THE HEAD AND NECK: SKULL

Learning Objectives

Upon completion of this session, the student will be able to:

1. Identify the individual bones that form the skull.
2. Identify all of the bones of the cranium and the facial bones.
3. Describe the different parts of each individual bone and notice that it is unnecessary for medical students to know the detailed features of each individual bone.
4. Identify all bones that contribute to the orbit and nasal cavity.
5. Describe the functions of the skull.
6. Describe the structure and function of fontanels.
7. Name the anatomical parts seen in AP, Lateral and Waters views of skull, and in bone window views in CT cuts

Required Materials

- Cadaver/ Articulated Skull/ Individual Bones of the Skull
- Handouts/ Atlases of Human Anatomy
- Visual and Electronic Media
- Images.

Instructions

- There are 3 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box

before to it, the group's supervisor can question you about it and expect a correct answer.

- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 23.1

EXTERNAL VIEWS OF THE SKULL

(Figure 23.1.1 - 23.1.5)

☐ The **cranium** consists of the following bones: (single and paired)

- ☐ ***Frontal***: single bone.
- ☐ ***Parietal***: paired bones.
- ☐ **Occipital:** single bone.
- ☐ ***Temporal:*** paired bones.
- ☐ ***Sphenoid:*** single bone.
- ☐ ***Ethmoid***: single bone.

☐ The **facial bones** consist of the following bones: (single and paired)

- ☐ ***Zygomatic***: paired bones.
- ☐ ***Maxillae***: paired bones.
- ☐ ***Nasal:*** paired bones.
- ☐ ***Lacrimal***: paired bones.
- ☐ ***Vomer***: single bone.
- ☐ ***Palatine***: paired bones.
- ☐ ***Inferior conchae***: paired bones.
- ☐ ***Mandible***: single bone.

Mandible

- ☐ The mandible is the bony lower jaw, which articulates with the skull at the ***temporomandibular joint***.
- ☐ The mandible formed of:
  - ☐ Body.
  - ☐ Two rami.
  - ☐ Anterior coronoid process.
  - ☐ Posterior condyloid process or head of mandible.
  - ☐ Mandi ular notch.
  - ☐ Angle.
  - ☐ Mandibular foramen.
  - ☐ Mental foramen.
- ☐ On the mandible identify tvhe permanent dentition from the midline anteriorly to posterior: two ***incisors***, one ***canine***, two ***premolars***, and three ***molars*** making a total of sixteen teeth in one jaw and a total of 32 in an adult.

Superior View of the Skull

- ☐ Identify the following:
  - ☐ Anteriorly, the frontal bone articulates with the two parietal bones at the ***coronal suture***.
  - ☐ In the middle, the two parietal bones articulate in the midline at the ***sagittal suture***.
  - ☐ Behind, the two parietal bones articulate with occipital bone at the ***lambdoid suture***.
  - ☐ Locate the ***bregma*** and ***lambda***, and notice that the bregma is known as the anterior fontanelle and lambda is known as posterior fontanelle in infancy.

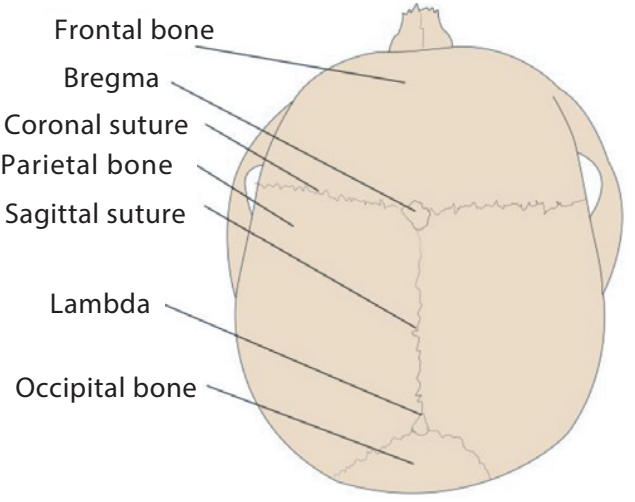

Fig. 23.1.1 Superior view of the skull

Anterior View of the Skull

- ☐ Identify the frontal bone, or forehead bone, curves downward to make the upper margins of the orbits. Observe the following:
  - ☐ Superciliary arches.
  - ☐ Supraorbital notch, or foramen.
  - ☐ Frontal bone articulates with the nasal bones medially.
  - ☐ Frontal bone articulates with the zygomatic bone laterally.
- ☐ Locate the orbital openings, and notice that the orbital margins are bounded by:
  - ☐ Frontal bone superiorly.
  - ☐ Zygomatic bone laterally.
  - ☐ Maxilla inferiorly.
  - ☐ Processes of the maxilla and frontal bone medially.
- ☐ Notice that within the frontal bone, just above the orbital margins, are two hollow spaces lined with mucous membrane called the ***frontal air sinuses***.

- ☐ Locate the anterior nasal aperture, and identify the nasal cavity, which is divided into two halves by the bony nasal septum that is largely formed by the **vomer**.
- ☐ Note that the ***superior and middle conchae*** are slopes of bone that project into the lateral wall of the nose from the ethmoid, while the ***inferior conchae***, one on each side, are one of the individual bone of the skull.
- ☐ Observe the two maxillae that form:
  - ☐ Upper jaw.
  - ☐ Anterior part of the hard palate.
  - ☐ Part of the lateral walls of the nasal cavities.
  - ☐ Part of the floors of the orbital cavities.
- ☐ Identify the two maxillae as they meet in the midline at the ***intermaxillary suture*** and form the lower margin of the anterior nasal aperture.
- ☐ Locate the ***infraorbital foramen*** below the orbit, it is perforation of maxilla (opening of infraorbital canal)
- ☐ Note that the maxilla contains hollow spaces lined with mucous membrane called the ***maxillary air sinuses***.

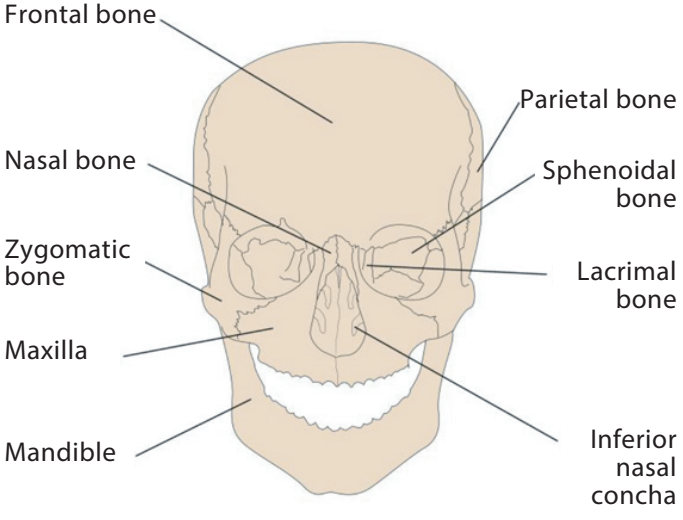

Fig. 23.1.2 Anterior view of the skull

Lateral View of the Skull

- ☐ Identify the following:
  - ☐ Frontal, parietal, temporal, and occipital bones.
- ☐ Identify the parts of the temporal bone:
  - ☐ Squamous.
  - ☐ Tympanic.
  - ☐ Mastoid Process.
  - ☐ Styloid Process.
  - ☐ Zygomatic Process.
- ☐ Note the position of the ***external auditory meatus***.
- ☐ Identify the ***greater wing of the sphenoid***.
- ☐ Identify the ***pterion***, and note that it is the thinnest part of the lateral wall of the skull where the anteroinferior corner of the parietal bone articulates with the greater wing of the sphenoid.
- ☐ Identify the superior and inferior temporal lines. The ***temporal fossa*** lies between the temporal lines.
- ☐ Identify the ***infratemporal fossa*** lies below the infratemporal crest of the greater wing of the sphenoid.
- ☐ Identify the ***pterygomaxillary fissure*** is a vertical fissure that lies (within the infratemporal fossa) between the pterygoid process of the sphenoid bone and back of the maxilla. It leads medially into the ***pterygopalatine fossa***.
- ☐ Identify the ***inferior orbital fissure*** is a horizontal fissure between the greater wing of the sphenoid bone and the maxilla. It leads forward into the orbit

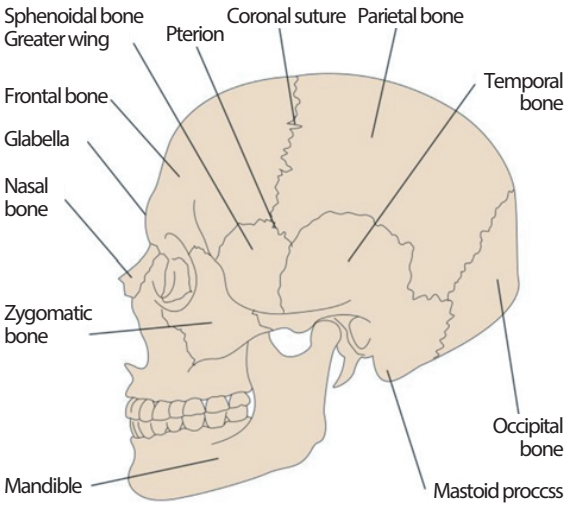

Fig. 23.1.3 Lateral view of the skull

Inferior view of the skull

- ☐ Observe that the ***palatine processes of the maxillae*** and the **horizontal palates of the palatine bones** form the ***hard palate*** and identify the following:
  - ☐ Incisive fossa and foramen.
  - ☐ Greater and lesser palatine foramina.
- ☐ Identify the ***choanae*** (posterior nasal apertures) that lies above the posterior edge of the hard palate. The choanae are separated from each other by the posterior margin of the ***vomer*** and are bounded laterally by the ***medial pterygoid plates of the sphenoid bone***.
- ☐ Identify at the inferior end of the medial pterygoid plate the prolonged curved spine of bone, the ***pterygoid hamulus***.
- ☐ Posterolateral to the ***lateral pterygoid plate***, the greater wing of the sphenoid is pierced by the large ***foramen ovale*** and the small ***foramen spinosum***. Posterolateral to the foramen spinosum is the ***spine of the sphenoid***.

- ☐ Observe that behind the spine of the sphenoid is ***petrous part of the temporal bone***.
- ☐ Locate the ***mandibular fossa*** of the temporal bone and the ***articular tubercle***.
- ☐ Locate the opening of the ***carotid canal***, ***foramen lacerum*** and ***jugular foramen***.
- ☐ Identify the ***stylomastoid foramen*** in the interval between the styloid and mastoid processes.
- ☐ Identify the ***foramen magnum***, and locate the following:
  - ☐ ***Sphenoid bone*** and the ***basilar part of the occipital bone***.
  - ☐ ***Pharyngeal tubercle***.
  - ☐ ***Occipital condyles***.
  - ☐ ***Hypoglossal canal***.
  - ☐ ***External occipital protuberance***.
  - ☐ ***Superior nuchal lines***.

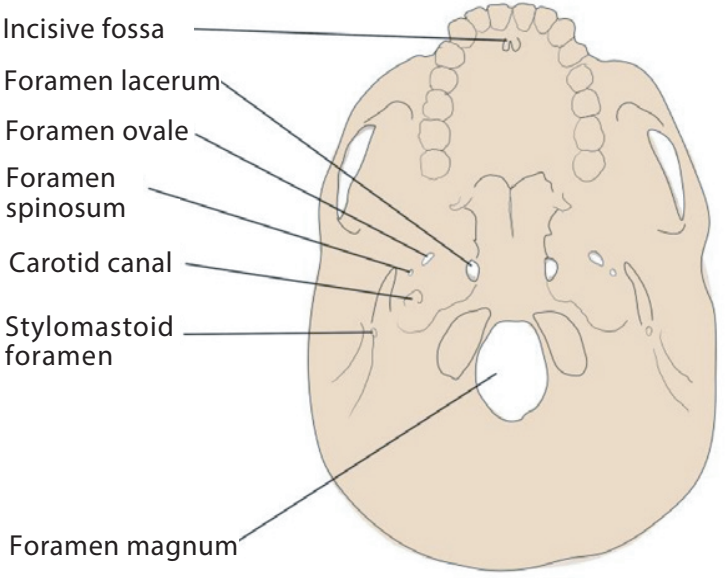

Fig. 23.1.4 Inferior view of the skull

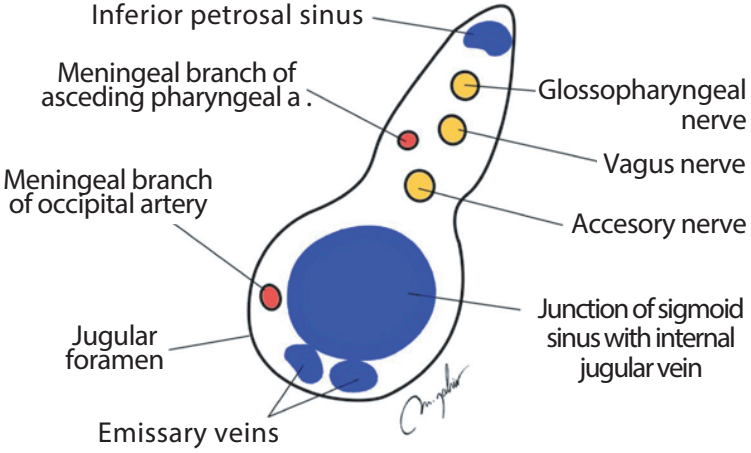

Fig. 23.1.5 Right jugular foramen and its contents

STATION 23.2

CRANIAL CAVITY

(Figure 23.2.1 + 23.2.2)

Vault of the Skull

- ☐ Notice that the internal surface of the vault shows the coronal, sagittal, and lambdoid sutures.
- ☐ Identify in the midline a shallow sagittal groove that lodges the ***superior sagittal sinus***. On each side of the groove are several small pits, called ***granular pits***.

Anterior Cranial Fossa

- ☐ Note that the anterior cranial fossa lodges the frontal lobes of the cerebral hemispheres.
- ☐ Identify the boundaries of the anterior cranial fossa:
  - ☐ Anteriorly by the inner surface of the frontal bone.
  - ☐ Posterior boundary is the sharp ***lesser wing of the sphenoid***. The medial

end of the lesser wing of the sphenoid forms the ***anterior clinoid process*** on each side.

- ☐ The median part of the anterior cranial fossa is limited posteriorly by the groove for the ***optic chiasma***.
- ☐ The orbital plates of the frontal bone form the floor of the fossa laterally and the ***cribriform plate of the ethmoid*** lies in the middle.
- ☐ The ***crista galli*** is a sharp upward projection of the ethmoid bone in the midline for the attachment of the falx cerebri.

Middle Cranial Fossa

- ☐ Note that the middle cranial fossa consists of a small median part, which is the ***body of sphenoid*** and expanded lateral parts, which lodge the temporal lobes of the cerebral hemispheres.
- ☐ Note that the body of the sphenoid contains the ***sphenoid air sinuses***.
- ☐ Identify the boundaries of the middle cranial fossa:
  - ☐ Anteriorly by the ***lesser wings of the sphenoid***.
  - ☐ Posteriorly by the superior borders of the ***petrous parts of the temporal bones.***
  - ☐ Laterally the ***squamous parts of the temporal bones***, the ***greater wings of the sphenoid***, and the ***parietal bones***.
- ☐ In the median part of the middle cranial fossa identify the following:
  - ☐ ***Sulcus chiasmatic***, which is related to the optic chiasma and leads laterally to the ***optic canal*** on each side.
  - ☐ ***Tuberculum sellae***.
  - ☐ ***Sella turcica***, which lodges the ***pituitary gland***.
  - ☐ ***Dorsum sellae***.
  - ☐ ***Posterior clinoid processes***.
  - ☐ ***Cavernous sinus***.
- ☐ In the lateral part of the middle cranial fossa identify the following:
  - ☐ ***Foramen rotundum***, ***Foramen ovale*** and ***Foramen spinosum***.

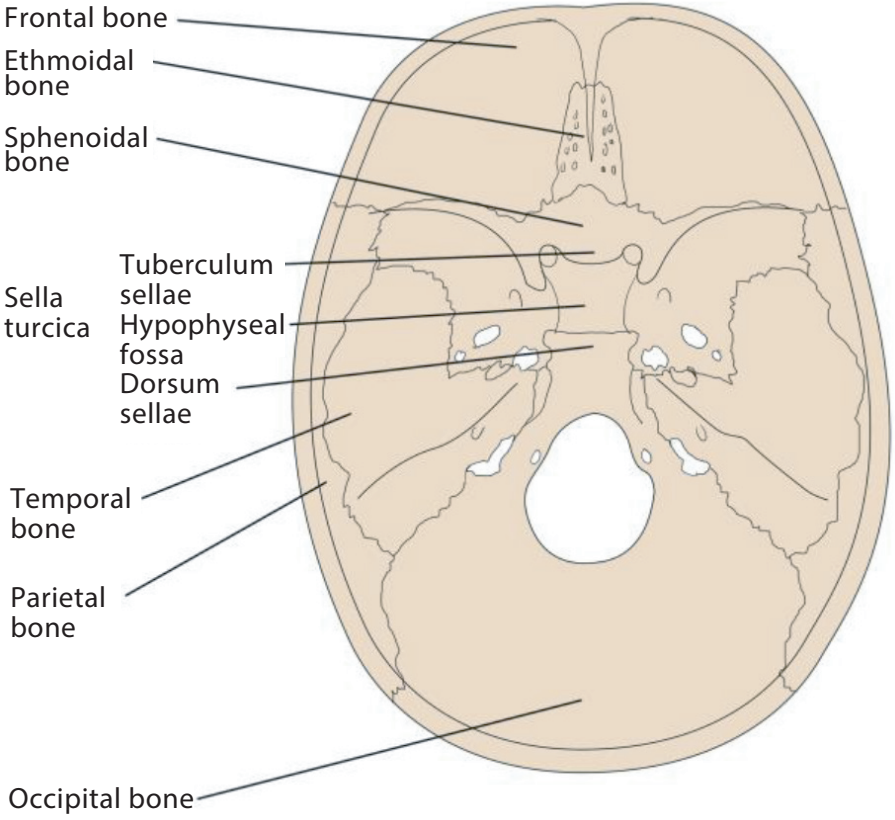

Fig. 23.2.1 Cranial cavity-bones and fossae

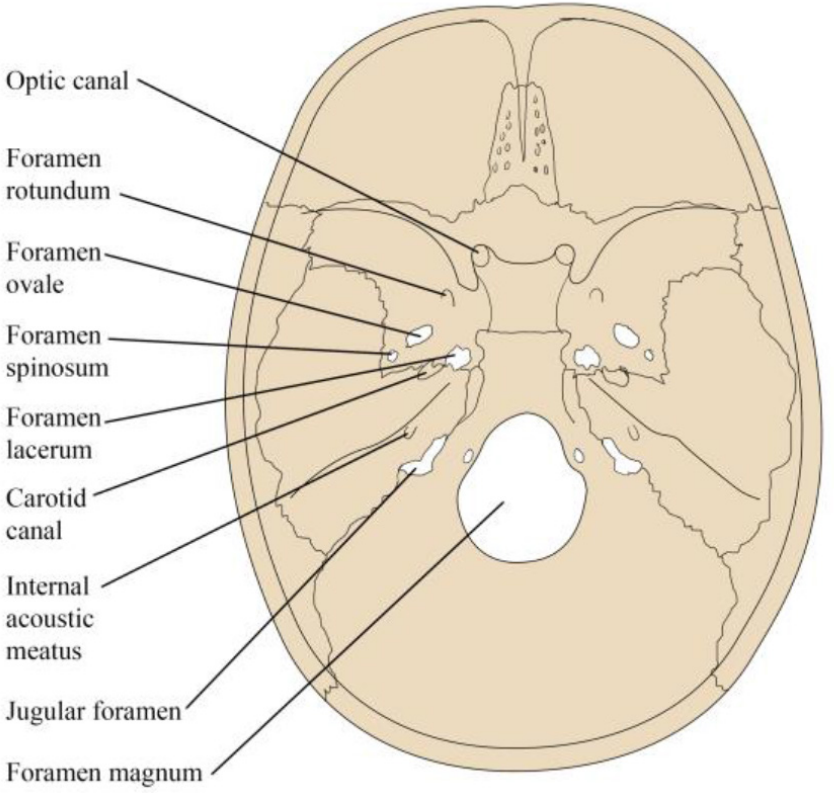

Fig. 23.2.2 Cranial cavity-foramina

Posterior Cranial Fossa

- ☐ Observe that the posterior cranial fossa is deep and lodges the parts of the hindbrain, namely, the cerebellum, pons, and medulla oblongata.
- ☐ Identify the boundaries of the posterior cranial fossa:
  - ☐ Anteriorly by the ***superior border of the petrous part of the temporal bone.***
  - ☐ Posteriorly by the internal surface of the ***squamous part of the occipital bone.***
  - ☐ The floor of the posterior fossa is formed by the ***basilar, condylar***, and ***squamous parts of the occipital bone*** and the ***mastoid part of the temporal bone***.
- ☐ Identify the following
  - ☐ ***Foramen magnum***.
  - ☐ ***Hypoglossal canal***.
  - ☐ ***Jugular foramen***.
  - ☐ ***Internal acoustic meatus***.
  - ☐ ***Superior petrosal sinus***.
  - ☐ ***Inferior petrosal sinus***.
  - ☐ ***Sigmoid sinus***.
  - ☐ ***Groove for the transverse sinus***.
  - ☐ ***Internal occipital crest.***
  - ☐ ***Internal occipital protuberance.***

STATION 23.3

THE IMPORTANT LANDMARKS ON THE CRANIAL BONES

- ☐ ***Glabella***: an area between the superciliary arches.
- ☐ ***Bregma***: the junction point of coronal and sagittal sutures. The anterior fontanelle is located.
- ☐ ***Lambda***: the junction point of lambdoid and sagittal sutures. The posterior fontanelle is located.
- ☐ ***Inion***: the tip of external occipital protuberance.

