CHAPTER

Scalp, Temple and Face

QLA-2 Why the infections of superficial fascia of scalp causes more pain?

Superficial fascia has abundant fibrous tissue and has rich nerve supply. Hence, infection of the superficial fascia irritates the nerve and one gets severe pain.

OLA-3 Why are sebaceous cysts and seborrhoea more frequently associated with the scalp?

Scalp has plenty of hair and sebaceous glands. The ducts of sebaceous glands are prone to infection and get damaged by combing. For this reason, scalp is a common site for sebaceous cysts. Hence, sebaceous cysts and seborrhoea are more common.

QLA-4 What is the "dangerous area of scalp" and why is it called so?

Third layer of scalp is loose areolar tissue. It is dangerous area of scalp. Any accumulation of blood in this area will not spread in following directions.

- 1. It cannot descend in neck because of firm attachment of epicranial aponeurosis to superior nuchal line.
- 2. It cannot descend laterally because of its attachment to superior temporal line. Only way it can spread is anteriorly. Hence, it accumulates deep to eyelid and results into black eye. This results in damage to eye hence it is called dangerous area.

OLA-5 What is "safety valve haematoma"? How the haemorrhage from the blood vessels of scalp is arrested?

- 1. Safety valve haematoma occurs due to the following reasons:
 - A. Fracture of the bone of the scalp, and
 - B. Intracranial bleeding (usually due to birth trauma in the newborn).
 - The symptoms of intracranial bleeding are delayed due to leakage of blood. It spreads to the subaponeurotic layer from the fracture site. It expands to accommodate large quantity of blood. Since this haematoma delays the onset of symptoms of a serious condition, it is called safety valve haematoma.

2. By compressing at the site of injury, bleeding is arrested since underneath the scalp is cranium which is hard structure.

QLA-6 Why the wounds of face bleed profusely?

Scalp has *profuse* blood supply. It is supplied by *5 paired* arteries. These arteries pass through the dense connective tissue. Ruptured arteries of any part of the body are constricted by the contraction of smooth muscles present in walls of the vessel.

The vessels in the scalp pass through the dense connective tissue. The arteries of the scalp cannot overcome the resistance of the tough dens deep fascia. Hence, they are kept open and they bleed profusely.

QLA-7 What are the modifications of palpebral fascia?

The palpebral fascia of the two eyelids forms the orbital septum.

- 1. In upper eyelid becomes thick and forms tarsal plates or tarsi. Tarsi are thin plates of condensed fibrous tissue located near the lid margins. They give stiffness to the lids. The upper tarsus receives two tendinous slips from the levator palpebrae superioris.
 - A. One from voluntary part, and
 - B. Another from involuntary part.
- 2. At the angles, it forms palpebral ligaments.

QLA-8 What is stye (hordeolum)?

- 1. **Definition:** It is a suppurative inflammation of one of the glands of Zeis. It is large sebaceous gland.
- 2. Clinical features
 - A. The gland is swollen, hard and painful.
 - B. Lid is oedematous.
 - C. Pus points near the base of one of the roots (follicle) of an eyelash.

QLA-9 What is chalazion?

Definition: It is inflammation of a tarsal gland, causing a localized swelling pointing inward.

SN-24 Modiolus

- 1. **Modiolus (nave, pillar):** It is a compact, mobile fibromuscular structure. It is present at about 1.25 cm lateral to the angle of the mouth opposite the upper 2nd premolar tooth.
- 2. The five muscles interlacing to form the modiolus are:
 - A. Buccinator,
 - B. Zygomaticus major,

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- C. Levator anguli oris,
- D. Depressor anguli oris
- E. Risorius.

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- 3. **Shape:** Like a hub of a cart-wheel . The muscles radiate from it lie in different planes.
- 4. **Palpation:** It can be palpated between the opposed thumb compressing the skin at the angle of mouth and index finger simultaneously compressing the oral mucosa at the same point.
- 5. Applied anatomy : The complex integrated movements of modiolar muscles help in biting, chewing, drinking, sucking, swallowing and speaking apart from the facial expressions.

LAQ-1 Describe scalp under the following headings:

- 1. Layers,
- 2. Blood supply,
- Nerve supply, and
 Applied anatomy
- 1. Layers (Fig. 2.1): SCALP
 - A. **Skin:** *Skin is hairy and exceptionally thick.* It contains plenty of sebaceous glands. It is adherent to the underlying epicranial aponeurosis through the dense superficial fascia.
 - B. **Connective tissue (superficial fascia):** It is very dense and contains plenty of blood vessels and nerves. *It has the richest cutaneous blood supply in the body.*
 - C. <u>Aponeurosis</u> (galea aponeurotica or epicranial aponeurosis): This contains occipitofrontalis muscle. It has
 - a. Occipital, and
 - b. Frontal belly.
 - a. Occipital belly arises from
 - I. External occipital protuberance, and
 - II. Highest nuchal lines and becomes continuous with epicranial aponeurosis.
 - b. Frontal belly arises from epicranial aponeurosis and merges with the procerus, corrugator supercilii and orbicularis oculi. The direction of the fibres is anteroposterior. Thus, the occipital belly is attached to the bone and the frontal belly is attached to the dermis of skin.

D. Loose areolar tissue extends

- a. Posteriorly from highest and superior nuchal lines,
- b. Laterally from superior temporal lines, and
- c. Anteriorly into the eyelids.
- E. **Pericranium:** It is loosely attached to the surface of the bone except near sutures. Hence, the fluid collected in this layer takes the shape of underlying bone.

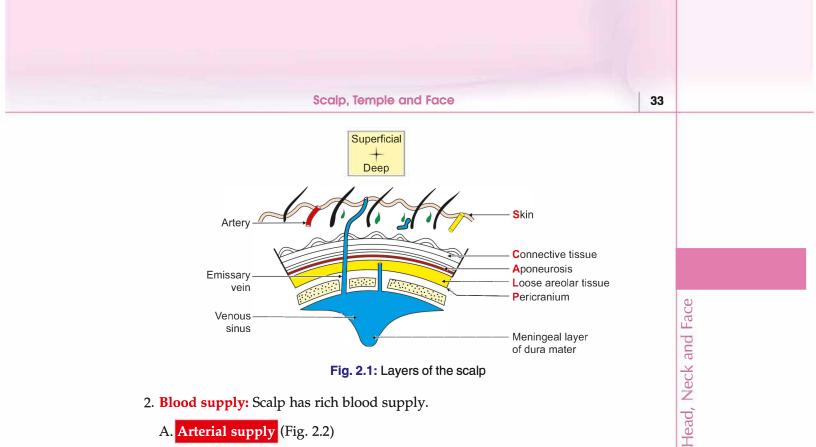


Fig. 2.1: Layers of the scalp

Meningeal layer of dura mater

- 2. **Blood supply:** Scalp has rich blood supply.
 - A. Arterial supply (Fig. 2.2)
 - a. In front of the auricle,
 - I. Supraorbital artery (branch of ophthalmic artery), and
 - II. Supratrochlear artery (branch of ophthalmic artery).
 - III. Superficial temporal artery (branch of external carotid artery).
 - b. Behind the auricle, it is supplied by
 - I. Posterior auricular artery (branch of external carotid artery), and
 - II. Occipital artery (branch of external carotid artery).

