the stomach,

b. left kidney,
c. splenic flexure of colon and
d. tail of pancreas

Q. 10 Write the main feature of the large intestine.

Ans. Following are the features of the large intestine:

a. It extends from ileocaecaljunction to the anus,
b. It 1.5m long and
c. It is divided into the following parts
- Caecum,
- Ascending colon,
- Descending colon,
- Transverse colon,
- Sigmoid colon,
- Rectum and
- Anal canal

Q. 11 Mention position of the appendix.

Ans. The appendix lies in the right lower quadrant of the abdomen.

Q. 12 Mention formation of Hepatopancreatic ampulla.

Ans. Hepatopancreatic ampulla forms into the duodenum.

a. The cystic duct and the common hepatic duct join together and form the common bile duct.
b. The Hepatopancreatic ampulla is formed by joining the common bile duct with the pancreatic duct.

Q. 13 Write any two differences between Jejunum and ileum.

Ans. Following are the differences between Jejunum and ileum.

a. Jejunum occupies the upper and left parts of the intestinal area whereas ileum occupies the lower and right parts of the intestinal area.
b. Walls of jejunum are thick and more vascular whereas that of the ilium are thinner and less vascular
c. Jejunum has wider and often empty lumen whereas ilium has a narrow and often loaded lumen.
d. Jejunum has large, thick, and abundant villi whereas ilium has shorter, thinner, and fewervilli
e. Peyer's patches are absent in the jejunum and present in the ilium.

Q. 14 Write down any two ligaments of the spleen.

Ans. The spleen is surrounded by peritoneum and is suspended by the following ligaments:

a. The gastrosplenic ligament
b. The lienorenal ligament and
c. The phrenicocolic ligament.

Q. 15 Write the subdivisions of the duodenum

Ans. The duodenum may be subdivided into four sections:

a. The superior part,
b. The descending part,
c. The horizontal part and
d. The ascending part

Q. 16 Mention visceral relations of liver

Ans. The visceral surface of the liver is directly related to the following anatomical structures:

a. Duodenum
b. Gallbladder
c. hepatic flexure
d. Transverse colon
e. Right kidney
f. Suprarenal gland

Q. 17 Write down Layers of kidneys

Ans. The kidney is protected by the following three layers:

a. The fibrous capsule (renal capsule)
b. The perinephric fat (perirenal fat capsule)
c. The renal fascia which besides the kidneys also encloses the suprarenal gland and its surrounding fat.

Q. 18 Mention Ends of oesophagus

Ans. The esophagus is connected at either end by the pharynx and stomach and forms in two junctions:

a. Pharyngoesophageal junction and
b. Gastroesophageal junction

Q. 19 Name the ligaments of spleen

Ans. The spleen is surrounded by the peritoneum and is suspended by following ligaments

a. The gastrosplenic ligament
b. The lienorenal ligament and
c. The phrenicocolic ligament.

Q. 20 What is The ligament of Treitz.

Ans. The ligament of Treitz is a fibromuscular band thatsuspends and supports the duodenojejunal flexure.

It arises from the right crus of the diaphragm close to the right side of the oesophagus.

Q. 21 Define Traube space of stomach.

Ans. Traube space is a topographic area overlying the fundus of the stomach which is tympanic on percussion. It's bounded:

a. superiorly by the lower border of the left lung,
b. inferiorly by the left costal margin,
c. on the left side by the lateral end of the spleen, and
d. on the right side by the lower border of the left lobe of the liver.

Q. 22 Define Gastric triangle

Ans. Gastric triangle is a triangular area of the stomach in contact together with the anterior abdominal wall. It's bounded:

a. on the left side by the left costal margin,
b. on the right side by the lower border of the liver, and
c. inferiorly by the transverse colon.

Q. 23 Name any 2 structures located in the right iliac fossa

Ans. Following structures are located in the right iliac fossa

a. Iliacus muscle
b. Obturator nerve and
c. Arcuate line

ABDOMEN TWENTY MARKS QUESTIONS

Q. 1 Describe the Anatomy of Duodenum in detail.

Ans. INTRODUCTION

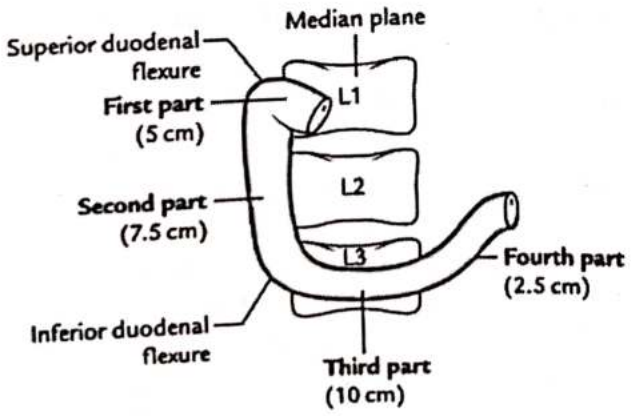
- The duodenum is a C-shaped structure. It is amongst the first of the three parts of the small intestine that receives partially digested food from the stomach and begins with the absorption of nutrients.
- It is directly attached to the pylorus of the stomach.
- It is closely related to the head of the pancreas.
- It consists of four sections: superior, descending, horizontal, and ascending parts.
- Histologically, it consists of the typical three layers common to all hollow organs of the gastrointestinal tract, but it has Brunner's glands, which is the characteristic feature of the duodenum.

FEATURES

- The duodenum is about 25 cm long.
- It is a C-shaped organ.
- It is located in the upper abdomen at the level of L1-L3.
- The head of the pancreas lies in the C loop.

SUBDIVISIONS

The duodenum is subdivided into four sections:



i. The superior part,

ii. The descending part,

iii. The horizontal part and

iv. The ascending part

i. Superior part

a. The superior part lies intraperitoneally and is enlarged proximally.

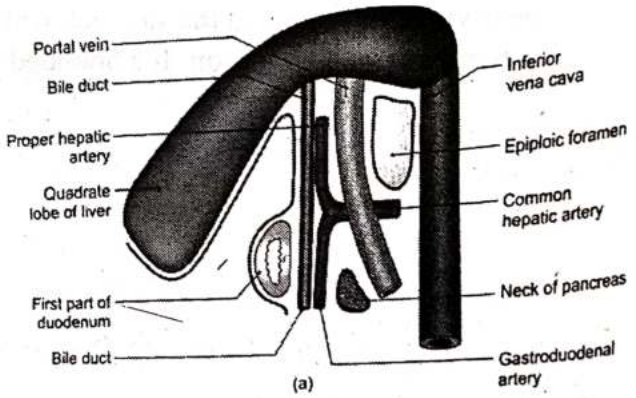
b. It is 5 cm long.

c. Extension: The superior part begins at the pylorus of the stomach and passes backwards and to the right to meet the second part at the superior duodenal flexure

d. Duodenal bulb
The superior part lies intraperitoneally and is enlarged proximally.
This enlargement is known as the duodenal bulb.

e. Relations: The superior part of the duodenum has the following peritoneal and visceral relations.

- Peritoneal relations



- The proximal 2.5 cm is a movable part. It is attached to the lesser omentum above and to the greater omentum below.
- The hepatoduodenal ligament connects the superior part to the liver.
- The distal 2.5 cm is a fixed part.It is covered with peritoneum only on its anterior aspect.

- Visceral relations
The superior part is anteriorly related with:
  - The quadrate lobe of the liver and
  - Gallbladder

It is posteriorly related with:

- gastroduodenal artery,
- bile duct
- Portal vein.

ii. *Descending part*

a. The descending part lies retroperitoneally

b. It is 7.5 cm long.

c. Extension: The descending part begins at the superior duodenal flexure, passes downwards to reach the lower border of the third lumbar vertebra.

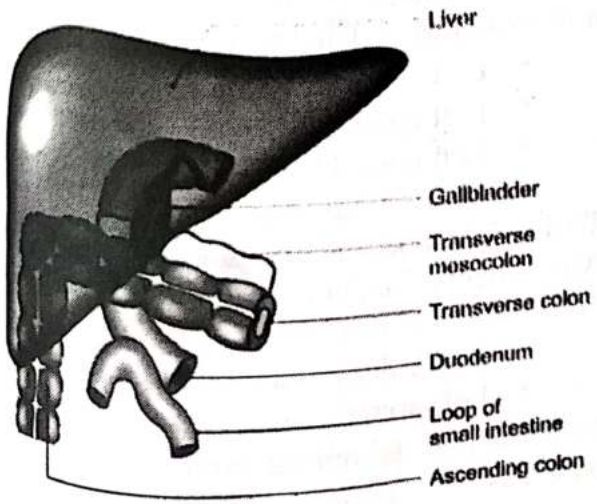
d. At this place it curves towards the left at the inferior duodenal flexure, to become continuous with the third part.

e. Ampulla of Vater:The common bile duct and the pancreatic duct unite at the hepatopancreatic ampulla or ampulla of Vater and open into the descending part of the duodenum

At the opening, there is an elevation of the mucosa, the major duodenal papilla known as papilla of Vater.

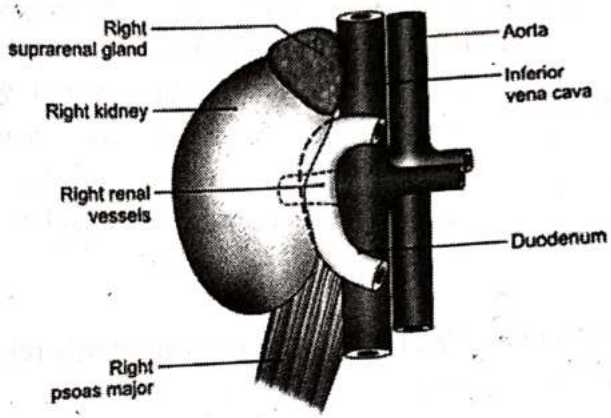
f. Relations: The descending part of the duodenum has the following peritoneal and visceral relations:

- Peritoneal relations: The descending part is retroperitoneal and fixed. Its anterior surface is covered with peritoneum, except near the middle, where it is directly related to the colon.



- Visceral relations: The descending part is anteriorly related with:
  - right lobe of liver,
  - Transverse colon
  - Root of transverse mesocolon and
  - Small intestine

It is posteriorly related with:



- Anterior surface of the right kidney near medial border
- Right renal vessels
- Right edge of the inferior vena cava
- Right psoas majormuscle

It is medially related with:

- Head of pancreas and
- Bile duct

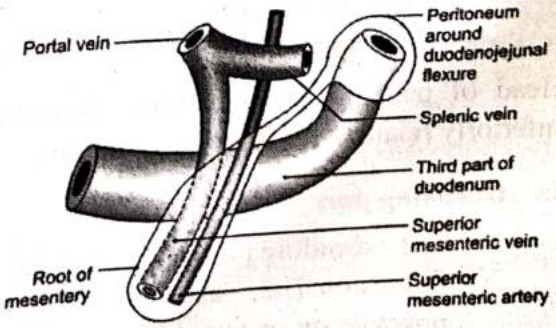
It is laterally related with:

Right colon of flexure

iii. *Horizontal part*

a. The horizontal part is about 10cm long.

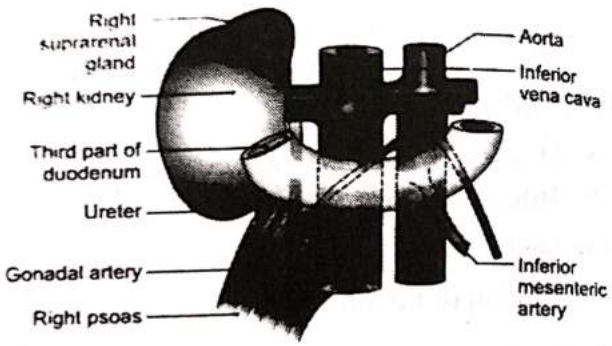
b. Extension: The horizontal part begins at the inferior duodenal flexure, on the right side of the lower border of the third lumbar vertebra.



c. It passes horizontally and slightly upwards in front of the inferior vena cava.
d. It ends by joining the ascending part in front of the abdominal aorta.
e. Relations: The horizontal part of duodenum is having following peritoneal and visceral relations

- Peritoneal relations: Thehorizontal part is retroperitoneal and fixed. Its anterior surface is covered with peritoneum, except in the median plane, where it is crossed by the superior mesenteric vessels and by the root of the mesentery.
- Visceral relations:
  The horizontal part is anteriorly related with:
  - Superior mesenteric vessels
  - Root of mesentery

  It is posteriorly related with:



  - Right ureter
  - Right psoas major
  - Right testicular or ovarian vessels
  - Inferior vena cava
  - Abdominal aorta with origin of inferior mesenteric artery

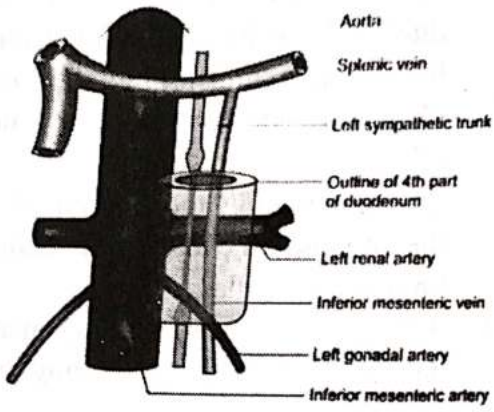
It is superiorly related with:
Head of pancreas with uncinate process: It is inferiorly related to coils of the jejunum.

iv. Ascending part

a. The ascending partis 2.5 cm long.
b. Extension:The ascending part runs upwards on or immediately to the left of the aorta, up to the upper border of the second lumbar vertebra.
c. At this level, it turns forwards and continues with jejunum at duodenojejunal flexure.
d. Relations: The ascending part of the duodenum is having the following peritoneal and visceral relations

Peritoneal relations:

- The ascending part is mostly retroperitoneal and only anteriorly covered with the peritoneum.
- The terminal mobile part is suspended by the uppermost part of the mesentery



Visceral relations:
The ascending part of the duodenum is anteriorly related with:

- Transverse colon
- Transverse mesocolon
- Lesser sac and
- Stomach

It is posteriorly related with:

- Left sympathetic chain
- Left renal artery
- Left gonadal artery and
- Inferior mesenteric vein

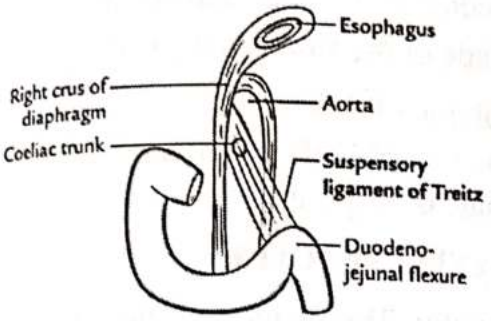
To the right side it is related with:
Attachment of upper part of the root of mesentery
To the left, it is related with:

- Left kidney and
- Left ureter

Superiorly it is related with the body of the pancreas.

LIGAMENT OF TREITZ

- The ligament of Treitz is a fibromuscular bandthatsuspends and supports the duodenojejunal flexure.



- It arises from the right crus of the diaphragm close to the right side of the oesophagus.
- Then it passes downwards behind the pancreas.
- It is attached to the posterior surface of the duodenojejunal flexure and the third and fourth part of the duodenum.
- Clinically the ligament of Treitz marks the border between the upper and lower gastrointestinal tract.

HISTOLOGY

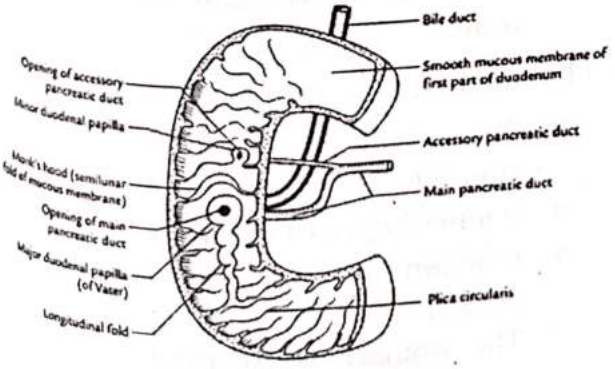
Histologically the duodenum is similar to all the other hollow organs of the gastrointestinal tract:

i. ***The mucosal layer***
ii. ***The submucosal layer and***
iii. ***The Muscularis layer***

i. *The mucosal layer*

The mucosa consists of:

a. Simple columnar epithelium,
b. A connective tissue layer and
c. A smooth muscle layer



ii. *The submucosal layeris made-up of*

a. Loose connective tissue,
b. Numerous blood vessels and
c. The Meissner's plexus.

iii. *The Muscularis layer consists of:*

a. An inner circular and
b. An outer longitudinalmusculature
c. Between these two layers, there is Auerbach's plexus.
There are microvilli, finger-shaped villi, and circular folds of the mucosa and submucosa, whichincrease the absorption area of the duodenum up to 1500 times.

Brunner's glands

- A characteristic feature of the duodenum is the Brunner's glandsembedded in the submucosa.
- The secretion of Brunner's gland contains bicarbonate which helps to neutralize the gastric acid.

BLOOD SUPPLY

The supply of blood to the duodenum is carried by:

- The anterior and posterior superior pancreaticoduodenal arteries
- The inferior pancreaticoduodenal artery

These arteries form an arterial arcade.

- The correspondent veins are responsible for the venous drainage.

NERVE SUPPLY

The sympathetic innervation is carried by nerves of the coeliac plexus, the parasympathetic innervation by the vagus nerve.

FUNCTIONS

The main functions of the duodenum are:

- Neutralization of the acidic gastric juice through production of alkaline secrets
- mechanical processing and digestion of chyme
- mixing bile and pancreatic enzymes
- absorption of water, electrolytes, and nutrients

Applied Anatomy

Stenosis and obstruction

The congenital stenosis and obstruction of the second part of the duodenum may occur at the site of the opening of the bile duct. Other causes of obstruction are:

- an annular pancreas
- Pressure by superior mesenteric artery on the third part of duodenum.
- Contraction of the suspensory ligament of the duodenum.

Q. 2 Describe the Anatomy of Stomach in detail.

Ans. INTRODUCTION

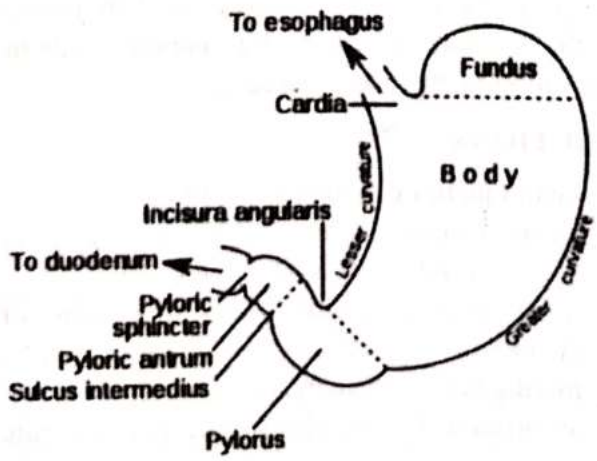
The stomach is the part of the alimentary canal between the oesophagus and the duodenum. It is the widest and most distensible part.

LOCATION

- The stomach is situated in the left hypochondriac, umbilical, and epigastric regions.
- It is located in the upper left part of the abdomen.
- It flows from the left hypochondriac region into the epigastric region obliquely.
- The majority of the stomach is located under cover of the left costal margin and lower ribs.

SHAPE

- The stomach is largely a "J" shaped organ.



- Its long axis enters downward, forward, and to the right and eventually backward and somewhat upward.
- It tapers from the fundus on the left of the median plane to the narrow pylorus.

The shape of the stomach depends upon the:

- Volume of fluid or food it includes.
- Position of body either erect or supine
- Stage of respiration

SIZE AND CAPACITY

a. Length: The length of the stomach is 10 inches.

b. Capacity: The capacity of the stomach is changeable as the stomach is extremely distensible:

- At birth, the capacity is only 30 ml (1 oz).
- At puberty, the capacity is 1000 ml (1 L).
- In adults, the capacity is 1500 to 2000 ml.

EXTERNAL FEATURES

The stomach presents the following external features:

- 2 ends: Cardiac and pyloric.
- 2 curvatures: Lesser and greater.
- 2 surfaces: Anterior (anterosuperior) and posterior (posteroinferior).

i. Ends

The stomach has two ends, cardiac end, and pyloric end.

a. Cardiac End

- The cardiac end is the upper end of the stomach.
- It joins the lower end of the esophagus.
- It presents an orifice known as the cardiac orifice.

b. Pyloric End

- The pyloric end is the lower end of the stomach.
- It joins the proximal end of the duodenum
- It presents an orifice known as the pyloric orifice.