- ☐ ***Nasion***: the mid point of junction of nasal bones with frontal bone.
- ☐ ***Pterion***: the junction point of temporal, frontal, parietal and greater wing of sphenoid bone. The anterolateral fontanelle is located. Clinically, the pterion is an important area because it overlies the anterior division of the ***middle meningeal artery*** and ***vein***.
- ☐ ***Asterion:*** the junction point of lambdoid, occipitomastoid and parietomastoid sutures. The posterolateral fontanelle is located.
- ☐ ***Gonion***: the junction point of the inferior edge of body of mandible with the posterior edge of mandibular ramus.

STATION 23.4

IMAGING (23.4.1 - 23.4.4)

- ☐ Identify the structures shown in figs. 23.4.1-23.4.4.

Fig. 23.4.1 X-radiograph lateral skull. Identify: frontal bone, parietal bone,squamous temporal bone, occipital bone, orbit, maxillary sinus, sphenoid sinus, ethmoid sinus, pituitary fossa, mandibular ramus – condyloid process, external acoustic meatus, coronal suture, lambdoid suture, posterior atlantic arch.Fig. 23.4.1: Cranial cavity-foramina

Fig. 23.4.2 X-radiograph AP skull. Identify: frontal sinus, left ethmoid sinus, left nasal cavity, petrous temporal bone

Fig. 23.4.3 X-radiograph of skull base. Identify: mandible, lateral wall of orbit, temporal bone, odentoid process, sphenoid sinus, foramen ovale, foramen spinosum, mastoid air cells.

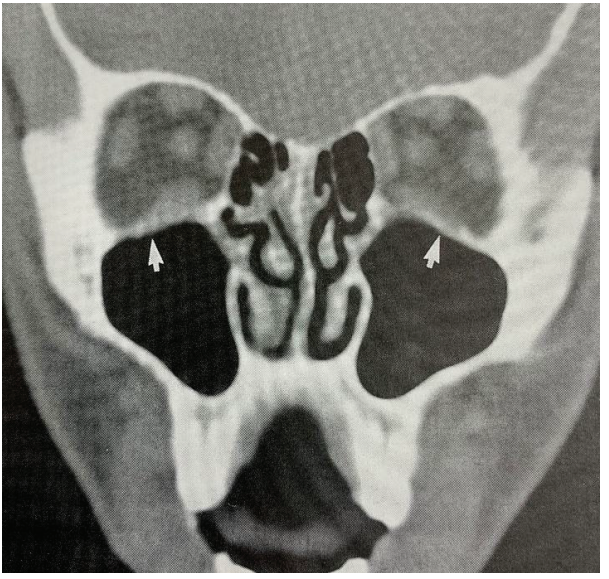

Fig. 23.4.4 CT coronal section of face. Identify: maxillary and ethmoid sinuses, nasal concha, orbital musclesQuestions

Questions

1. Mention the structure(s) pass(es) through each foramen.
2. Mention the boundaries of the infratemporal and pterygopalatine fossae.

THE SCALP AND FACE

Learning Objectives

Upon completion of this session, the student will be able to:

1. Define the scalp, its structural layers, muscles, nerves, and vessels.
2. Identify the muscles of facial expression.
3. Identify the motor and sensory innervation of the face.
4. Recognize the branches of the facial nerve in the face.
5. Trace the course of the facial artery and facial vein in the face.

Required Materials

- Cadaver/ Articulated Skull/ Model for the Muscles of the Face
- Handouts/ Atlases of Human Anatomy
- Visual and Electronic Media
- Images.

Instructions

- There are 2 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box before to it, the group's supervisor can question you about it and expect a correct answer.
- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 24.1

SCALP

- ☐ Identify the ***scalp***, which is the covering of the ***vault of the skull***.
- ☐ Note that the scalp extends from the external occipital protuberance and superior nuchal lines to the supraorbital margins, and from one ear and zygomatic arch on side to the other side.
- ☐ Note that the scalp made up of five layers selected by the letters of the word SCALP as follows:
  - ☐ S: ***Skin*****:** It includes numerous sebaceous glands and hair follicles.
  - ☐ C: ***Connective tissue***: A dense subcutaneous layer of fat and fibrous tissue, which lies under the skin, including the nerves and vessels of the scalp.
  - ☐ A: ***Aponeurosis*** called ***epicranial aponeurosis*** (or galea aponeurotica): It is a hard layer of dense fibrous tissue, which runs from the frontalis muscle anteriorly to the occipitalis posteriorly.
  - ☐ L: ***Loose areolar connective tissue*****:** Provides a plane of separation between the upper three layers and the pericranium. This layer is referred to as the "***danger zone***" by which infectious agents can extent through it to emissary veins, which then drain into the cranium.
  - ☐ P: ***Pericranium*****:** The periosteum of the skull bones.
- ☐ Identify the arterial supply of the scalp:
  - ☐ Supraorbital artery.
  - ☐ Supratrochlear artery.
  - ☐ Superficial temporal artery.
  - ☐ Posterior auricular artery.
  - ☐ Occipital artery.
- ☐ Identify the nerve supply of the scalp:
  - ☐ Supratrochlear nerve.
  - ☐ Supraorbital nerve.
  - ☐ Greater occipital nerve.

- ☐ Lesser occipital nerve.
- ☐ Zygomaticotemporal nerve.
- ☐ Auriculotemporal nerve.

STATION 24.2

MUSCLES OF FACIAL EXPRESSION

☐ Note that the ***facial muscles*** are subcutaneous (beneath the skin), muscles that control facial expression. They generally originate from the surface of the skull bone and its covering fascia, and inserted into the skin of the face. When they contract, the skin moves.

☐ Identify the ***facial nerve*** (cranial nerve VII), each nerve supplies the muscles on one side of the face.

☐ Identify the following facial muscles:

- ☐ Occipitofrontalis muscle.
- ☐ Temporoparietalis muscle.
- ☐ Auricular muscles (anterior, superior and posterior)
- ☐ ***Orbicularis oculi*** muscle.
- ☐ Corrugator supercilii muscle.
- ☐ Depressor supercilii muscle.
- ☐ ***Orbicularis oris*** muscle.
- ☐ Procerus muscle.
- ☐ Nasalis muscle.
- ☐ Depressor septi nasi muscle.
- ☐ Depressor anguli oris muscle
- ☐ Risorius muscle.
- ☐ Zygomaticus major muscle.
- ☐ Zygomaticus minor muscle.
- ☐ Levator labii superioris muscle.
- ☐ Levator labii superioris alaeque nasi muscle.
- ☐ Depressor labii inferioris muscle.

- ☐ Levator anguli oris muscle.
- ☐ ***Buccinator*** muscle.
- ☐ Mentalis muscle.

☐ Identify the ***platysma,*** which is innervated by the facial nerve. Although it is mostly in the neck and can be categorized with the neck muscles by location, it can be considered as one of the muscle of facial expression due to its common innervation.

☐ Identify the ***stylohyoid*** muscle, stapedius and posterior belly of the digastric muscle are also innervated by the facial nerve, but are not considered as muscles of facial expression.

☐ Identify the neurovascular supply of the face, which is derived from:

- ☐ Supraorbital nerve and vessels.
- ☐ Supratrochlear nerve and vessels.
- ☐ Infratrochlear nerve and vessels.
- ☐ Infraorbital nerve and vessels.
- ☐ Mental nerve and vessels.
- ☐ Superficial temporal vessels.
- ☐ Transverse facial vessels.
- ☐ ***Facial*** vessels: enter the face by crossing over the base of the mandible anterior to the masseter muscle and follow an oblique course towards the medial canthus (corner) of the eye. Along its course, the facial artery travels deep to the muscle of the face and gives the superior and inferior labial arteries, branches to the nose and ends by anastomosing with the vessels at the medial canthus.
- ☐ ***Facial nerve***: find its branches coming out from the anterior aspect of the parotid gland and coursing towards the various muscles of the face:
  - ☐ ***Temporal.***
  - ☐ ***Zygomatic***.
  - ☐ ***Buccal***.
  - ☐ ***Marginal mandibular***.
  - ☐ ***Cervical***.

Questions

1. Mention the layers of the scalp.
2. Describe the motor and sensory innervation of the face.
3. What are the branches of the facial artery?
4. What is the dangerous area of the face? Mention its clinical importance.

SALIVARY GLANDS, INFRATEMPORAL AND PTERYGOPALATINE FOSSAE

Learning Objectives

Upon completion of this session, the student will be able to:

1. Identify the location of the parotid gland posterior and deep to the ramus of the mandible, within the parotid fossa.
2. Trace the three main neurovascular structures that traverse the parotid gland: the facial nerve, the retromandibular vein and external carotid artery.
3. Locate the branches of the facial nerve in the face.
4. Identify the position and relations of the submandibular and sublingual glands.
5. Identify the boundaries and contents of the infratemporal and pterygopalatine fossae.
6. Identify the structures in the parotid triangle and in infratemporal and pterygopalatine fossae in MR images, and name the bones visible in CT cuts of this region.

Required Materials

- Cadaver/ Articulated Skull/ Model for the Face/ Head & Neck
- Handouts/ Atlases of Human Anatomy
- Visual and Electronic Media
- Images.

Instructions

- There are 2 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box before to it, the group's supervisor can question you about it and expect a correct answer.
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STATION 25.1

SALIVARY GLANDS

☐ Note that the salivary glands are exocrine glands, glands with ducts that produce saliva. Identify the following salivary glands:

Parotid glands

☐ The parotid gland are pair of major salivary glands, it is located posterior to the mandibular ramus. The parotid duct opening up into the oral cavity on the inner surface of the cheek, usually opposite the maxillary second molar tooth.

☐ Review the structures within the substance of the parotid gland, from lateral to medial, these are:

- ☐ Facial nerve.
- ☐ Retromandibular vein.
- ☐ External carotid artery.
- ☐ Superficial temporal artery.
- ☐ Branches of the great auricular nerve.
- ☐ Maxillary artery.

Submandibular glands

☐ Located beneath the lower jaws, superior to the ***digastric*** muscles.

☐ ***Submandibular duct*** or *Wharton* duct or submaxillary duct it is about

5 cm. long and its wall is much thinner than that of the parotid duct. It drains saliva from each bilateral submandibular gland and sublingual gland to the sublingual caruncle at the base of the tongue. The sublingual caruncle is a small papilla near the midline of the floor of the mouth on each side of the ***lingual frenulum***.

Sublingual glands

- ☐ Located inferior to the tongue.
- ☐ ***Sublingual duct*** (of *Bartholin*) joins the submandibular duct to drain through the sublingual caruncle.

STATION 25.2

INFRATEMPORAL AND PTERYGOPALATINE FOSSA

- ☐ Note that the ***infratemporal fossa*** is an irregularly shaped cavity, situated below and medial to the zygomatic arch.
- ☐ Identify the following boundaries of the infratemporal fossa:
  - ☐ Anteriorly, by the infratemporal surface of the maxilla.
  - ☐ Posteriorly, by the articular tubercle of the temporal and the sphenoidal spine.
  - ☐ Superiorly, by the greater wing of the sphenoid below the infratemporal crest.
  - ☐ Inferiorly, by the medial pterygoid muscle attaching to the mandible
  - ☐ Medially, by the lateral pterygoid plate.
  - ☐ Laterally, by the ramus of mandible.
- ☐ Note that the under surface of the temporal squama, containing the ***foramen ovale***, which transmits the ***mandibular branch of the trigeminal nerve***, and the ***foramen spinosum***, which transmits the ***middle meningeal*** artery.
- ☐ The infratemporal fossa contains:
  - ☐ Lower part of the ***temporalis*** and ***masseter*** muscles.
  - ☐ ***Lateral*** and ***medial pterygoid*** muscles.

- ☐ The ***internal maxillary*** vessels that gives the following branches, which found within the fossa:
  - ☐ Middle meningeal artery.
  - ☐ Inferior alveolar artery.
  - ☐ Deep temporal artery.
  - ☐ Buccal artery.
- ☐ Pterygoid venous plexus
- ☐ ***Otic ganglion***.
- ☐ ***Chorda tympani*** nerve.
- ☐ ***Mandibular nerve***, which is the third branch of the trigeminal nerve (CN V_3), also known as the "inferior maxillary nerve" or ***nervus mandibularis***, within the fossa it gives the following branches:
  - ☐ ***Inferior alveolar*** nerve.
  - ☐ ***Lingual*** nerve.
  - ☐ ***Buccal*** nerve.
  - ☐ Masseteric nerve.
  - ☐ Deep temporal nerve.
  - ☐ Lateral pterygoid nerve and medial pterygoid nerve.

☐ Locate the ***pterygopalatine fossa*** (sphenopalatine fossa), which is a fossa in the skull. It is a cone in shaped, located deep to the infratemporal fossa and posterior to the maxilla on each side of the skull, between the pterygoid process and the maxillary.

☐ Identify the boundaries of the pterygopalatine fossa:

- ☐ Anterior: superomedial part of the infratemporal surface of maxilla.
- ☐ Posterior: root of the pterygoid process and adjoining anterior surface of the greater wing of sphenoid bone.
- ☐ Medial: perpendicular plate of the palatine bone and its orbital and sphenoidal processes.
- ☐ Lateral: pterygomaxillary fissure.
- ☐ Inferior: pyramidal process of the palatine bone.

☐ Identify the contents of the pterygopalatine fossa:

- ☐ ***Pterygopalatine ganglion*** suspended by nerve roots from the maxillary nerve.

- ☐ Terminal third of the ***maxillary artery***.
- ☐ ***Maxillary nerve*** (CN V_2, the second division of the trigeminal nerve).

STATION 25.3

IMAGING (25.3.1)

☐ Identify structures shown in Fig.25.3.1.

Fig. 25.3.1 CT axial for pterygoid muscles. Identify: maxillary sinus, pterygoid plates and muscles, pharynx, masseter muscle, prevertebral tissues.

Questions

1. Mention the position of the major salivary glands.
2. Where do the ducts of the major salivary gland open?
3. Explains why parotid swellings tend to push the ear upwards and backwards.
4. What are the boundaries and contents of the infratemporal fossa?
5. What are the boundaries and contents of the pterygopalatine fossa?

THE NECK

Learning Objectives

Upon completion of this session, the student will be able to:

1. Identify the deep cervical fascia, its various layers.
2. In the root of the neck, locate the vagus and phrenic nerves and describe their relationships to the organs, fascia, vessels, and viscera of the neck.
3. Locate and describe the specific features of the thyroid gland and parathyroid glands.
4. Consider the thyroid/parathyroid gland relationship in terms of vascular supply and surgical intervention.
5. Identify the basic structures of the pharynx.
6. Identify the internal framework (skeleton) of the larynx.
7. Define the actions of the intrinsic muscles of the larynx in abducting, adducting, tensing, and relaxing the vocal folds.
8. Identify the boundaries of the anterior and posterior cervical triangles and their subdivisions.
9. Identify the sternocleidomastoid, digastric and infrahyoid (strap) muscles and list the attachments, innervation and action of each one.
10. Describe the cutaneous branches of the cervical plexus and identify their areas of distribution.
11. Name the structures seen in the lateral x-ray of the neck, and CT and MRI cuts at the level of C6.

Required Materials

- Cadaver/ Dissected Neck/ Sagittal Section of the Head & Neck
- Handouts/ Atlases of Human Anatomy
- Visual and Electronic Media
- Images.

Instructions

- There are 3 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box before to it, the group's supervisor can question you about it and expect a correct answer.
- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 26.1

ROOT OF THE NECK

Cervical Fascia

☐ Notice that the superficial cervical fascia has the following contents:

- ☐ ***Platysma*** Muscle.
- ☐ Superficial veins:
  - ☐ Anterior jugular vein.
  - ☐ External jugular vein.
- ☐ Cutaneous nerves:
  - ☐ Lesser occipital nerve.
  - ☐ Greet auricular nerve.
  - ☐ Transverse nerve of neck.
  - ☐ Supraclavicular nerve.
- ☐ Cervical branch of facial nerve.

- Notice that the deep cervical fascia has the following layers:
  - ***Investing layer*:** Encloses ***trapezius***, ***sternocleidomastoid***, ***posterior belly of digastric*** and ***parotid and submandibular glands***
  - ***Pretracheal layer***: Lies deep to the infrahyoid muscle; Encloses viscera of neck: ***pharynx, larynx, trachea, esophagus, thyroid gland*** and ***parathyroid glands***
  - ***Prevertebral layer*:** Lies anterior to bodies of cervical vertebrae and prevertebral muscles; Covers ***subclavian*** vessels and ***roots of brachial plexus.***

Thyroid Gland

- The ***thyroid gland***, is an endocrine gland in the neck, and consists of ***two lobes*** connected by an ***isthmus***. It is found at the front of the neck, below the Adam's apple.
- Note that the thyroid has an anterolateral surface covered by the infrahyoid muscles and the sternocleidomastoid and a medial surface facing the trachea and esophagus.
- Identify the following structures of the thyroid glands:
  - Right and left lobes joined by a central isthmus. The upper limit of the lobes reaches to the oblique line on the lamina of the thyroid cartilage and inferiorly to the level of the sixth tracheal ring.
  - Isthmus overlies the second, third, and fourth tracheal rings.
- Locate on the posterior aspect of the gland are situated four parathyroid glands. These are usually difficult to see because they are small and have a color similar to that of the gland.
- Identify the arterial supply of the gland:
  - ***Superior thyroid artery*** of the external carotid artery.
  - ***Inferior thyroid artery*** of the first part of the subclavian artery.
- The gland has three veins: the superior, middle, and inferior thyroid veins. The superior and middle empty in the ***internal jugular vein*** while the inferior will empty in the left brachiocephalic as it crosses from left to right.

- ☐ Identify the lymphatic drainage of the thyroid gland, which flows multidirectionally into the: prelaryngeal, pretracheal, and paratracheal nodes along the recurrent laryngeal nerve and then into mediastinal lymph nodes.
- ☐ Identify the two important nerves which are related to the gland and both supply the laryngeal muscles:
  - ☐ ***Superior laryngeal nerve.***
  - ☐ ***Recurrent laryngeal nerve***.

Suprahyoid and infrahyoid muscles

- ☐ Identify the hyoid bone at the neck region and its muscular attachments.
- ☐ Note that the muscles under the hyoid bone are named as infrahyoid muscles and they pull down the hyoid bone: ***thyrohyoid, omohyoid***, ***sternothyroid*** and ***sternohyoid*** muscles.
- ☐ Note that the muscles over the hyoid bone are named as suprahyoid muscles and they pull up the hyoid bone: ***digastric, stylohyoid, mylohyoid*** and ***geniohyoid*** muscles.