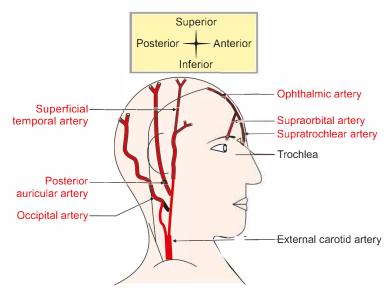


Fig. 2.2: Arterial supply of scalp

Sites of anastomosis of external and internal carotid arteries-Tip

Box 2.1

Note: Scalp is a site of anastomosis between branches of external and internal carotid arteries.

B. Venous drainage : It is described in Figs 2.3, 2.4 and Flowcharts 2.1 and 2.2.

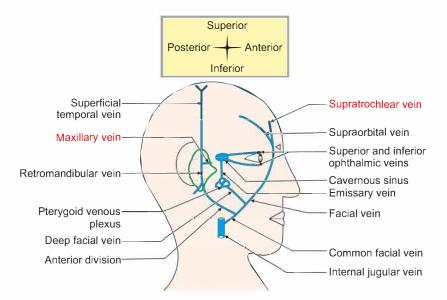
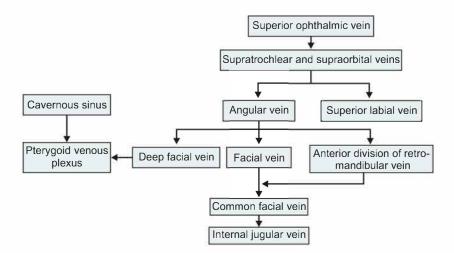
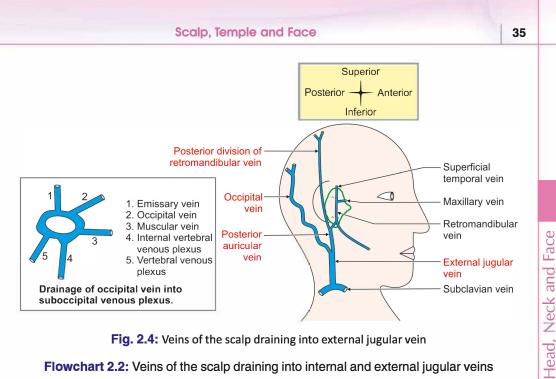


Fig. 2.3: Veins of the scalp draining into internal jugular vein

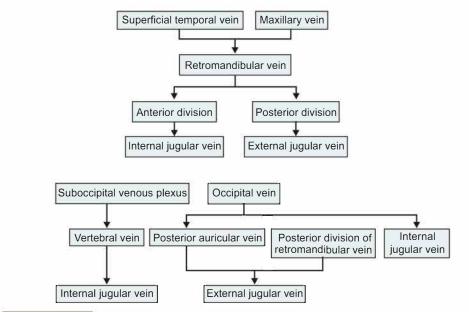
Flowchart 2.1: Veins of the scalp draining into internal jugular vein











3. Nerve supply

- A. Sensory (Fig. 2.5A)
 - a. In front of auricle:
 - I. Supraorbital and supratrochlear, branches of ophthalmic division of trigeminal nerve.
 - II. Zygomaticotemporal a branch of zygomatic nerve which is a branch of maxillary division of trigeminal nerve.
 - III. Auriculotemporal nerve-mandibular division of trigeminal.

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Exam-Oriented Anatomy

b. Behind the auricle **GaleO - Go To**

Posterior division of <u>G</u>reat <u>a</u>uricular nerve (ventral rami of C2–C3) <u>Le</u>sser <u>O</u>ccipital nerve. Ventral rami of (C2) <u>G</u>reater <u>O</u>ccipital nerve—dorsal ramus of C2 spinal nerve. <u>Third O</u>ccipital nerve—dorsal ramus of C3 spinal nerve.

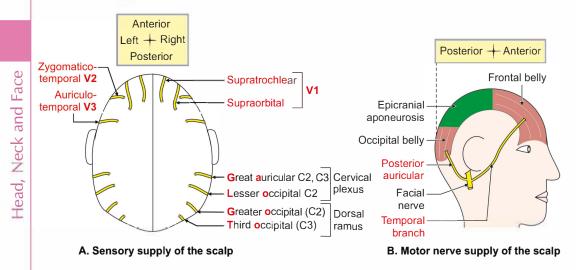


Fig. 2.5: Nerve supply of scalp

- B. Motor (Fig. 2.5B)
 - a. In front of the auricle: Temporal branch of facial nerve supplies frontal belly of occipitofrontalis.
 - b. Behind the auricle: Posterior auricular branch of facial nerve supplies occipital belly of occipitofrontalis.

4. Applied anatomy

First layer

- Skin is thick and hairy. It is the common site of sebaceous cyst.
- The infection of the scalp behind the ear may cause transverse venous sinus infection. It can be dangerous or fatal.

Second layer

- The bleeding in second layer is profuse. This is because of two reasons:
 - The scalp has rich blood supply (five arteries on each side),
 - The torn vessels are prevented from constriction because the walls of the blood vessels are adherent to the dense connective tissue. This prevents constriction of vessels.
 - The bleeding can be immediately arrested by compressing against hard bone, i.e. cranium.
 - As all the blood vessels of the scalp run from periphery to centre, bleeding from the scalp can easily be arrested by applying a tourniquet around the head.

Scalp, Temple and Face

- Third layer: The direction of injury to the scalp decides the rate of healing of the wound. There is rapid healing of the wound in injury parallel to direction of muscle fibres. There is delayed healing of wounds, in injury perpendicular to the muscle fibres.
- Fourth layer
 - This is the dangerous area of scalp. The infection from this layer spreads to the brain through emissary vein.
 - Accumulation of blood in this layer results in black eye.
- **Fifth** layer
 - Bleeding in 5th layer takes the shape of underlying bone. The condition is called **cephalohaematoma**.
 - **Caput succedaneum:** It is oedema occurring in and around scalp of newborn during labour.

QLA-10 Why do the wrinkles of face tend to gap?

As the person ages, the skin loses its elasticity (resilience) which results into wrinkles on the skin. If the skin incision is not parallel to these cleavage or wrinkle lines (Langer lines), it has tendency to gap.

OLA-11 In supranuclear lesion of facial nerve, only the lower part of the face is paralysed. Why the upper part of face is spared?

The supranuclear lesions are also called upper motor neuron lesions. It affects muscles of the lower ½ of the face only. The muscles of the upper ½ of the face are spared because muscles of the upper ½ of the face (muscles of forehead and eyebrows) are supplied by both cerebral hemispheres. This is called bilateral cortical innervation.