The stomach is comparatively fixed at

upper and lower ends but is mobile in between.

The cardiac end of the stomach is less mobile and not as likely to change in position on the other hand the pyloric end of the stomach is more mobile and more inclined to change in position.

Curvatures

The stomach has 2 curvatures, lesser curvature, and greater curvature.

a. Lesser curvature

- The lesser curvature is concave.
- It forms the shorter right border of the stomach.
- The angular notch or incisura angularis is the most dependent part of the lesser curvature and is present at the junction of the body and pyloric part.
- The lesser curvature gives a connection to the lesser omentum.

b. Greater curvature

- It is convex and creates the longer left border of the stomach.
- The cardiac notch is at the upper endofthegreater curvature.
- The cardiac notch divides it from the left aspect of the esophagus.
- The greater curvature gives a connection to the greater omentum, gastrosplenic, and gastrophrenic ligaments.

iii. Surfaces

a. Stomach has two surfaces,anteroinferior surface and posterosuperior surface

b. Anterosuperior or Anterior Surface faces forward and upwards.

c. Posteroinferior or Posterior Surface faces backward and downwards.

PARTS

The stomach has 4 parts:

i. ***Cardiac part (or cardia).***
ii. ***Fundus.***
iii. Body.
iv. Pyloric part.

i. Cardiac part

It is the part around the cardiac orifice.

ii. Fundus

a. The fundus is the upper dome-shaped part of the stomach situated above the horizontal plane drawn in the level of the cardiac notch.

b. Superiorly, the fundus typically reaches the level of the left fifth intercostal space just below the nipple, thus gastric pain occasionally copies the pain of angina pectoris.

c. The cardiac notch is located between the fundus and the oesophagus.

d. The fundus is usually distended with gas/ air.

e. Traubespace:Itsa topographic area overlying the fundus of the stomach that's tympanic on percussion. Its bounded superiorly by the lower border of the left lung, inferiorly by the left costal margin, on the left side by the lateral end of the spleen, and on the right side by the lower border of the left lobe of the liver.

iii. Body

a. The body is the major part of the stomach between the fundus and the pyloric antrum.

b. It can be distended tremendously along the greater curvature.

iv. Pyloric part

a. The pyloric part is the funnel-shaped outflow region of the stomach.

b. A line drawn downwards and to the left from an angular notch to the greater curvature divides it from the body.

c. It stretches from the angular notch to the gastroduodenal junction.

It split into 3 parts:

- *The pyloric antrum,*

- *The pyloric canal, and*
- *The pylorus.*
- *Pyloric antrum*

- The pyloric antrum is the proximal wide part separated from the pyloric canal by sulcus intermedius present on the greater curvature.
- Its about 3 inches (7.5 cm) long and leads into the pyloric canal.
- Pyloric canal
  - The pyloric canal is a distal narrow and tubular part measuring 1 inch (2.5 cm) in length.
  - It is located on the head and neck of the pancreas.
- Pylorus
  - Pylorus is the distal-most and sphincteric region of the pyloric canal.
  - The circular muscle fibers are thickened in this region, which controls the discharge of stomach contents via the pyloric orifice into the duodenum.

RELATIONS

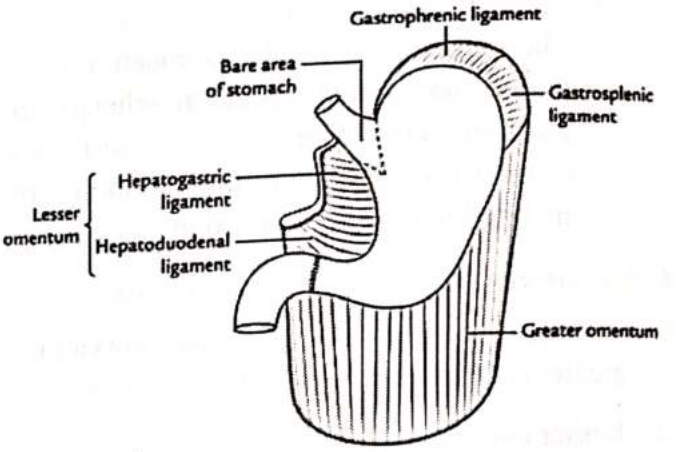
Stomach has peritoneal and visceral relations,

i. Peritoneal relations

- The stomach is covered by the peritoneum except where blood vessels run along its curvatures and a small area at its posterior surface near the cardiac orifice.
- The bare area is related to the left crus of the diaphragm.
- The peritoneal folds taking origin from both lesser and greater curvatures of the stomach are as follows:

a. Lesser omentum

- It is attached with the lesser curvature of the stomach and extends to the liver.
- Greater omentum: It is attached to the lower two-third of the greater curvature and extends to the transverse colon.



b. Gastrosplenic ligament

It goes from the upper one-third of the greater curvature to the hilum of the spleen.

c. Gastrophrenic ligament

It stretches the uppermost part of the fundus to the diaphragm.

ii. Visceral relations

Relations of the anterior (anterosuperior) surface:

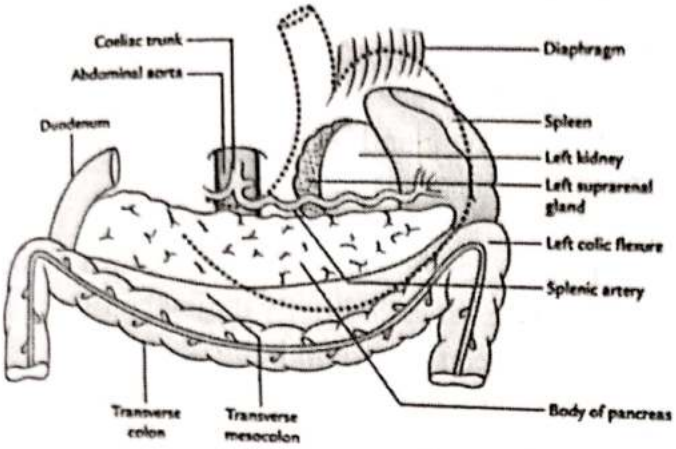
a. On the right side, it is relatedtothe left lobe of the liver, and its pyloric part is related to the quadrate lobe of the liver.
- The left stomach is related to the diaphragm and rib cage.
- The lower part of the anterior surface is having a relation with the anterior abdominal wall.

b. Gastric triangle: The gastric triangle is a triangular area of the stomach in contact together with the anterior abdominal wall.

c. Its bounded on the left side by the left costal margin, on the right side by the lower border of the liver, and inferiorly by the transverse colon.

Relations of the posterior (posteroinferior) surface:

a. The posterior surface is related to several structures on the posterior abdominal wall, which jointly create the stomach bed.



b. These structures are:

- Diaphragm
- Left kidney.
- Left suprarenal gland.
- Pancreas.
- Transverse mesocolon.
- Left colic flexure (splenic flexure of the colon).
- Splenic artery.
- Spleen.

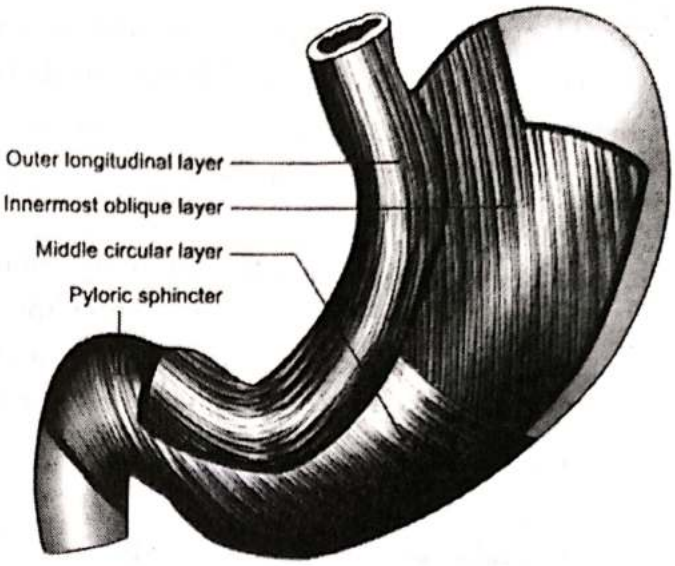
MNEMONIC:

Dinesh Kartik, Sandeep Patiland Mahendra Singh Dhoni speedy scored runs
D from Dinesh = diaphragm,
K from Kartik = Left kidney
S from Sandeep = Suprarenal gland
P from Patil = Pancreas
M from Mahendra = Mesocolon
S from Singh = splenic flexure of colon
Nothing from Dhoni
S from speedy = Splenic artery
S from score = Spleen
Nothing from run

All the structures creating the stomach bed are divided from the stomach by the lesser sac. Only the spleen is divided from the stomach by the greater sac of the peritoneum.

Microscopic structures

The wall of the stomach is composed of 4 coats. From outside inward, all these are serous, muscular, submucous, and mucous coatings.



a. Serous coat

The serous coating is composed of the peritoneum.

b. The muscular coat

The muscular coating contains 3 layers of unstriped muscles-

- The outer longitudinal,
- The middle circular, and
- The inner oblique

- Close to the pyloric end the longitudinal muscle jacket divides into superficial and deep fibers. The deep fibers turn inward at the pylorus and join with circular muscle coating to help create the pyloric sphincter.
- The circular muscle coat thickens at the pylorus to create a ring of muscle termed pyloric sphincter.
- The major sphincteric component of the pyloric sphincter is originated from the circular muscle layer and its minor dilator component is originated from the longitudinal muscle coating.

c. The submucous layer

It is made of loose areolar tissue

d. The mucous membrane

- The mucous membrane is thick, soft, and velvety.
- It presents a number of temporary folds which vanish when the stomach is distended.

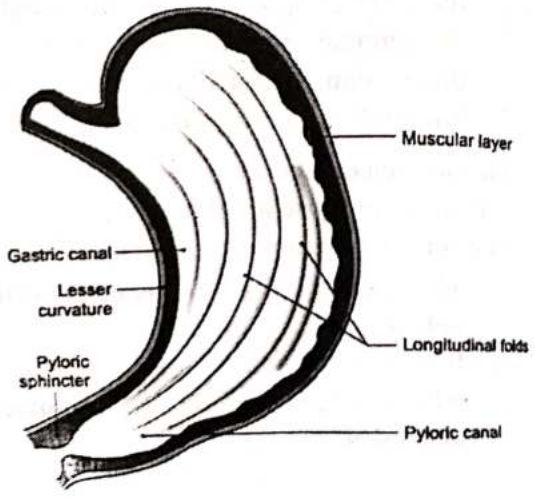
- The mucous membrane of the stomach is lined by simple columnar epithelium which creates simple tubular glands.
- Glands in the cardiac region secrete mucus.
- Glands in the fundus and body include mucus neck cells which secrete mucus, parietal/oxyntic cells which secrete hydrochloric acid and gastric intrinsic factor, and chief cells which secrete pepsinogen.
  Glands in the pyloric region secrete mucus.
- Anatomically, the stomach is split into 4 parts, viz. cardia, fundus, body, and pylorus, whereas histologically it is split into 3 parts, viz. cardia, body, and pylorus because fundus and body share the common histological features.

Inside of the stomach

When the stomach is cut open, the inner part of the stomach presents these features:

a. Gastric folds/gastric rugae:

- The mucosa of an empty stomach is thrown into numerous folds termed gastric rugae.
- The gastric folds are longitudinal along the lesser curvature and irregular in the remaining part of the stomach.
- The rugae are flattened when the stomach is distended.



Gastric pits:

- The gastric pits are small depressions on the mucosal surface.
- The gastric glands open at gastric pits.

b. Gastric canal (or Magenstrasse):

- The gastric canal is a longitudinal furrow that is created briefly during consumption between the longitudinal folds of the mucosa along the lesser curvature.
- The gastric canal is created because of the solid connection of the gastric mucosa to the underlying muscular layer, which doesn't have an oblique layer at this site.
- This canal enables a fast passage of swallowed liquids along the lesser curvature to the lower part before it propagates to the different parts of the stomach.

ARTERIAL SUPPLY

- The stomach has abundant arterial supply originated from the coeliac trunk and its branches.
- The arteries supplying the stomach are:
  - Left gastric artery, a direct branch from the coeliac trunk.
  - Right gastric artery, a branch of the common hepatic artery.
  - Left gastroepiploic artery, a branch of the splenic artery.
  - Right gastroepiploic artery, a branch of the gastroduodenal artery.
  - Short gastric arteries (5 to 7 in number), branches of the splenic artery.

VENOUS DRAINAGE

a. The veins of the stomach correspond to the arteries and drain directly or indirectly into the portal vein.

b. The veins of the stomach are:

- Left gastric vein.
- Right gastric vein.
- Left gastroepiploic vein.
- Right gastroepiploic vein.

- Short gastric veins.

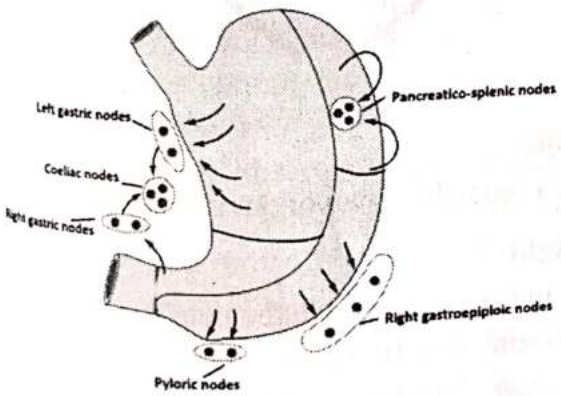
c. The right and left gastric veins drain directly into the portal vein. The left gastroepiploic and short gastric veins drain into the splenic vein. The right gastroepiploic vein empties into the superior mesenteric vein.

LYMPHATIC DRAINAGE

a. The understanding of lymphatic drainage of the stomach is medically very significant because gastric cancer propagates via the lymph vessels.

b. To understand the lymphatic drainage split the stomach into 4 lymphatic lands as follows:

- First, divide the stomach into right two-third and left one-third by a line along its long axis.
- Now break up the right two-third into upper two-third (area 1) and lower one-third (area 2), and
- Left one-third into upper one-third (area 3) and lower two-third (area 4).
- This way, 4 lymphatic lands are marked out and numbered 1 to 4.



Lymphatic drainage is as follows:

i. *Area 1*

a. This area is also named pancreaticosplenic area.

b. The lymph from this area empties into the pancreaticosplenic nodes lying along the splenic artery. Lymph vessels from these nodes travel along the splenic artery to reach the coeliac nodes

ii. *Area 2*

The lymph from this area is drained into the right gastroepiploic lymph nodes along the right gastroepiploic artery. Lymph vessels from these nodes drain into the subpyloric nodes, which are located in the angle between the first and 2nd parts of the duodenum.

iii. *Area 3*

a. It is the largest area along the lesser curvature.

b. The lymph from this area is drained into the left gastric lymph nodes along the left gastric artery.

c. These lymph nodes also drain the abdominal part of the esophagus. The lymph from left gastric nodes drains into the coeliac nodes

iv. *Area 4*

a. It contains the pyloric antrum and pyloric canal.

b. The lymph from this area is drains in different directions into the pyloric hepatic and left gastric nodes.

c. The efferents from all these lymph node groups pass to the coeliac nodes.

d. Finally, efferent from coeliac nodes goes into the cisterna chyli through the intestinal lymph trunk.

NERVE SUPPLY

- The stomach has both sympathetic and parasympathetic innervation.
- The sympathetic fibers are originated from T6 to T10 spinal sections via greater splanchnic nerves, and coeliac and hepatic plexuses. They get to the stomach by running along its arteries.
- The sympathetic supply to the stomach is (a) vasomotor, (b) motor to the pyloric sphincter, and inhibitory to the staying gastric musculature, and (c) acts as the

main nerve pathway for pain sensations from the stomach.

- The parasympathetic fibers are derived directly from the vagus nerves.

FUNCTIONS

The key functions of the stomach are:

- Creates a reservoir of food.
- Blends food with gastric secretions to create a semi fluid substance referred to as chyme.
- Controls the speed of delivery of chyme into the small intestine to enable proper digestion and absorption in the small intestine.
- Hydrochloric acid secreted by the gastric glands ruins bacteria existing in the food and beverage.
- Citadel's intrinsic factor within the gastric juice helps in the absorption of vitamin B12 in the small intestine.

Applied anatomy

i. Gastric carcinoma

a. It typically appears in the region of the pyloric antrum along the greater curvature of the stomach.

b. Gastric cancer propagates by lymph vessels to the left supraclavicular lymph nodes.

- The enlarged and palpable left supraclavicular node (Virchow's node) may be the first indication of gastric cancer (Troisier's indication).
- The cancer cells get to the left supraclavicular lymph node via the thoracic duct.

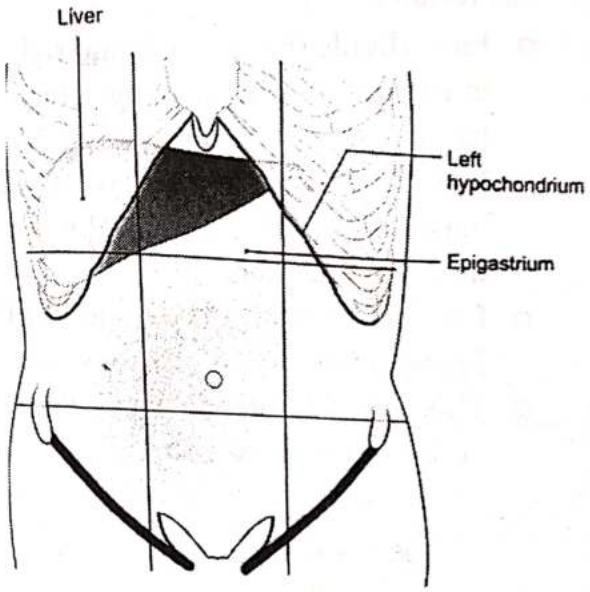
Q. 3 Describe the Anatomy of Liver in detail

Ans. INTRODUCTION

- The liver is a large multifunctional essential peritoneal organ found in the upper right quadrant of the abdomen.
- It helps for detoxification, protein synthesis, biochemical production as well as nutrient storage.
- Working synchronously with other organs, it contributes its role to maintain the basic homeostatic mechanisms of the body.

LOCATION

- The liver is predominantly located in the right hypochondrium.
- It occupies the whole right hypochondrium,thegreater part of epigastric areas, and extends into the left hypochondrium.
- From the above, it will be obvious that most of the liver is covered by ribs and costal cartilages, except in the upper part of the epigastrium where it is in contact with the anterior abdominal wall.



Shape

It is a reddish-brown organ in the shape of a cone.

Weight

It is the largest gland in the human body, weighing approximately 1000grams in male and 1300 grams in female. External Features

a. The liver is a wedge-shaped organ.

b. It resembles a four-sided pyramid laid on one side.

c. The Liver has:

- Two main lobes,
- Five surfaces and
- One prominent border

Lobes

The liver is divided into main two lobes:

i. ***The right lobe***
ii. ***The left lobe***

The division is by:

- The attachment of the falciform ligament anteriorly and superiorly.
- The fissure for the ligamentumteres inferiorly.
- The fissure for the ligamentumvenosum posteriorly.

i. ***The right lobe***

- The right lobe is the largest among all four lobes.
- It forms fifth- sixth of the liver.
- It contributes to all five surfaces of the liver.
- There are two more lobes in the right lobe of liver.

The caudate lobe

The caudate lobe is situated on the posterior surface of the liver.

a. It is bounded:

- On right by groove for inferior vena cava
- On left by fissure for ligamentumvenosum and
- Inferiorly by the porta hepatis
- Above it is continuous with the superior surface of the liver.
- Below and to the right, just behind the porta hepatis, it is connected to the right lobe of the liver by the caudate process.
- Below and to the left it presents a small rounded elevation known as the papillary process.

b. The quadrate lobe

- The quadrate lobe is situated on the inferior surface of the liver.
- It is rectangular in shape.
- It is bounded anteriorly by the inferior border, posteriorly by the porta hepatis, on right by the fossa of the gallbladder, and on the left by the fissure for ligamentumteres.

c. Porta hepatis

- The porta hepatis is a deep, transverse fissure about 5 cm long on the inferior surface of the right lobe of the liver.
- It lies between the caudate lobe above and the quadrate lobe below and in front.
- It is the place for entry of portal vein, hepatic artery and hepatic plexuses of nerves in the liver.
- It is also an exit gate for right and left hepatic ducts from the liver.
- In the porta hepatis, the portal vein isatthe back, the hepatic artery is in between and the hepatic duct is most forward.
- The lip of the porta hepatis provides attachment to the lesser omentum.