Larynx

- ☐ Locate the ***larynx*** within the anterior aspect of the neck, anterior to the inferior portion of the pharynx and superior to the trachea. It is complex organ of voice production.
- ☐ Note that the larynx is composed of 3 large, unpaired cartilages (***cricoid, thyroid*** and ***epiglottis***) and 3 pairs of smaller cartilages (***arytenoids, corniculate*** and ***cuneiform***).
- ☐ Cricoid cartilage forms a complete ring surrounding the laryngeal air pathway.
- ☐ There are two sets of paired joints, which aid the movement of the vocal cords in the larynx, the cricothyroid and cricoarytenoid joints.
- ☐ Identify the ligaments of the larynx, which are:
  - ☐ ***Extrinsic ligaments***:
    - ☐ Thyrohyoid membrane.
    - ☐ Hyoepiglottic ligament.
    - ☐ Cricotracheal ligament.

- Intrinsic ligaments:
  - The ***conus elasticus***. The free superior margin of the conus elasticus is thickened to form the ***vocal ligament***, which forms the ***vocal folds (true vocal cords).***
  - The ***quadrangular membrane.*** The free lower inferior margin of this membrane is thickened to form the ***vestibular ligament***, which forms the ***vestibular folds (false vocal cords).***

- Note that the laryngeal cavity extend from laryngeal inlet, through which it communicates with the laryngopharynx, to the level of the inferior border of the cricoid cartilage through which it communicates with the trachea. It is divided into 3 major regions: the ***vestibule***, the ***ventricle*** and the ***infraglottic cavity***.

- Observe the ***rima glottidis*** is the opening between the true vocal cords and the arytenoid cartilages.

- Identify the internal laryngeal muscles:
  - ***Cricothyroid*** *muscles:* stretches and tenses the vocal ligaments.
  - ***Thyroarytenoid*** *muscles:* acts to relax the vocal ligament.
  - ***Lateral cricoarytenoid*** *muscles***:** major adductors of the vocal folds.
  - ***Posterior cricoarytenoid*** *muscles:* abductors of the vocal folds
  - ***Transverse and oblique arytenoid*** *muscles:* adduct the arytenoid cartilages, closing the posterior portion of rima glottidis. This narrows the laryngeal inlet.

- Identify the neurovascular bundle of the larynx:
  - ***Superior laryngeal*** *nerve, which is the branch of vagus nerve*
  - ***Recurrent laryngeal*** *nerve, branch of the vagus nerve*
  - Superior and inferior laryngeal arteries
  - Superior and inferior laryngeal veins
  - Note that the superior laryngeal nerve external branch takes place only in the innervation of ***cricothyroid*** muscles.
  - The rest of internal laryngeal muscles are innervated by recurrent laryngeal nerve**.**

- Note that sensory innervation to the glottis and laryngeal vestibule is by the internal branch of the superior laryngeal nerve and sensory innervation to the subglottic part is by the recurrent laryngeal nerve

Pharynx

- Locate the ***pharynx***, which is part of the digestive system and also the respiratory system. The pharynx extends from the cranial base to the ***inferior border of the cricoid cartilage at the level of C6.***
- The pharynx is divided into three sections:
  - ***Nasopharynx*** (epipharynx) extends from the base of the skull to the level of the soft palate at C1. Identify the following of the nasopharynx:
    - ***Pharyngeal tonsils and tubal tonsil***.
    - ***Eustachian tubes***, opening of Eustachian tube.
    - ***Salpingopharyngeal fold***.
    - ***Salpingopalatine fold***.
    - ***Pharyngeal isthmus***.
    - ***Pharyngeal recess*** (posteriorly carotid canal is present).
  - ***Oropharynx*** (mesopharynx) extends from the soft palate at the level of C1 to the epiglottis at the level of C3. Identify the following of oropharynx:
    - ***Palatine tonsil***.
    - ***Lingual tonsil***.
    - ***Palatoglossal arch***.
    - ***Palatopharyngeal arch***.
    - ***Oroharyngeal isthmus***.
    - ***Median*** and two ***lateral glossoepiglottic folds***.
  - ***Laryngopharynx*** (hypopharynx) extends from the epiglottis at the level of C3 to the inferior border of the cricoid cartilage, where it becomes continuous with esophagus at the level of the C6.
- Identify the pharyngeal muscles, which arranged into two groups:

- ***Circular***, which are:
  - ***Superior pharyngeal constrictor*** is found in the oropharynx.
  - ***Middle pharyngeal constrictor*** is found in the laryngopharynx.
  - ***Inferior pharyngeal constrictor*** is found in the laryngopharynx and has two components: the superior component (thyropharyngeus) has oblique fibres that attach to the thyroid cartilage and the inferior component (cricopharyngeus) has horizontal fibres that attach to the cricoid cartilage.
- ***Longitudinal***
  - ***Stylopharyngeus***
  - ***Palatopharyngeus***
  - ***Salpingopharyngeus***

- Identify the neurovascular bundle of the pharynx:
  - Innervation of the pharynx is done by the ***pharyngeal plexus***, which includes:
    - Branches of the ***glossopharyngeal nerve (CN IX)***
    - Branches of the ***vagus nerve (CN X)***
    - ***Sympathetic fibers of the superior cervical ganglion.***
  - ***Sensory*****:** each section of the pharynx have a different innervation:
    - The **nasopharynx** by the maxillary nerve (CN V2).
    - The ***oropharynx*** by the glossopharyngeal nerve (CN IX).
    - The ***laryngopharynx*** by the vagus nerve (CN X).
  - ***Motor***: ***all the muscles of the pharynx*** are innervated by the vagus nerve, except the ***stylopharyngeus***, which is innervated by the glossopharyngeal nerve.
- Blood supply of the pharynx is done by**:**

- Ascending pharyngeal, lingual, facial and maxillary arteries: branches of the external carotid artery.
- Pharyngeal venous plexus, which drains into the internal jugular vein.

STATION 26.2
CERVICAL TRIANGLES

(Figure 26.2.1 - 26.2.4)

Anterior Triangle

- Identify the anterior triangle of the neck, which is a descriptive triangle bordered by:
  - The sternocleidomastoid muscle.
  - The midline of the neck anteriorly.
  - Base of the mandible.
  - Not that the investing layer of deep cervical fascia forms the roof.
  - The anterior triangle is further subdivided into a number of smaller triangles which are as follows:
- Digastric or submandibular triangle
  - Boundaries:
    - Lateral: anterior and posterior bellies of digastric muscle.
    - Superior: Inferior border of mandible.
    - Floor: mylohyoid muscle, hyoglossus muscle, and middle constrictor of pharynx.
  - Contents:
    - Submandibular gland and duct.
    - CN XII, nerve to mylohyoid.
    - Submental artery.
- Carotid triangle

- Boundaries:
  - Superior belly of omohyoid muscle.
  - Posterior belly of digastric muscle.
  - Anterior border of sternocleidomastoid.
- Contents:
  - Carotid sinus.
  - Carotid body.
  - Carotid sheath (common carotid artery, CN X, internal jugular vein).
  - Ansa cervicalis (supply infrahyoid muscles).

- Muscular triangle
  - Boundaries:
    - Superior belly of omohyoid muscle.
    - Anterior midline of the neck.
    - Anterior border of sternocleidomastoid.
  - Contents:
    - Infrahyoid muscles (sternohyoid, sternothyroid, thyrohyoid, omohyoid).
    - Viscera of neck (thyroid gland, parathyroid glands, larynx).
- Submental triangle
  - Boundaries:
    - Apex: mandibular symphysis and bellies of digastric muscle.
    - Base: body of hyoid bone.
    - Floor: mylohyoid muscle.
  - Contents:
    - Submental lymph nodes.
    - Veins forming anterior jugular vein.

Posterior Triangle

- Identify the posterior triangle of the neck, which is bordered by:
  - Anterior: posterior border of sternocleidomastoid.
  - Posterior: anterior border of trapezius.
  - Inferior: middle third of clavicle.

- [ ] Roof: skin, superficial fascia, platysma, investing layer of deep fascia.
- [ ] Floor: muscles covered by prevertebral fascia.

- [ ] Identify the posterior triangle is divided into two triangles by the inferior belly of omohyoid muscle. The superior triangle is ***occipital triangle*** and the inferior is ***supraclavicular (subclavian) triangle***.
- [ ] Identify the ***occipital triangle*** of the neck, which is ***bordered*** by:
  - [ ] Anterior: posterior border of sternocleidomastoid.
  - [ ] Posterior: anterior border of trapezius.
  - [ ] Inferior: inferior belly of omohyoid muscle.
  - [ ] Floor: splenius, levator scapula, middle and posterior scalene muscles
- [ ] Identify the following ***contents*** of occipital triangle of the neck:
  - [ ] Accessory nerve.
  - [ ] Occipital artery.
  - [ ] Cervical plexus branches.
  - [ ] Brachial plexus (trunk part).
  - [ ] Lymph nodes.
- [ ] Identify the ***omoclavicular triangle*** of the neck, which is ***bordered*** by:
  - [ ] Anterior: posterior border of sternocleidomastoid.
  - [ ] Inferior: clavicle.
  - [ ] Superior: inferior belly of omohyoid.
  - [ ] Floor: middle scalene muscle, the first rib.
- [ ] Identify the following ***contents*** of omoclavicular triangle of the neck:
  - [ ] Brachial plexus trunk part.
  - [ ] Subclavian artery.
  - [ ] External jugular vein.
  - [ ] Supraclavicular lymph nodes.
- [ ] Identify the following ***contents*** of posterior triangle of the neck:
  - [ ] Semispinalis capitis muscle.
  - [ ] Splenius capitis muscle.

- ☐ Levator scapulae muscle.
- ☐ Scalenus medius muscle.
- ☐ Scalenus anterior muscle.
- ☐ Subclavian artery.
- ☐ Occipital artery.
- ☐ External jugular vein.
- ☐ Branches of cervical plexus.
- ☐ Spinal part of accessory nerve.
- ☐ The brachial plexus.

Sub-occipital Triangle:

- ☐ Note that the suboccipital triangle is ***located*** at the posterior part of the neck, inferior to the occipital bone, under the semispinalis capitis muscle.
- ☐ Identify the suboccipital triangle of the neck:
  - ☐ Superomedially: rectus capitis posterior major muscle
  - ☐ Inferolaterally: obliquus capitis inferior muscle
  - ☐ Superolaterally: obliquus capitis superior muscle
  - ☐ Floor: posterior atlantooccipital membrane, atlas (first cervical vertebra)
  - ☐ Roof: semispinalis capitis muscle, the greater occipital nerve and the occipital artery branches distribute at the roof.
- ☐ Identify the following ***contents*** of suboccipital triangle of the neck:
  - ☐ Vertebral artery
  - ☐ Suboccipital nerve