LAQ-2 Describe muscles of face under the following headings:

- 1. Action,
- 2. Nerve supply, and
- 3. Applied anatomy
- 1. Action: The muscles of facial expression can be grouped as (mimetic muscles)
 - A. **Muscles acting on the orifice of the orbit:** These are subgrouped as constrictor (sphincters) and dilators.
 - a. **Frontal belly of occipitofrontalis** is responsible for elevation of eyebrows as in an expression of surprise and it also contracts in looking upwards. The action is antagonistic to the orbital part of orbicularis oculi.
 - b. **Corrugator supercilii** drags the eyebrow medially and downward and protects the eye from bright sunlight. It produces vertical wrinkles of the forehead.
 - c. Orbicularis oculi has three parts.
 - I. Palpebral part closes the eye gently as in sleep and blinking.
 - II. Orbital part closes the eye firmly as in dust storm.
 - III. Lacrimal part dilates the lacrimal sac.

Face

Neck and

B. Muscles acting on the orifice of the nose

- a. Procerus (extended, tall). It is extended part of frontalis. It produces transverse wrinkles across bridge of nose as in frowning.
- b. Nasalis has two parts.
 - I. Transverse part called *compressor naris*. It compresses the nasal aperture.
 - II. Alar part called *dilator naris*. It dilates the anterior nasal aperture in deep inspiration.
- c. Depressor septi dilates anterior nasal aperture in anger.

Table 2.1: Muscles acting on openings of the face			on openings of the face
Face	Openings	Closing (sphincter)	Opening (dilator)
Neck and	• Ocular (eyelids)	 Orbicularis oculi Corrugator supercilii (frowning) 	Levator palpebrae superiorisFrontal belly of occipitofrontalis
	• Lacrimal sac		Lacrimal part of orbicularis oculi
Head,	• Anterior nasal aperture	 Compressor nasi 	 Alar part of nasalis Depressor septi (anger) Levator labii superioris alaeque nasi (sadness)
	Oral opening	 Orbicularis oris (closing the mouth) 	 Levator labii superioris Levator labii superioris alaeque nasi (sadness) Zygomaticus minor (contempt) Levato ranguli oris (sadness)
	Angle of mouth		Zygomaticus major (smiling and laughing)Depressor anguli oris (grief)

Table 2.1: Muscles acting on openings of the face

C. Muscles acting on the orifice of the mouth (Fig. 2.6)

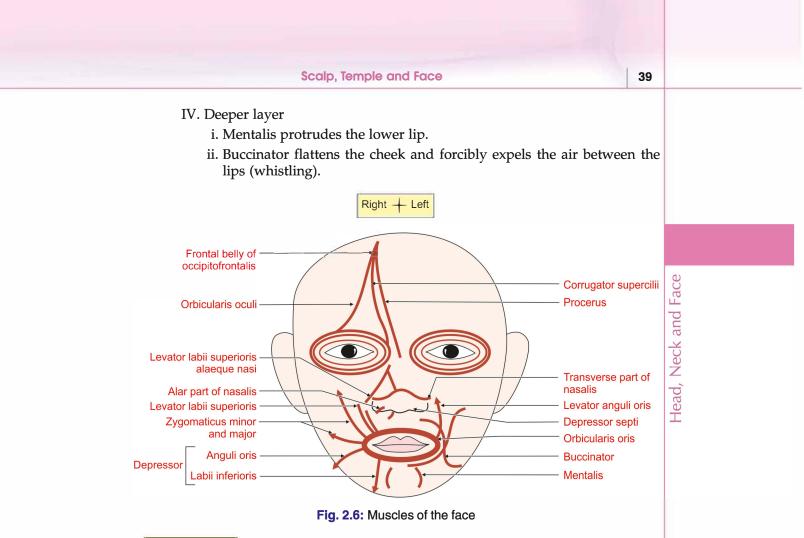
a. Closure: Orbicularis oris closes the mouth.

b. Dilators

- I. Subcutaneous layer: Risorius (*risus*—to laugh).
- II. Superficial layer:
 - i. Zygomaticus major draws the angle of mouth upward and laterally as in laughing.
 - ii. Zygomaticus minor elevates and everts upper lip.
 - iii. Levator labii superioris alaeque nasi elevates and everts the upper lip and dilates the nostril.

III. Middle layer

- i. Depressor anguli oris draws the angle of mouth downward.
- ii. Levator anguli oris
- iii. Depressor labii inferioris draws angle of mouth downward and somewhat laterally as in expression of irony.
- iv. Levator labii superioris elevates the lip.



2. **Nerve supply**: The muscles of the face are developed from 2nd pharyngeal arch and the nerve of the 2nd pharyngeal arch is facial nerve. Hence, all the muscles are supplied by facial nerve.

3. Applied anatomy

Table 2.2: Differences between upper motor neuron and lower motor neuron lesions

Particulars	Upper motor neuron lesion	Lower motor neuron lesion
• Synonym	• Supranuclear facial palsy.	 Infranuclear facial palsy, e.g. Bell's palsy
• Site of lesion	• Above the facial nerve nucleus, i.e. damage of corticonuclear fibres in the internal capsule.	• At and below the facial nerve nucleus, i.e. facial nerve
Muscles paralysed	• Muscles of lower half of the face of the opposite side are paralysed.	• Muscles of the whole face of the same side.
Clinical features	• Asymmetry of the face	Asymmetry of the face

Contd.

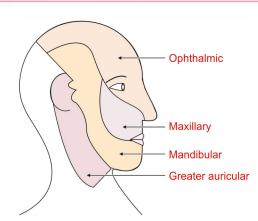
Particulars	Upper motor neuron lesion	Lower motor neuron lesion
	 Inability of angle of mouth to move upwards. Loss of nasolabial fold Accumulation of food in the vestibule of the mouth Dribbling of saliva Inability to inflate the cheek laterally. Able to close the eye Able to wrinkle the forehead 	 Inability of angle of mouth to move upwards. Loss of nasolabial fold. Accumulation of food in the vestibule of the mouth. Dribbling of saliva Inability to inflate the cheek laterally. Inability to close the eye. Inability to wrinkle the forehead

Table 2.2: Differences between upper motor neuron and lower motor neuron lesions (Contd.)

CNI 25	Soncor		supply	of the	1000
211-22	Sensor	y nerve	supply		lace

Table 2.3: Sensory nerve supply of the face (Fig. 2.7)

Source	Cutaneous nerve	Area of distribution
• Ophthalmic division of trigeminal nerve	 Supratrochlear nerve Supraorbital nerve Lacrimal nerve Infratrochlear nerve External nasal nerve 	 Scalp up to vertex Forehead Upper eyelid Conjunctiva Root, dorsum and tip of nose.
• Maxillary division of trigeminal nerve	Infraorbital nerveZygomaticofacial nerveZygomaticotemporal nerve	 Upper lip Side and ala of nose Lower eyelid, Upper part of cheek Anterior part of temple.
 Mandibular division of trigeminal nerve 	 Auriculotemporal nerve Buccal nerve Mental nerve 	 Lower lip, chin, lower part of cheek, Lower jaw except over the angle, and Lower margin, upper 2/3rd of lateral surface of auricle and side of head.
Cervical plexus	 Anterior division of great auricular nerve (C2, C3). Upper division of transverse (anterior) cutaneous nerve of neck (C2, C3). 	 Skin over the angle of the jaw and over the parotid gland. Lower margin of the lower jaw.