***ii.* The left lobe**

- The left lobe is flat and much smaller.
- It forms only one-sixth of the liver.
- Near the fissure for ligamentumvenosum, its inferior surface presents a rounded elevation, called as the omental tuberosity or tuber omentale.

Surfaces

The liver has five surfaces as below:

a. Anterior surface
b. Posterior surface
c. Superior surface
d. Inferior surface
e. Right surface.

- Amongst these five surfaces, the inferior surface is well defined because it is demarcated anteriorly, by a sharp inferior border.
- The other surfaces are more or less continue with each other and are imperfectly separated from one another by ill-defined and rounded borders.
  - Anterior surface: The anterior surface is triangular and slightly convex.
  - Posterior surface: The posterior surface is triangular
  - Superior surface: The superior surface

is quadrilateral with a cavity in the middle.

- Inferior surface: The inferior surface is quadrilateral and is directed downwards, backwards, and to the left.
- Right surface: The right surface is quadrilateral and convex.

One prominent border

- The liver shows one prominent border, an inferior border.
- The inferior border is sharp anteriorly where it separates the inferior surface from the anterior surface.
- It is somewhat rounded laterally where it separates the right surface from the inferior surface.
- The sharp anterior part of the border is marked by two notches, interlobular and cystic
  - An interlobular notch or notch for the ligamentumteres and
  - A cystic notch for the fundus of the gallbladder.

RELATIONS

The liver has peritoneal and visceral relations.

i. Peritoneal relations

A major part of the liver is covered with the peritoneum.

The areas not covered by peritoneum are as follows:

a. Bare area
- It is a triangular area on the posterior surface of the right lobe of the liver.
- It is limited by superior and inferior coronary ligaments and by the right triangular ligament.

b. The groove for the inferior vena cava
- The groove for the inferior vena cava is on the posterior surface of the right lobe of the liver.
- It lies between the caudate lobe and the bare area.

c. The fossa for gallbladder
The fossa for the gallbladder lies on the inferior surface of the right lobe to the quadrate lobe.

d. The area of attachment of lesser omentum and

e. The fissure for attachment of ligamentumvenosum

ii. Visceral relations

a. All five surfaces of the liver are related to few or more visceras.

b. The posterior and inferior surfaces are having maximum visceral relations.

c. Following are the visceral relations of each surface.

Anterior surface

The anterior surface of the liver is related with following structures:

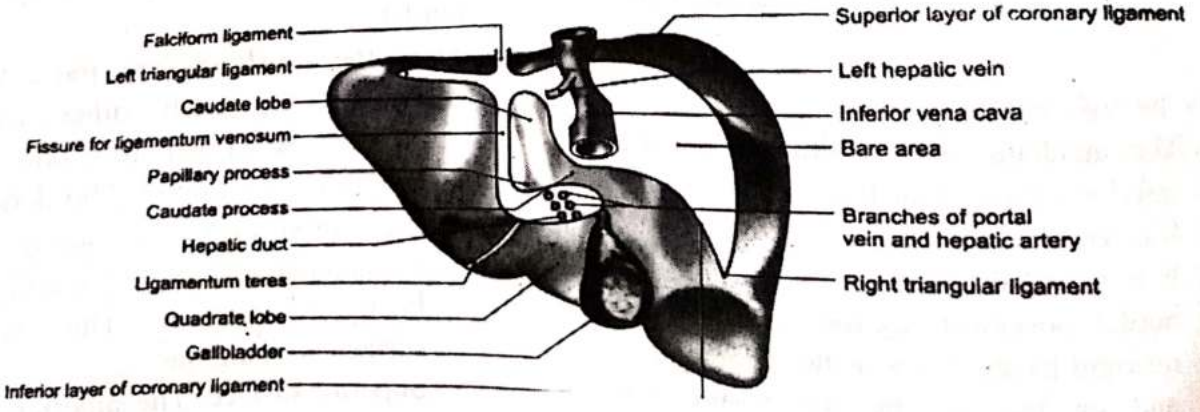
a. Xiphoid process in median plane

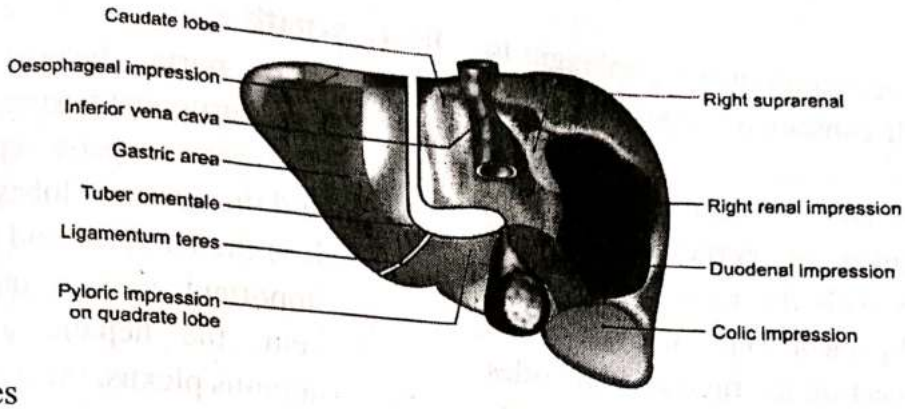
b. Anterior abdominal wall in median plane

c. Diaphragm on each side

Posterior surface

The posterior surface of the liver is related with





following structures

a. The bare area is related to the diaphragm and the right suprarenal gland
b. The inferior vena cava lodges in the groove for it.
c. The floor of the groove for the inferior vena cava is pierced by the hepatic veins
d. The caudate lobe lies in the superior recess of the lesser sac.
e. The caudate lobe is related to crura of the diaphragm above the aortic opening, to the right inferior phrenic artery, and to the coeliac trunk.
f. The very deep fissure for the ligamentumvenosum contains two layers of the lesser omentum.
g. The oesophageal impression is present on the posterior surface of the left lobe.
h. The visceral surface is covered by the peritoneum except at the porta hepatis and the bed of the gallbladder.

Remember- Relations of posterior surface are right suprarenal gland, inferior vena cava, hepatic veins, and crura of the diaphragm, right inferior phrenic artery, coeliac trunk, and oesophagus impression.

Superior surface

a. The diaphragm separates superior surface from the pericardium and heart in the middle and the pleura and lungs on each side.
b. The superior surface shows concavity in the middle, it is the cardiac impression.

Inferior surface

a. The inferior surface shows the following impressions:

Gastric impression: The large concave gastric impression is present on the inferior surface of the left lobe.

- Tuber omentale: The tuber omentale is raised left lobe of the liver which comes in contact with lesser omentum.
- Fissure for ligamentumteres
- The quadrate lobe is related with:
  - Lesser omentum
  - The pylorus of the stomach and
  - First part of the duodenum
- Fossa for the gallbladder lies to the right of the quad rate lobe.
- To the right of the fossa the inferior surface of the right lobe shows:
  - Colic impression for hepatic flexure of colon
  - The renal impression for the right kidney and
  - The duodenal impression for its second part

Right surface

The right surface of the liver is related with diaphragm and pleura of the lungs

LIGAMENTS

There are following five ligaments related to the liver:

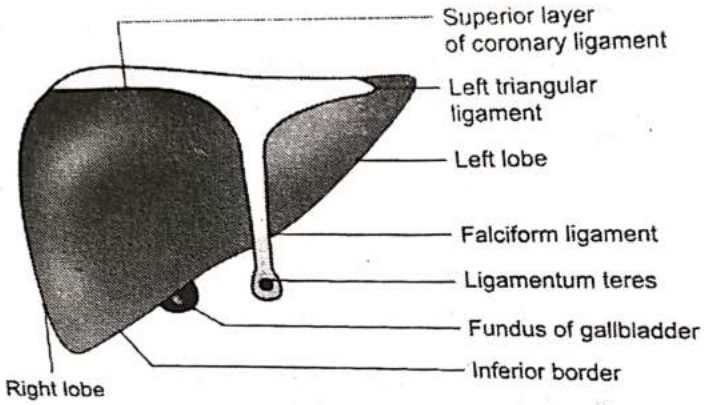
a. *Coronary ligament*
b. *Left triangular ligament*
c. *Falciform ligament*
d. *Ligamentumtereshepatis and*
e. *Ligamentumvenosum*

a. *Coronary ligament*

- The coronary ligament is formed by the

peritoneal reflection of the diaphragm to the liver. It consists of upper and lower layer.

- The upper layer of liament is formed by reflexation of peritoneum and it continuous with the right layer of the falciform ligament. The two layers of the ligament meet on the right and left sides forms right and left triangular ligaments respectively.



b. Left triangular ligament

The left triangular ligament is a mix of the falciform ligament and the lesser omentum.

c. Falciform ligament

- The Falciform ligament is not of embryological origin, but a peritoneal reflection of the upper abdominal wall from the umbilicus to the liver.
- It has the round ligament of the liver on its free edge.

d. Ligamentumtereshepatis.

- The Ligamentumtereshepatisis also known as the round ligament of the liver.
- It is a fibrous remnant of the umbilical vein which still extends from the internal aspect of the umbilicus up to the liver.

e. Ligamentumvenosum

- The Ligamentumvenosum is also an embryonic remnant of the ductus venosus.
- It extends between the umbilical vein and the inferior vena cava.

Porta hepatis

- The porta hepatis is the central intraperitoneal fissure of the liver.
- The porta hepatis separates the caudate and the quadrate lobes.
- It is the entrance and the exit for several important vessels including the portal vein, the hepatic artery, the hepatic nervous plexus, the hepatic ducts, and the lymphatic vessels.

The recesses of the liver

There are two recesses, the subphrenic recess, and hepatorenal recess.

a. Thesubphrenic recess: The subphrenic recess which is split by the falciform ligament of the liver is the division between the liver and the diaphragm.

b. The hepatorenalrecess: The hepatorenal recess is on the inferior right aspect of the liver and separates it from the kidney anterior inferiorly and the suprarenal gland posterior inferiorly.

HISTOLOGY

Histology of the liver can be studied by liver biopsy which is done from the right lateral surface. The liver is covered by Glisson's capsule.

The liver consists of the following major histological components

a. Parenchyma
b. Stroma
c. Sinusoids
d. The spaces of Disse

i. ***Parenchyma***

a. The Parenchyma is represented by hepatocytes
b. Hepatocytes
c. These large and polyhedral cells make up 80% of the total cells of the liver.
d. The adjacent hepatocytes leave a very small space between them known as bile canaliculi.

The cell membranes near these canaliculi are joined by tight junctions.

In addition, hepatocytes contain the following organelles:

- Smooth endoplasmic reticulum
- Mitochondria
- Golgi network
- Peroxisomes
- Glycogen deposits
- Lipid droplets
- Lysosomes

ii. Stroma

The stroma is a continuation of the surrounding capsule of Glisson.

iii. Sinusoids

The sinusoids are capillaries traveling between hepatocytes

iv. The spaces of Disse

a. The Space of Disse is situated between the layers of hepatocytes and the sinusoidal endothelial cells.

b. The hepatocytes extend villi into the Space of Disse, increasing the extent and rate of material exchange, together with the microvilli.

STRUCTURES

In histological terms, the liver consists of a large number of microscopic functional units that work in unison to ensure the overall, proper activity of the entire organ. There are three possible ways of describing one such unit, as given below:

i. Classic lobule
ii. Portal lobule
iii. Liver acinus

i. Classic lobule

- The classic lobule view focuses on the blood supply and hepatic mass arrangement.
- The classic lobule consists of hexagonal plates of hepatocytes.
- Within each plate, the hepatocytes radiate outwards from a central vein.
- The hepatocytes are arranged into strips.
- Hepatic sinusoids travel between the strips of hepatocytes, draining into the central vein.
- One Portal canal is located at each corner of the hexagonal classic lobule, making a total of six for each lobule.

ii. Portal lobule

- The portal lobule view underlines the exocrine function of the liver i.e. bile secretion.
- Each functional unit is a triangle, having a central axis through a portal canal and the imaginary vertices through the three different but closest portal canals surrounding it.
- The area covered by the triangle represents the hepatic regions that secrete bile into the same bile duct.

iii. Liver acinus

- The liver acinus is focused on the perfusion, metabolism, and pathology of hepatocytes. ,
- A liver acinus functional unit is in the shape of an oval.
- The short axis is represented by a shared border between two adjacent lobules together with the portal canals and the long axis is an imaginary line between two adjacent central veins.
- Each liver acinus is divided into three zones, zone 1 zone 2, and zone 3 respectively.

FUNCTIONS OF LIVER

a. The liver is an indispensable gland of the body.

b. It helps for following functions

- Metabolism of carbohydrates, fats, and proteins
- Synthesis of bile and prothrombin
- Excretion of drugs, toxins, poisons and heavy metals
- Protective by phagocytosis and antibody formation and excretion.

- Storage of glycogen, iron, fat, vitamin A and D

LYMPHATIC DRAINAGE

The lymphatic drainage is governed mainly by the hepatic nodes which can be found around the porta hepatis. From there they continue to the celiac nodes and eventually drain into the cisterna chyli.

BLOOD SUPPLY

- The liver is a special organ in the sense that it receives more venous blood than arterial blood so that the liver can clean the blood via detoxification.
- The majority of the vascular supply is brought into the liver by the portal vein which carries the blood-filled with metabolites absorbed in the intestines.
- The hepatic artery originates from the abdominal aorta and carries the oxygenated blood to the liver.
- The hepatic veins drain the blood supply to the liver and they are formed by the union of the central veins which drain directly into the inferior vena cava just before it passes through the diaphragm.

NERVE SUPPLY

The nervous supply of the liver comes from the hepatic plexus which travels along with the hepatic artery and the portal vein. The liver also receives sympathetic fibers from the celiac plexus and parasympathetic fibers from the anterior and posterior vagal trunks.

Applied anatomy

Metastatic tumors

- The liver is a common site for metastatic tumors.
- Venous blood from the gastrointestinal tract with primary tumor drains into the liver via portal veins.

Liver transplantation

- Liver transplantation can be done in patients with end- stage liver disease.
- The implant of the graft requires an inferior caval anastomoses, followed by anastomoses of the portal vein. Finally, the arterial and biliary anastomoses are performed.

Q. 4 Describe the Anatomy of Right Kidney in detail.

Ans. ### INTRODUCTION

- The kidneys are bilateral organs placed retroperitoneally in the upper left and right abdominal quadrants.
- The kidney is the functional unit of the urinary system.
- The main function of the kidney is to eliminate excess bodily fluid, salts, and by-products of metabolism.
- Hence the kidney helps in the regulation of acid-base balance, blood pressure, and many other homeostatic parameters.

LOCATION

- The right kidney occupies the epigastric, hypochondriac, lumbar, and umbilical regions.
- Vertically the right kidney extendsbetween the upper borders of the twelfth thoracic vertebra to the centerof the body of the third lumbar vertebra.
- The left kidney is slightly higher than the right.

SHAPE AND COLOUR

- The kidney resembles a bean shape.
- The kidneys are reddish-brown in colour.

SIZE

- The right kidney is about 11 cm long, 6 cm broad and 3cm thick.
- The right kidney is a little shorter and broader than the left kidney.

WEIGHT

On an average, the right kidney weighs 150 gm in male and 135 gm in female.

ORIENTATION

- The long axis of the right kidney is directed downwards and laterally so that the upper poles are nearer to the median plane than the lower poles.
- The transverse axis of the right kidney is directed laterally and backwards.
- Its major convexity pointed laterally, and the minor concavity pointed medially.

EXTERNAL FEATURES

- The right kidney has two poles the upper or superior and lower or inferior poles.
- It has two surfaces anterior and posterior surfaces and two borders medial and lateral

POLES

- Each kidney has two poles upper and lower poles.
- The upper pole lies at the level of the T12 vertebra.
- The lower pole lies at the level of the L3 vertebra.
- The upper pole is more medially pointed towards the spine than the lower pole.
- The upper pole is broad and is in close contact with the right suprarenal gland.
- The lower pole is pointed.

SURFACES

- The anterior surface is separated from the posterior surface by the medial and lateral borders of the kidney.
- The anterior surface faces towards the anterior abdominal wall, whereas the posterior surface is facing the posterior abdominal wall.
- The anterior surface is irregular whereas the posterior surface is flat.

BORDERS

- The kidney has two borders: medial and lateral.
- The lateral border is directed towards the periphery, while the medial border is the one directed towards the midline.
- The lateral border is convex whereas the medial border is concave.
- The borders of the kidney separates the anterior surface from the posterior surface.
- The medial border of the kidney contains the hilum of the kidney, the entry and exit point for the vessels of the kidney and ureter.

HILUM

- The hilum of the kidney usually projects at the level of the L2 vertebra at the medial border.
- The renal artery enters the kidney, and the renal vein and ureter leave the kidney through the hilum.
- The most superior vessel in the hilum is the renal vein, just under it is the renal artery, and under the artery is the ureter.
- In the hilum, the renal vein is at anterior; the ureter is most posterior, and renal artery is in between the vein and ureter.

COVERING

The kidney is protected by the following three layers:

i. The fibrous capsule

The fibrous capsule is a thin membrane that closely invests the kidney and it also lines the renal sinus.

ii. The perirenal fat

The perirenal fat is a layer of adipose tissue lying outside the fibrous capsule.

It thickens at the borders of the kidney.

iii. The renal fascia

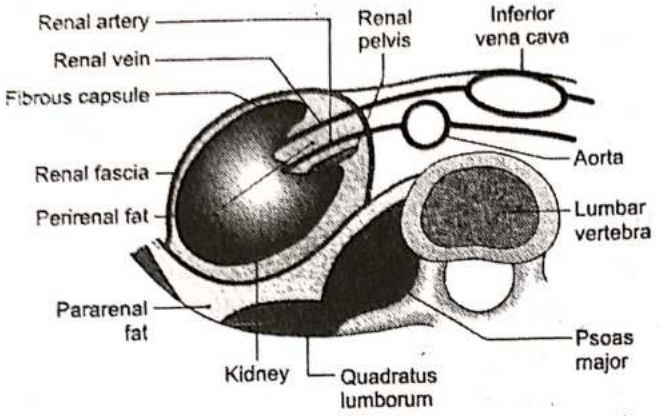
The renal fasciais made up of two layers, anterior and posterior.

These two layers fuse together and form the lateral conal fascia.

The renal fasciaencloses the kidneys and also encloses the suprarenal gland and its surrounding.

RELATIONS

- The kidneys are retroperitoneal organs and are only partly covered bythe peritoneum anteriorly.
- The relations of the kidney can be studied under the following heads.



i. Common relations

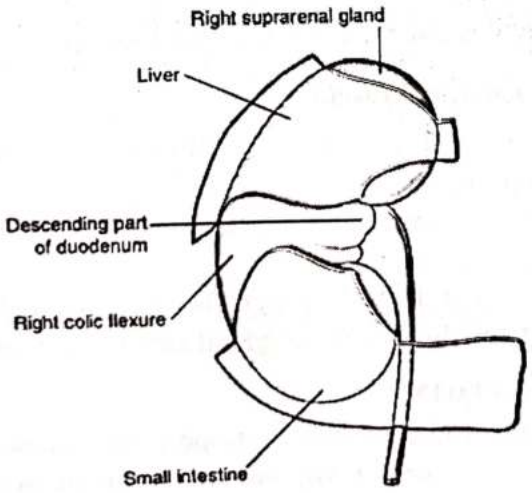
The common relations of the right kidney are as follows:

a. The upper pole is related to right suprarenal gland.
b. The lower pole lies about 2.5 cm above the left iliac crest.
c. The medial border is related to right suprarenal gland above the hilum and to the left ureter below the hilum.

ii. Anterior relations

Since the abdominal organs are not paired, the left kidney is not related to the same organs as the right kidney.