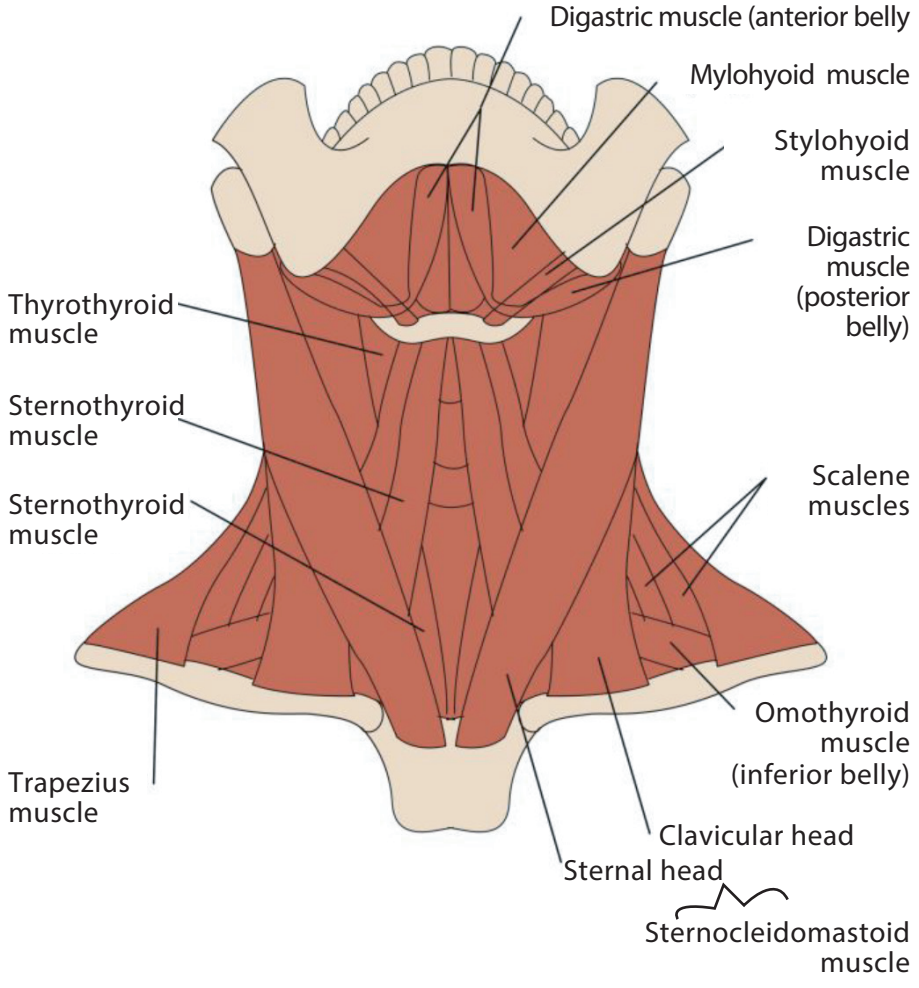


Fig. 26.2.1 Muscles of the neck, supra- and infrahyoid muscles

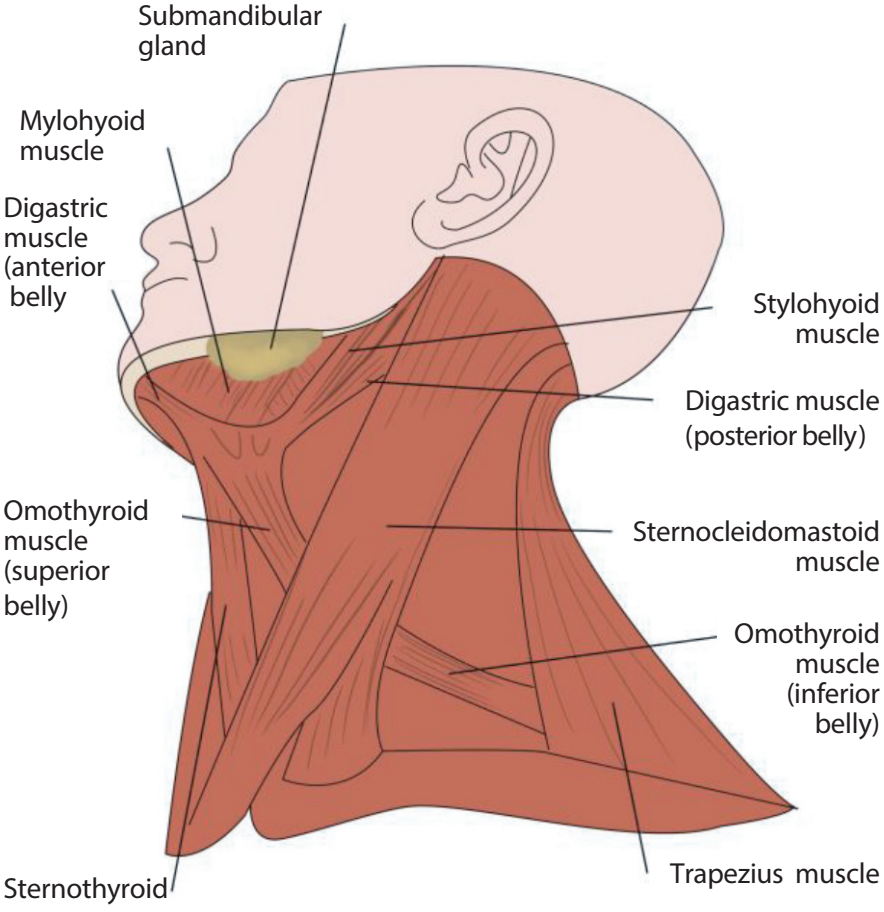


Fig. 26.2.2 Triangles of the neck

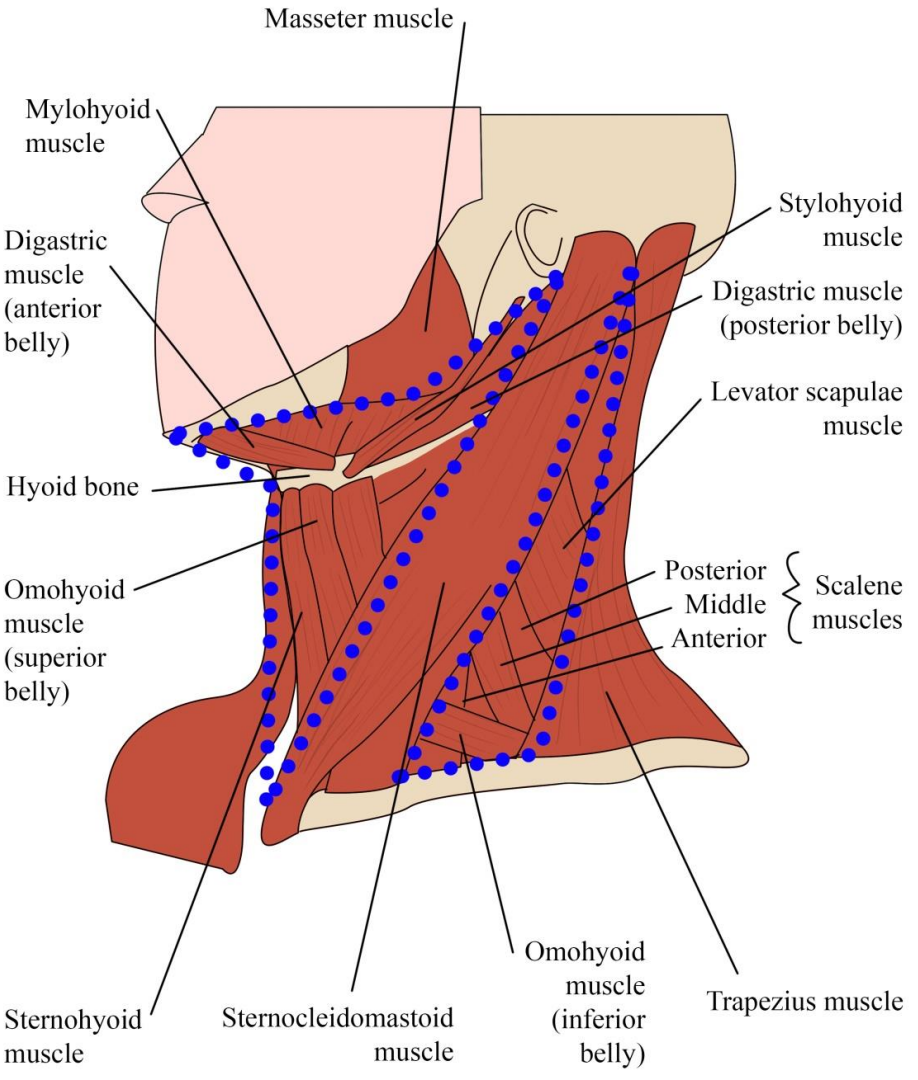


Fig. 26.2.3 Anterior and posterior triangles

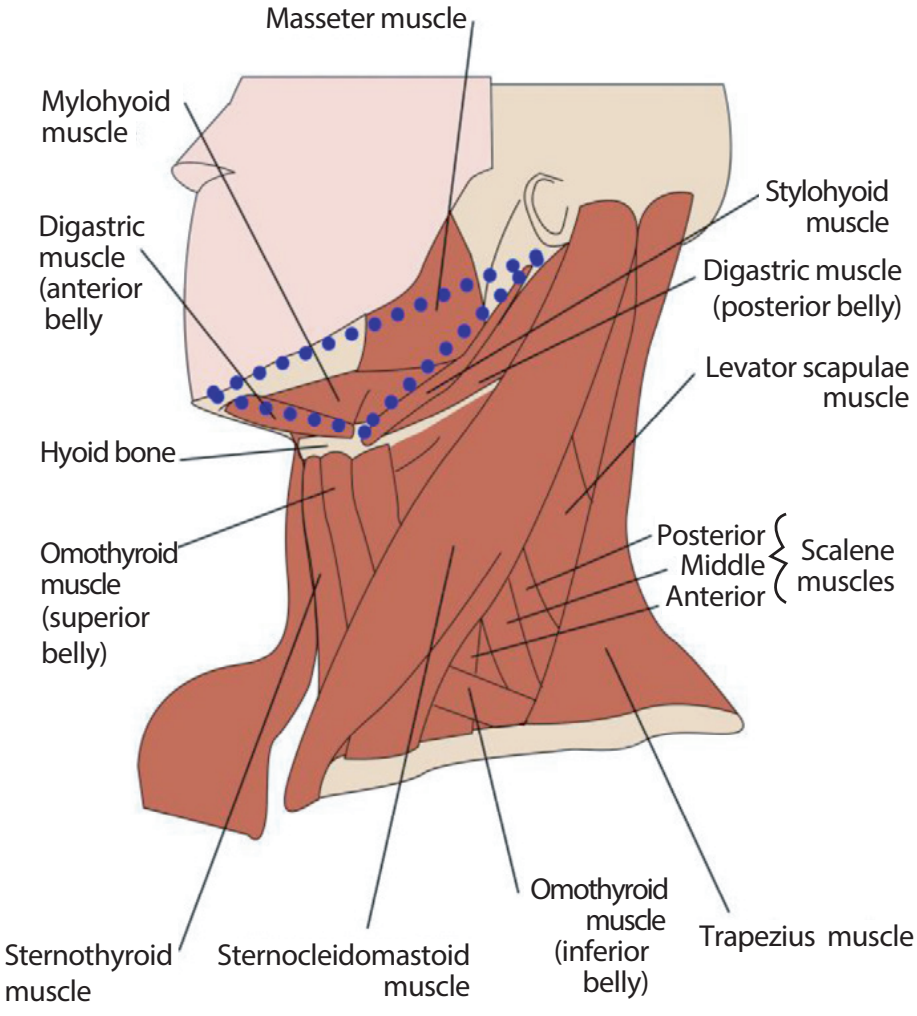


Fig. 26.2.4 (a) Digastric triangle

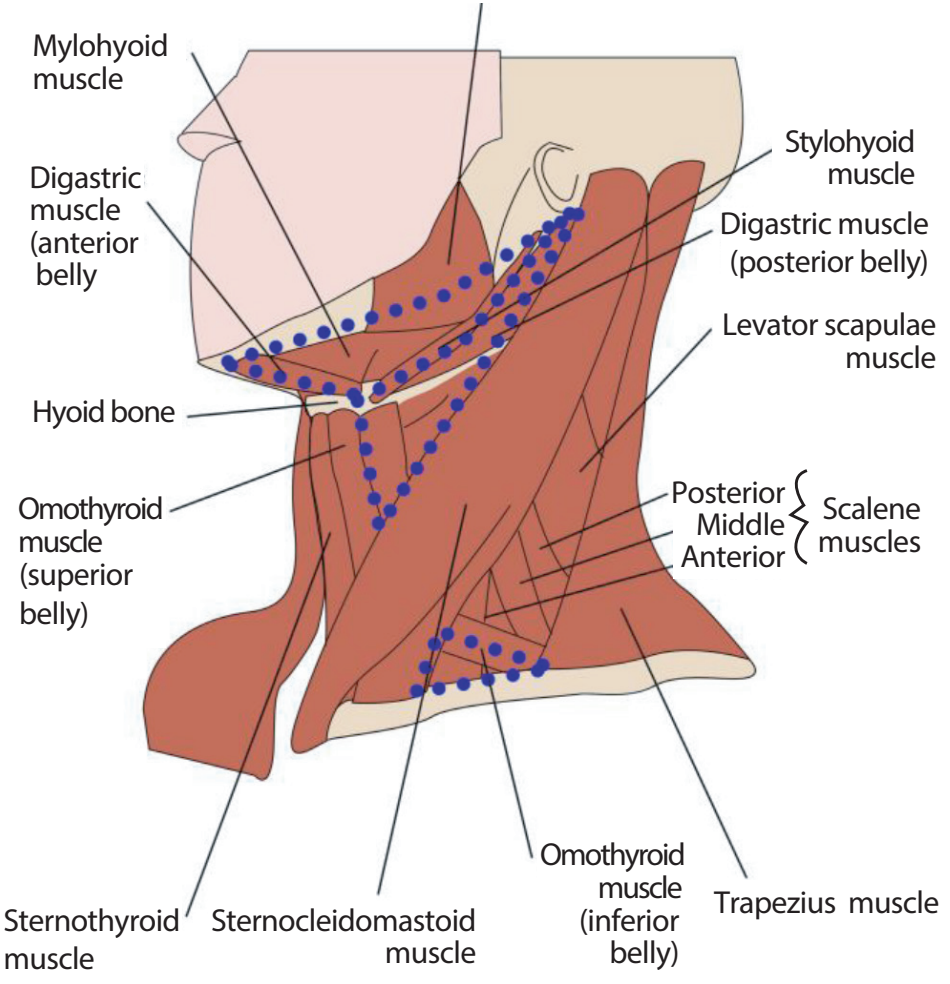


Fig. 26.2.4 (b) Submental and supraclavicular triangles

STATION 26.3

IMAGING

(Figure 26.3.1 + 26.3.2)

☐ Identify the anatomical structures seen in images 26.3.1 and 26.3.2

Fig. 26.3.1 Sagittal CT of the neck and face. Note the soft tissues in the prevertebral region.

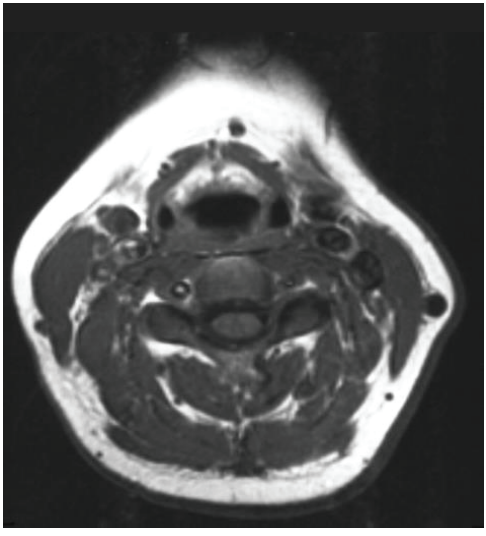


Fig. 26.3.2 Soft tissues of the neck. Identify: sternocleidomastoid, external jugular, Prevertebral

Questions

1. Mention the actions of the laryngeal muscles.
2. Describe the boundaries of each part of the pharynx.
3. Mention the actions and nerve supply of the suprahyoid and infrahyoid muscles.
4. What are t contents of the posterior triangle of the neck?

THE NERVOUS SYSTEM: THE SPINAL CORD

Learning Objectives

Upon completion of this session, the student will be able to:

1. Identify the spinal cord and locate its beginning and termination.
2. Observe the coverings and the supportive structures of the spinal cord.
3. Detect the terminal specialties of the spinal cord, their relation to lumbar puncture, and the nerve rootlets.
4. Describe the anatomy of the spinal cord (external and internal features).
5. Recognize the relationship between the spinal cord and vertebrae as related to fractures, dislocations, and possible spinal cord injury.
6. Define the location of the basic somatic motor, sensory and autonomic neurons on a cross section of the spinal cord.
7. Define the typical spinal nerves, their somatic motor and sensory components, and their distribution.

Required Materials

- Cadaver (Back is Exposing)/ Model of CNS/ Transverse Sections of the Spinal Cord
- Handouts/ Atlases of Human Anatomy
- Visual and Electronic Media
- Images.

Instructions

- There are 3 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box before to it, the group's supervisor can question you about it and expect a correct answer.
- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 27.1

EXTERNAL FEATURES OF SPINAL CORD

(Figure 27.1.1)

☐ Observe the ***spinal cord*** extends from the ***foramen magnum*** to the ***conus medullaris*** at the level of the lower border of the first lumbar vertebra.

☐ Notice that the spinal cord give rise to ***31 pairs of spinal nerves*** as following:

- ☐ 8 pairs of cervical nerves.
- ☐ 12 pairs of thoracic nerves.
- ☐ 5 pairs of lumbar nerves.
- ☐ 5 pairs of sacral nerves.
- ☐ 1 pair coccygeal nerve.

☐ Note that the spinal cord is protected by three layers of tissue, called ***spinal meninges:***

- ☐ ***Dura mater*****.**
- ☐ ***Arachnoid mater*****.**
- ☐ ***Pia mater*****.**

☐ Identify the following spaces:

- ☐ **Epidural space**: between the dura mater and the surrounding bone of the vertebrae.
- ☐ ***Subdural space***: between the dura mater and arachnoid mater.

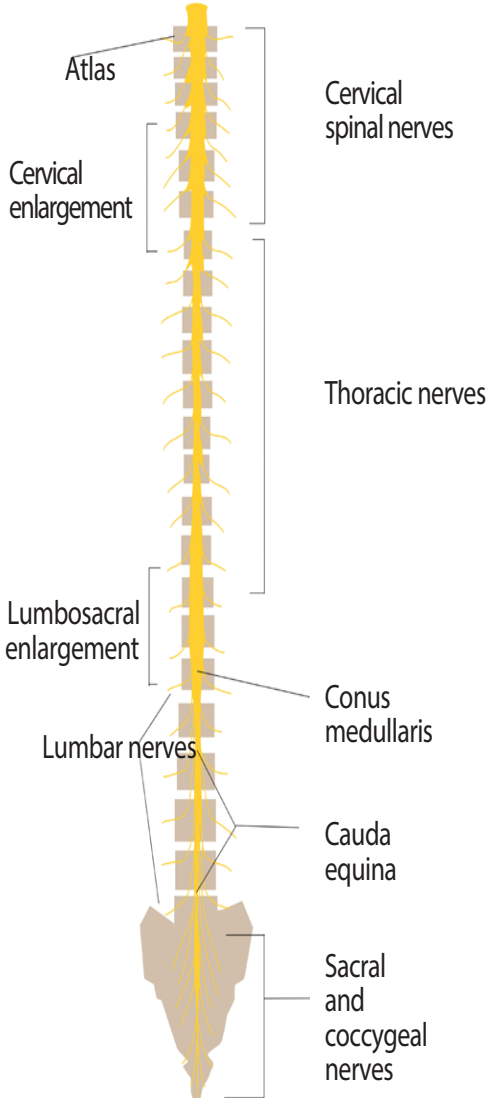


Fig. 27.1.1 External features of the spinal cord

- ☐ ***Subarachnoid space***: between the arachnoidmater and the underlyng pia mater.

☐ Identify the following:

- ☐ ***Filum terminale*.**
- ☐ ***Denticulate ligaments*.**
- ☐ ***Cauda equina*.**

☐ Observe that there are two regions where the spinal cord enlarges:

- ☐ ***Cervical enlargement***: corresponds to the brachial plexus nerves that innervate the upper limb. It includes spinal cord segments from C4 to T1. The vertebral level of the enlargement is from C4 to T1.
- ☐ ***Lumbosacral enlargement***: corresponds to the lumbosacral plexus nerves that innervate the lower limb. It includes the spinal cord segments from L2 to S3. The vertebral level of the enlargement is from T9 to T12.

STATION 27.2

INTERNAL FEATURES OF SPINAL CORD

(Figure 27.2.1)

☐ Identify the ***dorsal and ventral nerve roots of spinal nerve***.

☐ Locate the spinal nerve as they leave the vertebral canal through the intervertebral foramen.

☐ Notice that each segment of the spinal cord is associated with a pair of ganglia, called ***dorsal root ganglia***, which are situated just outside of the spinal cord.

☐ In cross-section identify the grey matter and notice the following:

- ☐ Pair of ***dorsal or posterior horns*** in all segments.
- ☐ Pair of ***ventral or anterior horns*** in all segments.
- ☐ ***Lateral horns*** in thoracic and superior lumbar segments.
- ☐ In cross-section identify the white matter and notice the following:
  - ☐ ***Dorsal white columns*.**

- ☐ ***Lateral white columns*.**
- ☐ ***Anterior white columns*.**

☐ In cross-section of spinal cord identify the following:

- ☐ ***Anterior median fissure in midline*.**
- ☐ ***Anterolateral sulcus*.**
- ☐ ***Posterior median septum in midline*.**
- ☐ ***Posterolateral sulcus*.**
- ☐ ***Posterior intermediate septum*** between the posterolateral and the midline posteriorly.
- ☐ ***Central canal of spinal cord*.**
- ☐ ***Anterior grey commissure*.**
- ☐ ***Posterior grey commissure*.**

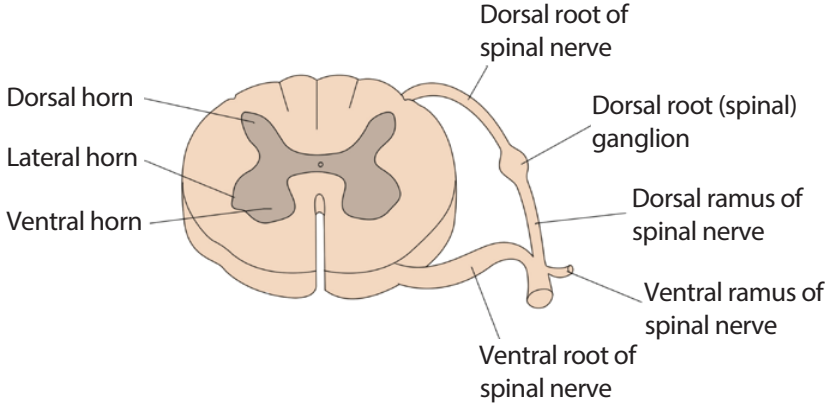


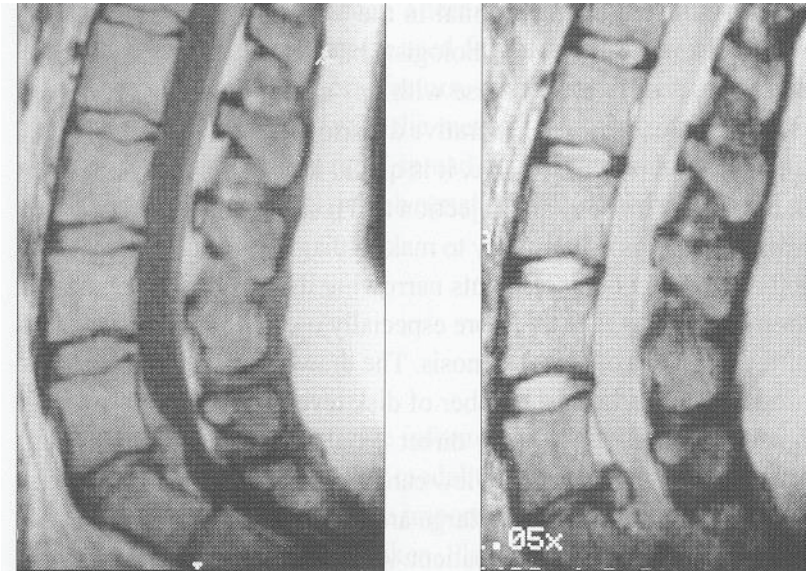
Fig. 27.2.1 Internal features of the spinal cord

STATION 27.3

IMAGING (27.3.1- 27.3.2)

- ☐ Check the structures shown in the cervical spinal cord in Fig.27.3.1.
- ☐ Identify the structures and abnormality seen in Fig.27.3.2.

Fig. 27.3.1 MRI (T1) cervical spinal cord



Fig, 27.3.2 MRI (T1, T2) of lumber spine showing L5-S1 disc herniation

Questions

1. Describe the external features of the spinal cord.
2. Describe the organization of the grey and white matter of the spinal cord.
3. Explain the formation of spinal nerves.
4. Locate the ascending and descending pathways of the spinal cord.
5. What are the functions of the spinal cord tracts?

THE BRAIN STEM AND CRANIAL NERVES

Learning Objectives

Upon completion of this session, the student will be able to:

1. Distinguish the regions of the brainstem.
2. Observe external structural features of the brainstem.
3. Identify the location of the cranial nerves within the brain stem.
4. Distinguish the ascending and descending pathways throughout the brainstem.
5. Learn the name and number of each pair of cranial nerves and identify the region of the brain to which each pair is involved.
6. Learn and perform the function for each pair of cranial nerves.
7. Identify the pass way and branches for each pair of cranial nerves.

Required Materials

- Cadaver/ Model of CNS/ Sagittal Sections of the Brain
- Handouts/ Atlas of Human Anatomy
- Visual Media

Instructions

- There are 5 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box before to it, the group's supervisor can question you about it and expect a correct answer.

- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 28.1

EXTERNAL FEATURES OF MIDBRAIN

- ☐ Identify the ***crus cerebri*** that connects the ***midbrain*** and the rest of the brainstem to the cerebral hemispheres.
- ☐ Identify the ***interpeduncular fossa***, the fossa contains:
  - ☐ ***Pituitary gland*** (or its remains) anteriorly.
  - ☐ ***Mamillary bodies*** posteriorly.
  - ☐ ***Posterior perforated substance*** posterior to the mamillary bodies
- ☐ Observe a dark band called the ***substania nigra***.
- ☐ Locate the ***cerebral aqueduct of Sylvius*** that connects the third ventricle to the fourth ventricle.
- ☐ Notice the ***tegmentum***, which is the area between the substania nigra and the aqueduct.
- ☐ Identify the ***tectum*** that is made up of two superior and inferior colliculi.
- ☐ Identify the ***superior cerebellar peduncle***.
- ☐ Locate the ***oculomotor*** and ***trochlear nerves***.

STATION 28.2

EXTERNAL FEATURES OF PONS

- ☐ Note that the ***pons*** has an anterior convexity with a midline groove anteriorly (basilar groove) for the ***basilar artery***.
- ☐ Identify the fibers that form the anterior convexity converge laterally on either side to enter the cerebellum as the ***middle cerebellar peduncles***.
- ☐ Locate the superior limit of the pons has junction with the crura, and inferiorly the pons bordered by the ***pontomedullary junction***.

- ☐ Identify the ***trigeminal nerve***.
- ☐ In the pontomedullary junction, identify the exits of the:
  - ☐ ***Abducent.***
  - ☐ **Facial.**
  - ☐ ***Nervus intermedius*.**
  - ☐ **Vestibulocochlear nerve.**
- ☐ Notice that posteriorly the lower half of the pons forms the upper part of the floor of the ***fourth ventricle***. Identify the followings:
  - ☐ ***Rhomboid fossa*.**
  - ☐ ***Median sulcus*.**
  - ☐ ***Medial eminence*.**
  - ☐ ***Sulcus limitans*.**
  - ☐ ***Facial colliculus*.**
  - ☐ ***Vestibular area.***
  - ☐ ***Stria medullaris of fourth ventricle*.**

STATION 28.3

EXTERNAL FEATURES OF MEDULLA OBLONGATA

- ☐ Note that the ***medulla oblongata*** is the last part of the brainstem before the commencement of the spinal cord.
- ☐ Anteriorly identify the following:
  - ☐ ***Anterior median sulcus*.**
  - ☐ ***Pyramids.***
  - ☐ ***Decussating pyramidal tracts*.**
  - ☐ ***Olive or olivary nucleus*.**
  - ☐ The groove separating the olive from the pyramid has the rootlets of the ***hypoglossal nerve*.**
  - ☐ The groove posterior to the olive has the rootlets of the ***glossopharyngeal, vagus and accessory nerves***.

- ☐ Posteriorly identify the following:
  - ☐ ***Posterior median sulcus*.**
  - ☐ ***Gracile and cuneate tubercles*.**
  - ☐ ***Gracile and cuneate tracts*.**
  - ☐ ***Spinal tubercles and tract*.**
- ☐ Identify the ***inferior cerebellar peduncle***.
- ☐ Note that the upper half of the medulla oblongata forms the lower half of the floor of the ***fourth ventricle***.
- ☐ On the posterior surface of the medulla oblongata try to identify the followings:
  - ☐ ***Rhomboid fossa*.**
  - ☐ ***Median sulcus*.**
  - ☐ ***Sulcus limitans*.**
  - ☐ ***Vagal trigone*.**
  - ☐ ***Hypoglossal trigone*.**

STATION 28.4

CRANIAL NERVES

(Figure 28.4.1)

- ☐ Identify the ***olfactory nerve*** and locate the olfactory bulb and olfactory tract.
- ☐ Identify the ***optic nerve*** and locate the optic chiasm and optic tract.
- ☐ Identify the ***oculomotor nerve***.
- ☐ Identify the ***trochlear nerve***.
- ☐ Identify the ***trigeminal nerve*** and locate the following:
  - ☐ Trigeminal ganglion.
  - ☐ Ophthalmic nerve:
    - ☐ Frontal nerve.
    - ☐ Nasociliary nerve.