Scalp, Temple and Face

Fig. 2.7: Sensory nerve supply of the face

LAQ-3 Describe facial vein under the following headings: 1. Formation; 2. Relations; 3. Tributaries; 4. Termination; 5. Applied anatomy

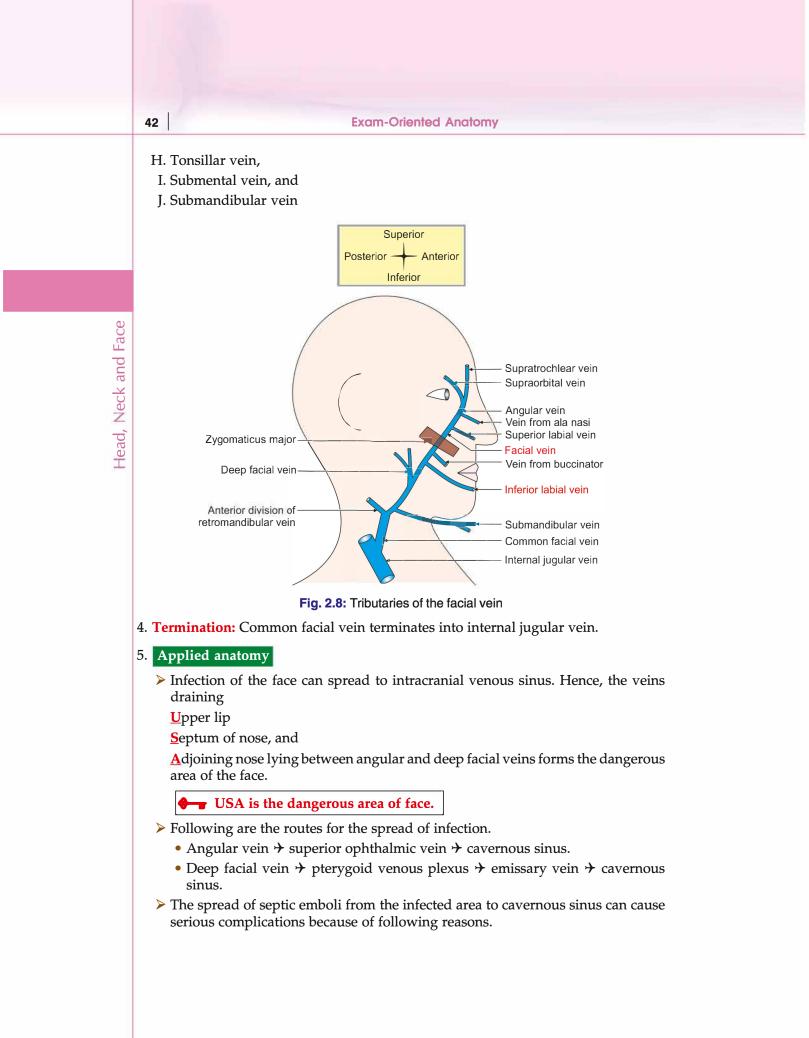
Head, Neck and Face 1. Formation: The angular vein receives superior labial vein and continues as facial vein.

2. Relations

- A. It lies deep to
 - a. Zygomaticus major,
 - b. Risorius, and
 - c. Platysma.
- B. From above downwards, it lies superficial to
 - a. Buccinator,
 - b. Body of mandible,
 - c. Masseter,
 - d. Submandibular gland,
 - e. Posterior belly of digastric, and
 - f. Stylohyoid muscle.
- C. At termination, it crosses: a. Internal carotid artery, b. External carotid artery, c. Hypoglossal nerve, and d. Loop of lingual artery.

3. Tributaries

- A. Superior ophthalmic vein,
- B. Vein from alar nasi,
- C. Superior labial vein,
- D. Buccal vein,
- E. Deep facial vein from pterygoid plexus,
- F. Inferior labial vein,
- G. Masseteric vein,



Scalp, Temple and Face

- Veins of the face do not have valves.
- Veins of the face lie on facial muscles.
- There is no deep fascia on the face.
- The movements of the facial muscles may facilitate the spread of septic emboli to cavernous sinus.

QLA-12 Why the facial muscles are called "muscles of facial expression"?

The muscles of face are not inserted on bone but in the skin. Since there is no deep fascia in the face, contraction of these muscles causes contraction of some part of skin on the face. It acts as a medium to express the emotional feelings. Hence, facial muscles are called muscles of facial expression.

QLA-13 What is the nerve supply of facial muscles?

- 1. All the muscles on the face are supplied by facial nerve except levator palpebrae superioris which is supplied by oculomotor nerve.
- 2. Majority of the muscles on the face are muscles of facial expression. However, there are exceptions. These are buccinator and platysma. They are supplied by facial nerve.
- 3. The muscles present on the face but included as muscles of mastication are temporalis, masseter, medial and lateral pterygoid. These are supplied by mandibular nerve, branch of trigeminal nerve (Vth cranial nerve).

SN-26 Deep facial vein

Introduction: It is a communicating channel that connects the facial vein to pterygoid venous plexus (Fig. 2.9).

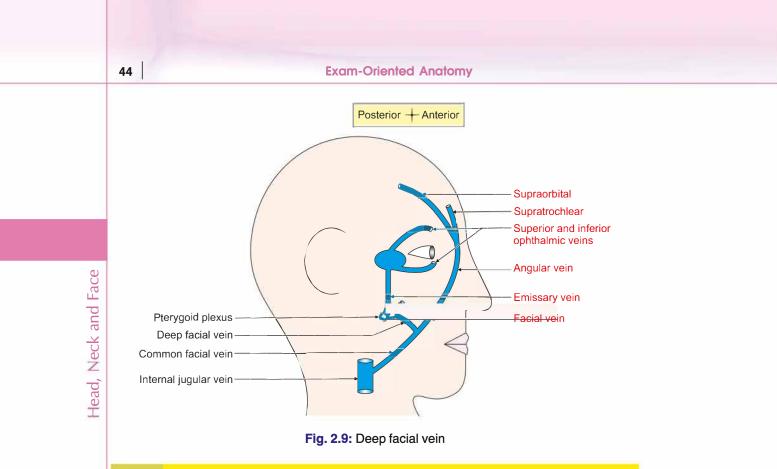
- 1. **Course:** It leaves the facial vein before it crosses the lateral surface of masseter and to the ramus of mandible.
- Communications: It is connected to the cavernous sinus by the emissary veins passing through the
 - A. Foramen lacerum,
 - B. Foramen ovale, and
 - C. Foramen spinosum.
- 3. Peculiarities: It has no valves.