The anterior surface of the right kidney has the following relations:

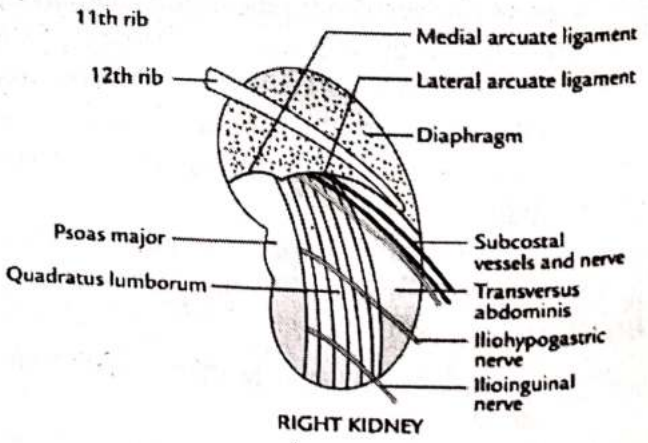


a. The upper portion of the upper pole is related with right suprarenal gland
b. The superior one-half of the anterior surface of the right kidney is in relation with the layer of the peritoneum and the liver
c. This potential space that separates the liver from the right kidney is called the hepatorenal pouch of Morison.
d. The part at the center of the anterior surface is directly touched by the retroperitoneal posterior wall of the descending duodenum.
e. The lateral part of the inferior half of the anterior surface shows the right colic flexure impression.
f. The right colic flexure impression is also known as the hepatic flexure impression.
g. The rest of the inferior pole is related with the peritoneum of the small intestine, especially the jejunum

iii. Posterior relations

The posterior surface of the left kidneyis related to the following structures:

a. Diaphragm
b. Medial and lateral arcuate ligaments
c. Psoas major
d. Quadratuslumborum
e. Transversus abdominis
f. Subcostal vessels and nerves



INTERNAL STRUCTURES

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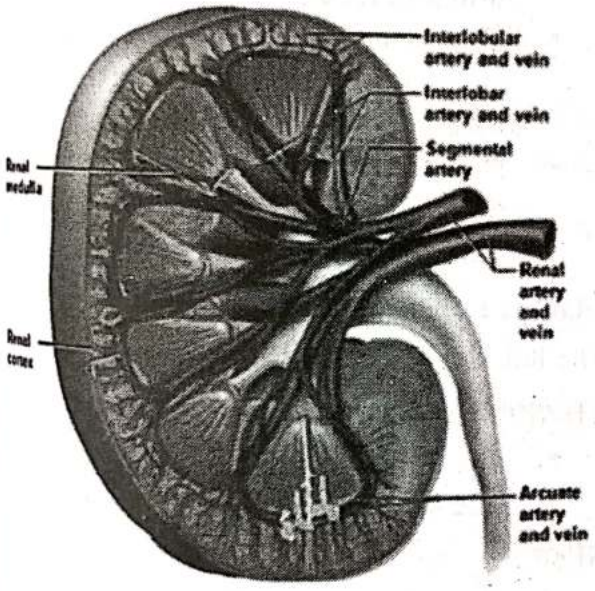
- The cortex of the kidney shows cut sections of glomeruli, many sections of proximal convoluted tubules, some sections of distal convoluted tubules, and few collecting ducts.
- The main unit of the medulla is the renal pyramid.
- The section through the pyramid of the medullar shows following:
  - The light staining collecting ducts,
  - The sections of loop of Henle,
  - The thick and thin segments of descending and ascending limbs,
  - The capillaries and connective tissue.
- There are 8-18 renal pyramids in each kidney.



- The apex of the pyramid projects medially toward the renal sinus. This apical projection is called the renal papilla.
- The renal papilla opens to the minor calyx.
- The minor calyces unite to form a major calyx.
- Two to three major calyces again unite to form the renal pelvis.
- The ureter emerges from the renal pelvis and leaves the kidney through the hilum.

NEPHRON

- The pyramids contain the functional units of the kidney called as the nephrons.
- The nephrons filter blood in order to produce urine which then is transported through a system of structures called calyces which then transport the urine to the ureter.
- Each nephron consists of a renal corpuscle, an initial component that filters the blood, and a renal tubule that processes and carries the filtered fluid to the system of calyces.

ARTERIAL SUPPLY

- Each kidney is supplied by a single renal artery, which is a direct lateral branch of the abdominal aorta.
- Both renal arteries, left and right, arise just below the superior mesenteric artery, with the left renal artery positioned slightly superiorly to the right one.
- When the renal arteries enter the kidney through the hilum, they split into anterior and posterior branches.

VENOUS DRAINAGE

- The venous blood is collected bytherenal vein.
- The renal veins empty to the inferior vena cava.

NERVE SUPPLY

The kidneys are innervated by the renal plexus. This plexus provides input from:

- The sympathetic nervous system from the lower thoracic splanchnic nerves for the regulation of the vascular tone, and
- The parasympathetic nervous system as well, through thevagus nerve.
- The sensory nerves from the kidney travel to the spinal cord at levels T10-T11.

FUNCTIONS

The kidney is a very important organ in regard to body homeostasis.

It participates in:

i. Regulation of blood pressure.

The kidney regulates the amount of fluid in the

body by increasing or decreasing the urine flow and helps in regulating blood pressure, vital processes such as regulation of blood osmolarity and pH, regulation of blood volume, production of hormones, and filtration of foreign substances.

ii. Hormones production

Kidney produces Calcitriol which is the active form of vitamin D

It produces Erythropoietin which stimulates bone marrow for the production of blood cells

iii. Acid-base balance regulation

The kidney helps to maintain the pH of blood at 7.4 by decreasing or increasing the excretion of hydrogen ions

Applied Anatomy

i. Third kidney

There are many clinical states related to kidney malfunction. Some of them are congenital, such as a third kidney, which is usually atrophic. In other cases, both kidneys can be fused, usually at the inferior poles, which is a congenital state called the horseshoe kidney.

ii. Renal agenesis

Sometimes, one or both kidneys fail to develop, which causes unilateral or bilateral renal agenesis. People with unilateral agenesis often are unaware that they lack one kidney until an accidental discovery since the one kidney that they have can functionally compensate for the other. On the other hand, babies with bilateral agenesis cannot survive without an immediate kidney transplant.

iii. Renal calculus

It is one of the most common conditions. It is the formation of the stones within the system of calyces because of too much calcium or uric acid into the filtrate. The calcium or uric acid will precipitate and form stones. The stones can move into the ureter and get stuck there because the lumen of the ureter is much smaller compared to the calyces, which is very painful for the patient.

iv. Acute renal failure

Acute renal failure is a serious and urgent medical condition. The ischemia of the kidney and toxic effects of some medications leads to ARF, resulting in the failure of all kidney functions. Acute kidney failure can lead to a quick fall of blood pressure which presents as a state of shock.

Q. 5 Describe the Anatomy of the Left Kidney in detail.

Ans. INTRODUCTION

- The kidneys are bilateral organs placed retroperitoneally in the upper left and right abdominal quadrants.
- The kidney is the functional unit of the urinary system.
- The main function of the kidney is to eliminate excess bodily fluid, salts, and by-products of metabolism.
- Hence the kidney helps in the regulation of acid-base balance, blood pressure, and many other homeostatic parameters.

LOCATION

The left kidney is slightly higher than the right.

SHAPE AND COLOUR

- The kidney resembles a bean shape.
- The kidneys are reddish-brown in colour.

SIZE

- The left kidney is about 11 cm long, 6 cm broad and 3cm thick.
- The left kidney is a little longer and narrower than the right kidney.

WEIGHT

On an average, the left kidney weighs 150 gms in males and 135 gm in females.

ORIENTATION

Thelong axis of theleft kidney is directed downwards and laterally so that the upper poles are nearer to the median plane than the lower poles.

EXTERNAL FEATURES

- The left kidney has two poles the upper or

superior and lower or inferior poles.
- It has two surfaces anterior and posterior surfaces and two borders medial and lateral

POLES
- Each kidney has two poles upper and lower poles.
- The upper pole lies at the level of T12 vertebra.
- The lower pole lies at the level of L3 vertebra.
- The upper pole is more medially pointed towards the spine than the lower pole.
- The upper pole is broad and is in close contact with the left suprarenal gland.
- The lower pole is pointed.

SURFACES
- Theanterior surface from posterior surfaces is separated from each other by the medial and lateral borders of the kidney.
- The anterior surface faces towards the anterior abdominal wall, whereas
- The posterior surface is facing the posterior abdominal wall.
- The anterior surface is irregular whereas the posterior surface is flat.

BORDERS
- The kidney has two borders: medial and lateral.
- The lateral border is directed towards the periphery, while the medial border is the one directed towards the midline.
- The lateral border is convex whereas the medial border is concave.
- The borders of the kidney separated the anterior surface from the posterior surface.
- The medial border of the kidney contains thehilum of the kidney, the entry and exit point for the vessels of the kidney and ureter.

HILUM
- The hilum of the kidney usually projects at the level of the L2 vertebra at the medial border.
- The renal artery enters the kidney, and the renal vein and ureter leave the kidney through hilum.
- The most superior vessel in the hilum is the renal vein, just under it is the renal artery and under the artery is the ureter.
- In the hilum, the renal vein is at anterior; ureter is most posterior and renal artery is in between the vein and ureter.

COVERING

The kidney is protected by the following three layers:

i. The fibrous capsule

The fibrous capsule is a thin membrane closely invests the kidney and it also lines the renal sinus.

ii. The perirenal fat

Theperirenal fat is a layer of adipose tissue lying outside the fibrous capsule.

It is thicken at the borders of kidney.

iii. The renal fascia

The renal fasciais made up of two layers, anterior and posterior.

These two layers fuse together and form the lateral conal fascia.

The renal fasciaencloses the kidneys and also encloses the suprarenal gland and its surrounding.

RELATIONS

The kidneys are retroperitoneal organs and are only partly covered bythe peritoneum anteriorly.

The relations of the kidney can be studied under the following headings:

i. Common relations

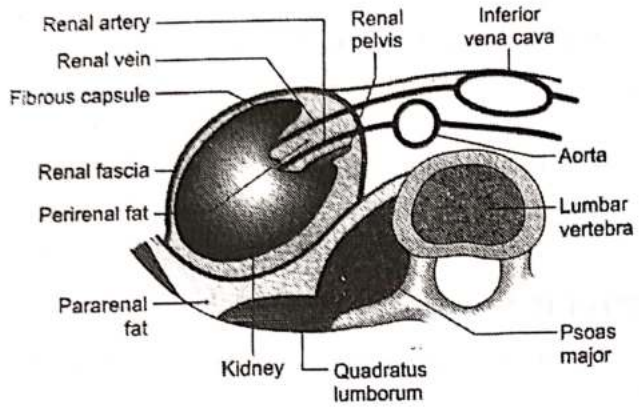
The common relations of the left kidney are as follows:

a. The upper pole is relatedto the left suprarenal gland.

b. The lower pole lies about 2.5 cm above the left iliac crest.

c. The medial border is related to left

suprarenal gland above the hilum and to the left ureter below the hilum.

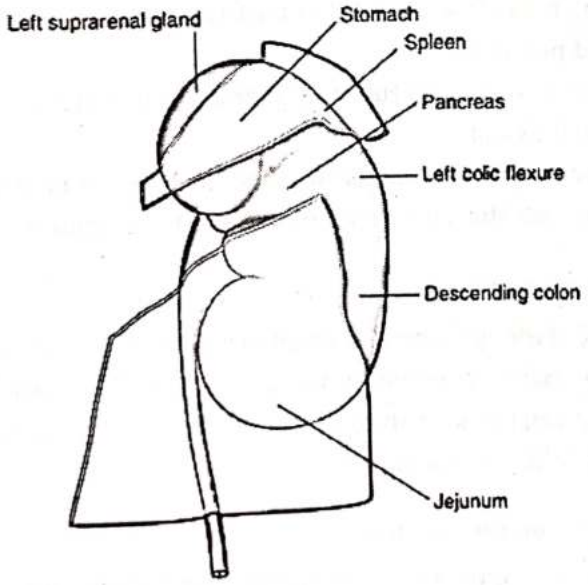


ii. Anterior relations

Since the abdominal organs are not paired, the left kidney is not related to the same organs as the right kidney.

The anterior surface of the left kidney has the following relations:

a. The upper portion of the upper pole is related with left suprarenal gland.



b. The lower portion of the upper pole is medially related totheperitoneum of the stomach and laterally with the spleen.

c. Just below the impression of the stomach and spleen, the left kidney is in direct contact with the pancreas

d. The lateral part of the inferior half of the anterior surface shows a left colic flexure impression and descending colon impression.

e. The left colic flexure impression is also known as the splenic flexure impression

f. The medial part of the inferior half and the inferior pole are related tothe peritoneum ofthe jejunum.

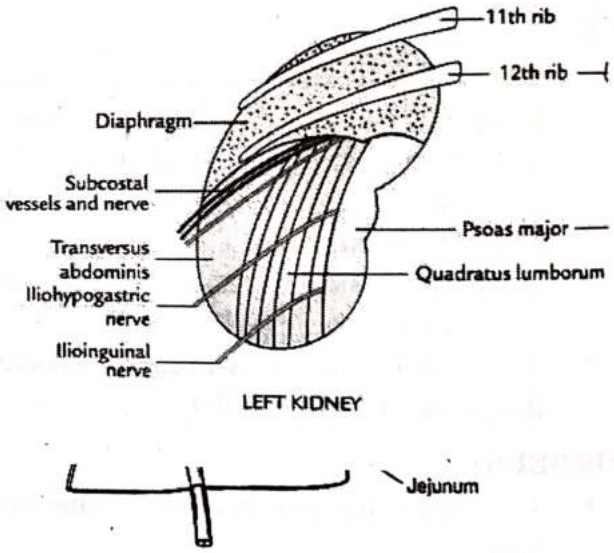
iii. Posterior relations

The posterior surface of the left kidneyis related to the following structures:

a. Diaphragm

b. Medial and lateral arcuate ligaments

c. Psoas major



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FUNCTIONS

The kidney is a very important organ in regards to body homeostasis.

It participates in

i. Regulation of blood pressure.

a. The kidney regulates the amount of fluid in the body by increasing or decreasing the urine flow and helps in regulating the blood pressure.

b. Its responsible for various vital processes such as regulation of blood osmolarity and pH, regulation of blood volume and blood pressure, production of hormones, and filtration of foreign substances.

ii. Hormones production

a. Kidney produces Calcitriol which is the active form of vitamin D.

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Q. 6 Describe the Anatomy of Spleen in detail.

Ans. INTRODUCTION

- Thespleen is the largest intraperitoneal organ of the lymphatic system, a subdivision of the immune system located in the left hypochondria inferior to the diaphragm.
- Its network of trabeculae, blood vessels, and lymphoid tissue provides an environment for the proliferation of white blood cells and recycling off old damaged red blood cells.
- The spleen is constantly working as a blood filter to detect the presence of microorganisms.

LOCATION

- The spleen is a wedge -shaped organ located mainly in the left hypochondriac region and partly in the epigastric region of the abdomen.
- The spleen is tetrahedral in shape.
- The spleen is posterior to the stomach and anterior to the left hemidiaphragm at the level of the 9th-10th ribs.

APPEARANCE

The spleen is a soft, highly vascular, and dark purple colored organ

DIMENSIONS

- The size and weight of the spleen are markedly variable.
- On an average, the spleen is 1 inch or 2.5 cm thick.
- It is 3 inches or 7.5 cm broad and 12.5 cm long.
- It weighs near about 7 ounces.
- It is related toribs, ninth to eleventh
- Normally, the spleen is non-palpable.

POSITION

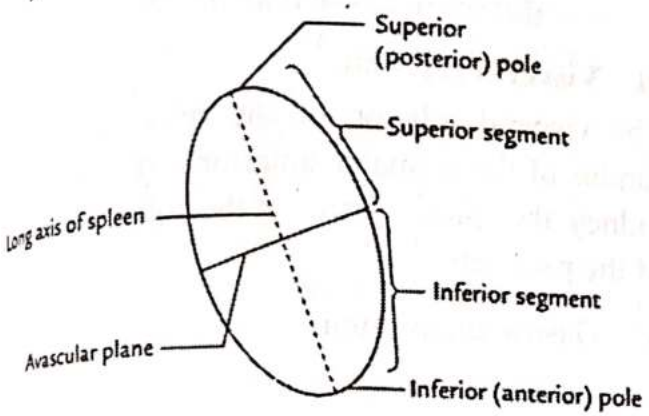
- The spleen lies obliquely along the long axis of the tenth rib.
- It is directed downwards, forwards, and laterally.
- It is making an angle of 5 degrees with the horizontal plane.

EXTERNAL FEATURES

Spleen has the following external features:

i. ***Two ends***
ii. ***Three borders***
iii. ***Two surfaces***

iv. *Two angles*
v. *Hilum*



i. *Ends*

a. Spleen has two ends, anterior or lateral and posterior or medial respectively.
b. The anterior end is expanded and is more like a border. It is directed downwards and forwards and reaches the mid axillary line
c. The posterior end is rounded. It is directed upwards, backwards, and medially and rests on the upper pole of the left kidney.

ii. *Borders*

a. The spleen has three borders, superior, inferior, and intermediate respectively.
b. The superior border is having a notch near the anterior end.
c. The inferior border is rounded whereas the intermediate border is also rounded and is directed to the right.

iii. *Surfaces*

a. The spleen has two surfaces, diaphragmatic and visceral respectively.
b. The diaphragmatic surface is convex and smooth.
c. The diaphragmatic surface is related to the diaphragm.
d. This surface separates the spleen from the Costodiaphragmatic recess of the pleura, lung, and ninth, tenth, and eleventh ribs of the left side.
e. The visceral surface is concave and irregular.

iv. *Angles*

a. The spleen has two angles, anterobasal, and posterodorsalangles respectively.
b. The anterobasal angle is the junction of the superior border with the anterior end.
c. The anterobasal angle is the most forward projecting part of the spleen.
d. The posterobasal angle is the junction of the inferior border with the anterior end of the spleen.

v. *Hilum*

a. The hilum of the spleen lies between superior and intermediate borders.
b. The hilum is pierced by branches and tributaries of splenic vessels.
c. The hilum lies on the inferiomedial part of the gastric impression along the long axis of the spleen.
d. The hilum also provides attachments to the gastrophrenic and lienorenal ligaments.

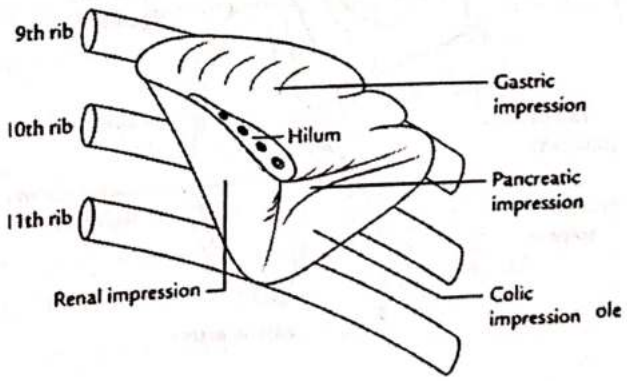
RELATIONS

The spleen has:

i. Peritonealrelations
ii. Visceral relations

i. Peritoneal relations

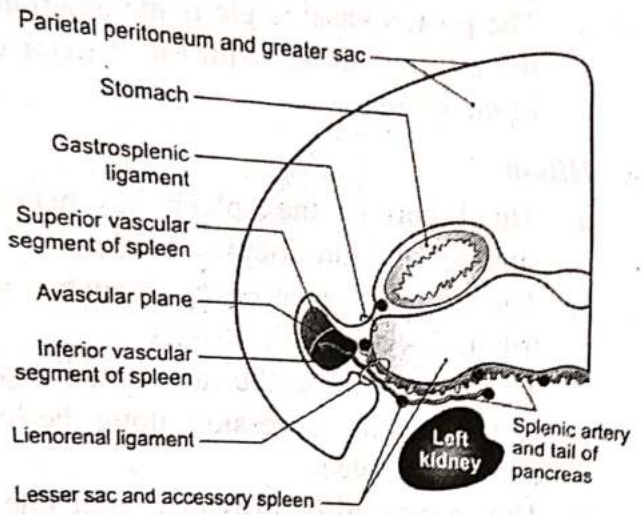
The spleen is surrounded by the peritoneum and is suspended by the following ligaments:



a. The gastrosplenic ligament
b. The lienorenal ligament
c. The phrenicocolic ligament.

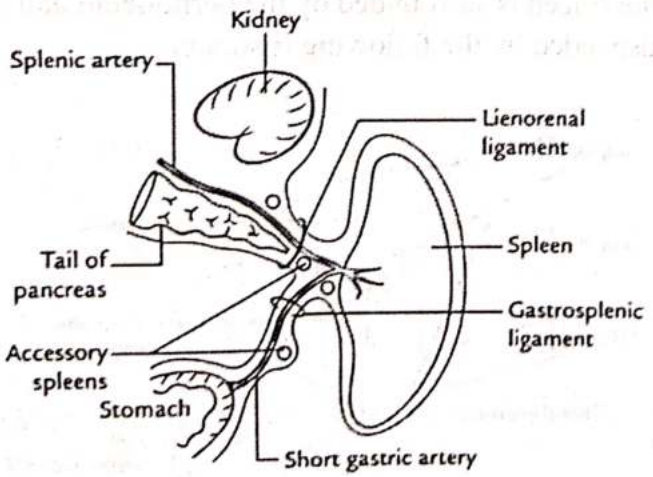
a. The gastrosplenic ligament

- The gastrosplenic ligament attaches the spleen tothe stomach.
- It extends from the hilum of the spleen to the greater curvature of the stomach.
- It contains short blood vessels.



b. The lienorenal ligament

- The lienorenal ligament attaches the spleen tothe left kidney.
- It extends from the hilum of the spleen to the anterior surface of the left kidney.
- It contains the tail of the pancreas, the splenic vessels.