- ☐ Lacrimal nerve.
- ☐ Maxillary nerve:
  - ☐ Infraorbital nerve.
- ☐ ***Mandibular nerve***:
  - ☐ Inferior alveolar nerve mental nerve.
  - ☐ Lingual nerve.
  - ☐ Auriculotemporal nerve.

☐ Identify the ***abducent nerve.***

☐ Identify the ***facial nerve*** and locate the following:

- ☐ Intracranial:
  - ☐ ***Geniculate ganglion***.
  - ☐ ***Greater petrosal nerve***.
  - ☐ Nerve to stapedius muscle.
  - ☐ ***Chorda tympani***.
- ☐ Extracranial:
  - ☐ Posterior auricular nerve.
  - ☐ Nerve to posterior belly of the digastric muscle.
  - ☐ Nerve to the stylohyoid muscle.
- ☐ Within the parotid gland, the nerve terminates by splitting into five branches:
  - ☐ Temporal branch.
  - ☐ Zygomatic branch.
  - ☐ Buccal branch.
  - ☐ Marginal mandibular branch.
  - ☐ Cervical branch.

☐ Identify the ***vestibulocochlear nerve.***

☐ Identify the ***glossopharyngeal nerve*** and locate the otic ganglion.

☐ Identify the ***vagus nerve*** and locate the following:

- ☐ Superior laryngeal nerve.
- ☐ Inferior laryngeal nerve.

☐ Identify the ***accessory nerve*** and observe its cranial and spinal roots.

☐ Identify the ***hypoglossal nerve***.

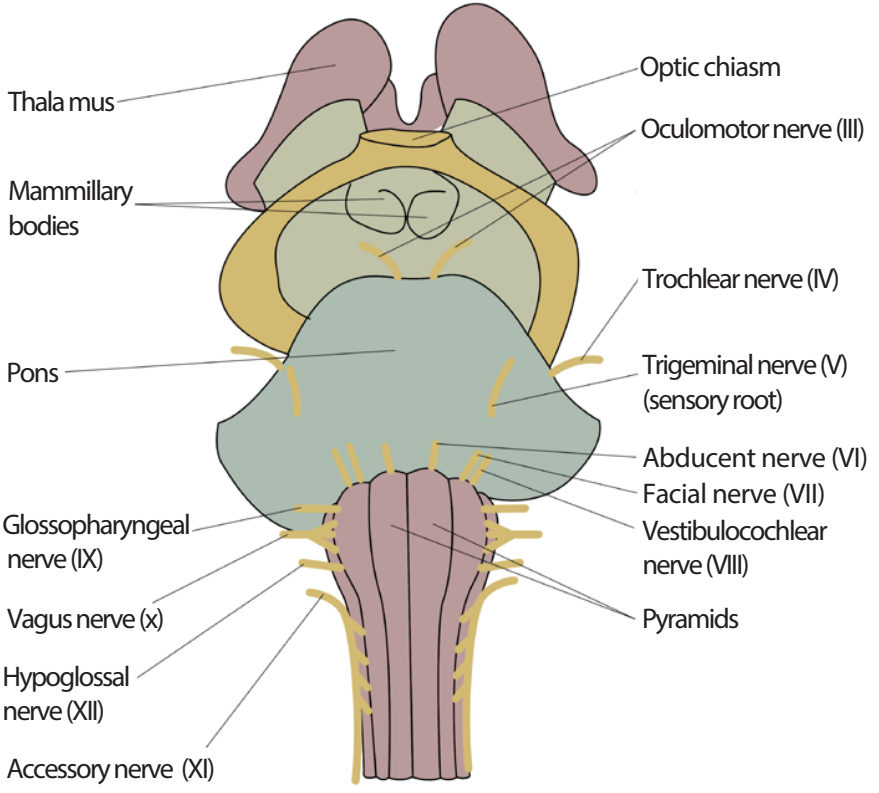


Fig. 28.4.1 (a) The Anterior surface of the brainstem

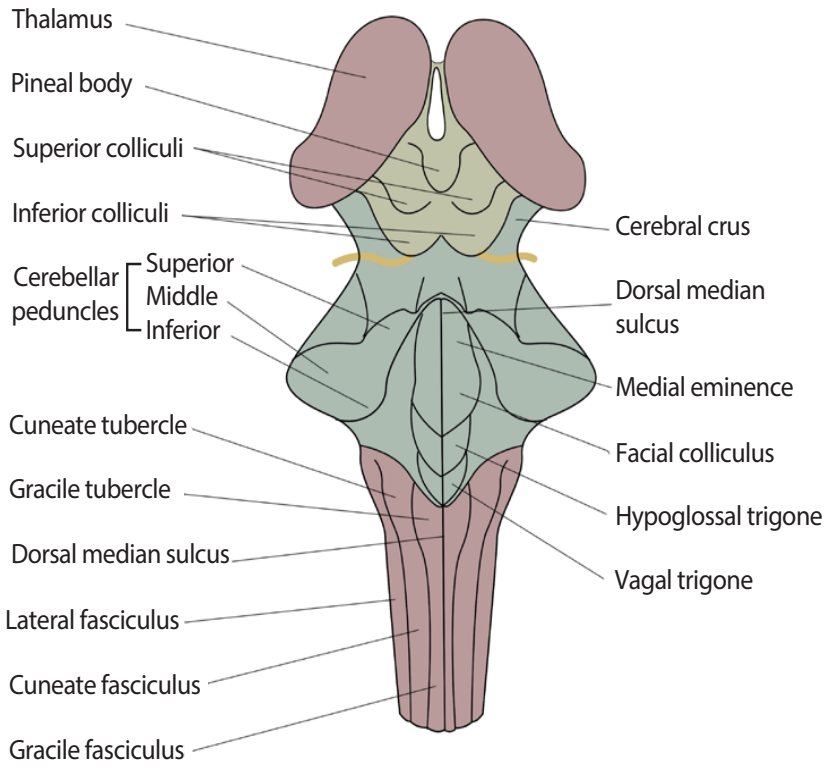


Fig. 28.4.1 (b) The posterior surface of the brainstem

STATION 28.5

IMAGING (28.5.1- 28.5.2)

☐ Identify the structures shown in Figs.28.5.1, 28.5.2.

Fig. 28.5.1 Axial CT at the level of the third ventricle. Identify the frontal and temporal lobes, lateral and third ventricles, insula

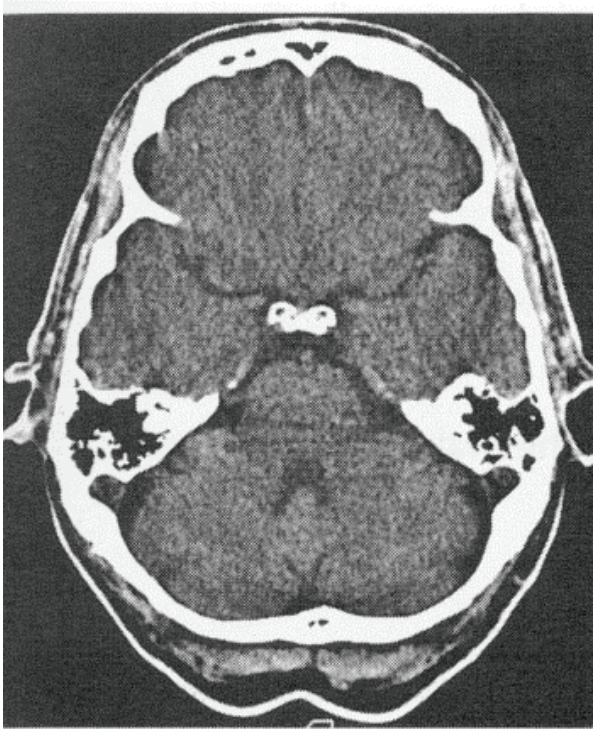


Fig. 28.5.2 Axial CT at the level of the 4th ventricle. Identify thefrontal and temporal lobes, pons, cerebellum, fourth ventricle, mastoid air cells, quadrigeminal cistern

Questions

1. Mention the external features of midbrain, pons and medulla oblongata.
2. Which nuclei of cranial nerves are present at the medulla oblongata?
3. Which nuclei of cranial nerves are present at the pons?
4. Which nuclei of cranial nerves are present at the mesencephalon?

THE CEREBRUM AND DIENCEPHALON

Learning Objectives

Upon completion of this session, the student will be able to:

1. Identify the lobes of the each cerebral hemisphere and its important gyri and sulci.
2. Identify the functional areas of the cerebral cortex, locate the areas for higher cortical functions and list the major traumatic lesions affecting the functional areas.
3. Identify the interhemispheric and intrahemispheric communications (association and commissural fibers).
4. Identify the components of the diencephalon, localize the major nuclear groups in the thalamus, hypothalamus and subthalamus and describe their functions.

Required Materials

- Cadaver/ Model of CNS/ Sagittal and Transverse Sections of the Brain
- Handouts/ Atlases of Human Anatomy
- Visual and Electronic Media
- Images.

Instructions

- There are 6 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box

before to it, the group's supervisor can question you about it and expect a correct answer.

- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 29.1

GENERAL FEATURES OF THE CEREBRAL HEMISPHERES

- ☐ Identify the two ***cerebral hemispheres*** that are the major divisions of the brain.
- ☐ Observe that each cerebral hemisphere consists of an external highly convoluted cortex and internal mass of white matter that partly surrounds the basal ganglia.
- ☐ Observe that each cerebral hemisphere encloses a lateral ventricle, which is continuous with the third ventricle through the ***interventricular foramen of Monro***.
- ☐ Observe that the two hemispheres are connected by the ***corpus callosum*** and are separated by the ***median longitudinal fissure***.
- ☐ Note that each cerebral hemisphere is divided into six lobes as following:
  - ☐ ***Frontal, parietal, occipital*** and ***temporal lobes*****,** these four lobes are named according to the overlying cranial bones.
  - ☐ The ***insular lobe*** is the fifth lobe, which is located internally to the lateral sulcus.
  - ☐ The ***limbic lobe*** is the sixth lobe, which is located on the medial surface of each cerebral hemisphere.
- ☐ Identify the following important sulci in each cerebral hemisphere:
  - ☐ ***Central sulcus*****.**
  - ☐ ***Lateral sulcus*** *(Sylvian fissure)***.**
  - ☐ ***Parieto-occipital sulcus*****.**
  - ☐ ***Calcarine sulcus*****.**
- ☐ Note that each cerebral hemisphere has the following surfaces:

- The ***superolateral surface*** : convex surface follows the concavity of the vault of the skull.
- The ***medial surface*** : flat and vertical surface, separated from the opposite hemisphere by the median longitudinal fissure.
- The ***inferior surface (basal)*** : irregular surface divided into anterior orbital and posterior tentorial parts:
  - Orbital part: lies above the roofs of orbital and nasal cavities.
  - Tentorial part: lies above the tentorium cerebelli that separates it from the superior surface of the cerebellum (in the middle cranial fossa).

STATION 29.2

SUPEROLATERAL SURFACE OF THE CEREBRAL HEMISPHERE

(Figure 29.2.1)

- In the **frontal Lobe** identify the following:
  - ***Frontal pole***: the most anterior part of the frontal lobe.
  - ***Precentral sulcus*****:** runs parallel to the central sulcus.
  - ***Precentral gyrus***: is a landmark for the primary motor area of the cerebral cortex.
  - ***Superior, middle***, and ***inferior frontal gyri*****:** separated by the ***superior*** and ***inferior frontal sulci***.
  - Observe that the anterior and ascending rami of the lateral sulcus divide the inferior frontal gyrus into ***opercular, triangular*** and ***orbital portions***. In the left hemisphere, the opercular and triangular portions consist of cortex of ***motor speech (Broca's) area.***
- In the **parietal lobe** identify the following:
  - ***Postcentral sulcus***: runs parallel to the central sulcus.
  - ***Postcentral gyrus***: is the landmark for the first somatic sensory (somesthetic) area of the cortex.
  - ***Intraparietal sulcus*****:** extends posteriorly from the postcentral sulcus and divides the surface into ***superior*** and ***inferior parietal lobules***.

- ☐ The portion of the inferior parietal lobule that surrounds the upturned end of the lateral sulcus is called the ***supramarginal gyrus*.**
- ☐ The portion of the inferior parietal lobule that surrounds the upturned end of the superior temporal sulcus is called theangular ***gyrus*.**
- ☐ In the left hemisphere, the supramarginal and angular gyri are included in the receptive language area, which is necessary for perception and interpretation of *spoken and written language (**Wernicke's) area**.*

☐ In the **temporal lobe** identify the following:

- ☐ ***Temporal pole***: the most anterior part of the temporal lobe.
- ☐ ***Superior, middle***, and ***inferior temporal gyri*:** separated by the ***superior*** and ***inferior temporal sulci***. Note that the superior temporal gyrus forms the floor of the lateral sulcus.
- ☐ ***Transverse temporal gyri*** (*Heschl's* gyri): on the anterior part of the superior temporal gyrus, extend to the bottom of the lateral sulcus and mark the location of the primary auditory area of the cortex.
- ☐ ***Planum temporale*:** on the posterior part of the superior temporal gyrus, includes part of the receptive language area.

☐ Identify the ***insular lobe*** (Insula), the regions that conceal the insula are known as the ***frontal, parietal***, and ***temporal opercula***.

☐ Note the *circular sulcus* that bordered the insula and divided it into two regions. Short gyri lie in front of the central sulcus, and one or two long gyri lie behind it.

☐ Identify the *limen insulae*, which is the inferior part of the insula.

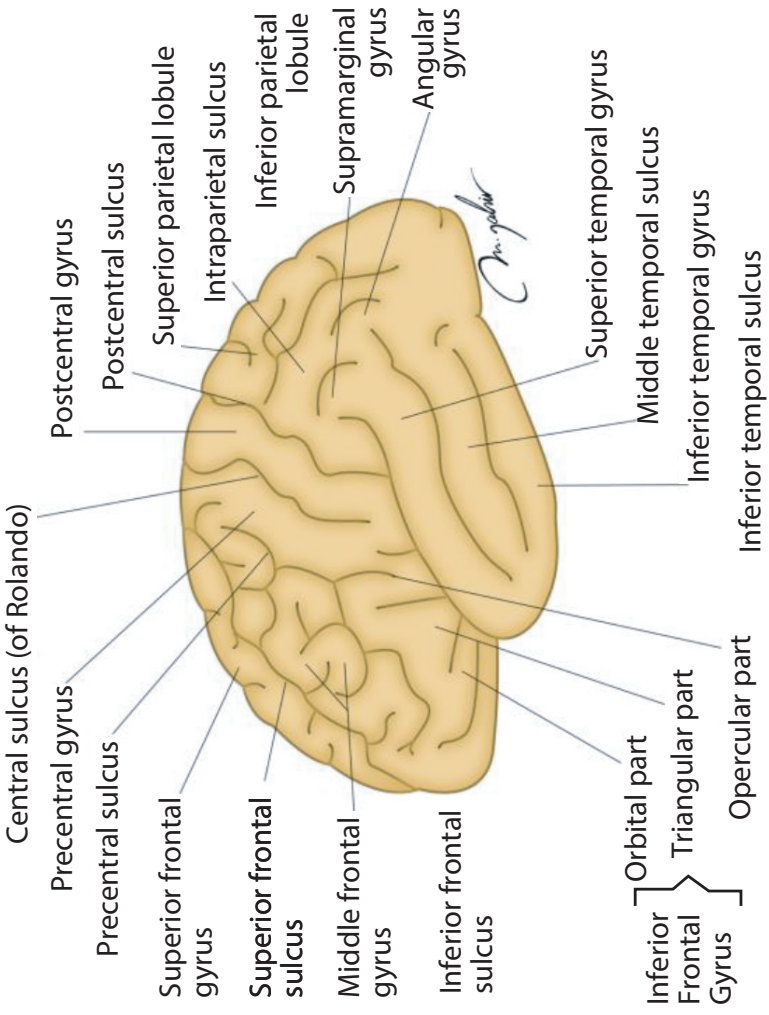


Fig. 29.2.1 Superolateral surface of the cerebral hemisphere

PRACTICAL 29

STATION 29.3

MEDIAL SURFACE OF THE CEREBRAL HEMISPHERE

(Figure 29.3.1)

- ☐ On the medial surface Identify the following:
  - ☐ ***Medial frontal gyrus***: continuous with the superior frontal gyrus on the lateral surface of the hemisphere.
  - ☐ ***Subcallosal gyrus*****:** underneath the rostrum of the corpus callosum.
  - ☐ ***Cingulate gyrus:*** begins under the genu of the corpus callosum and continues above the corpus callosum as far back as the splenium.
  - ☐ ***Cingulate sulcus*****:** release a ***paracentral sulcus*** and then divides into ***marginal*** and ***subparietal sulci*** in the parietal lobe.
  - ☐ ***Paracentral lobule***: the anterior and posterior parts of the paracentral lobule are the extensions of the precentral and postcentral gyri of the lateral surface of the hemisphere.
  - ☐ ***Precuneus:*** continuous with the superior parietal lobule on the lateral surface.
  - ☐ ***Calcarine sulcus*****:** is the landmark for the visual cortex.
  - ☐ ***Parieto-occipital sulcus*****:** extends from the calcarine sulcus to the superior border of the hemisphere, which it crosses about 4 cm from the **occipital pole**.
  - ☐ The parieto-occipital and calcarine sulci bound the ***cuneus*** of the occipital lobe.
- ☐ Identify the following commissural fibers:
  - ☐ ***Corpus callosum***.
  - ☐ ***Fornix***.
  - ☐ **Anterior commissure**.
  - ☐ ***Posterior commissure***.