4. Applied anatomy

- > The dangerous area of face lies between angular and deep facial veins.
- The infection from the upper lip and the lower part of the nose can spread through the deep facial vein and cause cavernous sinus thrombosis. The movements of the facial muscles may facilitate the spread of septic emboli.

Face

Head, Neck and



SN-27 Dangerous area of face

Infection of the face can spread to intracranial venous sinus. Hence, the veins draining the following area is called dangerous area of face.

1. Area: 🗣 USA

Upper lip.

Septum of nose.

<u>A</u>djoining part of nose and lip lying between angular and deep facial veins forms the dangerous area of the face (Fig. 2.10).

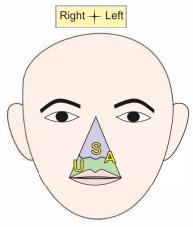


Fig. 2.10: Dangerous area of the face

Scalp, Temple and Face

- 2. Following are the routes for the spread of infection.
 - A. Facial vein \rightarrow deep facial vein \rightarrow pterygoid venous plexus \rightarrow cavernous sinus.
 - B. Angular vein \rightarrow superior ophthalmic vein \rightarrow cavernous sinus.
- 3. The spread of septic emboli from the infected area to cavernous sinus can cause serious complications because of following reasons.
 - A. Veins of the face do not have valves.
 - B. Veins of the face directly lie on the muscles of face.
 - C. There is no deep fascia on the face.
 - D. The movements of the facial muscles may facilitate the spread of septic emboli to cavernous sinus.

QLA-14 What are the constituents of lacrimal apparatus?

It consists of

- 1. Lacrimal gland
 - A. Orbital part, and
- B. Palpebral part
- 2. Conjunctival sac
- 3. Punctum
- 4. Canaliculus
 - A. Superior, and
 - B. Inferior canaliculus
- 5. Lacrimal sac
- 6. Nasolacrimal duct

OLA-15 What are the structural differences between lacrimal gland and serous salivary gland?

Particulars	Lacrimal gland	Serous salivary gland
• Shape of acini	 Larger Irregular and elongated 	 lar in shape Apical cytoplasm is eosinophilic due to the presence of eosinophilic granules called zymogen granules Cytoplasm at the base of each cell is basophilic. The secretion of serous acini is watery
• Lumina	• Wider	• Small
• Myoepithelial cells	• Present between glandular epithelium and basement membrane	 Spindle shaped cells with oval nuclei They are located within the basal lamina of the secretory acini and

Table 2.4: Structural differences between lacrimal gland and serous salivary gland

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Head, Neck and Face

Table 2.4: Structural differences between lacrimal gland and serous salivary gland (Contd.)

Particulars	Lacrimal gland	Serous salivary gland
		the ducts of the glands. Contraction in these cells propels the secretions from the acini and the duct.
• Lining epithelium of smaller duct (intralobular excretory duct)	• Cuboidal epithelium	 Intercalate (inserted or placed between) Simple cuboidal epithelium. Striated: Simple cuboidal epithelium; cells have basal striations.
• Lining epithelium of bigger duct (interlobular excretory duct)	 Columnar or pseudostratified 	• Simple columnar epithelium in small ducts and stratified columnar epithelium in large ducts

Head, Neck and Face

QLA-16 D/L microscopic structure of serous demilune

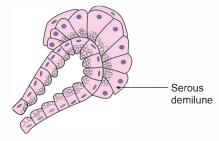


Fig. 2.11: Serous demilune

QLA-17 Enumerate the difference between serous and mucus acini.

Particulars	Serous acini	Mucous acini
• Cells	• 📥 lar	• Tall
Nucleus	 Round nucleus at base 	Flat nucleus at the base
• Cytoplasm at the apex	 Eosinophilic due to the presence of eosinophilic granules 	 Cells appear pale as the cytoplasm does not stain well. Cellsappear empty.
Cytoplasm at the base	• Basophilic	-
• Lumen	• Small	 Larger as compared to serous acini.
• Type of secretion	• Watery	• Thick

QLA-18 What are serous demilunes?

1. Some of mucous acini are capped with serous cells.

- 2. They are arranged as a half moon.
- 3. Hence, they are called serous demilunes.

OLA-19 Where do we get myoepithelial cells in the body? How will you identify them?

1. Site

- A. **Ducts:** Between the epithelium and the basement membrane of the ducts.
- B. **Sweat gland:** There are cuboidal secretory cells of the sweat gland. At the base of the secretory cells, there are numerous myoepithelial cells.
- C. Identifying features (Fig. 2.12):
 - a. The cells are thin and spindle **1** shaped.
 - b. They are located at the base of the secretory cells.

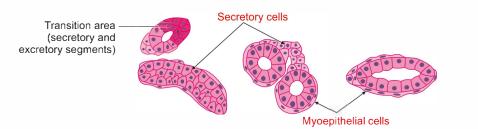


Fig. 2.12: Cross-section and three-dimensional appearance of an eccrine sweat gland. Stain: hematoxylin and eosin. Low magnification

QLA-20 What are the functions of saliva?

1. The saliva lubricates the luminal surface of the upper digestive and respiratory tracts.

- 2. It moistens the food to help in deglutination.
- 3. It initiates digestion of carbohydrates by the enzyme salivary amylase.
- 4. It contains lysozyme and immunoglobulin. They are bactericidal in nature.

LAQ-4 Describe lacrimal apparatus under the following heads:

- 1. Components,
- 2. Blood supply,
- 3. Nerve supply, and
- 4. Applied anatomy

 Components: Lacrimal gland with ducts, conjunctival sac, lacrimal caruncle, lacrimal punctate, lacrimal canaliculus, lacrimal sac and nasolacrimal duct.
 A. Lacrimal gland: Table 2.6 shows different parts of lacrimal gland.

Particulars	Orbital part	Palpebral part
Location	 Medial surface of frontal process of zygomatic bone (lacrimal fossa) 	 Below levator palpebrae superioris
• Shape	Almond 病	• Flat
• No. of ducts	• 4–5	• 8

 Table 2.6: Orbital and palpebral parts of lacrimal gland

Maintains <u>T</u>ransparency of cornea

Expresses emotion,

Acts as bactericidal,

<u>R</u>enders nourishment to cornea,

Keeps the orbital <u>S</u>urface of conjunctiva moist.

B. Conjunctiva

- a. **Gross features:** It is transparent membrane covering sclera and lining the inner surface of eyelid.
- b. **Conjunctival sac:** It is a potential space between two eyelids and cornea/sclera in the closed position of eyelids. It consists of
 - I. Orbital part which is in contact with the sclera and cornea.
 - II. *Palpebral part:* It is highly vascular, adherent to tarsal plate. It lines the eyelid.