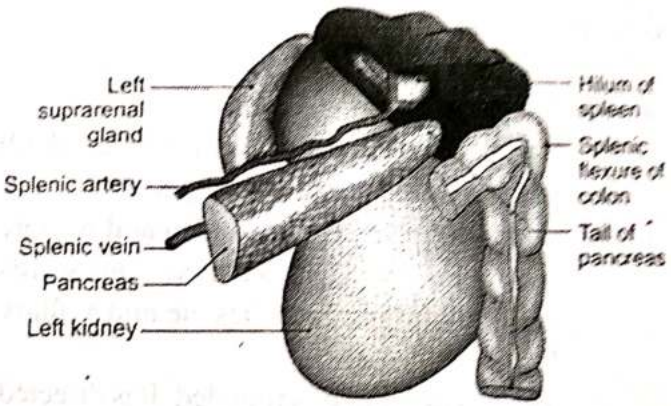
c. The phrenicocolic ligament

- The phrenicocolic ligament is not attached tothe spleen but supports its anterior end.
- It is a horizontal fold of the peritoneum that extends from the splenic flexure of the colon to the diaphragm.

***ii.* Visceral relations**

The visceral relation of the spleen is with the fundus of the stomach, anterior surface of the left kidney, the splenic flexor of the colon, and the tail of the pancreas.

a. Gastric impression



- It is the impression of the fundus of stomach onspleen.
- The fundus of the stomach lies between superior and intermediate borders.
- It is the largest and most concave impression on the spleen.

b. The renal impression

- It is the impression of the left kidney on the spleen.
- The left kidney lies between the inferior and intermediate borders.

c. Colic impression

- It is the impression of the splenic flexure on the colon on the spleen.
- The splenic flexure on the colon occupies a triangular area adjoining the anterior end of the spleen.

iv. Pancreatic impression

- It is the impression of the tail of the pancreas on the spleen.
- The tail of the pancreas lies between the hilum and the colic impression.

FUNCTIONS

- The spleen is a secondary lymphoid organ.
- Following are the functions of the spleen:

i. ***Phagocytosis***

a. The spleen is an important component of the reticuloendothelial system.

b. The splenic phagocytes include:

- The reticular cell and free macrophages of red pus.
- Modified reticular cells of ellipsoids
- Free macrophages and endothelial cells of the venous sinusoids and
- Surface reticular cells of the lymphatic follicles.

ii. ***Haemopoiesis***

a. The spleen is an important haemopoietic organ during foetal life.

b. Lymphopoiesis continues throughout life.

iii. ***Immune responses***

Under antigenic stimulation, immune system response takes place with:

a. Increased Lymphopoiesis for cellular responses and

b. Increased formation of plasma cells for the humoral responses

iv. ***Storage of RBC's***

The red blood cells can be stored in the spleen and released into circulation when needed.

ARTERIAL SUPPLY

- The arterial supply of the spleen comes from the tortuous splenic artery, which reaches the spleen as it travels through the splenorenal ligament.
- This artery emerges from the celiac trunk, a branch of the abdominal aorta.

VENOUS DRAINAGE

- The venous drainage of the spleen occurs via the splenic vein, which also receives blood from the inferior mesenteric vein.
- The splenic vein unites with the superior mesenteric vein, at the posterior to the neck of the pancreas, and forms the hepatic portal vein.

LYMPHATIC DRAINAGE

- The splenic lymph nodes lie at the hilum and receive lymph via perivascular and subcapsular lymphatic vessels.
- It is then drained to the superior pancreatic (pancreaticosplenic) lymph nodes found at the superior surface of the pancreas.
- From there, the lymph is drained to the celiac lymph nodes.

NERVE SUPPLY

- The spleen is innervated by autonomic nerves from the celiac plexus.
- These nerves form the splenic plexus which reaches the splenic hilum traveling along the splenic artery and its branches.

Applied anatomy

Splenectomy

The Splenectomy is the surgical removal of the spleen either entirety or partially. Despite its important function for the immune system, the spleen is a non-vital organ. The reasons for removing the spleen include:

- Extensive splenomegaly
- Rupture of spleen
- Severe infection
- A wandering spleen
- Certain blood disorders like sickle cell anaemia and immune thrombocytopenic purpura.

4

Pelvis

PELVIS TWO MARKS QUESTIONS

Q.1 Name two false ligaments of the uterus.

Ans. The uterus has the following ligaments:

a. Pubocervical,
b. Transverse cervical and
c. Uterosacral ligament

Q.2 Name two structures within the prostate gland.

Ans. Following are the structures present in the prostatic gland:

a. Prostatic urethra,
b. Prostatic utricle and
c. Ejaculatory duct

Q.3 Name the coverings of testes.

Ans. The testis are covered by:

a. layer of scrotum
b. tunica vaginalis
c. tunica albuginea and
d. tunica vasculosa

Q.4 Four ligaments of the uterus.

Ans. Following are the ligaments of the uterus:

a. peritoneal ligament
b. Fibromuscular ligament
c. Uterosacral ligament
d. Round ligament

Q.5 Fibromuscular ligaments of the uterus.

Ans. The fibromuscular ligaments provide support to the uterus.

These ligaments are:

a. Round ligament of uterus
b. Transverse cervical ligaments
c. Uterosacral ligaments

Q. 7 The peritoneal ligaments of the uterus

Ans. The peritoneal ligaments are the folds of the peritoneum.

They do not provide any support to the uterus.

These ligaments are:

i. Anterior ligament
ii. Posterior ligament and
iii. Broad ligaments

Q. 8 True ligaments of bladder

Ans. There are six true ligaments of the bladder:

i. The lateral true ligament
ii. The lateral puboprostatic or lateral pubovesical ligament
iii. The medial puboprostatic or lateral pubovesical ligament
iv. The median umbilical ligament and
v. The posterior ligament

Q. 9 False ligaments of bladder

Ans. The false ligaments of the bladder are:

i. Median umbilical fold
ii. Medial umbilical fold
iii. Lateral false ligament is formed by the peritoneum of the paravesical fossa.
iv. Posterior false ligament is formed by the peritoneum of the sacrogenital folds.

Q. 10 Write the anterior relations of the anal canal

Ans. The anal canal is anteriorly related with :

i. Perineal body in both male and female
ii. In males, it is also related tothe membranous urethra and bulb of the

penis

iii. In females, it is also related to the lower end of the vagina

Q. 11 Write the surgical spaces related to the anal canal

Ans. There are three surgical spaces related to the anal canal:

a. The ischioanal space
b. The perianal space and
c. The submucous space

Q. 12 Write the posterior relations of the anal canal

Ans. The anal canal is posteriorly related with:

a. Anococcygeal ligament and
b. Tip of the coccyx

Q. 13 Name two curvatures of rectum

Ans. The rectum shows two types of curvatures in its course anteroposterior and lateral: There are two anteroposterior and three lateral curves.

The anteroposterior curves are:

- The sacral flexure of rectum
- The perineal flexure of the rectum

The lateral curves are:

- The upper lateral curve
- The middle lateral curve
- The lower lateral curve

Q. 14 Name two junctions of rectum

Ans. The rectum has two junctions one with a sigmoid colon and another with an anal canal.

The junctions of the rectum are:

a. Recto sigmoid junction
b. Anorectal junction

Q. 15 Write the peritoneal relations of the rectum

Ans. Following are the peritoneal relations of the rectum:

a. The front and the sides of the upper one-third of the rectum is covered with peritoneum.
b. only the front of the middle one-third of rectum is covered by peritoneum whereas
c. The lower one-third is devoid of peritoneum.

Q. 16 Name the anterior visceral relations of the rectum in males

Ans. Following are the anterior visceral relations of rectum in males:

a. The upper two-third of the rectum is related to the rectovesical pouch with the coils of the intestine and sigmoid colon
b. The lowerone-third of the rectum is related to:

- The base of the urinary bladder,
- The terminal part of ureters,
- The seminal vesicles,
- The deferent ducts and
- The prostate

Q. 17 Name the anterior visceral relations of the rectum in females.

Ans. Following are the anterior visceral relations of the rectum in females.

a. The upper two-third of the rectum is related to the rectouterine pouch with the coils of the intestine and sigmoid colon
b. The lower one-third of the rectum is related to the lower part of the vagina

Q. 18 Name the anterior visceral relations of rectum.

Ans. The posterior visceral relations of the rectum are the same for males and females. They are as follows:

a. Bones: Lower three pieces of sacrum, coccyx
b. Ligaments: The Anococcygeal ligament
c. Muscles: Piriformis, the coccygeus, and the levatorani muscles
d. Vessels: The median sacral, the superior sacral, and the lower sacral vessels

e. Nerves: The sympathetic chain with the ganglion impar,
The anterior primary rami of S3, S4, S5, Coccygeal 1
The pelvic sympathetic nerves
f. Lymph: Lymph nodes, lymphatics and
g. Fat

Q.19 What are Houston's valves of the rectum?

Ans. The Houston's valves are three transverse folds of rectal mucosa.
These folds are:

a. First transverse fold
b. Second transverse fold and
c. Third transverse fold

Q.20 Name the parts of a full urinary bladder

Ans. The full bladder has the following parts:

a. Apex
b. Neck
c. Two surfaces

Q.21 Mention the recess of ischioanal fossa

Ans. The ischioanal fossa is a wedge-shaped space situated one on each side of the anal canal.
There are narrow extensions of the fossa beyond its boundaries are known as ischioanal fossa.
There are following three recesses of the ischioanal fossa:

a. The anterior recess
b. The posterior recess and
c. The horseshoe recess

Q.22 Mention contents of pudendal canal

Ans. The pudendal canal is a fascial tunnel present in the lateral wall of the is chioanal fossa.

The pudendal canal contains:

a. Pudendal nerve
b. Internal pudendalartery and vein
c. Inferior rectal arteryand vein
d. Perineal artery and vein
e. Artery to penis and vein

Q. 23 Mention any 2 parts of the uterine tube

Ans. The uterine tube has the following parts:

a. Infundibulum
b. Ampulla
c. Isthmus and
d. Uterine or interstitial part

Q. 24 Name any two relations of tubal pole of ovary

Ans. The tubal or upper pole of the ovary is related to:

a. The uterine tube
b. External iliac vein and
c. Right ovarian tubal pole with appendix

Q. 25 Name any 2 false ligaments of the urinary bladder

Ans. The false ligaments of the urinary bladder are:

a. Median umbilical fold
b. Medial umbilical fold
c. Lateral false ligament is formed by the peritoneum of the paravesical fossa.
d. Posterior false ligament is formed by the peritoneum of the sacrogenital folds.

Q. 26 Name any 2 true ligaments of the urinary bladder

Ans. There are six true ligaments of the bladder. They are as follows:

a. The lateral true ligament
b. The lateral puboprostatic or lateral pubovesical ligament
c. The medial puboprostatic or lateral pubovesical ligament
d. The median umbilical ligament and
e. The posterior ligament

PELVIS TWENTY MARKS QUESTIONS

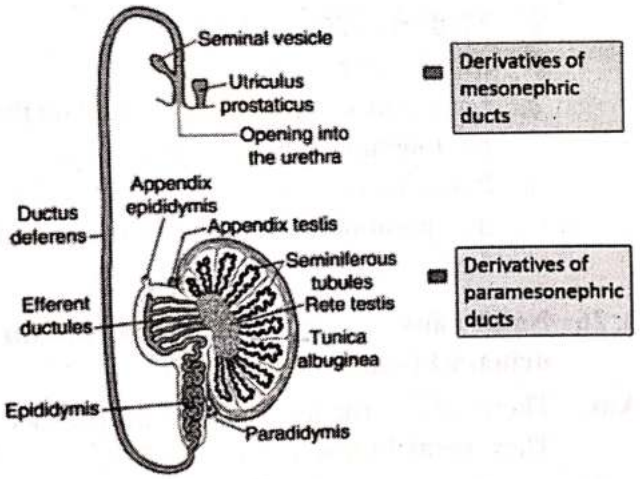
Q. 1 Describe in detail anatomy of Testis. Add a note on its applied anatomy.

Ans. INTRODUCTION

- The testes are male reproductive glands found in the scrotum.
- It is homologous with the ovary of the female.
- It lies obliquely so that its upper pole tilted forwards and laterally.
- The left testis is slightly lower than the right.

SHAPE AND SIZE

- The testis is oval in shape and is compressed from side to side.
- It is 3.75 cm long, 2.5 cm broad from backwards.
- It is 1.8 cm thick from side to side.
- The weight of adult testis is about 10 to 15 grams.



EXTERNAL FEATURES

The testis has the following external features:

i. Two poles
ii. Two borders
iii. Two surfaces

i. Poles

a. The testis is having two poles, upper and lower.
b. Both poles are convex and smooth.
c. The upper pole provides attachment to the spermatic cord.

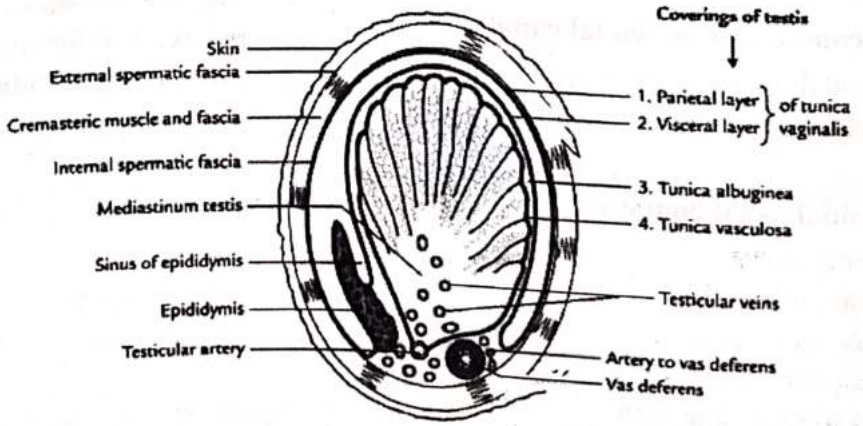
ii. Borders

a. The testis is having two borders, anterior and posterior.
b. The anterior border is convex and smooth and is fully covered by the tunica vaginalis.
c. The posterior border is straight and is only partially covered by tunica vaginalis.
d. The epididymis lies along the lateral part of the posterior border.

iii. Surfaces

a. The testis is having two surfaces, medial and lateral
b. Both the surfaces are convex and smooth.

Covering of testis



Testis is covered by:

i. *Scrotum*
ii. *Three coats*

i. *Scrotum*

a. Scrotum is a cutaneous sac that protects the testes.
b. It consists of two layers.
c. The superficial layer is of the skin and the deeper layer is of the dartos fascia.
d. The muscle fibers of dartos fascia contract during cold climate, which results in wrinkling of the scrotal skin and brings the testes closer to the body. This results in the reduction of heat loss when the outside temperature is too low.

ii. *The coats*

a. The testis is covered by three coats.
b. From inside outwards they are:
   - Tunica vaginalis
   - Tunica albuginea and
   - Tunica vasculosa

- *Tunica vaginalis*
  - The Tunica vaginalis partially encloses the testes.
  - It has two layers, parietal and visceral respectively.
    * Parietal layer: The parietal layer is larger than the visceral layer.
  - It covers the distal part of the spermatic cord and the duct of the epididymis.
  - Then it continues over the visceral layer of tunica vaginalis.
  - Between the layers is a small amount of serous fluid that preventsfriction and allows the testis to move in the scrotum.
    * Visceral layer: The visceral layer covers the testis, the head of theepididymis, and the inferior part of the ductus deferens.

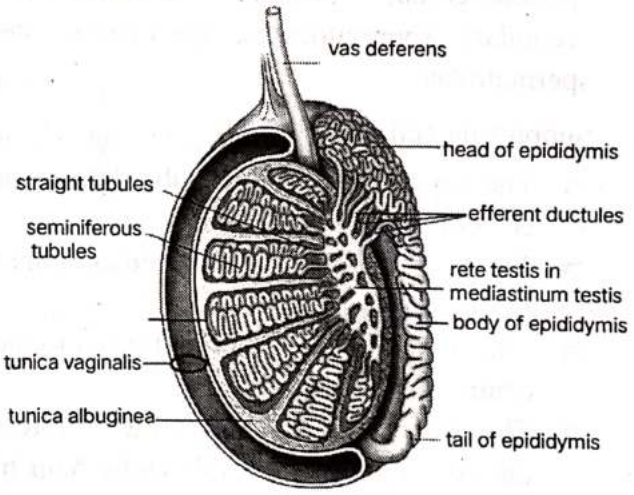
- *Tunica albuginea*
  - The tunica albuginea is a dense, white fibrous coat covering the testis all around.
  - It is covered by the visceral layer of tunica vaginalis except at the place where the testicular nerve and vessels enter the gland.
  - The thickened posterior border of tunica albuginea forms an incomplete vertical septumcalled as mediastinum testis.

- *Tunica vasculosa*

The tunica vasculosa is the innermost, vascular layer of the testis lining its lobules.

STRUCTURES OF TESTIS

- The glandular part of the testis consists of 200 to 300 lobules.



- Each lobule contains two to three seminiferous tubules.
- Each tubule is highly coiled on itself.
- When stretched out each tubule measures about 60 cm long with 0.2 mm diameter.
- The seminiferous tubules join together at the apices of the lobules to form 20 to 30 straight tubules.
- In the mediastinum, the seminiferous tubules anastomose and form a network of tubules, called rete testis.
- The rete testis gives rise to 12 to 30 efferent ductules.
- The ductules emerge near the upper pole of the testis and enter in the epididymis.
- Finally, it continues with the ductus deferens.

Histology

Histology of testis shows

i. ***Cells of seminiferous tubules and***
ii. ***Interstitial cell of Leydig***

i. Cells of seminiferous tubules

The seminiferous tubule consists of cells arranged in four to eight layers in fully functioning testis. These cells are of two types, namely:

a. *The spermatogenic cells and*
b. *Supporting cells*

a. The spermatogenic cells

The spermatogenic cells include spermatogonia, primary spermatocytes, secondary spermatocytes, spermatids, and spermatozoa.

b. Supporting cells

- The supporting cells are also known as cells of Sertoli.
- The cells of Sertoli are tall and columnar in shape.
- They extend from the basal lamina to the central lumen.
- The supporting cells support and protect the developing germ cells and - help in the maturation of spermatozoa.
- The follicular stimulating hormone of the anterior pituitary gland controls spermatogenesis.

ii. Interstitial cell of Leydig

- The Interstitial cells of Leydig are found as small clusters in between the seminiferous tubules.
- They secrete testosterone/ androgen.
- The activities of Leydig cells are under the control of the interstitial cell stimulating hormone of the anterior pituitary gland.

ARTERIAL SUPPLY

- The testes are supplied by a pair of the testicular arteries which are thebranches of the abdominal aorta.
- On the other hand, the scrotumis supplied by theinternal pudendal artery which is a branch of the internal iliac artery.
- Besides the testicular arteries, the testes also have a collateral blood supply formed by thecremasteric artery and the artery to ductus deferens.

VENOUS DRAINAGE

- Deoxygenated blood from the testes drains into the small spermatic veins, and then they intercommunicate and form a venous network called the pampini form plexus.
- The veins of the plexus ascend through the inguinal canal, anterior to the ductus deferens.
- Just below the superficial inguinal ring, they merge into three or four veins that enter the abdomen.
- These veins unite to form a single testicular vein at each side.
- The right testicular vein drains into the inferior vena cava.
- The left testicular vein drains into the left renal vein.

LYMPHATIC DRAINAGE

- The testicles are drained by the pre aortic and lateral aortic lymph nodes.
- The scrotum is drained by the inguinal lymph nodes.

NERVE SUPPLY

- The testes are innervated by autonomic nerves.
- Parasympathetic visceral afferent fibers and sympathetic fibers come from the testicular plexus.

Applied anatomy

i. Cryptorchidism

a. Cryptorchidismis the failure of the testes to descend to the scrotum.
b. It occurs in premature babies since the last two months of gestation is the period when the testes descend through the inguinal canal.
c. If the testes remain within the abdomen, they undergo atrophy which can cause

irreversible sterility.

Torsion of the testes

a. The torsion of the testes is the twisting of the spermatic cord and results in the obstruction of venous drainage and prevents fresh arterial blood fromtestis.
b. As venous blood cannot leave the testes, arterial blood cannot reach it.
c. If this state is not resolved within six hours, it will lead to ischemia and infarction of the testicular tissue, and results in infertility.