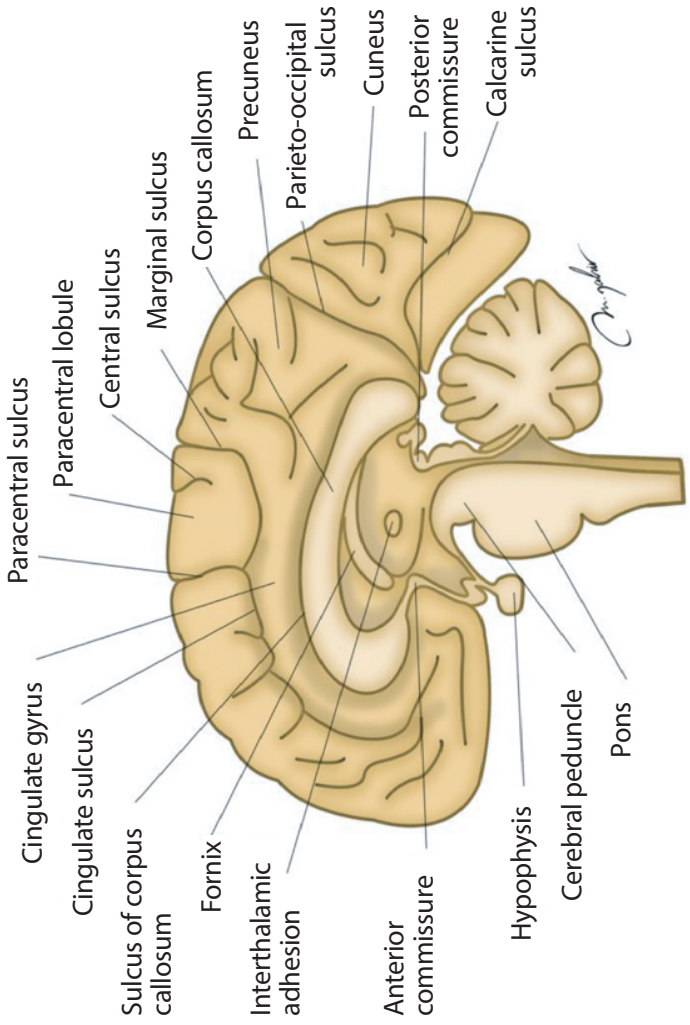


Fig. 29.3.1 Medial surface of the right cerebral hemisphere

STATION 29.4

INFERIOR SURFACE OF THE CEREBRAL HEMISPHERE

(Figure 29.4.1)

- ☐ On the inferior surface identify the following:
  - ☐ ***Orbital gyri*** (medial, anterior, posterior, and lateral): separated by H-shaped sulci.
  - ☐ ***Olfactory bulb*** and ***olfactory sulcus***.
  - ☐ ***Gyrus rectus*****:** located medially to the olfactory sulcus.
  - ☐ ***Lingual gyrus***.
  - ☐ ***Parahippocampal gyrus***: hooks forward on its medial aspect to form the **uncus** an area where fibers of the olfactory tract end.
  - ☐ ***Collateral sulcus:*** demarcates the lateral margin of the lingual and parahippocampal gyri.
  - ☐ **Rhinal sulcus**: located at the lateral edge of the parahippocampal gyrus anteriorly, demarcates the **entorhinal area**, which belongs to the olfactory and limbic systems.
  - ☐ **Medial occipitotemporal gyrus** (**fusiform gyrus)**: lies along the lateral side of the collateral sulcus.
  - ☐ **Lateral occipitotemporal gyrus**: continuous with the inferior temporal gyrus of the lateral surface of the hemisphere.
  - ☐ **Occipitotemporal sulcus**: intervenes between the medial occipitotemporal gyrus and the lateral occipitotemporal gyrus.
- ☐ Identify the ***limbic lobe*** (***limbic system)***, which integrates numerous structures, most prominently the ***hippocampus***, the ***dentate gyrus*** and the ***amygdaloid body*** (in the temporal lobe), the ***hypothalamus***, the ***septal area***, and some nuclei of the ***thalamus.***

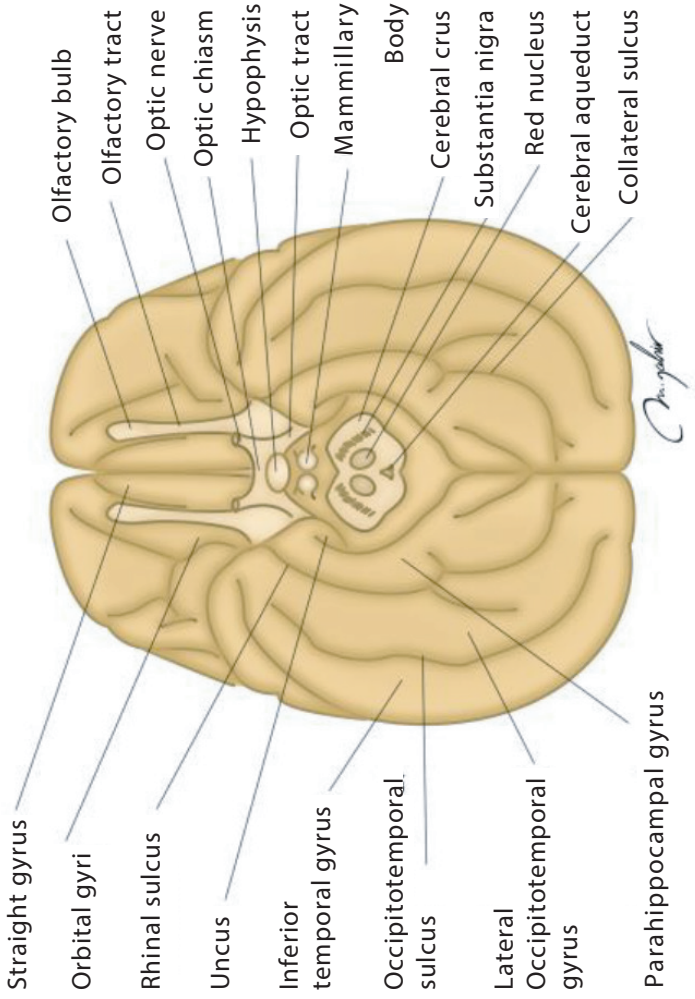


Fig. 29.4.1 Inferior surface of the cerebral hemisphere

STATION 29.5
DIENCEPHALON

(Figure 29.5.1)

- ☐ Locate he rostral end of the midbrain that merges with the ***diencephalon***, which has four subdivisions on each side, separated by the **third ventricle**, which is a slit-like cavity in the midline.
  - ☐ Identify the ***thalamus*****,** which is the largest part of the diencephalon and note the following:
    - ☐ It forms much of the wall of the third ventricle and floor of the lateral ventricle.
    - ☐ It's basic nuclei communicate with the cerebral cortex. Most thalamic nuclei also receive input from subcortical sources and some are stages in pathways for sensory, motor and cognitive activities.
    - ☐ At the anterior (rostral) end of each thalamus, the third ventricle becomes continuous with the lateral ventricle, through the ***interventricular foramen of Monro***.
  - ☐ Identify the ***interthalamic adhesion*** and ***hypothalamic sulcus***.
  - ☐ Identify the ***subthalamus***: closest to the midbrain, contains the ***subthalamic nucleus*** that involved in motor circuitry, and ascending tracts that are terminate in the thalamus: the medial lemniscus, spinothalamic tract and fibers from the cerebellum.
  - ☐ Identify the ***hypothalamus:*** is medial and rostral to the subthalamus, and has landmarks on the inferior (ventral) surface of the brain. This region controls important autonomic and endocrine functions. Neural and vascular links from the hypothalamus control the pituitary gland.
  - ☐ Identify the ***epithalamus*****:** is associated with the junction of the cerebral aqueduct and third ventricle. It includes the ***pineal gland*****,** which is dorsal to the superior colliculi of the midbrain.

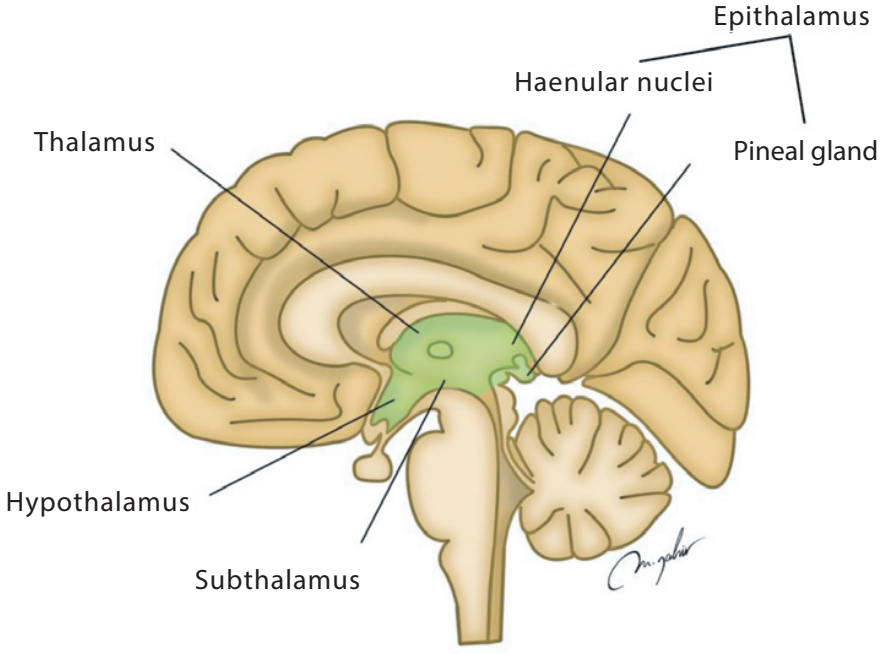


Fig. 29.5.1 The diencephalon

STATION 29.6

IMAGING (29.6.1)

☐ Identify the structures shown in Fig.29.6.1.

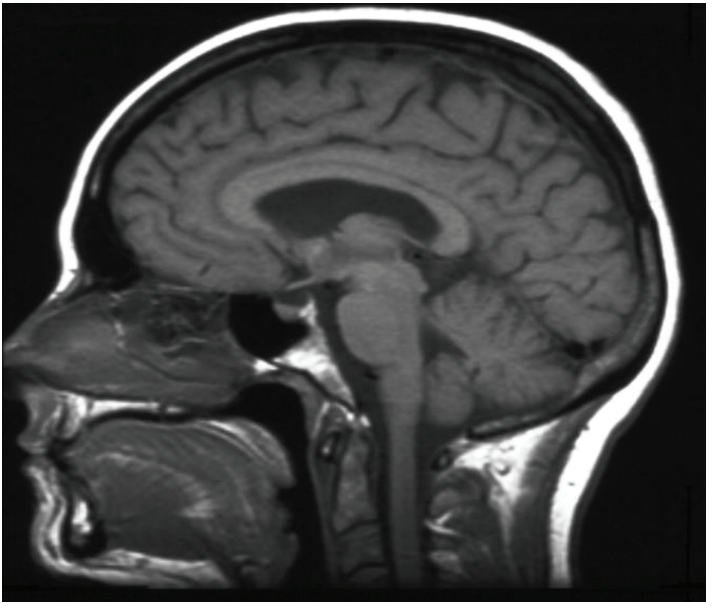


Fig. 29.6.1 Sagittal MRI (T1) of the brain showing the midline structures of the diencephalon, midbrain, pons, medulla, cerebellum fourth ventricle

Questions

1. What are the important cortical areas? Which symptoms appear due to the lesions of these cortical areas?
2. What are the functions of commissural fibers?
3. Mention the association fibers and the brain regions that are connected by them.
4. What are the functions of hypothalamic nuclei?

CEREBELLUM, BASAL GANGLIA, HYPOTHALAMUS AND HYPOPHYSIS

Learning Objectives

Upon completion of this session, the student will be able to:

1. Describe the external and internal features of the cerebellum.
2. Identify the basal ganglia and locate their position and relationship.
3. Identify the structures of the hypothalamus.
4. List the parts of pituitary gland.
5. Describe hypothalamic control of the pituitary gland.

Required Materials

- Cadaver/ Skull/ Model of CNS/ Sagittal and Transverse Sections of the Brain
- Handouts/ Atlases of Human Anatomy
- Visual and Electronic Media
- Images.

Instructions

- There are 4 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box before to it, the group's supervisor can question you about it and expect a correct answer.

- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 30.1
CEREBELLUM

- ☐ Note that the ***cerebellum*** is located at the bottom of the brain (posterior cranial fossa), with the cerebral cortex above it and the pons in front of it. It is separated from the overlying cerebrum by the tentorium cerebelli.
- ☐ Identify the cerebellum as it divided into two hemispheres; it also contains a narrow midline zone (the ***vermis***).
- ☐ Identify the nuclei of cerebellum: dentate, globosus, fastigii and emboliformis.
- ☐ Note that the cerebellum is connected to the midbrain, pons, and medulla oblongata by three pairs of peduncles:
  - ☐ The ***superior cerebellar peduncle*** (brachium conjunctivum): connects the cerebellum with the midbrain.
  - ☐ The ***middle cerebellar peduncle*** (brachium pontis): connects the pons with the cerebellum.
  - ☐ The ***inferior cerebellar peduncle*** (restiform and juxtarestiform bodies): connects the medulla with the cerebellum.
- ☐ Note that the cerebellum is divided anatomically by two transverse fissures (anterior and posterolateral or prenodular) into three lobes: anterior, posterior, and flocculonodular.

STATION 30.2
BASAL GANGLIA

(Figure 30.2.1 + 30.2.2)

- ☐ In the transverse section of the brain try to identify the followings basal ganglia:
- ☐ ***Corpus striatum***, formed of:

- ***Caudate nucleus.***
- ***Lentiform nucleus,*** has two parts:
  - ***Putamen***.
  - ***Globus pallidus***.
- ***Subsantia nigra***.
- ***Subthala3nucleus***.
- **Claustrum.**
- ***Internal capsule (anterior*** and ***posterior crura*** and ***genu***).
- ***External capsule***.
- ***Extreme capsule***.

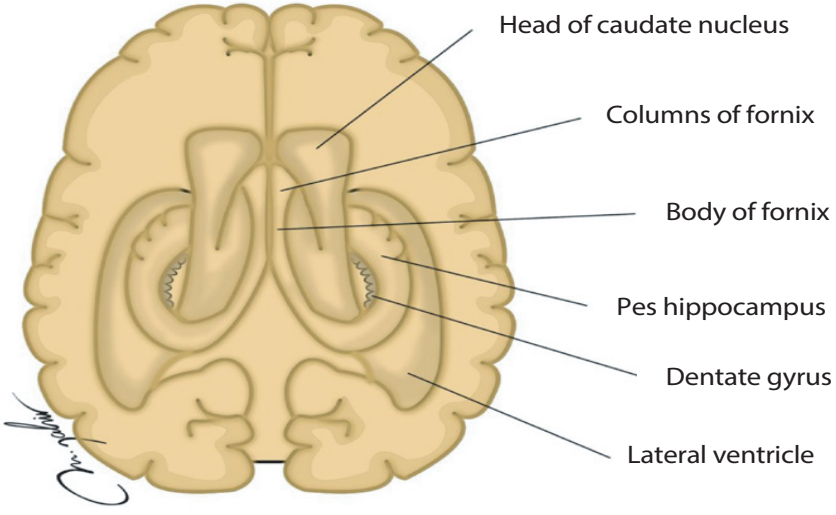


Fig. 30.2.1 Transverse section of the cerebral hemisphere showing the basal ganglia

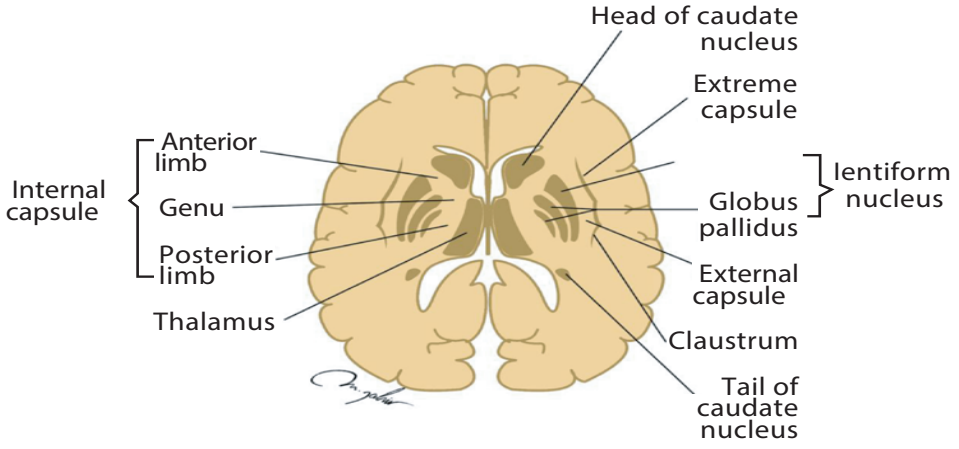


Fig. 30.2.2 Basal ganglia

STATION 30.3

HYPOTHALAMUS AND HYPOPHYSIS

- ☐ Observe the groove extending between the ***foramen of Monro*** and the ***aqueduct of Sylvius***, the ***hypothalamic sulcus***, that divides the diencephalon into a dorsal portion, the thalamus, and a ventral portion, the hypothalamus.
- ☐ Note that the ***hypothalamus*** is located below the thalamus, just above the brain stem.
- ☐ Identify from rostral to caudal three regions, which are distinguished in the hypothalamus and are correspond to three prominent features on its ventral surface:
  - ☐ ***Supraoptic*** or anterior region at the level of the ***optic chiasm***.
  - ☐ ***Tuberal*** or middle region at the level of the ***tuber cinereum*** (also known as the median eminence—the bulge from which the ***infundibulum*** extends to the hypophysis).

- ☐ Mammillary or posterior region at the level of the mammillary bodies.

☐ Identify the ***pituitary gland***, which is a pea-sized gland that lies in a protecting bony enclosure called the ***sella turcica***.

☐ It is composed of three lobes:

- ☐ Anterior.
- ☐ Intermediate.
- ☐ Posterior.

☐ Identify the ***pituitary stalk*** (also known as the infundibular stalk or simply the infundibulum), which is the connection between the hypothalamus and the posterior pituitary.

STATION 30.4

IMAGING (30.4.1)

☐ Identify the structures shown in Fig.30.4.1.

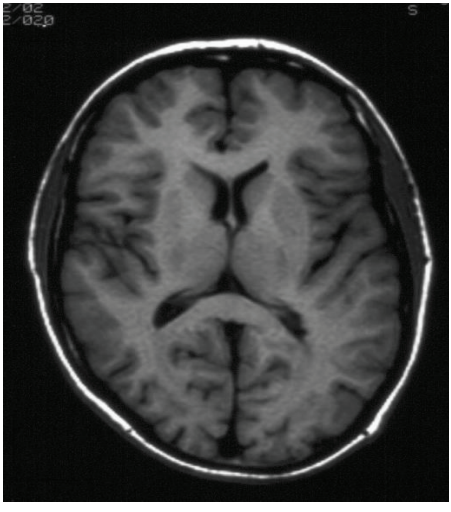


Fig. 30.4.1 Cross section of brain at level of basal ganglia showing the caudate nucleus, lentiform nucleus,, thalamus, internal capsule, lateral ventricle, third ventricle, genu and Splenium of corpus callosum

Questions

1. Describe the topography of the cerebellum and mention it is role in motor control.
2. What is functional importance of basal nuclei?
3. What are the names of important nuclei at hypothalamus?
4. Which hormones are released from the hypophysis?

VENTRICULAR SYSTEM

Learning Objectives

Upon completion of this session, the student will be able to:

1. Identify the components of the ventricular system.
2. Describe the position and relations of each ventricle.
3. Locate the position and shape of the choroid plexus in each ventricle.
4. Follow the passage of cerebrospinal fluid from its formation to absorption.

Required Materials

- Cadaver/ Model of CNS/ Sagittal and Transverse Sections of the Brain
- Handouts/ Atlases of Human Anatomy
- Visual and Electronic Media
- Images.

Instructions

- There are 3 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box before to it, the group's supervisor can question you about it and expect a correct answer.
- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 31.1
LATERAL AND THIRD VENTRICLES

(Figure 31.1.1)

- ☐ Note that the ventricular system is a set of structures containing cerebrospinal fluid within the brain. It is continuous with the central canal of the spinal cord. The ventricle lining consists of an epithelial membrane (***ependymal***).
- ☐ The system contains four ventricles:
  - ☐ ***Right*** and ***left lateral ventricles*** (first and second ventricles).
  - ☐ ***Third ventricle***.
  - ☐ ***Fourth ventricle***.
- ☐ Identify the ***lateral ventricles*****:** they are the largest of the ventricles, classified as part of the telencephalon.
- ☐ Note that the lateral ventricles connect to the central third ventricle through the ***interventricular foramen of Monro***.a
- ☐ Each lateral ventricle has five parts:
  - ☐ The anterior or frontal horn extends into the frontal lobe.
  - ☐ The body of the lateral ventricle is the central portion.
  - ☐ The posterior or occipital horn extends into the occipital lobe.
  - ☐ The inferior or temporal horn extends into the temporal lobe.
  - ☐ The trigone of the lateral ventricle is a triangular area defined by the temporal horn inferiorly, the occipital horn posteriorly, and the body of the lateral ventricle anteriorly.
- ☐ Identify the ***third ventricle*****:** it is a median cleft between the two thalami, and is filled with cerebrospinal fluid (CSF).
- ☐ Running through the third ventricle is the ***Interthalamic adhesion***, which are fibers that connect the two thalami.
- ☐ Observe the following communications of the third ventricle:
  - ☐ It communicates with the lateral ventricles anteriorly by the interven-

tricular foramina (of *Monro*).

- ☐ It communicates with the fourth ventricle posteriorly by the cerebral aqueduct (of *Sylvius*).

☐ Identify the boundaries of the third ventricle:

- ☐ The thalamus and hypothalamus on both the left and right sides.
- ☐ The lamina terminalis forms the anterior wall of the third ventricle.
- ☐ A thin layer of ependyma forms the roof of the third ventricle.
- ☐ The optic chiasm, the tuber cinereum and infundibulum, the mamilary bodies, the posterior perforated substance, and the upermost part of the tegmentum form the floor (the structures arranged from anterior to posterior).