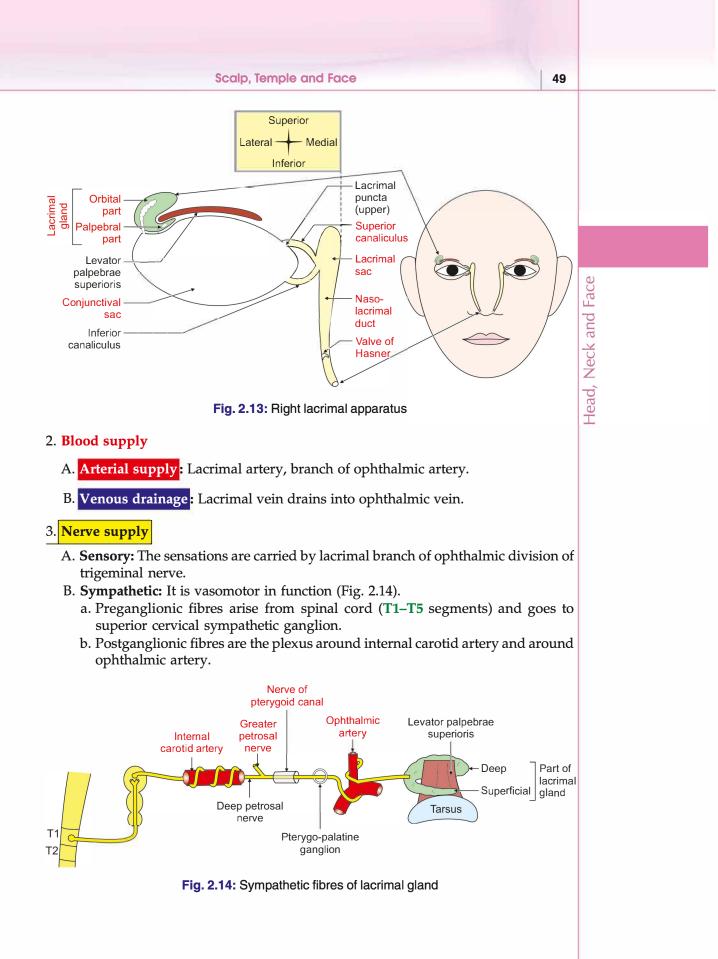
c. Nerve supply

- I. Ophthalmic division of trigeminal nerve.
- II. Maxillary division of trigeminal nerve.
- d. Blood supply: Palpebral branch of ophthalmic artery.
- C. Puncta with lacrimal canaliculi: Each lacrimal canaliculus begins with punctum.
 - a. Length of canaliculus:10 mm. It has
 - I. Vertical part—2 mm
 - II. Horizontal part-8 mm
 - b. It is lined by stratified squamous non-keratinized epithelium. It opens in the lateral wall of lacrimal sac behind medial palpebral ligament.
- D. Lacrimal sac: It is a membranous sac, continues with nasolacrimal duct. It is a blind pouch. Superiorly, it measures 12×5 mm. It continues inferiorly with nasolacrimal duct.
- E. Relations of lacrimal sac (Fig. 2.13)
 - a. Anterior

I. Medial palpebral ligament.

II. Orbicularis oculi muscle.

- b. Medially: Lacrimal groove.
- c. Laterally: Lacrimal fascia and lacrimal part of orbicularis oculi.
- F. **Nasolacrimal duct:** It is a membranous passage of 18 mm long. It runs from the lower end of lacrimal sac and opens in the inferior meatus of nose. The lower end of the duct is guarded by valve of Hasner. It prevents backward flow of fluid.



- C. **Parasympathetic nerve** is secretomotor in function (Fig. 2.15). It is carried by facial nerve \rightarrow pterygopalatine ganglion \rightarrow maxillary nerve (VII— pterygopalatine ganglion—V2).
 - a. Preganglionic fibres arising from lacrimatory nucleus present in the pons, pass via facial nerve, greater petrosal nerve and joins with deep petrosal nerve to form nerve to pterygoid canal. The fibres are relayed in the pterygopalatine ganglion.

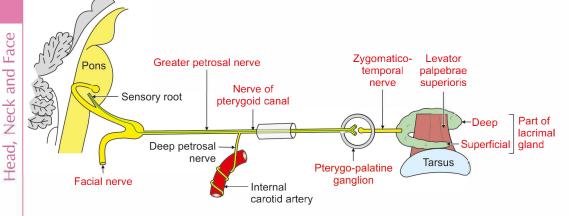


Fig. 2.15: Secretomotor fibres of lacrimal gland

b. Postganglionic fibres pass through maxillary nerve (zygomaticotemporal) lacrimal nerve—lacrimal gland.

4. Applied anatomy

- **Dacryoadenitis** (dacryo—tear) is the inflammation of lacrimal gland.
- Dacryocystitis is inflammation of lacrimal sac and presents with pain, oedema and redness.
- > **Dacryocystectomy** is removal of lacrimal sac.
- Removal of palpebral part is equal to the removal of entire gland because the ducts of the orbital part pass through palpebral part.
- **Epiphora** (*Epiphora*—sudden burst)—overflow of tears.

QLA-21 What is dacryocystitis?

Inflammation of the lacrimal sac is called dacrocystitis.

QLA-22 What is nature of lacrimal gland?

It is serous gland.

QLA-23 What are the parts of lacrimal gland?

- 1. Orbital part
- 2. Palpebral part

SN-28 Orbicularis oculi

(Orbiculus—orbit, oculi—eyeball)

Introduction: It is a muscle of face, the sphincter of orbital fissure.

- 1. Attachments: It has three parts:
 - A. **Palpebral part:** It is confined to the lids. It arises from medial palpebral ligament. It is inserted into lateral palpebral raphe.
 - B. Orbital part: It extends beyond orbit. It arises from
 - a. Nasal part of frontal bone
 - b. Anterior lacrimal crest
 - c. Frontal process of maxilla: It forms concentric rings and return to the point of origin.
 - C. Lacrimal part (deeper part): It is attached medially to the
 - a. Posterior lacrimal crest, and
 - b. Lacrimal sac,
 - c. They are inserted into upper and lower eyelids.

2. Nerve supply

- A. Mainly by zygomatic branch of facial nerve.
- B. It is also supplied by temporal branch of facial nerve.

3. Actions

- A. Palpebral part closes the eyelid gently.
- B. Orbital and palpebral parts together closes the eyelid forcibly.
- C. Levator palpebrae superioris is the opponent of upper palpebral fibres of orbicularis oculi.

Occipitofrontalis opposes the orbital part.

- 4. Development: They are developed from the mesoderm of the 2nd pharyngeal arch.
- 5. Applied anatomy: Infranuclear lesion of the facial nerve leads to paralysis of orbicularis oculi. Hence, the patient cannot close the eyelid tightly. Frequent closure of eyelids is required for the normal drainage of tears through the lacrimal ducts. Due to paralysis of orbicularis oculi, there is overflowing of tears through the eyelid and expose keratitis.

QLA-24 Enumerate the branches of facial artery on the face

- 1. Inferior labial,
- 2. Superior labial,
- 3. Lateral nasal, and
- 4. Angular artery.