2 Describe the Anatomy of Uterus in detail.

INTRODUCTION

- The Uterus is also known as the womb.
- It is also called hystera. The uterus is a child-bearing organ in females.
- It is a hollow firm and thick wall organ.
- It provides nutrition to the fertilized ovum for its growth in order to becomeafully formed foetus.
- The contractive muscle power of the uterus helps for parturition, at the time of childbirth.

LOCATION

The uterus is located in the pelvis between the urinary bladder and rectum.

SIZE AND SHAPE

- The uterus is pyriform in shape.
- Its about 7.5 cm long and 2.5 cm thick.
- It weighs about 30 to 40 grams.

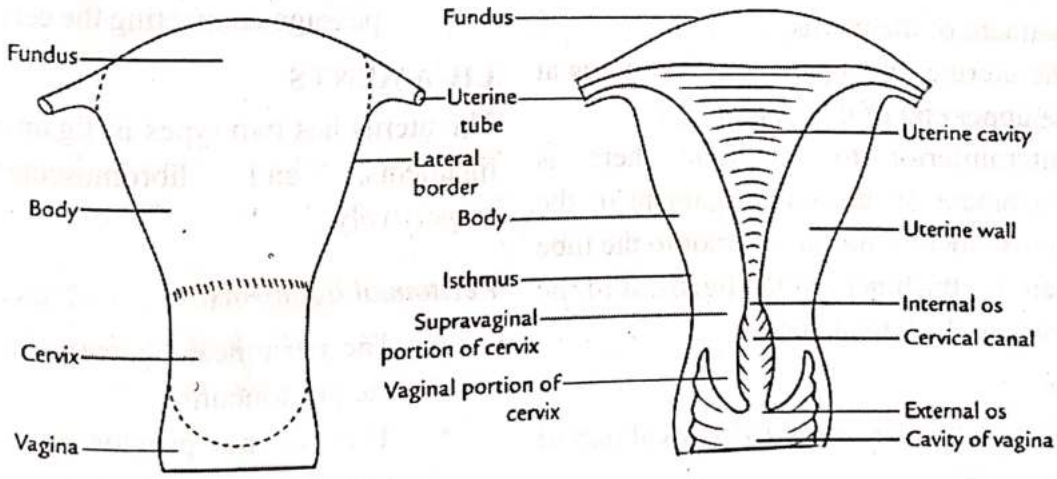
PARTS

The uterus consists of several anatomical parts, they are as follows:

i. A fundus
ii. Body
iii. To lateral borders and
iv. Cervix

i. A Fundus

a. The base of the uterus is called the fundus.
b. It lies above the opening of uterine tubes.



c. It is convex like a dome.
d. It is directed forwards when the bladder is empty.

Body

a. The body or corpus lies intraperitoneally.
b. It has a "triangle" lumen through its connection to the isthmus and both fallopian tubes.
c. The corpus is bent forward against the cervix at the isthmus which is known as anteflexion.
d. The long axis of the uterus also inclined towards the vagina is known as anteversion.

e. The shape and size of the body may vary depending on age, number of pregnancies, and hormonal status.

f. The body of the uterus is having two surfaces, visceral and intestinal respectively.

- *Visceral surface*
  - The visceral or anterior surface is flat and is related to the urinary bladder.
  - It is covered with the peritoneum and forms the posterior or superior wall of the uterovesical pouch.
- *Intestinal surface*
  - The intestinal or posterior surface is convex and it is related tothe coils of the terminal part of the ilium and also to the sigmoid colon.
  - It is covered with the peritoneum and forms the anterior or superior wall of the rectouterine pouch.

iii. Lateral borders

a. Each lateral border is rounded and convex.

b. It provides attachment to the broad ligament of the uterus.

c. The uterine tube opens into the uterus at the upper end of this border.

d. Anteroinferior to the tube there is attachment of the round ligament of the uterus whereas posteroinferior to the tube there is attachment of the ligament of the ovary to the lateral border.

iv. Cervix

a. The cervix is the lower cylindrical part of the uterus.

b. It is also known as the neck of uterus.

c. It lies subperitoneally.

d. It is less mobile than the body.

e. It is about 2.5 cm long and is slightly wider in the middle than at the end.

f. Its divided into two portions, supravaginal and vaginal parts.

g. The supravaginal portion is fixed in the parametrium.

h. The supravaginal part is anteriorly related tothe urinary bladder and posteriorly tothe rectouterine pouch.

i. The vaginal part of the cervix projects into the anterior wall of the vagina.

j. The spaces between the cervix and the vagina are called vaginal fornices.

k. The cervical canal opens into the vagina by an opening called external os.

l. The cervical canal isafusiform-shaped cavity of the cervix.

m. The cervical canal communicates above with the cavity of the body of the uterus via the internal os and below with the vaginal cavity via the external os.

n. The canal has anterior and posterior walls, due to the flattening of the canal from before backwards.

o. The walls of the cervical canal show mucous folds known as arborvitae uteri.

p. Interlocking of the folds of the anterior and posterior wall helps to close the canal.

q. The isthmus is about 1 cm long narrow passage connecting the cervix and corpus.

LIGAMENTS

The uterus has two types of ligaments, peritoneal ligaments, and fibromuscular ligaments respectively.

Peritoneal ligaments

- The peritoneal ligaments are the folds of the peritoneum.
- They do not provide any support to the uterus.

These ligaments are:

i. Anterior ligament
ii. Posterior ligament and
iii. Broad ligaments

i. Anterior ligament

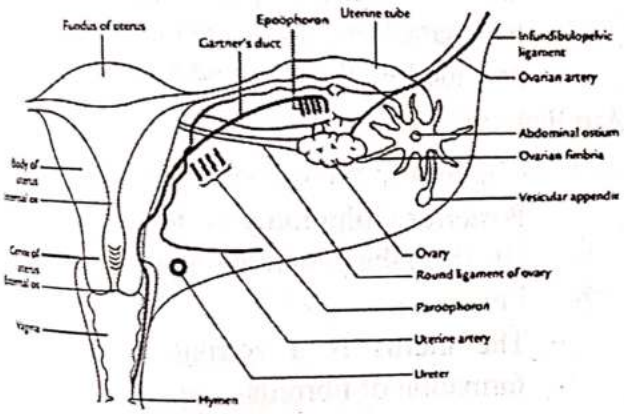
The anterior ligament consists of the uterovesical folds of the peritoneum.

ii. Posterior ligament

The posterior ligament consists of the rectovaginal folds forming the rectovaginal pouch of the peritoneum

iii. *Broad ligaments*

a. There are two broad ligaments, right and left respectively.
b. They help to attach the uterus to the lateral pelvic wall.
c. The upper border of the broad ligament is free.
d. The lateral and inferior borders of the broad ligament are attached to the corresponding parts of the pelvic wall.



e. The medial border of the broad ligament is attached to the lateral margin of the uterus.
f. The ovaries are attached to the posterior layer of the broad ligament.
g. The broad ligament contains following structures:

- The uterine tube
- The round ligament of uterus
- The ligament of ovary
- Uterine vessels
- Ovarian vessels
- Uterovaginal and ovarian nervous plexuses
- Epoophoron
- Paroophoron
- Lymph nodes and lymph vessels

Fibromuscular ligaments

The fibromuscular ligaments actually provide support to the uterus.

These ligaments are:

a. *Round ligament of uterus*
b. *Transverse cervical ligaments*
c. *Uterosacral ligaments*

a. Round ligament of uterus

- The round ligaments are two 10 to 12 cm long fibromuscular bands.
- They lie between the two layers of the broad ligament, anteroinferior to the uterine tube.
- Each ligament begins at the lateral angle of the uterus and merges with the areolar tissue of labium majus.
- The round ligament keeps the fundus pulled forwards and helps to maintain the angle of anteversion.

b. Transverse cervical ligaments

- These are fan-shaped condensations of endopelvic fascia on each side of the cervix above the levatorani and around the uterine vessels.
- They connect the lateral aspect of the cervix and the upper vaginal wall to the lateral pelvic wall.
- They form a hammock that supports the uterus.

c. Uterosacral ligaments

- The uterosacral ligaments are also condensations of the endopelvic fascia.
- They connect the cervix to the periosteum of the sacrum.
- They are enclosed within the rectouterine folds of the peritoneum.
- The uterosacral ligament keeps the cervix braced backward.

HISTOLOGY

The uterus has the following three layers:

i. ***Endometrium,***
ii. ***Myometrium and***
iii. ***Perimetrium***

i. ***Endometrium***

a. The endometrium or uterine mucous membrane is lined with simple columnar epithelium and contains numerous tubular glands.
b. Physiologically the endometrium is divided into the functional layer (stratum functionale) and basal layer (stratum basale).

ii. ***Myometrium***

a. The myometrium or uterine musculature comprises a complex of three smooth muscle layers, subvascular layer, vascular layer, and supravascular layer respectively.
b. The subvascular layer is rather thin and mainly participates in the sealing of the tubes and the separation of the endometrium during the menstrual cycle.
c. The vascular layer is quite strong and well-perfused running around the uterus like a net. It plays a major role during labor.
d. The supravascular layer is again a thin sheet of crossing muscle fibers stabilizing the uterine wall.

iii. ***Perimetrium***

The perimetrium equals the peritoneum and is surrounded by a thin connective tissue layer.

FUNCTIONS

- The uterus plays an important role in human reproduction.
- It helps to pushout the baby during birth through muscle contraction.
- The uteruses of women ofchildbearing age underlie an about 28-day hormone-controlled rhythm known as the menstrual cycle.

ARTERIAL SUPPLY

It is supplied by branches of the uterine arteries, the branches of the internal iliac artery.

VENOUS DRAINAGE

The venous blood drains through the uterine venous plexus into the internal iliac vein.

LYMPHATIC DRAINAGE

The lymphatic drainage for the uterus is to the external and internal iliac lymph nodes, obturator lymph node, and para-aortic lymph nodes

NERVE SUPPLY

- The nerves are derived from the inferior hypogastric plexus.
- Sympathetic innervation originates from the T12 and L1 spinal segments, while the parasympathetic nervous supply is provided by the S2 to S4 spinal segments.

Applied anatomy

a. Colpotomy and colporrhaphy
Posterior Colpotomy is done to drain the pus from the pouch of Douglas.
b. Fibroid
The uterus is a common site for the formation of fibroids

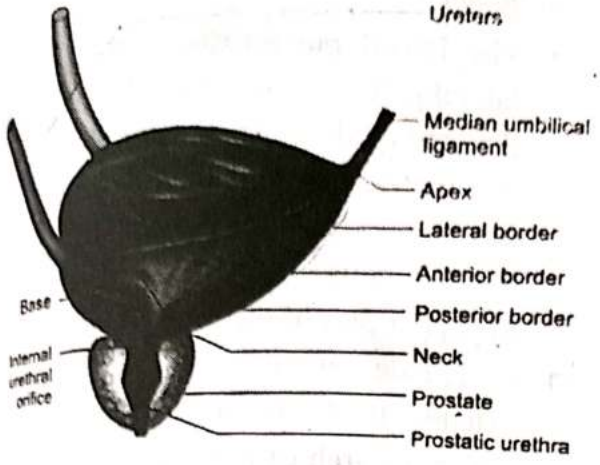
Q. 3 Describe in detail anatomy of Urinary bladder. Add a note on its applied anatomy.

Ans. INTRODUCTION

- The urinary bladder is a temporary storehouse of urine.
- It is present in the pelvis.
- It is a muscular reservoir of urine.

FEATURES

- The urinary bladder is a muscular reservoir of urine.
- It lies in the anterior part of the pelvic cavity.
- The mass contraction of urinary bladder is due to whorls and spiral arrangement of the detrusor muscles
- Size, shape, and position



- The bladder varies in its size, shape, and position according to the amount of urine it contains.
- When the bladder is empty it lies entirely within the pelvis.
- The urine-filled bladder extend upward in the abdominal cavity

EXTERNAL FEATURES

- The external features of the empty and full bladder vary.
- An empty bladder is tetrahedral in shape whereas a full bladder is ovoid in shape.

i. *Empty bladder*

An empty bladder has:

a. Apex: The apex of the empty bladder is directed forwards

b. Base or fundus: The base of the empty bladder is directed backward

c. Neck: The neck of empty bladder is the lowest and most fixed part of the bladder: It lies three to four centimeters behind the lower part of the pubic symphysis. It is pierced by the internal urethral orifice.

d. Surfaces: The empty bladder has three surfaces, superior, right, and left inferolateral respectively

e. Borders: The empty bladder has four borders, two lateral, one anterior and one posterior respectively

ii. *Full bladder*

The full bladder has:

a. Apex: The apex of the full bladder is directed upwards towards the umbilicus.

b. Neck: The neck of the full bladder is directed downwards.

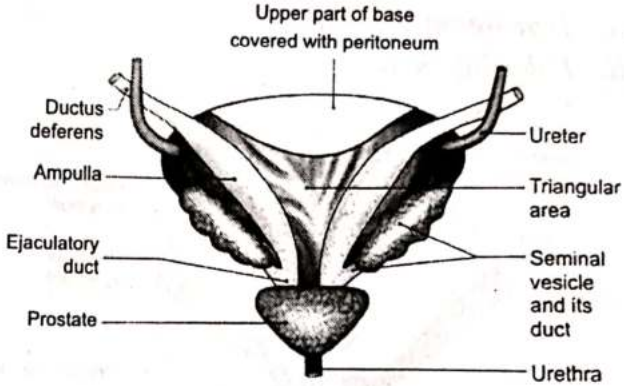
c. Surfaces: The full bladder is having two surfaces, anterior and posterior respectively.

RELATIONS

The relations of the bladder vary in males and females.

a. Apex

The apex of the bladder is connected to the umbilicus by a median umbilical ligament.



b. Base

- In females, the base is related to the uterine cervix and to the vagina.
- In males, upper part of the base is related to the rectum whereas lower part is related to seminal vesicles and the termination of vas deferens.

c. Neck

- In females, the neck is related to the pelvic fascia surrounding the upper part of the urethra.
- In males, the neck is related tosmooth muscle bundles which surround the bladder neck and preprostatic urethra.

d. Superior surface

- In females, the major part of the superior surface is covered bytheperitoneum, except a small area near the posterior border.
- In males the superior surface is completely covered by the peritoneum and is in contact with the sigmoid colon and terminal part of the ilium.

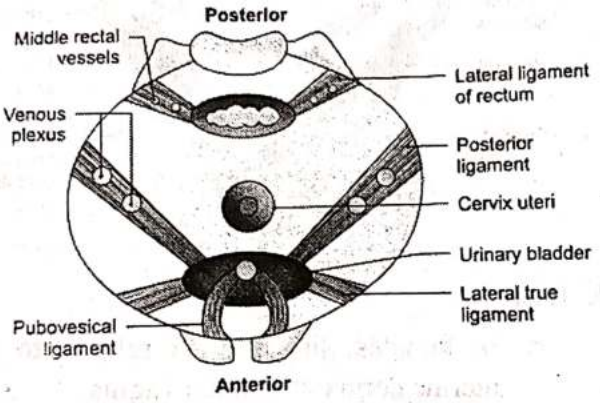
e. Inferolateral surfaces

- In female each inferolateral surface is related to pubis, pubovesical ligament, and the levatorani and obturator internus muscles.
- In males each inferolateral surface is related to the pubis, puboprostatic ligament, and the levatorani and obturator internus muscles.

LIGAMENTS

The ligaments of the bladder are:

i. True ligaments and
ii. False ligaments



i. True ligaments

The true ligaments of the bladder are condensations of pelvic fascia around the neck and base of the bladder.

There are six true ligaments of the bladder:

a. The lateral true ligament
b. The lateral puboprostatic or lateral pubovesical ligament
c. The medial puboprostatic or lateral pubovesical ligament
d. The median umbilical ligament and
e. The posterior ligament

a. The lateral true ligament

The lateral true ligament extends from the side of the bladder to the tendinous arch of the pelvic fascia.

b. The lateral puboprostatic or lateral pubovesical ligament

- The lateral puboprostatic in males and lateral pubovesical ligament in females is directed medially and backwards.
- In males, the lateral puboprostatic ligament extends from the anterior end of the tendinous arch of the pelvic fascia to the upper part of the prostatic sheath.
- In female lateral pubovesical ligament extends from the anterior end of the tendinous arch of the pelvic fascia to the neck of the bladder.

c. The medial puboprostatic or lateral pubovesical ligament

- The medial puboprostatic in males and lateral pubovesical ligament in females is directed downwards and backwards.
- In males the medial puboprostatic ligament extends from the back of the pubic bone to the prostatic sheath.
- In females, the medial puboprostatic ligament extends from the back of the pubic bone to the neck of the bladder.

d. The median umbilical ligament

The median umbilical ligament is a remnant of the urachus

e. The posterior ligament

The posterior ligament of the bladder is directed backwards and upwards along the vesical plexus of veins.

ii. False ligaments

The false ligaments are the peritoneal folds. They do not form any support to the bladder. The false ligaments are:

a. Median umbilical fold
b. Medial umbilical fold
c. Lateral false ligament is formed by the peritoneum of the paravesical fossa.
d. Posterior false ligament is formed by the peritoneum of the sacrogenital folds.

INTERIOR OF BLADDER

- In an empty bladder, the major part of the mucosa shows irregular folds.
- In the triangular area at the lower part of the bladder, the mucosa is smooth.
- This area with smooth mucosa is known as trigone of the bladder

CAPACITY OF BLADDER

The mean capacity of the bladder in an adult male is 220ml, varying from 120 to 20 ml.

ARTERIAL SUPPLY

The main arterial supply of the bladder is by superior and inferior vesical arteries.
Additionally, it is supplied by the obturator and inferior gluteal arteries and in female by uterine and vaginal arteries.

VENOUS DRAINAGE

The Bladder drains venous blood into vesical venous plexus.

LYMPHATIC DRAINAGE

The lymphatics from the bladder terminate into the external iliac nodes.

NERVE SUPPLY

The urinary bladder is supplied by vesical plexus of nerves.

Applied anatomy

a. Rupture

A distended bladder may be ruptured by injuries of the lower abdominal wall.

b. Hypertrophy of bladder

Chronic obstruction to the outflow of urine by an enlarged prostate causes hypertrophy of the bladder leads to a trabeculated bladder.

Q. 4 **Describe in detail anatomy of Anal Canal. Add a note on its applied anatomy.**

Ans. INTRODUCTION

- The anal canal is the terminal part of the gastrointestinal tract and large intestine.
- It is situated below the level of the pelvic diaphragm.
- It lays in the anal triangle of the perineum between the right and left ischioanal fossae.

LENGTH

The anal canal is 3.8 cm long

EXTENSION

- The anal canal extends from the anorectal junction to the anus.
- It is surrounded by inner involuntary and outer voluntary sphincters which help to keep the lumen closed in the form of an anteroposterior split.

JUNCTIONS

- The anorectal junction is marked by the forward concavity of the perineal flexure of the rectum.
- It lies 2 to 3 cm in front of and slightly below the tip of the coccyx.
- Here the ampulla of rectum suddenly narrows and pierces the pelvic diaphragm.

Anus

The anus is a surface opening of the anal canal, situated about 4 centimeters and in front of the tip of the coccyx in the cleft between the two buttocks.

RELATIONS

The anal canal is having anterior, posterior, lateral, and all-round relations.

a. Anterior relations

The anal canal is anteriorly related to:

- Perineal body in both male and female
- In males, it is also related to membranous urethra and bulb of penis
- In females, it is also related to the lower end of the vagina

b. Posterior relations

The anal canal is posteriorly related to:

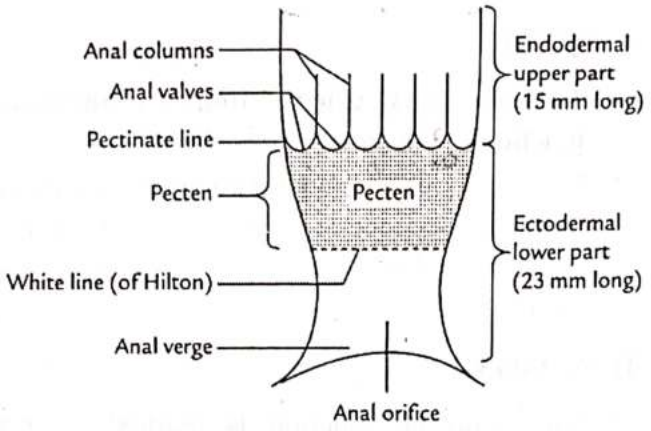
- Anococcygeal ligament and
- Tip of the coccyx

c. Lateral relations

The anal canal is laterally related toischioanal fossae

d. All round relations

Anal canal is surrounded by the sphincter muscles, the tone of which keeps the canal closed.