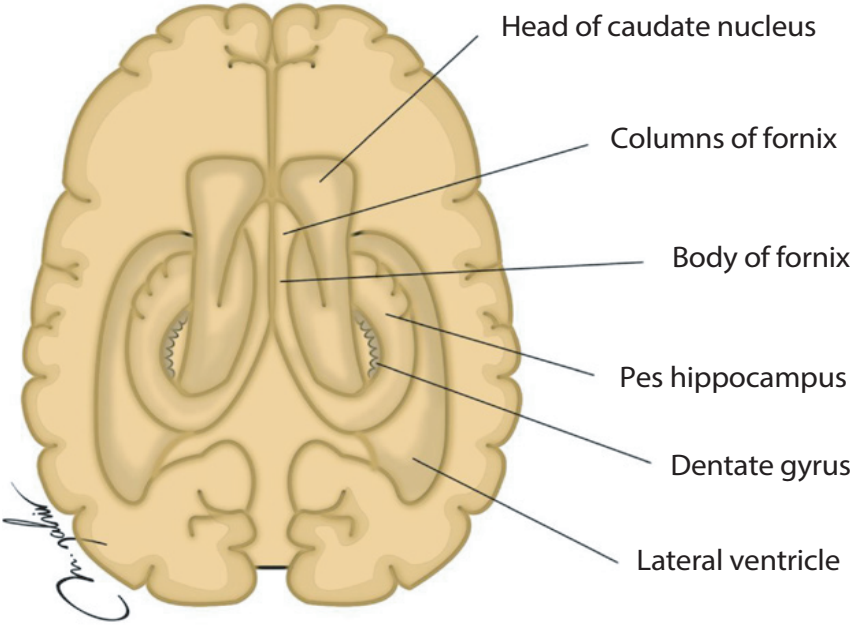


Fig. 31.1.1 Lateral ventricle

STATION 31.2

FOURTH VENTRICLE AND SUBARACHNOID CISTERNAE

(Figure 31.2.1)

- ☐ Identify the ***fourth ventricle*****:** is a diamond shape in cross-sections of brain. It is located between the pons and upper part of the medulla oblongata anteriorly and the cerebellum posteriorly.
- ☐ Observe that the CSF entering the fourth ventricle through the cerebral aqueduct and exit to the subarachnoid space of the spinal cord through:
  - ☐ Two lateral ***foramina of Luschka***.
  - ☐ A single, midline ***foramen of Magendie***.
- ☐ Note that the fourth ventricle has a ventral floor and dorsal roof as follows:
  - ☐ The roof: is formed by the cerebellum (superior and inferior medullary vela).
  - ☐ The floor: formed by the rhomboid fossa, and the side walls formed by the cerebellar peduncles. Identify the following prominent features of the floor of the fourth ventricle:
    - ☐ ***Facial colliculus***: formed by the internal part of the facial nerve as it loops around the abducent nucleus in the lower pons.
    - ☐ ***Sulcus limitans***: which represents the border between the alar plate and the basal plate of the developing neural tube.
    - ☐ ***Median sulcus***: divides the floor into right and left halves. It extends from cerebral aqueduct of the midbrain to central canal of the spinal cord.
    - ☐ ***Stria medullaris***: fibers derived from arcuate nuclei, which emerge from the median sulcus and run transversely across the floor to enter into the inferior cerebellar peduncle.
    - ☐ ***Medial eminence***: elevations on either side of the median sulcus.
    - ☐ ***Sulcus limitans***: medial eminence is laterally bounded by sulcus limitans.
    - ☐ ***Vestibular area***: lateral to sulcus limitans are vestibular nuclei.
    - ☐ The upper end of the sulcus limitans widens into a triangular depression called suprior fovea above suprior fovea sulcus limitans

presents a flattend grey area called ***locus ceruleus***.

- The lower end of the sulcus limitans widens into a triangular depression called Inferior fovea.
- ***Hypoglossal triangle*** and vagal triangle.

Observe that at the certain parts of the base of the brain, the arachnoid is separated from the pia mater by wide intervals, which communicate freely with each other and are named ***subarachnoid cisterae;*** which are:

- ***Cerebellomedullary cistern (cisterna manga).***
- ***Interpeduncular cistern***.
- ***Chiasmatic cistern***.
- ***Cisterna ambiens (ambient cistern).***
- ***Pontine cistern.***
- ***Cistern of lateral cerebral fossa.***
- ***Lumbar cistern.***

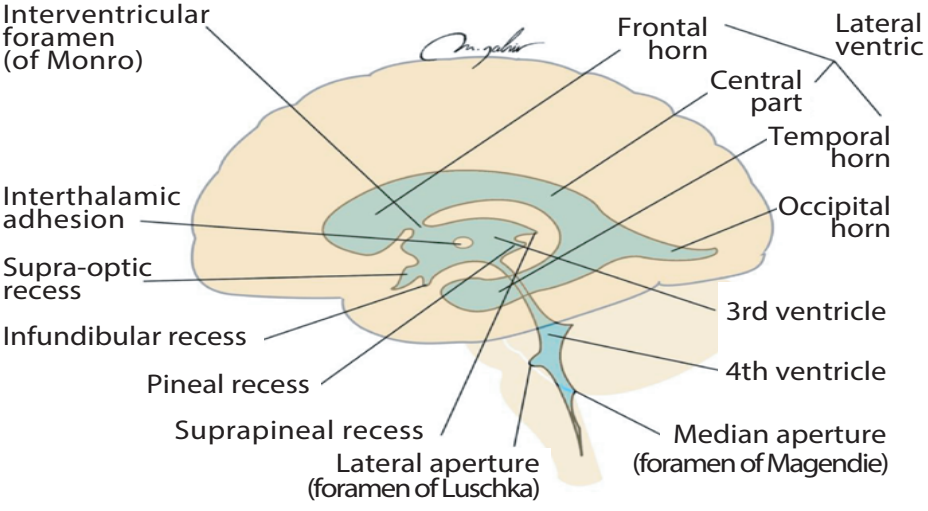


Fig. 31.2.1 Ventricular system

STATION 31.3

IMAGING (31.3.1)

☐ Identify the com[onents of the ventricular system shown in Fig.31.3.1.

Fig. 31.3.1 Axial MRI of Brain showing the lateral and third ventricles, cortex and white matter, insula.

Questions

1. What are the functions of ventricles?
2. Where is the cerebrospinal fluid produced?
3. Explain the circulation of the cerebrospinal fluid.
4. Name the subarachnoid cistern.

MENINGES AND BLOOD SUPPLY OF THE BRAIN

Learning Objectives

Upon completion of this session, the student will be able to:

1. Identify the prominent landmarks on the internal surface of the skull base.
2. Identify the major blood vessels of the brain, the cranial meninges, and dural matter folds.
3. Identify the main arterial supply of the brain; follow its course and branches.
4. Identify the Dural venous system of the brain.

Required Materials

- Cadaver/ Skull/ Model of CNS/ Sagittal and Transverse Sections of the Brain
- Handouts/ Atlases of Human Anatomy
- Visual and Electronic Media
- Images.

Instructions

- There are 3 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box before to it, the group's supervisor can question you about it and expect a correct answer.
- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 32.1
MENINGES OF THE BRAIN

(Figure 32.1.1)

- ☐ Note that the meninges are the system of membranes that cover the central nervous system. The meninges consist of three layers: the ***dura mater***, the ***arachnoid mater***, and the ***pia mater***.
- ☐ Identify the dura mater as divided into the outermost meningeal layer and is composed of two parts meningeal and periosteal. The latter layer is a layer lined to the inner aspect of the skull, and the meningeal layer separates from it in certain sites to form **dural folds**:
  - ☐ ***Falx cerebri*.**
  - ☐ ***Tentorium cerebelli*.**
  - ☐ ***Falx cerebelli*.**
- ☐ Note that when the two dural layers separate they usually accommodate special venous channels known as the dural venous sinuses:
  - ☐ ***Superior sagittal sinus***: posteriorly ends by turning toward the right to form the ***right transverse sinus***.
  - ☐ ***Inferior sagittal sinus***.
  - ☐ ***Straight sinus***: formed from the confluence of the inferior sagittal sinus and the great cerebral vein of Galen. Note that the straight sinus posteriorly ends by turning toward the left to form the left transverse sinus.
  - ☐ ***Two transverse sinuses***: curve down and medially to form the sigmoid sinuses. Then follow an S shaped course to the jugular canal.
  - ☐ ***Two superior petrosal sinuses***.
  - ☐ ***Two inferior petrosal sinuses*.**
  - ☐ ***Cavernous sinus***: on either side of the pituitary fossa. Identify the following:
    - ☐ Structures within the lateral wall of the cavernous sinus:
      - ☐ Oculomotor nerve.
      - ☐ Ophthalmic nerve.

- ☐ Trochlear nerve.
- ☐ Maxillary nerve.
- ☐ Trigeminal ganglion.

☐ Structures passing through the medial portion of the cavernous sinus:

- ☐ Abducent nerve.
- ☐ Internal carotid artery accompanied by the Internal carotid plexus.

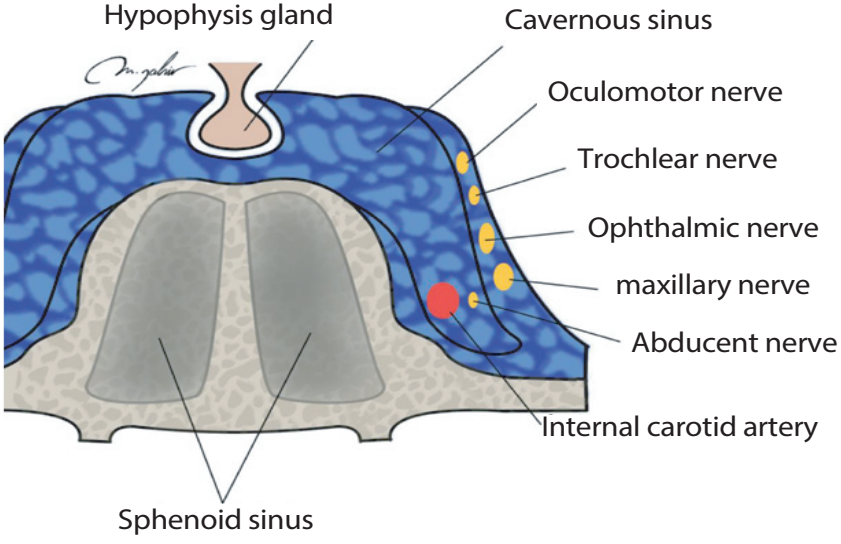


Fig. 32.1.1 Cavernous sinus and cavernous sinus contents

STATION 32.2

BLOOD SUPPLY OF THE BRAIN

- ☐ Note that the brain receives its arterial supply from four main arteries which are:
  - ☐ ***Two internal carotids arteries*****.**
  - ☐ ***Two vertebral arteries*****.**
- ☐ Note that the internal carotid artery after emerging from the roof of the carotid sinus gives: (note that it gives the ***ophthalmic*** artery before it).
  - ☐ ***Anterior cerebral artery***, which gives anterior communicating artery.
  - ☐ ***Middle cerebral artery*****.**
  - ☐ ***Posterior communicating artery*****.**
  - ☐ ***Choroidal artery*****.**
- ☐ Note that the vertebral artery after entering through the foramen magnum gives:
  - ☐ ***Two anterior spinal arteries*** that join to form one single anterior spinal artery.
  - ☐ ***Two posterior spinal arteries***.
- ☐ Then the vertebral artery gives:
  - ☐ ***Inferior cerebellar artery*** to the cerebellum.
- ☐ Following this the two vertebral arteries unite to form the basilar artery.
- ☐ Identify the basilar artery which gives:
  - ☐ ***Anterior inferior cerebellar*** artery.
  - ☐ Small ***pontine branches*** on either side that appear on the anterior surface of the pons.
  - ☐ ***Labyrinthine*** artery destined to the inner ear that travels with the 7th and 8th cranial nerves.
  - ☐ ***Superior cerebellar*** artery.
- ☐ The basilar artery Just before it terminates is dividing into the two posterior cerebral arteries.

- ☐ Identify the ***Circle of Willis***, is a part of the cerebral circulation and is composed of the following arteries:
  - ☐ Anterior cerebral artery (left and right).
  - ☐ Anterior communicating artery.
  - ☐ Internal carotid artery (left and right).
  - ☐ Posterior cerebral artery (left and right).
  - ☐ Posterior communicating artery (left and right).
- ☐ Note that the basilar artery and middle cerebral arteries, supplying the brain, are not considered part of the circle.

STATION 32.3

IMAGING (32.3.1 - 32.3.5)

- ☐ Identify the branches of the carotid source to the brain shown in Fig.32.3.1.
- ☐ Identify the branches of the vertebrobasilar source to the brain seen in Fig.32.3.2.
- ☐ Identify the CT appearance of the infaction caused by obstruction of the carotid (Fig.32.3.3). middle cerebral (Fig.32.3.4) and the anterior cerebral (Fig.32.3.5).

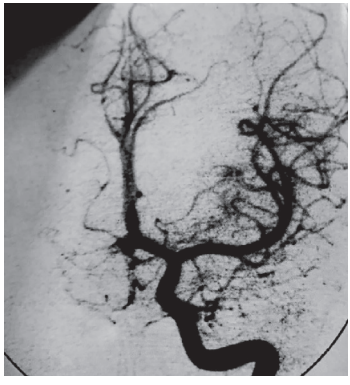


Fig. 32.3.1 Digital subtraction angiogram of the carotid source of blood supply. Identify the anterior and middle cerebral arteries.

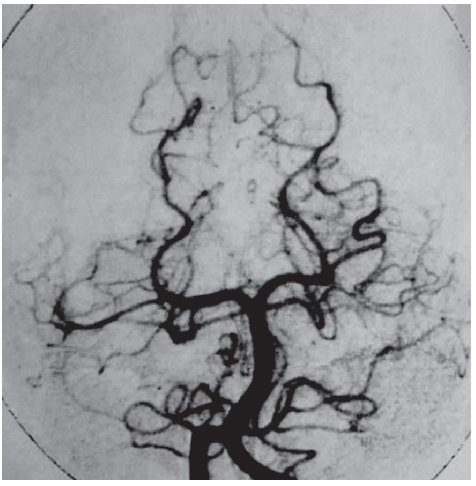


Fig. 32.3.2 Digital subtraction angiogram of the vertebrobasilar source of blood supply. Identify the posterior cerebral, anterior and posterior cerebellar arteries.

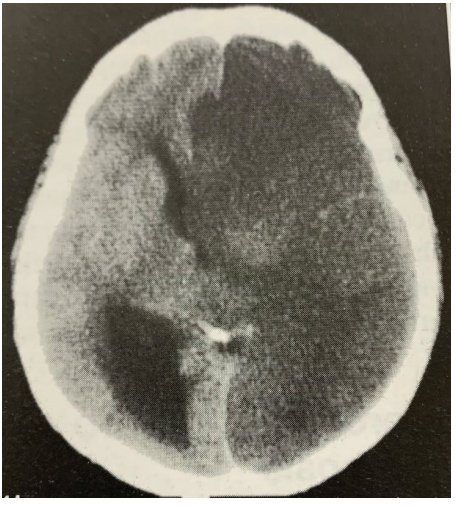


Fig. 32.3.3 Infarction of the internal carotid territory involving the left hemisphere

Fig.32.3.4 Infarction of the middle cerebral territory involving most of the left hemisphere

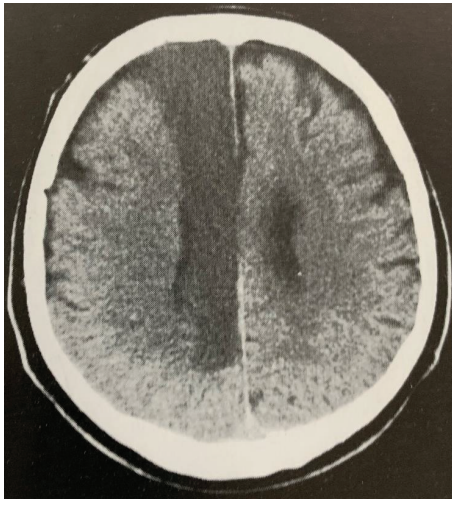


Fig.32.3.5 Infarction of the anterior cerebral territory involving parts of the left hemisphere

Questions

1. Mention the dural venous sinuses.
2. Mention the branches of the internal carotid artery.
3. Mention the branches of the vertebral artery.
4. What is the function of circle of Willis?
5. Explain the formation of the circle of Willis.

ORBITAL CAVITY AND THE EYEBALL

Learning Objectives

Upon completion of this session, the student will be able to:

1. Define the prominent bony features of the orbit with included foramina and fissures.
2. Identify the components of the eyelids with associated muscles, tarsal glands, connective tissue fascia and conjunctiva.
3. Locate the extraocular muscles, their function and innervation
4. Trace all sensory, motor and autonomic nerves of the orbit.
5. Trace branches of ophthalmic arteries and veins.

Required Materials

- Cadaver/ Skull/ Model of Eye/ Dissected Eye
- Handouts/ Atlases of Human Anatomy
- Visual and Electronic Media
- Images.

Instructions

- There are 3 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box before to it, the group's supervisor can question you about it and expect a correct answer.

- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 33.1

ORBITAL CAVITY

- ☐ Note that the ***orbit*** is the large hollow in the superolateral aspect of the face that houses the eyeball and its associated structures.
- ☐ Anteriorly the orbit has its open base onto the face and has its apex pointing posteriorly towards the cranial cavity.
- ☐ The orbit has four margins, on a skull identify the followings:
  - ☐ The ***superior margin*** of the orbit is formed wholly by the orbital margin of the frontal bone. This margin bears a foramen known as the ***supraorbital foramen***. This foramen may sometimes be present just as a groove or notch.
  - ☐ The ***lateral margin*** of the orbit is formed by the frontal and the zygomatic bones meeting in the zygomaticofrontal suture.
  - ☐ The ***inferior margin*** is formed by the zygomatic bone laterally and the maxilla medially, the two articulating at the zygomaticomaxillary suture. This margin has the ***infraorbital foramen***.
  - ☐ The ***medial margin*** is formed by the frontal process of the maxilla and the maxillary process of the frontal bone. Posterior to them is the small lacrimal bone. The lacrimal bone and the maxilla have a small fossa known as the lacrimal fossa bounded anteriorly and posteriorly by the ***anterior and posterior lacrimal crests***. The fossa contains the ***lacrimal sac*** and leads inferiorly into the opening of the ***nasolacrimal duct***.
- ☐ The orbit has four walls, on a skull identify the followings:
  - ☐ The ***superior wall*** is formed mainly by the:
    - ☐ Orbital plate of the frontal bone
    - ☐ Lesser wing of the sphenoid bone
    - ☐ The ***lesser*** and ***greater wings of sphenoid*** are separated by obliquely running ***superior orbital fissure*** that connects the orbit

to the cranial cavity.

- ☐ Identify the contents of superior orbital fissure: ***oculomotor nerve***, ***trochlear nerve***, ***abducent nerve***, the o***phtalmic branches of trigeminal nerve, superior ophtalmic vein***.
- ☐ Slightly anterior to the superior orbital fissure is the ***optic canal*** that transmits the ***optic nerve*** and ***ophtalmic artery***.
- ☐ The ***inferior orbital fissure*** is the other obliquely fissure and connects the orbit to the infratemporal fossa.
- ☐ Identify the contents of inferior orbital fissure: maxillary nerve branch of trigeminal nerve, ***infraorbital artery*** and ***vein***.

☐ The ***medial wall*** is formed by:

- ☐ Lacrimal bone.
- ☐ Orbital plate of the ethmoid bone. Above this plate the frontal bone has two small foramina that are the ***anterior*** and ***posterior ethmoidal foramina***.
- ☐ Body of the sphenoid.
- ☐ The four ***rectus muscles*** attach to the medial wall with their originating tendon. This muscular attachment is termed as annulus of *Zinn*.
- ☐ The ***annulus of Zinn*** surrounds some of the nerves and arteries as a circle: optic nerve, oculomotor nerve, ophtalmic branches of trigeminal nerve, abducent nerve, ophtalmic artery.
- ☐ Note that trochlear nerve is not a content of annulus of *Zinn*.

☐ The ***inferior wall*** is formed by the:

- ☐ Maxilla medially, it shows a groove known as the infraorbital sulcus that leads into an infraorbital canal that opens into the infraorbital foramen.
- ☐ Zygomatic bone laterally.
- ☐ Orbital process of palatine bone.

☐ The ***lateral wall*** is formed by the:

- ☐ Zygomatic bone anteriorly.
- ☐ Greater wing of the sphenoid bone posteriorly.