Head, Neck and Face



LAQ-5 Describe facial nerve under the following headings:

- 1. Course and relations
 - 2. Branches
- 3. Applied anatomy

It is a nerve of 2nd pharyngeal arch.

1. Course and relations

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A. Intraneuronal (Fig. 2.16)

- a. Motor root arises from motor nuclei of facial nerve situated in deep part of pons. It winds around abducent nucleus. It forms a bulging in the floor of IVth ventricle called facial colliculus. It is due to the phenomenon of neurobiotaxis. The nerve fibres have a tendency to migrate in the direction from which they receive their stimuli.
- b. Sensory root (nervus intermedius) is formed by
 - I. Superior salivatory nucleus and lacrimatory nucleus.
 - II. Nucleus tractus solitarius.
 - Both the roots emerge at the junction of pons and olive.

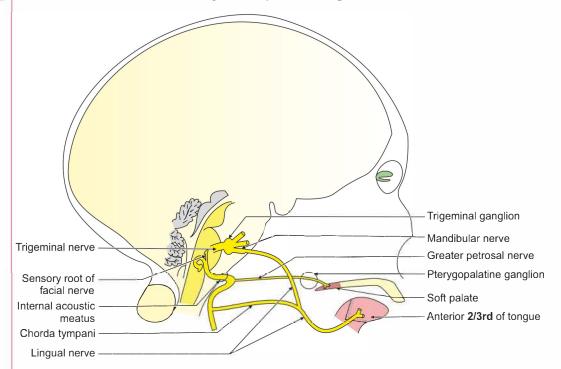


Fig. 2.16: Facial nerve showing taste sensation fibres of anterior two-thirds of tongue

B. Extraneuronal: Divided into three parts (Fig. 2.17)

a. First part: It passes through the internal acoustic meatus. It reaches anterosuperior angle of the medial wall of the middle ear cavity. It bends to form second part. It forms a bulging at the bend called geniculate ganglion.

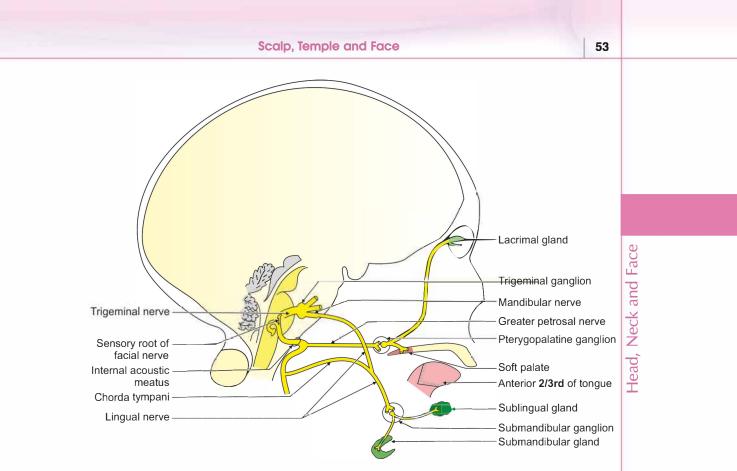


Fig. 2.17: Facial nerve showing secretomotor fibres to the glands

- b. Second part: It runs horizontally backwards along medial wall of tympanic cavity. It lies above promontory and fenestra vetibuli and runs to the posterior part of medial wall.
- c. Third part: It is posterior to posterior wall of middle ear cavity. Runs vertically downwards and comes outside the cranium through stylomastoid foramen.
- C. Extracranial: It turns anteriorly and pierces the posteromedial surface of parotid gland. It emerges from anteromedial surface of parotid gland.
- D. Terminates in the parotid gland: By dividing into terminal branches.

2. Branches

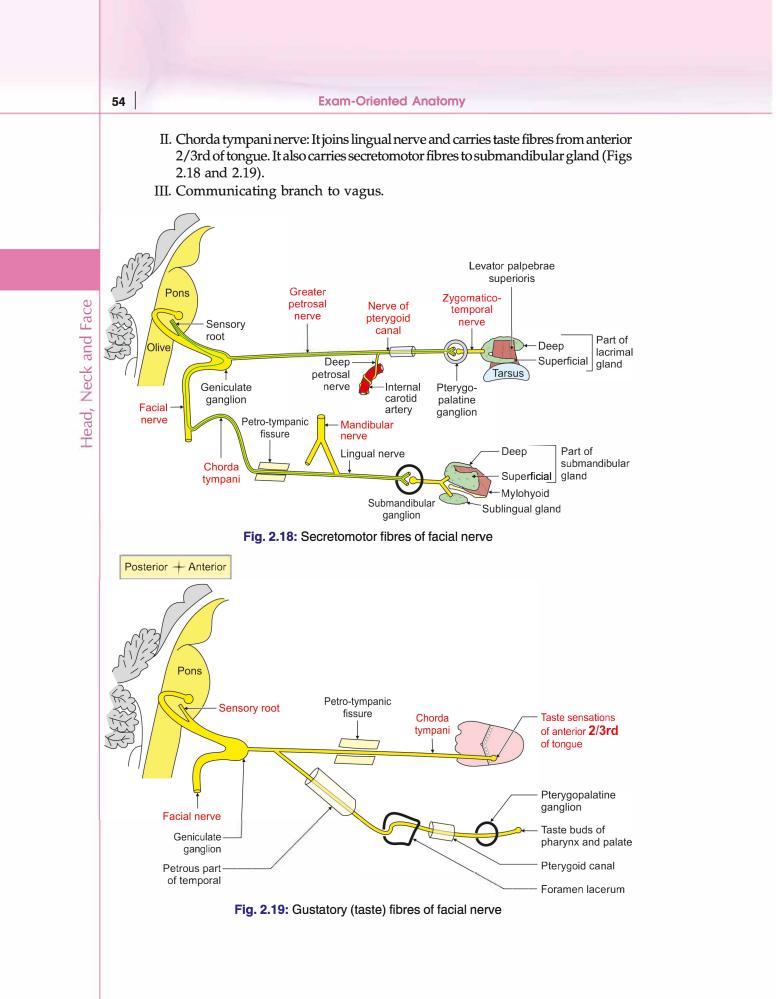
A. Intracranial

- a. First part: No branches:
- b. At the junction of 1st and 2nd parts, greater petrosal nerve arises. It carries secretomotor fibres to the lacrimal gland.
- c. Second part:

I. Sympathetic branches to middle meningeal artery.

II. Branch to lesser petrosal nerve, by which it reaches the otic ganglion.

- d. Third part:
 - I. Stapedial branch: It passes through small canal and supplies stapedius muscle.