INTERIOR

The interior of the anal canal is studied under the following three headings:

i. Upper mucous part
ii. Middle part or transitional zone or Pecten
iii. Lower cutaneous part.

i. Upper mucous part

a. The upper mucous part is about 15mm long.
b. It is lined by a mucous membrane.
c. The mucous membrane shows:
- Anal column: The mucous membrane shows six to ten vertical ridges known as anal column.
- Anal valves: The Lower end of anal columns are united with transverse folds of mucous membrane known as anal valves
- Anal sinus:
  - The depression in the mucosa above each valve is known as anal sinus.
  - Pectinate or dentate line The anal valves together forms a transverse line all around the anus is known as Pectinate or dentate line
  - The pectinate line is situated opposite to the middle of the internal anal sphincter, the junction of ectodermal and endodermal parts.

d. Anal gland
- The anal sinus contains anal glands.
- The secretion of these glands produces a peculiar smell which is important in lower animals to attract.

ii. Middle part or transitional zone or Pecten

a. The middle part is also about 15 mm long.
b. It is next to the upper mucous part.
c. It is also lined by a mucous membrane.

It shows the following characteristic features:
- The anal column is not present in the middle zone.
- Dense venous plexus between the middle part and the muscle coat gives a bluish appearance to this part. The mucosa of this part is less mobile than the upper part, so it is known as pecten or transitional zone.
- The lower limit of the transitional zone has a whitish appearance, so it is referred to as white line of Hilton.

iii. Lower cutaneous part

a. The lower cutaneous part is also about 8 mm long.
b. It is lined by true skin containing sebaceous glands.
c. The epithelium contains sweat glands, hair along with sebaceous glands.

MUSCULATURE

The musculature of the anal canal can be studied under the following headings:

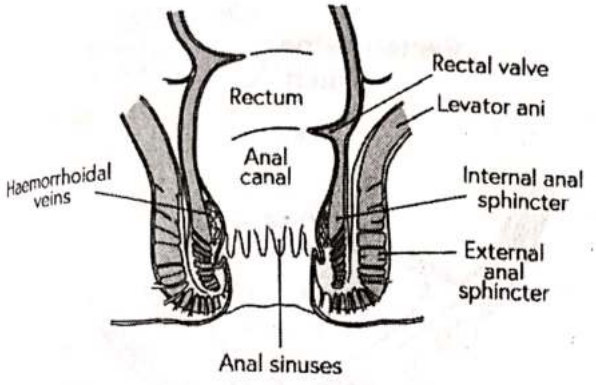
i. Anal sphincters
ii. Conjoint longitudinal coat and
iii. Anorectal ring

i. Anal sphincters

There are two anal sphincters, external and internal respectively

a. External anal sphincter
- The external anal sphincter is under

voluntary control.



- It is made up of striated muscles.
- It is supplied by the rectal nerve and peripheral branch of the fourth sacral nerve.
- The external anal sphincter is a single functioning and anatomical entity.
- It is made up of three layers of fibers, upper, middle, and lower.
- The upper fibers blend with fibers of the puborectalis, the middle fibers surroundthe lower part of the internal anal sphincter and the lower fibers lie below the level of the internal anal sphincter.

b. Internal anal sphincter

- The internal anal sphincter is under involuntary control.
- It is formed by thickened circular muscle coat.
- It surrounds the upper three-fourth part of the anal canal.
- It extends from the upper end of the anal canal to the white line of Hilton.

ii. *Conjoint longitudinal coat*

a. The Conjoint longitudinal coat is formed by the fusion of the puborectalis with the longitudinal muscle coat of the rectum at the anorectal junction.

b. It lies between external and internal anal sphincters.

c. When traced downwards, at the level of white line of Hilton, it breaks up into a number of fibroelastic septa.

iii. *Anorectal ring*

a. The anorectal ring is a muscular ring present at the anorectal junction.

b. It is formed by the fusion of puborectalis, uppermost fibers of the external sphincter, and the internal sphincter.

SURGICAL SPACES

There are three surgical spaces related to the anal canal:

- The ischioanal space
- The perianal space and
- The submucous space

The ischioanal space lies on each side of the anal canal, the perianal space surrounds the anal canal below white line whereas the submucous space lies above the white line.

ARTERIAL SUPPLY

- The part of the anal canal above the pectinate line is supplied by the superior rectal artery and
- The part of the anal canal below the pectinate line is supplied by the inferior rectal artery

VENOUS DRAINAGE

- The internal rectal venous plexus drain mainly into the superior rectal vein.
- The upper part of the external rectal venous plexus drained by the superior rectal vein, the middle part of the plexus is drained by the middle rectal vein whereas the lower part of the plexus is drained by the inferior rectal vein

LYMPHATIC DRAINAGE

Lymph vessels from the part above the pectinate line drain into the internal iliac nodes whereas the lymph vessels from the part below the pectinate line drain into the medial group of the superficial inguinal node.

NERVE SUPPLY

- Above the pectinate line, the anal canal is supplied by the autonomous nerves
- Below the pectinate line, the anal canal is

supplied by the somatic nerves
- Internal sphincter is controlled by sympathetic and parasympathetic nerves and
- The external sphincter is supplied by the inferior rectal nerve

Applied anatomy

a. Internal Piles/ Hemorrhoids
- The piles are secular dilatations of the internal rectal venous plexus.
- They bleed profusely during straining for defecation.

b. External piles
- The external pile occurs below the pectinate line.
- They are very painful.
- They do not bleed on straining at stool.

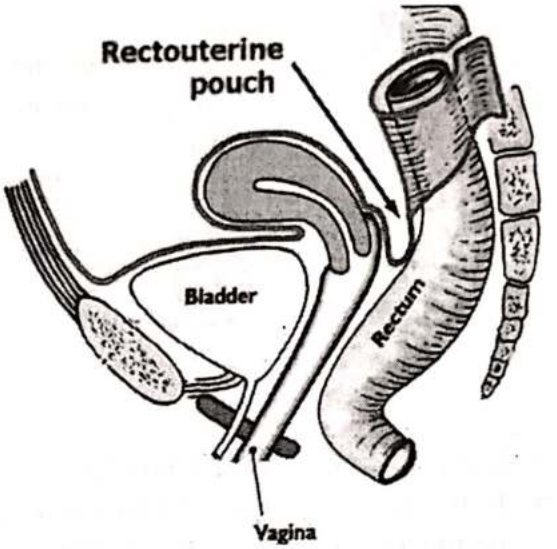
Q. 5 Describe the Anatomy of Rectum in detail. Add note on its applied anatomy

Ans. INTRODUCTION
- The lower part of the gastrointestinal tract is formed by rectum and anal canal.
- Rectum is the distal part of the large intestines.
- It is located between the sigmoid colon above and anal canal below.
- Rectum is anteroposteriorly and side to side curved organ.

LOCATION

The rectum is situated in the posterior part of the lesser pelvis, in front of the lower three pieces of sacrum and coccyx.

EXTENT
- The rectum begins as a continuation of the sigmoid colon at the level of the third sacral vertebra.
- The rectosigmoid junction is the junction between the lower end of the sigmoid mesocolon and rectum.
- The rectum ends by becoming continuous with the anal canal at anorectal junction.
- The anorectal junction lies two to three centimetersat front and a little below the tip of the coccyx.



JUNCTIONS

The rectum has two junctions one with a sigmoid colon and another with anal canal.

The junctions of the rectum are:

i. Rectosigmoid junction and
ii. Anorectal junction

i. Rectosigmoid junction

a. The rectosigmoid junction is the junction between the lower end of the sigmoid mesocolon and rectum.

b. At rectosigmoid junction, the rectum begins as a continuation of -the sigmoid colon.

c. The rectosigmoid junction lies at the level of the third sacral vertebra.

ii. Anorectal junction

a. The anorectal junction is the junction between the lower ends of rectum with upper part of anal canal.

b. At the anorectal junction,the rectum ends and continues as the anal canal.

c. The anorectal junction lies two to three centimetersat front and a little below the tip of the coccyx.

DIMENSIONS
- The rectum is 12 cm long.
- The diameter of the rectum, in the upper

part, is 4 cm.

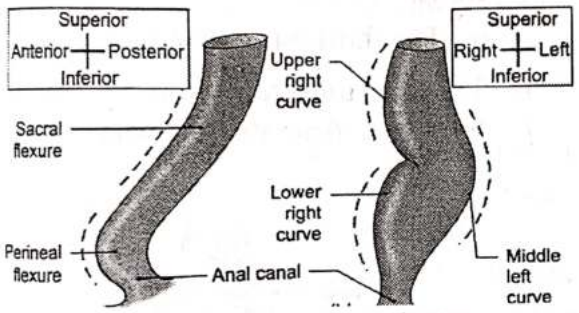
- At the lower part, it is dilated to form the rectal ampulla.

COURSE AND DIRECTION

- In its course, the rectum runs first downwards and backwards, then downwards and finally downwards and forwards.
- The beginning and the end of the rectum lie in the median plane.

CURVES

- The rectum shows two types of curvatures in its course, two anteroposterior and three lateral curves.



Anteroposterior curves

There are two anteroposterior curves, the sacral flexure, and the perineal flexure.

- The sacral flexure of rectum follows the concavity of the sacrum and coccyx.
- The perineal flexure of rectum is a backward bend at the anorectal junction.

Lateral curves

There are three lateral curves, upper, middle, and lower lateral curves respectively

a. The upper lateral curve of the rectum is convex to the right
b. The middle lateral curve is convex to the left and most prominent whereas
c. The lower lateral curve is convex to the right.

RELATIONS

The rectum has the following peritoneal and visceral relations:

Peritoneal relations

Following are the peritoneal relations of the rectum:

a. The front and the sides of the upper one-third of the rectum is covered with peritoneum.
b. only the front of the middle one-third of the rectum is covered by peritoneum whereas
c. The lower one-third is devoid of peritoneum.

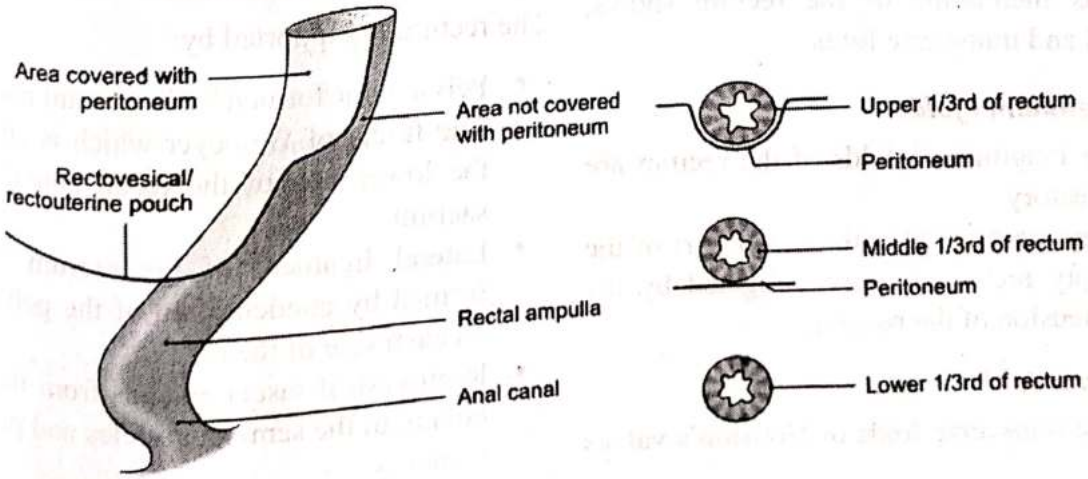
Visceral relations

The rectum has anterior and posterior visceral relations.

a. Anterior visceral relations
The anterior visceral relations are different in males and females.

In male

- The upper two-third of the rectum is related to the rectovesical pouch with the coils of the



intestine and sigmoid colon

- The lower one-third of the rectum is related to;
- The base of the urinary bladder,
- The terminal part of ureters,
- The seminal vesicles,
  - The deferent ducts and
  - The prostate

In female

- The upper two-third of the rectum is related to the rectouterine pouch with the coils of the intestine and sigmoid colon
- The lower one-third of the rectum is related to the lower part of the vagina.

b. Posterior visceral relations

The posterior visceral relations of the rectum are the same for males and females. They are as follows:

- Bones: Lower three pieces of sacrum, coccyx
- Ligament: The Anococcygeal ligament
- Muscles: Piriformis, the coccygeus, and the levatorani muscles
- Vessels: The median sacral, the superior sacral, and the lower sacral vessels
- Nerves: The sympathetic chain with the ganglion impar,
  The anterior primary rami of S3, S4, S5, Coccygeal 1
  The pelvic sympathetic nerves
- Lymph: Lymph modes, lymphatics and
- fat

Mucosal folds

The mucous membrane of the rectum shows, longitudinal and transverse folds

i. The longitudinal folds

a. The longitudinal folds of the rectum are transitory.

b. They are present in the lower part of the empty rectum and are obligated by the distension of the rectum.

ii. Transverse folds

a. The transverse folds or Houston's valves or plicae transversalis are permanent and marked when the rectum is loaded.

b. There are three transverse folds.

- The first transverse fold

c. It lies near the upper end of the rectum.

d. It projects from the left wall situated 7.5 cm above the anus.

e. It may encircle and partially constrict the rectum.

- The second transverse fold

f. It is the largest and most constant fold.

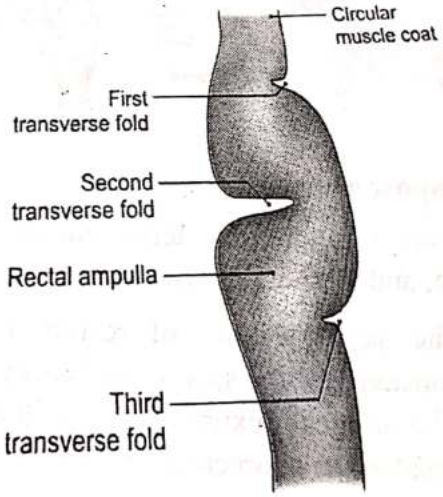
g. It lies at the upper end of the rectal ampulla.

h. It projects from the anterior and the right walls.

- The third transverse fold

i. The third transverse fold is inconstant.

j. It projects from the left wall.



SUPPORTS OF RECTUM

The rectum is supported by:

- Pelvic floor formed by levatorani muscles
- The fascia of Waldeyer which is attached to the lower part of the rectal ampulla to the sacrum
- Lateral ligament of the sacrum which is formed by condensation of the pelvic fascia on each side of the rectum.
- Rectovesical fascia extends from the rectum behind to the seminal vesicles and prostate in front.

- Pelvic peritoneum
- Perineal body with its muscles

ARTERIAL SUPPLY

The rectum is supplied by:

- The superior rectal artery: The superior rectal artery is the chief artery of the rectum.
- The middle rectal artery: The middle rectal artery supply only the superficial coats of the lower rectum whereas
- The median rectal artery: The Median rectal artery supply the posterior wall of the anorectal junction

VENOUS DRAINAGE

The rectum drains venous blood into superior, middle, and median rectal veins.

LYMPHATIC DRAINAGE

- Lymphatics from more than the upper half of the rectum passes along the superior rectal vessels to the inferior mesenteric nodes
- Lymphatics from lower half of the rectum passes along the middle rectal vessels to the internal iliac nodes
- Lymphatics from the lower part of the rectum drain into superficial inguinal nodes

NERVE SUPPLY

Rectum is supplied by sympathetic and parasympathetic nerves through the superior rectal or inferior mesenteric and inferior hypogastric plexuses.

Applied anatomy

i. Proctoscopy and sigmoidoscopy

a. The interior of the rectum and anal canal can be examined under direct vision with special instruments, like Proctoscope or sigmoidoscope.

b. The Proctoscopy shows internal piles and growths in the lower part of the rectum.

c. The sigmoidoscopy helps in revealing the ulcers, growths, and diverticula. It also helps in taking the rectal biopsy.

ii. Prolapse of rectum

a. The prolapse of the rectum may be incomplete or complete.

b. The incomplete prolapse may occur during violent straining whereas complete prolapse is the condition in which the whole thickness of the rectal wall protrudes through the anus.

5

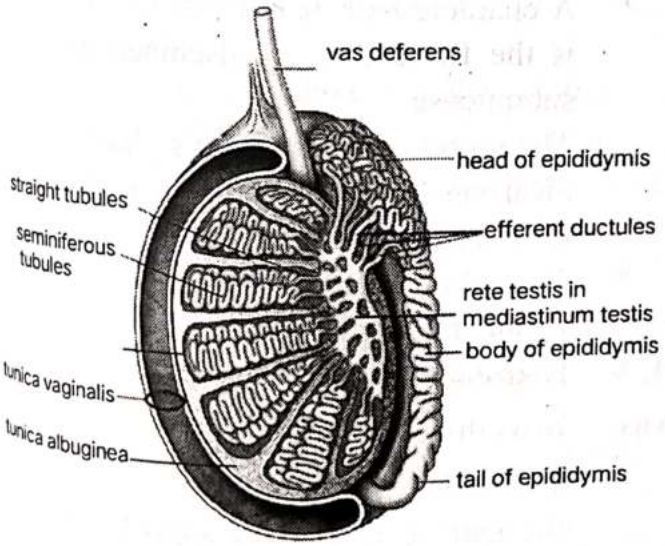
Histology

HISTOLOGY FIVE MARKS QUESTIONS

Q. 1 **Histology of Testis**

Ans. **Structure of testis**

- The glandular part of the testis consists of 200 to 300 lobules.
- Each lobule contains two to three seminiferous tubules.
- Each tubule is highly coiled on itself.
- When stretched out each tubule measures about 60 cm long with 0.2 mm diameter.
- The seminiferous tubules join together at the apices of the lobules to form 20 to 30 straight tubules.



- In the mediastinum, the seminiferous tubules anastomose and form a network of tubules, called rete testis.
- The rete testis gives rise to 12 to 30 efferent ductules.
- The ductules emerge near the upper pole of the testis and enter in the epididymis.
- Finally, it continues with the ductus deferances.

Histology

Histology of testis shows:

i. Cells of seminiferous tubules

ii. Interstitial cells of Leydig

i. Cells of seminiferous tubules

a. The seminiferous tubule consists of cells arranged in four to eight layers in fully functioning testis.

b. These cells are of two types, namely

- The spermatogenic cells
- Supporting cells

- *The spermatogenic cells*
  - The spermatogenic cells include spermatogonia, primary spermatocytes, secondary spermatocytes, spermatids, and spermatozoa.
  - The spermatogonia rest on the basement membrane.

- *Supporting cells*
  - The supporting cells are also known as the cells of Sertoli.
  - The cells of Sertoli are tall and columnar in shape.
  - They extend from the basal lamina to the central lumen.
  - The supporting cells support and protect the developing germ cells and help in the maturation of spermatozoa.
  - The folliclestimulating hormone of the anterior pituitary gland controls

spermatogenesis.

ii. Interstitial cells of Leydig

a. The Interstitial cells of Leydig are found as small clusters in between the seminiferous tubules.

b. They secrete testosterone/androgen.

c. The activities of Leydig cells are under the control of the interstitial cell stimulating hormone of the anterior pituitary gland.

Q. 2 Histology of duodenum

Ans. Introduction

- The duodenum is C-shaped,thefirst of the three parts of the small intestine that receives partially digested food from the stomach and begins with the absorption of nutrients.
- It is directly attached to the pylorus of the stomach.
- It is closely related to the head of the pancreas.
- It consists of four sections: superior, descending, horizontal, and ascending parts.

Histology

- Histologically, it consists of the typical three layers common to all hollow organs of the gastrointestinal tract, but it has Brunner's glands, which is the characteristic feature of the duodenum.
- Histologically the duodenum is similar to all the other hollow organs of the gastrointestinal tract

The mucosal layer: The mucosa consists of:

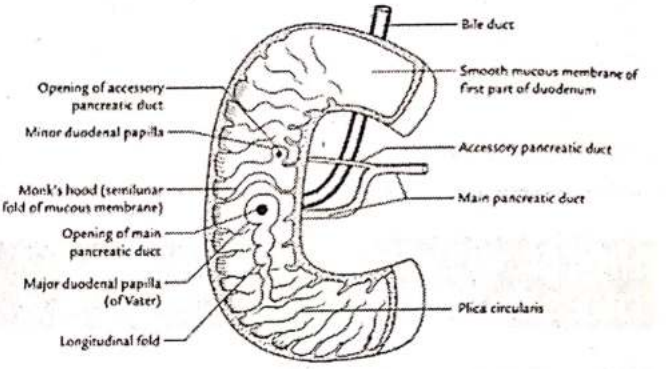
- Simple columnar epithelium,
- A connective tissue layer and
- A smooth muscle layer

The submucosal layer:The submucosal layer is madeup of:

- Loose connective tissue,
- Numerous blood vessels and
- The Meissner's plexus.