STATION 33.2

EYEBALL

(Figure 33.2.1 - 33.2.3)

- ☐ Observe the following characteristics on the eyes of your partners:
  - ☐ ***Palpebral fissure*.**
  - ☐ ***Lateral angle (canthus, commissure)*.**
  - ☐ ***Medial angle (canthus, commissure)*.**
  - ☐ ***Lacrimal caruncle*.**
  - ☐ ***Lacrimal lake*.**
  - ☐ ***Semilunar fold*.**
  - ☐ ***Upper*** and ***lower lacrimal papillae*.**
  - ☐ ***Lacrimal puncta (pores)*.**

- ☐ On the cadaver pull the lids away from the bulb and define palpebral and bulbar conjunctiva and the fornices formed.
- ☐ Define ***conjunctival sac***, ***tarsal glands*** and locate orifices and glands on the cadaver and your partner. Consider the flow of lacrimal fluid across the eye.
- ☐ In the specimen of the orbit prepared identify the following:
  - ☐ The eyeball or globe; It has an outer white covering called the ***sclera*** that becomes the transparent ***cornea*** anteriorly.
  - ☐ ***Ophthalmic artery*.**
  - ☐ ***Optic nerve*** as it leaves the posterior aspect of the globe.
  - ☐ ***Trochlear nerve*.**
  - ☐ ***Oculomotor nerve*.**
  - ☐ ***Abducent nerve*.**
  - ☐ ***Frontal branch of the ophthalmic nerve*.**
  - ☐ ***Levator palpebrae superioris*.**

- ***Superior oblique muscle*.**
- ***Inferior oblique muscle*.**
- ***Superior rectus muscle*.**
- ***Medial rectus muscle*.**
- ***Lateral rectus muscle***
- ***Inferior rectus muscle*.**

In the specimen of the eye prepared try to examine the following:

- **Fibrous layer of eyeball formed of**:
  - Sclera.
  - Cornea.
- **Vascular layer of eyeball formed of**:
  - ***Choroid*.**
  - ***Ciliary body*.**
  - ***Ciliary muscle*.**
  - ***Ciliary process*.**
  - ***Aqueous humour*.**
  - ***Iris*.**
  - ***Lens*.**
  - ***Pupil*.**
  - ***Sphincter pupillae*.**
  - ***Dilator pupillae*.**
- **Nervous layer of eyeball formed of**:
  - ***Optic part of retina*.**
  - ***Nonvisual retina*.**
  - ***Ora serrate*.**
  - ***Optic disc*.**
  - ***Macula lutea*.**
  - ***Fovea centralis*.**
  - ***Central retinal artery*** and ***vein*.**
  - ***Vorticose veins*.**

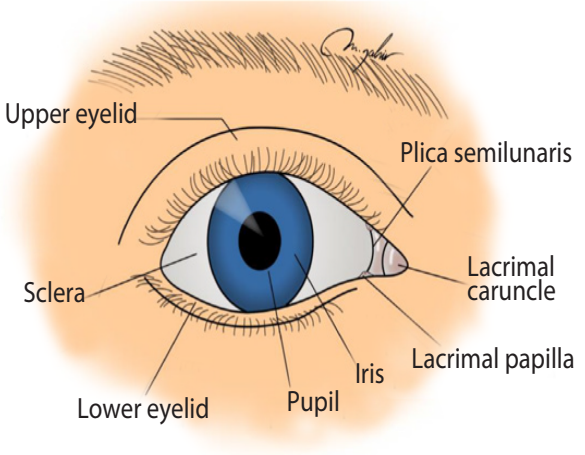


Fig. 33.2.1 Right eyeball

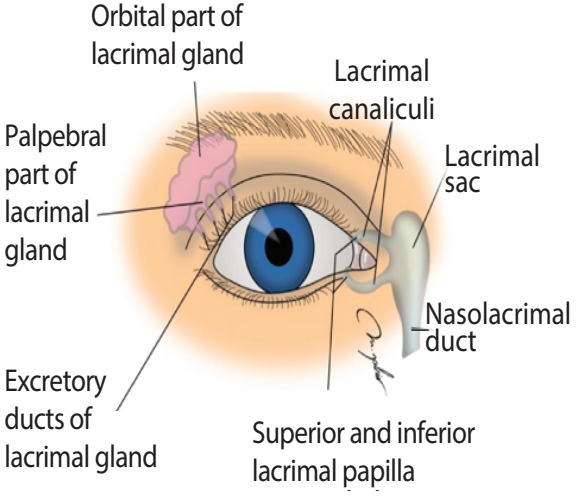


Fig. 33.2.2 Right lacrimal apparatus

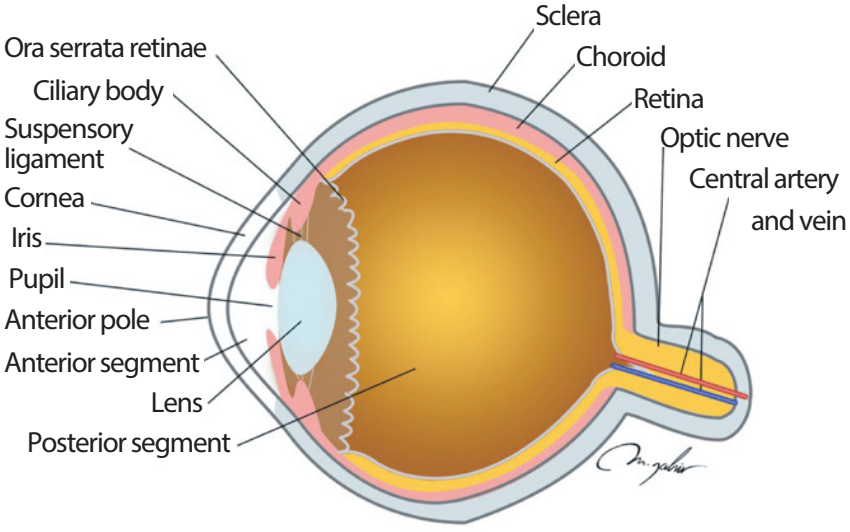


Fig. 33.2.3 Layers of eyeball

STATION 33.3

IMAGING (33.3.1 - 33.3.2)

☐ Identify the strucures shown in CT image (Fig.33.3.1) and MR image (Fig. 33.3.2)

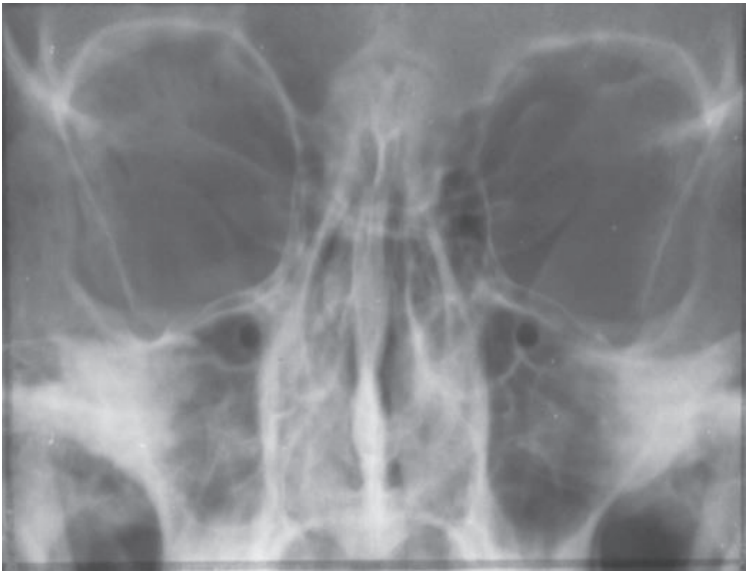


Fig. 33.3.1 X-ray of orbit and sinuses showing the medical boundary, lateral boundary, superior boundary, inferior boundary, frontal sinus, ethmoid sinuses, maxillary sinuses.

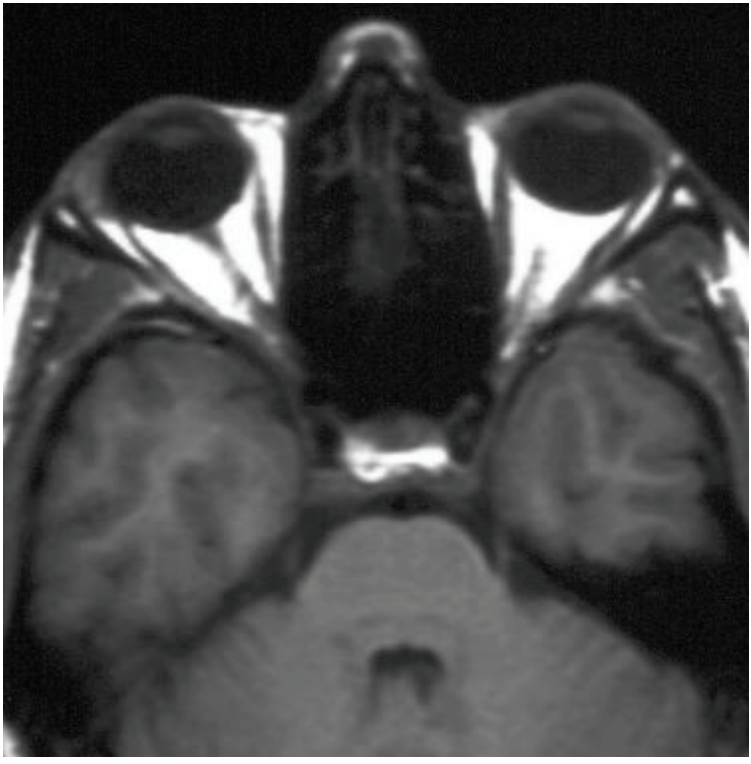


Fig. 33.3.2 MRI orbit and parts of the brain showing the eyeball, medial and lateral rectus muscles, optic nerve, pons, fourth ventricle and temporal lobe.

Questions

1. Explain the functions and innervations of extraocular muscles.
2. Explain anatomic localization and functions of neurons of visual perception.

THE EAR

Learning Objectives

Upon completion of this session, the student will be able to:

1. Observe the three parts of the ear and the function of each part.
2. Identify the shape and features of the auricle and external acoustic meatus.
3. Define the structures and actions of the tympanic membrane, the auditory ossicles, and the muscles of the middle ear.
4. Recognize the four walls of the middle ear cavity and identify the deeper structures.
5. Locate the auditory tube and explain its function.
6. Trace the course of the facial nerve throughout the temporal bone and describe the origin, course and functional components of its intracranial branches.
7. Identify the components of the inner ear and locate the cochlea dedicated to hearing and the vestibular system dedicated to balance.

Required Materials

- Cadaver/ Skull/ Model of Ear/ Dissected Ear
- Handouts/ Atlases of Human Anatomy
- Visual and Electronic Media
- Images.

Instructions

- There are 4 stations of activities in this practical.

- When you have completed a particular task you should put a tick in the box before to it, the group's supervisor can question you about it and expect a correct answer.
- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 34.1

EXTERNAL EAR

(Figure 34.1.1 + 34.1.2)

☐ In the ear model in front of you identify the following:

- ☐ **External ear,** which is formed of:
  - ☐ Auricle; has the following parts:
    - ☐ ***Auricle*.**
    - ☐ Lobule of auricle.
    - ☐ Tragus.
    - ☐ Antitragus.
    - ☐ Intertragic incisura.
    - ☐ Auricular tubercle.
    - ☐ ***Helix.***
    - ☐ Crus of helix.
    - ☐ Antihelix.
    - ☐ Crura of antihelix.
    - ☐ Triangular fossa.
    - ☐ Concha of auricle.
    - ☐ ***External acoustic meatus***, which is S shaped, formed of outer cartilaginous and inner bony part.

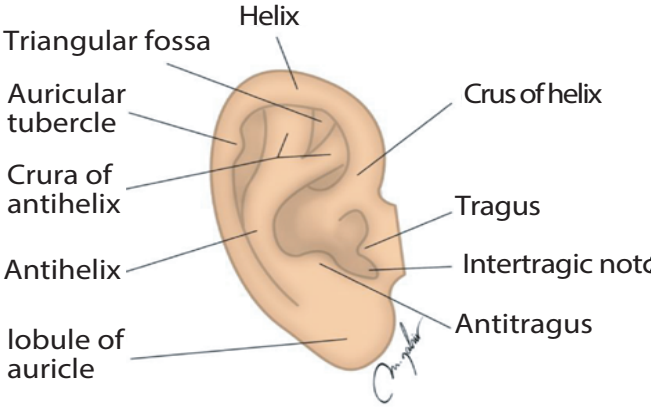


Fig. 34.1.1 Right auricle

- ☐ Identify the ***tympanic membrane (eardrum)*** that forms the medial limit of the outer ear. There are two general regions of the tympanic membrane: the pars flaccida (upper region) and the pars tensa.
- ☐ Note that the tympanic membrane is superiorly related to middle cranial fossa, posteriorly to the ear ossicles and the facial nerve, inferiorly to the parotid gland and anteriorly to the temporomandibular joint.

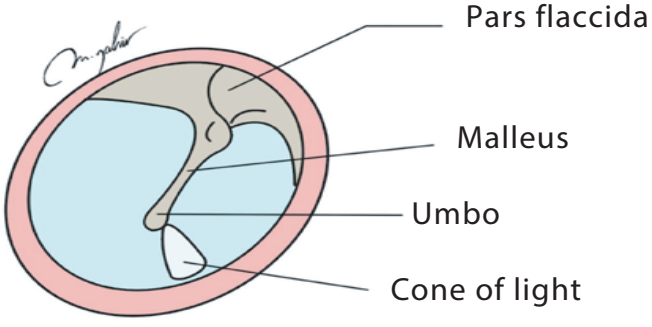


Fig. 34.1.2 Tympanic membrane

STATION 34.2

MIDDLE EAR

(Figure 34.2.1 + 34.2.2)

- ☐ Observe the ***middle ear*** or ***tympanic cavity*** is an irregular compressed space inside the temporal bone. It is filled with air that is conveyed to it from the nasal part of the pharynx via the auditory tube. It contains a chain of movable bones that connect its lateral and medial walls, and serve to convey the vibrations communicated to the tympanic membrane across the cavity to the internal ear.
- ☐ Identify the middle ear cavity (tympanic cavity), which is formed of the following structures:
  - ☐ Bony ossicles that are from medial to lateral the ***maleus, incus***, and ***stapes.***
  - ☐ ***Stapedius*** and the ***tensor tympani*** muscles.
  - ☐ ***Horizontal*** and ***chorda tympani branches of the facial nerve.***
  - ☐ On the posteromedial piece identify:
    - ☐ ***Promontory.***
    - ☐ ***Vestibular (oval) window.***
    - ☐ ***Cochlear (round) window.***
    - ☐ ***Canal for facial nerve.***
- ☐ Note that the tympanic cavity has pharyngeal connection through the ***auditory (Eustachian) tube***.
- ☐ Note that the tympanic cavity consists of two parts: the tympanic cavity proper, opposite the tympanic membrane, and the attic or epitympanic recess, above the level of the membrane.

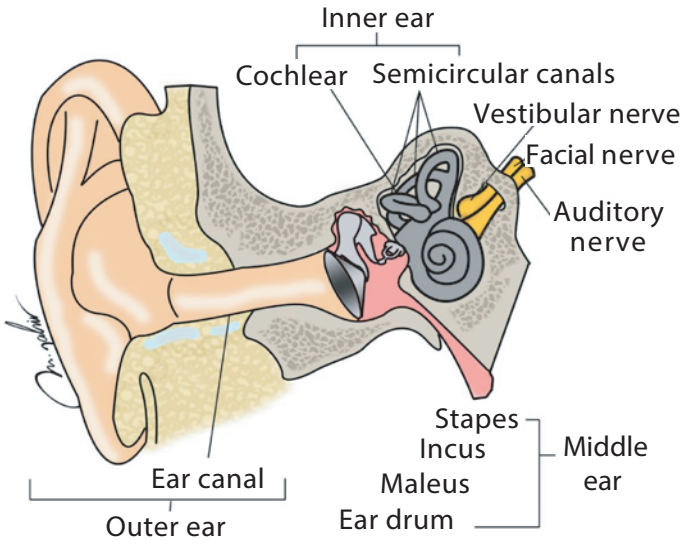


Fig. 34.2.1 Outer, middle and inner ear (right side)

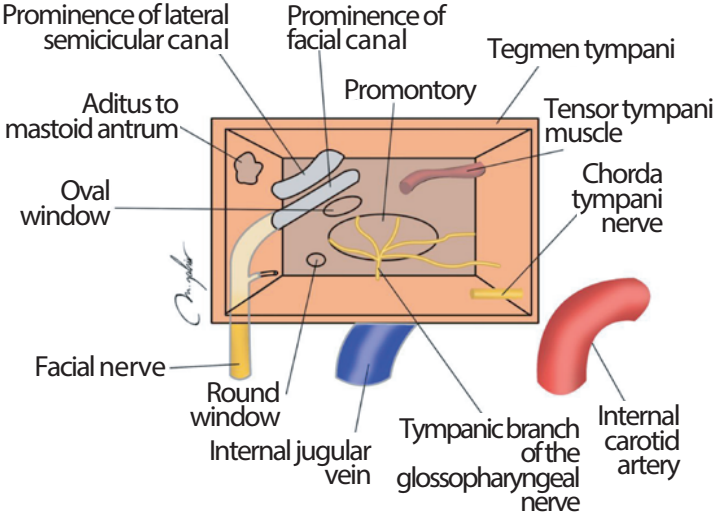


Fig. 34.2.2 Middle ear walls and borders

STATION 34.3

INNER EAR

(Figure 34.3.1)

- ☐ Observe the ***inner ear*** is the innermost part of the ear. It consists of the bony labyrinth, a hollow cavity inside the temporal bone that comprising two main functional parts:
  - ☐ The ***cochlea***, dedicated to hearing.
  - ☐ The ***vestibular system***, dedicated to balance.
- ☐ Note that the labyrinth can be divided into:
  - ☐ The ***bony labyrinth***, or osseous labyrinth.
  - ☐ The ***membranous labyrinth*** runs inside of the bony labyrinth, a layer of ***perilymph fluid*** lies between them.
- ☐ Identify the three parts of the bony labyrinth which are:
  - ☐ Cochlea, consists of:
    - ☐ ***Scala vestibule*.**
    - ☐ ***Scala tympani*.**
    - ☐ ***Cochlear duct*.**
  - ☐ ***Semicircular canals***, consists of:
    - ☐ ***Anterior semicircular canal*.**
    - ☐ ***Posterior semicircular canal*.**
    - ☐ ***Lateral semicircular canal*.**
  - ☐ ***Vestibule of the ear***, consists of two membranous sacs as follows:
    - ☐ ***Utricle and saccule*.**
- ☐ Identify the followings:
  - ☐ ***Vestibular nerve*.**
  - ☐ ***Cochlear nerve*.**
  - ☐ ***Vestibular ganglion*.**
  - ☐ ***Spiral ganglion*.**

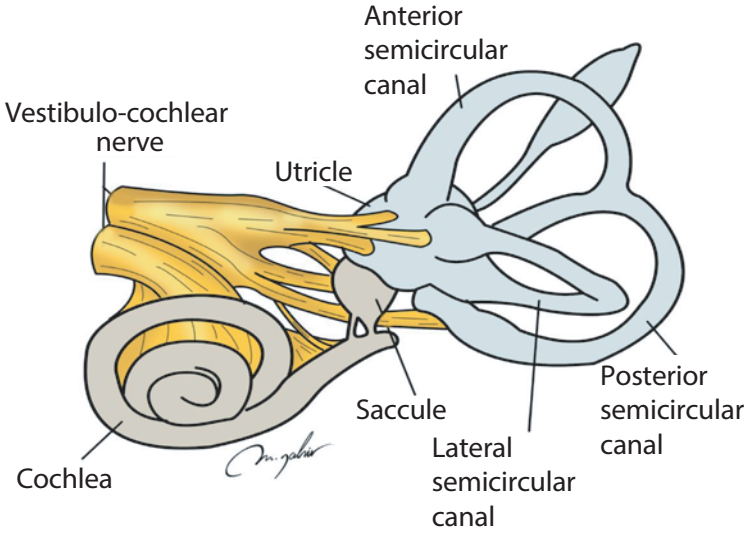


Fig. 34.3.1 Inner ear

STATION 34.4

IMAGING (34.4.1 - 34.4.2)

☐ Identify the strucures shown in x-ray image (Fig.34.4.1) and CT image (Fig.34.4.2).

Fig. 34.4.1 Lateral x-ray temporal bone showing anterior and posterior surfaces, external and internal acoustic meatus, air cells, temporomandibular joint.

Fig. 34.4.2 3D-CT temporal bone showing the jugular foramen, external and internal acoustic canals, middle, cochlea

Questions

1. Describe the mechanism of hearing.
2. Describe the walls of the middle ear and the related structures.

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