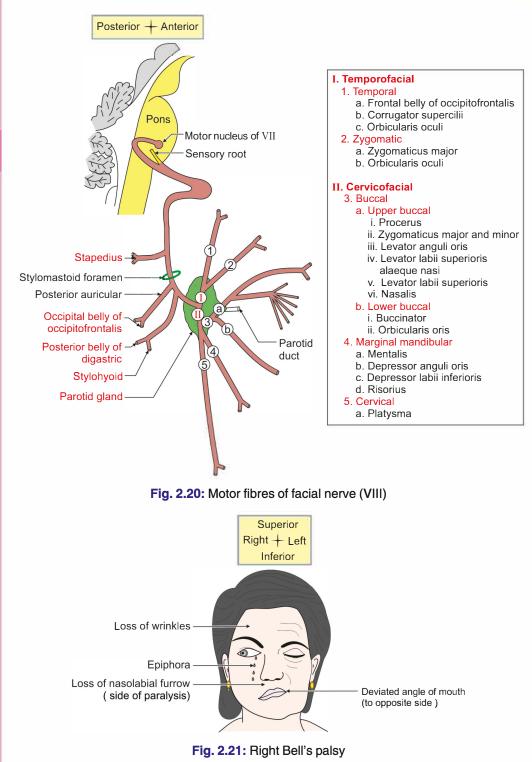


 B. Extracranial a. Posterior auricular branch gives communicating branch to great auricular lesser occipital. It divides into I. Auricular branch to auricularis posterior. 	
lesser occipital. It divides into	
I. Auricular branch to auricularis posterior.	r and
II. Occipital branch to occipital belly of occipitofrontalis.	
b. Digastric branch to posterior belly of digastric.	
c. Stylohyoid branch to stylohyoid muscle.	
C. Terminal	
a. Temporal branch to	
I. Frontal belly of occipitofrontalis,	
II. Muscles of external ear	
i. Auricularis superior	
ii. Auricularis anterior	
III. Corrugator supercilii.	
b. Zygomatic branch to orbicularis oculi	
c. Buccal	
I. Upper (lower zygomatic)	
i. Zygomaticus major	
ii. Zygomaticus minor	
iii. Levator labii superioris	
iv. Levator labii superioris alaequae nasi	
v. Levator anguli oris	
II. Lower	
i. Buccinator	
ii. Orbicularis oris	
d. Mandibular branch to risorius.	
e. Cervical branch to platysma (Fig. 2.20)	
D. Pes anserinus (<i>pes</i> —foot, <i>anser</i> —goose) ^{NEET} : Branches of the facial nerve is substance of parotid gland form a network called pes anserinus. This divide parotid gland into superficial and deep parts.	
Box 2.2	
Pes anserinus	
1. Branches of facial nerve	
2. Muscles attached to upper part of medial surface of tibia.	
3. Applied anatomy: Upper and lower motor neuron lesion of facial nerve (Fig. 2	



Head, Neck and Face

Exam-Oriented Anatomy



Note: While attempting to close the right eye (paralyzed side), the eye does not close and the eyeball rotates superiorly and laterally

SN-29 Upper and lower motor neuron lesions of facial nerve

The difference in the upper and lower motor neuron lesions is displayed in Table 2.7.

Particulars	Upper motor neuron lesion (supranuclear palsy)	Lower motor neuron lesion (LMNL) (intranuclear palsy)
• Site	• Above the facial nerve nucleus.	• Below the facial nerve nucleus
Cause of lesion	• Lesion in the genu of internal capsule is due to cerebral haemorrhage	 Damage in the parotid gland Bell's palsy Lesion in the middle ear Tumours in the internal acoustic meatus
• Muscles paralysed	• Muscles of the lower half of the face on opposite side are paralysed	• All the muscles of the same side of the face are paralysed

Table 2.7: Upper and lower motor neuron lesions of facial nerve

SN-30 Lower motor neuron lesion of facial nerve

The causes, and manifestation of lower motor lesion are described below.

- 1. Lesion of facial nerve distal to stylomastoid foramen: The lesion of facial nerve is due to vertical incision of the parotid gland.
- 2. Lesion of facial nerve at the stylomastoid foramen: It results in Bell's palsy. The 'Bell's palsy' is the lower motor neuron type of facial palsy (paralysis of muscles of facial expression). It occurs due to inflammation of facial nerve in the facial canal at the stylomastoid foramen. The exact cause of inflammation is not known, but it is thought to be due to viral infection. It causes inflammation and oedema of facial nerve. It results in compression of facial nerve in the facial canal.

Pain of variable intensity behind the ear precedes facial weakness which develops over 48 hours period.

- 3. Characteristic features (All muscles of whole face are affected on the side of paralysis.)
 - A. Facial asymmetry: Due to unopposed action of muscles of opposite side.
 - B. Loss of wrinkles on forehead: Due to paralysis of fronto-occipitalis.
 - C. Inability to close the eye (wide palpebral fissure): Due to paralysis of orbicularis oculi.
 - D. **Inability to move the angle of the mouth upwards** and laterally during laughing due to paralysis of zygomaticus major.
 - E. Loss of nasolabial furrow due to paralysis of levator labii superioris alaeque nasi.
 - F. Accumulation of food in the vestibule of the mouth due to paralysis of the buccinator.
 - G. Dribbling of saliva: Due to paralysis of orbicularis oris.
 - H. Inability to inflate the cheek properly: Due to paralysis of buccinator muscle.

Head, Neck and Face

- 4. Lesion in the vertical course of the facial nerve within the mastoid bone results in the
 - A. Loss of taste sensation on the anterior two-thirds of the tongue on the side of the lesion.
 - B. There is loss of secretion from submandibular salivary gland; however, lacrimation and the stapedius reflex would be normal.
 - C. A lesion in the middle ear segment of the nerve (tympanic) does not affect lacrimation but results into ipsilateral **hyperacusis** due to paralysis of stapedius.

5. Lesion at or proximal to the geniculate ganglion (translabyrinthine) produces diminished lacrimation on the same side, as well as disturbance in function of the other branches. After regeneration, the parasympathetic secretomotor fibres intended for salivary glands grow, and join the secretomotor fibres intended to supply the lacrimal gland; the anticipation of food then produces lacrimation, instead of salivation (syndrome of crocodile tears or Bogard syndrome)^{NEET}. The specific feature of this syndrome is paroxysmal lacrimation during eating.

6. Exact cause of lesion is not known. Most often it is due to viral infection leading to oedema and inflammation of the nerve.

SN-31 Upper motor neuron lesion

- 1. Causes: It is due to damage of corticonuclear fibres. The lesion may be
 - A. Facial nerve nucleus in the pons or
 - B. Above the nucleus.
 - The main cause is lesion in the internal capsule.

2. Manifestations:

- A. Supranuclear lesions produce upper motor neuron type of paralysis. The muscles of the lower half of the face of opposite side are paralysed. The muscles of the upper half of the face are normal because they are bilaterally innervated.
- B. Effects of upper motor neuron lesion: The patient is able to wrinkle the skin of his forehead, but he is not able to perform the actions of the muscles of lower 1/2 of the face (as they have unilateral innervation from the cerebral hemisphere hence paralyzed).

QLA-25 What are the functions of buccinator muscle?

- 1. It flattens cheek against gums and teeth.
- 2. It prevents accumulation of food in the vestibule.
- 3. This is the whistling muscle.