The Muscularis layer: It consists of :

- An inner circular and
- An outer longitudinalmusculature
- Between these two layers, there is Auerbach's plexus.



- There are microvilli, finger-shaped villi, and circular folds of the mucosa and submucosa, which increase the absorption area of the duodenum up to 1500 times.
- The mucous membrane shows evaginations in the form of villi and evagination to form crypts of Lieberkuhn.
- The villi are linked with microvilli by columnar cells.

Brunner's glands

- A characteristic feature of the duodenum is the Brunner's glandsembedded in the submucosa.
- The secretion of Brunner's gland contains bicarbonate which helps to neutralize the gastric acid.
- The submucosa is full of mucus-secreting Brunner's glands.

Q. 3 Histology of kidney

Ans. Introduction

- The kidneys are bilateral organs placed retroperitoneally in the upper left and right abdominal quadrants.
- The kidney is the functional unit of the urinary system.
- The main function of the kidney is to eliminate excess bodily fluid, salts, and by-products of metabolism.
- Hence the kidney helps in the regulation

of acid-base balance, blood pressure, and many other homeostatic parameters.

Histology

- The kidney consists of the outer cortex and inner medulla.
- The cortex of the kidney shows cut sections of glomeruli, many sections of proximal convoluted tubules, some sections of distal convoluted tubules, and few collecting ducts.
- The main unit of the medulla is the renal pyramid.

The section through the pyramid of the medullar shows following:

a. The light staining collecting ducts,
b. The sections of loop of Henle,
c. The thick and thin segments of descending and ascending limbs,
d. The capillaries and connective tissue.

- There are 8-18 renal pyramids in each kidney,
- The apex of the pyramid projects medially toward the renal sinus. This apical projection is called the renal papilla.
- The renal papilla opens to the minor calyx.
- The minor calyces unite to form a major calyx.
- Two to three major calyces again unite to form the renal pelvis.
- The ureter emerges from the renal pelvis and leaves the kidney through the hilum.

Nephron

- The pyramids contain the functional units of the kidney called the nephrons.
- The nephrons filter blood in order to produce urine which then is transported through a system of structures called calyces which then transport the urine to the ureter.
- Each nephron consists of a renal corpuscle, an initial component that filters the blood, and a renal tubule that processes and carries the filtered fluid to the system of calyces.

Q. 4 Histology of Liver

Ans. Introduction

- The liver is a large multifunctional essential peritoneal organ found in the upper right quadrant of the abdomen.
- It helps for detoxification, protein synthesis, biochemical production as well as nutrient storage

Histology

- Histology of the liver can be studied by liver biopsy which is done from the right lateral surface.
- The liver is covered by Glisson's capsule.

The liver consists of the following major histological components:

i. Parenchyma
ii. Stroma
iii. Sinusoids
iv. The spaces of Disse

i. Parenchyma

a. The Parenchyma is represented by hepatocytes
b. Hepatocytes: These large and polyhedral cells make up 80% of the total cells of the liver.

The adjacent hepatocytes leave a very small space between them known as bile canaliculi.

The cell membranes near these canaliculi are joined by tight junctions.

In addition, hepatocytes contain the following organelles:

- Smooth endoplasmic reticulum
- Mitochondria
- Golgi network
- Peroxisomes
- Glycogen deposits
- Lipid droplets
- Lysosomes

ii. Stroma

The stroma is a continuation of the surrounding

capsule of Glisson.

ii. Sinusoids

The sinusoids are capillaries traveling between hepatocytes

iii. The spaces of Disse

a. The Space of Disse is situated between the layers of hepatocytes and the sinusoidal endothelial cells.

b. The hepatocytes extend villi into the Space of Disse, increasing the extent and rate of material exchange, together with the microvilli.

Structures

In histological terms, the liver consists of a large number of microscopic functional units that work in unison to ensure the overall, proper activity of the entire organ. There are three possible ways of describing one such unit, as given below:

i. Classic lobule
ii. Portal lobule
iii. Liver acinus

i. Classic lobule

a. The classic lobule view focuses on the blood supply and hepatic mass arrangement.

b. The classic lobule consists of hexagonal plates of hepatocytes.

c. Within each plate, the hepatocytes radiate outwards from a central vein.

d. The hepatocytes are arranged into strips.

e. Hepatic sinusoids travel between the strips of hepatocytes, draining into the central vein.

f. One Portal canal is located at each corner of the hexagonal classic lobule, making a total of six for each lobule.

ii. Portal lobule

a. The portal lobule view underlines the exocrine function of the liver i.e. bile secretion.

b. Each functional unit is a triangle, having a central axis through a portal canal and the imaginary vertices through the three different but closest portal canals surrounding it.

c. The area covered by the triangle represents the hepatic regions that secrete bile into the same bile duct.

iii. Liver acinus

The liver acinus is focused on the perfusion, metabolism, and pathology of hepatocytes. ,

a. A liver acinus functional unit is in the shape of an oval.

b. The short axis is represented by a shared border between two adjacent lobules together with the portal canals and the long axis is an imaginary line between two adjacent central veins.

c. Each liver acinus is divided into three zones, zone 1 zone 2, and zone 3 respectively.

Q. 5 Histology of stomach

Ans. Introduction

- The stomach is the part of the alimentary canal between the oesophagus and the duodenum. It is the widest and most distensible part.
- It works as a reservoir of food and convertsthe food into a semi-fluid substance referred to as chyme.
- Hydrochloric acid secreted by the gastric glands killsbacteria existing in the food and beverage.
- Citadel's intrinsic factor within the gastric juice helps in the absorption of vitamin B12 in the small intestine.

Histology

- The stomach is lined by simple columnar epithelium.
- The stratified epithelium of the oesophagus is changed into the simple columnar epithelium.
- The wall of the stomach is composed of 4 coats. From outside inward, all these are serous, muscular, submucous, and mucous coatings.

- The coats differ in cardiac, fundal, and pyloric parts.

The histology of the stomach is studied at the following three places:

i. ***Cardiac end***
ii. ***Fundus and***
iii. ***Pyloric end***

i. ***Cardiac end***

a. The cardiac end is composed of 4 coats.
b. From outside inward, all these are serous, muscular, submucous, and mucous coatings.

Serous coat

The serous coat or serosa at the cardiac end is lined by a single layer of squamous cells.

Muscular coat

The muscular coat at the cardiac end is made up of outer longitudinal and inner circular layers.
The myenteric plexus of nerves are found in the muscular coat.

Submucous coat

The submucous coat at the cardiac end consists of loose connective tissue with Meissner's plexus.

Mucous coat

The epithelium of the mucous membrane at the cardiac end is a simple columnar with small tubular glands.
The lower half of the gland is of secretory type whereas the upper half is of conducting type.

ii. ***Fundus***

a. The fundus is composed of 4 coats.
b. From outside inward, all these are serous, muscular, submucous, and mucous coatings.

Serous coat

The serous coat or serosa at the cardiac end is lined by a single layer of squamous cells.

Muscular coat

The muscular coat at the cardiac end is made up of outer longitudinal and inner circular layers.
The myenteric plexus of nerves are found in the muscular coat.
It also contains an additional innermost oblique coat of muscle fibers.

Submucous coat

The submucous coat at the cardiac end consists of loose connective tissue with Meissner's plexus.

Mucous coat

The mucous membrane contains tall simple tubular gastric glands.
The lower two-third of the gland is of secretory type whereas the upper one-third is of conducting type.

iii. Pyloric

a. The pylorus is composed of 4 coats.
b. From outside inward, all these are serous, muscular, submucous, and mucous coatings.

Serous coat

The serous coat or serosa at the cardiac end is lined by a single layer of squamous cells.

Muscular coat

The muscularisexterna is made up of a thick layer of circular fibers forming the pyloric sphincter.

Mucous coat

The mucous membrane contains pyloric glands.
The lower one-third of the gland is mucus secretory component and the upper two-third is the conducting part.

Q. 6 Histology of Pancreas

Ans. Introduction

- Pancreas is partly exocrine and partly endocrine gland.
- The exocrine part secretes the digestive juices and the endocrine part secretes the hormones.

Histology

For the histological study, both the exocrine and endocrine parts are being considered.

a. Exocrine part

- The exocrine part is a serous gland, made up of tubular acini.
- These acini are lined by pyramidal cells.
- The pyramidal cells are having basal round nuclei.
- The pyramidal cells contain the zymogen granules.
- The exocrine part secretes the digestive pancreatic juice.

b. Endocrine part

- The endocrine part is made up of microscopic elements.
- These elements are called as pancreatic islets of Langerhans.
- The pancreatic islets of Langerhans are isolated masses of cells distributed throughout the pancreas.
- They are most numerous in the tail of the pancreas.
- The pancreatic islets of Langerhans have beta and alpha cells.
- The beta cells are granulated basophilic types of cells.
- They form about 80% of the cell population.
- The beta cells produce insulin.
- The alpha cells are granular and acidophilic.
- The alpha cells form about 20% of the cell population.
- The alpha cells are of two subtypes A1 and A2 respectively.
- The A1 cells belong to enterochromaffin group and secrete gastrin and serotonin.
- The A2 cells secrete glucagon.

Q. 7 Histology of Lung

Ans. Introduction

- The lungs are a pair of respiratory organs situated in the thoracic cavity.
- The alveoli are the end part of the bronchial tree.

Histology

- The visceral pleura of the lung is covered by mesothelium.
- The structure of the lung is a lacework of alveoli. They are separated by thin-walled septa.
- This is traversed by a system of intrapulmonary bronchi, bronchioles, and alveolar ducts, into which atria, alveolar sac, and alveoli open.

***i.* Intrapulmonary bronchus**

a. The Intrapulmonary bronchus is lined by pseudostratified ciliated columnar epithelium with goblet cells resting on a thin basement membrane.

b. The cilia prevent the accumulation of mucus in the bronchial tree.

c. The lamina propria consists of reticular and elastic fibers.

d. The submucosal coat contains both mucous and serous acini.

e. A complete layer of smooth muscle fibers is present which is responsible for infoldings of the mucous membrane.

f. The outermost is hyaline cartilage which is visible as small cartilaginous plates of varying sizes and shapes with tunica adventitia.

g. The terminal bronchiole is part of conducting system of the respiratory pathway.

h. It is less than 1 mm in diameter.

i. It is lined by simple columnar epithelium.

j. The lamina propria contains elastic and smooth muscle fibers.

k. Both the glands and cartilages are absent in terminal bronchioles.

***ii.* Respiratory Bronchiole**

a. Therespiratory bronchiole is lined by cuboidal epithelium.

b. The walls of respiratory bronchioles consist of collagenous connective tissue.

c. These contain bundles of interlacing smooth muscle fibers and elastic fibers.

iii. Alveoli

a. The alveoli are thin-walled polyhedral sacs.

b. The alveoli are lined by two types of cells, which rest on a basement membrane.

c. The elastic fibers provide the main support to the alveoli.

d. The majorities of cells lining the alveoli are the squamous cells or type I pneumocytes.

e. Few cells are larger or type II pneumocytes.

- The type II cells secrete the surfactant which lowers surface tension and prevents alveoli from collapsing.

Anatomy II- 1

1. Course and year : First BHMS (2015)
2. Subject Code : 04111A
3. Subject (PSP) : ANATOMY
   (TT) : ANATOMY
4. Paper : II
5. Total marks : 100
6. Total time : 3 hrs

Q. 1 Write short Ans (any ten out of fifteen)

a. Name the parts of large intestine.
b. Name two structures passing through inguinal ring in females.
c. Name two arteries supplying pancreas.
d. Write contents of rectus sheath.
e. Write down any two ligaments of spleen.
f. Name the muscles supplied by sciatic nerve
g. Name ligaments of ankle joint
h. Name any two content of popliteal Fossa.
i. Write origin and insertion of sartorius muscle.
j. Name two contents of adductor canal
k. Total no. of true ribs
l. Which is the principle muscle of respiration?
m. What are the major openings of diaphragm?
n. Crux is meeting point of which vessels?
o. Name 2 contents of middle mediastinum

Q. 2 Write shorts (any four out of six)

a. Describe external features of left lung
b. Write in detail about Tracheobronchial Tree
c. Describe in detail the Thoracic Inlet
d. Describe in detail the Superior Mediastinum
e. Describe in detail trachea.
f. Write about Conducting System of Heart

Q. 3 Write shorts (any four out of six)

a. Anterior tibial artery
b. Femoral Triangle
c. Write short Iliotibial tract
d. Histology of Lung
e. Histology of stomach
f. Histology of kidney

Q. 4 Write longs (two out of four)

a. Describe in detail the Femoral Artery.
b. Write the Anatomy of Obturator Nerve.
c. Write in detail Arches of foot.
d. Describe Ankle joint in detail.

Q. 5 Describe the anatomy of Liver in detail

Q. 6 Describe anatomy of Left kidney in detail

Q. 7 Describe anatomy of Uterus in detail

Anatomy II - 2

1. Course and year : First BHMS (2015)
2. Subject Code : 04111A
3. Subject (PSP) : ANATOMY
   (TT) : ANATOMY
4. Paper : II
5. Total marks : 100
6. Total time : 3 hrs

Q. 1 **Write shorts (any ten out of fifteen)**

a. Name the branches of abdominal aorta.
b. Name the structures forming stomach bed
c. Mention formation of Hepatopancreatic ampulla.
d. Write the subdivisions of duodenum
e. Mention Ends of oesophagus
f. Name the muscles forming quadriceps femoris
g. Name the branches of dorsalis pedis artery.
h. Name the bones forming knee joint.
i. Mention the muscles of posterior compartment of the leg.
j. Name the divisions of sciatic nerve
k. Any two structures of tracheobronchial tree
l. How many bronchopulmonary segments are there in the left lung?
m. What are the sinuses present in pericardium?
n. What are the vertebral levels of different diaphragmatic openings?
o. Name the tributaries of Hemiazygos Vein

Q. 2 **Write shorts (any four out of six)**

a. Describe coronary circulation
b. Describe in detail the Middle Mediastinum
c. Describe in detail the Root of right lungs.
d. Bronchopulmonary segments
e. Blood supply of the heart
f. Openings in the Diaphragm

Q. 3 Write shorts (any four out of six)

a. Femoral nerve.
b. Fascia Lata
c. Dorsalis pedis artery
d. Histology of Lung
e. Histology of Testis
f. Histology of duodenum

Q. 4 Write longs (two out of four)

a. Write the Anatomy of Sciatic nerve.
b. Write in detail the Hip Joint
c. Describe Great Saphenous Vein in detail.
d. Write the Anatomy of Popliteal Fossa.

Q. 5 Describe the anatomy of the stomach in detail

Q. 6 Describe anatomy of the right kidney in detail

Q. 7 Describe anatomy of the rectum in detail

Anatomy II - 3

1. Course and year : First BHMS (2015)
2. Subject Code : 04111A
3. Subject (PSP) : ANATOMY
   (TT) : ANATOMY
4. Paper : II
5. Total marks : 100
6. Total time : 3 hrs

Q. 1 Write shorts (any ten out of fifteen)

a. Name the parts of the pancreas.
b. Mention different positions of vermiform Appendix.
c. Write any two differences between Jejunum and ileum.
d. Mention visceral relations of liver
e. Write down Layers of kidneys
f. Write any four ligaments of Hip joint
g. Write the names of muscles of the anterior compartment of the leg.
h. Name the hamstring muscles.
i. Name the branches of popliteal artery.
j. Mention muscle supplied by femoral nerve.
k. Any two branches of left coronary artery
l. Above downwards what are the structures passing through the right hilum?
m. What are the branches of arch of aorta?
n. Write the names of structures forming boundaries of superior mediastinum
o. Write any four differences between right ventricle and left ventricle of the heart.

Q. 2 Write shorts (any four out of six)

a. Describe in detail the Root of left lungs.
b. Describe Pericardium in detail
c. Openings in the Diaphragm
d. Describe in detail the Superior Mediastinum
e. Describe in detail the Thoracic Inlet
f. Write in detail about Tracheobronchial Tree

Q. 3 Write shorts (any four out of six)

a. Quadriceps femoris muscle
b. Adductor canal
c. Gluteus maximus muscle
d. Histology of Lung
e. Histology of stomach
f. Histology of Testis

Q. 4 Write longs (two out of four)

a. Write in detail the Hip Joint
b. Write in detail Arches of foot.
c. Write the Anatomy of Popliteal Fossa.
d. Describe in detail the Femoral Artery.

Q. 5 Describe anatomy of spleen in detail

Q. 6 Describe anatomy of duodenum in detail

Q. 7 Describe anatomy of the anal canal in detail. Note on its applied anatomy.

Anatomy II - 4

1. Course and year : First BHMS (2015)
2. Subject Code : 04111A
3. Subject (PSP) : ANATOMY
   (TT) : ANATOMY
4. Paper : II
5. Total marks : 100
6. Total time : 3 hrs

Q. 1 **Write shorts (any ten out of fifteen)**

a. Write visceral relations of the spleen.
b. Write the main feature of the large intestine.
c. Mention position of the appendix.
d. Name the ligaments of spleen
e. What is the ligament of Treitz?
f. Write the names of muscles producing locking and unlocking of the knee joint.
g. Name the structures passing deep to flexor retinaculum of ankle joint.
h. Mention the muscles in the second layer of the sole of foot.
i. Mention the muscles forming boundaries of the adductor canal.
j. Name branches of deep fibular nerve
k. Name elements of conducting system of heart
l. Name subdivisions of pericardium
m. Name any four contents of posterior mediastinum
n. How many bronchopulmonary segments are there in the right lung?
o. Which muscle separates thoracic and abdominal cavity?

Q. 2 **Write shorts (any four out of six)**

a. Describe in detail trachea.
b. Write about Conducting System of Heart
c. Describe in detail the diaphragm.
d. Describe in detail the Middle Mediastinum
e. Describe in detail the Root of right lung.
f. Thoracic duct

Q. 3 Write shorts (any four out of six)

a. Ligaments of ankle joint
b. Sartorius Muscle
c. Dorsalis pedis artery
d. Histology of Liver
e. Histology of Pancreas
f. Histology of Testis

Q. 4 Write longs (any two out of four)

a. Describe Ankle joint in detail.
b. Describe Great Saphenous Vein in detail.
c. Write the Anatomy of Obturator Nerve.
d. Write in detail Arches of foot.

Q. 5 Describe the anatomy of the stomach in detail. Add a note on its applied anatomy

Q. 6 Describe the anatomy of spleen in detail

Q. 7 Describe the anatomy of Testis in detail

Anatomy II - 5

1. Course and year : First BHMS (2015)
2. Subject Code : 04111A
3. Subject (PSP) : ANATOMY
   (TT) : ANATOMY
4. Paper : II
5. Total marks : 100
6. Total time : 3 hrs

Q. 1 Write shorts (any ten out of fifteen)

a. What is the ligament of Treitz?
b. Name any 2 structures located in the right iliac fossa
c. Define Gastric triangle
d. Define Traube space of stomach
e. Write any two differences between Jejunum and ileum.
f. Mention ligaments of ankle joint.
g. Name the muscles of quadriceps femoris group
h. Any four branches of the tibial nerve
i. Write down the external rotators of knee
j. Name any 2 bones participating in the formation of the medial longitudinal arch
k. Any two anterior relations of trachea
l. Which lung may have azygos lobe?
m. What are the valves of the heart?
n. Ligamentumarteiosum attached to which two structures?
o. Write the names of major structures piercing the diaphragm.

Q. 2 Write shorts (any four out of six)

a. Bronchopulmonary segments
b. Blood supply of the heart
c. Describe oesophagus in detail.
d. Describe in detail the Inferior Mediastinum
e. Describe in detail the Root of lungs.
f. Azygos venous system

Q. 3 Write shorts (any four out of six)

a. Anterior tibial artery
b. Femoral nerve.
c. Ligaments of ankle joint
d. Histology of duodenum
e. Histology of kidney
f. Histology of Testis

Q. 4 Write longs (any two out of four

a. Describe Ankle joint in detail.
b. Write the Anatomy of Popliteal Fossa
c. Describe in detail the Femoral Artery.
d. Write the Anatomy of Sciatic nerve.

Q. 5 Describe the anatomy of the Duodenum in detail

Q. 6 Describe the anatomy of Liver in detail

Q. 7 Describe the anatomy of the Urinary Bladder in detail